MATANUSKA-SUSITNA BOROUGH INFORMATION MEMORANDUM IM No. 18-172

SUBJECT: AN ORDINANCE OF THE MATANUSKA-SUSITNA BOROUGH ASSEMBLY ADOPTING THE CITY OF HOUSTON LOCAL HAZARD MITIGATION PLAN AND AMENDING MSB 15.24.030(B) (34), COMPREHENSIVE PLAN.

AGENDA OF: November 27,2018

ASSEMBLY ACTION:

MANAGER RECOMMENDATION: Introduce and set for public hearing.

APPROVED BY JOHN MOOSEY, BOROUGH MANAGER: for

Route To:	Department/Individual	Initials	Remarks
	Originator (J. Smith)		
	Planning and Land Use Director		
	Borough Attorney	for N.S.	
	Borough Clerk		11/19/18

ATTACHMENT(S): Fiscal Note: YES ____ NO X
Planning Commission Resolution No 18-23 (2 pp)
City of Houston, Alaska Resolution 18-01 (2 pp)
U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA), Region 10, Letter of approval (9 pp)
City of Houston Local Hazard Mitigation Plan (148 pp)
Ordinance Serial No. 18-109 (1 pp)

SUMMARY STATEMENT:

On April 12, 2018, The City of Houston adopted the Local Hazard Mitigation Plan (LHMP). The City of Houston must review and revise its LHMP to reflect developmental progress in mitigation efforts and changes in priorities, and resubmit the plan to FEMA for approval every five years to maintain eligibility for mitigation project grant funding. On April 24, 2018, the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA), Region 10, approved the City of Houston LHMP as a local plan as outlined in 44 CFR 201.

RECOMMENDATION OF ADMINISTRATION: Assembly adoption of OR 18-109.

By: Jessica Smith
Introduced: June 4, 2018
Public Hearing: June 18, 2018
Action: Approved

MATANUSKA-SUSITNA BOROUGH
PLANNING COMMISSION RESOLUTION NO. 18-23

A RESOLUTION OF THE MATANUSKA-SUSITNA BOROUGH PLANNING COMMISSION RECOMMENDING ASSEMBLY APPROVAL OF THE CITY OF HOUSTON LOCAL HAZARD MITIGATION PLAN.

WHEREAS, on April 12, 2018, the City of Houston adopted the Local Hazard Mitigation Plan (LHMP); and

WHEREAS, hazard mitigation is the process of profiling hazards, analyzing risk, and developing preventive actions; and

WHEREAS, the City of Houston must review and revise its LHMP to reflect developmental progress in mitigation efforts and changes in priorities, and resubmit it to FEMA for approval every five years to maintain eligibility for mitigation project grant funding; and

WHEREAS, on April 24, 2018, the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA), Region 10, approved the City of Houston Hazard Mitigation Plan as a local plan as outlined in Code of Federal Regulations Title 44 Part 201; and

NOW, THEREFORE, BE IT RESOLVED, that the Matanuska-Susitna Borough Planning Commission hereby recommend Assembly adoption of the City of Houston Local Hazard Mitigation Plan (LHMP).

ADOPTED by the Matanuska-Susitna Borough Planning Commission this 18th day of June, 2018.

Colleen Vague
COLLEEN VAGUE, Chair

ATTEST

Karol Riese for Mary Brodigan
MARY BRODIGAN, Planning Clerk

(SEAL)

YES: Vague, Anderson, Patterson, Chesbro, Elder, Glashen, and McKechnie

NO:

Introduced by: Mayor Thompson
Introduction Date: March 08, 2018
Action: Approved, April 12, 2018
Vote: Barney, Brunswick, Kruger, Stout, Wilson and Thompson in favor
Johnson Absent

CITY OF HOUSTON, ALASKA
RESOLUTION 18-01

A RESOLUTION OF THE HOUSTON CITY COUNCIL ADOPTING THE CITY OF HOUSTON LOCAL HAZARD MITIGATION PLAN (LHMG)

WHEREAS, hazard mitigation is the process of profiling hazards, analyzing risk, and developing preventive actions; and

WHEREAS, the purpose of a Local Hazard Mitigation Plan (LHMP) is to identify and coordinate risk mitigation efforts with State, Federal, and local partners to fulfill requirements set forth by Code of Federal Regulations (CFR), Title 44 "Emergency Management and Assistance", Part 201 "Mitigation Planning", Subsections 6 and 7; and

WHEREAS, on April 10, 2008 the City of Houston approved Resolution 2008-13 adopting a Hazard Mitigation Plan; and

WHEREAS, the City must review and revise its plan to reflect developmental progress in mitigation efforts and changes in priorities, and resubmit it to FEMAfor approval every five years to maintain eligibility for mitigation project grant funding; and

WHEREAS, the Office of the City Clerk applied for mitigation project grant funding in anticipation of the City plan update; and

WHEREAS, the State of Alaska, Department of Military and Veterans Affairs, Division of Homeland Security and Emergency Management (DHS & EM) was awarded a Pre-Disaster Mitigation Program grant from the Federal Emergency management Agency (FEMA) to develop a Local Hazard Mitigation Plan (LHMP) update for the City of Houston; and

WHEREAS, LeMay Engineering & Consulting, Inc. was contracted by the State to assist the City of Houston with the plan update; and

WHEREAS, the LHMP provides information on natural hazards that may affect Houston, describes past disasters, and lists projects that may help the community mitigate disaster impacts; and

WHEREAS, the LHMP will assist the City as a valuable resource tool in making decisions regarding natural hazards that may affect the City of Houston; and

WHEREAS, the city must have a State and FEMA approved community adopted HMP to receive FEMA pre and post disaster grants; and

WHEREAS, The Mayor, or his or her designee, is responsible for monitoring the plan and will require an annual report from agencies and departments responsible for implementing the mitigation projects in chapter 4 of the plan, and the compiled report will be provided to the City Council and to the public;

NOW, THEREFORE, BE IT RESOLVED, the Houston City Council adopts the Local Hazard Mitigation Plan (LHMP) update attached hereto; and

NOW, THEREFORE, BE IT FURTHER RESOLVED, the Houston City Council 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 Federal Laws and the Local Hazard Mitigation Plan Update, pursuant to 44 CFR13.11(d).

PASSED AND APPROVED by the Houston City Council on April 12, 2018

THE CITY OF HOUSTON, ALASKA

Virgie Thompson

Virgie Thompson, Mayor

ATTEST:

Sonya Dukes

Sonya Dukes, CMC, City Clerk

U.S. Department of Homeland Security
FEMA Region 10
130 – 228th Street, SW
Bothell, Washington 98021-8627

FEMA

April 25, 2018

Ms. Sonya Dukes
Clerk, City of Houston
PO Box 940027
Houston, Alaska 99694

Dear Ms. Dukes:

On April 24, 2018, the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA), Region 10, approved the City of Houston Hazard Mitigation Plan as a local plan as outlined in Code of Federal Regulations Title 44 Part 201. This approval provides the jurisdiction eligibility to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's, Hazard Mitigation Assistance (HMA) grants projects through April 23, 2023, through your state.

FEMA individually evaluates all application requests for funding according to the specific eligibility requirements of the applicable program. Though a specific mitigation activity or project identified in the plan may meet the eligibility requirements, it may not automatically receive approval for FEMA funding under any of the aforementioned programs.

Over the next five years, we encourage your communities to follow the plan's schedule for monitoring and updating, and to develop further mitigation actions. To continue eligibility, jurisdictions must review, revise as appropriate, and resubmit the plan within five years of the original approval date.

If you have questions regarding your plan's approval or FEMA's mitigation grant programs, please contact Mike Johnson, Emergency Management Specialist with Alaska Division of Homeland Security and Emergency Management, at (907) 428-7055 who locally coordinates and administers these efforts.

Sincerely,

Mark Carey, Director
Mitigation Division

cc: Brent Nichols, Alaska Division of Homeland Security and Emergency Management

Enclosure

AS:vl

IM 18-172
OR 18-109

APPENDIX A:
LOCAL MITIGATION PLAN REVIEW TOOL

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

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

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

Jurisdiction: Houston, Alaska (Region 10)	**Title of Plan:** City of Houston, Alaska Local Hazard Mitigation Plan	**Date of Plan:** August 24, 2017
Local Point of Contact: Sonya Dukes, CMC		**Address:** P.O. Box 940027 Houston, AK 99694
Title: City Clerk		
Agency: City of Houston		
Phone Number: (907) 892-6869		**E-Mail:** SDukes@houston-ak.gov

State Reviewer:	**Title:**	**Date:**
George J Grady	Emergency Management Specialist II	

FEMA Reviewer:	**Title:**	**Date:**
Amanda Siok Amanda.Siok@fema.dhs.gov	Mitigation Planner	12/01/2017 02/05/2018
Date Received in FEMA Region 10	10/17/2017; 12/20/2017	
Plan Not Approved		
Plan Approvable Pending Adoption	02/06/2018	
Plan Approved	04/24/2018	

SECTION 1:
REGULATION CHECKLIST

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT A. PLANNING PROCESS			
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Chapter 1, pages 1-8, Table 1 on pages 2 and 3, Appendix A PDF 16-22, 116-121	X	
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Chapter 1, pages 4 and 5, plan will be uploaded to DHS&EM webpage for review PDF 18-19 PDF 118	X	
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Chapter 1, pages 4 and 5, Appendix A PDF 19, PDF 118	X	
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	Chapter 1, pages 3-4 PDF 17-18	X	
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Chapter 1, page 6, Appendix E PDF 20	X	
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	Chapter 1, pages 6 and 7, Appendix E PDF 20-21, 151-154	X	
ELEMENT A: REQUIRED REVISIONS			

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT			
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Chapter 3, Section 1-10 PDF 53-86	X	
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Chapter 3, Pages 39-40, 47-49, 53-55, 59-61, 65-66, 68, 70 PDF 54-85	X	
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	Chapter 3, Pages 35-36, 39, 47, 53, 59, 65, 68, 70 Tables 16 and 17 PDF 45-50, 49-84, 34-35	X	
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	Chapter 3, Pages 37, 40-43 PDF 51, 57	X	
ELEMENT B: REQUIRED REVISIONS			

ELEMENT C: MITIGATION STRATEGY			
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Section 2.3, Tables 3, 4, and 5 as well as Page 77 PDF 29-36, 91	X	
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	Pages 40-43 PDF 54-57	X	
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Chapter 3, Pages 43, 49-50, 55-56, 61-62, 66, 68-69 PDF 57, 64-65, 70-71, 75, 80, 82	X	
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	Chapter 4, Tables 25 and 26 PDF 92-105	X	
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Chapter 4, Table 26 PDF 97-102	X	
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	Chapter 1, page 6 PDF 19-20	X	
ELEMENT C: REQUIRED REVISIONS			

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

SECTION 2:
PLAN ASSESSMENT

A. Plan Strengths and Opportunities for Improvement

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

Element A: Planning Process

Plan Strengths:

- The planning team includes multiple departments from within the City of Houston as well as a representative from the Mat-Su Borough.
- The planning team reviewed several plans while developing the HMP including economic development and comprehensive plans.
- The plan has a visual graphic of the Hazard Mitigation Planning Cycle.

Opportunities for Improvement:

- The public process can be significantly improved by developing an outreach process that is engaging to the public, rather than expecting the public to read through draft plans on a website. The intended booth at the Annual Founder's Day Celebration is a move in the right direction. Consider asking more specific goals of the public, rather than using the event for hazard awareness. Potential public engagement questions:
    - What do you want the City to do to reduce the risk of flood, earthquake, etc.
    - Rank the top five proposed mitigation projects.
    - Do you have an idea for a project that will reduce the risk of X in Houston?

  Be sure to document the process and comments from the public in the Annual Founder's Day celebration. A new survey specific to Houston is being designed now and will be added to the final Plan after an APA has been issued.

Element B: Hazard Identification and Risk Assessment

Plan Strengths:

- The Plan references the Mat-Su Borough's HMP to identify hazards in the planning area and to exclude those that aren't.
- The Plan identifies Climate Change as a Hazard.

Opportunities for Improvement:

- Consider adding population and infrastructure related to the tourism/recreation population to Houston's vulnerabilities. (seasonal influx in population, vacant houses, language/unique needs of tourist population
- Consider adding wells, septic, and plumping infrastructure to the City's critical infrastructure list.
- PDF 45, Section 2 reads "Houston is a small community of 2,163 residents, every structure is essential to the sustainability and survivability of residents". If this is true, why were the above suggestions identified in Section 2 Community Profile Culture, Population, and Facilities (PDF24-25) sections not recognized in Section 2.2's Capability Assessment Infrastructure, Critical Facilities, Essential Facilities, and Critical Infrastructure (PDF 27)?
- Table 14 and 15 list facilities in the community from the Hazus database; consider obtaining GIS data from the City of Houston, Mat-Su Borough, or in-person visits to increase the understanding and spatial awareness of essential facilities.

Element C: Mitigation Strategy

Plan Strengths:

- The plan identifies existing authorities, policies, programs, and resources including staff, GIS capabilities, and funding.

Opportunities for Improvement:

- The plan integration section should be expanded to include more detail and include specific processes for integration of the HMP and Comprehensive Plan. Identification of the Comprehensive Plan is only the beginning step to integration. The HMP could go into more detail to explain the overlapping goals/mission/objectives of the comprehensive plan and identify specific processes to integrate the two plans. Consider mutual meetings, safe growth audits, and shared public engagement requirements.
- PDF 59 states that "The City of Houston has no enforcement authority over the quality of buildings constructed" but PDF 29 Table 4 documents building codes, zoning ordinances, and site plan review requirements. Consider expanding on the capabilities in Table 4 to identify how enforcement can be improved and supported.
- While the plan does document existing authorities, policies, programs, and resources, there is no description of how these can be improved and/or expanded to support identified mitigation actions.
- There are no goals or actions identified to reduce the risks/vulnerabilities associated with climate change.

B. Resources for Implementing Your Approved Plan

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

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

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

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

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

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

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

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

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

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

City of Houston, Alaska

Local Hazard Mitigation Plan

August 2017

Prepared by:

City of Houston, Alaska

LeMay Engineering & Consulting, Inc.

IM 18-172
OR 18-109

Acknowledgements

Houston City Council

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Matanuska-Susitna Borough

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Taunnie Boothby, Mat-Su Borough Floodplain Coordinator

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Technical Assistance

Alaska State Division of Homeland Security & Emergency Management

George Grady, State Hazard Mitigation Planner
Brent Nichols, State Hazard Mitigation Officer

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Acronyms

APA	Approval Pending Adoption
ARDORs	Alaska Regional Development Organizations
ATV	All-Terrain Vehicle
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
DRF	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
LHMP	Local 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
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

City of Houston Letter of Commitment

City of Houston, Alaska
Mayor's Office

June 21, 2017

George Grady
State of Alaska
DMVA DHS&EM
P.O. Box 5750
Joint Base Elmendorf-Richardson, Alaska 99505-5750

Mr. Grady:

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

Sincerely,
CITY OF HOUSTON

Virgie Thompson
Mayor Virgie Thompson

CC: City Clerk

City of Houston, Mayor's Office • P.O. Box 940027 • Houston, Alaska 99694-0027
Phone: (907)892-6869 • Fax: (907) 892-7677 • email: mayor@houston-ak.gov
Website: www.houston-ak.gov

City of Houston Adoption Resolution

Introduced by: Mayor Thompson
Introduction Date: March 08, 2018
Action: Approved, April 12, 2018
Vote: Barney, Brunswick, Kruger, Stout, Wilson and Thompson in favor
Johnson Absent

CITY OF HOUSTON, ALASKA
RESOLUTION 18-01

A RESOLUTION OF THE HOUSTON CITY COUNCIL ADOPTING THE CITY OF HOUSTON LOCAL HAZARD MITIGATION PLAN (LHMG)

WHEREAS, hazard mitigation is the process of profiling hazards, analyzing risk, and developing preventive actions; and

WHEREAS, the purpose of a Local Hazard Mitigation Plan (LHMP) is to identify and coordinate risk mitigation efforts with State, Federal, and local partners to fulfill requirements set forth by Code of Federal Regulations (CFR), Title 44 "Emergency Management and Assistance", Part 201 "Mitigation Planning", Subsections 6 and 7; and

WHEREAS, on April 10, 2008 the City of Houston approved Resolution 2008-13 adopting a Hazard Mitigation Plan; and

WHEREAS, the City must review and revise its plan to reflect developmental progress in mitigation efforts and changes in priorities, and resubmit it to FEMA for approval every five years to maintain eligibility for mitigation project grant funding; and

WHEREAS, the Office of the City Clerk applied for mitigation project grant funding in anticipation of the City plan update; and

WHEREAS, the State of Alaska, Department of Military and Veterans Affairs, Division of Homeland Security and Emergency Management (DHS & EM) was awarded a Pre-Disaster Mitigation Program grant from the Federal Emergency management Agency (FEMA) to develop a Local Hazard Mitigation Plan (LHMP) update for the City of Houston; and

WHEREAS, LeMay Engineering & Consulting, Inc. was contracted by the State to assist the City of Houston with the plan update; and

WHEREAS, the LHMP provides information on natural hazards that may affect Houston, describes past disasters, and lists projects that may help the community mitigate disaster impacts; and

WHEREAS, the LHMP will assist the City as a valuable resource tool in making decisions regarding natural hazards that may affect the City of Houston; and

WHEREAS, the city must have a State and FEMA approved community adopted HMP to receive FEMA pre and post disaster grants; and

WHEREAS, The Mayor, or his or her designee, is responsible for monitoring the plan and will require an annual report from agencies and departments responsible for implementing the mitigation projects in chapter 4 of the plan, and the compiled report will be provided to the City Council and to the public;

NOW, THEREFORE, BE IT RESOLVED, the Houston City Council adopts the Local Hazard Mitigation Plan (LHMP) update attached hereto; and

NOW, THEREFORE, BE IT FURTHER RESOLVED, the Houston City Council 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 Federal Laws and the Local Hazard Mitigation Plan Update, pursuant to 44 CFR13.11(d).

PASSED AND APPROVED by the Houston City Council on April 12, 2018

THE CITY OF HOUSTON, ALASKA

Virgie Thompson

Virgie Thompson, Mayor

ATTEST:

Sonya Dukes

Sonya Dukes, CMC, City Clerk

Bold and Underline, added. ~~Strike-through,~~ deleted.

City of Houston Resolution No. 18-01

FEMA Approval Letter

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

FEMA

February 6, 2018

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

Dear Mr. Nichols:

As requested, on February 06, 2018, the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA), Region 10, completed a pre-adoption review of the City of Houston Local Hazard Mitigation Plan. This letter serves as Region 10's commitment to approve the plan upon receiving documentation of its adoption by the community. The plan successfully contains the required criteria, excluding the adoption, for hazard mitigation plans, as outlined in Code of Federal Regulation Title 44 Part 201.

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

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

Sincerely,

2/6/2018

X Tamra Biasco

Signed by: TAMRA D BIASCO

Tamra Biasco
Chief, Risk Analysis Branch
Mitigation Division

BH:vl

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

1.1.1 Purpose

The purpose of this LHMP 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.

