City of Shaktoolik/Shaktoolik Tribal Council, Alaska

Multi-Jurisdictional Hazard Mitigation Plan

September 2015

Prepared by:

Native Village & City of Shaktoolik,

LeMay Engineering & Consulting, Inc.

Alaskan Solution Based—Customer Driven

Acknowledgements

Native Village of Shaktoolik
Tribal Council

Harvey Sookiayak, Sr., President
Axel Jackson, Vice President
Edna Savetilik, Secretary
Agnes Takak, Treasurer
Edgar Jackson, Sr.
Randall Takak
Matilda Hardy

Native Village of Shaktoolik

Matilda Hardy, Acting President
P.O. Box 100
Shaktoolik, AK 99771-0100
Phone: (907) 955-3701
Fax: (907) 955-2352
Email: ksagoonich@kawerak.org

Shaktoolik City Council

Edgar Jackson Sr., Mayor
Eugene Asicksik, Vice Mayor
Axel Jackson
Agnes Takak
Edna Savetilik
Gail Evan
Randall Takak

City of Shaktoolik

P.O. Box 10
Shaktoolik, AK 99771
Phone: (907) 955-3441
Fax: (907) 955-3221
Email: skkcity@arctic.net

Contractor

LeMay Engineering & Consulting, Inc.
Jennifer LeMay, PE, PMP
4272 Chelsea Way
Anchorage, Alaska 99504
Phone: (907) 350-6061
Email: jlemay@lemayengineering.com

Technical Assistance

Alaska State Division of Homeland Security
& Emergency Management

Scott Nelsen
Ann Gravier

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Acronyms

APA	Approval Pending Adoption
ARDORs	Alaska Regional Development Organizations
ATV	All-Terrain Vehicle
AVEC	Alaska Village Electric Cooperative
AWCG	Alaska Wildfire Coordinating Group
BCA	Benefit-Cost Analysis
BCR	Benefit-Cost Review
CDBG	Community Development Block Grant
CFR	Code of Federal Regulations
DCCED	(Alaska) Department of Commerce, Community and Economic Development
DCRA	(DCCED) Division of Community and Regional Affairs
DFR	Disaster Relief Fund
DHS&EM	(Alaska) Division of Homeland Security and Emergency Management
DMA	Disaster Mitigation Act
DNR	Department of Natural Resources
DPC	Disaster Policy Cabinet
EHRSAP	Earthquake Hazards Reduction State Assistance Program
°F	Degrees Fahrenheit
FDIC	Federal Deposit Insurance Corporation
FEMA	Federal Emergency Management Agency
FHLBB	Federal Home Loan Bank Board
FIRM	Flood Insurance Rate Maps
FLD	Flood Projects
FMA	Flood Mitigation Assistance
GO Bonds	General Obligation Bonds
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
HMPG	Hazard Mitigation Planning Grant
HMTAP	Hazard Mitigation Technical Assistance Program
IA	Individual Assistance
IGAP	Indian General Assistance Program
IAW	Immediate Action Workgroup
MHMP	Local Multi-Hazard Mitigation Plan
MJHMP	Multi-Jurisdictional Hazard Mitigation Plan
NFIP	National Flood Insurance Program
NOAA	National Oceanographic and Atmospheric Administration
NRCS	National Resource Conservation Service
NTHMP	National Tsunami Hazard Mitigation Grant Program

PA	Public Assistance
PDM	Pre Disaster Mitigation
PDMG	Pre Disaster Mitigation Grant
PNP	Private Nonprofit
RCASP	Remote Community Alert Systems Program
REAA	Regional Educational Attendance Area
RSA	Reimbursable Service Agreements
SBA	Small Business Administration
SHMAC	State Hazard Mitigation Advisory Council
SHMO	State Hazard Mitigation Office
USACE	United States Army Corps of Engineers, Alaska District
USC	United States Code
USGS	United States Geological Survey
VA	Veterans Administration
VPO	Village Police Officer
VPSO	Village Public Safety Officer

Joint Adoption Resolution

City of Shaktoolik
PH #: (907) 955-3441
FAX #: (907) 955-3221

P. O. Box 10
Shaktoolik, Alaska 99771

A JOINT RESOLUTION OF THE NATIVE VILLAGE OF SHAKTOOLIK AND THE CITY OF SHAKTOOLIK COUNCILS TO ADOPT THE CITY OF SHAKTOOLIK/SHAKTOOLIK TRIBAL COUNCIL MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN

WHEREAS, the community of Shaktoolik recognizes the threat from natural disasters pose to residents and property; and

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

WHEREAS, an adopted Multi-Jurisdictional Hazard Mitigation Plan is required as a condition of future grant funding for mitigation projects; and

WHEREAS, the Shaktoolik Multi-Jurisdictional Hazard Mitigation Plan has been sent to the Alaska Division of Homeland Security and Emergency Management Agency for their approval; and

NOW THEREFORE BE IT RESOLVED, that the Native Village and the City of Shaktoolik hereby adopts the City of Shaktoolik/Shaktoolik Tribal Council Multi-Jurisdictional Hazard Mitigation Plan as an official plan; and

BE IT FURTHER RESOLVED, that the community of Shaktoolik will submit the adopted Multi-Jurisdictional Hazard Mitigation Plan to the Alaska Division of Homeland Security and Emergency Management Agency officials for final review and approval.

CERTIFICATION

We, the undersigned members of the Native Village of Shaktoolik IRA Council and the Shaktoolik City Council do hereby certify that the foregoing joint resolution was adopted at a duly held meeting on September 4, 2015 by a vote of 12 members.

YES ✓ NO ___ ABSTAIN 0 ABSENT 2

Native Village of Shaktoolik IRA President

City of Shaktoolik Mayor

ATTEST:

Tribal Coordinator

City Clerk

FEMA Approval Letter

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

FEMA

September 23, 2015

Honorable Matilda Hardy, Acting President
Native Village of Shaktoolik
P.O. Box 100
Shaktoolik, Alaska 99771-0100

Honorable Edgar Jackson Sr.
Mayor, City of Shaktoolik
P.O. Box 10
Shaktoolik, Alaska 99771

Dear Acting President Hardy and Mayor Jackson:

The U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) has approved the ***City of Shaktoolik/Shaktoolik Tribal Council Multi-Jurisdictional Hazard Mitigation Plan*** as a multi-jurisdictional Tribal and Local Mitigation Plan, in accordance with 44 CFR Part 201. With approval of this plan, the Native Village of Shaktoolik is eligible to apply directly to FEMA as a grantee for Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) non-emergency programs and the City of Shaktoolik is eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's hazard mitigation project grants through September 22, 2020. To continue eligibility, the plan must be reviewed, revised as appropriate and re-submitted for approval within five years of approval.

As a result of the Disaster Mitigation Act of 2000, states and tribes are required to develop and maintain hazard mitigation plans compliant with FEMA standards as a condition for receiving non-emergency Stafford Act assistance. Applicable Stafford Act assistance includes Public Assistance (Categories C-G), Fire Management Assistance, Hazard Mitigation Grant Program (HMGP), and Pre-Disaster Mitigation grants.

FEMA's approval of your plan as a Tribal Mitigation Plan provides the Tribe eligibility to apply for various Stafford Act programs and hazard mitigation projects through your state. All requests for assistance, however, will be evaluated individually according to the specific eligibility and other requirements of the particular programs. For example, a mitigation action identified in the approved plan may or may not meet the eligibility requirements for HMGP funding. If you have any questions regarding specific program requirements and eligibility, please contact Braden Allen, Hazard Mitigation Assistance Specialist, at 425-487-4749.

www.fema.gov

If you have questions regarding your plan's approval or FEMA's mitigation grant programs, please contact Scott Nelson, Emergency Management Specialist with Alaska Division of Homeland Security and Emergency Management, at (907) 428-7010, who coordinates and administers these efforts for local entities. You may also contact our Regional Tribal Liaison, Ramona Van Cleve, at 907-271-4302, or our Regional Mitigation Planning Manager, Kristen Meyers, at 425-487-4543 with any plan specific questions or for further assistance.

Sincerely,

Kenneth D. Murphy
Regional Administrator

cc: Ann Gravier, Alaska Division of Homeland Security and Emergency Management

Chapter 1. Planning Process and Methodology

1.1 Introduction

Hazard mitigation is the process of profiling hazards, analyzing risk, and developing preventative actions. When the preventative actions are implemented, risks are reduced or eliminated. This Multi-Jurisdictional Hazard Mitigation Plan for the Community of Shaktoolik includes information to assist the city and tribal government and residents with planning to avoid future disaster losses. The plan provides information on natural hazards that affect Shaktoolik, describes past disasters, and lists projects that may help the community prevent disaster losses. The plan was developed to help the City and Tribe make decisions regarding natural hazards that affect Shaktoolik.

1.1.1 Purpose

The purpose of this Multi-Jurisdictional Hazard Mitigation Plan (MJHMP) is to identify and coordinate risk mitigation efforts with State, Federal, and local partners and to fulfill the requirements set forth by the Code of Federal Regulations (CFR), Title 44 "Emergency Management and Assistance", Part 201 "Mitigation Planning", Subsections 6 and 7 (44 CFR §201.6, §201.7):

> 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 Hazard Mitigation Assistance (HMA) programs in both the pre- and post-disaster timeframes.

Current Federal regulations 44 CFR §201.6 and §201.7 require local communities and tribes, except under Regional Administrator approved "extraordinary circumstances" [§201.6(a)(3)], to have a Federal Emergency Management Agency (FEMA) approved hazard mitigation plan for most of FEMA's grant programs [all but Public Assistance (PA) Categories A, B, and Individual Assistance (IA)]. Currently, Federal regulations require local plans to be formally updated and approved by FEMA every five years.

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

This MJHMP complies with Title 44 CFR current as of March 11, 2015 and applicable guidance documents. Specific FEMA programs, such as PA Categories C through G, Pre-Disaster Mitigation (PDM), Flood Mitigation Assistance (FMA), and the Hazard Mitigation Grant Program (HMGP) are detailed in Chapter 2, Subsection "Resources."

1.1.2 Authority

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 FEMA's mitigation plan requirements for mitigation grant assistance.

For implementation guidance, FEMA published the Final Rule in the Federal Register on September 16, 2009 [Docket ID FEMA-2006-0010], 44 CFR Part 201 with subsequent updates. The planning requirements for local entities are described in detail throughout this chapter and are identified in their appropriate sections throughout this HMP.

Alaskan Native Tribes with an approved Tribal Mitigation Plan in accordance with 44 CFR 201.7 may apply for assistance from FEMA as a grantee. If the Tribe coordinates with the State of Alaska for development and review of their Tribal Mitigation Plan, then the Tribe also has the option to apply through the State as a subgrantee. A grantee is an entity such as a State, territory, or Tribal government to which a grant is awarded and is accountable for use of the funds. A subgrantee is an entity, such as a community, local, or Tribal government; State-recognized tribe; or a private nonprofit (PNP) organization to which a subgrant is awarded and is accountable to the grantee for use of the funds.

1.2 Plan Development

The Shaktoolik Tribal Council and City of Shaktoolik developed their plan with assistance from the State of Alaska, Division of Homeland Security and Emergency Management (DHS&EM). This plan includes:

1. Community demographic, land use, and economic information.
2. A review of the local hazards facing the community.
3. A hazard vulnerability assessment and exposure analysis.
4. A hazard mitigation strategy with attainable goals and actions.
5. A glossary of terms.
6. A list of incorporated planning documents.

Shaktoolik Tribal members reside within the City of Shaktoolik and are included as City residents in all State and Federal demographic research.

Project Staff

The City and Tribe of Shaktoolik designated Tribal grants coordinator, Michael Sookiayak as the primary local staff person on this project.

LeMay Engineering & Consulting, Inc. was hired to write the plan with the community. Scott Nelsen and Ann Gravier of the Division of Homeland Security and Emergency Management (DHS&EM) provided technical assistance and reviewed the drafts of this plan.

Plan Research

The following five-step process took place from April through June 2015:

1. Organize resources: Members of the planning team identified information resources, such as local experts and various organizations, capable of providing the technical expertise and historical information.
2. Assess risks: The planning team reviewed their hazards and risk assessments.
3. Assess capabilities: The planning team assessed their community's current administrative, technical, regulatory, and fiscal capabilities.
4. Develop the mitigation strategy: The planning team identified and prioritized their mitigation goals and actions.
5. Monitor, evaluate, and update the plan: The planning team evaluated their goals and actions for compatibility with community priorities.

The plan was developed utilizing existing Shaktoolik plans and studies as well as outside information and research. The following list contains the most significant of the plans, studies, and websites that were used in preparing this document. Additional sources are listed in the bibliography.

1. *Alaska All-Hazard Risk Mitigation Plan*, prepared by and for DHS&EM, October 2013.
2. *Shaktoolik, Alaska: Climate Change Adaptation for an At-Risk Community Adaptation Plan*, February, 27, 2014.
3. *Division of Community and Regional Affairs (DCRA) Community Information*: http://commerce.state.ak.us/cra/DCRAExternal/community/Details/714db5e4-899f-423c-a78d-e2396ee6bfe8
4. *Shaktoolik Local Economic Development Plan,* prepared by Kawerak, Inc., April 2013.
6. *Shaktoolik Coastal Flooding Analysis*, prepared by Community of Shaktoolik, Denali Commission, Kawerak, Inc., U.S. Army Corps of Engineers, Alaska District, and the Coastal and Hydraulics Laboratory, October 2011.
7. FEMA How to Guides:
    a. *Getting Started: Building Support For Mitigation Planning* (FEMA 386-1)
    b. *Local Multi-Hazard Mitigation Planning Guidance*, July 1, 2008 (FEMA 386-8)
    c. *Understanding Your Risks: Identifying Hazards and Estimating Losses* (FEMA 386-2)
    d. *Developing The Mitigation Plan: Identifying Mitigation Actions And Implementing Strategies* (FEMA 386-3)
    e. *Bringing the Plan to Life: Implementing the Hazard Mitigation Plan* (FEMA 386-4)
    f. *Using Benefit-Cost Review in Mitigation Planning* (FEMA 386-5)
8. USGS Earthquake Probability Mapping: http://geohazards.usgs.gov/eqprob/2009/index.php

9. Alaska Interagency Wildlife Management, http://fire.ak.blm.gov/predsvcs/maps.php
10. USACE Baseline Erosion Assessments, http://www.poa.usace.army.mil/Library/ReportsandStudies/AlaskaBaselineErosionAssessments.aspx
11. *Shaktoolik Planning Project Final Project Report*, Prepared by Glenn Gray and Associates in Association with Kawerak, Inc. and McKnight and Associates, March 3, 2012.

General Hazard Planning Web Sites

American Planning Association:	http://www.planning.org
Association of State Floodplain Managers:	http://www.floods.org
Federal Emergency Management Agency:	http://www.fema.gov
Community Rating System:	http://www.fema.gov/national-flood-insurance-program-community-rating-system
Flood Mitigation Assistance Program:	https://www.fema.gov/flood-mitigation-assistance-grant-program
Hazard Mitigation Grant Program:	http://www.fema.gov/hazard-mitigation-grant-program
Individual Assistance Program:	http://www.fema.gov/individual-assistance-program-tools
Interim Final Rule:	https://www.fema.gov/media-library/assets/documents/4590
National Flood Insurance Program:	http://www.fema.gov/national-flood-insurance-program
Public Assistance Program:	http://www.fema.gov/public-assistance-local-state-tribal-and-non-profit/

Public Involvement

On April 20, 2015, DHS&EM began community relations with the City Office regarding the hazard mitigation plan update.

On June 17, 2015, the planning team announced the hazard mitigation plan project during their public meeting. An invitation was extended to the entire community through a public announcement in a posted newsletter (Appendix A). The planning team posted a project newsletter describing the plan update process at the City and Tribal Offices and the Store. The newsletter was also placed on the DHS&EM website for review by the State Hazard Mitigation Advisory Council (SHMAC), Disaster Policy Cabinet (DPC), and general public, http://ready.alaska.gov/plans/localhazmitplans. During the meeting, participants reviewed the existing 2009 plan and updated the plan. Identified hazards known to impact the Community of Shaktoolik:

1. Flood/Erosion

2. Severe Weather
3. Wildland Fire
4. Earthquake
5. Climate Change

The planning team conducted a vulnerability assessment of Shaktoolik's assets. The results revealed the extent of damage each hazard could inflict in a worst case scenario.

The City of Shaktoolik and Shaktoolik Tribal Council adopted the 2015 plan by resolution during a public meeting on September 4, 2015. Adoption took place after the State of Alaska DHS&EM and FEMA reviewed and pre-approved the plan.

Incorporation of Existing Plans

During the planning process, the planning team reviewed and incorporated information from existing plans into the MJHMP. The Shaktoolik MJHMP and all future updates or changes will be adopted through joint resolution of the City and IRA Councils. These governing bodies have the authority to promote sound public policy regarding hazards. The MJHMP will be assimilated into other Shaktoolik plans and documents as they come up for review according to each plan's review schedule. Current plans for the community of Shaktoolik are listed in Table 1.

Table 1. Shaktoolik Plans

Document	Completed	Scheduled Review
Shaktoolik Comprehensive Plan	2006	Needs to be updated
Shaktoolik Erosion Assessment	April 2006	As needed
Local Economic Development Plan	April 2013	2019
Shaktoolik Long Range Transportation Plan	March 2007	As needed
Emergency Operations Plan	2010	As needed
Evacuation Plan	2010	As needed
Continuity of Operations Plan	2010	As needed
Norton Bay Climate Adaptation and Action Plan	2012	As needed
Adaptation Plan	2014	As needed
Comprehensive Strategic Management Plan	In Progress	As needed once complete

1.3 Plan Maintenance

This MJHMP will be maintained using the following five step process:

1. Incorporation into existing planning mechanisms.
2. Continued public involvement.
3. Monitoring, reviewing, evaluating, and updating the MJHMP.

4. State and FEMA review and technical assistance.
5. Formal plan adoption and assurances.

Incorporation into Existing Planning Mechanisms

The planning team will incorporate planning mechanisms into their MJHMP through the following activities:

Research the community's regulatory tools when implementing mitigation planning initiatives.

Involve pertinent agencies when integrating hazard mitigation concepts.

Update or amend existing planning mechanisms as necessary.

The City of Shaktoolik and Tribal Council will involve the public to continually reshape and update this MJHMP. A paper copy of this plan will be available at the Tribal and City offices. This MJHMP is also stored on the State Department of Commerce, Community, and Economic Development Community and Regional Affairs, (DCCED/DCRA) plans website for public reference, http://commerce.state.ak.us/dnn/dcra/PlanningLandManagement/CommunityPlansAndInfrastructure.aspx. Planners are encouraged to integrate components of this MJHMP into their own plans.

Continued Public Involvement

Through community outreach activities, the planning team will continue to raise awareness of this plan. Outreach activities could include attendance and provision of materials at City and Tribal-sponsored events, outreach programs, and public distributions. Any public comments regarding this plan will be collected by the planning team leader, included in the annual report, and considered during future plan updates.

Monitoring, Evaluating and Updating the Plan

> Section §201.6(c)(4)(i) of the mitigation planning regulation requires that 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.

Monitoring the Plan: The Shaktoolik mayor, grants coordinator, Tribal President, or their designees are responsible for monitoring the plan. On an annual basis, the Administration will seek a report from the agencies and departments responsible for implementing the mitigation projects in Chapter 4 of the plan. The compiled report will be provided to the City and Tribal Councils as information and noticed to the public. Public comments will be sought. A report outlining all five years of the plan monitoring will be included in the plan update.

Evaluating the Plan: The Shaktoolik mayor, grants coordinator, Tribal President, or their designee will evaluate the plan during the five-year cycle of the plan. On an annual basis, concurrent with the report above, the evaluation should assess whether:

- The goals and objectives address current and expected conditions.
- The nature, magnitude, and/or types of risks have changed.
- The current resources are appropriate for implementing the mitigation projects in Chapter 4.
- There are implementation problems, such as technical, political, legal, or coordination issues with other agencies.
- The outcomes have occurred as expected (a demonstration of progress).
- The agencies and other partners participated as originally proposed.

Updating the Plan: Plans must be updated and resubmitted to FEMA for approval every five years in order to continue eligibility for FEMA hazard mitigation assistance programs. Plan updates must demonstrate that progress has been made in the past five years to fulfill commitments outlined in the previously approved plan. This involves a comprehensive review and update of each section of the plan and a discussion of the results of evaluation and monitoring activities described above. Plan updates may validate the information in the previously approved plan or may involve a major plan rewrite. A plan update may not be an annex to this plan; it must stand on its own as a complete and current plan.

The tasks required to monitor, evaluate, and update the MJHMP are illustrated on Figure 1.

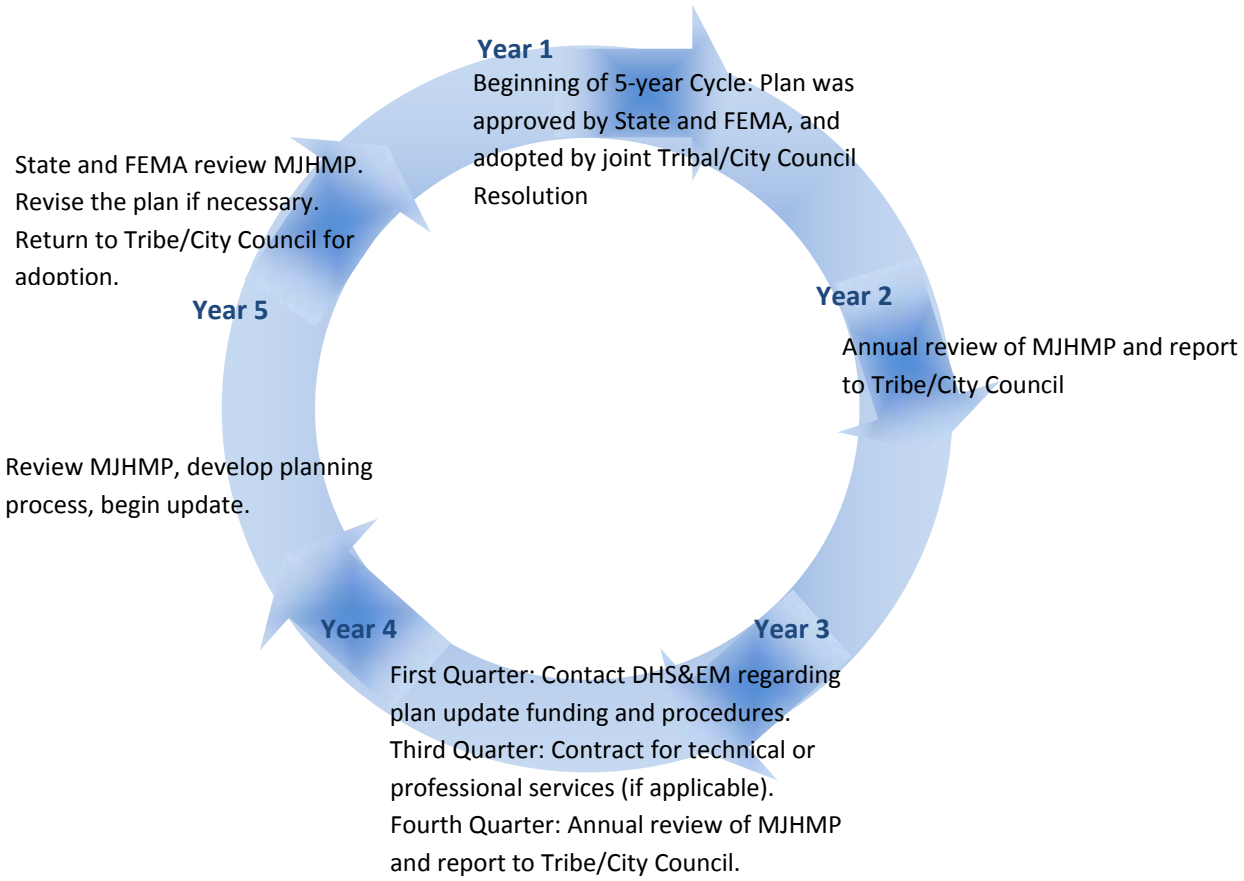
State and FEMA Review and Technical Assistance

Draft local hazard mitigation plans are submitted to the State Hazard Mitigation Officer (SHMO) for review. The SHMO reviews the plan for consistency with the State HMP and the DMA 2000 regulations. The primary guidance is the FEMA Tribal Multi-Hazard Mitigation Planning Guidance and Crosswalk, March 2010. The State assists the community with any necessary revisions and then forwards the plan to FEMA Region 10 for final review. If no further revisions are necessary, FEMA issues an "approval pending adoption" (APA) letter to the City and Tribal councils. The local community council will formally adopt the plan by a resolution. Once the plan is adopted, the SHMO forwards a copy of the adoption resolution to FEMA Region 10 for final approval. FEMA sends the final approval letter to the community and the State for their records. Finally, the SHMO places a copy of the FEMA approved Local MJHMP in DHS&EM files and on the State web site for reference.

