HOUSTON COUNTY

HAZARD MITIGATION PLAN

Preparing for a Sustainable Future for Human Life and Property

DRAFT: DECEMBER 23, 2013

H2O PARTNERS

THE STATE OF TEXAS
COUNTY OF HOUSTON

SECTION 1: INTRODUCTION

BACKGROUND

Houston County is named for Sam Houston, a president of the Republic of Texas and Governor of Texas. Houston County was the first new county created under the 9-year Republic of Texas on June 12, 1837. The original boundaries of Houston County also included all of present-day Anderson and Trinity Counties, and portions of present-day Henderson and Polk Counties. The City of Crockett is the county seat of Houston County.

The Federal Emergency Management Agency (FEMA) defines mitigation as "any action taken to reduce or eliminate the long term risk to human life and property from natural hazards.[1]" Mitigation differs from emergency preparedness and protective measures, which focus on activities designed to make communities more ready to take appropriate action in a disaster with emergency response and equipment. Mitigation activities involve alteration of physical environments to reduce risks and vulnerabilities to hazards and make it more cost-effective to respond to and recover from disasters.

Houston County is susceptible to a wide range of natural hazards, including drought, hurricane, thunderstorms and wildfires. These life-threatening hazards can destroy property, disrupt the economy and lower the overall quality of life for individuals.

While it is impossible to prevent a hazard event from occurring, the impact of hazards can be lessened in terms of their effect on people and property through effective hazard mitigation planning and implementation. This Plan provides an opportunity for the County to evaluate successful mitigation actions and explore opportunities to avoid future disaster loss.

[1] www.fema.gov

SECTION 1: INTRODUCTION

Figure 1-1. Overview of the Planning Area

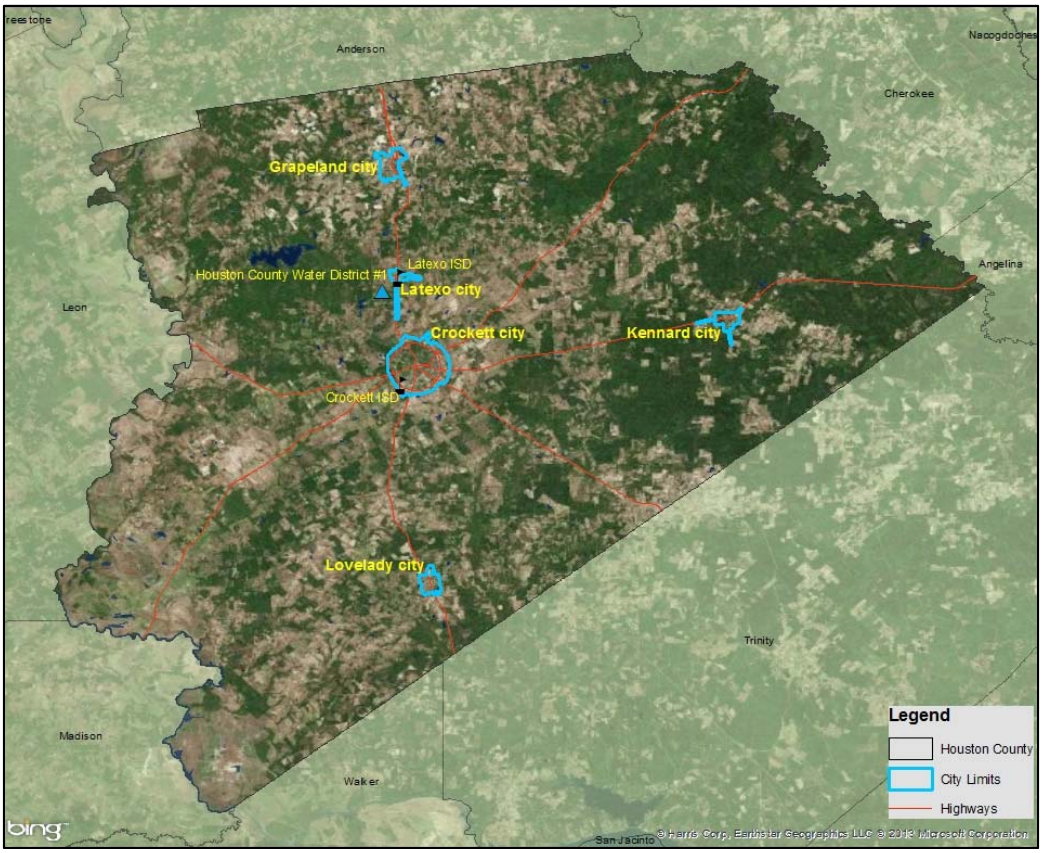


Table 1-1. Planning Team members

ENTITY	TITLE
Houston County	EMC
City of Crockett	Mayor
City of Grapeland	Mayor
City of Kennard	Mayor
City of Latexo	Mayor
City of Lovelady	Mayor
Crockett ISD	Superintendent
Latexo ISD	Superintendent
Houston County Water Control and Improvement District #1	Manager

SECTION 1: INTRODUCTION

SCOPE

The Planning Team for the multi-jurisdictional Plan includes Houston County, the Cities of Crockett, Grapeland, Kennard, Latexo, and Lovelady, Crockett Independent School District, Latexo Independent School District, and Houston County Water Control and Improvement District. Other entities and businesses participated as stakeholders. These groups, and others, provided valuable input into the planning process.

The focus of the Plan is to mitigate those hazards classified as "high" or "moderate" risk as determined through a detailed hazard risk assessment conducted for Houston County. Hazards that pose a "low" or "negligible" risk will continue to be evaluated during future updates to the Plan, but they may not be fully addressed until they are determined to be of high or moderate risk. This enables all entities to prioritize mitigation actions based on hazards which are understood to present the greatest risk to lives and property.

PURPOSE

This Plan was prepared by Houston County and H2O Partners, Inc. It is an opportunity for Houston County and participating Planning Team members to evaluate successful mitigation actions and explore opportunities to avoid future disaster loss.

In developing the Plan, Houston County and Plan participants identified eleven (11) natural hazards to be addressed, as the goal of the Plan is to minimize or eliminate long-term risks to human life and property from known hazards by identifying and implementing cost-effective mitigation actions. *Mitigation* is defined by FEMA as *sustained actions taken to reduce or eliminate long-term risk to people and property from hazards and their effects*. Therefore, the purpose of the Plan is to continue developing successful mitigation projects to bring together cities and other entities in order to reduce future risk of loss of life or damage to property in Houston County.

Through this process, Houston County and Plan participants seek to:

- Assess any previous mitigation projects and develop unique mitigation strategies to meet future development and risks;
- Encourage improvements in floodplain management, participation in the National Flood Insurance Program (NFIP); and qualifying for FEMA's Community Rating System, thereby reducing flood insurance premiums for citizens;
- Devise solutions to strengthen emergency management by addressing moderate and high risk natural hazards; and
- Develop and implement a comprehensive Hazard Mitigation Plan for Houston County.

SECTION 1: INTRODUCTION

AUTHORITY

The Plan will be tailored specifically for Houston County. When complete, the Plan will comply with all requirements promulgated by the Texas Division of Emergency Management (TDEM) and all applicable provisions of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, Section 104 of the Disaster Mitigation Act of 2000 (DMA 2000) (P.L. 106-390), and the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004 (P.L. 108–264), which amended the National Flood Insurance Act (NFIA) of 1968 (42 U.S.C. 4001, et al). It will also comply with FEMA's February 26, 2002 Interim Final Rule ("the Rule") at 44 CFR Part 201, which specifies the criteria for approval of mitigation plans required in Section 322 of the DMA 2000 and standards found in FEMA's "Local Mitigation Plan Review Guide" (October 2011), and the "Local Mitigation Planning Handbook" (March 2013). The Plan will also be developed in accordance with FEMA's Community Rating System (CRS) Floodplain Management Plan standards and policies.

SUMMARY OF SECTIONS

Sections 1 and 2 of the Plan outline the purpose and the process of development. Section 3 profiles Houston County in terms of population, demographics, economy, and education. Section 4 provides an overview of the hazards facing the area, including the process of identification and risk assessment methodologies utilized.

Sections 5 through 15 present information on individual, natural hazards. These hazards generally appear in order of priority based on potential losses in terms of loss of life and property and other community concerns. For each hazard, the Plan presents a description of the hazard, a list of historical hazard events, and the results of the vulnerability and risk assessment process.

Section 16 presents mitigation goals and objectives. Mitigation actions for the County are presented in Section 17, while Section 18 identifies plan maintenance mechanisms.

Appendix A contains a list of the planning team and participating stakeholders. Public survey results are analyzed in Appendix B. Appendix C contains Critical Facilities locations. Appendix D contains Dam locations. Appendix E contains information regarding workshops and public meetings. Appendix F includes the completed Capability Assessment matrix for Planning Team members. Appendix G includes an overview of the proposed County-wide alert and communication system.

SECTION 2: PLANNING PROCESS

PLAN PREPARATION AND DEVELOPMENT

Mitigation planning involves bringing together multiple components and players to create more disaster-resistant communities. This section provides an overview of the planning process, highlighting key steps as well as providing a detailed description of how stakeholders and the public were involved.

OVERVIEW OF THE PLAN

Houston County received funding under the Pre-Disaster Mitigation Grant Program (PDM) to develop a FEMA-approved Hazard Mitigation Plan. The County solicited bids and hired the consultant team of H2O Partners, Inc. to provide technical support and oversee the development of the Plan. In developing the Plan, the consultants used the October 2011 "*Local Mitigation Plan Review Guide*" and the March 2013 "*Local Mitigation Plan Handbook"* to create the Plan in accordance with the process as shown in Figure 2-1 below.

SECTION 2: PLANNING PROCESS

Figure 2.1. Mitigation Planning Process

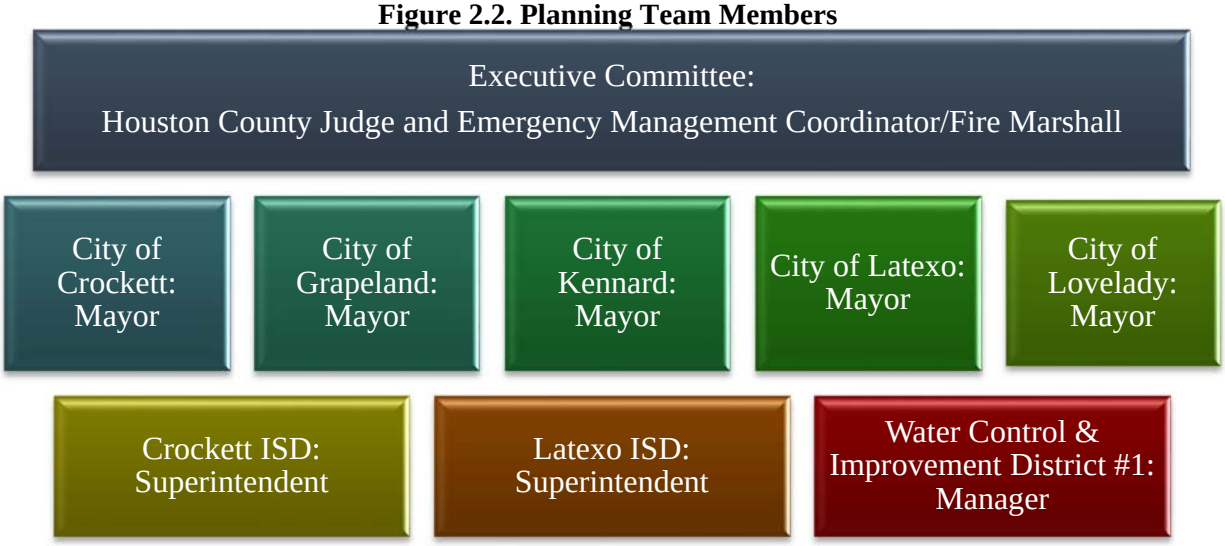
Houston County and the participating jurisdictions, along with other participating entities, met with the consultant team in April 2013 to begin organizing resources by identifying Planning Team Members and conducting a Capability Assessment. Crockett ISD, Latexo ISD and the Water Control and Improvement District #1 were invited as stakeholders to attend initial meetings and decided to participate fully in the planning effort.

PLANNING TEAM

The Planning Team was established using a direct representation model. Key members of H2O Partners, Inc. developed the plan in conjunction with the Executive Committee comprised of the County Judge, Emergency Management Coordinator, Mayors for the Cities of Crockett, Grapeland, Kennard, Latexo and Lovelady, School District Superintendents, and Manager of the Water Control and Improvement District #1. Departments and titles of team members are illustrated in Figure 2-2.

SECTION 2: PLANNING PROCESS

Figure 2.2. Planning Team Members



Some of the responsibilities of the Planning Team included: completing capability assessment surveys, providing input regarding the identification of hazards, reviewing the previous risk assessment and mitigation strategy from the 2007 HMAP Draft Plan, evaluating and updating previous mitigation actions, identifying mitigation goals and developing new mitigation strategies.

PLANNING PROCESS

The process used to prepare this Plan included following the four major steps included in Figure 2-1. After the Planning Team was organized, a Capability Assessment Survey was developed and distributed at the Kick-Off Workshop. Appendix F is a Capability Assessment overview for each Planning Team member. Hazards were identified and assessed, the result of which was provided at the Risk Assessment Workshop. Based on the County's vulnerabilities, specific mitigation strategies were discussed and created at the Mitigation Workshop. Finally, Plan Maintenance and Implementation procedures were developed and are included with this Plan in Section 18. Documentation for participation at each workshop is found in Appendix E.

At the meeting development workshops held throughout the planning process described herein, the following factors were taken into consideration:

- The nature/magnitude of risks currently affecting the community;
- Mitigation goals to address current and expected conditions;
- Whether current resources will be appropriate for implementing the Plan;
- Implementation problems, such as technical, political, legal or coordination issues that may hinder development;
- Anticipated outcomes; and
- How both County and City departments will participate in the implementation process.

SECTION 2: PLANNING PROCESS

KICKOFF WORKSHOP

The Kickoff Workshop was held at the County Court House Annex in the City of Crockett on April 3, 2013. This initial meeting was an opportunity to inform City officials and key department personnel about how the planning process pertained to their distinct roles and responsibilities, and also to involve stakeholder groups such as the Crockett ISD, Latexo ISD and area businesses. In addition to the kickoff presentation, participants received the following information:

- Background and summary of the HMAP planning process;
- Public participation survey for distribution; and
- Hazard Ranking Sheet.

HAZARD IDENTIFICATION

At the close of the Kickoff Meeting, and through a series of email and phone correspondences, the Planning Team conducted preliminary hazard identification. The group reviewed and considered a full range of natural hazards, then narrowed the list to significant hazards by reviewing hazards affecting the area as a whole, the State of Texas Hazard Mitigation Plan, and initial study results from reputable sources such as federal and state agencies. Based on this initial analysis, the team identified a total of eleven (11) natural hazards that could affect the area.

RISK ASSESSMENT

An initial risk assessment for the County was completed in July, 2013. Planning Team members and stakeholder groups were invited to the Risk Assessment live webinar, which presented the results of the assessment on July 31, 2013. During this webinar, the characteristics and consequences of each hazard were evaluated to determine how much of the area would be affected in terms of potential danger to property and citizens.

Potential dollar losses from each hazard were estimated using the Federal Emergency Management Agency's Hazards U.S. Multi-Hazards (MH) Model (HAZUS-MH) and other HAZUS-like modeling techniques. The assessments examined the impact of various hazards on the built environment, including the general building stock (e.g., residential, commercial, industrial), critical facilities, lifelines, and infrastructure. The resulting risk assessment profiled hazard events, provided information on previous occurrences, estimated probability of future events, and detailed the spatial extent and magnitude of impact on people and property.

The assessments were also used to set priorities for mitigation based on potential dollar losses and loss of lives. A hazard profile and vulnerability analysis for each of the hazards can be found in Sections 5 through 15 in this Plan.

MITIGATION REVIEW AND DEVELOPMENT

The mitigation strategy development for the Plan involved developing mitigation goals and developing new mitigation actions. A Mitigation Workshop was held on September 17, 2013 at the County Courthouse

Annex. The Mitigation Workshop was followed the public meeting that evening. As with the Risk Assessment Workshop, stakeholder groups were invited.

An inclusive and structured process was used to develop and prioritize new mitigation actions for this Plan, including the following steps:

- A "menu" of optional mitigation actions was developed based on plan reviews, studies, and interviews with federal, state, and local officials. The participants reviewed the optional mitigation actions, and narrowed the list down to those that were most applicable to their area of responsibility, most cost-effective in reducing risk, could be implemented easily, and would be most likely to receive institutional and community support.
- The participants inventoried federal and state funding sources that could potentially assist in implementing the proposed mitigation actions. Information was collected, including the program name authority, purpose of the program, types of assistance and eligible projects, conditions on funding, types of hazards covered, matching requirements, application deadlines, and a point of contact. Mitigation Planning Team Members considered benefits that would result from the mitigation actions versus the cost of those projects. Detailed cost-benefit analyses were beyond the scope of this plan. However, economic evaluation was one factor that helped Team Members select one mitigation action from competing actions.
- Team Members then selected and prioritized mitigation actions.

The prioritization method was based on FEMA's STAPLE+E criteria and included social, technical, administrative, political, legal, economic, and environmental considerations. As a result of this exercise, an overall priority was assigned to each mitigation action by each Team Member. The overall priority of each action is reflected in the mitigation actions found in Section 17.

Team Members developed action plans identifying proposed actions, costs and benefits, the responsible organization(s), effects on new and existing buildings, implementation schedules, priorities, and potential funding sources.

Mitigation actions identified in the process were made available to the Planning Team for review. In addition, the Plan will be made available for review and comment on Houston County's website.

REVIEW AND INCORPORATION OF EXISTING PLANS

REVIEW

A variety of existing studies, plans, reports, and technical information were reviewed as part of the planning process. Sources of the information included FEMA, the United States Army Corps of Engineers (USACE), the Texas Forest Service, National Oceanic and Atmospheric Administration (NOAA), the Texas Water Development Board (TWDB), the Texas Commission on Environmental Quality (TCEQ), the State Comptroller, the Texas State Data Center, the Texas Division of Emergency Management (TDEM), local hazard assessments and plans.

SECTION 2: PLANNING PROCESS

Section 4 and the hazard-specific sections of the Plan summarize the findings from these information sources. Some of these documents, including those from FEMA, provided information on risk, existing mitigation actions currently underway, and ideas for possible future mitigation actions. Other documents, including those from NOAA, provided histories of disasters in the area. The USACE studies were reviewed for their assessment of risk and potential projects in the county. State Data Center documents were used to obtain population projections. Materials from FEMA and TDEM were reviewed for guidance on plan development requirements. Communities included actions from other plans, such as Floodplain Management Plans and developed actions to implement and incorporate other plans such as Storm Water Management Plans. Current projects and studies were utilized as a starting point for discussing mitigation actions among Team Members. This information was also developed into a table for review by the Planning Team for an assessment on the County's capability.

Previous hazard events, occurrences and descriptions were identified through NOAA's National Climatic Data Center (NCDC). Results of past hazard events were found through searching the NCDC and included in each hazard section 4 of this Plan. The preliminary results were also presented at the Risk Assessment Workshop held in July, 2013 in order to facilitate a discussion on risk to help participants appropriately rank hazards for their jurisdiction.

The TWDB studies were reviewed for population and other projections and included in Section 3 of the Plan. Further, these studies were used as a starting point for suggesting grant and mitigation activities based on flood-related funding availability. The State Comptroller materials were reviewed for regional economic projections, which were also used to fully develop Section 3 of the Plan. Information from the Texas Forest Service was used to appropriately rank the wildfire hazard, and to help identify potential grant opportunities. The State of Texas Mitigation Plan, developed by TDEM, was discussed in the initial planning meeting in order to develop a specific group of hazards to address in the planning effort. The State Plan was also used as a guidance document, along with FEMA materials, in the development of the Plan.

Many of Houston County's participating jurisdictions are relatively small, incorporated communities with limited staff and resources with which to implement ordinances, policies, local laws and State statutes. Incorporating mitigation planning activities to reduce long-term vulnerability can be a challenge. However, goals and objectives of the mitigation strategy may be accomplished by coordinating and implementing actions with government functions and planning tools in place at all levels of government, including smaller, incorporated jurisdictions. All Planning Team members have adopted, or plan to adopt, a Comprehensive Plan, local Emergency Management Plan, and Post-disaster Recovery Plan. Additionally, incorporated communities within the County have adopted building codes, and all communities, with the exception of the City of Latexo, participate in the National Flood Insurance Program (NFIP). As an NFIP participating jurisdiction, hydraulic and hydrologic data may be available through FIS Studies to support mitigation actions pertaining to storm water retention and improving drainage. Regulations and policies exist through these ordinances and programs, such as the NFIP, that provide the basis for implementing mitigation actions and projects identified at the local level in the Hazard Mitigation plan.

Participating Houston County communities have adopted, or are in the process of adopting a Comprehensive Plan which dictates long-term public policy in terms of transportation, utilities, land use, recreation, and housing. This strategic planning tool is aligned with a community's annual budget meeting. Houston County, all participating jurisdictions, school districts, and the WCID #1 conduct an annual budget

review. The community's fiscal objectives are, in turn, aligned with the goal of the Hazard Mitigation Plan – to implement cost-effective mitigation actions and to minimize the costs of disaster response and recovery.

A major element of fiscal responsibility as it pertains to mitigation strategy rests in the act of budgeting. Budgeting is the process of allocating resources and prioritizing needs of a local jurisdiction, school district, or other organization. In most cases, for a governmental entity, the budget represents the legal authority to spend money, and implied set of decisions by City administrators that matches resources with the entity's needs. As such, the budget is a product of the planning process, including mitigation planning and reducing risk from natural hazards. The annual budget review is an important tool in controlling and executing mitigation goals and objectives, and funding identified mitigation actions. Each jurisdiction, and the identified contact within each community participating in the Houston County Plan will participate in their local budgetary process for tracking identified mitigation actions, recommending prioritization for grant funding, and updating and maintaining the mitigation strategy developed for the community.

Appendix F provides an overview of Planning Team members' existing planning and regulatory capabilities to support implementation of mitigation strategy objectives. Table F-1 provides further analysis of how each intends to incorporate mitigation actions into existing plans, policies, and the annual budget review as it pertains to prioritizing grant application for funding and implementation of identified mitigation projects.

TIMELINE FOR INCORPORATION OF MITIGATION ACTIONS

Planning Team members have engaged in discussions regarding a timeframe for how and when to implement each mitigation action. Considerations include when the action will be started, how other existing plans' timelines affect implementation, and when the action should be fully implemented. Timeframes may be general, and there will be short, medium, and long term goals for implementation based on prioritization of each action as identified on individual mitigation action worksheets included in the Plan for each respective community.

The planning team will evaluate and prioritize the most suitable mitigation actions for the community to implement. For some of the participating jurisdictions, the timeline for implementation of actions will partially be directed by their comprehensive planning process or capital improvements plan; for other jurisdictions, budgetary constraints and community needs will affect the timeline for implementation. For example, unincorporated Houston County has identified multiple programs for Wildfire Protection and implementing a FIREWISE program county-wide. These are coupled with educating the public on dangers of wildfire and how to reduce fire fuels for structures. These are high priority actions for implementation and will be addressed as such with respect to budgets, other existing plans, and other constraints that need to be considered. Overall, the Planning Team is in agreement that goals and actions of the hazard mitigation plan shall be aligned with the timeframe for implementation of mitigation actions with respect to annual review and updates of existing plans and policies.

Houston County's Emergency Management office (EMO) recognizes limitations of smaller jurisdictions within the County and provides invaluable guidance to local communities. The county Emergency Management Coordinator, who also serves as the county's Floodplain Administrator, guides local communities in updating and maintaining their Flood Damage Prevention Ordinance to ensure uniformity

and compliance. The EMC has also included mitigation actions to develop outreach programs county-wide to support local communities in educating residents with information regarding the NFIP Program, including availability of flood insurance.

Recognizing the limited capabilities of local communities, the county EMC works closely with City officials to ensure mitigation activities for reducing hazard risk are part of the local Emergency Operations Plan and that the Plans remain current and uniform.

Additionally, the County Judge's office and County Commissioner, as members of the Deep East Texas Council of Government (DETCOG), work to establish effective, mutually beneficial communication among the local communities in planning for and responding to natural and man-caused hazards. This is particularly important for smaller, local jurisdictions in the County that may need additional staff support. The County also ensures all entities are advised of future funding opportunities such as HMGP grants and are prepared to apply for funding that will assist them in the coordinated plan of response to weather- related disasters. The County further works to identify existing mutual aid agreements and put in place additional mutual aid agreements as needed.

The Houston County EMC also advises local jurisdictions on programs that will reduce hazard risk, along with further efforts of the regional Community Emergency Response Team (CERT) to provide area training and emergency response classes. Training includes classroom instruction on disaster preparedness, fire safety, disaster medical operations, light search and rescue operations, CERT organization and disaster psychology.

Houston County will also provide guidance in developing HMGP grant applications for communities' mitigation projects included in the HMAP underway.

PUBLIC AND STAKEHOLDER INVOLVEMENT

An important component of mitigation planning is public participation and stakeholder involvement. Input from individual citizens and the community as a whole provides the Planning Team with a greater understanding of local concerns and increases the likelihood of successfully implemented mitigation actions. If citizens and stakeholders, such as local businesses, non-profits, hospitals and schools, are involved, they are more likely to gain a greater appreciation of the hazards present in their community and take steps to reduce their impact.

Stakeholders invited to participate in the HMAP process included members of the area Chamber of Commerce, Deep East Texas Council of Government (DETCOG), insurance agencies, the County Appraisal District and Extension office, Texas Forest Service, and others. Two of the area school districts along with the Water Utility District attended the kickoff and ultimately chose to join the project as formal Planning Team members.

The major focus of these programs is to assist city and county governments in developing basic emergency plans and/or upgrading existing emergency plans. Programs include the development of mutual aid agreements, facilitation of interoperability protocols, and the upgrading of public health preparedness for and in response to Bioterrorism and other public health threats and emergencies

SECTION 2: PLANNING PROCESS

PUBLIC PARTICIPATION

Public involvement in the development of the Houston County Hazard Mitigation Plan was sought throughout the planning process: (1) during the beginning of the planning process; (2) during mitigation development, but prior to official plan approval and adoption, through the local media, and through the county's website. Public input was sought using three methods: (1) open public meetings; (2) survey instruments; and (3) making copies of draft Plan deliverables available for public review on the Houston County website, as well as in government offices and public libraries. Two separate public meetings were held during the development of this Plan, as described below.

FIRST SERIES OF PUBLIC MEETINGS

The first public workshop, in a series of open public meetings, was held on April 3, 2013 at the Houston County Annex in the City of Crockett. This meeting was scheduled on the same day as the Kickoff Workshop. These meetings were scheduled specifically for seeking public and stakeholder input and a Press Release posted in the local paper. The meeting was also promoted via the County's website. Topics of discussion for this first meeting included the purpose of hazard mitigation, discussion of the planning process, and types of natural hazards.

SECOND SERIES OF PUBLIC MEETINGS

The second public meeting was held on September 17, 2013 at the Houston County Annex in the City of Crockett. This meeting was scheduled in the evening, following the Planning Team's Hazard Mitigation workshop, specifically seeking public and stakeholder input. The meeting was advertised through a variety of means, including a newspaper ad, flyers at meeting locations, notices on the Houston County's website, and invitations sent via e-mail to community members. Topics of discussion for this meeting focused on mitigation projects that would reduce risk to residents of the County from those hazards identified and prioritized for each jurisdiction.

Members of the general public did attend each of the public meetings. Representatives from area civic organizations were present, and other interested citizens. The purpose of the HMAP and the planning process was described as a whole. Lengthy discussion regarding hazards facing the county ensued. A key topic during the public meetings was long-term drought and wildfire threat. Public surveys were distributed and attendees were asked to sign in so that they could be invited to future public meetings.

Documentation of participation in meetings is found in Appendix E.

PUBLIC PARTICIPATION SURVEY

In addition to the open public meetings, Houston County was able to solicit input from citizens and stakeholders through the use of a public participation survey. This survey was designed to obtain data and information from the residents of Houston County. Planning Team member communities distributed surveys at public forums and posted the survey on their community website.

SECTION 2: PLANNING PROCESS

Copies of the Public Participation Survey were distributed by local officials and at public meetings. A total of 44 responses to the survey were submitted, which provided valuable input in the development of the Plan. A summary of the survey findings is provided in Appendix B.

STAKEHOLDER INVOLVEMENT

Stakeholders provide an essential service in hazard mitigation planning; therefore, throughout the planning process, members of state and federal agencies, community groups, local businesses, schools and hospitals were invited to workshops held throughout the planning process. A list of organizations invited to attend may be found in Figure 2-3. Attendance is noted in parenthesis. If attendance is not noted, no response to the meeting invitation was received.

Stakeholders, businesses, and residents were invited to participate through a series of public notices and an article regarding the project posted in the local paper, and through the area Chamber of Commerce. The Grapeland Messenger, a local newspaper, provided coverage at the Mitigation Strategy workshop and public meeting.

Figure 2-3. List of Stakeholders Invited to Participate in Public Meetings

- Representative, Houston County Electric Coop (attended)
- Representative, Houston County Extension Service (attended)
- Staff, Houston County Appraisal District (attended)
- Representative, Texas Forrest Service (provided Firewise Program information but did not attend)
- Representative, U.S. Forrest Service
- News Reporter, Grapeland Messenger (attended)
- Board Member, Crockett Area Chamber of Commerce
- Crockett Insurance Company
- Houston County Life Magazine
- Houston County Sheriff's Office (responded but unable to attend)
- Phoenix Disaster Services
- Metro Planning
- Deep East Texas Council of Governments (DETCOG) (provided training schedule via email but did not attend)
- PChem, Inc.
- Vulcraft
- Trinity River Authority
- Texas Fish and Game
- Private timber interest companies

SECTION 3: COUNTY PROFILE

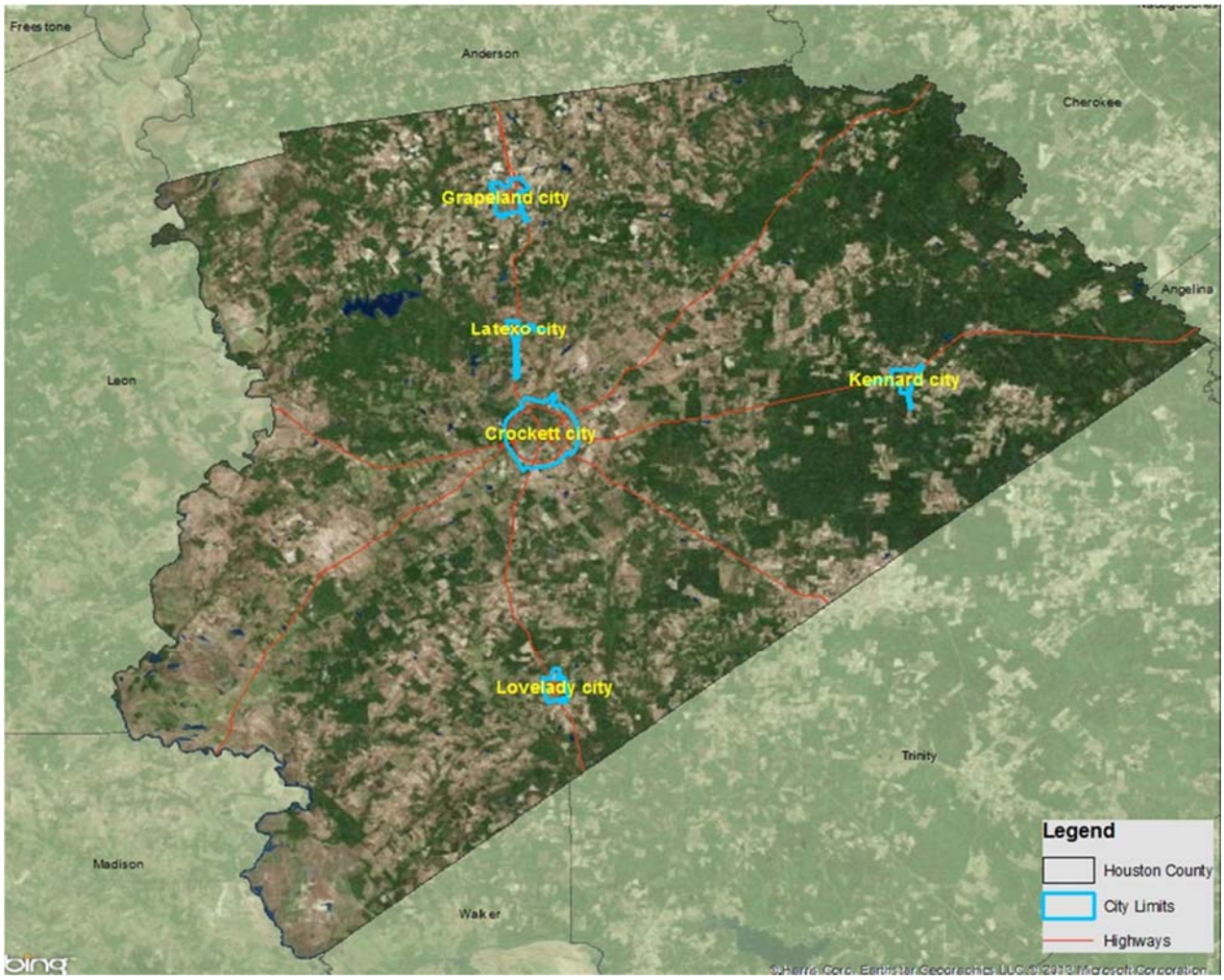
OVERVIEW

Houston County extends over a 1,237-square-mile-area bordered by the Neches River along the northeast and the Trinity River along the western boundary, and includes the following cities: Crockett, Grapeland, Kennard, Latexo, and Lovelady for an aggregate population of 23,732, according to the 2010 U.S. Census Bureau. The City of Crockett is the county seat. Houston County is located east of Waco in the East Texas Timberlands region, and is bordered by Anderson County to the north, Angelina, Cherokee, and Trinity Counties to the east, Madison and Walker Counties to the south, and Leon County to the west. Houston County is a member of the Deep East Texas Council of Government (DETCOG).

Sam Houston, a president of the Republic of Texas and Governor of Texas, is the county's namesake. On June 12, 1837, Houston County was the first county formed under the Republic of Texas.

SECTION 3: COUNTY PROFILE

Figure 3-1. Map of Houston County Study Area



The map above, Figure 3-1, illustrates the extent of the study area, including the five participating jurisdictions that form Houston County, two independent schools districts, and Houston County WCID #1. Provided in Table 3-1 below is a listing of the jurisdictions and stakeholders in Houston County that participated in the Hazard Mitigation Plan.

Table 3-1. Participating Jurisdictions and Other Entities in the Study Area

PARTICIPATING JURISDICTIONS	OTHER PARTICIPATING ENTITIES
Houston County	Crockett ISD
City of Crockett	Latexo ISD
City of Grapeland	Houston County Water Control & Improvement District #1

SECTION 3: COUNTY PROFILE

PARTICIPATING JURISDICTIONS	OTHER PARTICIPATING ENTITIES
City of Kennard	
City of Latexo	
City of Lovelady	

POPULATION AND DEMOGRAPHICS

Houston County has a population of 23,732, according to the 2010 U.S. Census Bureau. The unincorporated areas are the largest jurisdiction in Houston County, with a population of 13,985, accounting for 58.9 percent of the total population. Crockett City makes up the second largest population, accounting for 29.3 percent of the Houston County population. All of the other jurisdictions are smaller in comparison, cumulatively accounting for less than 12.0 percent of the total population.

Table 3-2. Population Distribution by Jurisdiction

JURISDICTION	TOTAL 2010 POPULATION	PERCENTAGE OF TOTAL 2010 POPULATION	ESTIMATED SPECIAL NEEDS POPULATIONS	
			Elderly (Over 65)	Below Poverty Level
City of Crockett	6,950	29.3%	1,280	1,911
City of Grapeland	1,489	6.3%	347	292
City of Kennard	337	1.4%	53	16
City of Latexo	322	1.4%	49	128
City of Lovelady	649	2.7%	100	79
Unincorporated Areas	13,985	58.9%	2,733	2,602
HOUSTON COUNTY TOTAL	**23,732**	**100.0%**	**4,562**	**4,913**

SECTION 3: COUNTY PROFILE

Figure 3-2. 2010 Population for Houston County

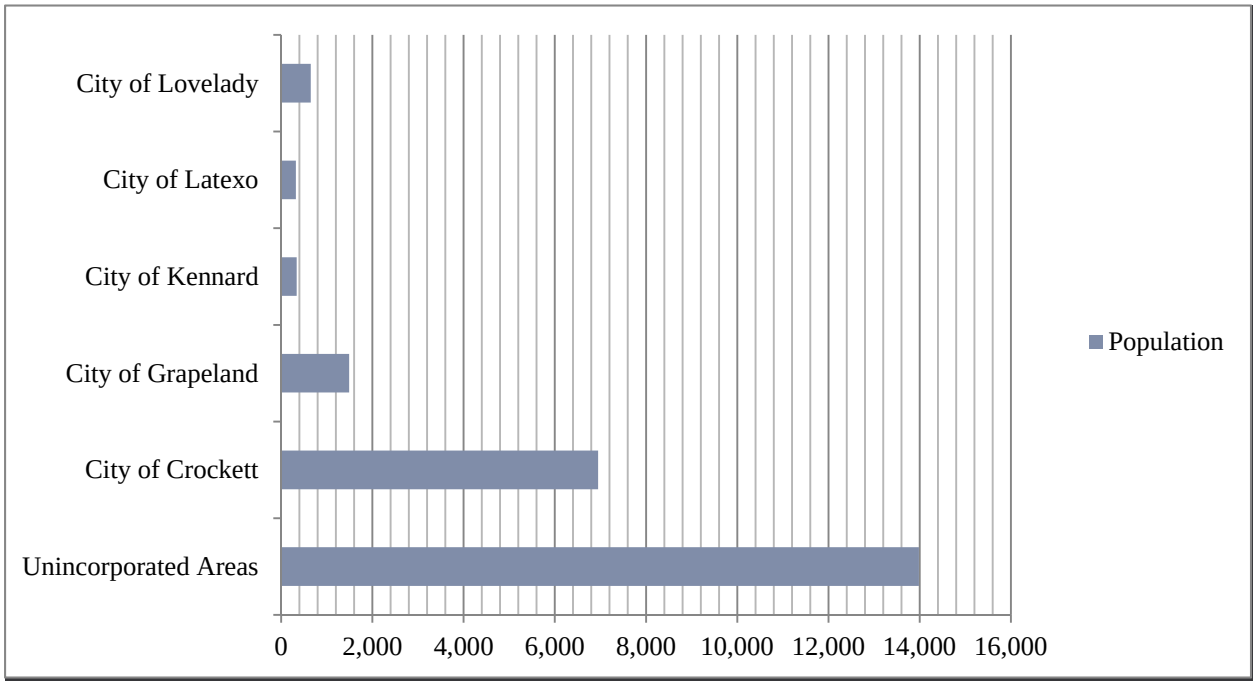


Table 3-3. Population Distribution by School District

SCHOOL DISTRICT	2013 POPULATION
Crockett ISD	1404
Latexo ISD	571

POPULATION GROWTH

Houston County experienced an increase in population between 1980 and 2010 by 6 percent, or 1,413 people. The jurisdictions of Lovelady, Latexo, and the County's unincorporated areas all exhibited an increase in population between 1980 and 2010, and continued to have population growth between 2000 and 2010. Between 2000 and 2010, the City of Crockett experienced a population loss of 2.7 percent. During that same time period, the Cities of Grapeland and Kennard had population growth.

Table 3-4. Population for Houston County, 1980 – 2010

JURISDICTIONS	1980	1990	2000	2010	POP CHANGE 1980-2010	PERCENT OF CHANGE	POP CHANGE 2000-2010	PERCENT OF CHANGE
City of Crockett	7,405	7,024	7,141	6,950	-455	-6.5%	-191	-2.7%
City of Grapeland	1,634	1,450	1,451	1,489	-145	-8.9%	38	2.6%

SECTION 3: COUNTY PROFILE

JURISDICTIONS	1980	1990	2000	2010	POP CHANGE 1980-2010	PERCENT OF CHANGE	POP CHANGE 2000-2010	PERCENT OF CHANGE
City of Kennard	424	341	317	337	-87	-20.5%	20	-5.9%
City of Latexo	312	289	272	322	10	3.2%	50	15.5%
City of Lovelady	509	587	608	649	140	27.5%	41	6.3%
Unincorporated Areas	12,015	11,684	13,396	13,965	1,950	16.2%	569	4.1%
HOUSTON COUNTY TOTAL	**22,299**	**21,375**	**23,185**	**23,712**	**1,413**	**6.3%**	**527**	**2.2%**

AGE

The median age of persons living in Houston County varies for the different jurisdictions, ranging from 36.0 years of age to 44.0 years of age, according to the 2010 U.S. Census Bureau. The City of Latexo has the highest percentage of persons under the age of 19, with 32.0 percent of the population. The jurisdiction with the highest percentage of persons 65 years of age and older is the City of Grapeland, with 23.3 percent of the population.

Table 3-5. Age of Population for Houston County

JURISDICTION	MEDIAN AGE	UNDER 19	AGE 20 TO 24	AGE 25 TO 34	AGE 35 TO 44	AGE 45 TO 54	AGE 55 TO 64	AGE 65 TO 74	AGE 75 TO 84	AGE 85+
City of Crockett	37.2	29.8%	6.3%	11.6%	10.7%	12.8%	10.4%	8.0%	6.3%	4.1%
City of Grapeland	44.0	25.6%	4.9%	10.7%	9.7%	12.3%	13.4%	10.8%	9.0%	3.5%
City of Kennard	39.5	28.7%	4.2%	11.0%	15.4%	12.1%	12.7%	9.8%	4.2%	1.8%
City of Latexo	36.0	32.0%	5.3%	11.2%	11.8%	13.4%	11.2%	10.2%	4.7%	0.3%
City of Lovelady	36.8	31.0%	4.2%	12.2%	15.1%	10.6%	11.5%	8.9%	3.8%	2.6%
HOUSTON COUNTY TOTAL	**43.6**	**23.1%**	**4.6%**	**11.4%**	**12.9%**	**15.6%**	**13.3%**	**10.4%**	**6.2%**	**2.7%**

EDUCATION

The level of education varies among the different jurisdictions, according to the U.S. Census Bureau 2007-2011 American Community Survey 5-year estimates. The City of Kennard has the highest population of people with a graduate or professional degree with 4.0 percent. In Houston County, the highest percentage of population with a Bachelor's Degree resides in the City of Grapeland, with 12.1 percent of their population. Table 3-6 depicts the level of education data for Houston County.

Table 3-6. Level of Education for Houston County

JURISDICTION	GRADUATE OR PRO-FESSIONAL DEGREE	BACHELOR'S DEGREE	ASSOCIATE'S DEGREE	SOME COLLEGE, NO DEGREE	HIGH SCHOOL GRADUATE	NO DIPLOMA
City of Crockett	4.0%	9.3%	4.2%	21.5%	39.4%	12.8%
City of Grapeland	2.9%	12.1%	4.6%	11.9%	38.5%	21.5%
City of Kennard	6.3%	5.6%	2.5%	20.7%	47.7%	10.9%
City of Latexo	0.4%	1.7%	1.5%	20.4%	64.8%	10.1%
City of Lovelady	0.0%	5.0%	8.3%	32.7%	40.2%	5.6%
HOUSTON COUNTY TOTAL	**3.7%**	**10.2%**	**4.6%**	**19.6%**	**40.5%**	**11.8%**

HOUSEHOLD INCOME

The data for household income is reported from the 2007-2011 5-year estimates of the U.S. Census Bureau's American Community Survey. The median household income for the State of Texas is $50,920, and the median household income for the United States is $52,762. The jurisdiction with the highest median household income in Houston County is the City of Latexo, which is $40,694. Conversely, at 39.4 percent, the City of Latexo also has the highest percentage of residents living below the poverty level in the County. Statistics indicate that 13.2 percent of all individuals residing in the State of Texas are in poverty. All but one city in Houston County have a higher percentage of residents living in poverty than the State of Texas.

Table 3-7. Household Income for Houston County

JURISDICTION	MEDIAN FAMILY INCOME	AT OR ABOVE $200K	$150,000 TO $199,999	$100,000 TO $149,999	$75,000 TO $99,999	$50,000 TO $74,999	$35,000 TO $49,999	$25,000 TO $34,999	$15,000 TO $24,999	$10,000 TO $14,999	LESS THAN $10,000	BELOW POVERTY LEVEL
City of Crockett	$22,640	1.1%	0.5%	5.6%	5.6%	9.8%	12.3%	9.5%	26.4%	11.8%	17.5%	19.7%
City of Grapeland	$22,204	0.0%	1.4%	10.3%	4.1%	10.3%	8.6%	10.9%	22.2%	21.2%	11.0%	17.5%
City of Kennard	$36,667	0.0%	4.6%	0.0%	5.9%	21.1%	22.4%	6.6%	18.4%	17.1%	3.9%	2.1%
City of Latexo	$40,694	0.0%	0.0%	5.4%	4.4%	20.5%	21.0%	15.1%	15.1%	17.1%	1.5%	34.9%
City of Lovelady	$32,880	0.0%	4.6%	0.0%	10.9%	20.1%	6.3%	30.5%	7.5%	10.9%	9.2%	14.1%

JURISDICTION	MEDIAN FAMILY INCOME	AT OR ABOVE $200K	$150,000 TO $199,999	$100,000 TO $149,999	$75,000 TO $99,999	$50,000 TO $74,999	$35,000 TO $49,999	$25,000 TO $34,999	$15,000 TO $24,999	$10,000 TO $14,999	LESS THAN $10,000	BELOW POVERTY LEVEL
HOUSTON COUNTY TOTAL	**$32,437**	**1.7%**	**1.8%**	**6.5%**	**9.1%**	**15.2%**	**12.9%**	**11.9%**	**18.7%**	**11.2%**	**10.9%**	**15.0%**

FUTURE DEVELOPMENT

To better understand how future growth and developments in the County might affect hazard vulnerability, it is useful to consider population growth, occupied and vacant land, the potential for future development in hazard areas, and current planning and growth management efforts.

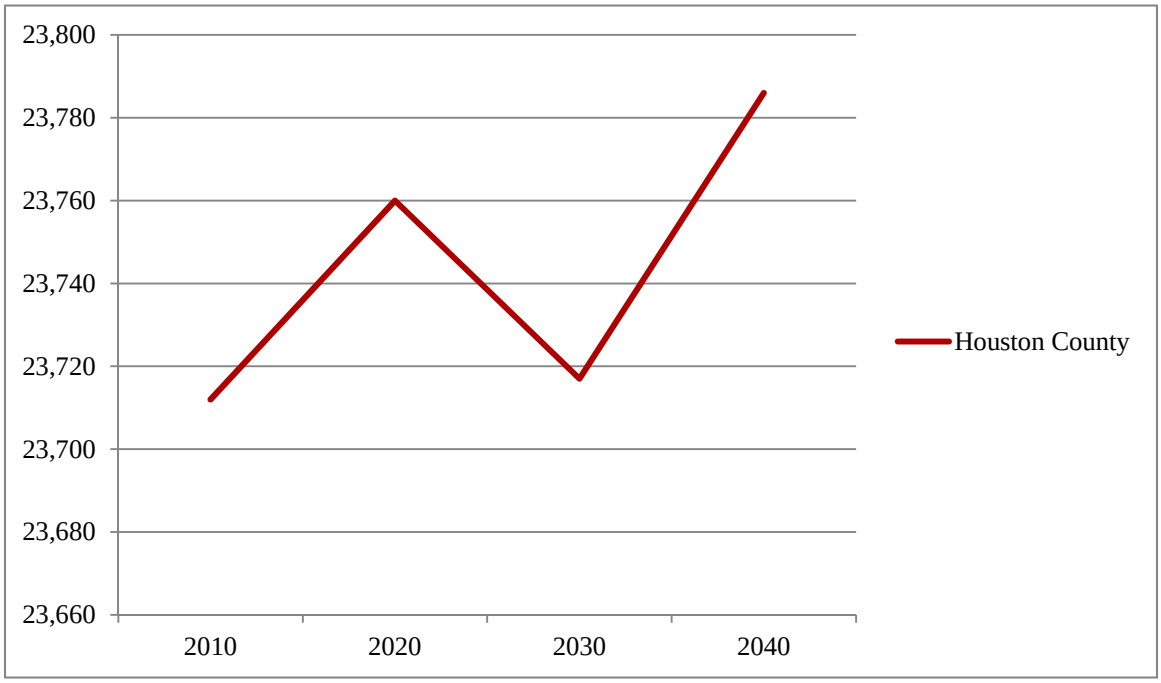
This section includes an analysis of the projected population change, the number of permits that have been issued throughout the county and economic impacts.

Population projections from 2010 to 2040 are listed in Table 3-9 and illustrated in Figure 3-3, as provided by the Office of the State Demographer, Texas State Data Center, and Institute for Demographic and Socioeconomic Research. Population projects were based on a 0.5 scenario growth rate, which is 50 percent of the population growth rate that occurred during 2000-2010.

Table 3-8. Houston County Population Density Projections

COUNTY	LAND AREA	2010		2020		2030		2040	
		Population							
		Total Number	Density (Land Area, SQ MI)	Total Number	Density (Land Area, SQ MI)	Total Number	Density (Land Area, SQ MI)	Total Number	Density (Land Area, SQ MI)
Houston	1,230.91	23,712	19.3	23,760	19.3	23,717	19.3	23,786	19.3

Figure 3-3. Houston County Population Density Projections



ECONOMIC IMPACTS

The economy is vital to all infrastructures. Located in the City of Crockett is the Crockett Economic and Industrial Development Corporation (CEIDC), which is committed to support a balanced and steady economic growth through job creation and new investment. CEIDC works to promote policies that foster growth while protecting the sense of community that makes Crockett a great place to live. The CEIDC offers services to achieve these goals, which include: assisting in or constructing a building to meet the desired needs of companies, equipment purchase and relocation expense, sales tax rebate, infrastructure to facility, employee training and workforce solutions, job creation incentives, roll back fees on reclassification of property from agriculture to commercial, interest buy-down on loans, city and county tax abatement on building and fixed equipment owned, and provides land for new buildings in industrial parks.

Additionally, a critical portion of the economy lies within the major industries in Houston County. With many being in the City of Crockett, the major employers are Steel Fabrication, Crocket ISD, and East Texas Medical Center.

Table 3-9. City of Crockett Major Employers

City of Crockett Major Employers		
Employer	**Industry**	**Number of Employees**
Steel Fabrication	Steel Industry	265
Crockett ISD	Education	205
East Texas Medical Center	Hospital	185
Alloy Polymers	Plastics	43
Crockett Sand & Gravel	Sand, Gravel, Fill	37
Quantex	Machine Parts	34
Zilkha	BioEnergy	23
Elastotech	Rubber Molded Products	21
Houston County Ready-Mix	Concrete	12
Tex-Fin	Heat Exchangers	11
Publication Development of Co. of Texas	Typesetter	10
City of Crockett	City Services	82

BUILDING PERMITS

Building permits indicate what types of buildings are being constructed and their relative uses. Table 3-10 lists the number of residential building permits for Houston County that have been granted between 1990 and 2012. The data includes all sizes of family homes for reported permits, as well as the construction costs to show the potential increase in vulnerability of structures to the various hazards assessed in this risk assessment. The increase in vulnerability can be attributed to the higher construction costs that would be factored into repairing or replacing a structure using current market values. Permits are reported annually in September, and the data includes that for the years of 2010 and 2012, if available, to demonstrate growth.

Table 3-10. County Residential Building Permits[1]

Houston County			
Year	Buildings	Units	Construction Cost
1990	2	2	$231,000
1995	16	16	$1,153,800
2000	5	5	$433,392
2005	7	7	$606,748
2010	2	2	$173,357
2012	5	5	$271, 875

[1] http://censtats.census.gov/cgi-bin/bldgprmt/bldgdisp.pl

SECTION 4: RISK OVERVIEW

HAZARD IDENTIFICATION

This section begins the risk assessment, which also includes hazard profiles and vulnerability assessments found in Sections 5 through 15. The purpose of this section is to provide background information for the hazard identification process, as well as descriptions for the natural and technological hazards identified.

Upon a review of the full range of natural hazards suggested under FEMA planning guidance, Houston County and participating jurisdictions identified eleven hazards that are to be addressed in the Plan. These hazards were identified through an extensive process utilizing input from planning team members, and a review of the current State of Texas Hazard Mitigation Plan ("State Plan"). Readily available online information from reputable sources such as federal and state agencies was also evaluated to supplement information as needed. Based on this review, ten natural hazards and one quasi-technological hazard (dam failure) were identified as significant as shown in Table 4-1.

Atmospheric hazards are events or incidents associated with weather generated phenomenon. Atmospheric hazards identified as significant from Table 4-1 include: extreme heat, thunderstorm, tornado, hail, hurricane wind, and winter storm.

Hydrologic hazards are events or incidents associated with water related damage and account for over 75 percent of Federal disaster declarations in the United States. Hydrologic hazards identified as significant includes flood and drought. For the purposes of the risk assessment, the hazards wildfire and earthquake are considered "other" since they may be natural or man-caused and are neither atmospheric nor hydrologic.

The term "technological hazards" refers to the origins of incidents that can arise from human activities, such as the construction and maintenance of dams. Incidents are distinct from natural hazards primarily in that they originate from human activity. While the risks presented by natural hazards may be increased or decreased as a result of human activity, they are not inherently human-induced; therefore dam failure is classified as a quasi-technological hazard, referred to as "technological" in Table 4-1 for purposes of description.

SECTION 4: RISK OVERVIEW

Table 4-1. Hazard Descriptions

HAZARD	DESCRIPTION
ATMOSPHERIC	
Extreme Heat	Extreme heat is the condition whereby temperatures hover ten degrees or more above the average high temperature in a region for an extended period.
Hail	Hailstorms are a potentially damaging outgrowth of severe thunderstorms. Early in the developmental stages of a hailstorm, ice crystals form within a low-pressure front due to the rapid rising of warm air into the upper atmosphere and subsequent cooling of the air mass.
Thunderstorm	A severe thunderstorm contains large damaging hail of 1 inch (2.7 cm) diameter or larger, and/or damaging winds greater than 58 mph (95 km/h or 50 knots) or greater. Isolated tornadoes are also possible but not expected to be the dominant severe weather event.
Tornado	A tornado is a violently rotating column of air that has contact with the ground and is often visible as a funnel cloud. Its vortex rotates cyclonically with wind speeds ranging from as low as 40 mph to as high as 300 mph. The destruction caused by tornadoes ranges from light to catastrophic depending on the intensity, size and duration of the storm.
Hurricane Wind	A hurricane is an intense tropical weather system of strong thunderstorms with a well-defined surface circulation and maximum sustained winds of 74 mph or higher.
Winter Storm	Severe winter storms may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation. Blizzards, the most dangerous of all winter storms, combine low temperatures, heavy snowfall, and winds of at least 35 miles per hour, reducing visibility to only a few yards. Ice storms occur when moisture falls and freezes immediately upon impact on trees, power lines, communication towers, structures, roads and other hard surfaces. Winter storms and ice storms can down trees, cause widespread power outages, damage property, and cause fatalities and injuries to human life.
HYDROLOGIC	
Drought	A prolonged period of less than normal precipitation such that the lack of water causes a serious hydrologic imbalance. Common effects of drought include crop failure, water supply shortages, and fish and wildlife mortality.

SECTION 4: RISK OVERVIEW

HAZARD	DESCRIPTION
Flood	The accumulation of water within a body of water, which results in the overflow of excess water onto adjacent lands, usually floodplains. The floodplain is the land adjoining the channel of a river, stream, ocean, lake or other watercourse or water body that is susceptible to flooding. Most floods fall into the following three categories: riverine flooding, coastal flooding, or shallow flooding.
OTHER	
Wildfire	An uncontrolled fire burning in an area of vegetative fuels such as grasslands, brush, or woodlands. Heavier fuels with high continuity, steep slopes, high temperatures, low humidity, low rainfall, and high winds all work to increase the risk for people and property located within wildfire hazard areas or along the urban/wildland interface. Wildfires are part of the natural management of forest ecosystems, but most are caused by human factors.
Earthquake	An earthquake (also known as a quake, tremor or temblor) is the result of a sudden release of energy in the Earth's crust that creates seismic waves. The seismic activity of an area refers to the frequency, type and size of earthquakes experienced over a period of time. An earthquake is any seismic event whether natural or human-caused that generates seismic waves. Earthquakes are caused mostly by rupture of geological faults, but also by other events such as volcanic activity, landslides, mine blasts, and nuclear tests. An earthquake's point of initial rupture is called its focus or hypocenter.
TECHNOLOGICAL	
Dam Failure	Dam failure is the collapse, breach, or other failure of a dam structure resulting in downstream flooding. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and severe property damage if development exists downstream of the dam.

OVERVIEW OF HAZARD ANALYSIS

This risk assessment was conducted using two distinct methodologies: HAZUS-MH (FEMA's loss estimation software) and a statistical approach. Each approach provides estimates of potential impact by using a common, systematic framework for evaluation.

The HAZUS-MH risk assessment methodology is parametric, in that distinct hazard and inventory parameters (e.g., wind speed and building types) were modeled using the HAZUS-MH software to determine the impact (e.g., damages and losses) on the built environment. The HAZUS-MH software was used to estimate losses from the flood hazard.

SECTION 4: RISK OVERVIEW

HAZUS-MH is FEMA's standardized loss estimation software program built upon an integrated geographic information system (GIS) platform. This risk assessment applies HAZUS-MH produce regional profiles and estimate losses for the flood hazard only.

Records retrieved from National Climatic Data Center (NCDC) and Sheldus are reported for the named participating cities. Remaining records occurring in a named area in a county were considered in the total for county events and maximum recorded magnitude of event.

The risk assessment includes four general parameters that are described for each hazard; frequency of return, approximate annualized losses, a description of general vulnerability, and a statement of the hazard's impact.

Frequency of return was calculated by dividing the number of events in the recorded time period for each hazard by the overall time period that the resource database was recording events. Frequency of return statements are defined in Table 4-2.

Table 4-2. Frequency of Return Statements

PROBABILITY	DESCRIPTION
Highly Likely	Event is probable in the next year.
Likely	Event is probable in the next 3 years.
Occasional	Event is probable in the next 5 years.
Unlikely	Event is probable in the next 10 years.

Each of the hazard profiles includes a description of a general vulnerability assessment. Vulnerability is the total of assets that are subject to damages from a hazard (based on historic recorded damages). Assets in the region were inventoried and defined in hazard zones where appropriate. The total amount of damages (including property and crop damages) for each hazard is divided by the total number of assets (building value totals) in that community in order to find out the percentage of damage that each hazard can cause to the community.

Once loss estimates and vulnerability were known, an impact statement was applied to relate the potential impact of the hazard on the assets within the area of impact.

SECTION 5: DROUGHT

HAZARD DESCRIPTION

Drought is a period of time without substantial rainfall that persists from one year to the next. Drought is a normal part of virtually all climatic regions, including areas with high and low average rainfall. Drought is the consequence of anticipated natural precipitation reduction over an extended period of time, usually a season or more in length. Droughts can be classified as meteorological, hydrologic, agricultural, and socioeconomic. Table 5-1 presents definitions for these different types of drought.

Droughts are one of the most complex of all natural hazards as it is difficult to determine their precise beginning or end. In addition, droughts can lead to other hazards such as extreme heat and wildfires. Their impact on wildlife and area farming is enormous, often killing crops, grazing land, edible plants and even in severe cases, trees. A secondary hazard to drought is wildfire because dying vegetation serves as a prime ignition source. Therefore, a heat wave combined with a drought is a very dangerous situation.