FEMA's October 2007, July 2008, and October 2012 changes to 44 CFR §201.6 combined and expanded flood mitigation planning requirements with LHMPs. 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.

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 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 LHMP.

1.2 Plan Development

The City of Houston developed their LHMP in 2008. This LHMP is a complete rewrite of the 2008 plan due to a change in Political Administrations and should be considered a new LHMP. This LHMP is being accomplished with assistance from the State of Alaska, Division of Homeland Security and Emergency Management (DHS&EM) and its contractor, LeMay Engineering & Consulting, Inc. This plan documents hazard mitigation planning on the local level for the City of Houston to receive federal disaster mitigation funds. This plan is intended as a guide for reducing losses, both human and economic, due to natural disasters. This document follows the required processes of identification of hazards, evaluation of vulnerabilities, and presentation of mitigation strategies. It is understood that this plan will be revised in response to changing conditions with a significant update occurring every five years. 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.

Project Staff

The City designated Sonya Dukes, City Clerk, as the primary local staff person on this project. Jennifer LeMay, PE, PMP of LeMay Engineering & Consulting, Inc. was hired to develop the plan with input from the Planning Team and the community. George Grady of DHS&EM provided technical assistance and reviewed the draft of this plan. Table 1 identifies the Planning Team.

Table 1. Hazard Mitigation Planning Team

Name	Title	Organization	Phone
Virgie Thompson	Mayor	City of Houston	892.6869
Sonya Dukes	City Clerk	City of Houston	892.6869

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OR 18-109

Name	Title	Organization	Phone
Casey Cook	Regional Emergency Manager	Matanuska-Susitna Borough	861.8004
Christian Hartley	Fire Chief	City of Houston	892.6869
Jennifer LeMay, PE, PMP	Planner/Consultant	LeMay Engineering & Consulting, Inc.	350-6061
George Grady	State Hazard Mitigation Planner	DHS&EM	428.7055
Brent Nichols	State Hazard Mitigation Officer	DHS&EM	428.7085

Plan Research

The following five-step process took place from March through August 2017:

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.

This plan was developed utilizing existing Houston and Matanuska-Susitna Borough 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. *City of Houston Comprehensive Plan*, adopted by Houston City Council and the Matanuska-Susitna Borough in September 2016 and February 2017, respectively.
3. *Matanuska-Susitna Borough Hazard Mitigation Plan*, prepared by Matanuska-Susitna Borough, 2013.
4. *City of Houston's Hazard Mitigation Plan,* adopted by Houston City Council Resolution on April 10, 2008.
5. *Division of Community and Regional Affairs (DCRA) Community Information*: http://www.commerce.alaska.gov/web/dcra/home.aspx
6. *Matanuska-Susitna Borough Core Area Comprehensive Plan*, prepared by Matanuska-Susitna Borough Department of Planning and Land Use, 2007 Update.

7. *Mat-Su Comprehensive Economic Development Strategy,* prepared by Matanuska-Susitna Borough Department of Planning and Land Use, 2008.
8. *Risk Report, FEMA Region X – Matanuska-Susitna Borough, Alaska and the Incorporated Cities of Houston, Palmer, and Wasilla,* prepared by FEMA; the Alaska Department of Commerce, Community, and Economic Development; and Alaska Geological and Geophysical Surveys in December 2016.
9. City of Houston Website: http://www.houston-ak.gov/
10. 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)

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: program-community-rating-system	https://www.fema.gov/national-flood-insurance-
Flood Mitigation Assistance Program: grant-program	https://www.fema.gov/flood-mitigation-assistance-
Hazard Mitigation Grant Program:	http://www.fema.gov/hazard-mitigation-grant-program
Individual Assistance Program: tools	http://www.fema.gov/individual-assistance-program-
Interim Final Rule: library/assets/documents/4590	https://www.fema.gov/media-
National Flood Insurance Program: program	http://www.fema.gov/national-flood-insurance-
Public Assistance Program: tribal-and-non-profit/	http://www.fema.gov/public-assistance-local-state-

Public Involvement

On March 29, 2017, DHS&EM began community relations with the City Office regarding the LHMP. City Clerk Sonya Dukes discussed the upcoming LHMP development activities with the City Council.

In Houston, collaboration and review work much better when participants are provided with a draft document to review and critique. Rather than begin the process at the stakeholder level, it was necessary for a draft to be first developed which could be used by the community to provide constructive feedback. Jennifer LeMay prepared a working draft copy of the plan by evaluating the 2013 *Matanuska-Susitna Borough All Hazards Plan* and the 2017 *Comprehensive Plan* for Houston as well as existing plans identified in Subsection Plan Research on pages 3 and 4 of this document.

On July 5, 2017, the Planning Team attended a work session and reviewed the draft working copy of the LHMP for accuracy, ensuring the LHMP plan met the City's needs. The meeting was productive with the Team further refining the plan and adding input based on each team member's area of expertise. Changes were specifically targeted to plan development information, hazard impacts, community vulnerability analysis, and the mitigation strategy. During the work session, team members agreed that identified hazards known to impact the Community of Houston are:

1. Flood
2. Severe Weather
3. Wildland Fire
4. Earthquake
5. Ground Failure
6. Volcano
7. Climate Change

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

On August 24, 2017, a public notice was issued announcing the availability of the LHMP for comment. The public notice was posted on the City of Houston's Facebook page, City of Houston's web page, and on the City Office, Miller's (local ice cream shop), and U.S. Post Office's bulletin boards. A paper copy of the LHMP was available for review in the City Office from August 24 to December 8, 2017. No public comments were received through any of these methods.

The City of Houston adopted the 2017 LHMP by City Council resolution during a regularly scheduled meeting on December 14, 2017. Adoption took place after the State of Alaska DHS&EM and FEMA reviewed the plan.

Incorporation of Existing Plans

During the planning process, the Planning Team reviewed and incorporated information from existing plans into the LHMP. The Houston LHMP and all future updates or changes will be adopted through resolution of the City Council. This governing body has the authority to promote sound public policy regarding hazards. The LHMP will be assimilated into other Houston plans and documents as they are prepared when funding is available. Current plans for the community of Houston are listed in Table 2.

Table 2. Houston Plans

Document	Completed	Scheduled Review
City of Houston Comprehensive Plan	2017	As needed

1.3 Plan Maintenance

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

Incorporation into Existing Planning Mechanisms

The planning team will incorporate the LHMP into their planning mechanisms 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 Public Works Clerk will be responsible for providing a list of all City of Houston documents to contractors working on new or updating existing City Plans and ensuring that this LHMP is incorporated into plans as necessary.

The City of Houston will involve the public to continually reshape and update this LHMP. A paper copy of this plan will be available at the City Office. This LHMP will also be stored on the State Department of Commerce, Community, and Economic Development Community and Regional Affairs, (DCCED/DCRA) plans website for public reference. Planners are encouraged to integrate components of this LHMP into their own plans.

Continued Public Involvement

Through community outreach activities, the planning team will continue to raise awareness of this plan. The main community outreach activity would be at the Annual Founder's Day Celebration. A booth will be set up to remind the public of hazards in the Houston area and a fact sheet will be publicly distributed with relevant information. 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

Monitoring the Plan: The Houston mayor, or his or her designee, is 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

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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.

be provided to the City Council 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 Houston mayor, or his or her 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 LHMP are illustrated on Figure 1.

State and FEMA Review and Technical Assistance

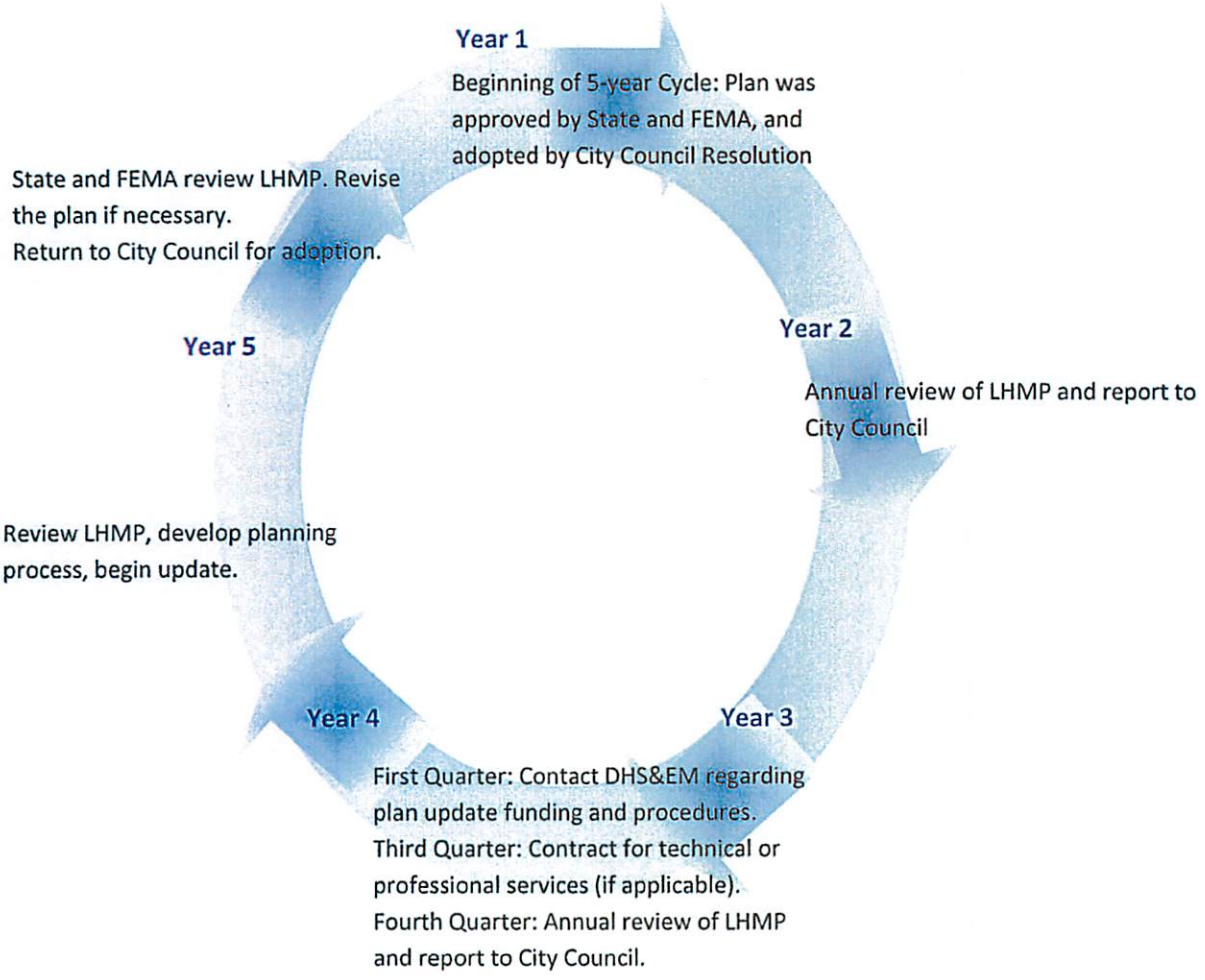
Draft LHMPs are submitted to the State Hazard Mitigation Officer (SHMO) for review. The SHMO reviews the plan for consistency with the State HMP and the DMA 2000 regulations. The primary guidance is the FEMA Local Mitigation Plan Review Tool, 2010. The State and its contractor assist the City with any necessary revisions and then forward 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. The Houston City 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 City of Houston and the State for their records. Finally, the SHMO places a copy of the FEMA-approved LHMP in DHS&EM files and on the State web site for reference.

Formal Plan Adoption and Assurances

The Houston City Council 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 Houston, with assistance from the SHMO, the State Hazard Mitigation Advisory Committee (SHMAC), and FEMA, are responsible for monitoring, evaluating, and updating the LHMP in accordance with 44 CFR §201.6.

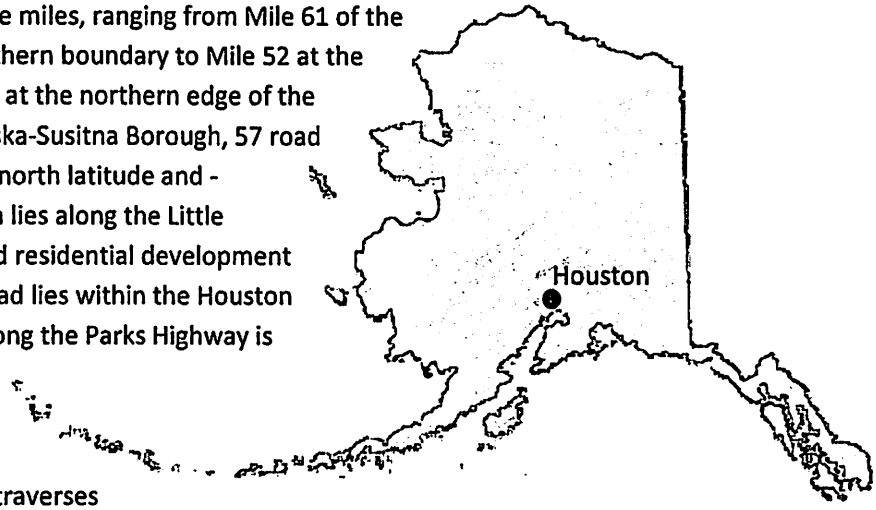
Figure 1. Hazard Mitigation Planning Cycle



Chapter 2. Community Profile

2.1 Community Overview

Location



Houston encompasses 25.3 square miles, ranging from Mile 61 of the George Parks Highway at the northern boundary to Mile 52 at the southern boundary and is located at the northern edge of the population center of the Matanuska-Susitna Borough, 57 road miles from Anchorage at 61.630° north latitude and -149.818° west longitude. Houston lies along the Little Susitna River. The commercial and residential development along the first mile of Big Lake Road lies within the Houston city limits. Houston 's position along the Parks Highway is significant from a transportation standpoint not only in terms of its location, but also because the Alaska Railroad traverses the George Parks Highway within the city limits. Houston is located in the Palmer Recording District.

Current Population:	2,163; 2016 Department of Labor Estimate
Pronunciation:	(h)yo͞osten
Incorporation Type:	2nd Class City
Borough:	Matanuska-Susitna
Census Area:	FIPS code for Houston city is 33800

Table 3 provides local and regional contact information for Houston.

History

Herning Trail (now Willow Creek Sled Trail) was used for freighting supplies to the Willow Creek Mining District. "Houston Siding" was first listed on a blueprint map of the Alaska Railroad in 1917; it was named after Congressman Houston of Tennessee. Several coal mines were developed in the area during 1917-18. A railroad spur was constructed to the Janios & Athens coal mine, which supplied coal to Anchorage and the LaTouche Mining Company in Prince William Sound. The coal found in Houston was used extensively by the U.S. Navy up through World War II, when the mines shut down. In the mid-1920s, the Heaven brothers operated a mink farm at Mile 59.6. In 1953-54, gravel roads and power lines were extended west of Wasilla, and Houston was quickly settled. In 1966, Houston incorporated as a third-class city; it was reclassified as a second-class city in 1973. In 1998, tests were conducted into the availability, quantity, and quality of natural gas and found huge deposits of coal-bed methane, but the wells were capped due to local restrictions and a lack of marketing.

Table 3. Community Information

Community Information	Contact Information and Type
City of Houston	City of Houston Sonya Dukes, City Clerk PO Box 940027 Houston, AK 99694 Phone: (907) 892-6869 Fax: (907) 892-7677 Email: sdukes@houston-ak.gov
Borough Located In:	Matanuska-Susitna Borough
Electric Utility	Matanuska Electric Association, Incorporated PO Box 2929 Palmer, AK 99645 Phone: (907) 761-9328 Website: www.mea.coop/
School District	Matanuska-Susitna School District 501 N. Gulkana St Palmer, AK 99645 Phone: (907) 746-9255 Fax: (907) 761-4076 Website: www.matsuk12.us

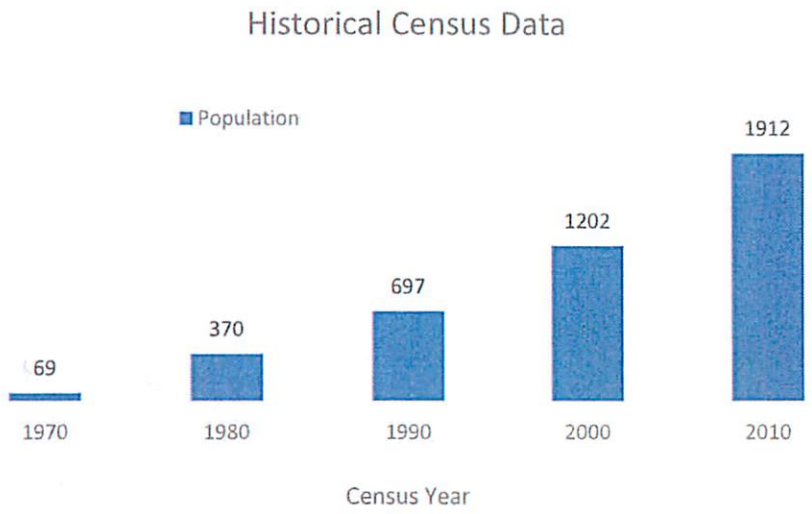
Culture

Houston is a rural-residential community that experiences consistent growth and is encouraging businesses to relocate to the community. Popular recreation sites include Little Su Campground, Long Lake, Cheri Lake, Prator Lake, Loon Lake, Woody Lake, Zero Lake, Bear Paw Lake, and Birch Lake. Founder's Day, a community celebration, boasts live entertainment, vendors, activities for kids, and a fireworks display. Trails for hiking and ATVs crisscross most of Houston and are popular in the winter months for dog sledders and snowmachiners. During the summer months, a water trail is popular in the Nancy Lakes region. There are several community organizations, such as the Mid-Valley Seniors, Homesteaders Community Center, Susitna Rotary, Houston Lions, and Houston Fire Department Auxiliary. Elementary students attend Big Lake and Willow schools. The Houston High School and Middle School serve students from the surrounding area.

Population

Houston's estimated population in 2008 was 2,018 which is more than double the recorded 697 residents in 1990. According to the 2010 U.S. Census, Houston has a population of 1,912 residents, and 82 percent of residents are White. The 2016 Department of Labor Estimate identified a population of 2,163. Figure 2 provides historical census data. The community has a total of 973 housing units and 731 units are occupied. A total of 242 housing units are vacant, and 134 are vacant due to seasonal use.

Figure 2. Historic Populations



Economy

Houston's residents are employed in the nearby Wasilla/Palmer area with some commuting to Anchorage and the North Slope. Since Houston is a popular fishing and recreation center for the Little Susitna River and area lakes, several businesses provide hospitality and transportation services. The total potential work force is 1,422; 747 residents were employed according to DCRA. 16.8 percent of residents live below the poverty line. The per capita income is $26,442 with a median household income of $51,974.