Formal Plan Adoption and Assurances

The Shaktoolik City and Tribal Councils supports 44 CFR 201 and assures compliance with all applicable federal statutes and regulations during the periods for which it receives grant funding, in compliance with 44 CFR 13.11(c), and will amend its plan whenever necessary to reflect changes in tribal or federal laws and statutes as required in 44 CFR 13.11(d). The City of Shaktoolik and Shaktoolik Tribal Council, with assistance from the SHMO, the State Hazard Mitigation Advisory Committee (SHMAC), and FEMA, are responsible for monitoring, evaluating, and updating the MJHMP in accordance with 44 CFR §201.7.

Figure 1. Hazard Mitigation Planning Cycle



Chapter 2. Community Profile

2.1 Community Overview

Location

Shaktoolik is located 125 miles east of Nome and 33 miles north of Unalakleet on the east shore of Norton Sound. The area encompasses 1.1 square miles of land. It lies at approximately 64.333890° north latitude and -161.153890° west longitude. Shaktoolik is located in the Cape Nome Recording District.

Current Population: 251; 2015 Department of Community and Economic Development (DCRA) referencing 2010 US Census

Pronunciation: shock-TOO-lick

Incorporation Type: 2nd Class City

Borough: Unorganized

Census Area: Nome

Table 2 provides local and regional contact information for Shaktoolik.

Table 2. Community Information

Community Information	Contact Information and Type
City of Shaktoolik	City of Shaktoolik Edgar Jackson Sr., Mayor P.O. Box 10 Shaktoolik, AK 99771 Phone: (907) 955-3441 Fax: (907) 955-3221 Email: skkcity@arctic.net
Borough Located In:	Unorganized
Village Council	Native Village of Shaktoolik Matilda Hardy, Acting President P.O. Box 100 Shaktoolik, AK 99771-0100 Phone: (907) 955-3701 Fax: (907) 955-2352 Email: ksagoonick@kawerak.org

Community Information	Contact Information and Type
Electric Utility	Alaska Village Electric Cooperative (AVEC) 4831 Eagle St Anchorage, AK 99501 Phone: (907) 561-1818 Web: http://www.avec.org
Regional Native Corporation	Bering Straits Native Corporation 4600 Debarr Rd., Suite 200 Anchorage, AK 99508-3126 Phone: (907) 563-3788 Web: http://www.beringstraits.com
School District	Bering Straits School District PO Box 225 Unalakleet, AK 99684 Phone: (907) 624-4261 Fax: (907) 624-3099 Web: http://www.bssd.org
Regional Native Non-Profit	Kawerak, Inc. P.O. Box 948 Nome, AK 99762 Phone: (907) 443-5231 Fax: (907) 443-4452 Web: http://www.kawerak.org

History

Shaktoolik was the first and southernmost Malemiut settlement on Norton Sound, occupied as early as 1839. Twelve miles northeast, on Cape Denbigh, is "Iyatayet," a site that is 6,000 to 8,000 years old. Reindeer herds were managed in the Shaktoolik area around 1905. The village was originally located six miles up the Shaktoolik River, and moved to the mouth of the river in 1933. The 1933 site was prone to severe storms and winds; the village relocated to its present, more sheltered location in 1967. The City was incorporated in 1969.

Culture

Shaktoolik is a Malemiut Eskimo village dependent on a subsistence lifestyle. According to the Alaska Division of Subsistence 2010 statewide update, the total annual harvest of subsistence foods for the Bering Strait region, which includes the Nome Census area (but not the city of Nome), is about 3.4 million pounds or about 581.8 pounds per person. Subsistence is an important part of Shaktoolik's culture.

Population

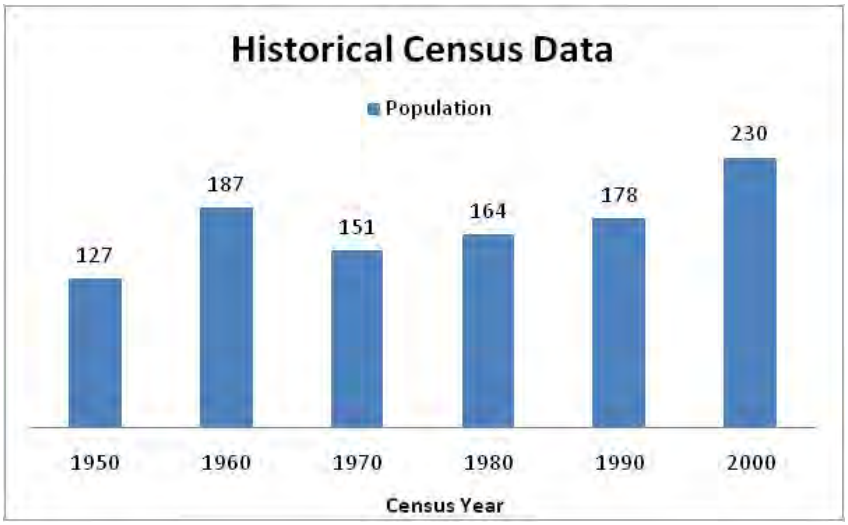
According to the 2010 U.S. Census, Shaktoolik has a population of 251 residents, and 96 percent of residents are all or part Alaska Native. Figure 2 provides historical census data. The community has a

total of 70 housing units and 64 units are occupied. A total of six housing units are vacant, and none are vacant due to seasonal use.

Economy

Shaktoolik's economy is based on subsistence and supplemented by part-time employment. 39 residents hold commercial fishing permits. Development of a new fish processing facility is a village priority. Reindeer herding also provides income and food.

Figure 2. Historic Populations



The total potential work force is 159; 122 residents are employed. The unemployment rate provided in the 2013 State of Alaska Hazard Mitigation Plan is 27.6 percent although practical unemployment or underemployment is likely to be significantly higher. 19.6 percent of residents live below the poverty line. The per capita income is $15,054 with a median household income of $38,750.

Facilities

Water is drawn from the Togoomenik River, treated, stored and piped to nearly 75 percent of Shaktoolik households. The city owns and operates a central washeteria/water treatment plant. Residents not connected to piped water depend on the fill-and-draw system for water. The system is capable of pumping 120 gallons of water per minute. The city charges $60 for residents and $70 for commercial water and sewer services.

Wastewater is piped to steel septic tanks with vertically perforated aluminum culverts serving as seepage pits which facilitate the community's wastewater disposal. The majority of homes in Shaktoolik are connected to multiple dwelling septic systems, which can handle two to four homes per system. A septic sludge disposal site exists, but does not meet the Alaska Department of Environmental Conservation standards.

Refuse is burned at a landfill located too close to the airport to meet State standards. A new site selected for the landfill is approximately one and a half miles to the southeast. The community is currently in the process of relocating the existing landfill. The electric utility (AVEC) operates a diesel-powered generator.

Shaktoolik School, a kindergarten through 12th grade with 83 students and 8 teachers in 2012, is located within the Bering Straits School District. The Shaktoolik School parcel is home to the main school building, a head-start building, shop, play ground, and power plant.

The Shaktoolik Clinic is operated by Norton Sound Health. The clinic has five small office areas, one exam room, and one trauma room. Shaktoolik is classified as an isolated village; emergency services have coastal and air access.

Transportation

A state-owned 4,000-foot-long by 75-foot-wide gravel airstrip allows regular air service from Nome. Access during the summer is possible by all terrain vehicle (ATV), motorbike, truck, or boat; during winter, snow machines and dog teams also provide access. The community has no docking facility.

Climate

Shaktoolik is located in a sub-arctic climate with maritime influences. Summer temperatures average between 47 degrees Fahrenheit (°F) and 62°F. Winter temperatures average between -4°F to -11°F. Temperature extremes from -50°F to 87°F have been recorded. The average annual precipitation is 14 inches and 43 inches of snowfall. The Norton Sound is generally ice-free from May to October.

Vegetation and Soils

Shaktoolik is located in a coastal lowland region, dotted with small tundra lakes. The landscape surrounding the village is primarily tundra, bare of timber. Willows and shrubs are the predominant vegetation. Foothills located 15 miles inland are surrounded by strands of spruce groves and other deciduous trees.

The community of Shaktoolik is located on a narrow strip of land between the ocean and the Tagoomenik River. The narrow strip is a flat sand bar only 200 feet wide at its northern end. The elevation of the highest ground in the Shaktoolik area is approximately 14 feet above mean high tide. The soils around Shaktoolik are poorly drained with a peaty surface layer. Gray sand and gravel extends below the organic mat to a depth exceeding 100 feet. Drainage on the wave-formed barrier bar where the townsite is located is excellent. The warming effect of water bodies on both sides of Shaktoolik's sand bar combined with the underlying well-drained gravel keeps the area virtually free of permafrost, although it is occasionally present (Rodney P. Kinney Associates, 2008).

Wildlife

The Tagoomenik River and the Shaktoolik River empty into the Norton Sound about two miles northwest of the village; making the village centrally located near the annual herring run. Chinook, chum, coho,

pink, and sockeye salmon also have local runs. Tideland areas support beluga, ringed seal, walrus, ducks, and geese. Caribou migrate through inland areas which are also home to moose and brown bear.

Shaktoolik is located in the southern half of the Department of Natural Resources (DNR) Management Unit Six: Norton Sound. Unit Six contains 13 bird rookeries and 23 anadromous streams, including the Tagoomenik River. Shaktoolik Bay is an enclosed estuary. Known heritage resources along the coast include sites near the City of Shaktoolik, including the historic Iditarod Trail.

2.2 Shaktoolik Capability Assessment

Government

Shaktoolik is located in an unorganized borough. The City of Shaktoolik was incorporated in 1969. The community has a "strong mayor" form of government. Under Alaska Statute Title 29, the City of Shaktoolik assumes powers including the ability to tax and to administer transportation, police, fire protection, and various other services. The City Council has seven members that meet the first Thursday of every month. Regular elections are held on the first Tuesday in October. The city imposes a four percent sales tax.

Community Maps

Community maps were developed using data from the DCRA website, maps from the Corps of Engineers study, and input from residents. Map 1 provides a regional view of Shaktoolik. Map 2 provides an aerial view of Shaktoolik; Shaktoolik is sited on a spit that separates the Tagoomenik River from Norton Sound.

Infrastructure

Every jurisdiction is unique. The list of assets that are most important to protect, as well as the criticality of any given facility, can vary widely from community to community. For planning purposes, a jurisdiction should determine criticality based on the relative importance of its various assets for the delivery of vital services, the protection of special populations, and other important functions. Infrastructure may be considered critical for a variety of reasons.

Critical Facilities: Critical facilities are those facilities and infrastructure necessary for emergency response efforts and whose loss of function would present an immediate threat to life, public health, and safety. In Shaktoolik, they include:

- Shaktoolik airport
- Shaktoolik clinic
- City Hall/Public Safety building
- Public Works garage (fire equipment)
- Municipal Fire station
- Public utilities

Map 1. Regional Map

Essential Facilities: Essential facilities are those facilities and infrastructure that supplement response efforts and whose loss of function would present an immediate threat to life, public health, and safety, including:

- Designated shelters – Shaktoolik School, National Guard Armory
- Bulk fuel storage tank farms
- Public works complex
- Municipal power plant
- Shaktoolik Native Store

Critical Infrastructure: Critical infrastructure consists of the various service networks in Shaktoolik, including:

- Telephone lines
- Satellite Communication Tower
- Power lines

- Transportation networks
- Water storage and distribution network
- Wastewater collection and distribution facilities

Map 2. Aerial of Shaktoolik and 2009 Baseline Erosion

Source: USACE, 2009 Shaktoolik Assessment of Erosion Damages

Vulnerable Populations: Locations within Shaktoolik that serve populations with special needs or requiring special consideration include:

- Schools
- Senior housing
- Head Start preschool
- Clinic

Cultural and Historical Assets: Cultural and historical assets include those facilities that augment or help define community character that, if lost, would represent a significant loss to the community. These include:

- Shaktoolik Covenant Church and cemetery
- Shaktoolik cemetery
- Shaktoolik museum

2.3 Local Resources

Shaktoolik is a small community with a very limited number of planning and land management tools. The resources available in these areas have been assessed by the City, and are summarized in Tables 3-

5. While the Shaktoolik Tribal Council is a sovereign and federally recognized tribe, they are not a regulatory authority in the vicinity of Shaktoolik. Additional funding resources are identified in the next subsection.

The City of Shaktoolik and Shaktoolik Tribal Council depend upon any available government and private grants for much of their mitigation projects. With an approved hazard mitigation plan, sovereign tribes, such as Shaktoolik, may apply directly to FEMA for grants or apply through the State. If a Tribe applies to the State for FEMA mitigation grants, the State may pay the required matching funds. Tribes may also apply to the City for financial assistance.

Table 3. Legal and Technical Capability

Regulatory Tools (ordinances, codes, plans)	Local Authority (Yes/No)	Comments (Year of most recent update; problems administering it, etc.)
Building code	No	2014 discussion—no action taken
Zoning ordinance	No	
Subdivision ordinance or regulations	Yes	2013—no problems encountered
Special purpose ordinances (floodplain management, stormwater management, hillside or steep slope ordinances, wildfire ordinances, hazard setback requirements)	No	2014 teleconference with State of Alaska Floodplain Manager—no action taken
Growth management ordinances (also called "smart growth" or anti-sprawl programs)	No	
Site plan review requirements	No	
Comprehensive plan	Yes/City	Needs to be updated
A capital improvements plan	Yes/City	2014-2015
An economic development plan	Yes/Tribe	Updated for 2012-2017
An emergency response plan	Yes	2009, needs to be updated
A post-disaster recovery plan	Yes—current project with IRA/City/Native Corporation	Currently underway in 2015
Real estate disclosure requirements	Yes/City/Corp.	14 (c) 3 in process in 2015

Table 4. Administrative and Technical Capability

Staff/Personnel Resources	Y/N	Department/Agency and Position
City or Tribal Administrator	yes	IRA Council
City Clerk	yes	City
Health Officer	yes	Norton Sound Health Corp
City or Tribal Planner	no	Vacant
Public Works Director	no	
Public Safety Director	no	
Librarian	yes	Volunteer Shaktoolik School
Police Officer	yes	VPSO/VPO
Fire Chief	yes	Volunteer
Fire Department	yes	Volunteer
Engineer(s) or professional(s) trained in construction practices related to buildings and/or infrastructure	no	
Planners or Engineer(s) with an understanding of natural and/or human-caused hazards	no	Contract or request assistance from Kawerak, or Corps of Engineers
Floodplain manager	no	
Surveyors	no	Also contract with private surveyors
Staff with education or expertise to assess the community's vulnerability to hazards	no	Work with Kawerak Inc. and Corps of Engineers thru mitigation plan process of IRA, City, and Corporation
Personnel skilled in GIS and/or HAZUS	no	Yes, IRA Council members

Table 5. Fiscal Capability

Financial Resources	Accessible or Eligible to Use (Yes or No)
Community Development Block Grants (CDBG)	Yes, both City and IRA
Capital improvements project funding	Yes, both City and IRA
Authority to levy taxes for specific purposes	Yes, City 4% sales tax to assist city administration
Fees for sewer	Yes, City

Financial Resources	Accessible or Eligible to Use (Yes or No)
Impact fees for homebuyers or developers for new developments/homes	no
Incur debt through general obligation bonds (GO Bonds)	no
Incur debt through special tax and revenue bonds	no
Incur debt through private activity bonds	no
Withhold spending in hazard-prone areas	no

2.4 Hazard Mitigation Funding Resources

State Mitigation Funding

Direct State Disaster Mitigation Funding

While the State of Alaska has PA and IA programs under State declared disasters, it does not have a State disaster mitigation program. However, there have been a few occasions in which the Governor and/or Legislature have elected to identify and fund mitigation work through the State Disaster Relief Fund (DRF). These actions were taken under discretionary authority, and no permanent State mitigation program was established.

State Provision of Non-Federal Match to Federal Mitigation Programs

Many federal mitigation programs require a local match of non-federal funds. The match required varies with the program regulations and community being granted funds. There are several mitigation programs in which the State of Alaska may provide the entire non-federal match for local communities resulting in 100% funds being granted to the community for mitigation. These programs, described in detail below, include the Public Assistance (also called 406 mitigation) and Hazard Mitigation Grant Program (HMGP) which are funded under federally declared disasters. The matching funds are paid through the State DRF. Therefore, while these programs are listed below under "Federal mitigation programs" for convenience, the State provides substantial funding for these programs, sometimes in the millions of dollars. On occasion the State has likewise provided a portion of the non-Federal match for National Resource Conservation Service (NRCS) projects.

State of Alaska Supporting Mitigation Programs

Division of Homeland Security and Emergency Management Disaster Relief Fund

The State of Alaska provides State funding for PA and IA in State declared disasters and cost share funds for federally declared disasters through the DRF.

Department of Commerce, Community & Economic Development

Community Development Block Grants

These grants fund community projects and planning activities improving health, safety and essential

community services.

Alaska Regional Development Organizations

The Alaska Regional Development Organizations (ARDORs) funds cooperative economic development.

Rural Development Assistance Mini-Grants

These grants partially fund plan development, feasibility engineering studies, and capital projects. Mini-grants are awarded by the State Legislature.

Unincorporated Community Grants

These grants are awarded by the State Legislature to unincorporated communities and nonprofits for a wide range of projects and programs.

Federal Mitigation Funding

There are several Federal agencies and programs funding mitigation projects in the State of Alaska. Mitigation grants are administered through the DHS&EM as the grantee to local communities functioning as sub-grantees with the State providing the required matching funds for HMGP. Table 6 is an overview of grant programs and their eligible programs.

Table 6. FEMA 2013 HMA Eligible Activities

Activities	HMGP	PDM	FMA
1. Mitigation Projects	√	√	√
Property Acquisition and Structure Demolition	√	√	√
Property Acquisition and Structure Relocation	√	√	√
Structure Elevation	√	√	√
Mitigation Reconstruction			
Dry Floodproofing of Historic Residential Structures	√	√	√
Dry Floodproofing of Non-residential Structures	√	√	√
Minor Localized Flood Reduction Projects	√	√	√
Structural Retrofitting of Existing Buildings	√	√	
Non-Structural Retrofitting of Existing Buildings and Facilities	√	√	
Safe Room Construction	√	√	
Infrastructure Retrofit	√	√	

Soil Stabilization	√	√	
Wildfire Mitigation	√	√	
Post-disaster Code Enforcement	√		
5% Initiative Projects	√		
2. Hazard Mitigation Planning	√	√	√
3. Management Costs	√	√	√

FEMA administers Hazard Mitigation Assistance (HMA) grants through Congressional authorization of the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 2000 as amended (DMA 2000). While many features of the HMA grants overlap, such as the benefit cost analysis (BCA) requirement, each grant program has specific features. Detailed guidance for these grants is provided by FEMA at http://www.fema.gov/library/viewRecord.do?id=3649.

Federal Disaster Mitigation Grants

406 Public Assistance Mitigation

FEMA PA repair projects are eligible for additional mitigation funds through 406 PA mitigation. Section (406) of the Stafford Act stipulates the mitigation project must relate directly to the disaster damages.

Hazard Mitigation Grant Program

In contrast, whenever there is a presidentially declared disaster in the State of Alaska, FEMA offers mitigation grant funds based on a percentage of the overall Federal share of disaster costs (15% in 2013). This program, called the Hazard Mitigation Grant Program (HMGP), was created in 1988 by the Stafford Act, Section 404 (404 mitigation) and allows HMGP funds to be used anywhere in the State if it is stipulated in the State disaster declaration to the President. While HMGP is funded through a presidentially declared disaster, HMGP funds are not used to repair disaster damage but to reduce future disaster losses through mitigation projects and planning.

Federal Unmet Needs Program

Unmet Needs is a program activated in specific disasters based upon a Congressional determination there are unmet needs following a disaster. Mitigation funds may be available for jurisdictions receiving an unmet needs allocation. Mitigation projects are specified in the Unmet Needs allocation. The Unmet Needs funds up to 75% of an approved project.

Additional Primary Federal Mitigation Programs

FEMA

Pre-Disaster Mitigation Grant Program

The FEMA PDM grant program funds mitigation projects and planning for State, local, and eligible tribal organizations. The PDM program is annual, subject to Congressional appropriation, and nationally competitive. PDM sets aside a minimum monetary amount for each State and offers any remaining funds for national competition. Congress controls the PDM program and may award PDM funds in lieu of any competitive application process.

The State is the grantee of PDM funds and communities are the sub-grantees. Grant awards are a 75 % Federal/25 % applicant cost share match. Communities identified as "small and impoverished" are eligible for 90 % Federal and 10% applicant match. The State of Alaska does not pay the applicant match for the PDM program.

Earthquake Hazards Reduction State Assistance Program

In 2012 and 2013, the State of Alaska received funds through the FEMA Earthquake Hazards Reduction State Assistance Program (EHRSAP). These funds were awarded through FEMA to States with earthquake hazards based upon specific Congressional authorization and are designed to support State earthquake program activities. Out of the total Congressional allocation, a portion of the funds are awarded to each state based upon a FEMA earthquake risk calculation. FEMA intends to continue this program subject to Congressional appropriation. The State of Alaska has used EHRSAP funds to support earthquake active fault mapping and earthquake/tsunami education outreach displays. The SHMO manages and administers these funds.