Table 5-1. Drought Classification Definitions[1]

METEOROLOGICAL DROUGHT	The degree of dryness or departure of actual precipitation from an expected average or normal amount based on monthly, seasonal, or annual time scales.
HYDROLOGIC DROUGHT	The effects of precipitation shortfalls on stream flows and reservoir, lake, and groundwater levels.
AGRICULTURAL DROUGHT	Soil moisture deficiencies relative to water demands of plant life, usually crops.
SOCIOECONOMIC DROUGHT	The effect of demands for water exceeding the supply as a result of a weather-related supply shortfall.

[1] Source: Multi-Hazard Identification and Risk Assessment: A Cornerstone of the National Mitigation Strategy, FEMA

SECTION 5: DROUGHT

LOCATION

Droughts occur regularly throughout Texas and Houston County, and are a normal condition. However, they can vary greatly in their intensity and duration. There is no distinct geographic boundary to drought; therefore, it can occur throughout the Houston County planning area equally.

EXTENT

The Palmer Drought Index is used to measure the extent of drought by measuring the duration and intensity of long-term drought-inducing circulation patterns. Long-term drought is cumulative, with the intensity of drought during the current month dependent upon the current weather patterns plus the cumulative patterns of previous months. The hydrological impacts of drought (e.g., reservoir levels, groundwater levels, etc.) take longer to develop. Table 5-2 depicts magnitude of drought while Table 5-3 describes the classification descriptions.

Table 5-2. Palmer Drought Index

DROUGHT INDEX	DROUGHT CONDITION CLASSIFICATIONS						
	Extreme	Severe	Moderate	Normal	Moderately Moist	Very Moist	Extremely Moist
Z Index	-2.75 and below	-2.00 to -2.74	-1.25 to -1.99	-1.24 to +.99	+1.00 to +2.49	+2.50 to +3.49	n/a
Meteorological	-4.00 and below	-3.00 to -3.99	-2.00 to -2.99	-1.99 to +1.99	+2.00 to +2.99	+3.00 to +3.99	+4.00 and above
Hydrological	-4.00 and below	-3.00 to -3.99	-2.00 to -2.99	-1.99 to +1.99	+2.00 to +2.99	+3.00 to +3.99	+4.00 and above

Table 5-3. Palmer Drought Category Descriptions[2]

CATEGORY	DESCRIPTION	POSSIBLE IMPACTS	PALMER DROUGHT INDEX
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures; fire risk above average. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered.	-1.0 to -1.9

[2] Source: National Drought Mitigation Center

SECTION 5: DROUGHT

CATEGORY	DESCRIPTION	POSSIBLE IMPACTS	PALMER DROUGHT INDEX
D1	Moderate Drought	Some damage to crops, pastures; fire risk high; streams, reservoirs, or wells low, some water shortages developing or imminent, voluntary water use restrictions requested.	-2.0 to -2.9
D2	Severe Drought	Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions imposed.	-3.0 to -3.9
D3	Extreme Drought	Major crop/pasture losses; extreme fire danger; widespread water shortages or restrictions.	-4.0 to -4.9
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; exceptional fire risk; shortages of water in reservoirs, streams, and wells, creating water emergencies.	-5.0 or less

Drought is monitored nationwide by the National Drought Mitigation Center (NDMC). Indicators are used to describe broad scale drought conditions across the U.S. Indicators correspond to the intensity of drought.

Based on the historical occurrences for drought and the location of Houston County primarily in the East Texas Timberland, with areas of Post Oak/Claypan and Blackland Prairie, the area can anticipate a range of drought from abnormally dry to extreme drought or D0 to D3 based on the Palmer Drought Category.

HISTORICAL OCCURRENCES

Houston County may typically experience a severe drought. Tables 5-4 and 5-5 lists historical events that have occurred in Houston County as reported in the National Climatic Data Center (NCDC) and SHELDUS. Historical drought information, as provided by the NCDC and SHELDUS, shows drought activity across a multi-county forecast area for each event, the appropriate percentage of the total property and crop damage reported for the entire forecast area has been allocated to each county impacted by the event.

SECTION 5: DROUGHT

Table 5-4. Historical Drought Years, 1950-2012

Drought year
1996
1998
2000
2009
4 unique events

Table 5-5. Historical Drought Events, 1950-2012

JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Houston County	4/1/1996	0	0	$0	$0
Houston County	5/1/1996	0	0	$0	$0
Houston County	6/1/1996	0	0	$0	$0
Houston County	5/1/1998	0	0	$0	$0
Houston County	6/1/1998	0	0	$0	$0
Houston County	7/1/1998	0	0	$0	$0
Houston County	8/1/1998	0	0	$1,000,000	$7,300,000
Houston County	8/1/2000	0	0	$0	$0
Houston County	9/1/2000	0	0	$0	$0
Houston County	7/1/2009	0	0	$0	$3,177
Houston County	8/1/2009	0	0	$0	$4,833
County Totals		**0**	**0**	**$1,000,000**	**$7,308,010**

SIGNIFICANT PAST EVENTS

August 1, 2000 – Houston County

Severe drought continued across southeast Texas through September 2000. The combination of excessive heat and dryness caused many wildfires to burn during the first week of the month including a 4500 acre fire in Liberty County on the 4th and a 1965 acre fire in Trinity County on the 2nd. Water rationing continued during the first half of the month in several small communities and was briefly instigated in the city of Houston. Water line breaks and small grass fires were a common problem across southeast Texas, especially at the beginning of the month. By the end of September, damage estimates for the season to cotton, wheat, and forage crops and increased irrigation reached $102.3 million for southeast Texas.

SECTION 5: DROUGHT

July 1, 1998 – Houston County

Drought conditions continue from June. Very little rainfall across SE TX combined with soaring temperatures continue to plague agricultural and medical conditions. With the exception of one day in July, afternoon highs remained above 96 degrees each and every day at IAH as well as many other locations across the region. Little relief at night, with overnight lows in the 75-80 degree range. Drought conditions will continue into August.

April 1, 1996 – Houston County

The winter of 1995-1996 had below normal precipitation over all of Southeast Texas. This trend continued into April of 1996. Conditions have become so serious that this dry spell is now being referred to the drought of 1996. Through the first 4 months of 1996 the rainfall amounts have been less than 50% normal with some areas only receiving only 30% of their normal rainfall. The lack of rainfall has created hazardous conditions for wildfires throughout Southeast Texas especially in the forests of East Texas. If the drought continues, losses to agricultural products will be in the billions of dollars. Estimated property damage for Southeast Texas so far is $2 million, with agricultural losses at $8 million.

PROBABILITY OF FUTURE EVENTS

Based on 4 recorded drought events over the 62-year reporting period, jurisdictions within Houston County and Crockett ISD, Latexo ISD, and Houston County WCID #1 averages one drought every ten years. This lends to an unlikely frequency of occurrence meaning a drought can be expected on a 10-12 year cycle.

VULNERABILITY AND IMPACT

Loss estimates were based on 62 years of statistical data from the NCDC. A drought event frequency-impact was then developed to determine an impact profile on agriculture products and estimate potential losses due to drought in the area. Tables 5-6 and 5-7 show annualized exposure.

Table 5-6. Drought Event Damage Totals, 1950-2012

JURISDICTION	NUMBER OF EVENTS	PROPERTY DAMAGES	CROP DAMAGES	PROPERTY DAMAGES (2013 DOLLARS)	CROP DAMAGES (2013 DOLLARS)
Houston County	4	$1,000,000	$7,308,010	$1,432,798	$10,468,142
TOTAL LOSSES:		**$8,308,010**		**$11,900,939**	

Table 5-7. Potential Annualized Losses, 1950-2012

JURISDICTION	PROPERTY & CROP LOSS	ANNUALIZED LOSS ESTIMATES
Houston County	$11,900,939	$191,951

SECTION 5: DROUGHT

Drought impacts large areas and crosses jurisdictional boundaries. All existing and future buildings, facilities and populations are exposed to this hazard and could potentially be impacted. However, drought impacts are mostly experienced in water shortages and crop/livestock losses on agricultural lands and typically have no impact on buildings.

The economic impact of droughts can be significant as they produce a complex web of impacts that spans many sectors of the economy and reach well beyond the area experiencing physical drought. This complexity exists because water is integral to our ability to produce goods and provide services. If droughts extend over a number of years, the direct and indirect economic impact can be significant. Based on the 4 reported previous occurrences and potential exposure for the hazard, the potential severity of impact of droughts is limited with less than 10% of property destroyed. Annualized loss over the 62-year reporting period in Houston County is $191,951 annually.

SECTION 6: EXTREME HEAT

HAZARD DESCRIPTION

Extreme heat during the summer months is a common occurrence throughout the State of Texas, and Houston County is no exception. The unincorporated areas of the County and the jurisdictions of Crockett, Grapeland, Kennard, Latexo, and Lovelady typically experience extended heat waves.

Although heat can damage buildings and facilities, it presents a more significant threat to the safety and welfare of citizens. The major human risks associated with severe summer heat include: heat cramps; sunburn; dehydration; fatigue; heat exhaustion; and even heat stroke. The most vulnerable population to heat casualties are children and the elderly or infirmed, who frequently live on low fixed incomes and cannot afford to run air-conditioning on a regular basis. This population is sometimes isolated, with no immediate family or friends to look out for their well-being.

LOCATION

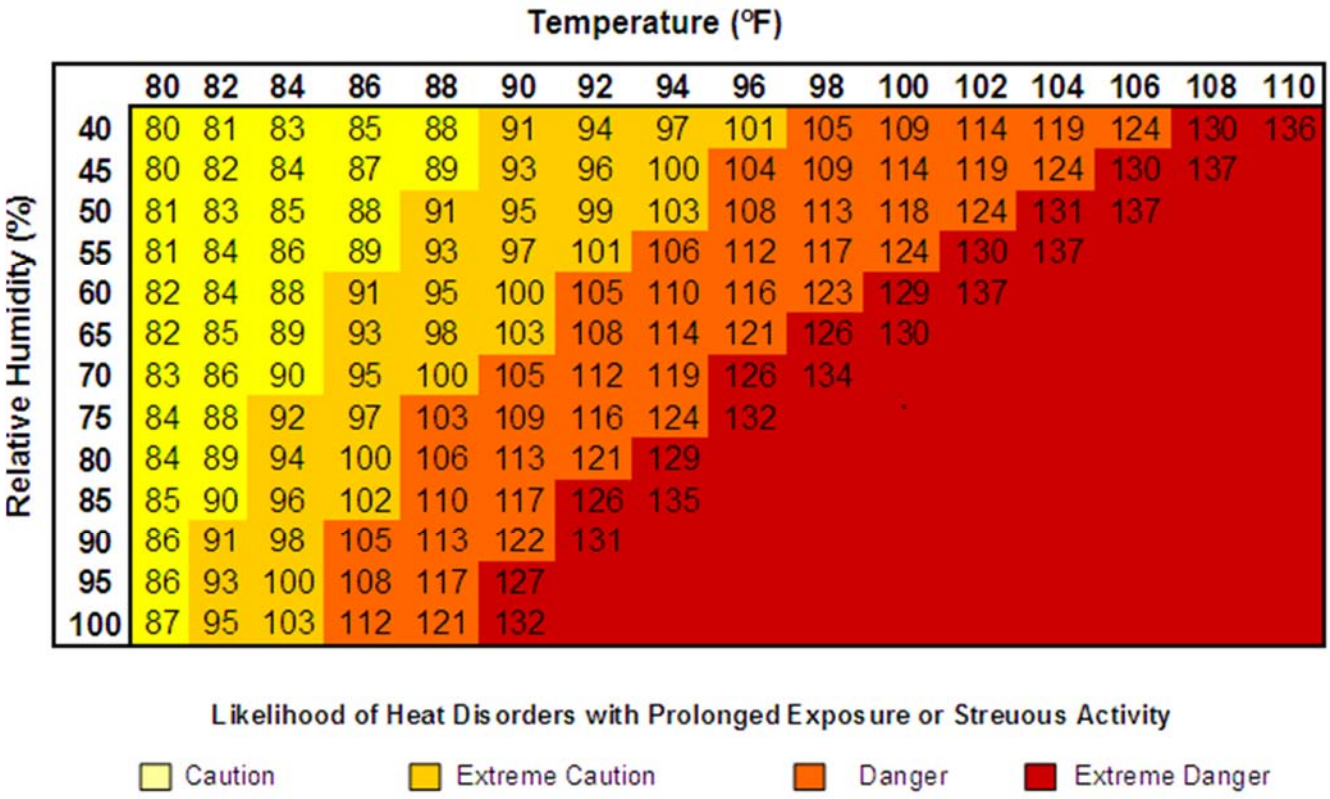
Though different temperatures for extreme heat have been recorded at various locations throughout the County, there is no specific geographic scope to the extreme heat hazard. Extreme heat could occur at any area of the County and participating jurisdictions.

EXTENT

The magnitude or intensity of an extreme heat event is measured according to temperature in relation to the percentage of humidity. According to the National Oceanic Atmospheric Administration (NOAA), this relationship is referred to as the "Heat Index," and is depicted in Figure 6-1. This index measures how hot it feels outside when humidity is combined with high temperatures.

SECTION 6: EXTREME HEAT

Figure 6-1. Extent Scale for Extreme Summer Heat[1]



The extent scale in Figure 6-1 displays varying degrees of caution depending on the relative humidity combined with the temperature. For example, when the temperature is at 90 degrees Fahrenheit (F) or lower, caution should be exercised if the humidity level is at or above 40 percent.

The shaded zones on the chart indicate varying symptoms or disorders that could occur depending on the magnitude or intensity of the event. "Caution" is the first level of intensity where fatigue due to heat exposure is possible. "Extreme Caution" indicates that sunstroke, muscle cramps or heat exhaustion are possible, whereas a "Danger" level means that these symptoms are likely. "Extreme Danger" indicates that heat stroke is likely. The National Weather Service (NWS) initiates alerts based on the Heat Index as shown in Table 6-1.

[1] Source: NOAA

SECTION 6: EXTREME HEAT

Table 6-1. Heat Index & Warnings

Category	Heat Index	Possible heat disorders	Warning
Extreme Danger	130° F and higher	Heat stroke or sun stroke likely.	A heat advisory will be issued to warn that the Heat Index may exceed 105° F.
Danger	105 – 129° F	Sunstroke, muscle cramps, and/or heat exhaustion are likely. Heatstroke possible with prolonged exposure and/or physical activity.	
Extreme Caution	90 – 105° F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity.	An Excessive Heat Warning is issued if the Heat Index rises above 105°F at least 3 hours during the day or above 80 °F at night.
Caution	80 – 90° F	Fatigue is possible with prolonged exposure and/or physical activity.	

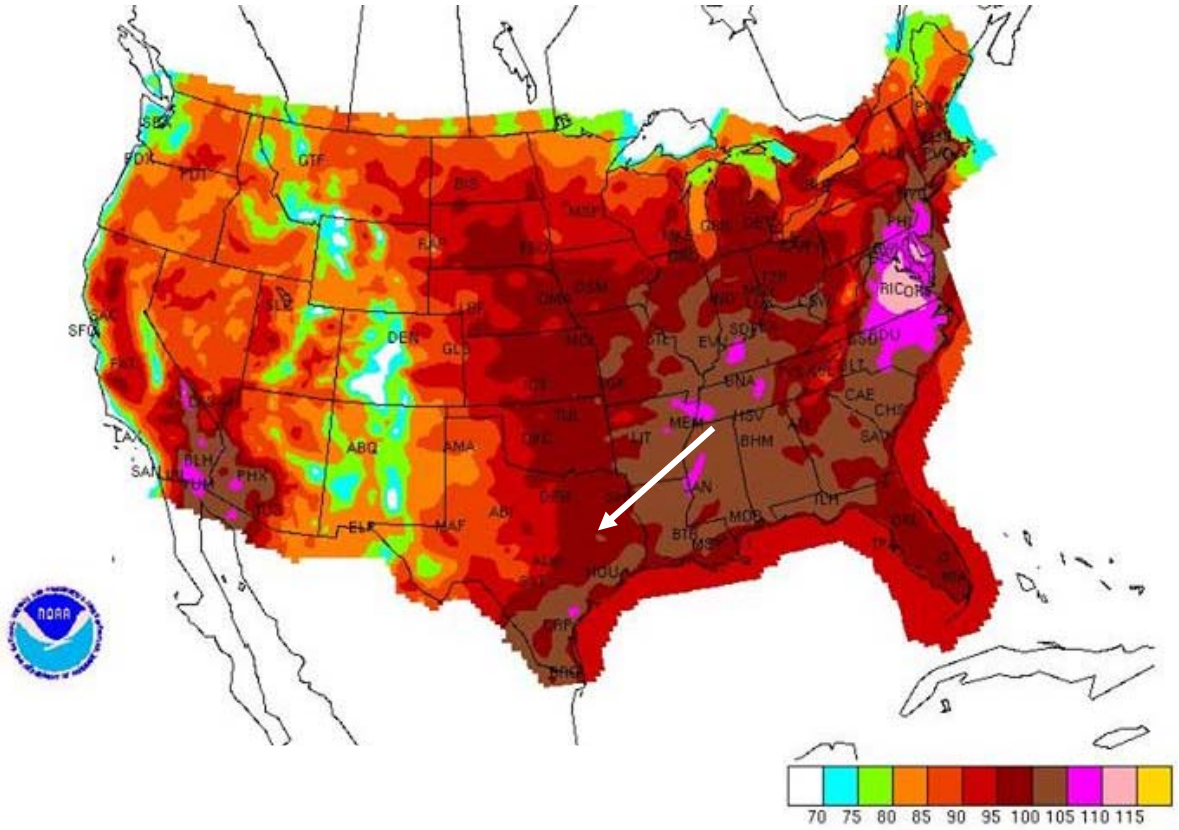
Most of the County is located within the East Texas Timberland, which makes up 54 percent of the East Texas Region.[2] The land is a mix of pine and hardwood forested gently undulating to hilly and well dissected by many streams. In the County there are also small areas known as the Blackland Prairie and Claypan Area. Due to its geography, and its subtropical and humid climate with hot summers, the Houston County planning area can expect an extreme heat event each summer. Citizens, especially children and the elderly should exercise caution by staying out of the heat for prolonged periods when a heat advisory or excessive heat warning is issued. Also at risk are those working or remaining outdoors.

Figure 6-2 displays the daily maximum heat index as derived from NOAA based on data compiled from 1849 to 2009. Dark red and brown indicate a daily maximum heat index of 95-105 degrees F.

[2] Texas Forest Service

SECTION 6: EXTREME HEAT

Figure 6-2. Average Daily Maximum Heat Index[3]



HISTORICAL OCCURRENCES

Every summer, the hazard of heat-related illness becomes a significant public health issue throughout much of the US. Mortality from all causes increases during heat waves, and excessive heat is an important contributing factor to deaths from other causes, particularly among the elderly. Preliminary data suggest that by December 5, 2011, record high summer temperatures in Texas resulted in more than 439 heat-related deaths statewide. Texas residents comprised 263 of these deaths. The United States Immigration and Naturalization Service reported that 51 foreign nationals died along the Texas/Mexico. Table 6-2 depicts historical occurrences of mortality from heat from 2003 to 2008 from the Texas Department of State Health Services, and 2009 to 2011 from the NCDC database.

[3] Source: NOAA and the black arrow points to Houston County.

SECTION 6: EXTREME HEAT

Table 6-2. Extreme Heat Related Deaths in Texas

YEAR	DEATHS
2003	62
2004	53
2005	111
2006	104
2007	43
2008	66
2009	6
2010	4
2011	46
2012	3
2013	4

Because the Texas Department of State Health Services reports on total events statewide, previous occurrences for extreme heat are derived from the NCDC and SHELDUS databases. According to heat related incidents located solely within Houston County there are seven heat waves[4] on record for Houston County (Table 6-3). Historical extreme heat information, as provided by the NCDC and SHELDUS, shows extreme heat activity across a multi-county forecast area for each event, the appropriate percentage of the total property and crop damage reported for the entire forecast area has been allocated to each county impacted by the event.

Table 6-3. Historical Extreme Heat Events, 1950-2010

JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Houston County	6/26/1999	0	0	$0	$0
Houston County	8/1/1999	0	0	$0	$0
Houston County	7/6/2000	0	0	$0	$0
Houston County	8/29/2000	0	0	$0	$0
Houston County	9/1/2000	0	0	$0	$0

[4] Even though the County experiences heat waves each summer, NCDC and SHELDUS data only records events reported. Based on reports, only seven events are on record.

SECTION 6: EXTREME HEAT

JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Houston County	9/22/2005	1	0	$0	$0
Houston County	6/24/2009	0	0	$0	$0
County Totals		**1**	**0**	**$0**	**$0**

SIGNIFICANT PAST EVENT

June 24-28, 2009

An upper level ridge built over the area, corresponding to a period of hot and humid conditions. Hot, humid conditions led to heat indices about 105 degrees for several days in late June.

PROBABILITY OF FUTURE EVENTS

According to historical records, Houston County, including all jurisdictions, Crockett ISD, Latexo ISD, and Houston County WCID #1 experience one extreme heat event every 10 years. Hence, the likelihood or future probability of excessive summer heat in Houston County is unlikely.

VULNERABILITY AND IMPACT

Because extreme heat events are not confined to specific geographic boundaries, all existing and future buildings, facilities, and populations are considered to be exposed to this hazard and could potentially be impacted.

Although heat can damage buildings and facilities, it presents a more significant threat to the safety and welfare of citizens, particularly the elderly population or the infirmed that live within the Houston County planning area and cannot afford air conditioning or to run it on a regular basis. Students at the participating Independent School Districts are also susceptible as sporting events and practices are often held outside during early fall or late spring when temperatures are at the highest. The major human risks associated with severe summer heat include: heat cramps; sunburn; dehydration; fatigue; heat exhaustion; and even heat stroke. Also area mobile home housing may not be equipped to cool residents. These persons may need a place to go during the hottest daytime hours.

Seven heat waves are on record for Houston County. The databases report they occurred in 1999, 2000, 2005, and 2009. Given that only 7 incidents were reported and limited likelihood for structural losses resulting from extreme heat occurrences in the planning area, annualizing potential structural losses over a long period of time would most likely yield a negligible annualized loss estimate for the county.

Typically more than twelve hours of warning time would be given before the onset of an extreme heat event. Only minor property damage would result. The potential impact of excessive summer heat is considered “minor” as injuries and/or illnesses do not result in permanent disability.

In terms of vulnerability to structures, the impact from extreme heat would be negligible. It is possible that critical facilities and infrastructure could be shut down for 24 hours if cooling units are run constantly,

leading to a temporary power outage. Less than 10 percent of residential and commercial property could be damaged if extreme heat events lead to structure fires.

The loss estimates due to extreme heat for Houston County are negligible. Based on historic losses and damages, the impact of extreme heat damages on Houston County can be considered "limited," indicating that less than 10 percent of property can be expected to be destroyed, and injuries are treatable with first aid, minor quality of life is lost, and facilities shut down for 24 hours or less. Annualized losses specifically for Houston County are negligible over the 62-year recording period.

SECTION 7: HURRICANE WIND

HAZARD DESCRIPTION

Hurricanes often begin as tropical depressions that intensify into tropical storms when maximum sustained winds increase to between 35-64 knots (39 – 73 mph). At these wind speeds the storm becomes more organized and circular in shape and begins to resemble a hurricane. Tropical storms can be equally problematic without ever becoming a hurricane, resulting in heavy rainfall, high winds and tidal surge in coastal communities. When maximum sustained winds reach or exceed 39 mph, the system becomes a tropical storm. Once sustained winds reach or exceed 74 mph, the storm becomes a hurricane.

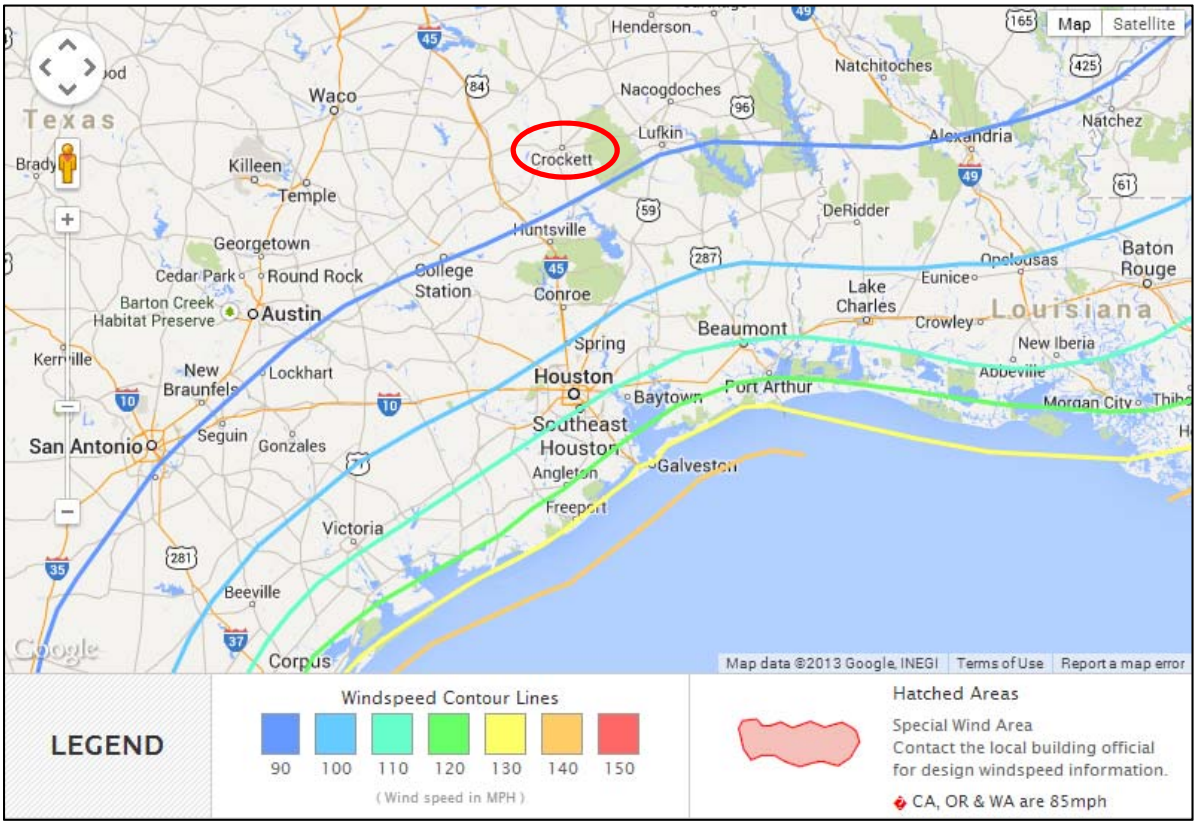
The intensity of a land falling hurricane is expressed in categories relating wind speeds and potential damage. Tropical storm-force winds are strong enough to be dangerous to those caught in them. For this reason, emergency managers plan to have evacuations completed and personnel sheltered before winds of tropical storm-force arrive, which precedes the arrival of hurricane-force winds.

LOCATION

Houston County is vulnerable to threats indirectly related to a hurricane event, such as high-force winds and heavy rainfall, which is addressed with the subsections on flooding. Houston County and the participating jurisdictions are located inland from the coast, which makes them less vulnerable to high winds from a hurricane event. Schools are also used as shelters for hurricane evacuees from the Texas Coast. Therefore, Houston County, Cities of Crockett, Grapeland, Kennard, Latexo, and Lovelady, Crockett ISD, Latexo ISD, and Houston County WCID #1 are in a low risk area for hurricane wind speeds of 90 miles per hour (mph) or less as shown in Figure 7-1 on the following page.

SECTION 7: HURRICANE WIND

Figure 7-1. Location of Hurricane Wind Zones[1]



EXTENT

Hurricanes are categorized according to the strength and intensity of their winds using the Saffir-Simpson Hurricane Scale (See Table 7-1). A Category 1 storm has the lowest wind speeds, while a Category 5 hurricane has the highest. This scale only ranks wind speed, but lower category storms can inflict greater damage than higher category storms depending on where they strike, other weather they interact with and how slow they move.

Table 7-1. Extent Scale for Hurricanes[2]

CATEGORY	MAXIMUM SUSTAINED WIND SPEED (Mph)	MINIMUM SURFACE PRESSURE (Millibars)	STORM SURGE (Feet)
1	74 – 95	Greater than 980	3 – 5
2	96 – 110	979 – 965	6 – 8
3	111 – 130	964 – 945	9 – 12

[1] Source: American Society of Civil Engineers (ASCE); the red circle indicates Houston County.

[2] Source: National Hurricane Center

SECTION 7: HURRICANE WIND

CATEGORY	MAXIMUM SUSTAINED WIND SPEED (Mph)	MINIMUM SURFACE PRESSURE (Millibars)	STORM SURGE (Feet)
4	131 – 155	944 – 920	13 – 18
5	155 +	Less than 920	19 +

Based on historical storm tracks for hurricanes and tropical storms, as well as the inland location of Houston County, the average extent to be mitigated for is a Category 1 storm. Houston County is located in the 80-90 mph wind zone in terms of average wind speeds that should be mitigated in the event of a hurricane. This data is based on the design wind speeds for a 100-year event.

HISTORICAL OCCURRENCES

Although hurricanes and tropical storms have made landfall at various magnitudes (categories) in Houston County, the storms have usually weakened to tropical storms or depressions by that time, being near the end of their life cycle. With the storms having reduced winds, extreme rainfall is the hazard of concern. Table 7-2 below lists the storms that have impacted the Houston County planning area during the years of 1960-2012.

Table 7-2. Historic Events for Houston County

YEAR	STORM NAME/ CATEGORY	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
1961	Carla/Tropical Storm	0	4	$505,051	$505,051
1998	Frances/Tropical Storm	0	0	$25,000	$0
2001	Allison/Tropical Storm	0	0	$1,070,000	$0
2005	Rita/Tropical Storm	0	0	$1,000,000	$0
2008	Ike/Category 2	0	0	$100,000,000	$0
TOTALS		**0**	**4**	**$102,600,051**	**$505,051**

SIGNIFICANT PAST EVENT

September 12, 2008

The eye of Hurricane Ike moved ashore in Galveston County near the city of Galveston. At landfall, Ike had a central pressure of 951.6 mb, as measured at Galveston Pleasure Pier, and a maximum estimated storm surge of 17 feet over portions of Chambers County and the Bolivar Peninsula. Maximum sustained winds at landfall were estimated at 95 knots (110 mph) with gusts to 110 knots (127 mph). A ship near the coast recorded a wind gust of 105 knots as the eye came through. At landfall, Ike was a Category 2 hurricane on the Saffir-Simpson scale based on wind speed, but due to its large size, had a storm surge more typical of a category 3 or 4. The height of the storm tide ranged from 4 to 6 feet in Matagorda County, 6 to 9 feet in Brazoria County, 10 to 13 feet along most of Galveston Island and Galveston Bay, to as high as 17 feet over portions of the Bolivar Peninsula and Chambers County. There were no known tornadoes associated

with Ike. In Houston County there was moderate wind damage with trees and limbs down. Shingle damage to roofs.

September 23, 2005

Monday, September 19th, Hurricane Rita had been consistently forecast to make landfall along the upper southeast Texas coast, when the 120 hour forecast from the National Hurricane Center depicted a landfall near San Luis, Hurricane Rita caused devastating storm surge flooding and wind damage in southwest Louisiana and extreme southeast Texas. Hurricane Rita was the strongest hurricane to make landfall across this portion of the U.S. coastline since Hurricane Audrey (1957). Rita affected a large inland area from southeast Texas across southwest and into south-central Louisiana. In Houston and Trinity Counties, tropical storm force winds with gusts to near 50 mph were observed. Numerous trees were down resulting in numerous power outages. One heat related indirect death occurred in Houston County during the evacuation. Total damage for both Houston and Trinity counties were near $2 million. No tornadoes were reported with Rita.

PROBABILITY OF FUTURE EVENTS

Based on historical occurrences and the infrequency of significant hurricane wind events, the probability of future event is unlikely for the Houston County planning area, meaning it is possible that the area will be impacted by a hurricane event in the next 10 years.

VULNERABILITY AND IMPACT

Hurricane-force winds can cause major damage to large areas; hence all existing buildings, facilities and populations are equally exposed and vulnerable to this hazard and could potentially be impacted. Warning time for hurricanes has lengthened due to modern and early warning technology. Hurricane-force winds can easily destroy poorly constructed buildings and mobile homes, as well as debris such as signs, roofing materials, and small items left outside become extremely hazardous in hurricanes and tropical storms. Extensive damage to trees, towers, and underground utility lines (from uprooted trees) and fallen poles cause considerable civic disruption.

Storm track data was available for the past 150 years; however, property and crop loss data is only available from 1950 to the present. Annual loss estimates were based on the 62 year reporting period for such damages (Table 7-3). The average annual loss estimate for Houston County is approximately $1,915,526. Table 7-4 shows impact or loss estimation for storms impacting the County.

Table 7-3. Summary of Historic Events for Houston County, 1950-2010

JURISDICTION	NUMBER OF EVENTS	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2013 DOLLARS)	CROP DAMAGE (2013 DOLLARS)
Houston County	5	$102,600,051	$505,051	$114,825,763	$3,936,847
		$103,105,101		**$118,762,610**	

SECTION 7: HURRICANE WIND

Table 7-4. Potential Annualized Losses, 1950-2012

JURISDICTION	PROPERTY & CROP LOSS	ANNUALIZED LOSS ESTIMATES
Houston County	$118,762,610	$1,915,526

The potential severity of impact from a hurricane for Houston County is classified as limited; injuries would be treatable with first aid, critical facilities would not be shut down for more than 24 hours, and less than 10 percent of property would be destroyed.

SECTION 8: THUNDERSTORM

HAZARD DESCRIPTION

Thunderstorms are created when heat and moisture near the Earth's surface are transported to the upper levels of the atmosphere. By-products of this process are the clouds, precipitation, and wind that become the thunderstorm, and sub-hazards of thunderstorms are hail, lightning and tornadoes.

According to the National Weather Service (NWS), a thunderstorm occurs when thunder accompanies rainfall. Radar observers use the intensity of radar echoes to distinguish between rain showers and thunderstorms. Along with rolling thunder, lightning detection networks routinely track cloud-to-ground flashes to help track thunderstorms.

LOCATION

Thunderstorms can develop in any geographic location, and are considered a common occurrence in Texas. A thunderstorm could occur at any location within Houston County's planning area, including the campuses of Crockett ISD, Latexo ISD, and Houston County WCID #1, as these storms develop randomly and are not confined to any geographic area within the County. It is assumed that Houston County is uniformly exposed to the threat of thunderstorms.

EXTENT

The extent or magnitude of a thunderstorm event is measured by the Beaufort Wind Scale. Table 8-1 describes the different intensities of wind in terms of speed and effects, from calm to violent and destructive.

SECTION 8: THUNDERSTORM

Table 8-1. Beaufort Wind Scale[1]

FORCE	WIND (KNOTS)	WMO CLASSIFICATION	APPEARANCE OF WIND EFFECTS
0	Less than 1	Calm	Calm, smoke rises vertically
1	1-3	Light Air	Smoke drift indicates wind direction, still wind vanes
2	4-7	Light Breeze	Wind felt on face, leaves rustle, vanes begin to move
3	8-12	Gentle Breeze	Leaves and small twigs constantly moving, light flags extended
4	13-18	Moderate Breeze	Dust, leaves and loose paper lifted, small tree branches move
5	19-24	Fresh Breeze	Small trees in leaf begin to sway
6	25-31	Strong Breeze	Larger tree branches moving, whistling in wires
7	32-38	Near Gale	Whole trees moving, resistance felt walking against wind
8	39-46	Gale	Whole trees in motion, resistance felt walking against wind
9	47-54	Strong Gale	Slight structural damage occurs, slate blows off roofs
10	55-63	Storm	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	64-72	Violent Storm	If experienced on land, widespread damage
12	73+	Hurricane	Violence and destruction

[1] Source: World Meteorological Organization

SECTION 8: THUNDERSTORM

On average, the planning area experiences one to two thunderstorms every year, which are not usually accompanied by maximum or extreme wind speeds. However, Houston County has experienced a significant wind event, or an event with winds in the range of "Force 11" on the Beaufort Wind Scale, although the average measurement of severe winds with a thunderstorm in Houston County is a "Force 9", with winds at 47-54 knots. Therefore, planning participants on average could experience a range of wind speeds where slight structural damage occurs and slate blows off roofs.

HISTORICAL OCCURRENCES

Since January 1950, 72 severe thunderstorm events are known to have impacted Houston County, based upon NCDC and SHELDUS records. Table 8-2 presents historical occurrences of thunderstorm events reported to NCDC for the Houston County study area. It is important to note that high wind events associated with other hazards, such as tornadoes, are not accounted for in this section.

The NCDC is a national data source organized under the National Oceanic and Atmospheric Administration. The NCDC is the largest archive available for climate data; however, the only incidents recorded are those that are reported to the NCDC. In the tables that follow throughout this section, some occurrences seem to appear multiple times in one table. This is due to reports from various locations throughout the County. In addition, property damage estimates are not always available. When this occurs, estimates are provided.

Table 8-2. Historical Thunderstorm Events, 1950-2012[2]

JURISDICTION	DATE	TIME	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
UNKNOWN	9/4/1968			4	0	$0	$0
UNKNOWN	3/17/1987			0	0	$50,000	$0
UNKNOWN	3/17/1987			0	0	$50,000	$0
UNKNOWN	5/18/1995			0	0	$2,000	$0
UNKNOWN	8/30/1995			0	0	$5,000	$0
UNKNOWN	11/1/1995			0	0	$60,000	$0
UNKNOWN	11/10/1995			0	0	$3,000	$0
GRAPELAND	4/20/1996	13:40		0	0	$5,000	$0
RATCLIFF	4/20/1996	14:05		0	0	$15,000	$0

[2] Only recorded events with fatalities, injuries, or damages are listed.

SECTION 8: THUNDERSTORM

JURISDICTION	DATE	TIME	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
GRAPELAND	5/27/1996	11:55		0	0	$5,000	$0
WECHES	6/1/1996	13:38		0	0	$5,000	$0
LOVELADY	7/4/1996	14:17		0	0	$35,000	$0
CROCKETT	7/4/1996	16:45		0	0	$5,000	$0
CROCKETT	7/24/1996	15:34		0	0	$5,000	$0
LOVELADY	9/26/1996	21:30		0	0	$5,000	$0
CROCKETT	11/7/1996	3:30		0	0	$10,000	$0
CROCKETT	1/23/1997	17:50		0	0	$5,000	$0
KENNARD	4/4/1997	14:30		0	0	$5,000	$0
RATCLIFF	5/30/1997	21:50		0	0	$5,000	$0
PORTER SPGS	6/10/1997	4:00		0	0	$5,000	$0
GRAPELAND	6/13/1997	2:00		0	0	$5,000	$0
CROCKETT	6/17/1997	4:45		0	0	$5,000	$0
LATEXO	2/26/1998	0:25		0	0	$3,000	$0
AUGUSTA	2/26/1998	0:30		0	0	$3,000	$0
WECHES	2/26/1998	0:40		0	0	$10,000	$0
COUNTYWIDE	6/15/1998	17:00		0	0	$5,000	$0
KENNARD	7/13/1998	19:15		0	0	$3,000	$0
KENNARD	7/17/1998	15:45		0	0	$5,000	$0
UNKNOWN	8/29/1998			0	0	$20,000	$0
GRAPELAND	5/17/1999	19:10		0	0	$15,000	$0
LOVELADY	3/26/2000	4:45		0	0	$25,000	$0
CROCKETT	3/26/2000	5:00		0	0	$25,000	$0
CROCKETT	8/21/2000	18:10		0	0	$75,000	$0
WECHES	9/2/2000	15:00		0	0	$15,000	$0
COUNTYWIDE	11/6/2000	0:00		0	0	$100,000	$0
LOVELADY	5/6/2001	19:57		0	0	$3,000	$0
COUNTYWIDE	5/20/2001	23:50		0	0	$20,000	$0
COUNTYWIDE	5/28/2001	3:30		0	0	$7,000	$0
CROCKETT	9/21/2001	14:39		0	0	$5,000	$0

SECTION 8: THUNDERSTORM

JURISDICTION	DATE	TIME	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
GRAPELAND	10/13/2001	1:15		0	0	$5,000	$0
GRAPELAND	10/13/2001	1:20		0	0	$5,000	$0
CROCKETT	10/13/2001	1:40		0	0	$5,000	$0
CROCKETT	4/7/2002	23:30		0	0	$40,000	$0
CROCKETT	7/8/2002	18:30		0	0	$3,000	$0
CROCKETT	8/4/2002	18:30		0	0	$5,000	$0
KENNARD	8/26/2002	23:55		0	0	$10,000	$0
CROCKETT	3/18/2003	10:35	52 knots	0	0	$3,000	$0
CROCKETT	5/16/2003	19:40	52 knots	0	0	$10,000	$0
CROCKETT	6/12/2003	18:02	53 knots	0	0	$9,000	$0
CROCKETT	6/12/2003	18:02	53 knots	0	0	$9,000	$0
CROCKETT	7/23/2003	6:15	58 knots	0	0	$14,000	$0
GRAPELAND	6/2/2004	21:15	50 knots	0	0	$45,000	$0
LOVELADY	6/2/2004	22:18	50 knots	0	0	$35,000	$0
LATEXO	4/5/2005	21:20	58 knots	0	0	$15,000	$0
WECHES	5/25/2005	17:05	51 knots	0	0	$8,000	$0
GRAPELAND	7/7/2005	12:00	55 knots	0	0	$9,000	$0
CROCKETT	10/31/2005	15:00	55 knots	0	0	$3,000	$0
WELDON	2/1/2006	22:30	56 knots	0	0	$65,000	$0
CROCKETT	12/29/2006	14:30	60 knots	0	0	$35,000	$0
CROCKETT	9/27/2007	16:13	52 knots	0	0	$2,000	$0
LATEXO	9/27/2007	16:13	52 knots	0	0	$2,000	$0
GRAPELAND	6/17/2008	13:45	54 knots	0	0	$6,000	$0
LATEXO	6/17/2008	14:02	54 knots	0	0	$5,000	$0
CROCKETT	6/17/2008	14:08	55 knots	0	0	$15,000	$0
BEREA	6/17/2008	14:10	53 knots	0	0	$5,000	$0
GRAPELAND	8/3/2008	17:45	53 knots	0	0	$5,000	$0
LOVELADY	8/3/2008	17:45	54 knots	0	0	$8,000	$0
GRAPELAND	2/11/2009	0:00	54 knots	0	0	$8,000	$0
CROCKETT	2/11/2009	0:00	54 knots	0	0	$4,000	$0

SECTION 8: THUNDERSTORM

JURISDICTION	DATE	TIME	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
CROCKETT	2/11/2009	0:05	54 knots	0	0	$4,000	$0
GRAPELAND	5/3/2009	5:12	65 knots	0	0	$200,000	$0
CROCKETT	5/3/2009	5:24	55 knots	0	0	$2,000	$0
CROCKETT	8/25/2009	17:50	53 knots	0	0	$5,000	$0
MAPLETON	9/3/2009	14:41	50 knots	0	0	$4,000	$0
GRAPELAND	6/10/2010	10:25	55 knots	0	0	$18,000	$0
AUSTONIA	8/6/2010	19:30	60 knots	0	0	$10,000	$5,000
CROCKETT	4/25/2011	20:18	55 knots	0	0	$10,000	$0
BEREA	4/25/2011	20:37	55 knots	0	0	$3,000	$0
LATEXO	4/26/2011	22:35	55 knots	0	0	$3,000	$0
PERCILLA	7/5/2011	16:38	52 knots	0	0	$5,000	$0
CROCKETT	1/25/2012	8:20	52 knots	0	0	$0	$50,000
ARBOR	4/20/2012	9:35	56 knots	0	0	$2,000	$0
LOVELADY	12/25/2012	8:55	65 knots	0	0	$15,000	$0

Table 8-3. Summary of Historical Thunderstorm Events, 1950-2012

JURISDICTION	EVENTS	MAGNITUDE (max extent)	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Crockett	28	60 knots	0	0	$313,000	$50,000
Grapeland	17	70 knots	0	0	$331,000	$0
Kennard	4	N/A	0	0	$23,000	$0
Latexo	5	58 knots	0	0	$28,000	$0
Lovelady	8	65 knots	0	0	$126,000	$0
Houston County	**72**	**70 knots**	**4**	**0**	**$1,303,000**	**$55,000**

SIGNIFICANT PAST EVENTS

December 25, 2012 – City of Lovelady

On Christmas Day strong to severe thunderstorms developed along a warm front that was lifting north through the area. One of those storms produced an EF-3 tornado near Pennington, TX. Strong winds moved through Lovelady damaging a bank.

SECTION 8: THUNDERSTORM

January 25, 2012 – City of Crockett

Severe thunderstorms produced tornado and wind damage along with some flash flooding. Severe thunderstorm winds downed trees across the county, and especially in and around the Crockett area.

May 3, 2009 – City of Grapeland

Several severe thunderstorms moved into the northern portion of the county warning area early on the morning of May 3rd. These thunderstorms produced numerous reports of wind damage and some flash flooding. Additionally, one brief tornado was associated with one of the stronger thunderstorms. Trees fell because of high winds.

PROBABILITY OF FUTURE EVENTS

Most thunderstorms occur during the spring, in the months of March, April and May, and in the fall, during the month of September. Even though the intensity of thunderstorms is not always damaging for the County, the frequency of occurrence for a thunderstorm event is highly likely, meaning that an event is probable within the next year for all of the Houston County planning area.

VULNERABILITY AND IMPACT

Vulnerability is difficult to evaluate since thunderstorms can occur at different strength levels, in random locations, and can create relatively narrow paths of destruction. Due to the randomness of this event, all existing and future structures, and facilities at the independent school districts, water district and in Houston County could potentially be impacted and remain vulnerable to possible injury and/or property loss from lightning, hail and strong winds associated with severe thunderstorm.

Trees, power lines and poles, signage, manufactured housing, radio towers, lighting, concrete block walls, storage barns, windows, garbage recepticles, brick facades, and vehicles, unless reinforced, are vulnerable to severe winds associated with thunderstorm events. More severe damage involves windborne debris—in some instances, patio furniture and other lawn items have been reported to have been blown around by wind and, very commonly, debris from damaged structures in turn have caused damage to other buildings not directly impacted by the event. In numerous instances roofs have been reported as having been torn off of buildings.

A severe thunderstorm can also result in heavy rains, traffic disruptions, injuries and in rare cases, fatalities, can occur. Impact of thunderstorms experienced in the Houston County planning area has resulted in 4 fatalities. Generally, the severity of impact would be limited because injuries are treatable with first aid, the quality of life lost would be minor, and facilities would only be shut down for 24 hours or less. Overall, the average loss estimate (in 2013 dollars) is $1,783,167, having an approximate annual loss estimate of $28,761 (Table 8-4).

SECTION 8: THUNDERSTORM

Table 8-4. Potential Annualized Losses for Houston County[3]

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATES
Crockett	$451,869	$7,288
Grapeland	$379,637	$6,123
Kennard	$31,655	$511
Latexo	$32,960	$532
Lovelady	$164,274	$2,650
Houston County	**$1,783,167**	**$28,761**

[3] Source: NCDC, values are in 2013 dollars and include property and crop damages.

SECTION 9: WILDFIRE

HAZARD DESCRIPTION

A wildfire can rapidly spread out of control and occurs most often in the summer, when the brush is dry and flames can move unchecked through a highly vegetative area. The fire often begins unnoticed and spreads quickly, lighting brush, trees and homes. It may be started by a campfire that was not doused properly, a tossed cigarette, burning debris, lightning or arson.

Wildfires can start as a slow burning along the forest floor, killing and damaging trees. They often spread more rapidly as they reach the tops of trees, with wind carrying the flames from tree to tree. Usually, dense smoke is the first indication of a fire.

Texas has seen a significant increase in the number of wildfires in the past 30 years, which included wildland, interface or intermix fires. Wildland fires are fueled almost exclusively by natural vegetation while interface or intermix fires are urban/wildland fires in which vegetation and the built-environment provide the fuel.

LOCATION AND HISTORICAL OCCURRENCES

Wildfires can be a potentially damaging outgrowth of drought. While they are not confined to any specific geographic location, and can vary greatly in terms of size, location, intensity and duration; they are most likely to occur in open grasslands. The threat to people and property is greater in the fringe areas where developed areas meet open grass lands. However, the Houston County planning area is equally at risk for wildfires.

The Texas Forest Service (TFS) database reported 428 wildfire events within the Houston County planning area between 2005 and 2009. TFS started collecting wildfire data in 1985, but volunteer fire departments did not start reporting events until 2005. Due to lack of recording prior to 2005, frequency calculations were based on a 7 year period, and only data received during those years were included in the calculations. The

map below shows approximate locations of wildfires and cause (Figure 9-1). Tables 9-1 thru 9-3 provide jurisdictional information (provided by local volunteer fire departments) on number of wildfires by ignition causes, number of fires reported by year, and acreage of suppressed wildfire by year.

Figure 9-1. Location and Historic Wildfire Events for Houston County

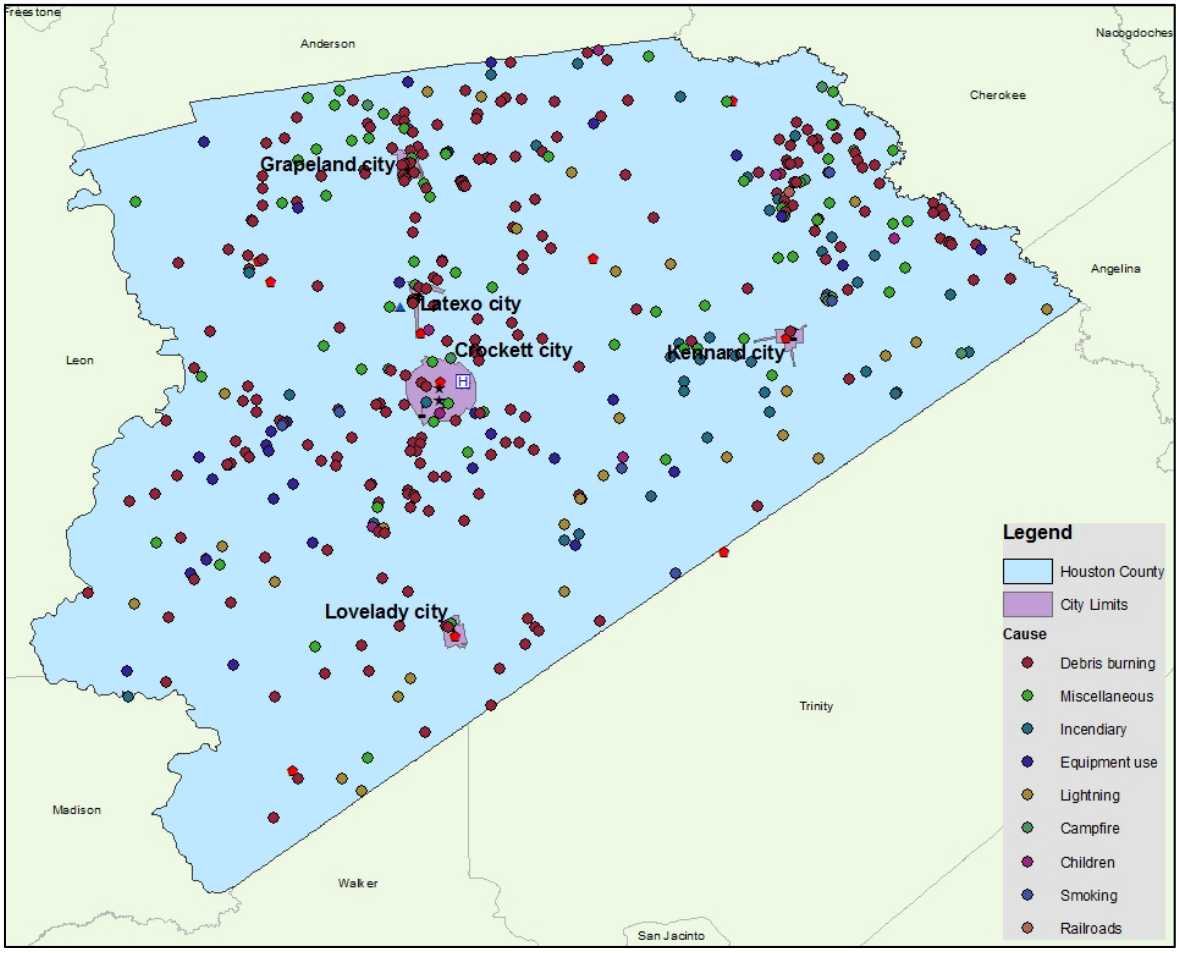


Table 9-1. Number of Wildfires by Cause for Houston County

JURISDICTION	Campfire	Children	Debris Burning	Equipment Use	Incendiary	Lightning	Misc.	Railroads	Smoking
Crockett	1	1	2	0	1	0	3	0	0
Grapeland	0	0	10	0	0	0	1	0	0
Kennard	0	0	1	0	0	0	0	0	0
Latexo	0	0	1	0	0	0	2	0	0
Lovelady	0	0	2	0	0	0	0	0	0
County Totals	**8**	**8**	**219**	**28**	**38**	**27**	**63**	**2**	**8**

SECTION 9: WILDFIRE

Table 9-2. Number of Wildfires by Year

JURISDICTION	2005	2006	2007	2008	2009
Crockett	1	2	0	0	5
Grapeland	0	1	1	4	5
Kennard	1	0	0	0	0
Latexo	0	0	0	0	3
Lovelady	0	0	0	1	1
County Totals	**47**	**89**	**45**	**80**	**140**

Table 9-3. Acreage of Suppressed Wildfire by Year

JURISDICTION	2005	2006	2007	2008	2009
Crockett	5	2	0	0	4.5
Grapeland	0	0.1	0.1	1.4	1.4
Kennard	5	0	0	0	0
Latexo	0	0	0	0	1.3
Lovelady	0	0	0	1	5
County Totals	**1,309.1**	**1,329.7**	**160.4**	**681**	**868**

SIGNIFICANT PAST EVENTS

September 4, 2011 – Houston County

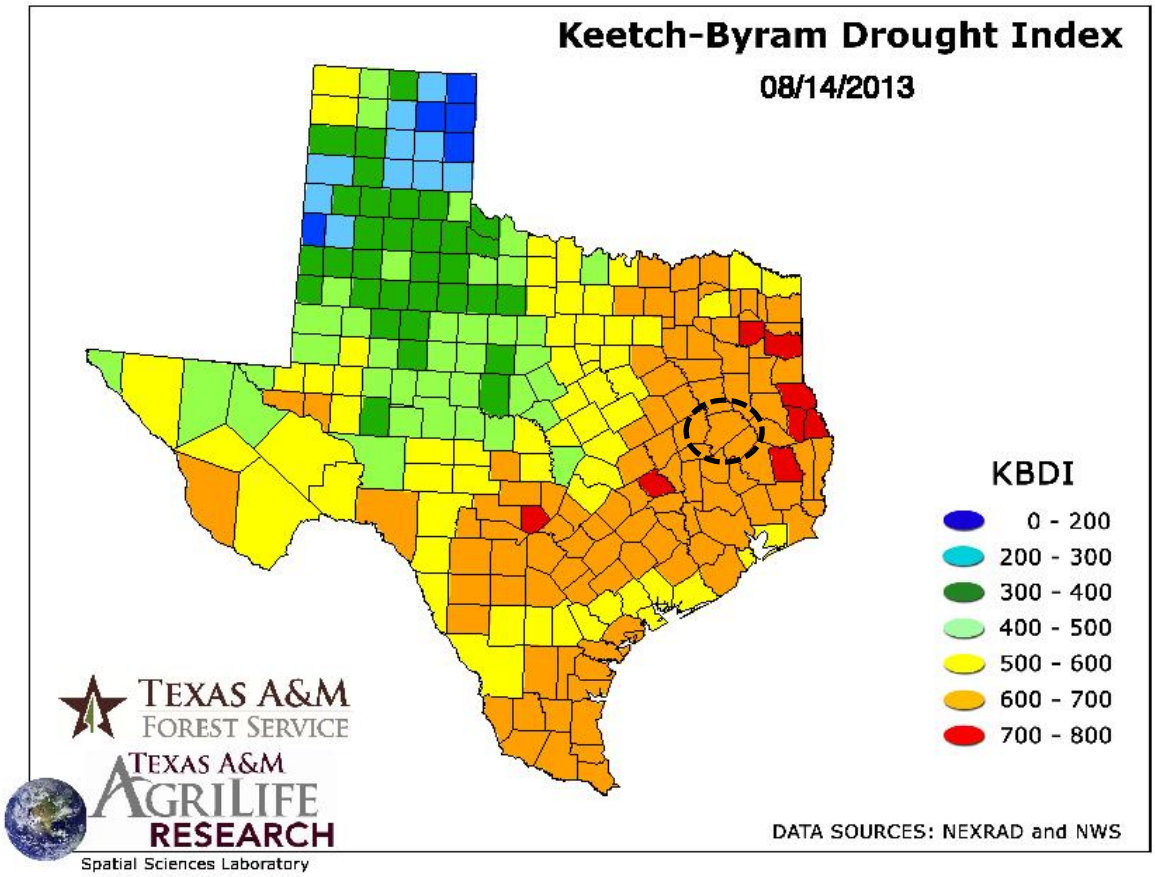
A wildfire occurred on Highway 7 East, four miles outside of Crockett on September 4th in the afternoon. The fire continued to spread into the evening jumping County Road 4505 across to County Road 4529. The Texas Forest Service reported the fire to be around 200 acres. There was also another wildfire reported on Highway 21, west from Crockett. The fire was reported to be around 80 acres.

EXTENT

Fire risk is measured in terms of magnitude and intensity using the Keetch Byram Drought Index (KBDI), a mathematical system for relating current and recent weather conditions to potential or expected fire behavior. The KBDI determines forest fire potential based on a daily water balance, where a drought factor is balanced with precipitation and soil moisture (assumed to have a maximum storage capacity of 8 inches), and is expressed in hundredths of an inch of soil moisture depletion.

Each color on the map represents the drought index at that location. The drought index ranges from 0 to 800, where a drought index of 0 represents no moisture depletion, and an index of 800 represents absolutely dry conditions.

Figure 9-2. KBDI for the State of Texas, 2013[1]



Fire behavior can be categorized at four distinct levels:

- **0 - 200** Soil and fuel moisture are high. Most fuels will not readily ignite or burn. However, with sufficient sunlight and wind, cured grasses and some light surface fuels will burn in spots and patches.
- **200 - 400** Fires more readily burn and will carry across an area with no gaps. Heavier fuels will still not readily ignite and burn. Expect smoldering and the resulting smoke to carry into and possibly through the night.
- **400 - 600** Fires intensity begins to significantly increase. Fires will readily burn in all directions exposing mineral soils in some locations. Larger fuels may burn or smolder for several days creating possible smoke and control problems.

[1] Houston County located within the black circle.

- **600 - 800** Fires will burn to mineral soil. Stumps will burn to the end of underground roots and spotting will be a major problem. Fires will burn through the night and heavier fuels will actively burn and contribute to fire intensity.

Using the KBDI index is a good measure of the readiness of fuels for wildland fire. Caution should be exercised in dryer, hotter conditions, and the KBDI should be referenced as the area experiences changes in precipitation and soil moisture.

The range for intensity for Houston County is within 600 to 700. The average extent to be mitigated for the Houston County planning area is a KBDI index of 660. At this level fires will burn readily, exposing mineral soils. Larger fuels burn or smolder for several days, and create smoke control problems.

PROBABILITY OF FUTURE EVENTS

Wildfires can occur at any time of the year. As the jurisdictions within the county move into wildland, the potential area of occurrence of wildfire increases. With 428 events in a 7 year period, an event within Houston County, including all jurisdictions is highly likely, meaning an event is probable within the next year.