Facilities

Sixty percent of Houston residents have individual wells, septic tanks, and complete plumbing. The schools use their own well water systems. The remainder of the population hauls water and uses outhouses. The Borough landfill in Big Lake is used. The Palmer MSB Central Landfill is also used.

Matanuska Electric Association, Southfork Hydro, LLC, and Enerdyne, LLC include Houston in their service area.

Elementary students attend Big Lake and Willow schools. Houston Middle School, 6th thru 8th grades with 307 students and 22 teachers per DCRA, is located within the Matanuska-Susitna Borough School District. Houston High School, 9th thru 12th grades with 388 students and 30 teachers per DCRA, is also located adjacent to Houston Middle School.

Health care is accessed in Anchorage, Palmer or Wasilla.

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Transportation

Transportation into Houston includes the George Parks Highway and the Alaska Railroad. Air services are available at Anchorage International Airport for large commercial flights, and Black Spruce Airport (Runways: 1), Gus Landing Airport (Runways: 1), Reids Landing Airport (Runways: 1), Satterbergs Airport (Runways: 1), and Morvro Lake Seaplane Base. The average daily traffic count along the George Parks Highway at Houston is 19,000 vehicles as measured by AKDOT & PF.

Climate

According to the City of Houston, January temperatures range from -33 to 33 °F while July temperatures range from 42 to 83° F. The average annual rainfall is 15 inches of precipitation, mostly gained from mid-July through the first-half of September, and 45 inches of snow. Winds are frequently lower than the Palmer/Wasilla area with daily averages ranging from less than 1 mph to 6 mph.

Vegetation and Soils

Soil in Houston ranges from well-drained, well-sorted gravel to wetlands. In the central and southern portions of the City of Houston, several lakes trending from the northeast to the southwest occur. These lakes are bordered by glacial moraines. The moraines consist of non-sorted glacial till. In general, the majority of the soil in the east-central portion of Houston, south of the Little Susitna River and east of the Parks Highway, are well-drained sand and gravel of pitted outwash and till material. To the west of the Parks Highway, there are large scattered areas of poorly-drained soil and peat bog.

North of the Little Susitna River and northeast of the Parks Highway, topography is controlled by rolling hills with perched silty areas. The soil is fine-grained with poor drainage characteristics. Development within the area is sparse.

Several gravel pits are located within the Houston area. These pits are generally cut in glacial moraine and esker/kame complexes.

The vegetation within the Houston area is comprised of three broad vegetation categories: bottomland spruce-poplar forest, lowland spruce-hardwood forest, and low brush bog. Vegetation types within these broad categories also vary. The bottomland spruce-poplar forest includes mixed forest, cottonwood, alder, and willow. The lowland spruce-hardwood forest includes the birch forest found in the Houston area. Lowbrush bog and musket areas are dominated by dwarf shrubs over mats of sedges, mosses, and lichens.

Wildlife

The Little Susitna River, a meandering salmon stream in a shallow valley, traverses the community from east to west near the center of town. The Houston area is also home to moose, black bear, and brown bear.

2.2 Houston's Capability Assessment

Government

Houston was incorporated in 1966 and is now classified as a second-class city. The community has a "strong mayor" form of government. Under Alaska Statute Title 29, the City of Houston assumes powers including the ability to tax and to administer fire protection, police, animal control, roads, park management, and various other services. The City Council has seven members that meet the second Thursday of every month. Regular elections are held on the first Tuesday in October. The city imposes a two percent sales tax.

Community Maps

Map 1 provides a regional view of Houston.

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 Houston, the 2008 LHMP identified critical facilities as:

- City Hall contains City Hall, Public Works, City Administration, City Finance, Communications.
- Houston Fire Department 9-1 (Willow Ambulance is also located here).
- Houston Fire Department 9-2
- Landing Zones for Helicopters

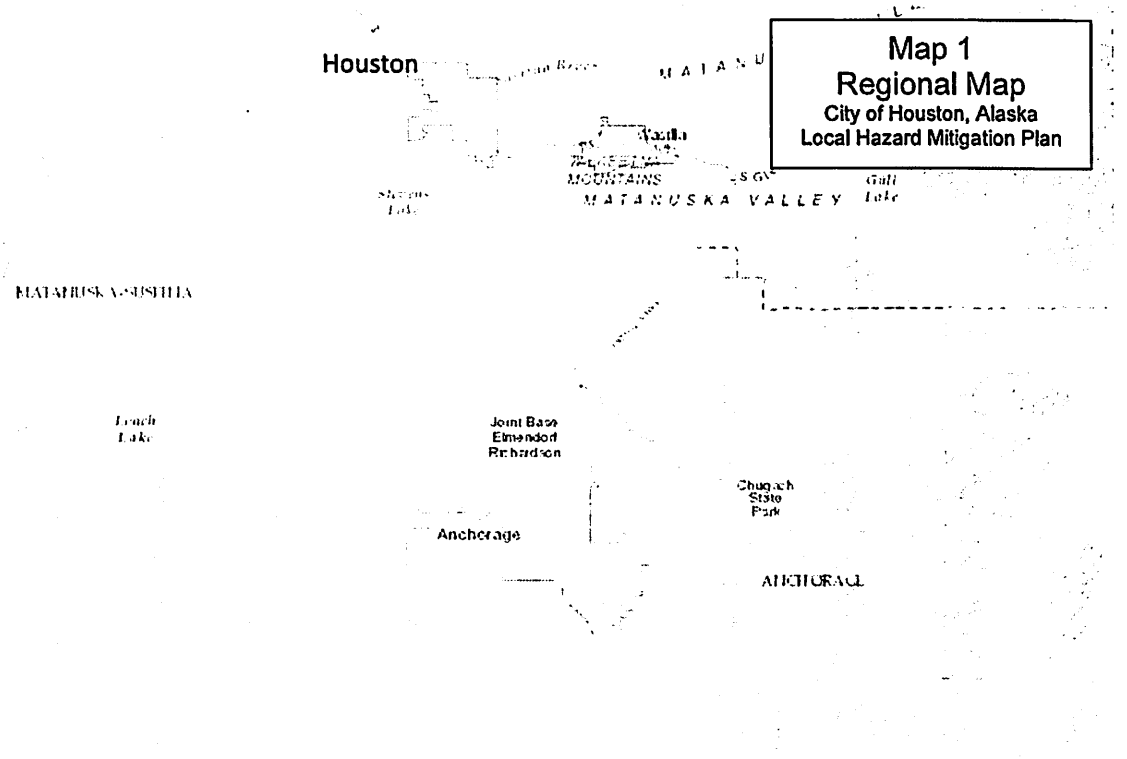
Essential Facilities: Essential facilities are those facilities and infrastructure that supplement response efforts and whose loss of function would present an immediate threat to life, public health, and safety, including:

- City Hall
- Post Office
- Houston Middle School and Houston High School (shelters)
- Alaska Railroad (track)
- Parks Highway

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

- City Hall (base station for communication; back up generator for power)

Map 1. Regional Map



- Telephone lines
- Water Supply (three fill sites: Big Lake Road/Parks Highway intersection, Birch Road at Fire Station 9-2 intersection, and Fire Station 9-1 on Armstrong Road)
- Power lines
- Transportation networks
- Three Bears/Shell Gas Station

Vulnerable Populations: Locations within Houston that serve populations with special needs or require special consideration include:

- Schools
- Senior Assisted Living Homes managed by Wasilla Area Seniors: Cranberry Ridge, Mid-Valley Manor, and Blueberry Pointe

Cultural and Historical Assets: Houston does not have any designated cultural or historical assets.

2.3 Local Resources

Houston 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 4-6. Additional funding resources are identified in the next subsection.

The City of Houston depends upon any available government and private grants for much of their mitigation projects. With an approved LHMP, the City of Houston may apply directly to FEMA for grants or apply through the State.

Table 4. 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	Limited City	Follows Ordinances
Zoning ordinance	City of Houston	
Subdivision ordinance or regulations	Matanuska-Susitna Borough	
Special purpose ordinances (floodplain management, stormwater management, hillside or steep slope ordinances, wildfire ordinances, hazard setback requirements)	Yes, Combination of Both	
Growth management ordinances (also called "smart growth" or anti-sprawl programs)	No	
Site plan review requirements	Yes	
Comprehensive plan	Yes	2017
A capital improvements plan	Yes	2017
An economic development plan	Yes	
An emergency response plan	Yes	
A post-disaster recovery plan	Yes	
Real estate disclosure requirements	No	

Table 5. Administrative and Technical Capability

Staff/Personnel Resources	Y/N	Department/Agency and Position
City Clerk	yes	Sonya Dukes
Animal Control	Yes	Christian Hartley
Code Compliance	Yes	Raymond Russell
City Planner	No	
Public Works Director	Yes	
Public Safety Director	No	
Treasurer	Yes	Jess Adams
Librarian	No	
Police Officer	No	
Fire Chief	Yes	Christian Hartley
Fire Department	Yes	Paid On Call
Engineer(s) or professional(s) trained in construction practices related to buildings and/or infrastructure	No	
Planners or Engineer(s) with an understanding of natural and/or human-caused hazards	No	
Floodplain manager	Yes	Taunnie L. Boothby, Matanuska-Susitna Borough
Surveyors	No	
Staff with education or expertise to assess the community's vulnerability to hazards	Yes	Christian Hartley, Fire Chief; Casey Cook, MSB Emergency Manager
Personnel skilled in GIS and/or HAZUS	Yes	Public Works Department

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Table 6. Fiscal Capability

Financial Resources	Accessible or Eligible to Use (Yes or No)
Community Development Block Grants (CDBG)	Yes, City
Capital improvements project funding	Yes, City
Authority to levy taxes for specific purposes	Yes, City 2% sales tax to assist city administration
Impact fees for homebuyers or developers for new developments/homes	Yes
Incur debt through general obligation bonds (GO Bonds)	Yes
Incur debt through special tax and revenue bonds	Yes

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 HMGP which are funded under federally declared disasters. The matching funds are paid through the State Disaster Relief Fund (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 7 is an overview of grant activities and their eligible programs.

FEMA administers 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.

Table 7. 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	√	√	√

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 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 NRCS is responsible for the Emergency Watershed Protection program which 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

Department of Housing & Urban Development

Community Development Block Grant

HOME Investment Partnerships Program

Department of the Interior

USGS

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 Houston LHMP meets those criteria are outlined below.

Table 8. Risk Assessment - Federal Requirements

Section §201.6(c)(2) Requirement	Where requirement is addressed in Houston Local 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; Chapter 3, Section 5 identifies severe weather; Chapter 3, Section 6 identifies wildland fire; Chapter 3, Section 7 identifies earthquake; Chapter 3, Section 8 identifies ground failures; Chapter 3, Section 9 identifies volcanoes; and Chapter 3, Section 10 identifies climate change as the natural hazards with the potential to be present in Houston. Chapter 3, Section 11 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 Houston Local 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 4-10 include hazard-specific sections of the Houston LHMP profile and describe how the natural hazards have the potential to affect the community. The Plan includes **location, extent, impact** and **probability** for each natural hazard identified. The LHMP 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 contains overall summaries of each hazard and its impacts on the community. Summaries are contained in hazard-specific sections in Chapter 3.
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.	Houston participates in the NFIP through the Matanuska-Susitna Borough. Chapter 3, Section 4 Flood 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 14 lists structures, infrastructure, and critical facilities located in the identified hazard areas.

Section §201.6(c)(2) Requirement	Where requirement is addressed in Houston Local 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 15 estimates potential dollar losses to City-owned facilities that are known.
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, page 38 contains 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 LHMP. A vulnerability matrix table of critical facilities as affected by each hazard is provided in Table 17.

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 LHMP includes an inventory of critical facilities and land use map (see Appendix B). The following assessment includes the following eleven sections:

Section 1. Identifying Hazards

Section 2. Assessing Vulnerability: Overview and Potential Losses

Section 3. Risk Analysis

Section 4. Flood

Section 5. Severe Weather

Section 6. Wildland Fire

Section 7. Earthquake

Section 8. Ground Failure

Section 9. Volcano

Section 10. Climate Change

Section 11. Hazards Not Profiled in the 2017 Houston LHMP

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.

Table 9 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.

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.

Table 10, 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.

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.

Table 9. 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 is 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

Magnitude/Severity	Criteria to Determine Extent
	□ 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

Table 10. 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.
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.

Section 1. Identifying Hazards

This section identifies and describes the hazards likely to affect Houston. 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 11 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 2013 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 Matanuska-Susitna Borough, a relatively large area of 24,682 square miles (i.e., slightly larger in land area than the state of West Virginia), so not all hazards listed as being present in the Matanuska-Susitna Borough necessarily affect Houston. For example, due to its inland location, Houston has no vulnerability to tsunami per the 2013 *Matanuska-Susitna Borough All-Hazards Mitigation* Plan.

Table 11. Hazard Matrix

Hazard Matrix – Matanuska-Susitna Borough				
Flood	**Wildland Fire**	**Earthquake**	**Volcano**	**Avalanche**
Y – H	Y – H	Y – H	Y – M	Y – M
Severe Weather	**Ground Failure**	**Erosion**	**Tsunami & Seiche**	
Y – M	Y – L	Y – M	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: 2013, Alaska All-Hazard Risk Mitigation Plan, 2013 Matrices – Matanuska-Susitna Borough

Table 12. Previous Occurrences of Hazards 1978 to Present

Previous Occurrences – Matanuska-Susitna Borough				
Flood	Wildland Fire	Earthquake	Volcano	Avalanche 7L
7L	2L	2L	2L	
Tsunami & Seiche	Severe Weather	Ground Failure	Erosion	
0	7L	0	2L	

Source: Alaska All-Hazard Risk Mitigation Plan, 2013

Identification of Natural Hazards Present in Houston

Based on consultation with the Alaska DHS&EM, Tables 11 and 12 from the *Alaska All-Hazard Risk Mitigation Plan*, the 2013 *Matanuska-Susitna Borough All-Hazards Mitigation* Plan, and plans and reports identified in Chapter 1, the Planning Team identified the following hazards to be profiled.

Table 13. Hazards Identification and Decision to Profile

Hazard	Yes/No	Decision to Profile Hazard
Flood	Yes	The National Weather Service operates a flood-forecasting network in Houston. Predictions are often difficult for many of the smaller rivers because of the short time span between when the precipitation occurs and flooding starts. Significant flooding in recent years on the Little Susitna River has been caused by ice jams, snow melt, and unusual amounts of precipitation.
Erosion	No	The Little Susitna River does not have a history of erosion.
Severe Weather	Yes	Designated as a hazard due to an extensive history of previous severe weather events. High winds can reach hurricane force and have the potential to seriously damage community infrastructures, especially above ground utility lines.

Hazard	Yes/No	Decision to Profile Hazard
Wildland Fire	Yes	Houston is located in a region where wildland fire is present at a high probability. The 1996 Miller's Reach Fire originated in Houston and spread to the Big Lake area and was one of the worst wildland fires in State History. It involved 37 fire departments and over 100 different agencies and organizations. In addition, 1,800 fire-fighting and support personnel responded within the first 48 hours. It took almost two weeks for the fire to be contained and during this time, it burned 37,336 acres and destroyed 344 structures. The 2015 Sockeye Fire affected Houston but did not enter onto Houston land.
Earthquake	Yes	Designated as a hazard in Alaska *All-Hazard Risk Mitigation Plan*. The Castle Mountain Fault was responsible for a mid-1980s quake felt locally. The fault crosses the Parks Highway and the Alaska Railroad tracks just before the new bridge over the Little Susitna River. Scientists looked at predicting peak ground acceleration within a 15-mile radius of the Wasilla city center at a depth of 15 miles. Their conclusions are that 50% of the area is highly quake-prone and 40% of the area would be considered a deep subduction zone (2013 *MSB All-Hazards Mitigation Plan*). The City has a Memorandum of Understanding with the State DMVA DHS&EM and has a seismograph to monitor earthquakes from City Hall.
Avalanche	No	Peaks susceptible to avalanches in Matanuska-Susitna Borough are not located near the City of Houston.
Volcano	Yes	Designated as a hazard in *Alaska All-Hazard Risk Mitigation Plan*.
Tsunami & Seiche	No	Historically, the Matanuska-Susitna Borough has not been impacted by tsunami or seiche.
Ground Failure	Yes	The terrain in Houston is not one likely to produce ground failure, but sink holes have been appearing randomly throughout the valley.
Climate Change	Yes	The community is experiencing an increase in wildland fires, increased temperatures, and increased floods.

See Section 11, Hazards not present in the Houston LHMP, for more information on the hazards not profiled for the community. Each hazard that is present in the community is profiled in hazard-specific sections.

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Section 2. Assessing Vulnerability

Overview

The vulnerability overview section is a summary of Houston's vulnerability to the hazards identified in Table 13. The summary includes type of hazard, 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

The Hazard Vulnerability Matrix in Table 14 includes a list of facilities, utilities and businesses in Houston that are considered critical infrastructure by the City, and whether, based on its location, each has a low, moderate, or high vulnerability to specific natural hazards.

Table 14. City of Houston Asset Matrix – Structures and Infrastructure

Structure	Flood	Severe Weather	Wildland Fire	Earth-quake	Ground Failure	Volcano
Bridge over Little Susitna River	H	M	H	H	M	L
Post Office	H	M	H	H	M	L
Houston Fire Department 9-1/Public Safety	H	M	H	H	M	L
Houston Fire Department 9-2/Public Safety	H	M	H	H	M	L
City Hall	H	M	H	H	M	L
Houston Middle School	H	M	H	H	M	L
Houston High School	H	M	H	H	M	L
Mid Valley Senior Center	H	M	H	H	M	L
Homesteaders Community Center	H	M	H	H	M	L
Alaska Railroad Track	H	M	H	H	M	L
Parks Highway	H	M	H	H	M	L
Telephone Lines	H	M	H	H	M	L
Water Supply Sites	H	M	H	H	M	L

Structure	Flood	Severe Weather	Wildland Fire	Earth-quake	Ground Failure	Volcano
Power Lines	H	M	H	H	M	L
Enstar gasline to high school	H	M	H	H	M	L
Alaska R&R Laundry & RV Park (well)	H	M	H	H	M	L
Division of Parks Little Su #2 (well)	H	M	H	H	M	L
Division of Parks Little Su Upper (well)	H	M	H	H	M	L
Division of Parks (Nancy Lake) (well)	H	M	H	H	M	L
Hilltop Assembly of God (well)	H	M	H	H	M	L
Homesteaders Community Club (well)	H	M	H	H	M	L
Houston Lodge (well)	H	M	H	H	M	L
Lavern Griffin Youth Camp (well)	H	M	H	H	M	L
Little Susitna Community Group (well)	H	M	H	H	M	L
Mid Valley Senior Center (well)	H	M	H	H	M	L
Millers Market (well)	H	M	H	H	M	L
Houston Junior High/High School (well)	H	M	H	H	M	L
Riverside Camper Park (well)	H	M	H	H	M	L
Triple B Bar (well)	H	M	H	H	M	L
Big Lake Elementary (well)	H	M	H	H	M	L
Napa Auto Parts	H	M	H	H	M	L
Spenard Builders Supply	H	M	H	H	M	L

Table 15 lists the critical facilities in the community, their owners, and type of construction. Limited information for Houston is contained in HAZUS and is included in Appendix B.