Hazard Mitigation Technical Assistance Program

Through the Hazard Mitigation Technical Assistance Program (HMTAP), FEMA creates technical products for Federal, State, and local community use. FEMA administers HMTAP contracts with State advisement. HMTAPs continue to be a potential tool to accomplish specific, clearly defined mitigation planning work as identified by the SHMO.

Department of Commerce National Oceanic and Atmospheric Administration (NOAA)

National Tsunami Hazard Mitigation Grant Program

The National Tsunami Hazard Mitigation Grant Program (NTHMP) combines Federal and State partners involved in mitigating tsunami risk. This NOAA directed program includes Federal partners from the United States Geological Survey (USGS), FEMA and NSF, and States with tsunami risk. The State of Alaska serves as a member of the Coordination Committee for the NTHMP and is the grantee for NTHMP funds allocated to Alaska. In Alaska, NTHMP funds are combined with State managed projects, local community sub-grants, and intra-state reimbursable services agreements (RSAs) for tsunami hazard mapping, outreach and warning systems. In Alaska, the NTHMP is managed though the SHMO.

Remote Community Alert Systems Program

The Remote Community Alert Systems Program (RCASP) funds multi-hazard warning communication systems for remote communities with limited 911 services, cell phone access, and communications capability. Where appropriate, the State directly manages the project (Unincorporated community in the Unorganized Borough) or sub-grants the funds. To date, funds have been used to install multi-hazard community warning sirens. In Alaska, the RCASP is managed through the SHMO.

Small Business Administration

Business Physical Disaster Loans are available for businesses and non-profit organizations in the area of a declared Federal disaster or Small Business Administration (SBA) declared disaster. SBA often sends representatives on federally declared disasters to present their disaster loan program.

Department of Agriculture

Natural Resource Conservation Service

Emergency Watershed Protection Program

The Natural Resource Conservation Service (NRCS) is responsible for the Emergency Watershed Protection (EWP) program. EWP provides financial and technical assistance to remove debris from streams, protect destabilized stream banks, establish cover on critically eroding lands, establish conservation practices, and purchase flood plain easements.

Department of Defense

U.S. Army Corps of Engineers

The U. S. Army Corps of Engineers (USACE) has accomplished many, extensive hazard mitigation studies and projects in Alaska, including the 2009 Kivalina community seawall and the Chena River flood control project in the Fairbanks North Star Borough. Funding for USACE projects and studies is dependent on Congressional appropriation and program requirements.

Additional Federal Agencies

Department of Agriculture

U.S. Forest Service

Department of Commerce

National Oceanic & Atmospheric Administration – See above under NTHMP and RCASP.

National Weather Service

Office of Coastal Resource Management

Department of Defense

USACE Army Corps of Engineers - National Flood Proofing Committee

Department of Health, Education & Welfare

Center for Disease Control (CDC)

Department of Housing & Urban Development

Community Development Block Grant

HOME Investment Partnerships Program

Department of the Interior

U.S. Geological Survey

U.S. Fish & Wildlife Service

Bureau of Land Management

Bureau of Indian Affairs

Environmental Protection Agency

Department of Transportation

Federal Highway Administration

Federal Aviation Administration

National Trust for Historic Preservation

Additional Mitigation Grant Resources

Information about other grant programs may be found in these sources:

- FEMA Disaster Assistance: A Guide to Recovery Programs

Chapter 3. Risk Assessment

3.1 Requirements

> Section 201.6(c)(2) of the mitigation planning regulation requires local jurisdictions to provide sufficient hazard and risk information from which to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards. (FEMA 386-8)

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

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

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

Table 7. Risk Assessment - Federal Requirements

Section §201.6(c)(2) Requirement	Where requirement is addressed in Shaktoolik Multi-Hazard Mitigation Plan
Identifying Hazards §201.6(c)(2)(i) The risk assessment *shall* include a description of the type . . . of all natural hazards that can affect the jurisdiction . . .	Chapter 3, Section 4 identifies flood/erosion, Chapter 3, Section 5 identifies severe weather, Chapter 3, Section 6 identifies wildland fire, and Chapter 3, Section 7 identifies earthquake as the natural hazards with the potential to be present in Shaktoolik. Chapter 8 discusses climate impacts, and Chapter 9 discusses all potential natural hazards not included in this plan and the rationale for not including them.

Section §201.6(c)(2) Requirement	Where requirement is addressed in Shaktoolik Multi-Hazard Mitigation Plan
Profiling Hazards §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.	Chapter 3, Sections 4-9 includes hazard-specific sections of the Shaktoolik MJHMP profile and describes how the natural hazards have the potential to may affect the community. The Plan includes **location, extent, impact** and **probability** for each natural hazard identified. The MJHMP also provides hazard specific information on **previous occurrences** of hazards events.
Assessing Vulnerability: Overview §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.	Chapter 3, Section 1 contain overall summaries of each hazard and its impacts on the community. Summaries are contained in hazard-specific sections in Chapter 3. City of Shaktoolik and Shaktoolik Tribal Council's risks do not vary.
Assessing Vulnerability: Addressing Repetitive Loss Properties §201.6(c)(2)(ii) The risk assessment in all plans approved after October 1, 2008 must also address NFIP-insured structures that have been repetitively damaged in floods.	Shaktoolik does not participate in the NFIP. Chapter 3, Section 4 Flood/Erosion explains this requirement in more detail.
Assessing Vulnerability: Identifying Structures §201.6(c)(2)(ii)(A) The plan *should* describe vulnerability in terms of the types and number of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.	Chapter 3, Section 2, Table 13 lists structures, infrastructure, and critical facilities located in the identified hazard areas.

Section §201.6(c)(2) Requirement	Where requirement is addressed in Shaktoolik Multi-Hazard Mitigation Plan
Assessing Vulnerability: Estimating Potential Losses §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.	Chapter 3, Section 2, Table 14 estimates potential dollar losses to municipal-owned and tribal-owned facilities that are known. Most values are unknown.
Assessing Vulnerability: Land Uses and Development Trends §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.	Chapter 3, pages 38 and 39 contain this information.

3.2 Vulnerability Assessment Methodology

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

Critical facilities are described in the Community Profile Section (Chapter 2) of this hazard plan. A vulnerability matrix table of critical facilities as affected by each hazard is provided in Table 13.

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

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

The following assessment includes the following nine sections:

Section 1. Identifying Hazards

Section 2. Assessing Vulnerability: Overview and Potential Losses

Section 3. Risk Analysis

Section 4. Flood/Erosion

Section 5. Severe Weather

Section 6. Wildland Fire

Section 7. Earthquake

Section 8. Climate Change

Section 9. Hazards Not Profiled in the 2015 Shaktoolik MJHMP

The description of each of the identified hazards includes a narrative and in some cases a map of the following information:

The **location** or geographical areas in the community that would be affected.

The location of identified hazards is described by a map wherever appropriate or in some cases with a narrative statement.

The **extent** (i.e. magnitude or severity) of potential hazard events is determined.

The following table is used to rank the extent of each hazard. Sources of information to determine the extent include the *Alaska All-Hazard Risk Mitigation Plan,* historical or previous occurrences, and information from the location of the hazard.

Table 8. Extent of Hazard Ranking

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

The **impact** of the hazard or its potential effects on the community is described.

The **probability** of the likelihood that the hazard event would occur in an area.

The following table, taken from the *Alaska All-Hazard Risk Mitigation Plan*, categorizes the probability of a hazard occurring. Sources of information to determine the probability include the *Alaska All-Hazard Risk Mitigation Plan*, historical or previous occurrences, and information from the location of the hazard.

Table 9. Probability Criteria Table

Probability	Criteria Used to Determine Probability
4 - High	□ Hazard is present with a high probability of occurrence within the calendar year. □ Event has up to 1 in 1 year chance of occurring (1/1 = 100 percent). □ Probability is greater than 33 percent per year. □ Event is Highly Likely.
3 - Likely	□ Hazard is present with a moderate probability of occurrence with the next three years. □ Event has up to 1 in 3 year's chance of occurring (1/3 = 33 percent). □ Probability is greater than 20 percent but less than or equal to 33 percent per year. □ Event is Likely.
2 - Plausible	□ Hazard is present with a probability of occurrence within the next five years. □ Event has up to 1 in 5 year's 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 is Plausible.

The **previous occurrences** of natural events are described for identified natural hazards. The information was obtained from the *Alaska All-Hazard Risk Mitigation Plan,* State Disaster Cost Index, City records, other state and federal agency reports, newspaper articles, web searches, etc.

Section 1. Identifying Hazards

This section identifies and describes the hazards likely to affect Shaktoolik. The community used the following sources to identify the hazards present in the community: the *Alaska All-Hazard Risk Mitigation Plan*, interviews with experts and long-time residents, and previous occurrences of events.

Table 10 is taken from the *Alaska All-Hazard Risk Mitigation Plan* of October 2013. Data for Table 11, the Previous Occurrences Matrix, comes from the DHS&EM Disaster Cost Index, including data from 1978 to the 2007 and major events such as the 1964 earthquake. It may not include events known to the community or from other sources discussed in the sections describing specific hazards. This table refers to the Bering Strait REAA, a relatively large area, so not all hazards listed as being present necessarily affect Shaktoolik. For example, while ground failure is listed as present, it does not occur within Shaktoolik where the relatively flat terrain is not conducive to this hazard.

Table 10. Hazard Matrix

Hazard Matrix – Bering Strait REAA				
Flood	**Wildland Fire**	**Earthquake**	**Volcano**	**Avalanche**
Y	Y	Y – M	N	Y – M
Severe Weather	**Ground Failure**	**Erosion**	**Tsunami & Seiche**	
Y – H	Y	Y	N	

Hazard Identification:

Y: Hazard is present in jurisdiction but probability unknown

Y-L: Hazard is present with a low probability of occurrence within the next ten years. Event has up to 1 in 10 year's chance of occurring.

Y-M: Hazard is present with a moderate probability of occurrence within the next three years. Event has up to 1 in 3 year's chance of occurring.

Y-H: Hazard is present with a high probability of occurrence within the next one year. Event has up to 1 in 1 year chance of occurring.

N: Hazard is not present

Source: Alaska All-Hazards Mitigation Plan, 2013, Alaska All-Hazard Risk Mitigation Plan, 2013 Matrices – Bering Strait Regional Educational Attendance Area (REAA)

Table 11. Previous Occurrences of Hazards 1978 to Present

Previous Occurrences – Bering Strait (REAA)				
Flood	**Wildland Fire**	**Earthquake**	**Volcano**	**Avalanche** 0
2 - L	3 - L	0	0	
Tsunami & Seiche	**Severe Weather**	**Ground Failure**	**Erosion**	
0	19 - L	0	1 - L	

Source: Alaska All-Hazard Risk Mitigation Plan, 2013

Identification of Natural Hazards Present in Shaktoolik

Based on consultation with the Alaska DHS&EM, Tables 11 and 12 from the *Alaska All-Hazard Risk Mitigation Plan*, Shaktoolik plans and reports, and interviews with Shaktoolik community members presented in the 2012 *Shaktoolik Planning Project Final Project Report,* the Shaktoolik Planning Committee identified the following hazards to be profiled.

Table 12. Hazards Identification and Decision to Profile

Hazard	Yes/No	Decision to Profile Hazard
Flood	Yes	Large western storms, resulting in wave run-up extending 30 feet in elevation, have forced the community of Shaktoolik to evacuate in the past.
Erosion	Yes	Designated as a hazard due to extensive history of erosion.
Earthquake	Yes	Designated as a hazard in Alaska *All-Hazard Risk Mitigation Plan*. Community members remember feeling the 1964 Earthquake. However, no earthquakes have been felt since 1964.
Volcano	No	Designated as not a hazard in *Alaska All-Hazard Risk Mitigation Plan*.
Avalanche	No	Shaktoolik's topography is not one likely to produce avalanches, and though it is listed as a hazard present in the Bering Strait REAA, no instances of avalanches has been observed in Shaktoolik.

Hazard	Yes/No	Decision to Profile Hazard
Tsunami & Seiche	No	Village elders have talked about a tsunami occurring approximately 100 years ago. The location of the village has changed since then. The bathymetry and shallow depth of Norton Sound protect the village from a tsunami hazard.
Severe Weather	Yes	Designated as a hazard due to extensive history of previous severe weather events.
Ground Failure	No	The terrain in Shaktoolik is not one likely to produce ground failure and though it is listed as a hazard present in the Bering Strait REAA, no instances of ground failure have been observed in Shaktoolik.
Wildland Fire	Yes	Shaktoolik is located in a region where wildland fire is present but at an unknown probability.
Climate Change	Yes	The community is experiencing an increase in severity and frequency of severe weather.

See Section 9, Hazards not present in Shaktoolik, for more information on the hazards not present in the community. Each hazard that is present in the community is profiled in hazard-specific sections.

Section 2. Assessing Vulnerability

Overview

The vulnerability overview section is a summary of Shaktoolik's vulnerability to the hazards identified in Table 12. The summary includes type of hazard, the types of structures, infrastructures, and critical facilities affected by the hazards. Some hazards are area wide in scope while others impact certain areas of the community to a greater or lesser extent.

Identification of Assets

Because Shaktoolik is a small community of 251 residents, every structure is essential to the sustainability and survivability of Shaktoolik residents. The Hazard Vulnerability Matrix in Table 13 includes a list of facilities, utilities and businesses in Shaktoolik, and whether, based on its location, each has a low, moderate, or high vulnerability to specific natural hazards.

Table 13. City of Shaktoolik Asset Matrix – Structures and Infrastructure

Structure	Flood/ Erosion	Earthquake	Severe Weather	Wildland Fire
Clinic	M	L	H	M
Washeteria & Water Treatment Plant	M	L	H	M
Water Tank	M	L	H	M
City Building	L	L	H	M
Post Office	L	L	H	M
Teen Center & Store	L	L	H	M
Shaktoolik School	H	L	H	M
Head Start	H	L	H	M
School Shop	H	L	H	M
School Generator	M	L	H	M
AVEC Tank Farm	H	L	H	M
AVEC Power Plant	H	L	H	M
Armory	H	L	H	M
Corp. Office Store & Housing	H	L	H	M
SNC Fuel Station	H	L	H	M
SNC, City, IRA & BSSD Tank Farm	H	L	H	M
GCI Antenna Site (aka Grand Central Station)	M	L	H	M
Inupiat Assembly	M	L	H	M
Alascom Building	L	L	H	M
Church Parsonage	M	L	H	M

Structure	Flood/ Erosion	Earthquake	Severe Weather	Wildland Fire
Covenant Church	M	L	H	M
Runway	M	L	H	M
New Dump	L	L	H	M
BSSD Tanks Close to School	H	L	H	M
Duplex for School Housing	H	L	H	M
Principal's Home	H	L	H	M
Fisheries Support Building	H	L	H	M
AVEC Wind Turbines	L	L	H	M

Table 14 lists the critical facilities in the community, their owners, and type of construction. Few replacement values were currently available. No information for Shaktoolik is contained in HAZUS.

Table 14. City-owned Critical Facilities with Replacement Value

Structure	Owner (City or Tribe, etc.)	Construction type	Year Built	Sq Ft	Building Value ($)	Contents Value ($)
Clinic	Tribe	Stick-built	05/2003	1,800	$150,000	$100,000
Washeteria & Water Treatment Plant	City	Stick built	c. 1984	1800		$200,000
Water Tank	City	Steel weld Construction	c. 1984			
City Building	City	Stick built	c. 1980	1500		
Post Office	City lease			Approx. 200		
Teen Center & Store	City	Stick built	1982	1800		
Shaktoolik School	Bering Straits School District	Concrete foundation/wood steel upper	1982			
Head Start	Kawerak Inc.	Modular trailer court, steel/wood	c. 1975	1800		
School Shop	BSSD	Within school 1000 sq ft	1982	1000		
School Generator	BSSD	Concrete wood	1982	Approx. 800		
AVEC Tank Farm	AVEC	Welded steel	c. 1972			
AVEC Power Plant	AVEC	Steel/wood	c. 1972			

Structure	Owner (City or Tribe, etc.)	Construction type	Year Built	Sq Ft	Building Value ($)	Contents Value ($)
Armory	AK National Guard	Wood steel		Approx. 1500		
Corp. Office Store & Housing	Shaktoolik Native Corp	wood	c. 1980	Approx. 2800		
SNC Fuel Station	Shaktoolik Native Corp	Steel const	c. 1972	Approx. 700		
SNC, City, IRA & BSSD Tank Farm	Corp	Steel Const	c. 1972		$500,000	
GCI Antenna Site	GCI	steel				
Inupiat Assembly	Private - w/parsonage	wood	1984	2200 sq ft combined		
Alascom Building	AT&T	wood				
Church Parsonage	Covenant church w/ parsonage	Wood separate buildings	c. 1980	2400 combined / church / concrete basement		
Covenant Church	private	Concrete /wood	c. 1980			
Cemetery						

The community of Shaktoolik has several current planned projects:

The Shaktoolik Clinic – The Native Village of Shaktoolik received their construction documentation for project management; civil engineering; structural engineering; mechanical engineering; and electrical engineering services for the Shaktoolik Health Clinic. The construction cost estimate for the Shaktoolik Health Clinic expansion with contingency and escalation is $2,350,898. The preliminary funding plan is currently (2015) being developed for specific tasks and advancing the project through construction, occupancy, and post-occupancy operations and maintenance of the facility.

The Shaktoolik Community Shelter Center – The Native Village of Shaktoolik IRA Council contracted with USKH Inc. to provide planning services for a new Community Shelter Center. In December 2012, the Tribe received the final report from USKH. The facility is conceived as a community resource with functions related to both emergency and non-emergency use. The estimated cost for the facility is in the range of $10,000,000, based on 2013 construction dollars. A preliminary implementation plan has been developed which outlines specific tasks for funding and advancing the project through design, construction, occupancy, and post-occupancy operations and maintenance.

Power Plant Relocation – AVEC is planning jointly with the City to relocate the power plant to the old Airport on the on/off loading ramp near the old building. The AVEC tank farm will also likely be relocated to the old airport.

Washeteria Upgrade

Storage Addition Under Warehouse

Section 3. Risk Assessment Summaries

The planning team used the State's Critical Facility Inventory to identify critical facility locations in relation to a potential hazard's threat exposure and vulnerability (Table 15). No locally obtained GPS coordinate data was available for Shaktoolik. Also, no cost information was available with the exception of a total expected damages estimate from the 2009 USACE Baseline Erosion Report. The data was used to model an exposure assessment for each hazard where applicable.

Table 15. Critical Infrastructure in Alaska

Fire Stations	Airports	Community Cemeteries
Police Stations	Schools	Community Stores
Emergency Operations Centers	Telecommunications Structures & Facilities	Service Maintenance Facilities
Hospitals, Clinics, & Assisted Living Facilities	Satellite Facilities	Critical Bridges
Water & Waste Water Treatment Facilities	Community Washeterias	Radio Transmission Facilities
Fuel Storage Facilities	Harbors / Docks / Ports	Reservoirs & Water Supply Lines
Community Halls & Civic Centers	Landfills & Incinerators	National Guard Facilities
	Power Generation Facilities	Community Freezer Facilities
	Oil & Gas Pipeline Structures & Facilities	
	Any Designated Emergency Shelter	

Source: State of Alaska Hazard Mitigation Plan, 2013

Replacement structure and contents value estimates are not known. A limited exposure analysis was conducted for each physical asset located within a hazard area with the available data. 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 casualty estimates were prepared.

The vulnerability estimates provided herein use the best data currently available, and are designed to approximate risk. Results are limited to the exposure of the built environment. It is beyond the scope of this MJHMP to estimate the range of injuries.

This analysis is an assessment of the community's risk to hazards without consideration of probability or level of damage.

Tables 16 and 17 list the infrastructure hazard vulnerability for Shaktoolik.

Table 16. Vulnerability Overview for City of Shaktoolik

Hazard	Percent of Shaktoolik's Geographic area	Percent of Population	Percent of Building Stock	Percent of Community Facilities and Utilities
Flood/Erosion	**100%**	**100%**	**100%**	**100%**
Earthquake	**100%**	**100%**	**100%**	**100%**
Severe Weather	**100%**	**100%**	**100%**	**100%**
Wildland Fire	**100%**	**100%**	**100%**	**100%**
Climate Change	**100%**	**100%**	**100%**	**100%**

Table 17. Vulnerability Overview for Native Village of Shaktoolik

Hazard	Percent of Shaktoolik's Geographic area	Percent of Population	Percent of Building Stock	Percent of Community Facilities and Utilities
Flood/Erosion	**100%**	**100%**	**100%**	**100%**
Earthquake	**100%**	**100%**	**100%**	**100%**
Severe Weather	**100%**	**100%**	**100%**	**100%**
Wildland Fire	**100%**	**100%**	**100%**	**100%**
Climate Change	**100%**	**100%**	**100%**	**100%**

Asset Inventory

Tables 13 and 14 identify critical infrastructure in Shaktoolik.

Potential Dollar Losses to Vulnerable Structures

Replacement values are not known. However, total erosion damages in Shaktoolik over the 50-year period of analysis were estimated in the 2009 USACE Baseline Erosion Report period of analysis and are $23.1 million with a net present value of $7.4 million and an average annual value of $387,400. A federal fiscal year 2009 discount rate of 4 5/8 percent was used, and Table 18 summarizes the expected damages by category.

Table 18. Total Erosion Damages

Damage Category	Quantity	Time Span (Years)			Total Value (50 years)	Net Present Value ($)	Average Annual Value ($)
		0-10	11-30	31-50			
Land (acres)	44.84	$97,000	$176,000	$176,000	$448,000	$179,000	9,200
Residential	18	2,000	421,000	3,343,000	3,766,000	673,000	34,700
Commercial	4	521,000	--	695,000	1,216,000	450,000	23,300
Public Buildings	4	--	4,191,000	616,000	4,807,000	1,234,000	63,700
Infrastructure	--	1,212,000	5,716,000	3,633,000	10,561,000	3,583,000	185,000
Environmental	--	1,495,000	--	823,000	2,318,000	1,326,000	68,500
Total Damages	**--**	**3,327,000**	**10,504,000**	**9,286,000**	**23,117,000**	**7,445,000**	**384,400**

Notes:

1. Shaktoolik is losing approximately 38,300 square feet of land per year (0.88 acre). It is expected that 44.84 acres will be lost over the 50-year analysis period. Land is valued at approximately $10,000 per acre.
2. Expected residential damages in the Baseline Erosion Report included 18 residences. The USACE estimated buildings via a flyover. There is a discrepancy the 18 residential homes in the table and the number of homes (70) identified in the 2010 U.S. Census. This table provides a general order of magnitude estimate for dollar losses.
3. Three commercial buildings are estimated to be subject to damages including two tank farms and a retail store. The classification of these structures is based on on-site analysis and aerial photographs. The USACE likely understates the commercial damages.
4. Four public buildings were identified in Shaktoolik including the school and various outbuildings.
5. Infrastructure that lies within the 50-year erosion profile includes: approximately 5,000 feet of roads, 1,400 feet of sewer lines, 275,000 gallons of bulk fuel tank storage, 848,000 gallons of water storage, and 10,000 feet of water lines due to compromising the fresh water source. The power plant is expected to be lost in the 30 to 50-year timeframe, but the corresponding fuel tank farm could be lost up to 10 years earlier than the plant itself.
6. Environmental concerns include damage to two fuel farms, sewage spillage, and loss of the village's fresh water source.