VULNERABILITY AND IMPACT

Periods of drought, dry conditions, high temperatures, and low humidity set the stage for wildfires. Areas along railroads and people whose homes are in rural woodland settings have an increased risk of being affected by wildfire.

The heavily populated, urban areas of Houston County are not likely to experience large, sweeping fires; areas outside of city limits and in the unincorporated areas of the County are vulnerable. Unoccupied buildings and open spaces that have not been maintained have the greatest vulnerability to wildfire. The overall level of concern for wildfires is located mostly along the perimeter of the study area where wildland and urban areas interface.

Within Houston County, a total of 428 fire events were reported from 2005 to 2012. All of these events were suspected wildfires. Historic loss and annualized estimates due to wildfires are presented in Table 9-4 below. The frequency is approximately 61 events every year.

SECTION 9: WILDFIRE

Table 9-4. Historic Loss Estimates Due to Wildfire[2]

JURISDICTION	NUMBER OF EVENTS	ACRES BURNED	ANNUAL ACRES LOSSES
Crockett	8	11.5	1.64
Grapeland	11	3.02	0.43
Kennard	1	5	0.71
Latexo	3	1.3	0.19
Lovelady	2	6	0.86
County Totals	**428**	**4,348**	**621**

Figures 9-3 through 9-8 show Houston County and the threat of wildfire to the County and participating jurisdictions.

[2] Events divided by 7 years of data.

SECTION 9: WILDFIRE

Figure 9-3. Wildfire Threat – Houston County

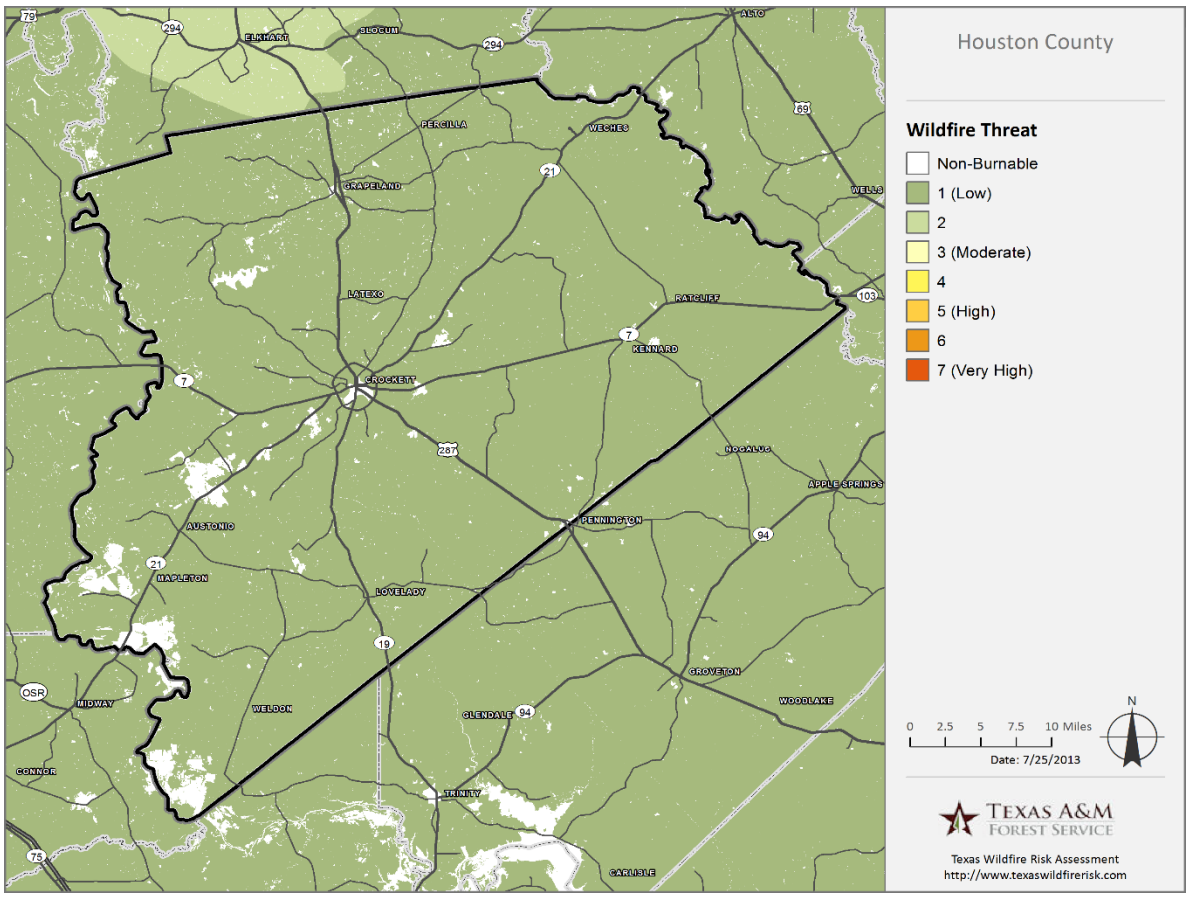
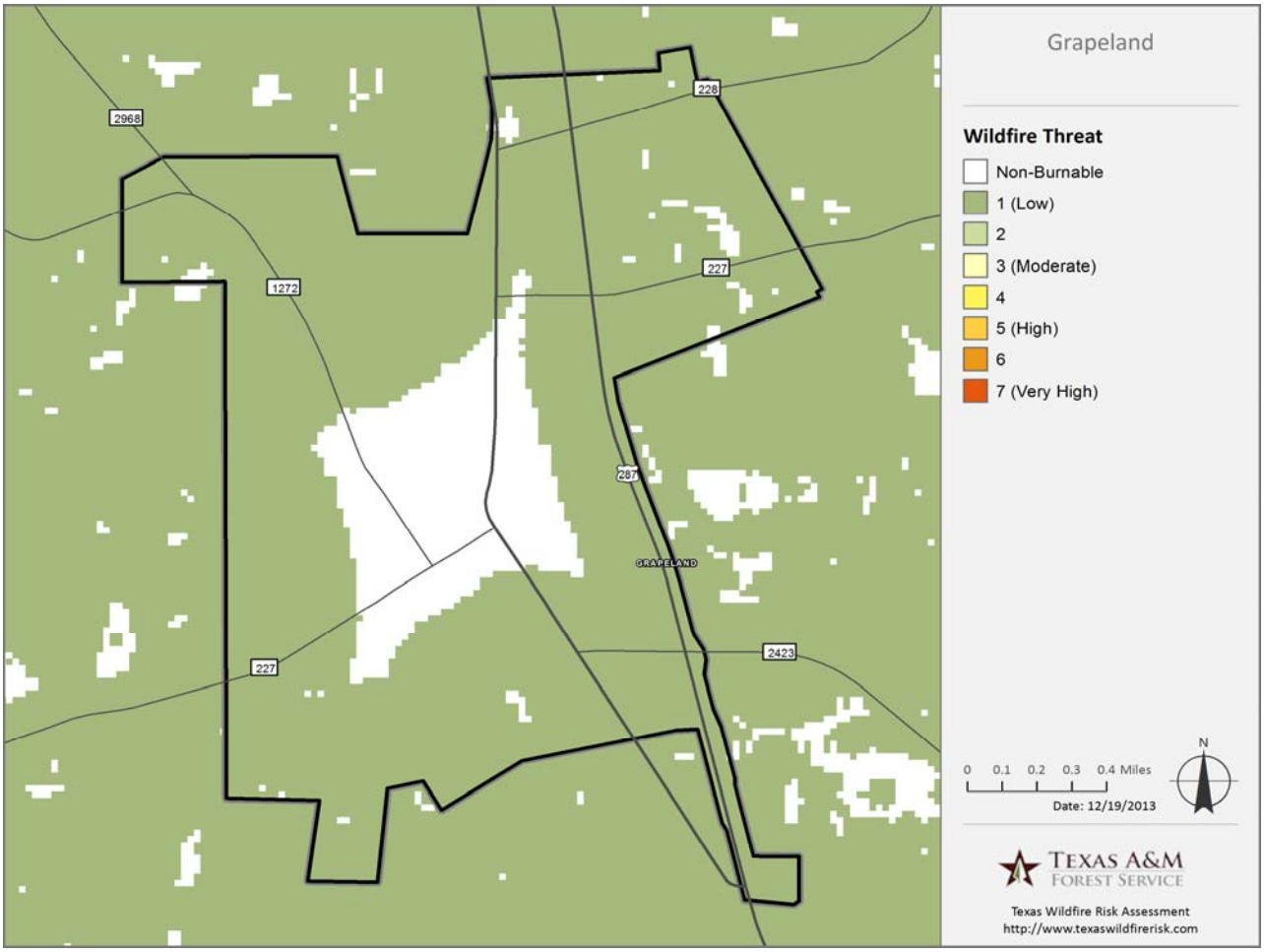


Figure 9-4. Wildfire Threat – City of Crockett

Figure 9-5. Wildfire Threat – City of Grapeland



SECTION 9: WILDFIRE

Figure 9-6. Wildfire Threat – City of Kennard

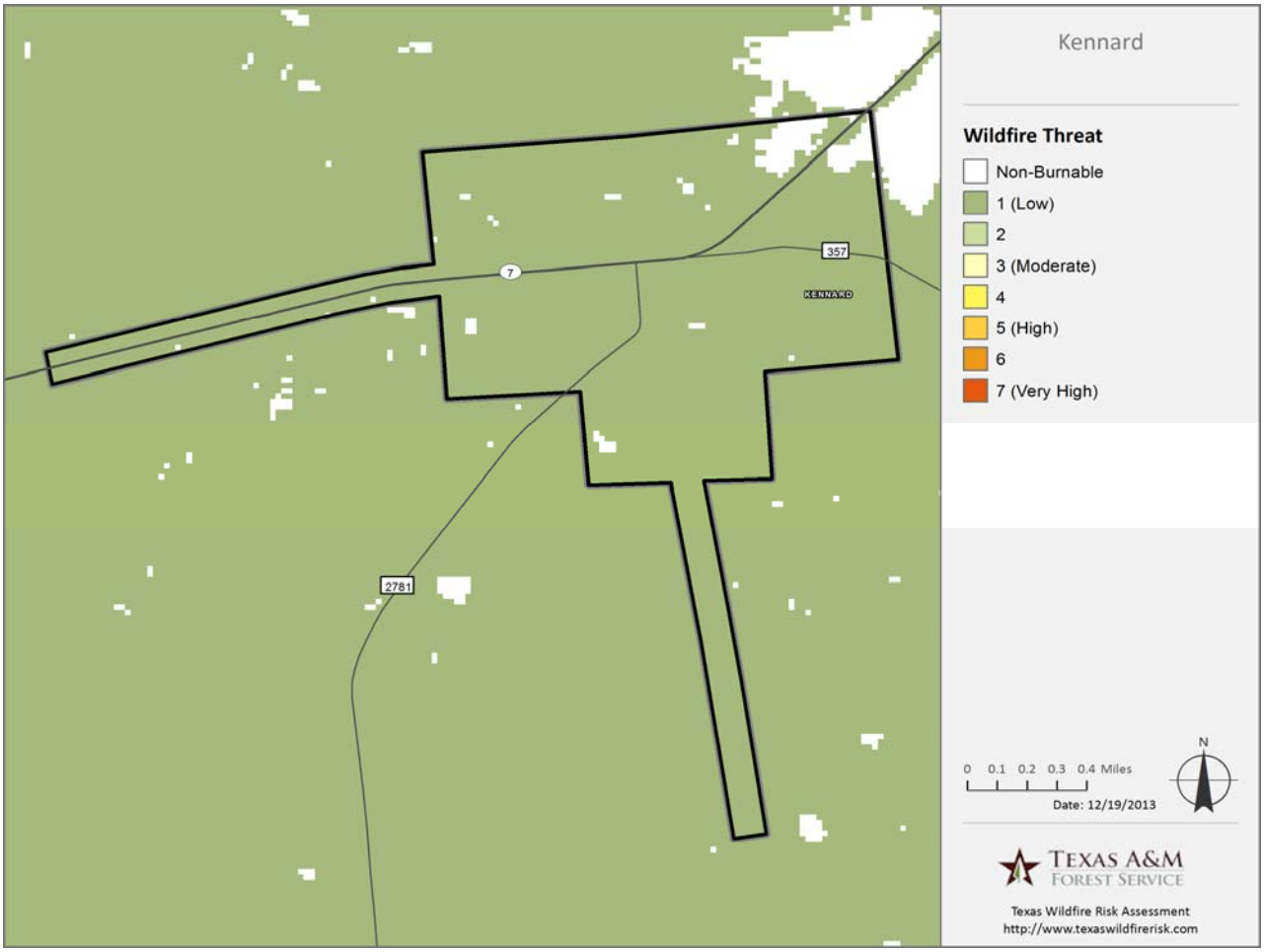
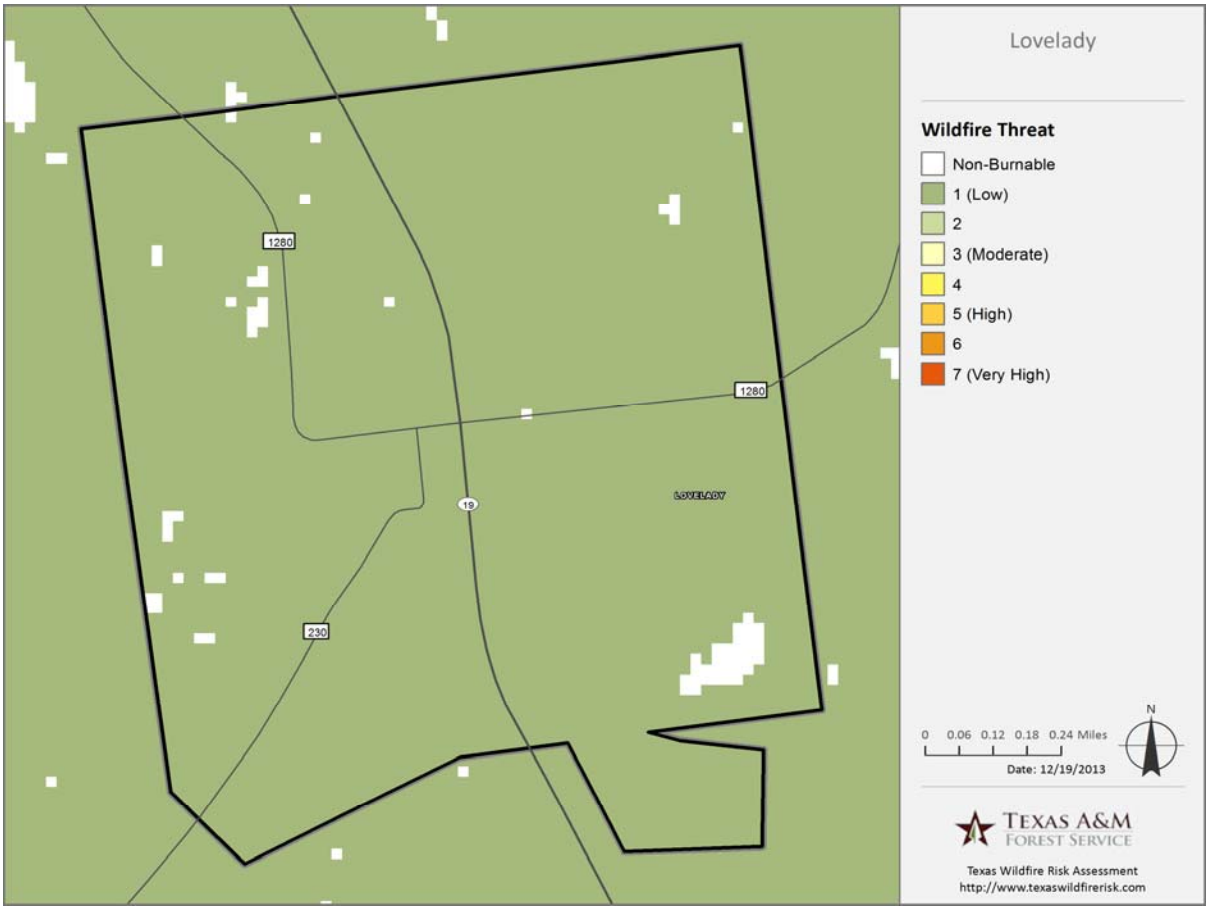


Figure 9-7. Wildfire Threat – City of Latexo

Figure 9-8. Wildfire Threat – City of Lovelady



Diminished air quality may be a result of wildfire. The smoke plumes from wildfires can contain potentially carcinogenic matter. Fine particles of invisible soot and ash that too small for the respiratory system to filter can cause immediate and possibly long term affects. The elderly or those individuals with compromised respiratory systems may be more vulnerable to these effects.

Climatic conditions such as severe freezes and drought can significantly increase the intensity of wildfires since these conditions kill vegetation, creating a prime fuel source for these types of fires. The intensity of fires and the rate at which they spread are directly related to wind speed, temperature, and relative humidity.

The severity of impact of major wildfire events can be substantial. Such events can cause multiple deaths, completely shut down facilities for thirty days or more, and cause more than fifty percent of affected properties to be destroyed or suffer major damage. Severity of impact is gauged by acreage burned, and injuries and fatalities. Based on this, impact can be considered to be limited, or injuries are treatable with first aid, shutdown of critical facilities and services for 24 hours or less, and less than 10 percent of property destroyed or with major damage.

SECTION 10: FLOOD

HAZARD DESCRIPTION

Floods generally result from excessive precipitation, and the severity of a flooding event is typically determined by a combination of several major factors, including: stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and the degree of vegetative clearing and impervious surface. Generally, floods are long-term events that may last for several days.

The primary types of general flooding are inland and coastal flooding. Due to Houston County's inland location, only inland flooding is profiled in this section. Inland or riverine flooding is a function of excessive precipitation levels and water runoff volumes within the watershed of a stream or river. It is natural and inevitable as it is the overbank flooding of rivers and streams, typically resulting from large-scale weather systems that generate prolonged rainfall over a wide geographic area. Some river floods occur seasonally when winter or spring rainfalls fill river basins with too much water, too quickly. Torrential rains from decaying hurricanes or tropical systems can also produce river flooding.

LOCATION

For mapping purposes, Digital Q3 Flood Data is also shown for Houston County in Figure 10-1. The Digital Flood Insurance Rate Mate (DFIRM) data provided by FEMA for Houston County shows the following flood hazard areas:

- Zone A: Areas subject to inundation by the 1-percent-annual-chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown. Mandatory flood insurance requirements and floodplain management standards apply.
- Zone AE: Areas subject to inundation by 1-percent-annual-chance shallow flooding. It is the base floodplain where base flood elevations are provided. AE zones are now used on new format FIRMs instead of A1-30 zones.

- 0.2% Annual Chance Flood Hazard: Area of minimal flood hazard, usually depicted on FIRMs as above the 500-year flood level.

Locations of flood zones in Houston County based on the digital Flood Insurance Rate Map (DFIRM) from FEMA are illustrated in Figures 10-1 to 10-6.

Figure 10-1. Estimated Flood Zones in Houston County

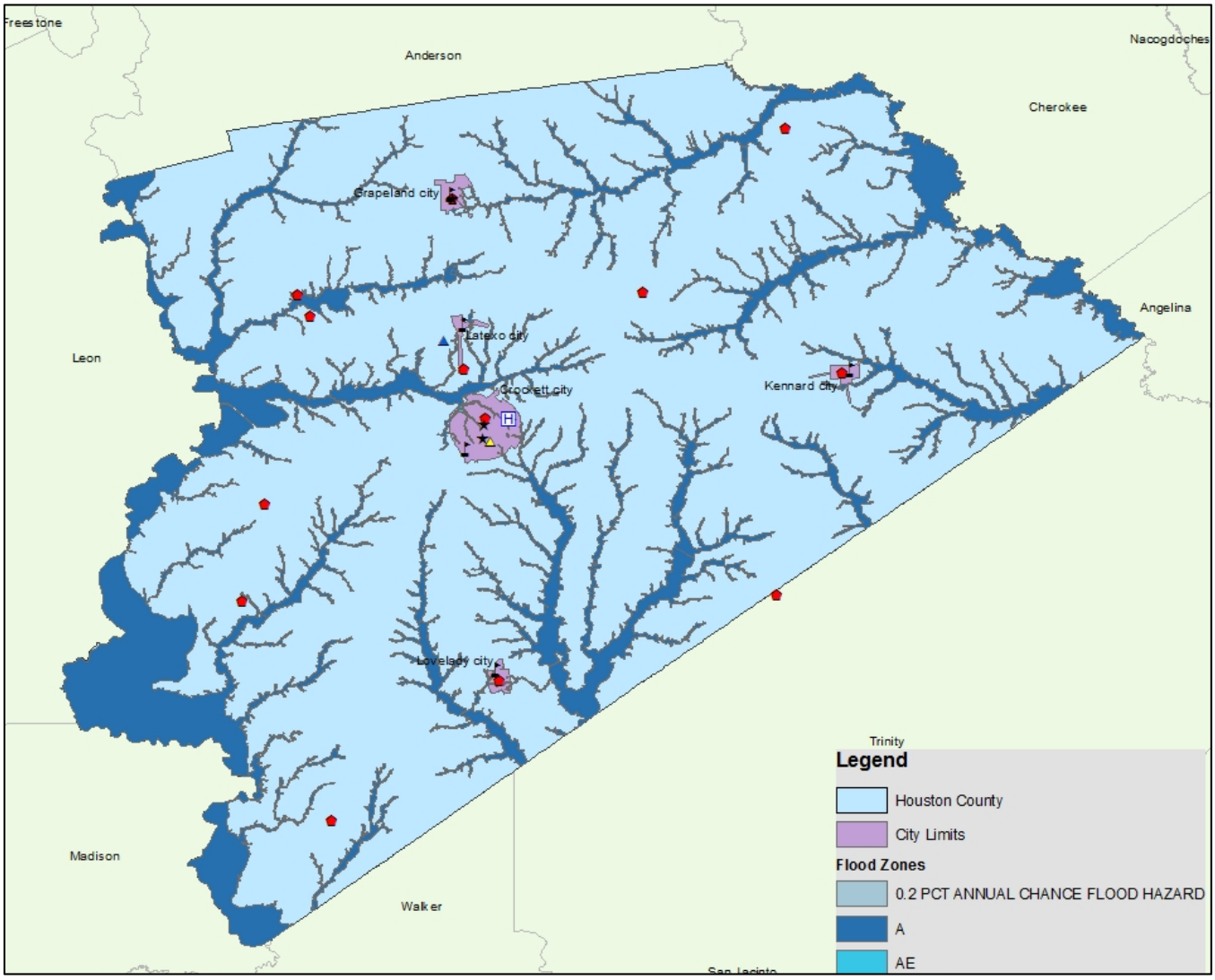


Figure 10-2. Estimated Flood Zones in the City of Crockett

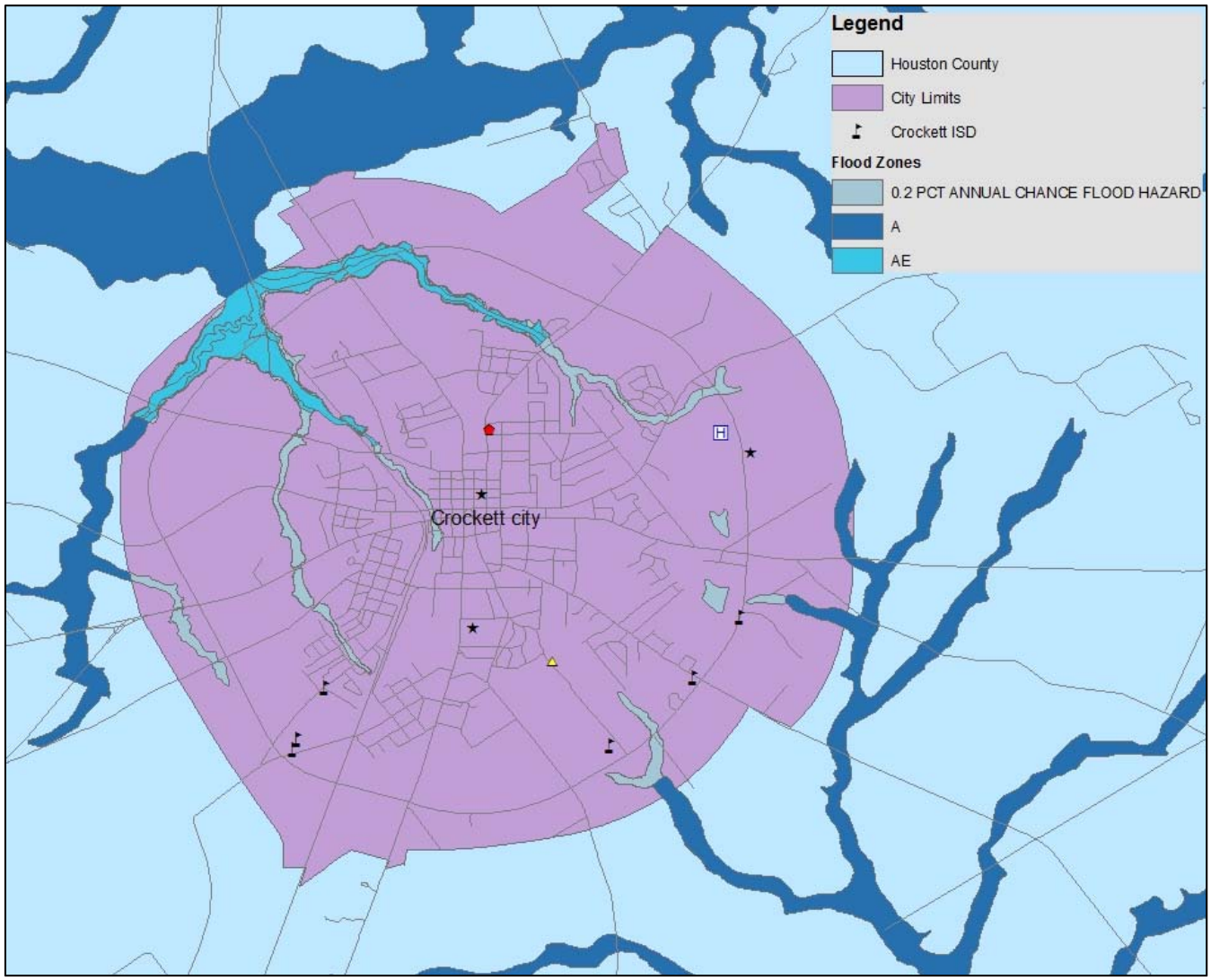


Figure 10-3. Estimated Flood Zones in the City of Grapeland

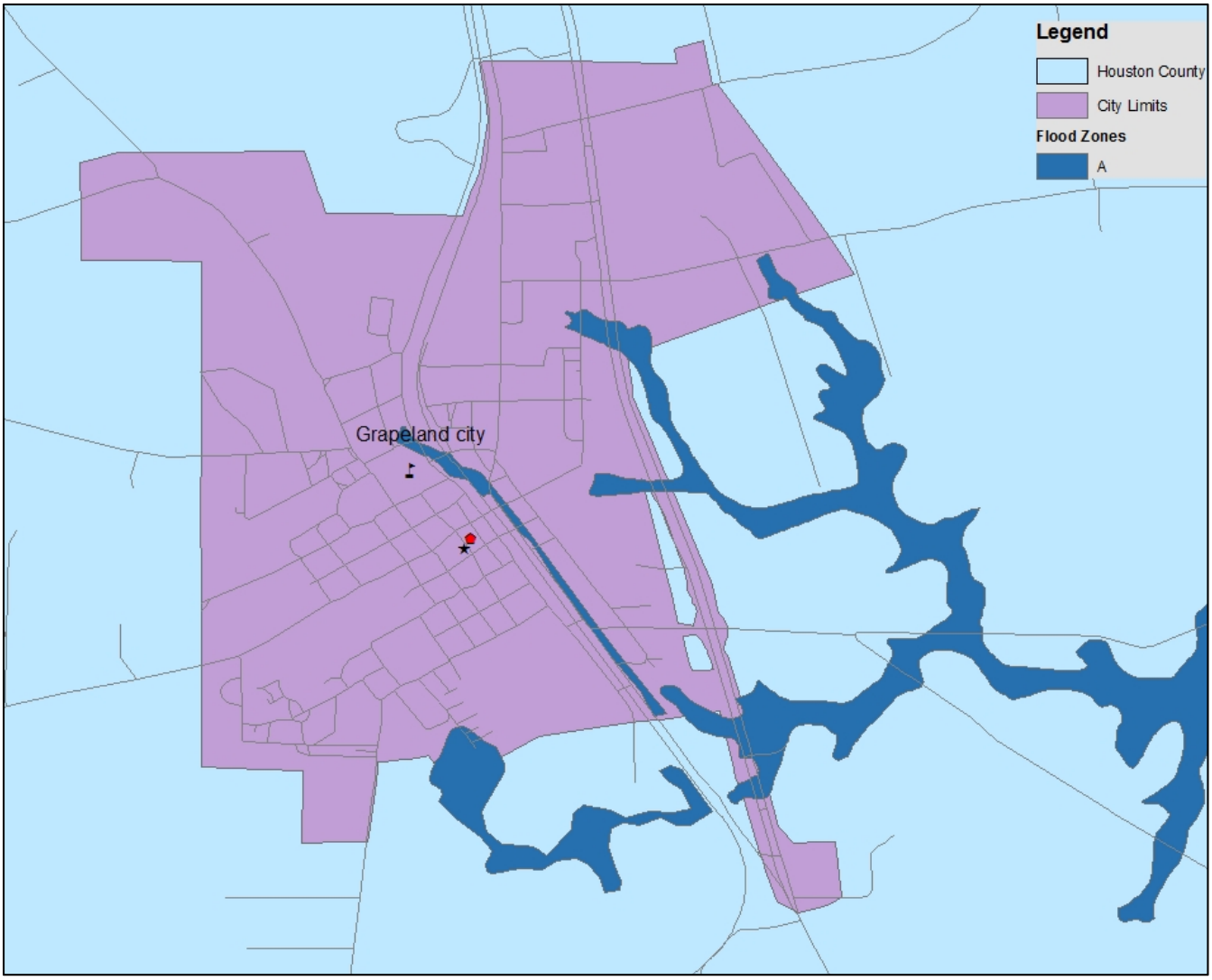


Figure 10-4. Estimated Flood Zones in the City of Kennard

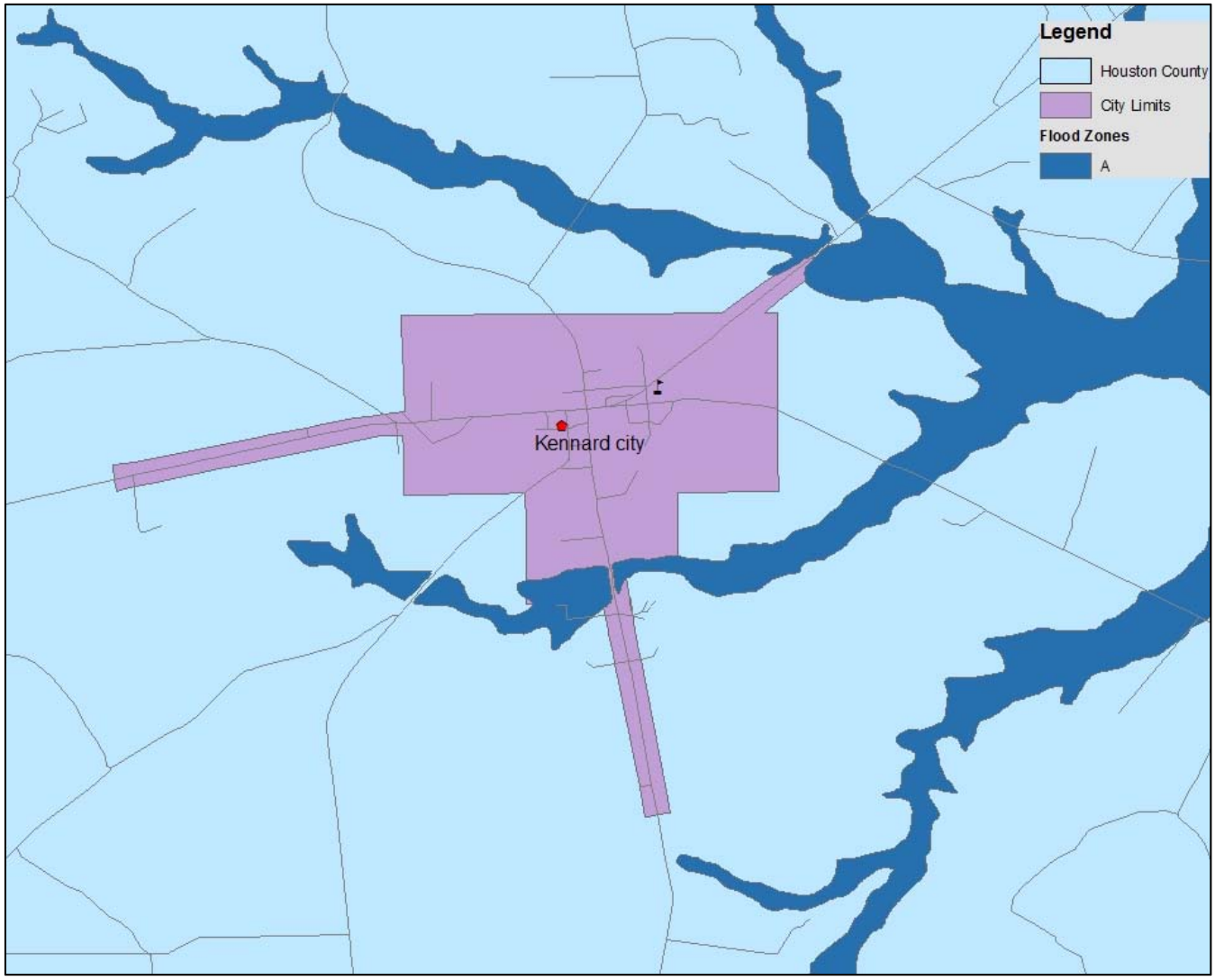


Figure 10-5. Estimated Flood Zones in the City of Latexo

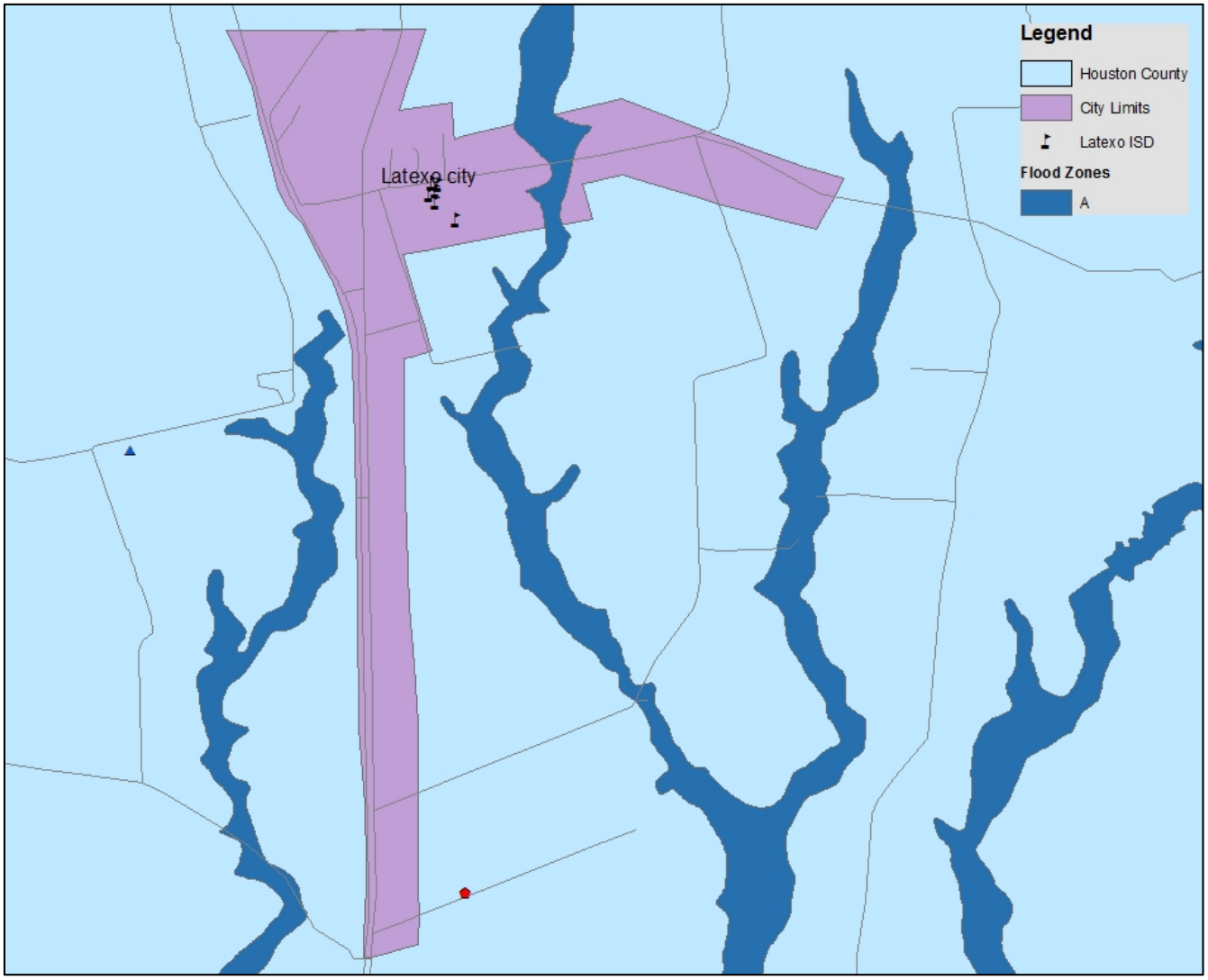
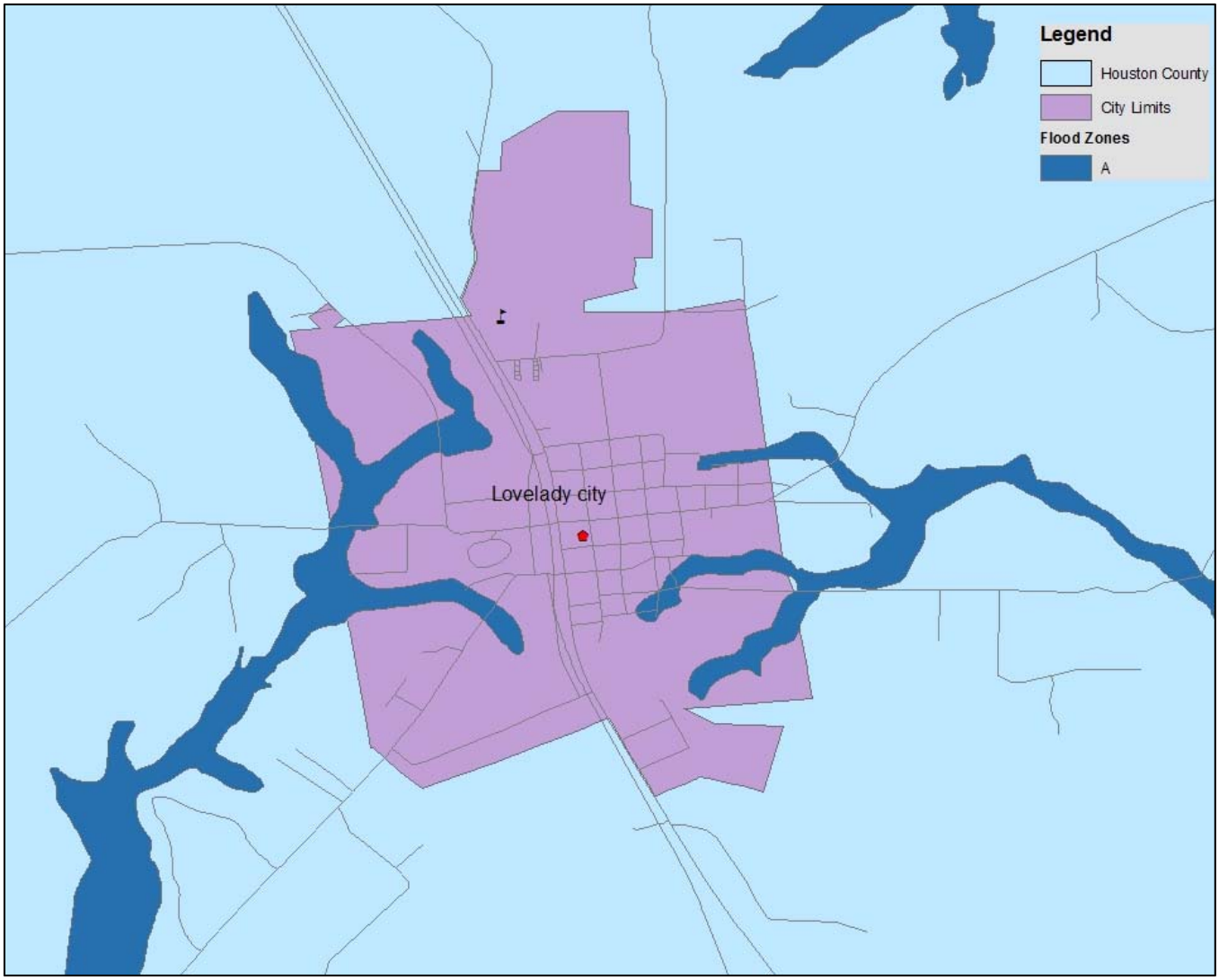


Figure 10-6. Estimated Flood Zones in the City of Lovelady



EXTENT

The severity of a flood event is typically determined by a combination of several factors including: stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and degree of vegetative clearing and impervious surface. Generally floods are long-term events that may last for several days.

Determining the intensity and magnitude of a flood event is dependent upon the flood zone and location of the flood hazard area in addition to depths of flood waters. Extent of flood damages can be expected to be more damaging in the areas that will convey a base flood. FEMA categorizes areas on the terrain according to how the area will convey flood water. Flood zones are the categories that are mapped on Flood Insurance

Rate Maps. Table 10-1 provides a description of FEMA flood zones and the flood impact in terms of severity or potential harm, Flood Zone A and AE are the only hazard areas mapped in the region. Figures 10-1 through 10-6 should be read in conjunction with the extent for flooding in Tables 10-1, 10-2, and 10-3 to determine the intensity of a potential flooding event.

Table 10-1. Flood Zones

INTENSITY	ZONE	DESCRIPTION
HIGH	ZONE A	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas, no depths or base flood elevations are shown within these zones.
	ZONE A1-30	These are known as numbered A Zones (e.g., A7 or A14). This is the base floodplain where the FIRM shows a BFE (old format).
	ZONE AE	The base floodplain where base flood elevations are provided. AE Zones are now used on the new format FIRMs instead of A1-A30 Zones.
	ZONE AO	River or stream flood hazard areas and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.
	ZONE AH	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
	ZONE A99	Areas with a 1% annual chance of flooding that will be protected by a federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.
	ZONE AR	Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.

INTENSITY	ZONE	DESCRIPTION
MODERATE to LOW	ZONE X 500	An area inundated by 500-year flooding; an area inundated by 100-year flooding with average depths of less than 1 foot or with drainage areas less than 1 square mile; or an area protected by levees from 100-year flooding.

Zone A is interchangeably referred to as the 100-year flood, the one-percent-annual chance flood, or the Special Flood Hazard Area (SFHA), or more commonly, the base flood. By any name, it is the area that will convey the base flood. This area constitutes a threat to the planning area.

Structures built in the Special Flood Hazard Area are subject to damage by rising waters and floating debris. Moving flood water exerts pressure on everything in its path and causes erosion of soil and solid objects. Utility systems, such as heating, ventilation, air conditioning, fuel, electrical systems, sewage maintenance systems and water systems, if not elevated above base flood elevation, may also be damaged.

In addition to the flood zones, extent is provided for the County in terms of depth of flood waters. Table 10-2 below describes the category of risk and potential magnitude of an event. The water depths depicted in Table 10-2 are an approximation based on elevation data (above sea level rather than above ground). Table 10-3 reflects extent associated with stream gauge data provided by the USGS.

Table 10-2. Extent Scale – Water Depth (Mean Sea Level, MSL)

SEVERITY	MSL (IN FEET)	DESCRIPTION
BELOW FLOOD STAGE	0 to 15	Water begins to exceed low sections of banks and the lowest sections of the floodplain.
ACTION STAGE	16 to 23	Flow is well into the floodplain, minor lowland flooding reaches low areas of the floodplain. Livestock should be moved from low lying areas.
FLOOD STAGE	24 to 28	Homes are threatened and properties downstream of river flows or in low lying areas begin to flood.
MODERATE FLOOD STAGE	29 to 32	At this stage the lowest homes downstream flood. Roads and bridges in the floodplain flood severely and are dangerous to motorists.

SEVERITY	MSL (IN FEET)	DESCRIPTION
MAJOR FLOOD STAGE	33 and above	Major flooding approaches homes in the floodplain. Primary and secondary roads and bridges are severely flooded and very dangerous. Major flooding extends well into the floodplain, destroying property, equipment and livestock.

Table 10-3. Extent for Houston County

JURISDICTION	ESTIMATED SEVERITY PER FLOOD EVENT[1]	PEAK FLOOD EVENT
Houston County	Flood Stage, 24 to 28 feet	Flood Stage: Trinity River near Crockett had floodwaters reach 52.2 feet in May 1966 and May 1969.

The range of intensity that the County can experience is high, or Zone A. Based on reporting from the Trinity River, a flood event can place the County at the extent of "Major Flood Stage" as shown in Tables 10-2 and 10-3. Based on historical occurrences, the planning area could expect to experience up to 4 feet of water within a 6 hour period due to flooding.

Reading the Tables 10-1 through 10-3 together with Figures 10-1 through 10-6 provide estimated and potential magnitude and severity for the county. For example Crockett, as shown in Figure 10-2, has areas designated as Zone A and Zone AE. Reading this figure in conjunction with Table 10-1 means the area is an area of high risk for flood.

HISTORICAL OCCURRENCES

Historical evidence shows that areas within the County are susceptible to flooding, especially in the form of flash flooding. It is important to note that only flood events that have been reported have been factored into this risk assessment. It is likely that additional flood occurrences have gone unreported before and during this recording period. Table 10-4 shows historical incident information for Houston County.

Table 10-4. Historical Flood Events by County, 1960-2010

COUNTY	EVENTS	DEATHS	INJURIES
Houston	28	0	0

[1] Severity estimated by averaging floods at certain stage level over the history of flood events by county.

SECTION 10: FLOOD

Table 10-5. Historical Flood Events, 1960-2011[2]

JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
UNKNOWN	6/20/1993	0	0	$500	$500,000
UNKNOWN	10/16/1994	0	0	$50,000	$5,000
UNKNOWN	6/10/1995	0	0	$5,000	$0
CENTRAL PORTION	7/25/1996	0	0	$10,000	$0
SW COUNTY	9/26/1996	0	0	$5,000	$0
COUNTYWIDE	2/20/1997	0	0	$5,000	$0
COUNTYWIDE	4/4/1997	0	0	$5,000	$0
COUNTY	5/15/1997	0	0	$5,000	$0
GRAPELAND	6/10/1997	0	0	$5,000	$0
HOPEWELL	6/13/1997	0	0	$5,000	$0
CENTRAL PORTION	11/5/1997	0	0	$25,000	$0
SOUTH PORTION	1/6/1998	0	0	$3,000	$0
GRAPELAND	10/6/1998	0	0	$3,000	$0
AUSTONIA	10/17/1998	0	0	$5,000	$0
CROCKETT	10/18/1998	0	0	$5,000	$0
UNKNOWN	11/12/1998	0	0	$50,000	$0
COUNTYWIDE	1/29/1999	0	0	$5,000	$0
COUNTYWIDE	1/29/1999	0	0	$5,000	$0
COUNTYWIDE	11/3/2000	0	0	$25,000	$0
CROCKETT	5/17/2002	0	0	$2,000	$0
COUNTYWIDE	11/4/2002	0	0	$20,000	$0
COUNTYWIDE	2/20/2003	0	0	$8,000	$0
CROCKETT	6/27/2004	0	0	$30,000	$0
GRAPELAND	9/29/2012	0	0	$50,000	$0

[2] Only recorded events with fatalities, injuries, and/or damages are listed.

SECTION 10: FLOOD

SIGNIFICANT EVENTS

Flash Flood on September 29, 2012

Heavy rainfall from a slow moving upper level low pressure system produced very heavy rainfall that led to flash flooding near Grapeland. Near ten inches of localized heavy rain caused flash flooding that washed away portions of FM 227 and led to road closures near the intersection of FM 227 and FM 2544 to the west through southwest of Grapeland. A metal roof awning collapsed due to the weight of the rain.

Flash Flood on March 30, 2008

Flooding was reported along SR 7 east of the town of Crockett. A warm frontal boundary moving inland from the coast created thunderstorms that produced localized heavy rain.

Flash Flood on November 5, 1997

Crockett flooded. FM 2115 bridge washed out. Houston County Lake Road between FM 229 & HWY 287 washed out.

PROBABILITY OF FUTURE EVENTS

Based on recorded historical occurrences and extent, flooding is highly likely meaning an event will occur in the next year.

VULNERABILITY AND IMPACT

A property's vulnerability to a flood depends on its location in, or in proximity, to the floodplain. Structures that lie along banks of a waterway are the most vulnerable and are often repetitive loss structures.

The County encourages development outside of the floodplain, and the impact for flood for the County is limited as facilities and services would be shutdown of facilities for 24 hours or less, depending on the scale of the storm.

Historic loss estimates due to flood are presented in Table 10-6 below. Considering 28 flood events over a 52-year period, frequency is approximately one event every other year. Annualized loss for the County over the same period is approximately $2.8 million in property and crop damages.

Table 10-6. Potential Annualized Losses by Jurisdiction, 1960-2012[3]

JURISDICTION	NUMBER OF EVENTS	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATES
Crockett	4	$19,611	$377
Grapeland	3	$62,307	$1,198
Kennard	0	$0	$0
Latexo	0	$0	$0
Lovelady	1	$0	$0
Houston County	**28**	**$1,237,767**	**$23,803**

The severity of a flooding event varies depending on the relative risk to citizens and structures located within each city. The level of impact for the Houston County planning area, including all participating cities, ISDs, and Houston County WCID #1, is considered to be limited, meaning any injuries or illnesses would be treatable with first aid, with minor quality of life lost. If critical facilities are shutdown it would be for 24 hours or less, and it is expected that less than 10 percent of property would be destroyed or damaged.

NFIP PARTICIPATION

Flood insurance offered through the National Flood Insurance Program (NFIP) is the best way for home and business owners to protect themselves financially against the flood hazard.

All of the jurisdictions located in Houston County participate in the NFIP with the exception of the City of Latexo. According to the Texas Water Development Board (TWDB), the City of Latexo was sanctioned from the NFIP in April, 2012, but is currently working towards a program of corrective and preventative measures for reducing flood damage in the community. These measures take a variety of forms and generally include requirements for zoning, subdivision or building, and special-purpose floodplain ordinances.

As an additional indicator of floodplain management responsibility, communities may choose to participate in FEMA's Community Rating System (CRS). This is an incentive-based program that allows communities to undertake flood mitigation activities that go beyond NFIP requirements. Currently, none of the Houston County planning area participates in CRS.

Houston County and all participating jurisdictions, except for the City of Latexo have adopted ordinances to regulate the floodplain, or any land area susceptible to being inundated by water from any source. Houston County and participating jurisdictions currently have in place minimum NFIP standards for new

[3] Source: NCDC, values are in 2013 dollars and include property and crop damages.

construction and substantial improvements of structures, but is considering adopting higher regulatory NFIP standards.

The flood hazard areas throughout Houston County are subject to periodic inundation, which may result in loss of life and property, health and safety hazards, disruption of commerce and governmental services, and extraordinary public expenditures for flood protection and relief, of which adversely affect public safety.

These flood losses are created by the cumulative effect of obstructions in floodplains which cause an increase in flood heights and velocities, and by the occupancy of flood hazard areas by uses vulnerable to floods and hazardous to other lands because they are inadequately elevated, flood-proofed or otherwise protected from flood damage.

It is the purpose of the County and NFIP participating jurisdictions to promote the public health, safety and general welfare and to minimize public and private losses due to flood conditions in specific areas by provisions designed to:

- Protect human life and health;
- Minimize expenditure of public money for costly flood control projects;
- Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;
- Minimize prolonged business interruptions;
- Minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, streets and bridges located in floodplains;
- Help maintain a stable tax base by providing for the sound use and development of flood-prone areas in such a manner as to minimize future flood blight areas; and
- Ensure that potential buyers are notified that property is in a flood area.

In order to accomplish these tasks, Houston County and its jurisdictions follow these guidelines:

- Restrict or prohibit uses that are dangerous to health, safety or property in times of flood, or cause excessive increases in flood heights or velocities;
- Require that uses vulnerable to floods, including facilities, which serve such uses, be protected against flood damage at the time of initial construction;
- Control the alteration of natural floodplains, stream channels, and natural protective barriers, which are involved in the accommodation of floodwaters;
- Control filling, grading, dredging and other development, which may increase flood damage; and
- Prevent or regulate the construction of flood barriers which will unnaturally divert floodwaters or which may increase flood hazards to other lands.

NFIP COMPLIANCE AND MAINTENANCE

Houston County and participating jurisdictions have also developed mitigation actions that relate to either NFIP maintenance or compliance. Compliance and maintenance actions can be found in Section 17.

County-wide, communities recognize the need and are considering adopting higher NFIP regulatory standards to further minimize flood risk in their community. Smaller no-growth communities that typically do not have personnel or funds to implement more stringent NFIP compliance measures are focusing on

NFIP public awareness activities. This includes promoting the availability of flood insurance by placing NFIP brochures and flyers in public libraries or public meeting places.

FEMA's Community Rating System (CRS) is an incentive-based program that allows communities to undertake flood mitigation activities that go beyond NFIP requirements. Currently, none of the participating jurisdictions in Houston County participate in CRS.

As part of continual compliance with the NFIP, the Houston County Public Works office assists NFIP participating jurisdictions in updating and keeping current their Flood Damage Prevention Ordinance. The County also periodically conducts education programs for residents throughout the county region and to bring awareness to the FEMA requirements for Flood Plain Management.

Houston County communities have also developed new mitigation actions that relate to NFIP compliance and public awareness. The HMAP Planning Team agreed at workshops that flooding wasn't as prevalent in Houston County as in some counties further east, but overall vulnerability is nonetheless considered moderate to high countywide. In addition to public safety risks, the assets most vulnerable to impact are housing and roadways, with the potential for structural damage to homes and temporary closure or in some cases damage to roads and bridges. Flash flooding is inherently a problem throughout the Houston County area, and flooding was identified by the majority of the Planning Team as a moderate risk during hazard ranking activities at the Risk Assessment Workshop. Many of the mitigation actions were developed with flood mitigation in mind. A majority of these flood actions address compliance with the NFIP and implementing flood awareness programs. Throughout the unincorporated areas of the County are numerous county roads that routinely wash out during severe rainfall events. The County has prioritized expanding culverts and clearing debris from bridges and roadside drainage ditches in an effort to mitigate minor flooding to these roadways, and have included new mitigation actions to address this issue.

Regarding the location of housing at risk from the impact of flooding, the Planning Team identified approximately 100 residential structures countywide that are at a high risk of damage from flooding. These structures are located 2-4 feet below the 100-year floodplain. Several of the participating jurisdictions recognize that adopting higher NFIP regulatory standards would be beneficial to minimizing flood risk and recommend revision/additions to development requirements within floodplain areas. Recommendations include adopting higher elevation requirements to Flood Damage Prevention Ordinances and requiring additional 2-3 foot of freeboard above the BFE in the Special Flood Hazard Area (SFHA) for new residential construction. It was suggested that at a minimum, new construction in the county, even outside the SFHA, be elevated to the crown of the road, one foot above curb level, or one foot higher than the highest adjacent grade at the building site. As a result of these discussions, many of the mitigation actions were developed with flood mitigation in mind.

The prioritization method for implementing actions was based on FEMA's STAPLEE criteria and included social, technical, administrative, political, legal, economic and environmental considerations. As a result of this exercise, an overall priority was assigned to each mitigation action by each Team Member. The overall priority of each action is reflected in the mitigation actions found in Section 17 for the participating jurisdictions. In prioritizing actions a community must consider many factors. Of primary consideration is targeting specific mitigation actions for implementation following a major disaster. Other factors that determine prioritization are, in part, ease of implementation by the community, cost of the project vs.

perceived benefit, timeframe for implementing the action, and available personnel to oversee and implement the project.

REPETITIVE LOSS

The Severe Repetitive Loss (SRL) Grant Program under FEMA provides federal funding to assist states and communities in implementing mitigation measures to reduce or eliminate the long-term risk of flood damage to severe repetitive loss residential structures insured under the NFIP. The Texas Water Development Board (TWDB) administers the SRL grant program for the State of Texas.

Severe Repetitive Loss properties are defined as residential properties that are:

- covered under the NFIP and have at least four flood related damage claim payments (building and contents) over $5,000.00 each, and the cumulative amount of such claims payments exceed $20,000; or
- at least two separate claim payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building.

In either scenario, at least two of the referenced claims must have occurred within any ten-year period, and must be greater than 10 days apart.[4] Currently, there are no repetitive loss and severe repetitive loss properties for Houston County and the participating jurisdictions according to the Texas Water Development Board.

[4] Source: Texas Water Development Board

SECTION11: TORNADO

HAZARD DESCRIPTION

Tornadoes are among the most violent storms on the planet. A tornado is a violently rotating column of air extending between, and in contact with, a cloud and the surface of the earth. The most violent tornadoes are capable of tremendous destruction, with wind speeds of 250 miles per hour or more. In extreme cases, winds may approach 300 miles per hour. Damage paths can be in excess of one mile wide and 50 miles long.

The most powerful tornadoes are produced by "super cell thunderstorms." Super-cell thunderstorms are created when horizontal wind shears (winds moving in different directions at different altitudes) begin to rotate the storm. This horizontal rotation can be tilted vertically by violent updrafts, and the rotation radius can shrink, forming a vertical column of very quickly swirling air. This rotating air can eventually reach the ground, forming a tornado.

Tornadic storms can occur at any time of year and at any time of day, but they are typically more common in the spring months during the late afternoon and evening hours. A typically smaller, high frequency period can emerge in the fall during the brief transition between the warm and cold seasons.