Table 15. Critical Facilities with Replacement Value

Structure	Owner (City, etc.)	Construction type	Year Built	Sq Ft	Building Value ($)	Contents Value ($)
City Hall	City	mixed	1977	1,736	$435,076	$555,024
U.S. Post Office	Miller's Market				$257,000	
Houston Fire Department 9-1/Public Safety	City	frame	1982	7,988	$1,500,000	$335,000
Houston Fire Department 9-2	City	frame	2016	4,294	$2,500,000	$336,200
Houston Middle School	Mat-Su School District	CMU, concrete, metal stud	1985	93,152	$30,607,884	$11,382,116
Houston High School	Mat-Su School District	CMU, concrete, metal stud	2003	88,240	$33,193,899	$8,806,101
MidValley Senior Center						
Homesteaders Community Center						
Alaska Railroad track	Alaska Railroad					
Parks Highway	Alaska Department of Transportation					
Telephone Lines						
Water Supply Sites						
Power Lines						
Bridge over Little Susitna River	Alaska Department of Transportation					

The community of Houston has several current planned projects to add to critical and essential infrastructure:

- Develop and implement Continuity of Operations Plan

The following funding has been requested from the Legislature:

- $100,000 for Houston Emergency Services Equipment;
- $946,542 for Cheri Lake Drive Construction;
- $200,000 for Road Repair Maintenance and Safety Equipment;

- $975,000 for Ladder Truck Engine (Quint);
- $60,000 for Emergency Communications; and
- $450,000 for Renovation of Fire Station 9-1.

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). Locally obtained GPS coordinate data was available for some facilities in HAZUS and is contained in Appendix B. The data was used to model an exposure assessment for each hazard where applicable.

Table 16. 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

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 LHMP 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.

Table 17 lists the infrastructure hazard vulnerability for the City of Houston.

Asset Inventory

Tables 14 and 15 identify critical infrastructure in Houston.

Table 17. Vulnerability Overview for City of Houston

Hazard	Percent of Houston's Geographic area	Percent of Population	Percent of Building Stock	Percent of Community Facilities and Utilities
Flood	25%	25%	25%	25%
Severe Weather	15%	15%	15%	15%
Wildland Fire	25%	25%	25%	25%
Earthquake	25%	25%	25%	25%
Ground Failure	5%	5%	5%	5%
Volcano	5%	5%	5%	5%
Climate Change	25%	25%	25%	25%

Note: The December 2016 *Risk Report, FEMA Region X – Matanuska-Susitna Borough, Alaska and the Incorporated Cities of Houston, Palmer, and Wasilla* prepared by FEMA; the Alaska Department of Commerce, Community, and Economic Development; and Alaska Geological and Geophysical Surveys determined that the following buildings in Houston were most affected by a Magnitude 7.5 Castle Mountain earthquake scenario and a 1-percent-annual-chance flood events:

- Houston U.S. Post Office (earthquake and flood);
- Houston Middle School (earthquake);
- Houston High School (earthquake);
- Houston PSB 9-2; (earthquake)
- Houston PSB 9-1 (earthquake);
- Houston City Hall (earthquake);
- Mid-Valley Senior Center (earthquake); and
- Homesteaders Community Center (earthquake).

Risk Assessment Summaries

Flood

An estimated 25% of the population of Houston, residential structures, and community facilities are vulnerable to floods. This includes 541 people in 244 residences valued at a ballpark value of $40,250,000 based on the median home price in Houston in 2012 and one critical City-owned buildings valued at $257,000.

Severe Weather

An estimated 15% of the population of Houston, residential structures, and community facilities are vulnerable to severe weather. This includes 325 people in 146 residences valued at a ballpark value of $24,150,000 million and no critical City-owned buildings.

Wildland Fire

An estimated 25% of the population of Houston, residential structures, and community facilities are vulnerable to wildland fire. This includes 541 people in 244 residences valued at a ballpark value of $40,250,000 and no critical City-owned buildings.

Earthquake

The City of Houston 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.

An estimated 25% of the population of Houston, residential structures, and community facilities are vulnerable to earthquake. This includes 541 people in 244 residences valued at a ballpark value of $40,250,000 and eight critical City-owned buildings valued at $87,658,700.

Ground Failure

Although the probability is low, an estimated 5% of the population of Houston, residential structures, and community facilities are vulnerable to sinkholes. This includes 109 people in 49 residences valued at a ballpark value of $8,050,000 and no critical City-owned buildings.

Volcano

Although the probability is low, an estimated 5% of the entire population of Houston, residential structures, and community facilities are vulnerable to ash from volcanoes. This includes 109 people in 49 residences valued at a ballpark value of $8,050,000 and no critical City-owned buildings.

Climate Change

An estimated 25% of the population of Houston, residential structures, and community facilities are vulnerable to climate change. This includes 541 people in 244 residences valued at a ballpark value of $40,250,000 and no critical City-owned buildings.

NFIP and Repetitive Loss Properties

There are no repetitive loss properties in Houston.

Land Use and Development Trends

Approximately 16,210 acres of land are within the City of Houston. The City has 11 distinct zoning districts that implement the policies of the *Comprehensive Plan*. The zoning districts are a part of Houston's Municipal Land Use Regulations. Almost 80% or 12,961 acres of the total land is undeveloped. Approximately 15% of the total land in Houston is currently being used for residential purposes. There are approximately 7,570 acres of land zoned for residential uses within the City of Houston. Currently, 15% of that zoned land is being used for residential purposes. The few existing commercial land uses are mostly concentrated to the city's southern border where the Parks Highway and Big Lake Road intersect, which is congruent with existing zoning. Commercial development in this location reflects the greater area trend of development along the Parks Highway and the expansion north from Anchorage and Wasilla, which is anticipated to continue.

The majority of all land parcels within the City of Houston's limits is privately owned, about 14,000 acres of the total 16,210 acres. Other large tract land owners include the City of Houston, 420 acres, and the Matanuska-Susitna Borough's 1,200 acres. The State of Alaska also owns about 470 acres of land in the city.

Population growth in the Matanuska-Susitna Borough is projected to slow from the current annual growth rate of slightly more than 3.6% to less than 2% by 2035. Since Houston is tied to the Matanuska-Susitna Borough economy and has comparable demographics, it is projected that Houston's population growth will reflect that of the region, growing approximately 2% over the current period to 2035. According to the City of Houston and Matanuska-Susitna Borough GIS data, a total of 4,742 acres within Houston are vacant, buildable, and zoned for residential development. Based on population projections, this amount of vacant, residentially zoned land suggests an ample amount is available to address future housing demand and residential development for single-family and multi-family homes in Houston by 2035.

Section 4. Floods

The following flood hazard profile includes a description of the hazard, the location, extent and probability of the hazard, and previous occurrences of flooding in Houston. Current mitigation projects and flood mitigation goals and projects are also included.

Hazard Description

Floods in the Matanuska-Susitna Borough can occur as a result of a combination of factors, including heavy snow pack, temperature, sunshine, and precipitation. The sequence of events affects the flooding potential. Spring floods on streams may occur as a result of an above-normal snowfall during the winter followed by an unusually cold spring and a rapid snowmelt. Summer and fall floods usually result from intense precipitation. In addition, an ice jam could occur during the winter or during spring breakup causing overbank flooding. Ice jams have caused the highest flooding on these streams, but no frequency has been applied to this type of flood. The principal flood problems are natural obstructions such as trees and vegetation along the banks, manmade obstructions such as bridges and boatdocks, ice jams, the accumulation of brush and debris along and within the streambed which can be carried downstream by high water and block bridge openings or other constrictions, and inadequately-sized culverts.

Flooding occurs when rain, snow, or glacial melt causes a waterway to exceed its capacity. It is of great concern in Houston because of the Little Susitna River. While there are many different types of flooding, Houston primarily experiences rainfall runoff, snowmelt, and ice jam floods. These are not exclusive categories as a flood event could have elements of more than one type and are described below.

Rainfall runoff flooding, the most common, usually occurs in mid to late summer and early fall. The rainfall intensity, duration, distribution, and geomorphic characteristics of the watershed all play roles in determining the magnitude of the flood. These floods usually result from weather systems that have prolonged rainfall associated with them.

Snowmelt floods usually occur in the spring or early summer. The depth of the snow pack and spring weather patterns influence the magnitude of flooding. Snowmelt floods can also be caused by glacial melt.

Ice Jam Floods occur after an ice jam develops, causing water to rise upstream behind the jam. When the jam releases, the stored water causes downstream flooding. Damage from ice jam floods is usually worse than from rainfall runoff or snowmelt floods because the floods are usually higher, the water levels change more rapidly, and the ice causes physical damage. Ice jams usually develop where the channel slope decreases, gets shallower, or where constrictions occur such as at bridges, bends in the river, headwaters, and reservoirs. During spring breakup, ice jams commonly dam water along big rivers. This flooding is exacerbated by snowmelt. Significant flooding in recent years on the Susitna River was caused by ice jams and snowmelt.

Ground water flooding occurs when water accumulates and saturates the soil. The water-table rises and floods low-lying areas, including homes, septic tanks, and other facilities.

Flash floods are characterized by a rapid rise in water. They are often caused by heavy rain on small stream basins, ice jam formation, or by dam failure. They are usually swift-moving and debris-filled, causing them to be very powerful and destructive.

Fluctuating lake level floods occur when lake inflow is excessive, flooding areas around the lake. Generally, lakes buffer downstream flooding due to the storage capacity of the lake.

Glacial outburst flooding is called a jokulhlaup. They are the result of a sudden release of water from a glacier-dammed lake resulting in rivers rapidly rising downstream. This can happen on many Alaskan Rivers, including the Susitna River. Sometimes, glacial outburst flooding is predictable, but not always.

Location

Certain areas have been identified as particularly susceptible to flooding. These are shown on FIRM panels published in 2016.

Extent

RiskMapping has been completed for Houston. 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 9, the City of Houston has a **limited** extent of flooding.

Impact

Physical damage from floods includes the following:

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

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

Probability

Based on the *Alaska All-Hazard Risk Mitigation Plan* and past historical events, Houston has a **high** probability of flooding. Table 10 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 Planning Team estimates that the reality of flooding actually occurs every six years.

The *Alaska All-Hazard Risk Mitigation Plan* lists the Matanuska-Susitna Borough (Houston is one of its cities) as having a flood hazard present with a high probability of occurrence within the calendar year.

Current Mitigation Projects

None

Previous Occurrences

Previous flood disasters are listed below.

October 198 Flood in Southcentral Alaska: FEMA-782-DR-AK, in "FLOODS OF OCTOBER 1986 IN SOUTHCENTRAL ALASKA" by Robert D. Lamke and Bruce B. Bigelow (USGS, 1988) [https://pubs.usgs.gov/of/1987/0391/report.pdf]. "Heavy precipitation associated with a large storm system resulted in major flooding in several areas of southcentral Alaska during October 10-12, 1986. Flooding was particularly severe in the Seward area of the Kenai Peninsula and in tributaries to **Susitna River** from Talkeetna downstream. Flood damage has been estimated at $20 million and the region was declared a Federal disaster area."

FEMA declared (DR-1072) on October 13, 1996: On September 21, 1995, the Governor declared a disaster as a result of heavy rainfall in South-central Alaska an as a result the Kenai Peninsula Borough, **Matanuska-Susitna Borough**, and the Municipality of Anchorage were initially affected. On September 29, 1995, the Governor amended the original declaration to include Chugach, and the Copper River Regional Education Attendance areas, including the communities of Whittier and Cordova, and the Richardson, Copper River and Edgerton Highway areas which suffered severe damage to numerous personal residences, flooding, eroding of public roadways, destruction & significant damage to bridges, flood control dikes and levees, water and sewer facilities, power and harbor facilities. On October 13, 1995, the President declared this event as a major disaster (AK-1072-DR) under the Robert T. Stafford Disaster Relief and Emergency Assistance Act. Individual Assistance totaled $699K for 190 applicants. Public Assistance totaled $7.97 million for 21 applicants with 140 DSR's. Hazard Mitigation totaled $1.2 million. The total for this disaster is $10.5 million.

07-220 2006 August Southcentral Flooding (AK-07-220) declared August 29,2006 by Governor Murkowski then FEMA declared (DR-1663) on October 16,2006: Beginning on August 18, 2006 and continuing through August 24, 2006, a strong weather system centered causing severe flooding resulting in severe damage and threats to life and property, in the Southcentral part of the State including the **Matanuska-Susitna Borough**, the City of Cordova and the Copper River Highway area in the Chugach Rural Education Attendance Area (REAA), the Richardson Highway area in the Copper River REAA and Delta/Greely REAA, the Denali Highway area, and **the Alaska Railroad and Parks Highway areas in the Matanuska-Susitna Borough** and the Denali Borough. Damage cost estimates are near $21 million in Public Assistance primarily for damage to roads, bridges and rail lines. Individual Assistance estimates are near $2 million.

12-240, 2012 September Storm declared by Governor Parnell on October 17, 2012 then FEMA declared November 27, 2012 (DR-4094): Beginning on September 4, 2012, and continuing, a strong weather system produced high winds and heavy rains, resulting in severe and widespread wind damage

and flooding throughout much of South-central and Interior Alaska. The series of storms created a threat to life and property in the **Matanuska-Susitna Borough,** Kenai Peninsula Borough, Alaska Gateway Regional Educational Attendance Area (REAA), and the Chugach area. The magnitude of the storm resulted in wind damages and flooding which necessitated debris clearance, emergency protective measures, damage to public facilities including roads, bridges, railroad, electrical distribution and water systems; and damage to private residences to include losses of personal property.

Community Participation in the NFIP

The City of Houston participates in the NFIP under the Matanuska-Susitna Borough's jurisdiction. The Matanuska-Susitna Borough is responsible for ensuring compliance with the NFIP, and its Code Enforcement Officer writes citations for lack of floodplain permits in the City limits of Houston. The City of Houston has a Memorandum of Understanding with the Matanuska-Susitna Borough stating that they will refer their residents to the Matanuska-Susitna Borough Floodplain Administrator to obtain permits to construct in floodplain areas.

The function of the NFIP is to provide flood insurance at a reasonable cost to homes and businesses located in floodplains. In trade, the Borough agrees to regulate new development and substantial improvement to existing structures in the floodplain, or to build safely above flood heights to reduce future damage to new construction. The program is based 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 elevation. Table 18 describes the FIRM zones.

Table 18. 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.

Firm Zone	Explanation
D	Areas of undetermined, but possible, flood hazards.

Development permits for all new building construction, or substantial improvements are required by the City in all A, AO, AH, A-numbered Zones as the Matanuska-Susitna Borough participates in the NFIP. Flood insurance purchase is required in flood zones A, AO, AH, A-numbered zones as a condition of loan or grant assistance. An Elevation Certificate is required as part of the development permit. The Elevation Certificate is a form published by the FEMA required to be maintained by communities participating in the NFIP. According to the NFIP, local governments maintain records of elevations for all new construction, or substantial improvements, in floodplains and to keep the certificates on file.

Elevation Certificates are used to:

- 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.

Table 19. Housing Stock

Housing Types	Number of Structures
Total Housing Units	973
Occupied Housing (Households)	731
Vacant Housing	242
Vacant Due to Seasonal Use	134

Table 20. Local and State Floodplain Coordinator Contact Information

Mat-Su Borough Floodplain Coordinator	Mat-Su Borough Contact Person – Taunnie Boothby 350 E. Dahlia Ave., Palmer, AK 99645 Phone: 861-8526
State of AK Floodplain Coordinator	Floodplain Management Programs Coordinator Division of Community Advocacy Department of Commerce, Community & Economic Development Jimmy C. Smith, State Floodplain Coordinator 550 W. 7th Avenue, Suite 1640 Anchorage, AK 99501 (907) 269-4132 (907) 269-4539 (fax) Email: jimmy.smith@alaska.gov

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. There are no repetitive loss properties in Houston per the Matanuska-Susitna Floodplain Coordinator.

Flood Mitigation Goals and Projects

Flood Goals

Goal 1. Reduce property loss and injuries caused by flooding

Flood Projects

FLD-1: Engineering Flood Controls.

FLD-2: Develop formalized relationship between the City of Houston and Matanuska-Susitna Borough through memorandums of understandings and memorandum of agreements to solidify relationship partnership.

FLD-3: Complete training courses in FEMA Flood Mitigation.

FLD-4: Develop and implement the Continuity of Operations (COOP) Plan.

See Table 25, Mitigation Project Plan for specific projects to mitigate flooding.

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 Houston include winter storms, severe winds, heavy snow, extreme cold, ice storms, and aufeis.

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.

High Winds

High winds occur in Houston when there are winter low-pressure systems in the North Pacific Ocean and the Gulf of Alaska. They can reach hurricane force and have the potential to seriously damage community infrastructure, especially above ground utility lines. High winds in Houston in excess of 60 mph occur frequently.

The general design and construction of buildings do not always consider wind resistance. Near-surface winds and associated pressure effects can exert pressure on walls, doors, windows, and roofs causing the structural components to fail. Debris carried by extreme winds can directly contribute to injury or loss of life and indirectly contribute to the building envelop components. A building envelop consists of the walls, foundation, doors, windows, and roof – all are surfaces that are the barrier between the indoors and outdoors. Upon impact, wind-driven debris can rupture a building.

Various wind scales equate wind speed to expected damages. Two widely-used wind scales are the Beaufort Scale and the Saffir-Simpson. See Tables 21 and 22.

Table 21. Beaufort Scale of Wind Strength

9	47-54	Chimneys blow down, slate and tiles torn from roofs
10	55-63	Trees broken or uprooted
11	64-75	Trees uprooted, cars overturned
12	75+	Devastation is wide-spread, buildings damaged or destroyed

Table 22. Saffir-Simpson Scale

1	74-95	4-5	Trees, shrubs, unanchored mobile homes, signs damaged
2	96-110	6-8	Trees toppled, roof coverings damaged, major damage to mobile homes
3	111-130	9-12	Large trees topple, structural damage to roofs, mobile homes destroyed, structural damage to homes and utility buildings
4	131-155	13-18	Extensive damage to roofs, windows, and doors, roof systems may completely fail
5	155+	18+	Damage is considerable and widespread, window and door damage is severe, extensive glass failure, building may fail

High winds and damage due to wind gusting is considerable and widespread throughout the City of Houston. The people most vulnerable to high-wind related deaths, injuries, and property damage are those residing in mobile homes and in deteriorating or poorly constructed homes. The City of Houston has no enforcement authority over the quality of buildings constructed. 95% of homes in the City of Houston are well-designed.

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.

Aufeis

Aufeis, sometimes called glaciations or icing, forms when emerging groundwater freezes in successive sheets until the ice is quite thick and covers a large area. Most are a few hundred yards long but cover several square miles. They are usually two or three feet thick but can reach 30 feet or more. Aufeis usually forms in winter and melts in summer. The conditions that lead to aufeis development are:

- Groundwater moving down slope, especially above the permafrost table;
- Cold air temperatures and thin snow cover during the early winter;
- A layer of seasonally frozen ground; and
- Thick snow cover in the late winter.