Note from 17 June 2015 Public Meeting: Former mayor believes FEMA estimated 144,000 acres near the old runway area will need to be replaced other than the 44.84 acres identified by the USACE. Reference could not be determined.

Risk Assessment Summaries

Flood Erosion

The total elevation gain in the Shaktoolik vicinity is no more than 14 feet above the riverbank and the ocean. Therefore, the entire population of Shaktoolik, residential structures and community facilities are vulnerable to floods. This includes 251 people in 70 residences valued at a ballpark value of $23.1 million based on the Total Erosion Damages estimated in the 2009 USACE Baseline Erosion Report.

Severe Weather

The entire population of Shaktoolik, residential structures, and community facilities are vulnerable to severe weather. This includes 251 people in 70 residences valued at valued at a ballpark value of $23.1 million based on the Total Erosion Damages estimated in the 2009 USACE Baseline Erosion Report.

Wildland Fire

Although the probability is low, the entire population of Shaktoolik, residential structures, and community facilities are vulnerable to wildland fires. This includes 251 people in 70 residences valued at valued at a ballpark value of $23.1 million based on the Total Erosion Damages estimated in the 2009 USACE Baseline Erosion Report.

Earthquake

The City of Shaktoolik and surrounding area may experience mild to significant earthquake ground movement sufficient to damage infrastructure. Although all structures are exposed to earthquakes, buildings constructed of wood exhibit more flexibility than those composed of unreinforced masonry.

Given its location, it is unlikely that an earthquake would be centered in an area around Shaktoolik. However, the entire population, residential structures, and critical facilities are vulnerable to an earthquake. For Shaktoolik, all 251 people in 70 residences valued at valued at a ballpark value of $23.1 million based on the Total Erosion Damages estimated in the 2009 USACE Baseline Erosion Report.

Climate Change

The entire population of Shaktoolik, residential structures, and community facilities are vulnerable to climate change. This includes 251 people in 70 residences valued at valued at a ballpark value of $23.1 million based on the Total Erosion Damages estimated in the 2009 USACE Baseline Erosion Report.

NFIP and Repetitive Loss Properties

The community of Shaktoolik does not participate in the NFIP.

Land Use and Development Trends

Shaktoolik applied for a Federal townsite in 1962 and was incorporated as a second class city in 1969. During the early 1970s, Shaktoolik experienced major changes in landownership. The Alaska Native Claims Settlement Act of 1971 created major economic changes throughout Alaska. During that time, the Shaktoolik Native Corporation was formed and subsequently received a land entitlement of 115,200 and is now the major landowner in Shaktoolik.

The village of Shaktoolik is located on the eastern shore of the Norton Sound and is situated on a gravel and sand spit separated by the Tagoomenik River and the Bering Sea. The ground underlying the current site is free of permafrost, a good gravel base for water & sewer improvements, a sound base for road construction, and solid ground for construction projects. The immediate “foot-print” of Shaktoolik’s landscape is bare of timber, while vegetation mainly consists of tundra covered with willows and beach rye. Marshy areas with lakes and ponds extend to the foot of the hill approximately 12 miles to the east of the community. The timbered areas begin about two miles from the mouth of the Shaktoolik River,

with strands of spruce trees and other deciduous trees and willows extending up to a mile from each bank of the river.

The existing land use patterns in Shaktoolik are influenced by a number of factors including past tenure of individual use and occupancy. The City of Shaktoolik has site control over several lots in town to house their city offices, teen center, and other public facilities. The State of Alaska Department of Transportation and Public Facilities leases land for the current airport while the State of Alaska Department of Education has a lease for the school property. Other public lands are currently being conveyed to the City of Shaktoolik pursuant to the terms of ANCSA Section 14 (c) 3 for community expansion purposes. This provision will have the greatest impact on present and future land use patterns. The location, types of improvements, designation of residential, commercial, public use, and potential future uses will be incorporated into the conveyance process. The location of the community between the Tagoomenik River and the Norton Sound leaves little room for expansion projects, and land use is predominantly residential with some commercial facilities.

The City of Shaktoolik does not have a formal zoning law enacted; however, in 2011, residents participated in a “subsistence use area map” which identifies designated hunting, fishing, and subsistence use areas. The map further identifies archeological sites, native allotments, summer and winter recreation areas, and potential development areas. Hunting is not permitted within the City limits; however, residents can protect life and property when wild game enters the village.

Section 4. Floods and Erosion

The following flood/erosion hazard profile includes a description of the hazard, the location, extent and probability of the hazard, and previous occurrences of flooding/erosion in Shaktoolik. Climate change, current mitigation projects, and flood and erosion mitigation goals and projects are also included.

Hazard Description

The primary flooding and erosion hazard in the Shaktoolik is storm surge flooding. Shaktoolik is located on the coast, and is therefore, susceptible to significant storm surge flooding. The effects of climate change are expected to add to natural hazards including flooding in coastal areas. As sea level rises and the offshore ice pack retreats, more coastal flooding can be expected.

Storm surge: 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.

Coastal erosion: Coastal erosion is the wearing away of coastal land. It is commonly used to describe the horizontal retreat of the shoreline along the ocean, or the vertical down cutting along the shores of the Great Lakes. Erosion is considered a function of larger processes of shoreline change, which includes erosion and accretion. Erosion results when more sediment is lost along a particular shoreline than is redeposited by the water body. Accretion results when more sediment is deposited along a particular shoreline than is lost. When these two processes are balanced, the shoreline is said to be stable. In assessing the erosion hazard, it is important to realize that there is a temporal, or time aspect associated with the average rate at which a shoreline is either eroding or accreting. Over a long-term period (years), a shoreline is considered to be eroding, accreting, or stable. A hazard evaluation should focus on the long-term erosion situation. However, in the short-term, it is important to understand that storms can erode a shoreline that is, over the long-term, classified as accreting, and vice versa.

Erosion is measured as a rate, with respect to either a linear retreat (i.e., feet of shoreline recession per year) or volumetric loss (i.e., cubic yards of eroded sediment per linear foot of shoreline frontage per

year). Erosion rates are not uniform, and vary over time at any single location. Annual variations are the result of seasonal changes in wave action and water levels.

Erosion is caused by coastal storms and flood events; changes in the geometry of tidal inlets, river outlets, and bay entrances; man-made structures and human activities such as shore protection structures and dredging; long-term erosion; and local scour around buildings and other structures. Further information on coastal erosion can be found in FEMA-55, Coastal Construction Manual, FEMA's Multi-hazard Identification and Risk Assessment, Evaluation of Erosion Hazards published by The Heinz Center, and Coastal Erosion Mapping and Management, a special edition of the Journal of Coastal Research. (FEMA, 386-2)

Location

Shaktoolik faces erosive forces from both the Tagoomenik River and Norton Sound. The Tagoomenik and Shaktoolik Rivers converge in a tidal lagoon two miles northwest of the community at the end of the sand spit. The entire community is located within the 100-year flood plain (USACE, 2011). The entire community is vulnerable to erosion and flooding when fall storms hit the sand and gravel spit on which Shaktoolik is located. There is no breakwater to protect the community from destructive waves. In severe storms, the community becomes an island. The beach has historically been susceptible to damage and erosion from storm conditions, tidal surges, and from the sea ice conditions.

Logs that float down the river change from being protective to becoming destructive during storm surges. Several areas along the coastline used by the community are vulnerable to erosion and flooding during the storm season.

The highest ground in the community is 24.7 feet above mean lower low water (MLLW) (USACE, 2011). The elevation drops to 14 feet above MLLW on the river side of the community (Kinney, 2008). The homes and other buildings are located in two rows, one on either side of a single gravel road that runs through the village. The road extends north to the airport and several miles south past the former townsite (Terry Johnson, Alaska Sea Grant Program & Glenn Gray, Glenn Gray and Associates, 2014).

Certain areas have been identified as particularly susceptible to flooding. These are shown on the Area Use Map in Appendix B, page 84.

Extent

Shaktoolik has no floodplain mapping; however, best available data and flood damage suggests the entire community is located in the floodplain. The extent (i.e. magnitude or severity) of the flood/erosion hazard is measured in this plan by using historical past events and the *Alaska All-Hazard Risk Mitigation Plan*. Based on these factors and using the criteria established in Table 8, the City of Shaktoolik has a **critical** extent of flooding not due to tsunami.

In 2008, the Immediate Action Workgroup of the Alaska Governor's Subcabinet on Climate Change identified Shaktoolik as one of six Alaska communities facing imminent threats to loss of life and infrastructure from flooding and erosion. In 2009, the Government Accounting Office identified Shaktoolik as one of four Alaska villages with the highest priority for relocation. Also in 2009, the U.S. Army Corps of Engineers listed Shaktoolik as a priority action community in its Alaska Baseline Erosion

Assessment Study (Glenn Gray and Associates in Association with Kawarek, Inc. and McKnight and Associates, 2012).

Impact

Natural barriers have eroded substantially. Risk includes isolation of the community if a narrow spit that connects Shaktoolik to the mainland becomes eroded, which also would cut the community off from its source of fresh water. The United States Army Corps of Engineers completed the Shaktoolik Coastal Flooding Analysis in October 2011 of flooding risks to the community from Norton Sound and the Tagoomenik River. That analysis predicted grave consequences to the community from extreme storms. For example, it predicted that a 50-year storm would inundate the community 1-3 feet, while a 100-year storm would overtop the community 4.6 feet. With the addition of waves, buildings in the community would be flooded between 2.9 and 7.4 feet above the finished floor elevations, depending on the elevation of the building. The Corps recommened additional investigations be completed to address safety issues, including design analysis of structural flood control measures (e.g., a revetment for wave protection or relocation of structures, etc. Additionally, while the actual area subject to flooding is limited, the impact of the flooding could affect the entire community; even those properties unaffected directly, will suffer due to road closures, impacts to public safety (access and response capabilities), limited availability of perishable commodities, and isolation. The greatest potential impact would be the loss of fresh water if the narrow spit that connects Shaktoolik to the mainland becomes eroded, cutting the community off from its fresh water source. Damage is expected before 2019 (USACE, 2009).

As a result of flooding and erosion, village officials have considered relocating, indentifying the Foothills area approximately 14 miles east of the present location as a potential site. The community has decided to pursue a "stay and defend" approach for the near term. Rather than plan to relocate the community, village leaders have decided to pursue all practical options that will allow residents to remain at the current location for as long as possible.

USAEC *Continuing Authorities Project Fact Sheet (Preliminary)*, dated October 1, 2009 states: "Lacking any action to protect the community from erosion, Shaktoolik is expected to experience a 1- to 2-foot shoreline retreat each year under current climate conditions. Total erosion damages in Shaktoolik over a 15-year period of analysis are estimated to be $7.8 million with a net present value of $6.0 million and an average annual value of $583,400." The 2011 study estimated the erosion rate at 1.5 feet per year.

In 2013, coastal engineers evaluated the Tagoomenik River at the narrowest part of the spit near the former community site and determined that there was no immediate threat from riverine erosion. It was estimated that the threat from a breach through the spit from the ocean side to the river at the water source is not imminent and that it would likely be at least 10 years before the beach on Norton Sound would erode through to the river (Terry Johnson, Alaska Sea Grant Program & Glenn Gray, Glenn Gray and Associates, 2014).

In 2014, Shaktoolik received over one million dollars from FEMA for repairs to leach fields and beach access. Using $620,000 in consolidated regional funding, a five-foot high berm of local gravel over

driftwood was built and topped by sod for vegetative cover on the seaward side of the village. The IRA is considering building an evacuation mound in the future once a funding source has been identified.

Probability

Based on the *Alaska All-Hazard Risk Mitigation Plan*, the 2009 and 2011 USACE studies, City records and past historical events, Shaktoolik has a **high** probability of flooding and erosion. Table 9 defines criteria used for determining high probability, as the hazard is present with a high probability of occurrence within the calendar year. Event has up to 1 in 1 year chance of occurring.

The *Alaska All-Hazard Risk Mitigation Plan* lists Shaktoolik as having a flood hazard present with an unknown probability.

Current Mitigation Projects

A reconnaissance study for an evacuation road was completed in 2009 ($33.4 million for a 14.6 mile road). Development of an evacuation shelter within the existing community is also being considered as a cost effective and near-term action (USACE, 2009).

The Alaska Community Coastal Protection Project is now underway and is being carried out by the Alaska DCCED DCRA DCRA through a grant from the Alaska Coastal Impact Assistance Program. This project, and the Alaska Coastal Impact Assistance Program, are funded with qualified outer continental shelf oil and gas revenues by the Coastal Impact Assistance Program, U.S. Fish and Wildlife Service, and the U.S. Department of the Interior. The Alaska Community Coastal Protection Project focuses on three of the most imminently threatened villages in Western Alaska: the communities of Kivalina, Shaktoolik, and Shishmaref. The objective of the project is to increase community resilience and sustainability to the impacts of natural hazards threatening these communities while protecting the natural coastal environment. The project is based on the premise that careful planning, agency collaboration, and strong community leadership are essential to successfully addressing the needs of imperiled communities.

Shaktoolik has decided to stay and “defend in place’ for as long as it can. An adaptation plan was adopted in 2014 with support from the Alaska Sea Grant Marine Advisory Program. The decision to fend off the ocean could cost less than $1 million for the basics: a pair of bioengineered defense structures that would provide a refuge and temper ocean waves. One approach laid out in the new plan calls for building a storm-surge mound from sand and gravel extracted from the beach, creating a man-made hill perhaps 15 feet tall that would become the highest ground in town. The mound would be large enough to protect everyone and could be seeded with plants and armored with large rocks to provide additional stability. Set back as far from the ocean as possible, it would offer safety if houses are swamped and floodwaters isolate the spit from the mainland and higher ground. The next part of the approach is to build an evacuation shelter atop the mound. One estimate pegs the facility’s cost at $10 million, but Shaktoolik is looking for ways to reduce that price according to the Adaptation Plan. Also, instead of a costly breakwater used to protect larger coastal communities, the plan suggests building a berm along the beach up to five feet high, using gravel, dirt, and native beach grass. The long berm would run alongside and stabilize the tangled piles of driftwood deposited by past storms and would be a makeshift wave barrier. The City of Shaktoolik built a 300-foot demonstration berm in front of the

community as a mitigation project in 2014 and is working to monitor storm surge levels. The berm is located between the village and the beach and is composed largely of naturally deposited driftwood logs. The City of Shaktoolik is continuing the "first-bend" (i.e., area of the Tagoomenik River locally known as “first bend”) mitigation project in Summer 2015.

Previous Occurrences

Shaktoolik was declared a State flood disaster area in 2004, 2005, 2009, 2011, and 2013. FEMA declared a Federal flood disaster in 2014.

05-211 2004 Bering Strait Sea Storm declared October 28, 2004 by Governor Murkowski then FEMA declared (DR-1571) on November 15, 2004. Amended declaration to extend incident to October 24, 2004: Between October 18 and 20, 2004, a severe winter storm with strong winds and extreme tidal surges occurred along the Western Alaska coastline, which resulted in severe damage and threat to life and property, specifically in the **Bering Strait Regional Educational Attendance Area (REAA)**, including Elim, Nome, Koyuk, **Shaktoolik**, Unalakleet, and other communities; in the Northwest Arctic Borough, including Kivalina, Kotzebue, and other communities; and in the City of Mekoryuk; with potentially unidentified damages in adjacent areas, and additional storm surges likely from continuing weather patterns in this area Alaska. Conditions that exist in the coastal communities of the Northwest Arctic Borough as a result of this disaster: severe damage to roadways, power distribution systems, and drain fields. Conditions that exist in the coastal communities of the Bering Strait REAA as a result of this disaster: severe damage to gabions (used to protect shoreline), major damage to coastal highways and roads, damage to water and septic systems, damage to a bridge, damage to power distribution systems, damage to fuel storage tanks, fuel spills, and property damage. Conditions that exist in the City of Mekoryuk as a result of this disaster: major damage to sea wall and damage to roadways. On November 16, 2004, the declaration was amended to reflect a more accurate timeframe of the disaster. The City of St. George appealed the denial of funding decision for the breakwater. The appeal was granted, which increased the original estimate for total funding of this disaster by more than $3 million. The dates of the severe storm were changed to October 18 through October 24, 2004. Individual assistance totaled $1 million for 271 applicants. Public Assistance total $13 million for 60 potential applicants. Hazard Mitigation totaled $800,000. The total for this disaster is $17 million.

06-215 2005 West Coast Storm declared October 24, 2005 by Governor Murkowski then FEMA declared (DR-1618) on December 9, 2005: Beginning on September 22, 2005 and continuing through September 26, 2005, a powerful fall sea storm produced high winds combined with wind-driven tidal surges resulting in severe and widespread coastal flooding and a threat to life and property in the Northwest Arctic Borough, and **numerous communities within the Bering Strait** (REAA 7), the Kashunamiut (REAA 55), the Lower Yukon (REAA 32) and the Lower Kuskokwim (REAA 31) Rural Education Attendance Areas including the cities of Nome, Kivalina, Unalakleet, Golovin, Tununak, Hooper Bay, Chevak, Mekoryuk and Napakiak. The following conditions existed as a result of this disaster: sever damage to personal residences requiring evacuation and sheltering of the residents; to businesses; to drinking water systems, electrical distribution systems, local road systems, airports, seawalls, and other public infrastructure; and to individual personal and real property; necessitating emergency protective measures and temporary and permanent repairs. On October 25, 2005, a request

for a federal time extension was submitted. On December 9, 2005 a presidential disaster was declared (DR-1618) for Public Assistance for the Northwest Arctic Boro, Bering Strait REAA, Kashunamiut REAA (Chevak) and the Lower Kuskokwim REAA however, they failed to include the Lower Yukon REAA in the federal declaration. The State will write Project Worksheets for the Lower Yukon REAA under or State Public Assistance Declaration. Individual Assistance total is estimated at $209K, with 220 applicants. Public Assistance is around $3.63 million for 16 potential applicants. Hazard Mitigation total is $254,000. The total cost for disaster is estimated at $5.33 million.

09-227, 2009 Spring Flood declared by Governor Palin on May 6, 2009 then FEMA declared under DR-1843 on June 11, 2009: Extensive widespread flooding due to snow melt and destructive river ice jams caused by rapid spring warming combined with excessive snow pack and river ice thickness beginning April 28, 2009 and continuing. The ice jams and resultant water backup along with flood waters from snow melt left a path of destruction along 3,000 miles of interior rivers, destroying the Native Village of Eagle and forcing the evacuation of multiple communities. The following jurisdictions and communities in Alaska have been impacted: Alaska Gateway Rural Regional Educational Attendance Area (REAA) including the City of Eagle and Village of Eagle; the Copper River REAA including the Village Community of Chisotchina; the Matanuska-Susitna Borough; the Yukon Flats REAA including the City Community of Circle, and City of Fort Yukon, the Villages Communities of Chalkyistik, Beaver, Stevens Village, and Rampart; the Yukon-Koyukuk REAA including the Cities of Tanana, Ruby, Galena, Koyukuk, Nulato, and Kaltag; the Iditarod Area REAA including the Cities of McGrath, Grayling, Anvik, and Holy Cross; the Northwest Arctic Borough including the Cities of Kobuk, and Buckland; the Lower Yukon REAA including the Cities of Russian Mission, Marshall, Saint Mary's, Mountain Village, Emmonak, Alakanuk and Pilot Station and the Community of Ohogamiut; the Lower Kuskokwim REAA including the Cities of Bethel, Kwethluk, Napakiak, Napaskiak, and the Village Community of Oscarville; the Yupiit REAA including the City of Akiak, and the Villages of Akiachak, and Tuluksak; the Kuspuk REAA including the Cities of Aniak, Upper Kalskag, Lower Kalskag, and the Villages Communities of Stony River, Sleetmute, Red Devil, Crooked Creek, and Napaimute; the Fairbanks North Star Borough including the City of North Pole and Community of Salcha; the **Bering Strait REAA** including the City of Nome area.

12-236, 2011 West Coast Storm declared by Governor Parnell on December 5, 2011 then FEMA declared December 22, 2011 (DR-4050): On November 7, 2011 the National Weather Service (NWS) issued the first of several coastal flood warnings for the western coastline of Alaska from Hooper Bay to the North Slope. The NWS warned of "*a rapidly intensifying storm…expected to be an extremely powerful and dangerous storm…one of the worst on record*." Over the next three days additional warnings in response to the 942 millibar low pressure system were issued for coastal villages as the storm moved northerly from the Aleutian Islands into the **Bering** and Chukchi **Seas**. The west coast was impacted with hurricane force winds exceeding 85 mph, high tidal ranges, and strong sea surges up to 10-ft above mean sea level (msl). Before the first storm had passed, a second equally-low pressure system (e.g., 942 millibar) impacted the western coastline from the Yukon-Kuskokwim Delta south to Bristol Bay. This combined weather extended the incident period for the state to November 13, 2011. The FEMA declaration was limited to the incident period from November 8 – 10, 2011.

13-S-244, 2013 November Storm Disaster declared by Governor Parnell on November 16, 2013 then FEMA declared January 23, 2014 (DR-4162). On November 5, 2013 the National Weather Service (NWS) issued the first of several coastal flood and winter storm warnings ranging from the central Aleutians to and including the western coastline of Alaska from Bristol Bay to the North Slope. In their published message the NWS warned of very strong low pressure system south of Shemya, moving to the central Bering and Chukchi Sea's bringing a combination of gale, high surf, high wind, freezing spray, coastal flooding and sea surge warnings and watches. The west coast was impacted with hurricane force winds exceeding 85 mph, high tidal ranges, and strong sea surges. The resultant impact culminated to, damage to public facilities including roads, seawalls, bridges, airports, and public buildings; damage to electrical distribution systems and drinking water systems; damages to private residences and the losses of personal and real property; and coastal flooding and power outages which necessitated evacuation and sheltering operations. Overall, the series of storms created a threat to life and property in 23 cities and villages in the **Bering Strait Regional Educational Attendance Area (REAA)**, Lower Yukon REAA, and Lower Kuskokwim REAA, and the Fairbanks North Star Borough.

The Alaska Department of Natural Resources Division of Geological & Geophysical Surveys conducted a rapid analysis of 2013 storm season change in Shaktoolik by combining their baseline measurement from 2011 with more recent satellite imagery. Maximum net retreat in the examined area was up to 5.4 +/- 1.6 m inland at some of the virtual transects. Erosion along the shoreline was most pronounced at the old village site and just south of the old airstrip. Heavy wave action and tidal surge from the storm eroded a 1.7 mile section of the old runway road. Although the dynamic, sandy portion of the beach exhibited short-term changes associated with a specific storm or season, the net retreat of the low, vegetated bluff observed in the 2013 storm season south of Shaktoolik was not a naturally reversible modification to the coast. Unlike the 2011 storm event, in which only a few logs were transported inland, wave runup in the 2013 storms significantly remobilized the Shaktoolik driftwood lines. The two most apparent changes in the distribution of the driftwood were a reduction in the total area covered by logs on the upper beach and the widespread deposition of logs on the upland part of the beach, onto the low bluffs.

As a result of efforts by NOAA in 2010, Shaktoolik now has a benchmark to reference mean lower low water. The DOT&PF installed a storm gauge in June 2013 and is considering implementing a grant it received for local monitoring of storm surges.

Climate Influence upon Storm Surge Flooding

The following is from the Alaska Chapter of the Climate Change Impacts in the United States: The Third National Climate Assessment, 2014:

> Arctic summer sea ice is receding faster than previously projected and is expected to virtually disappear before mid-century. This is altering marine ecosystems and leading to greater ship access, offshore development opportunity, and increased community vulnerability to coastal erosion. Arctic sea ice extent and thickness have declined substantially, especially in late summer, when there is now only about half as much sea ice as at the beginning of the satellite record in 1979. The seven Septembers with the lowest ice extent all occurred in the past seven years. There is new information that lack of sea ice causes storms to produce larger waves and more coastal erosion. An

additional contributing factor is that coastal bluffs that were "cemented" by permafrost are beginning to thaw in response to warmer air and ocean waters, and are therefore more vulnerable to erosion. Standard defensive adaptation strategies to protect coastal communities from erosion such as use of rock walls, sandbags, and riprap have been largely unsuccessful.

Community Participation in the NFIP

The City of Shaktoolik does not participate in the National Flood Insurance Program (NFIP), but may want to consider joining. The function of the NFIP is to provide flood insurance at a reasonable cost to homes and businesses located in floodplains. In trade, the City of Shaktoolik would agree to regulate new development and substantial improvement to existing structures in the floodplain, or to build safely above flood heights to reduce future damage to new construction. The program is based on mapping areas of flood risk, and requiring local implementation to reduce flood damage primarily through requiring the elevation of structures above the base (100-year) flood elevations. Table 19 describes the FIRM zones.

Table 19. FIRM Zones

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

Development permits for all new building construction, or substantial improvements, would be required by the City in all A, AO, AH, A-numbered Zones if Shaktoolik participated in the NFIP. Flood insurance purchase may be required in flood zones A, AO, AH, A-numbered zones as a condition of loan or grant assistance. An Elevation Certificate would be required as part of the development permit. The Elevation

Certificate is a form published by the Federal Emergency Management Agency required to be maintained by communities participating in the NFIP. According to the NFIP, local governments maintain records of elevations for all new construction, or substantial improvements, in floodplains and to keep the certificates on file.

Elevation Certificates are used to:

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

The entire community is located within the 100-year flood plain (USACE, 2011).

Table 20. Housing Stock

Housing Types	Number of Structures
Total Housing Units	70
Occupied Housing (Households)	64
Vacant Housing	6
Vacant Due to Seasonal Use	0
Households located in the flood plain	all

Table 21. Local and State Floodplain Coordinator Contact Information

Shaktoolik Floodplain Coordinator	City Contact Person – Vacant position Address Phone: Email:
State of AK Floodplain Coordinator	Floodplain Management Programs Coordinator Division of Community Advocacy Department of Commerce, Community & Economic Development Taunnie Boothby, State Floodplain Coordinator 550 W. 7th Avenue, Suite 1640 Anchorage, AK 99501 (907) 269-4567 (907) 269-4563 (fax) Email: taunnie_boothby@commerce.state.ak.us Web: http://www.commerce.state.ak.us/dca/nfip/nfip.htm

Repetitive Loss Properties

The risk assessment in all plans approved after October 1, 2008 must also address NFIP-insured structures that have been repetitively damaged in floods. Shaktoolik does not participate in the NFIP; this subsection is not applicable.

Flood and Erosion Mitigation Goals and Projects

Flood and Erosion Goals

Goal 1. Reduce or prevent future flood damage.

Support elevation, flood proofing, buyout or relocation of structures that are in danger of flooding or are located on eroding banks.

Consider the benefits and costs of joining the National Flood Insurance Program.

Goal 2. Increase public awareness.

Increase public knowledgeable about mitigation opportunities, floodplain functions, emergency service procedures, and potential hazards.

Flood and Erosion Projects

After receiving public input, it is the recommendation of this plan that the City and Tribe in Shaktoolik, along with other local, State and Federal entities look at the following projects for flood and erosion control.

See Table 24, Mitigation Project Plan for specific projects to mitigate flooding and erosion.

FLD-1. Structure Elevation and/or Relocation (Goal 1)

A list of homes, commercial structures, and critical facilities that are in danger of flooding and in erosion danger should be identified and mitigation projects for elevating and/or relocating the structures determined.

FLD-2. Investigate the Benefits of Joining the NFIP Program

Through the NFIP, property owners in participating communities are able to insure against flood losses. By employing wise floodplain management, a participating community can protect its citizens against much of the devastating financial loss resulting from flood disasters. Careful local management of development in the floodplains results in construction practices that can reduce flood losses and the high costs associated with flood disasters to all levels of government.

FLD-3. Shoreline Protection (Goal 1)

Protect critical infrastructure, including fuel tank farms, sewer lines and public buildings, through construction/installation of shoreline protection measures.

FLD-4. Water Source Protection (Goal 1)

Construction of the evacuation road and attendant shoreline erosion protection will serve to reinforce the narrow strip of land at First Bend, thus protecting the community's water source from saltwater intrusion.

If for some reason the evacuation road is not constructed, the water intake structure should be relocated to a site where breaching and saltwater contamination is not an imminent threat. This could entail piping water across the slough from an alternate fresh water river source or moving the water intake further up the Tagoomenik River to a point upriver from the potential breach site.

FLD-5. Clearly Mark Navigable Waterway for Evacuation (Goal 1, 2)

If floodwaters cover the southern portion of the spit of land where Shaktoolik is located, the community is cut off from overland evacuation. A clearly-marked, navigable waterway could be critical in the safe evacuation of residents, particularly in the dark.

FLD-6. Public Education (Goal 1, 2)

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

Youth should be trained in camping skills such as tent raising and camp cooking to reduce injury or loss of life in case of emergency evacuation.

Section 5. Severe Weather

Hazard Description

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

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

Weather issues in Shaktoolik include severe winds, winter storms, extreme cold, and dense fog.

Winter Storms

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

- Cold air - Subfreezing temperatures (below 32ºF, 0ºC) in the clouds and/or near the ground to make snow and/or ice.
- Moisture - The air must contain moisture in order to form clouds and precipitation.
- Lift - A mechanism to raise the moist air to form clouds and cause precipitation. Any or all of the following may provide lift:
    - The flow of air up a mountainside.
    - Fronts, where warm air collides with cold air and rises over the dome of cold air.
    - Upper-level low-pressure troughs.

Heavy Snow

Heavy snow, generally more than 12 inches of accumulation in less than 24 hours, can immobilize a community by bringing transportation to a halt. Until the snow can be removed, airports and major 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 villages. Injuries and deaths related to heavy snow usually occur as a result of vehicle accidents. Casualties also occur due to overexertion while shoveling snow and hypothermia caused by overexposure to the cold weather.

Extreme Cold

What is considered an excessively cold temperature varies according to the normal climate of a region. In areas unaccustomed to winter weather, near freezing temperatures are considered "extreme cold”. In

Alaska, extreme cold usually involves temperatures below -40 °F. Excessive cold may accompany winter storms, be left in their wake, or can occur without storm activity.

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

Extreme cold also interferes with a community's infrastructure. It causes fuel to congeal in storage tanks and supply lines, stopping electric generation. Without electricity, heaters do not work, causing water and sewer pipes to freeze or rupture. If extreme cold conditions are combined with low or no snow cover, the ground's frost depth can increase, disturbing buried pipes.

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

Ice Storms

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

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

Advection Fog

Advection fog is the result of condensation; occurring when warm moist air moves horizontally over a cold surface. Advection fog varies in depth from three feet to about 1,000 feet and is always found at ground level. This type of fog can reduce visibility to near zero (NOAA).

Unless equipped with an Instrumental Landing System, fog prevents aircraft from taking off or landing. Fog can be especially hazardous for light aircraft which often overfly the airfield to assess landing conditions.

The village of Shaktoolik is often impacted by fog during the spring; when sea ice cools, warm moist spring air creates a dense fog. Spring fog sometimes lasts a couple of day or even several weeks. The fog can prevent aircraft from landing and resupplying the village with food and other critical supplies.

Location

The hazards of severe weather impact Shaktoolik on an area-wide basis. A severe weather event would create an area-wide impact, could damage structures, and potentially isolate Shaktoolik from the rest of the state. Severe weather affecting regional transportation hubs (i.e. Nome and Unalakleet) also impacts Shaktoolik, grounding flights and preventing the transportation of critical goods into the village.

Extent

Extreme weather could result in a **critical** situation in Shaktoolik. Injuries and/or illness could result from extreme cold, high winds, and blowing snow that causes disorientation.

The *Alaska All-Hazard Risk Mitigation Plan*, 2013 lists severe weather as creating 19 limited-damage events in Shaktoolik.

Impact

Because of its remote location, Shaktoolik must be very self reliant. Severe weather can cut off air access limiting medevac availability and access to goods and services, including groceries and medical supplies. Extremely cold temperatures, storms that limit visibility, and dense fog all cause flights into or out of the community to be cancelled for days at a time.

Another major weather factor in the community is high winds. The wind chill factor can bring temperatures down to -60 °F, creating dangerous conditions for necessary outdoor activities. Severe winds cause damage to structures in Shaktoolik on a regular basis. Siding and roofing materials can be ripped away leaving utilities such as water pipes vulnerable to freezing. While most home and business owners are prepared for high winds and low temperatures, building practices must be followed to mitigate against potential damage.

Probability

Tribal staff and other residents describe severe weather as a serious natural hazard risk in Shaktoolik, due to extreme cold, snow, fog, and high winds. As shown in the data from nearby Unalakleet presented in Table 22, Shaktoolik has a high probability of severe weather, which is defined, as the hazard is present with a **high** probability of occurrence within the calendar year. Event has up to a 1 in 1 chance of occurring.

Previous Occurrences of Severe Weather Hazards

2004 Bering Strait Sea Storm *declared October 28, 2004 by Governor Murkowski then FEMA declared (DR-1571) on November 15, 2004*. Amended declaration to extend incident to October 24, 2004: Between October 18 and 20, 2004, a severe winter storm with strong winds and extreme tidal surges occurred along the Western Alaska coastline, which resulted in severe damage and threat to life and property, specifically in the Bering Strait Regional Educational Attendance Area (REAA), including Elim, Nome, Koyuk, **Shaktoolik**, Unalakleet, and other communities; in the Northwest Arctic Borough, including Kivalina, Kotzebue, and other communities; and in the City of Mekoryuk; with potently unidentified damages in adjacent areas, and additional storm surges likely from continuing weather patterns in this area Alaska. Conditions that exist in the coastal communities of the Northwest Arctic

Borough as a result of this disaster: severe damage to roadways, power distribution systems, and drain fields. Conditions that exist in the coastal communities of the Bering Strait REAA as a result of this disaster: severe damage to gabions (used to protect shoreline), major damage to coastal highways and roads, damage to water and septic systems, damage to a bridge, damage to power distribution systems, damage to fuel storage tanks, fuel spills, and property damage. Conditions that exist in the City of Mekoryuk as a result of this disaster: major damage to sea wall and damage to roadways. On November 16, 2004, the declaration was amended to reflect a more accurate timeframe of the disaster. The City of St. George appealed the denial of funding decision for the breakwater. The appeal was granted, which increased the original estimate for total funding of this disaster by more than $3 million. The dates of the severe storm were changed to October 18 through October 24, 2004. Individual assistance totaled $1 million for 271 applicants. Public Assistance total $13 million for 60 potential applicants with 125 PWs. Hazard Mitigation totaled $800,000. The total for this disaster is $17 million.

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Rampart; the Yukon-Koyukuk REAA including the Cities of Tanana, Ruby, Galena, Koyukuk, Nulato, and Kaltag; the Iditarod Area REAA including the Cities of McGrath, Grayling, Anvik, and Holy Cross; the Northwest Arctic Borough including the Cities of Kobuk, and Buckland; the Lower Yukon REAA including the Cities of Russian Mission, Marshall, Saint Mary's, Mountain Village, Emmonak, Alakanuk and Pilot Station and the Community of Ohogamiut; the Lower Kuskokwim REAA including the Cities of Bethel, Kwethluk, Napakiak, Napaskiak, and the Village Community of Oscarville; the Yupiit REAA including the City of Akiak, and the Villages of Akiachak, and Tuluksak; the Kuspuk REAA including the Cities of Aniak, Upper Kalskag, Lower Kalskag, and the Villages Communities of Stony River, Sleetmute, Red Devil, Crooked Creek, and Napaimute; the Fairbanks North Star Borough including the City of North Pole and Community of Salcha; the **Bering Strait REAA** including the City of Nome area.

12-236, 2011 West Coast Storm declared by Governor Parnell on December 5, 2011 then FEMA declared December 22, 2011 (DR-4050): On November 7, 2011 the National Weather Service (NWS) issued the first of several coastal flood warnings for the western coastline of Alaska from Hooper Bay to the North Slope. The NWS warned of "*a rapidly intensifying storm…expected to be an extremely powerful and dangerous storm…one of the worst on record*." Over the next three days additional warnings in response to the 942 millibar low pressure system were issued for coastal villages as the storm moved northerly from the Aleutian Islands into the **Bering** and Chukchi **Seas**. The west coast was impacted with hurricane force winds exceeding 85 mph, high tidal ranges, and strong sea surges up to 10-ft above mean sea level (msl). Before the first storm had passed, a second equally-low pressure system (e.g., 942 millibar) impacted the western coastline from the Yukon-Kuskokwim Delta south to Bristol Bay. This combined weather extended the incident period for the state to November 13, 2011. The FEMA declaration was limited to the incident period from November 8 – 10, 2011.

13-S-244, 2013 November Storm Disaster declared by Governor Parnell on November 16, 2013 then FEMA declared January 23, 2014 (DR-4162). On November 5, 2013, the National Weather Service (NWS) issued the first of several coastal flood and winter storm warnings ranging from the central Aleutians to and including the western coastline of Alaska from Bristol Bay to the North Slope. In their published message the NWS warned of very strong low pressure system south of Shemya, moving to the central Bering and Chukchi Sea's bringing a combination of gale, high surf, high wind, freezing spray, coastal flooding and sea surge warnings and watches. The west coast was impacted with hurricane force winds exceeding 85 mph, high tidal ranges, and strong sea surges. The resultant impact culminated to, damage to public facilities including roads, seawalls, bridges, airports, and public buildings; damage to electrical distribution systems and drinking water systems; damages to private residences and the losses of personal and real property; and coastal flooding and power outages which necessitated evacuation and sheltering operations. Overall, the series of storms created a threat to life and property in 23 cities and villages in the **Bering Strait Regional Educational Attendance Area (REAA)**, Lower Yukon REAA, and Lower Kuskokwim REAA, and the Fairbanks North Star Borough.

Historic weather data is not available for Shaktoolik but is available for Unalakleet, a community just south of Shaktoolik. That data is presented in Table 22.

Climate Influence upon Severe Weather

Climatic influences upon regional weather activity are the El Nino/La Nina Southern Oscillation patterns, atmospheric composition and temperatures, and sea temperatures. The Governor appointed Alaska Climate, Ecosystems & Human Health Work Group is determining the pending impact to human health from a changing climate, and subsequently, regional ecosystems. Shaktoolik residents report more rainy periods, more unpredictable weather, and shorter winters (Alaska Sea Grant, 2014).

Severe Weather Mitigation Goals and Projects

Severe Weather Goals

Goal 1: Reduce severe weather damage.

Encourage weather resistant building construction materials and practices.

Goal 2: Increase public awareness

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

Goal 3: Prevent future severe weather damage.

Develop practical measures to warn in the event of a severe weather event.

Severe Weather Projects

SW-1. Storm Ready (Goal 1, 2, 3)

Research and consider instituting the National Weather Service program of "Storm Ready".

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

To be officially Storm Ready, a community must:

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

Table 22. Unalakleet Weather Summary

Station:(509564) UNALAKLEET WSO AIRPORT															
From Year=1949 To Year=1998															
	Monthly Averages			Daily Extremes				Monthly Extremes				Max. Temp.		Min. Temp.	
	Max.	Min.	Mean	High	Date	Low	Date	Highest Mean	Year	Lowest Mean	Year	>= 90 F	<= 32 F	<= 32 F	<= 0 F
	F	F	F	F	dd/yyyy or yyyymmdd	F	dd/yyyy or yyyymmdd	F	-	F	-	# Days	# Days	# Days	# Days
January	9.9	-3.7	3.1	47	21/1961	-59	28/1989	20.8	1977	-10.1	1971	0	28.5	30.7	17.2
February	10.3	-5.1	2.9	46	Dec-80	-50	28/1956	17.3	1977	-11.4	1954	0	26.3	28	15.8
March	16.9	-0.5	8.2	47	29/1954	-50	Nov-71	24.9	1965	-7.3	1972	0	26.5	30.8	15.4
April	29.3	12.7	21	62	30/1960	-30	Dec-77	31.6	1957	9.8	1977	0	16.8	28.7	6.4
May	45.8	30.4	38.1	78	24/1969	-6	Jul-52	44.5	1951	30.8	1952	0	2.6	18.3	0.1
June	54.6	41.4	48	86	26/1951	25	Jun-52	54.9	1957	43.2	1955	0	0	1.8	0
July	61	47.6	54.3	87	Jul-72	32	16/1953	59.4	1972	50.2	1959	0	0	0.1	0
August	59.8	46.1	52.9	85	Jun-68	28	16/1953	58.5	1977	46.4	1969	0	0	0.7	0
September	51.2	36.7	43.9	75	Jan-81	6	30/1957	50.6	1974	38.4	1970	0	0.1	7.9	0
October	33	20.8	26.9	57	Jan-50	-20	30/1953	34.3	1969	19.5	1956	0	14.2	26.7	1.7
November	19.1	7.3	13.2	48	Jan-95	-36	23/1994	22	1949	-3.5	1956	0	26.3	29.8	8.4
December	8.4	-4.8	1.8	43	Aug-83	-52	31/1974	18.4	1960	-12.7	1959	0	29	30.9	18
Annual	**33.3**	**19.1**	**26.2**	**87**	**19720707**	**-59**	**19890128**	**29.6**	**1957**	**21.1**	**1956**	**0**	**170.4**	**234.2**	**83**
Winter	9.5	-4.6	2.6	47	19610121	-59	19890128	15.1	1977	-5.6	1971	0	83.8	89.5	51
Spring	30.7	14.2	22.4	78	19690524	-50	19710311	29.8	1957	13.5	1971	0	45.9	77.8	21.9
Summer	58.5	45.1	51.8	87	19720707	25	19520606	55	1977	49.2	1955	0	0	2.6	0
Fall	34.4	21.6	28	75	19810901	-36	19941123	34.2	1949	19.6	1956	0	40.6	64.3	10.1

Table Updated 7/28/2006, Source: Western Regional Climate Center, http://wrcc.dri.edu

SW-2. Conduct severe weather awareness activities. (Goal 1, 2, 3)

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

Activities may include events such as Winter Weather Awareness Week, Flood Awareness Week, etc.

SW-3. NOAA Weather Radio. (Goal 1, 2, 3)

Expand public awareness about NOAA Weather Radio for continuous weather broadcasts and warning tone alert capability.

SW-4. Encourage weather resistant building construction materials and practices. (Goal 1)

Section 6. Wildland Fire

Hazard Description and Characterization

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

Fire is recognized as a critical feature of the natural history of many ecosystems. It is essential to maintain the biodiversity and long-term ecological health of the land. In Alaska, the natural fire regime is characterized by a return interval of 50 to 200 years, depending on the vegetation type, topography, and location. The role of wildland fire is an essential ecological process and natural change agent has been incorporated into the fire management planning process. The full range of fire management activities is exercised in Alaska to help achieve ecosystem sustainability, including its interrelated ecological, economic, and social consequences on firefighter and public safety and welfare, natural and cultural resources threatened, and the other values to be protected dictate the appropriate management response to the fire. Firefighter and public safety is always the first and overriding priority for all fire management activities.

Fires can be divided into the following categories:

- *Structure fires* – originate in and burn a building, shelter, or other structure.
- *Prescribed fires* - ignited under predetermined conditions to meet specific objectives, to mitigate risks to people and their communities, and/or to restore and maintain healthy, diverse ecological systems.
- *Wildland fire* - any non-structure fire, other than prescribed fire, that occurs in the wildland.
- *Wildland Fire Use* - a wildland fire functioning in its natural ecological role and fulfilling land management objectives.
- *Wildland-Urban Interface Fires* - fires that burn within the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. The potential exists for extremely dangerous and complex fire burning conditions, which pose a tremendous threat to public and firefighter safety.

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

Location

The hazards of wildland fire impact Shaktoolik on an area-wide basis. A wildland fire event could damage structures, and smoke could potentially isolate Shaktoolik from the rest of the state by reducing visibility and grounding flights. Driftwood piles up along the beaches on the west side of the community providing potential fuel for fires, which could spread rapidly if conditions are right.

Extent

A wildland fire could result in a **critical** situation in Shaktoolik. Injuries and/or illness could result from excessive smoke and fire damage could shutdown critical facilities, damage property and isolate Shaktoolik. The *Alaska All-Hazard Risk Mitigation Plan*, 2013 lists wildland fires as creating three limited-damage events in Shaktoolik.

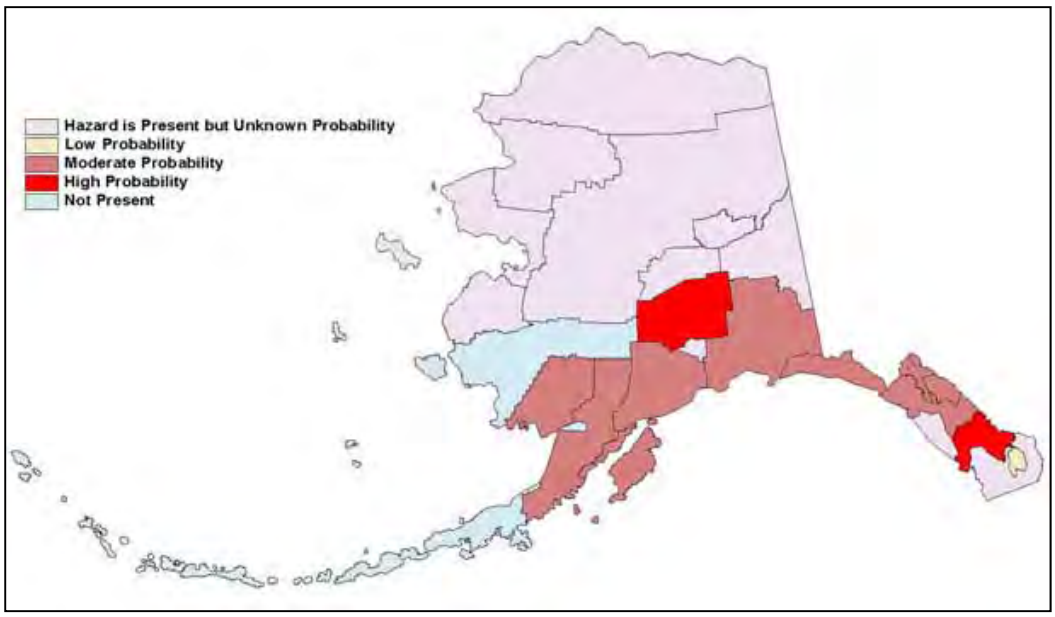
Impact

Wildland fire could destroy the entire community of Shaktoolik, especially if the fire is wind-driven. Fire or smoke impacting the airport could cut-off access to the community preventing the transportation of goods. Additionally, the loss of any structures is devastating to such a small community where services and housing are limited and prohibitively expensive to replace.

Probability

The following map from the *Alaska All-Hazards Risk Mitigation Plan* depicts Shaktoolik as being in an area where the hazard is present but at an unknown probability. Based on previous occurrences of

Map 3. Alaska All-Hazards Mitigation Plan - Fire Risk Map



wildland fire in the vicinity of Shaktoolik, most caused by lightning strikes, and based on the assessment in the *Alaska All-Hazard Risk Mitigation Plan*, 2013, Shaktoolik has a low probability of wildland fire.

Source: ***Alaska All-Hazard Risk Mitigation Plan, 2013***

Previous Occurrences

There have been no reports of wildland fire damage within Shaktoolik. See Figure 3. Ten wildland fires have burned an estimated 20,894.3 acres of land within a 25 mile radius of Shaktoolik.

Egavik Creek: burned an estimated 129.2 acres in one day, started June 30, 2010, by lightning strike.

Christmas Mountain: burned an estimated 73 acres over three days, started June 12, 2007, by lightning strike.

Shaktoolik River: burned an estimated 1 acre in one day, started June 18, 2003, by lightning strike.

UNK NW 10: burned an estimated 20 acres in one day, started June 8, 1994, by lightning strike.

UNK N 35: burned an estimated 10 acres in one day, started June 22, 1993, by lightning strike.

UNK NW 40: burned an estimated 1 acre in one day, started June 5, 1993, by lightning strike.

UNK NW 25: burned an estimated 0.1 acres in one day, started June 8, 1991, by lightning strike.

Tag River: burned an estimated 2,500 acres over two days, started July 10, 1972, by lightning strike.

Christmas Mountain: burned an estimated 2,350 acres, started May 19, 1960, by human recreation.

Shaktoolik: burned an estimated 15,700 acres over 83 days, started June 10, 1957, by lightning strike.

Besboro Island: burned an estimated 10 acres, started June 11, 1956, by human recreation.

Shaktoolik: burned an estimated 100 acres, started June 23, 1943, by lightning strike.

Climatic Influence

A potential increase in global atmospheric temperature may influence weather activity in Alaska. Hotter and drier summers and increased electrical storm activity would contribute to volatile and rapidly expansive wildland fires. As tundra soils dry, they are more vulnerable to fires. An increase in wildfires has been attributed to climate change in Alaska. Alaska wildfires are expected to double by the middle of the century and triple by the end of the century. Due to its location on the spit, Shaktoolik is unlikely to suffer direct damage from tundra fires, but important subsistence harvesting areas could be affected (Alaska Sea Grant, 2014).

Wildland Fire Mitigation Goals and Projects

Wildland Fire Goals

Goal 1: Mitigate against fire damage.

Establish building regulations to mitigate against fire damage.

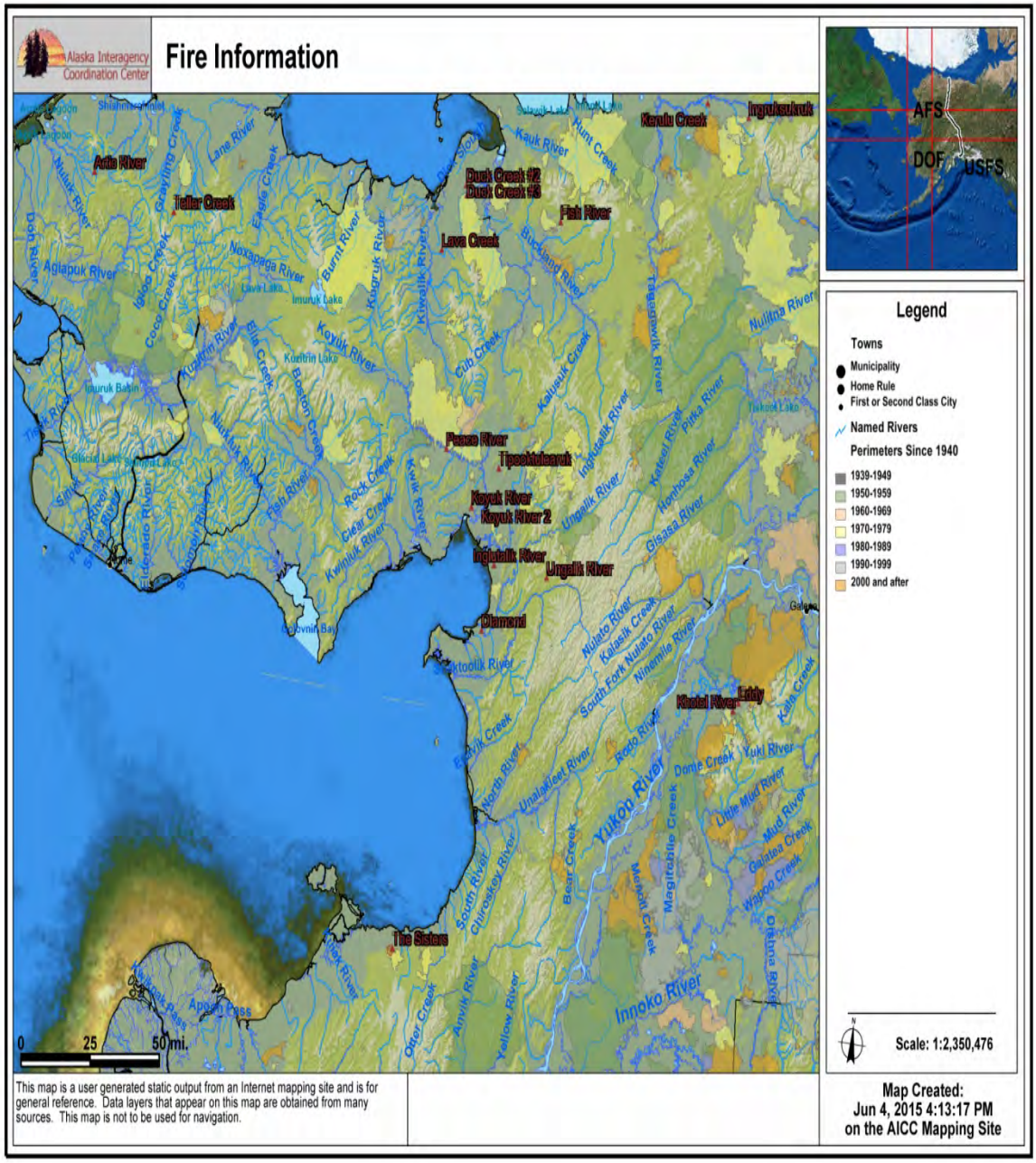
Goal 2: Public awareness and preparedness.

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

Goal 3: Evaluate emergency plans.

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

Figure 3. Historical Wildland Fire Burn Perimeters 1942-2015



Goal 4: Prevent future wildland fire damage.

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

Wildland Fire Projects

WF-1: Promote Fire Wise building design, siting, and materials for construction. (Goals 1, 2)

WF-2: Join the Alaska Fire Wise Program (Goals 1, 2)

The Alaska Fire Wise Program is designed to educate people about wildland fire risks and mitigation opportunities. It is part of a national program that is operated in the State by the Alaska Wildfire Coordinating Group (AWCG).

WF-3: Encourage development of building codes and requirements. (Goals 1, 2)

WF-4: Enhance public awareness of potential risk to life and personal property. (Goals 1, 2)

WF-5: Encourage mitigation measures in the immediate vicinity of residential and business property. (Goals 1, 2, 4)

Section 7. Earthquake

Hazard Description and Characterization

Approximately eleven percent of the world's earthquakes occur in Alaska, making it one of the most seismically active regions in the world. Three of the ten largest quakes in the world since 1900 have occurred here. Earthquakes of magnitude seven or greater occur in Alaska on average of about once a year; magnitude eight earthquakes average about 14 years between events.

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

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

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

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

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

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

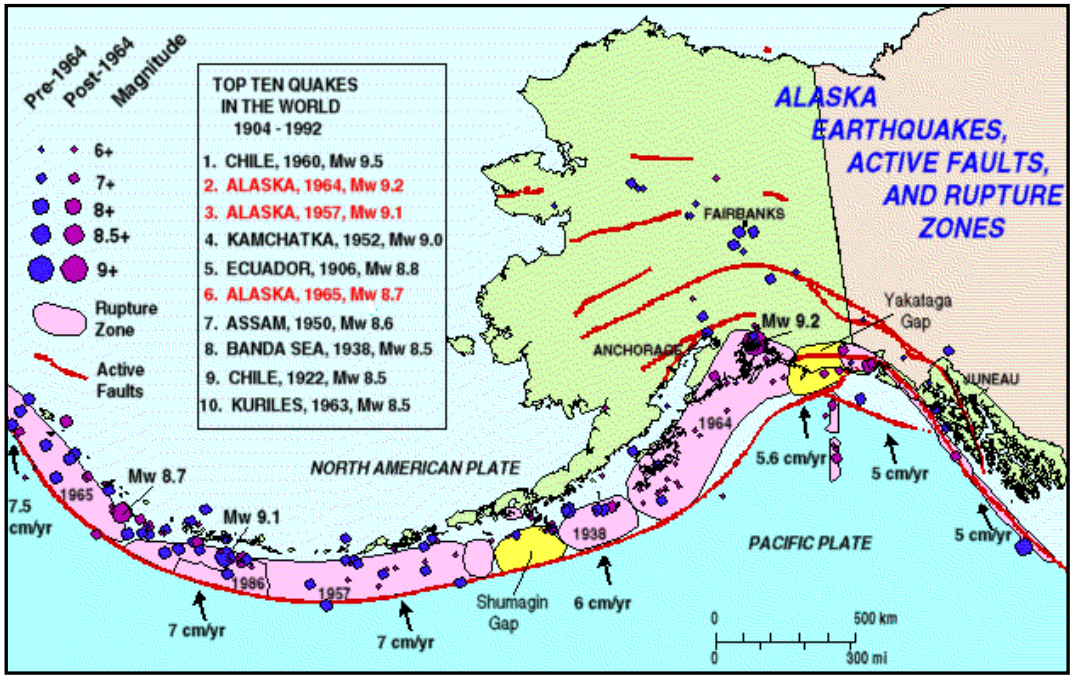
Strike-slip faults are where each side of the fault moves horizontally. Normal faults have one side dropping down relative to the other side. Thrust (reverse) faults have one side moving up and over the fault relative to the other side.

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

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

Similar ground failures can result from loss of strength in saturated clay soils, as occurred in several major landslides that were responsible for most of the earthquake damage in Anchorage in 1964. Other

Map 4. AEIS Earthquake Active Faults



types of earthquake-induced ground failures include slumps and debris slides on steep slopes.

Source: University of Alaska, Fairbanks, and Alaska Earthquake Information Center (AEIC) website

Location

An earthquake hazard event could potentially impact any part of Shaktoolik. Earthquake damage would be area-wide with potential damage to critical infrastructure up to and including the complete abandonment of key facilities. Limited building damage assessors are available in Shaktoolik to determine structural integrity following earthquake damage. Priority would have to be given to critical infrastructure to include: public safety facilities, health care facilities, shelters and potential shelters, and public utilities.

Extent

The extent of an earthquake in Shaktoolik could be ***critical***; Table 8 uses the following criteria to determine the extent of possible damage: Injuries and/or illnesses result in permanent disability,

complete shutdown of critical facilities for at least two weeks, and more than 25 percent of property is severely damaged.

Intensity is a subjective measure of the strength of the shaking experienced in an earthquake. Intensity is based on the observed effects of ground shaking on people, buildings, and natural features. It varies from place to place within the disturbed region depending on the location of the observer with respect to the earthquake epicenter.

The "intensity" reported at different points generally decreases away from the earthquake epicenter. Local geologic conditions strongly influence the intensity of an earthquake; commonly, sites on soft ground or alluvium have intensities two to three units higher than sites on bedrock.

The Richter scale expresses magnitude as a decimal number. A 5.0 earthquake is a moderate event, 6.0 characterize a strong event, 7.0 is a major earthquake and a great earthquake exceeds 8.0. The scale is logarithmic and open-ended. (*Alaska All-Hazard Risk Mitigation Plan*, 2013)

A magnitude of 2 or less is called a microearthquake; they cannot even be felt by people and are recorded only on local seismographs. Events with magnitudes of about 4.5 or greater are strong enough to be recorded by seismographs all over the world. But the magnitude would have to be higher than 5 to be considered a moderate earthquake, and a large earthquake might be rated as magnitude 6 and major as 7. Great earthquakes (which occur once a year on average) have magnitudes of 8.0 or higher (British Columbia 1700, Chile 1960, Alaska 1964). The Richter Scale has no upper limit, but for the study of massive earthquakes, the moment magnitude scale is used. The modified Mercalli Intensity Scale is used to describe earthquake effects on structures.

Maps 5 and 6 show active fault lines in western Alaska. The 2013 Alaska All-Hazard Risk Mitigation Plan lists the Shaktoolik area as having zero impact for previous occurrence but a moderate probability of an earthquake. However, since all of Alaska is at risk for an earthquake event, Shaktoolik could be at risk for an earthquake or have secondary impact from an earthquake in the region.

Impact

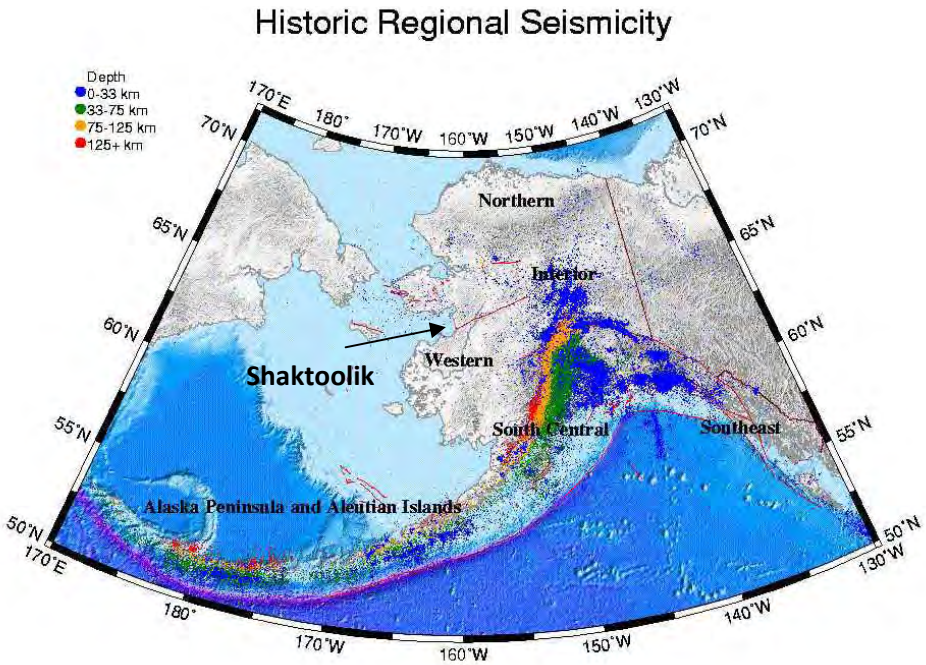
The impact on the community of Shaktoolik of a severe earthquake could be extensive. Portions of the community could be cut off from critical facilities, and infrastructure and services could be disrupted for an extended period.

Earthquake damage would be area-wide with potential damage to critical infrastructure up to and including the complete abandonment of key facilities. Limited building damage assessors are available in Shaktoolik to determine structures integrity following earthquake damage. Priority would have to be given to critical infrastructure to include: public safety facilities, health care facilities, shelters and potential shelters, and public utilities.

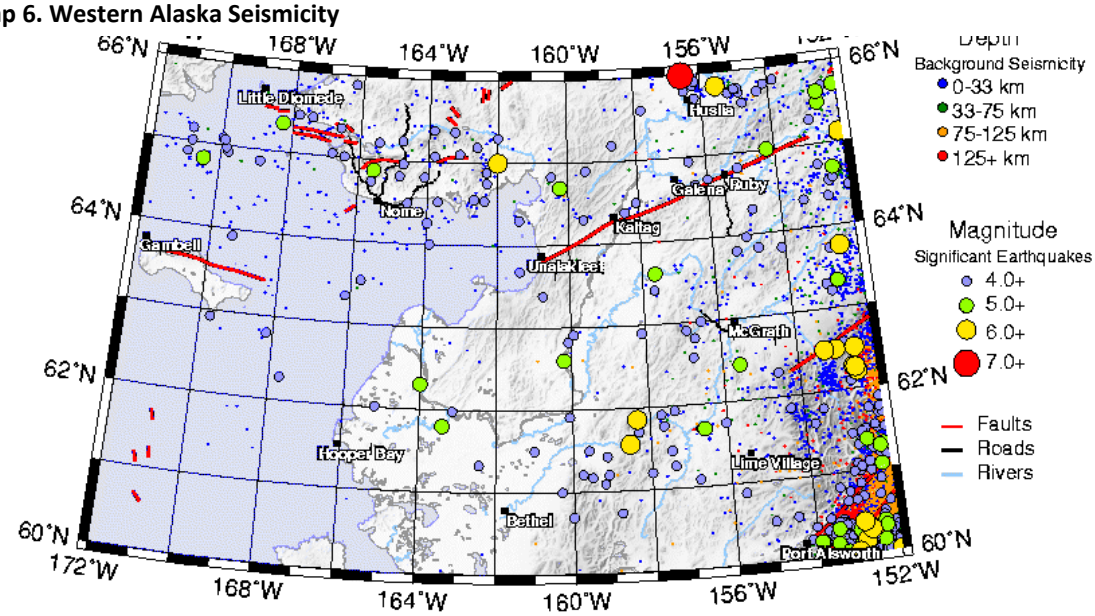
Probability

Shaktoolik has a low probability of earthquake hazard. Map 7 lists the following criteria for a low probability: hazard is present with a low probability of occurrence with the next ten years. Event has up to 1 in 10 years chance of occurring.

Map 5. Alaska Earthquake Information System Historic Regional Seismicity



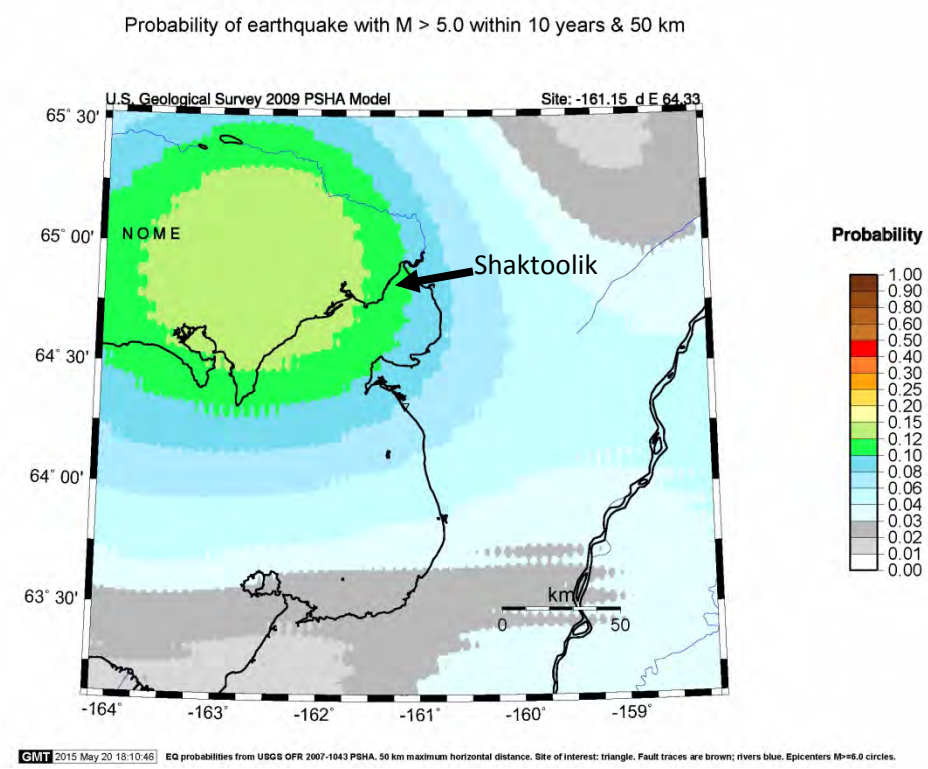
Map 6. Western Alaska Seismicity



Source: ***http://www.aeic.alaska.edu/html_docs/information_releases.html***

While it is not possible to predict an earthquake, the USGS has developed Earthquake Probability Maps that use the most recent earthquake rate and probability models. These models are derived from earthquake rate, location, and magnitude data from the USGS National Seismic Hazard Mapping Project. Map 7 indicates that the USGS earthquake probability model places the probability of an earthquake with an intensity of 5.0 or greater occurring within the next ten years within 50 kilometers (31 miles) of Shaktoolik is 8 to 10 percent.

Map 7. USGS Shaktoolik Earthquake Probability Map



Previous Occurrences

The USGS earthquake database does not contain any previous occurrences of earthquakes in Shaktoolik greater than an intensity of 5.0. The community remembers the 1964 earthquake as the last one they felt.

Earthquake Mitigation Goal and Projects

Earthquake Goals

Goal 1: Mitigate against earthquake damage.

Obtain funding to protect existing critical infrastructure from earthquake damage.

Earthquake Projects

E-1: Identify critical facilities. (Goal 1)

Identify buildings and facilities that must be able to remain operable during and following an earthquake event.

E-2: Improve earthquake resistance. (Goal 1)

If funding is available, perform an engineering assessment of the earthquake vulnerability of each identified critical infrastructure owned by the City of Shaktoolik and Native Village of Shaktoolik.

E-3: Nonstructural Mitigation Projects (Goal 1)

Assess facilities and improve earthquake preparedness through such measures as installing bookshelf tie-downs, improving computer servers' resistance to earthquakes, and moving heavy objects to lower shelves, etc.

Section 8. Climate Change

Hazard Description

For this MJHMP, climate change refers to the long term variation in atmospheric composition and weather patterns on a global scale. Global climate change may occur gradually due to small variations or rapidly due to large catastrophic forces. Greenhouse gasses, especially carbon dioxide and methane are commonly regarded as the most significant factors influencing the Earth's current climate.

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

Location

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

Extent

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

Local Impact

Climate change has the potential to aggravate natural disasters along the coastline, particularly flooding and permafrost degradation. Shaktoolik already has been identified as a community requiring relocation. Climate change will continue to exacerbate the issue.

Global Impact

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

Probability

Given the Earth's history of mass extinctions attributed to climate change, the current observed changes in the atmosphere, and the criteria identified in 9, it is "Credible" a disaster event attributed to climate change will occur in the next ten years as the probability is less than or equal to 10 percent likely per year.

Previous Occurrences

Previous rapid changes in the earth's climate appear in the fossil record as global mass extinctions. According to National Geographic, more than 90 percent of all organisms that have ever lived on Earth

are extinct. Not all of them were subject to mass extinction events from climatic forces. However, fossilized remains of species known to be alive during periods of mass extinction are under scrutiny for evidence of root causes.

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

1. End Ordovician (~443Ma): The second largest know mass extinction on record. 12% of all families and 65% of all species ceased to exist.
2. Late Devonian (~370 Ma): Sharks appeared in this mass extinction, some of which still exist today and mostly unchanged. 14% of all families and 72% of all species became extinct.
3. End Permian (~250Ma): known as the Great Dying, this is the most thorough known mass extinction in history. 52% of all families and greater than 90% of all species perished.
4. End Triassic (~210Ma): 12% of all families and 65% of all life in the Triassic period perished.
5. End Cretaceous (~65Ma): 11% of all families and 62% of all species became extinct.

Section 9. Hazards Not Profiled in the 2015 Shaktoolik MJHMP

Ground Failure

Ground failure is a problem throughout Alaska with landslides presenting the greatest threat. Ground failure hazards exist to some degree in all areas of the state.

Ground Failure Vulnerability Assessment

Shaktoolik is located on relatively flat terrain. No previous occurrences of ground failure have been reported.

Avalanche

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

Avalanche Vulnerability Assessment

The terrain surrounding Shaktoolik does not provide the necessary conditions for avalanche. No threat from avalanche is present in Shaktoolik.

Volcano

Alaska is home to more than 40 historically active volcanoes stretching across the entire southern portion of the state, from the Wrangell Mountains to the far western Aleutians. On average, one to two eruptions occur per year in Alaska. In 1912, the largest eruption of the twentieth century occurred at Novarupta and Mount Katmai, located in what is now Katmai National Park and Preserve on the Alaska Peninsula.

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

Cinder Cones

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

Composite Volcanoes

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

Shield Volcanoes

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

Volcanic eruptions create several types of hazards:

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

Volcano Vulnerability Assessment

The Alaska Volcano Observatory identifies the closest active volcano to Shaktoolik as being Mount Spurr, approximately 350 miles away.

Tsunamis and Seiches

Historic tsunami information and ongoing numeric studies indicate that tsunami flood threat along this region of the western Alaska coast. In preliminary tsunami propagation models, two hypothetical tsunami sources (earthquakes of Mw 9.0) were placed in the eastern and western parts of the Aleutian chain. The tsunami waves propagated through the Northern Pacific and into the Bering Sea.

Tsunamis and Seiches Vulnerability Assessment

The continental shelf in the Bering Sea substantially dissipates tsunami energy and slows down the waves. As a result, tsunami waves arrive at Hawaii before they reach the Bering Sea coastline, which gives sufficient warning time to Alaskan communities.

Chapter 4. Mitigation Strategy

Benefit - Cost Review

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

The projects listed in Table 23, were prioritized using a listing of benefits and costs review method as described in the FEMA *How-To-Guide Benefit-Cost Review in Mitigation Planning* (FEMA 386-5).

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

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

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

Other criteria that were used in developing the benefits – costs listing depicted in Table 23:

1. Vulnerability before and after Mitigation
    - Number of people affected by the hazard, area wide or specific properties.
    - Areas affected (acreage) by the hazard
    - Number of properties affected by the hazard
    - Loss of use
    - Loss of life (number of people)
    - Injury (number of people)
2. List of Benefits
    - Risk reduction (immediate or medium time frame)
    - Other community goals or objectives achieved
    - Easy to implement
    - Funding available

- Politically or socially acceptable

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

This method supports the principle of benefit-cost review by using a process that demonstrates a special emphasis on maximization of benefits over costs. Projects that demonstrate benefits over costs and that can start immediately were given the highest priority. Projects that the costs somewhat exceed immediate benefit and that can start within five years (or before the next update) were given a description of medium priority, with a timeframe of one to five years. Projects that are very costly without known benefits probably cannot be pursued during this plan cycle, but are important to keep as an action were given the lowest priority and designated as long term.

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

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

> Benefit-Cost Review vs. Benefit-Cost Analysis (FEMA 386-5) states in part:
>
> Benefit-Cost Review for mitigation planning differs from the benefit cost analysis (BCA) used for specific projects. BCA is a method for determining the potential positive effects of a mitigation action and comparing them to the cost of the action. To assess and demonstrate the cost-effectiveness of mitigation actions, FEMA has developed a suite of BCA software, including hazard-specific modules. The analysis determines whether a mitigation project is technically cost-effective. The principle behind the BCA is that the benefit of an action is a reduction in future damages.
>
> DMA 2000 does not require hazard mitigation plans to include BCAs for specific projects, but does require that a BCR be conducted in prioritizing projects.

Benefit-Cost Analysis

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

Facilitating BCA

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

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

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

To assist applicants and sub-applicants, FEMA has prepared the *FEMA Mitigation BCA Toolkit* CD. This CD includes all of the FEMA BCA software, technical manuals, BC training courses, data-documentation templates, and other supporting documentation and guidance.

The *Mitigation BCA Toolkit* CD is available free from FEMA Regional Offices or via the BC Helpline (at bchelpline@fema.dhs.gov or toll free number at (855) 540-6744.

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

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

Eligible Projects for PDM Funding

The Pre-Disaster Mitigation (PDM) Grant Program is federally funded through FEMA at 75% of the plan or project and requires a 25% local fund match. Small, impoverished communities may be eligible for up to a 90 percent Federal cost share in accordance with the Stafford Act. The program is annual, nationally competitive, and is intended to reduce overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. PDM grants include Hazard Mitigation Planning Grants and Hazard Mitigation Project Grants.

- A Hazard Mitigation Planning Grant are available for communities to either update or create who do not have a FEMA/State approved and community adopted All-Hazard Mitigation Plan.

- A Hazard Mitigation Project Grant is only available for communities who have a FEMA/State approved and community adopted Hazard Mitigation Plan.

Hazard Mitigation Projects are intended to reduce risk to life and property and examples include:

- Elevation of flood prone structures;
- Structural and non-structural seismic retrofits of public facilities;
- Voluntary acquisition or relocation of structures out of the floodplain;
- Natural hazard protective measures for utilities, water and sanitary sewer systems; and
- Localized storm water management and flood control projects.

Eligible Projects for HMGP Funding

These criteria are designed to ensure that the most appropriate projects are selected for funding. Projects may be of any nature that will result in protection of public or private property from natural hazards. Some types of projects that **may be eligible** include:

- Acquisition of hazard prone property and conversion to open space;
- Retrofitting existing buildings and facilities;
- Elevation of flood prone structures;
- Vegetative management/soil stabilization;
- Infrastructure protection measures;
- Stormwater management;
- Minor structural flood control projects; and
- Post-disaster code enforcement activities.

The following types of projects **may not be eligible** under the HMGP:

- Retrofitting places of worship (or other projects that solely benefit religious organizations); and
- Projects in progress.
- New structures or infrastructure.

There are five minimum criteria that all projects must meet in order to be considered for funding:

- Conforms with the State Hazard Mitigation Plan;
- Provides beneficial impact upon the designated disaster area;
- Conforms with environmental laws and regulations;
- Solves a problem independently or constitutes a functional portion of a solution; and,
- Is cost-effective.

Benefit – Costs Review of Projects

The first section of Table 23 lists the projects developed by the Immediate Action Workgroup (IAW) a multi-agency panel organized to deal with the early assessment and development of an action plan to address climate change impacts on coastal communities in Alaska. Shaktoolik was one of the first six high priority communities studied by this group. The remainder of Table 23 lists other mitigation projects and their benefits, costs, and prioritization from the Adaptation Plan (Terry Johnson, Alaska Sea Grant Program & Glenn Gray, Glenn Gray and Associates, 2014).

Results from the risk assessment in Sections 4-7 from Chapter 3 were used to develop mitigation goals and actions. Referencing the City of Shaktoolik/Shaktoolik Tribal Council's 2009 Hazard Mitigation Plan, most of their goals were not accomplished as mitigation funds were appropriated to other communities involved in a disaster. Since this MJHMP is multi-jurisdictional as was the HMP in 2009, both the City of Shaktoolik and the Shaktoolik Tribal Council have selected and prioritized the goals and actions. Goals and projects were described in Sections 4-7 in Chapter 3.

Upon adoption of their MJHMP, the City of Shaktoolik and Shaktoolik Tribal Council will incorporate it into existing planning mechanisms using the following methods:

- Use the City of Shaktoolik's regulatory tools to integrate the mitigation goals and actions. These regulatory tools are identified in Section 2.3 *Capability Assessment*.
- Encourage relevant departments and authorities to implement MJHMP goals and actions into relevant planning mechanisms.
- Update or amend specific planning mechanisms to integrate MJHMP goals and principles.

The Shaktoolik Tribal Council may advise the City as appropriate regarding the incorporation of the mitigation strategy into new plans and plan updates. Both jurisdictions are responsible for prioritizing their mitigation projects and submitting them for grant programs outlined in Chapter 2.4, "Resources".

Table 23. Benefit - Costs Review Listing Table

Mitigation Projects	Benefits (pros)	Costs (cons)	Priority
Shaktoolik IAW Projects			
IAW-1. State funding for partial funding of Evacuation Road design and engineering.	This will leverage funds from Kawerak, Denali Commission, and BIA**.**	2009 Plan—$500,000 in State funding, leveraging $2.5m in other cooperating organizations' funds. Not yet in Governor's budget. 2015 Plan—Costs are now estimated at $26-$64 million per Adaptation Plan.	High
IAW-2. Shaktoolik should request from Congress to be added to the Alaska Coastal Erosion Program.	Benefit to entire community	Undetermined	High
IAW-3. DNR – Division of Geological & Geophysical Surveys (DGGS) Geologic and Hazardous Mapping to identify sites acceptable for evacuation road, site and identifying relocation sites.	2009 Plan—Benefit to entire community. $180k Funded through Federal Coastal Impact Assistance Program (CIAP). 2015 Plan—DGGS conducted a Rapid Analysis of 2013 storms season shoreline change —documented in letter report 6/27/14. IAW-3 is complete.	2009 Plan—Funds now available at DGGS; however, hiring freeze precludes having human resource capacity needed to do the work. 2015 Plan—IAW-3 is complete.	High
Flood/Erosion (FLD)			
FLD-1. Structural elevation or relocation	Life/Safety project. Benefit to government and private properties.	Definite cost unavailable. Could exceed $50,000.	Medium
FLD-2. Investigate the benefits of joining NFIP	Provides reasonable flood insurance for structures in floodplain, floodplain mapping, and eligibility for Flood Mitigation Assistance grant program.	Staff time. Community support required. Would require changes in ordinances and enforcement.	High

Mitigation Projects	Benefits (pros)	Costs (cons)	Priority
FLD-3. Shoreline protection a. 260 feet of articulated concrete mat in front of south tank farm b. 4,500 feet of rock revetment at current community site c. Groin field in front of community d. 3,350 feet of rock revetment at old village site e. Beach nourishment f. Site visit by USACE g. Berm Demonstration Project h. Install Storm Gauges i. 200 feet of rock revetment on river at 1st bend	Life/safety issue Benefit to entire community through protection of tank farms, utility lines, etc. USACE currently studying project.	Costs are high: a. $3,300,000 ($12,700 per foot) for articulated concrete mat, the revetment of choice per USACE, 2009. b. $29.2 million (10,000 per foot) for rock revetment per USACE, 2009. c. $30.8 million for groin field per USACE, 2009 d. $18.6 million (10,000 per foot) for rock revetment per USACE, 2009. e. $36.5 million for rock revetment per USACE, 2009. f. $10,000 nonfederal funds per personal communication with Bruce Sexauer on 11/27/12 g. $60,000 funding secured by H. Smith with funds for community—Completed with local resources in 2014. h. $85,000 total for up to 8 communities secured by H. Smith with funds for community i. Up to $1.5 million available (35% local match required) per personal conversation with Bruce Sexauer on 11/27/12	High

Mitigation Projects	Benefits (pros)	Costs (cons)	Priority
FLD-4. Water source protection	Life/safety issue, as it provides fresh water for the entire community. Benefit to entire community. May be accomplished as part of another project, or as a separate, stand alone project. 2015 Update—On-going in Summer 2015.	Evacuation road and shoreline reinforcement will protect water source, but is very expensive. Relocation of freshwater intake provides a less expensive alternative, but does not address the issue of evacuation capability.	High
FLD-5. Clearly mark navigable waterway for evacuation	Life/safety project. Benefit to entire community. Relatively inexpensive.	Channel marker buoys can range in cost from $50 to $200 per buoy. Unknown how markers will stand up to freeze up or if they will have to be deployed annually.	High
FLD-6. Public education	Life/safety project. Benefit to entire community. Inexpensive.	Volunteer and staff time	High
Severe Weather (SW)			
SW-1. Research and consider implementation of "Storm Ready", a National Weather Service program.	Life/Safety issue Risk reduction Benefit to entire community Inexpensive State assistance available	Staff time	High
SW-2. Conduct special awareness activities, such as Winter Weather Awareness Week, Flood Awareness Week, etc.	Life/Safety issue Risk reduction Benefit to entire community Inexpensive State assistance available Could be an annual event	Staff time	High

Mitigation Projects	Benefits (pros)	Costs (cons)	Priority
SW-3. Expand public awareness about NOAA Weather Radio for continuous weather broadcasts and warning tone alert capability	Life/Safety issue Risk reduction Benefit to entire community Inexpensive State assistance available Could be an annual event	Staff time	High
SW-5. Encourage weather resistant building construction materials and practices.	Risk and damage reduction. Benefit to entire community.	Could require ordinance change. Potential for increased staff time. Research into feasibility necessary. Political and public support not determined.	Medium
Wildland Fire (WF)			
WF-1. Promote Fire Wise building design, siting, and materials for construction.	Life/Safety issue Risk reduction Benefit to entire community, Annual project. State assistance available	Dollar cost not determined. Staff time to research grants	High
WF-2. Join Alaska Fire Wise program.	Life/Safety issue Risk reduction Benefit to entire community State assistance available Annual project.	Dollar cost not determined. Staff time to research grants	High
WF-3. Encourage development of building codes relating to fire safety.	Life/Safety issue Risk reduction Benefit to entire community Inexpensive	Staff time Community support not determined	Medium

Mitigation Projects	Benefits (pros)	Costs (cons)	Priority
WF-4. Enhance public awareness of potential risk to life and personal property.	Life/Safety issue/Risk reduction Benefit to entire community Inexpensive State assistance available Could be implemented annually	Staff time	High
WF-5. Encourage mitigation measures in the immediate vicinity of residential and business property.	Life/Safety issue/Risk reduction Benefit to entire community Inexpensive State assistance available Could be implemented annually	Staff time	High
Earthquake (E)			
E-1. Identify buildings and facilities that must be able to remain operable during and following an earthquake event.	Life/Safety issue/Risk reduction Benefit to entire community	Staff time	High
E-2. If funding is available, perform an engineering assessment of the earthquake vulnerability of each identified critical infrastructure owned by the City of Shaktoolik	Life/Safety issue/Risk reduction Benefit to entire community	No local capacity for assessment External contractor would be required 1-5 years implementation	Medium
E-3. Nonstructural mitigation projects	Inexpensive. Reduces property damage and reduces risk of injury from falling objects	Staff or volunteer time	High

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

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

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

Mitigation Projects

Table 24 presents Shaktoolik's strategy for mitigation of the natural hazards faced by the community and includes a brief description of the projects, lead agencies, costs, potential funding sources and an estimated timeframe for each project. The final column allows the community to make note of specific progress on projects during the 5-year life of the plan.

Table 24. Mitigation Strategy

Mitigation Projects	Responsible Agency	Cost	Funding Sources	Estimated Timeframe	Project Status (for local review)
Shaktoolik IAW Projects					
IAW-1. State funding for partial funding of Evacuation Road design and engineering.	DOT&PF	$3m	DOT&PF Kawerak Denali Commission BIA	IAW recommendation for 2010 budget.	Route Recon Study Completed/Long Range Transportation Plan Updated/IRR updated
IAW-2. Shaktoolik should request from Congress to be added to the Alaska Coastal Erosion Program.	City/Tribe	Undetermined	Congressional designation.	IAW recommendation for 2010 budget.	
IAW-3. DNR – Division of Geological & Geophysical Surveys (DGGS) Geologic and Hazardous Mapping to identify sites acceptable for evacuation road, site and identifying relocation sites.	Alaska DGGS	$180k	State	IAW recommendation for 2010 budget.	Completed—2011 and updated in 2014

Mitigation Projects	Responsible Agency	Cost	Funding Sources	Estimated Timeframe	Project Status (for local review)
Flood/Erosion (FLD)					
FLD-1. Structural elevation or relocation	City/Tribe, DCRA, DHS&EM, FEMA	TBD	PDM, HMGP	1-5 years	Funding sources yet to be determined in 2015
FLD-2. Investigate the benefits of joining the NFIP program	City/Tribe, DCRA, FEMA	Staff time		1 year	April 2013 teleconference with State NFIP Manager to discuss pros/cons
FLD-3. Shoreline protection	USACE	$3.3m	USACE	1 year	Completed berm in 2014.
FLD-4. Water source protection	DOT&PF or BIA for road development. Or, DHS&EM for water source relocation.	TBD	DOT&PF, BIA, Kawerak PDM, HMGP	1 year	Started in summer 2014; on-going in summer 2015; involves work around "first bend"
FLD-5. Clearly mark navigable waterway for evacuation	Tribe	$50-$200/buoy	PDM, HMGP	1 year	Not completed
FLD-6. Public education	City/Tribe	Staff time		1 year	On-going on an annual basis

Mitigation Projects	Responsible Agency	Cost	Funding Sources	Estimated Timeframe	Project Status (for local review)
Severe Weather (SW)					
SW-1. Research and consider instituting the National Weather Service program of *"Storm Ready"*.	City/Tribe	Staff Time	City/Tribe	1 year	Not completed
SW-2. Conduct special awareness activities, such as Winter Weather Awareness Week, Flood Awareness Week, etc.	City/Tribe	Staff Time	City/Tribe	Ongoing	Cultural Awareness annual Elders & Youth Group
SW-3. Expand public awareness about NOAA Weather Radio for continuous weather broadcasts and warning tone alert capability	City/Tribe	Staff Time	City/Tribe	Ongoing	Social media awareness
SW-4. Encourage weather resistant building construction materials and practices.	City/Tribe	Staff Time	City/Tribe	1-5 years	Not competed; community needs building codes to follow
Wildland Fire (WF)					
WF-1. Promote Fire Wise building design, siting, and materials for construction.	DHS&EM, City/Tribe	Staff Time	City/Tribe	Ongoing	Research and follow-up actions need to be completed
WF-2. Join Alaska Fire Wise program.	DHS&EM, City/Tribe	TB	City/Tribe	1 year	No action taken
WF-3. Encourage development of building codes relating to fire safety.	DHS&EM, City/Tribe	Staff Time	City/Tribe	1-5 years	Not completed; community building codes to follow

Mitigation Projects	Responsible Agency	Cost	Funding Sources	Estimated Timeframe	Project Status (for local review)
WF-4. Enhance public awareness of potential risk to life and personal property.	DHS&EM, City/Tribe	Staff Time	City/Tribe	Ongoing	Ongoing
WF-5. Encourage mitigation measures in the immediate vicinity of residential and business property.	DHS&EM, City/Tribe	Staff Time	City/Tribe	Ongoing	Ongoing
Earthquake (E)					
E-1. Identify buildings and facilities that must be able to remain operable during and following an earthquake event.	City/Tribe, DHS&EM, DCRA	Staff Time	PDM, State Grants	1 year	Not completed as of 2015
E-2. If funding is available, perform an engineering assessment of the earthquake vulnerability of each identified critical infrastructure owned by the City of Shaktoolik.	City/Tribe, DHS&EM	TBD	PDM, State Grants	1-5 years	Not completed due to lack of funding
E-3. Nonstructural mitigation projects	City/Tribe, DHS&EM	Staff Time, approximately $5k	PDM	1 year and ongoing	Current and ongoing

Chapter 5. Glossary of Terms

A-Zones

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

Acquisition

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

Asset

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

Base Flood

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

Base Flood Elevation (BFE)

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

Base Floodplain

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

Building

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

Building Code

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

Community

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

Community Rating System (CRS)

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

Critical Facility

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

Designated Floodway

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

Development

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

Digitize

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

Disaster Mitigation Act (DMA)

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

Earthquake

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

Elevation

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

Emergency Operations Plan

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

Erosion

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

Federal Disaster Declaration

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

Federal Emergency Management Agency (FEMA)

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

Flood

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

Flood Disaster Assistance

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

Flood Elevation

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

Flood Hazard

Flood Hazard is the potential for inundation and involves the risk of life, health, property, and natural value. Two reference base are commonly used: (1) For most situations, the Base Flood is that flood which has a one-percent chance of being exceeded in any given year (also known as the 100-year flood); (2) for critical actions, an activity for which a one-percent chance of flooding would be too great, at a minimum the base flood is that flood which has a 0.2 percent chance of being exceeded in any given year (also known as the 500-year flood).

Flood Insurance Rate Map

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

Flood Insurance Study

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

Floodplain

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

Floodplain Management

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

Floodplain Management Regulations

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

Flood Zones

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

Flood Zone Symbols

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

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

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

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

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

B - X Area of moderate flood hazard.

C - X Area of minimal hazard.

D - Area of undetermined but possible flood hazard.

Geographic Information System (GIS)

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

Governing Body

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

Hazard

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

Hazard Event

A specific occurrence of a particular type of hazard.

Hazard Identification

The process of identifying hazards that threaten an area.

Hazard Mitigation

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

Hazard Mitigation Grant Program

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

Hazard Profile

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

Hazard and Vulnerability Analysis

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

Mitigate

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

Mitigation Plan

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

National Flood Insurance Program

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

One Hundred (100)-Year

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

Planning

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

Repetitive Loss Property

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

Risk

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

Riverine

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

Riverine Flooding

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

Runoff

That portion of precipitation that is not intercepted by vegetation, absorbed by land surface, or evaporated, and thus flows overland into a depression, stream, lake, or ocean (runoff, called immediate subsurface runoff, also takes place in the upper layers of soil).

Seiche

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

Seismicity

Describes the likelihood of an area being subject to earthquakes.

State Disaster Declaration

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

Topography

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

Tribal Government

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

Tsunami

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

Vulnerability

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

Vulnerability Assessment

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

Watercourse

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

Watershed

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

Chapter 6. Bibliography

1. *Alaska All-Hazard Risk Mitigation Plan*, prepared by and for DHS&EM, October 2013.
2. *DCRA Community Information*: http://commerce.state.ak.us/dnn/dcra/Home.aspx.
3. *Federal Aviation Administration, Alaska* website: http://www.faa.gov/search/?omni=MainSearch&q=shaktoolik
4. FEMA How to Guides

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

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

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

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

   Using Benefit-Cost Review in Mitigation Planning (FEMA 386-5)
5. *Shaktoolik Local Economic Development Plan,* 2013-2018, prepared by Kawerak, Inc., April 4th and 5th, 2013.
6. *Shaktoolik Comprehensive Community Development Plan*, Prepared by Gerald Pilot, September 2007.
7. *Shaktoolik Community Profile, Draft*. Prepared by Fison and Associates. June 1987.
8. *Shaktoolik Draft Flood Mitigation Plan,* 2003, Prepared Tanana Chiefs Conference.
9. USACE Draft Section 117 Project Fact Sheet for Shaktoolik, Prepared by Alaska USACE.
10. USACE Continuing Authorities Project Fact Sheet (Preliminary), Prepared by Alaska USACE, October 1, 2009.
11. USACE Alaska Baseline Erosion Assessment: http:www.poa.usace.army.mil/Library/ReportsandStudies/AlaskaBaselineErosionAssessments.aspx. March 2009.
12. USACE Floodplain Manager's Report: http://206.174.16.211/floodplain_data/Shaktoolik/Documents/Shaktoolik.pdf
13. Shaktoolik Coastal Flooding Analysis, October 2011. Community of Shaktoolik, Denali Commission, Kawerak, Inc., U.S. Army Corps of Engineers, Alaska District, and the Coastal and Hydraulics Laboratory.
14. Shaktoolik Planning Project, March 3, 2012. Prepared by Glenn Gray and Associates in Association with Kawerak, Inc. and McKnight and Associates for the Community of Shaktoolik.
15. Shaktoolik, Alaska: Climate Change Adaptation for an At-Risk Community, Adaptation Plan, February 27, 2014. Prepared by: Terry Johnson, Alaska Sea Grant Program & Glenn Gray, Glenn Gray and Associates. Funded by: OAR National Sea Grant College Program.

16. Letter Report regarding Preliminary Calculation of Shoreline Change Associated with the 2013 Storm Season in Shaktoolik, Alaska, Dated June 27, 2014 from Nicole Kinsman, Alaska Department of Natural Resources Division of Geological & Geophysical Surveys to City of Shaktoolik, Native Village of Shaktoolik, Shaktoolik Native Corporation.
17. Shaktoolik Evacuation Road Project: Road Reconnaissance Report. Prepared for the Native Village of Shaktoolik by Kawerak Transportation Program in Cooperation with Rodney P. Kinney Associates. 2008.
18. Alaska Chapter of the Climate Change Impacts in the United States: The Third National Climate Assessment, 2014.

Web Sites with General Hazard Planning Information

American Planning Association:	http://www.planning.org
Association of State Floodplain Managers:	http://www.floods.org
Federal Emergency Management Agency:	http://www.fema.gov
Community Rating System:	http://www.fema.gov/national-flood-insurance-program-community-rating-system
Flood Mitigation Assistance Program:	https://www.fema.gov/flood-mitigation-assistance-grant-program
Hazard Mitigation Grant Program:	http://www.fema.gov/hazard-mitigation-grant-program
Individual Assistance Program:	http://www.fema.gov/individual-assistance-program-tools
Interim Final Rule:	https://www.fema.gov/media-library/assets/documents/4590
National Flood Insurance Program:	http://www.fema.gov/national-flood-insurance-program
Public Assistance Program:	http://www.fema.gov/public-assistance-local-state-tribal-and-non-profit/

Appendix A: Public Involvement

May 29, 2015

Contact the Planning Team!

Jennifer LeMay, PE, PMP, Lead Planner

907-350-6061

jlemay@lemayengineering.com

Scott Nelsen, State of Alaska DHS&EM Emergency Management Specialist

907-428-7010

Scott.nelsen@alaska.gov

Isabelle Jackson, City Clerk

907-955-3441

skkcity@arctic.net

Michael Sookiayak, Sr., Community Coordinator

907-955-3701

michaelsookiayak@yahoo.com

We're Updating Our Plan!

The plan update team is reviewing the community's Hazard Mitigation Plan for 2015.

Join The Planning Team

Any interested community member may join the plan update team.

To join, contact the City Clerk.

Offer Your Advice

Academia, businesses, and government agencies are encouraged to participate.

Alert us to any new or revised relevant publications for our Mitigation Plan Update.

Public Meeting

We will hold a council meeting on June 17, 2015 at 1 pm to discuss updates for the Mitigation Plan.

For a copy of the current Hazard Mitigation Plan, visit the City of Shaktoolik Office or:

http://commerce.state.ak.us/dnn/dcra/PlanningLandManagement/CommunityPlansAndInfrastructure.aspx

Importance to the Community

Hazard Mitigation Plans are required by the Federal Emergency Management Agency (FEMA) for disaster mitigation funding. The plans are updated every 5 years.

What We're Updating

- Community Demographics
- Planning Process
  - New Planning Team
  - Expert Contributors
  - Public Involvement Strategy
- Maps, Figures, and Tables
- New or Revised Publications
- Hazard Profiles
  - Incident History
  - New Hazards
- Any Changes in Land Status
  - Revised Ordinances
  - Boundary or Zone Revisions
  - New Construction or Demolition
- Vulnerability and Risk Assessment
  - Has development changed our vulnerability and risk?
- Critical Facility and Infrastructure Inventory
- Mitigation Strategy
  - Progress toward Hazard Mitigation Goal Achievement
  - Progress Review of our Hazard Mitigation Projects
- NFIP Information

Mitigation Planning Resources

Hazard Mitigation
Alaska State Hazard Mitigation Plan
http://ready.alaska.gov/plans/documents/Alaska%20HMP%202013%20reduced%20file%20size.pdf

FEMA Mitigation Planning Guidance
http://www.fema.gov/plan/mitplanning/resources.shtm

Floods

FEMA=Floodsmart https://www.floodsmart.gov/floodsmart/

NFIP https://www.fema.gov/national-flood-insurance-program

National Weather Service http://www.weather.gov/

Alaska Department of Commerce, Community and Economic Development Floodplain Management
http://commerce.state.ak.us/dnn/dcra/PlanningLandManagement/FloodplainManagement.aspx

U.S. Army Corps of Engineers -
2204 3rd Street, Elmendorf AFB,
AK 99506 – phone: 907-753-2610 http://www.poa.usace.army.mil/

Wildfires

FEMA - http://www.fema.gov/hazard/wildfire/index.shtm

Fire Ready - http://fireready.com/

Firewise http://www.firewise.org/?sso=0

US Geological Survey (USGS)
http://www.usgs.gov/natural_hazards/#fire

Alaska Dept. of Natural Resources – Division of Forestry
http://forestry.alaska.gov/fire/current.htm

Erosion
US Army Corps of Engineers Alaska Baseline Erosion Assessments
http://www.poa.usace.army.mil/Library/ReportsandStudies/AlaskaBaselineErosionAssessments.aspx

Earthquakes

United States Geological Survey – USGS http://www.usgs.gov/natural_hazards/#eq

FEMA https://www.fema.gov/earthquake

Alaska Earthquake Information Center
http://www.aeic.alaska.edu/

Tsunami

FEMA - http://www.ready.gov/tsunamis

National Oceanic Atmospheric Administration (NOAA)
http://ptwc.weather.gov/

Univ. of Washington -
http://earthweb.ess.washington.edu/tsunami/index.html

National Weather Service/West Coast and Alaska Tsunami Warning Center
http://wcatwc.arh.noaa.gov/

Severe Weather

FEMA - http://www.ready.gov/winter-weather

National Weather Service
http://www.weather.gov/

National Weather Service (Fairbanks)
http://pafg.arh.noaa.gov/
http://pafg.arh.noaa.gov/

Shaktoolik Multi-Hazard Mitigation Plan Meeting

June 17, 2015

1 pm

Name	Organization	Contact Information (phone or email)
Agnes R. Takak	City of SKK	955-3441
Matilda Hardy	IRA	955-3701
Edna Savetilik	City	955-2508
Crystal Katchatag	City	956-1028
[illegible]	CITY	956-1011
Randy Takak	City	955-8227
Eugene Asicksik	City + Corp.	955-3828
Rhoda Asicksik	self (concerned citizen)	955-3828
[illegible] JACKSON	City	[illegible]
Shawn Evan	IRA	8883191
Teresa Perry	IRA	256 1271
Isabella Jackson	City Clerk	955-3441
JENNIFER LEMAY	LEMAY ENGINEERING + CONSULTING, INC.	350-6061

Hazard Mitigation Plan Meeting
Tri-Organization
City and IRA Councils
1PM

1). Mayor Edgar Jackson calls meeting to order at 1:00PM and asks City Clerk Isabelle Jackson for a roll call –
Present for the City Council were **Mayor** Edgar Jackson, **Vice Mayor** Eugene Asicksik, **Treasurer** Edna Savetilik, **Secretary** Agnes Takak, **Member** Randall Takak, **Member** Axel Jackson, **City Clerk** Isabelle Jackson, **Summer Youth Program Intern** Crystal Katchatag, and excused was **Member** Gail Evan.

Present from IRA Council were **President** Teresa Perry, Shawn Evan, and Matilda Hardy. And excused was **Community Coordinator** Michael Sookiayak. Also with IRA Edgar Jackson, Agnes Takak, Axel Jackson, and Edna Savetilik

Corporation President Eugene Asicksik

1 **Community member** present was Rhoda Asicksik.

Quest Speaker Jennifer LeMay – PE, PMP, Lead Planner.

Mayor Edgar asks for invocation from community member Rhoda Asicksik. Jennifer LeMay explains that the plan is from 2009 and one of the FEMA requirements to get funding from the state is that the plan needs to be updated. Jennifer thanks Michael and Isabelle for helping her update the plan.

Jennifer wanted to give an overview of what we have been doing. What this handout represents is the key tables that we've been looking at from the plan that was developed in 2009. One of the FEMA requirements for villages to get funding after storms and other hazard events is that this plan needs to be updated. The 2013 storm was a big one for Shaktoolik as well as the ones in 2009 and 2011.

In the back of the 1st page this is the hazard matrix page which the State of Alaska prepared for the Bering Strait region. And not all the hazards are specific to

Shaktoolik. As you'll see on the next page on table 11 where the number of avalanches is still 0 and the number of volcanoes is 0.

And really the only difference between this table now and the 2009 is that the flood had one more potential chance of limited occurrence in the severe weather was raised from 17 limited events to 19. After consulting with Mike and the state, the hazards that appear to be the most prevalent in Shaktoolik are definitely flooding and erosion which are the two big ones. Jennifer just wanted to ask everybody in here, "Do you think that flooding and erosion are the two big events?" Mayor Edgar replies that they are the two biggest events here. Another question from Jennifer, "Has there been any earthquakes?" Rhoda Asicksik says that there was an earthquake when they were really young like when they were 10 or 12 years old. Something like 50 years ago. Also heard stories of a tsunami like about 100 years ago.

Jennifer ask if there has been any wild land fires. There was fire between the two villages Shaktoolik and Unalakeet and also up the river but no major fires. If you will look at table 13 and Jennifer says Mike has check the sketches and this table which are same structures in 2009 plan are being identified as crucial to Shaktooliks being.

Are there any additions that need to be made to this table such as like any buildings that been demolished or need to add buildings in the last five years? Mike thought it was complete but Jennifer just wanted to give everyone an opportunity to add or delete. Eugene mentions that the school is getting their own place for the tank farm so that would be separate from the one in the table. Matilda mentions also they didn't add the school Duplex near the Washeteria and the old library which is the principal's home. Shawn adds the new fishermen support building that will be built this summer of 2015. Also, need to add the two AVEC wind turbines at the old airport and the new landfill which was built like five years ago in 2010.

On page 34 and on that one it says at the present time there are three projects that are currently being planned in the community: 1) Clinic Expansion, 2) Community Evacuation Center, 3) AVEC working with the City to relocate the water plant. Jennifer asks if there is any more projects besides these three. Mayor Edgar adds the washeteria upgrade and Member Randall adds the Anica

warehouse. Vice Mayor Eugene mentions the AVEC upgrade with tank farm. If you turn the page, and Jennifer knows that there isn't any flood planning mapping for Shaktoolik. And just by looking at the map, the whole community is going to be affected if there is flooding or erosion. If there is flooding, erosion or severe weather Jennifer just had put 100% with what's owned by the city and what's owned by the village will be affected with any hazards and asked if we would be in agreement with that? Secretary Agnes and Mayor Edgar replies to leave it the same at 100%. Vice Mayor Eugene commented that there is a map at the City Office from the armory corp. of engineers for flooding in like 5 years, 10 years, and 20 years. More recently the storms have occurred in odd years like 2009, 2011 and 2013. And that is like on page 37 which is a document from armory corp. of engineers. They are estimating 40 to 44 acres will be lost in the next 50 years. Vice Mayor Eugene adds that based on 2011 and 2013 storms there was an ariel survey of the old village and the old airport which FEMA had surveyed and 144 thousand acres has to be replaced. The remainder of page 37 and 38 just summarizes if that any event happens then all 251 people and 70 residences will be affected as of the 2010 census. The Armory Corp. of Engineers value 23.1 million.

The several pages of the handout are different projects that were proposed back in 2009. Jennifer and Mike has gone through this table and updated it with what had been done. The story of a lot it is that there has not been funding. So a lot of these projects haven't been done. Based on some work that has been done in 2014 by the Alaska Sea Grant which we've added couple projects in there. If you would like to take a look at those and see if there is any deletions or additions to the table. Vice Mayor Eugene asks if we will be able to add the runway and the cemetery. Jennifer replies that she can definitely list this as a concern because that's historical. Mayor Edgar says evacuation road will not exactly go away. This is something that we've been trying to fix for a long time now. Regardless of that, every time we talk about evacuation or something like that our projects go away just like that. Every time we try and get a grant and see the word "evacuation"! They'll think twice before even funding us anyway. So, this is something that we are trying to change from evacuation to emergency. So therefore, we are not trying to use evacuation and relocation anymore. And Jennifer replies that Shishmaref says the word relocation really has hurt them too. Vice Mayor Eugene says on page 81 under E. - $60,000.00 funding secured by Harvey Smith. Eugene says he thinks that Harvey lost that money for a test berm. And the City secured

$120,000.00 from our outside entity funding which is through our NSEDC program to build the berm that's in front of the village. Mike and the IRA are going to review the document next week and after that the state department of emergency management will review the hazard mitigation and then coming back to you asking community to adopt the plan before the storm season. The division of homeland security is holding our monies for reimbursement from the 2013 storm because the City of Shaktoolik needs an audit for 2013 and 2014 reasoning being is that the City got a grant from the State of Alaska over $500,000.00. So the audit is in process now with Altman Rodgers Co.

The councils thanks Jennifer for setting and being there in the meeting.

2). Adjournment at 2PM.

Jennifer LeMay's additions to 6/17/15 Public Meeting Minutes. Discussion with Michael Sookiayak in bold font with action taken.

- The community is concerned that the Power Plant relocation on page 35 may not occur based on the money being spent this summer to redo and paint the tanks and add sandbag liners. **AVEC signed a 50-year lease in 2007 for relocation of the Power Plant and Wind Turbines. This project will not occur in the short-term but will happen in the long-term when funding is available. No action taken in MJHMP.**

- Table 23, FLD-3 Shoreline Protection, Item g. The community doesn't see that the $60,000 project with funding by H. Smith was completed in 2014. They stated that Harvey and Ruth lost their funding to install a test berm. Is there another project that was done instead with the $60,000? **This funding was secured in 2010, and the project was completed. No action taken in MJHMP.**

- Table 23, FLD-3 Shoreline Protection, Items h and i. The community doesn't think this funding was secured. **Funding was secured. No action taken in MJHMP.**

- Table 23, FLD-4. The community would like to change the word "evacuation" road to resource road. They view "evacuation" as negative. **The name of the road doesn't influence this plan either way, but "evacuation" road was used in the plan for consistency. No action taken in MJHMP.**

- General comment. Do you know if an Escape Plan (Evacuation Plan) has been done for the community? **2010. See Table 1.**

- General comment. Some community members do not think the Bering Straight REAA is specific enough for Shaktoolik and feel that the region favors Unakaleet and Nome. **This concern is noted as there has been much discussion concerning this issue in many public meetings (not just for this plan update). No action taken in MJHMP as that is how the data is tabulated by the state.**

- General comment. The community would like a road from Shaktoolik to the foothills to attract birders/tourists. They wanted this road included in the hazard mitigation plan update. **No action taken. Until 2005, this road was in all plans. When storm surges increased, the planned route was no longer considered safe due to the coastal erosion that occurred.**

- General comment. The community would like to adjust the cost benefit ratio as they feel it benefits Nome and Unakaleet and makes project costs in Shaktoolik more expensive. Community members feel their lives are worth just as much as people living in Nome and Unakaleet even though they feel federal and state money is skewed more heavily to those communities. **This concern is noted, but no action was taken in MJHMP as the cost benefit ratio is done per FEMA standards.**

Appendix B: Shaktoolik Area Use Map

AREA USE MAP
SHAKTOOLIK
64° 21' 15" N 161° 11' 40" W (NAD 83)
Approximate Elevation: 20'
Township 13 South, Ranges 12 & 13 West, K.R.M., AK
U.S.G.S. Quadrangle "Norton Bay B-5" Alaska
CAPE NOME RECORDING DISTRICT
SEE SHEETS 1 & 2 FOR DETAILED COMMUNITY MAPS
0 500 1000 1500
SCALE IN FEET
SCALE: 1"=500'
Date of Photography: June 27, 2004
Magnetic Declination computed by U.S.G.S. Geomag Program using AK-2000.COF model as of August 16, 2004.
SHEET 3 of 3
Legend & Notes
Berrypicking
Cultural Site
Periodic Flooding
Hazardous Materials Site
Future Proposed Site
Specified Land Use
MAP NOTES
This map was prepared by Kawerak Inc. in cooperation with the Alaska Department of Commerce, Community and Economic Development (Commerce) using funding from Commerce, the Bureau of Indian Affairs, the Alaska Native Tribal Health Consortium, (Village of Shaktoolik) and funding from the Initiative for Accelerated Infrastructure Development (IAID). The IAID is supported by grants from the Denali Commission, USDA Rural Development, Alaska Department of Transportation and Public Facilities and Commerce. Preparation of this map was financed in part by the Mini-Grant Program with funds from the U.S. Forest Service. The Mini-Grant Program is administered by the Department of Commerce, Community, and Economic Development, Division of Community Advocacy. Kawerak Inc. contracted with Global Positioning Services, Inc. in May of 2004 to prepare the map.
This map should not be construed as a survey. In-site surveys should be conducted prior to engineering or construction.
SHAKTOOLIK AREA USE MAP SHEET 3 1"=500' (2004 PHOTOGRAPHY)
SHAKTOOLIK RIVER
SECOND CREEK
FIRST CREEK
TAGOOMENIK RIVER
SHAKTOOLIK BAY
MYRON'S LAKE
NORTON SOUND
ENTIRE COAST IS SUBJECT TO EROSION
SHAKTOOLIK CITY BOUNDARY
TO NEW AIRPORT
FLOOD PLAIN
DUCK HUNTING & BERRY PICKING AREA
DUCK HUNTING AREA
DUCK HUNTING & EGG GATHERING AREA
BERRY PICKING
Subsistence Fishing
Fish Camp
Fish Rocks
TIDAL WATER
HUMPBACK SALMON (HIGH TIDE)
TOM COD
LING COD
TROUT
SALMON
GRAYLING
SEALS
BELUGA WHALES
KING & SILVER SALMON
Old Airport Runway
Gravel Source
Summer Recreation
Snow Fence
Winter Water Source
Boat Landing
Drying Racks
Boat Ramp
Archeological Site
Archeological Site Found Ruins
Cemetery
Proposed Clinic Site
Current Landfill
Sewage Disposal Site
Barge Landing
Approx. Location Fuel Line
Nesting Area
Subsistence Gathering Area
Preferred New Landfill Site
Alternate New Landfill Site
Old Landfill & Hazardous Materials
BERRIES & GREENS PICKING
APPROXIMATE LOCATION
25' Access Trail Easement EIN 5
One Acre Site Easement EIN 17
25' Access Trail Easement EIN 3A
Summer Water Source
Dog Staking Area
MUNICIPAL RESERVE
Trustees Deed to City of Shaktoolik 10/26/81 Bk.299, Pg.476 Lots 3&5, Blk. 4
Trustees Deed to City of Shaktoolik 10/26/81 Bk.299, Pg.474 Lots 6-9, Blk.2
Trustee Deed to City of Shaktoolik 10/28/81 Bk.299, Pgs.475-477 Lots 5&8, Blk. 3 USS 4085
US SURVEY No. 4085 SHAKTOOLIK TOWNSITE Pat. No. 50-68-0059
US SURVEY No.11615 Lot 3 NA Apln FO23261
REPLAT OF SHAKTOOLIK VILLAGE SITE ADDITION No.1 Plat No. 2003-63
SHAKTOOLIK AIRPORT TRACT IV PARCEL B
SHAKTOOLIK AIRPORT TRACT IV PARCEL C Plat No. 2001-04
TRACT B PARCEL A
Land Mngt. Assign. to Ak. DOT & PF Bk.348, Pg.577-583 6/16/86 TR.II, Pors.A&B Plat No. 2001-04
Warranty Deed to Ak. DOT & PF 10/06/97 Sec.10, Lot 4, Sec.15, Lot 1, T13S, R13W
Corporate Warranty Deed to Ak. DOT & PF Bk.347, Pgs.559-568 10/06/97 TR.IV, Por. A-C
SEC. 11 IC No. 719 SNC
SEC. 12 IC No. 719 SNC
SEC. 13 IC No. 719 SNC
SEC. 14 IC No. 719 SNC
SEC. 15 IC No. 719 SNC
SEC. 18 IC No. 719 SNC
SEC. 19
SEC. 23 IC No. 719 SNC
SEC. 24 IC No. 719 SNC
SEC. 25 IC No. 719 SNC
SEC. 30 IC No. 719 SNC
USS No. 12644 Lot 1 IC No. 719 SNC
USS No. 12644 Lot 2 IC No. 719 SNC NA Apln. No. FB3704
USS No. 12644 Lot 3 IC No. 719 SNC NA Apln. No. FB3704
USS No. 12644 Lot 4 NA Apln No. 023063
USS No. 12644 Lot 6 IC No. 719 SNC NA Apln. No. 022704
QCD to US & Assigns 4/25/05 Lots 2&3
QCD to US & Assigns 4/25/05 Lots 5&6
R. 12 W.
R. 13 W.
TOWNSHIP LINE