SECTION 11: TORNADO

Table 11-1. Variations among Tornadoes

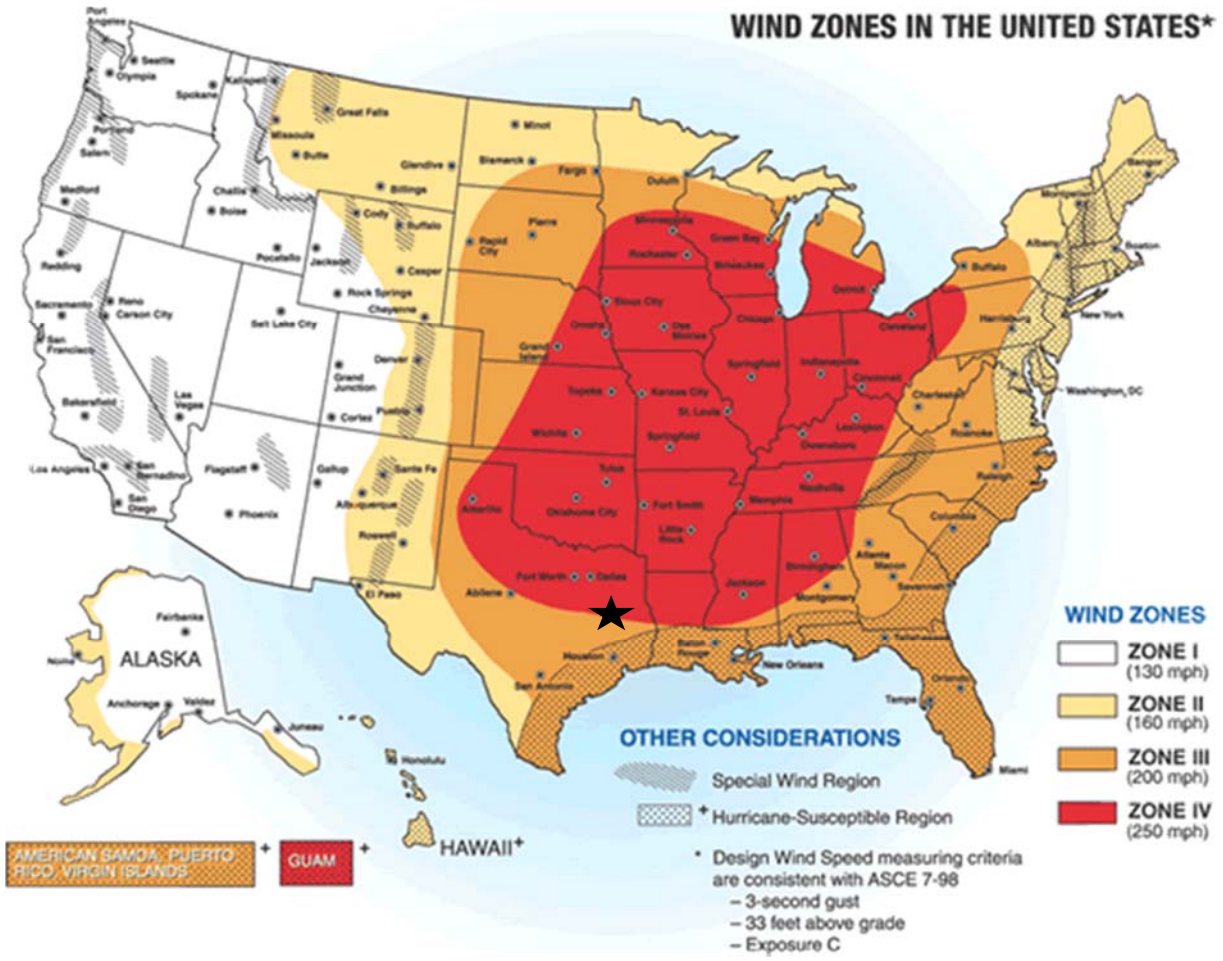
WEAK TORNADOES	STRONG TORNADOES	VIOLENT TORNADOES
• 69% of all tornadoes • Less than 5% of tornado deaths • Lifetime 1-10+ minutes • Winds less than 110 mph	• 29% of all tornadoes • Nearly 30% of all tornado deaths • May last 20 minutes or longer • Winds 110 – 205 mph	• 2% of all tornadoes • 70% of all tornado deaths • Lifetime can exceed one hour • Winds greater than 205 mph

LOCATION

As with thunderstorms, tornadoes do not have any specific geographic boundary and can occur throughout the County uniformly. It is assumed that the county planning area and the campuses of Crockett ISD, Latexo ISD, and Houston County WCID #1, are uniformly exposed to tornado activity. Houston County is located in Wind Zone IV, meaning tornado winds can be as high as 250 mph.

SECTION 11: TORNADO

Figure 11-1. FEMA Wind Zones in the United States[1]



EXTENT

The destruction caused by tornadoes ranges from light to inconceivable depending on the intensity, size and duration of the storm. Typically, tornadoes cause the greatest damage to structures of light construction, such as residential homes (particularly mobile homes). Additionally, it should be noted that tornado magnitudes prior to 2005 were determined using the traditional version of the Fujita Scale (Table 11-2).

[1] Houston County is indicated by the star.

Table 11-2. The Fujita Tornado Scale[2]

F-SCALE NUMBER	INTENSITY	WIND SPEED (MPH)	TYPE OF DAMAGE DONE	PERCENT OF APPRAISED STRUCTURE VALUE LOST DUE TO DAMAGE
F0	Gale Tornado	40 – 72	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards.	None Estimated
F1	Moderate Tornado	73 – 112	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off roads; attached garages may be destroyed.	0% – 20%
F2	Significant Tornado	113 – 157	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.	50% – 100%
F3	Severe Tornado	158 – 206	Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.	100%
F4	Devastating Tornado	207 – 260	Well-constructed homes leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.	100%
F5	Incredible Tornado	261 – 318	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles flying through the air in excess of 330 yards; trees debarked; steel reinforced concrete badly damaged.	100%

Since February 2007, the Fujita Scale (above) has been replaced by the Enhanced Fujita Scale (Table 11-3 below), which retains the same basic design as its predecessor with six strength categories. The newer scale reflects more refined assessments of tornado damage surveys, standardization, and damage consideration to a wider range of structures.

[2] Source: http://www.tornadoproject.com/fscale/fscale.htm

Table 11-3. Enhanced Fujita Scale for Tornadoes

STORM CATEGORY	DAMAGE LEVEL	3 SECOND GUST (MPH)	DESCRIPTION OF DAMAGES	PHOTO EXAMPLE
EF0	Gale	65 – 85	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards.	
EF1	Weak	86 – 110	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off roads; attached garages may be destroyed.	
EF2	Strong	111 – 135	Considerable damage; roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.	
EF3	Severe	136 – 165	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.	
EF4	Devastating	166 – 200	Well-constructed homes leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.	
EF5	Incredible	200+	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles flying through the air in excess of 330 yards; trees debarked; steel reinforced concrete badly damaged.	

Both the Fujita Scale and Enhanced Fujita Scale should be referenced in reviewing previous occurrences as tornado events prior to 2007 will follow the original Fujita Scale. The largest magnitude reported within the county planning area is F2 on the Fujita Scale, or a significant tornado. Based on this data, the area could experience anywhere from an EF0 to an EF3 depending on the wind speed.

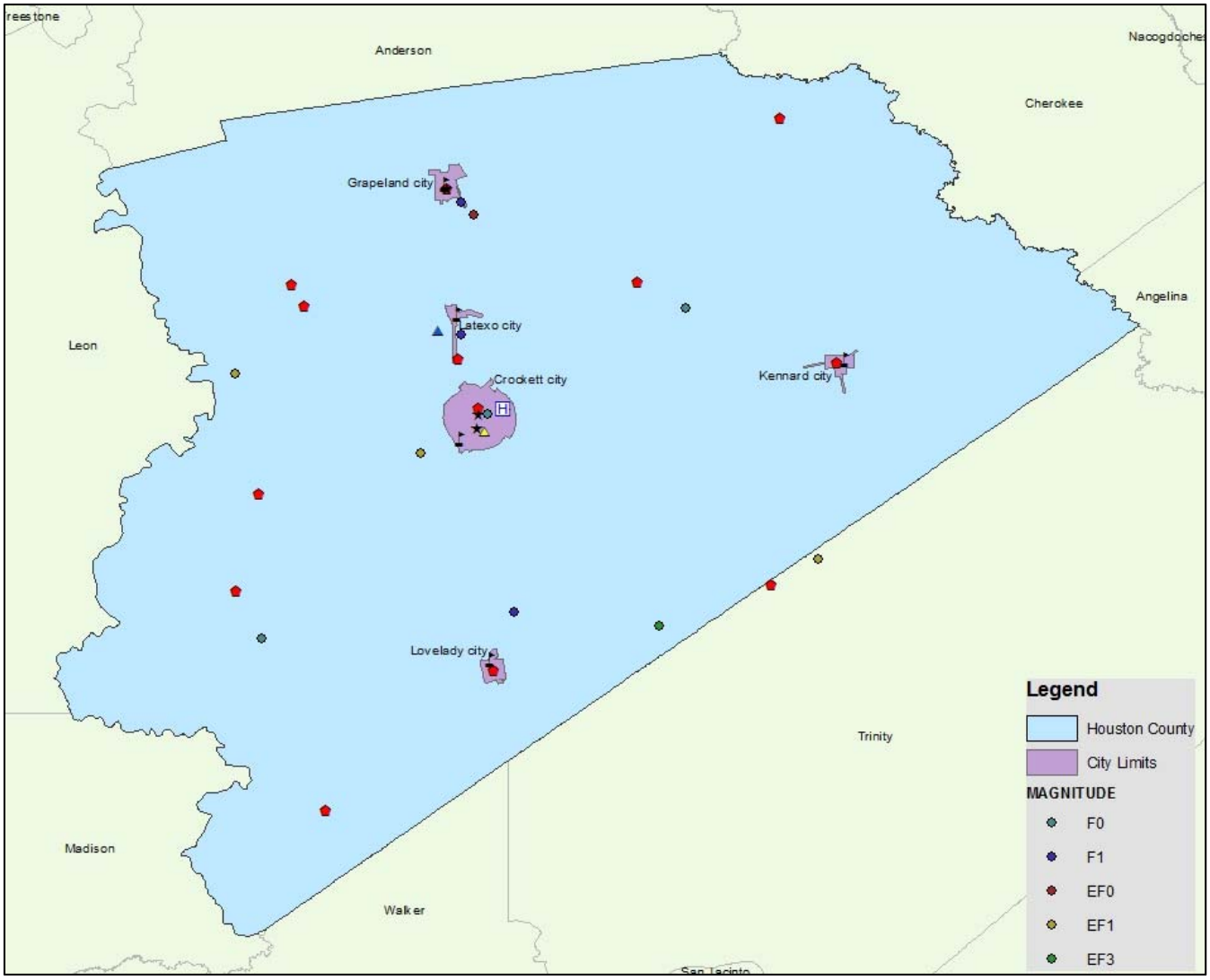
Although the County has experienced tornadoes as devastating as an F2 on the Fujita Scale, the typical range of intensity that the Houston County planning area would be expected to mitigate would be a low to moderate risk, or an EF0 to an EF3 (Table 11-4).

SECTION 11: TORNADO

HISTORICAL OCCURRENCES

It is important to note that only reported tornadoes were factored into the risk assessment. It is likely that a high number of occurrences have gone unreported over the past 62 years. Figure 11-2 shows the locations of previous occurrences in Houston County from 1950 to 2012. A total of 17 events have been recorded by the Storm Prediction Center (NOAA), NCDC, and SHELDUS databases for Houston County.

Figure 11-2. Spatial Historical Tornado Events, 1950–2010[3]



[3] Source: NOAA Records

SECTION 11: TORNADO

Table 11-4. Historical Tornado Events, 1950-2012[4]

JURISDICTION	DATE	TIME	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
UNKNOWN	3/28/1951	5:10		0	0	$2,500	$0
UNKNOWN	5/16/1953	14:30		1	8	$0	$0
UNKNOWN	3/26/1961	15:00		0	1	$250,000	$0
UNKNOWN	8/22/1980	17:40		0	0	$25,000	$0
UNKNOWN	3/28/1989	14:15		0	0	$25,000	$0
LOVELADY	4/4/1997	13:50	F1	0	0	$40,000	$0
CROCKETT	4/4/1997	14:05	F0	0	0	$10,000	$0
LATEXO	4/4/1997	14:15	F1	0	0	$40,000	$0
GRAPELAND	6/6/2005	16:00	F1	0	0	$275,000	$0
WHEELER SPGS	6/10/2010	9:56	EF1	0	0	$75,000	$0
WOOSTER	6/10/2010	10:29	EF0	0	0	$10,000	$0
CROCKETT	4/25/2011	20:15	EF1	0	0	$50,000	$0
FODICE	12/25/2012	9:05	EF3	0	0	$700,000	$0
County Totals				**1**	**9**	**$1,502,500**	**$0**

Table 11-5. Summary of Historical Tornado Events, 1950-2012

JURISDICTION	EVENTS	MAGNITUDE (max extent)	DEATHS	INJURIES	PROPERTY DAMAGE (2013 DOLLARS)	CROP DAMAGE (2013 DOLLARS)
Crockett	3	EF1	0	0	$66,329	$0
Grapeland	2	F1	0	0	$328,182	$0
Kennard	1	F0	0	0	$0	$0
Latexo	1	F1	0	0	$58,086	$0
Lovelady	2	EF1	0	0	$58,086	$0
Houston County	**17**	**EF3**	**1**	**9**	**$3,400,980**	**$0**

[4] Only recorded events with fatalities, injuries, and/or damages are listed.

SECTION 11: TORNADO

SIGNIFICANT PAST EVENTS

December 25, 2012 – Houston County

On Christmas Day strong to severe thunderstorms developed along a warm front that was lifting north through the area. One of those storms produced an EF-3 tornado near Pennington, TX. The worst of the tornado damage, rated EF3, was along Highway 287, or one mile north of the town of Pennington. An agricultural feed store and restaurant were completely destroyed with the debris scattered off toward the east in a field. There was severe damage to several homes and trailers along the path of the tornado that was indicative of either EF1 or EF2 scale damage.

June 10, 2010 – Houston County

A weak tornado downed trees in west-central Houston County near the Leon county line. Another brief touch down occurred near Latexo. The storm that generated the tornado formed ahead of a slow moving upper level low pressure system that generated flooding rains just outside our area. The tornado touched down on ranch land over west-central Houston County, south of route 7 and just east of the Trinity River. Numerous hardwood trees were downed or snapped along the damage path. Two salt mineral feeders were moved. Rancher reported 2200 pound bull was lifted and thrown into an adjoining pasture. The tornado moved north-northeast, crossing route 7 and moving near a rock quarry where it removed two large signs and split a tree in the middle of a field. It then continued another mile north northeast where it crossed County Road 2065 where it downed trees and uprooted trees and damaged a shed. The roof was damaged on an old building.

June 6, 2005 – Houston County

Tornado moved from southwest to northeast across Grapeland. Ten residential homes had patio, roof and chimney damage. Windows were blown out of the south side of the library. There was roof damage to six downtown businesses. Numerous trees were down on vehicles and over twenty power lines were down throughout town.

PROBABILITY OF FUTURE EVENTS

According to historical records, Houston County experiences one tornado touchdown every three years. Hence, the probability of future tornado occurrences affecting the jurisdictions within Houston County and Crockett ISD, Latexo ISD, and Houston County WCID #1 is likely, meaning an event may occur within the next 3 years.

VULNERABILITY AND IMPACT

Because tornadoes often cross-jurisdictional boundaries, all existing and future buildings, facilities and populations at the independent school districts, water district and Houston County are considered to be exposed to this hazard and could potentially be impacted. The damage caused by a tornado is typically a result of high wind velocity, wind-blown debris, lightning, and large hail.

SECTION 11: TORNADO

The average tornado moves from southwest to northeast, but tornadoes have been known to move in any direction. Consequently, vulnerability of humans and property is difficult to evaluate since tornadoes form at different strengths, in random locations, and create relatively narrow paths of destruction. Although tornadoes strike at random, making all buildings vulnerable, three types of structures are more likely to suffer damage:

- Manufactured Homes;
- Homes on crawlspaces (more susceptible to lift); and
- Buildings with large spans, such as shopping malls, gymnasiums, and factories.

Overall, the average loss estimate of property and crop (in 2013 dollars) is $3,400,980, having an approximate annual loss estimate of $54,855 (Table 11-6). Based on historic loss and damages, the impact of tornado damages on Houston County can be considered to be minor, with more than 10 percent of property expected to be destroyed, injuries don't result in permanent disability, and critical facilities shut down for more than 1 week.

Table 11-6. Potential Annualized Losses by Jurisdiction, 1950-2012[5]

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATES
Crockett	$66,329	$1,070
Grapeland	$328,182	$5,293
Kennard	$0	$0
Latexo	$58,086	$937
Lovelady	$58,086	$937
Houston County	**$3,400,980**	**$54,855**

[5] Source: HAZUS-MH MR4 (total exposure) and NCDC (annualized losses)

SECTION 12: WINTER STORM

HAZARD DESCRIPTION

A severe winter storm event is identified as a storm with snow, ice, or freezing rain – all of which can cause significant problems for area residents. Winter storms are associated with freezing or frozen precipitation such as freezing rain, sleet, snow and the combined effects of winter precipitation and strong winds. Wind chill is a function of temperature and wind. Low wind chill is a product of high winds and freezing temperatures.

Winter storms that threaten Houston County usually begin as powerful cold fronts that push south from central Canada. The County is at risk to ice hazards and extremely cold temperatures, as well as snow, the effects and frequencies of winter storm events are generally mild and short-lived. As indicated in Figure 12-1, on average, the area experiences no extreme cold days a year, meaning on average there are no days at or around freezing temperatures. During these times of ice and snow accumulation response times will increase until public works road crews are able to assist in making the major roads passable. Table 12-1 describes the types of winter storms possible to occur in Houston County.

SECTION 12: WINTER STORM

Figure 12-1. Extreme Cold Days 1960-2003[1]

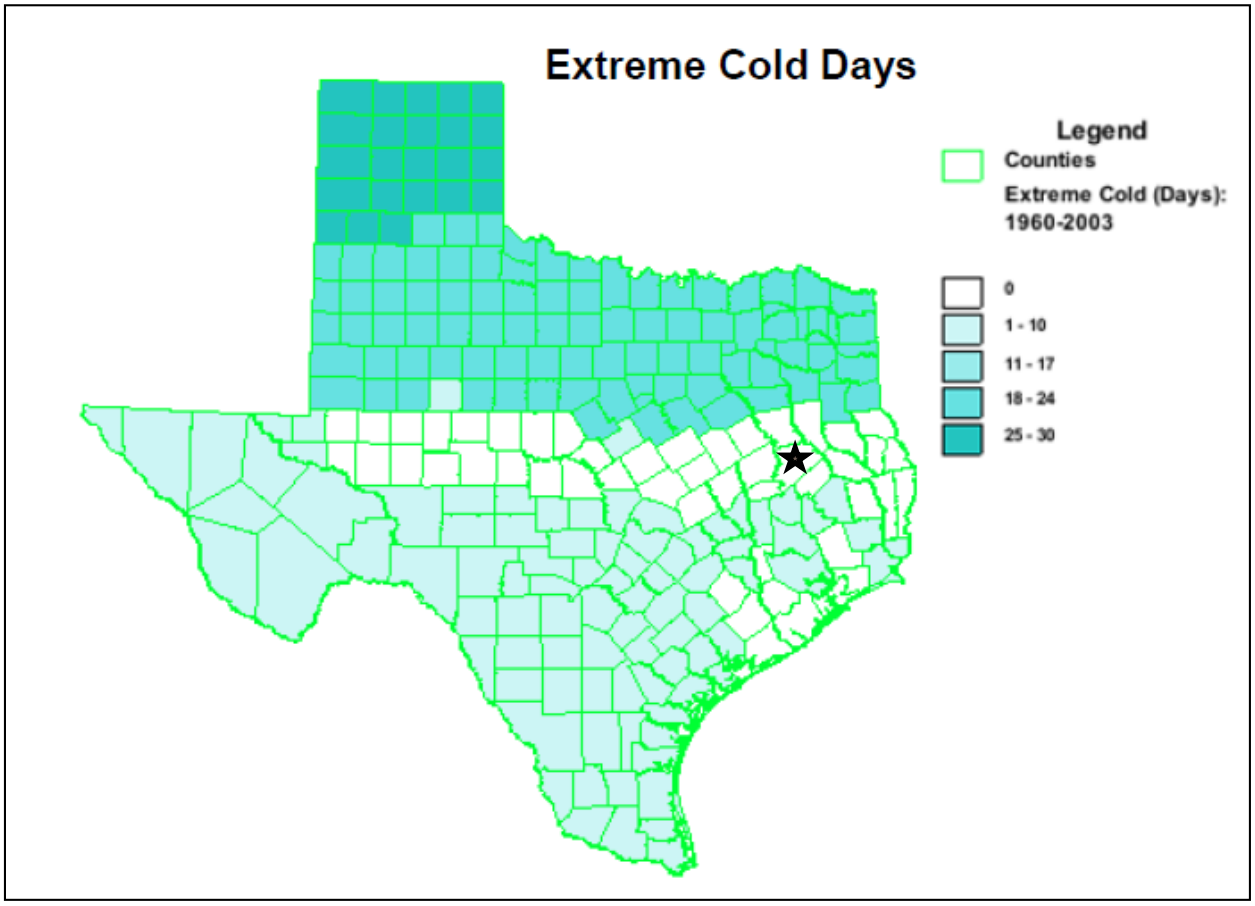


Table 12-1. Types of Winter Storms

TYPE OF WINTER STORM	DESCRIPTION
Winter Weather Advisory	This alert may be issued for a variety of severe conditions. Weather advisories may be announced for snow, blowing or drifting snow, freezing drizzle, freezing rain, or a combination of weather events.
Winter Storm Watch	Severe winter weather conditions may affect your area (freezing rain, sleet or heavy snow may occur separately or in combination).
Winter Storm Warning	Severe winter weather conditions are imminent.

[1] Houston County indicated by star.

SECTION 12: WINTER STORM

TYPE OF WINTER STORM	DESCRIPTION
Freezing Rain or Freezing Drizzle	Rain or drizzle is likely to freeze upon impact, resulting in a coating of ice glaze on roads and all other exposed objects.
Sleet	Small particles of ice usually mixed with rain. If enough sleet accumulates on the ground, it makes travel hazardous.
Blizzard Warning	Sustained wind speeds of at least 35 mph are accompanied by considerable falling or blowing snow. This alert is the most perilous winter storm with visibility dangerously restricted.
Frost/Freeze Warning	Below freezing temperatures are expected and may cause significant damage to plants, crops and fruit trees.
Wind Chill	A strong wind combined with a temperature slightly below freezing can have the same chilling effect as a temperature nearly 50 degrees lower in a calm atmosphere. The combined cooling power of the wind and temperature on exposed flesh is called the wind-chill factor.

LOCATION

Because winter storm events are not confined to specific geographic boundaries, all existing and future buildings, facilities and populations in all areas for Houston County are considered to be exposed to this hazard and could potentially be impacted.

EXTENT

The extent or magnitude of severe winter storms is measured in intensity based on the temperature and level of accumulations as shown in Table 12-2. This chart can be read in conjunction with the wind-chill factor described in Figure 12-2. This is an index developed by the National Weather Service, although the chart is not applicable when temperatures are over 50° or winds are calm.

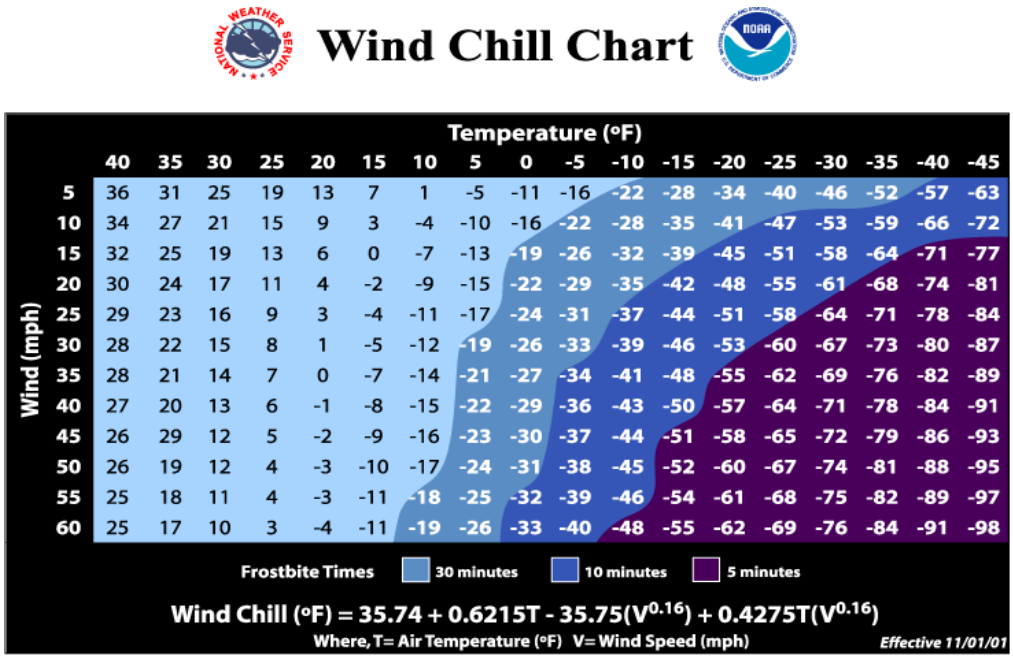
Table 12-2. Magnitude of Severe Winter Storms

INTENSITY	TEMPERATURE	EXTENT DESCRIPTION
Mild	40° – 50°	Winds less than 10 mph and freezing rain or light snow falling for short durations with little or no accumulations
Moderate	30° – 40°	Winds 10 – 15 mph and sleet and/or snow up to 4 inches

SECTION 12: WINTER STORM

INTENSITY	TEMPERATURE	EXTENT DESCRIPTION
Significant	25° – 30°	Intense snow showers accompanied with strong gust winds, between 15 and 20 mph with significant accumulation
Extreme	20° – 25°	Wind driven snow that reduces visibility, heavy winds (between 20 to 30 mph), and sleet or ice up to 5 millimeters in diameter
Severe	Below 20°	Winds of 35 mph or more and snow and sleet greater than 4 inches

Figure 12-2. Wind Chill Chart



Wind chill temperature is a measure of how cold the wind makes real air temperature feel to the human body. Since wind can dramatically accelerate heat loss from the body, a blustery 30° day would feel just as cold as a calm day with 0° temperatures. Houston County has never experienced a blizzard, but based on 9 previous occurrences recorded from 1950 to 2012, it has been subject to winter storm watches, warnings, freezing rain, sleet, snow and wind chill.

The average number of cold days is similar for the entire county planning area. Therefore the intensity or extent of a winter storm event to be mitigated for the area ranges from mild to moderate according to the definitions at Table 12-2.

SECTION 12: WINTER STORM

HISTORICAL OCCURRENCES

Table 12-3 shows historical occurrences for the county from 1950 to 2012 provided by the NCDC and SHELDUS databases. There have been 9 recorded events in Houston County, which include events for storm watches, warnings, freezing rain, sleet, snow and wind chill. Historical winter storm information, as provided by the NCDC and SHELDUS, shows winter storm activity across a multi-county forecast area for each event, the appropriate percentage of the total property and crop damage reported for the entire forecast area has been allocated to each county impacted by the event.

Table 12-3. Historical Winter Storm Events, 1950-2010

JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Houston County	1/9/1962	0	0	$19,686	$19,686
Houston County	12/10/1972	0	0	$197	$0
Houston County	1/8/1973	0	0	$1,969	$196,850
Houston County	3/29/1987	0	0	$0	$35,971
Houston County	2/9/1994	0	0	$64,935	$0
Houston County	1/12/1997	0	0	$34,783	$0
Houston County	12/13/2000	0	0	$111,111	$0
Houston County	1/16/2007	0	0	$2,833	$0
Houston County	2/4/2011	0	0	$0	$0
Houston County		**0**	**0**	**$235,513**	**$252,507**

SIGNIFICANT PAST EVENTS

February 4, 2011 – Houston County

A very cold air mass was in place in early February with overnight lows in the teens and 20s. A low pressure system moved from west to east across northern Texas on February 3rd and 4th drawing Gulf moisture into the area in the form of freezing rain and drizzle with some snow also occurring well north and northwest of

Houston. A period of freezing drizzle was followed by period of snow. Snow accumulated 1 to 2 inches on top of an icy glaze.

PROBABILITY OF FUTURE EVENTS

According to historical records, Houston County experiences one winter storm event every 5 years. Hence, the probability of a future winter storm event affecting the jurisdictions within Houston County and Crockett ISD, Latexo ISD, and Houston County WCID #1 is occasional, with a winter storm likely to occur within the next 5 years.

VULNERABILITY AND IMPACT

During periods of extreme cold and freezing temperatures, water pipes can freeze and crack and ice can build up on power lines, causing them to break under the weight or causing tree limbs to fall on the lines. These events can disrupt electric service for long periods.

Economic impact may be felt by increased consumption of heating fuel, which can lead to energy shortages and higher prices. House fires and resulting deaths tend to occur more frequently from increased and improper use of alternate heating sources. Fires during winter storms also present a greater danger because water supplies may freeze and impede firefighting efforts. In general, the study area is at risk with ice and snow hazards and extreme cold temperatures.

All populations, buildings, critical facilities, and infrastructure in Houston County are vulnerable to severe winter events. People and animals are subject to health risks from extended exposure to cold air. Elderly people are at greater risk of death from hypothermia during these events, especially in the rural areas of the county where populations are sparse, icy roads may impede travel, and there are fewer neighbors to check in on the elderly. According to the U.S. Center for Disease Control, every year hypothermia kills about 600 Americans, half of whom are 65 years of age or older.

Historic loss, in 2013 dollars, is estimated at $1,728,616 in damages over the 62-year recording period giving an approximate loss of $27,881 in damages annually (Table 12-4). The potential severity of impact has been substantial with fatalities resulting.

Table 12-4. Potential Annualized Losses, 1950-2012

JURISDICTION	PROPERTY & CROP LOSS	ANNUALIZED LOSS ESTIMATES
Houston County	$1,728,616	$27,881

SECTION 13: HAIL

HAZARD DESCRIPTION

Hailstorms are a potentially damaging outgrowth of severe thunderstorms. Early in the developmental stages of a hailstorm, ice crystals form within a low pressure front due to the rapid rising of warm air into the upper atmosphere, and the subsequent cooling of the air mass. Frozen droplets gradually accumulate into ice crystals, until they fall as precipitation that is round or irregularly shaped masses of ice greater than 0.75 inches in diameter. The size of hailstones is a direct result of the size and severity of the storm. High velocity updraft winds are required to keep hail in suspension in thunderclouds. The strength of the updraft is a byproduct of heating on the Earth's surface. Higher temperature gradients above Earth's surface result in increased suspension time and hailstone size.

LOCATION

Hailstorms are a potentially damaging outgrowth of severe thunderstorms. As a result, they are not confined to any specific geographic location, and can vary greatly in terms of size, location, intensity and duration. Therefore, the Houston County planning area is equally at risk to the hazard of hail.

EXTENT

The National Weather Service (NWS) classifies a storm as severe if hail of three-quarters of an inch in diameter (approximately the size of a penny) or greater is present, based on radar intensity or seen by observers. The intensity category of a hailstorm depends on its size and the potential damage it could cause, as depicted in the NCDC Intensity Scale in Table 13-1.

SECTION 13: HAIL

Table 13-1. Hail Intensity and Magnitude[1]

SIZE CODE	INTENSITY CATEGORY	SIZE (DIAMETER INCHES)	DESCRIPTIVE TERM	TYPICAL DAMAGE
H0	Hard Hail	Up to 0.33	Pea	No damage
H1	Potentially Damaging	0.33 – 0.60	Marble	Slight damage to plants and crops
H2	Potentially Damaging	0.60 – 0.80	Dime	Significant damage to plants and crops
H3	Severe	0.80 – 1.20	Nickel	Severe damage to plants and crops
H4	Severe	1.2 – 1.6	Quarter	Widespread glass and auto damage
H5	Destructive	1.6 – 2.0	Half Dollar	Widespread destruction of glass, roofs, and risk of injuries
H6	Destructive	2.0 – 2.4	Ping Pong Ball	Aircraft bodywork dented and brick walls pitted
H7	Very Destructive	2.4 – 3.0	Golf Ball	Severe roof damage and risk of serious injuries
H8	Very Destructive	3.0 – 3.5	Hen Egg	Severe damage to all structures
H9	Super Hailstorms	3.5 – 4.0	Tennis Ball	Extensive structural damage, could cause fatal injuries
H10	Super Hailstorms	4.0 +	Baseball	Extensive structural damage, could cause fatal injuries

The scale in Table 13-1 extends from H0 to H10, with its increments of intensity or damage potential related to hail size (distribution and maximum), texture, fall speed, speed of storm translation, and strength of the accompanying wind. Based on available data regarding the previous occurrences for the area, the Houston County planning area may experience hailstorms ranging from an H0 to an H7. Therefore the County can mitigate a storm from low risk or hard hail to a very destructive hailstorm with golf ball size hail that leads to severe roof damage and risk of serious injuries.

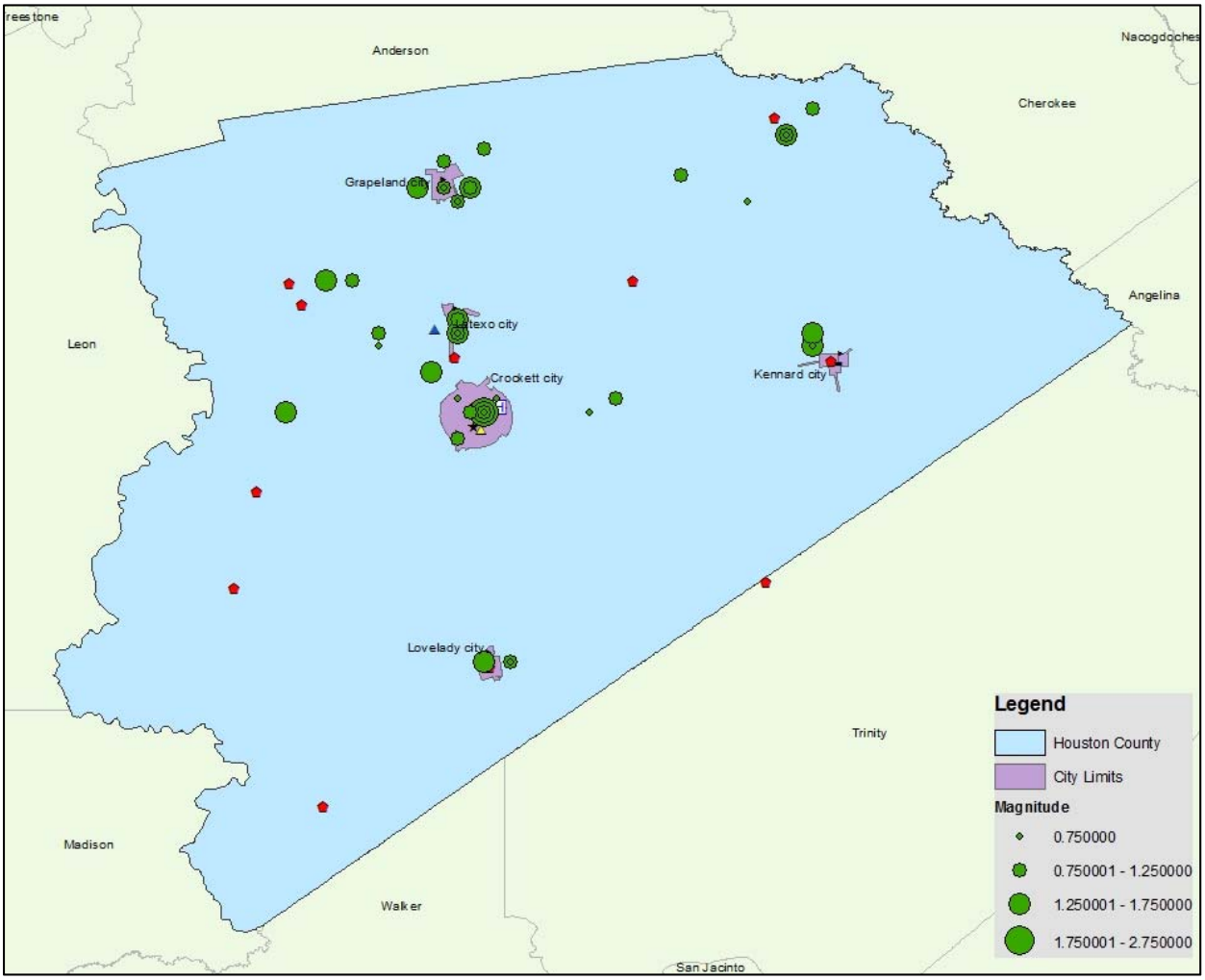
[1] NCDC Intensity Scale, based on the TORRO Hailstorm Intensity Scale.

SECTION 13: HAIL

HISTORICAL OCCURRENCES

Historical evidence shown in Figure 13-1 shows that the planning area is vulnerable to hail events overall, which typically result from severe thunderstorm activity. Indications are that 57 historical hail events are known to have impacted Houston County between 1950 and 2012 (Table 13-2). These events were reported to NCDC, NOAA, and SHELDUS databases, and may not represent all hail events to have occurred during the past 62 years. Only those events for Houston County with latitude and longitude available were plotted on the map (Figure 13-1).

Figure 13-1. Spatial Historical Hail Events in Houston County, 1950–2012[2]



[2] Source: NOAA/NCDC Records

SECTION 13: HAIL

Table 13-2. Historical Hail Impact

JURISDICTION	NUMBER OF REPORTED EVENTS	MAXIMUM HAIL SIZE (INCHES)
Houston County	57	2.75

Table 13-3. Historical Hail Events, 1950-2012[3]

JURISDICTION	DATE	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
UNKNOWN	4/9/1975		0	0	$50,000	$0
UNKNOWN	5/12/1978		0	0	$500	$0
KENNARD	4/20/1993	0.75 inch	0	0	$500	$0
COUNTY	4/25/1993	1.75 inch	0	0	$5,000	$0
GRAPELAND	8/19/1995	0.75 inch	0	0	$2,000	$0
PENNINGTON	8/19/1995	0.75 inch	0	0	$2,000	$0
WESLEY CHAPPEL	1/23/1996	0.75 inch	0	0	$5,000	$0
LATEXO	4/22/1996	0.75 inch	0	0	$5,000	$0
CROCKETT	4/22/1996	0.75 inch	0	0	$5,000	$0
GRAPELAND	4/28/1996	0.75 inch	0	0	$5,000	$0
LOVELADY	7/24/1996	0.75 inch	0	0	$5,000	$0
CROCKETT	5/15/1997	0.75 inch	0	0	$5,000	$0
WECHES	6/13/1997	1.75 inch	0	0	$10,000	$0
WECHES	6/13/1997	1.00 inch	0	0	$5,000	$0
WECHES	10/23/1997	1.75 inch	0	0	$5,000	$0
CROCKETT	11/5/1997	1.75 inch	0	0	$10,000	$0
CROCKETT	11/5/1997	1.00 inch	0	0	$5,000	$0
CROCKETT	11/5/1997	0.75 inch	0	0	$5,000	$0
CROCKETT	11/5/1997	1.00 inch	0	0	$5,000	$0
CROCKETT	11/5/1997	0.75 inch	0	0	$5,000	$0
CROCKETT	11/5/1997	1.75 inch	0	0	$10,000	$0

[3] Only recorded events with fatalities, injuries, and/or damages are listed.

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JURISDICTION	DATE	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
UNKNOWN	8/29/1998		0	0	$20,000	$0
WECHES	3/12/1999	1.00 inch	0	0	$10,000	$0
GRAPELAND	3/24/1999	1.00 inch	0	0	$10,000	$0
CROCKETT	3/24/1999	1.75 inch	0	0	$15,000	$0
GRAPELAND	3/24/1999	1.00 inch	0	0	$10,000	$0
LOVELADY	5/2/1999	1.00 inch	0	0	$15,000	$0
GRAPELAND	2/18/2000	0.88 inch	0	0	$10,000	$0
KENNARD	3/10/2000	1.75 inch	0	0	$50,000	$0
GRAPELAND	3/16/2000	1.00 inch	0	0	$15,000	$0
LOVELADY	3/18/2000	0.75 inch	0	0	$10,000	$0
GRAPELAND	4/7/2000	0.88 inch	0	0	$10,000	$0
CROCKETT	4/7/2000	1.50 inch	0	0	$15,000	$0
LATEXO	2/26/2001	1.00 inch	0	0	$5,000	$0
CROCKETT	5/6/2001	0.88 inch	0	0	$3,000	$0
CROCKETT	5/6/2001	0.88 inch	0	0	$2,000	$0
CROCKETT	3/30/2002	0.75 inch	0	0	$5,000	$0
CROCKETT	5/29/2002	0.75 inch	0	0	$3,000	$0
LATEXO	5/29/2002	0.75 inch	0	0	$3,000	$0
KENNARD	12/23/2002	0.75 inch	0	0	$7,000	$0
WECHES	5/16/2003	0.75 inch	0	0	$3,000	$0
GRAPELAND	4/7/2004	1.25 inch	0	0	$5,000	$0
WECHES	4/7/2004	1.00 inch	0	0	$5,000	$0
CROCKETT	4/10/2004	0.75 inch	0	0	$2,000	$0
CROCKETT	4/10/2004	2.75 inch	0	0	$30,000	$0
GRAPELAND	5/31/2004	0.75 inch	0	0	$1,000	$0
KENNARD	5/31/2004	1.75 inch	0	0	$10,000	$0
LATEXO	3/22/2005	1.50 inch	0	0	$19,000	$0
GRAPELAND	4/5/2005	0.75 inch	0	0	$3,000	$0
LOVELADY	5/28/2005	0.88 inch	0	0	$5,000	$0
GRAPELAND	6/6/2005	1.00 inch	0	0	$10,000	$0

SECTION 13: HAIL

JURISDICTION	DATE	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
GRAPELAND	4/21/2006	0.75 inch	0	0	$2,000	$0
LATEXO	4/16/2009	1.75 inch	0	0	$5,000	$0
LATEXO	4/16/2009	1.75 inch	0	0	$4,000	$0
GRAPELAND	8/26/2009	1.75 inch	0	0	$5,000	$0
LATEXO	4/25/2011	1.00 inch	0	0	$3,000	$0
GRAPELAND	4/25/2011	1.00 inch	0	0	$3,000	$0
GRAPELAND	4/25/2011	1.75 inch	0	0	$4,000	$0
GRAPELAND	4/25/2011	1.00 inch	0	0	$3,000	$0
LOVELADY	4/26/2011	1.75 inch	0	0	$3,000	$0
County Totals			**0**	**0**	**$493,000**	**$0**

Table 13-4. Summary of Historical Tornado Events, 1950-2012

JURISDICTION	EVENTS	MAGNITUDE (max extent)	DEATHS	INJURIES	PROPERTY DAMAGE (2013 DOLLARS)	CROP DAMAGE (2013 DOLLARS)
Crockett	21	2.75 inches	0	0	$170,487	$0
Grapeland	18	1.75 Inches	0	0	$126,860	$0
Kennard	4	1.75 Inches	0	0	$89,887	$0
Latexo	10	1.75 Inches	0	0	$53,454	$0
Lovelady	6	1.75 Inches	0	0	$51,022	$0
Houston County	**57**	**2.75 Inches**	**0**	**0**	**$810,255**	**$0**

SIGNIFICANT PAST EVENTS

June 14, 2012 – Houston County

A southward moving early morning thunderstorm produced large hail in Houston County east of Crockett. Hail to the size of half dollars was reported falling along Highway 7 approximately 3 miles east of the Houston County Airport.

SECTION 13: HAIL

April 25, 2011 – Houston County

Severe thunderstorms erupted along the dry line with the help of a shortwave aloft and produced large hail, strong damaging winds and tornadoes. Severe thunderstorms produced a lot of nickel size hail and a few hailstones up to golf ball size.

August 26, 2009 – Houston County

Showers and thunderstorms developed across Southeast Texas on the back side of a mid and upper level low centered to the east along the Louisiana and Mississippi border. Some of the stronger thunderstorms became severe and produced large hail and strong damaging winds. A severe thunderstorm produced golf ball size hail just west of Grapeland.

December 23, 2002 – Houston County

0.75 inch hail. This December 23rd tornado and severe thunderstorm outbreak developed as a strong upper level low pressure system moved out of the southwestern U.S. and off to the east and northeast across the state of Texas. Abundant low level moisture was already in place across southeast Texas. Very strong shear, or turning and strengthening of the winds with height, was expected to last throughout the day. A warm front moved northward throughout the day and became a focus for the development of showers and thunderstorms. With the strong shear present, a significant number of thunderstorms quickly became severe. During an eighteen hour stretch, ten tornadoes and several large hail events were reported mainly north and west of the Houston area. Locations from the Houston area to the beaches felt the brunt of this event in the evening when a squall line rapidly moved eastward toward the coast. Hail the size of 0.75 inch occurred in Kennard.

PROBABILITY OF FUTURE EVENTS

Based on the 57 events over the last 62 years (1950 – 2012), it is probable that a hail event is a highly likely occurrence happening within the next year for the county planning area and the campuses of Crockett ISD, Latexo ISD, and Houston County WCID #1. Most hailstorms occur during the spring (March, April and May) and in the fall during the month of September. Warning time for a hailstorm is generally minimal or there is no warning.

VULNERABILITY AND IMPACT

Damage from hail approaches $1 billion in the US each year. Much of the damage inflicted by hail is to crops. Even relatively small hail can shred plants to ribbons in a matter of minutes. Vehicles, roofs of buildings and homes, and landscaping are the other things most commonly damaged by hail.

Hail has been known to cause injury to humans, and occasionally has been fatal. Impact of hail experienced in the region has resulted in no injuries or fatalities supporting a possible limited severity of impact meaning

injuries are treatable with first aid, minor quality of life is lost, facilities shut down for 24 hours or less, and less than 10% of property is destroyed.

Annualized loss is neglible for hail damage; approximately $13,069 of damage occurs annually based on available data. Frequency of return of a hail event can be assumed to be one hail event every year.

Table 13-5. Potential Annualized Losses by Jurisdiction, 1950-2012

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATES
Crockett	$170,487	$2,750
Grapeland	$126,860	$2,046
Kennard	$89,887	$1,450
Latexo	$53,454	$862
Lovelady	$51,022	$823
Houston County	**$810,255**	**$13,069**

SECTION 14: DAM FAILURE

HAZARD DESCRIPTION

Dams are water storage, control or diversion structures that impound water upstream in reservoirs. Dam failure can take several forms, including a collapse of or breach in the structure. While most dams have storage volumes small enough that failures have few or no repercussions, dams storing large amounts can cause significant flooding downstream. Dam failures can result from any one or a combination of the following causes:

- Prolonged periods of rainfall and flooding, which cause most failures;
- Inadequate spillway capacity, resulting in excess overtopping of the embankment;
- Internal erosion caused by embankment or foundation leakage or piping;
- Improper maintenance, including failure to remove trees, repair internal seepage problems, or maintain gates, valves, and other operational components;
- Improper design or use of improper construction materials;
- Failure of upstream dams in the same drainage basin;
- Landslides into reservoirs, which cause surges that result in overtopping;
- High winds, which can cause significant wave action and result in substantial erosion;
- Destructive acts of terrorists; and
- Earthquakes, which typically cause longitudinal cracks at the tops of the embankments, leading to structural failure.

Benefits provided by dams include water supplies for drinking, irrigation and industrial uses; flood control; hydroelectric power; recreation; and navigation. At the same time, dams also represent a risk to public safety. Dams require ongoing maintenance, monitoring, safety inspections, and sometimes even rehabilitation to continue safe service.

In the event of a dam failure, the energy of the water stored behind the dam is capable of causing rapid and unexpected flooding downstream, resulting in loss of life and great property damage. A devastating effect on water supply and power generation could be expected as well. The terrorist attacks of September 11, 2001 generated increased focus on protecting the country's infrastructure, including ensuring the safety of dams.

One major issue with the safety of dams is their age. The average age of America's 80,000 dams is 51 years. More than 2,000 dams near population centers are in need of repair, according to statistics released in 2009

by the Association of State Dam Safety Officials[1]. In addition to the continual aging of dams there have not been significant increases in the number of safety inspectors resulting in haphazard maintenance and inspection.

The Association of State Dam Safety Officials estimate that $16 billion will be needed to fix all high-hazard dams, but the total for all state dam-safety budgets is less than $60 million[2]. The current maintenance budget does not match the scale of America's long-term modifications of its watersheds. Worse still, more people are moving into risky areas. As the American population grows, dams that once could have failed without major repercussions are now upstream of cities and development.

LOCATION

The State of Texas has 7,413 dams, all regulated by the Texas Commission on Environmental Quality (TCEQ). Of these, 854 are considered "high-hazard," 779 are considered "significant-hazard," and 5,780 are considered "low-hazard." According to the American Society of Civil Engineers' "Report Card," the Association of State Dam Safety Officials reports that there are 403 unsafe dams in Texas.[3] For dams in Houston County classifications, location, volume, elevation and condition information was provided and factored into the risk ranking in Figure 14-1, which illustrates general locations for each dam in the area. Currently, there are 33 dams located in Houston County, although 31 of the dams are classified as "low-

[1] Association of State Dam Safety Officials, Journal of Dam Safety

[2] Ibid

[3] Source: http://www.asce.org/reportcard/pdf/tx.pdf

hazard" dams. Two of the dams are classified as "significant-hazard" as recorded by the U.S. Army Corps of Engineers (USACE) in the National Inventory of Dams. All dams are listed in Table 14-1 with regulation information. Local level maps of each dam is provided below in Figures 14-2 through 14-34 to graphically illustrate flood risk areas.

Figure 14-1. Dam Locations in Houston County

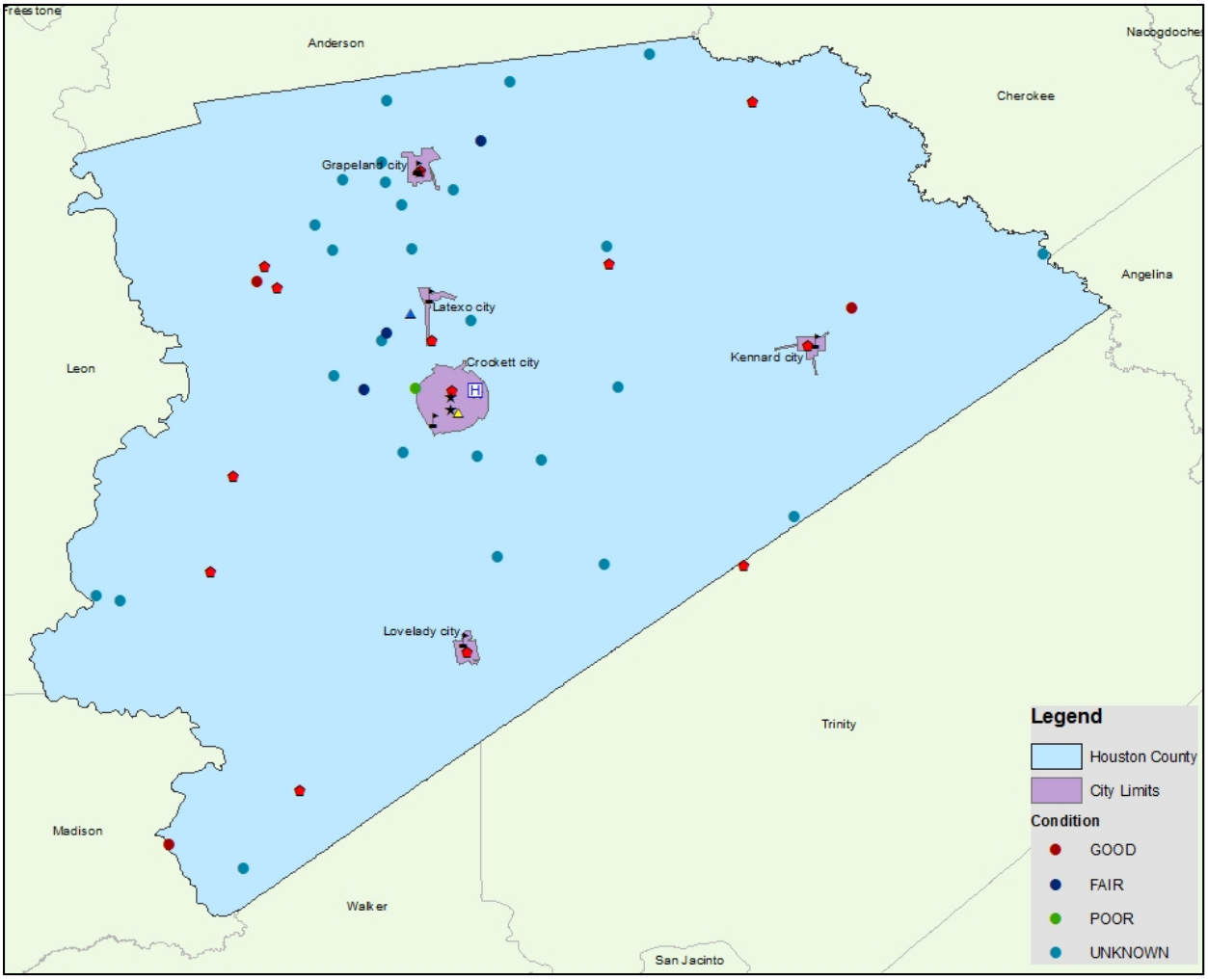

Table 14-1. Houston County Dam Survey

JURISDICTION	DAM NAME	HEIGHT (Ft.)	STORAGE (Acre Ft.)	CLASSIFICATION
Houston County	Clay Fulcher Dam	10	90	Low
Houston County	Frazier Lake Dam	36	230	Low
Houston County	Coon Dam 1	14	140	Low

SECTION 14: DAM FAILURE

JURISDICTION	DAM NAME	HEIGHT (Ft.)	STORAGE (Acre Ft.)	CLASSIFICATION
Houston County	Coon Dam 2	15	120	Low
Houston County	Lieder Lake Dam	25	280	Significant
Houston County	Skalciky Dam	17	210	Low
Houston County	Wirt Lake Dam	18	150	Low
Houston County	Spring Creek Country Club Lake Dam	33	670	Low
Houston County	Houston County Lake Dam	51	27000	Low
Houston County	Dan Pennington Dam	12	200	Low
Houston County	Bill Huff Dam	10	56	Low
Houston County	Warner Dam No 2	8	65	Low
Houston County	Warner Dam No 1	10	83	Low
Houston County	Lake Pennington Dam	18	300	Low
Houston County	Allday Dam	16	180	Low
Houston County	Northcutt Lake Dam	38	425	Low
Houston County	Lake Oliver Dam	19	50	Significant
Houston County	Cook Dam	18	135	Low
Houston County	M R Murchison Dam	14	1250	Low
Houston County	Bison Dam	28	350	Low
Houston County	Harold Goar Dam	16	140	Low
Houston County	Ratcliff Lake Dam	18	650	Low
Houston County	Malibu Club Dam	15	515	Low
Houston County	Grapeland Country Club Lake Dam	22	845	Low
Houston County	Wilkins Dam	30	250	Low
Houston County	Moore Lake Dam	30	881	Low
Houston County	Eastham Reservoir Dam	11	540	Low
Houston County	Garden Lake Dam	24	340	Low
Houston County	Barfield Lake Dam	18	91	Low
Houston County	Broxson Lake Dam	37	490	Low

SECTION 14: DAM FAILURE

JURISDICTION	DAM NAME	HEIGHT (Ft.)	STORAGE (Acre Ft.)	CLASSIFICATION
Houston County	Westbrook Lake Dam	21	230	Low
Houston County	Lake Brown Dam	30	143	Low
Houston County	Marietta Dam	20	242	Low