Aufeis is a significant problem for railroads and highways as it causes traffic problems and increased maintenance costs.

Location

The hazards of severe weather impact Houston on an area-wide basis. A severe weather event would create an area-wide impact and could damage structures.

Extent

Extreme weather could result in a limited situation in Houston. 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 seven limited-damage events in the Matanuska-Susitna Borough.

Impact

A 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 Houston on a regular basis. Siding and roofing materials can be ripped away leaving utilities such as water pipes vulnerable to freezing.

Probability

Severe weather to vulnerable parts of the population living in mobile homes or poorly-constructed houses is a serious natural hazard risk in Houston, due to extreme cold, snow, and high winds. As shown in the data presented in Table 10, Houston 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

00-191 Central Gulf Coast Storm declared February 4, 2000 by Governor Murkowski Murkowski then FEMA declared (DR-1316) on February 17, 2000: On Feb 4, 2000, the Governor declared a disaster due to high impact weather events throughout an extensive area of the state. The State began responding to the incident since the beginning of December 21, 1999. The declaration was expanded on February 8 to include City of Whittier, City of Valdez, Kenai Peninsula Borough, **Matanuska-Susitna Borough** and

the Municipality of Anchorage. On February 17, 2000, President Bill Clinton determined the event disaster warranted a major disaster declaration under the Robert T. Stafford Disaster Relief and Emergency Assistance Act, P.L. 93-288 as amended ("the Stafford Act). On March 17, 2000, the Governor again expanded the disaster area and declared that a condition of disaster exists in Aleutians East, Bristol Bay, Denali, Fairbanks North Star, Kodiak Island, and Lake and Peninsula Boroughs and the census areas of Dillingham, Bethel, Wade Hampton, and Southeast Fairbanks, which is of sufficient severity and magnitude to warrant a disaster declaration. Effective on April 4, 2000, Amendment No. 2 to the Notice of a Major Disaster Declaration, the Director of FEMA included the expanded area in the presidential declaration. Public Assistance, for 64 applicants with 251 PW's, totaled $12.8 million. Hazard Mitigation totaled $2 million. The total for this disaster is $15.66 million.

03-204 Southcentral Windstorm (AK-DR-1461) Declared March 28, 2003 by Governor Murkowski then FEMA declared April 26, 2003: A major windstorm with sustained and severe winds that exceeded 100 mph occurred between March 6 and March 14, 2003. The windstorm affected the **Matanuska-Susitna Borough,** the Municipality of Anchorage, and the Kenai Peninsula Borough. Severe damage occurred to numerous personal residences and local businesses; extensive damage occurred to public facilities (i.e. schools, libraries, community centers, airports, buildings and utilities) in the **Matanuska-Susitna Borough,** Municipality of Anchorage and the Kenai Peninsula Borough. Although damages were widespread, Anchorage facilities received the most damages. Federal Disaster Assistance for Debris Removal, Emergency Protective Measures and all Permanent Work categories were approved under the Public Assistance Program. FEMA also authorized 404 Mitigation funding and individual assistance under the Individual and Household Program. Individual Assistance totaled $48K. Public Assistance totaled $2.5 million for 24 potential applicants with 87 PW's. Hazard Mitigation totaled $532K. The total for this disaster is $3.47 million. (closeout data: $2.8 million total paid out (includes $220,000 mitigation and $47,600 State IA///posted 7/29/08 rbs).

12-240, 2012 September Storm declared by Governor Parnell on October 17, 2012 then FEMA declared November 27, 2012 (DR-4094): Beginning on September 4, 2012, and continuing, a strong weather system produced high winds and heavy rains, resulting in severe and widespread wind damage and flooding throughout much of South-central and Interior Alaska. The series of storms created a threat to life and property in the **Matanuska-Susitna Borough,** Kenai Peninsula Borough, Alaska Gateway Regional Educational Attendance Area (REAA), and the Chugach area. The magnitude of the storm resulted in wind damages and flooding which necessitated debris clearance, emergency protective measures, damage to public facilities including roads, bridges, railroad, electrical distribution and water systems; and damage to private residences to include losses of personal property.

Table 23. Severe Weather Events

[illegible]	[illegible]	[illegible]	[illegible]
Susitna Valley	February 5, 1993	Ice Storm	A winter storm warning for ice (freezing rain) accumulations of one-quarter inch or more was issued for Susitna Valley, including Houston.
Susitna Valley	December 15, 1998	Winter Winds	Wind chills in excess of -45° were calculated. Forecast zones affected Cook Inlet and Susitna Valley. Magnitude: 55 knots.
Parks Highway	October 5, 2000	Ice Storm	Freezing rain was reported prompting travel advisory from the Department of Transportation along the Parks Highway.
City of Houston	December 15, 2001	Winter Winds	Weather Underground reported wind gust up to 60 mph. Temperatures ranged from 1°F to -24° F.
City of Houston	March 14, 2003	Winter Winds	Hurricane force winds with gusts to 100 mph wreaked havoc in the Matanuska-Susitna Borough. High winds were sustained for several days with temperatures of 0°F, making for wind-chill factor of -53°F.
City of Houston	December 3, 2003	Winter Winds	Wind gusts up to 58 mph reported in Houston. Average temperature of 5°F. Wind-chill -25°F.
City of Houston	January 6, 2004	Winter Winds	Wind gusts up to 56 mph reported in Houston. Average temperature of 10°F. Wind-chill -18°F.
City of Houston	January 7, 2004	Winter Winds	Wind gusts up to 50 mph reported in Houston. Average temperature of 12°F. Wind-chill -19°F.
City of Houston	January 17, 2004	Winter Winds	Wind gusts up to 18 mph reported in Houston. Average temperature of -8°F. Wind-chill -30°F.
South-Central Alaska	October 17, 2012	Storm	The magnitude of the storm resulted in wind damages and flooding which necessitated debris clearance, emergency protective measures, damage to public facilities; and damage to provide residences.

Severe Weather Mitigation Goals and Projects

Severe Weather Goals

Goal 1: The Matanuska-Susitna Borough has an emergency plan that covers the City of Houston. Formalize MSB's relationship with a memorandum of understanding with the City. Review with local emergency agencies the projected need for emergency shelter locations to handle community needs during severe weather and develop memorandums of agreement for providing shelters.

Goal 2: Encourage installation/utilization of backup power supplies at critical facilities. This has been done in the past but the City would like this to be ongoing and more installed.

Goal 3: Institute measures that will improve resistance of new buildings to high winds and include information with construction permits.

Goal 4: Identify schools and other public buildings vulnerable to loss from high winds and suggest ways their owners can prepare for windstorms.

Goal 5: Encourage installation of damage-resistant glass replacements or liners in public buildings.

Severe Weather Projects

SW-1: The Matanuska-Susitna Borough has an emergency plan that covers the City of Houston. Formalize MSB's relationship with a memorandum of understanding with the City. Review with local emergency agencies the projected need for emergency shelter locations to handle community needs during severe weather and develop memorandums of agreement for providing shelters.

SW-2: Develop a system to inform builders, homeowners, and businesses that building with additional bracing for roof tresses, reinforced columns and bond beams, protected building openings, and securely mounted roof equipment including cowlings and flashing suffer fewer and less costly damages than other buildings as part of the land use permit process.

SW-3: Install reinforced clips to City-owned street name signs, directional and instructional signs to prevent damage and injury caused by flying debris.

SW-4: Conduct a survey of critical facilities and provide recommendations on wind proofing projects that might reduce damage caused by high winds (i.e., selected tree removal, tie-down or anchor equipment that might become airborne, etc.).

SW-5: Develop community campaign to encourage residents to cut back trees that might fall on buildings, check and refasten roof sheathing when patching or repairing roof, select wind resistant exterior wall finish.

SW-6: Seek grants to provide emergency back-up such as emergency generators, secondary power feeds, and portable generators with standard connections at all critical facilities.

SW-7: Seek grants to lower cost of installing damage-resistant glass or liners in buildings on critical facilities list.

See Table 25, Mitigation Project Plan for specific projects to mitigate erosion.

Table 24. Houston Weather Summary

Station:(503731) HOUSTON															
From Year=1984 To Year=2012															
	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	-99	-99	-99	47	21/1985	-48	29/1989	******	1900	*****	1900	-99	-99	-99	-99
February	-99	-99	-99	50	25/1991	-46	May-99	******	1900	*****	1900	-99	-99	-99	-99
March	-99	-99	-99	54	23/1998	-34	May-92	******	1900	*****	1900	-99	-99	-99	-99
April	53.8	28.1	41	69	29/2003	-15	Feb-85	41	2012	41	2012	0	0	18	0
May	-99	-99	-99	87	30/2006	16	15/2003	******	1900	*****	1900	-99	-99	-99	-99
June	65.2	45.1	55.2	87	16/1986	29	Feb-03	55.2	1988	55.2	1988	0	0	0	0
July	70.9	49.4	60	89	Feb-90	31	Jan-03	62.5	2004	58.9	1987	0	0	0	0
August	67.8	46.7	57.2	86	Dec-05	28	31/1987	59.3	2005	55.4	1995	0	0	0	0
September	59.8	37.6	48.7	72	15/1986	8	26/1992	50.6	2005	45.5	1988	0	0	6	0
October	47.1	25.4	36.3	64	Jan-03	-18	28/1996	38.4	2011	34.2	2004	0	1	23.7	0
November	24.9	-3.3	11.2	55	26/2002	-38	29/2005	11.2	2005	11.2	2005	0	21	30	20
December	-99	-99	-99	51	Dec-85	-31	31/1999	******	1900	*****	1900	-99	-99	-99	-99
Annual	-99	-99	-99	89	19900702	-48	19890129	******	1900	*****	1900	-99	-99	-99	-99
Winter	-99	-99	-99	51	19851212	-48	19890129	-99	1900	-99	1900	-99	-99	0	-99
Spring	-99	-99	-99	87	20060530	-34	19920305	-99	1900	-99	1900	-99	-99	18	-99
Summer	68	47.1	57.5	89	19900702	28	19870831	56.9	1988	56.9	1988	0	0	0	0
Fall	43.9	19.9	32.1	72	19860915	-38	20051129	32.6	2005	32.6	2005	0	22	59.7	20

Table updated on Oct 31, 2012

Table Updated 10/31/2012, Source: Western Regional Climate Center, http://wrcc.dri.edu

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 that 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

Nearly every community, including Houston, in the Matanuska-Susitna Borough contains an area designated for critical or full protection from wildfire. Wildfire risk includes damage to structures, property, and loss of life.

Extent

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

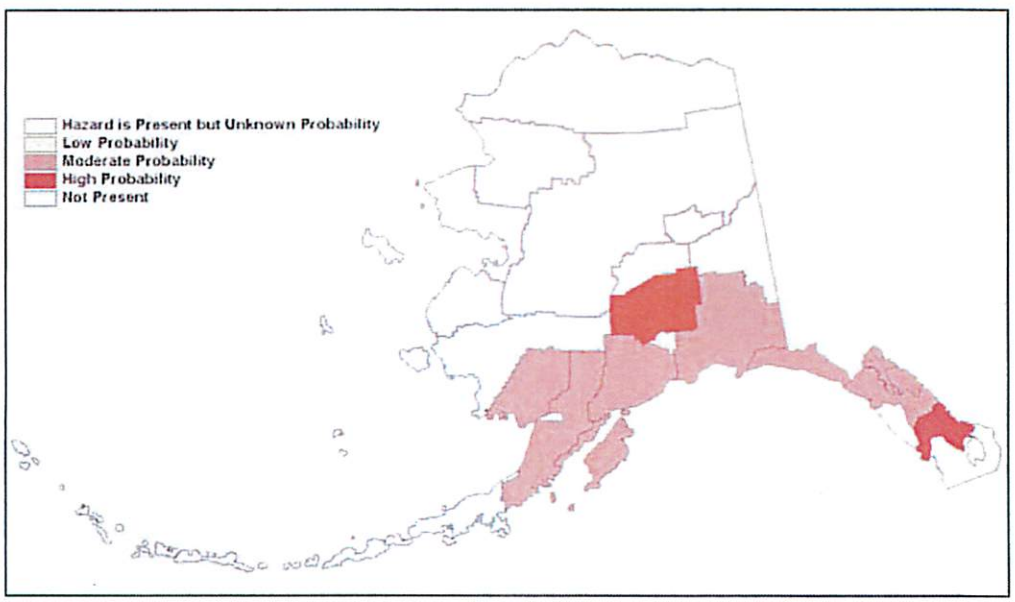
Impact

The 1996 Millers Reach Fire No. 2 originated in Houston and spread to the Big Lake area and was one of the worst wildland fires in Alaska's history. It involved 37 fire departments, and over 100 different agencies and organizations. In addition, 1,800 fire-fighting and support personnel responded within the first 48 hours. It took almost two weeks for the fire to be contained and during this time, it burned 37,336 acres and destroyed 344 structures.

Probability

The following map from the *Alaska All-Hazards Risk Mitigation Plan* depicts Houston as being in an area with a moderate probability.

Map 2. Alaska All-Hazards Mitigation Plan - Fire Risk Map



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

Previous Occurrences

The 2013 *Matanuska-Susitna Borough Hazard Mitigation Plan* states, "From 1990 to 2013, about 40 of 1,900 or so wildfire in the MSB were managed as one of a modified or limited priority category. The majority of wildfires were managed as critical or full priority wildfires, with about 1,600 fires in the former and over 230 fires in the latter category."

1996 Prator Lake Fire: "In 1996, one week before the devastating Millers Reach Wildfire No. 2, Houston found itself fighting a wildfire in Houston on the south side of Prator Lake. Most area firefighters were fighting other wildfires throughout the Mat-Su Borough. Firefighting was performed with a skeleton crew from Houston as well as the department's Explorer® post consisting of local teenagers. The fire was extinguished and kept around 12 acres in size. This fire was combined with the Millers Reach Wildfire No. 2 in the state and federal disaster declarations." [Borough Ordinance 96-96-088 that references this: ww2.matsugov.us/cpd/purchasing/doc_download/112410-96-088].

96-181 Millers Reach Fire declared June 4, 1996 by Governor Knowles then FEMA declared (DR-1119) on June 8, 1996: A fire which began on June 2,1996 near Houston, Alaska on Miller's Reach Road spread rapidly destroying 344 structures and burning 37,366 acres in the Houston-Big Lake area. Command and control of this fire was initially controlled from the Houston High School with a Type I Incident Management Team. Later a Unified Command structure was established at the Creekside Plaza Mall in Wasilla which consisted of Local, State and Federal representatives. On June 4th, 1996 Governor Knowles declared a State Disaster Declaration and President Clinton signed the Federal Disaster Declaration (AK-1119-DR) on June 8th, 1996. This provided the State with Federal Disaster relief funding for the incident. The fire was contained on June 10th and declared under control on June 15th. Individual Assistance totaled $1.87 million for 425 applicants. Public Assistance totaled $5.1 million for 7 applicants with 50 DSR's. Hazard Mitigation totaled $1.75 million. The total for this disaster is $9.35 million.

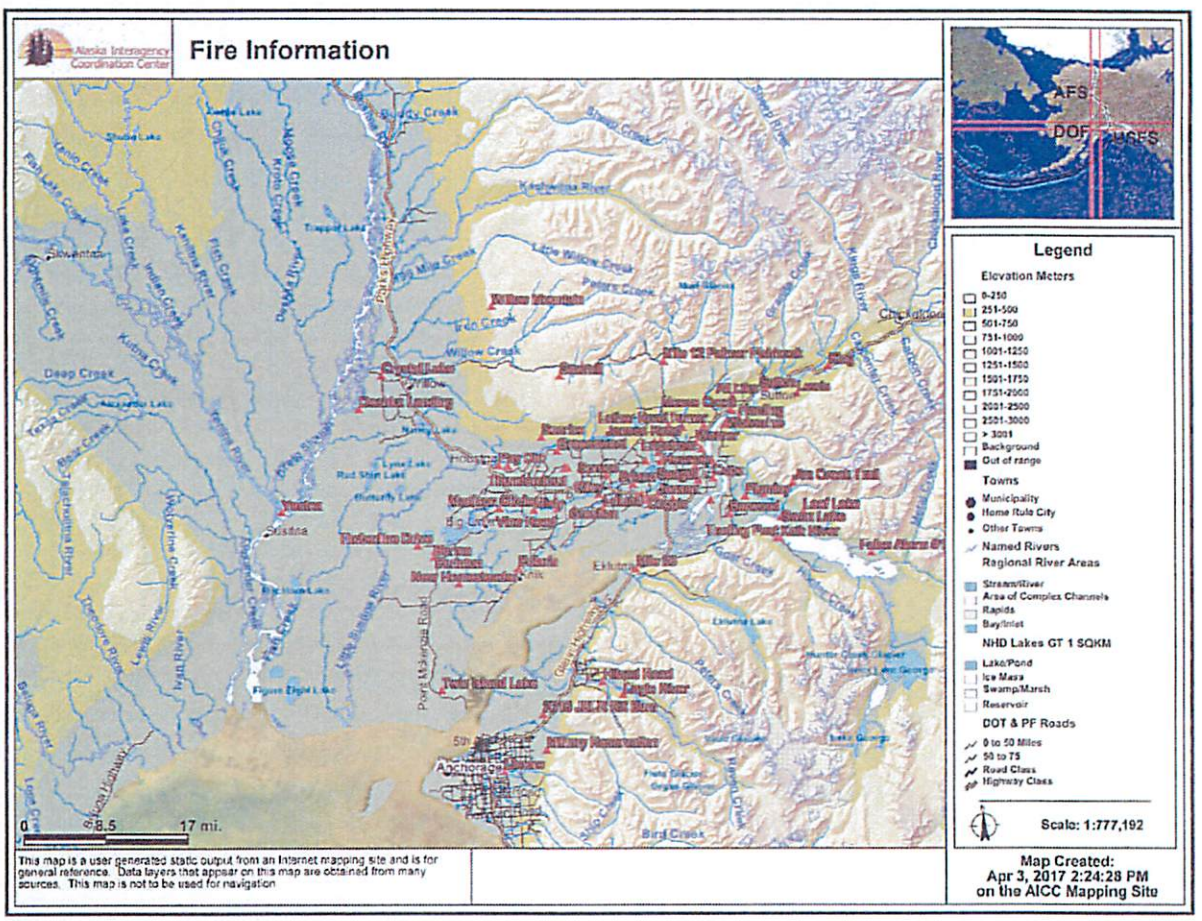
AK-15-249, 2015 Sockeye Wildfire declared by Governor Walker on June 15, 2015: Beginning on June 14, 2015 and continuing, a large urban interface wildfire exacerbated by record high temperatures caused widespread damage to the community of Willow and surrounding areas of the **Matanuska Susitna Borough**. The response to the wildfire is hampered by red flag warnings for record warm temperatures, strong winds, low humidity, and dry thunderstorms this month that affects the entire central portion of the state, including the Matanuska Susitna Borough. The wildfire damaged or destroyed at least 50 private homes and/or secondary structures and damaged several more, and resulted in 175 residents seeking refuge in temporary shelters, although these numbers are expected to rise. The following conditions exist as a result of this disaster: a robust emergency response and management operation requiring substantial additional labor, equipment, and support costs to combat the fire; activation of the emergency operations center; damage or destruction of at least 50 homes and other structures; evacuation and sheltering of 175 residents and hundreds of pets/work animals to date; severe damage to personal and real property; disruption of power, natural gas, communications, and other utility infrastructure.

The Alaska Interagency Coordination Center (AICC) maintains a website (http://fire.ak.blm.gov/aicc.php) to consolidate Alaska's wildland fire information. Figure 3 was developed from this site.

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.

Figure 3. Historical Wildland Fire Burn Perimeters 1942-2015



The City of Houston is presently conducting a project to clear out dead black spruce trees at Little Susitna Campground.

The Matanuska-Susitna Borough is presently using a FMA grant to conduct selective brush clearing and fuel reduction from the bridge to Pittman Road.

Wildland Fire Mitigation Goals and Projects

Wildland Fire Goals

Goal 1: Reduce fire injuries and damage to structures from fires. (**Objective:** Encourage use of "Defensible Space" design in location and construction of homes and businesses and other ways to reduce personal and property damage due to wild fires).

Goal 2: Educate Houston area residents about wildfires and urban fires. (**Objective:** Reduce number of fires caused by human carelessness).

Wildland Fire Projects

WF-1: Distribute information on how to find the Fire Wise web site and information that will help homeowners create a defensible space. 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.

WF-2: Educate the public on Borough ordinance requiring property owners to post addresses on all structures to reduce response time during an emergency, and enforce the ordinance.

WF-3: Encourage homeowners and businesses to use fire-resistant materials in construction of buildings and structures.

WF-4: Follow fire incident command protocols.

WF-5: Notify absent landowners whose property is at high risk for fire and encourage them to remedy the problem.

WF-6: Work with schools and Fire Department to distribute educational material on fire prevention.

WF-7: Identify neighborhoods especially vulnerable to fire and work with firefighters to conduct neighborhood meetings on fire safety and "Defensible Space" concepts.

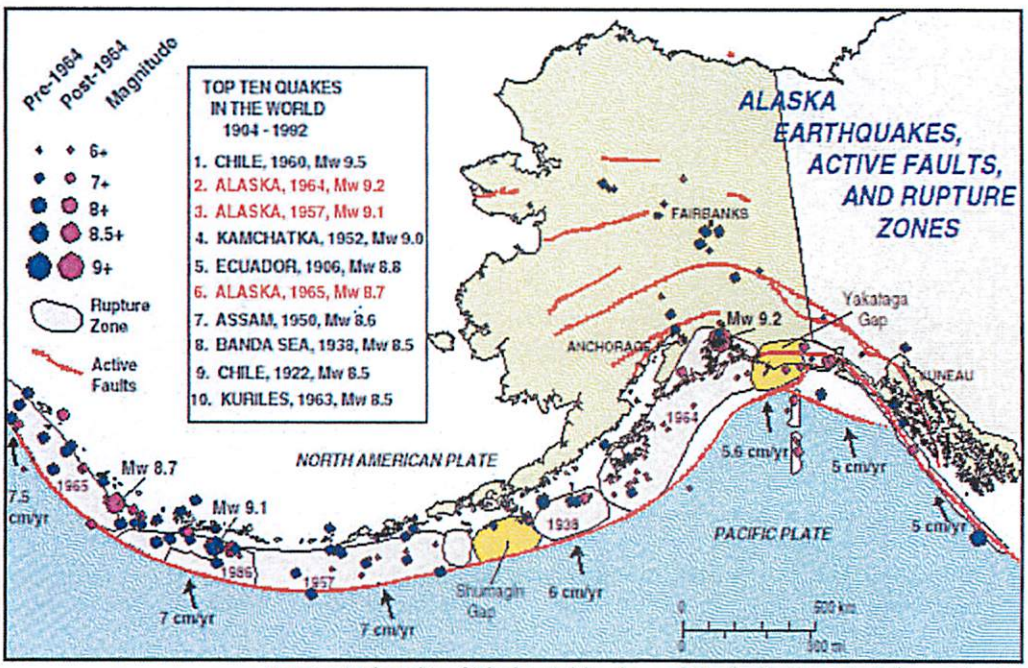
WF-10: Supply informational material with construction permits.

Section 7. Earthquake

Hazard Description and Characterization

Approximately 11% of the world's earthquakes occur in Alaska, making it one of the most seismically active regions in the world (see Map 3). Three of the 10 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.

Map 3. AEIS Earthquake Active Faults



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

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

Location

Approximately 75% of Alaska's detected earthquakes occur in the Alaska Peninsula, Aleutian, Cook Inlet, and Anchorage areas. Within 25 miles of Anchorage, there are at least three suspected active faults with the potential to create magnitude 7.5 earthquakes. One of them, the Castle Mountain Fault, produced a magnitude 5.7 earthquake near Sutton in 1984 and may have generated a magnitude 6.9 earthquake that shook Anchorage in 1933. This area is of concern to Houston as a great deal of subdivision development has and continues to occur along the fault (see figure in Appendix B).

An earthquake hazard event could potentially impact any part of Houston. Earthquake damage would be area-wide with potential damage to critical infrastructure up to and including the complete abandonment of key facilities.

Extent

The extent of an earthquake in Houston could be **limited**; Table 9 uses the following criteria to determine the extent of possible damage: Injuries and/or illnesses do not result in permanent disability, complete shutdown of critical facilities for one week, and less 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.

Map 3 shows active fault lines. The 2013 *Alaska All-Hazard Risk Mitigation Plan* lists the Matanuska-Susitna Borough area as having a high probability of an earthquake.

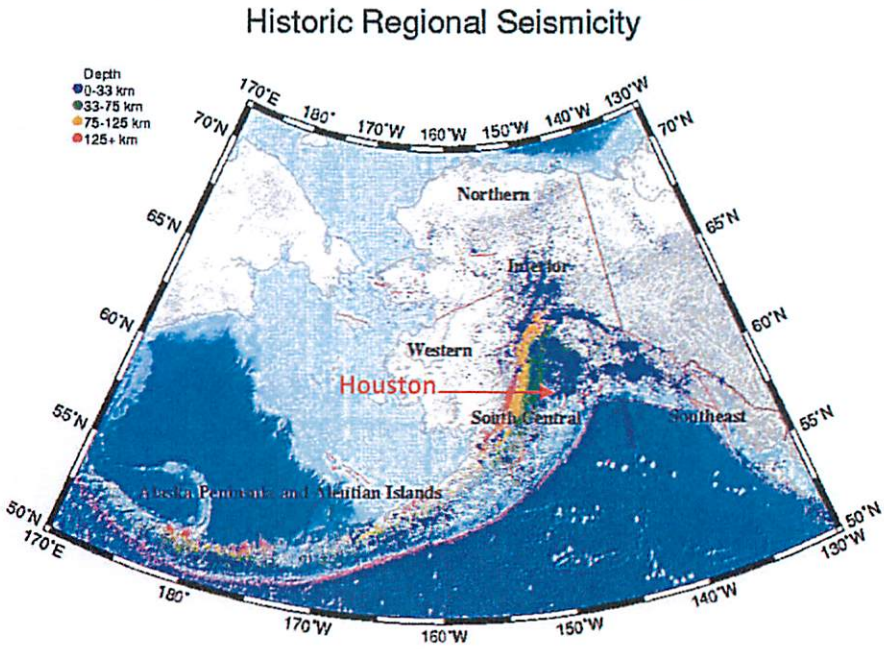
Impact

Map 4 shows historic regional seismicity. The impact on the community of Houston from a severe earthquake could be extensive. Earthquake damage would be area-wide with potential damage to critical infrastructure up to and including the complete abandonment of key facilities.

Probability

Houston has a high probability of earthquake hazard. Table 10 lists the following criteria for a high probability: hazard is present with a high probability of occurrence within one year. Event has up to 1 in 1 year chance of occurring.

Map 4. Alaska Earthquake Information System Historic Regional Seismicity

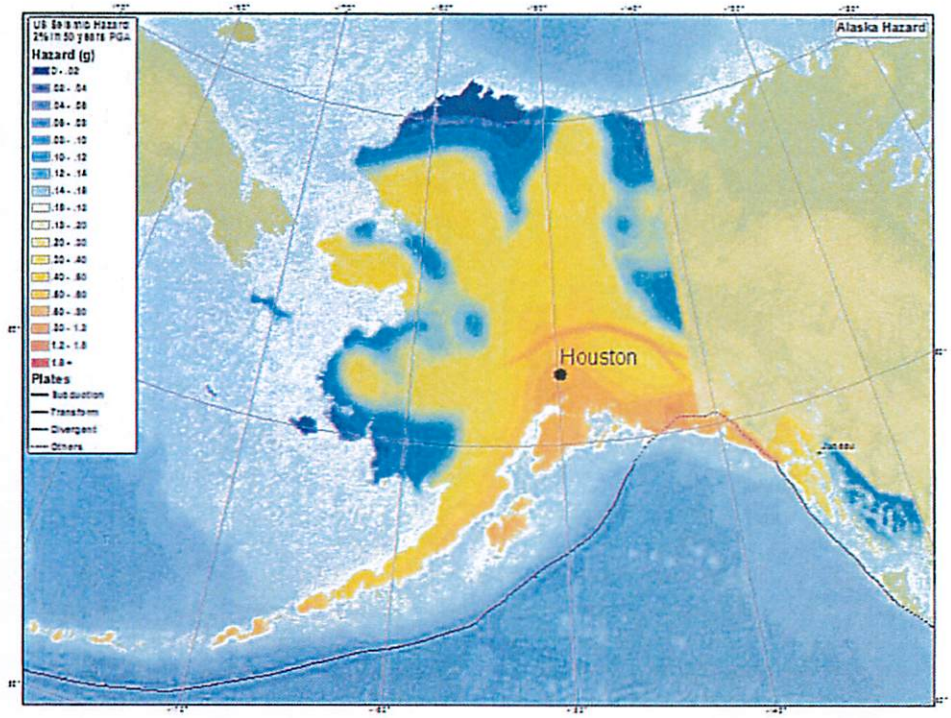


While it is not possible to predict an earthquake, the USGS has developed Earthquake Probability Maps that use the most recent earthquake rate and probability models. These models are derived from earthquake rate, location, and magnitude data from the USGS National Seismic Hazard Mapping Project. Map 5 indicates that the USGS earthquake probability model placed the probability of an earthquake with a likelihood of experiencing strong shaking (0.8g to 1.2g peak ground acceleration) with a 2% probability in 50 years, based on the USGS Alaska hazard model.

Previous Occurrences

From 1977-2017, 87 earthquakes were recorded above a magnitude of M 5.0 within a 50-mile radius of the City of Houston. The largest recorded earthquakes within 50 miles of the City measured M 5.8 occurring on December 4, 2012 and August 14, 1984. They caused no damage to critical facilities, residences, non-residential buildings, or infrastructure.

Map 5. USGS Houston Earthquake Probability Map



Earthquake Mitigation Goal and Projects

A Risk Map project by DCRA was completed in 2017. A public meeting was held in 2015 in Houston to inform the public of existing fault lines that may affect Houston.

Earthquake Goals

Goal 1: Publicize and promote general awareness of Matanuska-Susitna Borough earthquake emergency action plans (individuals, families, community). (**Objective:** Inform/remind community of need to discuss ways to communicate with family members, locate shelter, stockpile food and medication for use in earthquake or other emergency situation).

Goal 2: Inform public of measures they can take to protect structures from earthquake damage (**Objective:** Inform homeowners and businesses of action they can take to reduce structural damage and injuries caused by seismic activity).

Goal 3: Update emergency plan to provide food and shelter as the result of earthquake damage. This is a goal for all hazard scenarios. (**Objective:** Review with local emergency agencies the projected need for emergency shelter locations to handle community needs following an earthquake [consider both immediate and long term needs] and develop plan for providing number of locations identified).

Earthquake Projects

EQ-1: Continue ongoing efforts with schools and general public. (Goal 1)

EQ2: Develop education information similar to Are you prepared for the next big Earthquake in Alaska! with details specific to Houston for distribution to schools, churches, civil organizations, and general public. Distribute to schools, churches, civic organizations, and general public. (Goal 2)

EQ3: Distribute information on simple measures homeowners can take to strengthen structures before next earthquake with each construction permit issued. (For example, FEMA's Avoiding Earthquake Damage: A Checklist for Homeowners.) (Goal 3)

EQ4: Encourage owners of critical facilities to brace equipment (such as mechanical equipment, emergency generators, etc.) whose failure may disrupt the operations of a critical facility. (Goal 3)

Section 8. Ground Failure

Hazard Description

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

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

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

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

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

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

- **Slides,** the more accurate and restrictive use of the term landslide, refers to a mass movement of material, originating from a discrete weakness area that slides from stable underlying material. A *rotational slide* occurs when there is movement along a concave surface; a *translational slide* originates from movement along a flat surface.
- **Debris Flows** arise from saturated material that generally moves rapidly down a slope. A debris flow usually mobilizes from other types of landslide on a steep slope, then flows through confined channels, liquefying and gaining speed. Debris flows can travel at speeds of more than 35 mph for several miles. Other types of flows include debris avalanches, mudflows, creeps, earth flows, debris flows, and lahars.

- **Lateral Spreads** are a type of landslide that generally occurs on gentle slope or flat terrain. Lateral spreads are characterized by liquefaction of fine-grained soils. The event is typically triggered by an earthquake or human-caused rapid ground motion.
- **Falls** are the free-fall movement of rocks and boulders detached from steep slopes or cliffs.
- **Topples** are rocks and boulders that rotate forward and may become falls.
- **Complex** is any combination of landslide types.

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

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

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

Seasonal freezing can cause frost heaves and frost jacking. Frost heaves occur when ice forms in the ground and separates sediment pores, causing ground displacement. Frost jacking causes unheated structures to move upwards. Permafrost is frozen ground in which a naturally-occurring temperature below 32ºF has existed for two or more years. Permafrost can form a stable foundation if kept frozen but when thawed; the soil weakens and can fail. Approximately 85 percent of Alaska is underlain by continuous or discontinuous permafrost. (DHS&EM 2013).

A sinkhole is an area of ground that has no natural external surface drainage; when it rains, all of the water stays inside the sinkhole and typically drains into the subsurface. Sinkholes can vary from a few feet to hundreds of acres and from less than 1 to more than 100 feet deep. Some are shaped like shallow bowls or saucers whereas others have vertical walls; some hold water and form natural ponds.

Sinkholes are common where the rock below the land surface is limestone, carbonate rock, salt beds, or rocks that can naturally be dissolved by groundwater circulating through them. As the rock dissolves, spaces and caverns develop underground. Sinkholes are dramatic because the land usually stays intact for a while until the underground spaces just get too big. If there is not enough support for the land above the spaces, then a sudden collapse of the land surface can occur. These collapses can be small or they can be huge and can occur where a house or road is on top.

Typically, sinkholes form so slowly that little change is noticeable, but they can form suddenly when a collapse occurs. New sinkholes have been correlated to land-use practices, especially from groundwater

pumping and from construction and development practices. Sinkholes can also form when natural water-drainage patterns are changed, and new water-diversion systems are developed. Some sinkholes form when the land surface is changed, such as when industrial and runoff-storage ponds are created. The substantial weight of the new material can trigger an underground collapse of supporting material, thus causing a sinkhole.

The overburden sediments that cover buried cavities in the aquifer systems are delicately balanced by groundwater fluid pressure. The water below ground is actually helping to keep the surface soil in place. Groundwater pumping for urban water supply and for irrigation can produce new sinkholes in sinkhole-prone areas. If pumping results in a lowering of groundwater levels, then underground structural failure, and thus, sinkholes, can occur.

Indicators of a possible ground failure include:

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

The SOA 2013 *State Hazard Mitigation Plan* provides additional ground failure information defining mass movement types as well as topographic and geologic factors which influence ground failure which pertain to Houston.

Location
The Matanuska-Susitna Borough has stated that sinkholes have developed throughout the borough. Most happen with no notice and occur in areas surrounding unknown septic systems.

Extent
A sinkhole has the potential to be limited in nature.

Impact
A sinkhole could be deadly.

Probability
The 2013 *Alaska All-State Hazard Mitigation Plan* states that the Matanuska-Susitna Borough has a low probability of a sinkhole occurring.

Previous Occurrences

Sinkholes occur all over the Matanuska Susitna Valley, usually due to old septic cribs per Casey Cook, the MSB Emergency Manager.

Sinkhole Mitigation Goal and Projects

Sinkhole Goals

Goal 1: Eliminate the loss of life and assets due to sinkholes.

Avalanche Projects

GF-1: Support an aggressive sinkhole education program. (Goal 1)

Section 9. Volcanoes

Hazard Description

Alaska is home to more than 80 major volcanic centers, 41 of which have been active in the last 250 years (MSB, 2013). On average, there are one or two eruptions or reports of volcanic unrest each year. Over half of the State's population lives within 100 miles of an active volcano.

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

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.

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

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

Location

No active volcanoes exist in the immediate Houston area. Active volcanoes nearest to Houston are

Hayes, Mount Redoubt, and Mount Spurr.

Extent

The community is at low risk of receiving significant ash fallout from volcanic activity at Redoubt or Mount Spurr. Fresh volcanic ash may be harsh, acidic, and gritty.

Impact

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

Probability

The 2013 *Alaska All-State Hazard Mitigation Plan* states that the Matanuska-Susitna Borough has a moderate probability of being affected by a volcano erupting.

Previous Occurrences

Houston has experienced volcanic ash in 1989, 1990, and 1992.

Ash Fall Mitigation Goal and Projects

Ash Fall Goals

Goal 1: Reduce health problems caused by volcanic ash. **(Objective:** Inform those at risk of preventative measures in advance of ash fall danger by developing a public education campaign).

Goal 2: Reduce property damage caused by ash fall **(Objective:** Provide Houston residents with information on how to prevent property damage caused by volcanic ash by developing flyers on ash fall).

Ash Fall Projects

AF-1: Conduct a public meeting to explain respiratory problems resulting from exposure of ash fall. Provide information on how to reduce exposure. (Goal 1)

AF-2: Work with Matanuska-Susitna Borough on publicity campaign to inform/remind public to call MSB Air Quality Alert phone number (352-DUST) for daily air quality information. (Goal 1)

AF-3: Work with Alaska Department of Environmental Conservation to install air quality monitoring equipment in Houston, and add Houston information to MSB Air Quality Alert reports. (Goal 1)

AF-4: Develop materials on hazards to electrical and mechanical equipment and to roofs due to weight of ash and distribute to the public. (Goal 2)

AF-5: Develop/distribute information on increased danger of falls and auto accidents due to decreased visibility and slippery walking and driving conditions caused by ash. (Goal 2)

AF-6: Develop information on how to clean up after ash fall event and include information on flyers to be distributed to the public.