. **Figure 14-2. Clay Fulcher Dam Flood Risk Areas**

Figure 14-3. Frazier Lake Dam Flood Risk Areas

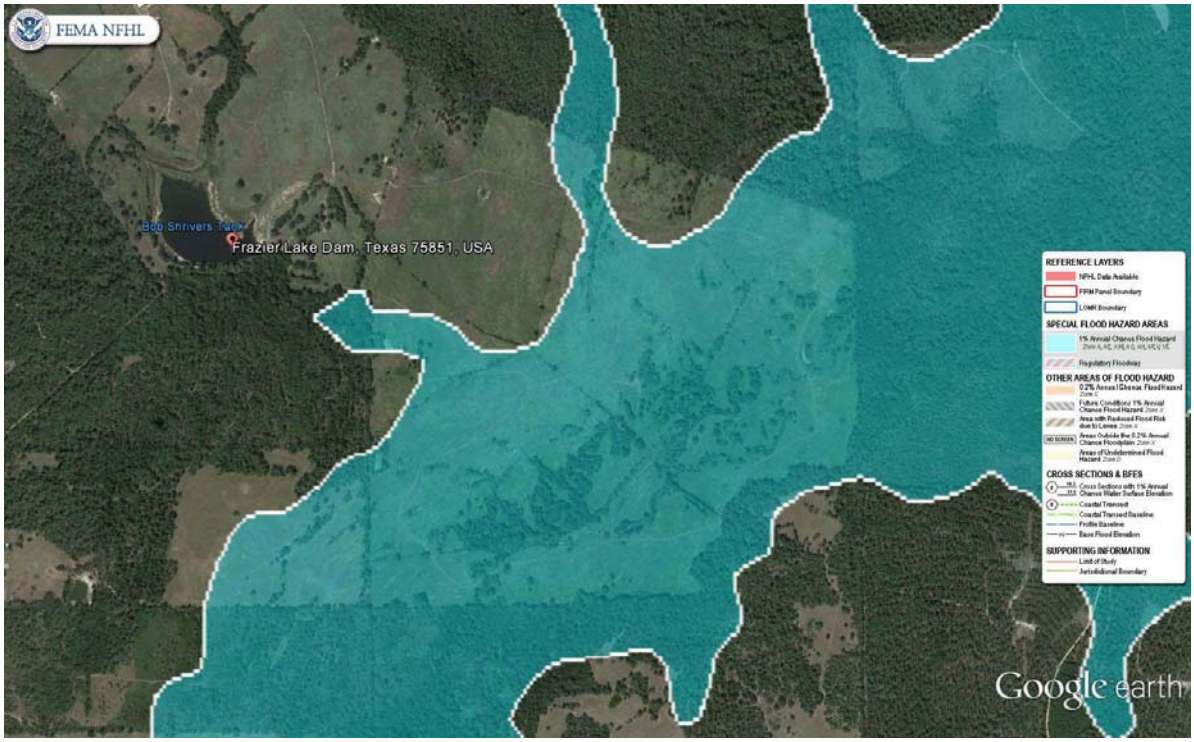

Figure 14-4. Coon Dam 1 Flood Risk Areas

Figure 14-5. Coon Dam 2 Flood Risk Areas

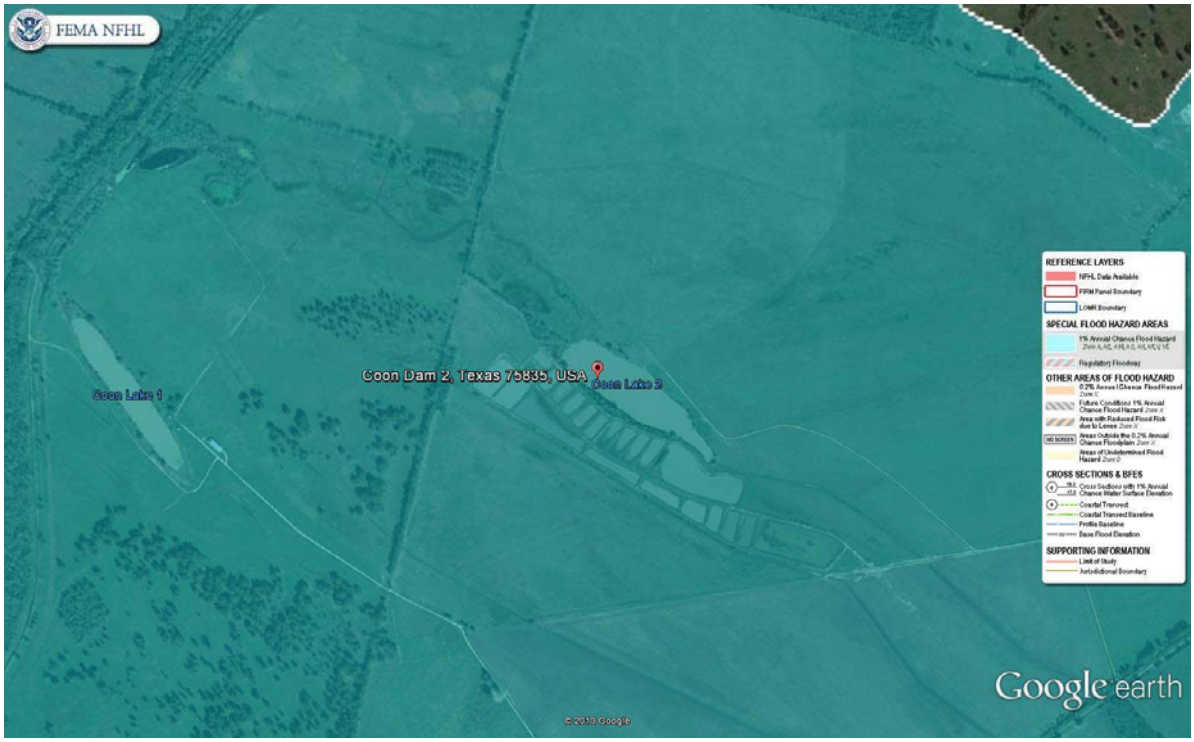

Figure 14-6. Lieder Lake Dam Flood Risk Areas

Figure 14-7. Skalicky Dam Flood Risk Areas

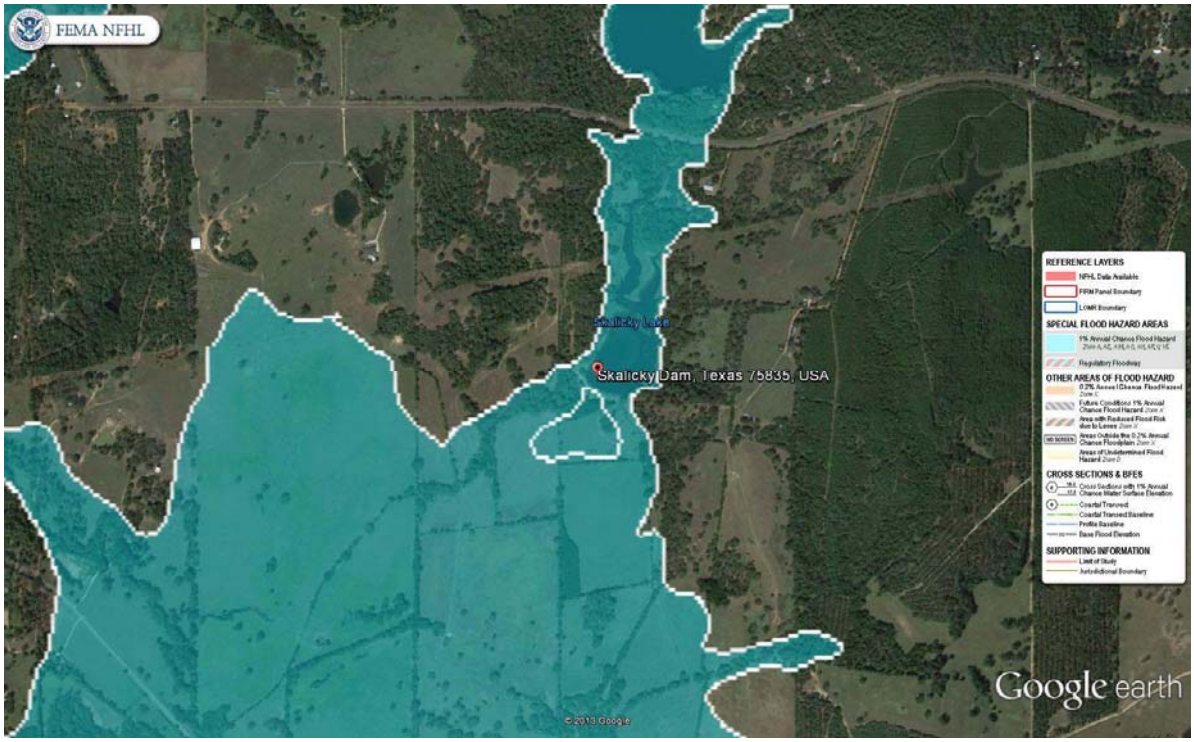

Figure 14-8. Wirt Lake Dam Flood Risk Areas

SECTION 14: DAM FAILURE

Figure 14-9. Spring Creek Country Club Lake Dam Flood Risk Areas

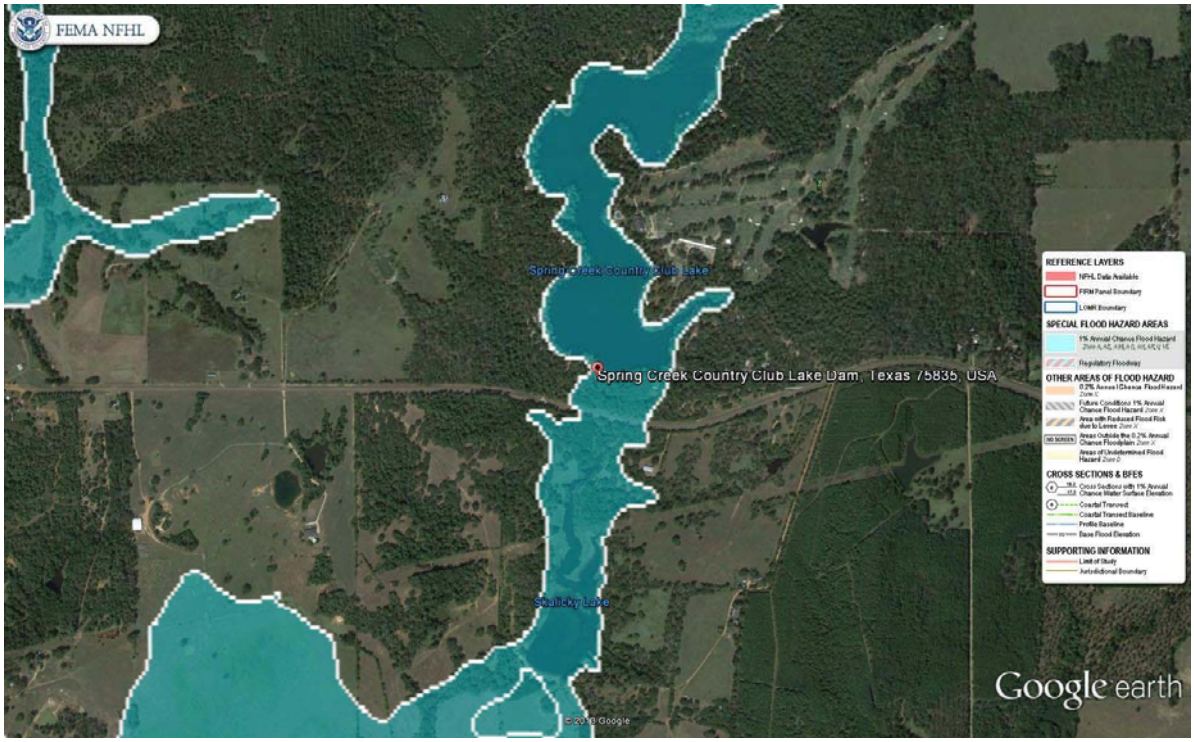

Figure 14-10. Houston County Lake Dam Flood Risk Areas

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Figure 14-11. Dan Pennington Dam Flood Risk Areas

Figure 14-12. Bill Huff Dam Flood Risk Areas

SECTION 14: DAM FAILURE

Figure 14-13. Warner Dam No 2 Flood Risk Areas

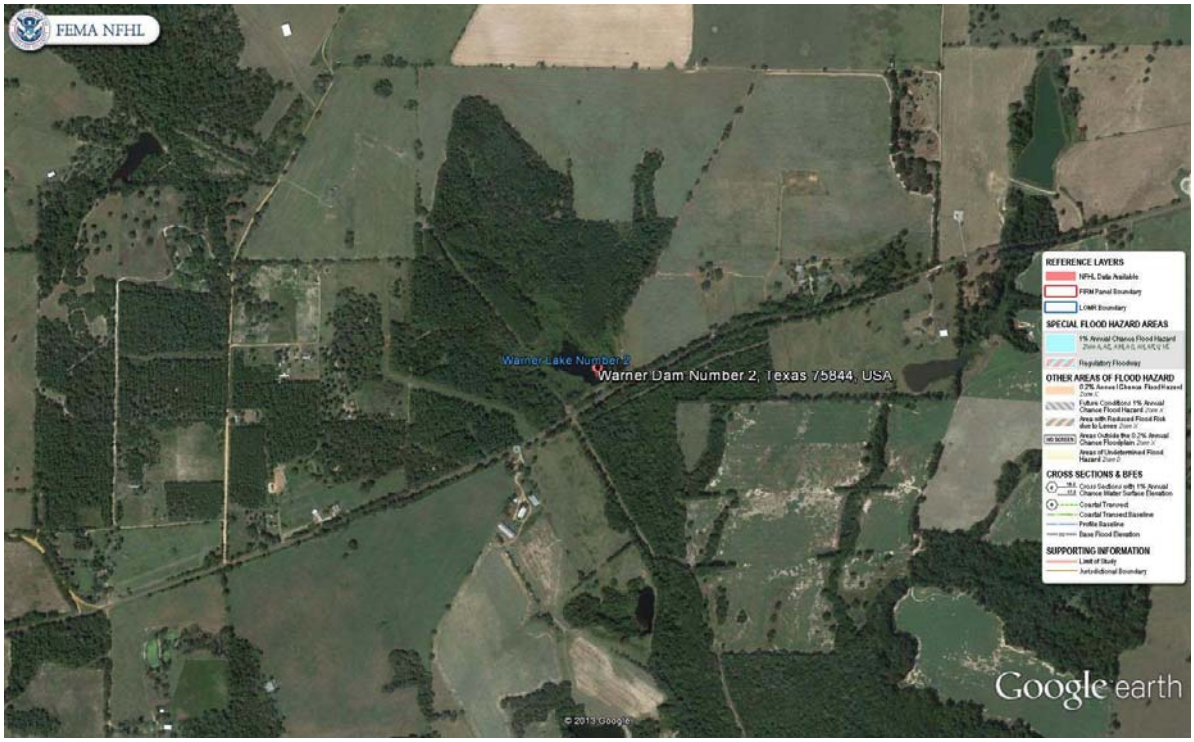
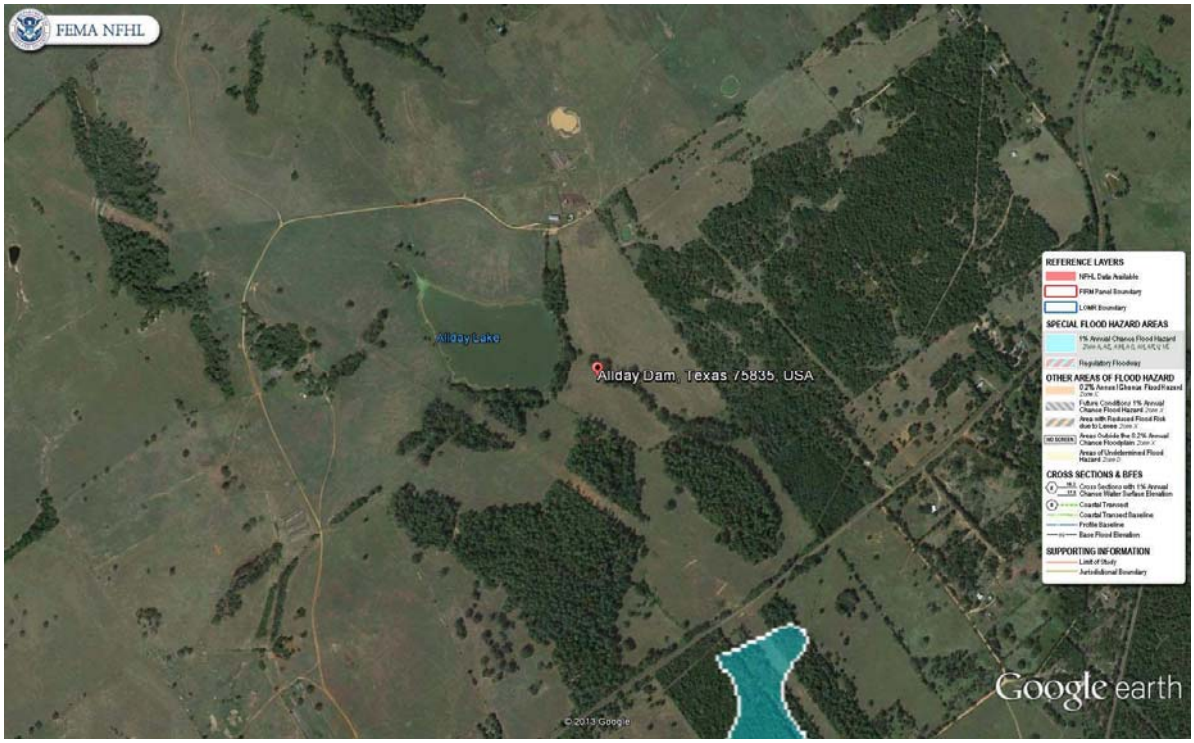


Figure 14-14. Warner Dam No 1 Flood Risk Areas

Figure 14-15. Lake Pennington Dam Flood Risk Areas

Figure 14-16. Allday Dam Flood Risk Areas



SECTION 14: DAM FAILURE

Figure 14-17. Northcutt Lake Dam Flood Risk Areas

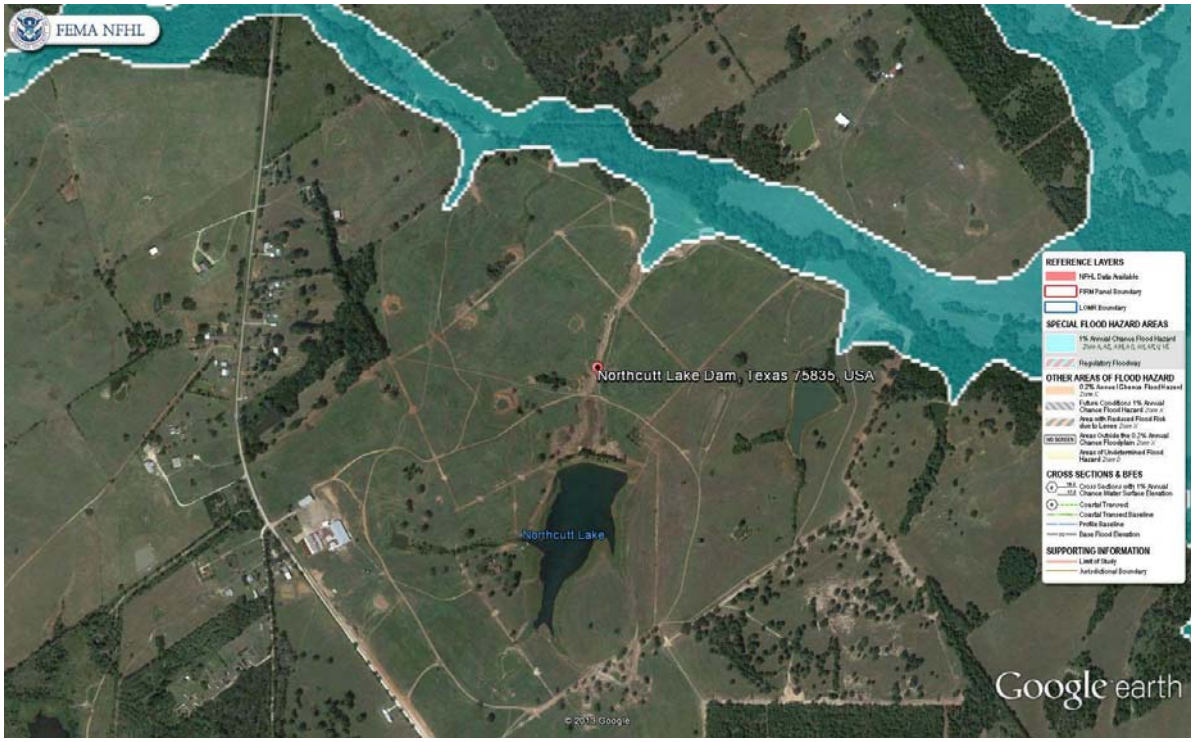


Figure 14-18. Lake Oliver Dam Flood Risk Areas

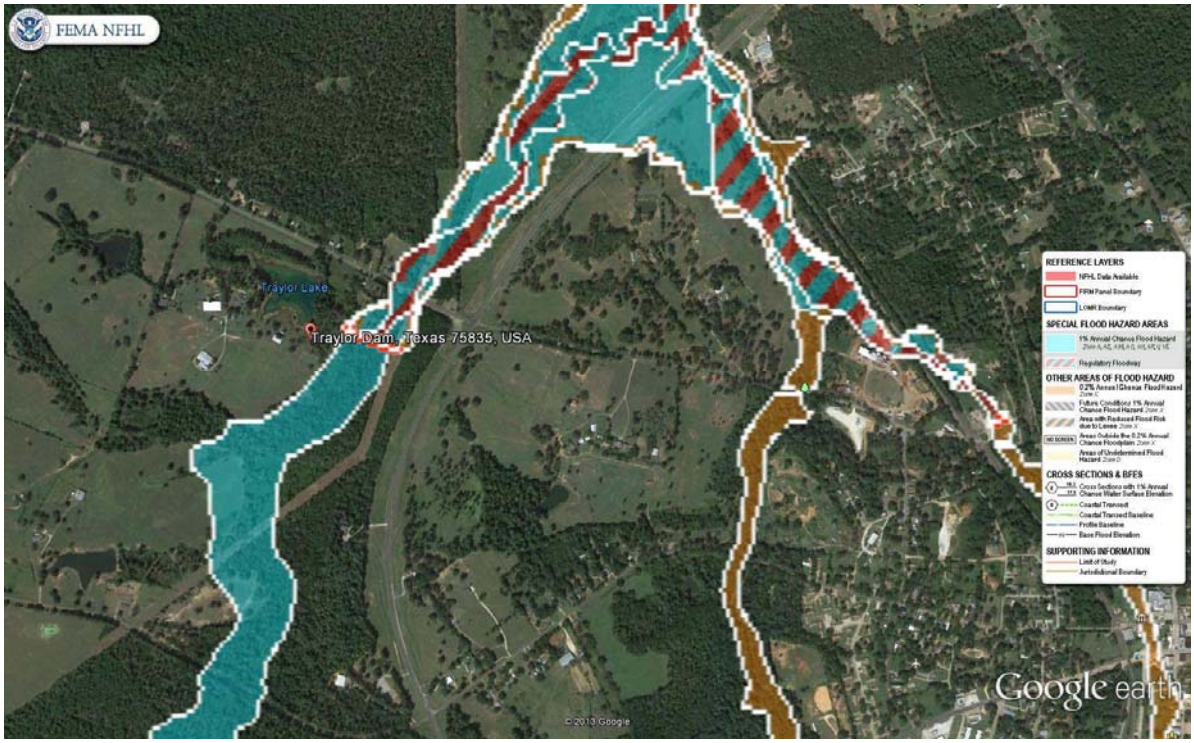


Figure 14-19. Cook Dam Flood Risk Areas

Figure 14-20. M R Murchison Dam Flood Risk Areas

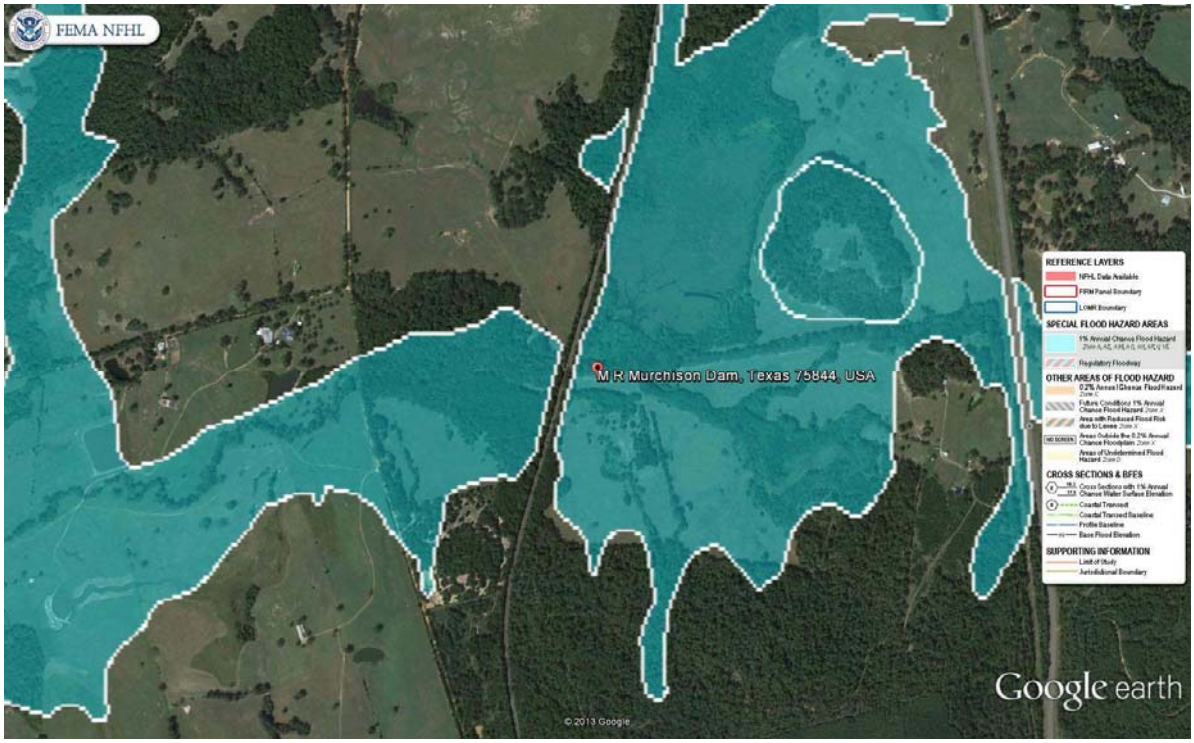


Figure 14-21. Bison Dam Flood Risk Areas

Figure 14-22. Harold Goar Dam Flood Risk Areas

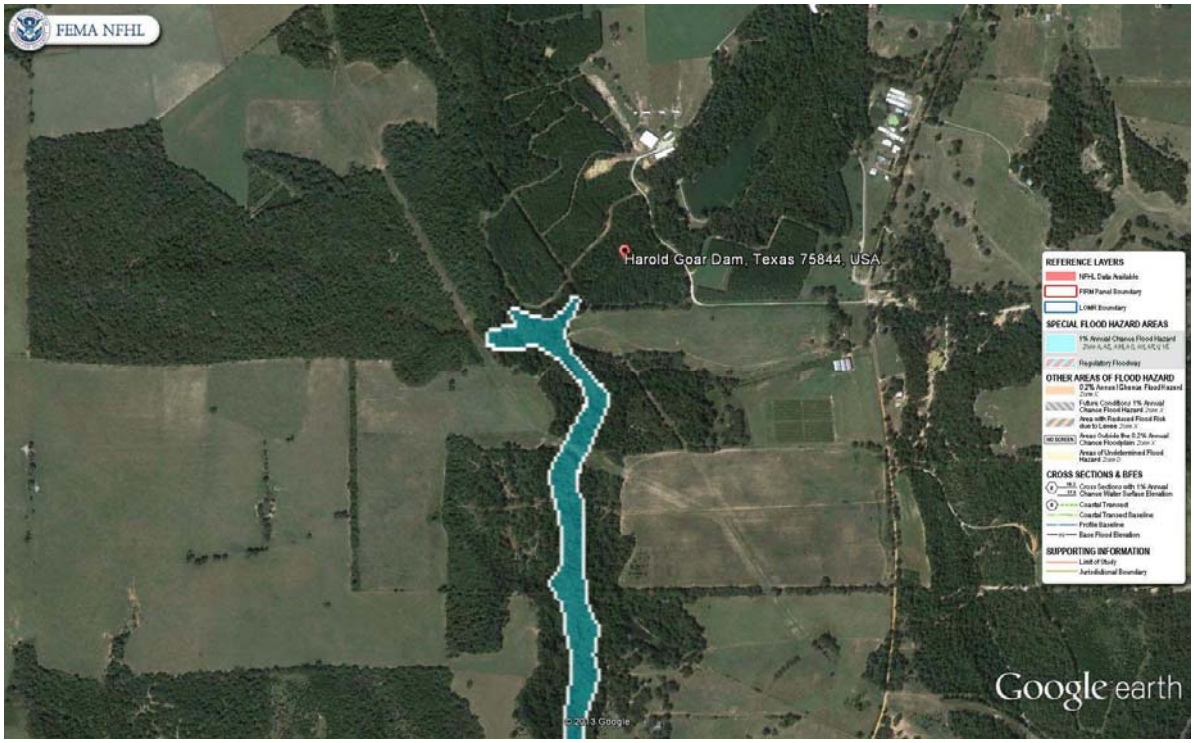


Figure 14-23. Ratcliff Lake Dam Flood Risk Areas

Figure 14-24. Malibu Club Dam Flood Risk Areas

Figure 14-25. Grapeland Country Club Lake Dam Flood Risk Areas

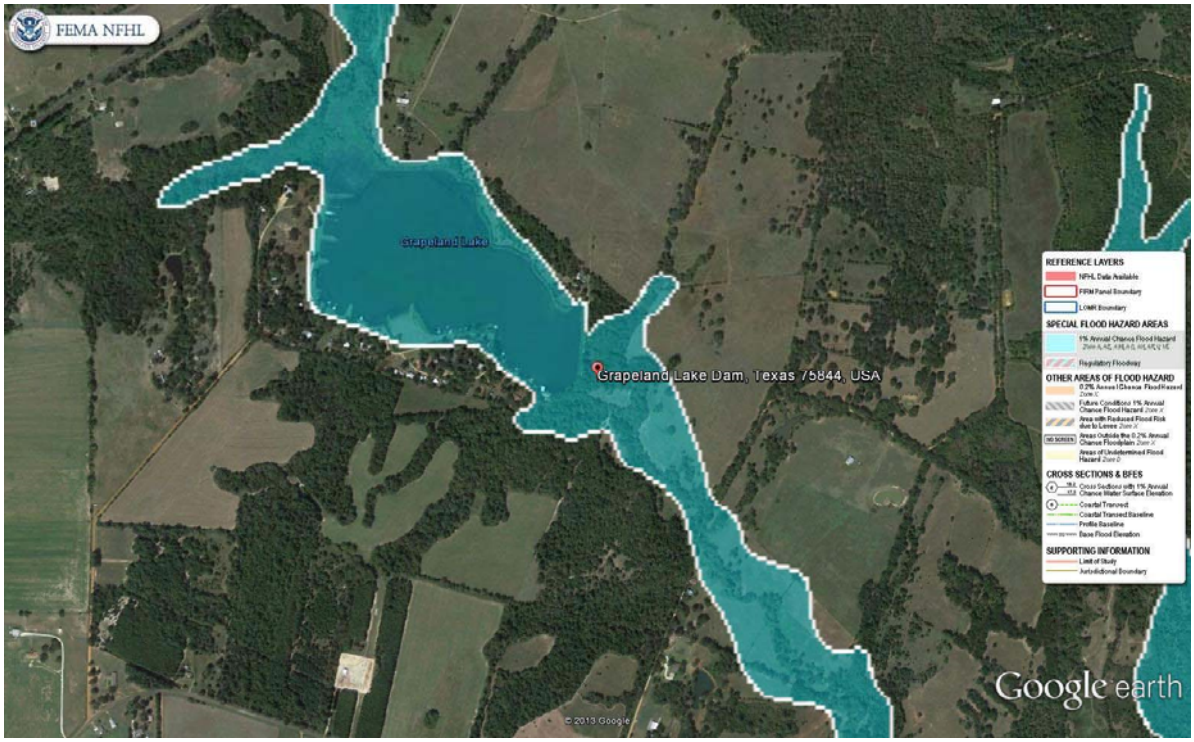
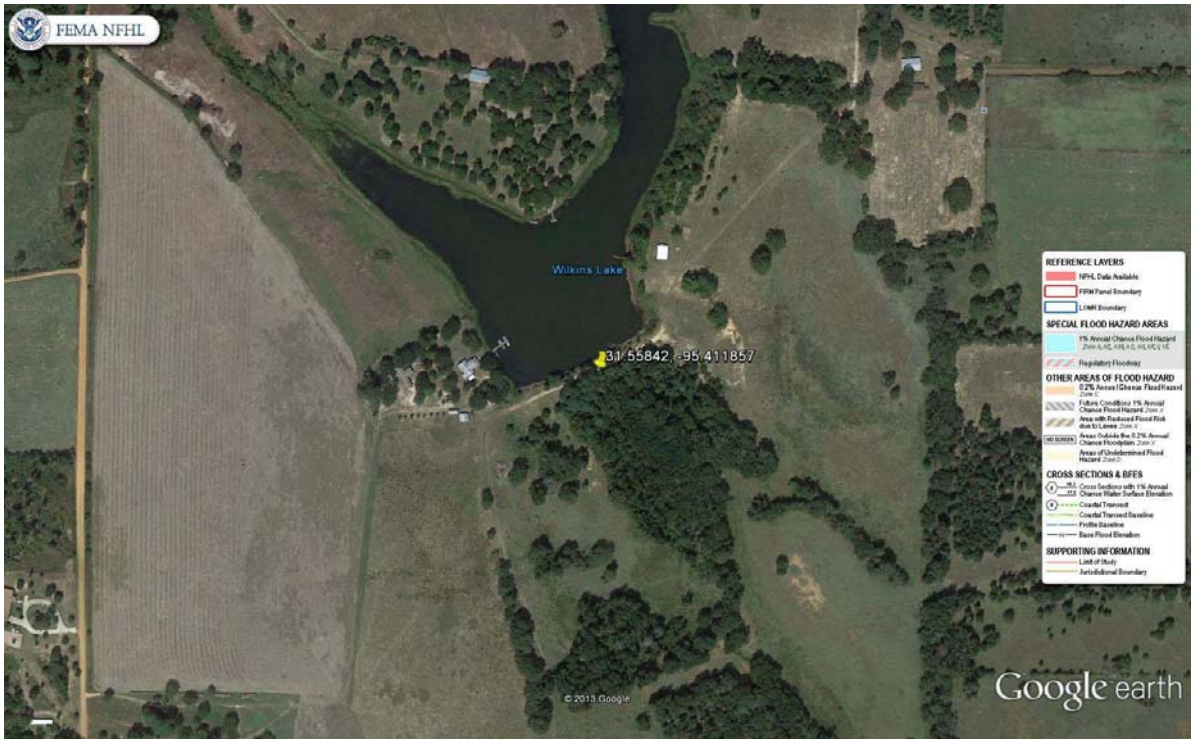


Figure 14-26. Wilkins Dam Flood Risk Areas



SECTION 14: DAM FAILURE

Figure 14-27. Moore Lake Dam Flood Risk Areas

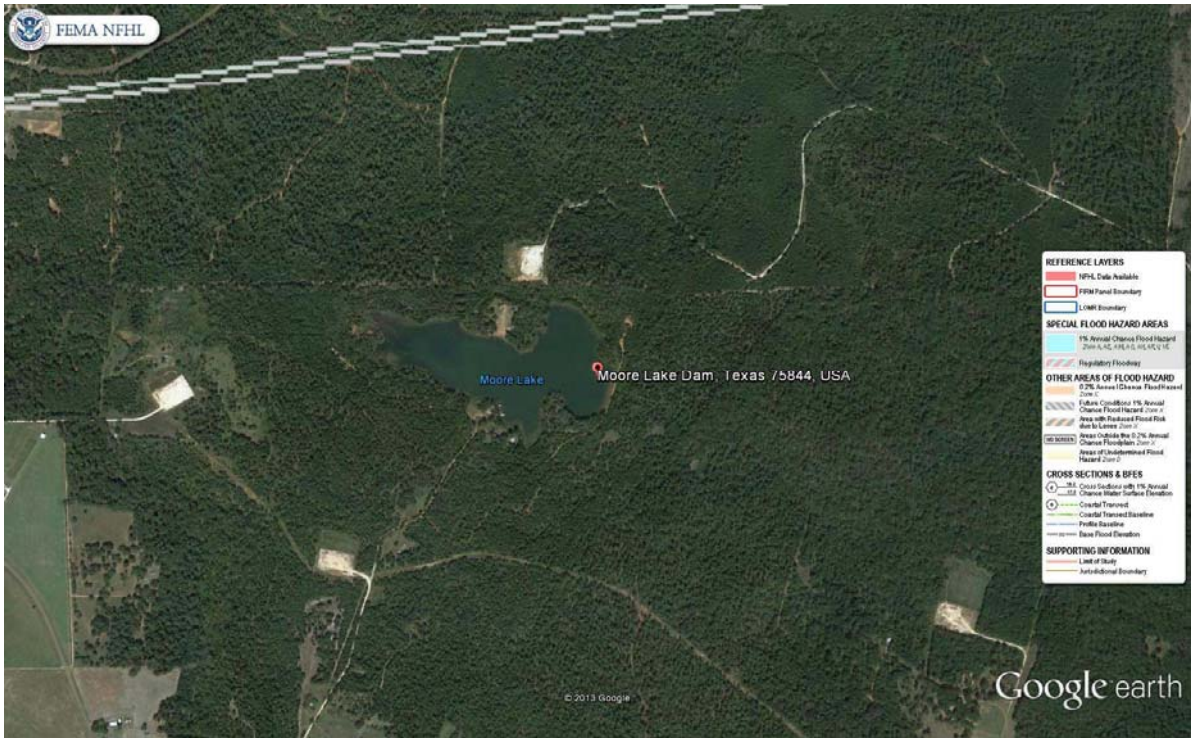


Figure 14-28. Eastham Reservoir Dam Flood Risk Areas

Figure 14-29. Garden Lake Dam Flood Risk Areas

Figure 14-30. Barfield Lake Dam Flood Risk Areas

Figure 14-31. Broxson Lake Dam Flood Risk Areas

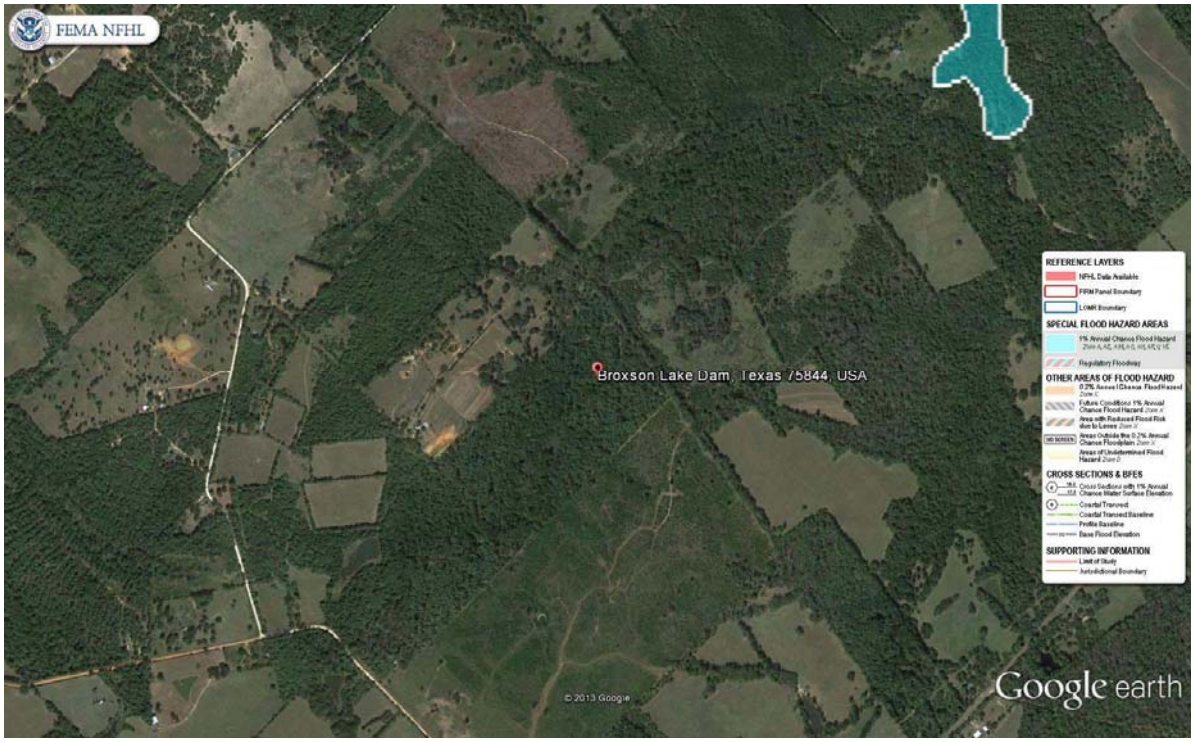


Figure 14-32. Westbrook Lake Dam Flood Risk Areas

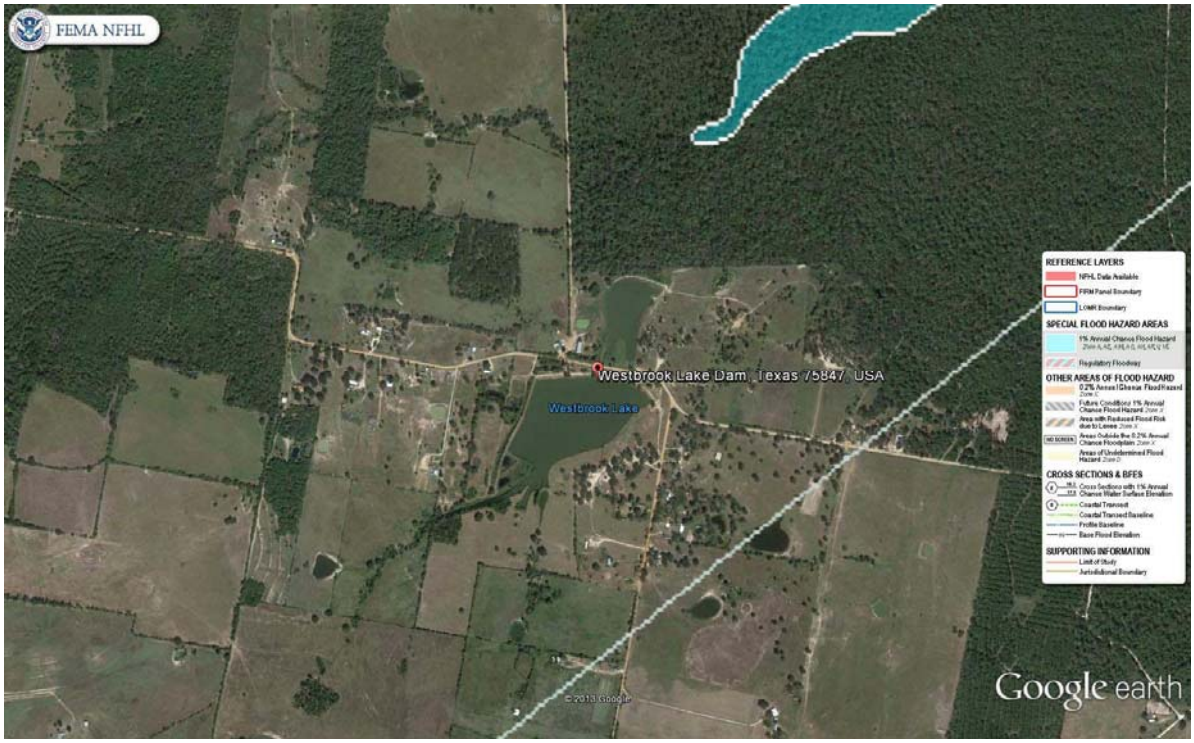


Figure 14-33. Lake Brown Dam Flood Risk Areas

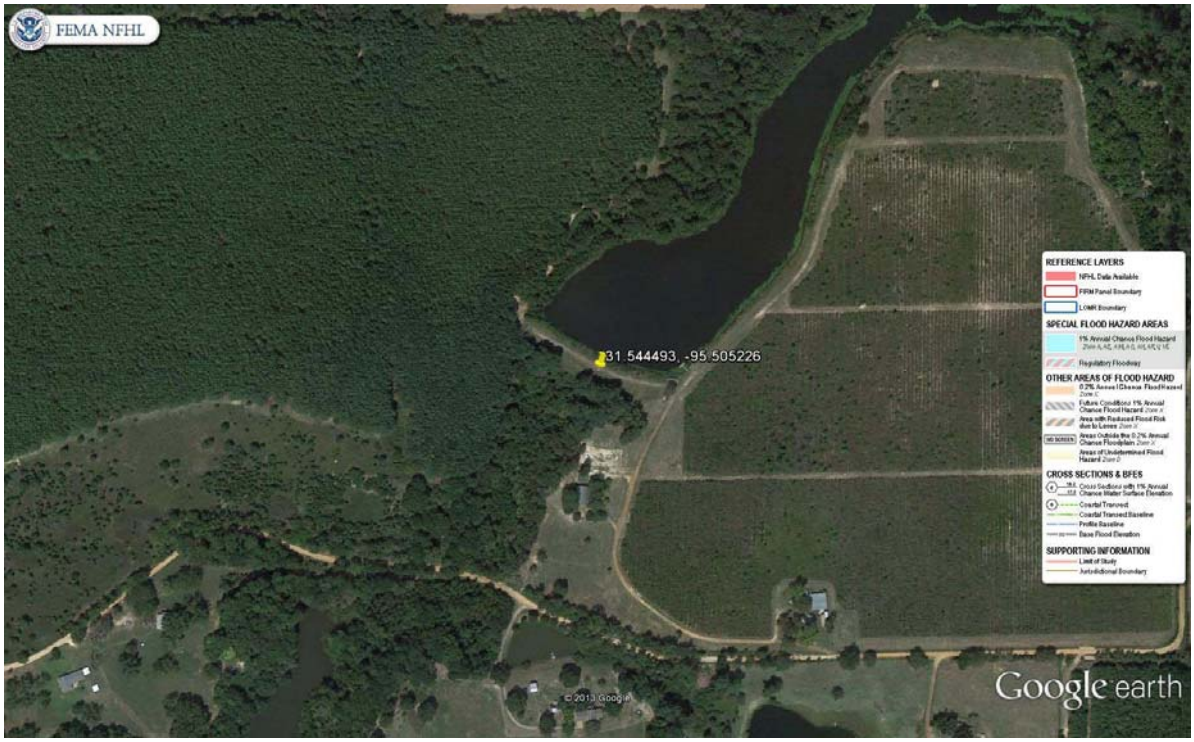


Figure 14-34. Marietta Dam Flood Risk Areas

SECTION 14: DAM FAILURE

As there are no inundation maps for the planning area, in order to determine location of potential total exposure for each dam can be estimated by using 2010 census population and building inventory data from HAZUS-MH, in combination with the location and maximum storage capacity of high and significant hazard dams. For dams with a maximum storage capacity between 10,000 and 100,000 acre-feet, all census blocks within three miles are considered to be at risk to potential dam failure hazards. For dams with a maximum storage capacity of less than 10,000 acre-feet, all census blocks within one mile are considered to be at risk to potential dam failure hazards. With developments downstream of the dams, all populations located downstream of the dams are considered to be at risk to potential safety hazard if a dam failure occurred.

EXTENT

The extent or magnitude of a dam failure event is described in terms of the classification of damages that could result from a dam's failure; not the probability of failure. The National Interagency Committee on Dam Safety defines high hazard dams as those where failure or mis-operation would cause loss of human life. Prior to 2009, high hazard dams were defined as those at which failure or mis-operation would probably cause loss of human life. Dams classified as "significant" were those at which failure or mis-operation probably would not result in loss of human life but could cause economic loss, environmental damage, disruption of lifeline facilities or other significant damage. Low hazard potential dams are those at which failure or mis-operation probably would not result in loss of human life but would cause limited economic and/or environmental losses. Losses would be limited mainly to the owner's property. Classifications for extent after 2009 are found in Table 14-2 below.

Table 14-2. Extent Classifications

HAZARD POTENTIAL CLASSIFICATION	LOSS OF HUMAN LIFE	DAM STORAGE CAPACITY
Low	None Expected	Less than 10,000 acre-feet
Significant	Probable (1 to 6)	Between 10,000 and 100,000 acre-feet
High	Loss of Life Expected (7 or More)	100,000 acre-feet or more

The extent or average magnitude of a dam failure event that could be expected for the county and the participating jurisdictions, including the independent school districts, and water control district, therein is shown in Table 14-3. The extent classification was determined by taking the average of dams in each jurisdiction and weighing low hazard dams as a 1, significant hazard dams as a 2, and high hazard dams as a 3 based on the potential severity, warning time, and duration.

SECTION 14: DAM FAILURE

Table 14-3. Extent by Jurisdiction

JURISDICTION	DAMS & CLASSIFICATION	EXTENT CLASSIFICATION	LEVEL OF INTENSITY TO MITIGATE
Houston County	33 – Total 2 – Significant 31 – Low	Low	The County only has 2 significant hazard dams that both have a maximum discharge of under 300 acre feet, therefore loss of life is not expected in a breach and any economic loss would be negligible.
Crockett	None	Low	There are no dams located within the city limits.
Grapeland	None	Low	There are no dams located within the city limits.
Kennard	None	Low	There are no dams located within the city limits.
Latexo	None	Low	There are no dams located within the town limits.
Lovelady	None	Low	There are no dams located within the city limits.

HISTORICAL OCCURRENCES

There are about 80,000 dams in the United States today.[4] Catastrophic dam failures have occurred frequently throughout the past century. Between 1918 and 1958, 33 major U.S. dam failures caused 1,680 deaths. From 1959 to 1965, nine major dams failed worldwide. Some of the largest disasters in the U.S. have resulted from dam failures. More than 520 dam incidents, including 21 dam failures, were reported in the past two years to the National Performance of Dams Program, which collects and archives information on dam performance from state and federal regulatory agencies and dam owners.

The State of Texas has not experienced loss of life or extensive economic damage due to a dam failure since the first half of the twentieth century. However, there may be many incidents that are not reported and, therefore, the actual number of incidents is likely to be greater.

There has not been a recorded dam failure event for Houston County.

[4] Federal Emergency Management Agency, Dam Safety Program, available at: http://www.fema.gov/hazards/damsafety/

SECTION 14: DAM FAILURE

PROBABILITY OF FUTURE EVENTS

No historical events of dam failure have been recorded in the Houston County planning area, though the risk of dam failure is monitored closely. Due to the lack of historical occurrences, the probability of a future event is unlikely, meaning an event is possible in the next ten years.

VULNERABILITY AND IMPACT

There are 33 dams in the Houston County planning area that are classified as significant and low hazard dams. While low hazard dams are those at which failure or mis-operation probably would not result in loss of human life and would cause limited economic and/or environmental losses, damage to agriculture and housing is possible due to the amount of low and significant hazard dams in the county.

Flooding is the most prominent effect of dam failure. If the dam failure is severe, a large amount of water would enter the downstream waterways forcing them out of their banks. There may be significant environmental effects, resulting in flooding that could disperse debris and hazardous materials downstream that can damage local ecosystems. In addition debris carried downstream can block traffic flow, cause power outages, and disrupt local utilities such as water and wastewater, which could result in school closures if severe.

Annualized loss-estimates for dam failure, as well as a breakdown of potential dollar losses of critical facilities, infrastructure and lifelines, or hazardous-materials facilities is not available. If a major dam should fail, however, the severity of impact could be substantial.

A dam breach could result in multiple deaths with facilities being shut down for 30 days or more, and more than 50 percent of property destroyed or damaged. For these reasons, creating mitigations actions to remove or protect people and structures from the path of destruction is necessary in order to minimize impact from dam failure.

SECTION 15: EARTHQUAKE

HAZARD DESCRIPTION

An earthquake is the sudden movement of the Earth's surface cause by the release of stress accumulated within or along the edge of the Earth's tectonic plates, volcanic eruption, or by a manmade explosion. The majority of earthquakes occur along faults; however earthquakes can occur within plate interiors. Over geologic time, plates move and plate boundaries change, pushing weaken boundary regions to the interior part of the plates. These areas of weakness within the continents can cause earthquakes in response to stresses that originate at the edges of the plate or in the deeper crust.

Earthquakes' locations are described by their focal depth and geographic position of the epicenter. The focal depth of an earthquake is the depth from the Earth's surface to the region where an earthquake's energy originates (the focus or hypocenter). The epicenter is the point on the Earth's surface directly above the hypocenter. Earthquakes usually occur without warning, with their effects impacting great distances away from the epicenter.

According to the U.S. Geological Society (USGS) Earthquake Hazards Program, an earthquake hazard is anything associated with an earthquake that may influence an individual's normal activities. Table 15-1 describes definition of examples.

SECTION 15: EARTHQUAKE

Table 15-1. Definitions of Earthquake Hazards[1]

HAZARD	DESCRIPTION
Surface Faulting	Displacement that reaches the earth's surface during slip along a fault. Commonly occurs with shallow earthquakes, those with an epicenter less than 20 kilometers.
Ground Motion (shaking)	The movement of the earth's surface from earthquakes or explosions. Ground motion or shaking is produced by waves that are generated by sudden slip on a fault or sudden pressure at the explosive source and travel through the earth and along its surface.
Landslide	A movement of surface material down a slope.
Liquefaction	A process by which water-saturated sediment temporarily loses strength and acts as a fluid, like when you wiggle your toes in the wet sand near the water at the beach. This effect can be caused by earthquake shaking.
Tectonic Deformation	A change in the original shape of a material due to stress and strain.
Tsunami	A sea wave of local or distant origin that results from large-scale seafloor displacements associated with large earthquakes, major submarine slides, or exploding volcanic islands.
Seiche	The sloshing of a closed body of water from earthquake shaking

LOCATION

Earthquake hazard areas are mapped by the US Geological Survey from lowest hazard to highest hazard areas. Figure 15-1 shows major earthquake hazard areas. An Earthquake Hazard Map, also known as a Percent Peak Ground Accelerations (%PGA) Map. The map shows the %PGA values with a 2% chance of being exceeded over 50 years. %PGA is an earthquake measurement that displays three things: the geographic area affected (all colored areas on the map), the probability of an earthquake of each given level of severity (2% chance in 50 years), and the strength of ground movement (severity) shown as percent of the acceleration force of gravity (%g) (the PGA is indicated by color). The Houston County study area is indicated in Texas and is located in the lowest hazard areas of 0-4%g peak ground acceleration.

[1] Source: USGS, 2012

SECTION 15: EARTHQUAKE

Figure 15-1. U.S. Map of Peak Ground Acceleration

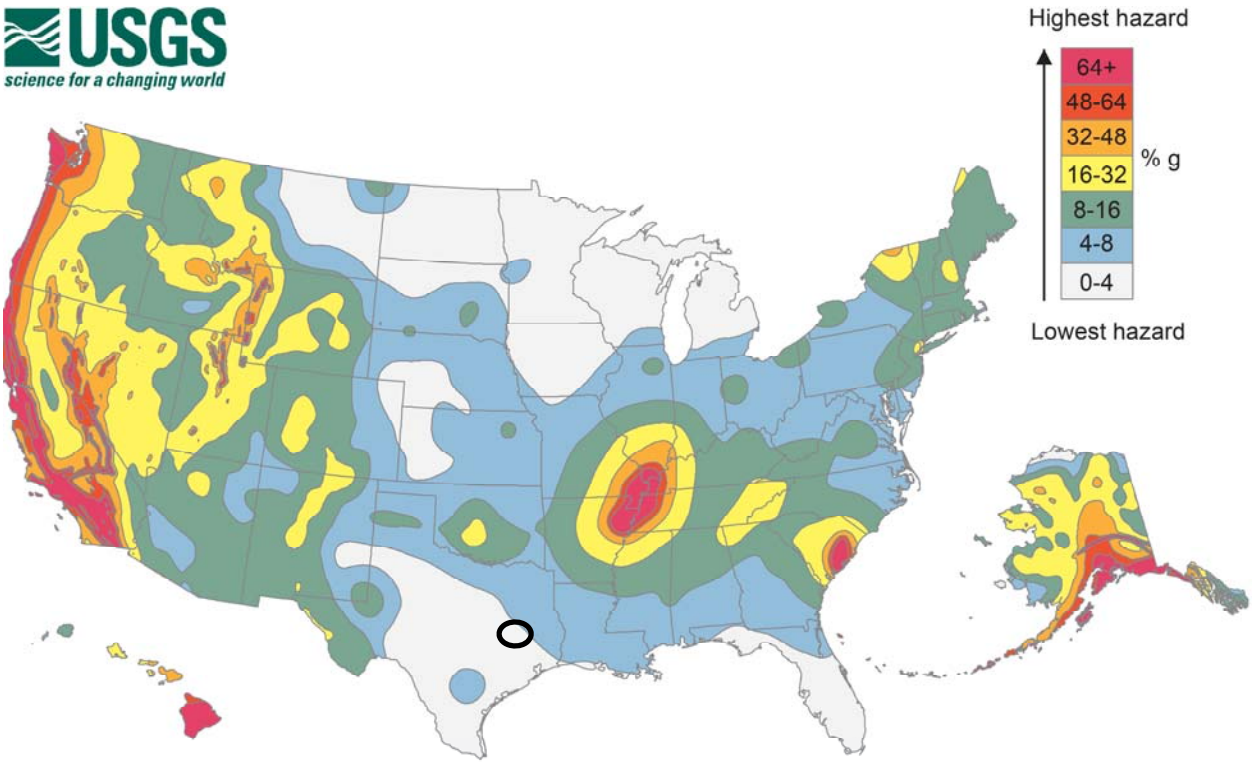
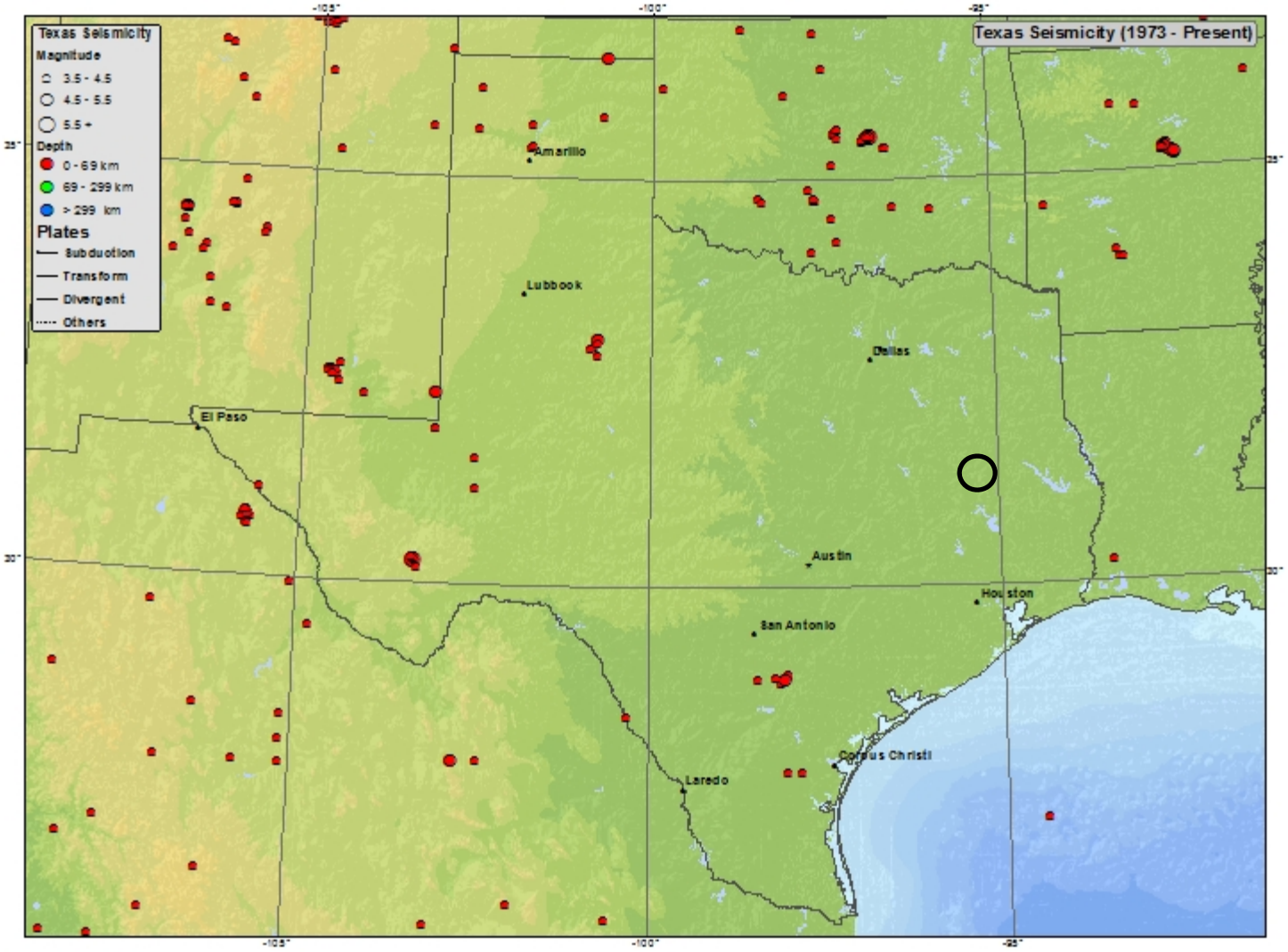


Figure 15-2 maps historic earthquake epicenters across Texas between 1973 and 2012. It is important to note that earthquakes that originate outside of Houston County's borders can still be felt, and be a hazard within the county.

SECTION 15: EARTHQUAKE

Figure 15-2. Earthquake Epicenters in Texas, 1973 to 2012



EXTENT

The magnitude, or intensity of an earthquake, is a recorded value of the amplitude of seismic waves. The Richter scale is the most commonly used scale that measures the magnitude of earthquakes. It has no upper limit, and is not used to describe damage (Table 15-2).

Table 15-2. Richter Scale

RICHTER MAGNITUDES	EARTHQUAKE EFFECTS
2.5 or LESS	Usually not felt, but can be recorded by seismograph
2.5-5.4	Often felt, but only causes minor damage
5.5-6.0	Slight damage to buildings and other structures
6.1 TO 6.9	May cause a lot of damage in very populated areas
7.0 TO 7.9	Major earthquake; serious damage
8 OR GREATER	Great earthquake; can totally destroy communities near the epicenter

The intensity of an earthquake is expressed by the Modified Mercalli Scale, based on the effects of ground shaking on people, buildings, and natural features, and is location dependent. The Modified Mercalli Scale gives the intensity of the earthquake in values ranging from I to XII. Table 15-3 summarizes earthquake intensity as described by the Modified Mercalli Scale, and provides a comparison between the Richter and Modified Mercalli Intensity Scales.

Table 15-3. Modified Mercalli Intensity (MMI) Scale

SCALE	INTENSITY	DESCRIPTION OF EFFECTS	CORRESPONDING RICHTER MAGNITUDE
I	INSTRUMENTAL	Not Felt except by a very few under especially favorable conditions	
II	FEEBLE	Felt only by a few persons at rest, especially on upper floors of buildings	< 4.2
III	SLIGHT	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration Estimated	
IV	MODERATE	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors, disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.	

SECTION 15: EARTHQUAKE

SCALE	INTENSITY	DESCRIPTION OF EFFECTS	CORRESPONDING RICHTER MAGNITUDE
V	SLIGHTLY STRONG	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.	< 4.8
VI	STRONG	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.	< 5.4
VII	VERY STRONG	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken	< 6.1
VIII	DESTRUCTIVE	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned	
IX	RUINOUS	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.	< 6.9
X	DISASTROUS	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.	< 7.3
XI	VERY DISASTROUS	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.	< 8.1
XII	CATASTROPHIC	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.	> 8.1

Table 15-4 lists the Modified Mercalli Intensity (MMI) with the corresponding Acceleration (%g) (PGA), as well as the perceived shaking and potential damage expected.

Table 15-5. Modified Mercalli Intensity (MMI) and PGA Equivalents

MMI	ACCELERATION (%g) (PGA)	PERCEIVED SHAKING	POTENTIAL DAMAGE
I	<.17	Not Felt	None
II	.17-1.4	Weak	None
III	.17-1.4	Weak	None
IV	1.4-3.9	Light	None
V	3.9-9.2	Moderate	Very Light
VI	9.2-18	Strong	Light
VII	18-34	Very Strong	Moderate

Taking into consideration the possible extent of an earthquake for the area, by reviewing Tables 15-1 through 15-3 in conjunction with previous occurrences as depicted in Table 15-4, the Houston County area experiences on average less than 2.5 Richter Scale or Level I or instrumental impact based on the Modified Mercalli intensity scale.

HISTORICAL OCCURRENCES

According to USGS, and the National Geophysical Data Center (NGDC), there are no "significant" earthquakes on record for the state of Texas and Houston County from 2150 B.C. to present. A significant earthquake, as defined by NGDC, is one that has caused at least moderate damage (approximately $1 million or more), has resulted in 10 or more deaths, has registered as a magnitude 7.5 or greater, has registered as Modified Mercalli Intensity (MMI) Scale X or greater, or generated a tsunami. None of these criteria have been met by any seismic activity known to have impacted Houston County and its jurisdictions.

PROBABILITY OF FUTURE EVENTS

Earthquake Hazard Maps show the distribution of earthquake shaking levels that have a certain probability of occurring over a given period. According to the USGS, in 2008, Houston County had a PGA of 0-4% for earthquakes with a 2-percent probability of occurring within 50 years. Based on historical records, the probability of an earthquake affects Houston County is unlikely, meaning that an event is probable in the next ten years.

SECTION 15: EARTHQUAKE

VULNERABILITY AND IMPACT

Little warning is usually associated with earthquakes, and can impact areas a great distance away from the epicenter. The amount of damage depends on the density of population and buildings, and infrastructure construction in the affected area. Some places may be more vulnerable than others based on soil type, building age, and building codes.

With no historical events recorded, annualized loss-estimates for earthquakes are not available; neither is a breakdown of potential dollar losses of critical facilities and infrastructure. If a major earthquake should occur it could be substantial. However, it can only be said that the potential severity of impact from an earthquake for the County is classified as limited, meaning that less than 10 percent of infrastructure would be damaged with critical facilities being shut down for less than 24 hours.

SECTION 16: MITIGATION STRATEGY

MITIGATION GOALS

Based on the results of the risk and capability assessments, the Planning Team was able to develop and prioritize the mitigation strategy. At the Mitigation Workshop held September 17, 2013, Planning Team members refined the mitigation strategy for the Plan, choosing to maintain the overall goal of reducing and eliminating the long-term risk of loss of life and property damage from the full range of disasters.

GOAL 1

Protect public health and safety in the county.

OBJECTIVE 1.1

Maintain critical facilities.

OBJECTIVE 1.2

Maximize the utilization of the latest technology to provide adequate warning, communication, and mitigation of hazard events.

OBJECTIVE 1.3

Reduce the danger to, and enhance protection of, high risk areas during hazard events.

OBJECTIVE 1.4

Protect critical facilities and services.

GOAL 2

Protect new and existing properties.

SECTION 16: MITIGATION STRATEGY

OBJECTIVE 2.1

Reduce repetitive losses to the National Flood Insurance Program (NFIP).

OBJECTIVE 2.2

Use the most cost-effective approach to protect existing buildings and public infrastructure from hazards.

OBJECTIVE 2.3

Enact and enforce regulatory measures to ensure that development will not put people in harm's way or increase threats to existing properties.

GOAL 3

Build and support partnerships to enhance mitigation to continuously become less vulnerable to hazards.

OBJECTIVE 3.1

Build and support local partnerships to continuously become less vulnerable to hazards.

OBJECTIVE 3.2

Build a cadre of committed volunteers to safeguard the community before, during and after a disaster.

OBJECTIVE 3.3

Build hazard mitigation concerns into planning and budgeting processes.

GOAL 4

Leverage outside funds for investment in hazard mitigation.

OBJECTIVE 4.1

Maximize the use of outside sources of funding.

OBJECTIVE 4.2

Maximize participation of property owners in protecting their properties.

OBJECTIVE 4.3

Maximize insurance coverage to provide financial protection against hazard event.

OBJECTIVE 4.4

Prioritize mitigation projects based on cost-effectiveness, starting with those sites facing the greatest threat to life, health and property.

GOAL 5

Increase the understanding of residents for the need for mitigation, and steps they can take to protect people and properties.

OBJECTIVE 5.1

Heighten public awareness of the full range of hazards they face.

OBJECTIVE 5.2

Educate the public on actions they can take to prevent or reduce the loss of life or property from all hazards.

OBJECTIVE 5.3

Publicize and encourage the adoption of appropriate hazard mitigation measures.

SECTION 17: MITIGATION ACTIONS

SUMMARY

As discussed in Section 2, at the mitigation workshop the planning team and stakeholders met to develop mitigation actions for each of the natural hazards included in the Plan. Each of the actions in this section were prioritized based on FEMA's STAPLEE criteria, which includes considering the social, technical, administrative, political, legal, economic and environmental factors necessary for the implementation of each action. As a result of this exercise, an overall priority was assigned to each mitigation action.

As part of the economic evaluation of the STAPLEE analysis, jurisdictions analyzed each action in terms of the overall costs, measuring whether the potential benefit to be gained from the action outweighed all costs associated with it. As a result of this exercise, priority was assigned to each mitigation action by marking them as High (H), Moderate (M), or Low (L). An action that is ranked as "High" indicates that the action will be implemented as soon as funding is received. A "Moderate" action is one that may not be implemented right away depending on the cost and number of citizens served by the action. Actions ranked as "Low" indicate that they will not be implemented without first seeking grant funding and after "High" and "Moderate" actions have been completed.

All mitigation actions created by Planning Team members are presented in this section. County-wide mitigation actions are found at the beginning of the section, followed by individual actions by jurisdictions and/or participating entities. More than one hazard is sometimes listed for an action if appropriate. Actions presented in this section represent a comprehensive range of mitigation actions per current state and FEMA Guidelines, including two actions per hazard per jurisdiction based on current FEMA Guidelines.

The county-wide action worksheets at the beginning of this section satisfy minimum state and FEMA guidelines for two actions, per hazard, and of two different types for each jurisdiction or participating entity. Additional actions for each Planning Team member are found throughout Section 17. Information is in color-coded format in Table 17-1.

SECTION 17: MITIGATION ACTIONS

Table 17-1. County-Wide Mitigation Action Matrix

Jurisdiction	Dam Failure	Drought	Extreme Heat	Flood/NFIP	Hail	Hurricane Wind	Thunderstorm	Tornado	Wildfire	Winter Storm	Earthquake
Houston County	XX	XXXX	XXXX	XXXXXX	XX	XX	XX	XX	XXXX	XX	XX
City of Crockett	XX	XXXX	XXXX	XXXXXX	XX	XX	XX	XX	XXXX	XX	XX
City of Grapeland	XX	XXXX	XXXX	XXXXXX	XX	XX	XX	XX	XXXX	XX	XX
City of Kennard	XX	XXXX	XXXX	XXXXXX	XX	XX	XX	XX	XXXX	XX	XX
City of Latexo	XX	XXXX	XXXX	XXXX	XX	XX	XX	XX	XXXX	XX	XX
City of Lovelady	XX	XXXX	XXXX	XXXXXX	XX	XX	XX	XX	XXXX	XX	XX
Crockett ISD	XX	XXXX	XXXX	XXXX	XX	XX	XX	XX	XXXX	XX	XX
Latexo ISD	XX	XXXX	XXXX	XXXX	XX	XX	XX	XX	XXXX	XX	XX
Houston County WCD #1	XX	XXXX	XXXX	XXXX	XX	XX	XX	XX	XXXX	XX	XX

TYPE OF ACTION:	
Action #1 – Local Plans/Regulations (Blue)	Action #4 – Education/Awareness (Orange)
Action #2 – Structure/Infrastructure (Red)	Action #5 - Flood (NFIP) (Black)
Action #3 - Natural System Protection (Green)	

SECTION 17: MITIGATION ACTIONS

COUNTY-WIDE ACTIONS

	County-Wide – Action #1
Proposed Action:	Create a series of county-wide detention ponds with filtration systems as an alternate water source as part of future smart growth initiatives and wildfire mitigation.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Houston County, Cities of Crockett, Grapeland, Kennard, Lovelady and Latexo, Houston County WCID #1, Latexo and Crockett ISDs
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduction on dependence of public water sources; sustain quality of life for residents and continued operation of services; ponds can be used as water source for firefighting as well.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Natural Systems Protection

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Drought, Wildfire
Effect on New/Existing Buildings:	Continue to provide water supply to new/existing structures during drought conditions
Priority (High, Moderate, Low):	High
Estimated Cost:	$2 million +
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	County Engineer, Public Works Director for each community, Supt., school districts, Manager, WCID
Implementation Schedule:	2015
Incorporation into Existing Plans:	Emergency Management Plan, Storm Water Management Plan, Comprehensive Plan

COMMENTS
Current water resource may not be sustainable for expected long-term population growth in the East Texas region. Safe growth initiatives include development regulations to include cluster subdivisions to preserve and promote water conservation, limiting growth in flood-prone and high risk wildfire areas.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	County-Wide – Action #2
Proposed Action:	Develop county-wide Wildfire Protection Plan/FIREWISE program for Houston County through the Texas Forest Service.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Houston County, Cities of Crockett, Grapeland, Kennard, Lovelady and Latexo, Houston County WCID #1, Latexo and Crockett ISDs
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Structure, timber, and grassland losses due to wildfires will be reduced; reduction in fire risk to residential and commercial structures during drought and extreme heat conditions.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire, Drought, Extreme Heat
Effect on New/Existing Buildings:	Reduction in damage or loss due to wildfire
Priority (High, Moderate, Low):	High
Estimated Cost:	$500,000
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	County EMS/ Volunteer Fire Departments for jurisdictions, ISD Administration, WCID Manager
Implementation Schedule:	2016
Incorporation into Existing Plans:	Emergency Management Plan, Fire Protection Plan

COMMENTS
Wildfire is considered the greatest natural threat in Houston County in its proximity to Davy Crockett National Forest in the eastern 1/3 of the county and privately owned forestlands throughout the county. Participating communities to promote fire-resistant construction for homes and attached structures, adopt stronger building codes, provide irrigation "credits" for homeowners.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	County-Wide – Action #3
Proposed Action:	Implement an outreach and public education program for the county-wide Wildfire Protection Plan and FIREWISE program.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Houston County, Cities of Crockett, Grapeland, Kennard, Lovelady and Latexo, Houston County WCID #1, Latexo and Crockett ISDs
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Structure, timber, and grassland losses due to wildfires will be reduced; reduction in fire risk to residential and commercial structures.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire, Drought, Extreme Heat
Effect on New/Existing Buildings:	Reduction in damage or loss due to wildfire
Priority (High, Moderate, Low):	High
Estimated Cost:	$500,000
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	County EMS/ Volunteer Fire Departments for jurisdictions, ISD Administration, WCID Manager
Implementation Schedule:	2016
Incorporation into Existing Plans:	Emergency Management Plan, Fire Protection Plan

COMMENTS
Wildfire is considered the greatest natural threat in Houston County in its proximity to Davy Crockett National Forest in the eastern 1/3 of the county and privately owned forestlands throughout the county. Outreach to include educating residents on designing/installing Firewise landscape, home ignition zones, fuel reduction around structures, emergency access routes and evacuation plan.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	County-Wide – Action #4
Proposed Action:	Purchase and install I-info alert/notification system including one user license per jurisdiction or participating entity (See Appendix G for system info).
BACKGROUND INFORMATION	
Jurisdiction/Location:	Houston County, Cities of Crockett, Grapeland, Kennard, Lovelady and Latexo, Houston County WCID #1, Latexo and Crockett ISDs
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Alert/Notification System will allow optimal response time to notify both residents and businesses of all natural and human-caused disasters; reduce loss of lives and property; ensure unified method of disseminating alerts by community officials, first responders.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam Failure, Drought, Extreme Heat, Flood, Hail, Hurricane Wind, Thunderstorm, Tornado, Wildfire, Winter Storm, Earthquake
Effect on New/Existing Buildings:	Reduce damage to structures with additional warning time to implement protective actions during severe weather events or other disasters
Priority (High, Moderate, Low):	High
Estimated Cost:	$500,000, plus $4,000 per user license fee annually
Potential Funding Sources:	HMGP Grants
Lead Agency/Department Responsible:	Emergency Management Coordinator for county, and appointed EMC Team lead for each participating entity; ISD Superintendents
Implementation Schedule:	2015
Incorporation into Existing Plans:	Emergency Management Plan, Emergency Response/Recovery Plan, Continued Continuity of Operations Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	County-Wide – Action #5
Proposed Action:	As part of the county-wide I-Info Alert/Notification System, develop a public education program for residents, businesses, and schools on responding to alerts, including evacuations and safe shelter locations.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Houston County, Cities of Crockett, Grapeland, Kennard, Lovelady and Latexo, Houston County WCID #1, Latexo and Crockett ISDs
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Educating the public through various social media outlets including PSA's, regarding Alert/Notification System will aid in implementing appropriate measures to manage the public before, during, and following a disaster; reduce loss of lives and property; allow residents to return to their communities in an orderly and expeditious time after the event.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam Failure, Drought, Extreme Heat, Flood, Hail, Hurricane Wind, Thunderstorm, Tornado, Wildfire, Winter Storm, Earthquake
Effect on New/Existing Buildings:	Residents/businesses can protect structures with additional warning time to implement protective actions during severe weather events or other disasters
Priority (High, Moderate, Low):	High
Estimated Cost:	$500 per participating entity, annually
Potential Funding Sources:	HMGP Grants
Lead Agency/Department Responsible:	Emergency Management Coordinator for county, and appointed EMC Team lead for each participating entity; Superintendent ISD's
Implementation Schedule:	2015
Incorporation into Existing Plans:	Emergency Management Plan, Emergency Response/Recovery Plan, Continued Continuity of Operations Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	County-Wide – Action #6
Proposed Action:	Cut firebreaks into public wooded areas throughout county and in accordance with high risk factors.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Houston County high fuel areas adjacent or in proximity to: Cities of Crockett, Grapeland, Kennard, Lovelady and Latexo, Houston County WCID #1, Latexo and Crockett ISDs, Davy Crockett National Forest, privately owned forestlands
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduction in timber damage and surrounding properties due to fire; natural landform protections.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Natural Systems Protection

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire, Extreme Heat, Drought
Effect on New/Existing Buildings:	Reduction of potential wildfire and urban fire damage
Priority (High, Moderate, Low):	High
Estimated Cost:	$500,000
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	County Emergency Management office, County Engineer, Mayors of cities, WCID Manager, ISD Administration and Maintenance
Implementation Schedule:	2015
Incorporation into Existing Plans:	Community wildfire protection program, Firewise Program

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	County-Wide – Action #7
Proposed Action:	Train firefighters and VFD in brush and forest firefighting.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Houston County high fuel areas adjacent or in proximity to: Cities of Crockett, Grapeland, Kennard, Lovelady and Latexo, Houston County WCID #1, Latexo and Crockett ISDs, Davy Crockett National Forest, privately owned forestlands
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Better and more effective firefighting response due to training.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire, Drought, Extreme Heat
Effect on New/Existing Buildings:	Reduction in damage due to improved response
Priority (High, Moderate, Low):	High
Estimated Cost:	$200,000 annually
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	County Emergency Management office, County Engineer, Mayors of cities, WCID Manager, ISD Administration and Maintenance
Implementation Schedule:	2014
Incorporation into Existing Plans:	Community wildfire protection program, Firewise Program, Emergency Response Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	County-Wide – Action #8
Proposed Action:	Install fire danger rating and burn ban signs throughout Houston County.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Major road locations in proximity to: Cities of Crockett, Grapeland, Kennard, Lovelady and Latexo, Houston County WCID #1, Latexo and Crockett ISDs, Davy Crockett National Forest, privately owned forestlands
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Better awareness by the public for fire prevention.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire, Drought, Extreme Heat
Effect on New/Existing Buildings:	Public education reduces potential for illegal burning
Priority (High, Moderate, Low):	High
Estimated Cost:	$100,000
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	County Emergency Management office, County Engineer, Mayors of cities, WCID Manager, ISD Administration and Maintenance
Implementation Schedule:	2015
Incorporation into Existing Plans:	Community wildfire protection program, Firewise Program, Emergency Response Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	County-Wide – Action #9
Proposed Action:	Construct public community safe rooms around the County per FEMA 361 construction guidelines; will also serve as multi-purpose community centers.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Locations include high schools, fire stations located in communities of Crockett, Grapeland, Kennard, Lovelady and Latexo, Houston County WCID #1, Latexo and Crockett ISDs
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Provide protection for county residents from storms, tornadoes and other disasters across the county.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Hail, Hurricane Wind, Thunderstorm, Tornado
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$9 million
Potential Funding Sources:	HMGP, PDM Grants
Lead Agency/Department Responsible:	County Emergency Management; County Judge; County Engineer, Mayors of cities, WCID Manager, ISD Administration and Maintenance;
Implementation Schedule:	2015-2017
Incorporation into Existing Plans:	Emergency Management Plan, Response/Recovery Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	County-Wide – Action #10
Proposed Action:	Install stream and rain gauges in flood prone areas and waterways as part of overall rainfall tracking, recording program, and new alert notification system.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Houston County, Cities of Crockett, Grapeland, Kennard, Lovelady and Latexo, Houston County WCID #1, Latexo and Crockett ISDs
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Monitor rainfall to reduce impact on residents, evacuation response time for flood management and flash flood events.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Elevate new construction in proximity to high recorded events in flood prone areas
Priority (High, Moderate, Low):	High
Estimated Cost:	$100,000
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	County Emergency Management office, County Engineer, Mayors of cities, WCID Manager, ISD Administration and Maintenance
Implementation Schedule:	2015
Incorporation into Existing Plans:	Emergency Management Plan, Flood Plan, Flood Damage Ordinance, Emergency Response/Recovery

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	County-Wide – Action #11
Proposed Action:	Plant erosion prevention vegetation on lands and levees adjacent to and along river banks to mitigate excessive runoff during flood events.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Houston County, Cities of Crockett, Grapeland, Kennard, Lovelady and Latexo, Houston County WCID #1, Latexo and Crockett ISDs
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Protect natural system areas, reduce flooding caused by excessive and rapid runoff into waterways.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Natural Systems Protection

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce overtopping of banks and minimize potential drainage and flooding to affected structures, subdivisions.
Priority (High, Moderate, Low):	High
Estimated Cost:	$50,000
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	Public Works Director for communities, ISD Superintendent, WCID Director, County Engineer
Implementation Schedule:	2017
Incorporation into Existing Plans:	Flood Plan, Flood Damage Ordinance, Storm Water Management. Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	County-Wide – Action #12
Proposed Action:	Conduct public education program and advertise Houston County Emergency Evacuation Plan, such as escape routes in coordination with TxDOT.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Houston County, Cities of Crockett, Grapeland, Kennard, Lovelady and Latexo, Houston County WCID #1, Latexo and Crockett ISDs
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Educating public improves community response to disasters, reduced loss of life.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Tornado, Wildfire, Earthquake
Effect on New/Existing Buildings:	Improve access/evacuation of new/existing structures
Priority (High, Moderate, Low):	High
Estimated Cost:	$20,000
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	TxDOT, Mayors of cities, ISD Administration, WCID Manager; Superintendent, ISD's
Implementation Schedule:	2014
Incorporation into Existing Plans:	Emergency Response and Evacuation Plan, Emergency Management Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	County-Wide – Action #13
Proposed Action:	Conduct an annual forest fuels cleanup program for Houston County in high fuel areas.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Houston County, communities of Crockett, Grapeland, Kennard, Lovelady and Latexo, Latexo and Crockett ISDs, in proximity to private and State/Federal Forest land
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce fire damage due to the lack of combustible material.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Natural Systems Protection

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Effect on New/Existing Buildings:	Reduced potential for wildland and urban fires
Priority (High, Moderate, Low):	High
Estimated Cost:	$100,000
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	County Emergency Management office, County Engineer, Mayors of cities, WCID Manager, ISD Administration and Maintenance
Implementation Schedule:	2015
Incorporation into Existing Plans:	Community Wildfire Protection Program, Firewise Program, Emergency Management Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	County-Wide – Action #14
Proposed Action:	Conduct public outreach to educate residents on protective measures to reduce effects of extreme temperatures, advertise locations of cooling centers and programs that provide air conditioners, fans to elderly, infirm, and indigent residents.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Houston County community recreation/ facilities in the Cities of Crockett, Grapeland, Kennard, Lovelady and Latexo
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduced damage to building/infrastructure due to better awareness of action plans.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Extreme Heat, Winter Storm
Effect on New/Existing Buildings:	None
Priority (High, Moderate, Low):	High
Estimated Cost:	$50,000
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	County Emergency Management office, WCID Manager, ISD Administration and Maintenance Fire, VFD, Parks & Rec. Dept. in communities
Implementation Schedule:	2015
Incorporation into Existing Plans:	Emergency Management Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	County-Wide– Action #15
Proposed Action:	Locate sites and install county-wide system of dry fire hydrants. Sites will be chosen based on population, property valuation, loss potential, and fire history. Approximately one hydrant per jurisdiction/entity.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Houston County, Cities of Crockett, Grapeland, Kennard, Lovelady and Latexo, Houston County WCID #1
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Maximize county-wide natural resources and available water sources; aid in preventing, reducing wildland and urban fire by installing an all-weather, year round water source for fire suppression; reduce fire insurance rates through ISO.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Natural Systems Protection

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Extreme Heat, Drought, Wildfire
Effect on New/Existing Buildings:	Reduce wildfire threat to new/existing structures
Priority (High, Moderate, Low):	High; phased projects, with installation of high priority hydrants first, and others in future years as a long-range plan
Estimated Cost:	$550 - $750 per hydrant, per participating entity, plus labor, materials
Potential Funding Sources:	HMGP, Texas Dept. Natural Resources, Texas Forest Service
Lead Agency/Department Responsible:	Emergency Manager within each jurisdiction, Director, WCID#1
Implementation Schedule:	2014 and phased project
Incorporation into Existing Plans:	Emergency Operations Plan

COMMENTS
Regularly back-flush dry hydrants to prevent debris accumulation; test and maintain system. Contact ISO to apply for insurance rate reduction once system is installed, maintain accurate records. Work with state agencies for necessary permitting.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	County-Wide – Action #16
Proposed Action:	Map locations of installed dry fire hydrants. Maps will be shared with all participating jurisdictions, the public, and local, county, and state agencies. Procure contracts and land use agreements with property owners, promote mapped sites through public awareness program.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Houston County, Cities of Crockett, Grapeland, Kennard, Lovelady and Latexo, WCID#1
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Expedite management and extinguishing of urban and wildland fires throughout county by mapping known locations of dry fire hydrants; aid in preventing, reducing wildland and urban fires. Reduce property and fire insurance rates county-wide through ISO.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Local Plans and Regulations, Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Extreme Heat, Drought, Wildfire
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	Labor, materials, permitting, land agreements, supplies estimated at $250 annually per entity
Potential Funding Sources:	HMGP, Texas Dept. Natural Resources, Texas Forest Service
Lead Agency/Department Responsible:	County Emergency Management office, County Engineer, Mayors of cities, WCID Manager, ISD Administration and Maintenance
Implementation Schedule:	2014 and phased project
Incorporation into Existing Plans:	Emergency Operations Plan

COMMENTS
The dry fire hydrant system described is designed to be used with fire department engines and/or high volume pumps, not small portable pumps. Interlocal and local agreements, and land use agreements are necessary for consent by landowners, municipalities, and other property owners when accessing dry hydrants.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

HOUSTON COUNTY

	Houston County – Action #1
Proposed Action:	Purchase NOAA "All-Hazards" radios for early warning and post-event information for all county government building locations, hospitals.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Unincorporated Houston County
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Improve notification time and response to natural disasters and severe weather events.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Hurricane Wind, Thunderstorm, Wildfire, Tornado, Winter Storm, Hail, Earthquake
Effect on New/Existing Buildings:	None
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	County EMS staff
Implementation Schedule:	2014
Incorporation into Existing Plans:	Emergency Response and Evacuation Plan, Emergency Management Plan, Risk Management Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	Houston County – Action #2
Proposed Action:	Install backup generators at critical facilities and shelters throughout county.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Houston County
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Assurance that critical buildings will have emergency backup power.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Hurricane Wind, Thunderstorm, Tornado, Winter Storm, Hail, Earthquake, Extreme Heat
Effect on New/Existing Buildings:	Ensure continued utility service to structures
Priority (High, Moderate, Low):	High
Estimated Cost:	$100,000
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	County Public Works
Implementation Schedule:	2017
Incorporation into Existing Plans:	Emergency Response and Recovery, Emergency Management Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

Houston County – Action #3 (NFIP)	
Proposed Action:	Clear debris from bridges, box culverts, and drainage systems throughout unincorporated county.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Houston County
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduced flooding through removal of obstructions to drainage areas.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Natural Systems Protection

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce overtopping of banks and minimize potential drainage and flooding to affected structures, subdivisions
Priority (High, Moderate, Low):	High
Estimated Cost:	$100,000
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	County Engineer
Implementation Schedule:	2016
Incorporation into Existing Plans:	Emergency Management Plan, Flood Plan, Flood Damage Ordinance, Emergency Response/Recovery

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	Houston County – Action #4 (NFIP)
Proposed Action:	Conduct routine inspection of manufactured home/mobile homes in flood-prone area to ensure proper tie-downs per Flood Damage Ordinance.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Unincorporated Houston County
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce damage or loss due to severe weather events.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Lessen impact and loss of homes for residents
Priority (High, Moderate, Low):	High
Estimated Cost:	$50,000
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	Floodplain Administrator
Implementation Schedule:	2015
Incorporation into Existing Plans:	Flood Damage Ordinance

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	Houston County – Action #5 (NFIP)
Proposed Action:	Conduct program to educate residents on NFIP /availability of flood insurance and elevating new construction in and outside of mapped floodplain areas.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Unincorporated Houston County
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce impact of flood disaster through flood insurance, reduce flooding of new construction.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce flooding of structures
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$1,000
Potential Funding Sources:	Local Revenue
Lead Agency/Department Responsible:	Floodplain Manager
Implementation Schedule:	2016
Incorporation into Existing Plans:	Flood Damage Ordinance, Public Awareness program

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	Houston County – Action #6
Proposed Action:	Implement tree trimming program and clear critical right of ways (electrical easements, road access, etc.) from overhanging limbs.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Unincorporated Houston County
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce danger to lives and property from falling limbs, trees, as a result of severe weather events; improve access for first responders.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Winter Storm, Drought, Extreme Heat, Thunderstorm, Tornado, Earthquake, Hail
Effect on New/Existing Buildings:	Reduce damage to new/existing structures
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$200,000
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	County Engineer
Implementation Schedule:	2014
Incorporation into Existing Plans:	Emergency Response and Recovery, Emergency Management Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	Houston County – Action #7
Proposed Action:	Retrofit Emergency Operations Center to improve technological capabilities for monitoring, recording, and responding to disasters.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Houston County Emergency Management office
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Better execution of emergency response due to improved technology.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam Failure, Drought, Extreme Heat, Flood, Hail, Hurricane Wind, Thunderstorm, Tornado, Wildfire, Winter Storm, Earthquake
Effect on New/Existing Buildings:	Minimize damage with improved response time
Priority (High, Moderate, Low):	High
Estimated Cost:	$500,000
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	Emergency manager
Implementation Schedule:	2014
Incorporation into Existing Plans:	Emergency Response and Recovery, Emergency Management Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	Houston County – Action #8 (NFIP)
Proposed Action:	Build earthen dike to elevate emergency vehicle access road to critical facilities to provide protection to 500-year flood level.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Unincorporated Houston County
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Improve emergency response in the event of severe flooding event.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Enable access to future developments in flood prone areas
Priority (High, Moderate, Low):	High
Estimated Cost:	$500,000
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	County Public Works office
Implementation Schedule:	2014
Incorporation into Existing Plans:	Risk Management Plan for ISD's, Emergency Management Plan, Response and Recovery Plan, Flood Damage Prevention Ordinance, Flood Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	Houston County – Action #9
Proposed Action:	Implement rainfall observer program utilizing volunteers.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Unincorporated county
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Improve data and information regarding recorded rainfall.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Thunderstorm
Effect on New/Existing Buildings:	Elevate structures in high risk areas
Priority (High, Moderate, Low):	Low
Estimated Cost:	$500
Potential Funding Sources:	Local Revenue, NOAA
Lead Agency/Department Responsible:	County Engineer/Volunteers throughout county
Implementation Schedule:	2016
Incorporation into Existing Plans:	Emergency Management Plan, Flood Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

Houston County – Action #10	
Proposed Action:	Expand and upgrade drainage culverts to prevent flooded roadways, add signage in low-water crossings.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Unincorporated Houston County
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Improved response time in the event of emergencies; reduce flooded roadways.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce localized flooding of structures
Priority (High, Moderate, Low):	High
Estimated Cost:	$20,000
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	County Engineer
Implementation Schedule:	2014
Incorporation into Existing Plans:	Storm Water Plan, Emergency Management Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

CITY OF CROCKETT

	City of Crockett – Action #1
Proposed Action:	Install backup generators at critical facilities.
BACKGROUND INFORMATION	
Jurisdiction/Location:	City wide
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Assurance that critical buildings will have emergency backup power.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Hurricane Wind, Thunderstorm, Tornado, Winter Storm, Hail, Earthquake, Extreme Heat
Effect on New/Existing Buildings:	Ensure continued utility service to structures
Priority (High, Moderate, Low):	High
Estimated Cost:	$25,000
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	2016
Incorporation into Existing Plans:	Emergency Response and Recovery, Emergency Management Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	City of Crockett – Action #2 (NFIP)
Proposed Action:	Implement program to clear debris from flood-prone areas, bridges, drains and culverts to prevent overtopping and backup during flash floods.
BACKGROUND INFORMATION	
Jurisdiction/Location:	City wide
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce minor flooding of structures in SFHAs.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Thunderstorm, Winter Storm
Effect on New/Existing Buildings:	Reduce potential for flooding structures
Priority (High, Moderate, Low):	High
Estimated Cost:	$50,000
Potential Funding Sources:	City
Lead Agency/Department Responsible:	Floodplain Manager
Implementation Schedule:	Annually starting in 2013
Incorporation into Existing Plans:	Emergency Operations Plan, Flood Damage Prevention Ordinance

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	City of Crockett – Action #3 (NFIP)
Proposed Action:	Develop and implement NFIP public education program for residents affected by high flood risk areas.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Citywide
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce economic and monetary losses from flooded structures.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Minimize post-disaster rebuilding/relocation costs; protect structures with flood policies
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$1,000
Potential Funding Sources:	Local Revenue
Lead Agency/Department Responsible:	Floodplain Administrator
Implementation Schedule:	2014
Incorporation into Existing Plans:	Flood Damage Prevention Ordinance, Flood Management Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	City of Crockett – Action #4
Proposed Action:	Adopt and enforce wind-resistant building siting and construction codes.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Citywide
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk to residents and property from threat of thunderstorm and high.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm, Tornado, Hurricane Wind
Effect on New/Existing Buildings:	Reduce potential damage from falling trees, limbs
Priority (High, Moderate, Low):	High
Estimated Cost:	$15,000
Potential Funding Sources:	HMGP Grants
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	2015
Incorporation into Existing Plans:	Emergency Management Plan, Building Code

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

CITY OF GRAPELAND

	City of Grapeland – Action #1 (NFIP)
Proposed Action:	Remove dead trees and limbs from roadside ditches, natural drainage areas and waterways.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Citywide
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce minor flooding due to debris obstructing natural drainage areas.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Natural Systems Protection

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Thunderstorm, Winter Storm, Tornado, Hurricane Wind
Effect on New/Existing Buildings:	Reduce minor flooding of structures
Priority (High, Moderate, Low):	High
Estimated Cost:	$15,000
Potential Funding Sources:	HMGP Grants
Lead Agency/Department Responsible:	Floodplain Manager
Implementation Schedule:	2015
Incorporation into Existing Plans:	Emergency Management Plan, Flood Damage Ordinance

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	City of Grapeland – Action #2
Proposed Action:	Remove dead trees and limbs from public right of ways and utility easements.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Citywide
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk to residents and property from wildfire and falling limbs, trees as a result of severe drought and extreme heat.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Drought, Wildfire, Extreme heat
Effect on New/Existing Buildings:	Reduce potential damage from falling trees, limbs
Priority (High, Moderate, Low):	High
Estimated Cost:	$15,000
Potential Funding Sources:	HMGP Grants
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	2015
Incorporation into Existing Plans:	Emergency Management Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	City of Grapeland – Action #3
Proposed Action:	Install backup generators to support critical facilities in the event of outage.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Citywide
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Ensure continued utility services and operation of facilities.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Hurricane Wind, Thunderstorm, Tornado, Winter Storm, Hail, Earthquake, Extreme Heat
Effect on New/Existing Buildings:	Ensure continued utility service to structures
Priority (High, Moderate, Low):	High
Estimated Cost:	$20,000
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	2014-2015
Incorporation into Existing Plans:	Emergency Response and Recovery, Emergency Management Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	City of Grapeland – Action #4 (NFIP)
Proposed Action:	Flood proof critical facilities to the 500-year flood that are located in flood-prone areas of the city.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Older city buildings serve as critical facilities in areas with poor drainage or flood-prone areas
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Ensure continued essential services to residents during severe weather events.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Protection to structures, minimize damage pre- and post-flood
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$3 Million
Potential Funding Sources:	HMGP
Lead Agency/Department Responsible:	Mayor office/Public Works
Implementation Schedule:	2014-2019
Incorporation into Existing Plans:	Floodplain Ordinance, Emergency Management Plan

COMMENTS
Several critical city buildings are located in areas that tend to have minor flooding during severe rainfall events.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

City of Grapeland – Action #5	
Proposed Action:	Adopt and enforce wind-resistant building siting and construction codes.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Citywide
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk to residents and property from threat of thunderstorm and high.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm, Tornado, Hurricane Wind
Effect on New/Existing Buildings:	Reduce potential damage from falling trees, limbs
Priority (High, Moderate, Low):	High
Estimated Cost:	$7,500
Potential Funding Sources:	General Revenue, Operating Budget, HMGP Grants
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	2015
Incorporation into Existing Plans:	Emergency Management Plan, Building Code

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

CITY OF KENNARD

	City of Kennard – Action #1
Proposed Action:	Install backup generators to support critical facilities in the event of outage.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Citywide
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Ensure continued utility services and operation of facilities.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Hurricane Wind, Thunderstorm, Tornado, Winter Storm, Earthquake, Extreme Heat
Effect on New/Existing Buildings:	Ensure continued utility service to structures
Priority (High, Moderate, Low):	High
Estimated Cost:	$20,000
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	2014-2015
Incorporation into Existing Plans:	Emergency Response and Recovery, Emergency Management Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 4; Legal = 5; Economically Sound = 5; and Environmentally Sound = 4

SECTION 17: MITIGATION ACTIONS

	City of Kennard – Action #2 (NFIP)
Proposed Action:	Implement program to routinely remove debris from drainage ways and roadside ditches to prevent back up of flood velocity and improve conveyance of stream during flood events.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Drainage ways in City
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce drainage and potential minor flooding issues along area creeks and streams.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Natural Systems Protection

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce potential flooding due to improved drainage
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$1,000
Potential Funding Sources:	Local Revenue
Lead Agency/Department Responsible:	Public Works Administration
Implementation Schedule:	2013-2014
Incorporation into Existing Plans:	Flood Damage Ordinance

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 4; Legal = 5; Economically Sound = 5; and Environmentally Sound = 4

SECTION 17: MITIGATION ACTIONS

	City of Kennard – Action #3 (NFIP)
Proposed Action:	Conduct public awareness program and distribute NFIP education information to citizens including availability of flood insurance.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Kennard City Hall
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Educate residents regarding low cost of flood insurance in low risk flood zones; increase policy base.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce cost of post-disaster rebuilding and recovery
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$1,000
Potential Funding Sources:	Local Revenue
Lead Agency/Department Responsible:	City Administration
Implementation Schedule:	2013-2014
Incorporation into Existing Plans:	Flood Damage Prevention Ordinance

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 4; Legal = 5; Economically Sound = 5; and Environmentally Sound = 4

SECTION 17: MITIGATION ACTIONS

CITY OF LATEXO

	City of Latexo – Action #1
Proposed Action:	Adopt and enforce updated building codes for all new construction and reconstruction to include requirements for hardening new construction.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Citywide
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Protect public buildings, strengthen new residential and commercial construction, and reduce risk to public health, safety, and welfare.
Type of Action (*Local Plans and Regulations, Public Education & Awareness, Natural Systems Protection, or Structural Projects)***:**	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Tornado, Thunderstorm, Wildfire, Hurricane Wind, Hail, Winter Storm, Earthquake
Effect on New/Existing Buildings:	Improved protection of new structures and retrofits
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000
Potential Funding Sources:	General fund revenue, grant
Lead Agency/Department Responsible:	City Inspection Department
Implementation Schedule:	Est. 2015
Incorporation into Existing Plans:	Building Code

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 4; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5

SECTION 17: MITIGATION ACTIONS

City of Latexo – Action #2	
Proposed Action:	Remove 300' of debris from trestle bridge at CR 2120.
BACKGROUND INFORMATION	
Jurisdiction/Location:	West of Latexo Cemetery at CR 2120
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduced flooding of newly paved road that washes out due to obstruction of debris at trestle bridge.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structural and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce overtopping of banks and minimize potential drainage and flooding to affected structures, subdivisions
Priority (High, Moderate, Low):	High
Estimated Cost:	$100,000
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	Mayor / Mayor Pro-tem
Implementation Schedule:	2016
Incorporation into Existing Plans:	Emergency Management Plan, Flood Plan, Emergency Response/Recovery

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	City of Latexo – Action #3
Proposed Action:	Install backup generators to support critical facilities in the event of outage.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Citywide
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Ensure continued utility services and operation of facilities
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Hurricane Wind, Thunderstorm, Tornado, Winter Storm, Hail, Earthquake, Extreme Heat
Effect on New/Existing Buildings:	Ensure continued utility service to structures
Priority (High, Moderate, Low):	High
Estimated Cost:	$20,000
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	2014-2015
Incorporation into Existing Plans:	Emergency Response and Recovery, Emergency Management Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	City of Latexo – Action #4
Proposed Action:	Improve strategies for debris management and removal including de-icing and clearing public roads.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Citywide
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Ensure continued utility services and operation of facilities; expedite debris removal.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Hurricane Wind, Thunderstorm, Tornado, Winter Storm
Effect on New/Existing Buildings:	Ensure continued utility service to structures
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000
Potential Funding Sources:	General Revenue, HMGP grant
Lead Agency/Department Responsible:	Public Works, Road and Bridge
Implementation Schedule:	2014-2015
Incorporation into Existing Plans:	Emergency Response and Recovery, Emergency Management Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	City of Latexo – Action #5
Proposed Action:	Remove debris from area culverts, drainage ditches, and roadways that reduce conveyance of floodwaters and overtop banks.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Citywide
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce local minor flooding and drainage problems; reduce washout and maintenance of roadways caused by sheet flow.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Hurricane Wind, Thunderstorm, Winter Storm
Effect on New/Existing Buildings:	Reduce minor flooding to structures
Priority (High, Moderate, Low):	High
Estimated Cost:	$25,000
Potential Funding Sources:	General Revenue, HMGP grant
Lead Agency/Department Responsible:	Public Works, Road and Bridge
Implementation Schedule:	2014-2015
Incorporation into Existing Plans:	Emergency Response and Recovery, Emergency Management Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	City of Latexo – Action #6
Proposed Action:	Initiate actions to reinstate community into the National Flood Insurance Program (NFIP).
BACKGROUND INFORMATION	
Jurisdiction/Location:	Citywide
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Provide flood insurance availability to residents, regulate development in SFHA's.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce potential for flooding to new structures
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000
Potential Funding Sources:	General Revenue
Lead Agency/Department Responsible:	Floodplain Administrator
Implementation Schedule:	2014-2015
Incorporation into Existing Plans:	Public Works

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

CITY OF LOVELADY

	City of Lovelady – Action #1
Proposed Action:	Implement a tree trimming program to clears limbs hanging in City right-of-way.
BACKGROUND INFORMATION	
Jurisdiction/Location:	City right of way, utility easements
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce danger to residents and property from falling limbs and trees as a result of severe weather events.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm, Winter Storm, Tornado
Effect on New/Existing Buildings:	Reduce damage to new/existing structures
Priority (High, Moderate, Low):	Low
Estimated Cost:	$10,000
Potential Funding Sources:	Local Revenue, grants
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	2016
Incorporation into Existing Plans:	Emergency Management Plan, Response and Recovery Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	City of Lovelady – Action #2
Proposed Action:	Install backup generators to support critical facilities in the event of outage.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Citywide
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Ensure continued utility services and operation of facilities.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Hurricane Wind, Thunderstorm, Tornado, Winter Storm, Hail, Earthquake, Extreme Heat
Effect on New/Existing Buildings:	Ensure continued utility service to structures
Priority (High, Moderate, Low):	High
Estimated Cost:	$20,000
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	2014-2015
Incorporation into Existing Plans:	Emergency Response and Recovery, Emergency Management Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	City of Lovelady – Action #3 (NFIP)
Proposed Action:	Conduct public awareness program to disseminate NFIP information to citizens regarding availability of flood insurance and elevating new construction outside the Special Flood Hazard Area.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Citywide
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Avoid loss of life by permitting and elevating buildings in all risk flood zones; increase policy base and reduce monetary outlay associated with flooded structures.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Increase flood policies for post-disaster recovery
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$1,000
Potential Funding Sources:	Local Revenue
Lead Agency/Department Responsible:	City Administration
Implementation Schedule:	2013-2014
Incorporation into Existing Plans:	Flood Damage Prevention Ordinance

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	City of Lovelady – Action #4 (NFIP)
Proposed Action:	Purchase NOAA "All-Hazards" radios for early warning and post-event information for all county government building locations, hospitals.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Unincorporated Houston County
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Improve notification time and response to natural disasters and severe weather events.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	None
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	County EMC
Implementation Schedule:	2014
Incorporation into Existing Plans:	Emergency Response and Evacuation Plan, Emergency Management Plan, Risk Management Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

CROCKETT INDEPENDENT SCHOOL DISTRICT

	Crockett ISD – Action #1
Proposed Action:	Construct storage facility adjacent to dome shelter with fuel depot and refrigeration capabilities.
BACKGROUND INFORMATION	
Jurisdiction/Location:	High school
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce loss of lives by providing essential medications, food, supplies to displaced residents.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Tornado, Hurricane Wind, Extreme Heat, Winter Storm
Effect on New/Existing Buildings:	Ensure continued essential services to displaced residents seeking shelter during severe weather events
Priority (High, Moderate, Low):	High
Estimated Cost:	$100,000
Potential Funding Sources:	HMGP, HMA Grants
Lead Agency/Department Responsible:	Grant Administrator
Implementation Schedule:	2014-2016
Incorporation into Existing Plans:	Emergency Management Plan, Evacuation Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	Crockett ISD – Action #2
Proposed Action:	Install shuttering for all HVAC systems in the district.
BACKGROUND INFORMATION	
Jurisdiction/Location:	1. Crockett Elementary School 2. Crockett Junior High School 3. Crockett High School 4. Piney Woods/ Crockett AEC 5. Crockett ISD Administration Building 6. Early Childhood Center
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Increase efficiency of units by minimizing debris damage, reduce electrical costs to ISD, and reduce health risk to students and faculty from overheating units unable to properly cool school buildings.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm, Hail, Tornado, Winter Storm, Extreme Heat
Effect on New/Existing Buildings:	Continue essential utilities to structures
Priority (High, Moderate, Low):	High
Estimated Cost:	$30,000
Potential Funding Sources:	HMGP Grants
Lead Agency/Department Responsible:	Superintendent, Grants Administrator
Implementation Schedule:	2014
Incorporation into Existing Plans:	Risk Management Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

Crockett ISD – Action #3	
Proposed Action:	Resurface high school parking lot with more formidable material such as Geotextile Crack Retardant fabric for more effective use during evacuation.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Crockett High School
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce cost to continually repair heavily traveled parking lot following heavy rainfall by resurfacing with improved materials to extend life to 15 years opposed to standard 2-year service life; improve driving conditions during evacuation.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	None
Priority (High, Moderate, Low):	High
Estimated Cost:	$190,000
Potential Funding Sources:	HMGP grants
Lead Agency/Department Responsible:	Grant Administrator
Implementation Schedule:	2014
Incorporation into Existing Plans:	Evacuation Plan, Risk Management Plan

COMMENTS
4,300 x 750 parking area has been damaged by sheet flow on numerous occasions following heavy rainfall. It is currently damaged and in need of repair due to potholes, cracking, rutting, and areas of standing water. Avoiding damaged surface is difficult under normal conditions. Evacuation during a disaster will further exacerbate navigating uneven and damaged surfaces.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	Crockett ISD – Action #4
Proposed Action:	Install back-up generators for all district buildings.
BACKGROUND INFORMATION	
Jurisdiction/Location:	1. Crockett Elementary School 2. Crockett Junior High School 3. Crockett High School 4. Piney Woods/ Crockett AEC 5. Crockett ISD Administration Building 6. Early Childhood Center
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Avoid disruption of essential utility services for all students and faculty during severe weather events.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Hurricane Wind, Thunderstorm, Tornado, Winter Storm, Hail, Earthquake, Extreme Heat
Effect on New/Existing Buildings:	Continue to provide essential services
Priority (High, Moderate, Low):	High
Estimated Cost:	$30,000
Potential Funding Sources:	HMGP Grants
Lead Agency/Department Responsible:	Superintendent, Grants Administrator
Implementation Schedule:	2014-2015
Incorporation into Existing Plans:	Emergency Management Plan, Risk Management Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

LATEXO INDEPENDENT SCHOOL DISTRICT

	Latexo ISD – Action #1
Proposed Action:	Install hail guards on A/C units.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Throughout school district
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Increase efficiency of units by minimizing debris damage, reduce electrical costs to ISD, and reduce health risk to students and faculty from overheating units unable to properly cool school buildings.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm, Hail, Tornado, Winter Storm, Extreme Heat
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$30,000
Potential Funding Sources:	HMGP grant
Lead Agency/Department Responsible:	School Administrator
Implementation Schedule:	2014 or upon funding
Incorporation into Existing Plans:	Emergency Response Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	Latexo ISD – Action #2
Proposed Action:	Acquire cell phone software application for enabling instructors/ISD employees' to access real-time weather alerts during outside sports activities, during/after school, and weekend school activities.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Throughout school district
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce potential weather-related accidents to students and faculty from lightning strikes and other severe weather events.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Local Plans and Regulations, Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm, Hail, Tornado, Winter Storm, Extreme Heat, Flood, Wildfire, Hurricane Wind
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	
Potential Funding Sources:	HMGP grant
Lead Agency/Department Responsible:	School Administrator
Implementation Schedule:	2014 or upon funding
Incorporation into Existing Plans:	Emergency Response Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	Latexo ISD – Action #3
Proposed Action:	Implement an emergency evacuation plan for students and faculty in the event of natural disasters and periodically conduct drills to ensure safe and expeditious evacuations.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Throughout school district
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce potential loss of life to students and faculty from severe weather events; improve emergency response time in the event of evacuation.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm, Hail, Tornado, Winter Storm, Flood, Wildfire, Hurricane Wind
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	
Potential Funding Sources:	HMGP grant
Lead Agency/Department Responsible:	School Administrator
Implementation Schedule:	2014 or upon funding
Incorporation into Existing Plans:	Emergency Response Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	Latexo ISD - Action #4
Proposed Action:	Replace rotted and worn guttering on buildings as a result of accumulated debris from severe weather events.
BACKGROUND INFORMATION	
Site and Location:	High school campuses
Risk Reduction Result *(Current Cost/Losses Avoided)***:**	Reduce ongoing maintenance of culverts and ditches, and clearing of debris due to runoff and poor drainage during flash flood events.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm, Hail, Tornado, Winter Storm, Flood
Effect on new/existing buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$50,000
Potential Funding Sources:	HMGP grant
Lead Agency/Department Responsible:	School Administrator
Implementation Schedule:	2014 or upon funding
Incorporation into Existing Plans:	Maintenance/Infrastructure Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

Latexo ISD – Action #5	
Proposed Action:	Remove large stand of weakened and/or dead pine trees on east side of high school building to prevent toppling during severe weather events.
BACKGROUND INFORMATION	
Jurisdiction/Location:	High school
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk to students and faculty from falling trees during wildfire and other severe weather events; reduce potential damage to high school and adjacent buildings in the event of toppling.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm, Hail, Tornado, Winter Storm, Extreme Heat, Drought, Flood, Wildfire, Hurricane Wind
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$15,000
Potential Funding Sources:	HMGP grant
Lead Agency/Department Responsible:	School Administrator
Implementation Schedule:	2014 or upon funding
Incorporation into Existing Plans:	Risk Reduction Plan

COMMENTS
Large stand of older, weak pine trees pose a risk to life and property due to wildfire and other severe weather events.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	Latexo ISD – Action #6
Proposed Action:	Expand existing culverts to improve natural drainage and reduce minor flooding on campus.
BACKGROUND INFORMATION	
Jurisdiction/Location:	High school
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce maintenance and removal of debris from waters coming out of banks during flash flooding; reduce risk to students and faculty by containing floodwaters.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Protect buildings
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$100,000
Potential Funding Sources:	HMGP, PDM, HMA
Lead Agency/Department Responsible:	School Administrator
Implementation Schedule:	2014-2016
Incorporation into Existing Plans:	Maintenance/Infrastructure Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

HOUSTON COUNTY WATER CONTROL & IMPROVEMENT DISTRICT #1

	Houston County WCID #1 – Action #1
Proposed Action:	Install water recycling system for the treatment plant to reduce evaporation affected by drought conditions.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Houston County Treatment Plant 589 CR2125, Latexo, Texas 75849
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce operating costs, save approximately 3- 4 million gallons of water per month.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Drought
Effect on New/Existing Buildings:	None
Priority (High, Moderate, Low):	High
Estimated Cost:	$1,000,000-$2,000,000
Potential Funding Sources:	FEMA, TWDB
Lead Agency/Department Responsible:	Houston County WCID #1
Implementation Schedule:	2-4 years
Incorporation into Existing Plans:	Land Use Plan, Treatment Plant Operations

COMMENTS
Severe drought conditions 2010-2012 affected amount of water in dam; Houston County Lake Dam is the primary source of drinking water for 5 WCID customers in the county, including several of the incorporated communities.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	Houston County WCID #1 – Action #2
Proposed Action:	Develop evacuation plan for residents downstream of Houston County Lake Dam.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Houston County Lake Dam (west of Crockett)
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce loss of life due to dam failure.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam Failure, Flood
Effect on New/Existing Buildings:	Possible flooding of structures in inundation area d/s
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000-$15,000
Potential Funding Sources:	FEMA, TWDB
Lead Agency/Department Responsible:	Houston County WCID #1
Implementation Schedule:	2-3 years
Incorporation into Existing Plans:	Emergency Actions Plan

COMMENTS
Though classified as low hazard dam, the dam is large at 27,000 acre/feet storage capacity.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	Houston County WCID #1 – Action #3
Proposed Action:	Adopt ordinance to limit amount of water pumped by each waterfront property owner around Houston County Lake.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Houston County Lake
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce water removed during water shortage or drought conditions.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Drought
Effect on New/Existing Buildings:	Provide continual supply of water to all water customers
Priority (High, Moderate, Low):	Low
Estimated Cost:	$12,000-$13,000 annually
Potential Funding Sources:	HMGP
Lead Agency/Department Responsible:	Houston County WCID #1
Implementation Schedule:	2014-2019
Incorporation into Existing Plans:	Emergency Action Plan

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	Houston County WCID #1 – Action #4
Proposed Action:	Fence emergency spillway to prevent 4-wheeler, trucks, and ATV traffic from destroying natural vegetation, causing erosion during severe rainfall event.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Houston County Lake near Crockett
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Avoid erosion of dam and outlying areas.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Natural Systems Protection

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Unknown
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000
Potential Funding Sources:	FEMA Grant
Lead Agency/Department Responsible:	Houston County WCID #1
Implementation Schedule:	2014-2016
Incorporation into Existing Plans:	Response Management Plan; Treatment Plant Operations

COMMENTS
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 17: MITIGATION ACTIONS

	Houston County WCID #1 – Action #5
Proposed Action:	Develop Emergency Action Plan for Houston County Lake Dam.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Houston County Lake near Crockett
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Recommended by TCEQ to mitigate dam failure and flood, and as a maintenance guideline for periodic inspections.
Type of Action (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam Failure, Flood
Effect on New/Existing Buildings:	Unknown
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000-$15,000
Potential Funding Sources:	FEMA Grant
Lead Agency/Department Responsible:	Houston County WCID #1
Implementation Schedule:	2014-2016
Incorporation into Existing Plans:	Response Management Plan

COMMENTS
Recommended by TCEQ.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 4; Legal = 3; Economically Sound = 4; and Environmentally Sound = 3

SECTION 18: PLAN MAINTENANCE

PLAN MAINTENANCE PROCEDURES

The following is an explanation of how the participating jurisdictions and Houston County will implement the Plan, and continue to evaluate and enhance it over time. In order to ensure that the Plan remains current and relevant, the following plan maintenance procedures will be addressed:

- Monitoring and Evaluating the Plan
- Updating the Plan
- Incorporating the Plan into other Planning Mechanisms
- Continued Public Involvement

MONITORING AND EVALUATION

Periodic revisions of the Plan are required to ensure that the goals, objectives, and mitigation action plans are kept current. In addition, revisions may be necessary to ensure that the Plan remains in full compliance with state and federal standards.

PLAN MONITORING

Monitoring the Plan will be the responsibility of Houston County, each respective jurisdiction included in the Plan, and any additional planning team members. Each community has designated one person or department responsible for the development and implementation of the Plan. This team member's title is listed in Appendix A. The person that holds the title listed in Appendix A will be responsible for monitoring the Plan. The Plan will be monitored by each jurisdiction annually. The department responsible will review

mitigation actions submitted and develop a brief report if any changes are needed, such as recommending an action for funding.

PLAN EVALUATION

As part of the evaluation process, team members from each jurisdiction will meet bi-annually. The first meeting will be held among those involved in the planning process for the specific jurisdiction. The second meeting will be held at the county level so that Houston County and the communities therein can assess any changes in risk, determine whether implementation of mitigation actions is on schedule or if there are any implementation problems (such as technical, political, legal or coordination issues), and reflect changes in land development or programs that affect mitigation priorities in their respective jurisdictions.

UPDATING

PLAN AMENDMENTS

At any time, minor technical changes may be made to the Plan to keep it current. If additional entities would like to join in the planning effort by way of an amendment they may do so provided that Houston County approves of the addition and FEMA regulations for adding a jurisdiction are followed. Any changes by a participating jurisdiction to the mitigation actions or modifications in the overall direction of the Plan will be subject to approval by the governing body of that jurisdiction. Upon ratification, the amendment will be transmitted to TDEM.

The following factors will be considered in developing an amendment:

- Errors or omissions made in the identification of issues or needs during the preparation of the Plan;
- New issues or needs that were not adequately addressed in the Plan; and
- Changes in information, data or assumptions from those on which the Plan was based.

FIVE (5) YEAR REVIEW

The Plan will be thoroughly reviewed by each planning team member at the end of three years from the date of adoption by the local governing body to determine whether there have been any significant changes that necessitate changes in the types of mitigation actions proposed. New development in identified hazard areas, an increased exposure to hazards, disaster declarations, the increase or decrease in capability to address hazards, and changes to federal or state legislation are examples of factors that may affect the content of the Plan.

This plan review will provide Houston County and participating jurisdictions with an opportunity to evaluate successful actions and document potential losses avoided due to the implementation of specific mitigation measures. The plan review also provides the opportunity to address mitigation actions that may

not have been successfully implemented as assigned. It is recommended that the planning team meet to review the Plan at the end of three years, as grant funds may be necessary for the development of a five-year update. Due to the timelines for grant cycles, it is wise planning to begin the review process in advance of the five-year deadline.

Following the review, any revisions deemed necessary will be summarized and utilized according to the reporting procedures and plan amendment process outlined herein. Upon completion of the review and update/amendment process and after being approved by the local governing body, the revised plan will be submitted to TDEM for final review and approval in coordination with FEMA.

INCORPORATION

At the beginning of the planning process, each team member was given a capability assessment survey to complete for their jurisdiction. The purpose of this survey was to identify the plans available for the incorporation of the Plan by inventorying each jurisdiction's relevant plans, programs and ordinances; identify shortfalls or weaknesses that could hinder the incorporation or implementation of mitigation actions; identify opportunities for establishing or enhancing mitigation policies, programs or projects; and establish goals based on an understanding of the organizational capacity and technical capability of each community.

INCORPORATION OF THE PLAN

Table 18-1 identifies several key planning mechanisms and how they correlate to the HMAP in terms of Plan maintenance and updates. Appendix F, Capability Assessment (Table F-1), includes a detailed summary of all existing planning mechanisms in place for each respective Planning Team member. It also reflects the contact person responsible for tracking mitigation actions in the community, and specific means by which to incorporate mitigation actions into other planning mechanisms.

Table 18-1. Examples of Incorporation of the Plan

PLANNING MECHANISM	METHOD OF INCORPORATION
Grant Applications	Jurisdictions will consult the Plan whenever there are yearly grant funding cycles available through FEMA, including the Pre-Disaster Mitigation (PDM) cycle and when there is a Disaster Declaration for Texas triggering Hazard Mitigation Grant Program (HMGP) funds. Mitigation actions for each jurisdiction will be reviewed by the planning team members and information will be updated for completing applications, such as maps and risk assessment data. If a project is not in the Plan, an amendment may be developed.

SECTION 18: PLAN MAINTENANCE

PLANNING MECHANISM	METHOD OF INCORPORATION
Annual Budget Review	Each jurisdiction that participated in the planning process will review the Plan and mitigation actions therein when conducting their annual budget review. When allocating funds for upcoming operating and construction budgets, high priority mitigation actions will be reviewed during City Council and Commissioner Court meetings. Each Planning Team member will be responsible for bringing mitigation actions to their respective county or city to discuss feasibility of the potential project in terms of the availability of funds, grant assistance and a preliminary cost benefit review.
Emergency Planning	Based on the results of the Capability Assessment Survey, jurisdictions in Houston County have an Emergency Operations or Management Plan. The Plan will be consulted when during updates to each jurisdiction's local emergency and/or disaster recovery plan. Risk assessment and vulnerability data will be pulled from the plan and reviewed in conjunction with the review, renewal or re-writing of an Emergency Operations or Management Plan. This data will either be included within the new emergency planning mechanism or included as an appendix. Mitigation projects that relate to prevention and protection will also be reviewed for relevance to determine if they should be included.
Capital Improvements	Before any updates to Capital Improvement Plans (CIP) are conducted, jurisdictions that have CIP programs in place will review the risk assessment and mitigation strategy sections of the Plan, as limiting public spending in hazardous zones is one of the most effective long-term mitigation actions available to local governments. Profile information and data regarding NFIP compliance and maintenance will be reviewed in conjunction with any CIP that is developed. If new census or land use data is available, this information should be added to the Plan.

SECTION 18: PLAN MAINTENANCE

PLANNING MECHANISM	METHOD OF INCORPORATION
Floodplain Management and Fire Protection	The Plan will be utilized in updating and maintaining floodplain management and fire protection plans, as the goals of both planning mechanisms are similar. In updating or maintaining these plans, the Plan will be consulted for NFIP compliance and flood risk. Information from these sections will be reviewed for inclusion. In addition, mitigation actions that address wildfire and flood will be reviewed for inclusion by jurisdictions.

CONTINUED PUBLIC INVOLVEMENT

Input from the public was an integral part of the preparation of the Plan and will continue to be essential as the Plan grows and changes. As noted above, a significant change to this plan will require opportunities for the public to make its views known.

This Plan will be posted on Houston County's website, www.co.houston.tx.us/, and the websites of participating jurisdictions, where available, so that officials and the public will be able to provide ongoing feedback. A copy of the Plan also will be kept for public review at Houston County Emergency Management offices.

Further, if necessary, Houston County can designate voluntary citizens or willing members of the private sectors as members of the planning team, as well as utilize local media to notify the public of any maintenance or periodic review activities taking place.

APPENDIX A: PLANNING TEAM

PLANNING TEAM MEMBERS

The Houston County Plan was organized using a direct representative model, as Houston County acted as the direct representative or Advisory Committee for participating jurisdictions in this effort. At the beginning of the process Houston County sent notices to jurisdictions asking for input and participation in the process. The following organizations[1] responded to the request and participated throughout the planning process.

Table B-1. Advisory Committee Planning Team Members – Organization and Title

ORGANIZATION	TITLE
Houston County Staff	Emergency Management Office
Houston County Judge	County Judge and Staff

Table B-2. Team Members – Organization and Title

ORGANIZATION	TITLE
Houston County	EMC
City of Crockett	EMC
City of Grapeland	EMC
City of Kennard	EMC
City of Latexo	EMC
City of Lovelady	EMC
Crockett ISD	Superintendent
Latexo ISD	Superintendent
Houston County Water Control & Improvement District #1	Manager

[1] Titles are given rather than names as the person holding the title in the respective organization will be responsible for continual maintenance of the Plan

APPENDIX B: PUBLIC SURVEY

OVERVIEW

Houston County prepared public surveys that asked a wide range of questions concerning the opinions of the public regarding natural and man-caused hazards. This fifteen-question survey was made available on the Houston County website. This survey link and paper copies of the survey were also distributed at public meetings and stakeholder events throughout the planning process.

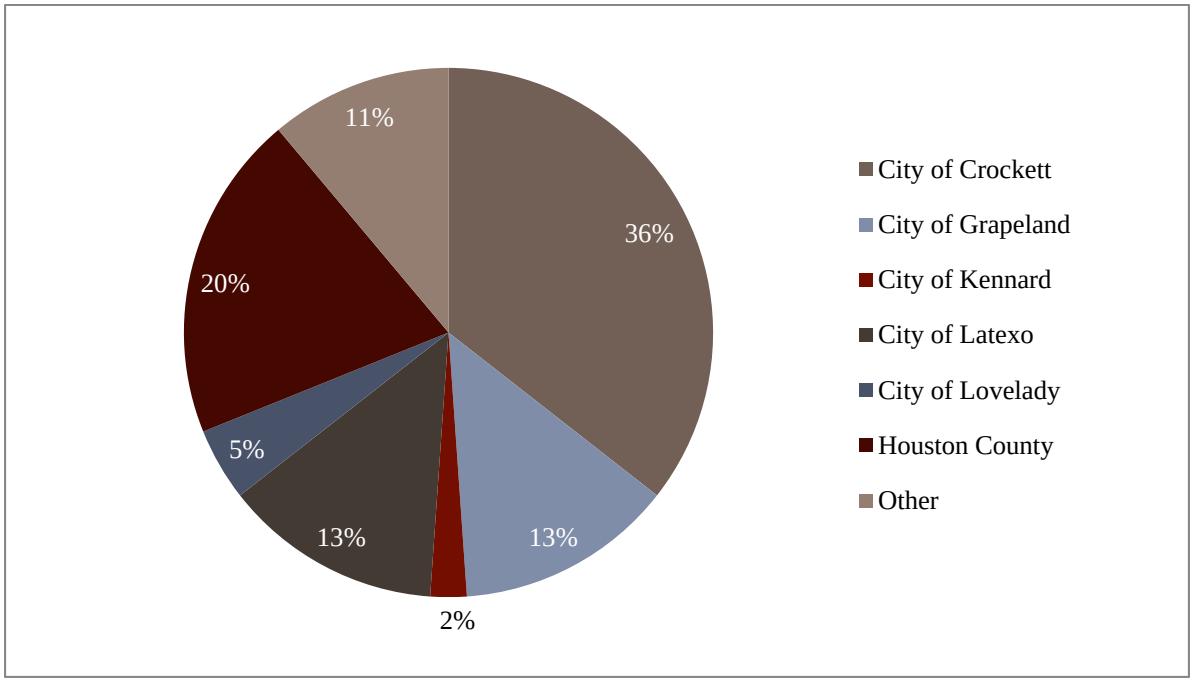
A total of 44 surveys were collected, the results of which are analyzed in this Appendix. The purpose of the survey was twofold: 1) to solicit public input during the planning process and 2) to help the jurisdictions to identify any potential actions or problem areas.

Survey results are depicted on the following pages, showing the percentage of responses for each answer. For questions that did not provide a multiple-choice answer, or that required an explanation, comments are summarized where similar.

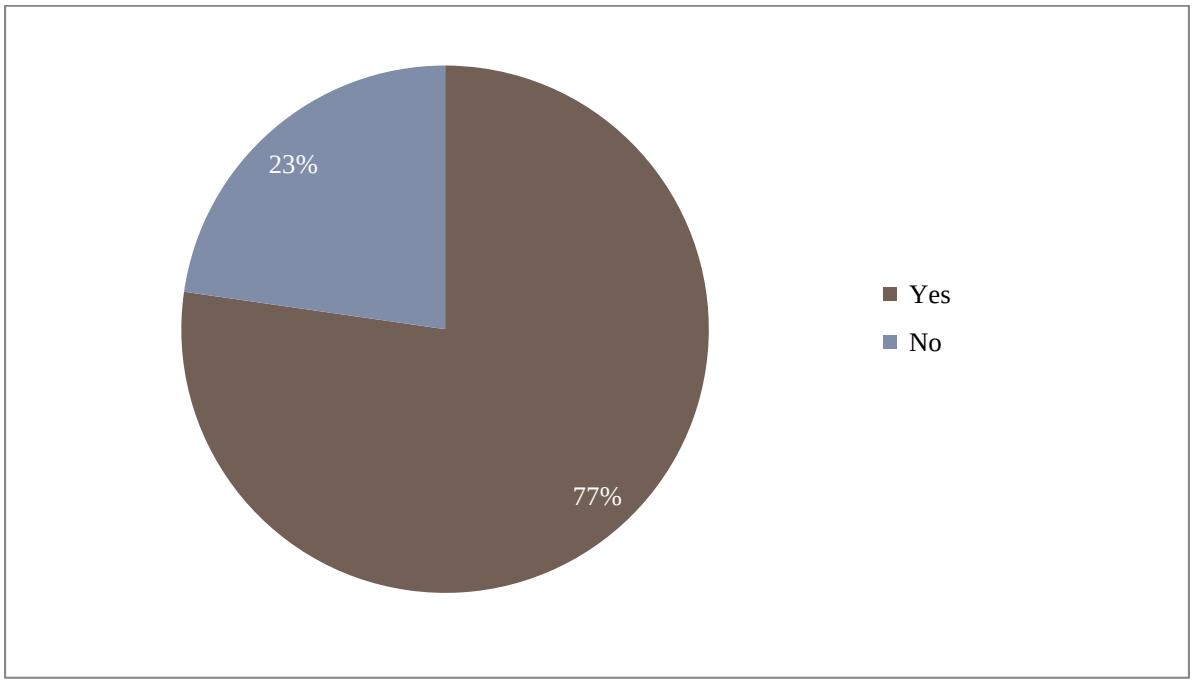
APPENDIX B: PUBLIC SURVEY

PUBLIC SURVEY RESULTS

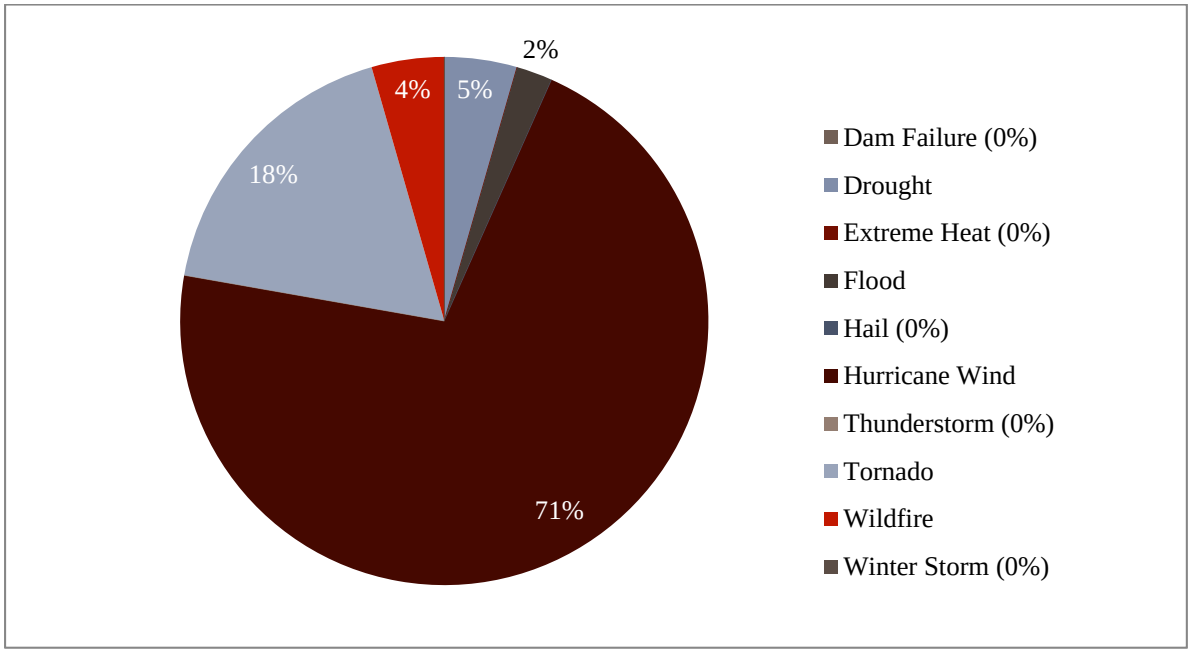
1. Please state the jurisdiction (city and community) where you reside.



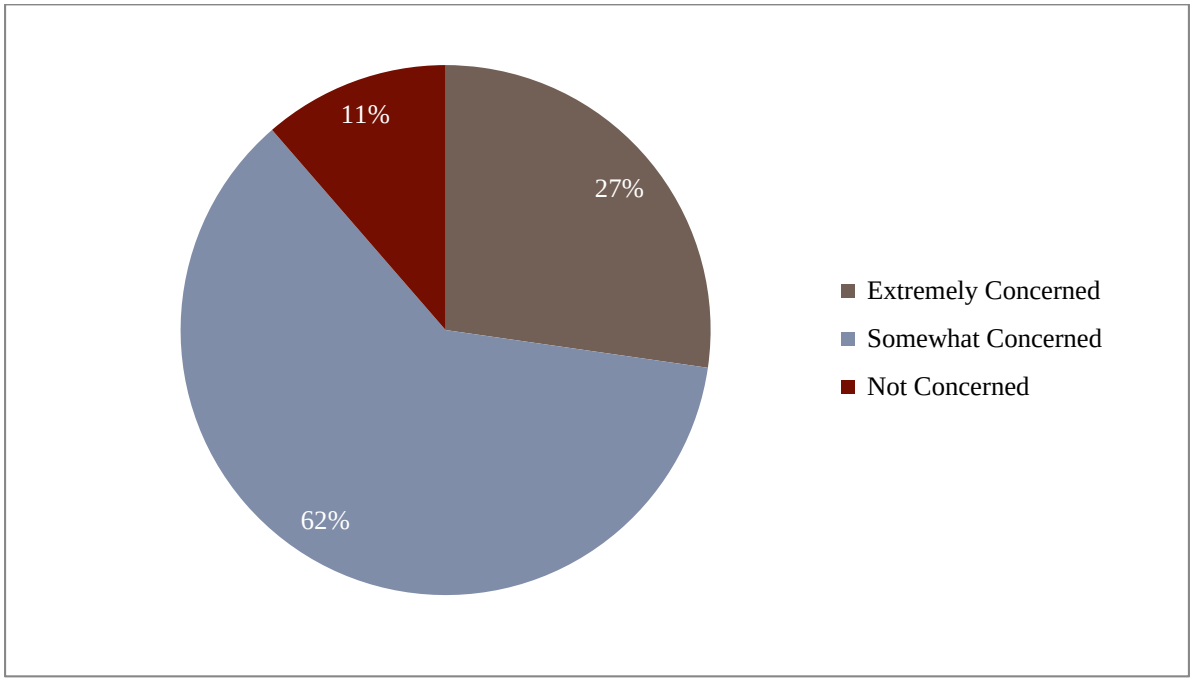
2. Have you ever experienced or been impacted by a disaster?



2. B. If “yes”, please explain:

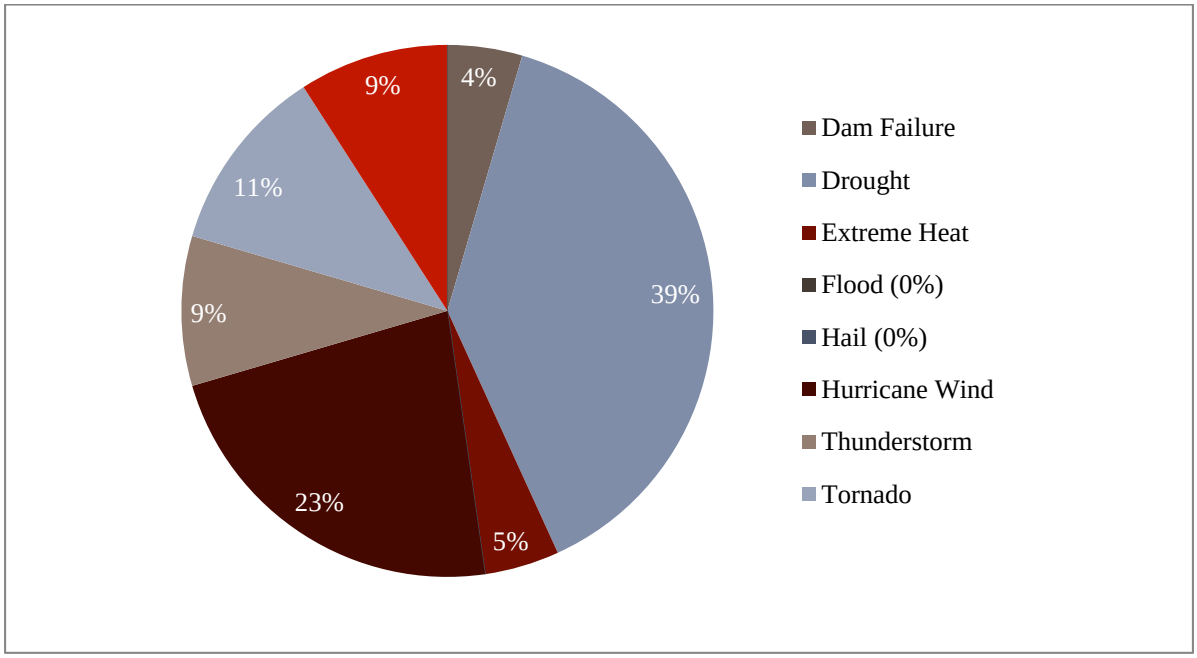


3. How concerned are you about the possibility of your community being impacted by a disaster?

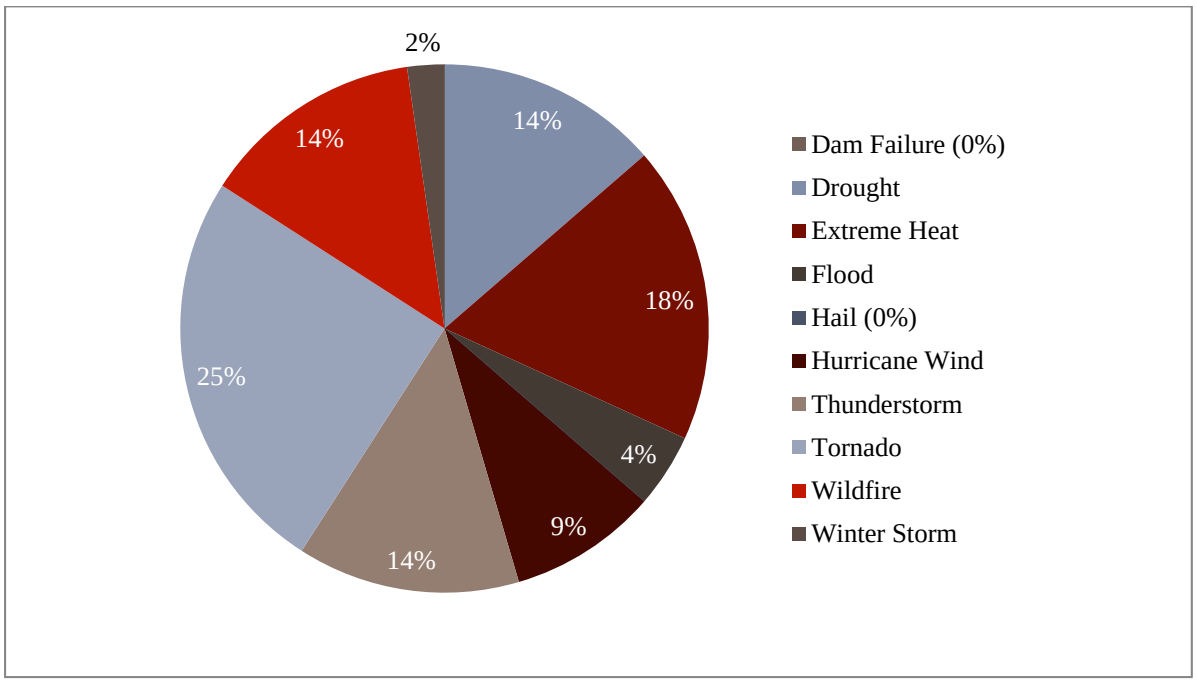


APPENDIX B: PUBLIC SURVEY

4. Please select the one hazard you think is the highest threat to your neighborhood:

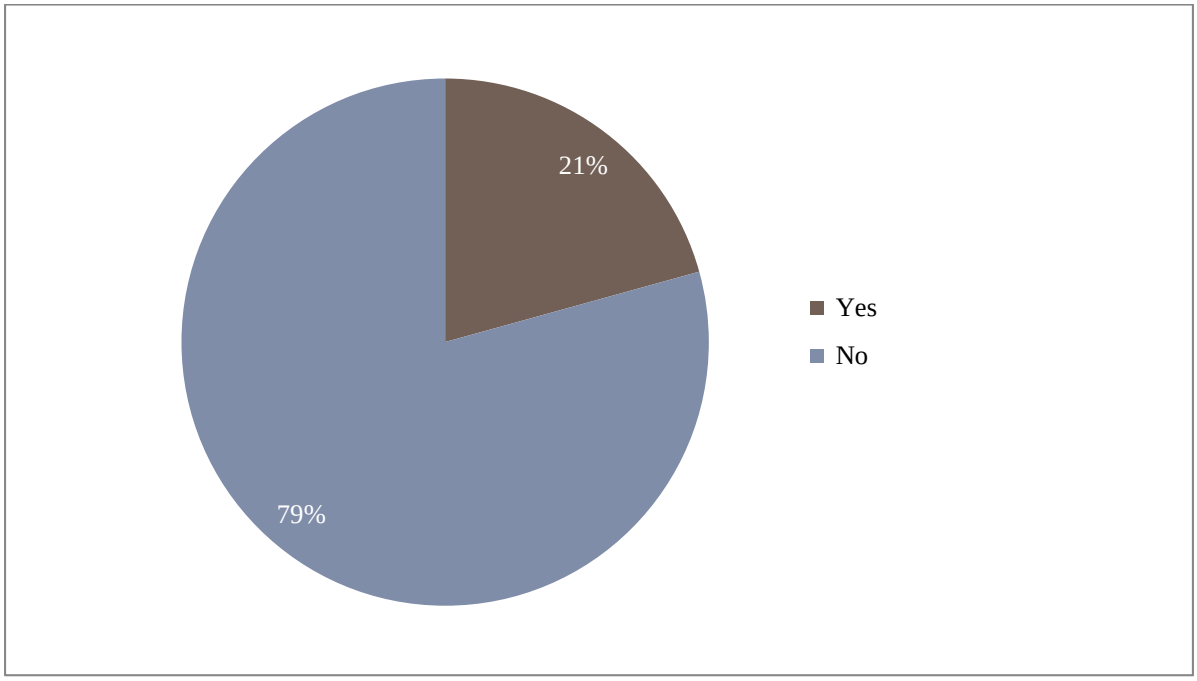


5. Please select the one hazard you think is the second highest threat to your neighborhood:

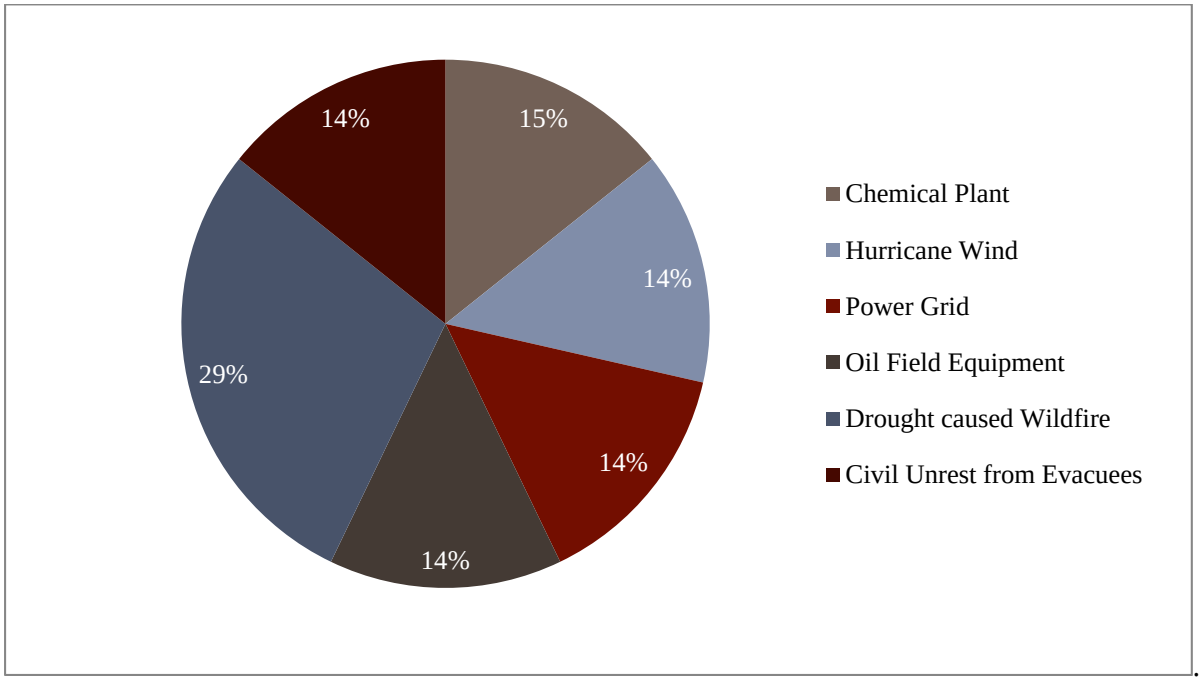


APPENDIX B: PUBLIC SURVEY

6. Are there hazards not listed above that you think is a wide-scale threat to your neighborhood?



6. B. If "Yes," please explain.



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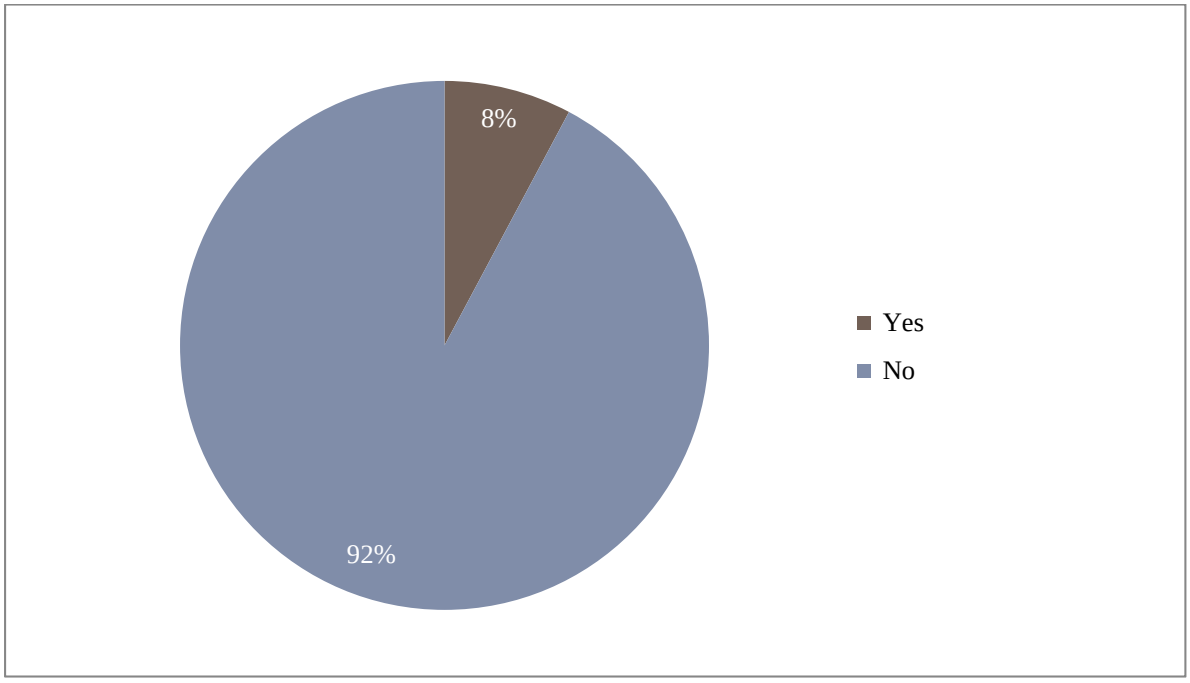
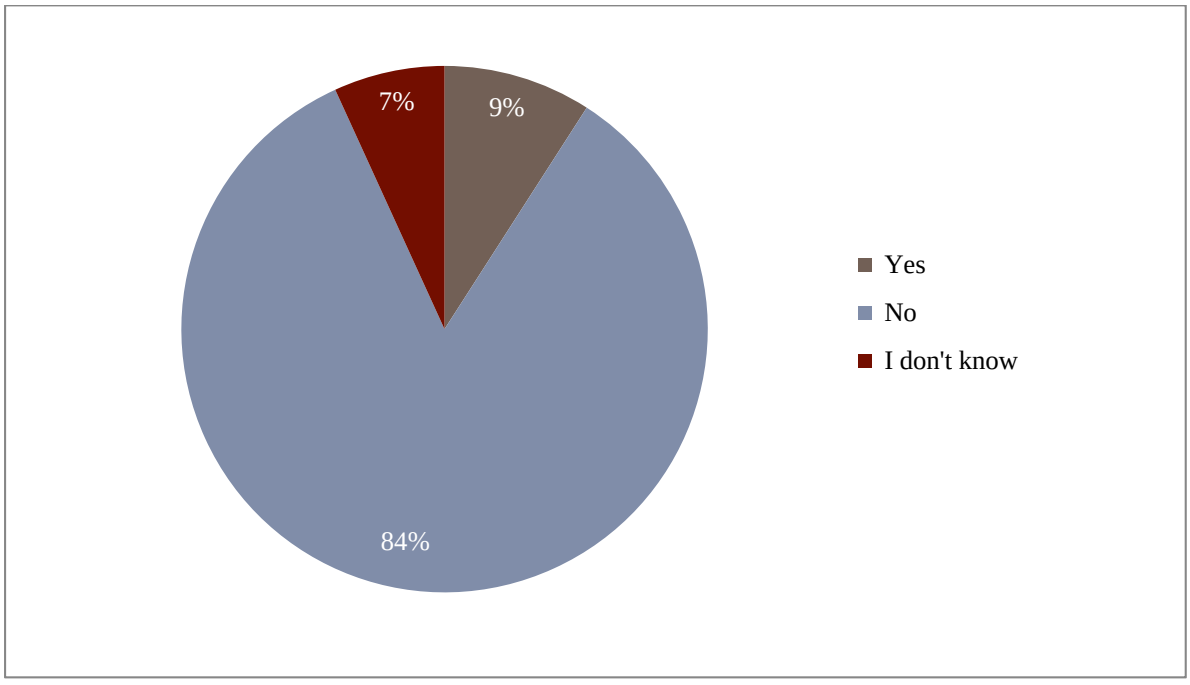
APPENDIX B: PUBLIC SURVEY

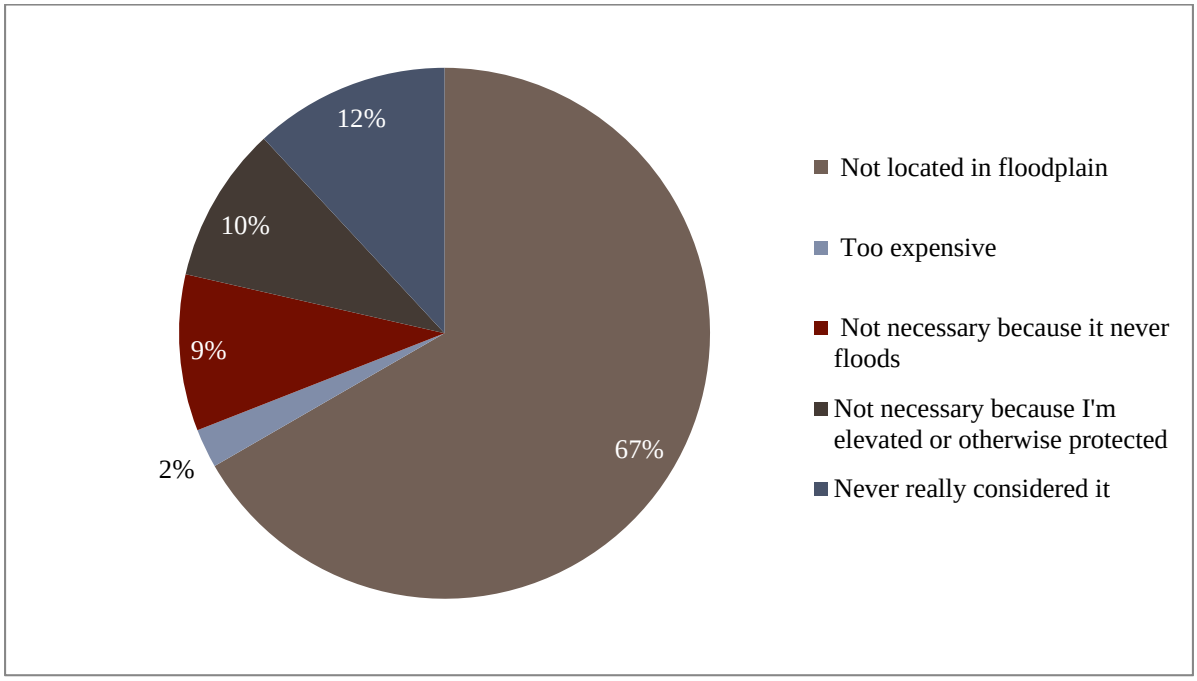
7. Is your home located in a floodplain?



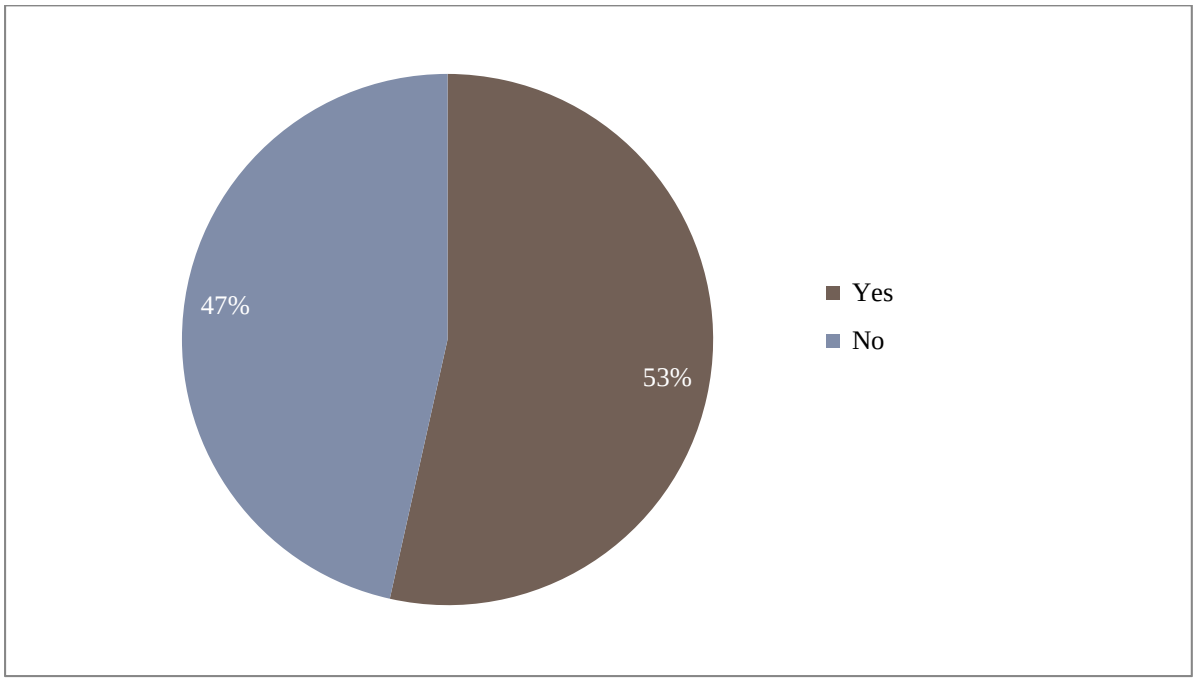
8. Do you have flood insurance?



9. If you do not have flood insurance, why not?

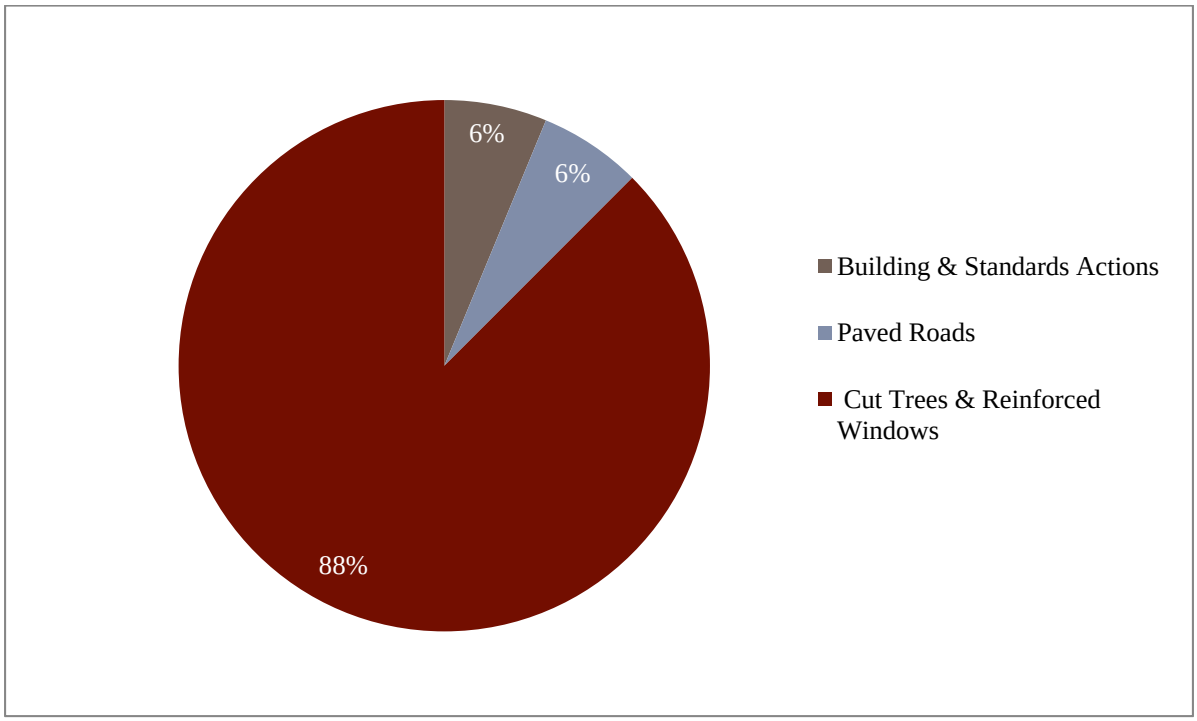


10. Have you taken any actions to make your home or neighborhood more resistant to hazards?

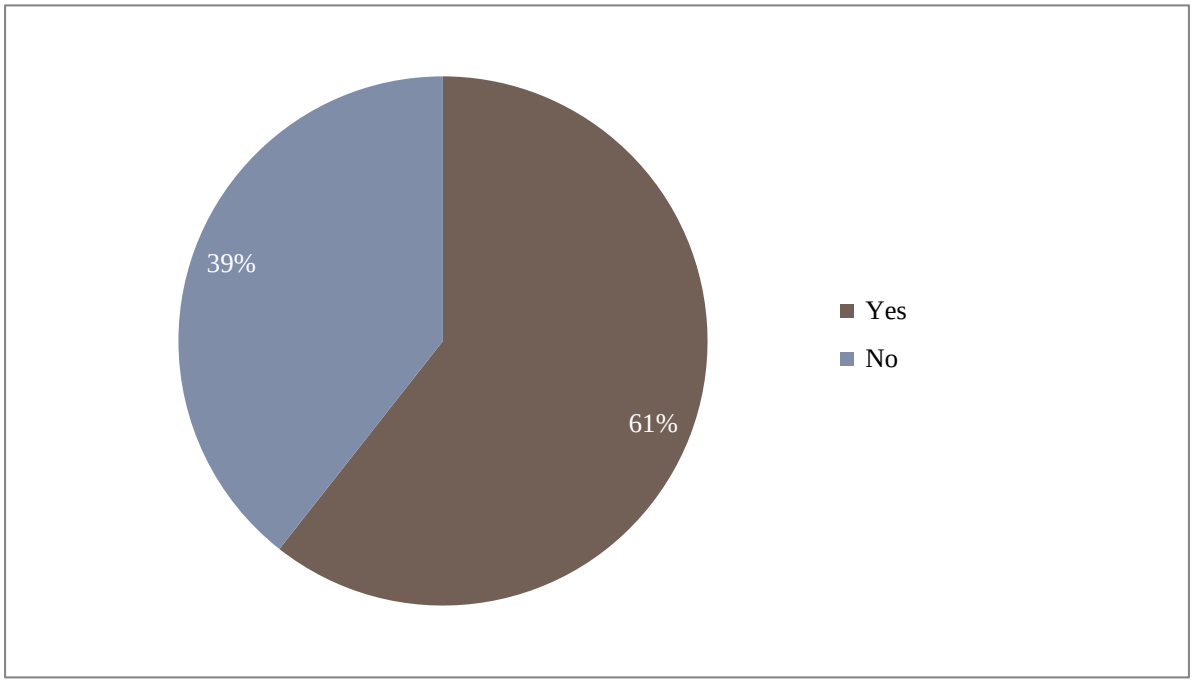


APPENDIX B: PUBLIC SURVEY

10. B. What have you done?

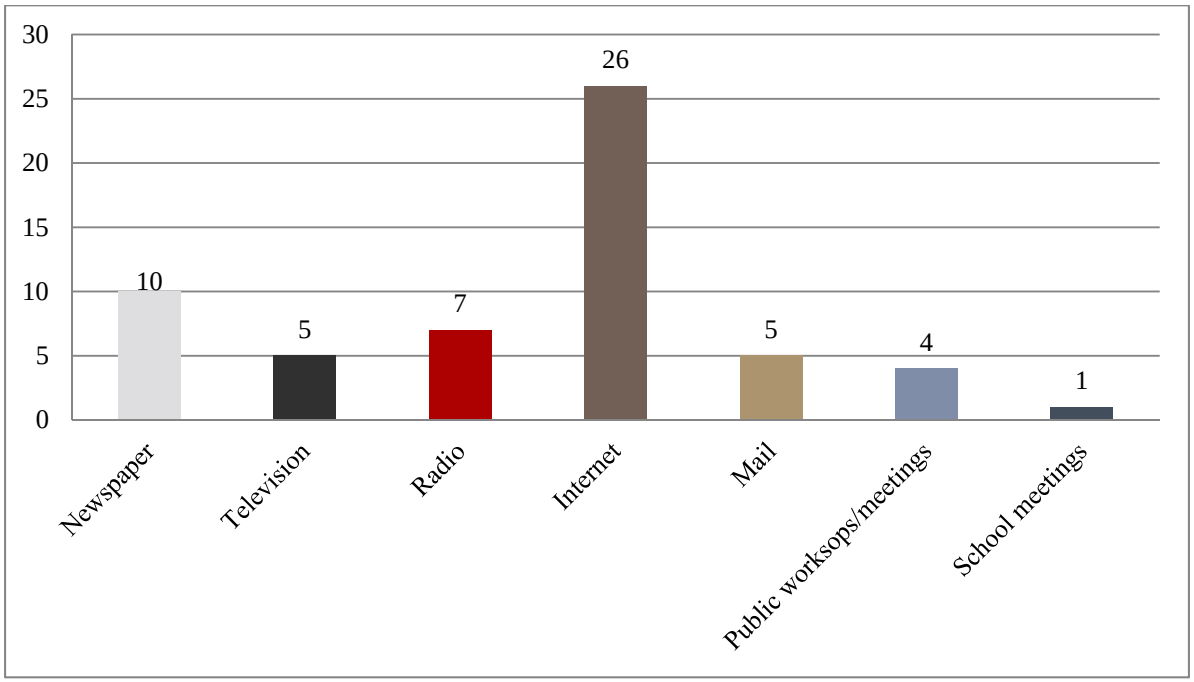


11. Are you interested in making your home or neighborhood more resistant to hazards?

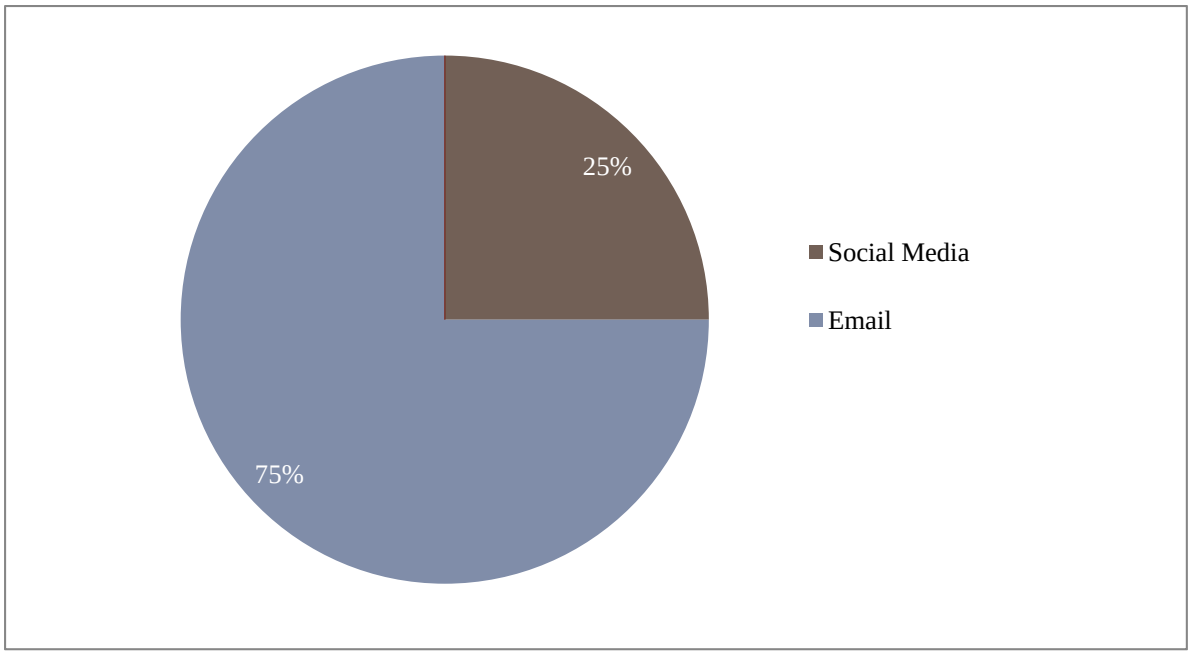


APPENDIX B: PUBLIC SURVEY

12. What is the most effective way for you to receive information about how to make your home and neighborhood more resistant to hazards?

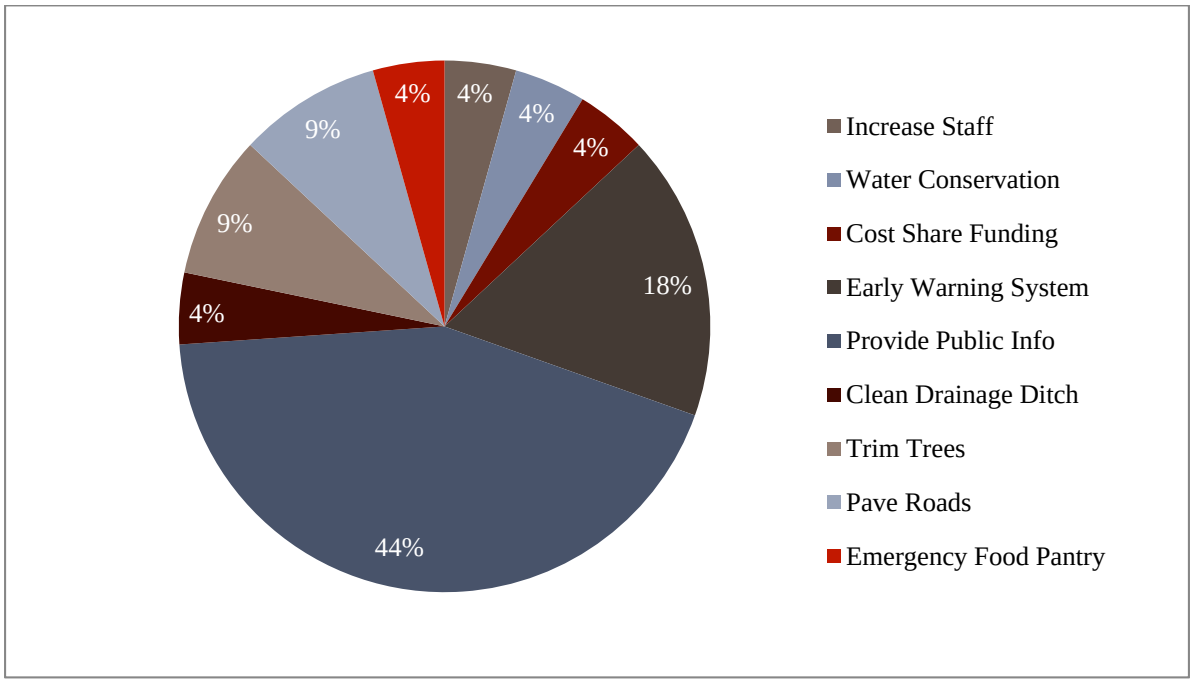


12. B. If other, please specify.

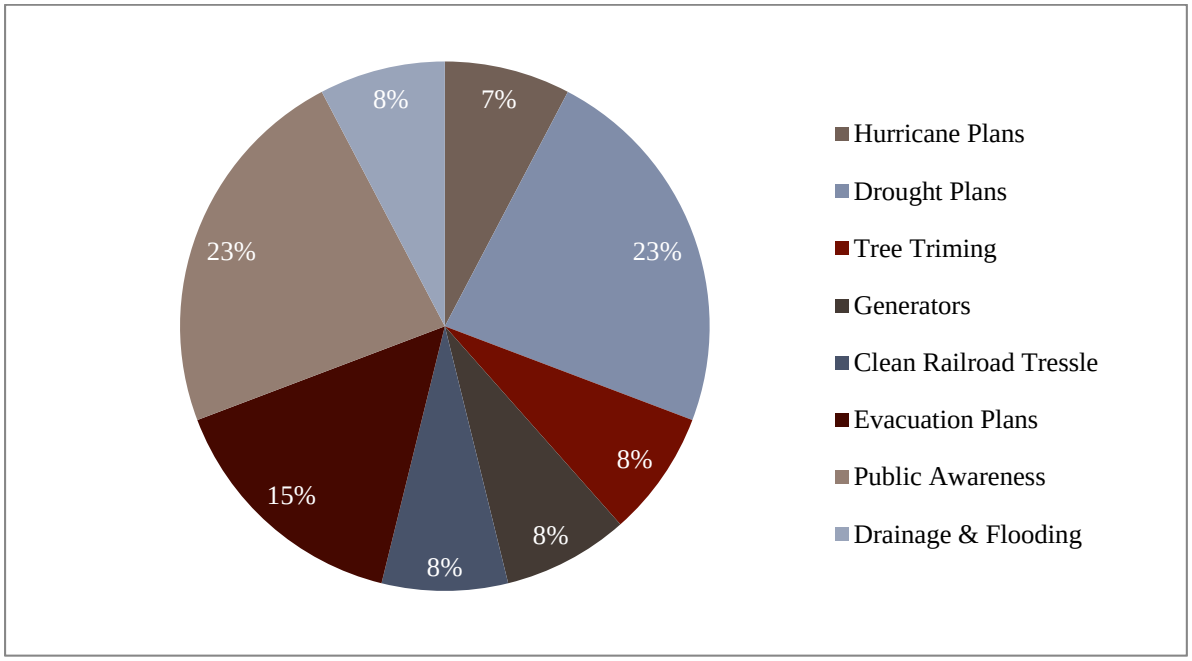


APPENDIX B: PUBLIC SURVEY

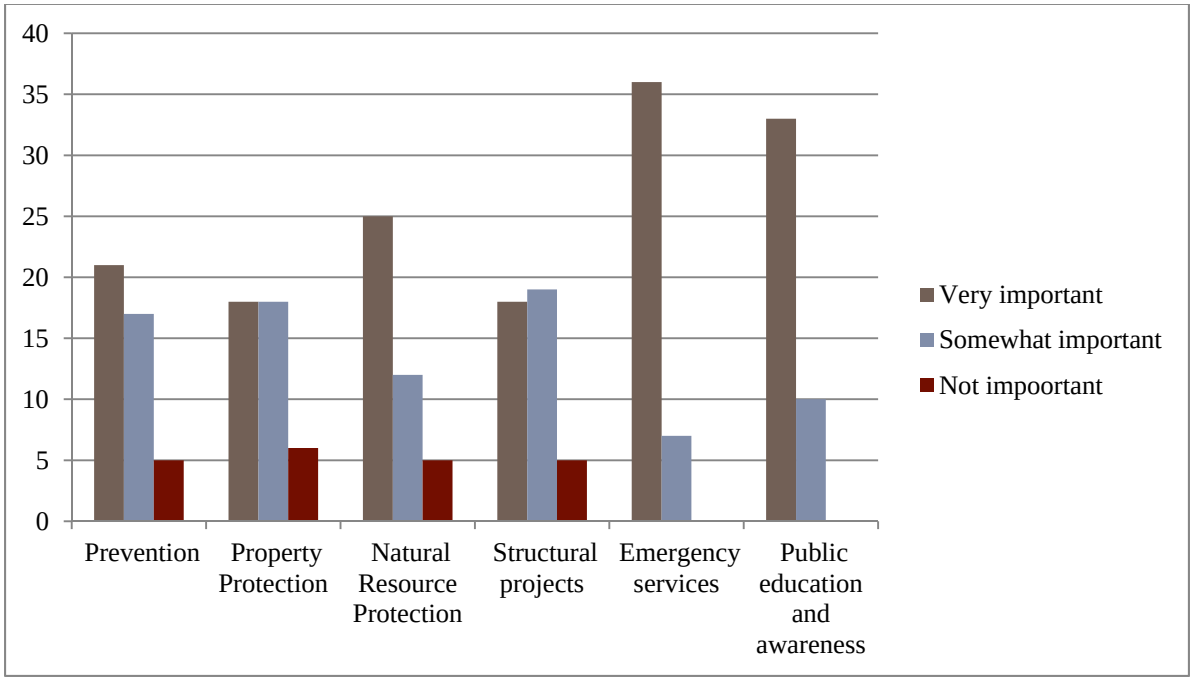
13. In your opinion, what are some steps your local government could take to reduce or eliminate the risk of future hazard damages in your neighborhood?



14. Are there any other issues regarding the reduction of risk and loss associated with hazards or disasters in the community that you think are important?



15. A number of community-wide activities can reduce our risk from hazards. In general, these activities fall into one of the following six broad categories. Please tell us how important you think each one is for your community to consider pursuing.



Local Plans/Regulations - Administrative or regulatory actions that influence the way land is developed and buildings are built. Examples include planning and zoning, building codes, open space preservation, and floodplain regulations.

Property Protection - Actions that involve the modification of existing buildings to protect them from a hazard or removal from the hazard area. Examples include acquisition, relocation, elevation, structural retrofits, and storm shutters.

Natural Resource Protection - Actions that in addition to minimizing hazard losses also preserve or restore the functions of natural systems. Examples include: floodplain protection, habitat preservation, slope stabilization, riparian buffers, and forest management.

Structural Projects - Actions intended to lessen the impact of a hazard by modifying the natural progression of the hazard. Examples include dams, levees, seawalls detention / retention basins, channel modification, retaining walls and storm sewers.

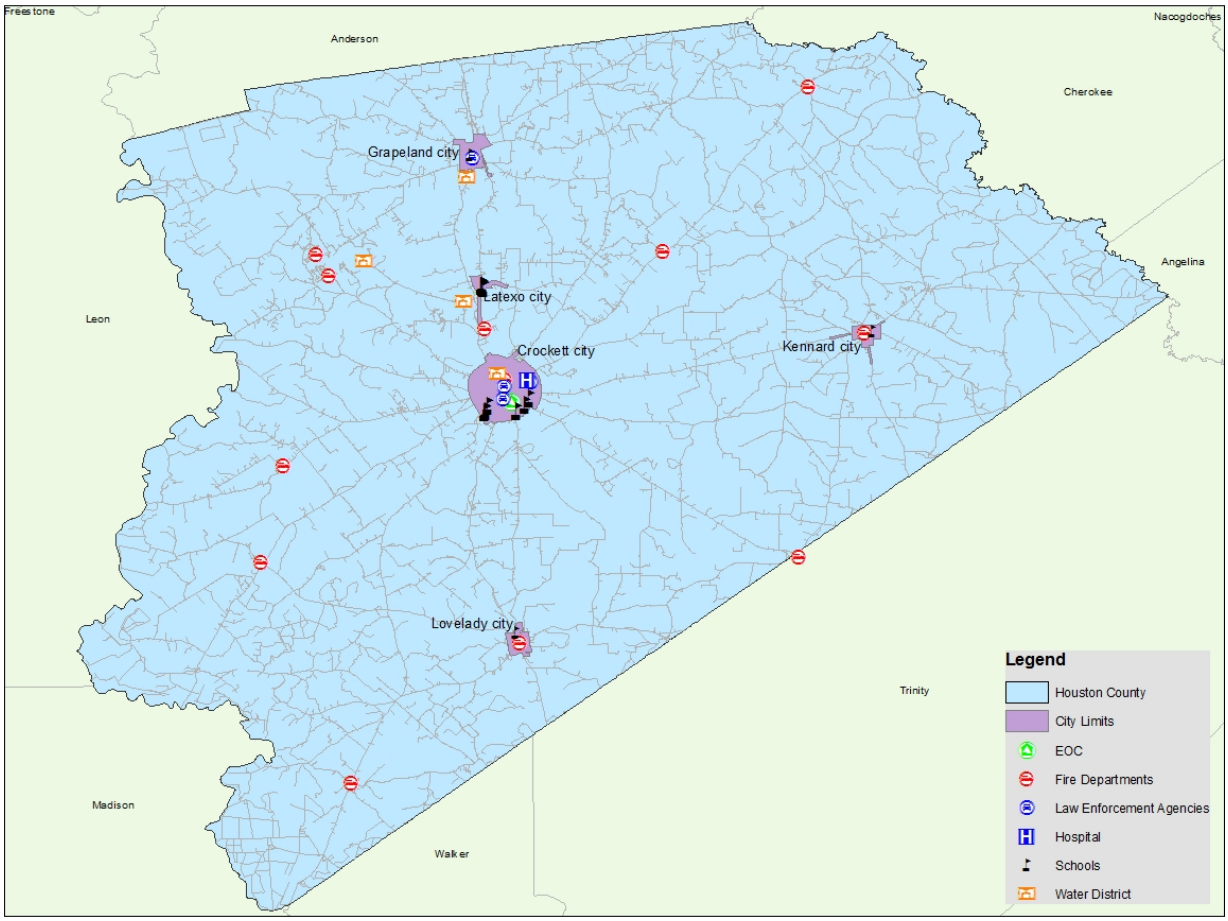
Emergency Services - Actions that protect people and property during and immediately after a hazard event. Examples include warning systems, evacuation planning, emergency response training, and protection of critical facilities or systems.

Public Education and Awareness - Actions to inform citizens about hazards and techniques they can use to protect themselves and their property. Examples include outreach projects, school education programs, library materials and demonstration events.

APPENDIX C: CRITICAL FACILITIES

This Appendix is **For Official Use Only (FOUO)** and may be exempt from public release under FOIA. Figures C-1 through C-9 locates all critical facilities that were included in the risk assessment. Facilities mapped were provided by the Houston County Planning Team members.

Figure C-1. Critical Facilities in Houston County



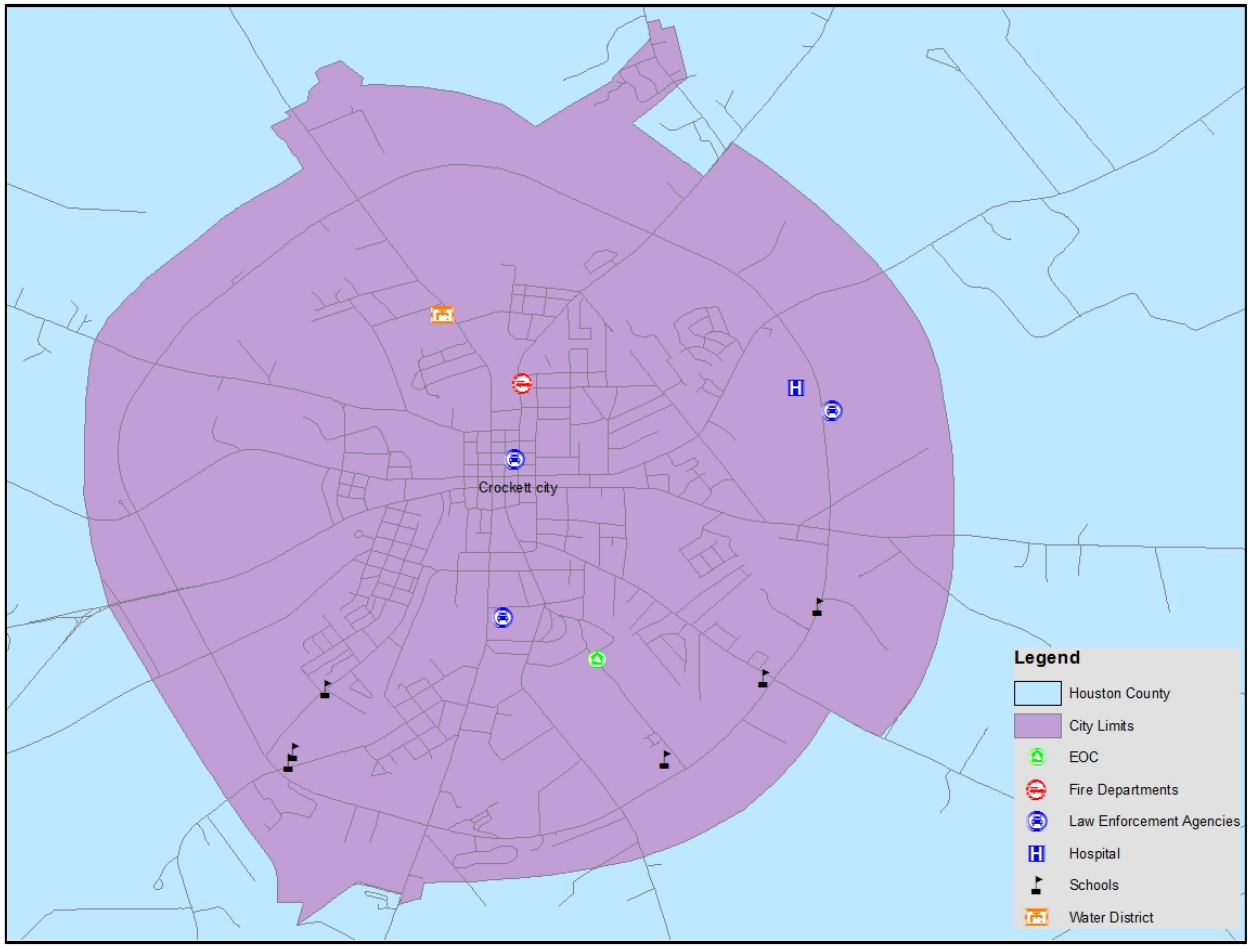
APPENDIX C: CRITICAL FACILITIES

Table C-1. Critical Facilities by Type in Houston County

TYPE	NUMBER
Emergency Operations Center	1
Fire Departments	13
Law Enforcement Agencies	4
Hospital	1
School Districts	4
School Buildings	23
Water District Locations	4

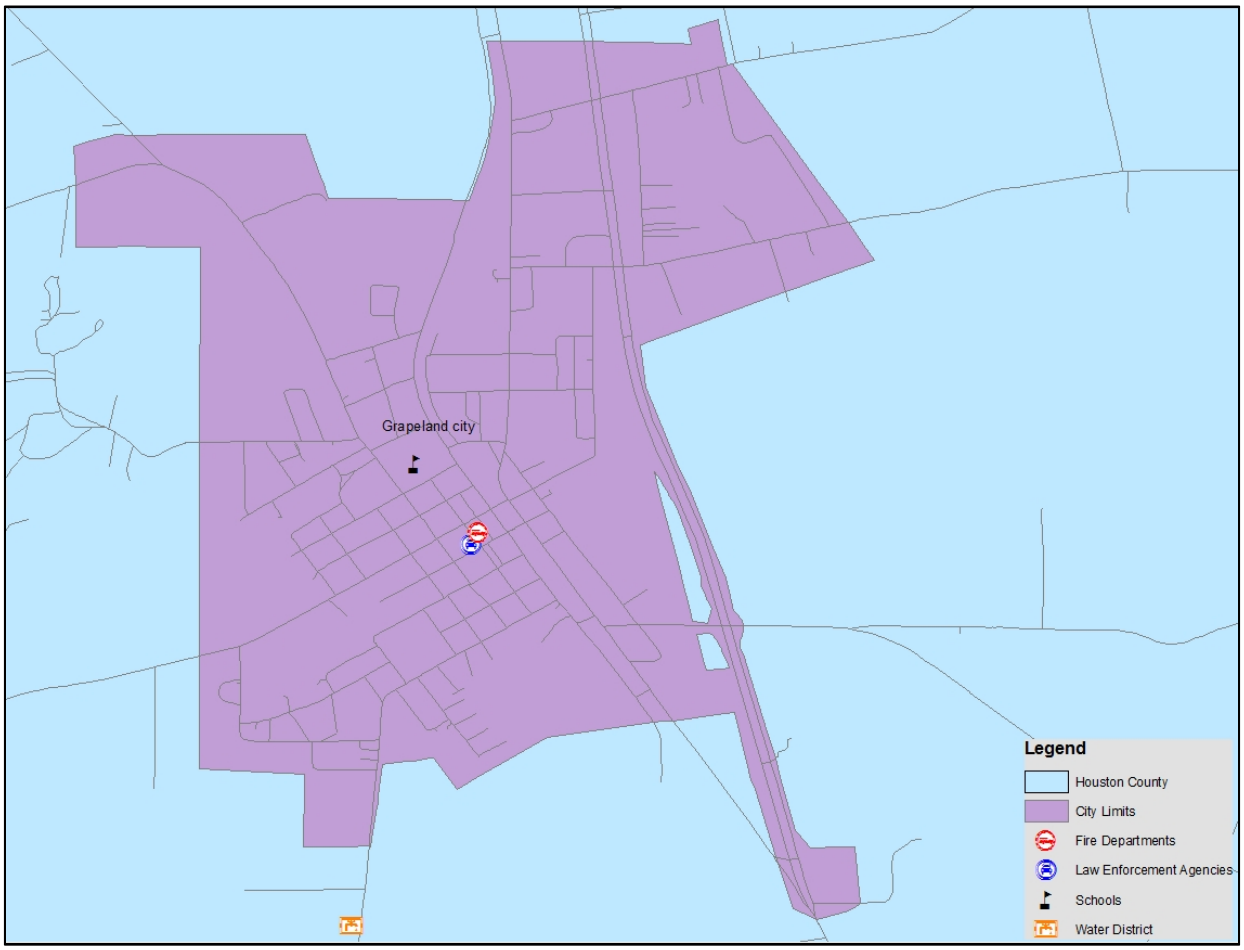
APPENDIX C: CRITICAL FACILITIES

Figure C-2. City of Crockett Critical Facilities



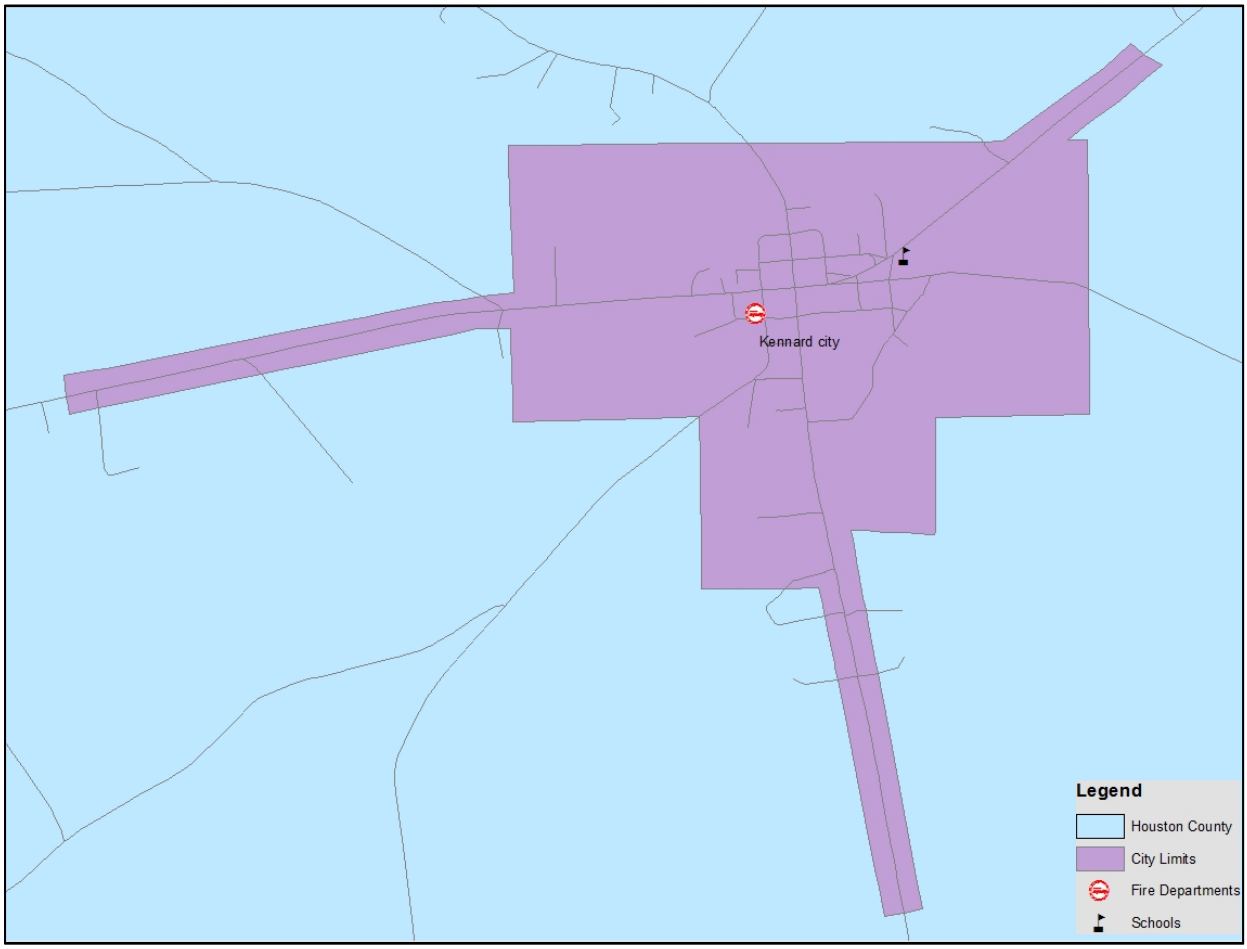
APPENDIX C: CRITICAL FACILITIES

Figure C-3. City of Grapeland Critical Facilities



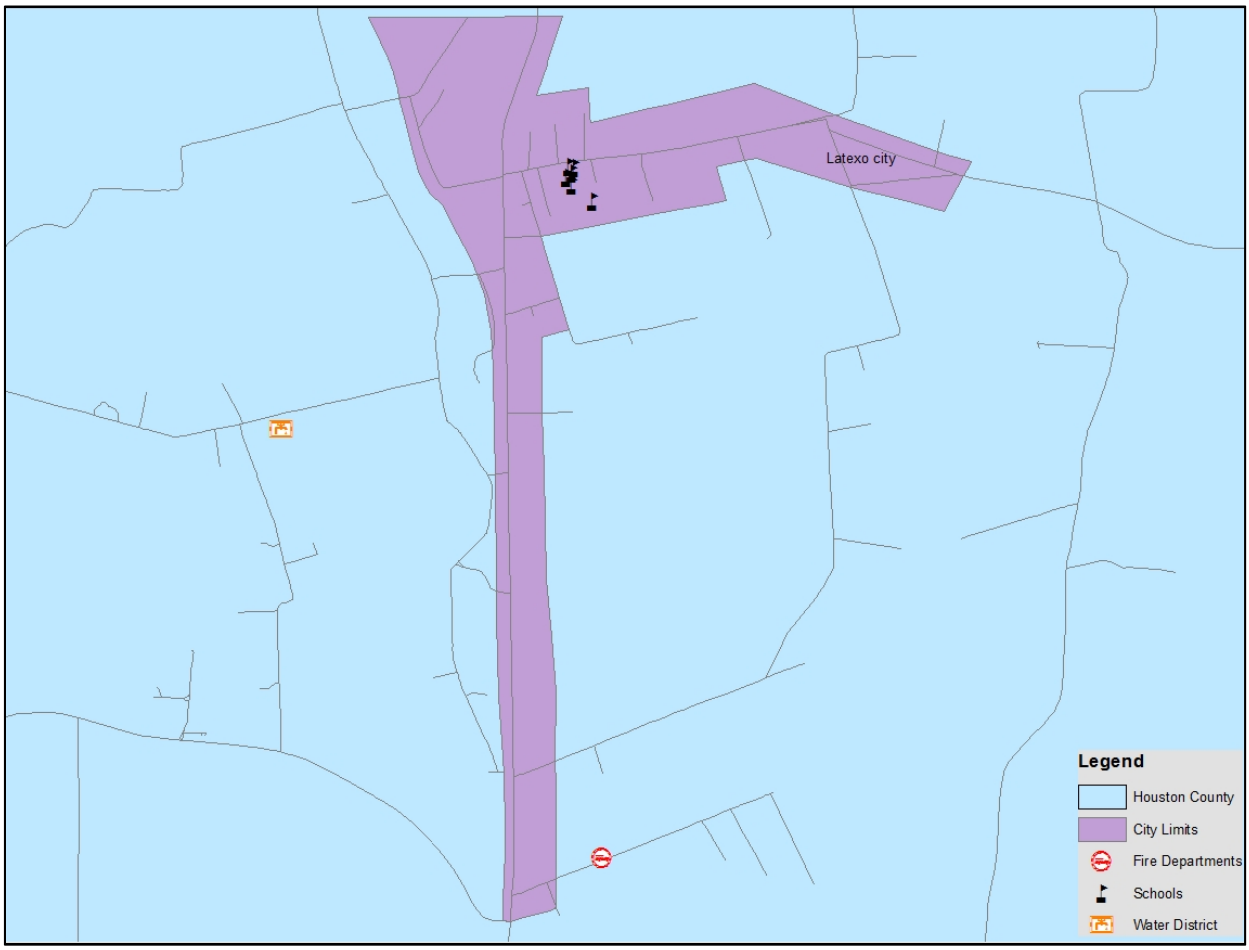
APPENDIX C: CRITICAL FACILITIES

Figure C-4. City of Kennard Critical Facilities



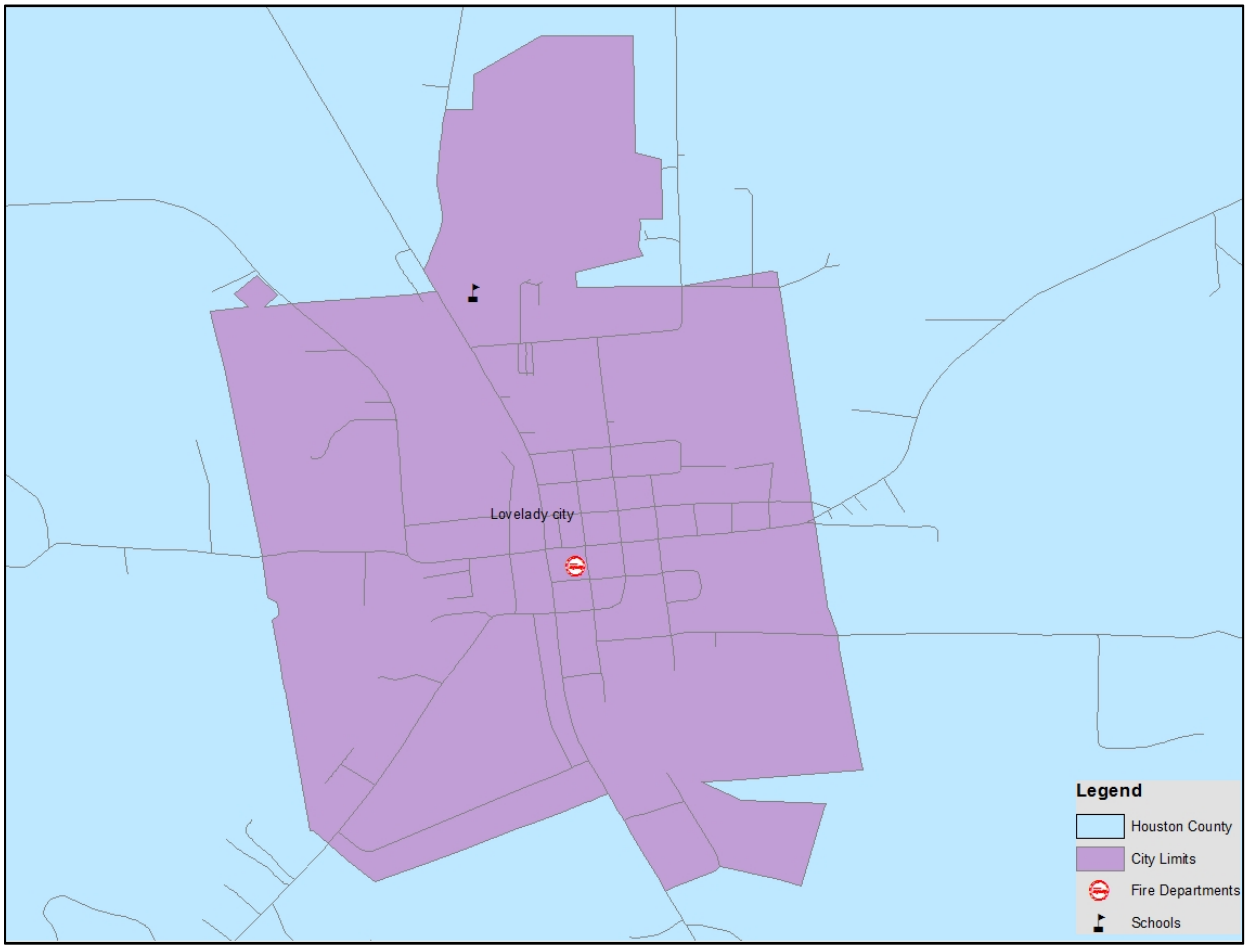
APPENDIX C: CRITICAL FACILITIES

Figure C-5. City of Latexo Critical Facilities



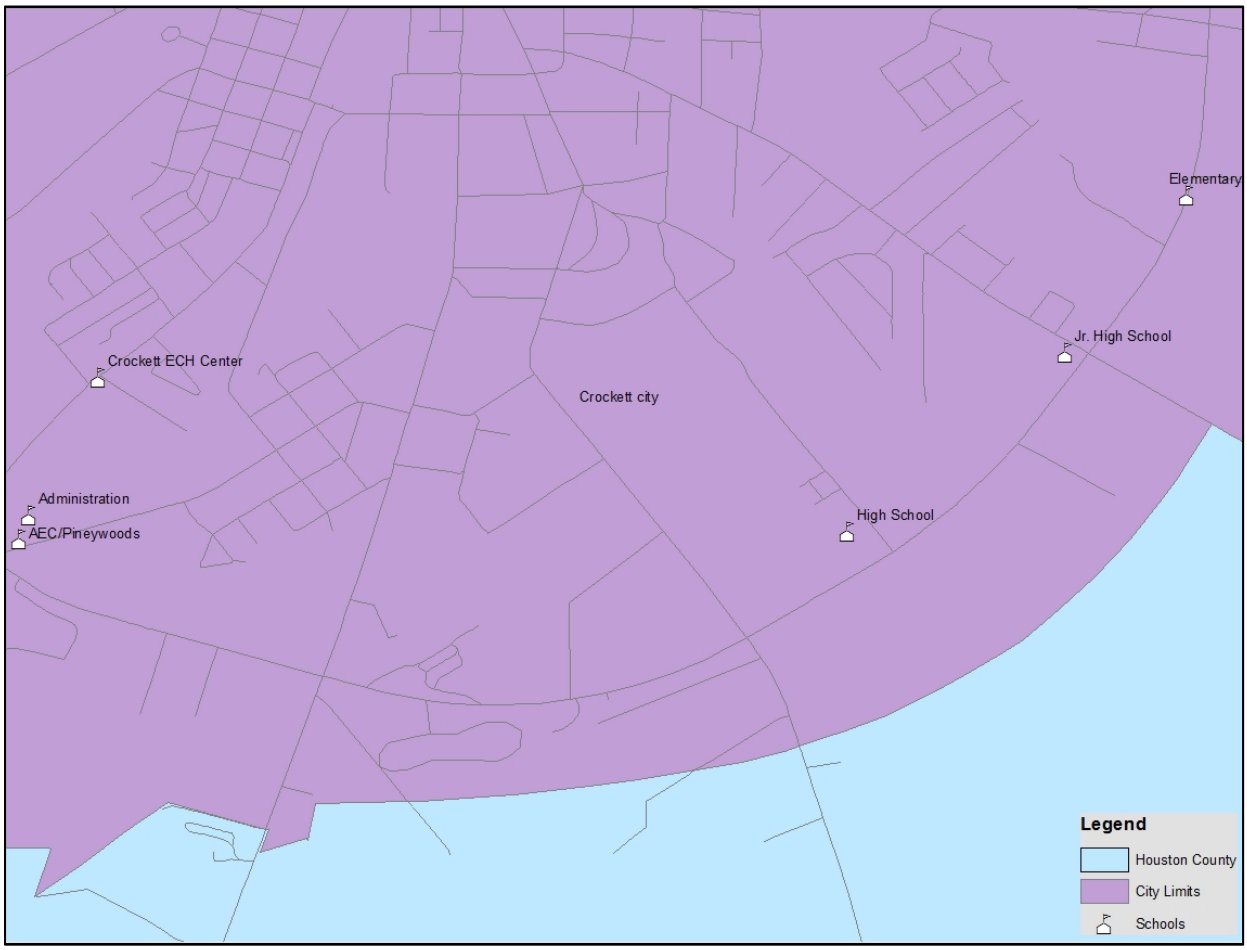
APPENDIX C: CRITICAL FACILITIES

Figure C-6. City of Lovelady Critical Facilities



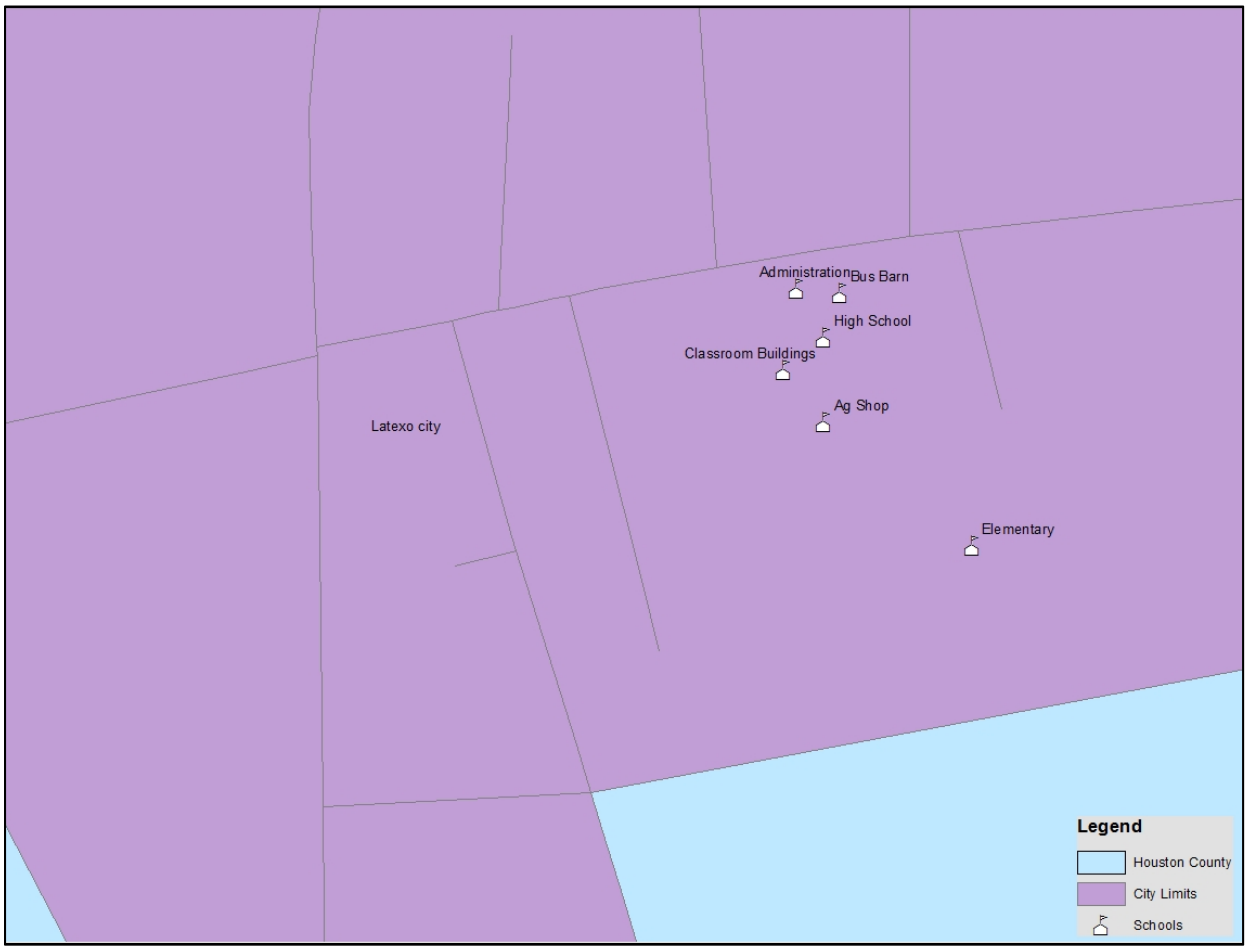
APPENDIX C: CRITICAL FACILITIES

Figure C-7. Crockett ISD Critical Facilities



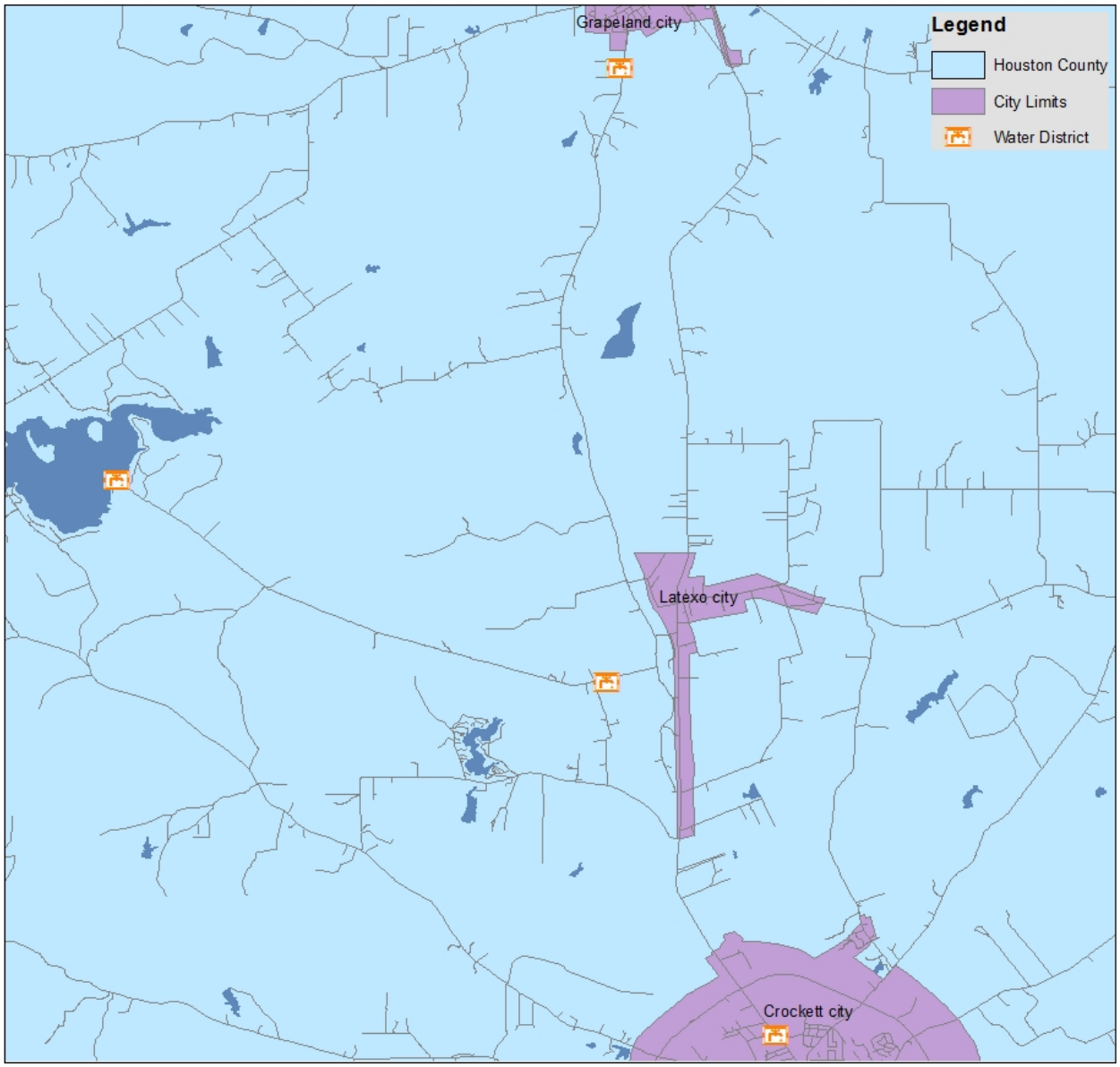
APPENDIX C: CRITICAL FACILITIES

Figure C-8. Latexo ISD Critical Facilities



APPENDIX C: CRITICAL FACILITIES

Figure C-9. Houston County Water Control District #1 Critical Facilities



APPENDIX D: DAM LOCATIONS

This Appendix is **For Official Use Only (FOUO)** and may be exempt from public release under the Freedom of Information Act (FOIA).

Listing of Dam Locations and Storage Capacities

COUNTY	LATITUDE	LONGITUDE	HEIGHT (Ft.)	STORAGE (Acre Feet)
Houston	31.19833	-95.4217	10	90
Houston	31.19289	-95.3407	36	230
Houston	31.16881	-95.7252	14	140
Houston	31.16471	-95.7069	15	120
Houston	31.32473	-95.5223	25	280
Houston	31.36198	-95.5089	17	210
Houston	31.33498	-95.5454	18	150
Houston	31.36825	-95.5052	33	670
Houston	31.40647	-95.6039	51	2,7000
Houston	31.43039	-95.5462	12	200
Houston	31.48375	-95.5385	10	56
Houston	31.4817	-95.5065	8	65
Houston	31.4976	-95.5089	10	83
Houston	31.45	-95.56	18	300
Houston	31.27722	-95.4928	16	180
Houston	31.27478	-95.4371	38	425
Houston	31.32561	-95.4833	19	50

APPENDIX D: DAM LOCATIONS

COUNTY	LATITUDE	LONGITUDE	HEIGHT (Ft.)	STORAGE (Acre Feet)
Houston	31.27157	-95.3881	18	135
Houston	31.43167	-95.4867	14	1,250
Houston	31.37752	-95.4412	28	350
Houston	31.46477	-95.4935	16	140
Houston	31.38687	-95.1534	18	650
Houston	31.42789	-95.0081	15	515
Houston	31.51385	-95.4339	22	845
Houston	31.55842	-95.4119	30	250
Houston	31.57976	-95.3065	30	881
Houston	30.98	-95.67	11	540
Houston	30.96162	-95.6143	24	340
Houston	31.47607	-95.4545	18	91
Houston	31.43333	-95.3383	37	490
Houston	31.2284	-95.1968	21	230
Houston	31.54449	-95.5052	30	143
Houston	31.32661	-95.3304	20	242

APPENDIX E:
MEETING DOCUMENTATION

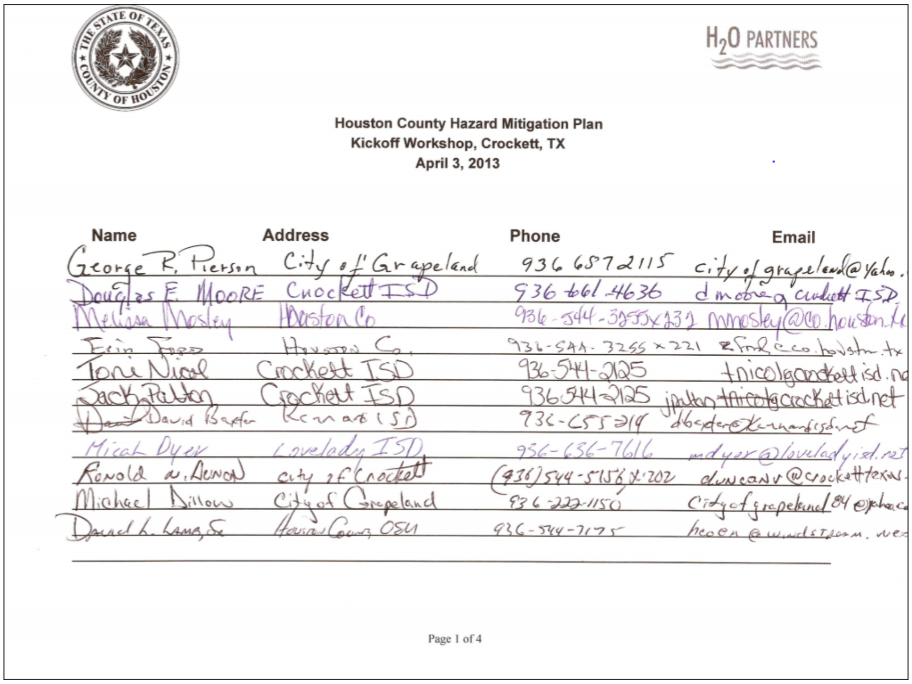
WORKSHOP DOCUMENTATION

This Appendix is **For Official Use Only (FOUO)** and may be exempt from public release under the Freedom of Information Act (FOIA).

Houston County held a series of planning team workshops: a Kickoff Workshop on April 3, 2013, Risk Assessment Webinar on July 31, 2013, and Mitigation Workshop on September 17, 2013. At each of these workshops, planners were informed of steps in the Risk Mitigation process and expressed opinions and volunteered information, as necessary. The sign in sheets for each workshop are included below. Public (stakeholders) meetings followed both the Kickoff Workshop and the Mitigation Workshop, sign in documentation is included in this section as well. For more details on the workshops and planning process, see Section 2.

APPENDIX E: MEETING DOCUMENTATION

Figure E-1. Kickoff Workshop, 04.03.13



H2O PARTNERS

Houston County Hazard Mitigation Plan
Kickoff Workshop, Crockett, TX
April 3, 2013

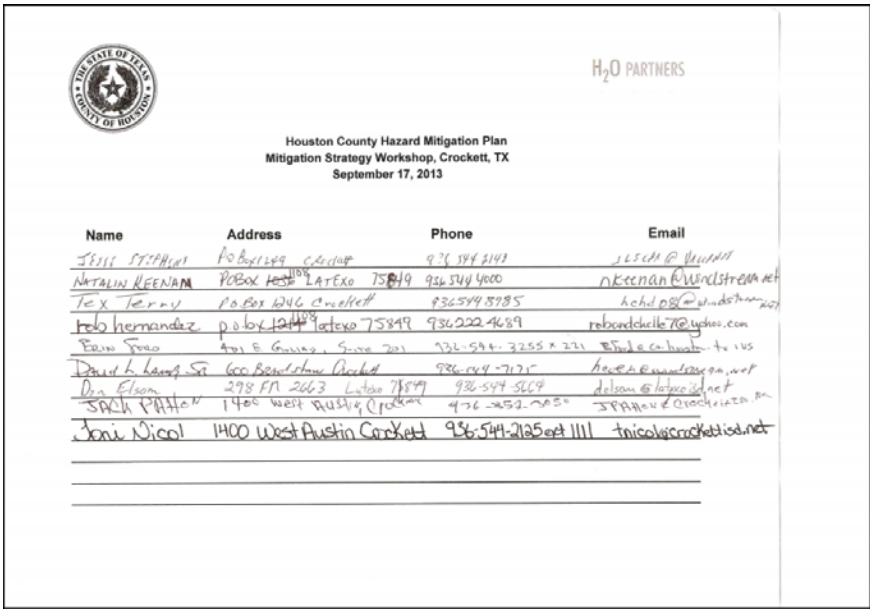
Name	Address	Phone	Email
George R. Pierson	City of Grapeland	936 687 2115	cityofgrapeland@yahoo.
Douglas E. Moore	Crockett ISD	936 661 4636	dmoore@crockett ISD
Melissa Mosley	Houston Co	936-544-3255 x 231	mmosley@co.houston.tx
Erin Ford	Houston Co.	936-544-3255 x 221	eford@co.houston.tx
Toni Nicol	Crockett ISD	936-544-2125	tnicol@crockettisd.net
Jack Patton	Crockett ISD	936 544 2125	jpatton@crockettisd.net
David Baxter	Kennard ISD	936-655-2114	dbaxter@kennardisd.net
Micah Dyer	Lovelady ISD	936-636-7616	mdyer@loveladyisd.net
Ronald W. Duncan	City of Crockett	(936) 544-5156 x 202	duncanr@crocketttexas.
Michael Dillow	City of Grapeland	936-222-1150	cityofgrapeland84@yahoo.c
David L. Lamb, Sr.	Houston County OEM	936-544-7175	[illegible]

Page 1 of 4

Figure E-2. Risk Assessment Webinar, 07.31.13

principal-name	principal-id	date-created	date-end
James Wiley	1285967640	7/31/2013 9:45	7/31/2013 10:50
Jessica Golden	1285776359	7/31/2013 9:56	7/31/2013 10:50
Heather Ferrara	1188022329	7/31/2013 9:41	7/31/2013 10:48
Dorothy Martinez	1163196794	7/31/2013 9:44	7/31/2013 10:50
Cathy Meek	1178060377	7/31/2013 9:50	7/31/2013 10:50
Tex Terry	1285959563	7/31/2013 10:03	7/31/2013 10:47
JESSE STEPHENS	1285748702	7/31/2013 9:48	7/31/2013 10:47

Figure E-3. Mitigation Workshop, 09.17.13



H2O PARTNERS

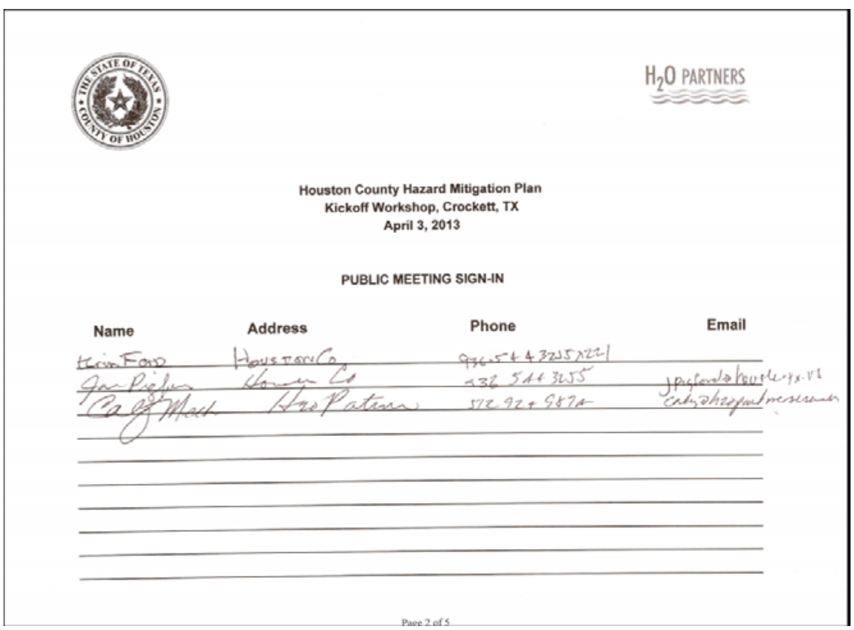
Houston County Hazard Mitigation Plan
Mitigation Strategy Workshop, Crockett, TX
September 17, 2013

Name	Address	Phone	Email
Jesse Stephens	PO Box 1249 Crockett	936 544 2149	[illegible]
Natalin Keenan	POBox 1108 Latexo 75849	936 544 4000	nkeenan@windstream.net
Tex Terry	P.O.Box 1246 Crockett	936544 8985	[illegible]
Rob hernandez	p.o.box 1108 latexo 75849	936222 4689	robandchelle70@yahoo.com
Erin Ford	401 E. Goliad, Suite 201	936-544-3255 x 221	[illegible]
David L. Lamb Sr	600 Beech Street Crockett	936-544-7175	[illegible]
Don Elsom	298 FM 2663 Latexo 75849	936-544-5669	delsom@latexoisd.net
Jack Patton	1400 West Austin Crockett	936-[illegible]	[illegible]
Joni Nicol	1400 West Austin Crockett	936-544-2125 ext 1111	tnicol@crockettisd.net

PUBLIC MEETING DOCUMENTATION

As discussed in Section 2, a series of two public meetings were held in conjunction with each of the workshops. Documentation in the form of sign in sheets for each of the meetings follows.

Figure E-4. Kickoff Workshop, Public, 04.03.13



H2O PARTNERS

Houston County Hazard Mitigation Plan
Kickoff Workshop, Crockett, TX
April 3, 2013

PUBLIC MEETING SIGN-IN

Name	Address	Phone	Email
Erin Ford	Houston Co.	936-544-3255 x221	
[illegible]	Houston Co	936 544 3255	[illegible]
[illegible]	H2O Partners	512 [illegible]	[illegible]

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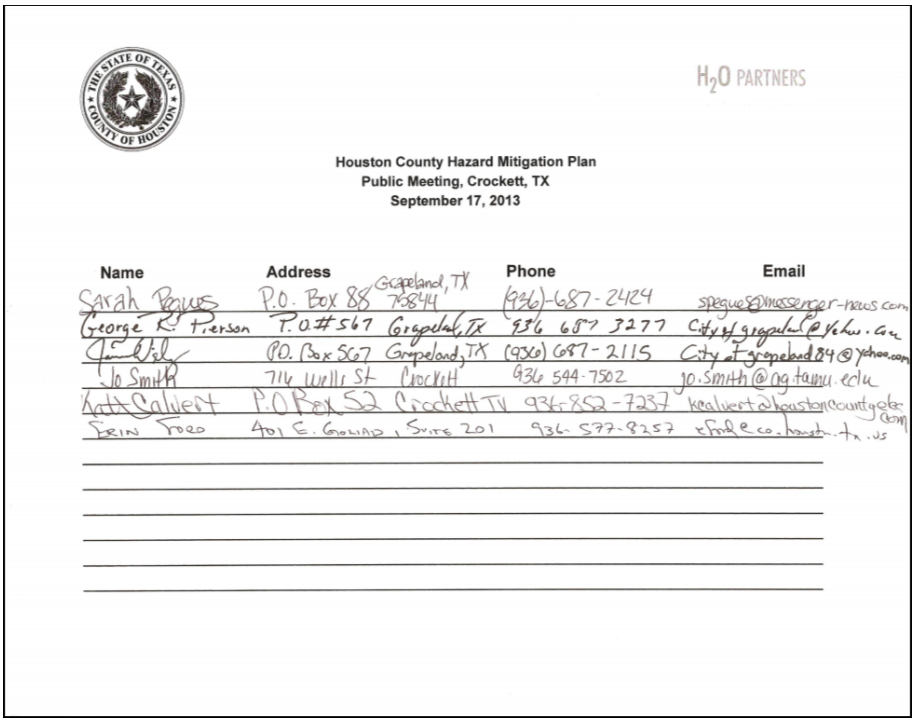
APPENDIX E: MEETING DOCUMENTATION

Figure E-5. Mitigation Workshop, Public, 09.17.13



H2O PARTNERS

Houston County Hazard Mitigation Plan
Public Meeting, Crockett, TX
September 17, 2013

Name	Address	Phone	Email
Sarah Pagues	P.O. Box 88 Grapeland, TX 75844	(936)-687-2424	spague5@messenger-news.com
George R. Pierson	P.O.#567 Grapeland, TX	936 687 3277	City of grapeland@yahoo.com
[illegible]	P.O. Box 567 Grapeland, TX	(936) 687-2115	City of grapeland84@yahoo.com
Jo Smith	714 Willis St Crockett	936 544-7502	jo.smith@ag.tamu.edu
Kathi Calvert	P.O Box 52 Crockett TX	936-852-7237	kcalvert@houstoncountytaxoffice.com
Erin Ford	401 E. Goliad, Suite 201	936-577-8257	eford@co.houston.tx.us

PUBLIC NOTICES

Public notices to announce Houston County's participation in the Hazard Mitigation Plan were posted in the county's newspaper. This provided further outreach to residents regarding the Plan and public meetings as shown below in Figure E-6 and Figure E-7. Figure E-8 shows the link to the Public Survey from Houston County's website.

APPENDIX E: MEETING DOCUMENTATION

Figure E-6. Public Notice, Houston County Courier, 09.15.13

PUBLIC NOTICE

Houston County Hazard Mitigation Plan Meeting

Houston County will hold a public meeting on Tuesday, Sept. 17, to gather public input for a county-wide Hazard Mitigation Plan. Project participants include the county and its' incorporated communities, two school districts, and a Water Utility district.

The meeting starts at 5 p.m. at the County Annex Commissioner's Courtroom at 401 E. Goliad Street in Crockett. The public is invited and encouraged to attend.

The purpose of the public meeting is to provide a project overview from H2O Partners, Project Consultant, and solicit information from the community.

The goal of the Hazard Mitigation Plan is to minimize or eliminate the long-term risk to human life and property from natural hazards by identifying and implementing cost-effective mitigation actions.

Natural hazards may include flood, tornado, hurricane wind, wildfire and others. Mitigation is defined by the Federal Emergency Management Agency as sustained actions taken to reduce or eliminate long-term risk to people and property from hazards and their effects.

If you cannot attend the public meeting, information about the planning process and a public participation survey are available on the county's website at http://www.surveymonkey.com/s/HoustonCountyHMAP

Questions about the Hazard Mitigation Plan should be addressed to Cathy Meek, Project Manager for H2O Partners at (512) 924-9874 or by email at cathy@h2opartnersusa.com.

APPENDIX E: MEETING DOCUMENTATION

Figure E-7. Newspaper Article, Houston County Courier, 09.15.13

COMMUNITY

Houston County developing FEMA-required Hazard Mitigation Plan

Houston County is developing a Hazard Mitigation Action Plan ("Plan" or "HMAP") that will address natural hazards that affect the county and participating entities.

A public meeting will be held at 5 p.m. Tuesday, Sept. 17 in the Houston County Commissioners Courtroom at 401 East Goliad St. in Crockett.

Background

The Federal Emergency Management Agency (FEMA) defines mitigation as sustained actions taken to reduce or eliminate long-term risk to people and property from hazards and their effects. Therefore, the goal of the plan is to minimize or eliminate the long-term risk to human life and property from known hazards through effective mitigation.

This plan will be prepared as a new, stand-alone plan, reflecting conditions that have had an impact area-wide. When complete, the plan will comply with all and applicable provisions of the Disaster Mitigation Act of 2000 (DMA 2000) and FEMA's criteria for approval of mitigation plans required in Section 322 of the DMA 2000.

A FEMA-approved hazard mitigation plan is required for eligibility for grant funds through FEMA's Hazard Mitigation Assistance (HMA) programs, which include: Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM), Flood Mitigation Assistance (FMA), Repetitive Flood Claims (RFC), and the Severe Repetitive Loss (SRL) program. Funds from these federal grant programs may be awarded to all planning participants, including schools, hospitals, and non-profit organizations, to implement mitigation projects identified in the Plan.

Process Of Plan Development

Houston County has secured the services of a project team headed by H2O Partners, Inc. to assist in the preparation of the plan and the planning process, which involves the following steps:

1. Capability Assessment

As part of this effort, the H2O team will conduct a Capability Assessment by examining and evaluating the programmatic, technical, administrative and fiscal capabilities of participants to mitigate the effects of natural hazards. This assessment includes the identification and review of relevant plans, policies and programs already in place such as land use plans, flood control programs, natural resource studies, zoning ordinances, building codes, subdivision regulations, post-disaster public assistance grants and capital improvements plans. The purpose is to detect any existing gaps, shortfalls or conflicts within existing or ongoing activities that could contribute to hazard vulnerability. The assessment will also highlight the positive measures in place that should continue to be supported and enhanced through future mitigation efforts.

2. Hazard Identification and Analysis

During this step, the project team will identify and compile relevant data on all potential hazards that threaten the county-wide area. Information that will be collected includes historical data on past hazard events and how these events impacted residents, property, and the overall community.

Based upon historical occurrences and best available data, the project team will identify and describe hazards that threaten the area. Detailed hazard profiles will include information on the frequency, magnitude, location and impact for each hazard in addition to estimating the probabilities for future hazard events.

3. Mitigation Strategy Development

Based on the findings of the Capability Assessment and Risk Assessment, the project team will work with plan participants toward drafting an overall mitigation strategy for the planning area. The strategy will be comprised of a comprehensive range of mitigation actions, such as: preventive actions, property protection techniques, natural resource protection strategies, structural projects, prevention and public information, and awareness activities. Once established, the actions will be prioritized and a method and schedule for implementing, evaluating and monitoring actions will be developed.

Public Participation

Public participation is integral to mitigation planning; as such the public will be invited to attend meetings through the Houston County website, social media, flyers and newspapers to solicit input, participation and feedback. In addition, a public participation survey will be available online.

Plan Review, Adoption And Approval

In accordance with federal planning requirements, all participating planning team members must review the plan. Once approved by the project team it will be submitted for formal approval to the Texas Division of Emergency Management (TDEM). H2O will complete any revisions requested by TDEM. After review and approval, TDEM will submit the plan to FEMA for review. After FEMA approval, all participating entities must formally adopt the plan.

Please direct any questions regarding the Plan to Cathy Meek, Project Manager for H2O Partners, at cathy@h2opartnersusa.com or by cell at (512) 924-9874.

COMMISSIONERS VOTE TO PAY, FROM PAGE A1

not been budgeted.

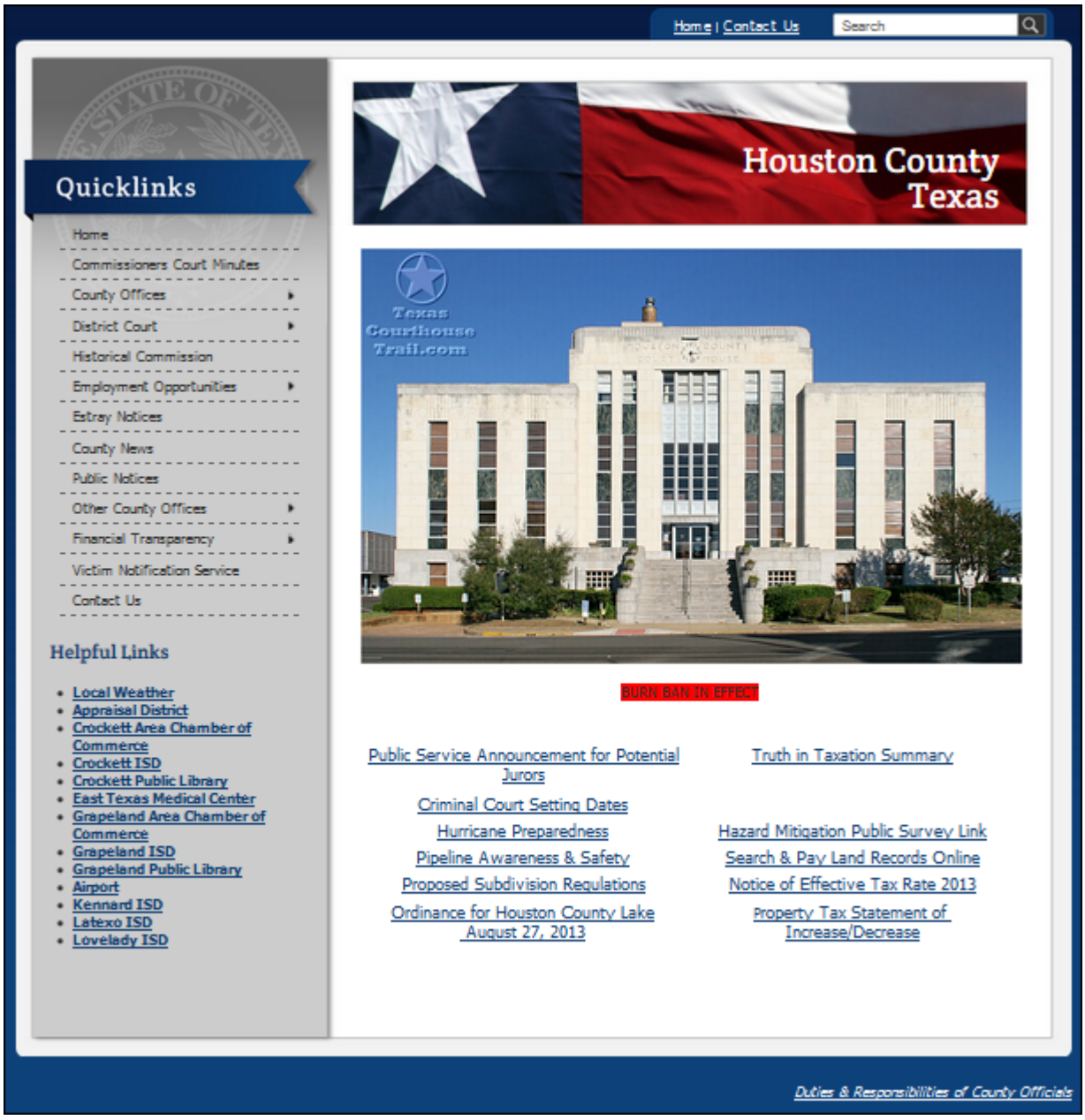
In other business, the commissioners unanimously voted to nominate the following persons for the Houston County Appraisal District Board of Directors: Kathy Calvert, James Anderson, W. F. "Red" Kitchen, Brenda Stubblefield and Jerry Pipes.

for Maintenance and Operations and $0.06868 for Debt Service) for Fiscal Year 2014 which starts Oct. 1.

CR 2105 in Road and Bridge Precinct 2 no longer is a county road after commissioners unanimously voted to close and abandon the roadway at the request of property owners. Precinct 2 Commissioner Willie Kitchen

APPENDIX E: MEETING DOCUMENTATION

E-8. Public Survey Link, Houston County Website, 09.24.13



APPENDIX F: CAPABILITY ASSESSMENT

OVERVIEW

A Community Capability Assessment is an integral component of the Hazard Mitigation Planning Process. It is an invaluable tool in assessing a community's existing planning and regulatory capabilities to support implementation of mitigation strategy objectives.

Beginning on Page 2, a completed Capability Assessment Checklist provides information on existing policies, plans and regulations in place for Planning Team members at the local level, or that may be provided by the county on an as-needed basis. ***Information is denoted with an "X" on the Checklist.*** For jurisdictions that do not have specific documents or programs in place, Houston County works with communities to provide essential service support to facilitate implementation of mitigation activities.

Houston County services include:

Emergency Management Services - maintains and administers an integrated Emergency Management program designed to assure a safe environment through training, prevention/mitigation, readiness, response, and recovery to natural and/or human-caused disasters. This office also currently oversees the administration of the county Homeland Security Program and Health and Safety Program.

Real Property Tax Information – provides tax services and property valuation information.

Geographic & Property Information – data resources include GIS/map inventory, geology, hazardous materials, infrastructure, managed lands, agricultural, wetland areas, hydrography, watersheds, and other GEOData inventory.

APPENDIX F: CAPABILITY ASSESSMENT

COMMUNITY CAPABILITY ASSESSMENTS

COMMUNITY CAPABILITY CHECKLIST	*Houston County*	*City of Crockett*	*City of Grapeland*	*City of Kennard*	*City of Latexo*	*City of Lovelady*	*Crockett ISD*	*Latexo ISD*	*Houston County WCID#1*
Plans									
Master or comprehensive plan		X	X	X	X	X	X		
Land use plan		X	X	X	X	X	X		
Capital improvement plan			X	X	X	X	X		
Economic development plan			X	X	X	X			
Redevelopment plan									
Post-disaster recovery plan	X	X	X	X	X	X	X	X	
Open space plan									
Flood mitigation plan									
Floodplain management plan (CRS/NFIP)	X	X	X	X		X			
Local waterfront revitalization plan (LWRP)									
Watershed protection plan									
College campus plan									
Comprehensive emergency management plan	X	X	X	X	X	X	X	X	
Emergency response/evacuation plan	X	X	X	X	X	X	X	X	X
Policies/Ordinance									
Building codes		X	X	X	X	X			
Zoning ordinance/land use restrictions									X
Subdivision regulations									
Steep slope ordinance									
Property set-back ordinance (water/wildfire/other hazard)									
Watershed ordinance									
Storm water ordinance									

APPENDIX F: CAPABILITY ASSESSMENT

COMMUNITY CAPABILITY CHECKLIST	*Houston County*	*City of Crockett*	*City of Grapeland*	*City of Kennard*	*City of Latexo*	*City of Lovelady*	*Crockett ISD*	*Latexo ISD*	*Houston County WCID#1*
Site plan review requirements		X	X						
Real estate disclosure requirements									
Programs									
National Flood Insurance Program participant	X	X	X	X		X			
NFIP Community Rating System participant									
Property acquisition program		X	X	X	X	X			X
Public education/awareness programs	X	X	X	X	X	X	X		
Stream maintenance program									
Storm drainage systems maintenance program									
Mutual aid agreement	X	X	X	X	X	X	X		
Studies/Reports									
Hazard analysis/risk assessment							X		X
Floodplain maps/flood insurance studies	X	X	X	X	X	X	X		
Hydrological/hydraulic studies		X							X
Annual Budget Report/Review	X	X	X	X	X	X	X	X	X
Staff/Departments									
Development planner							X		
Building code official		X	X	X	X	X			
GIS and/or HAZUS specialist	X	X	X	X	X	X			
Engineer/public works official	X	X	X	X	X	X			
Local floodplain administrator	X	X	X	X		X			
Environmental conservation specialist									
Hazard knowledge	X								
Public information official	X	X	X	X	X	X	X	X	X

APPENDIX F: CAPABILITY ASSESSMENT

INCORPORATING MITIGATION ACTIONS INTO LOCAL PLANNING MECHANISMS

The table below provides further analysis of how Planning Team members will incorporate identified mitigation actions in the Hazard Mitigation Plan into other planning mechanisms, and the point of contact for each entity.

ENTITY	POINT(S) OF CONTACT *(Contact will vary based on Type of Action to be Implemented)*	METHOD OF INCORPORATING MITIGATION ACTIONS INTO LOCAL PLANNING MECHANISMS
Houston County	County Judge, EMC, Fire	Annual budget review, FIREWISE program and Fire Management Plan, Comprehensive Plan, Flood Damage Ordinance, Emergency Operations Plan, Disaster Response and Recovery Plan
City of Crockett	Mayor	Annual budget review, Flood Damage Ordinance, Emergency Operations Plan. Building Codes
City of Grapeland	Mayor	Annual budget review, Comprehensive Plan, Flood Damage Ordinance, Emergency Operations Plan. Building Codes
City of Kennard	Mayor	Annual budget review, Comprehensive Plan, Flood Damage Ordinance, Emergency Operations Plan
City of Latexo	Mayor	Annual budget review, Comprehensive Plan, Emergency Operations Plan
City of Lovelady	Mayor	Annual budget review, Comprehensive Plan, Flood Damage Ordinance, Emergency Operations Plan
Crockett ISD	Superintendent	Annual budget review, Evacuation Plan, Risk Management Plan, Evacuation Plan
Latexo ISD	Superintendent	Annual budget review, Risk Management Plan, Evacuation Plan
Houston County WCID #1	Manager	Annual budget review, Response Management Plan; Treatment Plant Guidelines; Emergency Action Plan

APPENDIX G: I-INFO ALERT SYSTEM

MITIGATING NATURAL HAZARDS THROUGH THE I-INFO ALERT/NOTIFICATION SYSTEM

The I-Info Alert/Notification System for Houston County and participating jurisdictions and entities will allow optimal response time to notify both residents and businesses of all natural and human-caused disasters, reduce loss of lives and property, and ensure a unified method of disseminating alerts by community officials and first responders.

As an "all-hazards" alert system, it has many features invaluable to a local community or on a county-wide basis. Houston County and all Hazard Mitigation Action Plan (HMAP) participants may send out public education announcements to assist residents in understanding risk of natural hazards, announce watering restrictions during times of drought, and promote public education and awareness pertaining to natural and human-caused hazard risk in the planning area.

The system also allows users to target specific groups or residents at high risk. For instance, during extreme weather events, the system can alert elderly or infirm residents that do not have air-conditioning/heat in their homes to seek shelter at cooling/warming stations located throughout the county-wide area.

This system is the most beneficial and economic method for reaching residents and businesses county-wide regarding severe weather alerts or notifications, human-caused disasters, public service announcements, general hazard information, and upcoming public meetings. System notification methods include cell phone, land line, email, and pager. The system is compatible with numerous other regional alert systems currently being implemented across the State.