Section 10. Climate Change

Hazard Description

For this LHMP, 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 is a global event.

Extent

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

Local Impact

The major effect of climate change is the abrupt decline of the earth's bio-diversity and population of organisms.

Probability

Given the Earth's history of increasing CO_2 attributed to climate change and the current observed changes in the atmosphere, 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.

Section 11. Hazards Not Profiled in the 2017 Houston LHMP

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 Houston does not provide the necessary conditions for avalanche. No threat from avalanche is present in Houston.

Tsunamis and Seiches

Historic tsunami information and ongoing numeric studies indicate that tsunami flood threats occur along the 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

Houston is not located on the coast of Alaska.

Chapter 4. Mitigation Strategy

Benefit - Cost Review

This chapter of the plan outlines Houston'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, severe weather, wildland fire, earthquake, ground failure, volcanoes, and climate change; however, the mitigation strategy will be regularly updated as additional hazard information is added and new information becomes available.

The projects listed in Table 25, 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 Houston 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 25 are:

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 LHMP 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 25 lists the projects developed by the Planning Team.

Results from the risk assessment in Sections 4-10 from Chapter 3 were used to develop mitigation goals and actions. Goals and projects were described in Sections 4-10 in Chapter 3 and are prioritized in the table.

Upon adoption of their LHMP, the City of Houston will incorporate it into existing planning mechanisms using the following methods:

- Use the City of Houston'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 LHMP goals and actions into relevant planning mechanisms.
- Update or amend specific planning mechanisms to integrate LHMP goals and principles.

The City is responsible for prioritizing its mitigation projects and submitting them for grant programs outlined in Chapter 2.4, "Resources".

Table 25. Benefit - Costs Review Listing Table

Mitigation Projects	Benefits (pros)	Costs (cons)	Priority
Flood (FLD)			
FLD-1. Engineering Flood Controls. The Public Works Director would evaluate what specific flooding controls (generally culverts) could be added to known locations requiring action to mitigate future issues.	Benefit to government and private properties. During project design phases (i.e., permits), evaluate whether heights of roads need to be raised or culverts need to be made higher or storm water should be re-directed to other properties without buildings on it.	Definite cost unavailable. Could be minimal cost if process occurred during construction permit process.	High
FLD-2. Develop formalized relationship between City of Houston and Matanuska Borough through memorandums of understandings and memorandums of agreements to solidify relationship partnership.	The City of Houston participates under the jurisdiction of the Matanuska-Susitna Borough's NFIP. The MSB's Floodplain Administrator would like to see a new Memorandum of agreement to further delineate the City and Borough's responsibilities.	Staff time. Would require changes in ordinances and enforcement.	High
Severe Weather (SW)			
SW-1. Install backup power supplies at critical facilities. This has been done in the past, but the City would like all critical facilities to have backup power.	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-2. Develop a system to inform builders, homeowners, and businesses that building with additional bracing for roof tresses, reinforced columns and bond beams, protected building openings, and securely mounted roof equipment including cowlings and flashing suffer fewer and less costly damages than other buildings as part of the construction permit process.	Life/Safety issue Risk reduction Benefit to entire community Inexpensive State assistance available Could be an annual event	Staff time	High
SW-3. Develop community campaign to encourage residents to cut back trees that might fall on buildings, check and refasten roof sheathing when patching or repairing roof, select wind resistance exterior wall finish. Provide recommendations on wind proofing projects that might reduce damage caused by high winds (i.e., selected tree removal, tie-down, or anchor equipment that might become airborne).	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-4. Install reinforced clips to City-owned signs, directional and instructional signs to prevent damage and injury caused by flying debris.	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. 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
WF-3. 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
Earthquake (E)			
E-1. Continue ongoing efforts with schools and general public.	Life/Safety issue/Risk reduction Benefit to entire community	Staff time	High

Mitigation Projects	Benefits (pros)	Costs (cons)	Priority
E-2. Develop education information and distribute. Also distribute information on simple measures homeowners can take to strengthen structures before next earthquake with each construction permit issued.	Life/Safety issue/Risk reduction Benefit to entire community	Staff time 1-5 years implementation	Medium
E-3. Encourage owners of critical facilities to brace equipment (such as mechanical equipment, emergency generators, etc.) whose failure may disrupt the operations of a critical facility.	Inexpensive. Reduces property damage and reduces risk of injury from falling objects	Staff or volunteer time	High
Ground Failure (GF)			
GF-1. Support an aggressive sinkhole education program.	Life/Safety issue/Risk reduction Benefit to entire community	Staff time	High
Ash Fall (AF)			
AF-1. Conduct a public meeting to explain respiratory problems resulting from exposure of ash fall. Provide information on how to reduce exposure.	Life/Safety issue/Risk reduction Benefit to entire community	Staff time	Medium
AF-2. Work with Matanuska-Susitna Borough on publicity campaign to inform/remind public to call MSB Air Quality Alert phone number (352-DUST) for daily air quality information.	Life/Safety issue/Risk reduction Benefit to entire community	Staff time	Medium

Mitigation Projects	Benefits (pros)	Costs (cons)	Priority
AF-3. Work with Alaska Department of Environmental Conservation to install air quality monitoring equipment in Houston, and add Houston information to MSB Air Quality Alert reports.	Life/Safety issue/Risk reduction Benefit to entire community	Staff time	Medium
AF-4. Purchase supply of ash masks and keep them at emergency shelters.	Life/Safety issue/Risk reduction Benefit to entire community	Staff time	Medium

*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 26 presents Houston'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 26. Mitigation Strategy

Mitigation Projects	Responsible Agency	Cost	Funding Sources	Estimated Timeframe	Project Status (for local review)
Flood/Erosion (FLD)					
FLD-1. Engineering Flood Controls	City Public Works Director, MSB Public Works Director, DHS&EM, FEMA	TBD	City, Matanuska-Susitna Borough, PDM, HMGP	1-5 years	
FLD-2. Update formalized relationship between City of Houston and Matanuska Borough through memorandums of understandings and memorandums of agreements to solidify relationship partnership.	City Clerk, MSB Floodplain Administrator	Staff time	Matanuska-Susitna Borough, City	1 year	
Severe Weather (SW)					
SW-1. Install backup power supplies at critical facilities.	City Director of Public Works	Staff Time	Matanuska-Susitna Borough, City	Ongoing	

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Mitigation Projects	Responsible Agency	Cost	Funding Sources	Estimated Timeframe	Project Status (for local review)
SW-3. Develop a system to inform builders, homeowners, and businesses that building with additional bracing for roof tresses, reinforced columns and bond beams, protected building openings, and securely mounted roof equipment including cowlings and flashing suffer fewer and less costly damages than other buildings as part of the construction permit process.	City Director of Public Works	Staff Time	City, Matanuska-Susitna Borough	Ongoing	

Mitigation Projects	Responsible Agency	Cost	Funding Sources	Estimated Timeframe	Project Status (for local review)
SW-4. Develop community campaign to encourage residents to cut back trees that might fall on buildings, check and refasten roof sheathing when patching or repairing roof, select wind resistance exterior wall finish. Provide recommendations on wind proofing projects that might reduce damage caused by high winds (i.e., selected tree removal, tie-down, or anchor equipment that might become airborne).	City Director of Public Works	Staff Time	City, Matanuska-Susitna Borough	1-5 years	
SW-5. Install reinforced clips to City-owned signs, directional and instructional signs to prevent damage and injury caused by flying debris.	City Director of Public Works	Staff Time	City, Matanuska-Susitna Borough	1 year	
Wildland Fire (WF)					
WF-1. Promote Fire Wise building design, siting, and materials for construction.	DHS&EM, City Director of Public Works	Staff Time	City	Ongoing	
WF-2. Encourage development of building codes relating to fire safety.	DHS&EM, City Director of Public Works	Staff Time	City	1-5 years	

IM 18-172
OR 18-109

Mitigation Projects	Responsible Agency	Cost	Funding Sources	Estimated Timeframe	Project Status (for local review)
WF-3. Enhance public awareness of potential risk to life and personal property.	DHS&EM, City Director of Public Works	Staff Time	City	Ongoing	
Earthquake (E)					
E-1. Continue ongoing efforts with schools and general public.	City Director of Public Works, DHS&EM, DCRA	Staff Time	PDM, State Grants	1 year	
E-2. Develop education information and distribute. Also distribute information on simple measures homeowners can take to strengthen structures before next earthquake with each construction permit issued.	City Director of Public Works, DHS&EM	TBD	PDM, State Grants	1-5 years	
E-3. Encourage owners of critical facilities to brace equipment (such as mechanical equipment, emergency generators, etc.) whose failure may disrupt the operations of a critical facility.	City Director of Public Works, DHS&EM	Staff Time, approximately $5k	PDM	1 year and ongoing	

Mitigation Projects	Responsible Agency	Cost	Funding Sources	Estimated Timeframe	Project Status (for local review)
Ground Failure					
GF-1. Identify areas with City Limits that are susceptible to sinkholes.	City Public Works Director, Matanuska-Susitna Borough Emergency Director	Staff Time	PDM, State Grants	1 year	
GF-2. Develop new City code to prevent building in areas susceptible to sinkholes.	City Public Works Director	Staff Time	PDM, State Grants	1 year	
Ash					
AF-1. Conduct a public meeting to explain respiratory problems resulting from exposure of ash fall. Provide information on how to reduce exposure.	City Director of Public Works, DHS&EM	Staff Time	City, PDM	Ongoing	
AF-2. Work with Matanuska-Susitna Borough on publicity campaign to inform/remind public to call MSB Air Quality Alert phone number (352-DUST) for daily air quality information.	MSB, City Director of Public Works	Staff Time	City	Ongoing	

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Mitigation Projects	Responsible Agency	Cost	Funding Sources	Estimated Timeframe	Project Status (for local review)
AF-3. Work with Alaska Department of Environmental Conservation to install air quality monitoring equipment in Houston, and add Houston information to MSB Air Quality Alert reports.	ADEC, City Director of Public Works, MSB	Staff Time	City	Ongoing	
AF-4. Purchase supply of ash masks and keep them at emergency shelters.	DHS&EM, City Director of Public Works	Staff Time	DHS&EM	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

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2. *State of Alaska Current Disaster Cost Index*, February 17, 2016.
3. *DCRA Community Information*: http://commerce.state.ak.us/dnn/dcra/Home.aspx.
4. *City of Houston Comprehensive Plan*, April 1999, amended July 2003.
5. *City of Houston's Hazard Mitigation Plan, adopted by Houston City Council Resolution of April 1 0, 2008.*
6. *Division of Community and Regional Affairs (DCRA) Community Information*: http://www.commerce.alaska.gov/web/dcra/homeaspx
7. *FEMA-TO 08-J-0011, Alaska Critical Facilities Inventory, December, 2008*
8. *Matanuska-Susitna Borough Core Area Comprehensive Plan*, prepared by Matanuska-Susitna Borough Department of Planning and Land Use, 2007 Update.
9. *Matanuska-Susitna Borough Hazard Mitigation Plan*, prepared by Matanuska-Susitna Borough, 2013.
10. *Mat-Su Comprehensive Economic Development Strategy,* prepared by Matanuska-Susitna Borough Department of Planning and Land Use, 2008.
11. *Risk Report, FEMA Region X – Matanuska-Susitna Borough, Alaska and the Incorporated Cities of Houston, Palmer, and Wasilla*, prepared by FEMA; the Alaska Department of Commerce, Community, and Economic Development; and Alaska Geological and Geophysical Surveys in December 2016.
12. City of Houston Website: http://www.houston-ak.gov/
13. 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)

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: program-community-rating-system	http://www.fema.gov/national-flood-insurance-
Flood Mitigation Assistance Program: grant-program	https://www.fema.gov/flood-mitigation-assistance-
Hazard Mitigation Grant Program:	http://www.fema.gov/hazard-mitigation-grant-program
Individual Assistance Program: tools	http://www.fema.gov/individual-assistance-program-
Interim Final Rule: library/assets/documents/4590	https://www.fema.gov/media-
National Flood Insurance Program: program	http://www.fema.gov/national-flood-insurance-
Public Assistance Program: tribal-and-non-profit/	http://www.fema.gov/public-assistance-local-state-

Appendix A: Public Involvement

Hazard Mitigation Plan for Houston, Alaska

Newsletter #1: August 18, 2017

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

The Planning Team would like to announce the availability of the working draft copy. You are encouraged to provide comments, identify key issues or concerns, and improve mitigation ideas. This plan has been posted at City Hall and on the City Facebook page for your review. Comments or questions can be emailed to Jennifer LeMay at jlemay@lemayengineering.com or provided at City Hall.

For more information, contact:
Virgie Thompson, Mayor (907) 892-6869
Jennifer LeMay, PE, PMP, Lead Planner, (907) 350-6061
George Grady, DMVA, DHS&EM Project Manager, (907)428-7055

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Houston Multi-Hazard Mitigation Plan Work Session

July 5, 2017

2:00 pm

Name	Organization	Contact Information (phone or email)
Jennifer LeMay	LeMay Engineering + Consulting, Inc.	350-6061 jlemay@lemayengineering.com
Virgie Thompson	City of Houston	vthompson@houston-ak.gov
Sonya Dukes	City of Houston	sdukes@houston-ak.gov
Christian Hartley	City of Houston Fire Dept	907-355-8794 chartley@houston-ak.gov
Jessie Meyhin	City of Houston Public Works	jmeyhin@houston-ak.gov
Casey Cook	Matsu Borough	861-8004 casey.cook@matsugov.us

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July 7, 2017

Notes from the July 5 meeting at City Hall from Jennifer LeMay, PE, PMP

I met with Mayor Virgie Thompson, City Clerk Sonya Dukes, Fire Chief Christian Hartley, Public Works Department Jessie Meybim, and MTB Emergency Director Casety Cook from 2-4:30 on July 5 at Houston City Hall. We paged through the working copy of the Houston HMP and reviewed the draft for accuracy—ensuring that the 2017 document met the City's needs. We specifically targeted plan development information, hazard impacts, community vulnerability analysis, and mitigation strategies.

Significant discussion items are included below:

1. The 20017 Comprehensive Plan has been adopted.
2. The HMP is a new plan and not an update. Reference to the 2008 document can be kept in the 2017 plan as the 2008 document was accepted by Resolution. Remove references to HMP update.
3. Delete avalanche hazard and replace with ground failure.
4. Plan forward. After plan has incorporated comments received during July 5 meeting, community will be notified per a public notice. Sonya will post public notice, and draft HMP on City's website, facebook page, and at City Office and Miller's. Draft HMP will be submitted to State Review. Public comments will be received in the mean time. City Council will adopt plan after FEMA review. Resolution approval process takes approximately two months.

Multi-Jurisdictional Hazard Mitigation Plan for Houston, Alaska

Public Notice #2: December 11, 2017

The State of Alaska, Department of Military and Veterans Affairs, Division of Homeland Security and Emergency Management (DHS&EM) was awarded a Pre-Disaster Mitigation Program grant from the Federal Emergency Management Agency (FEMA) to develop a Local Hazard Mitigation Plan (LHMP) for the City of Houston. This plan will assist the City as a valuable resource tool in making decisions. Additionally, communities must have a State- and FEMA-approved and community-adopted HMP plan to receive FEMA pre- and post- disaster grants. LeMay Engineering & Consulting, Inc. was contracted to assist the City of Houston with the plan update.

The goal of Public Notice #2 is to announce the public comment hearing on the Draft Plan at the regularly scheduled City Council Meeting on December 14, 2017. The Draft Plan has been available for your review since August 24, 2017 at City Hall during business hours and on the City's Facebook page. Comments or questions can be emailed to Jennifer LeMay at jlemay@lemayengineering.com or provided at the phone number below.

For more information, contact:
Sonya Dukes, City Clerk, (907) 892-6869
Jennifer LeMay, PE, PMP, Lead Planner, (907) 350-6061
Rick Dembroski, DMVA, DHS&EM Project Manager, (907)428-7015

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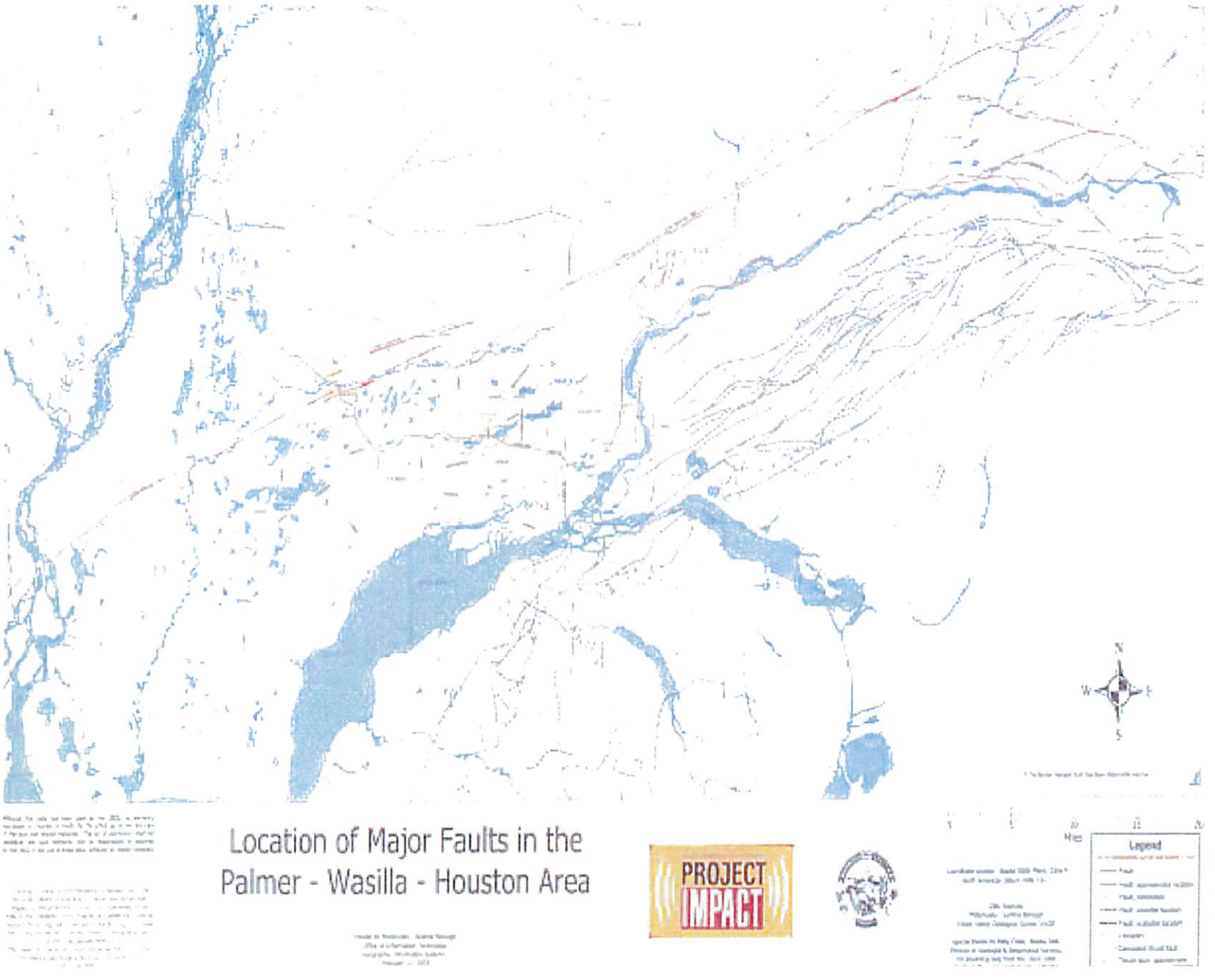
Appendix B: Houston Area Use Map



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Community Name	Total Locations	Fire Station	Police Station	Emergency Ops Ctr	Hospitals/Clinics	Potable Water Treat	Waste Water Treat	Power Generation	Fuel Storage (>500)	Emergency Shelter	Oil/Gas Pipe-Start	Oil/Gas Pipe-End	Airports	School	Telephone	Satellite	Washeteria	Harbor/Dock/Port	Landfill/Incinerator	Museum	Library	Community Hall	Park	Civic Center	Cemetery	Offices	Tannery	Sewage Lagoon	Teachers Quarters	Store	Service/Maintenance	Bridge	Post Office	Radio Transmitter	Reservoir/ Supply	Senior Center	Church	Community Freezer	Generators	National Guard	Community Storage
Hollis	16	1				1		1	1				1	1	1	1		1			2			1				1				1			1		1				
Holy Cross	40				1	1	2	1	5	1			1	1	1	3	1	1	1			2			1	3		1	1	2	2		1	2	2		1		1	1	
Hoonah	58	1	1	1	1	1	1	2	1		1	1	1	4			1	3	2	1	1	1	2	1	2	4		1	1	8	1	1	1		3	1	4	1	1	1	
Hooper Bay	46	1	1	1	1	1		1	4				1	3	1	1	1		1			1	1		1	4		1	3	6	1	1	1	1	4		2			1	
Hope	20	1							1	1			1	1					1	1	1	1	1		1					1		1	1		4		2				
Houston	35	1			1							1	1	2								1				1				3		1	1	5	14	1	2				
Hughes	15				1								1	1			1					2				2				2	1		1		1		1		1		
Huslia	27	1	1		1	1		1	1			1	1	1	1	1	1		1			1			1	1		1	1	1			1		1	1	3			1
Hydaburg	33	1			1	1	1	1	3					4	1			2	1			1	1			1				3	1		1		2	1	2		2	
Hyder	22								2									1		3		1			1	2				4	1		1		5		1			
Igiugig	22	1			1	1		1	1				1	1		1	1	1	1		1	1	1		1	1		1	1	1			1				1		1		
Iliamna	23	1	1		1				1				1		1	1	1	1	1		1	1			1	1		1		3	1		1		2		1			
Ivanof Bay	15	1			1				2					1				1	2			1	1							1			1		1			2		
Kachemak	8	1							1	1									1			1	1				1						1				1			
Kake	45	1	1	1	1	1	1	1	1	2			1	2	1		1	1	1		1	1	1	1	1	1				4	2	2	1	1	1	1	4	3	3		
Kaktovik	19		1		1	1			2					1					2			1				2	1	1	1			1		1		1		1		1
Kallag	33	1	1		1	1		1	2				1	2	1	1	1		1			1			2	3		1		1	1		1		2	1	1		2	1	2
Karluk	29		1	2	1	2	1	1	1	2			2	1	1	1			1			1			1	1		1			2		1		1		1	1	1		
Kasaan	21	1		1	1	1		1	1				1	1	1	1		1			1	1	1		1	1							1		2		1		1		
Kasigluk	33		1	2	1	1			2				1	2	1		1	1	2			1			3	1		1	2	2	1		1		2		2		1	1	
Kenny Lake	22	1				2				1		1		1	1	1	1				2	1			2					2	1	2		1		2				
Ketchikan	33	1	1		1	1		1	1	1			1	12	1			1	1	1	1	1	1	1						1		2			1		1			
Kiana	46	1		1	1	1	1	1	1				1	1	1	2		3	1			1			3	8		1	1	3	1		1		3		2		3	1	2
King Cove	49	1	1		1	1		1	5	1			1	1		5		9	2			2			1	3				3	3	2	1		1		2		1		1
King Salmon	30		1		1				3										5								20													
Kipnuk	32		1		2	1		1	2				2	1	1	1			1			1			1	1		1	1	3	1	3	1		3		1	1		1	
Kivalina	36		1		1	1		1	3				1	1	2	3	1		1			1			2	1		1	1	1	2		1		3		2	1	1	1	2
Klawock	31	1	1	1	1		1		1				1	2	1			2	1		1	2	3		1	2				3	1				2	1	1		1		
Klukwan	25	1	1			1	1	1	1					1	1	1			3			1	1		1	1		1	1	1	1	1			1		1	1	1		
Kobuk	35		1		1		2		2				1	1	1	2	1		1			1			2	2		1	1	2	2	1	1		2		2		3		2

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FEMA Critical Facilities Data Summary Report (2008)

Houston

FacilityType	FacilityName	LatitudeDD	LongitudeDD	Building Construction Type	Estimated Value	Data Quality Grade
Airport	private air strip					
Bridge	Over Little Susitna River					
Church	1					
Church	2					
Community Hall	NA					
Fire Station	Houston Volunteer Fire Dept	61.63064	-149.80764			
Hospital/Clinic/ER	Clinic PA					
Offices	City Hall					
Oil or Natural Gas Pipeline--End	Enstar - gas line to High School					
Post Office	NA					
Radio Transmitter	KADX CH 234	61.48471	-149.76221			
Radio Transmitter	KJHA CH 204	61.63193	-149.81055			
Radio Transmitter	KQEZ CH 221	61.33665	-149.51085			
Radio Transmitter	KRPM CH 242	61.33693	-149.51112			
Radio Transmitter	NA					
Reservoir/Water Supply	Alaska R&R Laundry & RV Park	61.57986	-149.6434			

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FEMA Critical Facilities Data Summary Report (2008)

Houston

FacilityType	FacilityName	LatitudeDD	LongitudeDD	Building Construction Type	Estimated Value	Data Quality Grade
Reservoir/Water Supply	Div of Parks Little Su #2	61.62982	-149.7932			
Reservoir/Water Supply	Div of Parks Little Su Upper	61.63068	-149.7945			
Reservoir/Water Supply	Div Parks Nancy Lake	61.70395	-150.0027			
Reservoir/Water Supply	Hilltop Assembly of God	61.65433	-149.898			
Reservoir/Water Supply	Homesteaders Community Club	61.58468	-149.7445			
Reservoir/Water Supply	Houston Lodge	61.62919	-149.8093			
Reservoir/Water Supply	Lavern Griffin Youth Camp	61.60929	-149.5638			
Reservoir/Water Supply	Little Susitna CG Houston	61.6313	-149.8029			
Reservoir/Water Supply	Mid Valley Senior Center	61.58048	-149.7332			
Reservoir/Water Supply	Millers Market	61.63005	-149.8134			
Reservoir/Water Supply	MSBSD Houston Jr/Sr High	61.5876	-149.7707			
Reservoir/Water Supply	Riverside Camper Park	61.6305	-149.811			
Reservoir/Water Supply	Triple B Bar	61.63112	-149.8178			
School	1					
School	2-Mid High					
Senior Center	NA					

FEMA Critical Facilities Data Summary Report (2008)

Houston

FacilityType	FacilityName	LatitudeDD	LongitudeDD	Building Construction Type	Estimated Value	Data Quality Grade
Store	Millers Market					
Store	Napa Auto Parts					
Store	Spenard Builders Supply					

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6440 Houston	Church	1
6444 Houston	School	1
6441 Houston	Church	2
6445 Houston	School	2-Mid High
317 Houston	Reservoir/Water Supply	Laundry & RV
6447 Houston	Offices	City Hall
6432 Houston	Hospital/Clinic/ER	Clinic PA
318 Houston	Reservoir/Water Supply	Little Su #2
319 Houston	Reservoir/Water Supply	Little Su Upper
320 Houston	Reservoir/Water Supply	Nancy Lake
6442 Houston	Oil or Natural Gas Pipeline--End	line to High
321 Houston	Reservoir/Water Supply	Assembly of
322 Houston	Reservoir/Water Supply	Community
323 Houston	Reservoir/Water Supply	Houston Lodge
743 Houston	Fire Station	Volunteer Fire
822 HOUSTON	Radio Transmitter	KADX CH 234
830 HOUSTON	Radio Transmitter	KJHA CH 204
828 HOUSTON	Radio Transmitter	KQEZ CH 221
831 HOUSTON	Radio Transmitter	KRPM CH 242
324 Houston	Reservoir/Water Supply	Youth Camp
325 Houston	Reservoir/Water Supply	CG Houston
326 Houston	Reservoir/Water Supply	Senior Center
327 Houston	Reservoir/Water Supply	Millers Market
6433 Houston	Store	Millers Market
328 Houston	Reservoir/Water Supply	Houston Jr/Sr
6446 Houston	Community Hall	NA
6437 Houston	Post Office	NA
6438 Houston	Radio Transmitter	NA
6439 Houston	Senior Center	NA
6435 Houston	Store	Parts
6436 Houston	Bridge	Susitna River
6443 Houston	Airport	private air strip
329 Houston	Reservoir/Water Supply	Camper Park
6434 Houston	Store	Builders Supply
330 Houston	Reservoir/Water Supply	Triple B Bar

					2 side buildings
					Big Lake Baptist
61.57986	-149.6434	NAD27	230432.4465	1296566.121	
					57.3 Armstrong Rd.
					Big Lake Rd. Homesteaders Mall
61.62982	-149.7932	NAD27	222166.2008	1301631.598	
61.63068	-149.7945	NAD27	222091.5514	1301723.239	
61.70395	-150.0027	NAD27	210617.2562	1309223.748	
					Hawk Lane
61.65433	-149.898	NAD27	216469.5101	1304021.319	
61.58468	-149.7445	NAD27	225057.8809	1296757.356	
61.62919	-149.8093	NAD27	221321.5145	1301507.523	
61.63064	-149.80764	NAD27	221398.9727	1301674.612	57.5 Parks Hwy
61.48471	-149.76221	NAD27	224835.6359	1285539.669	
61.63193	-149.81055	NAD27	221236.4028	1301808.902	
61.33665	-149.51085	NAD27	239270.3897	1269893.927	
61.33693	-149.51112	NAD27	239253.9033	1269924.201	
61.60929	-149.5638	NAD27	234416.7961	1300128.96	
61.6313	-149.8029	NAD27	221644.1612	1301764.378	
61.58048	-149.7332	NAD27	225684.834	1296326.939	
61.63005	-149.8134	NAD27	221099.2108	1301589.857	
					Source: Mourad.
					COLEMAN
					MISSION F
					BROADCASTER
					BROADCASTER
					Parks Hwy 57.4
61.5876	-149.7707	NAD27	223653.3545	1296994.754	
					57.3 Armstrong Rd.
					Millers Market
					Not up and running
					On Mid Valley Wy, Hawk Lane near school
					Parks Hwy
61.6305	-149.811	NAD27	221222.6171	1301648.077	
61.63112	-149.8178	NAD27	220859.618	1301694.647	

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Appendix C
FEMA REVIEW TOOL

APPENDIX A:
LOCAL MITIGATION PLAN REVIEW TOOL

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

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

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

Jurisdiction: Houston, Alaska (Region 10)	**Title of Plan:** City of Houston, Alaska Local Hazard Mitigation Plan	**Date of Plan:** August 24, 2017
Local Point of Contact: Sonya Dukes, CMC	**Address:** P.O. Box 940027 Houston, AK 99694	
Title: City Clerk		
Agency: City of Houston		
Phone Number: (907) 892-6869	**E-Mail:** SDukes@houston-ak.gov	

State Reviewer: George J Grady	**Title:** Emergency Management Specialist II	**Date:**

FEMA Reviewer: Amanda Siok Amanda.Siok@fema.dhs.gov	**Title:** Mitigation Planner	**Date:** 12/01/2017
Date Received in FEMA Region 10	10/17/2017	
Plan Not Approved	12/04/2017	
Plan Approvable Pending Adoption		
Plan Approved	02/06/2018	

SECTION 1:
REGULATION CHECKLIST

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT A. PLANNING PROCESS			
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Chapter 1, pages 1-8, Table 1 on pages 2 and 3, Appendix A PDF 16-22, 116-121	X	
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Chapter 1, pages 4 and 5, plan will be uploaded to DHS&EM webpage for review PDF 18-19 PDF 118	X	
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Chapter 1, pages 4 and 5, Appendix A PDF 18-19, PDF 118	X	
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	Chapter 1, pages 3-4 PDF 17-18	X	
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Chapter 1, page 6, Appendix E PDF 20	X	
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	Chapter 1, pages 6 and 7, Appendix E PDF 20-21, 151-154	X	
ELEMENT A: REQUIRED REVISIONS			

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT			
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Chapter 3, Section 1-10 PDF 53-86	X	
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Chapter 3, Pages 39-40, 47-49, 53-55, 59-61, 65-66, 68, 70 PDF 54-85	X	
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	Chapter 3, Pages 35-36, 39, 47, 53, 59, 65, 68, 70 Tables 16 and 17 PDF 49-84, 34-35	X	
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	Chapter 3, Pages 37, 40-43 PDF 51, 57	X	
ELEMENT B: REQUIRED REVISIONS			

ELEMENT C. MITIGATION STRATEGY			
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Section 2.3, Tables 3, 4, and 5 as well as Page 77 PDF 29-36, 91	X	
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	Pages 40-43 PDF 54-57	X	
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Chapter 3, Pages 43, 49-50, 55-56, 61-62, 66, 68-69 PDF 57, 64-65, 70-71, 75, 80, 82	X	
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	Chapter 4, Tables 25 and 26 PDF 92-105	X	
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Chapter 4, Table 26 PDF 99-	X	
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	Chapter 1, page 6 PDF 19-20	X	

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

SECTION 2:
PLAN ASSESSMENT

A. Plan Strengths and Opportunities for Improvement

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

Element A: Planning Process

Plan Strengths:

- The planning team includes multiple departments from within the City of Houston as well as a representative from the Mat-Su Borough.
- The planning team reviewed several plans while developing the HMP including economic development and comprehensive plans.
- The plan has a visual graphic of the Hazard Mitigation Planning Cycle.

Opportunities for Improvement:

- The public process can be significantly improved by developing an outreach process that is engaging to the public, rather than expecting the public to read through draft plans on a website. The intended booth at the Annual Founder's Day Celebration is a move in the right direction. Consider asking more specific goals of the public, rather than using the event for hazard awareness. Potential public engagement questions:
    - What do you want the City to do to reduce the risk of flood, earthquake, etc.
    - Rank the top five proposed mitigation projects.
    - Do you have an idea for a project that will reduce the risk of X in Houston?

  Be sure to document the process and comments from the public in the Annual Founder's Day celebration. A new survey specific to Houston is being designed now and will be added to the final Plan after an APA has been issued.

Element B: Hazard Identification and Risk Assessment

Plan Strengths:

- The Plan references the Mat-Su Borough's HMP to identify hazards in the planning area and to exclude those that aren't.
- The Plan identifies Climate Change as a Hazard.

Opportunities for Improvement:

- Consider adding population and infrastructure related to the tourism/recreation population to Houston's vulnerabilities. (seasonal influx in population, vacant houses, language/unique needs of tourist population
- Consider adding wells, septic, and plumping infrastructure to the City's critical infrastructure list.
- PDF 45, Section 2 reads "Houston is a small community of 2,163 residents, every structure is essential to the sustainability and survivability of residents". If this is true, why were the above suggestions identified in Section 2 Community Profile Culture, Population, and Facilities (PDF24-25) sections not recognized in Section 2.2's Capability Assessment Infrastructure, Critical Facilities, Essential Facilities, and Critical Infrastructure (PDF 27)?
- Table 14 and 15 list facilities in the community from the Hazus database; consider obtaining GIS data from the City of Houston, Mat-Su Borough, or in-person visits to increase the understanding and spatial awareness of essential facilities.

Element C: Mitigation Strategy

Plan Strengths:

- The plan identifies existing authorities, policies, programs, and resources including staff, GIS capabilities, and funding.

Opportunities for Improvement:

- The plan integration section should be expanded to include more detail and include specific processes for integration of the HMP and Comprehensive Plan. Identification of the Comprehensive Plan is only the beginning step to integration. The HMP could go into more detail to explain the overlapping goals/mission/objectives of the comprehensive plan and identify specific processes to integrate the two plans. Consider mutual meetings, safe growth audits, and shared public engagement requirements.
- PDF 59 states that "The City of Houston has no enforcement authority over the quality of buildings constructed" but PDF 29 Table 4 documents building codes, zoning ordinances, and site plan review requirements. Consider expanding on the capabilities in Table 4 to identify how enforcement can be improved and supported.
- While the plan does document existing authorities, policies, programs, and resources, there is no description of how these can be improved and/or expanded to support identified mitigation actions.
- There are no goals or actions identified to reduce the risks/vulnerabilities associated with climate change.

B. Resources for Implementing Your Approved Plan

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

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

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

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

The **Integration Hazard Mitigation and Climate Adaptation Planning: Case Studies and Lessons Learned** resource is a 2014 ICLEI publication for San Diego with a clear methodology that could assist in next steps for integration impacts of climate change throughout mitigation actions. [illegible]s/2015/08/Integrating-Hazard-Mitigation-and-Climate-Adaptation-Planning.pdf

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

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

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

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

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

Appendix D
Benefit–Cost Analysis Fact Sheet

Benefit-Cost Analysis Fact Sheet

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

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

All Benefit-Costs must be:

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

General Data Requirements:

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

Damage and Benefit Data

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

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

Building Data

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

Use Correct Occupancy Data

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

Questions to Be Answered

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

Common Shortcomings

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

Appendix E
Plan Maintenance Documents

Annual Review Questionnaire

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

Mitigation Action Progress Report

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

Project Title: _____ Project ID# _____

Responsible Agency: _____

Address: _____

City: _____

Contact Person: _____ Title: _____

Phone #(s): _____ email address: _____

List Supporting Agencies and Contacts:

_____

_____

Total Project Cost: _____

Anticipated Cost Overrun/Underrun: _____

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

Anticipated completion date: _____

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

_____

_____

_____

Milestones	Complete	Projected Date of Completion

Plan Goal (s) Addressed:

Goal: _____

Indicator of Success: _____

_____

_____

_____

Project Status

☐ Project on schedule

☐ Project completed

☐ Project delayed*

*explain: _____

_____

☐ Project canceled

Project Cost Status

☐ Cost unchanged

☐ Cost overrun*

*explain: _____

_____

☐ Cost underrun*

*explain: _____

_____

Summary of progress on project for this report:

A. What was accomplished during this reporting period?

_____

_____

_____

_____

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

_____

_____

_____

_____

C. How was each problem resolved?

_____

_____

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

Other Comments: