State of Texas Hazard Mitigation Plan

2010-2013

The 1900 Storm Memorial, created by Galveston artist David Moore, commemorates the 100 year anniversary of Texas's most devastating disaster. The monument stands as a memorial to over 6000 people lost at sea and the strength of those that stayed behind to rebuild the city.

Photo Courtesy of Alicia Cahill, City of Galveston

Cover created by Wendy Kirby, TDEM

ADOPTION AND IMPLEMENTATION

STATE OF TEXAS STANDARD MITIGATION PLAN

The purpose of hazard mitigation is to implement actions that eliminate the risk from hazards, or reduce the severity of the effects of hazards on people and property. Mitigation actions are both short-term and long-term activities that reduce the cause or occurrence of hazards; reduce exposure to hazards; or reduce effects of hazards through various means to include mitigation planning and projects.

This plan applies to all State agencies, boards, commissions, and departments assigned mitigation responsibilities, and to others as designated by the Governor or Director of the Texas Division of Emergency Management.

The State of Texas Hazard Mitigation Plan was prepared in compliance with Public Law 106-390, *Disaster Mitigation Act of 2000*, as amended. This plan implements hazard mitigation measures intended to eliminate or reduce the effects of future disasters throughout Texas, and was developed in a joint and cooperative venture by members of the State Hazard Mitigation Team.

The State of Texas will comply with all applicable Federal statutes and regulations in effect with respect to the periods for which it receives grant funding, in compliance with 44 Code of Federal Regulations (CFR) §13.11c. The State of Texas will amend its plan whenever necessary to reflect changes in State and/or Federal laws and statutes as required in 44 CFR, §13.11d. At a minimum, the State will review and update the Plan every three (3) years from the date of approval in accordance with 44 CFR, §201.3(c)(2) and (3) in order to continue program eligibility.

This State of Texas Mitigation Plan is hereby adopted and accepted for implementation to protect the lives and property of the citizens of Texas. This Plan supersedes all previous editions.

10·18·10
Date

Rick Perry

Rick Perry
Governor
State of Texas

Executive Summary

"At its heart, the contents of a mitigation plan are simple: List the natural hazards that threaten your community from worst to least, and provide some kind of logical, rational explanation for why you ranked them that way. Provide some ideas for what you can do to reduce their impacts, and finally, describe how you communicated the information to the community".

Bob Gibson, Original State Hazard Mitigation Officer, 2002

With the above quote in mind, we present the State of Texas Hazard Mitigation Plan.

<u>The Planning Process</u>

"Describe how you communicated the information to the community"

The first section of the State Hazard Mitigation Plan (hereafter referred to as the Plan) discusses the planning process. This section details how the Plan was prepared, who prepared it, who was involved, coordination among state and federal agencies, and the integration of the Plan with other planning efforts. The Plan was updated in 2010 through the joint efforts of the Mitigation Section of the Texas Division of Emergency Management (TDEM) and the State Hazard Mitigation Team (SHMT). The Mitigation Section staff (hereafter referred to as the Staff) and the SHMT (hereafter referred to as the Team) worked together to review and analyze each section of the Plan. Input from interested local government agencies, such as Councils of Governments, was solicited by presenting at Texas Association of Regional Councils (TARC) meetings. Once the initial risk assessment was complete, the draft plan was posted on the TDEM website for comment by cities, counties, river authorities, and the general population. Updates were deemed necessary when information was found to be outdated or when new data was created.

<u>The Risk Assessment</u>

"*List the natural hazards that threaten your community from worst to least, and provide some kind of logical, rational, explanation for why you ranked them that way*"

The second section of the Plan discusses the risk assessment process. This section identifies the natural hazards that can affect the State. There are currently fourteen natural hazards listed in the Plan. After describing these natural hazards, the Plan identifies location of occurrence, previous occurrences, probability of future occurrences and various vulnerabilities to jurisdictions and State-owned facilities. During the update of the Plan, if an existing natural hazards risk assessment was deemed to be insufficient, then the Staff and Team worked together to update that hazard's assessment. Examples include the updated risk assessment for floods by the Texas Water Development Board (TWDB) and the updated risk assessment for coastal erosion by the General Land Office (GLO).

Despite the extreme damages resulting from Hurricane Ike[1], on an annualized basis, inland riverine flooding was and remains the most serious natural hazard facing the State.

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[1] Only damages from high winds and storm-surge flooding are included in the estimates for hurricane risk. Inland riverine flooding damages resulting from a hurricane are counted under riverine flooding.

Not only is flooding the most damaging hazard, it is also the most lethal, with an average of 13 deaths each year. The table below lists and ranks the natural hazards facing the State.

	Natural Hazard	Annualized physical losses, State/local
1	**Inland Riverine Flooding**	$5.5 mil/$2.0 mil
2	**Hurricane & Tropical Storm**	$1.4 mil/$4.7 mil[2]
3	**Tornado**	$2.8 mil/$3.1 mil
4	**Drought**	minimal[3]/
5	Local Windstorm (non-tornado)	$0.5 mil/[4]
6	Hailstorm	$0.1 mil/
7	Wildfire	$0.1 mil/
8	Dam Failure	$0.2 mil/[5]
9	Severe Winter Storm	minimal[6]/
10	Extreme Heat	minimal/
11	Expansive Soils	minimal/
12	Coastal Erosion	minimal/
13	Land Subsidence	minimal/
14	Earthquake	minimal/

Generally speaking, computer modeling of the state facilities database, with FEMA provided hazard estimations software (HAZUS), forms the basis of the State damage estimates. Because state facilities are commonly collocated with the population they serve, they are a useful surrogate for estimating the location of hazards. Local losses were consolidated from data extracted from existing approved local mitigation plans.

Goals and Mitigation Strategies

"Provide some ideas for what you can do to reduce their impacts"

The third section of the Plan discusses the goals and mitigation strategies that will be followed to mitigate the loss of life and property from identified natural hazards. The goals in the Plan are to reduce or eliminate hazardous conditions that cause loss of life, inflict injuries, cause property damage or degrade important natural resources. During the update of the Plan, the Staff and Team reviewed and analyzed the mitigation strategies to

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[2] Estimated annualized Rita and Ike damages added to coastal jurisdiction figures, as local plan updates had not been received since last state plan update.

[3] Table contains physical losses. While drought typically produces few physical losses, the economic losses can be tremendous (annualized local estimate $325 mil) . This accounts for its # 4 ranking.

[4] A blank entry for local data indicates the local data was difficult to consolidate due to differing reporting standards and or units of measure.

[5] State damages for this hazard are slightly higher than for wildfire because state agencies hold a substantial inventory of dams. Summarizing language from local plans indicated it was less of a relative hazard than wildfire.

[6] A ranking of 'minimal' indicates reliable state estimates of annualized damages come to less than $50k per year.

determine if the strategies remained relevant to the State's mitigation goals. Additional strategies were added to mitigate the effects of floods, hurricanes, tornadoes, wildfires, droughts, and dam failure.

As a home rule state, most state level actions consist of encouraging, funding, or reinforcing the actions of local governments, rather than direct regulation or involvement in projects. Some public information dissemination and interagency cooperation is called for.

In this executive summary, only actions addressing the 'big four' most serious threats will be mentioned. In the full plan, actions are identified for all hazards.

1. In addressing the most serious threat, **Riverine Flooding**, the State has already taken the most effective action, increasing funding and personnel for the State Floodplain Management function. This will result, over time, in much more effective floodplain management at the local level, which will, in turn, reduce our flood damages. Grants to replace selected high-traffic low water crossings, or to provide warning systems with visual or audible alarms, should continue.

2. In addressing the threat from **Hurricanes and Tropical Storms**, continued enforcement of modern floodplain code and modern wind code is the most effective action the State can take. Damages from Hurricane Ike were substantial, but were largely confined to structures not compliant with modern wind and flood codes. Replacement structures, either funded from insurance proceeds or public sector assistance, will be code compliant; should a similar storm strike the Galveston Bay area next decade, we should expect substantially fewer damages. Large scale coastal engineering projects are under study, but face substantial obstacles. These obstacles could eventually be overcome; small scale coastal engineering projects are more likely to prove feasible, at least in the short term.

3. While **Tornados** are a substantial threat to the state, not all areas have an equal risk. In those areas of the state where a substantial risk exists, new state construction that will store public records should conform to a higher than commercial wind code standard. Current efforts to provide additional public warning and shelter through the provision of pass-through federal grants should continue.

4. The entire strategic effort at **Drought mitigation** is initiated by the evaluation mechanisms found in the *State Drought Preparedness Plan* and is coordinated with the various levels of drought stages. Actions to increase inter-agency cooperation before the event occurs have the greatest benefits in drought mitigation.

The remaining sections of the plan, summarized below, (4-6) are required for FEMA approval, but do not materially contribute to any understanding or implementation of mitigation in Texas.

Funding Sources and Technical Assistance

The fourth section of the Plan discusses the process by which the State provides funding and technical assistance for the development of local mitigation plans.

Comprehensive State Hazard Mitigation Program

The fifth section of the Plan discusses the State's commitment to a comprehensive mitigation program.

Plan Maintenance

The sixth and final section of the Plan discusses the plan maintenance process.

RECORD OF CHANGES

CHANGE NUMBER	*DATE OF CHANGE*	*INITIALS AND DATE ENTERED*

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SECTION DESCRIPTIONS

SECTION 1 – PLANNING PROCESS
This section discusses the planning process. Topics covered: how the mitigation plan was prepared, who prepared it, who was involved, coordination among agencies, and the integration of this plan with other planning efforts as well as FEMA mitigation programs and initiatives.

SECTION 2 – RISK ASSESSMENT
This section discusses the risk assessment process. Topics covered: identifying the hazards, profiling hazard events, assessing vulnerability and estimating losses by jurisdiction, and assessing the vulnerability and estimating losses of State facilities.

SECTION 3 – MITIGATION STRATEGIES
This section discusses mitigation strategies. Topics covered: hazard mitigation goals, State capability assessment, local capability assessment, mitigation measures, and funding sources.

SECTION 4 – FUNDING AND TECHNICAL ASSISTANCE
This section discusses the process by which the State provides funding and technical assistance for the development of local plans. Topics include: local funding and technical assistance, local plan integration, and prioritizing local assistance.

SECTION 5 – MITIGATION PROGRAM OVERVIEW
This section discusses the State's commitment to a comprehensive mitigation program. Topics include: program management capability and what Texas is doing as part of their commitment to a comprehensive mitigation program.

SECTION 6 – PLAN MAINTENANCE
The final section discusses the plan maintenance process. Topics include: a system for monitoring implementation of mitigation measures and project closeouts as well as a system for reviewing progress on achieving goals, activities, and projects in the mitigation strategy.

SECTION 7 - ATTACHMENTS
1. State Drought Preparedness Plan
2. State Annex P – Hazard Mitigation
3. State Annex F- Firefighting
4. Mitigation Success Stories
5. State Hazard Mitigation Team (SHMT) members, meeting agenda and sign-in sheet
6. Grant Funding Guide

SECTION 8 - ANNEXES
- Annex A: Hazard Mitigation Grant Program (HMGP) Administrative Plan

SECTION 9 - APPENDICES
- Appendix A: Repetitive Flood Loss Mitigation Strategy

SECTION 10 – REFERENCES

INTRODUCTION

Effective mitigation requires the planned and coordinated use of all available resources and a working partnership between all levels of government. Mitigation also requires many separate actions, which collectively accomplish mitigation goals. Hazard mitigation is essentially the common sense application of knowledge to save lives and prevent damages from occurring.

A quote from the Federal Emergency Management Agency's (FEMA) Mitigation Directorate states that, "Mitigation is the cornerstone of emergency management. It's the ongoing effort to lessen the impact disasters have on people's lives and property through damage prevention and flood insurance. Through measures such as building safely within the floodplain or removing homes altogether; engineering buildings and infrastructures to withstand earthquakes; and creating and enforcing effective building codes to protect property from floods, hurricanes and other natural hazards, the impact on lives and communities are lessened."

Authority for development and maintenance of this plan is as follows:

STATE AUTHORITIES

- Texas Disaster Act of 1975, V.T.C.A., Government Code, Chapter 418
- Executive Order of the Governor pertaining to Emergency Management
- State of Texas Emergency Management Plan

FEDERAL AUTHORITIES

- Public Law 93-288, as amended by Public Law 100-707 (Stafford Act).
- Public Law 100-707, as amended by Public Law 103-181 (Hazard Mitigation and Relocation Assistance Act).
- Public Law 103-324 (Reigle Community Development and Regulatory Improvement Act of 1994)
- Public Law 106-390 (Disaster Mitigation Act (DMA) of 2000)
- FEMA Regulation, 44 CFR Part 206, Subparts M and N.
- FEMA Regulation, 44 CFR Part 9.
- FEMA Regulation, 44 CFR Part 10.
- FEMA Regulation, 44 CFR Part 13.
- FEMA Regulation, 44 CFR Part 14.
- FEMA Regulation, 44 CFR Part 201
- Executive Order 11988, Floodplain Management.
- Executive Order 11990, Protection of Wetlands.
- Executive Order 12612, Federalism.

This plan establishes hazard mitigation goals, strategies, and specific measures that are designed to reduce the occurrence or severity of the consequences of natural hazards on the people, property, infrastructure, and environment of Texas. This plan also provides procedures for implementation and administration of the federally-funded Hazard Mitigation Grant Program (HMGP) within Annex A. This plan identifies the organization, operational concepts, administrative procedures, tasks, and responsibilities for accomplishing statewide, natural hazard mitigation objectives.

SECTION 1 – PLANNING PROCESS

Documentation of the Planning Process

Requirement §201.4(c)(1): *The State plan must include a description of the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how other agencies participated.*

The State of Texas Hazard Mitigation Plan (the Plan) was updated through the joint efforts of the State Hazard Mitigation Team and the Mitigation Section of the Texas Division of Emergency Management (TDEM), a division of the Texas Department of Public Safety.

The Mitigation Section is headed by the Mitigation Section Administrator, who is also the State Hazard Mitigation Officer (SHMO). The SHMO is responsible for leading and coordinating mitigation and long-term redevelopment efforts, including the administration of hazard mitigation programs, plans, and projects. The Mitigation Section of TDEM in Austin is comprised of six (6) full-time employees and three (3) temporary employees. The composition of the Mitigation Section is a Mitigation Section Administrator, a Mitigation Financial Specialist, two (2) Mitigation Specialists, a Mitigation Plans Officer, a Mitigation Grants Officer and the three (3) temporary employees who are all Mitigation Specialists. A second Mitigation Field Office in Houston manages the grant programs and projects in this highly disaster-prone region staffed with three (3) temporary Mitigation Specialists.

Participation by State agencies was critical in the update of the Plan. A State Hazard Mitigation Team (SHMT) was created with staff from various State agencies that have experience in mitigation. The SHMT acts as the focal point for comprehensive mitigation actions, with the SHMO as Team Leader. The SHMT conducts disaster site surveys, assists in processing applications for grant programs, monitors status of projects through completion, and forwards recommendations to the Governor that will have an impact upon the prevention of future losses.

The SHMT is composed of representatives from 10 State agencies:

- the Texas Division of Emergency Management (TDEM)
- the Texas Commission on Environmental Quality (TCEQ)
- the Texas Department of Transportation (TxDOT)
- the Texas Parks and Wildlife Department (TPWD)
- the Texas Department of Rural Affairs (TDRA)
- the Texas Water Development Board (TWDB)
- the Texas Department of Insurance (TDI)
- the Railroad Commission of Texas (RRC)
- the General Land Office (GLO)
- the Texas Forest Service (TFS)

And four organizations who have a role in mitigation:

- the Texas Geographical Society (TxGS)
- the Texas Tech University System (TTU)
- the Texas Floodplain Management Association (TFMA)
- the Emergency Management Association of Texas (EMAT)

The process used by the TDEM Mitigation Section (the Staff) and the certain members of the SHMT (the Team) to update the 2007 version of the Plan in 2010 worked successfully.

Each section of the Plan was reviewed and analyzed by the Staff and the Team to determine if changes were necessary. Updates were deemed necessary when the information was found to be outdated or when new data had been created. Updates were also deemed necessary when the original data was no longer relevant or when the original data lacked new hazard risk assessments or vulnerability. Goals and strategies were reviewed and analyzed to determine if they had been implemented, and if not, what actions were necessary to allow them to be implemented in the future. No unforeseen obstacles emerged during the planning and updated process.

The Staff led the development of this revised Plan, with the TDEM Hazard Mitigation Plans Officer leading the development within the TDEM Mitigation Section. The revision process began with the SHMO, who was instrumental in reviewing and analyzing each section of the Plan, and assigning each Staff member a specific role in revising the Plan. The Hazard Mitigation Grants Officer provided revisions concerning the Hazard Mitigation Grant Program (HMGP) while the Hazard Mitigation Plans Officer provided updates concerning the Pre-Disaster Mitigation (PDM) grant program and also local jurisdictional mitigation plan information. A Mitigation Specialist specializing in Geographic Information Systems (GIS) provided vulnerability and risk assessment updates with the use of Hazards United States (HAZUS) analysis while another Mitigation Specialist provided various research concerning hazard profile data collection. The entire TDEM Mitigation Staff contributed in the review and revisions provided in this Plan.

In addition, the Staff and all members of the SHMT were invited to attend a meeting at TDEM in Austin on May 4, 2010 to discuss the plan update process (see Section 7, Attachment 5 for agenda and sign-in sheet). The members of the Team that directly participated in the 2010 update of the Plan include:

- Manager of the Dam Safety Section for the Texas Commission of Environmental Quality
- Chief Hydraulics Engineer, Design Division, of the Texas Department of Transportation
- Division Director of Flood Mitigation Planning at the Texas Water Development Board
- Grants Coordinator of Flood Mitigation Planning at the Texas Water Development Board
- Senior Administrator of the Hazard Mitigation Program of the General Land Office
- State Coordinator Wildland Urban Interface and Fire Prevention of the TX Forest Service
- Mitigation Staff Forester of the Texas Forest Service
- Executive Director of the Texas Geographical Society

In addition, the Safety Officer of the Railroad Commission (RRC) and staff at the Texas Floodplain Management Association (TFMA) provided updated information, even though they were not present at the May 4, 2010 SHMT meeting at TDEM.

During the SHMT meeting, the Team was presented with the data relevant to their State agencies from the 2007 version of the Plan. Members were then encouraged to discuss with the group updates or changes that their State agency was more familiar with. In addition, the Team was encouraged to provide inputs on what changes the Plan needed to address. Also at the meeting, the SHMO briefed the Team on the progress of the State's goals and strategies from 2007-2010. At the conclusion of the meeting, the Team was asked to review the Plan and to respond to

TDEM within a month with their updates, or at the very least, a statement that the information was reviewed and no changes or additions were necessary at this time. The Team was allowed to submit their revisions to TDEM by e-mail. The Staff would then review and analyze the draft revisions before including them in the Plan updates.

Below is a more detailed explanation of how each section of the plan was reviewed and analyzed during the update process.

SECTION 1

This section discusses the planning process. The Staff and the Team reviewed this section to determine if the planning process was accurate and if it clearly described how the Plan was updated. The Staff analyzed if the process included a description of how the plan was reviewed and analyzed, and who was involved in the update process. The Team reviewed how other agencies participated in the process and analyzed how adding additional Team members would benefit the Plan. This section was revised as part of the update process.

SECTION 2

This section discusses the risk assessment. The Staff and the Team analyzed the risk assessment to determine if the natural hazards listed were still relevant and if the information about them was still accurate. If a natural hazards risk assessment was deemed to be insufficient, then the Staff and Team worked together to update that hazards risk assessment. The new information was then profiled by the Staff to include the location, previous occurrences, probability of future hazard events and various vulnerabilities to jurisdictions and State-owned facilities. This section was revised as part of the update process.

SECTION 3

This section discusses mitigation strategies. The Staff and the Team reviewed and analyzed the mitigation strategies to determine if the strategies were relevant to the State's goals for mitigation. The Team played a larger part in Section 3 compared to other sections in the Plan due to the amount of data in Section 3 provided by State agencies that compose the SHMT. The Team reviewed the information provided by their State agencies to determine if it required updating at this time, and if so, then that updated information was provided to the Staff. The Staff and the Team then analyzed which of the State's goals and strategies have been achieved since 2007, and for those that were not, an update of the status of those strategies and why they have not been achieved by 2010. This section was revised as part of the update process.

SECTION 4

This section discusses the process by which the State provides funding and technical assistance for the development of local mitigation plans. The Staff and the Team reviewed the current funding and technical assistance for the development of local mitigation plans and projects and analyzed whether those programs were achieving their mission. The Staff updated grant sources relevant to TDEM while the Team updated grant sources or programs relevant to their perspective agency. New or updated information was included in the Plan as appropriate. This section was revised as part of the update process.

SECTION 5

This section discusses the State's commitment to a comprehensive mitigation program. The Staff and the Team reviewed the various programs and mitigation workshops outlined in Section 5 and analyzed if they were successful in achieving a comprehensive mitigation program. Updates were

added when determined to be necessary by the Staff and the Team. This section was revised as part of the update process.

SECTION 6
This section discusses the plan maintenance process. The Staff and the Team reviewed the plan maintenance process to determine whether or not the process is viable or if additional modifications were necessary. Reviewing each State goal to determine their appropriateness with respect to changing situations and including project closeout information were determined by the Staff and the Team to be vital for successful mitigation planning by the local jurisdictions. This section was revised as part of the update process.

Coordination among Agencies

Requirement §201.4(b): *The mitigation planning process should include coordination with other State agencies, appropriate Federal agencies, and interested groups.*

The Staff and the Team coordinated the development and update of the Plan with other State agencies and with FEMA. Each participating State agency presented its programs, identified mitigation opportunities, and subsequently had an opportunity to comment on the draft versions of the plan. This was done through meetings, emails and TDEM's website. Other State agencies contributed to the Plan update by assisting TDEM with technical updates. Examples include The Texas Natural Resource Information Systems (TNRIS), which updated the electronic State Facilities Database, and also the Texas Geographic Society, which converted the hardcopy version of the State Hazard Analysis into a web-based interactive mapping system for local jurisdictions to access through the Internet (see Section 2: Risk Assessment for more information). The Staff held conference calls and had meetings with FEMA representatives during the update process. Coordination among Federal and State agencies did not change since approval of the last plan.

A notice was placed on the TDEM website announcing that the Plan was in the process of being updated. Businesses, non-profit organizations and other interested parties could use this opportunity to become participants in the update by reviewing the Plan and providing comments to TDEM's Mitigation Plans Officer.

In order to make the State plan update open for review to as many State agencies and local governments as possible, the Staff implemented the schedule as follows:

Table 1-1: Chronology of the 2010 Texas Mitigation Plan Update

Date	Action Taken
3/11/2009	TDEM staff begins the process of the Plan update with a brainstorming session between the SHMO and the Mitigation Plans Officer.
6/5/2009	The Mitigation Plans Officer submits a question to FEMA concerning the inclusion of success stories as part of an enhanced plan.
8/4/09	The Mitigation Plans Officer, in an attempt to further develop project success stories, printed out a series of situational reports from the Texas State Operations Center.

10/02/09	TDEM staff met with TNRIS staff to discuss the incorporation of the State Facilities Database into the Geospatial Emergency Management Support System (GEMSS). This update process will allow state agencies to edit their information using an internet browser from their office computer.
10/19/09	In the course of preparing for the Plan update, the SHMT learned that the representative from the Lower Colorado River Authority (LCRA) is retiring from his position. However, he also represents the Texas Floodplain Management Association (TFMA), so remains on the SHMT as the TFMA representative and LCRA is dropped from the Team.
10/28/09	TDEM Mitigation Section met to discuss the Plan update process.
11/18/09	FEMA personnel met with TDEM mitigation staff to provide technical assistance on the Plan update process.
12/3/09	FEMA's Senior Community Planner held a conference call with the state planners in Region VI in order to encourage communication between the various States on planning issues.
1/7/10	A second FEMA conference call with all state planners in Region VI was held. The call focused on the risk analyses components of the Crosswalk.
1/22/10	The Mitigation Plans Officer partnered with the Urban Wildland Interface Coordinator of the Texas Forest Service to discuss new developments on wildfire risk assessments.
1/29/10	The Mitigation Plans Officer notified the SHMT about the need to have a meeting sometime in the Spring to discuss the Plan update.
2/1/10	TDEM staff met with TNRIS staff again to discuss the on-going inclusion of the State Facilities Database into GEMSS.
2/3/10	TDEM held a conference call with staff from TWDB, TNRIS, TFS and FEMA to discuss how best to standardize the input of data in GEMSS.
5/4/10	TDEM hosts the SHMT meeting to discuss the on-going update of the Plan. SHMT members are asked to provide updates to TDEM within one month. See Section 7, Attachment 5 for a sign-in sheet and agenda.
5/7/10	TDEM staff met with TNRIS staff to discuss how state agencies would be able to edit their portion of the State Facility Database within GEMSS.
6/4/10	TDEM receives most of the updated data from SHMT members. However, some SHMT members indicate that it will take them longer to complete their revised data.
6/30/10	TWDB submits to TDEM the updated risk assessment and mitigation strategy for floods.
7/8/10	TDEM provided a draft copy of the updated Plan to FEMA Region VI for review, comments and recommendations.

7/23/10	TDEM staff met with TNRIS staff to discuss what information would need to be edited within the State Facility Database.
8/12/10	TNRIS staff demonstrated for TDEM how state agencies would be able to edit their portion of the State Facility Database within GEMSS.
8/27/10	FEMA returns the draft Plan to TDEM with required revisions.
8/31/10	TDEM conducts a conference call with FEMA to discuss the required revisions needed to the draft Plan.
9/3/10	TNRIS releases the State Facility Database within GEMSS back to TDEM to allow state agencies to edit their information at their convenience.
9/3/10	TCEQ submits to TDEM the updated risk assessment and mitigation strategy for dam failure.
9/9/10	GLO submits to TDEM the updated risk assessment and mitigation strategy for coastal erosion.
9/13/10	TDEM provided a copy of the revised updated Plan to FEMA Region VI for review, comments and recommendations.
9/22/10	FEMA returns the draft Plan to TDEM with required revisions.
9/23/10	TDEM conducts a conference call with FEMA to discuss the required revisions needed to the draft Plan.
9/27/10	TDEM provided a copy of the revised updated Plan to FEMA Region VI, for review, comments and recommendations.
9/28/10	FEMA sends TDEM notice that the State updated Plan is “Approvable Pending Adoption”.
10/18/10	The Governor of Texas officially adopts the updated Plan.
10/20/10	Adoption paperwork is submitted to FEMA Region 6 in Denton, Texas.
10/21/10	FEMA officially approves the updated Plan.

Program Integration

Requirement §201.4(b): *The mitigation planning process should be integrated to the extent possible with other ongoing State planning efforts as well as other FEMA mitigation programs and initiatives.*

State Annex P

The State of Texas has an *Annex P – Hazard Mitigation* annex to the *State of Texas Emergency Management Plan*. The purpose of the *Annex P* is to identify Emergency Support Function (ESF) tasks for hazard mitigation and to define organizations, responsibilities and procedures for taking action to eliminate or reduce long-term vulnerability risk to life and property from natural or human-caused disasters. The annex is applicable to all SHMT member agencies and to all other agencies, organizations and personnel with hazard mitigation ESF responsibilities. The primary focus of the annex is the coordination of State-level mitigation activities (See Section 7, Attachment 2).

Drought Preparedness Plan

The State of Texas has a *State Drought Preparedness Plan* (See Section 7, Attachment 1). The purpose of this plan is to provide the State of Texas with a framework for an integrated approach to minimize the impacts of drought on its people and resources. The plan outlines both long-term and short-term measures that are to be used to prepare for, respond to, and mitigate the effects of drought. To accomplish these goals, the *State Drought Preparedness Plan*:

- Identifies the local, State, Federal and private sector entities that are involved with State drought management and defines their responsibilities.
- Defines a process to be followed in addressing drought-related activities, including monitoring impact assessment and response.
- Identifies long and short-term activities that can be implemented to prevent and mitigate drought impacts.
- Acts as a catalyst for creation and implementation of local drought planning and response efforts.

Texas Windstorm Insurance Association

The Texas Department of Insurance (TDI), as a key member of the SHMT, provides reduction educational materials to the public. This State agency is the lead agency for windstorm mitigation in Texas. Since 1988, TDI has undertaken an ongoing process for the reduction of damage from windstorms in the coastal area through legislation, rule making, and policy. The 70th Legislature in House Bill 2012, as codified in Article 21.49 Section 6A, Texas Insurance Code, provides certain inspection requirements for structures to be considered insurable property for windstorm and hail insurance through the Texas Windstorm Insurance Association (TWIA). All new construction, repairs, or additions on or after January 1, 1988, shall be inspected or approved by TDI for compliance with the building specifications adopted by the Commissioner of Insurance. This applies solely to the tropical storm and hurricane-prone Tier 1 coastal counties of Texas. Insurers may offer insurance premium discounts to insures statewide for eligible impact-resistant roof coverings.

Integration with FEMA Mitigation Programs and Initiatives

National Flood Insurance Program (NFIP) & Community Rating System (CRS)

The 77th Legislature of the State of Texas amended Subchapter I, Chapter 16, Water Code, by adding Section 16.3145 to read as follows: "The governing body of each city and county shall adopt ordinances or orders, as appropriate, necessary for the city or county to be eligible to participate in the National Flood Insurance Program...., not later than January 1, 2001".

Currently within Texas, fifty-two (52) communities currently participate in the CRS part of the NFIP. The CRS is an incentive-based program where communities exceeding the minimum NFIP requirements for participation can secure up to 45 percent premium reductions for the policyholders in that community. As for NFIP participation, Texas has 1,190 communities that currently participate in NFIP. These communities have floodplain ordinances/court orders.

Several local mitigation action plans have identified as a mitigation action that they will join the CRS program. Another mitigation action listed in several regional and countywide mitigation plans is to encourage those communities that are not participating in NFIP to do so. The TDEM Mitigation Plans Officer also has access to the Community Information System (CIS) database, which provides information concerning NFIP participation and status.

In order to promote the removal of structures from the floodplain and floodway, Texas has made its highest priority for mitigation grants the property acquisition projects. These grants help pay for the removal of primary residences that sustained greater than 50 percent damage and that are in the floodplain and floodway; and properties that have suffered severe repetitive losses (using FEMA's Targeted Repetitive Loss List as a reference). By law, the land acquired must be retained as open space in perpetuity by that local jurisdiction.

FEMA Mitigation Grants

The Flood Mitigation Assistance (FMA) program and the Severe Repetitive Loss (SRL) program are State-administered by the Texas Water Development Board (TWDB). FMA and SRL are FEMA grant programs that utilize Federal funds available through flood insurance premiums and the NFIP. The primary goal of FMA and SRL is to decrease claims against the NFIP and to promote long-term flood mitigation planning. Both project and planning grants are available to eligible communities though the FMA and SRL programs. The highest priority for project grant award is to those proposing buyout and removal of repetitive loss structures that meet the highest cost/benefit analysis.

The Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM) and Repetitive Flood Claims (RFC) programs are State-administered by the Texas Division of Emergency Management (TDEM). HMGP, PDM and RFC are FEMA grant programs that utilize Federal funds to assist local communities with mitigation. Both project and planning grants are available to eligible communities through the HMGP and PDM programs. Project grants are available through the RFC program for the goal of decreasing claims against the NFIP.

More information concerning these FEMA mitigation grants may be found in Section Four: Funding Sources and Technical Assistance.

SECTION 2 – RISK ASSESSMENT

General

This is a summary of the geophysical, population, and weather data for Texas. More details can be found in the Texas Hazards Analysis. In 2005, the Texas Hazard Analysis was converted from hardcopy form to an interactive mapping system located on the Internet at www.thmp.info. The Texas Hazard Mitigation Package (THMP), or "THuMP", is an online digital geographic data resource for hazard analysis in Texas. The site is organized so that users can quickly assess their potential exposure to natural hazards by viewing summary maps depicting the historical frequency of those hazards by county in Texas. Users will quickly get a sense of their relative risk for these hazards. For assistance with this Web site, please contact the Texas Geographical Society at craig@geo-techvp.com.

In order to adequately identify and profile the hazards that occur throughout Texas, a general overview of the physical character of the state is necessary. A state the size of Texas, of over 267,000 square miles in area and roughly 7 percent of the contiguous United States, exhibits varied characteristics in both climate and physiography. The following sections provide a description of the general climate, physiography and population characteristics of Texas as they apply to an assessment of risks associated with natural hazards.

GEOPHYSICAL DESCRIPTION OF TEXAS

Geographically, Texas is a crossroads where four major physiographic subdivisions of North America come together: the Rocky Mountain Region, the Great Western High Plains, the Great Western Lower Plains and the Gulf Coastal Forested Plains. These coincide with the principal physical regions of: Trans-Pecos, Staked Plains (or Llano Estacado), North Central Plains and Gulf Coastal Plains.

The highest point in Texas is Guadalupe Peak at 8,749 feet above sea level. Guadalupe and its twin, El Capitan (8,085 feet) are in West Texas near the New Mexico boundary. A plateau, elevated at 2,600 to 4,300 feet above sea level, extends across West Texas above the Cap Rock. Below the escarpment, the surface slopes downward to sea level along the Gulf Coast. The geographic center is about 15 miles northeast of Brady in northern McCullough County. The smallest county in terms of area is Rockwall County (148.6 square miles) and the largest is Brewster County (6,193.1 square miles).

Texas occupies about seven percent (7%) of the total water and land area of the United States. It is as large as all of New England, New York, Pennsylvania, Ohio and Illinois combined. The State's area consists of 261,914 square miles (167,624,960 acres) of land area and 5,363 square miles (3,432,320 acres) of inland water for a total area of 267,277 square miles (171,057,280 acres). Texas' land area is drained by twelve river basins. These river systems played an important role in the western migration during the early development of Texas and remain equally important to the State's economy today. The upper reaches are impounded by dams to reduce massive flooding downstream and to conserve life-giving water to semi-arid lands. Many of the lower reaches remain navigable and support a healthy water transportation network of bays, inter-coastal canals and extensive commercial and sport fishing.

The longest straight-line distance in a general north-south direction is 801 miles from the northwest corner of the Panhandle to the extreme southern tip of Texas on the Rio Grande below Brownsville. The longest east-west distance is 773 miles from the extreme eastward bend in the Sabine River in Newton County to the extreme western bulge of the Rio Grande just above El Paso.

Texas has 367 miles of open Gulf shoreline of which 293 miles are open for public use. The Texas coastline runs from Port Arthur in the north to Boca Chica in the south, near the confluence of the Rio Grande and the Gulf of Mexico.

WEATHER

Texas weather is a story of extremes: suffering hail damage in a dust storm, temperatures ranging from a low of –23 F to a high of 120 F, and annual rainfall from a low of 1.76 inches to a high of 109.38 inches.

The mean annual temperature ranges from 59 degrees F in the Panhandle to 74 degrees F at Brownsville. The average date of the first freeze temperature in the fall is November 1, in the Panhandle and December 16, along the Lower Texas Coast. The average date of the last freeze in the spring is April 15, in the Northwest Panhandle and January 30, in the Brownsville area.

The mean annual precipitation in Texas ranges from 8.8 inches near El Paso in the southwest to 58.3 inches in the Southeast at Orange, on the Gulf Coast. The Texas annual precipitation for 1994 was 29.65 inches; for 1995, was 27.62 inches, for 1996, was 24.71 inches, and 28.52 inches for 1998.

Annual snowfall ranges from no snow to a record 65 inches in 1923-1924, at Romero, located southwest of Dalhart in Hartley County, near the border of the State of New Mexico. Heaviest recorded snowfall in a 24-hour period was 24 inches at Plainview in February 1956. Greatest monthly accumulation was 36 inches at Hale Center in February 1956.

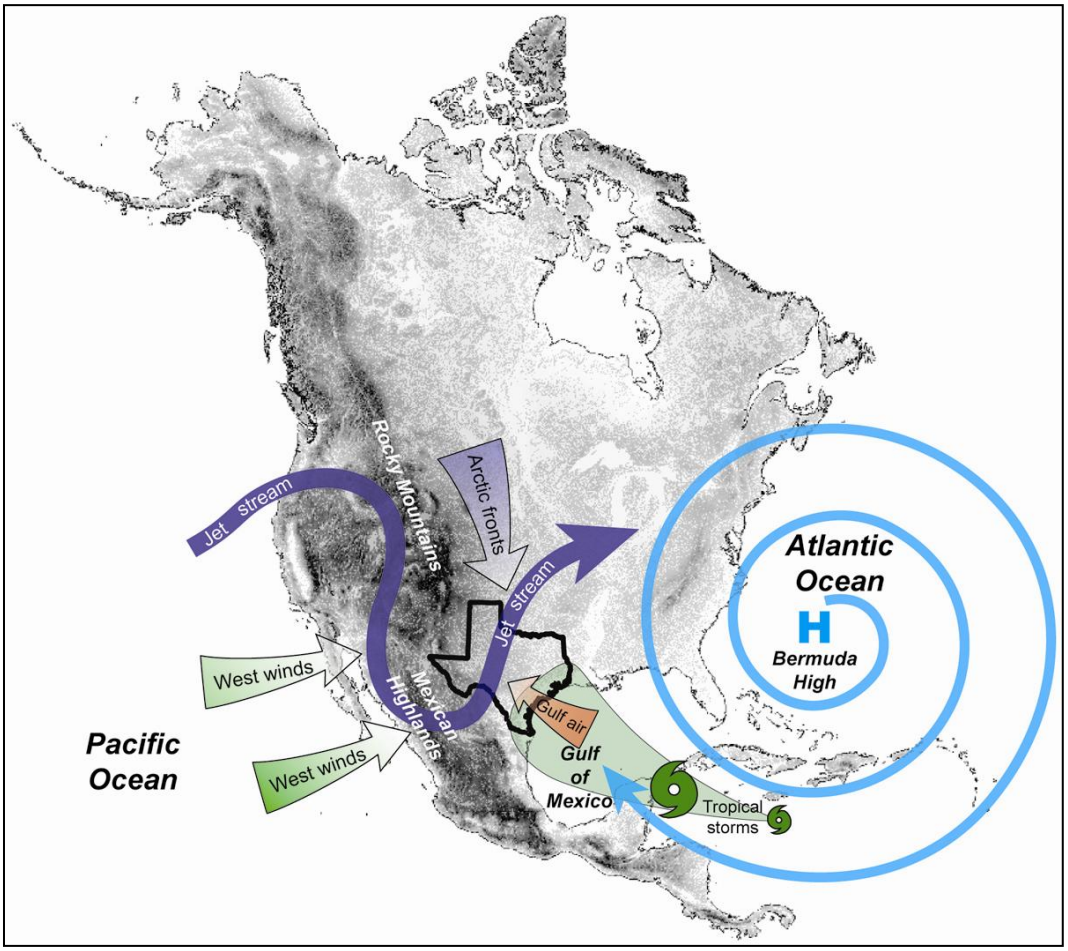
The Texas Gulf Coast is subject to one of the most destructive of all weather phenomena, hurricanes. Highest sustained wind was 145 miles per hour recorded during Hurricane Carla in 1961, and highest peak gust was 180 miles per hour measured during Hurricane Celia in 1970. Theoretically, much higher wind velocities are possible within the vortex of a tornado but no measurement with an anemometer has ever been made.

An average of 125 tornadoes touches down on Texas soil each year. The annual total varies considerably, and certain areas are struck more often than others. Tornadoes occur with greatest frequency in the Red River Valley, just north of the Dallas/Fort Worth Metroplex.

CLIMATE (from the Texas Water Development Board's *State Water Plan 2007*)

From the hot, dry desert of Far West Texas and the blue northers that blast the Llano Estacado to the humid, rainy pine forests of East Texas and the hurricanes that sweep across the Gulf Coast, Texas' climate is as varied as its landscape. That variability is a result of the interactions between Texas' unique geographic location and the movements of seasonal air masses, including arctic fronts, the jet stream, subtropical west winds, tropical storms, and a subtropical high pressure system known as the Bermuda High (see Figure 2-1).

Figure 2-1: Interaction of Seasonal Air Masses & North American Geography Affecting Texas Climate (Source: TWDB, 2007)

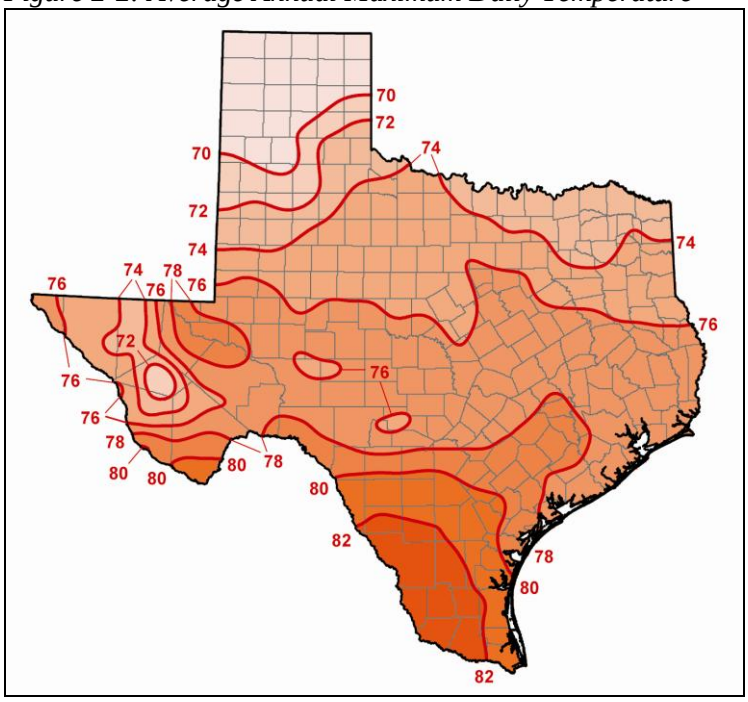


The Gulf of Mexico is a dominant geographical feature, moderating temperatures along the Gulf Coast and, more important, providing the major source of moisture for the state (Carr, 1967; Larkin and Bomar, 1983). The eastern Pacific Ocean and land-recycled moisture also provide, to a lesser extent, a source for annual rainfall to the state (Carr, 1967; Schmidt, 2001; Slade and Patton, 2003). Texas is prone to hurricanes that find their way into the Gulf of Mexico during the hurricane season. The Rocky Mountains guide cold fronts of arctic air moving southward into the state during late fall, winter, and early spring and also extract much of the Pacific moisture from subtropical depressions carried eastward by subtropical west winds during the summer. During the spring and fall, warm, dry air from the high plains of northern Mexico is pulled into the state by the jet stream and collides with humid air from the Gulf of Mexico funneled in by the western limb of the Bermuda High system – resulting in severe thunderstorms and tornadoes.

2.1.1 Temperature, Precipitation, and Evaporation

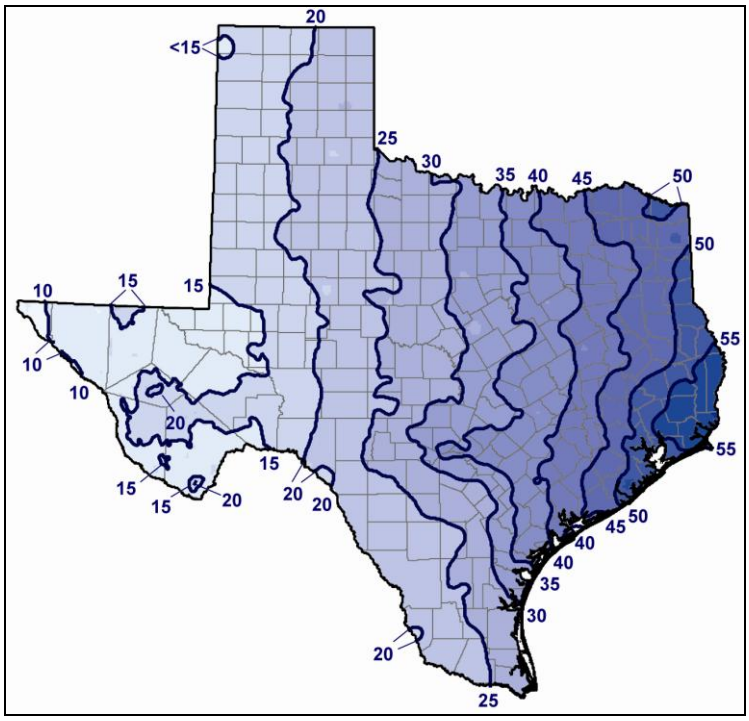
In general, average annual maximum daily temperature gradually increases from less than 70ºF in the northern Panhandle to more than 82ºF in the lower Rio Grande Valley, except for isolated mountainous areas of Far West Texas. In Far West Texas, the average annual maximum daily temperature sharply increases from less than 72ºF in the Davis and Guadalupe mountains to more than 80ºF in the Presidio and Big Bend areas (see Figure 2-2).

Figure 2-2: Average Annual Maximum Daily Temperature



Average annual precipitation decreases from over 55 inches in Beaumont to less than 10 inches in El Paso. Average annual gross lake surface evaporation ranges from less than 45 inches in East Texas to more than 90 inches in Far West Texas. Although most of the state's precipitation occurs in the form of rainfall, small amounts of ice and snow become increasingly probable toward the north and west. In addition, the variability of both daily temperature and precipitation totals increase inland across the state and away from the Gulf of Mexico. The majority of rainfall in Texas occurs during storm events when a large amount of precipitation falls over a short period of time. Except for the wetter, eastern portion of the state, evaporation exceeds precipitation for most of Texas, yielding a semi-arid climate that becomes arid in Far West Texas. Relative humidity varies throughout the state, depending on rainfall and evaporation rates, but generally decreases from east to west.

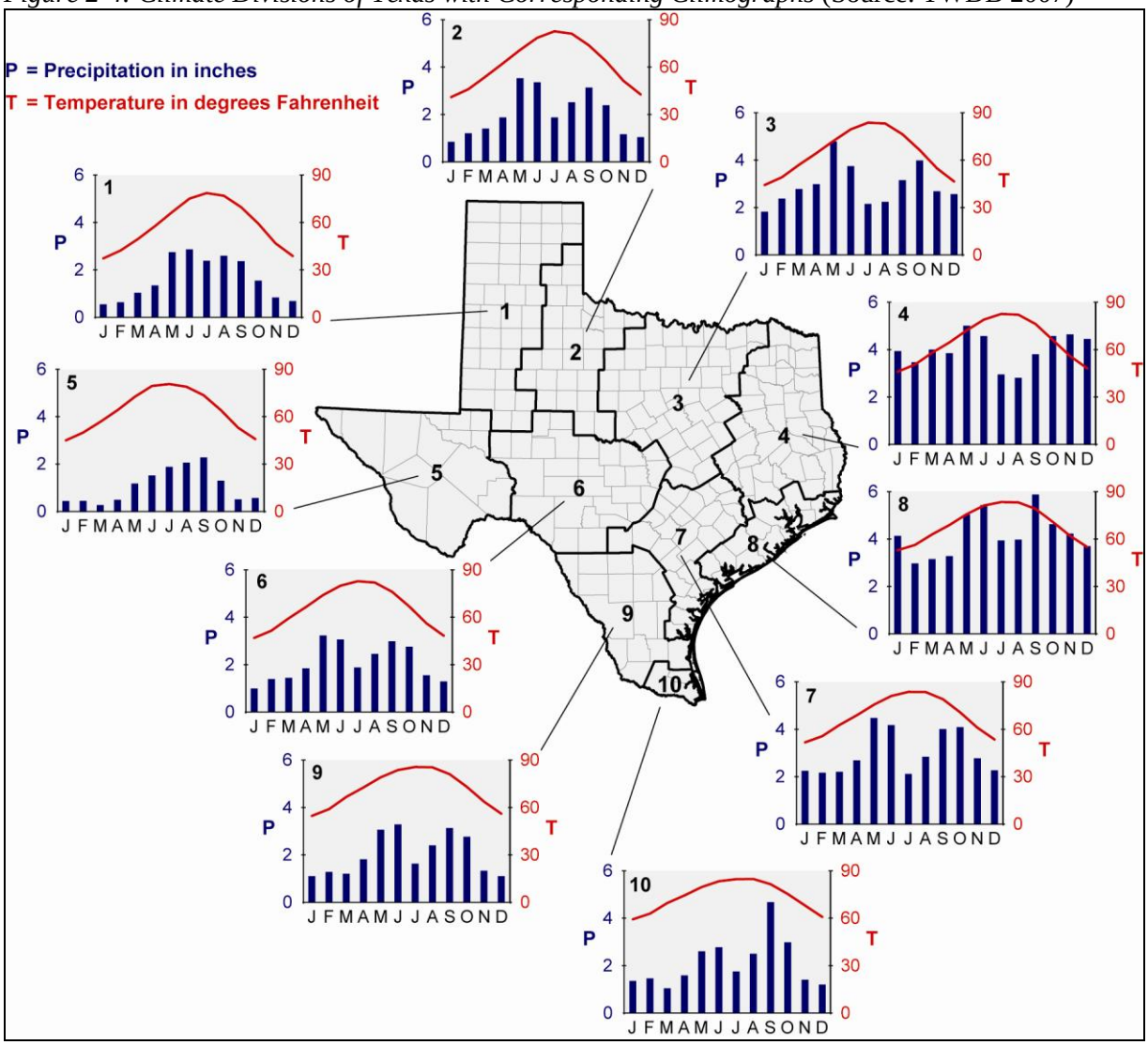
Figure 2-3: Average Annual Precipitation (Inches) for 1971-2000 (Source: TWDB, 2007).



2.1.2 Climate Divisions

The National Climatic Data Center divides Texas into 10 climate divisions, [representing] regions with similar climatic characteristics, such as vegetation, temperature, humidity, rainfall, and seasonal weather changes. Data collected at locations throughout the state are averaged within the divisions are averaged in order to make maps such as the one in Figure 2-4 (next page), which shows the average monthly precipitation (vertical bars) and temperature (curved line) for 1971-2000. These divisions are commonly used to report climatic information, such as precipitation, temperature, and drought indices.

Figure 2-4: Climate Divisions of Texas with Corresponding Climographs (Source: TWDB 2007)



2.1.3 Climate Influences

The El Nino Southern Oscillation, a cyclical fluctuation of ocean surface temperature and air pressure in the tropical Pacific Ocean, affects Pacific moisture patterns and is responsible for long-term (decadal) changes in Texas' precipitation, leading to periods of moderate to severe drought. During a weak oscillation, precipitation will generally be below average and some degree of drought will occur. However, during a period of strong oscillation, Texas will usually experience above average precipitation.

The range between summer and winter average monthly temperatures increases with increased distance from the Gulf of Mexico. In addition, the state climate divisions nearest the Gulf Coast show more pronounced rainy seasons in the fall and spring. These two rainy seasons are affected by polar fronts interacting with moist Gulf air during those seasons. The fall season also includes precipitation associated with hurricanes and tropical depressions approaching or entering the state from the Gulf of Mexico. These tropical disturbances will often move in and stall out over Central and North Texas, dumping large amounts of rain and causing flooding.

2.2 PHYSIOGRAPHY

Four principal physiographic regions of the Central United States occur in Texas. The Basin and Range Province of the Rocky Mountains extends into Far West Texas and includes the Davis and Guadalupe Mountains, the Big Bend area, and the Upper Rio Grande Valley. The Great Plains lies to the east and flanks the Rocky Mountains, includes the panhandle area of Texas (High Plains), and extends into the plateau areas as far south as the Rio Grande River and the Balcones Escarpment. The Interior Lowlands Region lies adjacent to and east of the Great Plains extending from Canada south into north-central Texas. The boundary of the Interior Lowlands in Texas is marked by the Caprock Escarpment along its western perimeter, the Balcones Escarpment along its eastern limit, and the northern extent of the plateau area and Llano Basin of Central Texas along its southern boundary. Lastly, the Gulf Coastal Plain covers the eastern third of the state, bounded along the west by the Balcones Escarpment from the Rio Grande River near the City of Del Rio, eastward to near San Antonio where the trend turns roughly north by north-east towards north-central Texas extending past the Dallas area and across the Red River. The physiographic regions are reflective of the underlying geology of the state, which also serves as the parent material deriving the occurrence and properties of specific soil groups. In addition, the boundaries of the physiographic regions also correspond to the primary Eco-regions of Texas denoting areas exhibiting similarities in ecological and biological diversity.

2.2.1 Basin and Range Province

This physiographic region is distinctive in its physical characteristics, traversed by an eastern range of the Rocky Mountains and containing the only true mountains in Texas. Several peaks within the Guadalupe Mountains and the Davis Mountains, as well as the Chisos Mountains within Big Bend, top out with elevations over 8,000 feet above mean sea level (msl), the highest being Guadalupe Peak at 8,749 feet msl. The mountainous areas are a geologic mix of faulted limestone reefs, volcanoes and associated extrusive rocks such as basalts, rhyolites, and tuffs. Beyond the major river drainages of the Rio Grande and the Pecos, the landscape is indicative of erosional features of local drainage occurrences and reflective of contrasts and variation in topography and vegetation. In addition to the mountain ranges, also included are desert flats and valleys, *bolson* drainages, plateaus and sand hills. Characteristic vegetation includes grasslands, shrublands, cactus savannas and mountain woodlands.

Figure 2-5: Physiographic Map of Texas

2.2.2 Great Plains Region

The Great Plains Physiographic Region lies to the east and flanking the Rocky Mountains, extending into northwest Texas south to the Rio Grande and the Balcones Escarpment. The vast, flat, High Plains of Texas is formed by thick deposits of Tertiary Age alluvial material (3 million to 11 million years old) derived from erosion of the Rocky Mountains, also known as the *Llano Estacado* or Staked Plains. The High Plains rises gradually from about 2,700 feet msl along the eastern boundary, to more than 4,000 feet msl along the Texas-New Mexico border. The area is characterized by smooth to slightly irregular plains that generate a high percentage of cropland. The natural vegetation of the region is primarily blue grama-buffalo grass compared to mostly wheatgrass-needlegrass to the north, Trans-Pecos shrub savanna to the south, and taller grasses to the east.

Included in this physiographic division are the Edwards Plateau, Stockton Plateau, Llano Basin, and Toyah Basin, differentiated from the High Plains lying to the north less by topographic characteristics, and more due to differences of geology, soils and vegetation. The Edwards Plateau and the separate Stockton Plateau are considered the southern extension of the Great Plains Physiographic Region. The area is described as a flat to slightly sloping plateau similar in topographic relief to the plains lying to its north, but different due to outcropping limestone geology, generally thin soils and vegetation consisting primarily of juniper-oak and mesquite-oak savannas. The Toyah Basin, located at the southwest extremity of the Great Plains and northwest of the Edwards and Stockton plateaus, is a broad, flat area formed by a relatively recent (1 to 3

million years old) inland sea. Natural vegetation in this area closely resembles that of the desert-like vegetation existing in the Basin and Range to its west, but as a result of recent irrigation practices, now supports an important agricultural environment. The Llano Basin lies east of the Edwards Plateau. The Llano Basin has similar surface topographic features and vegetation as the adjacent Edwards Plateau and therefore has been grouped with the Great Plains Physiographic Region marking its southern extent. Geologically, however, it is significantly different from any other area of the state. The Llano Basin is actually a domal structure created by older rocks (hundreds of millions to over a billion years old) being thrust upward into the younger overlying strata, more than likely during the same mountain building which created the Ouachita Mountains of southeastern Oklahoma and west-central Arkansas approximately 300 to 400 million years ago. Subsequent periods of deposition and erosion have resulted in the topographically low basin area of exposed older rocks evidenced today.

2.2.3 Interior Lowlands Region

This region is situated between the Great Plains to the north and west where it is bounded by the Caprock Escarpment, the Edwards Plateau and Llano Basin to the south and southwest, and the Gulf Coastal Plains to the east. Geologically, the Interior Lowlands feature alternating, gradational layers of sandstone and limestone formations of primarily Pennsylvanian, Permian, and Cretaceous age strata. Soils are generally deep, supporting a wide variety of vegetation types, but the area is also characterized by considerable dissection of strata by creeks and streams creating deep valleys and ridges. The region includes the North Central Plains, the Grand Prairie and the Eastern and Western Cross Timbers. The North Central Plains extend west to east from the Caprock Escarpment to the Blackland Belt and include the West Texas Rolling Plains, which comprise the western extent of the region, rising from east to west to nearly 2,000 feet msl at the base of the Caprock Escarpment. The Grand Prairie, also referred to as the Fort Worth Prairie, is the eastern extent of the lowlands region, located just to the north and west of Fort Worth; this area is distinct due to its limestone formations and is typically treeless, except along creek bottoms. The final sub-region is the Cross Timbers, two north-south bands connected by a narrow strip along the Red River. The Eastern Cross Timbers extend southward through the Dallas area to the Brazos River in Hill County and feature slightly acidic sandy or sandy loam soils, with woodlands dominated by post oak, blackjack oak, and cedar elm. The much larger Western Cross Timbers extend southward west of Fort Worth to the base of the Edwards Plateau and is characterized by hilly topography and sandy loam soils, with open grasslands interspersed with post oak – blackjack oak woodlands.

2.2.4 Gulf Coastal Plains

The Gulf Coastal Plains extend from the Atlantic Ocean across the southeastern United States and into Mexico, cutting through the eastern and southern portions of Texas, limited to the west and north by the Balcones Escarpment. It is characterized by a rolling to hilly surface topography sloping gently towards the Gulf coast. The dominant vegetation types vary throughout the region based upon physiographic and climatic factors. The region includes the Pine Belt of East Texas, referred to colloquially as the Piney Woods, where pine forests predominate and hardwood timbers occur along rivers and creeks. Much of the native vegetation has been cleared for commercial timber production, agriculture, and pasture. The Piney Woods are bordered to the west by Post Oak Savanna and the Blackland Prairie, which stretches all the way from the Rio Grande to the Red River and is notable for its rich, deep, alkaline clay soils favorable for agricultural production. To the south of the Pine Belt are the Coastal Prairies, which extend along the Gulf coast from the Louisiana border to the Lower Rio Grande Valley. Coastal prairie soils are dominated by heavy clay; common land uses include cattle ranching and farming of irrigated rice, cotton, and sorghum. To the south of the Coastal Prairies, Post Oak Savannas, and

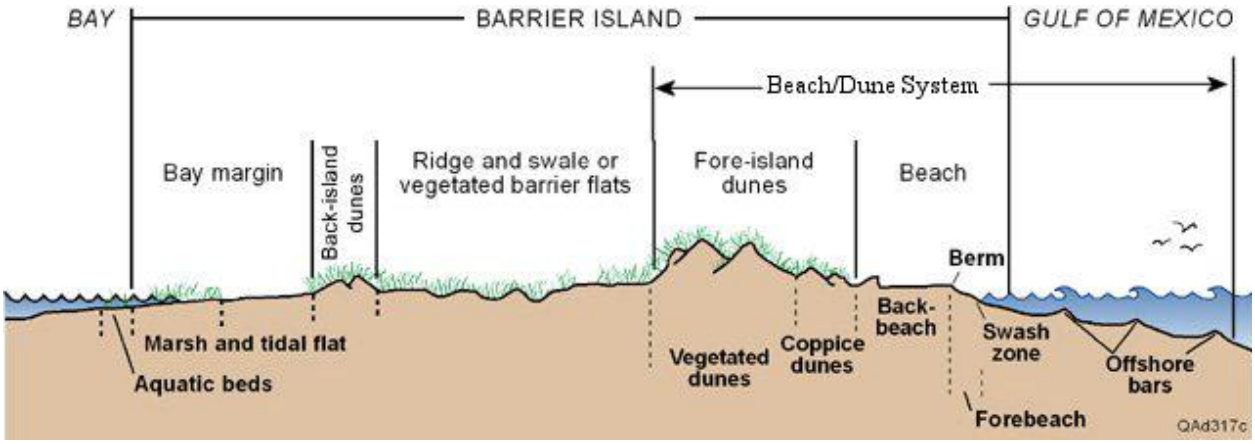
Blackland Prairie lies the Rio Grande Plain. This area occupies the most southern section of the state and shares landscape characteristics with northern Mexico. South Texas features mesquite savannas and dense brushlands of mesquite forests.

2.2.5 Barrier Islands

By definition, barrier islands are generally elongate, exposed narrow accumulation of sediment, usually sand, in the shallow coastal zone and are separated from the mainland by some combination of coastal bays and marshes. Texas has 17 barrier islands that total 191,762 acres.

Barrier Islands provide a level of protection for the mainland against storm impacts. The characteristic features of a barrier island (Figure 2-1) typify high energy environments on the Gulf side and low-energy environments on the bay side. There is a natural system on the Gulf side of Barrier Islands, commonly referred to as the Beach/Dune System, which extends from offshore sand bars landward to the landward side of the fore dunes. The Beach/Dune System is the front-line of defense against coastal storms and is essential to the integrity of the Barrier Island. A healthy Beach/Dune System allows Barrier Islands to recover from a storm. Sand dunes provide protective barriers for adjacent land and inland water against the action of waves, wind, and storm surge. Integral to a healthy dune system is the back beach or dune terrace area. The back beach area is easily identified as the sandy beach area having low relief seaward of the fore-dunes and above the mean high water line.

Figure 2-6: Cross Section of a Typical Texas Barrier Island



As a natural barrier to the destructive forces of wind and waves, sand dunes are an efficient defense against storm-surge flooding and beach erosion. The first apparent feature landward of the beach along the Texas Gulf coast, coastal dunes from Sabine Pass to the mouth of the Rio Grande vary in natural position, contour, volume, elevation, and vegetative cover. These variations are a direct result of natural processes, which include prevailing wind currents, sediment budget, climate, and biota, that influence dune formation. Coastal dunes are a dynamic component of the barrier islands that are in a constant state of change and part of a natural cycle that ensures the health of beaches, marshes, and wetlands along the Gulf and bay shoreline.

Dunes absorb storm surge and high wave impacts, preventing or delaying the intrusion of waters into inland areas. Dunes hold sand that help eroded beaches recover after storms. As part of a delicate natural cycle, storm tides remove sand from the dunes and pull most of it toward the shore. Some of this sand widens the beach profile allowing wave energy to dissipate sooner.

Sand is also deposited just off shore in sand bars, which after the storm will make its way back onshore and blown landward by the wind. The vegetation on the landward side of the dry beach traps this windblown sand and rebuilds the dunes for the next storm event.

2.2.6 River Basins of Texas

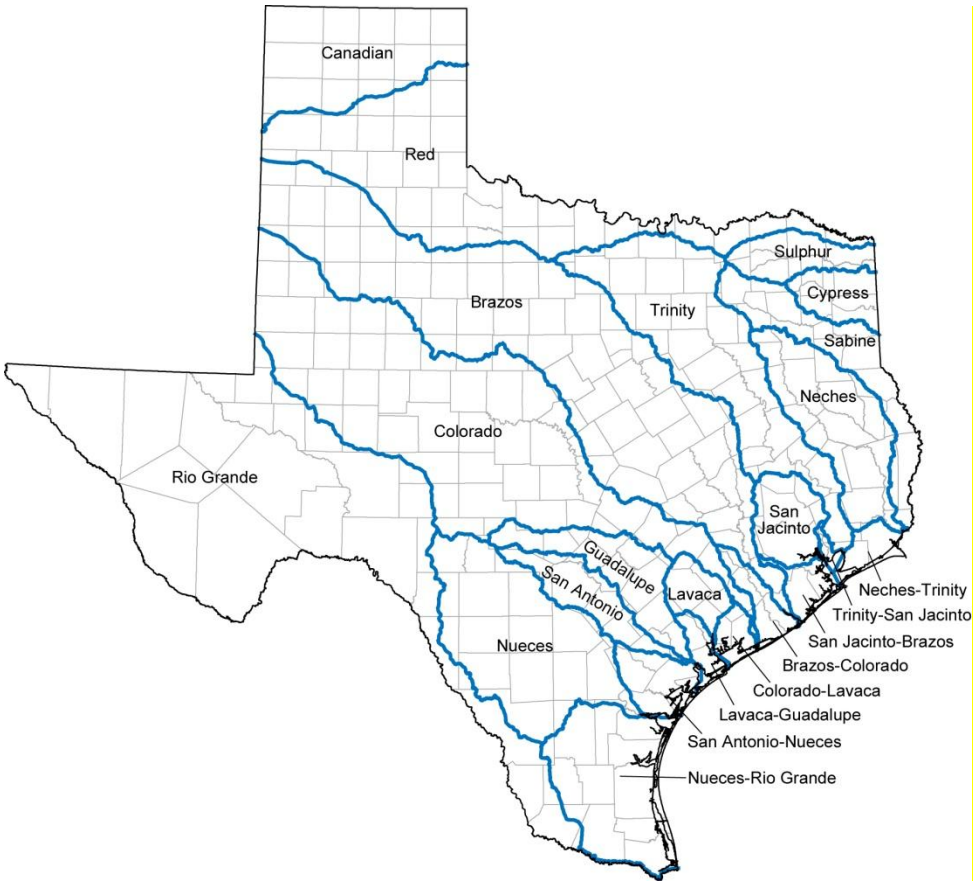
As provided as an excerpt from the 2007 State Water Plan prepared by the Texas Water Development Board, there are 15 major river basins within the state and eight coastal basins (see Figure 2-6), each with varying hydrological regimes and localized susceptibility to flooding. Each of the basins has several unique features, both climatic (such as precipitation and evaporation), as well as physiographic (geology, slope, soil type, vegetation and land use practices) which contribute to the nature of runoff from the basins. Table 2-1 provides a summary of the major river basins and includes watershed area, river length and average flow.

Table 2-1: Features of Major River Basins in Texas

River Basin	Total Area (Sq Mi)	Area in Texas (Sq Mi)	River Length (Miles)	Length in Texas (Mi)	Average Flow (Ac Ft/Yr)
Brazos	45,573	42,865	840	840	6,074,000
Canadian	47,705	12,865	906	213	196,000
Colorado	42,318	39,428	865	865	1,904,000
Cypress	3,552	2,929	90	75	493,700
Guadalupe	5,953	5,953	409	409	1,422,000
Lavaca	2,309	2,309	117	117	277,000
Neches	9,937	9,937	416	416	4,323,000
Nueces	16,700	16,700	315	315	539,700
Red	93,450	24,297	1,360	695	3,464,000
Rio Grande	182,215	49,387	1,896	889	645,500
Sabine	9,756	7,570	360	360	5,864,000
San Antonio	4,180	4,180	238	238	562,700

San Jacinto	3,936	3,936	85	85	1,365,000
Sulphur	3,767	3,580	222	222	932,700
Trinity	17,913	17,913	550	550	5,727,000

Figure 2-6: Major Rivers and Coastal Basins of Texas



POPULATION

The population of Texas on July 1, 2008, was estimated by the U.S. Census Bureau to be 24,326,975, an increase of 3.48 million persons from the 2000 census. Texas has 254 counties ranging in population from Loving County (the smallest) with a population of 42 to Harris County (the largest) with a population of 3,984,349. (Source: 2010-2011 *Texas Almanac*, p. 395) As of 2006, there are 1,208 incorporated cities included in the following breakdown:

Table 2-1: Cities per Population-Type in Texas

Cities with population of 100,000>	28
Cities with population of 50,000>	57
Cities with population of 10,000>	205
Cities with population <10,000	918

Source: http://www.texasalmanac.com/facts/

POPULATION GROWTH

GENERAL

Texas' population change was substantial in the 1990s and has remained large in the first decade of the 21st century. At the same time, there are signs of a short-term slowing of rates of population growth. Coupled with changes in the number of persons in Texas are data released from the 2000 census that show the 1990s brought substantial change in the socioeconomic characteristics of Texas, change that current economic conditions may threaten to, at least partially, stall or reverse.

POST-2000 PATTERNS SUGGEST CONTINUED GROWTH

Estimated population growth in Texas between 2000 and 2008 was the largest of any state in raw numbers, and was the sixth largest in percentage terms at 16.67%.

The population of Texas grows rapidly through both natural increase (the excess of births over deaths) and in-migration. The crude birth rate in Texas in 2005 was 16.8 births per 1,000 persons, compared to 14.0 births per 1,000 persons in the United States as a whole, second highest of any state.

Of the State's 25 metropolitan areas, 22 continued to show increases from 2000 to 2008. There were declines only in the Beaumont-Port Arthur, Wichita Falls and Abilene areas. Below in Table 2-2 is information on the 10 fastest growing counties, as well as information on the 10 slowest growing counties. In addition, the 25 largest Metropolitan Statistical Areas in the State are listed in Table 2-4 on page 23.

Table 2-2: Fastest Growing and Declining Counties (by percentage) in Texas: 2000 to 2008

Fastest Growing			Slowest Growing	
County	% Population Increase		County	% Population Decrease
Rockwall	80.2		Loving	-37.3
Williamson	57.7		King	-21.1
Collin	55.0		Knox	-20.2
Hays	53.2		Cochran	-20.2

Fort Bend	50.1		Borden	-18.7
Denton	47.0		Briscoe	-18.3
Montgomery	46.4		Culberson	-18.3
Kaufman	41.0		Kent	-17.6
Comal	40.5		Floyd	-16.9
Kendall	38.5		Foard	-16.1

Source: 2010-2011 *Texas Almanac,* p. 396

Table 2-3: Major Metropolitan Statistical Areas and their Population Changes

Metropolitan Statistical Areas (MSA)		
MSA	Population	% Change 2000 To 2008
Dallas-Fort Worth-Arlington	6,300,006	22.1
Houston-Baytown-Sugar Land	5,728,143	21.5

Source: 2010-2011 *Texas Almanac,* p. 397

Table 2-4: Metropolitan Statistical Areas (MSA)

Level A – Population of 1 Million or More		
MSA	Population	% Change 2000 to 2008
Dallas-Fort Worth-Arlington	6,300,006	22.1
Houston-Baytown-Sugarland	5,728,143	21.5
San Antonio	2,031,445	18.7
Austin-Round Rock	1,652,602	32.2

Level B – Population 250,000 to 1 Million		
MSA	Population	% Change 2000 to 2008
El Paso	742,062	9.2
McAllen-Edinburg-Pharr	726,604	27.6
Corpus Christi	415,376	3.0
Brownsville-Harlingen	392,736	17.2
Killeen-Temple-Fort Hood	378,935	14.6
Beaumont-Port Arthur	378,255	-1.8
Lubbock	270,610	8.4

Level C – Population 100,000 to 250,000		
MSA	Population	% Change 2000 to 2008
Amarillo	243,838	7.6
Laredo	236,941	22.7
Waco	230,213	7.8
Bryan-College Station	207,425	12.2
Longview	204,746	5.5
Tyler	201,277	15.2
Abilene	159,521	-0.4
Wichita Falls	147,328	-2.8
Texarkana	135,509	4.4
Odessa	131,941	8.9
Midland	129,494	11.6
Sherman-Denison	118,804	7.4
Victoria	114,313	2.4
San Angelo	109,563	3.6

Source: 2010-2011 *Texas Almanac,* p. 397

Identifying and Profiling the Hazards

Requirement §201.4(c)(2)(i): *The State plan must include an overview of the type and location of all natural hazards that can affect the State, including information on previous occurrences of hazard events, as well as the probability of future hazard events, using maps where appropriate.*

Of the eighty-three (83) federally-declared disasters in Texas from 1953 to 2010, Texas received 80 Federal declarations due to these following hazards: 30 - floods; 23 - hurricane/tropical storms; 16 - tornadoes; 6 - drought; 5 - wildfire emergency declarations. These hazards and others that Texas is vulnerable to are outlined in this section of the plan and in the Texas Hazard Analysis located at www.thmp.info.

A review of the past federally-declared disasters in Texas and a review of available local mitigation action plans, it was determined that the Plan should address the risks associated with the following fourteen (14) natural hazards:

- floods
- hurricanes and tropical storms
- tornadoes
- drought
- wildfires
- coastal erosion
- dam or levee failure
- earthquakes
- expansive soils
- extreme heat
- hailstorm
- land subsidence
- severe winter storms
- windstorms

This updated Plan did not add any newly identified hazards from the previously approved Plan, nor did it subtract any, because the SHMT did not deem it necessary. However, improved descriptions of hazards identified in the previous plan are available for floods and coastal erosion.

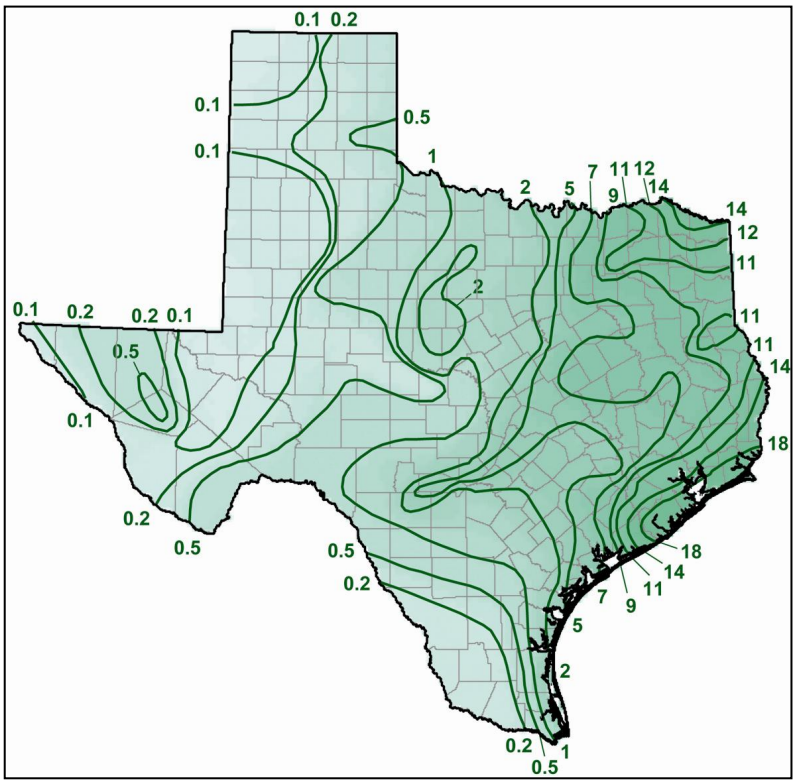
FLOODS

Floods are defined as the accumulation of water within a water body and the overflow of excess water into adjacent floodplain lands. Historically, floods are one of the most frequently occurring, destructive and costly natural hazards facing Texas, constituting over 90% of the disaster damage that has been experienced in the State. Few areas in the State are completely free from the threat of floods. Moreover, the statistical probability exists that a greater flood could occur in any given area than that which has occurred in the past. Flooding can occur during any season of the year. Winter and early spring floods are typically caused by seasonal rainfall patterns while summer floods (except for those associated with hurricanes and tropical storms) are usually caused by super-cell thunderstorms that generally affect only small, localized areas. Floods may be caused by large-scale weather systems that can generate prolonged rainfall events, by locally intense thunderstorms, or by coastal storms such as hurricanes and tropical storms. The Central Texas area is considered to be one of the three most flash flood-prone regions in the world, due primarily to a combination of climatic factors and the specific physiography of the

area. Damage due to flooding can range from water damage to structures and their contents to the complete destruction of the structures with a total loss of all contents. Roads and infrastructure may be undermined and damaged. Riverbank erosion, injury and loss of life are additional common consequences of flooding incidents. On average, Texas suffers approximately 400 floods annually, more than double the average of the second-highest State (ascertained by local data relating to events resulting in damages of at least $50,000). Since 1953, Texas has had 30 Federal disaster declarations as a result of flooding events. Between 1978 and 2000, an estimated $1.4 billion in flood insurance claims were filed in Texas, and an estimated $5 billion in uninsured flood damages occurred.

In hydrologic analysis, runoff is the portion of rainfall which, in combination with other factors, contributes to the stream flow of any surface drainage way. When runoff exceeds the carrying capacity of the stream or drainage, flooding occurs. Runoff is a product of two major groups of factors, climate and physiography. An understanding of the interrelation of these factors, as well as site specific data pertaining to these factors, is necessary in evaluating the flood hazard of an area, and in assessing mitigation strategies for that area. Climatic factors may include precipitation, evaporation, transpiration and interception. Physiographic factors would include the characteristics of the watershed such as size, shape and slope of the basin's drainage area, the general land use within the basin, and may also include characteristics of the drainage way itself such as the geometry of the channel. As illustrated in Figure 2-7, average annual runoff decreases unevenly moving east to west across Texas, the localized variations based on these factors listed above.

Figure 2-7: Annual Average Runoff from Precipitation in Inches (Source: TWDB, 2007)



The most obvious tool a local entity can utilize to assess the risks associated with flood hazards is to review the Flood Insurance Rate Map (FIRM) and the Flood Insurance Study (FIS), both produced by FEMA on a municipal or county-wide basis. FEMA is in the process of modernizing and digitizing the FIRMs for high-priority communities and counties. It is not the intent of this plan to include a State-wide review of the existing local FIRM maps, to conduct a "mapping needs" assessment for all the counties, or even a status of FEMA's Map Modernization activities. Instead the State wishes to recognize the importance of this tool in assessing flood hazards. Future updates to this plan may provide a more detailed assessment of the flood hazard mapping activities.

SEVERE REPETITIVE LOSS (SRL) PROPERTIES

Severe repetitive loss (SRL) properties are a subset of FEMA's repetitive loss classification for its worst cases. For a residential property to be classified as SRL, it must have experienced at least four claims over $5,000 (including building and contents payments) or at least two claims that cumulatively exceed the market value of the structure; for both instances, at least two of the referenced claims must have occurred within any ten-year period and must have been more than ten days apart. SRL properties are seen as a major burden to the National Flood Insurance Program (NFIP) and since they have been flooded frequently in the past, they are a high risk to be flooded again. Thus, they are a high priority for mitigation activities. SRL properties are most common in flood-prone areas along the Gulf Coast and problematic rivers and smaller creeks throughout the state. As of January 2010, there were 3,172 SRL properties in the State of Texas. Some structures are located in the floodway, many more are located in a floodplain and a greater number are located in a wetland area, but not in a Special Flood Hazard Area, yet are repetitively flooded. Table 2-5 provides a snapshot of severe repetitive loss properties in Texas.

Table 2-5: Severe Repetitive Loss Data for Texas

3,172 properties
217 NFIP participants affected in 81 counties
81% (2,567) of the SRL properties are in the following counties: Harris - 53% (1,681); Galveston – 11% (346); Montgomery – 7% (220); Brazoria – 6% (198); and Jefferson – 4% (122)

Source: Texas Water Development Board

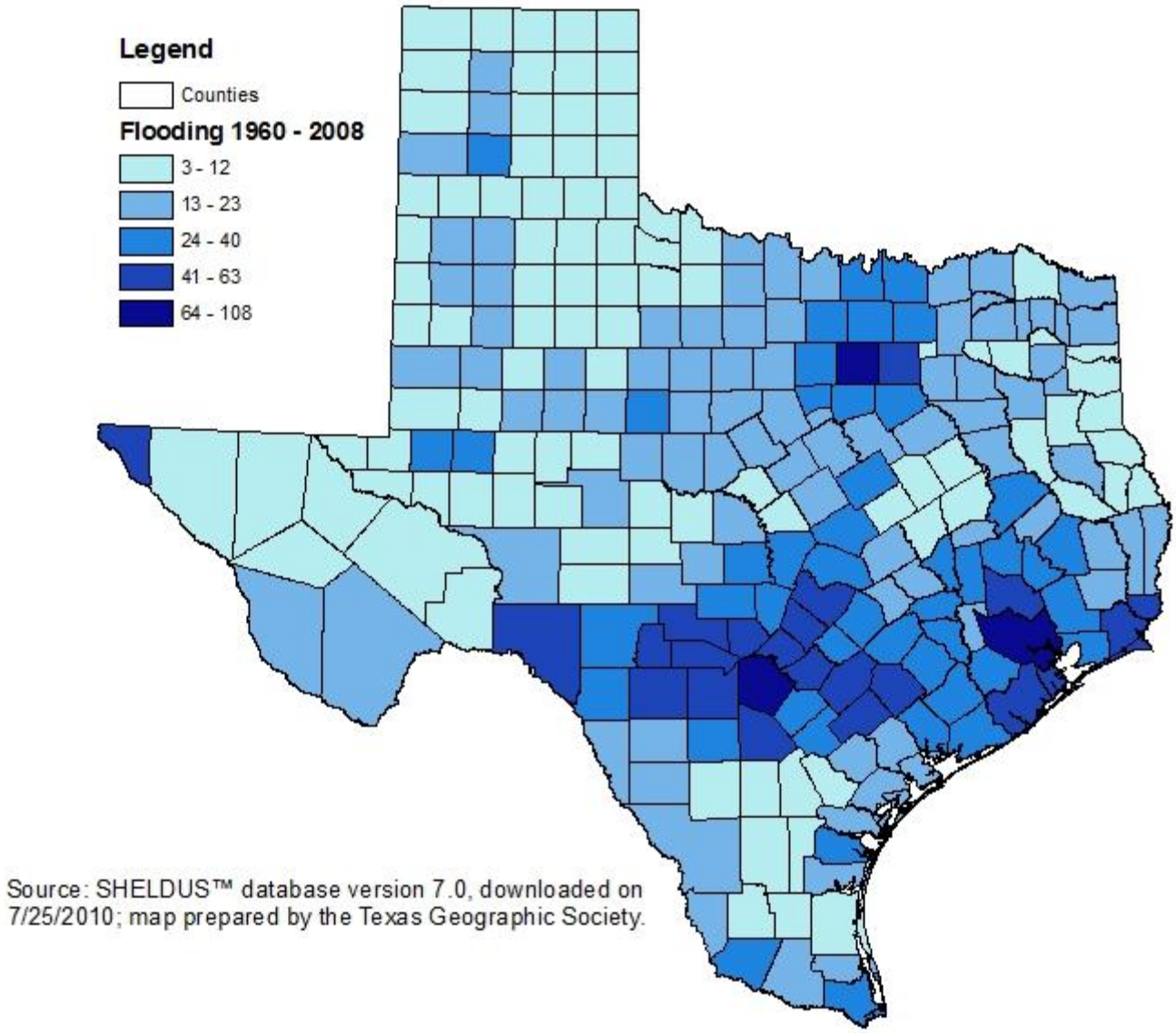
General NFIP and Community Rating System (CRS) Information

Fifty-two (52) communities currently participate in the CRS part of the NFIP. As for NFIP participation, Texas has 1,190 communities that currently participate in NFIP.

Location and Previous Occurrences of Floods

The map in Figure 2-1 (next page) shows the highest concentrations for floods in Texas from 1961 – 2008. This map was compiled by the Texas Geographic Society on behalf of TDEM. The data was sourced from the University of South Carolina, Hazards and Vulnerability Research Institute (formerly the Hazards Research Lab) and extracted from the SHELDUS (Spatial Hazard Events and Losses Database for the U.S.) database. The map is classified into five value ranges using the natural breaks (Jenks) method. The highest class (64-108 floods) contains 3 counties: Tarrant, Harris, and Bexar counties. These counties are considered the highest at risk for experiencing a flood event again.

Map 2-1: Flood Occurrences in Texas



The map shows the number of individual flood events per county from 1960 through 2008 as reported by FEMA through SHELDUS™. The underlying data includes every loss causing and/or deadly event between 1960 through 1975 and from 1995 onward. For the period 1976 through 1994 the data includes only those events that caused at least one fatality or more than $50,000 in property or crop damage.

Table 2-6: 100-Year Flood Areas

Flood Zones		
Zone A	The 100-year or Base Floodplain. There are six types of A zones:	
	A	The base floodplain mapped by approximate methods, i.e., BFEs are not determined. This is often called an unnumbered A zone or an approximate A 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).
	AE	The base floodplain where base flood elevations are provided. AE zones are now used on new format FIRMs instead of A1-30 zones.
	AO	The base floodplain with sheet flow, ponding, or shallow flooding. Base flood depths (feet above ground) are provided.
	AH	Shallow flooding base floodplain. BFEs are provided.
	A99	Area to be protected from base flood by levees or Federal flood protection systems under construction. BFEs are not determined.
	AR	The base floodplain that results from the de-certification of a previously accredited flood protection system that is in the process of being restored to provide a 100-year or greater level of flood protection
Zone V and VE	**V**	The coastal area subject to velocity hazard (wave action) where BFEs are not determined on the Flood Insurance Rate Map (FIRM).
	VE	The coastal area subject to velocity hazard (wave action) where BFEs are provided on the FIRM.
Zone B and Zone X (shaded)	Area of moderate flood hazard, usually the area between the limits of the 100-year and the 500-year floods. B zones are also used to designate base floodplains or lesser hazards, such as areas protected by levees from the 100-year flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than 1 square mile.	
Zone C and Zone X (unshaded)	Area of minimal flood hazard, usually depiction FIRMs as exceeding the 500-year flood level. Zone C may have ponding and local drainage problems that do not warrant a detailed study or designation as base floodplain. Zone X is the area determined to be outside the 500-year flood.	
Zone D	Area of undetermined but possible flood hazards.	

Source: *Understanding Your Risks, identifying hazards and estimating losses*, FEMA 386-2

HAZARD PROFILE WORKSHEET

Hazard: Floods	
Potential Severity Of Impact:	
Substantial X	• Multiple deaths • Complete shutdown of facilities for 30 days or more. • More than 50 percent of property destroyed or with major damage.
Major	• Injuries and/or illnesses result in permanent disability. • Complete shutdown of critical facilities for at least 2 weeks. • More than 25 percent of property destroyed or with major damage.
Minor	• Injuries and/or illnesses do not result in permanent disability. • Complete shutdown of critical facilities for more than 1 week. • More than 10 percent of property destroyed or with major damage.
Limited	• Injuries and/or illnesses are treatable with first aid. • Minor quality of life lost. • Shutdown of critical facilities and services for 24 hours or less. • Less than 10 percent of property destroyed or with major damage.

Frequency Of Occurrence:	**Seasonal Pattern:**
❑ Highly likely: Event probable in next year. ☒ Likely: Event probable in next 3 years. ❑ Occasional: Event possible in next 5 years. ❑ Unlikely: Event possible in next 10 years.	Mostly Spring or Fall

Source Documents, Studies, Maps, Etc. Researched:
Flood Insurance Rate Maps (FIRM), Texas Geographic Society Studies, www.thmp.info

Probable Duration:
Flood events can last from a few hours of one day, to several days or even months if certain weather conditions combine to allow precipitation to continue to fall.

Warning Time (Potential Speed Of Onset):
❑ Minimal (or no) warning.
☒ 3 to 6 hours warning.
❑ 6 to 12 hours warning.
❑ More than 12 hours warning.

Cascading Potential:
Loss of power generation and/or citizens who lose their homes and need public shelter

Existing Warning Systems:
U.S. Geological Society river gauges, National Oceanic and Atmospheric Administration (NOAA) weather radios, public service announcements on local television channels.

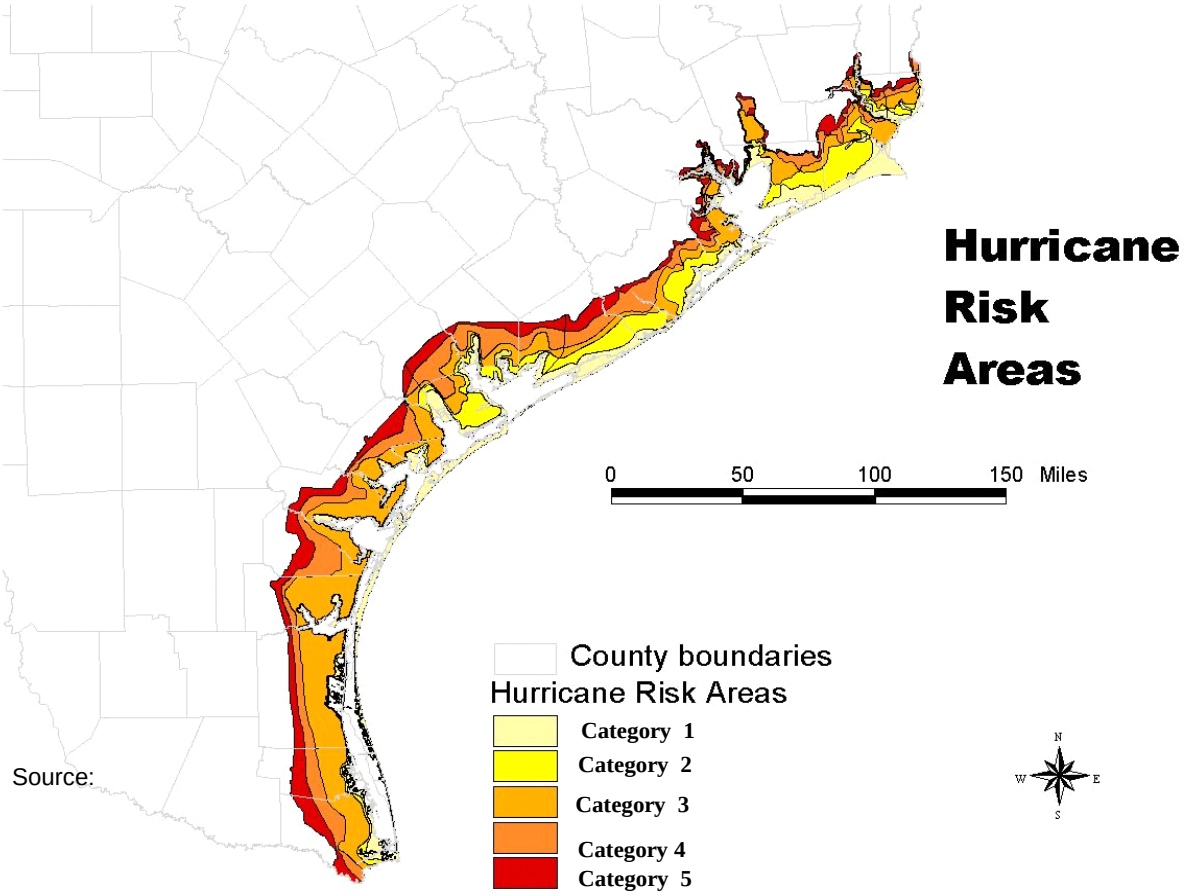
TROPICAL STORMS AND HURRICANES

Hurricanes, tropical storms, and typhoons, collectively known as tropical cyclones, are among the most devastating naturally occurring hazards in the United States and its territories. **A tropical cyclone is defined as a low pressure area of closed circulation winds that originates over tropical waters.** In the North Atlantic and Central and South Pacific basins east of the International Date Line, tropical cyclones with wind speeds between 39 mph and 74 mph are commonly known as Tropical Storms. When wind speeds exceed 74 mph they are commonly known as hurricanes. Tropical Storms are an annual event occurring from May through November with varying intensities and levels of destruction. Tropical Storms primarily cause severe flooding and frequent loss of life by citizens who are unfamiliar with the road and drive into flooded stream crossings and low lying areas. Hurricanes, however, occur less frequently and residents along the Texas Gulf Coast have a good chance of living many years there without experiencing a hurricane. However, none of the Texas coastal areas are immune from hurricanes. Since 1953, Texas has experienced 23 Federal disaster declarations due to hurricane/ tropical storm events, the most recent events being Hurricane Dolly (DR 1780) that was declared on July 24, 2008, Hurricane Ike (DR-1791) that was declared on September 13, 2008, and Hurricane Alex (DR-1931) that was declared on September 16, 2010.

Even after the high winds subside, floods brought on by the heavy rainfalls can be killers. As a hurricane/ tropical storm moves inland and begins to break up, the storm remnants can drop six to twelve or more inches of rain, resulting in extensive damage and loss of life. A prime example of this occurred during June 2001, when heavy rains from Tropical Storm Allison caused some of the worst flooding of this century. As much as 40 inches of rain fell in and around the City of Houston, Harris County and SE Texas causing $5 billion in damage and 41 fatalities. Thirty-one counties were federally declared.

Hurricanes do not even have to strike the Texas Coast to have an impact. On September 16-18, 1988, Hurricane Gilbert struck Mexico 125 miles south of Brownsville, Texas (Cameron County), bringing tides of three to six feet above average, rainfalls of 6 to 10 inches, and at least 29 tornadoes. Total damage associated with Gilbert in Texas was estimated at $3 - $5 million. The only death attributed to the storm in Texas was a woman killed by a tornado spawned by remnants of Gilbert in the San Antonio area. The risk to the Texas Gulf Coast Tier One and Tier Two county areas containing 22 counties, 181 jurisdictions, and 28% (5,601,462) of the total State population is moderate to high depending on the Pacific oscillation (El Niño/La Niña) phenomena. Hurricanes appear to be less frequent during La Niña periods and more prevalent during strong El Niño periods. Map 2-3 provides the location of hurricane risk areas in Texas.

Map 2-3: Texas Hurricane Risk Areas



Source:

Table 2-10: Saffir-Simpson Scale

Category	Winds	Effects
One	74-95 mph	No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Also, some coastal road flooding and minor pier damage.
Two	96-110 mph	Some roofing material, door, and window damage to buildings. Considerable damage to vegetation, mobile homes, and piers. Coastal and low-lying escape routes flood 2-4 hours before arrival of center. Small craft in unprotected anchorages break moorings.
Three	111-130 mph	Some structural damage to small residences and utility buildings with a minor amount of curtain wall failures. Mobile homes are destroyed. Flooding near the coast destroys smaller structures with larger structures damaged by floating debris. Terrain continuously lower than 5 feet ASL may be flooded inland 8 miles or more.
Four	131-155 mph	More extensive curtain wall failures with some complete roof structure failure on small residences. Major erosion of beach. Major damage to lower floors of structures near the shore. Terrain continuously lower than 10 feet ASL may be flooded requiring massive evacuation of residential areas inland as far as 6 miles.
Five	Greater than 155 mph	Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Major damage to lower floors of all structures located less than 15 feet ASL and within 500 yards of the shoreline. Massive evacuation of residential areas on low ground within 5 to 10 miles of the shoreline may be required.

Source: www.wikipedia.org

Table 2-11 lists occurrence data for tropical storms and hurricanes, which affected Texas between June 1, 2007 and June 30, 2010.

Table 2-11: Tropical Storm and Hurricane Occurrences in Texas

Location	Date	Time	Type	Magnitud	Death	Injurie	Propert Damag	Crop Damag
Aransas, Calhoun, Refugio Counties	8/15/07	2300	Tropical Storm Erin	N/A	0	0	0	0
Chambers, Galveston, Jefferson Counties	9/12/07	2200	Hurricane Humberto	N/A	1	12	37.5 M	0
Cameron, Willacy, Jim Wells, Hidalgo, Duval Counties	7/21/08	0900	Hurricane Dolly	N/A	0	0	1B	3.5 M
Jefferson, Orange Counties	8/05/08	0300	Tropical Storm Edouard	N/A	0	0	100 K	0
Chambers, Galveston, Jefferson, Orange, Brazoria Hardin, Fort Bend, Jasper, Waller, Harris, Grimes, Walker, Trinity, Montgomery, Liberty, Newton, Polk, Sabine, San Augustine	9/13/08		Hurricane Ike	N/A	135	N/A	29 B	N/A
Cameron, Hidalgo, Starr, Jim Hogg, Zapata, Webb, Maverick, Jim Wells, Calhoun Val Verde Counties	9/01/10		Hurricane Alex	N/A	N/A	N/A	TBD	TBD
Total					136	12	30.4B	3.5M

Source: http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms list

HAZARD PROFILE WORKSHEET

Hazard: Tropical Storms And Hurricanes	
Potential Severity Of Impact:	
Substantial	• Multiple deaths • Complete shutdown of facilities for 30 days or more. • More than 50 percent of property destroyed or with major damage.
Major X	• Injuries and/or illnesses result in permanent disability. • Complete shutdown of critical facilities for at least 2 weeks. • More than 25 percent of property destroyed or with major damage.
Minor	• Injuries and/or illnesses do not result in permanent disability. • Complete shutdown of critical facilities for more than 1 week. • More than 10 percent of property destroyed or with major damage.
Limited	• Injuries and/or illnesses are treatable with first aid. • Minor quality of life lost. • Shutdown of critical facilities and services for 24 hours or less. • Less than 10 percent of property destroyed or with major damage.

Frequency Of Occurrence:	**Seasonal Pattern:**
❑ Highly likely: Event probable in next year. ☒ Likely: Event probable in next 3 years. ❑ Occasional: Event possible in next 5 years. ❑ Unlikely: Event possible in next 10 years.	Hurricane Season lasts from June-November

Source Documents, Studies, Maps, Etc. Researched:
NOAA Web Sites, Texas Hazard Mitigation Package, www.thmp.info

Probable Duration:
From a few hours to a few days, depending on severity.

Warning Time (Potential Speed of Onset):
❑ Minimal (or no) warning.
❑ 3 to 6 hours warning.
❑ 6 to 12 hours warning.
☒ More than 12 hours warning.

Cascading Potential:
Power failures, destroyed infrastructure, inland flooding, tornadoes and loss of telecommunications

Existing Warning Systems:
NOAA weather forecasts, TV cable weather channels, local public TV weather reports

TORNADOES

A tornado is defined as a rapidly rotating vortex or funnel of air extending ground ward from a cumulonimbus cloud. Most of the time, vortices remain suspended in the atmosphere. However, when the lower tip of a vortex touches the ground, the tornado becomes a force of destruction. Tornadoes occur annually and most frequently in the northern two-thirds of the State caused by cool frontal systems that enter from the north and west, and in the remainder of the State primarily caused as a cascading hazard from tropical storms. The most costly tornadoes in deaths and injuries during the past 50 years was Waco on May 11, 1953 – 114 dead and 597 injured; Lubbock on May 11, 1970 – 26 dead and 500 injured; Wichita Falls and Vernon on April 10, 1979 – 54 dead and 1,807 injured with over 20,000 people left homeless; Jarrell, Cedar Park and Pedernales Valley on May 27, 1997 with 28 dead. In March 28-29, 2000, a tornado struck causing 4 deaths and 95 injuries in Tarrant County and in the spring of 2007 and tornado caused 10 deaths in Eagle Pass, Maverick County. Since 1953, Texas has had 16 Presidential declarations due to tornado events. Though Texas averages 123 tornadoes annually, 88% are F-0 or F-1 and only 3% are F-3 or F-4 that causes 65% of the deaths. Table 2-7 identifies previous occurrences for F-5 tornadoes in Texas between January 1, 1950 through June 30, 2010. Map 2-2 provides the likely locations of tornadoes in Texas.

Table 2-7: Tornado Occurrences in Texas

Location	Date	Time	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
McLenna	5/11/53	1610	Tornado	F-5	114	597	25.0 M	0
Wichita	4/3/64	1435	Tornado	F-5	7	111	25.0 M	0
Lubbock	5/11/70	2035	Tornado	F-5	26	500	250.0 M	0
McLenna	5/6/73	1925	Tornado	F-5	0	0	0	0
Brown	4/19/76	1730	Tornado	F-5	0	11	2.5 M	0
Jarrel	5/27/97	1440	Tornado	F-5	27	12	40.0 M	100 K
				TOTALS	174	1231	342.5 M	100 K

Source: http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms list

Map 2-2: NOAA Tornado Zones in Texas

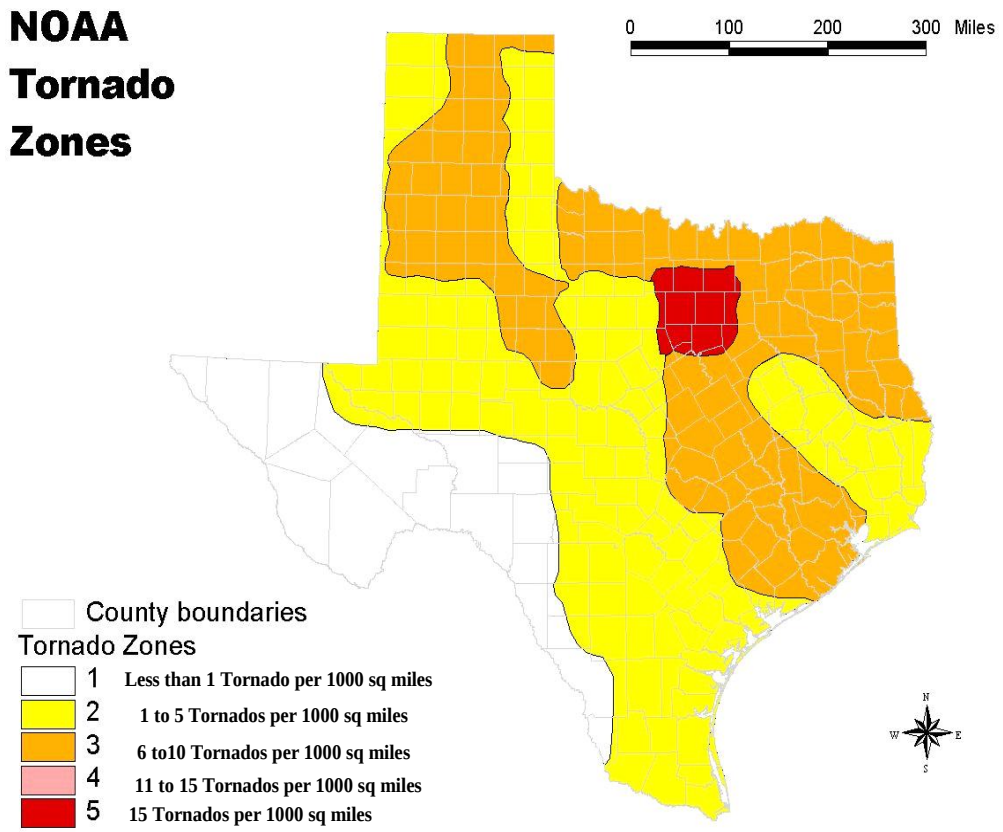


Table 2-8: Fujita Scale

F-Scale Number	Intensity Phrase	Wind Speed	Type of Damage
F0	Gale tornado	40-72 mph	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards.
F1	Moderate tornado	73-112 mph	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 the roads; attached garages may be destroyed.
F2	Significant tornado	113-157 mph	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
F3	Severe tornado	158-206 mph	Roof and some walls torn off well constructed houses; trains overturned; most trees in forest uprooted
F4	Devastating tornado	207-260 mph	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
F5	Incredible tornado	261-318 mph	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel reinforced concrete structures badly damaged.
F6	Inconceivable tornado	319-379 mph	These winds are very unlikely. The small area of damage they might produce would probably not be recognizable along with the mess produced by F4 and F5 wind that would surround the F6 winds. Missiles, such as cars and refrigerators would do serious secondary damage that could not be directly identified as F6 damage. If this level is ever achieved, evidence for it might only be found in some manner of ground swirl pattern, for it may never be identifiable through engineering studies

Source: http://en.wikipedia.org/wiki/Fujita_scale

On February 1, 2007, the Fujita scale (above) was decommissioned in favor of the more accurate Enhanced Fujita Scale (next page), which replaced it. None of the tornadoes recorded on or before January 31, 2007 will be re-categorized. Therefore maintaining the Fujita scale will be necessary when referring to previous events.

The Enhanced Fujita Scale, or EF Scale, is the scale for rating the strength of tornadoes in the United States estimated via the damage they cause. The scale has the same basic design as the original Fujita scale, six categories from zero to five representing increasing degrees of damage. It was revised to reflect better examinations of tornado damage surveys, so as to align wind speeds more closely with associated storm damage. The new scale takes into account how most structures are designed, and is thought to be a much more accurate representation of the surface wind speeds in the most violent tornadoes.

Table 2-9: Enhanced Fujita (EF) Scale

Enhanced Fujita Category	Wind Speed (mph)	Potential Damage
EF0	65-85	**Light damage.** Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
EF1	86-110	**Moderate damage.** Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	**Considerable damage.** Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	136-165	**Severe damage.** Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	166-200	**Devastating damage.** Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.
EF5	>200	**Incredible damage.** Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m (109 yd); high-rise buildings have significant structural deformation; incredible phenomena will occur.

Source: http://en.wikipedia.org/wiki/Enhanced_Fujita_Scale

HAZARD PROFILE WORKSHEET

Hazard: Tornado	
Potential Severity Of Impact*:*	
Substantial	• Multiple deaths • Complete shutdown of facilities for 30 days or more. • More than 50 percent of property destroyed or with major damage.
Major X	• Injuries and/or illnesses result in permanent disability. • Complete shutdown of critical facilities for at least 2 weeks. • More than 25 percent of property destroyed or with major damage.
Minor	• Injuries and/or illnesses do not result in permanent disability. • Complete shutdown of critical facilities for more than 1 week. • More than 10 percent of property destroyed or with major damage.
Limited	• Injuries and/or illnesses are treatable with first aid. • Minor quality of life lost. • Shutdown of critical facilities and services for 24 hours or less. • Less than 10 percent of property destroyed or with major damage.

Frequency Of Occurrence:	**Seasonal Pattern:**
❑ Highly likely: Event probable in next year. ☒ Likely: Event probable in next 3 years. ❑ Occasional: Event possible in next 5 years. ❑ Unlikely: Event possible in next 10 years.	Spring months, most common at night

Source Documents, Studies, Maps, Etc. Researched:
Local Mitigation Plans, Texas Hazard Mitigation Package, www.thmp.info

Probable Duration*:*
From a few hours for most tornadoes, to several days of various tornadoes, depending on severity of storm system.

Warning Time (Potential Speed Of Onset):
☒ Minimal (or no) warning.
❑ 3 to 6 hours warning.
❑ 6 to 12 hours warning.
❑ More than 12 hours warning.

Cascading Potential:
Power failures

Existing Warning Systems:
These exist only at the local level (for warning sirens) but cable TV and weather news stations can provide a measure of warning.

DROUGHT

Drought is defined as the consequence of a natural reduction in the amount of precipitation expected over an extended period of time, usually a season or more in length. Given the expanse of the land mass within Texas and the geographic location of 2/3rds of the counties of the State are located either in an arid or semi-area climate, roughly those west of a North-South line formed by Interstate Highway 35, are almost always in varying stages of drought. These counties normally are watered by infrequent large tropical systems that move westward out of the Gulf of Mexico in late summer and early fall or by strong spring Pacific systems that move easterly over these counties. During the past 15 years Texas has received no less than 2,921 declarations for multi-county and regional droughts. The worst year was 2000 when the entire State was declared. Peak years for drought were 1996, 2000, and 2002. After the summer floods of 2007 (DR-1709), most of Texas was declared drought free for the first time since 1996. Some previous occurrences of drought are listed in Table 2-12. Table 2-12 covers a period between January 1, 2007 and June 30, 2010.

Table 2-12: Drought Occurrences in Texas

Location	Date	Time	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Childress, Cochran, Dickens, Lamb, Lubbock Counties	06/01/2008	N/A	Drought	N/A	0	0	0	100K
Palo Pinto, Parker, Stephens, Tarrant Counties	07/23/2008	N/A	Drought	N/A	0	0	0	50 K
Bell, Milam Counties	12/01/2008	N/A	Drought	N/A	0	0	0	250 K
Bell, Milam Counties	01/01/2009	N/A	Drought	N/A	0	0	0	250 K
Childress Cottle, Dickens, Kent Counties	03/01/2009	N/A	Drought	N/A	0	0	0	10 M
Kent, King, Stonewall	04/01/2009	N/A	Drought	N/A	0	0	0	1 M

Counties								
				TOTALS	11.65 M			

Source: http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms list

Location of Droughts

All of Texas is vulnerable to droughts. However, the areas of Texas most vulnerable to droughts are west Texas, around the cities of Amarillo, Lubbock, Midland, Odessa, Fort Stockton, San Angelo, Laredo and El Paso.

PALMER DROUGHT SEVERITY INDEX (PDSI)

In 1965, Wayne Palmer developed an index to "measure the departure of the moisture supply." Palmer based his index on the supply-and-demand concept of the water balance equation, taking into account more than only the precipitation deficit at specific locations. The objective of the PDSI, as this index is now called, was to provide a measurement of moisture conditions that were "standardized" so that comparisons using the index could be made between locations and between months.

The PDSI is based on precipitation and temperature. The PDSI can therefore be applied to any site for which sufficient precipitation and temperature data is available.

The PDSI varies roughly between -4.0 and +4.0. Weekly PDSI values are calculated for the Climate Divisions during every growing season and are on the Internet from the Climate Prediction Center.

Table 2-13: PDSI Classifications for Dry and Wet Periods

4.00 or more	Extremely Wet
3.00 to 3.99	Very Wet
2.00 to 2.99	Moderately Wet
1.00 to 1.99	Slightly Wet
0.50 to 0.99	Incipient Wet Spell
0.49 to -0.49	Near Normal
-0.50 to -0.99	Incipient Dry Spell
-1.00 to -1.99	Mild Drought
-2.00 to -2.99	Moderate Drought
-3.00 to -3.99	Severe Drought
-4.00 or less	Extreme Drought

Source: http://drought.unl.edu/whatis/indices.htm

HAZARD PROFILE WORKSHEET

Hazard: Drought	
Potential Severity Of Impact:	
Substantial	• Multiple deaths • Complete shutdown of facilities for 30 days or more. • More than 50 percent of property destroyed or with major damage.
Major	• Injuries and/or illnesses result in permanent disability. • Complete shutdown of critical facilities for at least 2 weeks. • More than 25 percent of property destroyed or with major damage.
Minor X	• Injuries and/or illnesses do not result in permanent disability. • Complete shutdown of critical facilities for more than 1 week. • More than 10 percent of property destroyed or with major damage.
Limited	• Injuries and/or illnesses are treatable with first aid. • Minor quality of life lost. • Shutdown of critical facilities and services for 24 hours or less. • Less than 10 percent of property destroyed or with major damage.

Frequency Of Occurrence:	**Seasonal Pattern:**
☐ Highly likely: Event probable in next year. ☐ Likely: Event probable in next 3 years. ☒ Occasional: Event possible in next 5 years. ☐ Unlikely: Event possible in next 10 years.	Mostly summer, but could occur anytime

Source Documents, Studies, Maps, Etc. Researched:
Local Mitigation Plans, Texas Hazard Mitigation Package, www.thmp.info

Probable Duration:
From a few months to a few years, depending on severity of event

Warning Time (Potential Speed Of Onset):
☐ Minimal (or no) warning.
☐ 3 to 6 hours warning.
☐ 6 to 12 hours warning.
☒ More than 12 hours warning.

Cascading Potential:
Loss of crops and livestock, low water supplies for cities, drop in aquifer water levels

Existing Warning Systems:
NOAA weather reports, Texas Drought Preparedness Council

WILDFIRE

Wildfire is defined as a sweeping and destructive conflagration, especially in a wilderness or a rural area. Wildfires within Texas can be defined as being a 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. With the semi-arid climate of the western, southern and panhandle counties of the State, wildland fires are most common in the spring and summer months, but can occur at anytime during the year, as evident by the winter wildfire Federal disaster declaration (DR-1624) in January 2006. These wildland fires can have a significant economic impact to the local and regional economies. Threats to improved structures are a growing problem within this region and across the State. During the 1998, 1999, and 2000 fire seasons, The Texas Forest Service saved 11,065 structures worth an estimated value of $590 million. 268 structures were lost during the same period, with a value of 9.5 million dollars. The eastern part of the State, also known as the Piney Woods, contains the most hazardous fuels in the State: pine plantations. Fires burning in this fuel type under drought conditions are extremely hard to contain, require multiple fire fighting resources, and threaten all homes in its vicinity. The "Hill Country" located in the central part of the State has the potential for future damaging wildfires due to a combination of rapid population growth, topography and densely covered, highly volatile, scrub cedars. This is especially true during extended and prolonged drought conditions. Some regions within the State can be expected to experience wildland fires whenever localized drought conditions are in place. The State received emergency declarations due to wildfires during the years 1996, 1998, 1999, 2000, and 2006.

The wildfire disaster cycle begins when homes are built within urban/wildland interface areas. All too often, wildland fires have occurred before and will occur again in these areas. When wildfires do occur, they advance through all available fuels, which may well include homes and other structures. Even when homes are lost, many homeowners simply opt to build even larger homes in the same spot, because of the availability of low cost disaster loans. When homeowners rebuild homes without incorporation of wildfire mitigation measures, they unwittingly recreate the same conditions that led to the initial losses.

Wildland fires have destroyed more than 10,000 homes and 20,000 other structures and facilities nationwide since 1970. These wildfires cost government agencies some $20 billion in suppression costs and the insurance industry another $6 billion in restitution. More than 642 wildland firefighters have died in the line of duty since 1910.

Urban/Wildland Interface and fire personnel are working to make individuals and communities aware of the dangers associated with wildland fires so that the wildland fire disaster cycle can be stopped. Mitigation efforts by individual property owners represent great starts, but community-wide implementation of wildland fire safety measures remains the ultimate goal. Increased awareness and use of fire-wise practices will help save lives and property.

Some previous occurrences of wildfires in Texas, as listed on the National Climatic Data Center Web site may be found in Table 2-14. Table 2-14 covers a period from January 1, 2007 to March 31, 2010.

Table 2-14: Wildfire Occurrences in Texas

Location	Date	Time	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Wheeler County	3/31/08	1500	Wildfire	N/A	1	0	10.5K	0
Garza County	4/16/08	0700	Wildfire	N/A	0	0	100 K	0
Wheeler County	5/2/08	1000	Wildfire	N/A	0	2	0	0
Hidalgo County	1/19/09	1310	Wildfire	N/A	0	0	10 M	0
Wheeler	4/4/09	1135	Wildfire	N/A	0	4	1.5 M	0
Jack, Montague, Stephens, Young Counties	4/9/09	1100	Wildfire	N/A	1	2	5 M	1 M
				TOTALS	2	8	16.6 M	1 M

Source: http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms list

Table 2-15: Keetch-Byram Drought Index

The Keetch-Byram Drought Index (KBDI) is basically a mathematical system for relating current and recent weather conditions to potential or expected fire behavior. These numbers correlate with potential fire behavior as follows:
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. Also, expect smoldering and the resulting smoke to carry into and possibly through the night.
400 - 600 Fire 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.
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 thorough the night and heavier fuels will actively burn and contribute to fire intensity.

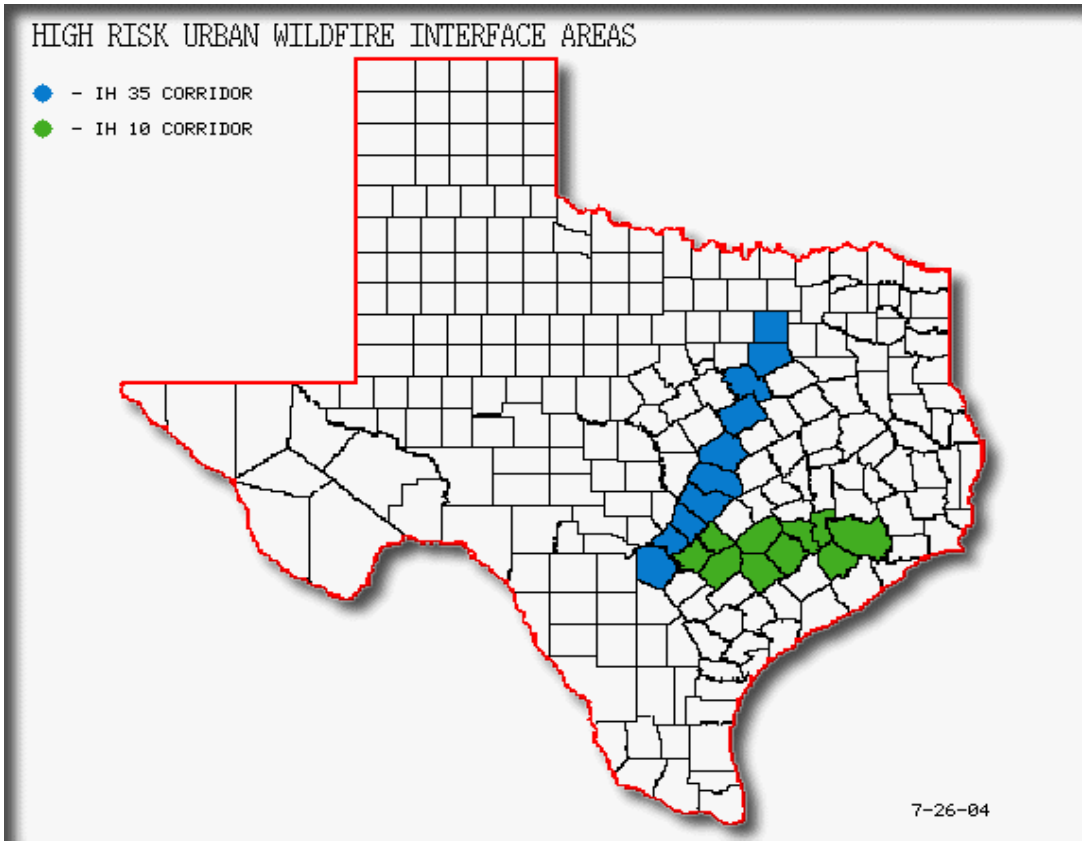
Source: http://www.wfas.us/content/view/32/49/

LOCATION

Seven different regions in Texas, each having some type of Urban/Wildland Interface issue, have been identified.

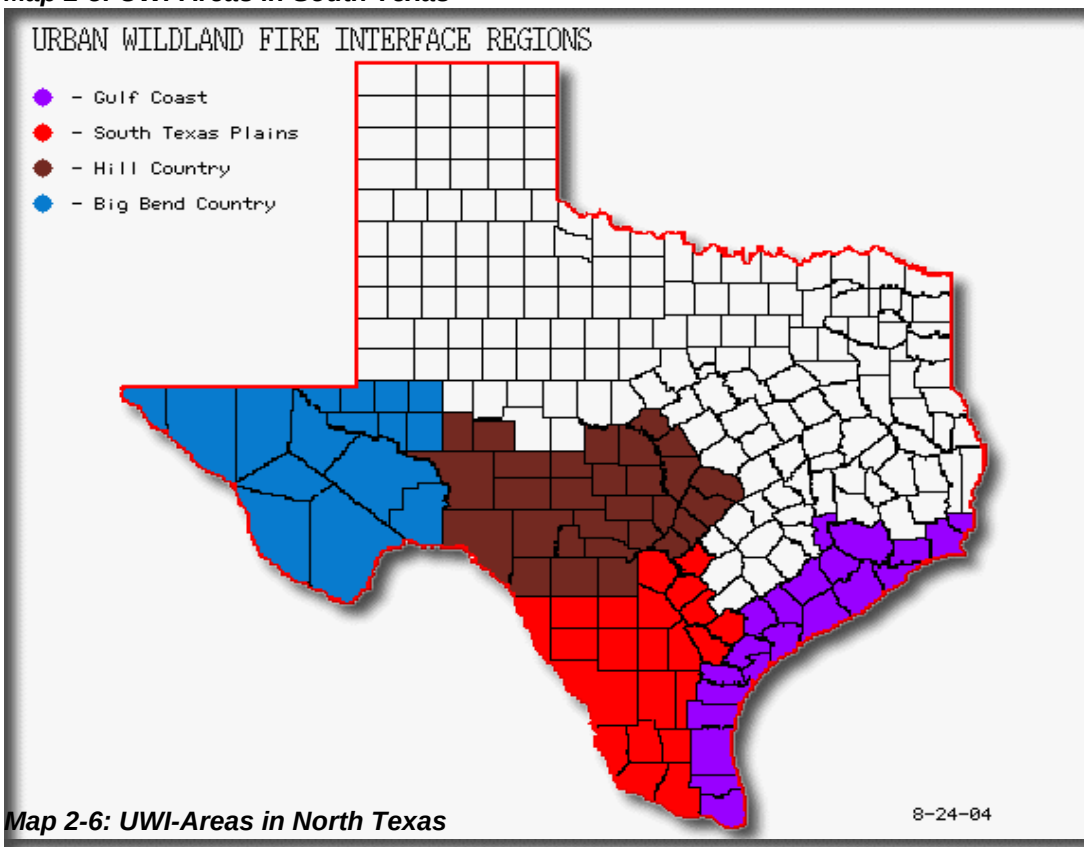
The largest concentrations of high-risk UWI areas can be found in counties along the I-35 corridor from Dallas to San Antonio and along the I-10 corridor from San Antonio to Houston (see Map 2-4 next page).

Map 2-4: High Risk UWI-Areas in Texas

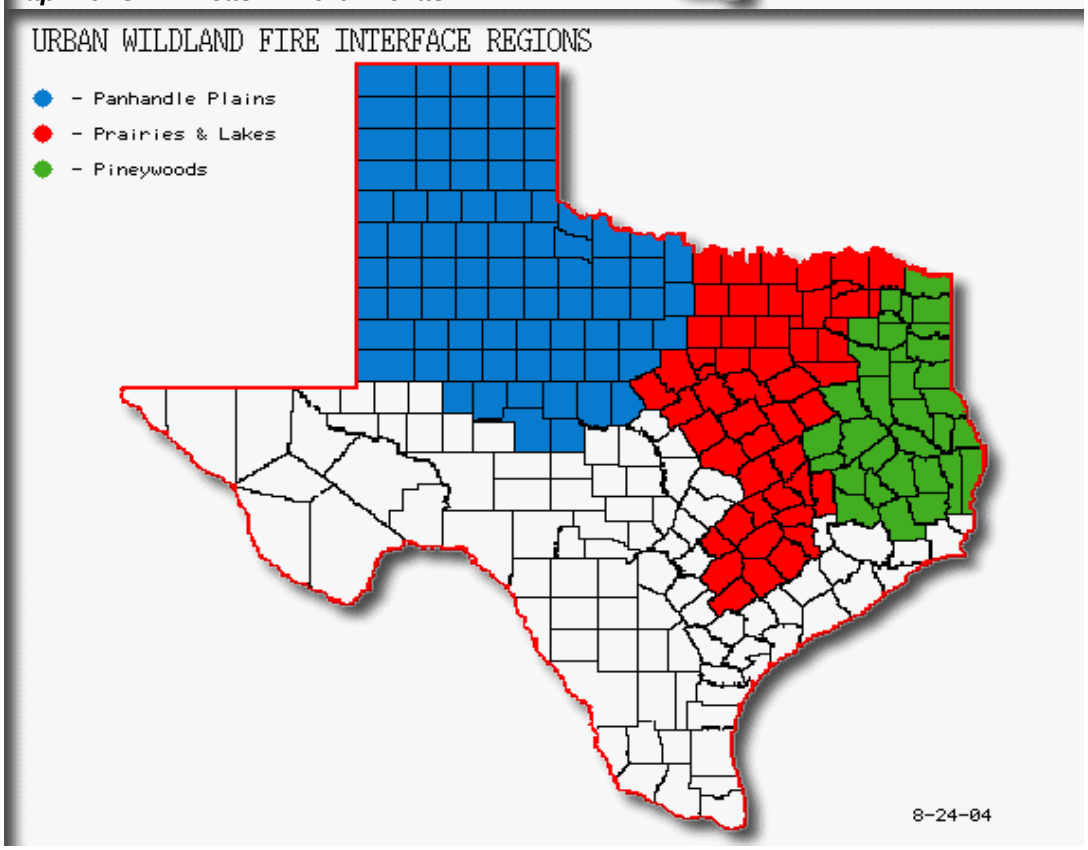


Seven different regions in Texas, each having some type of Urban Wildland Interface issue, have been delineated. The map on this page and the following map show the seven (7) regions.

Map 2-5: UWI-Areas in South Texas



Map 2-6: UWI-Areas in North Texas



HAZARD PROFILE WORKSHEET

Hazard: Wildfire	
Potential Severity Of Impact:	
Substantial	• Multiple deaths • Complete shutdown of facilities for 30 days or more. • More than 50 percent of property destroyed or with major damage.
Major	• Injuries and/or illnesses result in permanent disability. • Complete shutdown of critical facilities for at least 2 weeks. • More than 25 percent of property destroyed or with major damage.
Minor X	• Injuries and/or illnesses do not result in permanent disability. • Complete shutdown of critical facilities for more than 1 week. • More than 10 percent of property destroyed or with major damage.
Limited	• Injuries and/or illnesses are treatable with first aid. • Minor quality of life lost. • Shutdown of critical facilities and services for 24 hours or less. • Less than 10 percent of property destroyed or with major damage.

Frequency Of Occurrence:	**Seasonal Pattern:**
☐ Highly likely: Event probable in next year. ☐ Likely: Event probable in next 3 years. ☒ Occasional: Event possible in next 5 years. ☐ Unlikely: Event possible in next 10 years.	During dry seasons or drought

Source Documents, Studies, Maps, Etc. Researched:
Texas Forest Service, Local Mitigation Plans, www.thump.info

Probable Duration:
A wildfire can last from a few hours to several weeks, depending on wind and dry brush conditions

Warning Time (Potential Speed of Onset):
☐ Minimal (or no) warning.
☐ 3 to 6 hours warning.
☒ 6 to 12 hours warning.
☐ More than 12 hours warning.

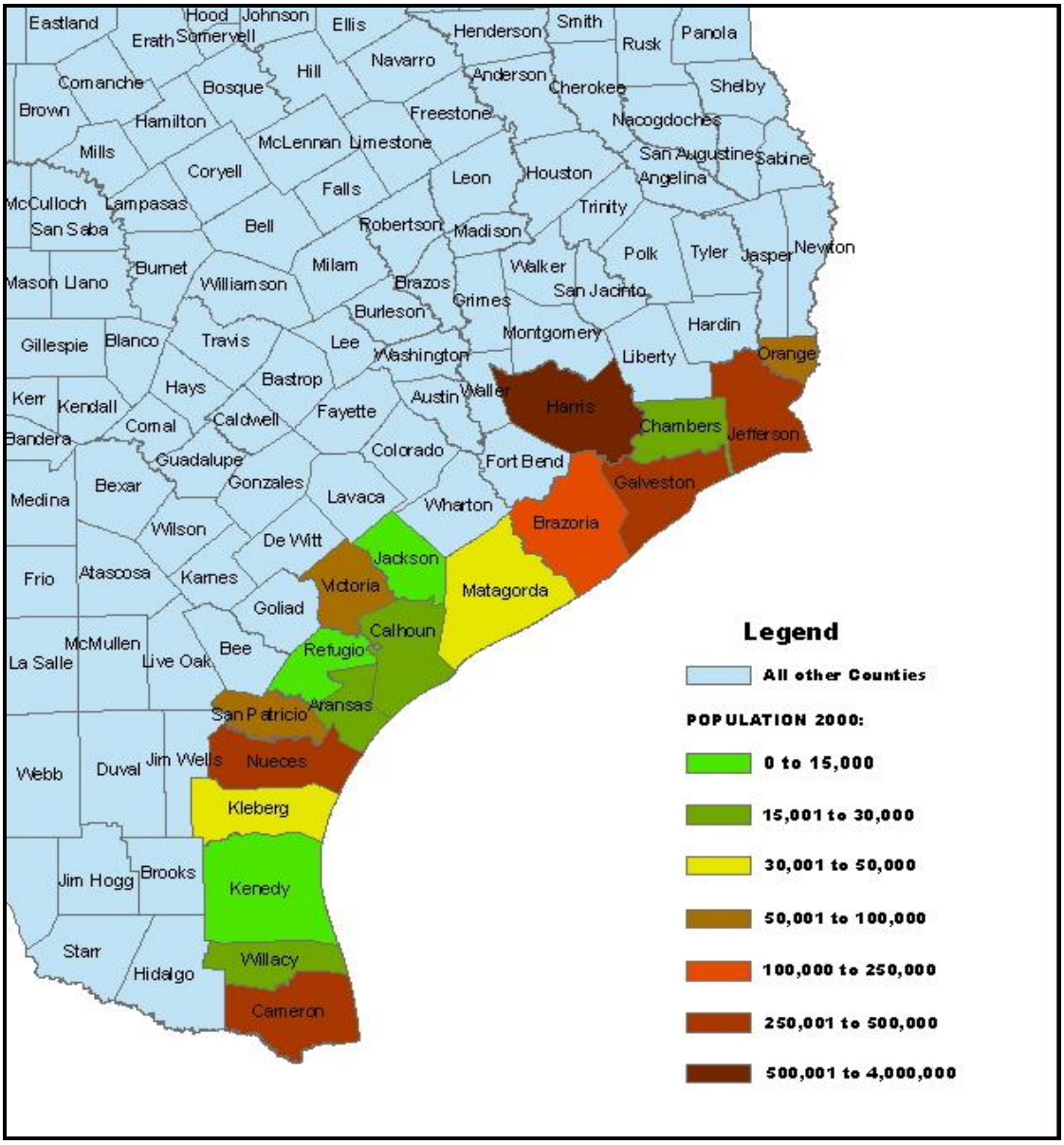
CASCADING POTENTIAL:
Crops lost, livestock killed, structures burned, roads closed.

EXISTING WARNING SYSTEMS:
Local jurisdictions may have warning systems

COASTAL EROSION IS A HYDROLOGIC HAZARD DEFINED AS THE WEARING AWAY OF LAND AND LOSS OF BEACH, SHORELINE, OR DUNE MATERIAL AS A RESULT OF NATURAL COASTAL PROCESSES OR MANMADE INFLUENCES.

The Texas Gulf Coast consists of a system of barrier islands and peninsulas, which provides protection for numerous bays and inlets from oncoming waves. These features are relatively young; most are less than 7,000 years in age. These primarily sandy islands have become in great demand for both residential and recreational development.

The eighteen coastal counties within the Texas Coastal Management Program Boundary (Map 1.1) are home to 5.2 million residents, which comprise 25 percent of the state's population (2000 U.S. Census). The highest density of population is generally located in the Upper Texas Coast



Map 1.1: Coastal Population Density (2000 U.S. Census)

Texas Barrier Islands:

By definition, barrier islands are generally elongate, exposed narrow accumulation of sediment, usually sand, in the shallow coastal zone, which parallel the coastline, and separated from the mainland by some combination of coastal bays and marshes. Texas has 17 barrier islands that total 191,762 acres. Barrier islands provide a level of protection for the mainland against storm impacts.

Barrier islands also serve as vital natural habitats and nesting areas for wading birds and sea birds, and a resting area for migratory birds. The fore-dunes are critical nesting sites for the endangered Kemps Ridley turtle.

The characteristic features of a barrier island (See Figure 2) are associated with high-energy environments on the Gulf side and low-energy environments on the bay side.

A natural system on the Gulf side of barrier islands, commonly referred to as the Beach/Dune System, extends from offshore sand bars landward to the landward side of the fore-dunes. The Beach/Dune System is the front-line of defense against coastal storms and essential to the integrity of the barrier island. A healthy Beach/Dune System allows barrier islands to recover from a storm and needs to be managed as one system. Vegetated and unvegetated sand dunes provide protective barriers for adjacent land and inland water against the action of waves, wind, and storm surge. Integral to a healthy dune system is the back beach or dune terrace area. The back beach area is easily identified as the dry sandy beach area having low relief seaward of the fore-dunes and above the mean high water line.

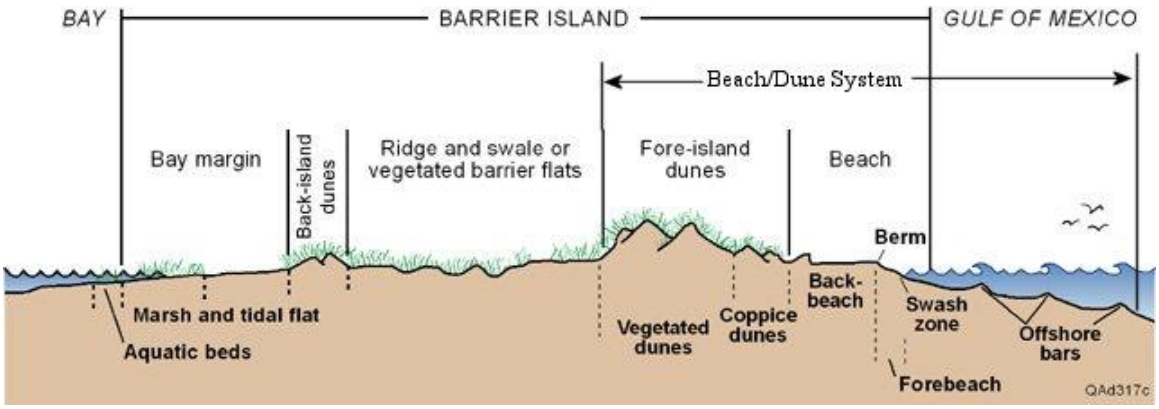


Figure 2. Cross Section of a typical Texas Barrier Island and the Beach/Dune System

During the storm, the beach is eroded and the waves begin to attack the dunes, resulting in erosion and suspension of the sand stored in the dunes. Some of the dune sand is deposited on the beach, widening the beach seaward. The wider beach helps minimize wave energy by allowing waves to break further seaward. The remaining sand is deposited offshore in sand bars, and will eventually return to the beach. The sand dries and is carried landward by the wind where it is trapped by the recovering vegetation rebuilding the dunes and completing the cycle. Certain actions taken over time have modified or destroyed the effectiveness of these protective barriers and caused

environmental damage in the process of developing the shoreline for various purposes. With the loss or reduction of the natural dunes and other human activities, less sediment is available to the beach/dune systems for the protection and recovery of the barrier island system. The result is an increase in erosion and a net loss of the shoreline.

Texas Coastal Economy at Risk:

The Texas coast is vital to the state's economy. Texas has 26 petroleum refineries along its coast, which can process nearly 4.8 million barrels of crude oil per day, and account for more than one-forth of total U.S. refining capacity. Galveston Bay supports one of the largest metropolitan areas in the U.S. and the nation's largest concentration of oil refineries and a sizable chemical industry, which ranks No. 1 in the nation in size and production. The Port of Houston is located in the largest petro-chemical complex in the U.S. and the second largest complex in the world. The Port of Houston ranks second in U.S. in total tonnage of freight handled.

More than half of the nation's chemical products and gasoline comes from plants along the Texas portion of the Gulf Intracoastal Waterway (GIWW). The GIWW is the nation's third busiest waterway with fifteen percent of the nation's freight carried on the GIWW at a fraction of the cost of moving the same cargo by truck or train. Of the total 1,300-mile long waterway, 423 miles are along the Texas Coast carrying 58% of the total traffic. Approximately 63 million tons of cargo with a commercial value estimated at $25 Billion travels the Texas GIWW each year on approximately 99,970 barge one-way trips. The GIWW also handles 90% of all gasoline shipped to the lower Rio Grande Valley.

Texas also leads the nation in the development of nine port facilities for importing Liquefied Natural Gas. To protect these facilities and ensure the safe passage of their cargo, the GIWW must be maintained and not breached by the waters of the Gulf of Mexico.

Coastal Erosion:

Coastal erosion is a hydrologic hazard defined as the wearing away of land and loss of beach, shoreline, or dune material because of natural coastal processes or manmade influences. Erosion along the Texas Coast is measured as an historical shoreline change rate, averaged over a 90-year period.

As shown in Table 1, Texas has one of the longest coastlines in America coupled with some of the highest rates of coastal erosion in the nation. Approximately 64% of the Gulf shoreline is considered critical erosion areas with 235 acres of Texas Gulf shoreline lost to erosion annually. That is equivalent to 178 football fields lost each year.

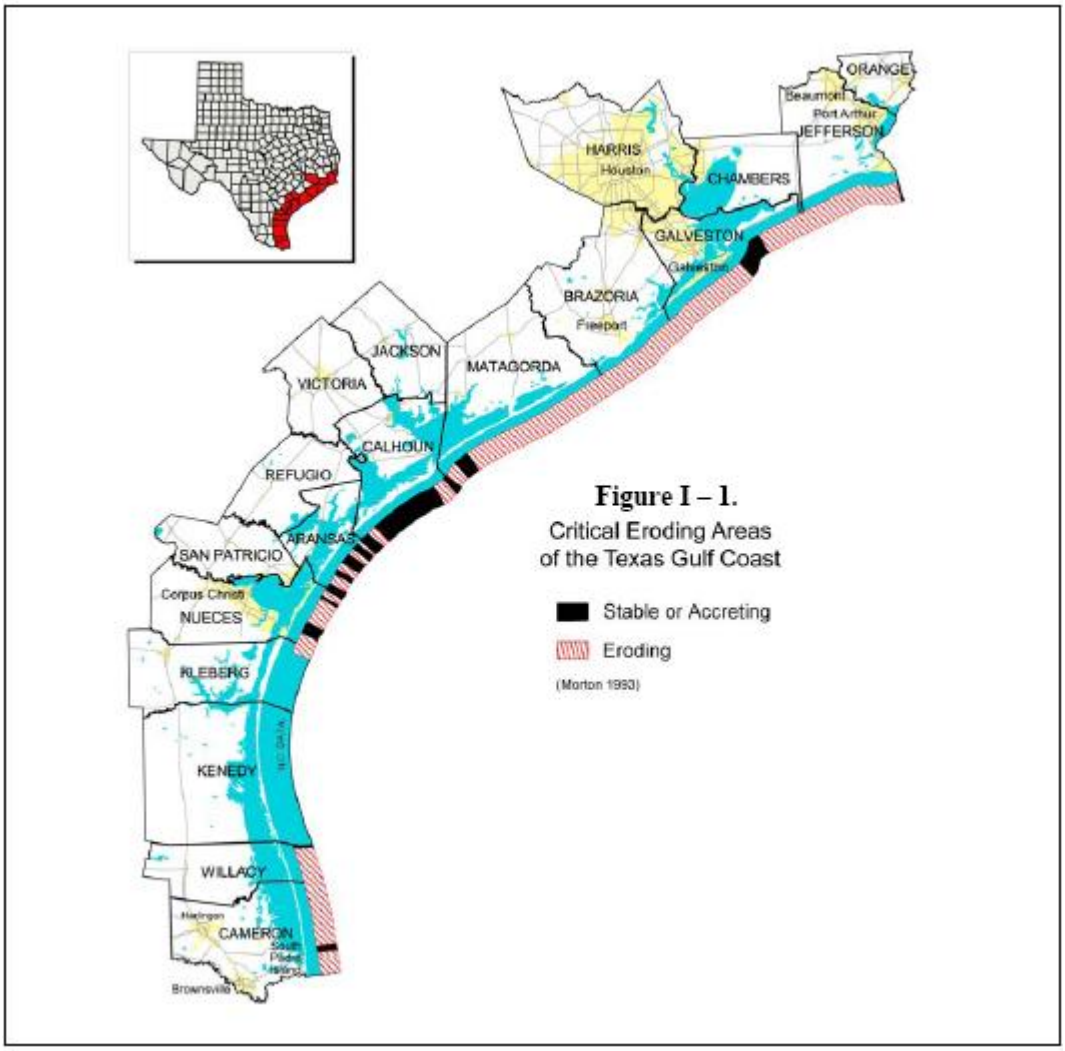
Erosion is a serious hazard on the Texas coast. Many homes, highways, and commercial establishments along the coast are threatened by continual shoreline erosion. Several processes contribute to chronic (long-term) or episodic (storm-induced) shoreline erosion. These processes include climate, tides, relative sea-level change, subsidence, tropical storms, and the amount and rate of sediment supply. Coastal erosion affects both Gulf and bay shorelines, resulting in the loss of agricultural, industrial, residential land, critical infrastructure, and wetlands. Erosion is attributable to relative sea level rise and to the fact that sediment removal by wave energy exceeds that supplied to the beach by currents. Climatic changes (from wetter to drier) have decreased the volume of sediments carried to the Texas coast by rivers.

On September 13, 2008, Hurricane Ike devastated beachfront property along the Upper Texas coast. High winds and storm surge destroyed dunes and homes, resulting in thousands of tons of debris scattered along the beach and in the bays. Hurricane Ike caused severe erosion along Galveston Island, Bolivar Peninsula, and Brazoria County. Hurricane Dolly, which struck south Texas on July 28, 2008, did not cause severe coastal erosion. The table below reflects locations of critical erosion using 2010 data.

County	Population*	Gulf Shoreline	Bay Shoreline	Critical Erosion (Gulf)	Erosion Rates (Gulf)
Orange	84,966	0	0	0	0
Jefferson	252,051	168,960 ft. (32.0 mi.)	327,360 ft. (62 mi.)	142,560 ft. (27 mi.)	-2 to -50 ft/yr
Chambers	26,031	5,280 ft. (1.0 mi.)	865,920 ft. (164 mi.)	5,280 ft. (1.0 mi)	-6 to -8 ft/yr
Harris	3,400,578	0	459,360 ft. (87 mi.)	0	0
Galveston	250,158	290,400 ft. (55.0 mi.)	1,536,480 ft. (291 mi.)	253.440 ft. (48 mi.)	-2 to -11 ft/yr
Brazoria	241,767	153,120 ft. (29.0 mi.)	924,000 ft. (175 mi.)	105,600 ft. (20 mi.)	-2 to -17 ft/yr
Matagorda	37,957	321,024 ft. (60.8 mi.)	2,170,080 ft. (411 mi.)	179,520 ft. (34 mi.)	-2 to -30 ft/yr
Jackson	14,391	0	147,840 ft. (28 mi.)	0	0
Victoria	84,088	0	15,840 ft. (3 mi.)	0	0
Calhoun	20,647	190,080 ft. (36.0 mi.)	2,381,280 ft. (451 mi.)	58,080 ft. (11 mi.)	-2 to -34 ft/yr
Refugio	7,828	0	285,120 ft. (54 mi.)	0	0
Aransas	22,497	100,320 ft. (19.0 mi.)	1,879,680 ft. (356 mi.)	84,480 ft. (16 mi.)	-2 to -7 ft/yr
San Patricio	67,138	0	390,720 ft. (74 mi.)	0	0
Nueces	313,645	108,768 ft. (20.6 mi.)	2,148,960 ft. (407 mi.)	31,680 ft. (6 mi.)	-2 to -6 ft/yr
Kleberg	31,549	115,104 ft. (21.8 mi.)	1,172,160 ft. (222 mi.)	10,560 ft. (2 mi.)	-2 to -6 ft/yr
Kenedy	414	246,576 ft. (46.7 mi.)	1,209,120 ft. (229 mi.)	168,960 ft. (32 mi.)	-2 to -15 ft/yr
Willacy	20,082	71,808 ft. (13.6 mi.)	601,920 ft. (114 mi.)	63,360 ft. (12 mi.)	-2 to -15 ft/yr
Cameron	335,227	166,320 ft. (31.5 mi.)	1,145,760 ft. (217 mi.)	147,840 ft. (28 mi.)	-2 to -25 ft/yr
TOTALS	5,211,014	1,937,760 ft. (367.0 mi.)	17,661,600 ft. (3,345 mi.)	1,251,360 ft. (237 mi.)	-2 to -50 ft/yr

** Source: 2000 Census*

Table1.2: Coastal County Population at Risk, Shoreline Distance, and Gulf Erosion Data



Map 1.3: Critical Eroding Areas of Texas Gulf Coast

Critical Dune Areas:

As a natural barrier to the destructive forces of wind and waves, sand dunes are an efficient defense against storm-surge flooding and beach erosion. The first apparent feature landward of the beach along the Texas Gulf coast, coastal dunes from Sabine Pass to the mouth of the Rio Grande vary in natural position, contour, volume, elevation, and vegetative cover. These variations are a direct result of natural processes, which include prevailing wind currents, sediment budget, climate, and biota that influence dune formation. Coastal dunes are a dynamic component of the barrier islands that are in a constant state of change and part of a natural cycle, that ensures the health of beaches as well as marshes and wetlands along the Gulf and bay shoreline. Immediately landward of the dry part of the beach, coastal dunes begin where there is an abrupt change in slope parallel to the beach called the foredunes or foredune ridge. At this boundary, the foredune ridge is usually the first line of dunes in a dune complex that can extend inland up to several thousand feet from the Gulf.

Dunes absorb storm surge and high wave impacts, preventing or delaying the intrusion of waters into inland areas. Dunes hold sand that help eroded beaches recover after storms. As part of a delicate natural cycle, storm tides remove sand from the dunes and pull most of it toward the shore. Some of this sand widens the beach profile allowing wave energy to dissipate sooner. Sand also deposits just off shore in sand bars, which after the storm will make its way back onshore and blown landward by the wind. The vegetation on the landward side of the dry beach traps this windblown sand and rebuilds the dunes for the next storm event.

Up and down the Texas Gulf coast there are a variety of coastal dune environments, each with its unique geomorphology and coastal processes. In areas along the upper coast, from Sabine Pass to the Freeport Ship Channel, the historical erosion rate varies between two to 34 feet per year. Coastal dunes in this area are relatively small in comparison to other parts of the coast, and although there are pockets of the coastline in this area that are stable or accreting, this area is characteristically a sediment starved system. Sediment starved systems have a detrimental effect on the natural formation of coastal dunes. In these areas, coastal dunes would have to be created, enhanced, and maintained through dune restoration projects. Along the middle coast, commonly referred to as the Coastal Bend, coastal dunes form an extensive and stable dune complex with foredune ridge approximately 26 to 40 feet high.

The GLO is committed to working closely with coastal communities to learn more about their erosion concerns, developing innovative program ideas and working towards effective, long-term management practices that will stem erosion and preserve a valuable habitat, protect public infrastructure and enhance the tax base of coastal communities.

A substantial reduction of the width of beaches, along with a reduction in dune structures, could allow hurricane driven storm surge to move further inland than what would otherwise be the case. A reduction in coastal marshes can have a similar effect.

Coastal Subsidence:

Subsidence occurs as water levels are lowered in the aquifers and interbedded clay begins to lose water and compact (Gabrysch, R. K., and Bonnet, C.W., 1975). The reduction in water or artesian pressure reduces the support for overlying sedimentary strata and the land surface begins to sink or subside.

Between the 1950's and 2000, subsidence (primarily from groundwater withdrawal and oil and gas production) and sea level rise converted over 26,400 acres of emergent wetlands in the Galveston Bay system, or about 30 percent of the total gross loss (88,500 acres), to open water and barren flats (White et. al., 1993). Losses are pronounced on the north and west side of the bay, including the San Jacinto and Trinity River fluvial-deltaic areas, where together almost 8,900 acres of vegetated wetlands have been replaced by open water and flats since the 1930's (White and Tremblay, 1995). Subsidence is the overriding cause of wetland loss along the river delta marshes, such as those of the San Jacinto River, which is near the center of maximum subsidence resulting from groundwater withdrawal and oil and gas production in the Houston area (White and Calnan, 1990; White and Tremblay, 1995). In the Neches River valley, a combination of factors, including subsidence, relative sea-level rise, fault movement, channel dredging, spoil disposal along levees, and impoundment of sediments along streams, has probably contributed to wetland loss (White and Calnan, 1990; White and Tremblay, 1995).

White and Morton (1995) report that thousands of acres of marsh on the upper coast have been lost because of fault activation and subsidence since the 1950's. White and Morton (1995) mapped

Thirty-nine faults with a cumulative length of more than 87 miles. Fault movement may have been related to oil and gas production and associated formation water.

In May of 1975, the 64th Texas Legislature created the Harris-Galveston Subsidence District (HGSD), as a regulatory agency to "end subsidence", and provided HGSD the authority to restrict groundwater withdrawals. In its 1999 plan, the HGSD established an ultimate groundwater reduction goal to reduce groundwater pumping to 20% by the year 2030.

Overall, the subsidence rate in the Houston-Galveston area has decreased, as industries have converted from using primarily groundwater to using primarily surface water. However, relative sea-level rise and limited amounts of sediments reaching the coast still contribute to coastal wetland loss.

Tidal-gauge data from stations bordering the Gulf of Mexico indicates that the Texas Gulf coast is subsiding at a significant rate. As shown in Figure 3, the highest rate of subsidence is well documented in the Houston and Galveston Bay area.

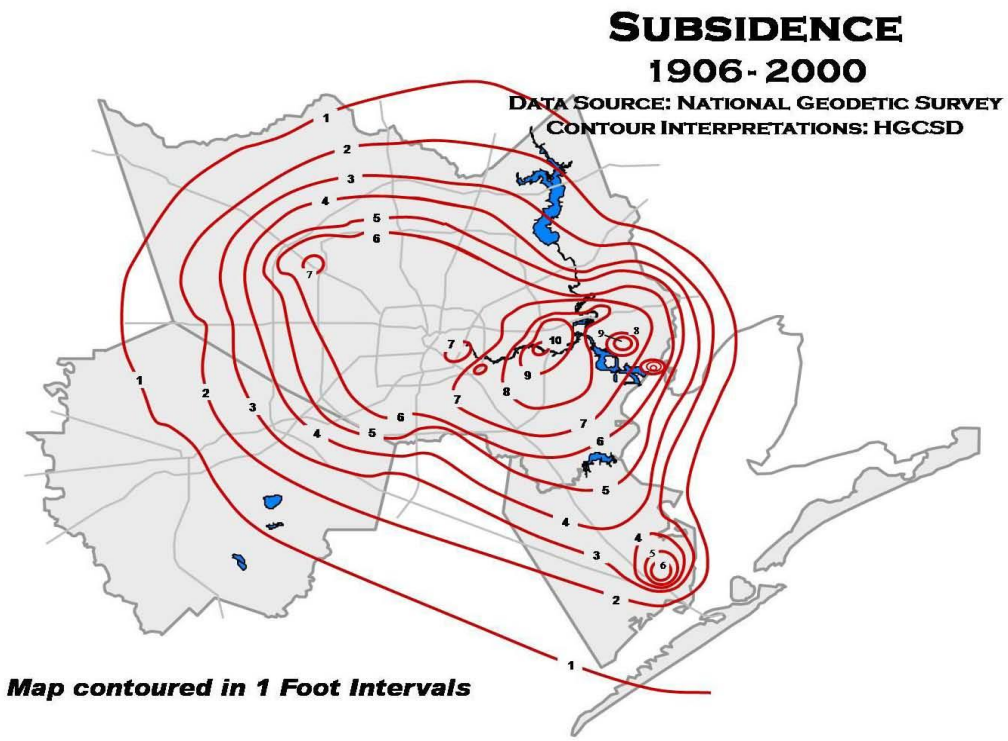


Figure 3. Rate of Coastal Subsidence (feet) 1906 – 2000

As a result of reduced elevation, loss of wetlands, and the loss of other natural coastal protective features, subsidence increases coastal communities' risk to inundation and saltwater intrusion from storm surge. Subsidence creates and exacerbates erosion along the shoreline that can threaten structures and critical infrastructure, including hurricane evacuation routes.

Relative Sea Level Rise:

Scientific observations show evidence of climatic changes that are contributing to sea level rise. Model projections by the Intergovernmental Panel on Climate Change predict that global sea-level rise will continue at an increase of as much as 1-meter during the next 100 years. Global average ocean temperatures are increasing, causing ocean water to expand, contributing to sea level rise. In addition, climatic change is causing widespread melting of snow and glacier ice contributing to rising global sea level. Because of climate change, the Texas coast is becoming more exposed to increasing risk of inundation and coastal erosion over the coming decades. The Intergovernmental Panel on Climate Change anticipates an accelerated rise in sea level of up to one meter (approximately three feet) or more by the year 2100. Sea-level rise measured by Texas Coastal Ocean Observation Network tide gauges in the Galveston area measured a current rise of about 6 millimeters per year. At this current rate of rise, local sea levels in the Galveston area can be projected to be 0.6 meters (approximately two feet) by the year 2100.

With current rates of subsidence and with the majority of the Texas Gulf coast being characterized by low-lying topography in addition to a broad gently sloping outer continental shelf, this anticipated rise in sea level is important. A small rise in sea level along the Texas coast can result in a significant shoreline retreat and an increased risk of inundation of wetlands, marshes, private property, and public infrastructure. Relative sea level rise increases the vulnerability of barrier islands and Peninsula's along the Texas coast to inundation from storm surge, even from smaller storms and coastal weather systems.

Coastal Storms:

Several types of meteorological events occur along the Texas Coast that can result in significant erosion and wind damage. These include excessive high tides, tropical disturbance, tropical depressions, tropical storms, and hurricanes.

- **Excessive High Tides** – Excessive high tide events are those where the tide levels exceed a normal high tide. Absent of a landfall of a tropical storm or hurricane along the Texas Coast, any tropical system in the Gulf of Mexico can cause elevated tides and erosion along the Texas Coast. An excessive high tide event common along the Texas Coast is referred to as a "bull tide." Bull tides are a twice-a-year occurrence tied to the change of season, triggered by the gravitational conditions associated with the equinox. They typically peak with highest tides around the full moon closest to the date of the equinox.

- **Tropical Disturbance** – Tropical disturbances are areas of disturbed weather in the tropics with no closed isobars (lines of equal atmospheric pressure) and no strong winds. They generally move in a westerly direction. Heavy rain, localized flooding, high tides, and localized coastal erosion can be associated with tropical disturbances.

- **Tropical Depression** – Tropical depressions are areas of disturbed weather in the tropics with one or more closed isobars and some rotary circulation at the surface. The highest wind speeds are up to 38 mph. Heavy rain, localized flooding, high tides, and localized coastal erosion can be associated with tropical depressions.

- **Tropical Storms** – Tropical storms are areas of disturbed weather in the tropics with closed isobars and a distinct rotary circulation. The highest wind speed ranges from 39 - 73 m.p.h. Heavy rain, localized flooding, high tides, localized coastal erosion, and minor wind damage can be associated with tropical storms.

- **Hurricanes** – Hurricanes are areas of disturbed weather in the tropics with closed isobars and strong and very pronounced rotary circulation. An area of clear weather called an "eye" is present in the center of the circulation. The wind speed is 74 M.P.H. or more. Hurricanes are classified into categories based on wind speed and the potential damage they cause (Table___). Heavy rain, localized flooding, high tides, localized coastal erosion, and significant wind damage can be associated with hurricanes. Most of the damage in a hurricane is a result of the storm surge.

Category	Maximum Sustained Wind Speed (MPH)	Damage Level	Description
1	74 - 95	MINIMAL	Minimal damage to building structures. Damage primarily to unanchored mobile homes, shrubs, trees, and minor pier damage. Also coastal flooding and shoreline erosion can be expected. Minor impacts to fore-dunes, and the line of vegetation.
2	96 - 110	MODERATE	Some roofing material, door, and window damage. Considerable damage to vegetation, mobile homes, etc. Flooding damages piers and small craft. In unprotected moorings, small craft may break their moorings. Considerable impacts to fore-dunes, dune complexes, and the line of vegetation. Storm surge can cause the complete failure of some structures, and larger structures can be damaged from floating debris.
3	111 - 130	EXTENSIVE	Some structural damage to small residences and utility buildings. Some breakaway wall failures from storm tides. Mobile homes are destroyed. Storm surge can cause complete failure of some structures, and larger structures can be damaged from floating debris. Considerable loss of vegetation and dune complexes, and significant erosion of beach area. Terrain may be flooded well inland.
4	131 - 155	EXTREME	More extensive breakaway wall failures with some complete roof structure failure on small residences. Considerable loss of vegetation and dune complexes, and major erosion of beach area. Catastrophic failure of structures can be expected from coastal flooding. Terrain

			may be flooded well inland.
5	155+	CATASTROPHIC	Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings destroyed. Storm tide and flooding causes major damage, up to complete failure of all structures near the shoreline. Significant damage to infrastructure including roads. Massive evacuation of residential areas may be required.

Table1.4: Hurricane Damage Classification

Storm Surge:

Storm surge is a rapid rise of offshore water elevation primarily caused by the extremely high winds which accompany a hurricane. The storm surge is the most deadly aspect of a hurricane, responsible for 90% of deaths during hurricanes. The barrier islands, specifically the dune systems along the Gulf shoreline, are the front line of defense for the mainland to the damaging effects of storm surge. The dunes are an integral part of the beach/dune system, acting as a "shock-absorber" to absorb wave energy. During a storm event, the dunes, when eroded, provide sediment to widen the beach and build offshore sand bars, so that waves break further offshore and dissipate their energy sooner.

Figure1.5: below represents the different stages, or processes, related to storm surges impacts on dune systems.

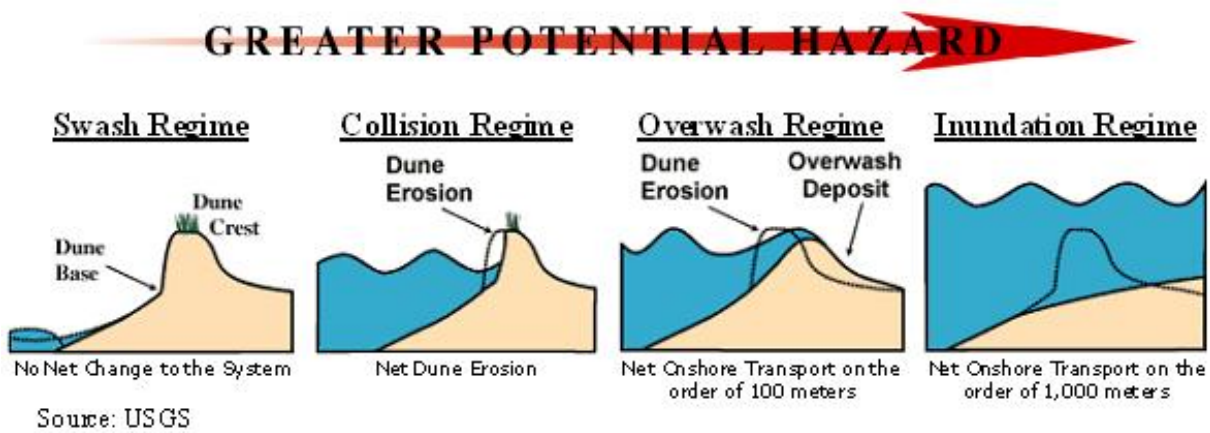


Figure 4: Classification of Storm-Induced Sedimentary Features and Responses

Swash Regime – During smaller coastal storms or high-tide events, wave run-up is usually confined to the beach, eroding the beach and depositing the sand offshore in sand bars. Over a period of weeks to a few months following the storm, the sand bar will naturally migrate back onto the beach restoring the beach to its pre-storm configuration.

Collision Regime – In stronger storms or high-tide events, if the wave run-up exceeds the elevation of the base of the dune, the run-up will collide with the dune, causing erosion of the dunes. The sand removed from the dune system is deposited on the beach and offshore in sand

bars. Similar to the swash regime, the sand bar will naturally migrate back to the beach. However, unlike the temporary changes of the swash regime, the restoration of the dunes can take years if at all. In some cases it can result in a net, or (semi-) permanent, change to the dunes.

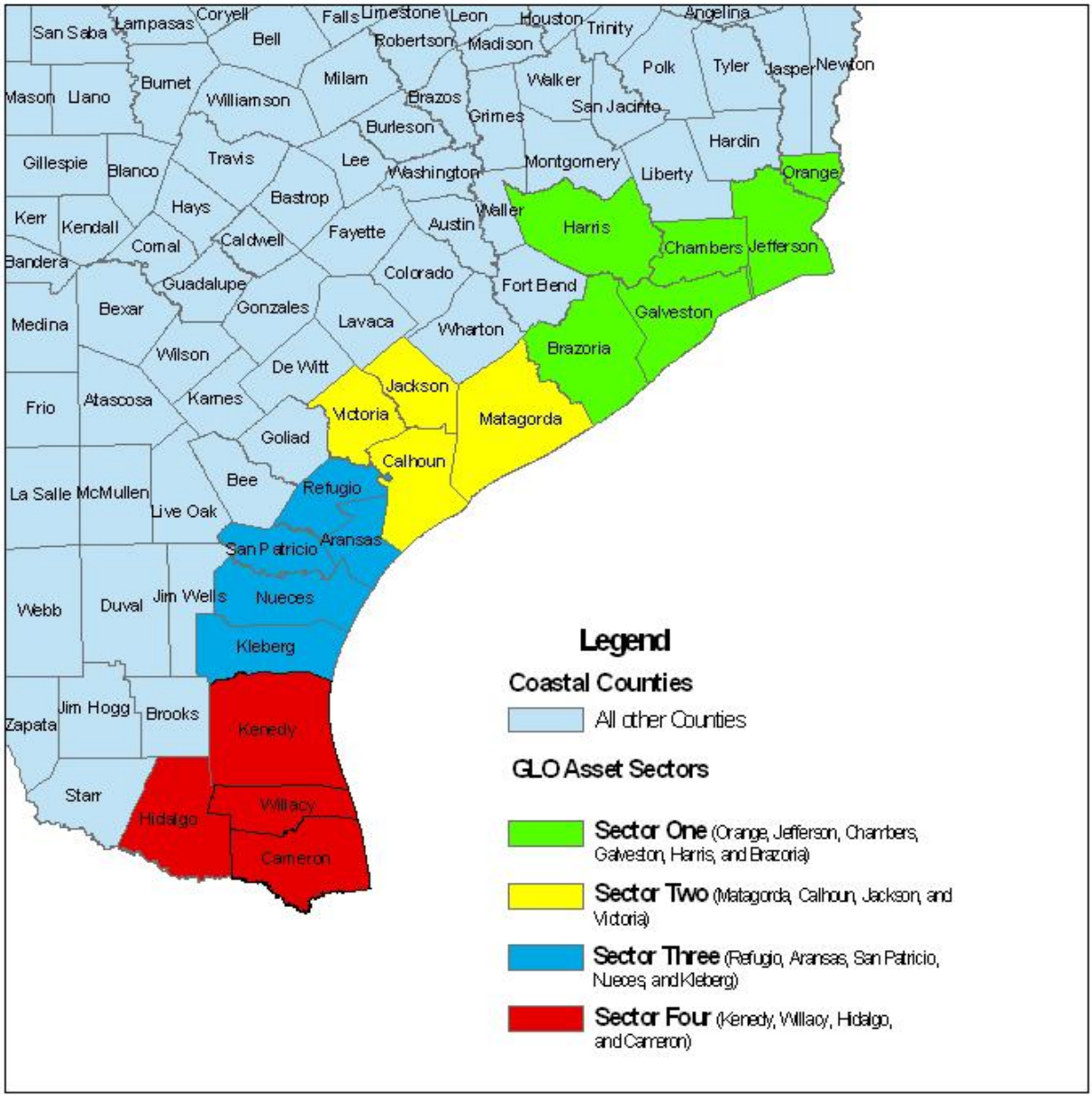
Overwash Regime – In more intense storms, if the wave run-up exceeds the elevation of the dunes, the dune system will be overtopped, transporting eroded sand landward. This net transport of sand landward contributes to the landward migration of the barrier islands.

Inundation Regime – In extreme storm events, if the elevation of the storm surge is sufficiently high, the barrier island or peninsula will become completely submerged. Large volumes of sand are transported landward resulting in the landward migration of the barrier island or peninsula. This extreme coastal change may result in a long-term, permanent change in the barrier island and peninsula morphology and may affect their future resilience in storms.

Hurricane Ike made landfall on the morning of September 13, 2008 on the East end of Galveston Island as a Category two storm with sustained winds of 110 MPH. The Bolivar Peninsula was just to the right of landfall, placing it on the strong side of the hurricane. Ike's sustained winds pushed up to a 21-foot storm surge (still water level) across Bolivar, destroying over 3000 homes and causing severe, permanent change in the shoreline. In contrast, Galveston Island at, 10.65-foot elevation, measured a storm surge elevation (still water level) of up to 14 feet. Property losses in Texas from Ike total an estimated $12.5 billion.

GLO Coastal Assets:

Following the impact of Hurricane Ike, the GLO developed a storm response plan to guide the agency in a safe, timely, and effective response to incidents, such as hurricanes and tropical storms, which threaten the state's coastal assets. Under the GLO Storm Response Plan, the agency needed to determine the pre-event baseline value of its coastal assets, which were at risk of a storm impact. In order to calculate the exposure of GLO coastal assets, the first step was to conduct an inventory of at-risk coastal assets of the GLO. An interactive GIS-based atlas was developed, which divided the coast into four sectors as shown in Map 1.6. The sectors provide an overview of GLO coastal assets in relation to high-risk hazard areas using a macro approach to ascertain the extent of vulnerability for GLO coastal assets within a predicted impact area. The inventory establishes baseline information, which provides the GLO the ability to track changes during response and recovery phases.



Map1.6: GLO Asset Sectors

In addition, each GLO coastal asset location is symbolized within each sector and includes important attribute information for each asset, including lease information, type of structure or facility, its purpose, and the amount of revenue the agency is receiving from each asset. The inventory also includes the location, details, and cost of mitigation and restoration projects conducted by the GLO. The atlas further identifies the highest concentration of exposure, by sector, for the agency's coastal assets.

Sector	Counties	GLO $ at Risk
Sector One	Orange, Jefferson, Chambers, Galveston, Harris, and Brazoria	$16,758,204.70
Sector Two	Matagorda, Calhoun, Jackson, and Victoria	$987,972.04
Sector Three	Refugio, Aransas, San Patricio, Nueces, and Kleberg	$4,827,088.30
Sector Four	Kenedy, Willacy, Hidalgo, and Cameron	$1,290,501.16
Total		$23,863,766.20

Table1.7: GLO Coastal Asset Sectors

HAZARD PROFILE WORKSHEET

Hazard: Coastal Erosion	
Potential Severity Of Impact:	
Substantial	• Multiple deaths • Complete shutdown of facilities for 30 days or more. • More than 50 percent of property destroyed or with major damage.
Major	• Injuries and/or illnesses result in permanent disability. • Complete shutdown of critical facilities for at least 2 weeks. • More than 25 percent of property destroyed or with major damage.
Minor	• Injuries and/or illnesses do not result in permanent disability. • Complete shutdown of critical facilities for more than 1 week. • More than 10 percent of property destroyed or with major damage.
Limited X	• Injuries and/or illnesses are treatable with first aid. • Minor quality of life lost. • Shutdown of critical facilities and services for 24 hours or less. • Less than 10 percent of property destroyed or with major damage.

Frequency Of Occurrence:	**Seasonal Pattern:**
☐ Highly likely: Event probable in next year. ☐ Likely: Event probable in next 3 years. ☒ Occasional: Event possible in next 5 years. ☐ Unlikely: Event possible in next 10 years.	

Source Documents, Studies, Maps, Etc. Researched:
Texas General Land Office Data

Probable Duration:
Subsidence and Retreat are long lasting events that may take months or years to detect.

Warning Time (Potential Speed of Onset):
☐ Minimal (or no) warning.
☐ 3 to 6 hours warning.
☐ 6 to 12 hours warning.
☒ More than 12 hours warning.

Cascading Potential:
Public and/or private beaches destroyed, structures destroyed

Existing Warning Systems:

DAM AND LEVEE FAILURE

A dam failure is defined as a systematic failure of the dam structure resulting in the uncontrolled release of water, often resulting in floods that could exceed the 100-year flood plain boundaries. A dam failure could create mass fatalities, mass structural damage and/or a cascading potential if a populated area is located below the dam structure.

Dams bring water, power, flood control, recreation, economic possibilities and many other advantages to people; however, safe operation and maintenance is essential to sustaining these advantages and avoiding potential disaster.

Dam owners are solely responsible for the safety and the liability of the dam and for financing its upkeep, upgrade and repair. While most infrastructure facilities (roads, bridges, sewer systems, etc.) are owned by public entities, the majority of dams in the United States are privately owned. Dams are owned and operated by individuals and many different types of entities.

Due to changes in the Dam Safety Program rules in January 2009, the definition of dam was changed to remove small dams with no downstream hazard from the list of dams under the Texas Commission on Environmental Quality (TCEQ) jurisdiction. As a result, there are 7,272 dams in Texas, including all federal dams. These dams are over 6-feet high and 50 acre-feet capacity at the top of the dam, many of which may pose a safety hazard to a downstream population. There are currently 1,031 dams, including federal dams, which are classified as high hazard, meaning if failure occurs, it is likely there will be loss of life. This classification does not necessarily mean that these dams are in need of repair--these dams could be in excellent condition or they could be in poor condition. The term "high-hazard" reflects the dam's potential for doing damage downstream should it fail. In addition, there are 737 dams which are classified as significant hazard, meaning that there could possibly be loss of life if the dam should fail.

There are an increasing number of these high-hazard structures--not because more high-hazard dams are being built, but because more development is occurring downstream. Owners of dams that were built as low hazard dams are finding that the hazard classification has changed due to the increase in population downstream of the dams. The owners are now finding that their dams are deficient because they are no longer adequate to meet State regulations and need to be upgraded.

The TCEQ currently does not have inundation maps for all high and significant hazard dams. TCEQ rules require the owners of these dams to have Emergency Action Plans (EAPs) to the TCEQ by Jan. 1, 2011, unless they have requested and received an extension of this deadline. All of these dams will not have an inundation map, but will have a map showing impact area. Preparing an inundation map is very costly and is often not necessary for the EAP. That could change in the future, and the owner will need to get an inundation map at that time. Our rules require yearly reviews and a table top exercise every 5 years. The TCEQ will attempt to get EAPs from all high and significant hazard dam owners by calendar year 2013. A mitigation strategy to address this data deficiency has been added to Section 3*: Mitigation Strategy*.

Lack of financing has resulted in deficient dams not being upgraded and downstream population being at risk.

In Texas, 95 percent of the dams are over 25 years old. If not adequately maintained, aging dams can present problems due to deterioration of the structure.

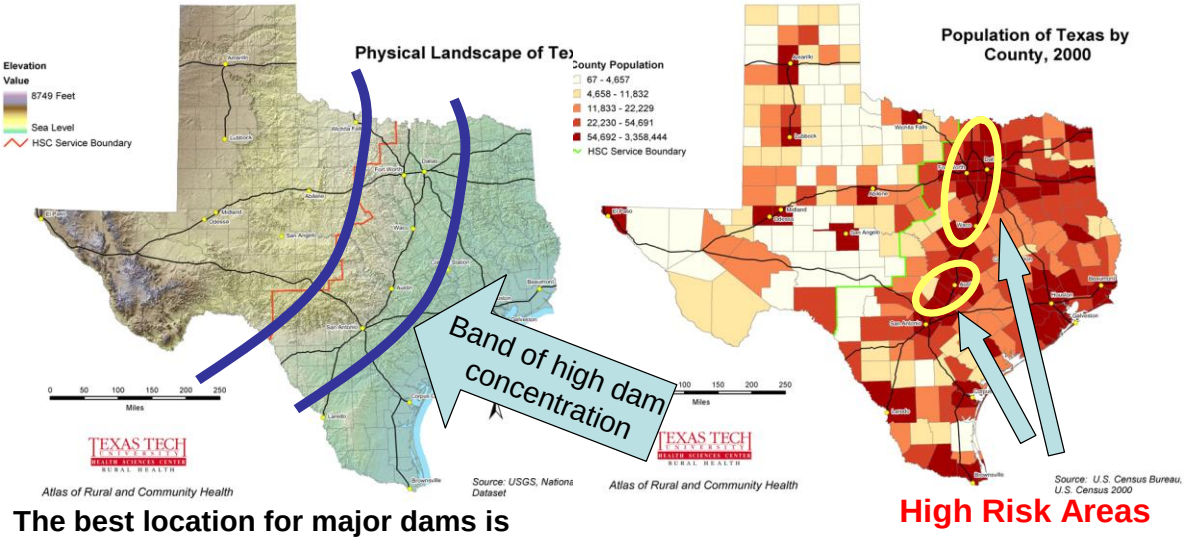
A levee failure is defined as a systematic failure of the levee structure resulting in the uncontrolled release of water, often resulting in floods that could exceed the 100-year flood plain boundaries. A levee failure could create mass fatalities, mass structural damage and/or a cascading potential if a city or farmland is protected by a levee(s). The TCEQ currently does not have inundation maps for potential levee failures.

In Texas, there is no state levee safety program. Under §16.236, an entity in the National Flood Insurance Program is required to approved new levee construction, or modifications to existing levees. However, there is no state inspection program and limited owner maintenance. In addition, there is no database identifying and locating the levee systems in Texas. Therefore, populated areas behind levees could be at risk during major flood events.

Levees have been constructed in Texas for over 100 years to protect farm and ranch land and populated areas from flood flows. It is also essential that levees have maintenance programs.

For information on the Dam Safety Program and inquiries regarding levees, contact the TCEQ Program Manager at 512-239-5195.

Figure 2-2: High-Risk Dams in Texas



The best location for major dams is the lowest portion of the watershed, combined with a narrow channel which reduces dam construction costs. In Texas, this combination of factors is best met where the drainage off the Llano uplift meets the coastal plains. Indeed, the highest concentration of major reservoirs occurs in this band.

High Risk Areas

High Hazard dams occur where many reservoirs are located in the vicinity of dense populations. Overlaying population density on high dam concentration results in areas of high risk.

FREQUENCY OF OCCURRENCE

Historically, Texas has had over 136 documented dam failures. At least two of those failures resulted in loss of life. In 1900, 25 people were killed when the Lake Austin Dam on the Colorado River at Austin failed. In 1989, one man was killed when the Nix Lake Dam in Rusk County failed. Considering the serious dam failure problems other states have experienced, Texas is extremely fortunate that no more lives have been lost. This becomes more obvious when considering that 24% of inventoried dams in the State present risk to human life, the high frequency of severe rainfall events in the State, and Texas' burgeoning population. The majority of the recent dam failures were small dams classified as low hazard. Texas has more dams listed in the National Inventory of Dams (NID) than any other State.

Previous Occurrences since 2007

The most recent dam failures in Texas occurred in 2009 as a result of a severe rainfall event in Northeast Texas, Montgomery, and McLennan Counties. There were seven earthen dams that failed or partially failed. Due to the rural nature of the area, there was no danger to human life.

A dam in Wood County was the scene of an emergency operation in October 2009 that prevented a dam from completely failing and causing possible loss of life and major damage to the state highway. When local emergency personnel arrived, the dam was being overtopped. The spillway was blocked with placed debris and the dam was in poor condition. Emergency personnel blocked the highway, evacuated several houses, placed sand bags, and eventually excavated a by-pass channel to release water, thereby preventing the dam from completely failing.

The "sunny day" (no flooding) failure of Rhines Lake Dam on New Year's Day, 2008, did not result in the loss of any lives, or directly cause any significant property damage. Due to the quick work of the Van Zandt County Emergency Management Coordinator, all downstream roads were blocked and there was no loss of life.

It is a recognized fact that despite the application of dam safety procedures, the possibility of dam failure still exists. Just because a dam or levee was in place for 40 to 50 years does not mean that its continued existence can be taken for granted. Without proper maintenance and oversight, trouble can occur anytime without warning, with catastrophic results.

MITIGATION MEASURES

In Texas, dam safety is a joint function of two State agencies – the TCEQ Dam Safety Section within the Field Operations Support Division, and the Texas Division of Emergency Management (TDEM).

The TCEQ is responsible for the approval of construction projects, and inspection of dams in Texas.

The TDEM is available to assist downstream jurisdictions in the development of emergency plans for warning and evacuation in the event of dam failure. TDEM, in conjunction with TCEQ, reviews Emergency Action Plans developed by dam owners/operators. TDEM provides recommendations to ensure that jurisdictions located downstream from the dam are aware of possible hazards and receive timely and identifiable warnings and notifications.

In January 2009, the TCEQ implemented new Dam Safety rules. There is a requirement in the rules that all owners of high and significant hazard dams develop an emergency action plan (EAP) by January 1, 2011. An extension of the date can be obtained to allow owners of multiple dam's time to complete the EAPs. There is also the requirement for the owner to work with local jurisdictions and to exercise the EAP with the local emergency personnel.

During Hurricane Rita, the Trinity River Authority implemented their EAP due to the severe damage to the Livingston Dam. Downstream entities were alerted to an increase in flow being released to lower the lake and provided sufficient time to properly warn downstream populations.

In April 2009, the City of Newcastle implemented their EAP for the two dams owned by the City due to high flows through the spillway and the potential for the lakes to continue to rise. Downstream populations were warned and no problems developed as a result. The City indicated a successful process.

The TCEQ has also held dam owners workshops around the state over the last four years. Emergency action planning has been a part of every workshop. The workshops have included dam owners, engineers, and local emergency personnel. In February 2010, 264 people were registered for two workshops. Two additional workshops are scheduled in June 2010.

The TCEQ has developed *Guidelines for Developing Emergency Action Plans for Dams in Texas.* Templates are provided in the guidelines for use by the dam owners in preparation of an EAP. The document is also available in a Word and pdf document online for ease in downloading. This can be found at
http://www.tceq.state.tx.us/compliance/field_ops/dam_safety/damsafetyprog.html.
Local jurisdictions must become more aware of the consequences and hazards of dams located above their populated areas and develop inundation maps, warning and notification systems, and evacuation plans for those endangered downstream areas.

If any jurisdiction has questions concerning the status of dams in their respective areas of responsibility, they can contact the Dam Safety Section, Field Operations Support Division, TCEQ, P.O. Box 13087, Austin, Texas 78711-3087 (512/239-0400).

Assistance in the preparation of warning and evacuation plans can be obtained from the Texas Division of Emergency Management, Texas Department of Public Safety, P.O. Box 4087, Austin, Texas 78773-0223.

HAZARD PROFILE WORKSHEET

Hazard: Dam Or Levee Failure	
Potential Severity Of Impact:	
Substantial	• Multiple deaths • Complete shutdown of facilities for 30 days or more. • More than 50 percent of property destroyed or with major damage.
Major	• Injuries and/or illnesses result in permanent disability. • Complete shutdown of critical facilities for at least 2 weeks. • More than 25 percent of property destroyed or with major damage.
Minor	• Injuries and/or illnesses do not result in permanent disability. • Complete shutdown of critical facilities for more than 1 week. • More than 10 percent of property destroyed or with major damage.
Limited X	• Injuries and/or illnesses are treatable with first aid. • Minor quality of life lost. • Shutdown of critical facilities and services for 24 hours or less. • Less than 10 percent of property destroyed or with major damage.

Frequency Of Occurrence:	**Seasonal Pattern:**
❑ Highly likely: Event probable in next year. ❑ Likely: Event probable in next 3 years. ❑ Occasional: Event possible in next 5 years. ☒ Unlikely: Event possible in next 10 years.	

Source Documents, Studies, Maps, Etc. Researched:
Local Mitigation Plans, Texas Hazard Mitigation Package

Probable Duration:

Warning Time (Potential Speed of Onset):
☒ Minimal (or no) warning.
❑ 3 to 6 hours warning.
❑ 6 to 12 hours warning.
❑ More than 12 hours warning.

Cascading Potential:
Dam or Levee failure can lead to flooding of crops or cities, structures destroyed

Existing Warning Systems:

EARTHQUAKES

What follows is an excerpt (i.e., Chapter 12) taken from the *State of Texas Hazards Analysis* publication by the Texas Division of Emergency Management, Department of Public Safety, Austin, Texas.

EARTHQUAKES

Introduction: Earthquakes in Texas

Earthquakes are defined as a shaking or trembling of the earth that is volcanic or tectonic in origin. For Texans, three essential facts about earthquakes are important to remember.

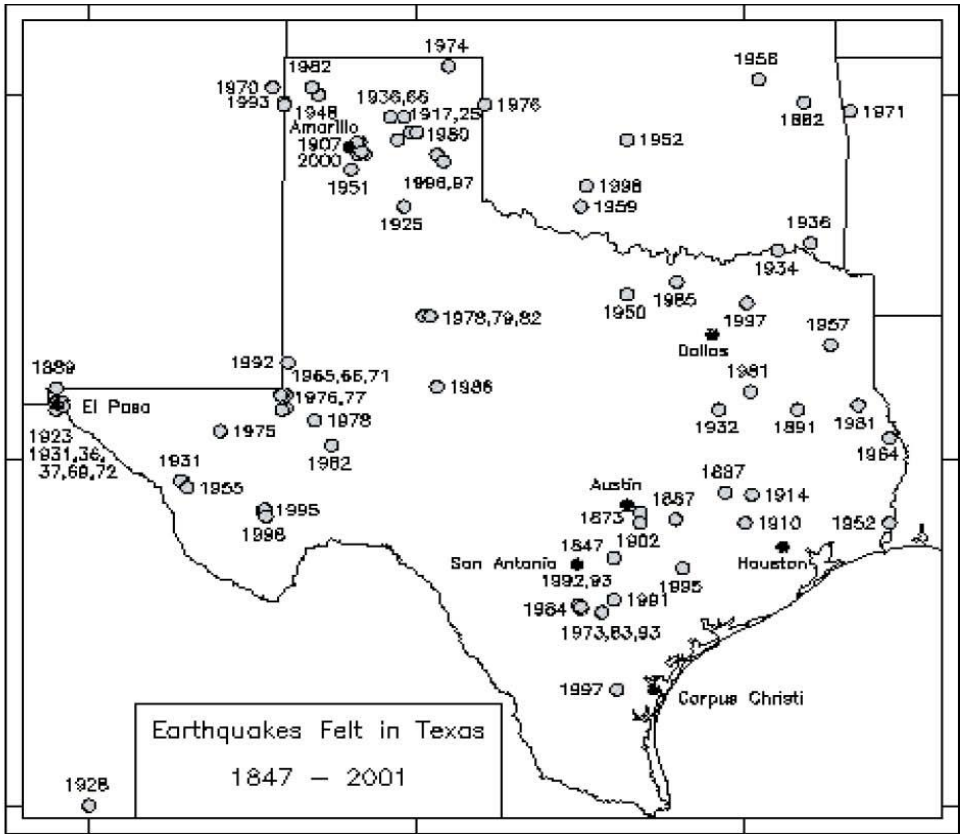
First, earthquakes do occur in Texas (see Figure 12A). Within the twentieth century there have been more than 100 earthquakes large enough to be felt; their epicenters occur in 40 of Texas's 257 counties. Four of these earthquakes have had magnitudes between 5 and 6, making them large enough to be felt over a wide area and produce significant damage near their epicenters.

Second, in four regions within Texas there have been historical earthquakes which indicate potential earthquake hazard (Figure 12B). Two regions, near El Paso and in the Panhandle, should expect earthquakes with magnitudes of about 5.5-6.0 to occur every 50-100 years, and even larger earthquakes are possible. In northeastern Texas the greatest hazard is from very large earthquakes (magnitude 7 or above) which might occur outside of Texas, particularly in Oklahoma or Missouri-Tennessee. In south-central Texas the hazard is generally low, but residents should be aware that small earthquakes can occur there, including some which are triggered by oil or gas production. Elsewhere in Texas, earthquakes are exceedingly rare. However, the hazard level is not zero anywhere in Texas; small earthquakes are possible almost anywhere, and all regions face possible ill effects from very large, distant earthquakes.

Third, while Texas does face some earthquake hazard, this hazard is very small in comparison to that in many other states, including California, Missouri, Montana, South Carolina, and Washington (Figure 12C). In most parts of Texas earthquake hazard is also small compared to the hazard attributable from other natural phenomena, such as hurricanes, tornadoes, and floods. Thus there is no need for Texas to enact sweeping changes in construction practices, or take other drastic measures to mitigate earthquake hazard.

However, Texans need to begin learning about earthquakes. Over the past 70 years Texas has changed from a sparsely populated State with an economy dominated by agriculture to an economically diverse State with various large, technical manufacturing industries centered in a few densely populated urban regions. For reasons of safety, economy, and (in some cases) law, Texans need to consider earthquake hazard when designing or sitting various structures which are essential for providing medical or emergency management services, which house sensitive manufacturing processes, or which store hazardous wastes.

Figure 12A
Locations of earthquakes and earthquake sequences that have occurred in Texas or that were felt by Texas residents. Numbers are the year of occurrence. (See a larger version of this figure.)



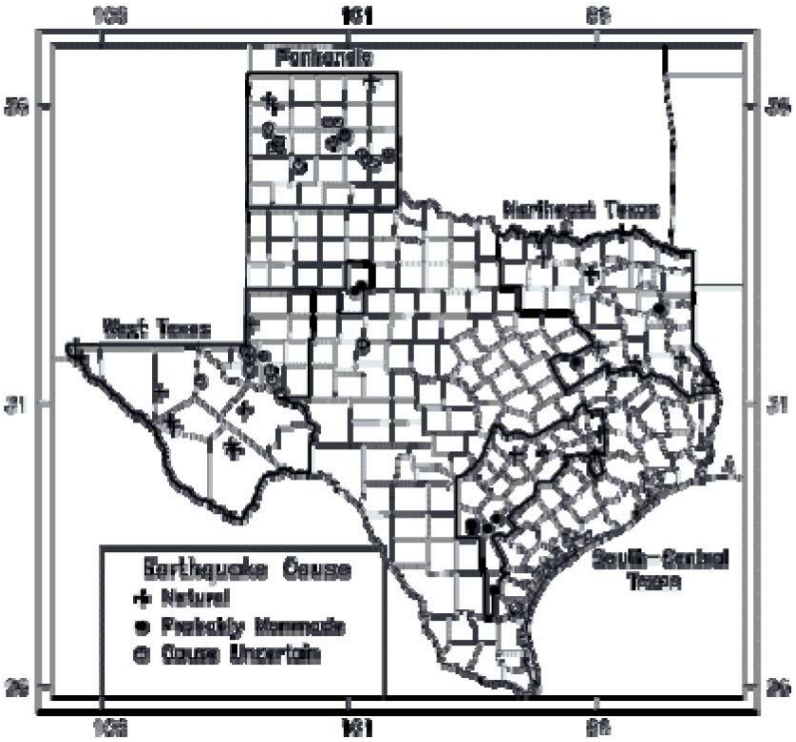
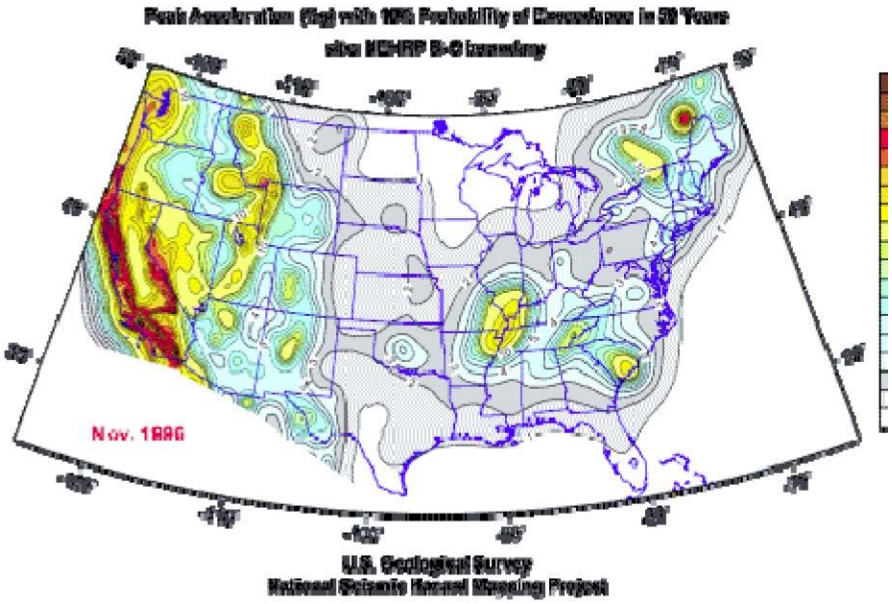


Figure 12B
Map indicating probable causes of earthquakes occurring in Texas. Solid lines show the four regions of Texas where historical earthquake activity indicates there is earthquake hazard. Light lines are county boundaries.

Figure 12C
Earthquake hazard map for the continental United States as prepared by the U. S. Geological Survey. In the central and eastern U. S., the regions expecting the highest accelerations all correspond to the sites of known historical earthquakes.



Earthquake Magnitude, Intensity, and Damage

The nature and geographical extent of earthquake hazard depends strongly on the quake's size or magnitude. Because earthquakes are rare, people are often confused about how risk depends on magnitude. Imagine that you were about to return from a vacation, and someone told you that animals had infested your property. Naturally, you would ask whether these animal were mice, armadillos, or cattle, because each might cause a different kind and amount of damage. Similarly, if your neighborhood has an earthquake, the kind and amount of damage depends on the earthquake's size. A quake with magnitude 3 may do no more than startle people and rattle dishes within a one-square mile region. However, a magnitude 7 would be felt by people over the entire State of Texas, and could do significant damage to buildings, bridges, and dams over a considerable region.

Scientists determine an earthquake's magnitude by measuring the amplitude of ground motion as recorded on a seismograph, and then correcting the measurement to account for the effects of distance from the epicenter. The magnitude scale is a 'power of ten' scale; thus if a magnitude 3.8 caused ground motion of 1/10 inch at a particular location, a 4.8 at the same epicenter would cause ground motion of 1 inch, and a 5.8 would cause ground motion of 10 inches. This means that magnitude 3 and magnitude 7 earthquakes are enormously different with respect to their ground motion and the size of and slip on the faults that produce them.

Scientists use the Modified Mercalli intensity (MMI) to describe how strong the motion is at a particular location. The MMI is a number between one and twelve, expressed as a Roman numeral such as MMI IV or MMI IX so that the number won't be confused with magnitude (see Figures 12D and 12E). While each earthquake has only one magnitude, it has much different intensities, since earthquake damage becomes less severe as one move’s away from the epicenter. Usually, most of the damage done by an earthquake occurs in the regions nearest the epicenter which have the highest intensities. While intensity depends strongly on factors such as soil properties, in most cases earthquakes with larger magnitudes have higher maximum intensities (see Figure 12F).

Because damaging earthquakes are rare in Texas, it is tempting to ignore them. A more responsible approach is to be selective about mitigation efforts, focusing attention on structures or areas where potential hazard is greatest. The argument for earthquake mitigation is analogous to the argument for having seatbelts and airbags in automobiles-although any one driver is unlikely to have an accident in any given day or year, over a person's lifetime there is a significant chance of having a serious accident. Even in West Texas and the Panhandle, at any particular place damaging earthquakes probably occur only once per century, or less. However, with a little prior planning it is possible to ensure that their damage is minimal.

Earthquake felt intensity - the Modified Mercalli Intensity Scale

MMI	What people feel, or what damage occurs.
I	Not felt except by a very few people under special conditions. Detected mostly by instruments.
II	Felt by a few people, especially those on the upper floors of buildings. Suspended objects may swing.
III	Felt noticeably indoors. Standing automobiles may rock slightly.
IV	Felt by many people indoors, by a few outdoors. At night, some people are awakened. Dishes, windows, and doors rattle.
V	Felt by nearly everyone. Many people are awakened. Some dishes and windows are broken. Unstable objects are overturned.
VI	Felt by everyone. Many people become frightened and run outdoors. Some heavy furniture is moved. Some plaster falls.
VII	Most people are alarmed and run outside. Damage is negligible in buildings of good construction, considerable in buildings of poor construction.
VIII	Damage is slight in specially designed structures, considerable in ordinary buildings, great in poorly built structures. Heavy furniture is overturned.
IX	Damage is considerable in specially designed buildings. Buildings shift from their foundations and partly collapse. Underground pipes are broken.

X Some well-built wooden structures are destroyed. Most masonry structures are destroyed. The ground is badly cracked. Considerable landslides occur on steep slopes.

XI Few, if any, masonry structures remain standing. Rails are bent. Broad fissures appear in the ground.

XII Virtually total destruction. Waves are seen on the ground surface. Objects are thrown into the air.

Figure 12D
Felt area and Modified Mercalli Intensities experienced by Texans from the magnitude 6.0 Valentine, Texas, earthquake of 16 August, 1931. Dashed lines are county boundaries; small square in south-central Texas indicates region mapped in next figure.

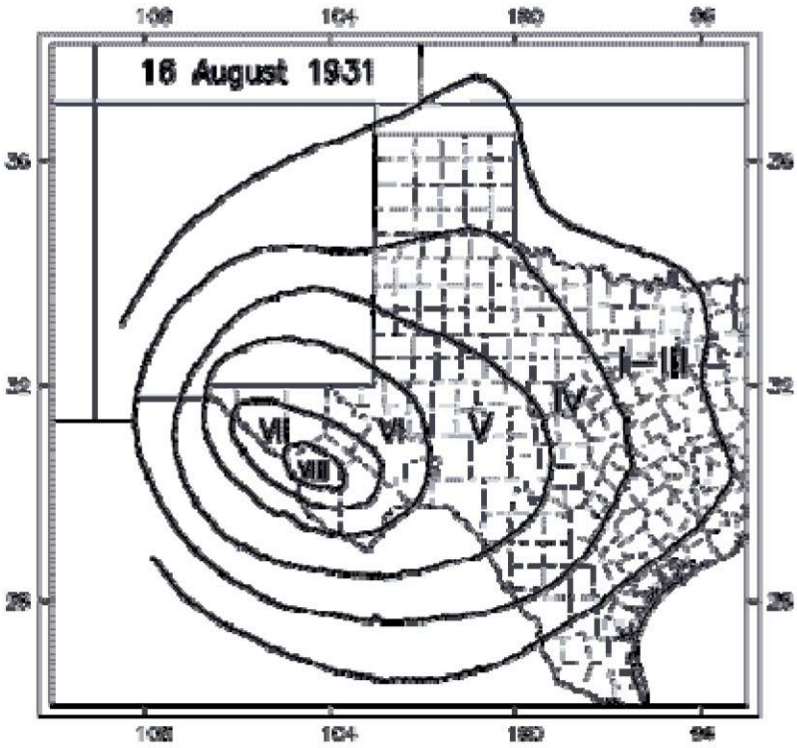


Figure 12E:
Felt area and Modified Mercalli Intensities experienced by Texans from the magnitude 4.3 Fashing, Texas, earthquake of 9 April 1993. Dashed lines are county boundaries; shaded regions indicate major oil (dark shading) and gas (light shading) fields. Note how this small earthquake is felt over a much smaller area than the 1931 magnitude 6.0 Valentine earthquake.

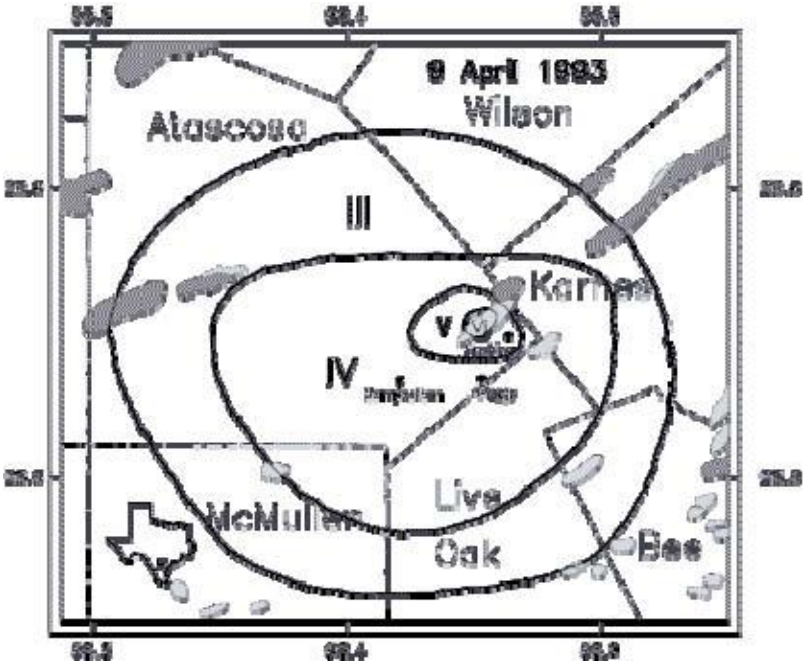


Figure 12F
Relationship Between Earthquake Magnitude and Maximum Observed Modified Mercalli Intensity (MMI).

Magnitude	Maximum MMI
3.0	III-IV
3.5	IV-V
4.0	V-VI
4.5	V-VI
5.0	VI
5.5	VI-VII
6.0	VIII

Note that the table values are only approximate, as there is great variation for individual Texas earthquakes.

Approximate Relationship Between Earthquake's Magnitude and the Diameter of and Slip Along the Fault that Produces It.

Fault Diameter

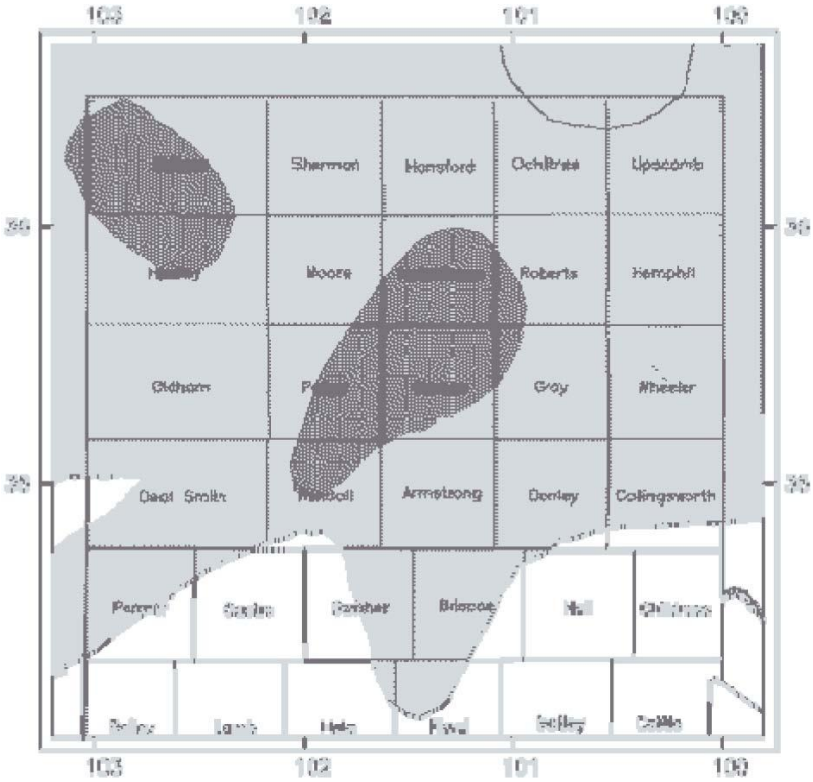


Figure 12P-A
Areas in the Panhandle which experienced Modified Mercalli Intensities of V (light gray) and VI (dark gray) during the earthquakes of 1925 and 1936 (near Borger, in Hutchison County), 1948 (near Dalhart, in Dallam County), 1952 (in Oklahoma), or 1974 (near Perryton, in Ochiltree County -curved line indicates intensity V region for this quake).

Mitigation Strategy

Architects and planners should be informed that damaging earthquakes can affect structures in the Panhandle. Sensitive structures-including dams, towers, very tall buildings, bridges, and highway overpasses-should be constructed with the possibility of earthquakes in mind. Institutions such as hospitals, schools, public meeting places, emergency management organizations, etc. should not be housed in poorly constructed un-reinforced masonry structures.

Public officials and educators should inform Panhandle residents that earthquakes can and do occur in this region. Citizens should be encouraged to plan for earthquakes; this includes taking steps at home and in the office to mitigate possible injury caused by falling objects such as bookcases or chimneys.

Citizens should be aware that it is possible that some Panhandle earthquakes are induced by petroleum production.

Regional Hazard Assessment
Northeast Texas (Largest Cities - Dallas-Fort Worth)

Counties Affected (41): Anderson, Bowie, Camp, Cass, Cherokee, Collin, Cooke, Dallas, Delta, Denton, Fannin, Franklin, Freestone, Grayson, Gregg, Harrison, Henderson, Hopkins, Hunt, Kaufman, Lamar, Limestone, Marion, Montague, Morris, Nacogdoches, Panola, Rains, Red River, Rockwall, Rusk, Sabine, San Augustine, Shelby, Smith, Tarrant, Titus, Upshur, Van Zandt, Wood, Wise

Hazard Level: This region is at risk from very large, distant earthquakes which might occur in Missouri-Tennessee or Oklahoma; the earthquakes that pose such a hazard are rare, probably occurring only once per 500 years or less. Such distant earthquakes would be most likely to damage large buildings or poorly reinforced masonry structures. Earthquakes with epicenters within this region are rare and small (see Figure 12N-A); several earthquakes with magnitudes 3 to 4.5 will probably occur each century. These pose little or no risk unless their epicenters are extremely close to poorly built or very sensitive structures.

Justification: Throughout this region the 1811-1812 Missouri-Tennessee earthquakes, although distant, probably produced Modified Mercalli Intensities of VI and higher.

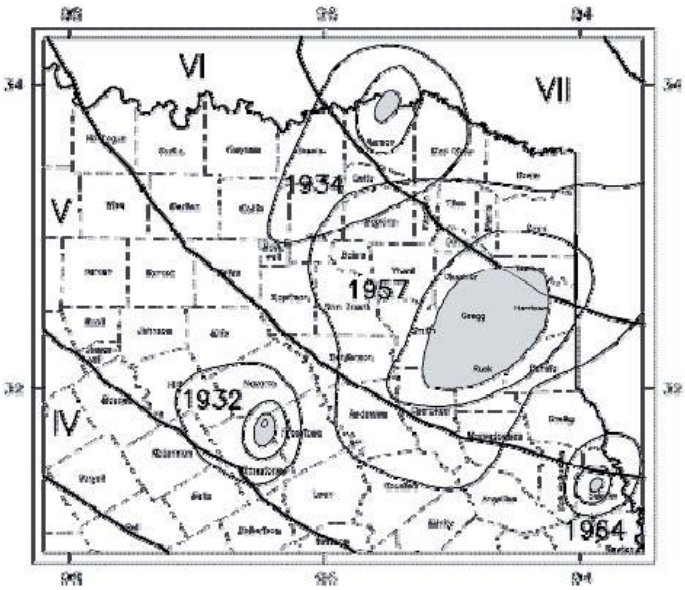
Significant Historic Earthquakes Affecting Northeast Texas

Throughout most of this region, the most intense shaking experienced over the past two centuries originated from several earthquakes with magnitude about 8 which occurred in Missouri-Tennessee in 1811-1812, or an earthquake with magnitude 5.6 which occurred in eastern Oklahoma in 1882. Although such distant earthquakes are unlikely to produce severe damage they can cause failure in very large structures, or structures which are designed with absolutely no earthquake-resistant features.

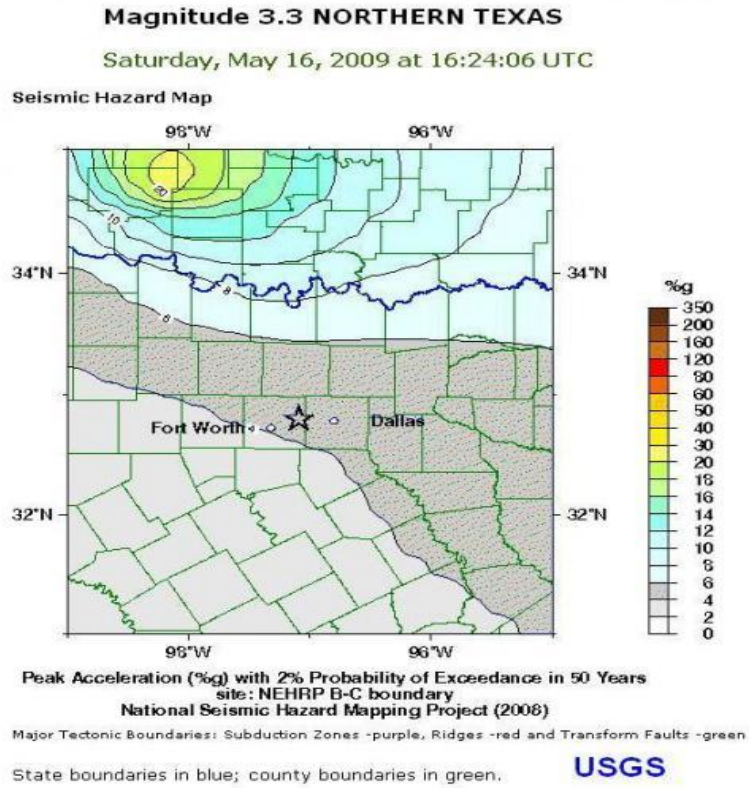
Small earthquakes with epicenters in this region occasionally do occur-some of natural origin and some apparently induced by petroleum production. These include:

- A magnitude 4.0 earthquake with an epicenter near Mexia, probably induced by oil production, that occurred on 9 April 1932.
- A magnitude 4.2 earthquake centered in Lamar County north of Paris that occurred on 12 April 1934.
- A magnitude 3.0 earthquake that occurred in Gregg County near Gladewater on 19 March 1957. This quake may have been induced by petroleum production in the East Texas Field.
- A series of earthquakes in 1964 with magnitudes of 4.0 and higher near Hemphill-Pineland in Sabine County.

Figure 12N-A:
Felt areas of representative historical earthquakes in northeastern Texas. Shaded regions indicate areas of intensity V and above for earthquakes of 1932 (Limestone County), 1934 (northern Lamar County), 1957 (Gregg County), and 1964 (Sabine County). Thick lines indicate estimated boundaries of Modified Mercalli Intensities for the 1811-1812 Missouri-Tennessee earthquakes.



- A magnitude 3.3 earthquake centered near Jacksonville in Cherokee County, which occurred on 6 November 1981.
- A magnitude 3.3 earthquake in Cooke and Denton County near Pilot Point an Valley View; this occurred on 18 September 1985.
- A magnitude 3.4 earthquake centered near Commerce in Hunt County; this occurred on 31 May 1997.
- A magnitude 3.3 earthquake centered near Fort Worth in Tarrant County; this occurred on May 16, 2009.



Events of these magnitudes seldom produce damage further than about a few miles from the epicenter.

Mitigation Strategy

- Architects and planners should be informed that distant earthquakes can affect large and sensitive structures in the northeastern Texas. Sensitive structures-including dams, towers, very tall buildings, bridges, and highway overpasses-should be constructed with the possibility of earthquakes in mind.
- Residents should understand that small earthquakes occasionally do occur in this region, including some induced by petroleum production. They should be informed that the principal hazard is from rare, distant, but very large earthquakes occurring outside of Texas.

Regional Hazard Assessment
South-Central Texas (Largest City - San Antonio)

Counties Included (19): Atascosa, Bastrop, Bexar, Brazos, Burleson, Caldwell, Comal, Guadalupe, Grimes, Hayes, Jim Wells, Karnes, Lavaca, Lee, Live Oak, Travis, Waller, Washington, Wilson

Hazard Level: Earthquakes with epicenters within this region are rare and small; perhaps 10-20 earthquakes with magnitudes between 3 and 4.5 will occur each century. A significant fraction of these earthquakes are induced by human activities, notably petroleum production. These events pose little or no risk unless their foci are extremely close to poorly built or very sensitive structures.

Justification: Many small earthquakes, some of natural origin and others induced by man's activities, have occurred in these counties.

Significant Historic or Induced Earthquakes Affecting This Region

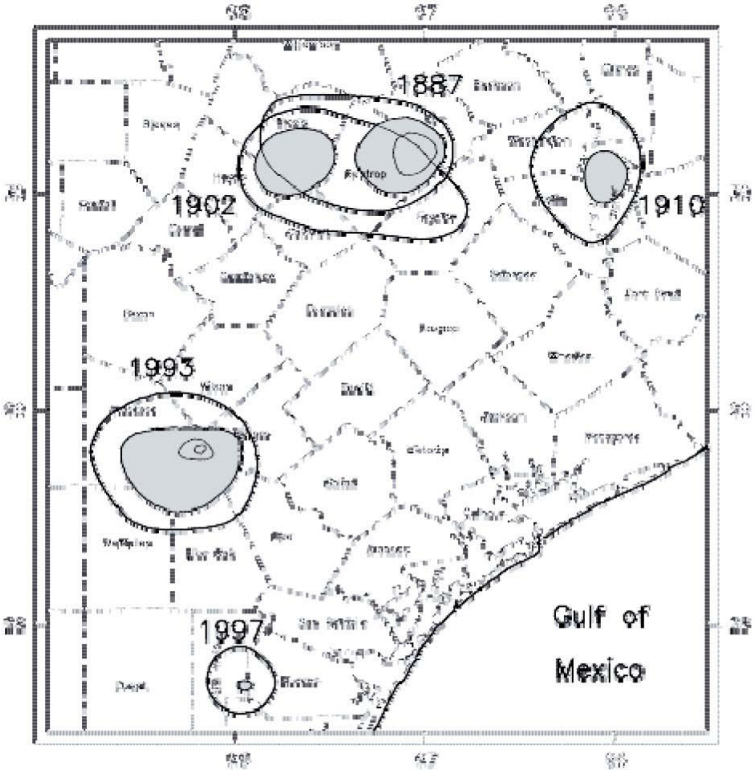
Small earthquakes with epicenters in this region occasionally do occur-some of natural origin and some apparently induced by petroleum production (see Figure 12S-A). These include:

- A magnitude 3.9 earthquake centered in Travis County south of Austin which occurred on 9 October 1902. This earthquake is clearly of natural origin.
- A magnitude 4.2 earthquake near Fashing in Atascosa County on 9 April 1993. This earthquake is one of several in this region which may have been induced by petroleum production.
- A magnitude 3.8 earthquake near Alice in Jim Wells County, which occurred on 24 March 1997. This earthquake may have been induced by petroleum production.
- A magnitude 4.0 earthquake near Alice in Jim Wells County, which occurred on 25 April 2010. No damage or injuries were reported.

Mitigation Strategy

- Residents of this region should understand that small natural earthquakes occasionally do occur in this region. However, the most numerous earthquakes are small events associated with petroleum production in some, but not all fields. These small earthquakes pose a hazard only in the immediate vicinity of their epicenter; the occurrence of significantly larger earthquakes is unlikely.

Figure 12S-A:
Felt areas of representative historical earthquakes in South-Central Texas. Shaded regions indicate areas of intensity IV and above for earthquakes of 1887 (Bastrop County), 1902 (Travis County), 1910 (Waller County), 1993 (Atascosa County), and 1997 (Jim Wells County).



HAZARD PROFILE WORKSHEET

Hazard: Earthquake	
Potential Severity Of Impact:	
Substantial X	• Multiple deaths • Complete shutdown of facilities for 30 days or more. • More than 50 percent of property destroyed or with major damage.
Major	• Injuries and/or illnesses result in permanent disability. • Complete shutdown of critical facilities for at least 2 weeks. • More than 25 percent of property destroyed or with major damage.
Minor	• Injuries and/or illnesses do not result in permanent disability. • Complete shutdown of critical facilities for more than 1 week. • More than 10 percent of property destroyed or with major damage.
Limited	• Injuries and/or illnesses are treatable with first aid. • Minor quality of life lost. • Shutdown of critical facilities and services for 24 hours or less. • Less than 10 percent of property destroyed or with major damage.

Frequency Of Occurrence:	**Seasonal Pattern:**
❑ Highly likely: Event probable in next year. ❑ Likely: Event probable in next 3 years. ❑ Occasional: Event possible in next 5 years. ☒ Unlikely: Event possible in next 10 years.	

Source Documents, Studies, Maps, Etc. Researched:
Local Mitigation Plans, Texas Hazard Mitigation Package

Probable Duration:
From a few minutes to hours, depending on the severity

Warning Time (Potential Speed of Onset):
☒ Minimal (or no) warning.
❑ 3 to 6 hours warning.
❑ 6 to 12 hours warning.
❑ More than 12 hours warning.

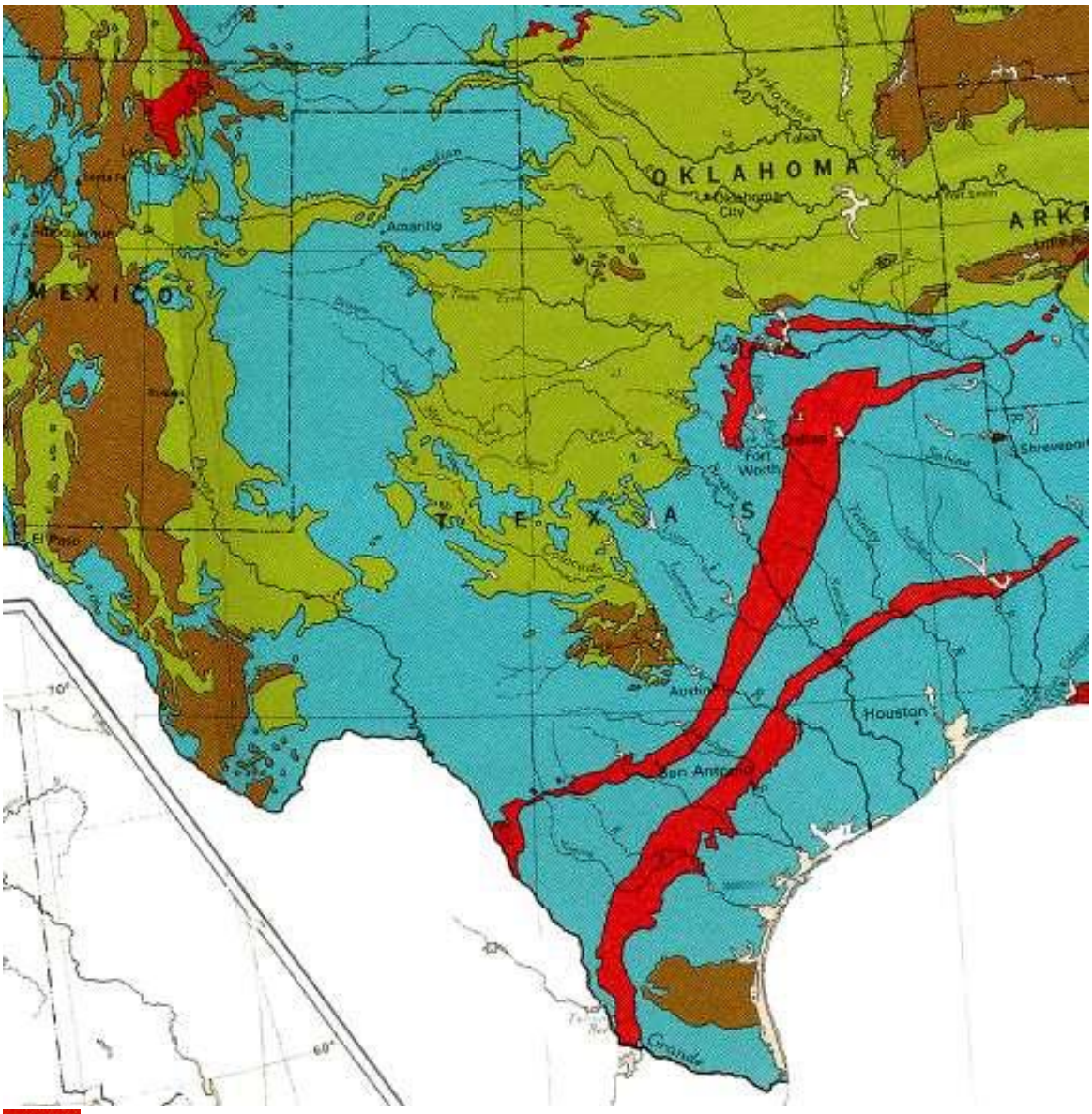
Cascading Potential:
Loss of power to cities, possible dam or levee failure, closed roads.

Existing Warning Systems:

EXPANSIVE SOILS

Expansive soils are defined as soils and soft rock that tend to swell or shrink due to changes in moisture content. Changes in soil volume present a hazard primarily to structures built on top of expansive soils. The most extensive damage occurs to highways and streets. In Texas, most expansive soils are located in a band 200 miles west from the coastline, stretching approximately from Beaumont down to Brownsville. There is another band of expansive soils stretching from Laredo northeast through San Antonio, Austin and Dallas along an area also known as the I-35 corridor. These areas receive the most moisture and are also vulnerable to droughts, which can cause the soils to expand and contract.

Map 2-13: Expansive Soils in Texas



- Unit contains abundant clay having high swelling potential
- Part of unit (generally less than 50%) consists of clay having high swelling potential
- Unit contains abundant clay having slight to moderate swelling potential
- Part of unit (generally less than 50%) consists of clay having slight to moderate swelling potential
- Unit contains little or no swelling clay

Texas is a State severely challenged with building failures caused by expansive soils. On the map above, soils coded red or blue generally present challenges in this regard, and ¾ of the State is so colored. According to a 1982 FEMA report, expansive soils have caused billions of dollars of damage to U.S. buildings, roads, pipelines, and other structures. Today, damage from expansive soils is costlier than damage caused by earthquakes, floods, tornadoes, and hurricanes combined.

Expansive soils (bentonite, smectite, or other reactive clays) expand when the soil particles attract water, and can shrink when the clay dries. Expansive soil can grow to as much as 15 times its original size, thus causing severe damage. Sidewalks, roads, and residential and commercial buildings may be lifted causing cracks and distortion.

It is differential expansion that causes damage. If the entire area under a foundation or road maintained the same moisture content, the entire structure would rise uniformly, and there would be no damage. Residential construction generally has more problems than commercial, but both experience significant losses. The foundation type most prevalent in Texas, slab on grade, is also the most susceptible to damage from expansive clays.

As many of our Texas communities are completely underlain by these expansive soils it is generally not feasible to completely avoid building on them. There are proven engineering solutions to building on expansive clays; foundations can be built on pilings or basement walls that extend sufficiently deep to get below the 'active layer' (that portion of the soil column that experiences significant annual changes in moisture content). Several feet of compacted select fill can reduce the degree of movement sufficiently to prevent cracking of foundations. The depth of the grade beams can be considerably extended to stiffen the slab in both dimensions. All of these methods are cost effective but add moderately to the cost of construction, and are seldom attempted in most subdivisions. Foundation irrigation (also called foundation maintenance) is a fourth method that when practiced religiously has been proven effective. In foundation maintenance, the area around the residential foundation out to a distance of at least 5 feet is irrigated uniformly at least once a week. This results in a relatively constant soil moisture level year-round, and thus a great reduction in differential soil expansion. The additional costs for water are small compared to the benefits, but it must be done diligently, and this method prohibits having large trees within 20 ft. of the home (the dense tree roots will extract water at a differential rate). Few citizens have the patience for this method and it should be counted on to rescue a deteriorating existing situation rather than as a design code criteria.

Commercial construction more commonly has mitigation measures applied, and is commonly completely surrounded by waterproof paving, which acts to maintain the soil moisture at a constant level without additional irrigation. Residential losses account for the bulk of damages.

FREQUENCY AND HISTORY

Table 2-18: Percentage of Insurance Claims Made in Texas Involving Foundations

1960	3%
1970	5%
1980	9%
1990	13%
2000	14%
2005	14%

The great increase in damages in Texas caused by problems with expansive soils can be traced to the rise in residential slab-on-grade construction which began to accelerate in the 1960s. Prior to that time, most residential construction in Texas was pier and beam, with wood siding or other non-masonry covering. This construction style was still susceptible to differential soil expansion, but re-leveling was simply and inexpensively accomplished by shimming the existing piers. The non-masonry siding would warp back to its original alignment without damage. Manufactured homes in Texas still enjoy these advantages. The tabular data provided by Texas Department of Insurance clearly shows the rise in foundation related claims over the past five decades. (The TDI data did not capture the exact cause of the claims). It is reported in percentage format as this automatically corrects for inflation, population growth, and the increasing purchase of homeowners insurance.

Once slab-on-grade construction became prevalent, there was initially little appreciation in city building code departments that the costs of foundation and wall failures caused by expansive soils were preventable. It was simply expected that a percentage of the homes in any subdivision would have severe foundation problems. Finally, as the housing boom of 2003-2006 began, communities began to realize that they were losing out on millions in property tax revenue by allowing the situation to continue. A home that has half of its value eliminated by foundation cracking (a common statistic) also generates half the tax and school revenue. This awaking is still in its infancy; thousands of communities across the State that are underlain by expansive soils still have no code requirements for special treatment of foundations.

However, due to a better understanding of the causes of expansive soils, communities since 2005 have passed stronger building code requirements that have leveled off the amount of insurance claims made in Texas involving foundations. Previous occurrences of expansive soils, measured through insurance claims made in Texas from 2005-2010, have not risen significantly in the past 5 years.

Table 2-19: Expansive Soils Index (in %)

0–20	Very Low
21-50	Low
51-90	Medium
91-130	High
>130	Very High

STATE REACTION

The States reaction to the situation has thus far been muted. Unlike hail, the State has required no premium discounts for above code foundation standards. There is no substantial outreach program to encourage local jurisdictions to enact and enforce building code improvements. A newly established State agency, the Texas Residential Construction Commission, which adjudicates builder/homebuyer disputes in the State, and which licenses all construction trades in the State, may prove the ideal mechanism to institute this outreach.

HAZARD PROFILE WORKSHEET

Hazard: Expansive Soils	
Potential Severity Of Impact:	
Substantial	• Multiple deaths • Complete shutdown of facilities for 30 days or more. • More than 50 percent of property destroyed or with major damage.
Major	• Injuries and/or illnesses result in permanent disability. • Complete shutdown of critical facilities for at least 2 weeks. • More than 25 percent of property destroyed or with major damage.
Minor	• Injuries and/or illnesses do not result in permanent disability. • Complete shutdown of critical facilities for more than 1 week. • More than 10 percent of property destroyed or with major damage.
Limited X	• Injuries and/or illnesses are treatable with first aid. • Minor quality of life lost. • Shutdown of critical facilities and services for 24 hours or less. • Less than 10 percent of property destroyed or with major damage.

Frequency Of Occurrence:	**Seasonal Pattern:**
❑ Highly likely: Event probable in next year. ❑ Likely: Event probable in next 3 years. ☒ Occasional: Event possible in next 5 years. ❑ Unlikely: Event possible in next 10 years.	

Source Documents, Studies, Maps, Etc. Researched:
Local Mitigation Plans

Probable Duration:
Varies from a few days to a few months

Warning Time (Potential Speed of Onset):
❑ Minimal (or no) warning.
❑ 3 to 6 hours warning.
☒ 6 to 12 hours warning.
❑ More than 12 hours warning.

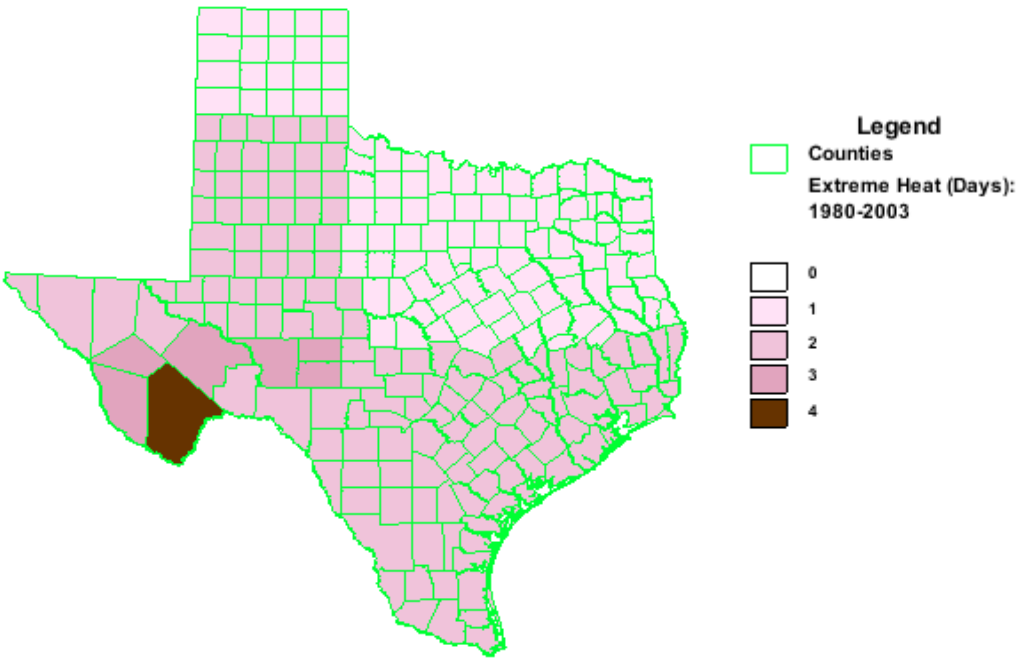
Cascading Potential:

Existing Warning Systems:

EXTREME HEAT

Extreme Heat is defined as a combination of very high temperatures and exceptionally humid conditions. When persisting over a period of time, it is called a heat wave. All of Texas is vulnerable to extreme heat, but most particular in West Texas. In addition, large metropolitan areas, such as Dallas/Fort Worth and Houston may experience extreme heat since they have an abundance of concrete. This effect is known as urban heat islands and can be dangerous to those without air conditioners.

Map 2-14: Extreme Heat in Texas



There is not a standard designation of an extreme heat day. It is a complex number assigned by local National Weather Service (NWS) regions based upon heat index, time of year, and area of the country. Thus a heat index of 105 in Austin, Texas in July is considered routine. The same index in New York City in August would warrant an extreme heat warning.

Extreme heat days normally trigger some level of response by local governments; cooling shelters are opened in local government buildings, local utilities forgive or defer high power bills, and local public pools are operated longer and without user fees. At the State level, the primary response is more careful monitoring of the statewide power grid, as extreme heat days usually result in dramatic electric power demands.

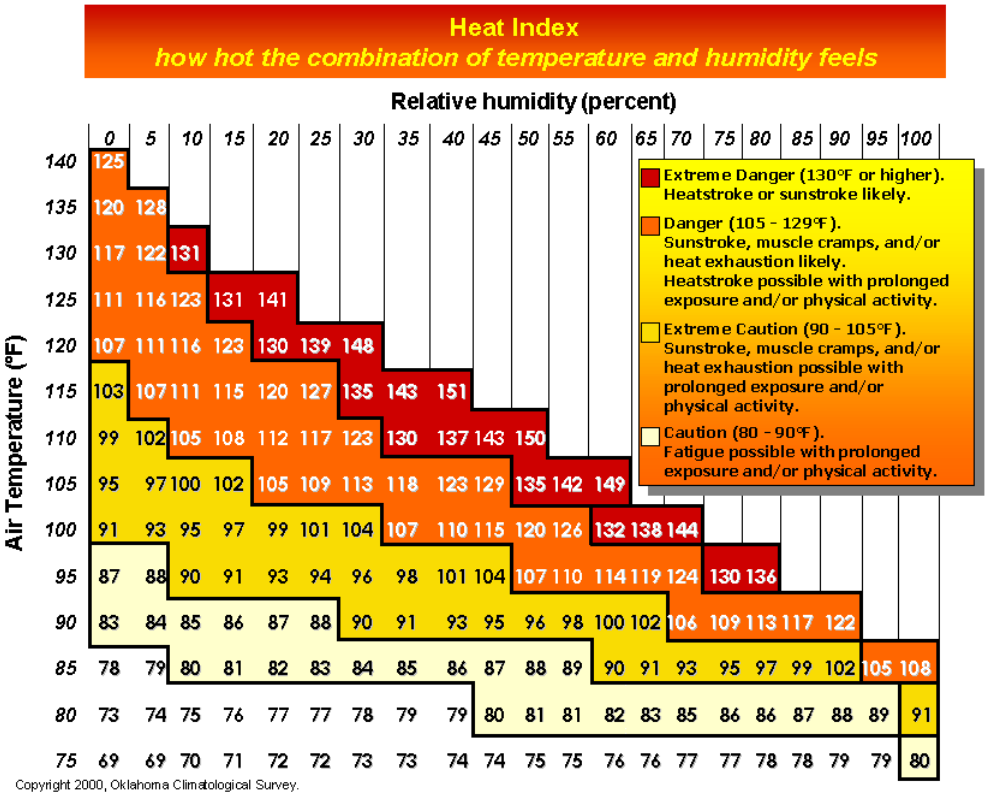
Extreme heat is not a hazard that responds to the traditional mitigation measures of building codes or land use restrictions. Public information campaigns to remind citizens to hydrate and avoid direct exposure to the sun between the peak UV hours of 1 PM and 4 PM can reduce the loss of life.

Table 2-20: Extreme Heat Occurrences in Texas

Begin Date	Hazard Type	State	County	Injuries	Fatalities	Property Damage*	Crop Damage*
7/23/08	"Heat"	TX	Dallas	0	1	0	0
8/1/08	"Heat"	TX	Dallas	0	4	0	0
8/28/09	"Heat"	TX	Navarro	0	1	0	0
Total				0	6	0	0

Source: http://webra.cas.sc.edu/sheldus_setup/sheldus_results.aspx

Figure 2-3: Extreme Heat Index



HAZARD PROFILE WORKSHEET

Hazard: Extreme Heat	
Potential Severity Of Impact:	
Substantial	• Multiple deaths • Complete shutdown of facilities for 30 days or more. • More than 50 percent of property destroyed or with major damage.
Major	• Injuries and/or illnesses result in permanent disability. • Complete shutdown of critical facilities for at least 2 weeks. • More than 25 percent of property destroyed or with major damage.
Minor	• Injuries and/or illnesses do not result in permanent disability. • Complete shutdown of critical facilities for more than 1 week. • More than 10 percent of property destroyed or with major damage.
Limited X	• Injuries and/or illnesses are treatable with first aid. • Minor quality of life lost. • Shutdown of critical facilities and services for 24 hours or less. • Less than 10 percent of property destroyed or with major damage.

Frequency Of Occurrence:	**Seasonal Pattern:**
☒ Highly likely: Event probable in next year. ☐ Likely: Event probable in next 3 years. ☐ Occasional: Event possible in next 5 years. ☐ Unlikely: Event possible in next 10 years.	Summer months

Source Documents, Studies, Maps, Etc. Researched:
Local Mitigation Plans, NOAA Weather Reports

Probable Duration:
From few days to several weeks

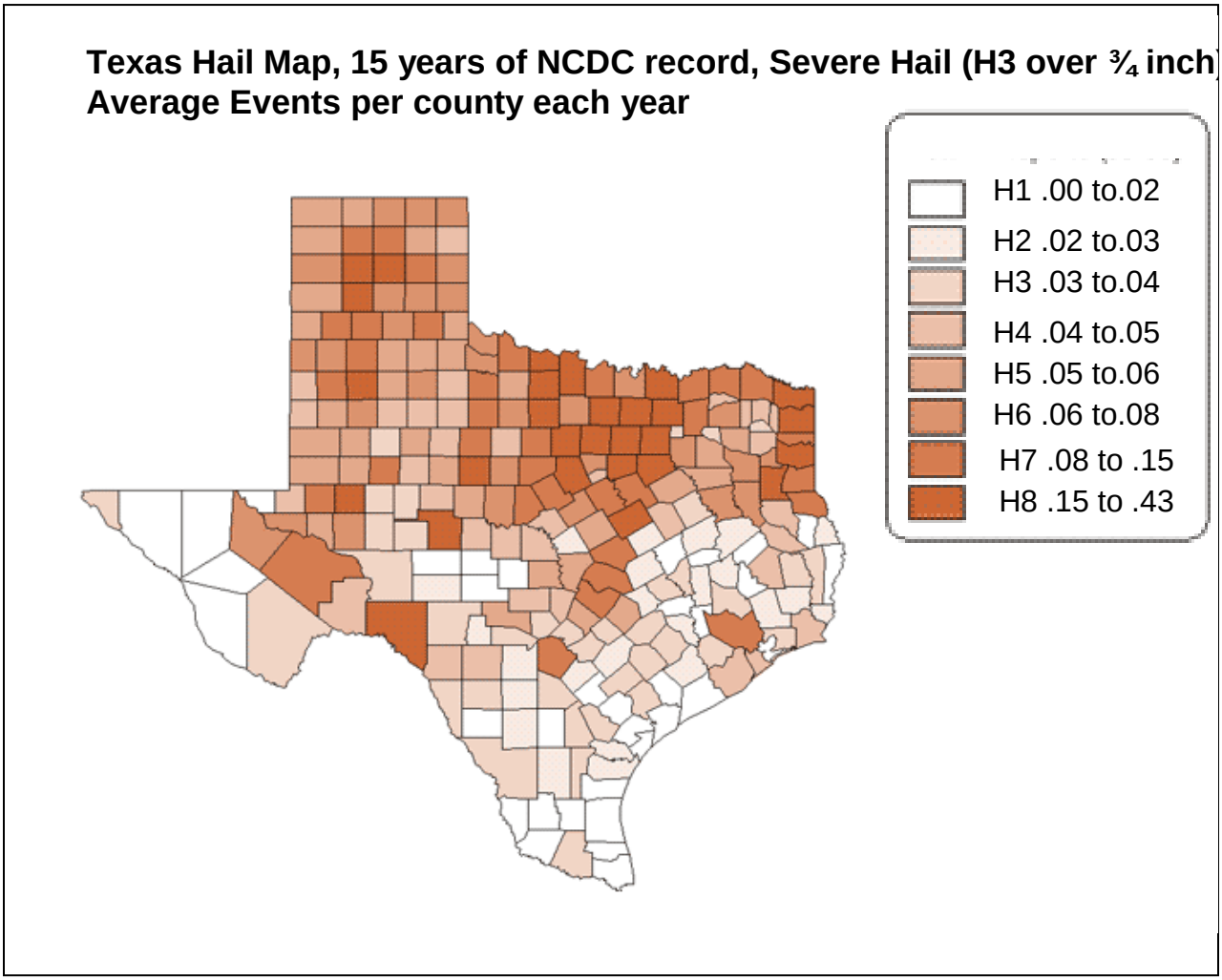
Warning Time (Potential Speed Of Onset):
☐ Minimal (or no) warning.
☐ 3 to 6 hours warning.
☐ 6 to 12 hours warning.
☒ More than 12 hours warning.

Cascading Potential:
Higher use of electricity, rolling blackouts, homes without air conditioners that work well enough

Existing Warning Systems:
NWS, local weather forecasts

HAILSTORM

Map 2-15: Hail Occurrences in Texas



Hail is defined as a precipitation in the form of small balls or lumps usually consisting of concentric layers of clear ice and compact snow.

Hail is a peril that threatens all but a handful of states in the United States, but it doesn't strike all areas equally. Since 1980, the country has averaged 3,000 hailstorms a year, with four states accounting for 42 percent of the total. Texas with 500 per year; Oklahoma with 400; Kansas with 225; and Nebraska with 135.

Texas officials estimate that up to 40 percent of all homeowners' insurance claims in that State result from hail damage. While the Midwest and Great Plains states have the most hailstorms, Colorado has the most storms with large-size hail (diameter greater than 1.5 inches). So even though Colorado has fewer storms, the storms that occur cause more damage.

The highest homeowner's insurance payouts involve hail. Among State Farm's 25 highest claim payouts in history, eight involved significant damage caused by hail. The company's fifth-largest payout for a single catastrophic event occurred in 1992—about 68,000 claims totaling nearly $245 million resulting from a hailstorm in Fort Worth, Texas. While a hailstorm usually strikes a relatively limited geographical area, there are parts of Texas where hailstorms average six strikes a year or more.

For hailstorms, insurers believe the best way to minimize damage is use of roofing materials that better resist hail damage. Typical flat commercial roofing, both asphalt and polyurethane, resists hail damage very efficiently. Breakthroughs in technology and standardized testing are contributing new materials expected to more effectively resist residential hail damage.

State insurance authorities in Texas are attacking the issue of hail damage by requiring premium discounts for consumers who install impact-resistant roofs. In January 1998, Insurance Commissioner Elton Bomer ordered homeowners insurance companies in the State to discount premiums up to 46 percent in some areas for policyholders who replace old roofs with certified impact-resistant roofs. At the time of this revision there are over 400 impact resistant roofing products on the list of products qualifying for premium discounts. Heavy duty metal and concrete tile are currently the most commonly used roofing materials qualifying for the discounts. Choices of qualified asphalt/fiberglass shingle roofing products are limited but expected to grow soon. According to National Climatic Data Center data, about 2% of reported hail events consist of severe hail, that over ¾ of an inch.

Table 2-21: Modified NOAA/TORR Hailstorm Intensity Scale

Modified NOAA/TORRO Hailstorm Intensity Scale				
Size Code	Intensity Category	Typical Hail Diameter (inches)	Approximate Size	Typical Damage Impacts
H0	Hard Hail	1/4	Pea	No damage
H1	Potentially Damaging	1/4 – 1/2	Marble or Mothball	Slight damage to plants, crops
H2	Potentially Damaging	1/2 - 3/4	Dime or Penny	Significant damage to fruit, crops, vegetation
H3	Severe	3/4 - 1 1/4	Nickel to Quarter	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	1 - 1 1/2	Ping Pong Ball	Widespread glass damage, vehicle bodywork damage
H5	Destructive	1 1/4 - 1 3/4	Golf Ball	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Destructive	1 1/2 - 2 1/4	Tennis ball	Aircraft bodywork dented, brick walls pitted
H7	Very destructive	2 - 3	Baseball	Severe roof damage, risk of serious injuries
H8	Very destructive	2 1/2 - 3 1/2	Teacup	Severe damage to aircraft bodywork
H9	Super Hailstorms	3 - 4	Grapefruit	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

Modified NOAA/TORRO Hailstorm Intensity Scale				
Size Code	Intensity Category	Typical Hail Diameter (inches)	Approximate Size	Typical Damage Impacts
H10	Super Hailstorms	4+	Softball and up	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

As one would expect, the northern half of the State which is subject to more severe thunderstorms, also experiences more frequent severe hailstorms. The increased frequency of reports from Harris County and Bexar County probably reflect a greater density of observers/reporters, rather than a magical attraction of hailstones to those counties.

Table 2-22: Hail Occurrences in Texas

Begin Date	Hazard Type	State	County	Injuries	Fatalities	Property Damage	Crop Damage
6/1/09	Hail	TX	Swisher	0	0	0	3 M
6/2/09	Hail	TX	Kent	0	0	30 K	0
6/2/09	Hail	TX	Fisher	0	0	700 K	0
6/7/09	Hail	TX	Pecos	0	0	1.5 M	0
7/28/09	Hail	TX	Hale	0	0	0	2 M
Total				0	0	2.2 M	5 M

Source: http://webra.cas.sc.edu/sheldus_setup/sheldus_results.aspx

HAZARD PROFILE WORKSHEET

Hazard: Hailstorm	
Potential Severity Of Impact:	
Substantial	• Multiple deaths • Complete shutdown of facilities for 30 days or more. • More than 50 percent of property destroyed or with major damage.
Major	• Injuries and/or illnesses result in permanent disability. • Complete shutdown of critical facilities for at least 2 weeks. • More than 25 percent of property destroyed or with major damage.
Minor	• Injuries and/or illnesses do not result in permanent disability. • Complete shutdown of critical facilities for more than 1 week. • More than 10 percent of property destroyed or with major damage.
Limited X	• Injuries and/or illnesses are treatable with first aid. • Minor quality of life lost. • Shutdown of critical facilities and services for 24 hours or less. • Less than 10 percent of property destroyed or with major damage.

Frequency Of Occurrence:	**Seasonal Pattern:**
❑ Highly likely: Event probable in next year. ☒ Likely: Event probable in next 3 years. ❑ Occasional: Event possible in next 5 years. ❑ Unlikely: Event possible in next 10 years.	Spring Thunderstorms or Early Winter

Source Documents, Studies, Maps, Etc. Researched:
Local Mitigation Plans

Probable Duration:
Few hours

Warning Time (Potential Speed of Onset):
❑ Minimal (or no) warning.
☒ 3 to 6 hours warning.
❑ 6 to 12 hours warning.
❑ More than 12 hours warning.

Cascading Potential:
Power failures

Existing Warning Systems:

LAND SUBSIDENCE

Land subsidence is defined as the loss of surface elevation due to the removal of subsurface support. It can range from broad, regional lowering of the land surface to localized collapses. The Gulf Coast areas, such as Houston, were at one time highly vulnerable to land subsidence prior to the restriction of ground water being pumped out. Land subsidence extent is measured by the number of feet the land loss, or sunk.

Previous Occurrence

Texas found no recorded events for Land Subsidence in local mitigation plans, or from the following Natural Hazards Databases:

Hazards and Vulnerability Research Institute, Department of Geography, University of South Carolina, Columbia, South Carolina 29208, http://webra.cas.sc.edu/sheldus%5Fsetup/

NOAA, National Climatic Data Center Web site:
http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms

Location of land subsidence in Texas would most likely be along the Texas Gulf Coast counties where the removal of subsurface support (such as groundwater) could cause the loss of surface elevation. Counties at high risk include Orange, Jefferson, Chambers, Harris, Galveston, Brazoria, Matagorda, Calhoun, Aransas, San Patricio, Nueces, Kleberg, Kenedy, Willacy, and Cameron.

HAZARD PROFILE WORKSHEET

Hazard: Land Subsidence	
Potential Severity Of Impact:	
Substantial	• Multiple deaths • Complete shutdown of facilities for 30 days or more. • More than 50 percent of property destroyed or with major damage.
Major	• Injuries and/or illnesses result in permanent disability. • Complete shutdown of critical facilities for at least 2 weeks. • More than 25 percent of property destroyed or with major damage.
Minor	• Injuries and/or illnesses do not result in permanent disability. • Complete shutdown of critical facilities for more than 1 week. • More than 10 percent of property destroyed or with major damage.
Limited X	• Injuries and/or illnesses are treatable with first aid. • Minor quality of life lost. • Shutdown of critical facilities and services for 24 hours or less. • Less than 10 percent of property destroyed or with major damage.

Frequency Of Occurrence:	**Seasonal Pattern:**
❑ Highly likely: Event probable in next year. ❑ Likely: Event probable in next 3 years. ❑ Occasional: Event possible in next 5 years. ☒ Unlikely: Event possible in next 10 years.	

Source Documents, Studies, Maps, Etc. Researched:
Local Mitigation Plans, Texas Hazard Mitigation Package, www.thmp.com

Probable Duration:

Warning Time (Potential Speed of Onset):
❑ Minimal (or no) warning.
❑ 3 to 6 hours warning.
❑ 6 to 12 hours warning.
☒ More than 12 hours warning.

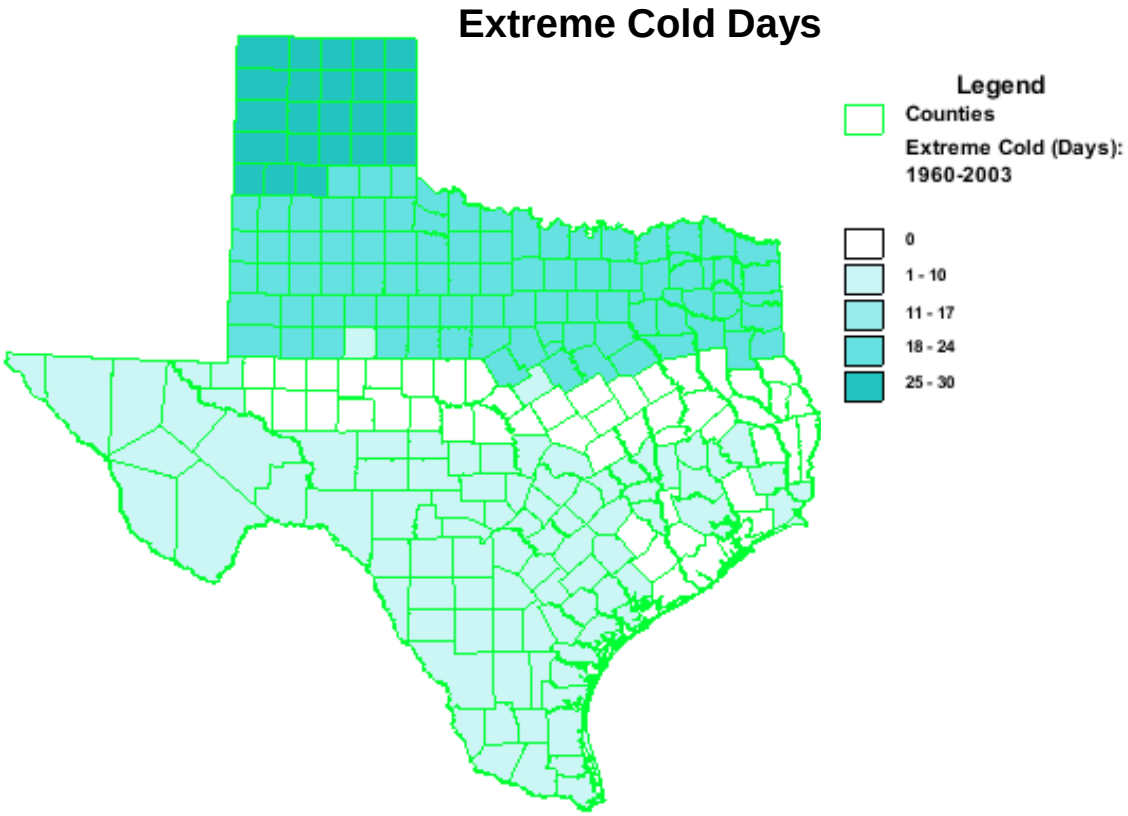
Cascading Potential:

Existing Warning Systems:

SEVERE WINTER STORM

Severe winter storms is defined as extreme cold and heavy concentrations of snowfall or ice. Texas is disrupted more severely by severe winter storms than are regions that experience severe weather more frequently. The Texas Panhandle and North Central Texas around Dallas and Texarkana are most vulnerable to severe winter storms.

Map 2-16: Cold Day Occurrences in Texas



PHYSICAL CHARACTERISTICS

Winter storms in Texas, although not as numerous as in our neighbor states to the north, do occur often enough and with enough severity to be a threat to people and property. The types, which Texans are most familiar with, are snowstorms, blizzards, cold waves and ice storms. Generally, the winter storm season in Texas runs from late November to mid-March, although severe winter weather has occurred as early as October and as late as May in some locations.

SNOWSTORMS

A snowfall with an accumulation of four (4) or more inches in a 12-hour period is considered a heavy snowfall. Snow accumulations of that amount are usually experienced in the northern half of the State and in the higher elevations of West Texas. Snowfalls in the central part of Texas are usually light to moderate but there have been exceptions when drifting snow has snarled transportation systems and stranded hundreds of motorists. Snowfall of any amount is rare south of a line from Del Rio to Port Arthur.

BLIZZARDS

Blizzards are the most perilous of all winter storms, characterized by low temperatures and strong winds in excess of 35 miles per hour, bearing large amounts of blowing or drifting snow. Blizzards take a terrible toll in livestock and people caught in the open. In Texas, blizzards are most likely to occur in the Panhandle and South Plains Regions. True blizzards are rare in Texas. However, blizzard-like conditions do exist during heavy snowstorms when gusty winds cause blowing and drifting snow. Table 2-23 identifies some examples of the worst blizzards in Texas.

Table 2-23: Blizzard Occurrences in Texas

Date	Affected Area	Remarks
February 1-5, 1956	Panhandle and South Plains	20 dead; heaviest snowfall on record in Texas
Feb. 20-22, 1957	Panhandle	6" to 26" of snow; 40 to 60 mph winds; drifts 12 feet high; 3 dead; livestock and property Losses, $3.1 million
March 22-25, 1957	Panhandle	10 dead; heavy livestock losses; transportation halted; 4,000 persons marooned
Feb. 20-22, 1971	Panhandle	6" to 26" of snow were whipped by 40 to60 mph winds into drifts up to 12'. 3persons killed; property and livestock damage at $3.1 million
October, 1979	Panhandle	9,000 head of cattle lost; thousands of motorists stranded
December, 1982	El Paso	18.2 recorded, the most in any month there
February 5, 2008	Moore County	2 dead, 5 injured; 15.2K in property damage

WINTER STORM: WIND CHILL, VOLUME OF ICE, VOLUME OF SNOW

The wind chill temperature you have undoubtedly heard of is simply 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. The index was created in 1870, and on November 1, 2001, the NWS released a more scientifically accurate equation which we use today. Here is a chart for calculating wind chill. (Please note that it is not applicable in calm winds or when the temperature is over 50°).

Figure 2-4: NOAA Wind Chill Chart

Wind Chill Chart

Wind (mph)	Temperature (°F) 40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	29	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph) *Effective 11/01/01*

Source: NWS and NOAA

Cold Wave

The passage of a winter cold front with a drastic drop in temperature heralds the arrival of a cold wave, usually referred to as a "blue north'er." In the Panhandle and South Plains Regions, it could mean a severe hardship for livestock caught in the open. If the mass of cold air reaches the Rio Grande Valley, it can cause great damage to the vegetable crops and citrus groves, in turn affecting Texas's economy.

The most intense cold wave on record throughout the State occurred on February 11-13, 1899. Minimum temperatures ranged from 6 to 23 degrees below zero over the northern portion of the State to about 12 degrees above zero over the southern portion. Galveston recorded a temperature of 7.5 degrees F; Galveston Bay was covered over with thin ice except in the tide current.

A very serious cold wave occurred on January 10-11, 1918. It was zero degrees in North Texas and temperatures from 20 to 50 degrees above zero along the lower Gulf Coast. The year 1983 brought the coldest December on record to the State with severe citrus and vegetable crop losses in the Rio Grande Valley. The loss to the citrus and agricultural industry was $500 million. The farm workers and laborers in related industries suffered $30 million in income loss.

Ice Storm

An ice storm occurs when rain falls out of the warm and moist upper layers of the atmosphere into a cold and dry layer near the ground. The rain freezes on contact with the cold ground and

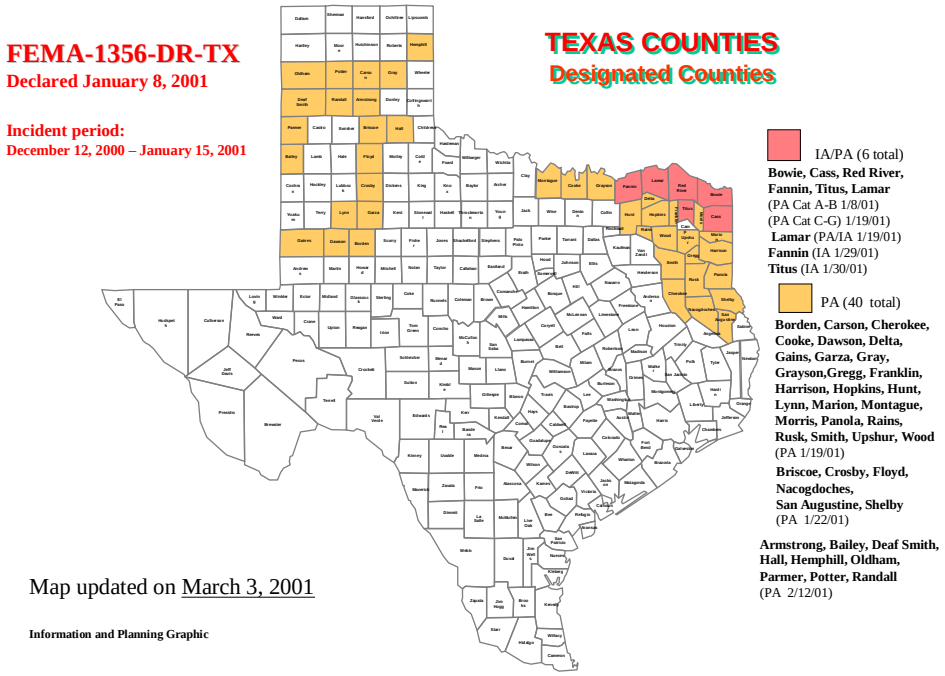
accumulates on exposed surfaces. If a half inch of rain freezes on trees and utility wires, damage can occur, especially if accompanied by high winds, thus half an inch is used as the criteria before an icing event is categorized as an "ice storm." Events with less ice are simply called "winter storms." Ice storms usually occur from late December into mid-February with most of them occurring in North Central and Northeast Texas. On January 8-9, 1977, an ice storm hit the North and Northeast portion of Texas. Up to three inches of ice caused six deaths and extensive damage. On February 7 and 8, 1978, Johnson, Ellis, Hill, and Navarro Counties had snow and ice-covered roads, causing three traffic fatalities and widespread damage. Thousands of motorists were stranded on U.S. Interstate Highway 35 near Hillsboro. On December 30 and 31, 1978, a devastating ice storm hit the City of Dallas and Dallas County particularly hard. Damage estimates reached $14 million and six deaths were storm related.

A series of severe winter events occurred during the period of January 11-14, 1982, when Texas was hit on consecutive days with a record cold wave, then freezing rain and drizzle, followed by a heavy snow storm and then topped off with another blast of arctic air.

On January 11, 1982, a bitterly cold arctic air mass moved into North Texas and spread south bringing below-zero weather to the Panhandle and 32 degree temperatures as far south as Brownsville. This was followed on January 12 by freezing rain north of a Laredo-Corpus Christi line and freezing drizzle south of that line. Roads became treacherous, especially for unaccustomed drivers. A 20-car pileup injured many in Brownsville. On January 13, a major snowstorm developed in West Central Texas and spread eastward across Texas. The heaviest snow, in excess of 9 to 10 inches, fell in a narrow, 15-20 mile wide band through Central Texas. About 15 inches fell in the Waco area. Numerous autos and trucks were stranded in the heavier snow area. It brought the first measurable snow (1/2 inch) to San Antonio in 9 years. On January 14, another surge of cold air, not as severe as January 11, brought a hard freeze as far south as the lower Rio Grande Valley causing damage to the winter vegetable and sugar cane crops but did not seriously damage the citrus crop.

In the year 2000, a weather event occurred which resulted in the only Federal disaster declaration for an ice storm in the State. A cold air mass sank into three State regions in the extreme Northeast part of the State. With temperatures hovering in the high teens, a pattern of overrunning Gulf moisture resulted in four days of alternating sleet and freezing rain. Between 2" and 4" of ice accumulated on the ground and on trees. The icing of the roads brought ground transportation to a halt; the ice on the trees brought millions down, which further blocked the roads, and more importantly, crippled the local electric power grid. As power remained out for days, neighborhoods became unlivable as local water supplies and sewage systems broke down, driving thousands into public sheltering. As is typical in these events, physical damages to structures from the ice were light.

Map 2-17: Federally Declared Disaster Areas Following Incident 1356 in Texas



MITIGATION MEASURES

Winter storms can affect Texans in a variety of ways. Loss of electric power and telephone service are the most common effects of any severe winter storms. These storms can disrupt transportation, reduce natural gas supplies, and freeze water mains disrupting the economy of the affected areas, causing personal inconvenience by disrupted and economic loss to businesses.

For the above reasons, it is important that all persons in a winter storm are aware of the dangers that accompany these storms and plan in advance to avoid situations that could cause personal injury and undue hardship. First of all, everyone that could be affected should be familiar with the bulletins issued by the NWS. A winter storm watch indicates there is a possibility of severe winter weather conditions within a geographic area that will be specified in the bulletin. A winter storm warning indicates that severe weather conditions are occurring in the area. Understanding the meaning of such weather bulletins will assist in emergency planning activities.

Communities can prepare for severe winter weather by ensuring that the necessary equipment for plowing and sanding is operational; adequate personnel are alerted to be available in the event they are needed; and communications lines are established to the agencies that could be needed to handle any storm related emergencies.

Community leaders must ensure that the general public receives the bulletins issued by the NWS and that they are aware of the dangers inherent in winter storms.

The third largest cause of insured property loss is from water damage caused by unprotected pipes and plumbing that freeze during a Texas “blue north’er.” These losses can be prevented by ensuring all exposed pipes and exterior plumbing is properly insulated and protected by some

source of heat during the subzero temperatures. These precautions will prevent thousands of dollars of damage to walls, ceilings, carpets, and furniture when the owner is caught away from home during a winter storm or suffers from an acute power failure during an ice storm. For example, in January of 1997, many residents of Liberty Hill, Austin, and isolated Texas Hill Country residents, experienced a massive, weeklong, ice storm that paralyzed the area. This storm caused power outages for an extended period of days as disruption of utilities from falling tree limbs and treacherous road conditions prevented timely repairs.

HAZARD PROFILE WORKSHEET

Hazard: Severe Winter Storm	
Potential Severity Of Impact:	
Substantial	• Multiple deaths • Complete shutdown of facilities for 30 days or more. • More than 50 percent of property destroyed or with major damage.
Major	• Injuries and/or illnesses result in permanent disability. • Complete shutdown of critical facilities for at least 2 weeks. • More than 25 percent of property destroyed or with major damage.
Minor	• Injuries and/or illnesses do not result in permanent disability. • Complete shutdown of critical facilities for more than 1 week. • More than 10 percent of property destroyed or with major damage.
Limited X	• Injuries and/or illnesses are treatable with first aid. • Minor quality of life lost. • Shutdown of critical facilities and services for 24 hours or less. • Less than 10 percent of property destroyed or with major damage.

Frequency Of Occurrence:	**Seasonal Pattern:**
☐ Highly likely: Event probable in next year. ☐ Likely: Event probable in next 3 years. ☒ Occasional: Event possible in next 5 years. ☐ Unlikely: Event possible in next 10 years.	Winter Months, Early Spring Months

Source Documents, Studies, Maps, Etc. Researched:
NWS, NOAA

Probable Duration:
From a few days to a few weeks

Warning Time (Potential Speed of Onset):
☐ Minimal (or no) warning.
☐ 3 to 6 hours warning.
☒ 6 to 12 hours warning.
☐ More than 12 hours warning.

Cascading Potential:

Existing Warning Systems:
NWS, NOAA

WINDSTORM

Extreme winds other than tornadoes are experienced in all regions of the United States. **Windstorms are defined as a storm marked by high winds with little or no precipitation**. Extreme windstorm events are associated with tropical cyclones, severe thunderstorms, and downbursts. Winds can vary from zero at ground level to 200 mph in the upper atmospheric jet stream. The Texas Panhandle is most vulnerable to windstorms as there are not many trees there to provide a natural wind break or barrier.

Map 2-18: Wind Zones in Texas

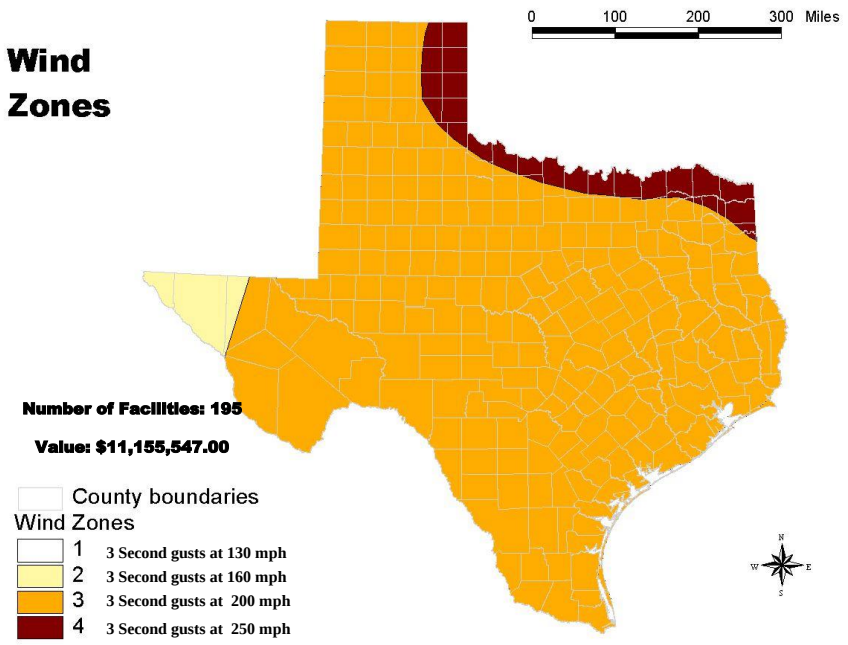


Table 2-24: Beaufort Wind Scale

Force	Wind (Knots)	WMO Classification	Appearance of Wind Effects	
			On the Water	**On Land**
0	Less than 1	Calm	Sea surface smooth and mirror-like	Calm, smoke rises vertically
1	1-3	Light Air	Scaly ripples, no foam crests	Smoke drift indicates wind direction, still wind vanes
2	4-6	Light Breeze	Small wavelets, crests glassy, no breaking	Wind felt on face, leaves rustle, vanes begin to move
3	7-10	Gentle Breeze	Large wavelets, crests begin to break, scattered whitecaps	Leaves and small twigs constantly moving, light flags extended
4	11-16	Moderate Breeze	Small waves 1-4 ft. becoming longer, numerous whitecaps	Dust, leaves, and loose paper lifted, small tree branches move
5	17-21	Fresh Breeze	Moderate waves 4-8 ft taking longer form, many whitecaps, some spray	Small trees in leaf begin to sway
6	22-27	Strong Breeze	Larger waves 8-13 ft, whitecaps common, more spray	Larger tree branches moving, whistling in wires
7	28-33	Near Gale	Sea heaps up, waves 13-20 ft, white foam streaks off breakers	Whole trees moving, resistance felt walking against wind
8	34-40	Gale	Moderately high (13-20 ft) waves of greater length, edges of crests begin to break into spindrift, foam blown in streaks	Whole trees in motion, resistance felt walking against wind
9	41-47	Strong Gale	High waves (20 ft), sea begins to roll, dense streaks of foam, spray may reduce visibility	Slight structural damage occurs, slate blows off roofs
10	48-55	Storm	Very high waves (20-30 ft) with overhanging crests, sea white with densely blown foam, heavy rolling, lowered visibility	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	56-63	Violent Storm	Exceptionally high (30-45 ft) waves, foam patches cover sea, visibility more reduced	
12	64+	Hurricane	Air filled with foam, waves over 45 ft, sea completely white with driving spray, visibility greatly reduced	

Source: www.wikipedia.org

Table 2-25: Severe Storm/Thunderstorm/Wind Occurrences in Texas

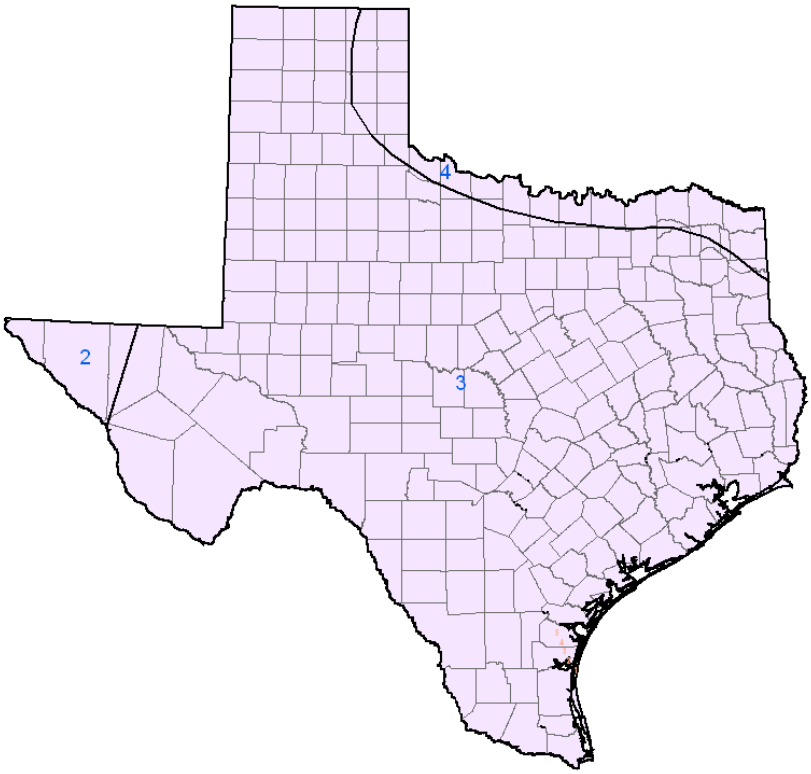
Begin Date	Hazard Type	State	County	Injuries	Fatalities	Property Damage	Crop Damage
1/29/08	"Severe Storm/Thunder Storm, Wind"	TX	Lamar	0	0	250 K	0
1/31/08	"Severe Storm/Thunder Storm, Wind"	TX	Bexar, Guadalupe, Williamson	0	0	250 K	0
4/2/09	"Severe Storm/Thunder Storm, Wind"	TX	Travis	0	0	100 K	0
4/9/09	"Severe Storm/Thunder Storm, Wind"	TX	Taylor	0	0	10 K	0
4/17/09	"Severe Storm/Thunder Storm, Wind"	TX	Grayson	1	0	15 K	0
Total				1	0	625 K	0

Source: http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms

HIGH WIND

Texas is subject to damaging high winds that are not the result of a tornado or hurricane event. Generally the risk is greatest in the northern part of the State.

Map 2-19: Wind Zones in Texas



Legend: Area 4 = highest risk Area 3 = moderate risk Area 2 = low risk

In Texas, a dozen times each year, local shelters must be opened to house citizens whose homes have been destroyed by wind. These windstorms are not from tornado or hurricane events, but from passing thunderstorms or sustained wind events. Almost universally, it is manufactured homes which do not survive these non-tornado events. In 2005, shelters were opened 11 times, with approximately three times that many homes affected. 2006 was a slightly better year, with local shelters opened only 9 times.

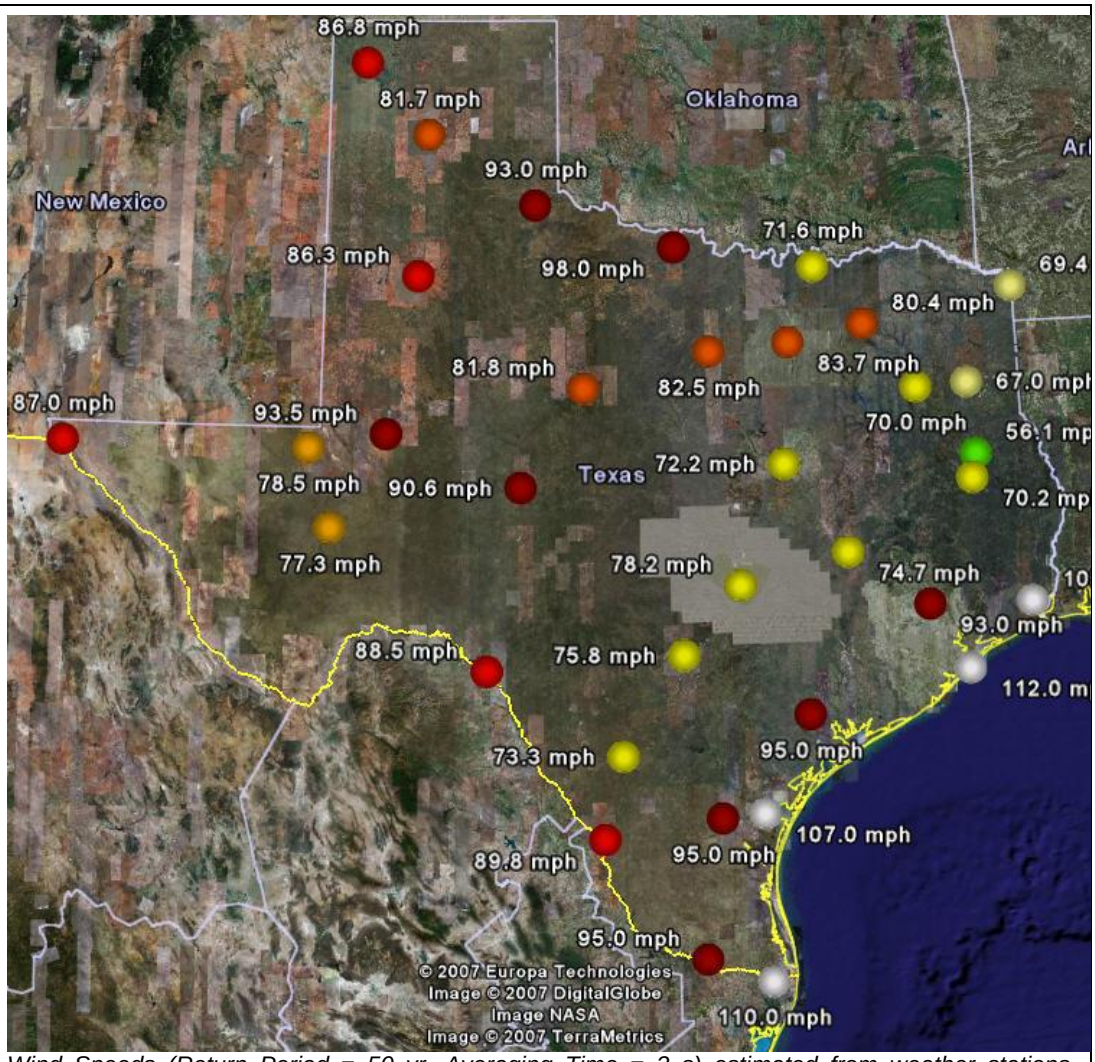
The table below results from a regression analysis of the measured wind at the Lubbock, Texas airport over the last 40 years. From it we can learn that a manufactured home or barn in the area in the next 10 years should expect to experience sustained winds of 65.3 mph at least once, and will experience winds from a passing thunderstorm of at least 72.8. This information should give pause to that portion of the population that lives in pre-HUD manufactured homes or in recreational vehicles.

Table 2-26: High Wind Frequency of Occurrence for Lubbock, Texas

Return Period (years)	Wind Speed (NTS/TS/Mixed)
2	56.4/58.2/60.6
5	61.8/67.0/69.5
10	65.3/72.8/73.8
25	69.8/80.2/80.9
50	73.1/85.6/86.3
100	76.4/91.0/91.5
500	84.6/104.0/104.0

Data in miles per hour. NTS = non-thunderstorm TS = thunderstorm Mixed = recommended design wind

Map 2-20: Example Wind Speeds in Texas



Wind Speeds (Return Period = 50 yr, Averaging Time = 3 s) estimated from weather stations throughout Texas. (Background courtesy of Google Earth)

The graphic above is the mixed analysis for 35 other stations across Texas, but displaying the 50 year event. Data for stations near the coast is skewed by wind measured from hurricane events.

ANALYSIS

Risk from high winds is greatest on the High Plains of the Panhandle, and just south of there, but the population density in these areas is small. The risk is less but still substantial in the Dallas–Ft Worth area, but here the population density is also very high. This is the most vulnerable area in the State.

MITIGATION

Well-written and –enforced codes will reduce or eliminate damages from high winds. The State mandated International Residential Code 2000 specifies a 90 mph building code for all non-coastal counties. Properly installed, modern manufactured housing, (Wind Zone I homes are required in the Panhandle and Dallas-Ft. Worth (DFW) areas) will withstand the winds shown in Table 2-26. Older model pre-HUD manufactured homes, or newer manufactured homes that were not properly tied down, or whose tie downs have failed, are at risk in these wind events; It is these homes that are damaged or destroyed and whose inhabitants the community must shelter a dozen times a year. That small portion of the population that lives in Recreational Vehicles (RVs) is certainly at risk. Local communities should provide warning and pre-sheltering for its RV residents during high wind events.

HAZARD PROFILE WORKSHEET

Hazard: Windstorm	
Potential Severity Of Impact:	
Substantial	• Multiple deaths • Complete shutdown of facilities for 30 days or more. • More than 50 percent of property destroyed or with major damage.
Major	• Injuries and/or illnesses result in permanent disability. • Complete shutdown of critical facilities for at least 2 weeks. • More than 25 percent of property destroyed or with major damage.
Minor	• Injuries and/or illnesses do not result in permanent disability. • Complete shutdown of critical facilities for more than 1 week. • More than 10 percent of property destroyed or with major damage.
Limited X	• Injuries and/or illnesses are treatable with first aid. • Minor quality of life lost. • Shutdown of critical facilities and services for 24 hours or less. • Less than 10 percent of property destroyed or with major damage.

Frequency Of Occurrence:	**Seasonal Pattern:**
❑ Highly likely: Event probable in next year. ☒ Likely: Event probable in next 3 years. ❑ Occasional: Event possible in next 5 years. ❑ Unlikely: Event possible in next 10 years.	

Source Documents, Studies, Maps, Etc. Researched:
Local Mitigation Plans, www.thmp.info

Probable Duration:
Few hours

Warning Time (Potential Speed of Onset):
❑ Minimal (or no) warning.
☒ 3 to 6 hours warning.
❑ 6 to 12 hours warning.
❑ More than 12 hours warning.

Cascading Potential:

Existing Warning Systems:
Local weather forecasts

Assessing Vulnerability and Estimating Losses by Jurisdiction

Requirement §201.4(c)(2)(ii): *The State plan shall include an overview and analysis of the State's vulnerability to the hazards described in this paragraph, based on estimates provided in local risk assessments as well as the State risk assessment. The State shall describe vulnerability in terms of the jurisdictions most threatened by the identified hazards, and most vulnerable to damage and loss associated with hazard events.*

GENERAL

Below are summaries of the jurisdictional assessments and the estimated losses. More details can be found in the various local mitigation action plans that were used to compile this data.

Note that there are variations in the way the vulnerability/risk assessment and loss estimation data is reported in the various local plans. Listed in the Plan are summaries of what each local plan reported to TDEM. Loss estimations for the local plans that are listed in this Plan were derived by using HAZUS-MH.

The jurisdictional plans contain maps that identify the hazard areas. Each plan outlines in great detail each jurisdictions risks by hazard and vulnerable by hazard. These risk assessments were used to develop the local mitigation actions as articulated in each of the plans. A summary of the estimated loss for natural hazards is found in Table 2-28.

SUMMARY OF VULNERABILITY AND RISK

Below you will see a summary of the State's vulnerability in terms of the areas of the State most threatened and vulnerable to damage and loss. This data is a summary compilation from the local plans and from past disaster declaration information. What follows are local government assessments. Vulnerability and loss data for State facilities are located at the end of this section.

TROPICAL STORMS AND HURRICANES

The risk is to the Texas Gulf Coast 22 counties (Cameron, Willacy, Kenedy, Kleberg, Nueces, San Patricio, Refugio, Aransas, Calhoun, Victoria Jackson, Matagorda, Chambers, Hardin, Newton, Orange, Jefferson, Jasper, Liberty, Brazoria, Harris, and Galveston) and all of the cities in those counties. The people at risk are 28% (5,601,462) of the total State population.

Estimated property losses: in excess of $21 billion depending at what geographic location on the Texas Gulf Coast the hurricane/tropical storm strikes. This is based on past disaster declarations and estimates from local mitigation action plans. Note: damages from Tropical Storm Allison in 2001 reached almost $5 billion.

FLOODS

Texas Hill Country is one of the three most flash flood prone areas in world. Estimated losses based on past disaster declarations and local mitigation action plans are approximately $2 billion.

TORNADOES

One of the worst areas of the State is North Central Texas. Estimated losses based on past disaster declarations and estimates from local mitigation action plans are approximately $3 billion.

WILDFIRES

Texas continues to face major fire risk each year similar to other states. This risk is compounded by the fact that in the Hill Country rapid population growth and unconstrained building in UWI areas has the potential for a major catastrophe.

In Texas, the greatest fire danger threats are forest brush and grass fires. The East Texas Piney Woods belt of commercial timber is the most susceptible to forest fires, but moderate to low UWI areas exist.

Total costs (fire suppression and staging) for the wildfires in 1996, 1998, 1999, 2000 and 2006 are approximately $88,486,604 (this is total of State costs and FEMA share). Local estimated losses for wildfires are approximately $10 million.

DROUGHT

Drought is often thought of as a condition of climatic dryness that is severe enough to reduce soil moisture and water supplies below the requirements necessary to sustain normal plant, animal, and human life. In every decade in the 20th century, Texas was a victim of one or more serious droughts. For more information on droughts, see the Drought Preparedness Plan (Attachment 2).

Texas has had 2,921 multi-county and regional disaster declarations due to drought conditions. Estimated losses from drought from the local plans are approximately $325 million (mainly crop damage).

LOCAL RISK ASSESSMENTS

Loss estimations for the local plans that are listed in this Plan were derived by using HAZUS-MH and local plan risk assessments.

TEXAS COLORADO RIVER FLOODPLAIN COALITION (TCRFC)

The TCRFC is an organization of over 50 communities from Brownwood in the Texas Hill Country to Matagorda Bay in the Gulf of Mexico. The TCRFC wrote a plan that covers the following communities: (Counties): Blanco, Burnet, Lampasas, San Saba, Mills, Bastrop, Fayette, Williamson, Colorado, Matagorda and Wharton; (Cities): Johnson City, Brownwood, Bertram, Cottonwood Shores, Granite Shoals, Highland Haven, Meadowlakes, Marble Falls, Kempner, Lampasas, Lometa, Mason, San Saba, Goldthwaite, Bastrop, Elgin, Smithville, Carmine, Flatonia, LaGrange, Lago Vista, Lakeway, Mustang Ridge, Point Venture, San Leanna, West Lake Hills, Columbus, Eagle Lake, Bay City, Palacios, El Campo, Wharton. The total population in 2000 was 1,371,439 in 15 counties spreading over 14,000 square miles.

Vulnerability assessment and estimated loss data for TCRFC

(a) Floods

(1) A 100-year flood along the main stem of the Colorado River would impact approximately 12,400 structures and 3,756 vehicles.

(2) People at risk: 105,500. Total damages from that flood would exceed $377 million in personal property (structures, contents and vehicle) losses. The expected annual damages total $25.186 million. The Lake Travis reach would experience the greatest economic impact of a 100-year flood and so has the highest annual expected

damages. A 100-year flood even along the Wharton reach would impact more structures than any other location along the main stem of the Colorado River.

(3) According to the NFIP, as of August 2002, there are 21 properties in the Basin on the FEMA list of Target Repetitive Loss Properties. Together these properties have experienced 77 losses for cumulative losses of $2.2 million. They are expected to incur damages in the future of almost $1.3 million.

(b) Hurricanes

(1) The entire building stock in the Lower Colorado River Basin, valued at over $262 billion, is exposed to the threat of hurricane winds.
(2) The total number critical facilities in 975.
(3) Potential Annualized losses for residential buildings at risk is approximately $84.3 million.
(4) Potential losses for commercial buildings are approximately $9.7 million.
(5) The total expected annualized property losses are approximately $98.6 million.

(c) Drought, Urban/Wildland Fires, Tornadoes, Hail, Thunderstorms, and Terrorism

(1) Residential buildings at risk: 754,414 with a value of $226.4 billion. Commercial buildings at risk: 5,674 with a value of $24.5 billion. Critical facilities: 975; Infrastructure: 9,087. Hazardous Material facilities: 195. Population at risk: 1,371,439.
(2) Expected annualized property losses from drought: $30,564,859.
(3) Expected annualized property losses from tornadoes: $14,616,891.
(4) Expected annualized losses from hail: $1,982,742.
(5) Expected annualized losses from thunderstorms: $2,344,504.

(d) Oil Pipeline Rupture

(1) Total potential residential buildings at risk: 14,933 with a value of $2,391,707.
(2) Potential commercial buildings at risk: 81 with a value of $176,058
(3) People potentially at risk: 30,570

(e) Dam Failures

(1) The Lower Colorado River Authority (LCRA) operates six major dams on the lower portion of the Colorado River in Central Texas. All are owned by LCRA with the exception of the Tom Miller Dam that is leased from the City of Austin until December 2020.
(2) Potential residential buildings at risk: 52,611 with a value of $15,843,723,720.
(3) Potential commercial buildings at risk: 140 with a value of $609,754,404.
(4) More than 45,000 people live within 10 miles downstream of high hazard dams.

GUADALUPE-BLANCO RIVER AUTHORITY (GBRA)

The Guadalupe River is one of the most biologically diverse rivers in the United States, stretching from the springs and canyons of the Texas Hill County to the marine environment of the Gulf Coast wetlands and San Antonio Bay. The jurisdictions included in the GBRA plan include: Kendall County and the city of Boerne; Caldwell County and the cities of Lockhart, Luling and Martindale; DeWitt County and the cities of Cuero, Nordheim, Yoakum, and Yorktown; Gonzales County and the city of Gonzales, Nixon, and Waelder; Calhoun County and the cities of Point Comfort, Port Lavaca, and Seadrift; Refugio County and the cites of Austwell, Bayside, Refugio, and Woodsboro; Victoria County and the city of Victoria. The total population of the Guadalupe River Basin in 2000 was 471,744 covering 7,301 square miles

Vulnerability assessment and estimated loss data for GBRA communities:

(a) Hurricanes

(1) The entire building stock in the Guadalupe River Basin, values at over $11.4 billion, is exposed to the threat of hurricane winds. Annualized expected property losses from hurricane winds in the Guadalupe River Basin total over $38 million per year. The total number of critical facilities is 492.

(2) Number of people exposed to the threat of hurricane winds: 471,774

(b) Flooding

(1) NFIP information: There are 9217 policies in effect with a total coverage of approximately $1.3 million. Total losses since 1971: 4133. Total dollars paid (historical): Approximately $144.5 million.

(2) Repetitive loss information: According to the NFIP, there are 76 properties on the Target Repetitive Loss Properties list. Together these properties have collectively incurred a total of 180 losses for cumulative losses of almost $16.7 million.

(3) An expected annualized loss for residential and commercial buildings at risk is approximately $12.7 million.

(4) Number of people in the 100-and 500- year floodplains: 29,667

(5) Thunderstorms, Drought, Hailstorms, Tornadoes, Urban/Wildland Fires, Winter Storms, Terrorism

(6) All the population, buildings, critical facilities, infrastructure, lifelines and hazardous materials facilities are considered exposed to the hazard and could potentially be affected. People at risk: 471,774.

(7) Total residential buildings: 214,237 with a value of $52,282,213,000. Total commercial buildings: 1456 with a value of $6,329,878,000. Critical facilities: 492. Infrastructure and lifelines (oil, gas, pipe, highway and railroad): 6223 kilometers.

(8) Annualized expected property losses for thunderstorms: $3,622,383.

(9) Annualized expected property losses for drought: $1,054,096.

(10) Annualized expected property losses for hailstorms: $852,048

(11) Annualized expected property losses for tornadoes: $269,685

(c) Pipeline Rupture

(1) A total of 133 accidents from energy pipeline failures have occurred in the Guadalupe River Basin between 1968 and 2002.

(2) Oil Pipeline: Potential residential and commercial buildings at risk: 7148 with a value of $1,265,940.

(3) Gas Pipeline: Potential residential and commercial buildings at risk: 9599 with a value of $1,738,027.

(d) Dam Failure

(1) Number of dams: 37 high-hazard; 20 significant hazard and 139 low-hazard

(2) In the 7-county planning area, an estimated 537 people live within 10 miles downstream of high-hazard dams.

(3) Residential buildings potentially at risk: 163 with a value of $57,822,791

(4) Commercial buildings at risk: 5 with a value of $785,436

ALAMO AREA COUNCIL OF GOVERNMENTS (AACOG)

The mitigation plans covers 12 counties (Atascosa, Bandera, Bexar, Comal, Frio, Gillespie, Goliad, Guadalupe, Karnes, Kerr, Medina, and Wilson and 56 cities (Charlotte, Christine, Jourdanton, Lytle, Pleasanton, Poteet, Bandera, Alamo Heights, Balcones Heights, China Grove, Castle Hills, Converse, Elmendorf, Fairs Oaks Ranch, Grey Forest, Helotes, Hill Country Village, Hollywood Park, Kirby, Leon Valley, Live Oak, Olmos Park, San Antonio, Selma, Shavano Park, Somerset, Terrell Hills, Universal City, Windcrest, Bulverde, Garden Ridge, New Braunfels, Dilley, Pearsall, Fredericksburg, Goliad, Cibolo, Marion, New Berlin, Schertz, Seguin, Falls City, Karnes City, Kenedy, Runge, Ingram, Kerrville, Castroville, Devine, Hondo, La Coste, Natalia, Floresville, La Vernia, Poth, and Stockdale). The Alamo Region covers almost 12,000 square miles and a population of 1,814,796.

Vulnerability assessment and estimated loss data for AACOG communities:

(a) Flooding
- (1) Total people at risk: 153,081
- (2) Residential buildings: 48,580;
- (3) Commercial buildings: 809; Critical facilities: 29;
- (4) Hazardous materials facilities: 9
- (5) Potential annualized losses: $51,196,000
- (6) Targeted repetitive loss properties: 68
- (7) Losses paid: 148
- (8) Cumulative losses paid: $16,372,939,000
- (9) Average Annual insured loss: $1,103,649,000

(b) Hurricane Winds
- (1) Potential annualizes losses for residential and commercial buildings: $34,928,005.
- (2) People: 1,814,796
- (3) Critical facilities: 1167

(c) Tornadoes, Hail, Thunderstorms
- (1) People: 1,814,796
- (2) Residential buildings: 747,937; Commercial buildings: 6794; Critical Facilities: 1167; Infrastructure and lifelines (oil & gas pipelines, highways and railroads): 5774 kilometers; Hazardous materials facilities: 69
- (3) Annualized expected property losses for tornadoes: $3,071,921
- (4) Annualized expected property losses for hail: $1,382,247
- (5) Annualized expected property losses for thunderstorms: $2,209,924

(d) Dam Failure
- (1) Potential people at risk: 24,257
- (2) Residential facilities: 23,839 with a value of $7,197,912,164
- (3) Commercial facilities: 81 with a value of $261,901,446

(e) Oil Pipelines
- (1) Potential people at risk: 30,772
- (2) Residential buildings: 11,664 with a value of $1,572,368,000
- (3) Commercial buildings: 109 with a value of $206,966,000

(f) Gas Pipelines
    (1) Potential people at risk: 5276
    (2) Residential buildings: 2941 with a value of $432,093,000
    (3) Commercial buildings: 49 with a value $82,221,000

HEART OF TEXAS COG (HOTCOG)

The HOTCOG Mitigation Action Plan covers the following counties: Bosque, Falls, Freestone, Hill, Limestone, and McLennan. Area covered: 103,227 square miles.

Vulnerability and Risk Assessment Data
Totals (Note: hazards such as tornadoes, winter storms, hail, and thunderstorms) affect the area equally as for numbers of people as well as the numbers of residential, commercial, critical facilities, etc. that are at risk).

- Population: 321,536
- Residential buildings: 120,725 with a value of $26,380,139
- Commercial Buildings: 810 with a value of $3,647,566
- Infrastructure and Lifelines: Oil Pipe – 4144 km; Gas Pipe – 1593 km; Highways – 1611 km; Railroads: 522 km
- Hazardous Materials Facilities 29
- Critical Facilities: 2128

(a) Riverine Flooding (300-foot buffered area around the major river reaches)
    (1) Residential buildings: 3553. Exposure: $870,497
    (2) Commercial buildings: 9. Exposure: $82,323
    (3) People: 10,506
    (4) Critical facilities and infrastructure: 24

(b) Hurricane Winds
    (1) Annualized losses for Residential buildings: $4,660,090
    (2) Annualized losses for Commercial Buildings: $632,580

(c) Tornadoes - Potential Annualized Losses: $629,000

(d) Hail - Potential Annualized Losses: Property - $227,000; Crop - $1,311,000

(e) Winter Storm - Potential Annualized losses: $4,481,000

(f) Thunderstorm - Potential annualized Losses: $297,000

(g) Hazardous Materials Release
    (1) Fixed Site Toxic Release:
        i. Immediate (primary) Impact – 921 units and 2,821 people at risk
        ii. Secondary Impact: 20,513 units and 61,135 people at risk
    (2) Mobile Site Toxic Release
        i. Primary Impact – 19,004 units and 49,684 people at risk.
        ii. Secondary Impact: 71,849 units and 191,192 people at risk.

(h) Gas Pipelines
  (1) Primary Impact - 4113 residential units, 25 commercial units, and 8891 people at risk.
  (2) Secondary Impact – 15,690 residential units, 73 commercial units, and 36,388 people

(i) Oil Pipelines
  (1) Primary Impact: 1819 residential units, 18 commercial units and 4587 people at risk
  (2) Secondary Impact: 7790 residential units, 89 commercial units, and 20, 089 people

(j) Urban and Wildland Fire
  (1) From 1989 to 1998 there were 112,834 incidents with a total dollar loss of $45,146,128
  (2) Potential Annualized losses: $5,011,000

(k) Earthquakes
  (1) Total annualized expected property losses: $94,992
  (2) Total critical facilities: 2128

(l) Nuclear Power Plants
  (1) The Comanche Peak Steam Electric Station in is located 4.5 miles northwest of Glen Rose in Somervell County and about 80 miles southwest of downtown Dallas. It is within enough proximity to Bosque and Hill Counties and could therefore pose immediate (15 km radius) or secondary (75 km radius) effects.
  (2) Primary Risk: zero (0) units and people
  (3) Secondary Risk: 19, 566 units and 41,211 people at risk

(m) Dam Failure
  (1) Total Dams: 355. Breakdown: 24-high hazard. 20-significant hazard, 292-low hazard and 19-information not available.
  (2) Number of buildings: 66,454
  (3) Number of people at risk: 182,967

BRAZOS VALLEY COUNCIL OF GOVERNMENTS (BVCOG)

The counties covered by the BVCOG Mitigation Action Plan are: Brazos, Burleson, Grimes, Leon, Madison, Robertson, and Washington. Area covered: 4250 square miles.

Vulnerability and Risk Assessment Data
Totals (Note: hazards such as hurricane winds, tornadoes, winter storms, hail, and thunderstorms) affect the area equally as for numbers of people as well as the numbers of residential, commercial, critical facilities, etc. that are at risk).

- Population: 267,085
- Residential Buildings: 93,838 with a value of $20,405,875,000
- Commercial Buildings: 751 with a value of $3,255,114
- Critical facilities: 1253
- Infrastructure and Lifelines (kilometers):
  - Oil Pipe: 1766
  - Gas Pipe: 8784
  - Highway: 1098

- Railroad: 782
- Hazardous Materials Facilities: 24 sites

(a) Riverine Flooding
  (1) Potential affected exposure for 100-year (riverine flooding)
  (2) Residential buildings: 60,004 with potential annualized losses of $104,206,000
  (3) Commercial buildings: 237 with potential annualized loses of $1,048,000
  (4) People at risk: 126, 989

(b) Hurricane Winds
  (1) Residential: Potential annualized losses of $9,217,715
  (2) Commercial: Potential annualized loses of $1,336,505

(c) Tornadoes - Potential annualized losses: $801,924

(d) Hail - Potential annualized loses: $164,590

(e) Winter Storms - Potential annualized losses: $1,023,415

(f) Thunderstorms - Potential annualized losses: $97,153

(g) Drought
  (1) Annualized expected agricultural product market value exposed to drought: $47,368,098

(h) Fixed Site Toxic Release
  (1) Immediate (Primary) Impact – 1153 units and 3429 people at risk
  (2) Secondary Impact: 22,050 units and 67,069 people at risk

(i) Mobile Site Toxic Release
  (1) Immediate (Primary) Impact: 14,723 units and 35,507 people at risk
  (2) Secondary Impact: 56,816 units and 157,062 people at risk

(j) Gas Pipelines
  (1) Immediate (Primary) Impact: 19,083 residential units, 147 commercial units, and 44.459 people at risk
  (2) Secondary Impact: 48,938 residential units, 387 commercial units and 125,162 people at risk

(k) Oil Pipelines
  (1) Immediate (Primary) Impact: 4921 residential units, 42 commercial units, and 13,0343 people at risk
  (2) Secondary Risk: 12,489 residential units, 104 commercial units, and 31,891 people at risk

(l) Urban/Wildland Fires - Potential annualized losses: $3,837,301

(m) Earthquake - Potential annualized loss for residential and commercial buildings: $101,410

(n) Dam Failure
  (1) Number of dams by hazard level

i. High: 15
ii. Significant: 35
iii. Low: 258
iv. Info not available: 7

(2) Estimated exposure of people and buildings (high hazard only)
i. Buildings: 9822
ii. Value: $2,249,560
iii. People: 18,439

SOUTH PLAINS ASSOCIATION OF GOVERNMENTS (SPAG)

The SPAG Regional Mitigation Action Plan covers the following counties: Bailey, Cochran, Crosby, Dickens, Floyd, Garza, Hale, Hockley, King, Lamb, Lubbock, Lynn, Motley, Terry, and Yoakum. The total population is 377,871. These counties are in the northwestern part of Texas near the Texas Panhandle.

Vulnerability and Risk Assessment Data
Totals (Note: hazards such as hurricane winds, tornadoes, winter storms, hail, and thunderstorms) affect the area equally as for numbers of people as well as the numbers of residential, commercial, critical facilities, etc. that are at risk).

- Population: 377,871
- Residential Buildings: 137,229 with a value of $30,294,000
- Commercial Buildings: 1390 with a value of $5,664,000
- Critical Facilities: 381
- Oil Pipeline: 777 kilometers (km)
- Gas Pipe: 758 km
- Highways: 2320 km
- Railroads: 497 km
- Hazardous Materials Facilities: 19

(a) Riverine Flooding
(1) People at risk: 24,882
(2) Potential annualized losses
i. Residential: $3,241,749
ii. Commercial: $1,107,961
(3) Critical facilities
i. 100-year flood: 10 with a slight risk and 371 with a negligible risk
ii. 500-year flood: 8 with a moderate risk, 6 with a slight risk at 367 with a negligible risk

(b) Hurricane Winds - Potential Annualized losses
(1) Residential: $574,190
(2) Commercial: $80, 273

(c) Tornadoes - Potential annualized losses: $331,410
(d) Hail - Potential annualized losses
(1) Property: $774,949
(2) Crops: $5,425,923

(e) Winter Storms - Potential annualized losses: $1,791,415

(f) Thunderstorms - Potential annualized losses: $2,723,460

(g) Drought - Potential annualized losses: $111,349,775

(h) Toxic Release
  (1) Gas Pipelines (Potential Annualized Losses)
    i. Residential: $124,977,000
    ii. Commercial: $14,968,000
    iii. People at risk: 1,468
  (2) Oil Pipelines (Potential Annualized Losses)
    i. Residential: $13,960,000
    ii. Commercial: $5,903,000
    iii. People at risk: 160

(i) Dam Failure
  (1) Total dams: 77
    i. High risk: 5
    ii. Significant risk: 13
    iii. Low risk: 59
    iv. People at risk (high hazard dams): 139
    v. Residential structure values: $1,193,000

WEST CENTRAL TEXAS (WCTCOG)

The WCTCOG Regional Mitigation Action Plan covers the following counties: Brown, Callahan, Coleman, Comanche, Eastland, Fisher, Haskell, Jones, Kent, Knox, Mitchell, Nolan, Runnels, Scurry, Shackelford, Stephens, Stonewall, and Throckmorton. The total population is 324,901.

Vulnerability and Risk Assessment Data

(a) Riverine Flooding

(a) Potential annualized losses
    i. Residential: $22,473,000
    ii. Commercial: $3,897,000
  (2) People at Risk: 29,633
  (3) Critical facilities: 381

(b) Hurricane Winds
  (1) Potential Annualized losses
    i. Residential: $1,432,981
    ii. Commercial: $193,750
  (2) Critical facilities: 341

(c) Tornadoes - Potential annualized property losses: $537,812

(d) Hail - Potential Annualized losses
  (1) Property: $941,800
  (2) Crop: $4,905,400

(e) Winter Storms - Potential annualized property losses: $5,310,700

(f) Thunderstorms - Potential annualized property losses: $4,243,173

(g) Drought - Potential annualized property losses: $105,322,322

(h) Toxic Release
  (1) Number residential buildings: 122
  (2) Number of commercial buildings: 2
  (3) Number of people: 377

(i) Gas Pipelines
  (1) 1405 residential buildings with a value of: $16,008,900
  (2) 18 commercial buildings with a value of $17,475,600
  (3) People at risk: 2,494

(j) Oil Pipelines
  (1) 8584 residential buildings with a value of $10,721,260
  (2) 75 commercial buildings with a value of $17,433,980
  (3) People at risk: 17,228

(k) Dam Failure
  (1) Number of Dams: 538
    i. High Hazard: 52
    ii. Significant hazard: 35
    iii. Low hazard: 451
  (2) High Hazard Risk
    i. People: 1,117
    ii. 840 residential buildings with a value of 92,045,000
    iii. 5 commercial buildings with a value of $1,528,000

HOUSTON-GALVESTON AREA COUNCIL (H-GAC)

The H-GAC Regional Mitigation Action Plan covers the following counties: Austin, Brazoria, Chambers, Galveston, Liberty, Montgomery, Waller and Walker. The cities participating in this plan include: These counties cover 6541square miles.

Vulnerability and Risk Assessment Data
The following represent totals in the H-GAC area:

- People: 4,854,454
- Residential Buildings: 2,426,098 with a value of $747,730,480
- Commercial Buildings: 20,580 with a value of $90,609,145
- Critical Facilities: 3,504
- Infrastructure and Lifelines
  - Oil Pipelines: 7,715 kilometers
  - Gas Pipelines: 10,005 kilometers
  - Highways: 3,678 kilometers
  - Railroads: 2,521 kilometers
- Hazardous Materials
  - Sites: 404
  - Materials: 2,975

(a) Riverine Flooding
    (1) People at risk: 76,165
    (2) Total potential annualized losses: $596,586,395
    (3) Residential buildings: 23,280 single family; 182 multi family
    (4) Commercial buildings: 2,285
    (5) Critical facilities: 25
    (6) Hazardous Materials: 164

(b) Coastal Flooding
    (1) Surge – Category 1 Hurricane
        i. People at risk: 119,756
        ii. Single family residential buildings: 45,951 with a value of $6,561,352
        iii. Multi-family residential buildings: 1,687 with a value of $1,496,278
        iv. Commercial buildings: 505 with a value of $975,508
        v. Hazardous Materials Facilities: 29
        vi. Critical facilities: 7 with a value of $39,801
    (2) Surge – Category 2 Hurricane
        i. People at Risk: 156,083
        ii. Single family residential buildings: 54,644 with a value of $8,374,951
        iii. Multi-family residential buildings: 2,038 with a value of $1,717,232
        iv. Commercial buildings: 621 with a value of $1,236,424
        v. Critical facilities: 7 with a value of $50,617
        vi. Hazardous materials facilities: 40
    (3) Surge – Category 3 Hurricane
        i. People at risk: 296,323
        ii. Single family residential buildings: 103,915 with a value of $15,196,705
        iii. Multi-family residential buildings: 2,788 with a value of $2,725,259
        iv. Commercial buildings: 1100 with a value of $2,134,907
        v. Hazardous materials facilities: 84
        vi. Critical facilities: 23 with a value of $147,852
    (4) Surge - Category 4 Hurricane
        i. People at risk: 481,406
        ii. Single family residential buildings: 163,100 with a value of $24,144,504
        iii. Multi-family residential buildings: 3,739 with a value of $3,912,430
        iv. Commercial buildings: 1673 with a value of $3,390,138
        v. Hazardous materials facilities: 102
        vi. Critical facilities: 26 with a value of $195,111
    (5) Surge – Category 5 Hurricane
        i. People at risk: 541,600
        ii. Single family residential buildings: 186,220 with a value of $27,915,249
        iii. Multi-family residential buildings: 4017 with a value of $4,308,453
        iv. Commercial buildings: 1,151 with value of $2,327,501
        v. Hazardous materials facilities: 139
        vi. Critical facilities: 35 with value of $251,350

Repetitive Loss Information (Based on FEMA's Target Group of 10,000 nationwide):

- Number of Target 10,000 properties: 416
- Number of losses paid: 1,984
- Cumulative losses paid: $59,272,533

- Average annual insured loss: $2,633,040
- Projected future damages avoided: $32,673,462

(a) Hurricane Winds
  (1) Total potential annualized losses: $877,512,504
  (2) Critical facilities: 955

(b) Tornadoes
  (1) Potential annualized losses: $34,828,804

(c) Drought
  (1) Potential annualized losses: $92,251,381 (mainly crop and farmland)

(d) Hail
  (1) Potential annualized losses: $2,741,199

(e) Thunderstorms
  (1) Potential annualized losses: $9,392,425

(f) Dam Failure
  (1) People at risk: 15,147
  (2) Potential residential buildings at risk: 12,166 value of $3,881,694,871
  (3) Potential commercial buildings at risk: 88 with a value of $448,136,249

(g) Oil Pipeline Rupture
  (1) People at risk: 504,281
  (2) Potential residential buildings at risk: 235,809 with a value of $48,290,176
  (3) Potential commercial buildings at risk: 2,912 with a value of $5,770,858

(h) Gas Pipeline Rupture
  (1) People at risk: 438,610
  (2) Potential residential buildings at risk: 236,498 with a value of $45,185,015
  (3) Potential commercial buildings at risk: 2,459 with a value of $5,051,328

(i) Toxic Release
  (1) People at risk: 123,171
  (2) Potential residential buildings at risk: 47,265 with a value of $13,643,848,460
  (3) Potential commercial buildings at risk: 478 with a value of $1,966,202,329
  (4) Number of facilities: 400 , Number of chemicals: 2,970

Panhandle Regional Planning Commission (PRPC)

The PRPC includes: Armstrong County and the city of Claude; Briscoe County and the cities of Silverton and Quitaque; Carson County and the cities of Panhandle, White Deer, Groom, and Skellytown; Collingsworth County and the cities of Wellington and Dodson; Deaf Smith County and the city of Hereford; Gray County and the cities of Pampa, McLean, and Lefors; Hall County and the cities of Estelline, Turkey, Memphis, and Lakeview; Hemphill County and the city of Canadian; Ochiltree County and the city of Perryton; Oldham County and the cities of Vega and Adrian; Roberts County and the city of Miami; Sherman County and the cities of Stratford and Texhoma; Swisher County and the cities of Tulia, Happy, and Kress; Wheeler County and the

cities of Wheeler, Shamrock, and Mobeetie; Lipscomb County and the cities of Higgins, Follett, Darrouzett, and Booker; Moore County and the cities of Dumas, Cactus, and Sunray; Castro County and the cities of Dimmitt, Nazareth, and Hart; Donley County and the cities of Clarendon, Hedley, and Howardwick; Childress County and the city of Childress; Hansford County and the cities of Spearman and Gruver; Parmer County and the cities of Friona, Bovina, and Farwell; Hutchinson County and the cities of Borger, Fritch, Stinnett, and Sanford; Dallam / Hartley Counties and the cities of Dalhart, Channing, and Texline; and the City of Amarillo-Potter County-Randall County.

Vulnerability and Risk Assessment Data

Totals (Note: hazards such as tornadoes, winter storms, hail, and thunderstorms) affect the area equally as for numbers of people as well as the numbers of residential, commercial, critical facilities, etc. that are at risk). PRPC has 948 critical facilities at risk with a total dollar value of $2,130,891,063. They have 30 dams. PRPC has 789 bridges totaling $669,985,334. There are 348,503 people in the PRPC planning area.

(a) Dam Failure
  (1) Dam failure is a very low, but possible occurrence with a frequency of about 1.8% per year per applicable county.
(b) Drought
  (1) Drought is a consistent problem for PRPC as they are largely farming and ranching communities. Overall risk is 25% chance with one event recently totaling $83,000,000 in loss.
(c) Earthquakes
  (1) PRPC has a very low, but tangible risk of earthquakes. Occurrence is between 1-4% per county per year.
(d) Flooding
  (1) Aggregate total percentage of occurrence: 31.1%.
(e) Hailstorms
  (1) Aggregate total percentage of occurrence: 66.32%.
  (2) Total annual loss due to hailstorms: $6,565,970.27
(f) Hazardous Materials Release
  (1) Risk varies from county to county, but the overall total risk is 60.74%.
  (2) Loss due to hazardous materials release is generally very minimal and easily contained with some notable exceptions.
(g) Terrorism
  (1) The PRPC plan addressed terrorism as a very small but existing possibility.
(h) Thunderstorms
  (1) Aggregate total percentage of occurrence: 40.82%.
  (2) Total annual loss due to thunderstorms: $2,856,162.70
(i) Tornadoes
  (1) Aggregate total percentage of occurrence: 35.71%.
  (2) Total annual loss due to tornadoes: $7,746,849.70
(j) Wildfires
  (1) Wildfires happen multiple times per year throughout PRPC, so the total chance of occurrence is truly 100%.
  (2) Loss due to wildfires is generally minimal due to preparedness and response.
(k) Winter/Ice Storms
  (1) Aggregate total percentage of occurrence: 66.41%.
  (2) Total annual loss due to winter/ice storms: $29,928,380.95

Please note that due to FEMA reducing the standards of §201.6(c)(2)(ii) from, "all elements of the requirement must be rated 'Satisfactory' in order for the requirement to fulfilled" to, "a 'Needs Improvement' score on elements shaded in gray will not preclude the plan from passing", the following information obtained from local mitigation plan risk assessments is not as detailed as the local risk assessments that preceded the reduced standard.

The information in the following summaries (pages 130-152) is current to the 2010 State plan update.

Forth Worth (FW)

The Fort Worth hazard mitigation plan covers the unincorporated areas of Tarrant County, and the cities of Azle, Blue Mound, Dalworthington Gardens, Everman, Fort Worth, Haslet, Keller, Kennedale, Lake Worth, Lakeside, Pelican Bay, River Oaks, Saginaw, Westlake, Westover Hills, Westworth Village, White Settlement.

Vulnerability and Risk Assessment Data
Totals (Note: hazards such as tornadoes, winter storms, hail, and thunderstorms) affect the area equally as for numbers of people as well as the numbers of residential, commercial, critical facilities, etc. that are at risk). Area covered: 897 square miles. Population: 1,745,050, though most of this is localized in the urban areas.

(a) Dam Failures

(1) The Texas Commission of Environmental Quality has identified two High Hazard Dams in unincorporated southeast Tarrant County. These dams are well maintained and monitored. There have been no reports of dam failures in Tarrant County. There is some concern that farm ponds are being converted to park lakes and detention structures in newly developing areas without proper engineering reviews.

(b) Droughts

(1) Almost all water supplies in Tarrant County are surface water and thus subject to drought. Citizens living in unincorporated areas of the County rely on a combination of well water, water from small water systems, and city owned water systems for their water supply. All are vulnerable to drought. Cities throughout Tarrant County are working with residents and businesses to reduce water consumption. National Climatic Data Center records indicate that in the past ten years there have been three periods of drought in Tarrant County, 1996 - 1998, 2000, and 2005 - 2006.

(c) Expansive Soils

(1) Expansive soils have caused damage to some structures in some portions of the County. Due to the variability of soil types and construction quality, it is very difficult to predict future occurrences of problems with expansive soils.

(d) Extreme Heat

(1) This is an annual occurrence. The summer of 1980 was a record year with 69 consecutive days of temperatures of 100 degrees or more. We were unable to find a reliable record of deaths or injuries related to heat. Hot summer temperatures are certain to continue to occur.

(e) Floods

(1) The topography of Tarrant County combined with the frequency of severe thunderstorms results in frequent flash flood events. There is a low risk of riverine flooding due to the presence of a well-maintained levee system. FEMA records indicate only 39 Repetitive Loss Properties in all of Tarrant County. However, this is probably more a reflection of the low number of flood insurance policies than vulnerability to flooding.

(2) The North Texas Council of Governments is in the process of conducting planimetric GIS surveys to accurately identify the number and types of buildings vulnerable to flooding; as well as access other data associated with those locations such as appraised value, census data, and owner information. This will also allow Fort Worth to include potential loss estimates in future mitigation updates which are not presently available.

(f) Hail Events

(1) FW averages eleven significant thunderstorm events (large hail, high winds) per year according to National Weather Service records. Most structures in FW can resist the effects of all but the most severe hailstorms.

(g) High Winds

(1) Severe thunderstorms and the associated hazard of high winds are a hazard in FW. FW averages ten reported significant thunderstorm events (large hail, high winds) per year. In addition, strong weather fronts can sometimes be accompanied by high winds which occasionally cause damage. Most structures in FW can resist the effects of all but the most severe high wind events. Public safety facilities, infrastructure, and special facilities do not have a history of being vulnerable to high winds.

(h) Landslides

(1) Although there is some relatively steep terrain in portions of unincorporated Tarrant County, the relief is associated with rocky outcrops and not susceptible to landslides.

(i) Levee Failures

(1) The only area in FW that has the potential for damage by levee failure would be the city of Fort Worth, which would be catastrophic (10 feet of water in residential homes). The probability of this is extremely low as the levees were designed to withstand a 500 year event and are well maintained.

(j) Lightning

(1) Lightning is one of the most common hazards in FW. Thunderstorms (and by definition, lightning) occur an average of 30 – 50 days per year (*Oklahoma Climatological Survey*). Lightning is the second most common cause of weather-related deaths in Texas (*National Weather Service*).

(k) Stream Bank Erosion

(1) The predominantly low rolling topography of FW prevents stream bank erosion from causing a hazard except in a few locations. Further analysis upon receipt of the GIS survey being performed by the NTCOG will confirm this.

(l) Thunderstorms

(1) Severe thunderstorms are the most common hazard in FW. From 1950 through August 2007 FW averaged eleven reported severe thunderstorm events county-wide per year. Public safety facilities, infrastructure, and special facilities do not have a history of being vulnerable to thunderstorms.

(m) Tornadoes

(1) All buildings in the Fort Worth area are vulnerable to tornadoes of which they average approximately 1 annually.

(n) Wildfires

(1) Tarrant County has been cited as having more undeveloped land than any other urban county in the United States. The relatively large rural-urban interface has resulted in significant wildfires. Wild land fires are likely to occur annually and increase in frequency and severity as the population continues to increase and formally rural areas are developed.

(o) Winter/Ice Storms

(1) Since 2000 the national Weather Service has reported 14 Winter Storm/Ice events. Occasionally an ice storm will cause widespread power outages for as long as several days. Public safety facilities, infrastructure, and special facilities do not have a history of being vulnerable to winter storms.

<u>Hopkins County</u> (HC)

The Hopkins County plan includes the cities of Como, Cumby, Sulphur Springs and Tira.

Vulnerability and Risk Assessment Data

Totals (Note: hazards such as tornadoes, winter storms, hail, and thunderstorms) affect the area equally as for numbers of people as well as the numbers of residential, commercial, critical facilities, etc. that are at risk). Area covered: 789 square miles. Population: 33,496.

(a) Dam Failures

(1) The region is at risk of dam failure if there is ever a large, distant earthquake which might occur in Missouri-Tennessee or Oklahoma. The hazard is rare and poses little or no risk.

(b) Droughts

(1) Probability is high that droughts will continue to occur in the region when the conditions are right. It is a normal, recurrent feature of climate. The region is highly vulnerable when there is a deficiency of precipitation over an extended period of time.

(c) Earthquakes

(1) The principal hazard is from rare, distant, but very large earthquakes occurring outside of Texas.

(d) Extreme Heat

(1) It is highly probable that extreme heat waves will continue to occur in the region when the conditions are right. The region is vulnerable when there is a deficiency of precipitation over an extended period of time and high temperatures.

(e) Floods

(1) Damage from previous floods is $255,000; 75% chance of a flood in any year with a potential average damage of $31,875.

(f) Hailstorms

(1) Given the history, hailstorms are highly probable. Vulnerability is high depending on magnitude of the storm. Damage potential is high in populated areas.

(g) Hazardous Materials Release

(1) The potential for a spill is low and there is insufficient data available to complete a risk analysis for the county.

(h) Thunderstorms

(1) Given the climate and history, thunderstorms are highly probable during the storm season. Vulnerability is high depending on magnitude of the storm. Damage potential is high in populated areas.

(i) Tornadoes

(1) Based on a historical trend over the past 50 years, Hopkins County can expect to receive several tornado touchdowns per year. Since the costs associated with an individual event are not considered high, but the population affected may be high, the level of vulnerability is considered moderate.

(j) Wildfires

(1) Historical weather conditions indicate that the probability of occurrence is low.

(k) Wind Storms

(1) The County is susceptible to wind damage from high and severe winds. Vulnerability is high depending on the magnitude of the storms.

(l) Winter/Ice Storms

(1) The probability of the occurrence of a freeze is high, given historical weather patterns. Hopkins County area is considered moderate in vulnerability because the number of people impacted by a freeze is low, and compared to other events the economic costs are not as dramatic.

<u>Trinity County</u> (TC)

The Trinity County plan includes the cities of Groveton and Trinity.

Vulnerability and Risk Assessment Data

Totals (Note: hazards such as tornadoes, winter storms, hail, and thunderstorms) affect the area equally as for numbers of people as well as the numbers of residential, commercial, critical facilities, etc. that are at risk). Area Covered: 714 square miles. Population: 14,296.

(a) Droughts

(1) There have been nine drought events that have been registered with the National Oceanic and Atmospheric Administration (NOAA) since 1994. This constitutes a thirty percent probability of future occurrence in a given year based on patterns of past events. Overall vulnerability to drought in Trinity County is considered moderate.

(b) Extreme Heat

(1) There have been five extreme heat events in Trinity County that have been registered with the National Oceanic and Atmospheric Administration (NOAA) since 1994. Overall vulnerability throughout the jurisdictions of Trinity County to extreme heat events is considered moderate to high by the HMT.

(c) Floods

(1) Based off of the NOAA information, the probability of occurrence rating would be ‘unlikely’, corresponding to flooding being possible but not likely in the next ten years.

(2) There are 105 residential homes plus an unaccounted number of campers located within the 100 year floodplain. There is also 15 total miles of road in the flood hazard area. While an annual loss is not achievable as there have been no

significant events documented the estimated total loss for a hazard event is $3,334,403.

(d) Hailstorms

(1) There have been 28 hail events in Trinity County that have been registered with the National Oceanic and Atmospheric Administration (NOAA) since 1975, an approximate average of one per year. Therefore, based on historic patterns, the probability of occurrence rating is in the range of 'likely' to 'highly likely'.

(2) Average annual loss due to hail damage - $43,981.

(e) Thunderstorm

(1) There is a "highly likely" rating of thunderstorm occurrence in Trinity County with a high vulnerability.

(2) Average annual loss estimates for thunderstorms are $202,029.

(f) Tornados

(1) There have been 22 tornado events in Trinity County that have been registered with the National Oceanic and Atmospheric Administration (NOAA) since 1952, an average of 0.42 tornados per year and constituting a 'likely' probability of occurrence rating. Housing units and other structures within Trinity County are at a medium to high level of vulnerability to damage from a tornado event.

(2) Average annual loss due to tornadoes - $213,562.

(g) Wildfires

(1) The probability of occurrence of some number of future wildfire events is highly likely, based on patterns of past occurrences and assessments of prevailing conditions. In terms of location, since greater than 70% of the population of Trinity County is located in rural areas, vulnerability to wildfires in these places is relatively high as compared to more urban areas that possess greater concentrations of firefighting resources.

(2) Average annual dollar loss due to wildfires - $312,481.

(h) Winter/Ice storms

(1) There have been 3 ice storm events in Trinity County that have been registered with the National Oceanic and Atmospheric Administration (NOAA) since 1994 a 0.3 storm per year average thus constituting a 'likely' probability of occurrence rating. Vulnerability is moderate.

Sabine County (SC)

The Sabine County plan includes the cities of Hemphill and Pineland.

Vulnerability and Risk Assessment Data

Totals (Note: hazards such as tornadoes, winter storms, hail, and thunderstorms) affect the area equally as for numbers of people as well as the numbers of residential, commercial, critical facilities, etc. that are at risk). Area Covered: 576 square miles. Population: 10,457. The overall value of structures within Sabine County is estimated at $ 478,111,441.

(a) Droughts

(1) Considering patterns of past occurrences and assessments of current conditions, probability of occurrence for Sabine County is considered 'likely'. The main vulnerable asset in Sabine County from drought events is crop loss countywide, both commercial and private, although livestock, humans and wildlife are also impacted.

(b) Floods

(1) There is a 0.43 flood per year average and a 'likely' or 'occasional' probability of occurrence rating according to the definitions from the State of Texas Mitigation Handbook. Overall, Sabine County's vulnerability to flooding could be considered low to moderate, with no vulnerable residential structures recognized and a relatively low likelihood of occurrence in a given year.

(2) Projected loss due to a flooding event - $198,000.

(c) Hailstorms

(1) Based on data provided by NOAA, with 23 significant events recorded during the last 31 years, the probability of occurrence rating is 'likely' with a statistical average of 0.7 hailstorms per year. People are generally at a medium to low vulnerability to damage from hail storms.

(d) Thunderstorm

(1) With an average of 2.4 per year over the last ten year period, probability of a storm event as defined by the NCDC occurring in a given year is considered 'highly likely'. Sabine County overall is at a moderate to high vulnerability from thunderstorms and high winds, as is the entire east Texas region.

(e) Tornados

(1) There have been 12 tornado events in Sabine County that have been registered with the National Oceanic and Atmospheric Administration (NOAA) since 1959, a 0.26 tornado per year average thus constituting an 'occasional' probability of occurrence rating. Overall vulnerability to tornados in Sabine County is moderate to high.

(f) Wildfires

(1) Wildfire has been determined by the Hazard Mitigation Team to be a high priority natural hazard in Sabine County. Since greater than 80% of the population of Sabine County is located in rural areas, vulnerability to wildfires is relatively high.

(2) Average annual loss due to wildfires - $321,855.

(g) Winter/Ice Storms

(1) With 3 winter/ice storms since 1994, or 0.25 per year, there is a "likely/occasional" rating given to this event. Trees, infrastructure and personal property are at a medium level of vulnerability to ice storm events since the events happen relatively infrequently, and tend to impact all aspects of communities across the region.

Tarrant County (TC)

The Tarrant County plan includes the cities of Euless, Haltom City, Hurst, Bedford, Grapevine, and Richland Hills.

Vulnerability and Risk Assessment Data
Totals (Note: hazards such as tornadoes, winter storms, hail, and thunderstorms) affect the area equally as for numbers of people as well as the numbers of residential, commercial, critical facilities, etc. that are at risk). Area Covered: 897 square miles. Population: 1,671,295. Rating table used:

Occurrence

- Highly likely - Event probable in next year.
- Likely - Event probable in next 3 years.
- Occasional - Event possible in next 5 years.
- Unlikely - Event possible in next 10 years.

Impact

- Substantial - Multiple deaths, complete shutdown of facilities for 30 days or more. More than 50 percent of property destroyed or with major damage.
- Major - Injuries and/or illnesses result in permanent disability. Complete shutdown of critical facilities for at least 2 weeks. More than 25 percent of property destroyed or with major damage.
- Minor - Injuries and/or illnesses do not result in permanent disability. Complete shutdown of critical facilities for more than 1 week. More than 10 percent of property destroyed or with major damage.
- Limited - Injuries and/or illnesses are treatable with first aid. Minor quality of life lost. Shutdown of critical facilities and services for 24 hours or less. Less than 10 percent of property destroyed or with major damage.

Extent (The known severity)

- High - Major extent is the potential maximum or near the top category for the Hazard. (Ex. EF5 Tornado)
- Medium - Medium extent is between major and minor extents (Ex. EF2-EF3 Tornado)
- Low Minor extent is the lower end category for the hazards (Ex. EF0 Tornado)

(a) Dam Failures
  (1) Occurrence is unlikely, Impact is limited, and Extent is low.
(b) Droughts
  (1) Occurrence is likely, Impact is limited, and Extent is low.
(c) Earthquakes
  (1) Occurrence is unlikely, Impact is limited, and Extent is unable to be determined.
(d) Expansive Soils
  (1) Occurrence is unlikely, Impact is limited, and Extent is low.
(e) Extreme Heat

(1) Occurrence is highly likely, Impact is limited, and Extent is low.

(f) Flooding

(1) Occurrence is occasional, Impact is minor, and Extent is medium.

(g) Hailstorms

(1) Occurrence is highly likely, Impact is limited, and Extent is medium.

(h) High Winds

(1) Occurrence is likely, Impact is limited, and Extent is medium.

(i) Tornados

(1) Occurrence is likely to highly likely, Impact is major, and Extent is medium.

(j) Winter/Ice Storms

(1) Occurrence is likely, Impact is minor, and Extent is medium.

<u>UT MD Anderson Medical Center</u> (UMAD)

Vulnerability and Risk Assessment Data

Totals (Note: hazards such as tornadoes, winter storms, hail, and thunderstorms) affect the area equally as for numbers of people as well as the numbers of residential, commercial, critical facilities, etc. that are at risk). Area Covered: 64 acres, critical facility.

(a) Explosive Blasts

(1) The frequency, or likelihood, of a conventional explosive blast at the Main Campus, ACB, or the CPB is "possible,". Depending on its size, the spatial extent of an explosive blast would be "limited," expected to affect 10 – 20 percent of people or property Between 25% and 50% of property in the affected area may be damaged or destroyed. There may be a complete shutdown of facilities for more than one week.

(b) Flooding

(1) The likelihood or probability of future occurrence of flooding at the institution was rated as "high," because of its close proximity to Brays Bayou and a flood event is considered probable in the next year. The spatial extent of damage due to flooding at the North Campus was rated as "moderate" because it is expected to affect 25% to 50% of the people and/or property. The potential impact of flooding at the North Campus was rated as "limited" because it would most likely cause minor injuries or exposure to bacteria or viruses in shallow ponded water and resulting mold in structures exposed to floodwaters.

(2) Expected annual damage due to flooding - $3,284.

(c) Hazardous Materials Release [external]

(1) The probability of future occurrence, or likelihood, of a small-scale hazardous materials release from an external source affecting the institution is "possible," with an event possible in the next 4-5 years. The spatial extent of the hazardous materials release is "moderate," expected to affect 25 percent - 50 percent of people and property. The potential impact is "limited" and may result in minor injuries and 10 percent - 25 percent of property in the affected area damaged or destroyed. There could be a complete shutdown of facilities for 1 day to 1 week.

(d) Hazardous Materials Release [internal]

(1) The probability of future occurrence, or likelihood, of a chemical hazardous materials release from an internal source is "likely," with an event probable in the next 2 - 3 years. The spatial extent of the hazardous materials release from inside the M.D. Anderson Cancer Center is "limited," expected to affect 10 percent - 25 percent of people or property. The potential impact is "limited" and may result in minor injuries and 10 percent - 25 percent of property in the affected area

damaged or destroyed. There could be a complete shutdown of facilities in the affected area for one day to one week.

(e) Hurricane/Tropical Storm

(1) The probability or likelihood of occurrence of a tropical storm or hurricane hitting the institution is "highly likely," with an event probable in the next year. The spatial extent is "large," meaning that the hazard is expected to affect 50 percent or more of people and/or property at the Main Complex, CPB, and ACB. The potential impact of a tropical storm or hurricane is "catastrophic" and may result in a high number of deaths and injuries, with more than 50 percent of property damaged or destroyed and a complete shutdown of facilities for 30 days or more

(2) Expected annual damage due to event - $2,801,004.

(f) Operations Disruptions

(1) The likelihood or probability of occurrence of a utility supply disruption has been identified as "highly likely," with an event probable in the next year. The spatial extent is "large," meaning the hazard is expected to affect 50% or more of people and/or property at the institution. The potential impact of a power disruption is "critical," with 25% to 50% of property likely affected.

(g) Pandemic Influenza

(1) The probability of future occurrence, or likelihood, of pandemic influenza at the institution is "possible," with an event possible in the next 4 to 5 years. The spatial extent of pandemic influenza is "moderate," meaning that the hazard is expected to affect 25% to 50% of the institution's population. The potential impact is "critical," with multiple deaths and injuries.

(h) Structure Fires

(1) The likelihood or frequency of occurrence of a structure fire at the Institution is "possible," with an event possible in the next 4-5 years. The spatial extent of a structure fire would be "limited," expected to affect 10 percent to 25 percent of people and/or property at the Institution. The severity of impact could be "catastrophic," with a high number of deaths and injuries, more than 50 percent of property destroyed, and/or a complete shut-down of facilities for 30 days or more.

(i) Terrorist Attacks (Chemical/Biological/Radiological [CBR])

(1) A CBR attack at the institution is considered "unlikely," even in the next 10 years. The spatial extent would be "large," expected to affect 25% to 50% of people and/or property. The potential impact would be "critical," resulting in multiple injuries and deaths, 25% to 50% of property damaged or destroyed, and a complete shutdown of facilities for a week to 30 days.

(j) Tornadoes

(1) The probability or frequency of occurrence of a tornado hitting Harris County is considered "possible," with an event possible in the next 4 – 5 years. The spatial extent of a tornado is "moderate" meaning that a tornado is expected to affect 25 percent to 50 percent of people and/or property at the Main Complex, CPB, and ACB. The potential impact of a tornado is "critical."

(2) Expected annual damages due to tornado - $155,672.

(k) Winter/Ice Storms

(1) A severe winter storm affecting the institution is rated as "possible" in the next 4 – 5 years. The spatial extent of a severe winter storm is expected to be "moderate," affecting 25 percent to 50 percent of people and property. The severity of impact of a severe winter storm is expected to be "minor," causing few if any injuries and less than 10 percent of property damaged or destroyed.

Rice University (RU)

Vulnerability and Risk Assessment Data

Totals (Note: hazards such as tornadoes, winter storms, hail, and thunderstorms) affect the area equally as for numbers of people as well as the numbers of residential, commercial, critical facilities, etc. that are at risk).

(a) Civil Disobedience
  (1) The impact of civil disobedience has a 25% maximum chance of occurrence equating to a potential for $240,112,534.00 loss in buildings and contents.

(b) Droughts
  (1) Drought is not a significant threat for Rice University.

(c) Earthquakes
  (1) Rice University buildings and utility facilities are rated for earthquakes per the building code regulations in place during the respective building/utility construction. There is such a remote chance of an earthquake occurrence that a dollar value for this event is not included.

(d) Extreme Heat
  (1) Extreme Heat is not a significant threat for Rice University, and the campus does not have records of previous occurrences, since 1984.

(e) Fires
  (1) The extent of fire is significant because there are buildings located throughout the campus that were constructed without fire retardant materials. Rice University is also vulnerable because of their dependency on the City of Houston's water supply, which is under their management and maintenance. Should water become unavailable from the City of Houston, then the potential loss of buildings and contents for the entire campus is at a cost over $900M.

(f) Flood/Hurricane/Tropical Storm
  (1) The impact of floods has a 35% maximum chance of occurrence equating to a potential for $336,157,547.60 loss to buildings and contents. The impact of hurricanes/tropical storms has a 45% maximum chance of occurrence equating to a potential for $432,202,561.00 loss to buildings and contents.

(g) Hailstorms
  (1) Hailstorms are not considered to be a significant threat for Rice University, and information on previous campus occurrences, from 1984 to the present are not available.

(h) Land Subsidence
  (1) The impact of land subsidence has a 25% maximum chance of occurrence equating to a potential for $240,112,534.00 loss to buildings and contents.

(i) Terrorist Attacks (Chemical/Biological/Radiological [CBR])
  (1) Rice University has determined that NBC Terrorist acts are a significant hazard to the facility. The impact of NBC Terrorism has a 100% maximum chance of occurrence equating to a potential for $960,450,136.00 loss to buildings and contents.

(j) Tornados
  (1) Tornados are not a significant hazard to Rice University. Rice University has no records of previous tornados affecting the campus, since 1984.

(k) Winter/Ice Storms
  (1) Winter/ice Storms have a 25% maximum chance of occurrence equating to a potential impact of a $240M loss to all buildings and contents on campus.

<u>Sabine River Authority</u> (SRA)

This plan includes all or parts of 21 different counties along the Sabine River and its tributaries. Enumerated Counties: Collin, Franklin, Gregg, Harrison, Hopkins, Hunt, Jasper, Kaufman, Newton, Orange, Panola, Rains, Rockwall, Rusk, Sabine, San Augustine, Shelby, Smith, Upshur, Van Zandt, and Wood.

Vulnerability and Risk Assessment Data
Totals (Note: hazards such as tornadoes, winter storms, hail, and thunderstorms) affect the area equally as for numbers of people as well as the numbers of residential, commercial, critical facilities, etc. that are at risk). Population: 501,729. Total market value located within zone: $106,842,030,625. Total property/structural value: $27,857,818,491.

(a) Droughts
  (1) In five of the last ten years the National Climatic Data Center (NCDC) has recorded drought events involving SRA counties. Therefore, based on patterns of past occurrence the probability of occurrence would be rated as 'occasional' or 'likely'. Crops are the most vulnerable in drought conditions.

(b) Extreme Heat
  (1) Based on patterns of past occurrences, there is statistical probability of 70% that a heat event which causes at least one fatality will occur in a given year. People throughout the region are the main asset vulnerable to damage from heat events, and it is assumed that the elderly and disabled without sufficient cooling systems and people disregarding the impact of heat events are at the highest vulnerability.

(c) Flooding
  (1) The total number of flood events for SRA counties for the period is 397, or 36 per year of some size or scale. Therefore, taking the Sabine River Authority region as a whole, probability of future flood events is rated as 'highly likely'. Overall vulnerability to flooding in the SRA jurisdiction is considered high.
  (2) The maximum estimated damage from flooding to residential structures and infrastructure in Sabine River watershed during or resulting from an event is $80,749,424.

(d) Hail
  (1) There have been 31 damage-causing hail events in the Sabine River Authority counties that have been registered with the NOAA in the past 10 years. This equates to an average of 3.1 damage causing hail storm events per year throughout the region and reflects a high likelihood of future occurrence in a given year. Overall vulnerability to hailstorms is considered moderate to low.
  (2) Average dollar loss amount per event is $2,966,864.

(e) Hurricanes/Tropical Storms
  (1) Three hurricanes have caused significant damage in the Sabine River Authority region over the past 10 years; Tropical Storm Frances (1998), Tropical Storm Allison (2001) and Hurricane Rita (2005). This level of frequency equates to a probability of occurrence rating of 'occasional' or 'likely'. Overall vulnerability to the Sabine River Authority counties is considered moderate to high.

(f) Thunderstorms
  (1) There have been 1,290 thunderstorm events recorded in Sabine River watershed counties over the past 10 years that have been registered with the National Oceanic and Atmospheric Administration (NOAA), an average of 129 storms per year. Therefore, probability of future occurrence is rated as 'highly likely'. SRA has a high level of vulnerability to thunderstorms.
  (2) Estimated annual loss due to thunderstorms is $14,698,743.

(g) Tornados
  (1) There have been 110 Tornado events in the Sabine River watershed counties that have been registered with NOAA since 1994. This equates to an average of over ten per year, and represents a probability of future occurrence rating of 'highly likely'. Overall, the HMT has determined that the Sabine River Authority region has a high vulnerability to tornado events, mostly in terms of property damage but also as a threat to public safety and potential interruptions in commerce.
(h) Wildfires
  (1) The probability of a wildfire event along the SRA is rated as "highly likely". Overall vulnerability to wildfires in the Sabine River watershed is considered high, particularly due to the large amount of downed trees and debris that resulted from Hurricane Rita and the dry conditions that existed throughout Texas during the winter months of 2005-2006.
  (2) Estimated annual loss for the SRA is $2,575,051.
(i) Winter/Ice Storms
  (1) The overall probability of occurrence rating for ice storms in the SRA jurisdiction is 'highly likely'. SRA has a moderate vulnerability to winter and ice storms.

<u>Cover the Border</u> (CB)

The Cover the Border plan covers the following counties: Brooks, Cameron, Duval, Hidalgo, Jim Hogg, Kenedy, McMullen, Pecos, Reeves, Starr, Terrell, Webb, Willacy, and Zapata. The cities included are: Alamo, Alton, Balmorhea, Benavides, Brownsville, Combes, Donna, Edcouch, Edinburg, El Cenizo, Elsa, Falfurrias, Ft. Stockton, Freer, Granjeno, Harlingen, Hidalgo, Iraan, La Feria, La Grulla, La Joya, Laguna Vista, Los Fresnos, Lyford, McAllen, Mercedes, Mission, Palmhurst, Palmview, Pecos, Penitas, Pharr, Port Isabel, Primera, Progresso, Progresso Lakes, Rancho Viejo, Raymondville, Rio Bravo, Rio Grande City, Roma, San Benito, San Diego, San Juan, San Perlita, Santa Rosa, South Padre Island, Sullivan City, Toyah, and Weslaco.

Vulnerability and Risk Assessment Data
Totals (Note: hazards such as tornadoes, winter storms, hail, and thunderstorms) affect the area equally as for numbers of people as well as the numbers of residential, commercial, critical facilities, etc. that are at risk). Total regional exposure: $35,839,065,000. Total number of critical facilities: 664. Total agricultural product exposure: $533,168,048.

(a) Dam Failure
  (1) The frequency of dam failure or probability to its occurrence is "Possible". The spatial extent is expected to be "Minimal," affecting less than 10 percent of people and/or property in the planning area. The severity of impact is expected to be "Critical," with 25% to 50% of property in the affected area damaged or destroyed and resulting in multiple deaths or injuries.
(b) Drought
  (1) The likelihood or future probability of occurrence of a drought in the City of Rio Grande Border Region is "highly likely", with an event possible in the next four to five years. The spatial extent of drought is "Large," expected to affect more than fifty percent of property in region. The potential impact of drought is "Limited" resulting in few, if any, injuries. Less than 10% of property damaged or destroyed is projected.
  (2) Total annual expected loss due to drought: $15,682,509.
(c) Extreme Heat

(1) The likelihood or future probability of occurrence of excessive summer heat in the Rio Grande Border Region is "Possible", with an event possible in the next four to five years. The spatial extent of excessive summer heat is "Limited," expected to affect 10% to 25% of property in the City of region. The potential impact of excessive summer heat is "Minor" resulting in few, if any, injuries.

(d) Flooding

(1) The likelihood or future probability of occurrence of flooding in the Rio Grande Border region is "highly likely". The spatial extent of flooding in the border region is "Moderate", with 25 to 50 percent of property potentially affected by the hazard. Major flooding and flash flooding events would have a "Limited" severity of impact, with few injuries. Flooding would destroy between 10 percent and25 percent of property and result in a complete shutdown of facilities for one day to one week.

(2) Potential residential buildings exposed: 113,387. Potential residential dollar loss amount: $9,234,610,000. Potential commercial buildings exposed: 2,780. Potential commercial dollar loss: $2,569,874,929. Total potential dollar loss: $11,804,484,929. People at risk 339,067. Critical facilities inside the 100 year floodplain: 58.

(e) Fuel Pipeline Breach

(1) The probability of future occurrence, or likelihood, of a small-scale fuel pipeline breach is "likely," with an event probable in the next 2-3 years. The spatial extent of a fuel pipeline breach is "minimal," expected to affect less than 10 percent of people and property. The potential impact is "limited" and may result in minor injuries and 10 percent - 25 percent of property in the affected area damaged or destroyed. There could be a complete shutdown of facilities for 1 day to 1 week.

(2) People endangered due to gas pipeline failure: 719,856. People at risk due to oil pipeline failure: 21,635.

(f) Hailstorms

(1) The likelihood or future probability of occurrence of hail in the Rio Grande Border Region is "Possible", with an event possible in the next 4 – 5 years. The spatial extent of hail is "Minimal," expected to affect less than 10% of property. The potential impact of hail is "Minor," resulting in few if any injuries and less than 10% of property in the affected area damaged or destroyed.

(2) Annual expected loss due to hail: $1,042,713.

(g) Hazardous Materials Release

(1) The probability of future occurrence, or likelihood, of a small-scale hazardous materials release is "likely," with an event probable in the next 2-3 years. The spatial extent of the hazardous materials release is "minimal," expected to affect less than 10 percent of people and property. The potential impact is "limited" and may result in minor injuries and 10 percent - 25 percent of property in the affected area damaged or destroyed.

(2) Estimated people at risk fixed site release: 1,076,257. Estimated dollar risk fixed site release: $2,219,829,000. Estimated people at risk mobile site release: 594,819. Estimated dollar risk mobile site release: $183,690. People at risk from HAZMAT site in Mexico release: 192,855. Potential dollar loss from a Mexican release: $50,249.

(h) Hurricane/Tropical Storm

(1) The probability or likelihood of occurrence of a tropical storm or hurricane hitting the Rio Grande border region is "highly likely," with an event probable in the next year. The spatial extent is "large," meaning that the hazard is expected to affect 50 percent or more of people and/or property in the region. The potential

impact of a tropical storm or hurricane is "catastrophic" and may result in a high number of deaths and injuries, with more than 50 percent of property damaged or destroyed and a complete shutdown of facilities for 30 days or more.

(2) Annual expected residential loss: $220,557,643. Annual expected commercial buildings loss: $21,037,792. Total annual expected loss: **$245,300,228.** In the event of a 100 year storm event 10 critical facilities would lose all function, 473 would lose partial functionality, and 181 would remain fully functional. In a 500 year event 246 would lose all functionality, 341 would only be partially functional, and a mere 77 would remain fully functional.

(i) Tornadoes

(1) The probability or frequency of occurrence of a tornado hitting the Rio Grande Border Region is considered "possible," with an event possible in the next 4 – 5 years. The spatial extent of a tornado is "minimal" meaning that a tornado is expected to affect less than 10 percent of people and/or property. The potential impact of a tornado is "minor."

(2) Annual expected property loss due to tornadoes: $1,525,797.

(j) Wildfire

(1) The probability of future occurrence, or likelihood, of a wildfire is "possible," with an event possible in the next 4-5 years. The spatial extent of a wildfire is "minimal," expected to affect less than 10 percent of people and property. The potential impact is "minor" and may result in few injuries and less than 10 percent of property in the affected area damaged or destroyed.

<u>Dallas County</u> (DC)

The Dallas County plan includes City of Sachse, Dallas County (Unincorporated Areas), City of Cedar Hill, City of Dallas, City of DeSoto, City of Farmer's Branch, City of Irving and City of Rowlett.

Vulnerability and Risk Assessment Data

Totals (Note: hazards such as tornadoes, winter storms, hail, and thunderstorms) affect the area equally as for numbers of people as well as the numbers of residential, commercial, critical facilities, etc. that are at risk). Population: 2,345,815. Area covered: 908 square miles.

Dallas county rating rubric:

Occurrence (Probability of Future Events)

- Highly likely - Event probable in next year.
- Likely - Event probable in next 3 years.
- Occasional - Event possible in next 5 years.
- Unlikely - Event possible in next 10 years.

Impact

- Substantial - Multiple deaths Complete shutdown of facilities for 30 days or more. More than 50 percent of property destroyed or with major damage.
- Major - Injuries and/or illnesses result in permanent disability. Complete shutdown of critical facilities for at least 2 weeks. More than 25 percent of property destroyed or with major damage.
- Minor - Injuries and/or illnesses do not result in permanent disability. Complete shutdown of critical facilities for more than 1 week. More than 10 percent of property destroyed or with major damage.
- Limited - Injuries and/or illnesses are treatable with first aid. Minor quality of life lost. Shutdown of critical facilities and services for 24 hours or less. Less than 10 percent of property destroyed or with major damage.

Vulnerability

- Very High Risk - People and facilities located in known risk areas (e.g. Hurricane risk area, floodway, 100-year floodplain, vulnerable zones around HAZMAT site, active fault line, etc.)
- High Risk - People and facilities located in areas that have previously experienced Impacts from hazards and/or in areas where impacts from hazards are Possible and probable (e.g. 500-year floodplain, fringe areas along Waterways, inland areas beyond coast, "tornado alley", etc.)
- Limited Risk - People and facilities located in areas that have low frequency history of impacts from hazards and/or in areas where impact is possible but not probable.
- Minimal Risk - People and facilities located in areas with no history of occurrence of hazards And/or in areas where impact is not possible or probable

Extent (The known severity)

- High - Major extent is the potential maximum or near the top category for the Hazard. (Ex. EF5 Tornado)
- Medium - Medium extent is between major and minor extents (Ex. EF2-EF3 Tornado)
- Low Minor extent is the lower end category for the hazards (Ex. EF0 Tornado)

(a) Dam Failure
  (1) Occurrence – unlikely. Impact – limited. Vulnerability – minimal risk. Extent – N/A.

(b) Droughts
  (1) Occurrence – likely. Impact – minor. Vulnerability – limited risk. Extent – medium.

(c) Earthquake
  (1) Occurrence – unlikely. Impact – limited. Vulnerability – minimal risk. Extent – N/A.

(d) Extreme Heat
  (1) Occurrence – highly likely. Impact – limited. Vulnerability – minimal risk. Extent – medium.

(e) Flooding
  (1) Occurrence – likely. Impact – major. Vulnerability – high risk. Extent – medium.

(f) Hailstorms
  (1) Occurrence –likely. Impact – minor. Vulnerability – limited risk. Extent – medium.

(g) Levee Failure
  (1) Occurrence – unlikely. Impact – limited. Vulnerability – minimal risk. Extent – n/a.

(h) Lightning
  (1) Occurrence – highly likely. Impact – limited. Vulnerability – limited risk. Extent – medium.

(i) Stream Bank Erosion
  (1) Occurrence – occasional. Impact – limited. Vulnerability – limited risk. Extent – low.

(j) Tornado
  (1) Occurrence – occasional. Impact – substantial. Vulnerability – high risk. Extent – medium.

(k) Windstorms
  (1) Occurrence –likely. Impact – minor. Vulnerability – limited risk. Extent – medium.

(l) Winter/Ice Storms

(1) Occurrence – likely. Impact – minor. Vulnerability – limited risk. Extent – low.

<u>Fannin County</u> (FC)

The Fannin County plan includes the cities of Bailey, Bonham, Town of Dodd City, Ector, Honey Grove, Town of Ladonia, Leonard, Ravenna, Savoy, Trenton, and Windom.

Vulnerability and Risk Assessment Data

Totals (Note: hazards such as tornadoes, winter storms, hail, and thunderstorms) affect the area equally as for numbers of people as well as the numbers of residential, commercial, critical facilities, etc. that are at risk). Population: 33,337. Area covered: 899 square miles.

(a) Dam Failures
   (1) Dam failures are a possibility but not a probability for Fannin County. Vulnerability depends largely on the size and extent of the dam failure.

(b) Droughts
   (1) Given that 12 severe drought events have occurred in the North Central Texas Region over the past 100 years one may conclude that Texas can expect a severe drought every decade. Although the entire county is vulnerable to a drought the vulnerability is greater in rural and agricultural areas of the county.

(c) Earthquake
   (1) Earthquakes centered in Fannin County are very rare and are pose little hazard due to their low magnitude. Most of Fannin County‘s seismic events are so small that they aren‘t felt but, these events could still be causing damage to the integrity of infrastructures.

(d) Expansive Soils
   (1) Since no records of specific incidences of loss associated with expansive soils were found and no specific areas of expansive soils were identified within the county, Probability of Future Events cannot be determined at this time.

(e) Extreme Heat
   (1) Fannin County has experienced five extreme heat events in the past 12 year and averages 15 to 20 days per year of daytime high temperatures greater than 100° F. Therefore extreme temperatures are highly likely to occur anywhere within the County. People and animals are highly vulnerable to extreme heat conditions, thought they usually do not lead to property loss.

(f) Flooding
   (1) The number of major floods in the last 100 years warrants a highly likely probability rating. Vulnerability is largely centered on the city of Bonham due to recent development.

(g) Hailstorms
   (1) Based on the previous occurrences of 65 large-hail events recorded in the last 53 years, an average of 1.2 events occur per year; therefore, the probability of large hail (equal to or greater than 1.5 inches in diameter) occurring within the county each year is highly likely. Vulnerability is low for humans, but high for potential property loss.
   (2) Average estimated dollar loss amount per hail event is $2,454.

(h) Hazardous Material Releases
   (1) Hazardous materials are transported to and through the county by vehicles using Hwy 82 and other main arteries. The risk of hazardous material spills during transport exists and may increase with the continued industrial development in the City Bonham. Fannin County transportation system doesn‘t require the

transportation of hazardous material to avoid driving through the city, thus vulnerability is quite high if material were to actually be released.

(i) Terrorism
  (1) According to the ―Fannin County Soil Survey‖, agriculture is the main business in Fannin County. Therefore an act of agriterrorism or the use of biological agents on agriculture would be the most damaging to the county. The risk of such attack is low but the use and exposure to these agents can remain unknown for several days, and allowing for the possible spreading of contamination.

(j) Thunderstorms
  (1) There is an average of six documented strong thunderstorms and high wind events in the county each year for the past 20 years. Based upon past occurrences the probability of future severe thunderstorm events within the county is highly likely. Fannin County‘s susceptibility to wind disaster is compounded by the fact that there are over 2200 manufactured homes in the county, according to the Texas Department of Housing and Community Affairs.
  (2) FC averages $15,094 in loss per thunderstorm event.

(k) Tornadoes
  (1) In the last 53 years Fannin County had 46 tornadoes, resulting in an average of 0.87 reported tornadoes per year. Therefore the probability of a tornado occurring within the county each year is highly likely. They rate their vulnerability as high.
  (2) FC averages $100,000 per year in loss due to tornadoes.

(l) Wildfires
  (1) Although the number of incidences indicate that wildfires are likely to occur, most wildfires are small in size and contained by local resources. Areas along railroads and people whose homes are in woodland settings in rural areas have an increased risk of wildfire.

(m) Winter/Ice Storms
  (1) Based on Previous Occurrences, 19 snow and/or ice events have occurred in the last 15 years. This would indicate that the probability of a winter storm occurring within the County is highly likely with an average of 1.3 events a year. All populations, buildings, critical facilities, and infrastructure in Fannin County are vulnerable to severe winter events.

<u>Houston County</u> (HC)

The Houston County plan includes the cities of Crockett, Grapeland, Kennard, Lovelady, and Latexo.

Vulnerability and Risk Assessment Data

Totals (Note: hazards such as tornadoes, winter storms, hail, and thunderstorms) affect the area equally as for numbers of people as well as the numbers of residential, commercial, critical facilities, etc. that are at risk). Population: 23,044. Area covered: 1,237 square miles. The overall value of structures within Houston County is estimated at $1,201,326,190.

(a) Droughts
  (1) There are 9 drought events across the region including Houston County registered with the NCDC since 1994. This average of 0.75 per year constitutes a ‘likely’ probability of occurrence rating. The main asset vulnerable to drought events in Houston County is crops and livestock, both commercial and private.

(b) Extreme Heat
  (1) Based on NCDC records, Houston County has experienced extreme heat events six times over the past seven years, a 0.85 event average per year. This equates to

a ‘highly likely’ probability of future occurrence. Overall vulnerability throughout the jurisdictions of Houston County to extreme heat events is considered moderate by the HMT.

(c) Floods
  (1) There have been 23 flood events in Houston County that registered with the National Oceanic and Atmospheric Administration (NOAA) since 1994. This constitutes a 1.9 flood per year average and thus a ‘highly likely’ probability of occurrence. The Hazard Mitigation Team agreed 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.
  (2) Total potential loss for a single hazard event: $2,850,089.

(d) Hail
  (1) There are 69 hail events in Houston County registered with NOAA in records dating to 1966. Of these, 67 occurred since 1984, constituting a 3.04 hailstorm per year average over this period and therefore a ‘highly likely’ probability of future occurrence rating. Vulnerability can vary based on population density, but overall is considered moderate to low for the jurisdictions of Houston County.
  (2) Average annual loss due to hail damage: $39,632.

(e) Thunderstorms
  (1) There have been 80 thunderstorm and high wind events in Houston County that have registered with NOAA since 1986. This constitutes an average of 4 storms per year and thus a ‘highly likely’ probability of future occurrence. Houston County overall is at a moderate to high vulnerability from thunderstorms and high winds, as is the entire east Texas region.
  (2) Average annual loss due to thunderstorms: $81,328.

(f) Tornadoes
  (1) There are 19 tornado events in Houston County registered with NOAA in records dating to 1951. This pattern of frequency constitutes a ‘likely’ probability of future occurrence. Overall vulnerability to tornados in Houston County is moderate to high.
  (2) Average annual loss due to tornadoes: $26,483

(g) Wildfires
  (1) The probability of future wildfire events is considered ‘highly likely’ In general, since more than 50% of the population of Houston County is located in rural areas, vulnerability of rural structures to wildfires is high, in addition to high vulnerability to both privately and publicly owned forest and timberlands.
  (2) Average annual loss due to wildfires: $118,098.

(h) Winter/Ice Storms
  (1) There are 3 ice storms in Houston County registered with NOAA since 1994, an average of 0.25 per year which constitutes an ‘occasional’ probability of future occurrence rating. Houston County has at least some level of vulnerability to significant and damage-causing ice storm events.

The following plans were prepared by the Rio Grande Council of Governments who created this table to rate hazards:

Extent (intensity of Hazard):

- Major: Major extent is the potential maximum or near the top category for the hazard (for example: F4 or F5 tornados)

- Median: Median extent is the average between major and minor extents (for example F2 or F3 tornados)

- Minor: Minor extent is the lower end category for the hazards (for example: F0 to F1 tornados).

PROBABILITY:

- Highly likely: Event probable in the next year
- Likely: Event probable in next 3 years
- Occasional: Event possible in the next 5 years
- Unlikely: Event possible in the next 10 years

Based on the previous occurrences the RISK LEVEL (Vulnerability) for each hazard is listed below. The description of the terms is as follows:

- Very High: People and facilities located in known risk areas (examples: hurricane risk area, 100-year floodplain, active fault line, HAZMIT site, etc.).

- High: People and facilities located in areas that have previously experienced impacts from hazards and/or in areas where impacts from hazards are possible and/or probable.

- Limited: People and facilities located in areas that have a low frequency history of impacts from hazards and/or in areas where impact is possible but not probable.

- Minimal Risk: People and facilities located in areas with no history of occurrence of hazards and/or in areas where impact is not possible or probable.

Based on the previous occurrences the POTENTIAL SEVERITY (Impact) for each hazard is listed below. The description of the terms is as follows:

- Substantial: Multiple deaths or complete shutdown of facilities for 30 days or more, or more than 50 percent of property destroyed or with major damage.
- Major: Injuries and/or illnesses result in permanent disability or complete shutdown of critical facilities for at least 2 weeks, or more than 25 percent of property destroyed or with major damage.
- Minor: Injuries and/or illnesses do not result in permanent disability or complete shutdown of critical facilities for more than 1 week, or more than 10 percent of property destroyed or with major damage.
- Limited: Injuries and/or illnesses are treatable with first aid or minor quality of life lost or shutdown of critical facilities and services for 24 hours or less, or less than 10 percent of property destroyed or with major damage.

<u>Rio Grande Council of Governments</u> (RGCOG)

The RGCOG plan covers the following counties: El Paso, Culberson, Brewster, Presidio, Hudspeth, and Jeff Davis. Included here are the cities of Alpine, Van Horn, El Paso, Clint, Vinton, Anthony, Socorro, Horizon City, Marfa, Presidio, Dell City, and Valentine. Also included in this plan is the Tigua Indian Reservation of Texas.

Vulnerability and Risk Assessment Data

Totals (Note: hazards such as tornadoes, winter storms, hail, and thunderstorms) affect the area equally as for numbers of people as well as the numbers of residential, commercial, critical facilities, etc. that are at risk).

(a) Dam/Levee Failures

(1) The extent of a disaster would be minor, with unlikely probability, minimal risk vulnerability and limited impact.

(b) Drought
(1) The extent of a disaster would be minor, with unlikely probability, minimal risk vulnerability and limited impact.
(c) Earthquakes
(1) The extent of a disaster would be minor, with unlikely probability, minimal risk vulnerability and limited impact.
(d) Extreme Heat
(1) The extent of a disaster would be major, with highly likely probability, limited vulnerability and limited impact.
(e) Flood
(1) The extent of a disaster would be minor, with unlikely probability, limited vulnerability and limited impact.
(f) Hail
(1) The extent of a disaster would be median, with occasional probability, limited vulnerability and limited impact.
(g) Thunderstorms
(1) The extent of a disaster would be major, with occasional probability, minimal risk vulnerability and limited impact.
(h) Tornados
(1) The extent of a disaster would be minor, with unlikely probability, limited vulnerability and limited impact.
(i) Wildfires
(1) The extent of a disaster would be minor, with occasional probability, limited vulnerability and limited impact.
(j) Windstorms and Downbursts
(1) The extent of a disaster would be major, with occasional probability, minimal risk vulnerability and limited impact.
(k) Winter/Ice Storms
(1) The extent of a disaster would be minor, with occasional probability, minimal risk vulnerability and limited impact.

Culberson County (CC)

The Culberson County plan includes the town of Van Horn.
Vulnerability and Risk Assessment Data
Totals (Note: hazards such as tornadoes, winter storms, hail, and thunderstorms) affect the area equally as for numbers of people as well as the numbers of residential, commercial, critical facilities, etc. that are at risk). Area Covered: 3,813 square miles. Population: 2,525.

(l) Dam/Levee Failures
(1) The extent of a disaster would be minor, with unlikely probability, minimal risk vulnerability and limited impact.
(m) Drought
(1) The extent of a disaster would be median, with likely probability, limited vulnerability and impact.
(n) Earthquakes
(1) The extent of a disaster would be minor, with occasional probability, limited vulnerability and impact.
(o) Extreme Heat

(1) The extent of a disaster would be minor, with occasional probability, limited vulnerability and impact.

(p) Flood

(1) The extent of a disaster would be minor, with occasional probability, limited vulnerability and minor impact.

(q) Hail

(1) The extent of a disaster would be median, with occasional probability, limited vulnerability and impact.

(r) Thunderstorms

(1) The extent of a disaster would be minor, with occasional probability, minimal risk vulnerability and limited impact.

(s) Tornados

(1) The extent of a disaster would be median, with unlikely probability, limited vulnerability and minor impact.

(t) Wildfires

(1) The extent of a disaster would be minor, with occasional probability, minimal risk vulnerability and limited impact.

(u) Windstorms and Downbursts

(1) The extent of a disaster would be median, with occasional probability, limited vulnerability and impact.

(v) Winter/Ice Storms

(1) The extent of a disaster would be minor, with occasional probability, limited vulnerability and impact.

Hudspeth County (HC)

The Hudspeth County plan includes Dell City.

Vulnerability and Risk Assessment Data

Totals (Note: hazards such as tornadoes, winter storms, hail, and thunderstorms) affect the area equally as for numbers of people as well as the numbers of residential, commercial, critical facilities, etc. that are at risk). Area Covered: 4,572 square miles. Population: 3,320.

(a) Dam/Levee Failures

(1) The extent of a disaster would be minor, with unlikely probability, minimal risk vulnerability and limited impact.

(b) Drought

(1) The extent of a disaster would be minor, with occasional probability, minimal risk vulnerability and limited impact.

(c) Earthquakes

(1) The extent of a disaster would be minor, with unlikely probability, minimal risk vulnerability and limited impact.

(d) Extreme Heat

(1) The extent of a disaster would be median, with highly likely probability, limited vulnerability and limited impact.

(e) Flood

(1) The extent of a disaster would be median, with occasional probability, limited vulnerability and limited impact.

(f) Hail

(1) The extent of a disaster would be median, with occasional probability, limited vulnerability and limited impact.

(g) Thunderstorms

(1) The extent of a disaster would be median, with occasional probability, minimal risk vulnerability and limited impact.

(h) Tornados

(1) The extent of a disaster would be minor, with unlikely probability, minimal risk vulnerability and limited impact.

(i) Wildfires

(1) The extent of a disaster would be minor, with occasional probability, minimal risk vulnerability and limited impact.

(j) Windstorms and Downbursts

(1) The extent of a disaster would be minor, with occasional probability, limited vulnerability and limited impact.

(k) Winter/Ice Storms

(1) The extent of a disaster would be minor, with occasional probability, limited vulnerability and limited impact.

Brewster County (BC)

The Brewster County plan includes the city of Alpine.

Vulnerability and Risk Assessment Data

Totals (Note: hazards such as tornadoes, winter storms, hail, and thunderstorms) affect the area equally as for numbers of people as well as the numbers of residential, commercial, critical facilities, etc. that are at risk). Area Covered: 6,192 square miles. Population: 9,048.

(a) Dam/Levee Failures

(1) The extent of a disaster would be minor, with unlikely probability, minimal risk vulnerability and limited impact.

(b) Drought

(1) The extent of a disaster would be minor, with unlikely probability, minimal risk vulnerability and limited impact.

(c) Earthquakes

(1) The extent of a disaster would be minor, with occasional probability, limited vulnerability and minor impact.

(d) Extreme Heat

(1) The extent of a disaster would be median, with occasional probability, limited vulnerability and minor impact.

(e) Flood

(1) The extent of a disaster would be median, with occasional probability, limited vulnerability and limited impact.

(f) Hail

(1) The extent of a disaster would be median, with occasional probability, limited vulnerability and minor impact.

(g) Thunderstorms

(1) The extent of a disaster would be median, with occasional probability, limited vulnerability and limited impact.

(h) Tornados

(1) The extent of a disaster would be median, with occasional probability, limited vulnerability and minor impact.

(i) Wildfires

(1) The extent of a disaster would be minor, with occasional probability, minimal risk vulnerability and limited impact.

(j) Windstorms and Downbursts

(1) The extent of a disaster would be median, with likely probability, limited vulnerability and minor impact.

(k) Winter/Ice Storms

(1) The extent of a disaster would be median, with occasional probability, minimal risk vulnerability and limited impact.

Effects of changes in development on loss estimations

Loss estimations are expected to go down as new building regulations are enforced in known hazard areas. According to the Texas Floodplain Management Association (TFMA), more communities are adopting 'freeboard' requirements into their local flood ordinances. Freeboard is the finished floor elevation above the Base Flood Elevation (BFE). By requiring that new development is built above the BFE, instead of just at BFE, it is expected that future losses caused by flooding will come down. According to TFMA, one hundred and sixty-eight (168) Texas communities have adopted freeboard requirements into their flood ordinances.

The Beaumont and Port Arthur area expects a reduction in loss estimations to floods and hurricanes due to their proactive approach on buying out Severe Repetitive Loss (SRL) properties, thus reducing the amount of future losses caused by flooding and hurricane storm surge. In addition, this area has been mitigating flooding by creating large flood control projects funded through FEMA's mitigation grants.

The San Antonio and Austin area expects an increase in loss estimations from wildfire as those two cities continue to expand into undeveloped areas that contain a large amount of brush that could act as fuel for wildfires. However, both cities encourage the use of an interface between the brush and structures to reduce the chance of a damaged or destroyed building.

The following matrix summarizes the loss estimation data on the natural hazards from the various Council of Governments plans. Information was taken from the local mitigation plans.

Table 2-27: Local Risk and Vulnerability Assessment Matrix

TCRFC - Texas Colorado River Floodplain Coalition	GBRA – Guadalupe Blanco River Authority
H-GAC – Houston Galveston Area Council	SPAG – South Plains Associations of Governments
AACOG – Alamo Area Council of Governments	HOTCOG – Heart of Texas Council of Governments
BVCOG – Brazos Valley Council of Governments	WCTCOG – West Central Texas Council of Governments

Table 2-28: Overview of Hazards Affecting Council of Governments in Texas

	TCRFC	GBRA	H-GAC	SPAG	AACOG	HOTCOG	BVCOG	WCTCOG
Hurricane Winds	$98.6M	$38M	$877.5M	$654,000	$34.9M	$5.2M	$10.5M	$1.6M
Floods			-	-		-	-	-
Riverine Flooding	$1.3B	$12.7M	$596.5M	$4.3M	$51.9M	$950,000	$105.2M	$26.3M
Coastal Flooding (Surge from Cat 5 hurricane)	-	-	$32.2M	-	-	-	-	-

Drought	$30.5M	$1.05M	$30M Mainly crop and farmland	$111M	-	-	$47M (agricultural product market value)	$105M
Tornadoes	$14.6M	$269,685	$34.8M	$331,410	$3M	$629,000	$801,924	$537,812
Hail	$1.8M	$852,048	$2.7M	$774,490 property $5.4M crops	$1.3M	$1.5M	$164,590	$941,800 property $4.9M crops
Thunderstorms	$2.3M	$36M	$9.3M	$2.7M	$2.2M	$297,000	$97,153	$4.2M
Winterstorms	-	-	-	$1.7M	-	$4.4M	$1.02M	$5.3M
Urban Wildland Fire	-	-	-	-	-	$5M	$3.8M	-
Earthquakes	-	-	-		-	$94,992	-	-
Totals	$1.5B	$88.8M	$1.5B	$127M	$93.3M	$18M	$171.5M	$148.7M

NOTE: Not all natural hazards were covered in all of the mitigation plans. This is explained in the local plans. Where a hazard was not discussed is indicated by a "-". The Number 1 for each regional area is bolded. The totals in the last row are rounded to the highest million.

HOW INFORMATION FROM LOCAL RISK ASSESSMENTS IS ANALYZED

Local risk assessment information is submitted to TDEM through local jurisdictions (cities and counties) or from COGs, and in some cases, State River Authorities.

Some COGs and river authorities decided to create large multi-jurisdictional mitigation plans to cover the communities within their region. These multi-jurisdictional plans are useful because it allows multiple jurisdictions to work together in an attempt to identify and mitigate natural hazards that could impact them. Since hazards do not stop at political boundaries, it is important that neighboring jurisdictions work together to determine which hazards might enter their areas from other jurisdictions. For example, a city might think they have no risk of a dam failure, only to learn through the planning process that the county contains an earthen dam upstream from the city, thus placing city residents at risk to floods in case of a dam failure.

The process used to analyze the information from local risk assessments includes reviewing the local mitigation plans for completeness and determining if the information is accurate. This process is begun by the TDEM mitigation planner reading the local risks assessments as they arrive in draft form to TDEM prior to submittal to FEMA. Often, TDEM will discover incomplete risk assessments that might focus on only a few of the natural hazards that could impact a jurisdiction. In these cases, the local mitigation plan will be returned to the jurisdiction with required revisions and instructions on how to correct the deficiencies. In other cases, when the risk assessment does appear to focus on all of the natural hazards that could impact a jurisdiction, the TDEM mitigation planner will access the electronic Texas Hazards Analysis at www.thmp.info to verify if the provided information is accurate. In addition, the planner may access the Web site of the National Climatic Data Center (NCDC) at http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms to verify previous occurrences of natural hazards in that area. Any deficiencies will cause the plan to be return to the local jurisdiction for required revisions prior to being submitted to FEMA Region VI for their review. After local risk assessments are approved by TDEM and FEMA, the process used to analyze the information is often conducted by SHMT.

As mitigation grant applications arrive at TDEM for either the HMGP, PDM grant program, or the RFC grant program, they are scored by the Section and the resulting scores are given to the SHMT for their review. If a local jurisdictional risk assessment is accurate, then the proposed mitigation project should be able to identify the best way to mitigate that natural hazard. The SHMT may vote to approve projects based on a more detailed risk assessment.

ASSESSING VULNERABILITY BY JURISDICTION AND CHANGES IN DEVELOPMENT FOR JURISDICTIONS IN HAZARD PRONE AREAS

Texas is too large and geologically varied to assess vulnerability per each jurisdiction, so instead this Plan will break them down into regions.

The Coastal Region is mostly vulnerable to hurricanes and tropical storms. With more people moving to the Texas coast each year, a higher percentage of people are placing themselves in harm's way. State goals and strategies to limit their vulnerability are discussed in Section 3. One mitigation action that has reduced the vulnerability of land subsidence was the discontinuation of pumping out ground water in the Harris County area (Houston). Another has been the implementation of hurricane storm surge markers so that local residents may see for themselves how high the water may rise during a hurricane storm surge event.

The Panhandle (Amarillo and Lubbock) and North Central Texas (Dallas and Fort Worth) is mostly vulnerable to tornadoes, wildfires, and river floods. As more people move to this area of Texas each year, the local jurisdictional vulnerability goes higher. State goals and strategies to limit deaths and property destruction are discussed in Section 3. One mitigation action that has reduced vulnerability to tornadoes are stronger building codes. Another has been the implementation of FEMA grants through TDEM for the installation of individual safe rooms to better protect families who are too rural for a community storm shelter.

Far West Texas (El Paso) is susceptible mostly to drought and the occasional river flood. This area is not experiencing a high population growth. State goals and strategies to mitigate the vulnerability to these hazards are discussed more in Section 3. One action item aimed at reducing vulnerability to extreme heat has been the process of setting up "cooling centers" (buildings with air conditioners) for elderly people to reside in until the heat subsides.

South Texas (Brownsville) is vulnerable to drought and floods from the Rio Grande. This area is experiencing large population increases. State goals and strategies to reduce vulnerability are discussed in Section 3. Implementation of mitigation actions to reduce vulnerability includes Farmer's Crop Insurance to protect their resources in times of drought and the acquisition of structures in the 100-year floodplain.

Central Texas (San Antonio and Austin) is highly vulnerable to flash floods from thunderstorms. This area continues to see high population gains. State Goals and Strategies to reduce vulnerability are discussed in Section 3. Implementation of mitigation actions to reduce vulnerability includes the acquisition or elevation of homes in the 100-year floodplain and the clearing of brush to reduce the impact of wildfires.

The City of Houston is still experiencing large population growth. However, Houston has done a good job of mitigating the effects of development in known flood hazard areas by requiring that all new development, if any, in these areas are required to build the first floor 18 inches above the know base flood elevation. In addition, Houston is aggressively acquiring structures through

HMGP and PDM grant funds that have previously flooded, eliminating the risk of future floods in those repetitive loss homes.

The City of San Antonio is also dealing with population growth into known flood hazard areas. San Antonio has passed an ordinance that does not allow any new development in the known flood plain areas. In addition, San Antonio continues to acquire repetitive flooded structures and removes them permanently from the flood plain.

The City of Austin continues to update their flood plain maps and is aggressively buying out homes in the flood plain to prevent future flood damages and deaths. This includes Travis County, where several properties flooded on Lake Travis in the summer of 2007.

Texas is encouraging more communities to incorporate UWI boundaries in their areas as to reduce the vulnerability of wildfires. Texas, through TDEM, supports major metropolitan areas and rural counties in their efforts to reduce vulnerability by distributing mitigation grants through HMGP and PDM.

For those hazards that do not have a defined boundary, such as tornadoes and hurricanes, most Texas cities are building with stronger building codes to reduce the vulnerability of these hazards. In addition, TDEM assists local communities to achieve these goals through the implementation of mitigation projects through HMGP and PDM grants. Texas counties are not allowed to enforce building codes, which makes it difficult for them to have control over new development. However, most Texas counties participate in the NFIP and they may regulate development in their flood plains.

Most of the population growth in the state continues in the five major urban centers: Dallas/Ft Worth, Austin, San Antonio, Houston and McAllen/Harlingen (often called 'The Valley'). The bad news is that of the five, two, Houston and the Valley, are experiencing growth in Hurricane hazard areas. Re-development in the Houston /Galveston area following Hurricane Ike is rapidly continuing. The operative question is: if a major hurricane like Ike returned to the Houston / Galveston area a decade from now, would damages be more or less extensive than Ike in 2008? The good news is that damages are expected to be less extensive due to modern building codes and their enforcement, including both floodplain management and windstorm building codes.

The first floodplain maps were published in Galveston in the late 1980's, with good enforcement of the maps taking even longer to develop. Yet a tremendous amount of the housing inventory of the area was built prior to 1985. Much of the destruction in the Galveston bay rim from Hurricane Ike was to pre-FIRM housing. Likewise, the Texas legislature first directed all coastal communities to adopt and enforce a 120 mph building code (IRC2000) in 2000. Again, it took several years before those communities became proficient in enforcement, and a tremendous amount of the housing inventory of the area was built prior to 2005.

Today, thanks to the more aggressive outreach and enforcement by the empowered TWDB, all post-Ike construction is compliant with current floodplain maps. And, due to half a decade of experience (with some education opportunities provided by FEMA) wind code compliance with the 2007 International Residential Code is commonplace.

So, while development in hazard prone area continues, the current enforcement regime will substantially protect that development.

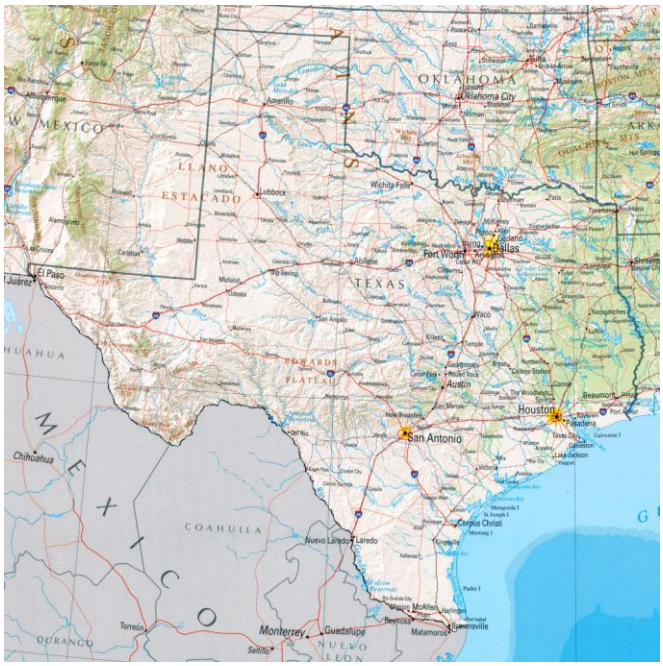
The Valley meanwhile, has not experienced a major storm surge and wind event, despite several smaller events. As a result, a large inventory of the 1980's vintage, non-code compliant housing inventory remains. Outreach by FEMA and the State to encourage all new construction to be flood and wind code compliant have been well received, and much of the recent growth is compliant. However, more outreach and education is needed.

The State assesses the flood and wind code compliance in the Houston and Galveston Bay Rim communities as good. The flood and wind code compliance in the Valley is getting better.

The higher inspection and outreach regime of the TWDB is resulting in two positive outcomes: better local enforcement of their minimum flood prevention ordinance, and increasing adoption of higher level ordinances. The increasing adoption of 'zero rise' ordinances and 'ultimate floodplain' ordinances means that the flood risk to population and structures is decreasing, this despite the overall increasing population.

SOCIOECONOMIC TREND ANALYSIS

Map 2-21: Map of Texas



Over the last three years Texas population has increased at a rate of just over 2% a year, but that growth has not been uniform, almost all the serious growth has been in just five metropolitan areas: Dallas-Ft Worth, Austin, San Antonio, Houston-Galveston, and Brownsville-Harlingen. Rural county (mostly west of I-35 but some in deep East Texas) populations have remained stagnant or even declined.

Over the same period, Texas incomes have largely mirrored the national average, with per-capita income rising faster than inflation, while wages rose less than inflation, resulting in a small segment of the population that is quite prosperous.

This growth pattern has been generally positive for mitigation, although there are some dangerous trends. The large urban areas do better building code enforcement and better flood-plain management than small rural communities. That segment of the population that is prospering is purchasing large, modern, well built homes, which were built under well enforced building codes,

with good floodplain management, while the rest of the population moves into the older homes that were vacated. The net result is that a decreasing percentage of the population lives in the floodplain, and a decreasing percentage of the population lives in a home that was not built to code.

There are some troubling trends however. The UWI area is increasing in San Antonio and Austin, as those communities expand west and north into the Balcones uplift. Steep slopes, generally dry conditions, and predominance of evergreen trees make these areas prone to wildfire.

Dallas-Ft. Worth is in a very tornado prone area, but has not had a serious event recently. Community and individual tornado shelter construction has not kept pace with population growth, nor has the expansion of community warning systems. The cell phone text warnings are a growing trend that may eventually solve the warning problem in this area.

The population exposed to storm surge and hurricane risks is increasing. Since 2000, all homes built in the coastal areas are supposed to be built to a much more substantial 130 mph wind code, but of course there is a huge percentage of the inventory that was built prior to that time and to less rigorous codes.

Good floodplain management is being practiced in Houston and Galveston, but building is regulated to the 100-year event, deep storm surge will exceed the 100-year event. Building trends are changing in this region, with fewer single family dwellings and more condominiums. Condominiums are easier to build to a strong wind code, and can be elevated above the storm surge on a concrete parking garage. The result is that an increasing percentage of the housing inventory will likely survive a significant hurricane, while the evacuation demand also increases.

Challenges are significant in Brownsville-Harlingen. The largest cities do an adequate job of building code enforcement and floodplain management, but governance is weak in small communities and in the county areas. Meanwhile, this is the single fastest growing metropolitan area. According to the Governors Evacuation Task Force Report of 2005, the population has already outgrown the currently available hurricane evacuation routes. An air evacuation plan has been developed to handle the overflow until the overland routes can be upgraded.

ASSESSING VULNERABILITY AND ESTIMATING LOSSES TO STATE FACILITIES

Requirement §201.4(c)(2)(ii): *The State plan shall include an overview and analysis of the State's vulnerability to…State owned critical or operated facilities located in the identified hazard areas.*

GENERAL

This section contains information on State-owned structures at risk to various hazard and their values.

As part of the mitigation planning requirements, the State of Texas in 2004 made a preliminary effort in gathering information and statistics about the State-owned or operated buildings, infrastructure, and critical facilities located in areas subject to hazards enumerated in 44 CFR §201.4(c)(2)(ii). A State database that existed at the time was incomplete and not in GIS form.

The State arrived at a basic list of required criterions from which a spreadsheet was drawn up and incorporated in to a Web form instrument (created by the Texas Department of Information Re-

sources), placed on a Web site, and made available to State agencies and State-owned Institutions of Higher Education. This spreadsheet was to be downloaded, populated, and returned to TDEM, who reviewed it and then forwarded to TNRIS, who was to then create a GIS database, from which the State could assess the vulnerability to hazards of those same State-owned or operated buildings, infrastructure, and critical facilities.

TDEM updated the State facility database (vulnerability and estimated losses) in 2009 by funding the creation of the Geospatial Emergency Management Support System (GEMSS). GEMMS was created by the Texas Natural Resource Information Systems (TNRIS). The State will continue to add and edit data by allowing GEMSS to be edited once a year by all of the State agencies that have buildings listed in the State facility database.

STATE BUILDING DESCRIPTION

The typical State building in Texas contains a gross area of approximately 56,000 square feet, two to three stories high, and a building structural type of steel frame, enclosed with masonry and glass. The occupancy class of government - general service with an approximate value of 6.8 million dollars, 3 out of 10 are owned by various State agencies with the remaining 7 out of 10 being leased or leased with option to purchase by the Texas Facilities Commission.

While the typical State building is as described above, State-owned buildings vary tremendously in square footage, cost, building structural type, occupancy class, and number of stories. State structures run the gamut from simple, small, ruggedly engineered structures housing critical equipment such as water pumps and emergency generators, to multi-million dollar university nuclear energy research facilities, to State schools and hospitals, to State correctional facilities, to aircraft hangers and repair facilities.

CRITICAL INFRASTRUCTURE AND STATE-OWNED FACILITIES

There has been a great deal of discussion over several years as to what constitutes a State critical infrastructure. The general discussion has been that both the function must be critical and the function and infrastructure must be not easily reproducible in order for the facility to be critical. Most of the business of government is conducted in rooms full of files, phones, and desktop computers. This layout can be quickly reproduced in alternate locations in most instances.

For example, if a Texas Department of Transportation Regional office was struck and demolished by a Cat 5 tornado, the office could be back in service within fourteen days in leased office space, by recovering data from the State Data Security facility. If a Texas Department of Corrections prison was damaged by a similar event, the inmates could be transferred to other similar facilities across the State, so that any prison facility in itself is not critical.

The final list of ten (10) State critical infrastructure follows. Note that for security reasons, the location of these facilities will not be listed.

Infrastructure that was determined to be classified as a Critical Facility

The State defines a critical asset as any entity or location, whether physical or virtual, the compromise or destruction of which would have profound and negative effect on;

1. Critical Infrastructure
2. Mass Gathering or cause Mass Casualty, or
3. Have a profound and negative Symbolic or Psychological Impact

The State Operations Center: 30 ft underground, outside the 500 year floodplain, outside the hurricane risk areas, not in an earthquake prone area, invulnerable to even a Cat 5 tornado, not in an urban-wildfire interface, and possessing emergency power generation. The secure video and telecommunication links to this facility are not easily reproduced.

The State Data Security Facility: 150 ft underground, outside the 500 year floodplain, outside the hurricane risk areas, not in an earthquake prone area, invulnerable to even a Cat 5 tornado, not in an urban-wildfire interface, and possessing emergency power generation.

There are eight (8) power generating hydro-electric dams owned and operated by State sanctioned River Authorities. There are more hydro-electric facilities than this throughout Texas, but these are the only ones that are State owned. All are outside the hurricane risk areas, not in an earthquake prone area, and invulnerable to even a Cat 5 tornado. By definition they are in the floodplain, but have emergency spillways designed to withstand the 500 year event. Some River Authorities have even begun the process of strengthening their dams to withstand the Probable Maximum Flood (PMF). PMF is greater than the 500 year event.

TDEM assess that these underground and/or massive structures have no vulnerability to the minor hazards of lightening, hail, and extreme heat.

The State classifies the State Operations Center (SOC,), the State Secure Data Facility and eight (8) power generating dams as state owned critical facilities. Currently the State maintains the Critical Infrastructure Database (CID) in the Preparedness Section of the Texas Division of Emergency Management (TDEM), specifically in the Critical Infrastructure Key Resources Section. Below is the hazard analysis for the state's critical facilities. Note that for security reasons, the location and details of these facilities will not be listed. For more information, contact the State Hazard Mitigation Officer at (512) 424-2429.

<u>Critical Facility Analysis</u>

State Operations Center
Location:
Why Critical: Communication links and subterranean location not easily replicated.
Replacement Value:
Contents Value:
Hazards & Potential Losses
Flood -
Hurricane -
Tornado –
Wildfire –

Dam Failure –
Earthquake –
Hail –
Winter Storm –
Extreme Heat –
Drought –
High Wind –
Expansive Soils –
Land Subsidence –
Coastal Erosion -

State Secure Data Facility
Location:
Why Critical: subterranean location not easily replicated.
Replacement Value:
Contents Value:
Hazards & Potential Losses
Flood -
Hurricane -
Tornado –
Wildfire –
Dam Failure –
Earthquake –
Hail –
Winter Storm –
Extreme Heat –
Drought –
High Wind –
Expansive Soils –
Land Subsidence –
Coastal Erosion -

Dam # 1
Location:
Why Critical: combined water and power resources not easily replicated.
Replacement Value:
Contents Value:
Hazards & Potential Losses
Flood -
Hurricane -
Tornado –
Wildfire –
Dam Failure –
Earthquake –
Hail –
Winter Storm –
Extreme Heat –
Drought –
High Wind –
Expansive Soils –

Land Subsidence –
Coastal Erosion -

Dam # 2
Location:
Why Critical: combined water and power resources not easily replicated.
Replacement Value:
Contents Value:
Hazards & Potential Losses
Flood -
Hurricane -
Tornado –
Wildfire –
Dam Failure –
Hail –
Winter Storm –
Extreme Heat –
Drought –
High Wind –
Expansive Soils –
Land Subsidence –
Coastal Erosion -

Dam # 3
Location:
Why Critical: combined water and power resources not easily replicated.
Replacement Value:
Contents Value:
Hazards & Potential Losses
Flood -
Hurricane -
Tornado –
Wildfire –
Dam Failure –
Earthquake –
Hail –
Winter Storm –
Extreme Heat –
Drought –
High Wind –
Expansive Soils –
Land Subsidence –
Coastal Erosion -

Dam # 4
Location:
Why Critical: combined water and power resources not easily replicated.
Replacement Value:
Contents Value:
Hazards & Potential Losses

Flood -
Hurricane –
Tornado –
Wildfire –
Dam Failure –
Earthquake –
Hail –
Winter Storm –
Extreme Heat –
Drought –
High Wind –
Expansive Soils –
Land Subsidence –
Coastal Erosion –

Dam # 5
Location:
Why Critical: combined water and power resources not easily replicated.
Replacement Value:
Contents Value:
Hazards & Potential Losses
Flood -
Hurricane -
Tornado –
Wildfire –
Dam Failure –
Earthquake –
Hail –
Winter Storm –
Extreme Heat –
Drought –
High Wind –
Expansive Soils –
Land Subsidence –
Coastal Erosion -

Dam # 6
Location:
Why Critical: combined water and power resources not easily replicated.
Replacement Value:
Contents Value:
Hazards & Potential Losses
Flood -
Hurricane -
Tornado –
Wildfire –
Dam Failure –
Earthquake –
Hail –
Winter Storm –
Extreme Heat –

Drought –
High Wind –
Expansive Soils –
Land Subsidence –
Coastal Erosion -

Dam # 7
Location:
Why Critical: subterranean location not easily replicated.
Replacement Value:
Contents Value:
Hazards & Potential Losses
Flood -
Hurricane -
Tornado –
Wildfire –
Dam Failure –
Earthquake –
Hail –
Winter Storm –
Extreme Heat –
Drought –
High Wind –
Expansive Soils –
Land Subsidence –
Coastal Erosion -

Dam # 8
Location:
Why Critical: combined water and power resources not easily replicated.
Replacement Value:
Contents Value:
Hazards & Potential Losses
Flood –
Hurricane -
Tornado –
Wildfire –
Dam Failure –
Earthquake –
Hail –
Winter Storm –
Extreme Heat –
Drought –
High Wind –
Land Subsidence –
Coastal Erosion -

Infrastructure that was determined to not be classified as a Critical Facility

The State Capital building was originally on a list of critical infrastructure. The building would be extraordinarily difficult to reproduce, but it failed the function test. The legislature in fact routinely meets in other areas of the state, and could meet in any courtroom or large office.

Causeways to Barrier Islands were not deemed critical; such as State Highway 100 to South Padre Island. Fewer than 3000 residents live full time on the island. When the causeway was damaged by a barge in 2004, transportation service to the island was restored by a TxDOT ferry within ten days. State Highway 22 to Padre Island in Corpus Christi likewise services fewer than 2000 permanent residents. Interstate Highway 45 onto Galveston Island serves a much higher and vulnerable population, but this is a federally owned infrastructure.

The Five State Crime Labs were not deemed critical. The facilities themselves are not easily reproducible, as they contain sophisticated scanning electron microscopes and DNA replication equipment, but because there are five of them, the function of one could be shared among the remaining structures.

The ERCOT Control Room. The Electric Reliability Council of Texas operates the electric grid and manages the deregulated market for 75 percent of the state. Strictly speaking the ERCOT control room bunker is not a state owned facility. But clearly it is critical. It is outside the 500 year floodplain, outside the hurricane risk areas, not in an earthquake prone area, invulnerable to even a Cat 5 tornado (14 inch concrete walls), not in an urban-wildfire interface, and possessing emergency power generation.

Nuclear Facilities. The two nuclear power plants in Texas are privately held. There are State facilities where fissile material is held, but the function is not critical to the functioning of State government. They are outside the 500 year floodplain, outside the hurricane risk areas, not in an earthquake prone area, and invulnerable to even a Cat 5 tornado.

HAZARD AREAS AFFECTING STATE-OWNED FACILITIES (NOT CRITICAL)

Tornado Hazard Frequency Zones
Zone 1 (frequency of less than 1 tornado per 1,000 square miles): 489 State-owned structures with a structure plus contents value of $148,705,513

(a) Zone 2 (frequency between 1 and 5 tornadoes per 1,000 square miles): 4,778 State-owned structures with a structure plus contents value of $4,476,985,349

(b) Zone 3 (frequency between 6 and 10 tornadoes per 1,000 square miles): 4,924 State-owned structures with a structure plus contents value of $8,374,688,470

(c) Zone 4 (frequency between 11 and 15 tornadoes per 1,000 square miles): zero (0)

(d) Zone 5 (frequency of more than 15 tornadoes per 1,000 square miles): 573 State-owned structures with a structure plus contents value of $777,813,061

(e) Summary: 10,764 State-owned structures with a total structure plus contents value of $13,778,192,400

Hurricane Risk Areas
Risk Area 1(Hurricane Category 1): 96 State-owned structures with a structure plus contents value of $6,553,646

(a) Risk Area 2 (Hurricane Categories 1 and 2): 113 State-owned structures with a structure plus contents value of $9,695,568

(b) Risk Area 3 (Hurricane Categories 1, 2, and 3); 297 State-owned structures with a structure plus contents value of $142,929,826

(c) Risk Area 4 (Hurricane Categories 1, 2, 3, and 4): 343 State-owned structures with a structure plus contents value of $199,194,630

(d) Risk Area 5 (Hurricane Categories 1- 5): 513 State-owned structures with a structure plus contents value of $547,759,051

100-year Floodplain:
1,336 State-owned structures with a structure plus contents value of $857,092,910 (Structure: $711,967,855, Contents: $145,125,055)

Urban Wildfire Interface
24 structures owned by three State universities/colleges mainly in Southeast Texas.
(e) Types include maintenance facilities, student housing, class rooms, conference centers, and office buildings.

(f) Total value (building and contents) is $15,637,336.

Summary
State-owned Structures: 12,339 structures with a structure plus contents value of $14,302,469,002.

ESTIMATED LOSSES TO STATE FACILITIES FROM NATURAL HAZARDS

Below are data on estimated losses, where available, to State-owned facilities for floods, tornadoes, hurricanes, drought, wildfires, coastal erosion, dam or levee failure, earthquake, expansive soils, extreme heat, hailstorm, land subsidence, severe winter storms and windstorms.

Floods
We used worksheets out of *Understanding Your Risks: Identifying Hazards and Estimating Losses, FEMA 386-2,* to assist us in estimating the flood losses to State facilities in the 100-year floodplain. We did estimates using 1', 2', 3', and 4' of flooding. To get the structural and content value of the average State facility in the 100-year floodplain we used the figures in paragraph c above (divide the value of the structure $711,967,855 and the value of the contents $145,125,055 by the number of structures 1336). The average State structure value is $532,910, and the contents of the average State structure are valued at $108,626, for a total of $641,536. Grand total equals Column 6 multiplied by number of State buildings in the 100-year floodplain (1336).

Table 2-29: Flood Loss Estimates to Texas-Owned Facilities

Depth of Flooding	% Damage to structure	$ Amount	% Damage to contents	$ Amount	Sub-Total (column 3 + column 5)	Grand Total
1’	9	47,961	13.5	14,664	$62,625	$83,667,000
2’	13	69,278	19.5	21,182	$90,460	$120,854,560
3’	18	95,923	27	29,329	$125,252	$167,336,672
4’	20	106,582	30	32,358	$138,940	$185,623,840

For the average annualized loss, we did an average of the figures in column 6 and multiplied that by 1%. The average annualized estimated losses for State facilities in the 100-year floodplain are $5,574,820.

Hurricanes

In an attempt to manage hurricane evacuation, the State has delineated 5 hurricane risk areas, and 6 hurricane study sectors; the risk areas correspond to the 5 categories of hurricane intensity, and the study sectors are simply the length of the Texas coastline divided by the average width of storm-force winds in an average hurricane. This same delineation was used to estimate hurricane losses.

Hurricane losses were estimated due to high winds and storm surge. Losses in a hurricane due to riverine flooding are counted under losses to flooding. The following logic was used to estimate losses. As with tornadoes, we assume a 65 mph roof design on State facilities.

Table 2-30: Hurricane Loss Estimates to Texas-Owned Facilities

A category 1 hurricane does 10% damage to State facilities in risk area 1, and 0% to other facilities.
A category 2 hurricane does 10% damage to State facilities in risk area 2, and 20% to facilities in risk area 1.
A category 3 hurricane does 10% damage to State facilities in risk area 3, and 20% to facilities in risk area 2, and 30% to facilities in risk area 1.
A category 4-5 hurricane does 10% damage to State facilities in risk area 4-5, 20% damage to facilities in risk area 3, 30% damage to facilities in risk area 2, and 100% damage (due to surge) to facilities in risk area 1.

Further, a hurricane only affects 1/5 (due to the 5 study sectors) of the State facilities in a risk area, and the probability of a hurricane strike was derived from NWS statistics. Category 4-5 storms were consolidated due to the inability to quantify the probability of strike based upon only one cat 5 event in recorded Texas history. The average annualized losses due to hurricanes are approximately $1,488,691.

Tornadoes

Texas estimated its risk to tornadoes by determining what percentage of its land is covered by a tornado track each year, within each tornado frequency zone, and then assuming an equal percentage of the states facilities, in that frequency zone, would be struck. National Weather Service data was used to determine the area covered and strength of and average Texas twister. We further assumed all of the States owned and leased structures are built to code (65 mph) rather than engineered and used 50% of the building and contents to estimate losses when a tornado

struck a building. Texas Department of Health reports no State employees have lost their lives at work due to tornadoes, in the last decade, thus we elected not to add to the estimated losses due to loss of life. Average annualized losses due to tornadoes are approximately $2,878,766. See below for tornado frequency zone data for Texas.

Table 2-31: Iteration One

Tornado Zone	Count	Sum Value B	Sum Value C
1	137	63412482.90	24952085.20
2	1204	2447145272.40	281974101.75
3	718	1015283663.80	728451835.23
5	183	454232560.80	21508808.50

Table 2-32: Iteration Two

Tornado Zone	Count	Sum Value B	Sum Value C
0	12	436614.00	969550.00
1	212	78345693.42	32264432.62
2	1938	3489304130.66	405133583.76
3	1897	5616299990.14	1781228268.32
5	340	519581418.19	169727020.71

Table 2-31: Iteration Three

Tornado Zone	Count	Sum Value B	Sum Value C
1	284	478548093.88	128153926.28
2	3294	4014902010.25	751879117.93
3	4083	11760698073.32	3706029327.89
5	595	2178323090.51	632309862.85

Drought

There have been no losses to State facilities from drought, therefore we have no historical data on which to base a loss estimate. Losses from drought are mainly local agricultural (crop and farmland) losses. According to the local plans that were submitted to TDEM it is estimated that there could be approximately $325 million in losses due to drought. The Farm Service Agency reports that during the past five (5) years, farmers have received $27,715,186 in drought emergency loans.

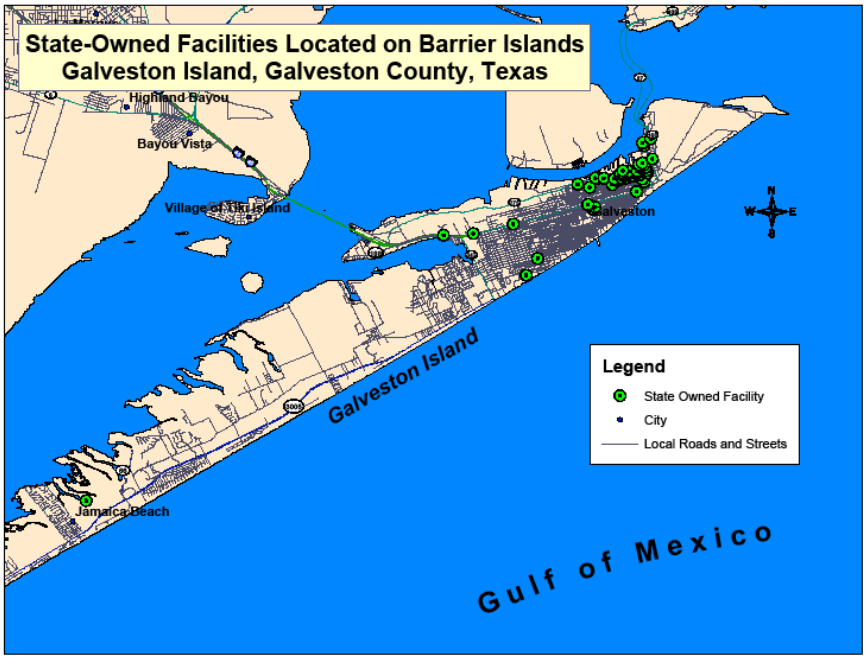
Wildfires

According to the Texas Forest Service, there have been no losses to State facilities from wildfires. So we have no historical data on which to base our loss estimates. Only 24 of the 12,340 State structures (.1%) that have been identified so far are in the UWI area. The best we can do is to take 1% of the value of the structures to come up with our average annualized loss. This equals $156,373.

Coastal Erosion

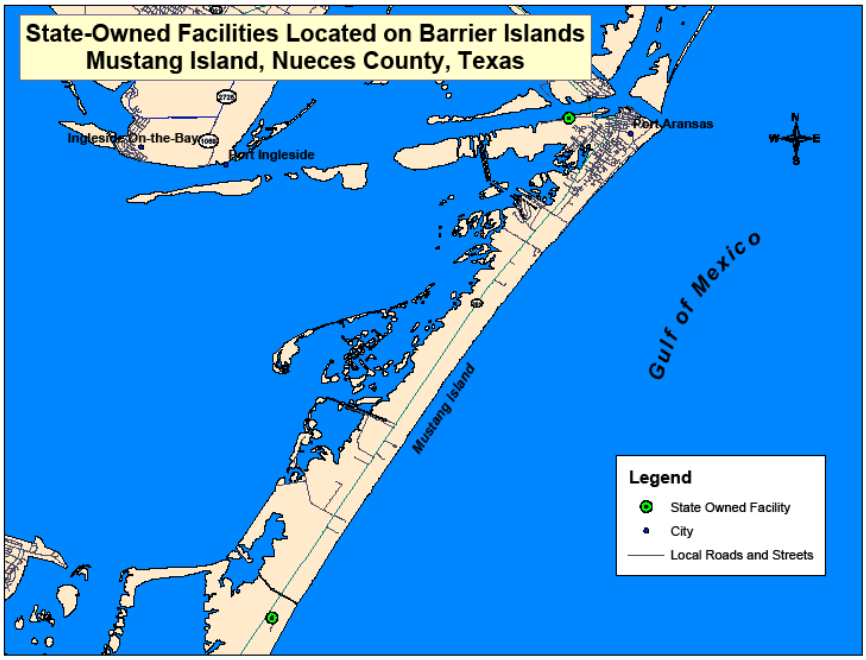
Totaling the expected losses from the three regions shown, the State should expect no losses from coastline retreat.

Map 2-22: Texas-Owned Facilities Located on Barrier Islands (Galveston)



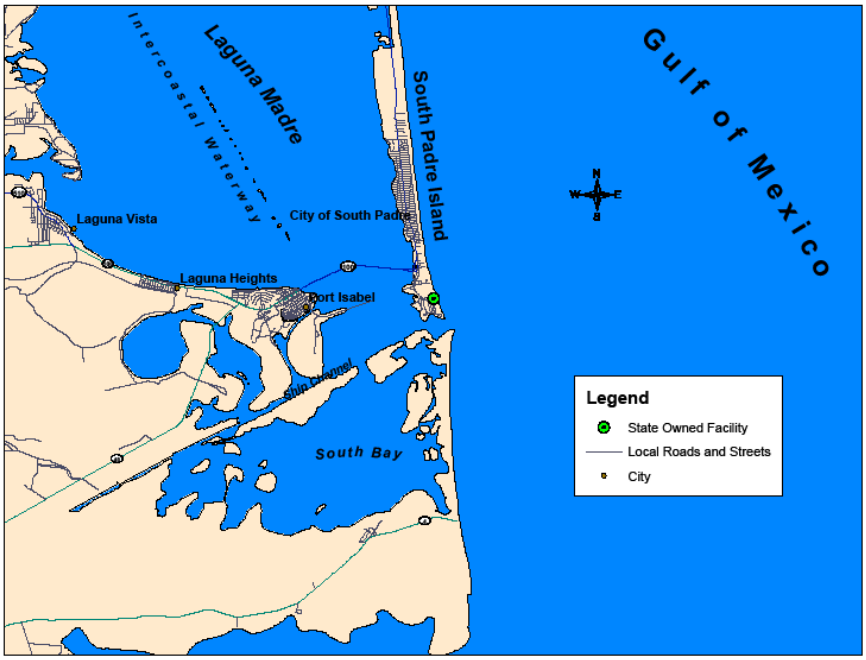
The vast bulk of State facilities are behind the seawall on Galveston and at no risk from coastal retreat. The one facility vicinity Jamaica Beach is a Texas Parks and Wildlife facility valued at $83k. The beach is retreating in this location, but at current rate of shoreline retreat it will still be there in 50 years, we therefore assess no annual damages against it.

Map 2-23: Texas-Owned Facilities Located on Barrier Islands (Mustang)



The beach near Port Aransas is accreting, while the beach on Mustang Island is stable. We therefore assess no damages against the two State facilities shown.

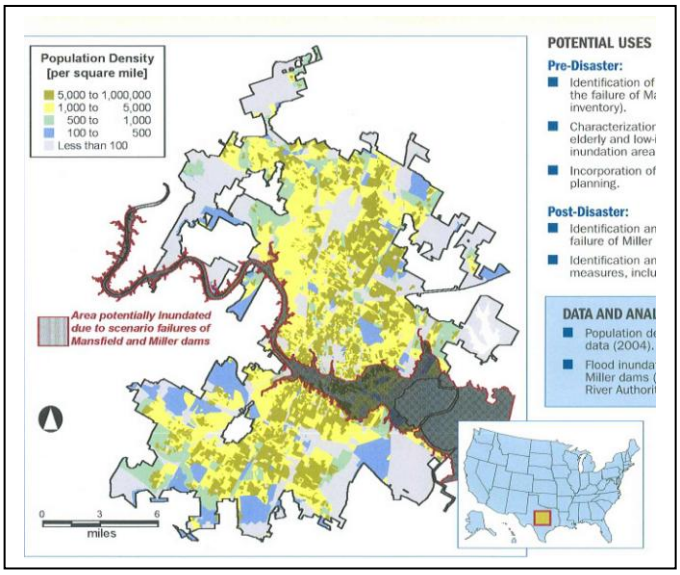
Map 2-24: Texas-Owned Facilities Located on Barrier Islands (South Padre)



The beach at South Padre Island is accreting; therefore, we assess no damages against the State facility shown.

Dam Failure or Levee Failure

Map 2-25: Dam Breach Inundation Map for Mansfield Dam



Austin, the State Capital, with the highest concentration of State facilities, is in the dam breach inundation area below Lake Travis (Mansfield Dam). Damages to State facilities from any other dam breach across the State would be dwarfed by this event. Applying the State Facilities Database against this map and assuming only 50% damage (most State structures in this area are multi-story) results in damages of $108,773,105. But assuming a breach of this dam is a 500-year event, results in annualized damages of $217,546.

Earthquake
While the most severe earthquake in the State's history is the magnitude 6.0 Valentine, Texas, earthquake of 16 August, 1931, there are very few State facilities in that area. A better indicator of earthquake risk to State facilities is one near a populated area. The 4.2 earthquake near Fashing in Atascosa County on 9 April 1993 (near San Antonio) fit this description.

The State facilities database is not configured yet to run under HAZUS-MH Earthquake. Running the 1993 Fashing earthquake with today's background census data results in $145,540 in damages to all government facilities. Assuming government facilities are equally distributed with 1/3 local, 1/3 State and 1/3 Federal, this results in damages to State facilities of $48,513 from a similar event. Converting this to an annual figure results in annualized damages of $3,465.

Expansive Soils
This is particularly difficult. First, a large percentage of the State's business is conducted in leased buildings, so foundation repairs are passed on to the owner, not absorbed by the State. State buildings tend to be more like commercial construction and thus have a much lower loss rate than residential construction. Losses due to pipe breaks from differential soil expansion are buried in routine maintenance figures. State buildings never change hands and so a reduction in value due to wall/foundation cracks is never detected. Finally, even when foundation repair bills are reported, it is not apparent if the repair was from soil expansion or from some other source, such as erosion. At best, reputable national data can be interpolated to provide an estimate.

The Jones and Hotlz study of 1973 expected losses in the United States from expansive soils to be $2.7 billion annually by the year 2000. Of this, 3.5% was ascribed to commercial style buildings. Other FEMA studies put the Texas share of national expansive soil losses at 40%. Finally, the Texas Economic Development Council estimates that State activities are 1.3% of the Texas economy. Combining these figures yields an estimate that the annual State government share of expansive soil losses would come to $4.9 million.

Severe Winter Storms
Claims against the FEMA Public Assistance program for repairs to State Facilities totaled $13,050 million in DR-1356. With five confirmed ice storms in the last thirty years, converting this to an annual loss figure results in an annualized damages of $2,175. Claims against the FEMA Public Assistance program for repairs to State Facilities totaled $13,050 million in DR-1356. With five confirmed ice storms in the last thirty years, converting this to an annual loss figure results in an annualized damages of $2,175.

Clearly, not all Texas-owned facilities are free of risk. Special attention and mitigation efforts may be to focus on the 1,154 facilities at or near any kind of flood plain, and the 201 inside the prone risk areas generated by rivers and stream buffers. Also considered at risk are 595 facilities in tornado zone 5 and 8 in hurricane risk areas 1 and 2, and 374 in wind zone 4.

Windstorm
Developing losses to State facilities from high winds is fairly straightforward. Assuming State facilities in interior counties are built to the State-mandated 90 mph code and applying the FEMA developed estimate of 2.5% damage per mph over design wind yields no losses in the 2, 5, 10, 25, and 50 year events. 2.5% damage is accrued in the 100-year event ($130,459,306) and 35% in the 500-year event ($1,826,430,282). These figures initially appear substantial, but when converted to annual damages total a more reasonable $495,745 per year.

Hailstorm
Using insurance industry figures for commercial structures, a H3 storm would inflict $2,764 in damages, mostly for window damages so State-owned facilities. Reducing this figure per storm to an annual amount will result in damages of $1,316.

Extreme Heat
Does not cause damages to State-owned or operated facilities.

Land Subsidence
Does not cause damages to State-owned or operated facilities.

EFFECTS OF CHANGES IN DEVELOPMENT ON LOSS ESTIMATE
According to the Texas Building and Procurement Commission (TBPC), the State has not purchased or built any new buildings since 2004. Therefore, the best way for the State to update the overview and analysis of vulnerable buildings, critical facilities and infrastructure was to update the State Facility Database (SFD) itself. The original editing process is described in E.1. General (a)2, page 2-26, of this plan. The update of the SFD was accomplished by TDEM giving a grant to the Texas Natural Resource Information Systems (TNRIS) to modify the database, thus allowing individual State agencies to edit and update their building information themselves, rather than submitting the data to TDEM. This small but important detail gives control of the process to the individual State agencies to maintain their own records, allowing them the ability to determine their own vulnerabilities of existing or new buildings, where appropriate.

PREVIOUS OCCURRENCES SINCE 2007

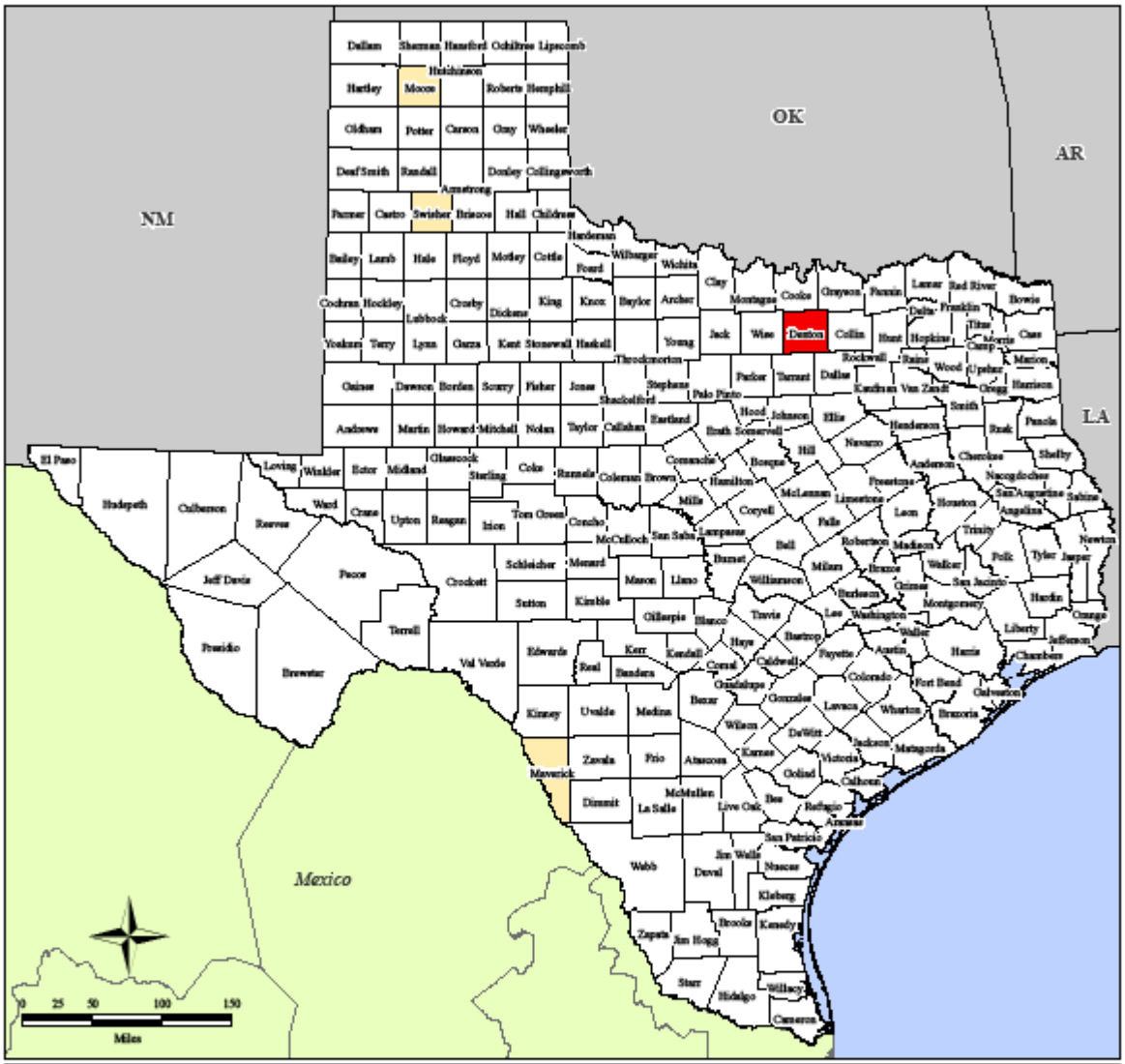
Since 2007, Texas has received six (6) Federal Disaster Declarations from major storms:

- 2007 DR 1697, Tornado kills 10 people in the City of Eagle Pass.
- 2007 DR 1709, Thunderstorms flood dozens of Central and North Texas counties.
- 2007 DR 1730, Tropical Storm Erin floods six counties and kills 7 people.
- 2008 DR 1780, Hurricane Dolly strikes South Texas (Cameron County).
- 2008 DR 1791, Hurricane Ike strikes Galveston, Houston and Beaumont areas.
- 2010 DR 1931, Hurricane Alex strikes Mexico, floods the Rio Grande Valley of Texas

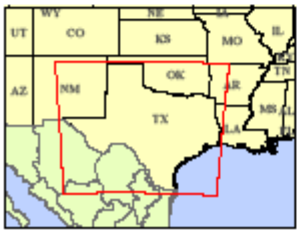
Maps showing the locations for these storm events and the probability of future events may be found on the following 6 pages.

Next page begins Map 2-26: Federally Declared Disasters in Texas Since 2007

FEMA-1697-DR, Texas
Disaster Declaration as of 05/07/2007



Location Map



Legend

Designated Counties

- No Designation
- Individual Assistance
- Individual Assistance and Public Assistance (Category B)

All counties are eligible for Hazard Mitigation

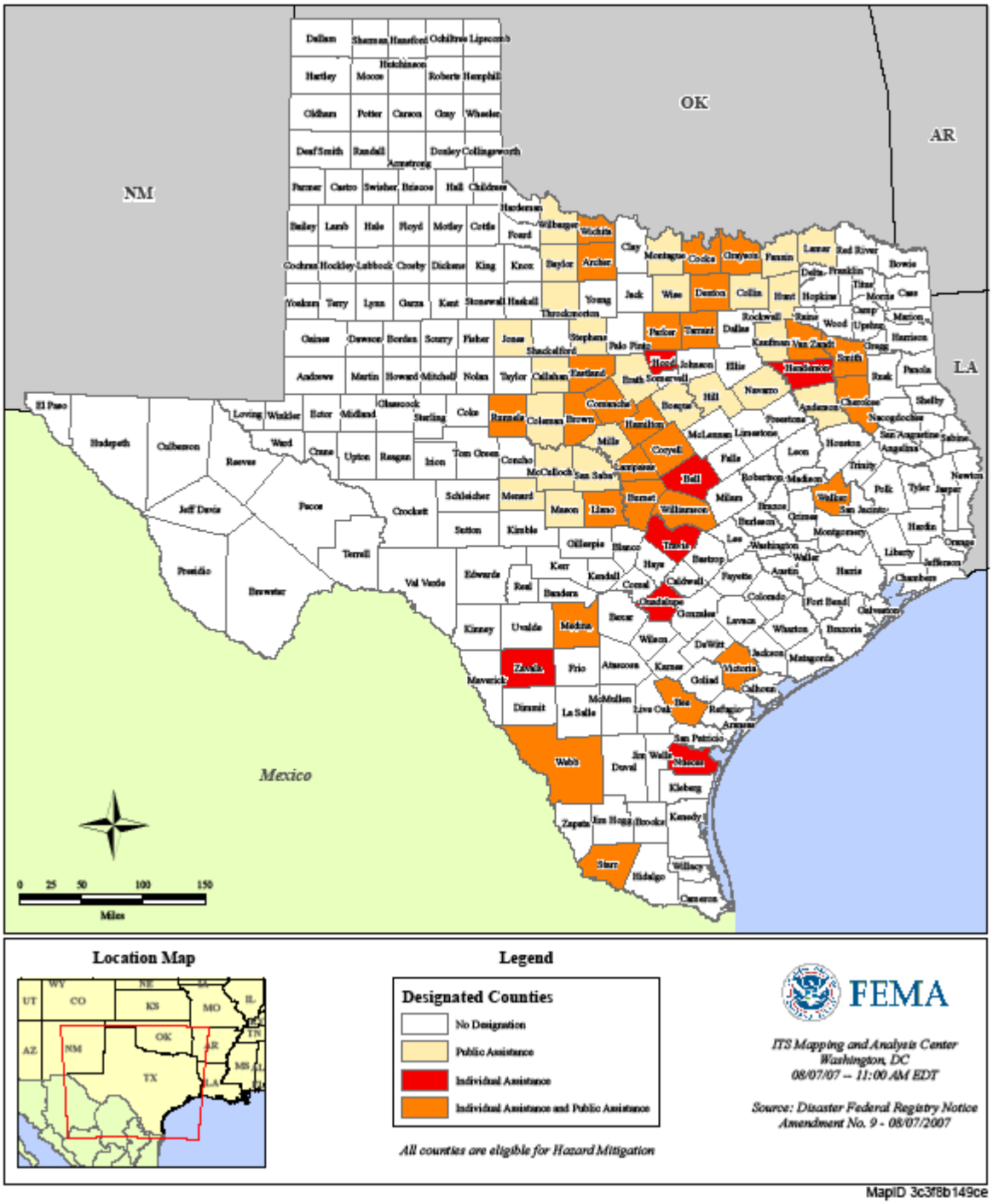
FEMA

ITS Mapping and Analysis Center
Washington, DC
05/07/07 -- 04:46 PM EDT

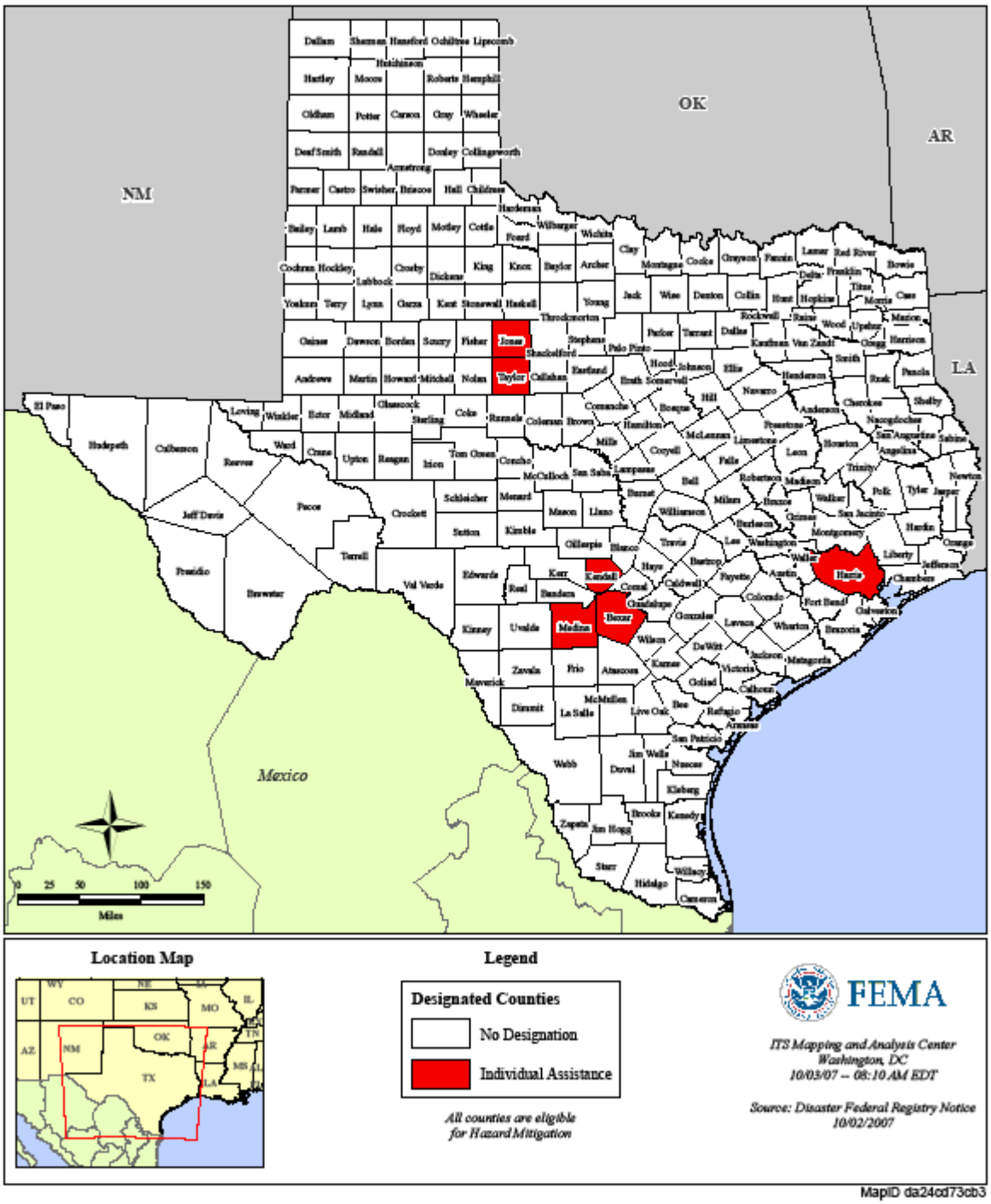
Source: Disaster Federal Registry Notice Amendment No. 1 - 05/07/2007

MapID e1c6271f8df

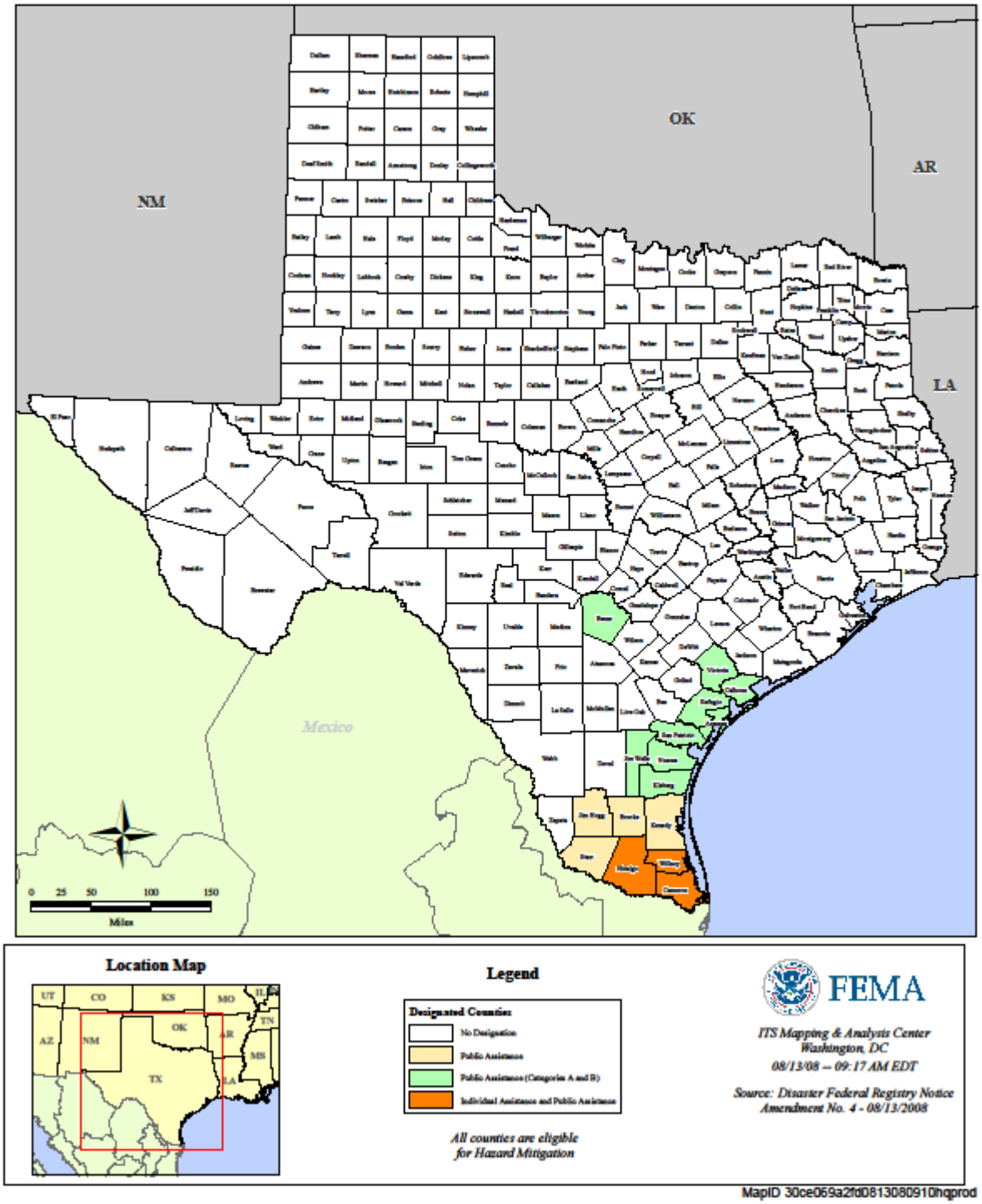
FEMA-1709-DR, Texas
Disaster Declaration as of 08/07/2007



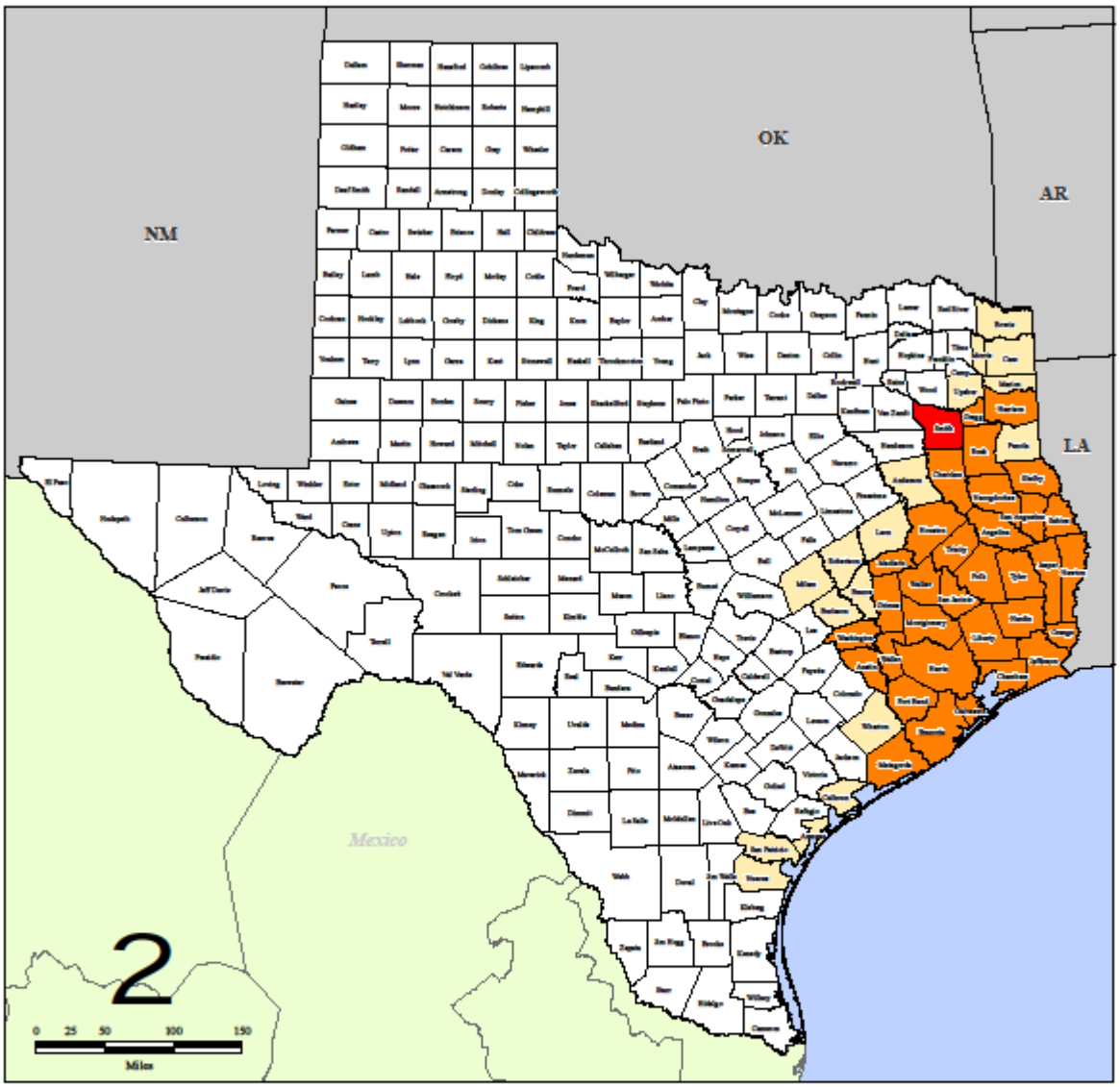
FEMA-1730-DR, Texas
Disaster Declaration as of 10/02/2007



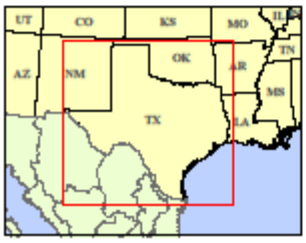
FEMA-1780-DR, Texas
Disaster Declaration as of 08/13/2008



FEMA-1791-DR, Texas
Disaster Declaration as of 11/21/2008



Location Map



Legend

Designated Counties

- No Designation
- Public Assistance
- Individual Assistance
- Individual Assistance and Public Assistance

All counties are eligible for Hazard Mitigation

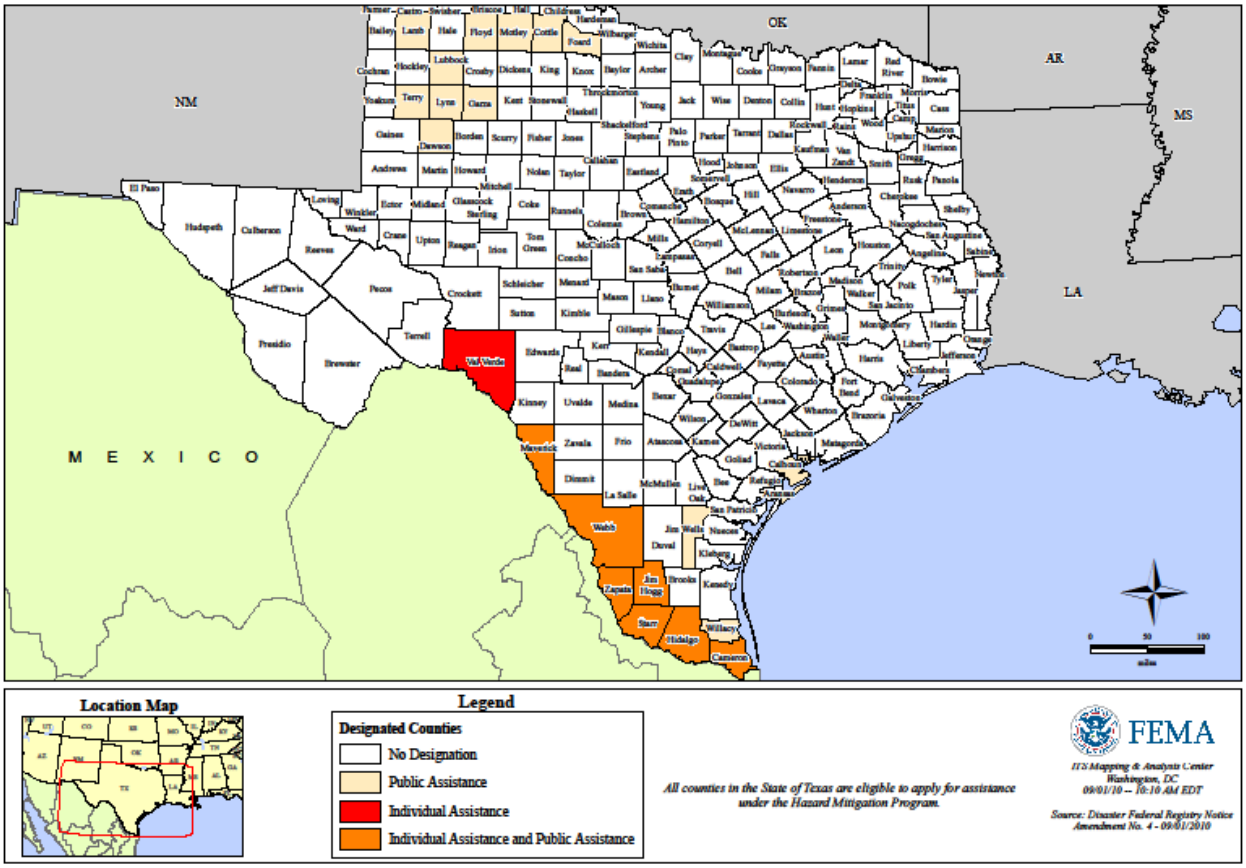
FEMA

ITS Mapping & Analysis Center
Washington, DC
11/21/08 -- 04:19 PM EST

Source: Disaster Federal Registry Notice
Amendment No. 13 - 11/21/2008

MapID 22f682b15cd1121081606hqprod

FEMA-1931-DR, Texas
Disaster Declaration as of 09/01/2010



SECTION 3 – MITIGATION STRATEGY

Requirement §201.4(c)(3)(i): *The State plan shall include a description of State goals to guide the selection of activities to mitigate and reduce potential losses.*

Hazard Mitigation Goals

Hazard mitigation is defined as any action taken to eliminate or reduce the long-term risk to life and property from natural and human-caused hazards. It is viewed as a long-term, ongoing management process that consists of a variety of both pre-incident and post-incident actions. Effective mitigation is characterized by a requirement for both planning and implementation activities. Mitigation is a complementary part of an effective comprehensive emergency management program.

To be effective any hazard mitigation effort must have goals. Several goals are attainable through the implementation of this plan. These goals are:

- Reduce or eliminate hazardous conditions that cause loss of life
- Reduce or eliminate hazardous conditions that inflict injuries
- Reduce or eliminate hazardous conditions that cause property damage
- Reduce or eliminate hazardous conditions that degrade important natural resources

The hazard mitigation goals were assessed for their relevance during the 2010 update of the Plan. The assessment began with the Staff reviewing the goals and the progress that has been accomplished since 2007. The efforts of TDEM to educate emergency management professionals (by teaching TDEM Mitigation Workshops) plus the continued State participation in the HMGP, SRL, FMA, RFC and the PDM grant programs, allow the State to successfully advance mitigation. TDEM determined that since 2007 the goals listed above were achieved through mitigation projects and in many cases resulted in a reduction or elimination of hazardous conditions that cause loss of life, inflict injuries, cause property damage, and degrade important natural resources. Quick examples include the prevention of loss of life through the implementation of projects that include individual safe rooms to protect against tornadoes and the acquisition of structures in the floodplain to eliminate deaths and property damage during flood events. Degradation of important natural resources, such as erosion of sand on public beaches, is a growing concern and this led the TDEM to work more closely with the General Land Office (GLO) to better prevent erosion on the Texas coast. Hurricanes and tropical storms can erode sand away from beaches, which may threaten homes that were built near the beach years ago.

However, TDEM recognizes that no matter how good mitigation goals may be, they may not be of value unless the local jurisdictions are able to implement them. One challenge faced by TDEM since 2007 is getting the local communities to embrace mitigation as a valuable tool in emergency management. What TDEM found is many local Emergency Management Coordinators (EMCs) are more experienced with preparedness or response and recovery actions and reflect this with action items in their local mitigation plans that have less to do with mitigation and more to do with preparedness (such as wanting fire trucks, weather radios, or backup generators). TDEM continues to work and expand the information about mitigation through workshops taught at TDEM in Austin or by taking the mitigation course on the road to jurisdictions that request it be taught in their area. In addition, the Staff is always available to answer questions through phone calls, faxes, emails, and meetings.

It is through the implementation of local mitigation projects that the State achieves its goals. Therefore, the State continues to support the various Federal mitigation grant programs so that reimbursement monies may reach the local communities, whom without these grants, would most likely not be able to afford mitigation projects and therefore would not attempt to begin them.

TDEM also continues to have a strong working relationship and cooperation with other State agencies whose experience in specific areas complement TDEM programs. This, in turn, helps TDEM achieve its goals.

Even with the concept of mitigation projects being considered relatively new to EMCs in Texas, the Staff is confident that the goals stated in 2007 are still relevant in 2010 and beyond. Therefore, for the reasons outlined above and the process that was described, TDEM states that the goals remain valid and will not be revised at this time. However, TDEM may revise the goals anytime in the future if doing so will increase the chance that the revised mitigation goals will better achieve their purpose.

State Capability Assessment

Requirement §201.4(c)(3)(ii): *The State mitigation strategy shall include a discussion of the State's pre-and post-disaster hazard management policies, programs, and capabilities to mitigate the hazards in the area, including: an evaluation of State laws, regulations, policies, and programs related to hazard mitigation as well as to development in hazard-prone areas [and] a discussion of State funding capabilities for hazard mitigation projects.*

STATE MITIGATION POLICY

The State of Texas views mitigation as encompassing two equally important components, pre-event mitigation and post-event mitigation. Pre-event mitigation activities are those proactive measures undertaken by State and local officials to reduce or prevent costly loss of life and property. Post-event mitigation activities are reactive measures that lead to recovery and rebuilding in a constructive way that prevents future loss of life, property, damages, and costs. The duality of this strategy recognizes that multi-peril conditions occur with frequency each year throughout the State.

Pre-event mitigation includes, but is not limited to, activities and measures that identify risks and vulnerabilities that threaten citizens and their property, economies, and resources in local jurisdictions. The key initial step in pre-event mitigation is to conduct a comprehensive quantitative hazard assessment. This process will not only identify risks and vulnerabilities, but will prioritize the hazardous conditions that responsible government officials must first address to protect lives and property in their communities. To set the example, the Texas Division of Emergency Management published a comprehensive State Hazard Analysis document that addressed the major natural perils and man-made hazards that frequently plague most communities in the State. In 2005, the State Hazard Analysis was updated to be an interactive mapping tool available on the Internet at www.thmp.info for better access to all Texas jurisdictions.

Pre disaster self assessment

The State assesses its pre-disaster condition as good, albeit with a few provisos. The State does a good job of availing itself of federal mitigation funding opportunities. TWDB routinely not

only expends the FMA and SRL grant allocations it receives, but goes out and captures un-used allocations from other states. It funds the State Floodplain Management function to the tune of $1.3 million dollars a year, and allocates $750,000 of state money to local flood studies. The State runs its own annual mitigation training program, teaching two grants classes a year, and two planning classes a year, in addition to presenting at numerous conferences and local meetings. One problem area is the lack of a State agency designated to the levee management function.

Post mitigation activities include determining the major or contributing causes of losses and acting on appropriate measures to prevent a recurrence of those losses. An evaluation of State laws, regulations, policies, programs and State funding capabilities related to hazard mitigation is discussed below.

Post disaster self assessment

The post disaster assessment is also good. The State routinely spends 90% of the post-disaster funding it receives, a figure far above the national average. The State avails itself of FEMA provided training and outreach activities after every declared disaster. The State maintains a stable of trained disaster reservists, similar to the FEMA DAE program, which allows it to rapidly increase its capacity when needed. One problem area is the limited use (so far) of 406 mitigation funding within the public assistance grants.

State policies related to development in hazard prone areas

The State has decided, through the actions of the Legislature, that it will continue to develop in hurricane prone areas. The State constitution prohibits the State from establishing state level zoning ordinances, and there has been no push to change this. Further, the recent re-adoption of the State Windstorm Insurance subsidy insures development in coastal areas will continue. With development in hurricane prone areas set to continue, only good wind and flood prevention ordinances that are well enforced will minimize the damages from natural hazards.

REVIEW OF TEXAS LAWS, REGULATIONS AND PROGRAMS

This section addresses the Pre and Post Disaster policies, programs, capabilities and development in hazard prone areas. (A summary can be found in table 3-1 below)

JURISDICTIONAL AUTHORITY

Texas law does not give authority to counties for certain actions or enforcement activities such as zoning or to adopt and enforce building codes because there is no enabling legislation. Until authority and enabling legislation is granted to county government by the State legislature, county government can take no action to reduce risk to life and property (unless they are a participant in the National Flood Insurance Program and the property to be developed is located in the 100-year floodplain). This means that counties cannot enact building and land management standards or use of zoning as a means to regulate development. A consequence of this is that minimal building standards are observed in rural areas while municipalities exercise complete authority to set higher standards for the protection of life and property.

Frequent legislative attempts to modify enabling legislation to give county governments the authority to regulate zoning and to adopt building codes have never been successful. Many rural legislators are opposed to strong county governments and believe these measures should be retained at the State and municipality levels of government. That way they will have the authority to regulate development in hazard areas and have equal authority to reduce risks for rural and unincorporated communities.

TEXAS GOVERNMENT CODE CHAPTER 418

Sections 102-104. These sections discuss county, municipal, and inter-jurisdictional emergency management programs. One of the requirements articulated is that a county "shall maintain an emergency management program or participate in a local or inter-jurisdictional emergency management program that, except as otherwise provided by this chapter, has jurisdiction over and serves the entire county or inter-jurisdictional area." In addition, Section 106 states: "Each county shall prepare and keep current an emergency management plan for its area providing for disaster mitigation, preparedness, response, and recovery."

TDEM requires that jurisdictions achieve and maintain the Advanced Standards (planning, training and exercises) outlined in the *DEM 100 – Preparedness Standards* to receive Emergency Management Performance Grant (EMPG) funding. One of the requirements is to have an Annex P – Hazard Mitigation that describes how they will do the function of hazard mitigation in their community. This at least requires the EMPG jurisdictions to address mitigation issues.

FLOODPLAIN MANAGEMENT

SENATE BILL 936

The 77th Texas Legislature amended the Texas Water Code, effective September 1, 2001 to authorize all political subdivisions to do the following:

- Adopt more comprehensive floodplain management regulations that the political subdivision determines are necessary for planning and appropriate to protect public health.
- Participate in floodplain management initiatives such as the National Flood Insurance Program's (NFIP) Community Rating system (CRS).

Enforcement: Probably less than 10 of the 254 counties have enacted any enforcement language—FEMA is beginning to remind counties that they now have the power to do so and that this is to be expected from the Federal standpoint. This is the only situation whereby the State legislature has granted county government the power to establish a floodplain management program, enforce floodplain management standards, and restrict growth in the floodplains.

Higher Standard: Few counties have adopted higher standard than the FEMA minimum standard. Exceptions are: Denton County, which is now accepted in the Community Rating System (CRS) Program, and Bastrop and Harris Counties, which are planning to do the same. (Note: There are two cities in Texas that have a CRS classification of a 5: Kemah and Friendswood as of June 2010).

Collecting Fees: The State NFIP (National Flood Insurance Program) Coordinator says that the counties with larger populations are collecting fees. Although, most of the rural communities feel they should not be charged fees for this service.

HOUSE BILL 1018

The 77th Texas Legislature amended Chapter I of Chapter 16, Water Code by adding section 16.3145 to read: "The governing body of each city and county shall adopt ordinances or orders, as appropriate, necessary for the city or county to be eligible to participate in the NFIP program, not later than January 1, 2001.

Assessment: Since enactment, about 150 communities have joined the NFIP Program. Most assumed they had to, even though the language does not explicitly require participation. The majority of which were small communities who were not initially aware of the program.

SENATE BILL 1436 (PASSED JUNE 2007)

Moves the National Flood Insurance Program (NFIP) from the Texas Commission on Environmental Quality (TCEQ) to the Texas Water Development Board (TWDB). TCEQ had the program since its inception, but had allowed it to dwindle to 2.5 staff with only $85,000 in annual State funding. The TWDB is a water-based agency with mapping and flood oriented programs. The move to TWDB also puts $3.05 million per year into a new floodplain fund. The Texas Dept. of Insurance will transfer this amount each year from its maintenance tax revenues to an account controlled by the TWDB. About half of this fund will be for mapping products while the remainder will go to fund additional staff and overhead. Staff will increase to a total of six full time employees.

LOCAL GOVERNMENT CODE, CHAPTER 240, SUBCHAPTER Z

The 63rd Legislature amended Chapter 240 and added Section 240.906 to authorize counties to prohibit or restrict outdoor burning and provided for a criminal penalty.

Assessment: Allows counties to issue burn bans if drought conditions exist in a county (determination by the Texas Forest Service). Jurisdictions (cities and counties) have used this tool (burn bans) to prohibit outdoor burning thereby decreasing the probability of grass and wildfires.

WINDSTORM MITIGATION

The 70th Texas Legislature in House Bill 2012, as codified as Article 21.49 Section 6A, of the Texas Insurance Code, provides certain inspection requirements for structures to be considered insurable property for windstorm and hail insurance through the Texas Windstorm Insurance Association (TWIA). All new construction, repairs or additions after January 1, 1988, shall be inspected or approved by the Texas Department of Insurance for compliance with the building specifications adopted by the Commissioner of Insurance.

Insurers may offer insurance premium discounts to insured's statewide for eligible impact-resistant roof coverings.

The Texas Department of Insurance (TDI) educates consumers about issues related to windstorms and other natural disasters through publications and by conducting outreach presentations. Following declared disasters, TDI also assists consumers by staffing disaster recovery centers in impacted areas. TDI's publications are available on the TDI Web site and in hard copy. In addition, TDI maintains a special "Storm Link" page on the Web site that contains useful storm-related information and links to other Web sites.

406 MITIGATION

The 406 Mitigation program are funds that allow Public Assistance projects to be reconstructed to a higher standard, thereby mitigating part or all future damage due to hazards. Placing emphasis on 406 Mitigation is a major priority for the Public Assistance program in the State of Texas. Over the last 4 years, 40% of the Public Assistance, Project Worksheets (PWs) written by the State have had 406 Mitigation dollars added.

During the Tropical Storm Allison disaster (DR TX 1379), the State's Public Assistance Staff requested four mitigation specialists from FEMA to assist local governments with the preparation of various 406 Mitigation proposals. To this date, local governments and FEMA in mitigation projects in DR TX 1379 have or will spend, more than $61 million. Of all the large PWs, greater than $50,600, 186 had some type of mitigation attached to them.

State Capability Assessments: Development in Hazard Prone Areas

The goals of the Plan are to motivate State government agencies, as well as the public and private sectors, to prevent the affects of hazards and to establish priorities for hazard mitigation programs at all levels of government, public, and private sectors within the State. The State also has funding programs that are available to communities that need assistance. These funds primarily come from the Federal government through FEMA mitigation programs such as the Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM), and from the National Flood Insurance Program (NFIP), the Flood Mitigation Assistance (FMA) program, the Severe Repetitive Loss (SRL) program and the Repetitive Flood Claim (RFC) program (see Attachment 6: "Funding Guide" for a listing of funding programs).

The Texas Division of Emergency Management (TDEM) maintains an Emergency Management Plan for Texas, and coordinates the State's mitigation, preparedness, response, and recovery operations; provides guidance and assistance to local jurisdictions for emergency management program development; administers federally-funded emergency management programs; provides training and annually conducts public awareness exercises and campaigns for hurricanes and severe weather. In addition, the State Hazard Mitigation Officer is the chairperson of the multi-agency State Hazard Mitigation Team.

The member agencies of the State Hazard Mitigation Team, as they relate to mitigation, provided the following capabilities. All member State agencies were invited to a State Hazard Mitigation Meeting on May 4, 2010 to discuss the State Mitigation Plan updates. Members were encouraged to provide updates to the Plan, or at the least, to review the information for accuracy and to reply back to TDEM Mitigation if no revisions were needed.

Like most government agencies, Texas state agencies are prohibited by law from lobbying the Texas legislature. However, private agencies or trade associations, with an interest in some aspect of public policy, may lobby; this is the avenue used by state agencies to influence needed public policy/funding. This is exactly how the state floodplain management function was moved to TWDB. The Texas Floodplain Management Association, a private trade organization of local officials, created a legislative action committee, which successfully lobbied the legislature to both shift the floodplain function and to adequately fund its operation. The Texas Windstorm Insurance Assn. also has an effective lobbying arm, which is the voice of the Texas Department of Insurance. The Emergency Management Assn. of Texas (EMAT), traditionally has not been,

but could be an effective lobbying organization with the Texas Legislature. EMAT has so far, been most active in supporting the goals of the national organization, the National Emergency Management Association (NEMA).

THE TEXAS GENERAL LAND OFFICE (GLO)

The GLO is the management agency for state lands and mineral rights totaling 20.4 million acres. This includes the Gulf Coast beaches and bays and other "submerged" lands extending 10.3 miles out from the shoreline. While these state lands offer ample economic opportunities, the GLO is also mindful of the importance of protecting the natural resources found in such varied geographic regions. The GLO leases state land for a variety of purposes, including oil and gas production, commercial development, and sustainable energy development. Much of the state land leases benefit the Permanent School Fund, an endowment fund for public school education in Texas.

As steward of the Texas coast, the GLO is responsible for the management of 367 miles of Gulf shoreline and 3,300 miles of Bay shoreline. Following are several programs stemming from that basic responsibility that have made the coastal region Texas' second-most popular tourist attraction, generating $7 billion a year. The GLO manages grant programs that regulate submerged land, beaches and dunes, and offshore oil production impacts—the Coastal Management Plan grants program, the Coastal Erosion Planning and Response Act (CEPRA) program, and the Coastal Impact Assistance Program (CIAP). These programs provide federal grants that provide funds for study, and mitigation projects that relate to hazards. The CEPRA program also provides state funds to address coastal hazards such as erosion.

GLO PROJECT FUNDING CAPABILITIES:

Coastal Erosion Planning and Response Act (CEPRA):

To address the erosion problem along the Texas coast, in 1999, the 76th Texas Legislature passed Senate Bill 1690, the Coastal Erosion Planning and Response Act (CEPRA), and authorized the GLO to administer coastal erosion control grants in partnership with local governments, state and federal agencies, non-profits, and homeowner associations.

The goals of the CEPRA are to:

- Protect public infrastructure;
- Protect and restore valuable habitat;
- Protect public and private property;
- Protect state natural resources;
- Mitigate storm damage, and assess post-storm damage;
- Remove debris and structures from the public beach easement; and
- Partner with local, state, and federal agencies to leverage funding opportunities and resources.

Texas defines “critical coastal erosion area” as a coastal area that is experiencing historical erosion of greater than two feet per year, according to the most recently published data of the Bureau of Economic Geology at The University of Texas at Austin, which the commissioner finds to be a threat to:

- Public health, safety, or welfare;
- Public beach use or access;

- General recreation;
- Traffic safety;
- Public property or infrastructure;
- Private commercial or residential property;
- Fish or wildlife habitat; or
- An area of regional or national importance.

Funding for CEPRA comes from state funds appropriated each biennium. The 81st Texas Legislature provided approximately $25 million in state appropriated funding for Cycle 6 projects in the FY2010 – FY2011 biennium. CEPRA requires a local partner match for most projects, and the match requirement is specific to the type of project that is conducted (e.g., beach nourishment and dune restoration projects require, at a minimum, a 25% local match, and studies, shoreline protection or marsh restoration projects require, at a minimum, a 40% local match).

Using existing authority given by the 79th Texas Legislature to fund projects for the relocation from, or demolition of structures on, the public beach under the Coastal Erosion Planning and Response Act (CEPRA), the GLO made available up to $50,000 of state funds per structure in reimbursement assistance as an incentive to homeowners to relocate from, or demolish their structures located seaward of the line of vegetation. In 2007, 15 projects (14 relocations and one demolition) were successfully completed with a total cost of $743,826.00, with a majority of those situated at the Village of Surfside Beach, where the problem is especially acute along a stretch of Gulf beach seaward of Beach Drive. In the case of Surfside, these structure removals prevented extensive damage or total loss of the structure during Hurricane Ike. It is an innovative alternative approach applied to a long-standing problem of costly and time-consuming litigation as a means for enforcement of the OBA.

Coastal Management Program (CMP):

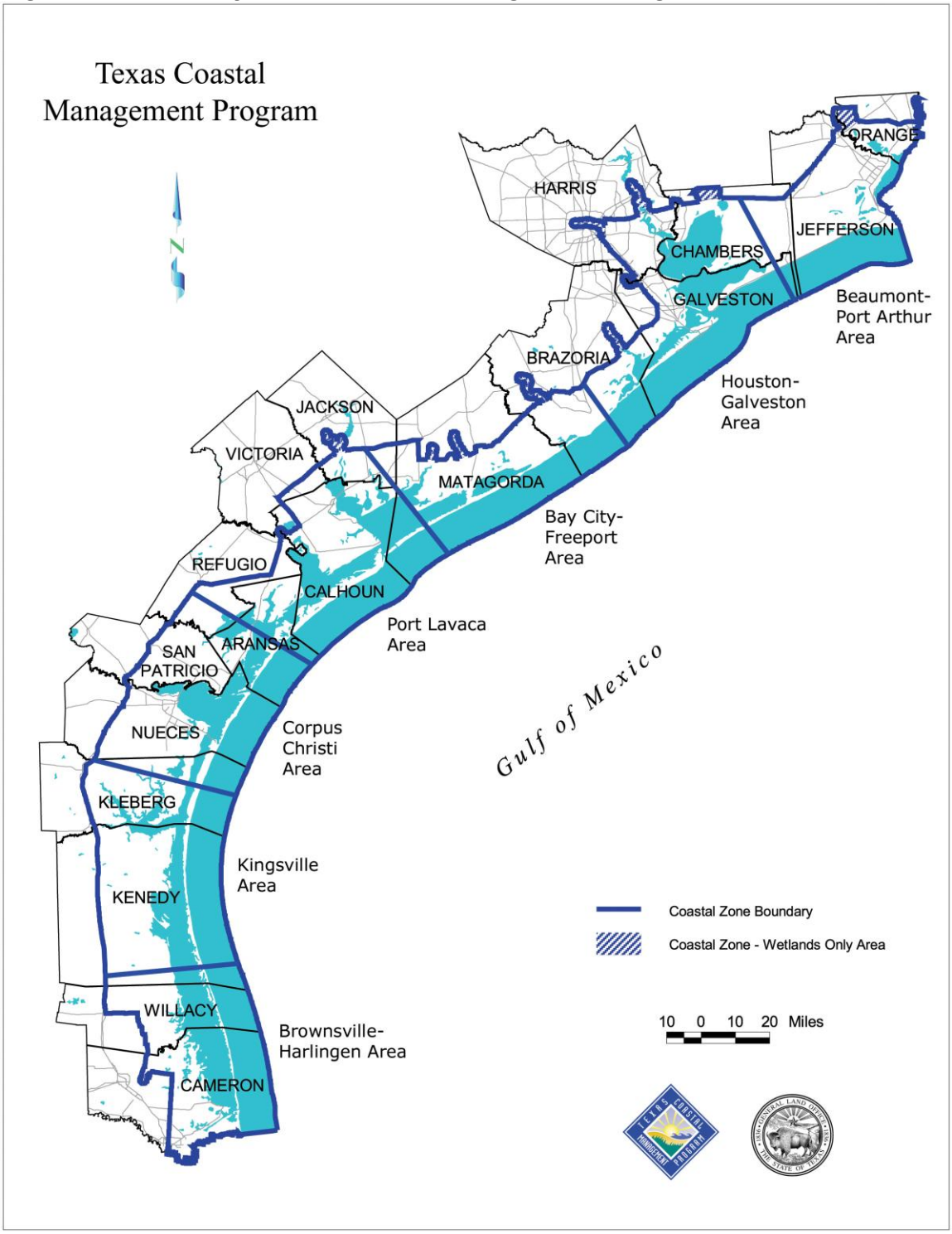
Coastal management is the sound management of coastal resources through protection, preservation, restoration, and enhancement efforts, while ensuring economic development and public access to, and enjoyment of coastal areas.

The Coastal Zone Management Act of 1972 requires states to develop a coastal management program in order to receive and administer federal grants for managing and improving coastal lands. The Texas Governor has designated the Texas General Land Office as the single State agency responsible for the development and management of the state coastal management program.

The Texas Coastal Management Program (CMP) is based primarily on the Coastal Coordination Act of 1991 (33 TEX. NAT. RES. CODE ANN. §201 et. seq.) as amended by HB 3226 (1995), which calls for the development of a comprehensive long-range plan for the coast in cooperation with state agencies, local governments, and coastal citizens. It established the Coastal Coordination Council to oversee the development of the state's coastal management plan, to adopt coast-wide management policies, and to implement the plan and designate the physical boundary for the coastal area.

The CMP boundary is set by statute and extends inland to encompass tidal waters. This boundary (shown in Figure 1) encompasses all or portions of 18 coastal counties: Orange, Jefferson, Chambers, Harris, Galveston, Brazoria, Matagorda, Jackson, Victoria, Calhoun, Refugio, Aransas, San Patricio, Nueces, Kleberg, Kenedy, Willacy, and Cameron.

Figure 1. Boundary of the Coastal Management Program



The policy framework of the CMP is built around a uniform set of coastal goals and policies adopted by the Council. The goals of the CMP are:

- to protect, preserve, restore, and enhance the diversity, quality, quantity, functions, and values of Coastal Natural Resource Area's (CNRA's);
- to ensure sound management of all coastal resources by allowing for compatible economic development and multiple human uses of the coastal zone;
- to minimize loss of human life and property due to the impairment and loss of protective features of CNRA's;
- to ensure and enhance planned public access to, and enjoyment of, the coastal zone in a manner that is compatible with private property rights and other uses of the coastal zone;
- to balance the benefits from economic development and multiple human uses of the coastal zone, the benefits from protecting, preserving, restoring, and enhancing CNRA's, the benefits from minimizing loss of human life and property, and the benefit from public access to and enjoyment of the coastal zone;
- to coordinate agency and local government decision-making affecting CNRA's by establishing clear, objective policies for the management of CNRA's;
- to make agency and local government decision-making affecting CNRA's efficient by identifying and addressing duplication and conflicts among local, state, and federal regulatory and other programs for the management of CNRA's;
- to make agency and local government decision-making affecting CNRA's more effective by employing the most comprehensive, accurate, and reliable information and scientific data available and by developing, distributing for public comment, and maintaining a coordinated, publicly accessible geographic information system of maps of the coastal zone and CNRA's at the earliest possible date;
- to make coastal management processes visible, coherent, accessible, and accountable to the people of Texas by providing for public participation in the ongoing development and implementation of the CMP; and
- to educate the public about the principal coastal problems of state concern and technology available for the protection and improved management of CNRA's.

In 2007, The National Oceanic and Atmospheric Administration (NOAA) and the Coastal States Organization (CSO) embarked on a joint initiative called *envisioning, the future of coastal management* to solicit ideas for improving the CZMA and coastal management in general. The CMP hosted public meetings in Galveston and Corpus Christi to ensure that Texans have an opportunity to participate in the process. The ideas collected during the meetings were submitted to NOAA and CSO for their consideration in drafting legislation to reauthorize the CZMA and policy changes at the federal and state levels.

Participants representing a variety of stakeholder groups, including federal and state agencies, local governments, non-profit organizations, universities, private industry, and the general public, were asked to 1) identify the most important coastal management issues on the Texas coast, 2) identify obstacles to effectively managing those issues, and 3) brainstorm innovative solutions to address the obstacles identified. Both meetings identified growth and land use changes as the greatest challenge to Texas followed by coastal hazards and inundation, primarily coastal erosion.

The federally approved CMP brings approximately $2.2 million in federal Coastal Zone Management Act (CZMA) funds to State and local entities to implement projects and program activities. Texas is one of only a handful of coastal states that pass substantial amounts of CZMA funds through to coastal communities for projects in the coastal zone.

Most coastal states use all or most of their CZMA funds for salaries and other administrative purposes. Even among the pass-through states, Texas is unique in that the Council passes through 90 percent of funds, retaining only 10 percent for administrative expenses. The Council has funded projects in all parts of the coastal zone for a wide variety of purposes. The Council established the following categories for use of these funds by coastal communities:

- Coastal Natural Hazards Response;
- Critical Areas Enhancement;
- Shoreline Access;
- Waterfront Revitalization and Ecotourism Development;
- Permit Streamlining/Assistance and Governmental Coordination;
- Information and Data Availability;
- Public Education and Outreach; and
- Water Quality Improvement.

CMP grants are administered annually, and the project closeout procedure is the same as with CEPRA, however NOAA, the federal funding sponsor, also reviews the projects during the course of the grant and on closeout.

In 2008, the CMP funded the development of the *Texas Sustainable Coast Initiative's Vulnerability Atlas* (Atlas). The Hazard Reduction and Recovery Center at Texas A&M University developed the Atlas as a coastal communities planning atlas to help local jurisdictions in Texas understand the implications of development decisions and plan appropriately. It provides an easily accessible, graphically represented, interactive internet-based database on environmental, hazard, and land use related issues for local communities. The Atlas will be transferred to the GLO within the next two years.

Coastal Impact Assistance Program (CIAP):

The Coastal Impact Assistance Program (CIAP) was authorized by Congress with the enactment of Section 384 of the Energy Policy Act of 2005 (Act), amending Section 31 of the Outer Continental Shelf Lands Act. The purpose of CIAP is to assist coastal states in mitigating the impacts associated with Outer Continental Shelf (OCS) oil and gas production through the disbursement of funds. Under the provisions of the Act, the authority and responsibility for the management of CIAP is vested in the Secretary of the Department of the Interior, who delegated this authority and responsibility to the Minerals Management Service (MMS), which in 2010 became the Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE).

The Act stipulates that a state shall only use CIAP funds for one or more of the following authorized uses:

- Projects and activities for the conservation, protection, or restoration of coastal areas, including wetlands;
- Mitigation of damage to fish, wildlife, or natural resources;
- Planning assistance and the administrative cost of complying with CIAP;
- Implementation of a federally-approved marine, coastal, or comprehensive conservation management plan; and
- Mitigation of the impact of OCS activities through funding of onshore infrastructure projects and public service needs.

In order to receive CIAP funds, states are required to submit a coastal impact assistance plan (Plan) that must be approved by BOEMRE prior to distribution of funds.

The Act requires the designation of the state agency that will have the authority to represent and act for the State in dealing with BOEMRE for CIAP purposes. Governor Rick Perry named the Office of the Governor as the designated state agency for the Texas CIAP and appointed the General Land Office (GLO) as the administrative agency for CIAP. To oversee the state portion of the CIAP program, on January 26, 2006, Governor Perry established a three-member Coastal Land Advisory Board (CLAB). The CLAB is comprised of commissioners from the Texas General Land Office, Texas Railroad Commission, and the Texas Department of Transportation.

Specifically, the program goals are: to conserve, restore, enhance, and protect the diversity, quality, quantity, functions, and values of the state's coastal natural resources including, but not limited to, any effects of oil and gas development of the Outer Continental Shelf. The objectives of the program will be to: restore, protect, and enhance coastal natural resources; improve water quality; enhance public access; improve onshore infrastructure and environmental management; mitigate erosion and stabilize shorelines; and educate the public on the importance of coastal natural resources. Protecting coastal natural resources, while facilitating economic development and multiple human uses of coastal resources, is a primary focus of this effort. Priority is given to projects that meet regional and/or coast-wide goals and objectives.

The Texas General Land Office will receive $109,269,670.25 for the 2007 – 2010 fiscal years.
Only the following project categories are accepted:

- Construction/Restoration/Mitigation;
- Debris removal/cleanup;
- Acquisition;
- Education/Outreach; and
- Data collection/Planning/Research.

Funding for projects under these categories must be used for one or more of the following authorized uses:

- Projects and activities for the conservation, protection, or restoration of coastal areas, including wetlands;
- Mitigation of damaged fish, wildlife, or natural resources; and
- Implementation of a federally approved marine, coastal, or comprehensive conservation management plan.

GLO INITIATIVE PROGRAM CAPABILITIES:

In addition to managing grant programs, the GLO provides the following initiative program capabilities:

- **Beach/Dune Program:** Through the adoption of the Beach/Dune rules (31 Texas Administrative Code § 15.1 et. seq.) in 1993, the Beach/Dune Program provides regulatory guidance to local governments for the administration of the Open Beaches Act (OBA) and the Dune Protection Act (DPA) generally within 1000 feet landward of mean high tide. The Texas Legislature adopted the OBA in 1959 to authorize the GLO to enforce a public beach easement from mean low tide to the natural line of vegetation, guaranteeing the public free and unrestricted access. The Texas legislature enacted the DPA in 1973 in recognition of the importance of sand dunes as a state natural resource for the health of the beach and for the protection they provide during storms.

- **The Hazard Mitigation Program:** The Hazard Mitigation Program is designed to achieve many of the goals and policies of the Texas Coastal Management Program (CMP).

The Hazard Mitigation Program serves coastal communities by providing assistance in amending, updating, and maintaining local and regional Mitigation Action Plans and with developing a pro-active approach to minimizing and mitigating the effects of coastal hazards. In 2009, with funding from the Texas CMP, the program collaborated with Texas A&M University in a study of Regional and Local Mitigation Action Plans (MAP) along the Texas Coast. The study focused on understanding the status of the current MAP's quality and functionality to help coastal planners identify opportunities for improving their MAP's to be more efficient and effective, and a tool for coastal communities to be more resilient. The results of the study are being provided to coastal communities to assist in updates to their MAP's.

The program also helps local communities identify potential mitigation projects that could be eligible for Mitigation Grants. By providing education, outreach, and technical assistance, the program's focus is to help coastal communities be better prepared and more resilient to storm impacts. An initiative of the program is to improve coordination and cooperation of coastal communities in mitigation actions. Helping to establish local hazard mitigation workgroups and regionally integrating these workgroups will provide local Emergency Managers, Floodplain Administrators, and local officials the opportunity to work together on mitigation strategies and local and regional Mitigation Action Plan maintenance.

In 2009, the Hazard Mitigation Program was instrumental in the development and implementation of the *Texas Storm Smart Coasts Network* website. The Texas site is part of the Storm Smart Coasts Network of all five Gulf of Mexico states, and is a web resource dedicated to helping decision makers in coastal communities address the challenges of storms, flooding, and increasing issues related to sea level rise and climate change.

In 2010, the Hazard Mitigation Program initiated the development of two publications for preparedness along the Texas Coast:

- The *Texas Homeowner's Handbook to Prepare for Coastal Natural Hazards* is intended to help coastal homeowners prepare for the natural hazards they may encounter from living in a coastal environment. The Handbook provides information so the homeowner can take action and implement many small and cost-effective steps that could significantly lower their risk.
- The *Texas Coastal Hazard Mitigation Guidebook* was developed for Coastal Planners to use in the planning and siting of coastal projects to reduce risk to coastal development by planning for natural hazards, such as erosion, flooding, and hurricanes.

In response to the Hurricane Ike disaster in 2008, the Hazard Mitigation Program provided technical support for GLO's assistance to the City of Galveston and Galveston County for their Hazard Mitigation Grant Program funded project to acquire houses substantially damaged or destroyed by Hurricane Ike. The GLO obtained $10 million from the state legislature to assist those property owners with their obligation of the 25% local match.

- **GLO Storm Plan:** In 2009, the GLO organized a storm response team (Storm Team), using the Incident Command System incident management approach, to respond to major hurricane events. That same year, the Storm Team developed the *GLO Storm Response Plan* to guide the GLO in a safe, timely, and effective response to tropical storms and

hurricanes that threaten the state's coastal assets. It also promotes coordination within the GLO and among public and private responders at the federal, state, and local levels.

- **GLO Debris Management Plan:** In 2009, the GLO developed a debris management plan, determined by FEMA to be compliant with the FEMA-325 Public Assistance Debris Management Guide, Debris Management Plan Outline/Checklist, and Title 44 Code of Federal Regulations Parts 13 and 206. The purpose of the debris management plan is to define roles, responsibilities, and procedures of the GLO, and provide guidance and assistance to local jurisdictions to ensure a coordinated response, which achieves removal, storage, and final disposition of debris deposited along or immediately adjacent to public beaches along the Gulf of Mexico and areas of state submerged lands.

- **Beach Maintenance and Monitoring Plan (BMMP):** The BMMP was developed by the GLO to meet guidelines established by the Federal Emergency Management Agency (FEMA) as a prerequisite for receiving funding under the Public Assistance (PA) program to mitigate damages to engineered beaches impacted by future federally declared disasters. The BMMP provides GLO the ability to determine the annual sand loss to engineered beaches, and to record the frequency for required replenishment.

  In the event of a declared disaster, the monitoring data from the BMMP will serve as a valuable benchmark to accurately identify impacted areas and quantify the amount of sand loss. This is critical for expediting FEMA approval for funding repairs to permanent projects.

- The Coastal Resources Program Area has three primary responsibilities for the coastal storm event:
  1) assessing changes to the line of vegetation that may identify houses on the public beach easement;

  2) maintenance, monitoring, and assessing damages to projects constructed under the Coastal Erosion Prevention Response Act (CEPRA), Coastal Management Program (CMP), and Coastal Impact Assistance Program (CIAP), for Federal Emergency Management Agency (FEMA) public assistance; and

  3) cleaning debris from the public beach easement (if the event is a declared disaster) and from state submerged lands. The Land Office does not have a specific mandate to participate in emergency response except as requested by the Governor through the Texas Department of Public Safety's Division of Emergency Management (DEM) – Hazard Mitigation Team. The emergency response by the Land Office would most likely be to provide assistance (such as CMP consistency review and review of beach/dune permits and certificates) in coordination with other local and state agencies in a post storm situation.

Additionally, the Land Office may be called upon to participate as a team member on the multi-agency task force involved with the possible removal of damaged structures on the public beach that may threaten public health and safety or significantly restrict public access. The Land Office has two coastal program areas with experienced field staff, Asset Inspection and Oil Spill Prevention and Response, with offices located along the coast.

Oil Spill personnel are specifically trained in emergency response, including work in hazardous areas and incident and unified command training, and they possess specialized field equipment and field communication abilities. Asset Inspection personnel are experienced in performing field assessments. Both program areas have developed Hurricane Plans and, depending on the severity of the storm, may provide support for Coastal Resources post-storm assessments.

- The *Texas Coastal Connection* is an online Land Office Website, which provides one-stop access to the wide array of resources available on Texas coastal and marine issues. This site connects to other organizations working in the coastal zone, provides resources for teachers and students, highlights hot topics along the Texas coast, assists in providing answers to questions on coastal issues and serves as the source for information on the state's cherished coastal resources.

RECENT LEGISLATIVE CHANGES:

The most recent legislative changes affecting the GLO occurred in the 81st Legislative Session in 2009. The following bills amended the Texas Natural Resources Code (TNRC) Chapter 33 for the management of coastal public land.

- **House Bill 2387** amended TNRC §33.603(b)(12) and (13) by providing the GLO the authority to use CEPRA funds for the acquisition of real property located on the public beach easement that is necessary for the construction, reconstruction, maintenance, widening, or extension of an erosion response project.

- **House Bill 2073** amended TNRC §33.605 and §33.607 by requiring a local government that is subject to Chapters 61 (Open Beaches Act) or Chapter 63 (Dune Protection Act), Natural Resources Code, which relate to use and maintenance of public beaches and dunes, to use historical erosion data and the Coastal Erosion Response Plan published by the GLO to prepare a local plan for reducing public expenditures for erosion and storm damage losses to public and private property, including public beaches.

- **House Bill 2074** amended TNRC §33.602 by providing the Land Commissioner the authority to designate critical erosion areas in the state's Coastal Erosion Response Plan and conduct a coast-wide analysis of the costs and benefits of coastal erosion avoidance, remediation, and planning for the purpose of designating critical erosion areas, including certain factors the Commissioner considers in designating the critical erosion areas.

- **House Bill 2457** amends Chapter 61 Natural Resources Code, specifically §61.067, by requiring the GLO to clean, maintain, and clear debris from a public beach that is located in an area designated as a threatened area in a declaration of a state of disaster issued under Section 418.014 (Declaration of State of Disaster), Government Code. This will allow the GLO to assume this responsibility for removing debris related to the event, and obtain reimbursement directly from FEMA in the event of a disaster declaration.

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY (TCEQ)

The TCEQ serves as the State-coordinating agency for the Dam Safety Program (Section 12.052 of the Texas Water Code). The TCEQ's primary function is to monitor and regulate both private and public dams in Texas. The program periodically inspects dams that pose a high or significant hazard and makes recommendations and reports to dam owners to help them maintain safe facilities. Additional functions that TCEQ may perform include:

- Providing technical assistance to dam owners, which includes political subdivisions;
- Assisting dam owners in addressing deficiencies at dams that could become problems during flood events;
- Evaluating adequacy of laws and regulations to prevent flood damage to dams and levees;
- Evaluating scientific data used to prevent flood damage to dams and levees;
- Conducting dam or levee failure studies;
- Publishing information on dams and emergency action plans;
- Evaluating proposed mitigation projects to assure compliance with dam and levee safety;
- Providing information and assistance on public inquiries regarding dams and levees.

TEXAS DEPARTMENT OF RURAL AFFAIRS (TDRA)

Effective September 1, 2009, the Legislature changed the name of the Office of Rural Community Affairs (ORCA) to the now Texas Department of Rural Affairs (TDRA). No other changes were made with this action.

The Texas Department of Rural Affairs (TDRA) administers the Texas Community Development Block Grant (TxCDBG) Program and within this program there is a fund set aside for declared natural disasters – the Disaster Relief Fund. One of the activities under this fund allows TDRA to utilize these federal funds to match other federal funds; however this fund is not used to provide the match for major hurricanes, such as Ike and Dolly, that received a separate CDBG appropriation from Congress. TDRA's Disaster Relief Funds CANNOT be used to match HMGP funds associated with these two hurricanes (Ike and Dolly). In fact, a separate division (Disaster Recovery Division) has been formed to administer these funds and they are located in a different location.

In a Federal Declaration that is not covered by a separate CDBG appropriation, such as Ike or Dolly, TDRA's Disaster Relief funds can assist small cities under 50,000 population and counties under 200,000 population meet the 25% match required by HMGP grants. If the application involves buyouts, a condition exists which requires the applicant to provide satisfactory evidence that the property to be purchased was not constructed or purchased by the current owner after the property site location was officially mapped and included in a designated floodplain area. Assistance with match an also be provided for projects associated with FEMA Public Assistance (PA) **(Categories A and C-G),** the Natural Resources Conservation Service (NRCS) with their Emergency Watershed Protection (EWP) program, the TxDOT Bridge Program, and other aid programs associated with a declared disaster. Potential applicants must consult with TDRA of the possible inclusion of HMGP funds for a **NEW** federal declaration and **to what extent**.

For **Pre-Disaster Mitigation** projects where a federal declaration is NOT required (yearly competition), a local government **cannot apply** for or receive Disaster Relief (DR) Funds since it takes a federal declaration to trigger these DR funds.

TEXAS WATER DEVELOPMENT BOARD (TWDB)

The TWDB administers two of FEMA's pre-disaster Hazard Mitigation Assistance grant programs that provide federal funding for mitigation activities that reduce or eliminate the long-term risk of flood damage to lives and property. These grants are open to all political subdivisions (municipalities, counties, and tribal entities) currently participating in the National Flood Insurance Program (NFIP) with jurisdiction over a particular area having special flood hazards.

The Severe Repetitive Loss (SRL) program provides federal funding to assist political subdivisions 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. For properties that qualify, SRL funds can be used for acquisition and demolition, relocation, elevation, mitigation reconstruction, minor localized flood reduction projects, and dry flood proofing (for historic properties only).

The Flood Mitigation Assistance (FMA) program provides federal funding to assist communities in funding cost-effective measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. Two types of grants are available – Planning and Project. Planning grants can only be used to develop or update the flood hazard component of the Multi-Hazard Mitigation Plan, with the goals of assessing flood risk and identifying feasible and cost-effective alternatives to reduce that risk. Project grants can be used to assist all structures insured under the NFIP for acquisition and demolition, relocation, elevation, minor localized flood reduction projects, and dry flood proofing. Applicants for FMA Project Grants must have an approved Multi-Hazard Mitigation Plan. TWDB may apply directly for technical assistance funding under the FMA program.

The TWDB administers the Flood Protection Planning grant program through the State's Research and Planning Fund. These grants are available to political jurisdictions to develop flood protection plans for watersheds, major or minor, to identify structural and non-structural flood mitigation measures to reduce the risk of flood damages to lives and property. TWDB employs four full-time staff to administer its grant programs.

The TWDB administers the Fund Development program, which provides loans for the planning, design, and construction of water supply, wastewater, and flood control projects. Structural flood protection improvements may include construction of storm water retention basins, enlargement of stream channels, public beach re-nourishment, control of coastal erosion, and modification or reconstruction of bridges. Non-structural flood protection improvements may include acquisition of floodplain land for use in public open space, acquisition and removal of buildings located in a floodplain, relocation of residents of buildings removed from a floodplain, flood warning systems, and the development of floodplain management plans. An environmental review is required for all construction projects.

Since September 2007, the Texas Water Development Board has served as the state coordinating agency for the National Flood Insurance Program (NFIP). They have garnered increased State funding ($3.05 million transferred annually from the Texas Department of Insurance from its maintenance tax revenues to an account controlled by the TWDB) and hired six field staff to better serve the needs of Texas communities. Field offices are located in Austin, El Paso, Harlingen, Houston, Mesquite, and San Antonio. At TWDB, the grants staff and the NFIP state coordinating office are housed together under the Division of Flood Mitigation Planning, with thirteen staff.

The Texas Natural Resources Information System (TNRIS) is a division of the TWDB that is responsible for producing, archiving, and distributing geographic data to agencies, businesses, and the public. TNRIS supports hazard mitigation in a variety of ways. They make data available to organizations for planning or response. They actively assist in events by developing, locating, and preparing data for a specific need, and they updated the State Critical Facility Database for TDEM Mitigation. When necessary, TNRIS actively participates in hazard mitigation by preparing data for use in the field and by emergency managers. TNRIS is capable of providing personnel to the State Operations Center to assist with data management for tropical storm and emergency preparedness events. TNRIS provided personnel to the FEMA field office during the Space Shuttle Columbia recovery to assist field crews with data integration organization and map productions. TNRIS staff in Austin prepared data for the field office and other agencies participating in the recovery effort.

In addition, TNRIS established an NFIP Mapping Services Group in April 2009 to serve as the state's principal center for statewide floodplain mapping resources. Their primary activities include cataloging and maintaining flood studies for areas not served by Cooperating Technical Partners (CTP's), developing and maintaining base mapping data sets, supporting TWDB field staff with technical solutions to address local mapping needs, serving as a coordinating group among state agencies, and collecting and reporting mapping needs to FEMA. In addition, TNRIS Floodplain Mapping Services will manage technology resources to meet the needs of the public through accessibility to base data and web-based floodplain mapping resources. TNRIS will work with existing CTP's to provide support by maintaining flood data standards and will provide regular updates and technical services to provide a common approach to finding and managing data.

TNRIS has significant collections of base map data available to communities and the public. These include digital aerial photographs, soil surveys, and transportation, boundaries, surface water, and elevation maps and data. TNRIS has census data, historical aerial photos, and paper maps from different State and Local agencies.

TEXAS PARKS AND WILDLIFE DEPARTMENT (TPWD)

The TPWD provides proactive comments on development projects that fall under the authority of the Clean Water Act, Fish and Wildlife Coordination Act (FWCA), and other Federal and State regulations. The TWPD also coordinates under the FWCA on US Army Corps of Engineers flood abatement/floodplain restoration projects. A primary focus of the TWPD comments all projects is preventing exacerbation of flood events from the degradation of flood storage and conveyance functions of wetlands and riparian zones. The staff also provides technical assistance and outreach/information on wetland and riparian functions specifically and the protection of natural resources in general.

The TWPD is a member of the Critical Infrastructure Work Group under the Texas Geographic Information Council. The Work Group is involved in planning GIS resources for natural and human-made disaster response and coordinates with TDEM. TWPD's GIS Lab has critical resources and staff and specialized GPS and remote sensing equipment and expertise that are available and have been utilized for disaster response (e.g. Columbia Shuttle disaster).

TPWD continues the actions listed above and added no new data at this time.

THE LOWER COLORADO RIVER AUTHORITY (LCRA)

The Lower Colorado River Authority (LCRA) is a conservation and reclamation district created by the Texas Legislature in 1934. It has no taxing authority and operates solely on utility revenues and fees generated from supplying energy, water and community services. LCRA supplies low-cost electricity for Central Texas, manages water supplies and floods in the lower Colorado River basin, develops water and wastewater utilities, provides public parks, and supports community and economic development in 58 Texas counties.

LCRA manages water supplies for cities, farmers and industries along a 600-mile stretch of the Texas Colorado River between San Saba and the Gulf Coast. It operates six dams on the Colorado River that form the scenic Highland Lakes: Buchanan, Inks, LBJ, Marble Falls, Travis and Lake Austin. Through this series of dams, LCRA regulates water discharges to manage floods, and releases water for sale to municipal, agricultural and industrial users. The organization helps communities plan and coordinate their water and wastewater needs. It also operates an environmental laboratory and monitors the water quality of the lower Colorado River.

With regards to flood control, the lower Colorado River basin has a higher risk of flooding than most regions of the United States. Over the decades, LCRA has developed an intricate system of dams, lakes, information gathering and experience that strengthens its ability to forecast floods and manage them. Since their completion in 1942, Mansfield Dam and Lake Travis have protected downstream residents by reducing the force of floods. The dam and the lake are the only flood control facilities in the lower Colorado River basin. In each flood event, Lake Travis held water that otherwise would have inundated downstream regions. The lake's flood pool can hold up to 260 billion gallons of floodwaters until it is safe to release water downstream.

However, dams and other flood management facilities do not eliminate floods. They are only a part of the solution. Another part is wise floodplain management. Texas ranks second in the nation (behind Louisiana) for the number of flood-prone structures that flood repeatedly, according to the Federal Emergency Management Agency. People who live and work on the Colorado River have a responsibility to build and reside outside of the floodplain. LCRA has developed an extensive floodplain management program working with cities, counties and State and Federal agencies to reduce the likelihood of flood damages. To this end, the LCRA has implemented a number of hazard mitigation actions.

LCRA MITIGATION ACTIONS

The LCRA assisted cities and counties in the basin with the formation of the Texas Colorado River Floodplain Coalition (TCRFC). The Coalition, which now consists of 52 cities and counties, believes that by "Working Together" they can better coordinate basin-wide floodplain management efforts and communicate upstream and downstream issues to reduce flood damages and save lives.

The LCRA and TCRFC have become a Cooperating Technical Partner (CTP) to improve floodplain mapping in the lower Colorado River basin. The TCRFC has developed a Map Master Plan to guide mapping priorities as FEMA proceeds with remapping of the Colorado River floodplains and providing digital floodplain maps to Coalition communities. The Map Master Plan also contains a unique and innovated plan to maintain the accuracy of digital maps as future development shapes floodplains in the region.

The Coalition and the LCRA have joined with the U.S. Army Corps of Engineers in a multiyear Colorado River Flood Damage Evaluation Project to improve knowledge about flooding in the basin and to identify ways to reduce property damage and loss of life during floods.

Utilizing a Federal grant, the TCRFC has developed a Basin-wide Regional Hazard Mitigation Action Plan to comply with requirements of the Disaster Mitigation Act of 2000.

With partners such as FEMA, TCEQ and the Texas Floodplain Management Association (TFMA), the Coalition and LCRA have developed a very aggressive training program to educate and train floodplain managers and emergency management coordinators to better manage and respond to emergencies such as flooding and other natural hazards.

LCRA has been involved in developing increasingly accurate topographic information and along with updated aerial photography; they have now created a Basin-wide mapping tool for communities along the Colorado River. Utilizing the latest in GIS technology, floodplain managers can now access a GIS version of the FEMA floodplain maps with better information features and more accurate topographic information. GIS training is also provided to local floodplain managers to assist them in the use of this valuable tool.

LCRA has developed an extensive system of automated rainfall and stream flow gages throughout the lower Colorado River basin. The Hydromet system now comprises around 200 stations and provides an elaborate system of date gathering on real-time basis for use in river and flood forecast models. This stream of date (rainfall and stream flow) provides a critical advantage in a region prone to flash floods: It allows LCRA to develop forecasts more frequently than the six-hour updates from the NWS. LCRA shares this real-time data with the NWS who then passes information to the public through recorded messages, news releases and weather radio broadcasts.

LCRA has purchased and installed eight (8) NOAA Weather Radio transmitters throughout the basin to increase the broadcast coverage of the weather radio. Now residents of the Lower Colorado River basin can receive this important public safety broadcast from upstream of Lake Buchanan to the Gulf of Mexico.

LCRA has expended over $50 million in a dam modernization program to make the six dams in the Highland Lakes chain more resistant to major floods, thus insuring the safety of the dams.

LCRA and the Texas Floodplain Management Association (TFMA) helped broadcast the important message of Turn Around, Don't Drive for areas that experience multiple deaths to people attempting to cross low water crossings. The Turn Around, Don't Drive (TADD) slogan is becoming popularized on local news weather reports during flash flood advisories, radio commercials, bumper stickers on State agency owned vehicles and road signs. The slogan was created a few years back and is now being heard often.

RAILROAD COMMISSION (RRC)

The Railroad Commission has primary regulatory jurisdiction over oil and natural gas industry, pipeline transporters, natural gas & hazardous liquid pipeline industry, natural gas utilities, the LP-gas industry, and coal & uranium surface mining operations. The Commission is responsible for research & education to promote the use of LP-gas as an alternative fuel. The Commission is also a member of the Emergency Management Council (EMC) of Texas. The role of the

Commission in the EMC is to provide rapid assessment capabilities of the state's oil and gas infrastructure, and to implement the state's energy assurance plan for major disruptions or shortages of natural gas and/or crude oil. The Commission provides accurate geospatially located infrastructure data to the Texas Division of Emergency Management, which is fully interoperable and accessible to emergency first responders statewide. The Commission also provides oil and gas subject matter expertise in operations from upstream drilling and production, to downstream processing and distribution. In addition, the Commission is listed in Annex's of Communications, Public Information, Energy & Utilities, Direction & Control, Hazard Mitigation, Haz-Mat & Oil Spill and Transportation of the Emergency Management Plan of Texas.

However, the role of the Commission concerning the State Mitigation Plan is a limited one. Currently, the Commission lists its State Capabilities as pre-disaster mitigation involving protecting public health and the environment by identifying, assessing and prioritizing wells, abandoned sites, or mine lands that require the use of State funds for remediation or reclamation. The Commission accomplishes this role by providing assistance for operator-initiated corrective actions, plugging abandoned/orphaned oil and gas wells, remediation of abandoned oilfield storage, and processing sites, and the reclamation and re-vegetation of surface mines.

The FEMA definition of *mitigation* is the effort to reduce loss of life and property by lessening the impact of disasters. It could be argued that the Commission is accomplishing mitigation by protecting public health and the environment by identifying, assessing and prioritizing wells, abandoned sites, or mine lands that require remediation or reclamation. But it could also be argued that the Commission is actually accomplishing *preparedness* by identify these wells, abandoned sites and mine lands *before* they even become a hazard, and then correcting the problem swiftly to prevent the community from ever having to respond to the threat, thus preventing the community from having to *mitigate* the situation themselves later.

Therefore, the TDEM Mitigation Section proposes that the Railroad Commission of Texas no longer be a voting member of the State Hazard Mitigation Team after 2010. In addition, language concerning the role of the Commission in relation to mitigation will be removed from the State Mitigation Plan after 2010. It's important to note that the Commission will still be available in a consultation role to the SHMT in case a situation arises where a well, abandoned site or mine lands impose a threat to a mitigation project, such as an abandoned unplugged well interfering with an acquisition project.

TEXAS DEPARTMENT OF TRANSPORTATION (TXDOT)

The Texas Public Works Association (TPWA)/ TxDOT Drainage Task Force was formed in September 2003 in order to improve coordination, with focus on FEMA requirements and to make sure that TxDOT and TPWA are in mutual agreement on the interpretation of the process. Of primary interest were:

- Permits vs. State Sovereignty: TxDOT, by State law, is prohibited from obtaining permits from a Community. It is suggested that some other non-permit documentation of coordination may be acceptable and fulfill the intent of the permit process.
- Communication/Informal Coordination: TxDOT pledged to revise guidance in the Hydraulic Design Manual to better fulfill the intent of the NFIP. The effort

would address communication and how TxDOT can meet the communities' criteria without violating State sovereignty.

- TxDOT is currently revising the Hydraulic Design Manual to include improved guidance on NFIP requirements. This guidance will now be a full chapter instead of a section. It contains point by point instructions to guide TxDOT personnel through analyses within a floodplain and through the coordination process. The revised manual is anticipated to be released late 2010.

TxDOT is also supporting the effort to certify floodplain managers (CFMs). Currently, all engineers in TxDOT's central hydraulics branch are CFMs. In addition, TxDOT has been supporting FEMA's "Managing Floodplain Development through the NFIP" class and encouraging TxDOT personnel to attend the class and become CFMs. This class provides the training that TxDOT personnel need to develop projects in FEMA-mapped floodplains and puts TxDOT staff on an equal level of program expertise when coordinating and resolving differences with the communities. The greatest benefit is the interaction between TxDOT personnel and the FPAs that improved the level of understanding between both parties. To date, TxDOT has 50 CFMs; 40 additional personnel have attended the class.

TxDOT has also encouraged participation in the planning process of any community's master drainage plan. The concept is for the community to be aware of TxDOT's long range plans within their community and incorporate any improvements into the master drainage plan. This enables the community to work with TxDOT to actively plan mitigation projects in their area and conserve and coordinate resources while providing drainage improvements through mitigation.

TEXAS ENGINEERING EXTENSION SERVICE (TEEX)

TEEX provides pre-incident mitigation to the counties, cities, and towns of the State of Texas by providing solid proactive training programs. These programs are taken to the citizens wherever they are requested and delivered by a well-trained staff in order to prepare responsible persons in each community to respond with the proper resources to the full spectrum of disaster situations. This training encompasses man-made disasters as well as weather related situations.

TEEX also provides to the communities' post-incident mitigation by sending staff personnel to assist the community officials in order to help guide their leadership past the first hours or days when the community is struggling to get services back in order. These personnel act as liaisons between many of the responding agencies and the effected community elected officials, this type of assistance is continued until the leadership is able to get a grasp on the devastation and a developed plan to lead these citizens toward the recovery and rebuilding of their lives, homes and businesses. It is Texans helping Texans help themselves.

TEXAS FOREST SERVICE (TFS)

Works closely with the United States Forestry Service (USFS) in several east Texas counties with national forests and north central counties with National Grasslands. Most of the actual wildfire mitigation projects are on the Federal side of the fence, but related to the Community Wildfire Protection Plans (CWPPs) being prepared in those counties.

For private landowners, we're working with USDA/NRCS to make the cost-shared practice "Fuel Breaks" available on a county-by-county basis, where the landowners opt for this as an eligible practice in the county.

TFS activities have centered on public awareness projects relating to wildfire. Various east Texas counties affected by Rita have received over 300 postcards on protecting homes from wildfire, through a USFS grant. Other counties are also being targeted for similar mail outs and/or newspaper inserts on home defense from wildfire.

TFS is still working with various communities on a Fire Wise Communities USA certification. This is a very effective program, similar to Neighborhood Crime Watch, but the TFS is limited on how many communities we can reach, due to our limited personnel.

TFS Predictive Services staff calculate and predict the statistical probability of fire occurrence and behavior; disseminate wildfire assessment information to elected officials, including KBDI drought information for burn ban determinations; and work with the National Weather Service to determine areas of extreme fire danger to pre-position personnel"

TFS Prevention staff work with local governments and the public to develop targeted prevention campaigns based on local fire activity"

TFS Urban Wildland Interface staff help communities determine wildfire risk levels, identify hazards, and determine mitigation treatment options through the Community Wildfire Protection Plan (CWPP) process. A user-friendly CWPP "template" is available online to empower communities to determine their own choices for reducing wildfire hazards"

TFS provides technical support for the development of Firewise Communities USA

TFS sponsors two Wildland Fire Training Academies annually. A Spring academy held in Lufkin, and a Fall academy held in Bastrop. The Rural Volunteer Fire Department Assistance Program (HB 2604) provides training grants for volunteer firemen to receive nationally certified wildfire and emergency management training"

TFS makes available Southern Fire Risk Assessment System (SFRAS) maps available to communities and counties. These maps can be used for wildfire mitigation purposes including maps which depict Surface Fuels, Wildfire Occurrence, Urban Wildland Interface Areas, Wildfire Suppression Difficulty, etc."

Revised Hazard Mitigation Capabilities

There was a desire by TDEM Mitigation to add technically focused members to the State Hazard Mitigation Team. Since the last update, we have added the Texas Geographical Society (for GIS expertise) and Texas Tech University (for wind engineering expertise). The Texas Tech representative also happens to represent the National Storm Shelter Association (NSSA), a private non-profit group dedicated to improving tornado shelter construction while the Texas Geographical Society member provided the necessary updates to digitize the State Hazard Analysis and placed it on the Internet.

Some proposed additions to the State Hazard Mitigation Team, which have not been done yet, include adding the Texas Residential Construction Commission (which regulates the Texas construction industry) and adding the Texas Department of Housing and Community Affairs (the

Texas variant of HUD). With the pending movement of the floodplain management function from the Texas Commission on Environmental Quality to the Texas Water Development Board, it has been proposed to drop TCEQ from the State Hazard Mitigation Team.

TDEM added Elevations to the HMGP and PDM grant programs for structures located in the 100-year floodplain. Previously, only Acquisition was an option. However, some NFIP communities did not want to buy-out homes in the floodplain because they fear losing their tax base. Therefore, TDEM now allows Elevations of homes to at or above the Base Flood Elevation (BFE) so that the structure may reduce their vulnerability to floods while the community can maintain their tax base.

Funding Capabilities

TDEM added the Repetitive Flood Claims (RFC) grant program for the fiscal year 2007. This grant program allows local jurisdictions to acquire structures from the 100-year floodplain in order to reduce that jurisdictions vulnerability to river and coastal floods. Unlike the requirements for acquisition grants under HMPG and PDM, a local jurisdiction does not need a FEMA approved mitigation plan to qualify.

TDEM added Individual Safe Room (ISR) grant program for fiscal year 2006. Previously, communities could only apply for HMGP or PDM grants to build community storm shelters centrally located between pockets of populations. But in rural areas, it is difficult for families to drive many miles to a community storm shelter during a tornado watch or tornado warning. Therefore, TDEM added the ISR program so that home owners could place a small shelter (holding up to eight people) on their property.

Currently, only two grant sources are funded only with State funds with no assistance from Federal funds. These programs are the Hurricane Local Grant Program (see page 60 for more information) and the Texas Water Development Boards planning grant that makes $750,000 available, per year, in State funds to help pay for surveys and flood studies (see page 48 for more information).

Other Inter-Agency Activities Include:

Texas Long Term Recovery Working Group: The Texas Department of Housing and Community Affairs (TDHCA) asked TDEM to be part of the 'Texas Long Term Recovery Working Group'. Just as HUD is the lead agency for Federal level long term reconstruction, TDHCA has the lead for State level. The first meeting of the working group was held in Houston on March 15, 2007. Attending were representatives from TDHCA, TDEM, the Houston-Galveston Area COG, Rice University, and the City of Pearland. A follow-up was held June 7, 2007. The next meeting is scheduled for early September 2007. That meeting did not occur and the following year, in September 2008, Hurricane Ike struck the Texas coast and the meetings have not resumed.

Even before Ike, a small group of State agencies met over a period of a year, to discuss the consequences and contingency planning for a major hurricane strike on Galveston Bay. These informal meeting are discussed in the previous plan update. The meetings were very useful in accelerating the debris cleanup after Hurricane Ike. Then, as a result of Ike, FEMA implemented ESF 14, Long Term recovery and Mitigation, for the first time in Texas. The ESF 14 meetings resulted in the formation of a local long term recovery organization 'the 'Bolivar vision". The

previous Long Term Recovery committee meetings have not resumed, as local and state agencies remain decisively engaged with Ike recovery.

Texas Manufactured Housing Council: As a result of a query from HUD as to the adequacy of manufactured building, TDEM was asked to participate in meetings of the TMHC. The council has met twice with TDEM participation. It has been noted that windstorms disproportional affect residents of manufactured housing in the State. The council is trying to determine if the codes are too weak, if the instillation is faulty, or if the destruction is simply older model manufactured homes reaching the end of their (short) useful life.

Local Capability Assessment (see Table 3-1)

The State Constitution assigns limited powers to the county governments. As such, counties in Texas have limited capabilities to make local laws or ordinances or to enforce laws unless the State legislature proves enabling legislation for specific powers. Consequently, counties have no land use authority or enforcement powers granted, except for floodplain management and only at the FEMA minimal level. Currently, no enabling legislation that allows counties to utilize zoning as a planning tool. Incorporated cities and town do have zoning ordinances; building & fire codes and many have an ordinance for floodplain management that exceeds the FEMA minimum standards.

BUILDING CODE EFFECTIVENESS GRADING SCHEDULE (BCEGS)

The BCEGS assesses the building codes in effect in a particular community and how the community enforces its building codes with special emphasis on mitigation of losses from natural hazards. The anticipated upshot: safe buildings, less damage and lower insured losses from catastrophes. The BCEGS program assigns each municipality a BCEGS grade of 1 (exemplary) to a 10.

DISTRIBUTION OF TEXAS COMMUNITIES BY BCEGS CLASS

Personal lines (This classification addresses building code adoption and enforcement for 1-and 2-family dwellings):

- Class 3: 1
- Class 4: 10
- Class 5: 9
- Class 6: 8
- Class 7: 1
- Class 8: 2

Commercial Lines (this classification is for all other buildings):

- Class 3: 1
- Class 4: 10
- Class 5: 7
- Class 6: 9
- Class 7: 1
- Class 8: 3

The anticipated upshot of this program: safe buildings, less damage and lower insured losses from catastrophes.

Fifty-two communities currently participate in the Community Rating System (CRS) part of the National Flood Insurance Program (NFIP). As for NFIP participation, Texas has 1,190 communities that currently participate in NFIP. These communities have floodplain ordinances/court orders. Several local mitigation action plans have identified as a mitigation action that they are going to join the CRS program. Another mitigation action listed in several regional and countywide plans is for those communities that are not participating in NFIP to join the flood insurance program.

The effectiveness of local floodplain management capabilities continues to increase statewide, as evidenced by the greatly increased numbers of certified floodplain mangers since the 2007 update. According to TFMA, there are 1,362 Certified Floodplain Managers (CFM's) in Texas as of August 2010. TFMA added 174 new CFM's in 2010.

In 2007, only one area of Texas, the Panhandle Regional Planning Commission in northwest Texas, had participated in an individual safe room rebate program. By 2010, five more jurisdictions had participated in effective regional programs. In 2007, the predominant recipients of mitigation grants were coastal communities, San Antonio, and Austin.

By 2010, grants were being awarded all across the state, from Alpine in the west, to Lubbock in the north, Hidalgo County in the Valley, and Hopkins County in NE Texas. In 2009, at the height, 80% of Texas Counties were covered by a local mitigation plan. The development of these plans, we believe, is what spread the knowledge of mitigation across the state, and is the reason for the more widespread current distribution of mitigation funding.

A general analysis by the State of the effectiveness of local mitigation policies, programs and capabilities shows that mitigation is working. More communities in Texas are strengthening their local floodplain ordinances for new development and using FEMA mitigation grants to acquire older structures from the floodplain. Communities in high tornado frequency zones are pursuing grants for the purpose of building individual safe rooms or larger community safe rooms. Local communities continue to update their local mitigation plans in order to remain eligible for FEMA mitigation grants. TDEM continues to assist local jurisdictions in the hopes that they can produce better mitigation ideas in the local plans and then obtain a FEMA grant to accomplish the project.

Past Mitigation Measures

Requirement §201.4(c)(3)(iii): *State plans* ***shall*** *include an identification, evaluation, and prioritization of cost-effective, environmentally sound, and technically feasible mitigation actions and activities the State is considering and an explanation of how each activity contributes to the overall mitigation strategy.*

The Texas Department of Insurance (TDI), as a key member of the State Hazard Mitigation Team, offers free to the public risk reduction educational materials. This State agency is the lead agency for windstorm mitigation in Texas. Since 1988, TDI has undertaken an ongoing process for the reduction of damage from windstorms in the coastal area through legislation, rule making, and policy. The 70th Legislature in House Bill 2012, as codified as Article 21.49 Section 6A, Texas Insurance Code, provides certain inspection requirements for structures to be considered

insurable property for windstorm and hail insurance through the Texas Windstorm Insurance Association (TWIA). All new construction, repairs, or additions on or after January 1, 1988, shall be inspected or approved by TDI for compliance with the building specifications adopted by the Commissioner of Insurance. This applies solely to the tropical storm and hurricane-prone Tier 1 coastal counties of Texas. Insurers may offer insurance premium discounts to insured's statewide for eligible impact-resistant roof coverings.

The Mitigation Section, TDEM prior to the advent of DMA 2000, during the period from 1997 through 2002, offered and managed a "Hurricane Property Protection Mitigation" (HPPM) Grant Program that was generally funded annually at $100,000 providing up to 10 or more $10,000 or lesser grants to local governments located in the hurricane-prone counties along the Texas Gulf Coast. The projects funded were for "hardening" critical facilities, e.g., record repositories, libraries, critical government facilities, emergency facilities, auxiliary power facilities, and communications nodes. The program was discount since most of the eligible applicants funding requests were filled and the advent of pre-disaster mitigation grants negated the requirement for a separate grant program.

FLOODS

Background

Flood mitigation functional areas were divided among three State agencies the Texas Commission on Environmental Quality (TCEQ), the Governor's Division of Emergency Management (TDEM) and the Texas Water Development Board (TWDB). All three agencies are key members of the SHMT whose staffs work closely together despite being resourced and directed by separate State agencies. The Texas Commission on Environmental Quality (TCEQ) used to house the staff for the State Coordinator of the National Flood Insurance Program (NFIP) who funds floodplain management training, compliance functions, mitigation activities and a community flood-mapping program. TDEM is responsible for managing FEMA mitigation planning and Pre and Post disaster Federal grant programs such as HMGP, RFC and PDM programs and chairs the SHMT. The TWDB manages the Flood Mitigation Assistance (FMA), the National Flood Insurance program as well as State funded water resource loan and grant programs.

(g) Implementation

Redirect $1 million in taxes and license fees collected by the Texas Department of Insurance and provide to the Texas Commission on Environmental Quality (TCEQ) to fund floodplain management training, compliance functions, mitigation activities and a community flood-mapping program. This strategy has not been accomplished as of 2007

Consolidate and enhance the State's flood mitigation efforts by moving the floodplain management program from TCEQ to TDEM and staffing it with at least five (5) full-time equivalent positions. The annual cost is $648,000. The benefit of having Mitigation and Floodplain Management in one agency is significant to the State's achieving its mitigation strategy for floodplain management and disaster reduction from flooding. This will require enabling legislation and a change to the Texas Water Code. The Texas Legislature next meets in full session in January 2005.

Instead of absorbing the State floodplain management program at TDEM, the National Flood Insurance Program (NFIP) instead went from the Texas Commission on Environmental Quality (TCEQ) to the Texas Water Development Board (TWDB). TCEQ had the program since its inception, but had allowed it to dwindle to 2.5 staff with only $85,000 in annual State funding. The TWDB is a water-based agency with mapping and

flood oriented programs. The move to TWDB also puts $3.05 million per year into a new floodplain fund. The Texas Dept. of Insurance will transfer this amount each year from its maintenance tax revenues to an account controlled by the TWDB. About half of this fund will be for mapping products while the remainder will go to fund additional staff and overhead. Staff will increase to a total of six full time employees. This move will still enhance the State's flood mitigation efforts.

DROUGHT

BACKGROUND

The entire strategic effort is initiated by the evaluation mechanisms found in the *State Drought Preparedness Plan* and is coordinated with the various levels of drought stages. This includes actions accomplished because of on-going drought and actions taken before a drought event to promote a more proactive atmosphere between affected parties. It is felt that this proactive approach will produce a more effective means of mitigating the effects of drought on the population, and natural and economic resources of Texas.

The following strategies have been accomplished (these items are from the *State Drought Preparedness Plan* – see Attachment 1):

- Established a Drought Preparedness Council with standing subcommittees: one for Drought Planning and Coordination and another for Drought Monitoring and Water Supply
- Developed and maintains a *State of Texas Drought Preparedness Plan* that provides for potential drought relief programs
- Developed a *Drought Assistance Reference Guide for State Agencies,*
- Developed an *Emergency Drinking Water Contingency Annex*
- Developed a *Drought Monitoring and Water Supply Plan*
- Verify status of emergency potable water facilities in hospitals.
- Establish a list of nearby medical facilities with cooling systems connected to the emergency electrical system.

Current Mitigation Strategies

GENERAL

The State Hazard Mitigation Team was involved in identifying the State priorities. All of the strategies/actions outlined were evaluated and are technically feasible, cost-effective, and environmentally sound. In addition, each of the actions/activities contributes to the State goals listed on page 3-1. For each of the hazards, specific mitigation strategies are listed in priority order, as ranked by the State. The priorities of the State are to mitigate, in the following order:

- floods
- hurricanes and tropical storms
- tornadoes
- wildfires
- droughts
- dam failure

There are also a couple of miscellaneous strategies that don't fall under a particular hazard and some strategies that discuss data shortfalls.

The priority ranking was determined by addressing the cost-effectiveness, environmental soundness and technical feasibility of each strategy. See below for more information. In addition, the priority ranking is based upon which mitigation strategies would best protect citizen's lives and protect property from being damaged.

The State's Hazard Mitigation Program requires any mitigation project proposed for funding though the Federal hazard mitigation grant programs administered by TDEM including, State agency projects to:

- Support the goals and objectives of the Plan
- Reduce identified hazard risk
- Prevent repetitive losses
- Protect critical areas including frequently flooded areas and geologically hazardous areas

Proposed State projects compete with projects proposed by eligible local governments. This ensures that Federal grant funded State and local projects address the State hazard mitigation priorities.

ADDRESSING COST-EFFECTIVENESS, ENVIRONMENTAL SOUNDNESS AND TECHNICAL FEASIBILITY

Any State government construction project, regardless of potential funding source, has to be cost effective, technically feasible and meet all of the appropriate Federal, State and local environmental laws and regulations before it is started.

State government projects funded by Federal mitigation grant programs administered by TDEM have to meet specific criteria related to cost effectiveness, environmental soundness and technical feasibility. These are outlined in the applicable FEMA grant program guidance for that particular funding program

Cost Effectiveness: In the case of the State strategies, we looked at whether the action would have benefits that are in excess of the cost.

Technical Feasibility: Only actions were considered for which there are reasonable solutions given the technical requirements of the project.

Environmental Impact: No proposed action was considered if it would a have serious negative impact in the environment.

The State of Texas will not and did not evaluate and consider for funding actions to promote activities that do not meet these criteria stated above and that do not support the State's mitigation goals outlined in this Plan on page 3-1. As stated in paragraph F.1.a above: All of the strategies/actions outlined are technically feasible, cost-effective, and environmentally sound.

Based on past project experience and SHMT expertise, the State has found these actions/strategies meets the States goals.

HAZARD SPECIFIC

FLOOD MITIGATION

Strategy #1: Work with Local Jurisdictions to Identify and Prioritize Mitigation for Repetitive Loss Structures

Background – TWDB receives updated repetitive loss data for the State of Texas from FEMA on a monthly basis. This information is covered under the Privacy Act of 1974 (5 U.S.C. § 552a) and cannot be publicly disclosed. Therefore, only local officials with signature authority can access it, and only after submitting a request.

Implementation – TWDB has utilized FEMA's repetitive loss data to develop tools to work with local jurisdictions in identifying mitigation projects. First, TWDB has developed the Texas Repetitive Loss Analysis Tool, which yields benefit-cost ratios for all repetitive loss (RL) and severe repetitive loss (SRL) properties on the State list and Greatest Savings to the Fund (GSTF) data for structures when that data is available. GSTF was developed by FEMA as an alternative to the standard benefit-cost ratio and can only be used in SRL grant applications. This Analysis Tool allows staff to identify specific mitigation projects that have a high likelihood of passing the positive benefit-cost ratio requirement of both the Flood Mitigation Assistance (FMA) and Severe Repetitive Loss (SRL) grant programs. This data can be provided to local jurisdictions upon their request. Moreover, it is used by TWDB staff to review applications and identify high-priority mitigation actions.

Second, TWDB has used GIS to map the State's RL and SRL properties, in order to better understand the geographic distribution of properties across the State and the localized distribution of properties within watersheds and local jurisdictions. TWDB has linked FEMA's RL and SRL data with data from the Texas Repetitive Loss Analysis Tool so that, for every property in the State, all relevant information can be viewed in GIS by clicking on the property. In addition, this data can be overlain with many different base layers including city boundaries, watersheds, road networks, and FEMA Digital Flood Insurance Rate Maps (DFIRMs). All necessary data is available via Texas Natural Resources Information System (TNRIS), which is part of the TWDB.

The State will continue to encourage the mitigation of RL and SRL properties at the local level. This will be accomplished through direct communication with municipal and county leaders, as well as through numerous training and education programs conducted by TDEM and TWDB staff throughout the year. TWDB has identified high-priority jurisdictions where it will actively promote its mitigation grant programs and will continue to serve all local jurisdictions that approach the State with interest in the programs.

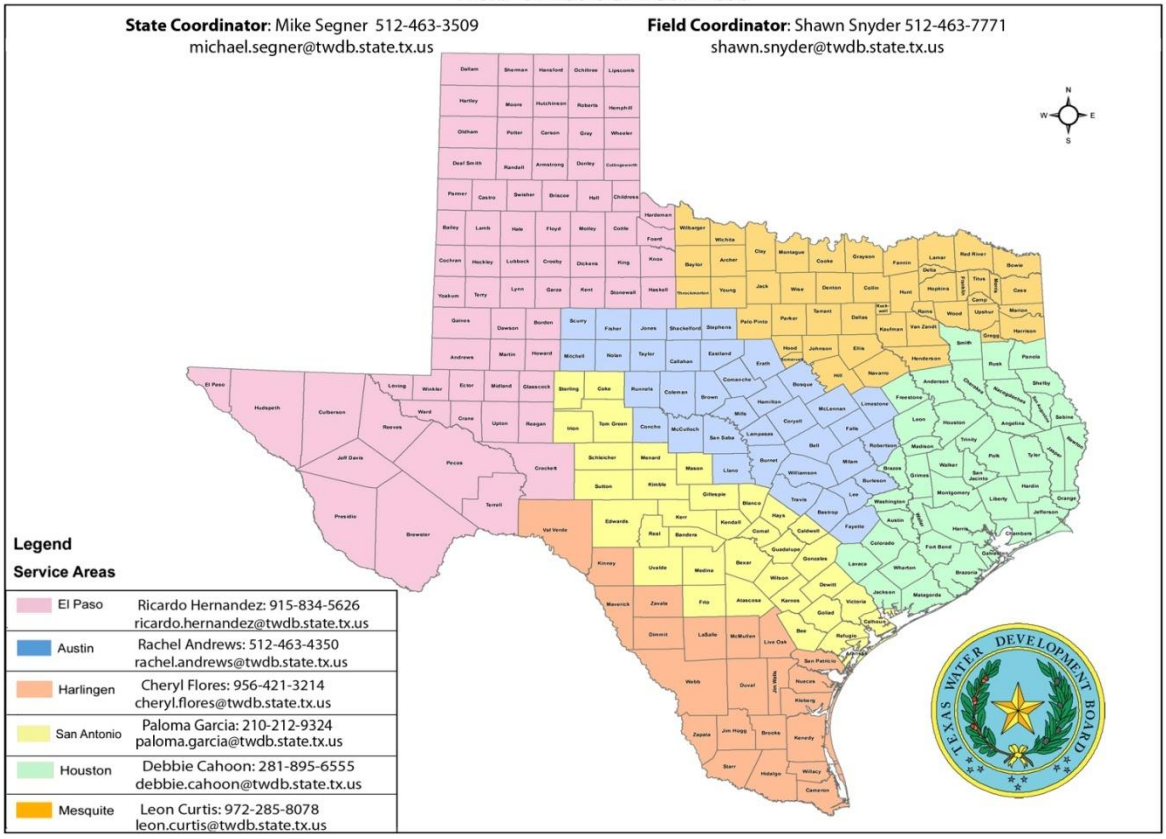
Strategy #2: Coordinate Better Communication between State Agencies and Local Jurisdictions to Enhance Local Floodplain Management

Background – Efforts have been made in recent years to consolidate the State's floodplain management responsibilities into one agency to strengthen the program. In 2007, through Senate Bill 1436, the Texas Legislature transferred the responsibilities of the state coordinating agency for the National Flood Insurance Program (NFIP) from the Texas Commission on Environmental Quality (TCEQ) to the Texas Water Development Board (TWDB). At TWDB, the program has garnered increased annual State funding that made it possible to hire six field staff to better serve Texas communities across the State. Field officers are stationed in Austin, El Paso, Harlingen,

Houston, Mesquite, and San Antonio. In 2008, TWDB began administering the Severe Repetitive Loss (SRL) grant program. TWDB has administered the Flood Mitigation Assistance (FMA) grant program since 1998 and the State-funded Flood Protection Planning grant program since 1984. These three grant programs are now housed together under Federal and State Programs, and TWDB has increased staff to manage these programs to four full-time employees. Together, the grants staff and the NFIP field staff are housed under the Division of Flood Mitigation Planning within Water Resources Planning & Information (WRPI) at TWDB. The role of TWDB expanded again in April 2009 with the addition of an NFIP Mapping Services Team within the Texas Natural Resources Information System (TNRIS), to serve as the State's principal center for statewide floodplain mapping resources. The Texas Department of Emergency Management (TDEM) administers the other three FEMA Hazard Mitigation Assistance Grant Programs: Pre-Disaster Mitigation (PDM), Repetitive Flood Claims (RFC), and the post-disaster Hazard Mitigation Grant Program (HMGP).

Implementation – With the majority of State responsibilities housed under TWDB, Texas is now better prepared to build a stronger and more integrated floodplain management program to serve the needs of the State. The six field officers for the NFIP (see Figure on next page) visit local communities to perform Community Assistance Contacts (CACS), Community Assistance Visits (CAVS), and provide training to local officials on the specifics of the program. The field staff provides information on available grant opportunities for mitigation planning and projects during these local contacts. Field staff also work closely with TNRIS NFIP Mapping Services staff to address local mapping needs. The Federal and State Programs staff also coordinates with TNRIS staff on data management and mapping projects that benefit both groups.

National Flood Insurance Program Coordinating Office for the State of Texas
Field Office Service Areas



Since FEMA's Hazard Mitigation Assistance grants are divided between TWDB and TDEM, these two agencies benefit from working together and sharing information. There is substantial overlap between the types of projects that can be done with these five grants, so local jurisdictions can approach either agency, and staff are trained to be able to provide information on all five programs. Moreover, funding appropriations and local cost shares vary for each of these grants, so state agencies work with local jurisdictions to find the most appropriate grant to suit their needs. TWDB and TDEM also have the capacity to share data, information, and experience, which strengthens the capacity of both agencies. The following table summarizes federal assistance programs administered by TWDB and TDEM that provide financial assistance to local entities essential to the mitigation of RL and SRL properties.

Program:	**Hazard Mitigation Grant Program (HMGP)**
Purpose:	Provides funding assistance to reduce or eliminate future risks to lives and property damage due to natural hazards or vulnerability to future damages
Funding:	Post-disaster, amount available dependent upon disaster damages (percentage of IA and PA requests)
Effectiveness:	Yes. Projects *may* be directed towards reducing losses associated with RL or SRL properties
Recent funding	Three disaster declarations in 2007, HMGP grant funding amounts unavailable

Program:	**Pre-Disaster Mitigation (PDM) Program**
Purpose:	Provides funding for planning/risk analysis, or for mitigation projects to reduce or eliminate the effects of hazards
Funding:	Annual, national competition for funding consideration
Effectiveness:	Yes. Projects *may* be directed towards reducing losses associated with RL or SRL properties
Recent funding:	For FY2005, Planning (4) and projects (10), $20.3 million
Program:	**Repetitive Flood Claims (RFC) Program**
Purpose:	Provides funding assistance to reduce or eliminate the long term risk of flood damage specifically to RL structures
Funding:	Annual allocation to the State. Restricted to applications from communities who are not eligible under other grant programs, or cannot meet the local share requirements
Effectiveness:	Yes. Specific to RL properties
Recent funding:	New program. Funding allocation and awards unavailable
Program:	**Flood Mitigation Assistance (FMA) Program**
Purpose:	Provides funding for flood mitigation planning, or projects to reduce or eliminate the flood risk to structures insured under the NFIP.
Funding:	Annual allocation to the State. Competitive application process, prioritization of applications considers the number of RL properties mitigated and the cost effectiveness of the proposed project.
Effectiveness:	Yes. Application prioritization targets RL properties for mitigation
Recent funding:	Since 2007, $14.82 million in project grants, $80,000 in planning grants, and $241,500 in direct technical assistance have been awarded; one project grant worth $10.2 million is currently pending FEMA approval.
Program:	**Severe Repetitive Loss (SRL) Grant Program**
Purpose:	Provides funding for projects to reduce or eliminate the flood risk to SRL properties
Funding:	Annual allocation to the State. Competitive application process, prioritization of applications considers the number of SRL properties mitigated and the cost effectiveness of the proposed project.
Effectiveness:	Yes. Program specifically targets SRL properties for mitigation
Recent funding:	Since 2008, $29.18 million in federal funding has been implemented; an additional $3.51 million has been recently awarded; an additional $4.23 million pending FEMA approval.

All of these State entities work directly with local jurisdictions to aid them in implementing flood hazard mitigation actions and managing their NFIP responsibilities. TWDB and TDEM share a focus on mitigating RL and SRL properties in high priority areas of the State. TWDB has developed a strong working relationship with Harris County Flood Control District, which has been proactive in property acquisitions and structural projects to reduce flood losses in the most flood-prone county in Texas. TWDB has also worked extensively on multiple Flood Mitigation Assistance projects with Jefferson County Drainage District No. 6, another area of high RL and SRL losses. The two agencies will continue to foster relationships with high-priority communities in the future to ensure that as local plans are updated, RL and SRL properties

residing within their jurisdiction will be evaluated, and mitigation actions directed towards these properties will be identified as part of the local plan update.

Strategy #3: Reduce the Number of Repetitive Loss and Severe Repetitive Loss Structures in Texas

Background – A repetitive loss (RL) property is defined by FEMA as any property that has had two or more flood insurance claims of $1,000 or more in any 10-year period. Severe repetitive loss (SRL) properties are a sub-set of RL properties; this term is applied to any property that has had either four or more claims of $5,000 per claim, or at least two claims with combined claims exceeding the market value of the structure. RL and SRL properties are most common in flood-prone areas along the Gulf Coast; 81% of SRL properties are located in just five counties: Harris, Galveston, Brazoria, Montgomery, and Jefferson. RL and SRL properties are also common along rivers and smaller creeks throughout the State, areas prone to flash-flooding, and areas of poor localized drainage, especially in the Texas Hill Country and the Dallas Fort Worth area.

RL and SRL properties are seen as a major burden to the National Flood Insurance Program. Since they have been flooded frequently in the past, they are at a high risk of flooding again without mitigation actions. According to FEMA data, at the end of January 2010, there were 20,378 RL properties and 3,172 SRL properties in the State of Texas. Despite ongoing mitigation activities, a substantial number of properties were added to both lists due to Hurricane Dolly and Hurricane Ike in 2008, and the April 2009 floods in Houston. Although the State can work to mitigate properties and remove them from the list, future flooding events will continue to add new properties. In the long-term, however, committed investment to structural and non-structural solutions should reduce the susceptibility of residential areas to flood hazards.

Implementation – Through their administration of FEMA's Hazard Mitigation Assistance grant programs, TWDB and TDEM have worked to reduce the number of RL and SRL properties in Texas and will continue to do so in the future.

Summary of FMA Funding:
TWDB has administered the Flood Mitigation Assistance (FMA) program since 1997. The TWDB has utilized available FMA funding to reduce the flood risks associated with RL and SRL properties. All funding allocated to the State under FMA has been utilized to the fullest extent. The TWDB has prioritized applications submitted for consideration under FMA, as those projects directly affecting structures that are on FEMA's RL list to be the highest priority. Cost-effectiveness is the second priority when evaluating applications under the program. Since 1997, TWDB has administered over $43.1 million in executed contracts under the FMA program, including $41.3 million in project funds, over $990,000 in planning funds, and over $870,000 in direct technical assistance. Included in these totals are executed contracts currently in progress, which amount to over $20.7 million in projects, $80,000 in planning, and close to $540,000 in technical assistance. In addition, one FMA project grant worth $10.2 million is currently pending.

Non-Structural Projects: To date, $11.55 million in federal funds have been allocated to buyout and remove 110 structures in Harris County ($10.62 million in federal funds), 6 structures in Travis County ($557,330), 2 structures in City of Denton ($147,065), 1 structure in City of Grand Prairie ($98,092), and 1 structure in City of Mansfield ($125,625).

Structural Projects: To date, $29.38 million in project funds have also been allocated to fund sixteen structural projects: Jefferson County Drainage District No. 6 has received $18.33 million

in federal funds for 10 projects, City of Beaumont has received $6.24 million to fund 4 projects, City of Grand Prairie received $277,500 to fund 1 project, and Sabine-Neches Navigation District received $4.54 million to fund one project. All but one of these projects has been in Jefferson County. These projects, structural in nature, were developed and funded because of their established mitigation results, and technically feasible, environmentally sound, and cost effective actions. All fifteen projects include minor structural activities such as detention, channelization, bridge or culvert enlargement or modification. Some of these projects have been completed, some are in various stages of implementation and some have just been initiated. Together, these projects are protecting over 7,000 residential, commercial and public structures, including an estimated 200 RL properties and 25 SRL properties. Based on FEMA data, these projects will significantly reduce the risks due to flooding associated with nearly 25% of the RL properties existing in Jefferson County and will reduce the number of SRL properties by around 50%. The success of these structural improvements were seen when Hurricane Rita caused minimal damage to property and infrastructure in Jefferson County.

Summary of SRL Funding:
TWDB began administering the Severe Repetitive Loss (SRL) grant program in 2008. Since then, $29.18 million in federal funding has been allocated to administer buyouts of SRL properties. This includes $17.92 million in funding to acquire 131 structures for Harris County Flood Control District, and $10.76 million in funding for the City of Pasadena to acquire 19 apartment complexes. Two additional SRL projects have recently been approved by FEMA: $3.32 million for Harris County Flood Control District to buyout 22 SRL structures, and $189,450 for City of Pasadena to buyout 1 SRL structure. Three additional applications are currently pending FEMA approval to buyout 24 SRL structures and elevate 6 SRL structures for a total federal funding amount of $4.23 million. This would be the first elevation project administered under SRL program in Texas. TWDB plans to garner more SRL funds for projects other than property acquisitions, including elevation and mitigation reconstruction projects, in the coming years.

Additional Strategies to Reduce the Number of RL and SRL Properties in Texas:
Continued efforts to reduce the number of RL and SRL properties are a top priority for the State of Texas. Several additional actions and priorities specific to achieving these mitigation goals have been identified and include the following:

- Encourage the mitigation of RL and SRL properties at the local level. This will be accomplished through direct communication with local leaders, as well as through the numerous training and education programs conducted by TWDB and TDEM staff throughout the year;
- Promote hazard mitigation grant opportunities in RL communities by the TWDB Flood Mitigation staff as part of their NFIP State Coordination activities, CAVs, CACs, and workshops performed by staff;
- TWDB and TDEM will continue to coordinate those program activities that both agencies administer that are associated with floodplain management and the mitigation of risks associated with flooding;
- TWDB will continue to administer the FMA and SRL grant programs to implement cost effective, environmentally sound projects that will substantially reduce the risks due to flooding and the associated flood insurance claims under the NFIP; projects that target RL and SRL properties will continue to receive top priority; mitigation projects located in Harris, Galveston, Brazoria, Montgomery, and Jefferson counties will receive the highest prioritization for grants to mitigate their RL and SRL properties;

- When requested, TWDB will provide technical assistance to repetitive loss communities to review and evaluate the occurrence of RL and SRL properties within their jurisdiction;
- FEMA's Web Data Exchange database will form the basis for prioritizing applications for financial assistance, for developing program marketing efforts, and for tracking the successes of projects funded by these programs; data will be maintained and organized on a community basis to ease prioritization and tracking efforts;
- Efforts within the RL communities will be prioritized based not only on the numbers of RL and SRL properties occurring within their jurisdictions, but also on estimates of avoidable damages calculated by FEMA for specific RL properties;
- TWDB will coordinate with TDEM to ensure that both agencies are effectively utilizing staff to efficiently promote the various funding programs available to the RL communities within the State, and to provide technical assistance to those communities when requested;
- Finally, TWDB will also coordinate with TDEM to ensure that plan updates include an assessment of RL and SRL properties within specific RL communities.

HURRICANE/TROPICAL STORMS

Hazard Mitigation Goal

Hazard mitigation is defined as "any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazardous conditions." It is viewed as a long-term, on-going management process that consists of a variety of both pre-incident and post-incident actions.

The General Land Office (GLO) is the responsible State agency for the Gulf coast shoreline and for all coastal issues that arise. With increased populations along our coastlines and growing awareness of coastal risks associated with climate change, the GLO will expand the assistance it provides coastal communities to assist coastal communities in being better prepared.

The following strategies and goals reflect the current assessed needs of the coastal counties.

***Strategy #1:* Restore the Natural Beach/Dune System Through Dune Restoration.**

Some coastal areas are in need of dune restoration. A healthy beach/dune system can minimize damage to homes and critical infrastructure by absorbing energy from storm surge and waves, and providing sediment to the beach. Wide beaches and high continuous dunes are the best defense against coastal storms. The significance of sand dunes to coastal protection is highlighted in studies by the U.S. Geological Survey (USGS) (Morton and Peterson, 2005; 2006a; 2006b).

The priority areas for restoring the beach/dune system are those dune complexes severely damaged or destroyed by Hurricane Ike in 2008 along the Gulf shorelines of Galveston Island, Bolivar Peninsula, and Brazoria County. There were areas along the Gulf shoreline on Bolivar Peninsula and Galveston Island where Geotextile tube projects were destroyed during Hurricane Ike. These projects are being replaced with an alternative project consisting of a natural dune to replace the failed Geotextile tubes.

The GLO has completed successful dune restoration projects in similar locations along the Gulf of Mexico, providing protection to environmental habitats and existing residential and public properties, including roads and critical public infrastructure. In 2008, 100,000 cubic

yards of beach quality sand was placed on the upper beach area of the Northern portions South Padre Island from Bahia Mar to the La Quinta. The restoration project repaired erosion damages to 4,600 feet of shoreline from high tides associated with Hurricane Dolly as well as long-term chronic erosion. The restoration project reduces the vulnerability of homes and critical infrastructure to the impacts of storm surge.

Goal 1.1 **- Galveston Island (Galveston County):**
Background: Chronic coastal erosion along the 18 miles of Gulf of Mexico shoreline on Galveston Island, west from the Galveston Seawall to San Luis Pass, migrated the shoreline landward into existing developments. This resulted in houses being located seaward of the line of vegetation and exposed to the Gulf of Mexico with little or no protection from future storm events. Presence of structures seaward of the line of vegetation can inhibit dune development or recovery, weaken the entire dune system, and narrow the width of the beach, increasing the Island's vulnerability to inundation from storm surge and increasing the risk to adjacent properties within the community.

Episodic erosion from storm surge and wave action following Hurricane Ike in 2008 has resulted in the natural dune system being severely damaged or destroyed. The lack of a healthy dune system leaves private property and public infrastructure vulnerable to storms.
FM 3005 is the only hurricane evacuation route for these 18-miles of Galveston Island and is within 1000 feet landward of mean high tide. Without an established dune system, there is a high risk of FM 3005 suffering damage from storm tides and becoming impassable.

Implementation: GLO has identified the need for the natural dune system to be restored along the 18 miles of Galveston Island west of the Galveston Seawall. This involves several residential subdivisions that have been impacted by Hurricane Ike and are subjected to coastal flooding associated with severe storms and high tide events. A cost effective approach would be to restore the natural dune system complete with dune vegetation along the project area. Dune restoration is estimated to cost $1,000,000 per mile to construct. Estimated construction cost for the entire project area is $18,000,000.

***Goal 1.2* - Bolivar Peninsula (Galveston County):**

Background: The natural dune system along the 21 miles of Gulf of Mexico shoreline of Bolivar Peninsula from High Island west to Port Bolivar, including Rollover Pass and Little Beach, has been destroyed by Hurricane Ike in 2008. Hurricane Ike's devastating effects altered the topography and the shoreline of Bolivar Peninsula. Ike caused 130 to 300 feet of average Gulf shoreline retreat along Galveston Island and Bolivar Peninsula, over three feet of vertical erosion, and destroyed over 3,500 homes. The result of this elevation change has increased Bolivar Peninsula's vulnerability to inundation even with a small storm event, threatening Highway 87, Bolivar Peninsula's only evacuation route. In June 2010, Hurricane Alex made landfall in Northern Mexico as a Category 2 storm with sustained winds of 100 mph. Although Hurricane Alex made landfall approximately 385 miles to the South of Bolivar Peninsula, high tides associated with Alex caused erosion and flooding along Bolivar, making portions of Highway 87 impassible.

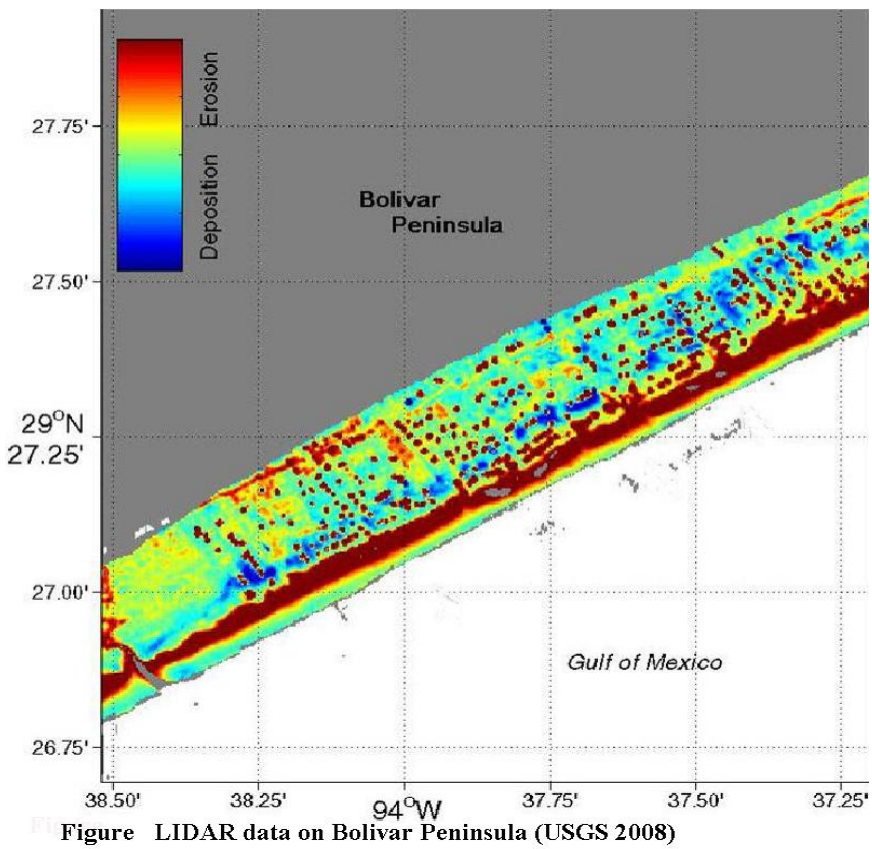


Figure LIDAR data on Bolivar Peninsula (USGS 2008)

Implementation: GLO has identified the need to restore the natural dune system for this area, complete with dune vegetation along the Gulf of Mexico shoreline in this 21-mile area of

Bolivar Peninsula. The estimated cost for the entire Dune restoration project is $110,200,000 to construct.

***Goal 1.3* - Follet's Island / Village of Surfside (Brazoria County):**

Background: Located in Brazoria County Texas, Follet's Island is a Peninsula bordered by the Gulf of Mexico on the east, Christmas Bay on the West and separated from Galveston Island to the north by San Luis Pass. County Road 257 (CR257 or Bluewater Highway) is the only road along the length of Follet's Island. CR257 serves as a direct link between Galveston Island and south Brazoria County, including the Cities of Surfside, Freeport, Angleton, and various communities on Follett's Island. It is a major evacuation route for Galveston Island and Brazoria County, and is the only evacuation route for residents along Follet's Island. Because of reduced sediment being carried to the coast by rivers, chronic erosion is the key issue affecting areas along Follett's Island.

On September 13, 2008, Hurricane Ike caused major damage to the Gulf shoreline beach/dune system along Follett's Island. The beach/dune elevation along most of the 14 mile length eroded by 3 to 4 vertical feet on average. Some of this elevation may recover, but most is likely permanent, especially in the dune system. Areas along CR257 eroded to at or below the elevation of CR257 while other areas eroded to around mean sea level. Approximately 3.25 miles of CR257 was partially breached and needed repair and an additional 2.3 miles of CR257 was completely breached and impassible.

Implementation: GLO has identified the need for dune and berm restoration along 14 miles of Gulf facing shoreline South of Treasure Island to the northern jetty of the Freeport Jetties at the Village of Surfside Beach. Dune restoration is estimated to cost $1,000,000 per mile to construct. Estimated construction cost for the entire project area is $14,000,000.

Goal 1.4 **- Matagorda County:**

Background: Situated at the mouth of the Colorado River, Matagorda County is one of the least developed areas along the Texas coast. However, county officials are reviewing plans for future development in the county. In 1929, because of the removal of a persistent logjam, the Colorado River developed a delta across Matagorda Bay to Matagorda Peninsula. A channel was dug across the delta in 1936 to allow the Colorado River to empty directly to the Gulf of Mexico.

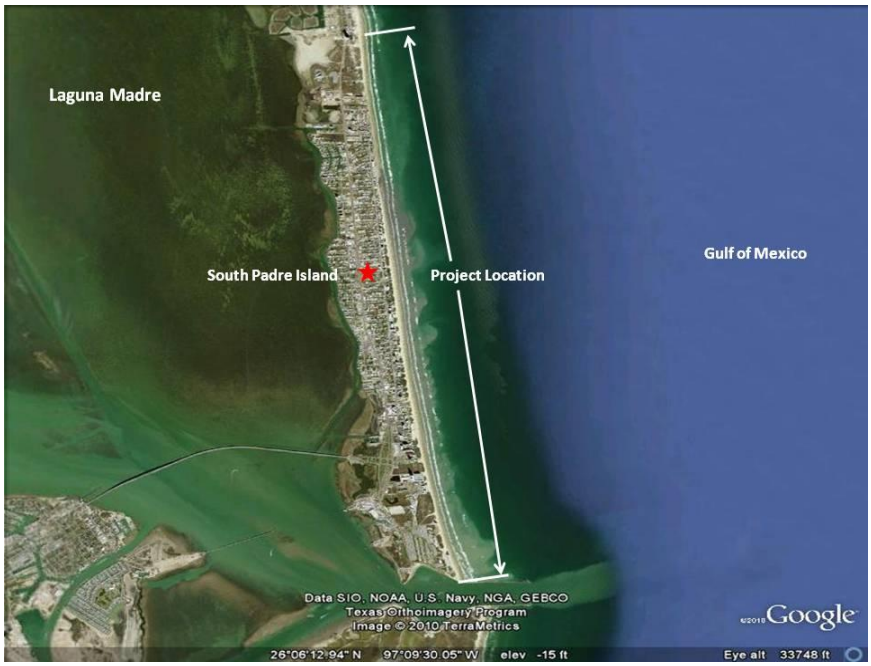
Shoreline changes along the Matagorda Peninsula range from relatively stable, and in some areas accreting, near the Matagorda Ship Channel to highly eroding at rates greater than 30 feet per year at Sargent Beach. In 1998, an 8-mile long granite revetment wall was completed by the Army Corps of Engineers to protect the Gulf Intracoastal Waterway (GIWW) from incursion by the Gulf of Mexico due to chronic erosion. Approximately 63 million tons of cargo with a commercial value estimated at $25 billion travels the Texas GIWW each year on approximately 99,970 barge one-way trips.

The GIWW also handles 90% of all gasoline shipped to the lower Rio Grande Valley. With this current rate of erosion along Sargent Beach, the Bureau of Economic Geology at the University of Texas estimates that the Gulf of Mexico will intersect the revetment wall in less than 20 years. However, as a result of the continuing long-term erosion of the shoreline, perhaps along with some localized effects from the upland granite revetment on the nearshore profile during storms, the sandy soils in the Project area have eroded from the nearshore leaving an exposed clay substrate seaward of the granite revetment. Hurricane Ike in 2008 further eroded this exposed clay substrate exposing the revetment to the Gulf in several locations. Exposed to direct wave impacts, the integrity of the granite revetment may be compromised, placing the GIWW at risk. Loss of the GIWW to the open Gulf of Mexico would result in a severe economic impact to the State of Texas.

Implementation: The GLO has identified eight miles of the Sargent Beach area as a recommended project area for dune restoration projects to help provide a level of protection for the granite revetment from the effects of wave energy and storm surge. Dune restoration is estimated to cost $1,000,000 per mile to construct. Estimated construction cost for the entire project area is $8,000,000.

***Goal 1.5* - South Padre Island and Cameron County:**

Background: The Town of South Padre Island is located in Cameron County at the southern tip of the state, bordered on the south by the Rio Grande River and Mexico. Tourism is one of the big economic engines of this region generating over $700 million a year primarily from Spring Breakers and Winter Texans – northerners who travel south for the winter seeking the milder climate and warmer temperatures and to bird watch.



Climate plays a role in coastal change in the South Padre Island area. This part of the coast receives less rainfall, and has experienced prolonged droughts that have destroyed coastal vegetation that help hold sand in place within the beach/dune system and prevent erosion. The South Padre area is generally sand-starved with little to no sand brought to the Gulf beaches by the Rio Grande because little or no sediment comes down the river to replenish that lost to erosion, as has historically occurred. Gulf shorelines are retreating from two to 25 feet per year, with the highest rates of erosion occurring at the mouth of the Rio Grande and just south of the Willacy/Cameron County line.

Implementation: GLO has identified the need for the restoration of the natural dunes, dune vegetation, and berm along the Gulf shoreline extending approximately five miles north of the Brazos Santiago Pass jetties. Dune restoration is estimated to cost $1,000,000 per mile to construct. Estimated construction cost for this project is $5,000,000.

Strategy #2 **Restore Coastal Wetlands and Marshes.**

Background: Coastal wetlands are transitional areas of vegetation and soils between dry uplands and open marine water environments. They are typically saturated or periodically inundated by tidal waters. In addition to providing a habitat to wildlife and a nursery for fish, crabs, and other shellfish, wetlands also enhance water quality and serve as buffers for reducing both the severity of floods and shoreline erosion.

Coastal marshes are complexes of multiple species of marine-adapted vegetation within wetlands that are subject to frequent and continuous flooding. Floods are a major hazard in many coastal regions. Tropical cyclones often generate high waves, which crash into the shore, eroding away sand dunes, wetlands, and marshes, which protect inland areas. Coastal marsh hydrology is influenced by a system of tidal creeks over flat topography, which disperses water quickly and efficiently over large areas, allowing for effective buffering of the forces generated by storms and floods.

Implementation: The GLO has identified the need to restore coastal wetlands and marshes along West Bay on Galveston Island, because these wetlands are experiencing developmental pressure along their fringes. Other factors contribute to the degradation of the coastal wetlands and marshes including regional land subsidence and soil erosion from wind and wave action. The loss of the protective function these natural systems provide is increasing the vulnerability of houses and infrastructure to impacts from storms and floods. Restoring these wetlands and marshes will restore the natural flood control system of the barrier islands.

Strategy #3 **Coordinate Mitigation Planning with Local Governments.**

Background: The GLO engages in many activities to facilitate and enhance the public's understanding of the Texas Coast and the local capabilities for managing their coastal community.

Implementation: The GLO intends to continue utilizing education to increase public and private sector awareness and support for hazard mitigation planning along the Texas coast. Hurricane Ike in 2008 drove home the importance of preparedness and mitigation. These activities would include:

- Development of multi-county regional planning committees consisting of Emergency Managers, Floodplain Managers, and coastal decision makers for the purpose of long-term planning on a regional scale.
- Local and regional workshops, in conjunction with Texas A&M University, to promote two CMP funded projects - *Texas Sustainable Coast Initiative's Vulnerability Atlas* and the study of local and regional mitigation action plans along the Texas Coast as tools for planning.
- Annual training for coastal governments, in conjunction with the Texas Division of Emergency Management and the Texas Water Development Board, for the promotion

and processing of all hazard mitigation assistance funding. This includes the Hazard Mitigation Grant Program (HMGP), Pre-disaster Mitigation Program (PDM), Flood Mitigation Assistance Program (FMA), Repetitive Flood Claims (RFC) Program, and Severe Repetitive Loss (SRL) program grants to maximize local governments' efforts for funding mitigation projects.

- The promotion and awareness of the Texas Storm Smart Coasts Network website as a resource tool for coastal decision makers and for sharing of information and resources with other Gulf States.
- Development and distribution of the Texas Coastal Homeowners Handbook to help coastal property owners protect their property and prepare for coastal natural hazards.
- Development and distribution the Texas Hazard Mitigation Guidebook to provide a tool for coastal communities to plan for natural hazards such as erosion, floods, and hurricanes.

Strategy #4 **Remove Houses Seaward of the Line of Vegetation and above Mean-High-Tide Elevation.**

Background: In 2008, Hurricane Ike moved the shoreline along Galveston Island and Bolivar Peninsula landward into existing developments resulting in houses being located seaward of the line of vegetation, and seaward of the protective function of the dunes. In 1999, following Tropical Storm Frances, an inventory was conducted, which identified 107 houses seaward of the line of vegetation. A second inventory was conducted in 2004, following Hurricane Claudette, which identified additional properties seaward of the line of vegetation. A current inventory has not been conducted at this time due to ongoing recovery efforts from Hurricane Ike.

The removal of these homes seaward of the line of vegetation could prevent damage to other homes if these homes deteriorate in a tropical storm or hurricane. The homes located seaward of the line of vegetation are the first houses to be affected in storms, and the debris from these homes could cause serious damage to other homes as well as increased cost of debris removal and delay response and recovery efforts. Depending on fair market value of the houses, the needs under this priority are estimated to be $5,000,000. This strategy is on-going.

With the adoption of House Bill 2387 in 2009, during the 81st legislative session, the GLO is authorized to acquire property seaward of the line of vegetation, as needed for the construction, reconstruction, maintenance, widening, or extension of coastal management projects.

Implementation: Acquisition of structures seaward of the line of vegetation and within dune restoration projects will be necessary in order to have an effective project, and provide protection to property and critical infrastructure. When necessary, GLO will use state appropriated CEPRA funds as a match funding source to leverage federal funding for the acquisition of properties that are affected by a dune restoration project.

TORNADOES

Background

Tornadoes are a major threat to people and property with virtually the entire State at risk. Since 1953, Texas has had 15 Presidential declarations due to tornadoes. The destruction potential coupled with unpredictability, speed of onset, and limited reaction times require a strategy that

focuses on four (4) types of measures. These measures consist of insurance, awareness, protective shelters, and warning.

Strategies
Promote and provide for the protection and safety of the population in the State. This includes the adoption and enforcement of appropriate building codes and/or design criteria, construction of area mass shelters in public facilities, schools, mobile home parks, etc., the construction of "safe rooms" in homes, and other public or personnel protective shelter initiatives. For fiscal year 2006, TDEM added the "individual safe room" grant program under HMPG and PDM to better provide for the protection and safety of the people.

Promote and provide for expanded coverage options for standard peril and windstorm insurance coverage for public and private property. This strategy is on-going.

Promote and provide enhanced, statewide awareness, along with information, instructions, and guidelines concerning risks, consequences, public safety, and mitigation of the tornado hazard.

Promote and provide enhanced warning capabilities that ensure 90% or more of the State's population receives accurate and timely warnings and adequate reaction time prior to the occurrence of weather related disaster events. This includes actions to enhance and expand hazard occurrence indicators such as volunteer storm-spotters networks, river, tide, seismic, wind and rainfall gauge systems, and data collection projects such as post-storm analysis that collect and record damage area footprints and high water markers, etc. This also includes actions that proactively pursue installation of additional NOAA Weather Radio transmitters by local governments, schools districts, State agencies, river authorities and civic-minded groups in all parts of the State not yet under the umbrella of NOAA. This strategy is on-going.

Lead by example: Require all new State construction to meet IRC wind speed. This strategy is on-going.

WILDFIRE MITIGATION

Background
Generally, large damaging wildland fires occur when the complex interactions of weather and fuels combine to create extreme fire behavior potentials. These weather patterns and fuel buildups occur over time and are precursors of major wildland fire outbreaks. However, these weather patterns and fuel accumulations do not predestine major wildland fires; man usually strikes the match.

Strategies
TFS maintains an Urban Wildland Interface traveling exhibit that illustrates and demonstrates what can be done to protect a home and property with just a few steps for making a home fire-wise. The exhibit van is wrapped in illustrations depicting the seven regions of Texas complete with wildlands, vegetation and construction similar to those found in rural areas. The trailer wrap depicts homes, wild lands, and firefighters fighting rural fires.

TFS maintains a web site that contains a number of fire safe mitigation initiatives such as how to protect homes from wildland fires; explaining Urban-wildland interface and risk reduction

measures to take by property owners; and a number of other risk reduction topics. The website may be found at http://texasforestservice.tamu.edu.

The Texas Education Agency requires fire prevention and safety to be taught in public schools. Adherence to this requirement varies from district to district.

TFS Predictive Services staff calculates and predicts the statistical probability of fire occurrence and behavior; disseminate wildfire assessment information to elected officials, including KBDI drought information for burn ban determinations; and work with the National Weather Service to determine areas of extreme fire danger to pre-position personnel.

TFS Prevention staff work with local governments and the public to develop targeted prevention campaigns based on local fire activity.

TFS Urban Wildland Interface staff help communities determine wildfire risk levels, identify hazards, and determine mitigation treatment options through the Community Wildfire Protection Plan (CWPP) process. A user-friendly CWPP "template" is available online to empower communities to determine their own choices for reducing wildfire hazards.

TFS provides technical support for the development of Firewise Communities USA.

TFS sponsors two Wildland Fire Training Academies annually. A Spring academy held in Lufkin, and a Fall academy held in Bastrop. The Rural Volunteer Fire Department Assistance Program (HB 2604) provides training grants for volunteer firemen to receive nationally certified wildfire and emergency management training.

TFS makes available Southern Fire Risk Assessment System (SFRAS) maps available to communities and counties. These maps can be used for wildfire mitigation purposes including maps which depict Surface Fuels, Wildfire Occurrence, Urban Wildland Interface Areas, Wildfire Suppression Difficulty, etc.

DROUGHT

Background

The Texas Legislature enacted enabling legislation in HB 2660, in 1999, after years of ad hoc State committees, to have a proactive approach to drought planning by mandating a formal organization comprised of State and Federal agencies within the State to manage drought, emphasize drought monitoring, assessment, preparedness, mitigation and assistance. In addition, the Texas Department of Health is responsible for establishing policies and procedures for alerting and monitoring communities who experience extreme heat over long periods of time for the protection of all citizens, especially the young and elderly, and animal's populations.

Strategies (Taken from the State Drought Preparedness Plan):

Note that these are taken as they were written from the State Drought Preparedness Plan. These actions are ongoing. Responsible Agency: Drought Preparedness Council

The actions that are proposed to be carried out by the respective State, Federal and local agencies emphasize the acceleration or targeting of agency resources to affected parties and encourage existing agencies to develop strong partnerships between these agencies, their customer, and the general population of Texas. The efforts may challenge the management of many agencies to

look beyond their current service or regulatory role and identify new partnerships and opportunities that will be of greatest benefits to the State in minimizing the effects of drought.

(a) Strategies:

TDEM will provide training and educational programs focusing on the preparation of Emergency Management Coordinators to respond to natural hazards and to teach them the best ways to mitigation the affects of those hazards. TDEM continues to provide training in the G-710 & G-720 classes. This strategy is on-going.

The Texas Department of State Health Services maintains a web site that provides health tips and actions for citizens, governments and medical facilities. This strategy is on-going.

DAM FAILURE

Background

The Texas Commission on Environmental Quality (TCEQ) currently does not have inundation maps for all high and significant hazard dams. TCEQ rules require the owners of these dams to have Emergency Action Plans (EAPs) to the TCEQ by Jan. 1, 2011, unless they have requested and received an extension of this deadline. All of these dams will not have an inundation map, but will have a map showing impact area.

Strategies

The State will provide funds that will assist local jurisdictions to pay for the cost of a study that determines the dam failure inundation area.

(a) For local jurisdictions that have obtained a mitigation planning grant for the purpose of creating or updating their local mitigation plan, TDEM will provide State Technical Assistance funds, if requested and when available, for the purpose of determining the inundation area as part of the local risk assessment for dam failure.
(b) Local jurisdictions may apply for funds to develop a dam failure inundation map through the Flood Protection Planning (FPP) grant offered by the Texas Water Development Board.

The following information discusses some other strategies that don't fall under a particular hazard and some strategies that discuss data shortfalls.

Other Strategies

There was a desire by TDEM Mitigation to add technically focused members to the State Hazard Mitigation Team. Since the last update, we have added the Texas Geographical Society (for GIS expertise) and Texas Tech University (for wind engineering expertise). The Texas Tech representative also happens to represent the National Storm Shelter Association (NSSA), a private non-profit group dedicated to improving tornado shelter construction while the Texas Geographical Society member provided the necessary updates to digitize the State Hazard Analysis and placed it on the Internet. In addition, TDEM would like to add a new member to the SHMT from the TCEQ, since the TCEQ representative has moved to the TWDB.

Data Shortfall Strategies

(a) Local Government Data

For those local mitigation plans approved in 2005, their updates were due in 2010 and expected to be incorporated into the 2010 State Plan update. However, these local mitigation plans are currently in draft status and are unavailable to be included before this Plan goes to FEMA for review and approval in 2010. For those local plans not listed in this State Plan that were approved in 2005, the State will summarize their findings (vulnerability, estimated losses, mitigation actions, and local capability assessments) into the 2013 update of this Plan. For those local mitigation plans that were approved between 2007-2010, a summary of their findings may be found on pages 130-152.

(b) State Data

TDEM updated the State facility database (vulnerability and estimated losses) in 2009 by funding the creation of the Geospatial Emergency Management Support System (GEMSS). GEMMS was created by the Texas Natural Resource Information Systems (TNRIS). The State will continue to add and edit data by allowing GEMSS to be edited once a year by all of the State agencies that have buildings listed in the State facility database.

Some of the actions the State of Texas wants to accomplish are going to require enabling legislation by the Texas Legislature and if passed by the Legislature, signed by the Governor. This may take some time because the Texas Legislature only meets in full session every other year.

Local Mitigation Actions

GENERAL

The State Hazard Mitigation Team is charged to evaluate each project at the time the application for funding is submitted to determine the project's feasibility and how the projects fit into the State's priorities. They are also reviewed to see if each is cost-effective and technically feasible. The State will not recommend any project to FEMA that do not meet these criteria. The State has two administrative plans that govern the award of mitigation grant money: HMGP (Annex A) and PDM (Annex B). For more details, see the HMGP and PDM Administrative Plans. Appendix 1 of the HMGP Administrative Plan outlines the priorities for HMGP projects. For PDM-C, that appendix will be adapted based on the national priority set by FEMA at the time the "Notice of Funds Availability" is announced.

The State currently does not have the capability to evaluate a project's benefit-cost ratio or to do environmental reviews and relies on the supporting FEMA Region Mitigation Directorate to accomplish these actions. However, the State is currently exploring options to eventually add these capabilities to the State mitigation staff. The additional staff may require legislative authority and approval.

Funding sources to be used for the local mitigation actions include grant funds from HMGP, PDM, FMA, RFC & local capital improvement programs, local government general revenue, and sources listed in Attachment 7 (Funding Guide.)

The following is a summary of local mitigation actions that were identified in the various local mitigation plans submitted at the time this Plan was submitted to FEMA. Specifics as to funding source, benefits achieved, cost, cost effectiveness, and a timeline for implementation are detailed in the various plans. These mitigation measures are cost-effective, environmentally sound, and

technical feasible and are the types of mitigation projects that the State has previously funded and fit into the State's priority listing. The actions were prioritized using social, technical, administrative, political, legal, economic, and environmental criteria. These criteria as well as criteria mentioned in the local plans were used in determining what actions the local communities would take to mitigate the hazards discussed in their plan. The State will not recommend for funding those projects that do not coincide with the State's goals and strategies. The State supports any efforts that are taken by the local communities to mitigate the effects of hazards. All of the actions listed below coincide with the State mitigation goals listed in Section 3 of this Plan.

Actions from other local plans will be added incrementally and will be included in future updates to the State plan. An (I) represents *implemented* actions from local jurisdictions, while an (NI) represents actions *not implemented* by local jurisdictions.

MULTI-HAZARD MITIGATION ACTIONS (CAN BE IMPLEMENTED FOR MORE THAN ONE HAZARD)

- Implement and promote an multi-hazard public awareness program (I)
- Develop mutual aid agreements with area communities (NI)
- Acquire, conserve and utilize easements to prevent development of known hazard areas. (I)
- Adopt the 2006 International Building Code (I)
- Enhance code enforcement and inspection services (I)
- Send appropriate local officials to FEMA's Emergency management Institute for continuing education and other (State) sponsored training classes (I)
- Install outdoor warning systems (I)
- Identify safe shelter locations to be used during emergency events (I)
- Provide a telephone communications system network which will alert specific residents of emergency situation in their area (I)
- Develop a mass debris removal plan (I)
- Identify all critical and community facilities that are deemed necessary for emergency operations and conduct a structural assessment for multiple hazards to determine if retrofits are necessary (NI)

FLOOD MITIGATION ACTIONS

- Undertaking a review of the county's/cities floodplain management ordinances. (I)
- Work with State and Federal agencies to maintain current hazard data maps(NI)
- Require completed elevation certificates pre-and post-construction for buildings located in the special flood hazard are to ensure that elevation requirements are met. (I)
- Cross-train building inspectors in floodplain management requirements.
- Track and record high-water marks following floods (I)
- Verify FEMA's repetitive loss inventory and maintain current loss data (NI)
- Retain and maintain natural vegetation in storm water channels (I)
- Develop an acquisition program to remove homes from the floodplain(I)
- Create a GIS map and show related NFIP policies, claims and losses including repetitive losses (NI)
- Install flood gauges (I)
- Improve drainage in sites that are subject to flooding (I)
- Clear culverts and drainage systems (I)
- Construction of retention dams to assist in control of flash flooding (I)

- Join the Community Rating System in order to reduce flood insurance rates (I)
- Where acquisitions are not feasible (reducing the local tax base), work toward doing elevations of flood-prone properties(I)
- Install low water crossing barriers that activate automatically and lower gates (the type found at train crossings) over the road to prevent vehicles from entering. (I)

DROUGHT/EXTREME HEAT, SEVERE WINTER STORMS

- Develop an enforcement plan for implementing mandatory water rationing (NI)
- Educate residents about water conservation and landscape planting practices to preserve water supplies (I)
- Educate the public about extreme heat/drought safety and health issues (I)
- Cooling or heating centers to assist the public (I)

URBAN/WILDLAND FIRES

- Remove downed trees that increase the fire risk (I)
- Establish and implement burning standards (I)
- Consider an ordinance requiring fire extinguishers for all homes and business (I)

WIND, THUNDERSTORMS, TORNADOES, HURRICANES, HAILSTORMS

- Provide standards for burial of electrical, telephone, cable lines and other utilities (NI)
- Wind: Mandate and inspect to ensure standard tie-downs of mobile homes(I)
- Require mobile home parks to provide safe storm shelters (I)
- Encourage the installation of safe rooms in new and existing homes and businesses (I)
- Hurricane shelters for the public (I)
- Strengthening Emergency Operation Centers windows with hurricane shutters (I)
- Strengthening Emergency Operation Center roofs with enforced materials (I)

DAM OR LEVEE FAILURE, EARTHQUAKES

- No new development in the dam inundation area (NI)
- Strengthen building codes to protect against earthquakes (I)

COASTAL EROSION, EXPANSIVE SOILS, LAND SUBSIDENCE

- No specific local mitigation actions have yet to address coastal erosion, expansive soils or land subsidence.

Funding Sources

Requirement §201.4(c)(3)(iv): *The State mitigation strategy* ***shall*** *include an identification of current and potential sources of Federal, State, local, or private funding to implement mitigation activities.*

The State currently uses both Federal and State funding sources to implement its hazard mitigation activities. Federal funds support the Hazard Mitigation Grant Program (HMGP), the Repetitive Flood Claims (RFC), and Pre-Disaster Mitigation (PDM) Program. The NFIP Flood Mitigation Assistance (FMA) and Severe Repetitive Loss grant programs are funded by policy premiums that are available to communities and policyholders within the State through the Texas Water Development Board's (TWDB) sub-grant program. In addition, both TWDB and the Texas Department of Rural Affairs (TDRA) provide grants and funding to communities for

mitigation and storm water management projects that come from State appropriated funds. The Federal funded programs are 75% Federal and 25% local match programs, with the exception of the Severe Repetitive Loss program, which has a 90% Federal cost share. Additionally, the Pre-Disaster Mitigation program offers a cost share of 90% Federal for communities that fit the definition of "small impoverished community. Below is a summary of several mitigation funding programs. These funding sources listed below are applicable to the current planning process and have been available since 2007, which the exception of the Severe Repetitive Loss (SRL) program, which began in 2008. A complete listing of Federal and State funding programs is found in Attachment 6 – Funding Guide.

HAZARD MITIGATION GRANT PROGRAM (HMGP)

Administered by the TDEM Mitigation Section, the program provides post-disaster funds to communities to help implement long-term hazard mitigation strategies. Estimated annual funding due the frequent number of declaration averages $10.8 million.

PRE-DISASTER MITIGATION (PDM) GRANT PROGRAM

Administered by the TDEM Mitigation Section, this program provides pre-disaster funds to communities for mitigation projects and for the development of mitigation plans. Estimated annual funding is $15 million.

FLOOD MITIGATION ASSISTANCE (FMA) PROGRAM

The Flood Mitigation Assistance (FMA) program provides federal funding to assist communities in funding cost-effective measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. Two types of grants are available – Planning and Project. Planning grants can only be used to develop or update the flood hazard component of the Multi-Hazard Mitigation Plan, with the goals of assessing flood risk and identifying feasible and cost-effective alternatives to reduce that risk. Project grants can be used to assist all structures insured under the NFIP for acquisition and demolition, relocation, elevation, minor localized flood reduction projects, and dry flood proofing. Applicants for FMA Project Grants must have an approved Multi-Hazard Mitigation Plan. TWDB may also apply directly for technical assistance funding under the FMA program. This grant is available to local jurisdictions with up to 75% Federal cost share. Between 2006 and 2008, TWDB received $15,687,867 in Project grants, $137,406 in Planning grants, and $319,500 in Technical Assistance.

SEVERE REPETITIVE LOSS (SRL) PROGRAM

Administered by the Texas Water Development Board (TWDB), the SRL program provides federal funding to assist political subdivisions 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. For properties that qualify, SRL funds can be used for acquisition and demolition, relocation, elevation, mitigation reconstruction, minor localized flood reduction projects, and dry flood proofing (for historic properties only). This grant is available to local jurisdictions with up to 90% Federal cost share. Since the program began in 2008, TWDB has received $29,184,879.90 in federal funding to administer these projects.

REPETITIVE FLOOD CLAIM (RFC) PROGRAM

The Repetitive Flood Claims (RFC) Program is authorized by Flood Insurance Reform act of 2004. The RFC Program is an annual program that provides a means to fund residential acquisitions or relocations with the property thereafter deed-restricted to open space. RFC is a nationwide competitive, reimbursable, grant program. The grant is a matching funds grant which will provide 75% of the projects cost, with the local jurisdiction providing 25%, however in some circumstances it can be 100% Federal. The grant window normally opens in December each year and closes in February.

TECHNICALLY FEASIBLE, COST-EFFECTIVE, AND ENVIRONMENTALLY SOUND MITIGATION ACTIONS

The State Hazard Mitigation Team was involved in identifying the State priorities. All of the strategies/actions outlined were evaluated and are technically feasible, cost-effective, and environmentally sound. In addition, each of the actions/activities contributes to the State goals listed in this section.

ANALYSIS OF EFFECTIVENESS OF LOCAL MITIGATION POLICIES, PROGRAMS AND CAPABILITIES

TDEM is able to analyze the effectiveness of local mitigation policies, programs and capabilities through mitigation success stories (see Attachment 8 for examples). After a jurisdiction completes a mitigation project, TDEM keeps in contact with that jurisdictions for years to come and requests reports from the local communities when a new natural hazards impacts the region. For example, the City of Houston has been steadily acquiring homes in the 100-year floodplain for the past several years. When and if a repeat flood event occurs in that area, TDEM will request pictures and documentation of the area to analyze if the buy-outs were successful. What will be seen in the pictures is flood water inundating the property that once contained structures, but has seen been open space.

PRIORITIZATION OF ACTION ITEMS AND CONTRIBUTION TO THE OVERALL STATE MITIGATION STRATEGY

The State of Texas will not and did not evaluate and consider for funding actions to promote activities that do not meet these criteria stated above and that do not support the State's mitigation goals outlined in this Plan on page 3-1. Furthermore, the State prioritizes action items as they relate to achieving the goals of reducing the loss of life and destruction of property. Prioritization of action items continues with those that are the most cost-effective and will contribute to the overall State mitigation strategy of improving mitigation plans and projects to better serve and protect all Texas citizens.

OVERALL SUMMARY

It's important to remember that it may take years to accomplish goals and strategies and possibly more years before a similar hazard event occurs again in that region to determine if the previous projects were successful. With this in mind, TDEM will continue to monitor the effectiveness of the State's goals and strategies and may amend them at any time to better enhance the capabilities of mitigation in Texas.

Table 3-1: Local Capability Assessment Summary of Existing Local Policies

Policy	Description	Applicability	Effectiveness
National Flood Insurance Program participation	Federal Flood Insurance Program	So far 1,190 communities in Texas participate in this program	People in these communities are able to purchase flood insurance.
Community Rating System participation	Reduces flood insurance rates for those people living in special hazard flood areas	52 Texas communities participate in this program.	The cities of Friendswood and Kemah have the only Class 5 in Texas thereby reducing flood insurance premiums by 25%.
International Residential Code	By State law SB365, the 2000 IRC was automatically adopted for every city in Texas statewide. Unincorporated areas are not included. A city did not have to take action to adopt the IRC the State law. They could have some local ordinances establishing administrative requirements. By law, cities may update to an edition later than 2000, i.e. 2003.	Every city in Texas, except unincorporated areas, is required by SB365 to enforce the IRC.	Unsure as to how many have actually complied. The TDEM Mitigation Plans Officer checked with the Texas IRC representative. The representative indicated that they (IRC) have no records as to what cities may have adopted the 2003 edition. See page 3-10 for a success story on the City of Austwell.
Building Code Effectiveness Grading	Assess the building codes in effect in a particular community and how the community enforces its building codes with special emphasis on mitigation of losses from natural hazards. Grades of 1 (exemplary) to 10 are given.	32 communities have grades in the personal line category (1 and 2-family dwellings) and commercial line category (classification is for all other buildings).	The anticipated upshot of this program: safe buildings, less damage and lower insured losses from catastrophes.
Jurisdictional Authority	Texas law does not give authority to counties for certain	Unincorporated areas of all 254 Texas counties	This means that counties cannot enact building and land use

	actions or enforcement such as zoning or to adopt and enforce buildings codes such as the IRC because there is no enabling legislation that allows them to do so.		management standards or use zoning as a means to regulate development. A consequence of this is that minimal building standards are observed in rural areas while municipalities exercise complete authority to set higher standards.

Table 3-2: Summary of State Strategies

Flooding		
Strategy	Rationale	How action contributes to State's goals
Mitigating Severe Repetitive Loss Properties either by elevation or acquisition	Texas has 3,162 properties on FEMA's Targeted Repetitive loss list	Reduces the number of severe repetitive loss properties.
Redirect $6.1 million in taxes and license fees collected by TDI biannually and give to TWDB so they can fund floodplain management training compliance functions and other mitigation activities	More training is needed by local governments when it comes to NFIP, CRS, floodplain management training, etc.	Education and training is always good tool. It makes people aware of the opportunities that NFIP and CRS have to offer by obtaining flood insurance at reduced rates.
Consolidate State's flood mitigation efforts by moving the floodplain management program from TCEQ to TWDB.	The benefit of having Mitigation and Floodplain management in one agency is significant to the State's achieving it mitigation strategy for floodplain management and disaster reduction from flooding.	It will allow the State to consolidate the floodplain management and mitigation into one agency. This strategy was completed, but the NFIP went to the TWDB rather than the TDEM Mitigation Section. The TWDB is better suited than TDEM to administer this program.
Adopt a "No Adverse Impact" Policy	It will insure that future development activity both in and out of the floodplain be part of mitigation plan	It is an approach that will lead to reducing flood losses while promoting and rewarding strong management, planning and mitigations actions at the local level. The State has no information on its goal of getting more jurisdictions to adopt 'No Adverse Impact/Zero Rise' in their local floodplain

		ordinance. However, we now have some baseline data to start from. According to a freeboard survey conducted by the Texas Floodplain Managers Assn. (TFMA) in 2006, of the 1,127 communities in Texas that were enrolled in the NFIP at that time, 96 had a freeboard requirement in their local ordinance of *at least* 12" over the Base Flood Elevation (BFE). 26 had a freeboard requirement in their local ordinance of *at least* 12" over the BFE & *had adopted either* Ultimate Floodplain or Zero Rise. An additional 12 were in the process of adding a freeboard requirement. TFMA is in the process of updating the survey with 2010 statistics, although this has not yet been completed.
Tornadoes		
Strategy	Rationale	How action contributes to State's goals
Adopt and enforce building codes and/or design criteria, construction of storm shelters and the construction of safe rooms.	Promote and provide the protection and safety of the population in the State	Adopting and enforcing building codes may reduce the risk to property. The construction of storm shelters and safe rooms may reduce the loss of life. TDEM has approved HMGP grants for the construction of safe rooms, but has no control to enforce building codes.
Promote and provide for expanded coverage options for standard peril and windstorm insurance coverage for public and private property	Same as above	Expanded coverage options will provide better insurance to the public. Better insurance coverage may result in less disaster assistance funds being paid out to homeowners and businesses. This strategy is on-going.
Promote and provide enhanced statewide awareness concerning the risks and consequences of tornadoes	Provides information, instructions and guidelines	As has been mentioned before, education is a key tool in informing the public of their risk to natural and human-caused hazards. By using education, the public is better informed about the risks and can take steps to reduce the risk to themselves and their property. This strategy is on-going.

Promote and provide enhanced warning capabilities	Tornadoes are a present threat in Texas.	Adequate warning systems will alert the public to impending danger. They may have time to take steps to adequately protect themselves from the hazard thereby saving lives. TDEM has approved HMGP grants for warning systems.
Hurricanes/Tropical Storms		
Strategy	Rationale	How action contributes to State's goals
Continue to fund Coastal Erosion and Response Act Projects	Reduces the numbers properties affected by coastal flooding	Reduces or eliminates hazardous conditions the cause loss of life that cause property damage and degrade important natural resources. This strategy is on-going.
Continue to promote the Hurricane Local Grant Program	Enhances hurricane-related public awareness and education	Education is the key to reducing the risk to people and property. This program is currently dormant.
Wildfires		
Strategy	Rationale	How action contributes to State's goals
TFS maintains an Urban Wildfire Interface traveling exhibit	This traveling exhibit illustrates and demonstrates what can be done to protect a home and property with just a few steps for making a home fire-wise.	By educating people about the risks from wildfires, they can take preventive measure to reduce the risk to life and property. This strategy is on-going.
Urban Forestry Grants.	Designed to star or improve a community forestry program or to educate the public about the importance of urban trees.	The program in intended to support new initiatives or expand existing programs. This strategy is on-going.
TFS maintains a Web site that contains a number of fire safe mitigation initiatives	These initiatives show how to protect homes from wildland fires explains Urban Wildland Interface.	This Web site outlines risk reduction measures to take by property owners as well as a number of risk reduction topics. Education is a key to reducing the risk to wildfires. This Web site strategy is on-going.
The Texas Education Agency requires fire prevention and safety to be taught in the schools.	Education a key to preventing loss of life and property due to fires.	Same as rationale for the action. This strategy is on-going.

Drought		
Strategy	Rationale	How action contributes to State's goals
TDEM provides training and education programs for EMCs.	Focuses on the preparation of EMCs to respond to natural and human-caused disasters	The objective in all of our training is to provide knowledge and enhance the skills and abilities of those who attend our courses so they can improve their capability to mitigate against, plan for, respond to and recover from emergency situations. This strategy is on-going within the G-710, G-720 workshops.
The Texas Department of State Health Services maintains a Web site that provides tips and actions for citizens, governments and medical facilities.	To promote a more proactive atmosphere between affected parties – local State and Federal governmental agencies	This proactive approach will produce a more effective means of mitigating the effects of drought on the population, and natural and economic resources of Texas. This Web site strategy is on-going.

SECTION 4 – LOCAL MITIGATION PLANNING COORDINATION

Requirement §201.4(c)(4)(i): *The section on the Coordination of Local Mitigation Planning must include a description of the State process to support, through funding and technical assistance, the development of local mitigation plans.*

Technical Assistance and Local Funding

TECHNICAL ASSISTANCE

The TDEM Mitigation Section provides plan development assistance to local jurisdictions upon request. Providing planning assistance is a daily affair as much of it is done via telephone calls and emails. TDEM Mitigation Section developed the *TDEM 21-Mitigation Handbook*. *TDEM 21* provides information and guidance on the hazard mitigation process and mitigation program activities in Texas to include participation in State and federally-funded mitigation opportunities. The handbook also serves as a guide for developing hazard analysis, how to develop local mitigation action plans, how to establish and maintain a viable, and effective mitigation program to reduce vulnerabilities, risks, and human suffering caused by hazards. The *TDEM 21* discusses the following topics: (1) why mitigation is important; (2) building partnerships to include establishing a hazard mitigation team; (3) the hazard analysis process; (4) developing mitigation goals and strategies; and (5) developing a comprehensive local mitigation plan. . It is an excellent one of a kind mitigation handbook design for Texans. The *TDEM 21* is available for download from the TDEM Web site.

Also available for download from the TDEM website in a rich text format are hazard profile worksheets, vulnerability and risk assessments forms and a hazard risk summary worksheet. Local governments can use these tools to assist in the hazard identification and risk assessment portion of their local mitigation plan.

TDEM continues to provide development assistance to local jurisdictions upon request. Teaching the mitigation workshops, having meetings at local jurisdictions about Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM) and Repetitive Flood Claims (RFC) grant possibilities and answering phone and email questions is some of the technical assistance provided by TDEM.

Teaching of the mitigation workshops continues to be TDEM's strongest technical assistance tool for the local jurisdictions. The G-710 Mitigation Planning Workshop focuses on the concept of mitigation, how to create or update a local mitigation plan, and provides valuable instruction on how to create better mitigation strategies. The G-720 Mitigation Grants Workshop focuses on how to complete a mitigation project grant application and how to manage the project grant once the local jurisdiction has been awarded one from FEMA. Both workshops may be taught in Austin or on the road at the local jurisdiction, if they choose so.

Below is a list of months and years when each of these workshops were taught between 2007 – 2010.

G-710 Planning Workshop

- 2007 – February
- 2008 – February, August, October

- 2009 – March, July, September
- 2010 – February, March, July

G-720 Grants Workshop

- 2007 – July
- 2008 – May
- 2009 – October
- 2010 – May

FUNDING

Funds for planning assistance come from two Federal sources: the States HMGP 7% planning assistance funds and the State's PDM program funds. When funding becomes available, application procedures, deadlines for applications, etc. is posted on the TDEM Web site and in the *Texas Register.* An HMGP application package is available on line that contains forms and instructions on how to fill out these forms. A package is also made available to those jurisdictions wishing to submit an HMGP application during post disaster assistance visits by TDEM field staff.

Funds for projects are from the State applying to FEMA to participate in Federal grant programs as mentioned above. Also, Attachment 6 contains a Funding Guide that can be used by local governments when seeking other funding for their mitigation projects.

When there is a federally declared disaster, letters are sent to all declared jurisdictions requesting each to submit a "Notice of Interest" indicating that they are interested in applying for HMGP grant money. A sample of the form to be used is located in the local Annex P (Hazard Mitigation).

For PDM, TDEM will post the information on the TDEM Web site and place a notice in the *Texas Register*. For all PDM grant cycles, a massive mail-out method was used to inform all County Judges and Mayors that PDM grant money was available and how to go about applying. TDEM also places a *Notice of Funds Availability* in the *Federal Register*.

TDEM continues to provide funding to local jurisdictions in completing approvable mitigation plans. TDEM does this by allowing jurisdictions or their Councils of Government to apply for planning grants under HMPG and PDM funding sources. A PDM FY07 planning grant was awarded to Galveston County for the enhancement of their local mitigation plan. The Texoma COG is expected to request a HMPG planning grant to cover their areas. In addition, the State Hazard Plans Officer has traveled to the North Central Texas COG (NCTCOG) five times in 2007 for multiple days each trip to assist the NCTCOG with development of the plan. In addition, the same Plans Officer has traveled to the Middle Rio Grande COG and the Far West Rio Grande COG in similar attempts to complete their plan requirements. The Far West Rio Grande COG completed their plan requirements for El Paso County, while the Middle Rio Grande and NCTCOG communities have made significant progress and should be completed in fall of 2010.

Local Plan Integration

STATE REVIEW PROCESS

Texas has taken a two-pronged approach to the review of local plans. The TDEM Mitigation Section divided the FEMA and State Standards into 2 parts with one part being reviewed by the TDEM Mitigation Section and the other part by the Regional Liaison Officers (RLOs) who are a field extension of TDEM. The initial review is conducted by the appropriate RLO. Once the review is finished for that portion the RLO is responsible to conduct, the plan is forward to the TDEM Mitigation Section for the final State review process. Each person puts his or her comments on the FEMA-Texas Local Mitigation Action Plan Review Crosswalk ("the Crosswalk"). If revisions are necessary, the Crosswalk will be returned to the local jurisdictions informing them of the required corrections to be made. Once the corrections completed, TDEM Mitigation staff will again review the local plan. If no corrections are necessary, the plan will be sent to FEMA by the TDEM staff. The TDEM review process should take 45 days for a local mitigation plan to make its way through the State review process depending on the density of workload in each section and the size of plans being reviewed.

Additionally, the TDEM Mitigation Section will bring in Mitigation Reservist(s) to assist in the State-level review, as needed.

To assist local governments in this process, the TDEM Mitigation Section developed Mitigation Job Aid #5 – Local Mitigation Planning Document Review. This document explains the local plan review process and what is needed during the various stages of review. This job aid is available on the TDEM Web site.

LOCAL PLAN INTEGRATION

For those plans that have been completed prior to the State sending its plan to FEMA, the State will summarize the findings (vulnerability assessment, estimated losses, local capability assessments, and mitigation actions) and incorporate them into the Plan.

TDEM will review and analyze local goals and strategies to work together with local communities to achieve the same results. As more local jurisdictions become knowledgeable of mitigation projects, TDEM will continue to integrate their goals, strategies and successfully stories into the State Mitigation Plan.

TDEM assimilates local plan data into the State plan once per year. Information from the local mitigation plans is integrated into the State plan based on their findings of vulnerabilities, and actions taken to reduce that vulnerability. TDEM keeps a library of FEMA approved local mitigation plans and the State Plans Officers reviews them annually to incorporate new data into the State Plan.

Prioritizing Local Assistance

GENERAL

The TDEM has developed criteria for selecting projects for funding in two administrative plans: HMGP (Annex A) and PDM (Annex B). Below is a summary of those plans. For more details, see the HMGP and PDM Administrative Plans that are attached to this Plan. These Administrative Plans cover those projects funded by Federal programs administered by TDEM.

For all mitigation grant programs administered by TDEM, the following factors will also be taken into account when prioritizing mitigation projects: disaster histories, repetitive loss history using FEMA's repetitive loss listing, past grants management, communities with the most intense development pressures, communities with the highest risk, magnitude of past events, projects having a benefit-cost ratio of at least 1, technical feasibility, environmentally sound, and whether the action is listed in the local mitigation action plan.

The State's Hazard Mitigation Program requires any mitigation project proposed for funding though the Federal hazard mitigation grant programs administered by TDEM including, State agency projects, to:

- Support the goals and objectives of the State Mitigation Plan
- Reduce identified hazard risk
- Prevent repetitive losses
- Protect critical areas including frequently flooded areas and geologically hazardous areas

Proposed State agency projects compete with projects proposed by eligible local governments.

Any local and State agency construction project has to be cost effective, technically feasible and meet all of the appropriate Federal, State and local environmental laws and regulations before it is started.

Projects funded under FMA as well other State and Federal Agencies that are listed in Appendix 6 (Funding Guide) will follow their own internal operating procedures and the rules of the funding program they administer when it comes to prioritizing projects for funding.

HAZARD MITIGATION GRANT PROGRAM (HMGP)

The highest priority mitigation projects will be the voluntary removal of primary residential structures, hence the removal of small children, the elderly and disabled from the floodplain, and other forms of residential property from flood-prone areas. The result will be a permanent land use change that includes a significant enhancement to the natural resource values and low-impact recreational opportunities for the public. The State will seek to fund as many projects as available funds allow.

The primary focus for use of HMGP funds will be the acquisition of structures from floodways and floodplains. Based on projections of available funds for HMGP, there is usually not adequate funding to address all mitigation projects. Therefore, projects must be prioritized to maximize mitigation benefits.

Priority 1 projects include structures in the floodway and floodplain with > 50% damage and properties on FEMA's Targeted Repetitive Loss List. Other considerations include: structure is the primary residence and structures with repetitive losses in the past 10 years could be considered over other structures.

Priority 2 projects listed in order of priority: relocation of structures, elevation of structures, non-structural projects, retrofitting, and structural control measures.

Priority for funding will be Priority 1 projects followed by Priority 2 projects.

Up to 7% of HMGP money may be used for mitigation action plan development. To date, 42 planning projects have been funded under HMGP.

First priority for HMGP funding is whether the jurisdiction is in the declared disaster area. Once that is determined, projects are then ranked according to the "State of Texas Strategy Guidelines for HMGP Projects" outlined in Appendix 1 of the HMGP Administrative Plan (See Annex A). This may be modified based on the type of hazard that caused the federally –declared disaster. Appendix 1 will also apply to those jurisdictions that are not in the declared disaster area. Again, this may be modified based on the type of hazard that caused the disaster. The criteria outlined in Appendix 1 provide consistent guidelines for the selection of HMGP projects. The HMGP Administrative Plan was approved by FEMA.

PRE-DISASTER MITIGATION (PDM)

For FY02 and FY03, FEMA provided PDM grants to participating states that in turn provided grants to local governments for mitigation activities such as planning and the implementation of projects identified as a result of a local hazard identification and risk assessment. PDM grants were awarded to local governments on a competitive basis. The primary focus for FY02 and 03 was the development of mitigation action plans that meet the Federal requirements in 44 CFR Section 201 and the State Standards outlined in *Checklist P*. To date, eleven (11) planning projects have been funded under PDM.

PDM FY 2010

The FY 2010 Pre-Disaster Mitigation (PDM) Program was announced in the July 2009 edition of the *Federal Register*. It was a nationwide competitive program with a web-based Internet application process. The national priority was the reduction in the number of repetitive loss properties. A TDEM Mitigation Reservist and the Mitigation Section Administrator presented recommendations to the State Hazard Mitigation Team in September of 2009. The SHMT reviewed the applications. The basic criterion for scoring was of the projects was based on the having a benefit-cost analysis score of 1:1 or higher (Federal requirement). The projects that scored the best ratio were ranked from the top in a descending order. Secondly, the scope of work for each project was ranked in accordance with the national priorities. Another criteria that was used was whether the jurisdiction had ever received any previous mitigation funding. The project list was sent to the State Coordinator for final approval on the ranking of the applications. Texas submitted 32 sub-applicant applications into the E-grants systems.

It is anticipated that we will follow the same procedures for future PDM funding cycles. Appendix 1 to Annex A (HMGP Admin Plan) will be used as a guideline for future PDM program project eligibility. We will also follow the published FEMA Program Guidance that is in effect at the time the application is made. See Table 2-3 in Section 2 for a local vulnerability assessment summary for natural hazards.

OTHER STATE AGENCIES PROJECT FUNDING PRIORITY

TEXAS WATER DEVELOPMENT BOARD

Flood Mitigation Assistance Program

Applications submitted to the TWDB for FMA project grants are reviewed and prioritized using an established evaluation system based on FEMA criteria and requirements. The highest priority

would be given to applications where the structures affected by the project are on the FEMA repetitive loss list. Projects could be the buyout and removal of these structures or protecting the structures by elevating or by structural measures such as regional detention or minor channel. Next would be to recommend those proposed projects reflecting the best or highest benefit-cost ratio. Other factors that can be used to evaluate and prioritize applications is if the proposed project is a regional detention project and would be protecting many more houses than just the ones on the repetitive loss list.

Applications submitted for FMA planning grants are evaluated and prioritized based on the communities need for planning and the number of structures within the planning area that appear on FEMA's repetitive loss list. Through the seven (7) years of the program. TWDB has been able to utilize available FMA planning grants allocations to fund every request for a planning grant.

TWDB Flood Protection Study Grants

The purpose of flood protection planning grants is to develop flood protection plans for entire major or minor watersheds that provide protection from flooding through structural and non-structural measures. Funding is appropriated to the Research and Planning Funds by the State legislature and distributed amongst the various programs under the Research and Planning Fund. Announcements are made each year as to the availability of funds and requesting submittal of applications for funding by eligible political jurisdictions of the State. Applications are evaluated based on established criteria, scored and ranked. Funding is 50/50 State/local cost share. Funding is awarded based on application ranking until all available funds are meted out.

The TWDB has and will continue to offer the Flood Mitigation Assistance Program and TWDB Flood Protection Study Grants.

GENERAL LAND OFFICE

Coastal Priority & Restoration Act Projects

The GLO will evaluate project goal summaries received based on the following criteria:

- The feasibility and cost-effectiveness of the proposed project;
- The economic impacts of erosion in the area of the proposed project;
- The effect of the proposed project on public infrastructure or resources threatened by erosion;
- The effect of the proposed project on natural resources threatened by erosion;
- The effect of the proposed project on private property threatened by erosion;
- If the project is located within the jurisdiction of a local government that administers a beach/dune program, whether the local government is adequately administering its duties under the Open Beaches Act (Texas Natural Resources Code, Chapter 61) and the Dune Protection Act (Texas Natural Resources Code, Chapter 63);
- Whether the project will provide for beneficial use of beach-quality sand dredged in constructing and maintaining navigation inlets and channels of the State;
- Whether funding can be leveraged with sources other than the Account; and whether the potential project partner has already made or received a binding commitment to fund all or a portion of a given project.

Sometimes projects cannot be completed within a biennium and they are carried over. Projects are closed out through a project manager and contract specialist checklist/review then audited by

our Financial and Technical Services Division. The General Land Office has and will continue to offer these evaluations.

Coastal management Program (CMP)

The federally approved coastal management program brings approximately $2.2 million in Federal CZMA (Coastal Zone Management Program) funds to State and Local entities to implement projects and program activities. Texas is one of only a handful of coastal states that pass substantial amounts of CZMA funds through to coastal communities for projects in the coastal zone. Most coastal states use all or most of their CZMA funds for salaries and other administrative purposes. Even among the pass-through states, Texas is unique in that the Council passes through 90 percent of funds, retaining only 10 percent for administrative expenses. The Council has funded projects in all parts of the coastal zone for a wide variety of purposes. The Council established the following categories for use of these funds by coastal communities:

- Coastal Natural Hazards Response
- Critical Areas Enhancement
- Shoreline Access
- Waterfront Revitalization and Ecotourism Development
- Permit Streamlining/Assistance and Governmental Coordination
- Information and Data Availability
- Public Education and Outreach
- Water Quality Improvement

CMP grants are administered annually, and the project closeout procedure is the same as with CEPRA, however NOAA, the Federal funding sponsor, also reviews the projects during the course of the grant and on closeout.

The General Land Office has and will continue to offer the Coastal Management Program. TDEM continues to provide development assistance to local jurisdictions upon request. Teaching the mitigation workshops, having meetings at local jurisdictions about HMGP, PDM, and RFC grant possibilities and answering phone and email questions is some of the technical assistance provided by TDEM.

SECTION 5 - COMPREHENSIVE STATE HAZARD MITIGATION PROGRAM

Integration with Other Planning Initiatives

The concept of hazard damage reduction and hazard mitigation planning can and should be integrated into other important State planning initiatives. This includes the Flood Mitigation Assistance Program (FMA), the floodplain management program, and FEMA-funded/State administered hazard mitigation programs and into the State Emergency Management Plan.`

The 77th Texas Legislature amended the Texas Water Code (TWC). Effective September 1, 2001, the TWC authorizes political sub-divisions to do the following:

- Adopt more comprehensive floodplain management regulations that the political sub-divisions determines are necessary for floodplain management planning.
- Participate in floodplain management initiatives such as the National Flood Insurance Program's Community Rating system.

As mentioned in Section 1.C.2, the State of Texas has an Annex P – Hazard Mitigation annex to the State of Texas Emergency Management Plan. Annex P identifies emergency support function tasks for hazard mitigation. As well as defining organizations, responsibilities and procedures for taking action to eliminate or reduce long-term vulnerability risk to life and property. It also establishes the SHMT. See Section 5.F.4 and Section 1.A.4 for more information on the SHMT.

State hazard mitigation planning is integrated into the following mitigation grant programs: the Hazard Mitigation Grant Program, Pre-Disaster Mitigation, and the Flood Mitigation Assistance. As of October 2009, 43 local mitigation plans had been approved by FEMA. These plans cover 153 counties, 157 cities, four (4) river authorities, one (9) Council of Governments, one (1) university, one (1) drainage district, and three (3) medical centers/hospitals.

The majority of the plans were funded with either HMGP or PDM grant money. Sixteen (16) of the grant recipients were Council of Governments are using the money to develop regional plans and/or assist counties with the development of countywide plans. Several of the jurisdictions received FMA funds to complete the flood portion of the plan and used local money to bring the plan into compliance with the 44CFR Section 201.6 requirements. Also, a couple of the jurisdictions followed the Community Rating System (CRS) Plan outline thereby obtaining CRS points for their jurisdiction.

Section 3.B.2 addresses Texas laws, regulations and programs as they pertain to the integration of mitigation. The following are the referenced paragraphs:

- Texas Government Code Chapter 418: Section 3.B.2.b
- Floodplain Management: Section 3.B.2.c
- Local Government Code, Chapter 240, Subchapter Z: Section 3.B.2.d
- Windstorm Mitigation: Section 3.B.2.e

Section 3.C outlines State Capability Assessments that also shows how various members of the State Hazard Mitigation Team integrate mitigation into their programs. The following are the referenced paragraphs:

- Governor's Division of Emergency Management: Section 3.C.2
- Texas General Land Office: Section 3.C.3.a

- Texas Commission on Environmental Quality: Section 3.C.3.b
- Office of Rural Community Affairs: Section 3.C.3.c
- Texas Water Development Board: Section 3.C.3.d
- Texas Parks and Wildlife Department: Section 3.C.3.e
- Lower Colorado River Authority: Section 3.C.3.f
- Railroad Commission of Texas: Section 3.C.3.g
- Texas Department of Transportation: Section 3.C.3.h
- Texas Engineering Extension Service: Section 3.C.3.i

Project Implementation Capability

GENERAL

The State list for eligible projects is published within the Hazard Mitigation Grant Program (HMGP) Admin Plan and the Pre-Disaster Mitigation (PDM) Admin Plan. The lists were developed in coordination with the SHMT. For both programs the eligibility criteria requires projects to be: (a) cost effective, (b) be located in the most vulnerable area as identified in the State Mitigation Plan, and (c) have local matching funds to include in-kind contributions.

HAZARD MITIGATION GRANT PROGRAM (HMGP)

GENERAL

Annex A (HMGP Admin Plan) of the State of Texas Hazard Mitigation Plan was approved by FEMA Region VI in December 2005. It outlines the responsibilities, staffing requirements, policies, procedures and goals for any State of Texas HMGP participation. The administrator of this program is the Mitigation Grants Officer. The purpose of the Admin Plan is delineated below:

- The State shall be a constant advocate for mitigation activities through a program of cooperation, education, and incentive grants.
- This administrative plan describes how the State will administer a portion of the third leg of its Mitigation program (incentive grants), by identifying the responsibilities and procedures in the administration of the FEMA Hazard Mitigation Grant Program (HMGP).
- The State assures FEMA that it shall comply with all applicable Federal statutes and regulations, and the terms and conditions of this plan in effect during each declared disaster period for which it receives grant funding.

OVERVIEW OF THE HMGP CYCLE:

The following narrative describes the way the TDEM Mitigation Section (GMS) manages the grant application process. Details can be found in Annex A - HMGP Admin Plan and are summarized below.

(1) A disaster occurs
(2) Local jurisdictions and the State teams begin to assess the damages
(3) The Governor declares an emergency and submits a request for a Federal Declaration
(4) The President authorizes a Federal Declaration that permits the State to participate in HMGP funding to mitigate losses
(5) FEMA establishes a joint field office (JFO) and a number of disaster recovery centers within the area impacted by the disaster event

(6) All jurisdictions within the declared area are notified of the availability of HMGP funds, the public information meetings are held and Notice of Interest (NOIs) are distributed
(7) Completed NOIs are received by GMS no later than the posted deadline (usually 30 to 60 days after the Federal declaration)
(8) Application packages are mailed to all jurisdictions submitting qualifying NOIs
(9) Applications are received by GMS and evaluated (See Annex A and B for score sheets)
(10) The State Hazard Mitigation Team (SHMT) meets, reviews, prioritize projects for funding and develops a recommended list of projects to be submitted to the GAR
(11) The GAR reviews and evaluates the team recommendations and forwards the State's list of recommended projects with the HMGP grant funds final selection to FEMA for processing and selection for grant approval
(12) Applicants are notified of the terms and conditions of the FEMA approved projects
(13) Grants are administered within the time limits of the grant agreement
(14) Upon completion, the project is inspected, audited and submitted to FEMA to be closed
(15) Continuous annual evaluation of project effectiveness

PRE-DISASTER MITIGATION GRANT (PDM) PROGRAM

The current PDM Admin Plan (Annex B to the State Mitigation Plan) was revised in January 2006. In addition to Annex B, the State publishes annual State PDM Guidelines shortly after FEMA announces the publication of its current fiscal year PDM Guidance. This State Guidance contains such information as:

- Project eligibility criteria (in addition to FEMA's guidance).
- How to request access to the e-Grants system
- Application process
- List of eligible and ineligible projects based on FEMA's guidance
- List of the State's project priorities for the current fiscal year

The following is the process that will be used upon the submission of the initial PDM application from the local government:

- TDEM Mitigation will first determine whether it is an eligible project using the current FEMA PDM Guidance. When a project is determined to be ineligible, it will be removed from funding consideration and the jurisdiction will be notified.
- The next step is to determine that the benefit-cost ratio of the project is at least a 1:1 ratio. This will be determined by reviewing the Evaluation Section of each application. This is where the BCR is recorded. If the BCR is less than a 1:1 ratio, the project will be removed from funding consideration.
- The next check will be to determine if the Benefit-Cost Analysis (BCA) and all supporting documentation is attached to the application. If not, then the application will be sent back to the jurisdiction and given a deadline for re-submission. If they fail to attach the required BCA information by the deadline, then the application will be removed from funding consideration.

If the project is determined to be eligible and has a BCR of at least a 1:1 ratio, the following procedures will be used:

- Each section of the application will be thoroughly reviewed for completeness and accuracy of the information. If revisions are required, then the application will be sent back to the jurisdiction to develop and provide further information. They will be given a deadline for those revisions. If the deadline is not met then the application will be removed from funding consideration.
- For FY 2006, the TDEM Mitigation Section introduced the use of a score sheet (See Appendix 2 to Annex B – PDM Admin Plan). Points will be given for cost effectiveness, whether the project is in the local government's mitigation action plan, what State strategy priority it meets, environmental; CRS rated community as well as other criteria.
- The scores will be recorded in a spreadsheet or MS Word document the projects will be prioritized based on their score. If there is a tie, the tiebreaker will be the actual benefit-cost ratio for the project. The spreadsheet/MS Word document along with the scope of work for each project will be presented to the SMHT for use the development of the list of recommendations. The SHMT will also assign a subjective score on a scale of 1-10. That subjective score will be averaged and added to the points from the score sheet.

For FY 2006 and future PDM funding cycles, the SHMT will make the recommendation on which applications get "approved by grantee" and the final ranking recommendation. The SHMT recommendations will be presented to the Chief, Emergency Management Division who has the final say on the ranking of the applications. Once this is completed, the jurisdictions will be notified as to whether their sub-application will be attached to the State application that is submitted to FEMA Region VI and where on the ranking list their project ranks.

Mitigation Program Management Capability

The State is effectively managing the additional funds provided through the Disaster Mitigation Act (DMA) of 2000. From past audits, The State has established and maintains a very good record for managing project funding and maintaining all necessary reporting and documentation as required. The Mitigation Section has a Mitigation Financial Specialist whose sole function is to maintain the financial records for the Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation (PDM) grant programs. For the Flood Mitigation Assistance (FMA) program, the Texas Water Development Board is assigned by State government to be the executing agency responsible for the project management of FMA programs.

For HMGP and PDM funded planning grants: a new sub-grantee reimbursement policy went into effect beginning with the FY 2005 PDM funding cycle and any planning grants awarded under HMGP beginning with DR 1606. This policy states: TDEM Mitigation will withhold 25% of the Federal share until the Mitigation Action Plan (MAP) is approved by FEMA. There will also be interim deadlines that must be met based on the performance period of the grant. These deadlines will be outlined in the sub-grantees award letter. Failure to meet any of the interim deadlines will result in a payment being paid of no more than 50% of the Federal share until the MAP is approved by FEMA.

For HMGP and PDM: Quarterly Progress Reports are due to TDEM Mitigation not later than the 15th of January, April, July, and October until the project has been completed and closed out. TDEM Mitigation will then submit its Quarterly Progress Report to FEMA Region VI not later than the 30th of the same months. One of the key items on the QPR is for the local government to indicate how much money they have requested from Smart Link on their grant. The TDEM Support Services Section submits financial reports for all grants administered by TDEM.

Summary of HMGP, FMA, SRL, RFC and PDM Projects

HAZARD MITIGATION GRANT (HMGP) PROGRAM

The State has had 197 HMGP projects active within the past ten years. The Mitigation Financial Specialist is responsible for maintaining the financial records associated with this program. This person maintains a database of all active mitigation projects. As of December 2008, TDEM closed the mitigation portion of the following disasters: DR 1041, DR 1179, DR 1239, DR 1245, DR 1274, DR 1287, DR 1323, and one DR 1257 Unmet Needs Initiative (EMT-2000-GR-0033).

Additionally, each declared disaster is assigned a project officer whose responsibility is to insure all projects are up-to-date on their documentation and monitors the progress the sub-grantees are making on their projects. All of the projects documentation is current.

FLOOD MITIGATION ASSISTANCE (FMA) PROGRAM

The Texas Water Development Board (TWDB) administers the FMA program in Texas on behalf of the State. When NFIP funds are allocated to Texas each year by FEMA, TWDB is responsible for announcing funding availability, and for reviewing and evaluating planning grant and project grant applications. TWDB utilizes a similar process used for HMGP and PDM projects for reviewing and ranking FMA projects. TWDB awards planning grants to eligible communities and forwards project grant applications that meet the FMA program criteria to FEMA for final review and approval. Contracting responsibilities for both planning and project grants are the responsibility of TWDB. Planning and project grant recipients are required to submit quarterly status reports to TWDB. The FMA Coordinator communicates with the communities and their subcontractors at minimum on a monthly basis. Information on the Flood Mitigation Assistance Program can be found on the TWDB website at http://www.twdb.state.tx.us/wrpi/flood/fma.asp

SUMMARY OF FMA GRANTS

Between 2005 and 2009, the Texas Water Development Board has administered five FMA planning grants for a total funding amount of $217,500. During the same period, the TWDB has administered twenty FMA project grants totaling $35.25 million. Fifteen structural projects accounted for $28.44 million of the total amount awarded during this period. Seven of these have been completed, and eight are still in progress. Five non-structural project grants were awarded for buyouts of repetitive loss properties for a total funding amount of $6.81 million to purchase 66 properties. Three of these grant contracts have been completed, and two are still in progress.

THE SEVERE REPETITIVE LOSS (SRL) PROGRAM

TWDB also administers the SRL program in Texas on behalf of the State. When NFIP funds are allocated to Texas each year by FEMA, TWDB is responsible for announcing funding availability, and for reviewing and evaluating planning grant and project grant applications. TWDB utilizes a similar process used for HMGP and PDM projects for reviewing and ranking SRL projects. TWDB awards project grant applications that meet the SRL program criteria to FEMA for final review and approval. Contracting responsibilities for both planning and project grants are the responsibility of TWDB. Planning and project grant recipients are required to submit quarterly status reports to TWDB. The SRL Coordinator communicates with the communities and their subcontractors at minimum on a monthly basis. Information on the Severe Repetitive Loss Program can be found on the TWDB website at http://www.twdb.state.tx.us/wrpi/flood/srl.asp

SUMMARY OF SRL GRANTS

The Severe Repetitive Loss grant program was established in 2007 and has been administered in Texas by TWDB since its inception. Between 2007 and 2010, TWDB has administered eight SRL grants for a total funding amount of $39.18 million. This funding has been used to buyout 211 flood-prone properties and to elevate six properties above the base flood elevation. Each of these contracts is still in progress.

REPETITIVE FLOOD CLAIMS (RFC) PROGRAM

The State has had 7 RFC projects active within the past three years. The Mitigation Financial Specialist is responsible for maintaining the financial records associated with this program. This person maintains a database of all active mitigation projects. We are working to close RFC FY07 which expired September 30, 2010.

PRE-DISASTER MITIGATION (PDM) GRANT PROGRAM:

As with the HMGP Program, the Mitigation Financial Specialist is responsible for maintaining the financial records associated with the PDM Program. The project officer for the PDM Program is the Mitigation Plans Officer. This staff member's responsibility is to ensure all project documentation is up-to-date, tracks how and when the projects are being implemented as well as how the funding is being used. If there is problem or conflict, the Project Officer works with the jurisdiction to resolve the problem as quickly and efficiently as possible. In some cases the State Hazard Mitigation Officer (SHMO) will be consulted as to resolve the conflict or problem.

UNMET NEEDS

Texas continues to administer a consolidated unmet needs initiative for FEMA-DR-1257-TX. There are two (2) active projects totaling $5,738,435.

Preparation and Submittal of Environmental Reviews and Benefit-Cost Analysis

GENERAL

Before recommending a project to FEMA, the State requires applicants to ensure their projects comply with all applicable Federal, State and local codes and standards. If determined to be necessary, engineers from various State agencies and/or State Mitigation Reservists may be used to conduct the engineering analysis and, at a minimum, will check environmental issues, review the benefit-cost analysis, verify cost estimates and determine the engineering feasibility of the projects prior to submitting the projects to FEMA.

ENVIRONMENTAL REVIEWS

GENERAL

The State Mitigation Staff relies on the staff of FEMA Region VI to conduct environmental reviews for construction projects seeking hazard mitigation grant funding. Before recommending FEMA approval for either hazard mitigation grant (PDM and HMGP), the State requires all applicants to ensure their proposed projects comply with all applicable Federal, State and local codes and standards, including the National Environmental Policy Act (PL 91-190, as amended) and all Federal laws covered within the act and for securing the necessary permits and approvals. The TDEM Mitigation Section undertakes an environmental review, coordination and

documentation as part of the grant management process. The staff also coordinates proposed project grants with members of the State Hazard Mitigation Team.

Starting in 2006, TDEM Mitigation Staff and reservists will be required to enroll and complete FEMA course *IS 253 –Coordinating Environmental and Historic Preservation.* In this way TDEM Mitigation personnel can provide another level of environmental review of local government applications for HMGP and PDM prior to the applications being sent to FEMA Region VI. For all new personnel in the Mitigation Section, it will be a mandatory requirement to complete FEMA course IS 253 within the first year of employment. As of 1-30-2006: two (2) TDEM Mitigation staff members have completed the IS 253 course.

PRE-DISASTER MITIGATION GRANT PROGRAM (PDM)

As with HMGP, projects funded under PDM must comply with certain environmental requirements. Coordination with all appropriate agencies and individuals is very important. For PDM project applications, all sub-applicants are required to answer the questions in the "Environmental/Historical Preservation Section" of the electronic e-Grants project application. The TDEM Mitigation Section reviews the answers to those questions for accuracy. If there are discrepancies, the application is sent back to the sub-applicant for clarification and revision. Those questions cover the following areas:

- National Historic Preservation Act – Historic Buildings and Structures
- National Historic Preservation Act – Archaeological Resources
- Endangered Species Act and Fish and Wildlife Coordination Act
- Clean Water Act, Rivers and Harbors Act and Executive Order 11990 (Protection of Wetlands)
- Executive Order 11988 (Floodplain Management)
- Coastal Zone Management Act
- Farmland Protection Policy Act
- RCHA and CERCLA (Hazardous and Toxic Materials)
- Executive Order 12898 – Environmental Justice for Low Income and Minority Populations
- Other Environmental/Historic Preservation Laws or Issues. This could include whether the project is consistent with land use in the area, whether the project might have a significant effect on economic activities, effects on parks and recreation area and effects on prime and unique farmlands or farmland with State or local importance.

Any letters of response or phone records showing coordination with the various agencies should be scanned and attached to the application.

HAZARD MITIGATION GRANT PROGRAM (HMGP)

Projects funded under HMGP must comply with certain environmental requirements. Coordination with all appropriate agencies and individuals is very important. Applications for HMGP are submitted in paper to the TDEM Mitigation Section. Application instructions are in the HMGP Application package that is a part Annex A – HMGP Admin Plan. This application package is given to those local governments that will be submitting HMGP applications. Below is a summary of the environmental information. All "brick and mortar" project applications are required to include an environmental analysis to aid in the compliance with environmental requirements. Many of the same areas mentioned with the PDM program need to also be addressed with HMGP applications.

Other State agencies such as the Texas Commission on Environmental Quality (TCEQ) or the Texas Historical Commission may have information pertinent to the potential environmental impacts of the project. Documentation such as letters, permit applications, copies of actual permits, and phone records should be included in the submittal package. Information provided in the environmental analysis should be as complete and thorough as possible.

All issues must be addressed in a narrative paragraph(s) form as an attachment to the application. The issues that need to be addressed include:

- Land Use and Socioeconomic Issues
- Air and Water Quality Issues
- Natural Resources Issues
- Floodplain Management Issues
- Archaeological and Historical Issues
- Hazardous Materials Issues

All parties that were contacted in the development of this project application and in the preparation of the environmental analysis must be identified. The project application may be accepted before the agencies have responded but may not be funded until the letters of concurrence have been returned and any issues raised by an agency for clarification are resolved. The information provided will be analyzed by the State and FEMA regional levels to determine if there will be significant environmental impacts resulting from the proposed project.

As a minimum, letters from the following agencies are required:

- Texas Parks and Wildlife
- Texas Historical Commission
- General Land Office: Compliance with Coastal Zone Management programs.
- Texas Commission on Environmental Quality
- U.S. Department of the Interior
- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife
- U.S. Environmental Protection Agency
- Appropriate local departments and/or agencies

BENEFIT-COST ANALYSIS

For all HMGP, RFC, SRL, FMA and PDM applications, the State requires that all jurisdictions complete a Benefit-Cost Analysis (BCA) on all projects that are requesting mitigation funding. The jurisdictions must use a FEMA-approved BCA methodology such as the FEMA BCA software. The software is available at no cost from FEMA. The software is also on the TDEM Web site.

With funding from FEMA Region VI we were able to offer a BCA class in 2004 to assist eligible sub-applicants in doing a BCA for their project. Depending on available funding, we hope to be able to offer more classes in the future. We are also exploring whether the new Technical Sub-Committee to the SHMT may have some resources we can tap into in order to do a more thorough review.

Four (4) TDEM Mitigation staff members have attended the FEMA BCA training. Those personnel are responsible for reviewing the BCA for completeness, ensuring the Benefit-cost Ratio (BCR) is at least a 1:1 ratio or larger and ensuring all supporting documentation is attached

to the BCA. If there are any discrepancies, the application is sent back to the sub-applicant for revisions. If the BCA is less than 1:1 ratio, the application is automatically disapproved and the sub-applicant is notified.

Assessment of Mitigation Actions

HMGP, RFC AND PDM FUNDED PROJECTS

The following is the system and strategy that the State will use to conduct an assessment of completed mitigation actions and have a record of the effectiveness (i.e. cost avoidance) of the mitigation actions.

The process is actually quite simple. TDEM Mitigation Section maintains a database of all completed projects that were funded by HMGP, RFC and PDM. This database has the latitudes and longitudes of the completed project.

When a situation occurs, we check our records to see if a project mitigating the type of hazard occurring took place in the area. If the answer is yes, we contact the Emergency Management Coordinator or the project officer for the project to get specifics. We also ask if the previously funded mitigation project is being tested by the disaster event. If the answer from the EMC is "no," then no further action is taken. If the answer from the EMC is yes, we run a report from the completed projects database to calculate the losses that were avoided.

Example: There is a severe flooding event in the Onion Creek area of Travis County. An HMGP project was completed in that area. A call would be placed to the EMC or the project officer for that project. We would obtain specific information about the flooding event to include whether it was in the area of a previous buy-out. If the answer is yes, TDEM Mitigation would develop a report to determine what losses in terms of dollars were avoided. We are currently exploring the possibility of merging the completed projects database with HAZUS. That way we could explore various "what-if" scenarios for various hazards. TDEM has a Mitigation Specialist who is trained and competent in HAZUS software.

FMA, AND SRL FUNDED PROJECTS

The FMA staff and the SRL staff at the TWDB plans on contacting the staff of those who have completed a structural project to conduct an assessment (i.e. whether project was tested) when a natural hazard event occurs.

Effective Use of Available Mitigation Funding

Texas uses a variety of funds and programs to achieve its mitigation goals including the Flood Mitigation Assistance Program (FMA), Hazard Mitigation Grant Program (HMGP), Severe Repetitive Loss (SRL), Repetitive Flood Claims (RFC) and the Pre-Disaster Mitigation (PDM) Program, and the Emergency Management Performance Grant Program (EMPG). These are described below:

EMERGENCY MANAGEMENT PERFORMANCE GRANT (EMPG) PROGRAM

This is a Federal grant program that provides augmentation funds to finance local emergency management programs. In order to participate in this program, local governments must achieve an Advanced Level of planning, training, and exercise preparedness as defined in the *Preparedness Standards for Texas Emergency Management (TDEM 100)* and complete a number

of preparedness tasks each year. One of the emergency planning requirements for the Advanced Level of Preparedness is to have a current Annex P (Hazard Mitigation). The TDEM Preparedness Section administers this program.

HAZARD MITIGATION GRANT PROGRAM (HMGP)

Texas has participated and managed HMGP funds for post-disaster hazard mitigation projects since 1994. Because HMGP funds are post-disaster funds and their availability from year to year is uncertain and limited, Texas has consistently and unfaltering adhered to the flood reduction priorities that are outlined in the HMGP Administrative Plan (Annex A to the State Mitigation Plan). In addition, TDEM will, as a method considers only allowing funds for local projects that were identified in existing local mitigation strategies as articulated in the applicant's mitigation action plan unless there is a compelling reason to make an exception. Texas will continue to use the 7% HMGP set-aside funds to jurisdictions that apply for grants to develop federally required mitigation action plans.

PRE-DISASTER MITIGATION (PDM) GRANT PROGRAM:

Note: The Texas Division of Emergency Management is still accruing this information. It will be available in August 2010 and added to the Plan.

Commitment to a Comprehensive Mitigation Program

EMERGENCY MANAGEMENT MITIGATION TRAINING

The TDEM Mitigation Section conducts hazard mitigation workshops for State agencies, non-profit agencies/organizations, regional planning organizations, and local governments. Topics address and cover a variety of mitigation techniques and planning methods that include case studies and lessons learned. The concept of a Hazard Mitigation Workshop has proven to be a very useful tool in helping local Emergency Management Coordinators (EMCs) develop local mitigation programs. These mitigation workshops were well received and plans to further expand the training scope are under consideration pending additional resources. Hazard Mitigation Workshops will continue to focus toward assisting officials in the 1450 plus State-chartered local communities within the State. The TDEM Mitigation Section also provides instruction and classes on mitigation at the annual State Emergency Management Conference. The TDEM training calendar as well as the training application can be found on the TDEM Web site. For the courses listed below as with the other emergency management courses, TDEM pays for the student's lodging and mileage.

G710 – BASIC TEXAS HAZARD MITIGATION COURSE

This 16-hour course is for newcomers to emergency management. The course covers the role of hazard mitigation and a portion of on how to develop mitigation action plans - from how to build the local hazard mitigation team through conducting a comprehensive hazard analysis. The course is intended to educate members of emergency management on their role in mitigation planning. The target audiences are Emergency Management Performance Grant (EMPG) recipients, newcomers to emergency management, representatives of agencies and organizations that are members of local hazard mitigation teams, and State and local officials with responsibilities for developing, implementing or maintaining mitigation plans or programs.

G711 – Public Officials Mitigation Planning Course

This 8-hour course provides guidance and instructions for the development, approval, implementation, and maintenance of a comprehensive mitigation action plan. This course is available for download and self-study from the TDEM Web site. During FY 2002 and 2003 it was a field-delivered course. The self-study method of training reduced expenses and permitted more members of a local government staff to enroll in the course. The workshop can be tailored to the needs of the community. Any local government in Texas may request that this course be presented in their community. The target audience is State and local officials and representatives of agencies and organizations that are members of local hazard mitigation teams with responsibility to develop, implement, and/or maintain comprehensive mitigation plans.

G712 – Basic Hazard Mitigation Train-the-Trainer

This 16-hour course is essentially the same as the standard G710 course but is specifically designed in a train-the-trainer format. The course is conducted to train trainers to teach the G711 course described above to local government representatives and to expand the State's ability to provide local-based mitigation program assistance. The target audience is selected individuals from agencies and organizations with responsibility to teach the G711 course or to provide direct technical assistance to local governments for the development of comprehensive mitigation action plans. This course is currently taught on request. In July 2002, the TDEM Mitigation Section trained 20 COG representatives to teach the G711 course. They, in turn, taught 35 classes that had 447 attendees during fiscal years 2002 and 2003.

G720 – Advanced Hazard Mitigation Course

This 16-hour course is the latest course developed and is for personnel who will lead or be senior members in their local mitigation team and who will create and maintain mitigation action plans that meet Federal (44 CFR Section 201) and State requirements. This course covers establishing eligibility for the HMGP and PDM grants. Starting with the hazard analysis, instruction focuses on developing mitigation goals and strategies, developing standing projects lists and development of viable grant applications. The target audience is grant writers, city and county land use planners, public works officials, floodplain managers, contractors hired by locals to develop mitigation action plans and State and local officials with responsibility for developing, implementing, and/or maintaining mitigations plans and programs.

In addition, local representatives may attend periodic workshops presented in Austin or request delivery of the Disaster Recovery Course that includes a hazard mitigation component taught by the TDEM Mitigation Section. Also, as a part of the Texas Emergency Planning course, there is a module that discusses risk assessment development that is taught by the TDEM Mitigation Section.

Emergency Management Certification

Note that the following information is quoted from the Emergency Management Association of Texas (EMAT) Web site: www.emat-tx.org

The Emergency Management Association of Texas (EMAT) fully supports and endorses the importance of Emergency Management to the safety and benefit of our citizens especially here in Texas. As a partner with the International Association of Emergency Managers (IAEM) we encourage all to ascribe to these goals support EMAT and IAEM in getting the word out.

Mission Statement: To promote and advance the professionalism of emergency management and disaster preparedness in Texas.

The Texas Emergency Manager (TEM©) certification is an indicator of experience, hard work, continuing education, dedication to integrity, and creativity. It is also an assurance that the individual has passed at least a minimum screening of competence. Obtaining certification as a TEM© proves that emergency managers can effectively accomplish the goals and objectives of comprehensive emergency management in Texas. EMAT developed and sponsors this certification program. The Emergency Administration and Planning Program and Center for Public Management (EADP) at the University of North Texas administer it.

The TEM© certification program is a modification of the International Association of Emergency Managers Certified Emergency Manager (CEM®) certification program. It is different from the CEM® because the TEM© has Texas-unique requirements such as experience and exercise/disaster event participation and does not require a degree. For more information on the TEM© certification program, go the EMAT Web site listed above.

FLOODPLAIN MANAGEMENT TRAINING/CERTIFICATION

Note that the following information is quoted from the Texas Floodplain Management Association (TFMA) Web site: www.tfma.org

The Texas Floodplain Management Association (TFMA) is an organization of professionals involved in floodplain management, flood hazard mitigation, the National Flood Insurance Program (NFIP), flood preparedness, warning and disaster recovery. The TFMA has become a respected voice in floodplain management because it represents such a wide variety of professionals. The Association includes flood hazard specialists from local, State and Federal governments, the mortgage, insurance and research community, and the associated fields of flood determination specialists, engineering, hydraulic forecasting, emergency response, water resources and others.

The TFMA has gained a respected voice within the national floodplain management community as one of the first to become a State Chapter of the Association of State Floodplain Managers. Many of members have been actively involved in the Association of State Floodplain Managers (ASFPM) organization by presenting papers at national conferences, serving on the Board of Directors as well as various committees, and providing significant input into the national certification of the nation's floodplain managers.

The TFMA has pioneered the way for the professional certification of local floodplain managers and is in the forefront of efforts to increase the educational opportunities and professional skills of the State's floodplain management professionals. TFMA has now joined the ranks of those few states, which are nationally accredited through ASFPM, and now provides training and testing for those seeking their National Certification as Floodplain Managers.

Partnerships

TEXAS ASSOCIATION OF REGIONAL COUNCILS (TARC)

The TARC was organized in 1973 as an association of Texas' 24 regional councils of governments, more commonly called COGs. COGs are small State funded regional planning units that assist local governments of a region in the development of plans to enhance economic development and to intelligently plan for population growth. This can be a very important role in a State the size of Texas, where citizens look to mayors, county judges and other local elected officials on all types of government issues. COGs provide a variety of services to include homeland security resources and funding, mitigation planning, emergency preparedness planning, nutrition programs for the elderly, 9-1-1 services, economic development assistance, and transportation planning.

In May 2002, TDEM initiated an interagency contract with the TARC to teach mitigation planning courses around the State to assist local governments in the development of mitigation action plans now required by changes to the Stafford Act. In July 2002, TDEM conducted a *G712 Basic Hazard Mitigation Train the Trainer* course to qualify planners/trainers from all 24 Council of Government (COG) areas in Texas to teach the *G711 Public Officials Mitigation Planning Course*. This effort is greatly increased the availability of mitigation related technical assistance to local governments statewide. By the time the contract ended in May 2003, the COGs had conducted 35 classes that had 447 attendees. TDEM and the Mitigation Section staff very much appreciate the effort of TARC and the COGs in conducting this training. This was inter-agency cooperation as its best.

TEXAS FLOODPLAIN MANAGEMENT ASSOCIATION (TFMA)

TDEM Mitigation Section staff for a number of years has maintained a strong working and coordination relationship with TFMA. The Section Administrator and senior mitigation staff in the section are Certified Floodplain Managers (CFM). The Mitigation Section Administrator requires as a condition of retention that after one year, all new mitigation staff members be trained and achieves the status of CFM. TFMA requests and provides training opportunities for the Mitigation Staff to present mitigation topics of interest at all annual and technical conferences and workshops each held semi-annually.

TEXAS COLORADO RIVER FLOODPLAIN COALITION (TCRFC)

The TCRFC was established by the Texas Legislature. They believe that by "working together" they can better coordinate basin-wide floodplain management efforts and communicate upstream and downstream issues to reduce flood damages and save lives. One of the things they did was to develop a 13-county, 31-city mitigation action plan that also includes the Lower Colorado River Authority. The plan was approved by FEMA Region VI on 7-14-2004.

STATE HAZARD MITIGATION TEAM (SHMT)

As mentioned in Section 1, Texas has a SHMT that is composed of staff expertise from various State agencies. The mission of this team is to bring together staff personnel from State agencies to identify areas of vulnerability and problems intrinsic to different types of hazards, develop strategies for preventing or reducing loss of life, injuries and damage to property. They can also make specific recommendations regarding changes to State regulations, plans or laws that can reduce the risk of loss to the citizens of Texas.

One of the strategies outlined in Section 3 is to expand the SHMT to include members of academia to form a technical sub-committee and local government representation. The Technical Sub-Committee will hopefully consist of the following agencies and organizations: Texas Tech University, University of Texas Institute for Geophysics, and Texas Geographic Society. The local government representative will include a member of the Emergency Management Association of Texas (EMAT).

OFFICE OF RURAL COMMUNITY AFFAIRS (ORCA)

The Office of Rural Community Affairs (ORCA) is able to provide Disaster Relief funds to local governments to help them meet the 25% match required by HMGP grants. A condition is that the applicant can provide satisfactory evidence that the property to be purchased was not constructed or purchases by the current owner after the property site location was officially mapped and included in a designated floodplain area. Eligible jurisdictions are small cities fewer than 50,000 in population and counties under 200,000 in population included in a Federal Declaration. Since 1995, ORCA has awarded $4,613,404 in grant money to 17 communities to help them meet the 25% match required to receive HMGP grant funds. ORCA maintains a list of communities that were awarded money, how much was received and the type of project that was funded.

Coordination among agencies

See Section 1

MITIGATION AND POST-DISASTER RECOVERY OPERATIONS

See Section 3.B.2.f on page 3-4 for details on the 406 Mitigation Program.

Hazard mitigation is an integral part of Texas's post-disaster recovery operations. Staff from the Mitigation Section co-locates with FEMA mitigation staff at the Joint Field Office (JFO) as soon as the JFO is operational. Staff from other State agencies that may have a particular interest or legislative appointed responsibility in the disaster recovery operations may also co-locate at the JFO. State and FEMA staffs work to identify mitigation opportunities through the HMGP program and the 406 Mitigation portion of the Public Assistance programs. The SHMT may be convened after a disaster is declared to consider situational issues and to develop recommendations for TDEM staff to follow in special situations. State mitigation staff quickly disseminates Notices of Interest and HMGP programmatic information on the HMGP program to potential applicants and provides technical assistance to potential applicants on the grant application process.

The State's commitment to a comprehensive State mitigation program is further evidenced by the compilation of mitigation success stories. Attachment 4 contains success stories from the City of Austwell, Harris County Flood Control District, Rice University, and Jefferson County Drainage District 6. We are continually looking for additional success stores that can be added to this attachment.

FLOODPLAIN MANAGEMENT

See Sections 3.B.2.c(1) and (2) for information on Floodplain Management legislation

See Section 3.C.3.b for information on the role of the Texas Commission on Environmental Quality in relation to Floodplain Management in Texas.

The following legislation and enhanced activities have changed since the original State Standard Mitigation Plan was approved 10-27-2004:

- House Bill 1018 (Ordinance/order adoption to be eligible to participate in the NFIP): over 1190 communities have now joined the NFIP
- Senate Bill 936 (adopting more comprehensive floodplain management regulations): more than 100 of the 254 counties have now enacted enforcement language.
- Conducts assessments of approximately 25 local floodplain management programs annually

The Texas Floodplain Management Association (TFMA) has developed a very comprehensive training program to bring workshops to Texas. More information may be found on their website at http://tfma.org/ .

Below is a listing of the workshops to be taught for the remainder of 2010.

July 2010				
	Date(s)	Event Name	Location	Registration
	12-16	4 Day Floodplain Administrators Training Class and CFM Exam	Fellowship Hall of Moody Methodist Church	**Registration has ended.**
	15	Floodplain Management and Floodplain Mapping	United Way Center, Houston	
	20	TFMA CFM Exam	AECOM - Houston	Click here to Register
August 2010				
	Date(s)	Event Name	Location	Registration
	16-20	Managing Floodplain Development Through The National Flood Insurance Program	The Tool Yard, San Antonio	Event Full
	16-20	Managing Floodplain Development Through The National Flood Insurance Program	Halff Associates, Inc., Richardson	Click here to Register
September 2010				
	Date(s)	Event Name	Location	Registration
	13-17	Managing Floodplain Development Through The National Flood Insurance Program	College Station Conference Center, College Station	Click here to Register

These courses are designed to be at no cost to the participants and will be taught by qualified FEMA or State instructors with help from and expert subject matter guest instructors. These courses are an excellent way to prepare for the CFM exam and participants can be awarded up to 30 hours of Continuing Education Credit for CFM requirements and a lesser number of hours for continuing education for the Professional Engineer (P.E.) These are great training opportunities and will provide a better understanding of the National Flood Insurance Program (NFIP) and the role of a local floodplain manager in proper land use management.

Pre-Disaster Mitigation (PDM) Admin Plan

In order to properly administer the PDM program, the State has developed a PDM Admin Plan (Annex B to the State Mitigation Plan) even though this Admin Plan is not required according to

44CFR Section 201. The current PDM Administrative Plan is dated January 2006. It will be reviewed whenever FEMA publishes a new set of current fiscal year PDM Program guidelines and will be updated as necessary.

The purpose of the PDM Admin Plan is similar to the HMGP Admin Plan in that it outlines the organization, roles and responsibilities for the administration of the PDM program. Details are in Annex B.

Building Codes

Texas Administrative Code, Title 28, Part 1, Chapter 5, Sub-Chapter E

Section 5.4009.Applicable Building Code Standards in Designated Catastrophe Areas for Structures Constructed, Repaired or to Which Additions Are Made On and after February 1, 2003 and before January 1, 2005.

To be eligible for catastrophe property insurance, structures located in the designated catastrophe shall comply with the 2000 International Residential Code or the 2000 International Building Code, as revised by the Texas Revisions to the International Residential Code and the Texas Revisions to the International Building Code, and all of which are adopted by reference to be effective February 1, 2003. The following wind speed requirements shall apply:

- Areas Seaward of the Intracoastal Canal: shall be designed and constructed to resist a 3-second gust of 130 miles per hour.
- Areas Inland of the Intracoastal Canal and Within Approximately 25 Miles of the Texas Coastline and east of the Specified Boundary Line and Certain Areas in Harris County: shall be designed and constructed to resist a 3-second gust of 120 miles per hour.
- Areas Inland and West of the Specified Boundary Line. shall be designed and constructed to resist a 3-second gust of 110 miles per hour.

Section 5.4010.Applicable Building Code Standards in Designated Catastrophe Areas for Structures Constructed, Repaired or to Which Additions Are Made On and After January 1, 2005.

To be eligible for catastrophe property insurance, structures located in the designated catastrophe areas shall comply with the 2003 Editions of the International Residential Code and the International Building Code, as each revised by the 2003 Texas Revisions, and all of which are adopted by reference to be effective January 1, 2005. The following wind speed requirements shall apply:

- Areas Seaward of the Intracoastal Canal. To be eligible for catastrophe property insurance, structures located in designated catastrophe areas which are seaward of the Intracoastal Canal shall be designed and constructed to resist a 3-second gust of 130 miles per hour.
- Areas Inland of the Intracoastal Canal and Within Approximately 25 Miles of the Texas Coastline and east of the Specified Boundary Line and Certain Areas in Harris County shall be designed and constructed to resist a 3-second gust of 120 miles per hour.
- Areas Inland and West of the Specified Boundary Line shall be designed and constructed to resist a 3-second gust of 110 miles per hour.

For more detailed information, refer to the Texas Administrative Code, Title 28, Part 1, Chapter 5, Sub-chapter E. Questions can be directed to the Manager of the Windstorm Inspection Program at 512-322-2203.

SECTION 6 – PLAN MAINTENANCE PROCESS

Requirement §201.4(c)(5)(i): *[The Standard State Plan Maintenance Process must include an] established method and schedule for monitoring, evaluating, and updating the plan.*

Monitoring, Evaluating, and Updating the Plan

Texas recognizes that the Hazard Mitigation Plan is not a static document and requires regular review and evaluation. The State will review the Plan annually to ensure that the plan is being properly implemented and is achieving the objectives set forth in the Plan. If necessary the Plan will be reviewed after a disaster declaration has been made in Texas.

The TDEM Mitigation Plans Officer has been assigned the responsibility for monitoring and coordinating the review and evaluation of the plan. The State Hazard Mitigation Team is committed to extensive participation in the monitoring, evaluation and updating of the plan, as well as those agencies, organizations and associations that were a part of the initial plan development management process. The Team will be scheduled to meet once a year from the date FEMA approves the State Mitigation Plan to analyze the overall success and progress in implementing the Plan during the past year and will be asked to develop recommendations, where applicable, to incorporate appropriate changes and updates. Emails will also be sent to the SHMT reminding them that it is time for the annual review of the Plan.

Since the preponderance of the funds for State and local projects is derived from various Federal grant programs, the TDEM Mitigation Staff will monitor the progress of the projects as a normal part of the duties and responsibilities of the staff members who manage these grant programs. For those projects that are funded solely with State funds for State mitigation related programs, these will be handled by the agency that provides the State funded grant or loan.

The Team will review each State goal and objective as articulated in Section 3 of the Plan, to determine their appropriateness with respect to changing situations in the State as well as changes in policy and to ensure they are addressing current and expected conditions of a rapidly growing State that is hazard-prone. Federal and State legislative directed changes in policy and procedures will be addressed as they arise as well as addressing evolutionary or anticipated changing conditions. The Team will also review the risk assessment and capabilities portion of the Plan to determine what information requires update or modification. Each strategy and the associated mitigation actions will be reported to the agency responsible for its implementation and will include which implementation processes worked well, any difficulties encountered, how coordination efforts were preceding, and which strategies or processes need to be modified, revised or strengthened.

FEMA will be notified of any changes to the Plan and will be sent a copy of the changes or updates or will be provided a justification and explanation as to why no changes were deemed necessary. In case of a disaster declaration in the State, the State of Texas Mitigation Plan can be updated if the Texas Division of Emergency Management believes this is necessary. At a minimum, the Plan will be updated every 3 years in accordance with 44CFR Section 201.3.

The final Plan will be put on the TDEM Web site permanently allowing for anyone to review it at any time. Approximately 2-3 months prior to the required 3-year update TDEM will put an

additional notice on the Web site and in the *Texas Register* that the Plan is under-going a formal review and update process. We will follow the same process as outlined in section 1 when it comes to involving other agencies, organizations, and local jurisdictions. As indicated in paragraph 4 on the "Adoption and Implementation" page: "At a minimum, the State will review and, if necessary, update the Plan every 3 years from the date of approval in accordance with 44CFR, sections 201.3(c)(2) and (3). "

TDEM analyzed if the previously approved plan's method and schedule used for monitoring, evaluating and updating worked or not. The conclusion is that the previously approved plan's methods and schedule did work. The analysis was completed by determining the progress in achieving the mitigation goals described in this Plan. Texas has achieved many of the goals through the implementation of local mitigation projects. No elements or processes were changed from 2007-2010 and no elements or processes are expected to be changed from 2010-2013, as Texas continues to achieve its goals.

The State will evaluate the updated Plan annually to ensure that the plan is being properly implemented and is achieving the objectives set forth in the Plan The TDEM Mitigation Plans Officer has been assigned the responsibility for monitoring and coordinating the review and evaluation of the plan from 2010-2013. The State Hazard Mitigation Team is committed to extensive participation in the monitoring, evaluation and updating of the plan, as well as those agencies, organizations and associations that were a part of the initial plan development management process. The Team will be scheduled to meet once a year from the date FEMA approves the revised State Mitigation Plan to analyze the overall success and progress in implementing the Plan during the past year and will be asked to develop recommendations where applicable to incorporate appropriate changes and updates. Emails will also be sent to the SHMT reminding them that it is time for the annual review of the Plan.

Since the preponderance of the funds for State and local projects is derived from various Federal grant programs, the TDEM Mitigation Staff will continue to monitor the progress of the projects as a normal part of the duties and responsibilities of the staff members who manage these grant programs. For those projects that are funded solely with State funds for State mitigation related programs, these will be handled by the agency that provides the State funded grant or loan.

The Team will continue to review each State goal and objective as articulated in Section 3 of the Plan, to determine their appropriateness with respect to changing situations in the State as well as changes in policy and to ensure they are addressing current and expected conditions of a rapidly growing State that is hazard-prone. Federal and State legislative directed changes in policy and procedures will be addressed as they arise as well as addressing evolutionary or anticipated changing conditions. The Team will also review the risk assessment and capabilities portion of the Plan to determine what information requires update or modification. Each strategy and the associated mitigation actions will be reported to the agency responsible for its implementation and will include which implementation processes worked well, any difficulties encountered, how coordination efforts were preceding, and which strategies or processes need to be modified, revised or strengthened.

FEMA will be notified of any updates to the Plan and will be sent a copy of the changes or will be provided a justification and explanation as to why no changes were deemed necessary. In case of a disaster declaration in the State, the State of Texas Mitigation Plan can be updated if the Texas Division of Emergency Management believes this is necessary. At a minimum, the Plan will be updated every 3 years in accordance with 44CFR Section 201.3.

Monitoring Progress of Mitigation Activities

The Mitigation Section staff is responsible for the monitoring and tracking of progress towards mitigation measures. The Mitigation Section Administrator has designated the Mitigation Plans Officer as the staff member assigned to follow-up with other agency staff on a semi-annual basis. The information will be placed in a database. Goals, objectives, and projects will be reviewed in the event of a disaster to determine whether they will need to be modified to reflect the new conditions and the findings appended to the existing plan.

HMGP AND PDM PROJECT MONITORING AND CLOSEOUT

PROJECT MONITORING

For all grant recipients (HMGP and PDM): Quarterly Progress Reports are due to TDEM Mitigation not later than the 15th of October, January, April and July until the project has been completed and closed out. Those reports are then forwarded to FEMA Region 6 not later than the 30th of October, January, April and July.

When necessary we have and will continue to follow-up with phone calls, emails and formal letters. Sub-grantees are told up front that if they are not current with the Quarterly Progress Reports, then future grant payments will be withheld until they become current in submitting their Quarterly Progress Reports. TDEM Mitigation has also instituted the following policy:

HMGP: We will withhold the final 10% of the grant award plus the admin money until the project has been successfully completed and closed out

PDM: We will withhold the final 10% of the grant award until the project has been completed and closed out.

Coordination with other State Agencies: Since the actions listed in Section 3 are being done by members of the SHMT, we will have the team meet at least annually to discuss progress on their actions. When necessary we will also use email.

PROJECT CLOSEOUT

Current Closeout Procedures

Sub-grantees send a signed "Certificate of Completion" from the TDEM Mitigation office informing them that they are ready to close out their project. The program audit includes site inspections of work performed to see if all work was performed as stated in the application, all rules and regulations were followed and that everything is in compliance with FEMA rules. If at this time we have a financial auditor traveling with the Mitigation Financial Specialist and the assigned Project Officer, they will do the final reconciliation on the sub-grantees financial records. If there is no financial auditor then the financial audit will be scheduled at a later date. Once both the audits have been completed, the sub-grantee will be paid the admin amount (HMGP only) based on the financial audit and the project will be closed. For PDM, the sub-grantee will be paid the final 10% of their grant. For HMGP: once we have closed all of the projects in the disaster, we then send a letter to FEMA Region 6 requesting de-obligation of unspent funds and begin closure of the disaster. For PDM: we will follow the same procedure.

TDEM Mitigation has started new approach to closing out "brick and mortar" HMGP-funded projects effective May 2004. Instead of TDEM Mitigation doing the site visit then the auditors doing financial reconciliation, our goal it is to do this on the same trip. Our reasoning for beginning this process is to try and closeout the projects and eventually the disaster sooner. Time will tell how this will work.

PDM Planning Grants: Once the MAP (Mitigation Action Plan) has been approved by FEMA Region 6, a financial audit will be done.

All Federal circulars, FEMA policy and guidance for monitoring and closing out of projects will be followed for each HMGP and PDM project that is closed out. See paragraph b above for closeout procedures for HMGP and PDM Projects.

The following is a listing of Federal circulars, policy and guidance:

- 44CFR, Part 14 – "Administration of Grants: Audits of State and Local Governments"
- OMB Circulars A-128, A-102, A-87, and A-133
- Single Audit Act of 1984, Public Law 98-502
- HMGP Desk Reference, Section 14 – Closeouts and Audits

FMA Project Completion, Payment Request Processing and Closeouts

All financial records, supporting documentation, statistical records and all other records pertinent to these instrument shall be retained for a period of 3 years year/s from the date of your final expenditure report (SF 269) or FEMA Form 20-10.

The Board will reimburse the grant recipient in a total amount not to exceed the Federal share of the total project costs of the contract. The contractor will submit vouchers and associated documentation for reimbursement billing in accordance with the voucher submission schedule. The contractor is fully responsible for paying all charges by subcontractors prior to reimbursement by the Board. The Board shall reimburse the contractor for costs determined by FEMA to be allowable, allocable, and reasonable in accordance with OMB Circular A-87. To request reimbursement, the contractor shall submit to the Project Manager, a FEMA Form 20-17 (Request for Reimbursement Form) and the following information (the contractor will include a Payment Request Checklist to insure that all required information is submitted with the payment request:

- The Board (and FEMA) Contract Number;
- Contractor's vendor identification number;
- Mailing address for payment;
- Beginning and ending date for the billing period;
- Total expenses for the billing period;
- Total in-kind services, if applicable;
- Less local share of the total study costs for the billing period; and
- Total Federal share of the study costs for the billing period to be reimbursed by the Board.

The Contract Specialist will review and verify all payment requests and is responsible for following the payment request checklist to ensure that all documentation has been submitted.

Following the completion of the project or planning studies, final performance (FEMA Form 20-22, Narrative Report Form) and financial (FEMA Form 20-10) reports are due to the Project Manager from the grantees within 90 days after the termination of the grant. Termination of the

project is then reported on the quarterly financial and performance reports submitted by the Board to FEMA.

Project Closeout is a process in which FEMA determines that the recipient and FEMA have completed all applicable administrative actions and all required work of the grant. Information required from the Board to FEMA is as follows:

- Standard Form 269 (SF 269) or FEMA Form 20-10, Financial Status Report, Project Manager will prepare Form 20-10
- Standard Form 270 (SF 270), Final Request for Reimbursement (if necessary, Contract Specialist will prepare)
- Original signature on the Grantee's Assignment of Refunds, Rebates, Credits, and Other Amounts
- Original signature on the Recipients Release
- Final Narrative Report - this report should be all inclusive of only this grant activity

The following are steps that must be followed when conducting a closeout:

- Contract Specialist will draft a memo to the Executive Administrator, through the Deputy Executive Administrator, Fiscal Services, Legal, Director of Planning, and the FEMA Coordinator
- Contract Specialist will draft a transmittal letter to FEMA for the Board Executive Administrator's signature.

The State did not modify any systems used to track the initiation, status, and completion of mitigation activities. The mitigation actions that were implemented were completed by the local jurisdictions and not the State. However, local mitigation actions that were implemented help the State achieve its mitigation goals and strategies. Therefore, the State administers HMGP, PDM and RFC mitigation grant programs to assist local mitigation projects, thus, achieving the State goals and strategies.

Monitoring Progress of Mitigation Activities 2007-2010

The Mitigation Section staff is responsible for the continued monitoring and tracking of progress towards mitigation measures. The Mitigation Section Administrator has designated the Mitigation Plans Officer as the staff member assigned to follow-up with other agency staff on a semi-annual basis. The information will be placed in a database.

Goals, objectives, and projects will be reviewed in the event of a disaster to determine whether they will need to be modified to reflect the new conditions and the findings appended to the existing plan.

HMGP AND PDM PROJECT MONITORING AND CLOSEOUT

PROJECT MONITORING

For all grant recipients (HMGP and PDM): Quarterly Progress Reports are due to TDEM Mitigation not later than the 15th of October, January, April and July until the project has been completed and closed out. Those reports are then forwarded to FEMA Region 6 not later than the 30th of October, January, April and July.

When necessary we have and will continue to follow-up with phone calls, emails and formal letters. Sub-grantees are told up front that if they are not current with the Quarterly Progress Reports, then future grant payments will be withheld until they become current in submitting their Quarterly Progress Reports. TDEM Mitigation has also instituted the following policy:

- HMGP: We will withhold the final 25% of the grant award plus the admin money until the project has been successfully completed and closed out
- PDM: We will withhold the final 25% of the grant award until the project has been completed and closed out.

Coordination with other State Agencies: Since the actions listed in Section 3 are being done by members of the State Hazard Mitigation Team (SHMT), we will have the team meet at least annually to discuss progress on their actions. When necessary we will also use email.

PROJECT CLOSEOUT

Current Closeout Procedures

Sub-grantees send a signed "Certificate of Completion" from the TDEM Mitigation office informing them that they are ready to close out their project. The program audit includes site inspections of work performed to see if all work was performed as stated in the application, all rules and regulations were followed and that everything is in compliance with FEMA rules. If at this time we have a financial auditor traveling with the Mitigation Financial Specialist and the assigned Project Officer, they will do the final reconciliation on the sub-grantees financial records. If there is no financial auditor then the financial audit will be scheduled at a later date. Once both the audits have been completed, the sub-grantee will be paid the admin amount (HMGP only) based on the financial audit and the project will be closed. For PDM, the sub-grantee will be paid the final 25% of their grant. For HMGP: once we have closed all of the projects in the disaster, we then send a letter to FEMA Region 6 requesting de-obligation of unspent funds and begin closure of the disaster. For PDM: we will follow the same procedure.

TDEM Mitigation has started new approach to closing out "brick and mortar" HMGP-funded projects effective May 2004. Instead of TDEM Mitigation doing the site visit then the auditors doing financial reconciliation, our goal it is to do this on the same trip. Our reasoning for beginning this process is to try and closeout the projects and eventually the disaster sooner. Time will tell how this will work.

PDM Planning Grants: Once the MAP (Mitigation Action Plan) has been approved by FEMA Region 6, a financial audit will be done. The current grant performance ending dates are:

- PDM FY04 combined with PDM FY05: September 9, 2005 with the financial reconciliation due September 30, 2008.
- PDM FY06: Texas not awarded any PDM grants from this fiscal year.
- PDM FY07: Texas grants not yet officially awarded as of this draft.

All Federal circulars, FEMA policy and guidance for monitoring and closing out of projects will be followed for each HMGP and PDM project that is closed out. See paragraph b above for closeout procedures for HMGP and PDM Projects.

The following is a listing of Federal circulars, policy and guidance:

- 44CFR, Part 14 – "Administration of Grants: Audits of State and Local Governments"
- OMB Circulars A-128, A-102, A-87, and A-133

- Single Audit Act of 1984, Public Law 98-502
- HMGP Desk Reference, Section 14 – Closeouts and Audits

FMA PROJECT COMPLETION, PAYMENT REQUEST PROCESSING AND CLOSEOUTS

All financial records, supporting documentation, statistical records and all other records pertinent to these instrument shall be retained for a period of 3 years year/s from the date of your final expenditure report (SF 269) or FEMA Form 20-10.

The Board will reimburse the grant recipient in a total amount not to exceed the Federal share of the total project costs of the contract. The contractor will submit vouchers and associated documentation for reimbursement billing in accordance with the voucher submission schedule. The contractor is fully responsible for paying all charges by subcontractors prior to reimbursement by the Board. The Board shall reimburse the contractor for costs determined by FEMA to be allowable, allocable, and reasonable in accordance with OMB Circular A-87. To request reimbursement, the contractor shall submit to the Project Manager, a FEMA Form 20-17 (Request for Reimbursement Form) and the following information (the contractor will include a Payment Request Checklist to insure that all required information is submitted with the payment request:

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- Total expenses for the billing period;
- Total in-kind services, if applicable;
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- Total Federal share of the study costs for the billing period to be reimbursed by the Board.
- The Contract Specialist will review and verify all payment requests and is responsible for following the payment request checklist to ensure that all documentation has been submitted.
- Following the completion of the project or planning studies, final performance (FEMA Form 20-22, Narrative Report Form) and financial (FEMA Form 20-10) reports are due to the Project Manager from the grantees within 90 days after the termination of the grant. Termination of the project is then reported on the quarterly financial and performance reports submitted by the Board to FEMA.
- Project Closeout is a process in which FEMA determines that the recipient and FEMA have completed all applicable administrative actions and all required work of the grant. Information required from the Board to FEMA is as follows:
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- Original signature on the Recipients Release
- Final Narrative Report - this report should be all inclusive of only this grant activity

The following are steps that must be followed when conducting a closeout:

- Contract Specialist will draft a memo to the Executive Administrator, through the Deputy Executive Administrator, Fiscal Services, Legal, Director of Planning, and the FEMA Coordinator
- Contract Specialist will draft a transmittal letter to FEMA for the Board Executive Administrator's signature.

The State continues to monitor previously completed acquisition buyouts to ensure compliance to the open-spaced deed restrictions. TDEM revisits 2% of the addresses each year.

SECTION 7 – ATTACHMENTS

Attachment One
The Texas Drought Preparedness Plan may be found and downloaded from the following Web site: http://www.txdps.state.tx.us/dem/droughtCouncil/documents/droughtPrepPlan.pdf

Attachment Two
The State Annex P: Hazard Mitigation may be found and downloaded from the following Web site: ftp://ftp.txdps.state.tx.us/dem/plan_state/state_annex_p.pdf

Attachment Three
The State Annex F: Firefighting may be found and downloaded from the following Web site: ftp://ftp.txdps.state.tx.us/dem/plan_state/state_annex_f.pdf

Attachment Four
This attachment will highlight mitigation success stories. This attachment will be updated periodically with new stories as they become available.

Attachment Five
This attachment includes a list of State Hazard Mitigation Team members, meeting agenda and sign-in sheets.

Attachment Six
This attachment includes a comprehensive list of grant sources.

Attachment Four: Mitigation Success Stories

DIVISION OF EMERGENCY MANAGEMENT

Office of the Governor

RICK PERRY
Governor

STEVEN McCRAW
Director
Office of Homeland Security

Mailing Address:
PO Box 4087
Austin, Texas 78773-0220

Contact Numbers:
512-424-2138 Duty Hours
512-424-2277 Non-Duty Hours
512-424-2444 Fax

Physical Address:
5805 N. Lamar Blvd.
Austin, Texas 78752

JACK COLLEY
Chief

January 5, 2007

William E. Peterson
Regional Director
FEMA Region 6
800 North Loop 288
Denton, TX 76209-3698

Attn: Kathy Reimer, Emerg. Mgmt. Program Spec.

Reference: FEMA-1379-DR-TX, project #84, Klein High School

Dear Mr. Peterson:

The State would like to take this opportunity to inform you of the success of one of your previously funded mitigation projects

As a result of over 19 inches of rain over a 7-day period from Tropical Storm Allison in the summer of 2001, Klein High School (located on Stuebner Airline Road in Klein, Texas a suburb of northwest Houston, Texas) sustained flooding damage of approximately $44,700 to a significant portion of the campus. This was in part due to a number of construction projects that had taken place to accommodate a steadily expanding student population. The existing drainage system, which was built in the 1960s, was not sufficient to handle the volume of water, and flooding occurred after this and every large rainfall event. The damage caused by TS Allison was the most recent in a long line that had been incurred due to this drainage insufficiency.

As a result of the flooding from Allison, the Klein Independent School District applied through the State of Texas to FEMA for $1,001,379 (Federal share $751,034) in HMGP funds to renovate the drainage system on campus. The project that was approved by the State of Texas and FEMA to mitigate this hazard involved was completed in two phases: The first (completed in May of 2003) involved excavating a storm water detention facility on the practice football field between the stadium and the band hall, and installing about 150 feet of 12-inch drainage pipe. The second phase (completed in July of 2005) involved the installation of a 54-inch gravity pipe with grated flumes between the pavilion and Administration/Classroom building to the edge of campus then east to Theiss gully.

[Below are an aerial and ground photos of where the project was built]

Aerial View of Klein High School Campus

The northeast section of the practice field/detention facility with the outfall drain in the corner (White Square)

The inlet grates (wide black line on the ground) between the girl's gymnasium and the administration building (facing north towards Louetta Road).

While not declared, the flood in October 2006 was the result of over 6 inches of rainfall over a 24-hour period on the Klein High School area. The project functioned as designed and the school sustained no damage. The project prevented an estimated $47,000 in damages only fifteen months after completion.

Sincerely,

Jack Colley
Chief

GP/tl

DIVISION OF EMERGENCY MANAGEMENT
Office of the Governor

RICK PERRY
Governor

STEVEN McCRAW
Director
Office of Homeland Security

JACK COLLEY
Chief

Mailing Address:
PO Box 4087
Austin, Texas 78773-0220

Contact Numbers:
512-424-2138 Duty Hours
512-424-2277 Non-Duty Hours
512-424-2444 Fax

Physical Address:
5805 N. Lamar Blvd.
Austin, Texas 78752

July 30, 2009

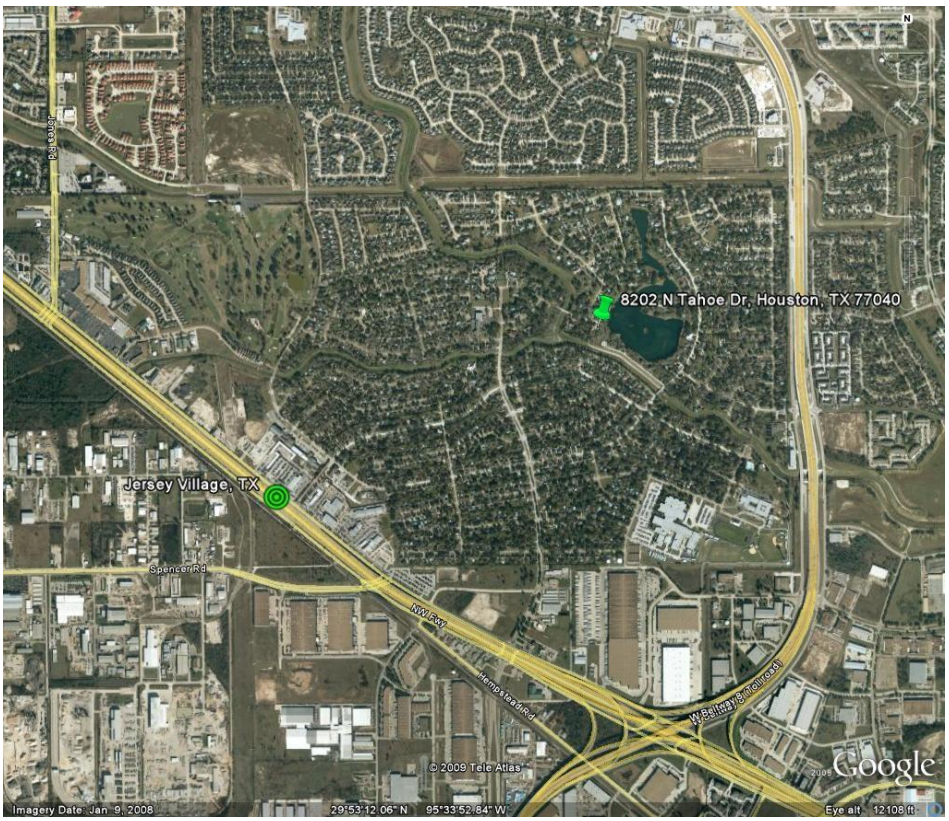
Mr. Gary Jones
Acting Regional Administrator
FEMA Region 6
Federal Center
800 North Loop 288
Denton, TX 76209

Dear Mr. Jones:

The State would like to take this opportunity to inform you of the success of one of your previously funded mitigation projects.

The City of Jersey City, Texas applied for a Pre-Disaster Mitigation grant for FY03. As a part of that grant, $218,160 in Federal share was awarded to fund an elevation project for a private residence located at 8202 North Tahoe Drive.

8202 North Tahoe Drive: before Tropical Storm Allison



Jersey Village and Property location Map

The residence had suffered a total of $217,054 in losses during two previous flooding events, including Tropical Storm Allison. The home was elevated 4 feet or one foot above the base flood elevation. The project was completed January 2007.

8202 North Tahoe Drive: early in the process of being elevated

8202 North Tahoe Drive: elevation complete. Note the skirting below the first floor

On April 28, 2009 the City of Jersey Village recorded an 8 inch in 12 hour rainfall event in which this project was tested—10 inches of water would have entered the house. As a result of the mitigation action flood waters did not reach the first floor, and (using FEMA's Benefit-Cost Analysis Software) approximately $133,000 in damages were avoided

8202 North Tahoe Drive: Level of flooding for April 28, 2009 event. Debris line marked at 12 inches on shirting

Again, using FEMA's Benefit-Cost Analysis software, approximately $66,000 in expected annual damages will be avoided. Over 30 years this will amount to approximately $820,000 in expected damages avoided—not to mention the savings to local government in response cost.

Sincerely,

Jack Colley
Chief

GP:TL

DIVISION OF EMERGENCY MANAGEMENT
Office of the Governor

RICK PERRY
Governor

JACK COLLEY
Chief

Mailing Address:
PO Box 4087
Austin, Texas 78773-0220

Contact Numbers:
512-424-2138 Duty Hours
512-424-2277 Non-Duty Hours
512-424-2444 Fax

Physical Address:
5805 N. Lamar Blvd.
Austin, Texas 78752

August 12th, 2009

Mr. Gary Jones
Acting Regional Administrator
FEMA Region 6
Federal Center
800 North Loop 288
Denton, Texas 76209

Dear Mr. Jones,

The State would like to take this opportunity to inform you of the success of one of your previously funded mitigation projects.

Since Hurricane Rita made landfall in Southeast Texas in 2005, preparing for frequent major storms has become part of Baptist Hospitals of South Texas' normal summer routine. This caution is well founded, with a seemingly endless stream of recent windstorms. Hurricane Humberto caught everyone by surprise when it formed into a Category 1 storm overnight on September 12, 2007. One year later, the massive

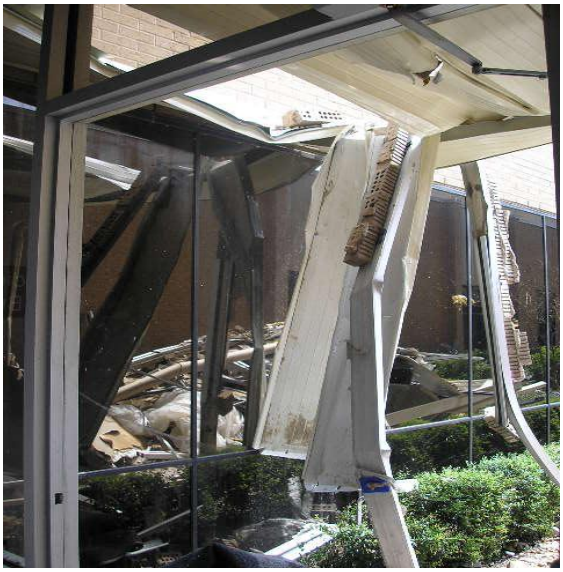
Location of the two hospitals, in Beaumont and the City of Orange

Category 2 Hurricane Ike pounded Southeast Texas and Southwest Louisiana.
Hurricane Rita devastated the campuses of the Baptist hospitals in Beaumont and the City of Orange. Roof-mounted HVAC units were ripped from their mounts and hurled into

the parking lot. Windows failed under debris impacts, and the roof membranes failed in several locations. With the building envelopes fatally compromised, rain water penetration completed the destruction, shorting out building electrical power distribution, communication, and medical monitoring systems. The buildings sustained tens of millions of dollars in direct damages and were out of service for months following the storm.

Instead of simply repairing back to original conditions, Baptist Hospitals of Southeast Texas (BHST) made the decision to mitigate future damages after Hurricane Rita and was awarded $4,942,000 in funding under the Hazard Mitigation Grant Program (HMGP) for mitigation projects on the Beaumont and Orange campuses. Through these grants, BHST was able to add hurricane shutters, purchase emergency back-up generators that run the entire facilities, add water wells, and upgrade roofs. These measures were tested during Hurricane Humberto and Ike and proved to be very satisfactory.

(The following photos are a sampling of damages to BHST hospitals in Beaumont and Orange Texas as a result of Hurricane Rita)



Pedestrian bridge after Rita

Repaired Pedestrian bridge with wind retrofit in place, before Ike.

Instead of putting plywood on windows, which takes three to four days and costs about $8,000, activating the shutters in preparation for a storm takes less than half a day . Another advantage that was found to having shutters on the windows was the protection they provide against water leaks from wind driven rain.

Electric roll-down shutters on front entryway of Orange County Memorial before Ike.

The upgraded roofs and windows held up to the Category 2 winds of Ike and did not sustain any damages. BHST came very close to using the water well because salt water entered the City of Beaumont's water supply.

Using FEMA's Benefit-Cost Analysis Software, approximately $197,000 in damages was avoided during Hurricane Ike.

During Hurricane Ike, BHST was able to transition to generator power seamlessly and run the main campus for approximately five days until power could be restored. During the time the campus was on generator power, two open-heart surgeries were performed and thirteen babies were delivered. In addition, BHST provided safe lodging and food for Beaumont EMS professionals, and Beaumont Police and hospital employees. Additionally local reporters from the Beaumont Enterprise were given space to get the newspaper out.

Again, using FEMA's Hurricane Benefit-Cost Analysis software, on both projects, a total of approximately $766,000 in expected annual damages will be avoided. Over 30 years this will amount to approximately $5,220,000 in expected damages avoided—not to mention the savings to local government in response cost.

Respectfully,
Jack Colley

Attachment 5

Attachment 5 includes a list of State Hazard Mitigation Team members, meeting agenda and sign-in sheets.

Organization **Primary Member** **Address**	**Work Phone** **Fax Phone** **Email Address**	**Alternate** **Contact**
GENERAL LAND OFFICE Jim Weatherford P.O. Box 12873 Austin, TX 78711-2873	512/463-2572 512/475-0680 Jim.weatherford@glo.State.tx.us	Dr. Juan Moya 512/475-3735 512/463-0680 juan.moya@glo.State.tx.us
TEXAS DEPT. OF PUBLIC SAFETY TDEM - SHMO Greg Pekar 5805 North Lamar Blvd. Austin, TX 78773-0220	512/424-2429 512/424-5647 Gregory.Pekar@txdps.State.tx.us	Mitigation Specialist Mildred Reno 512/424-2428 512/424-5647 Mildred.Reno@txdps.State.tx.us
RAILROAD COMMISSION OF TEXAS Mr. John Rissler 1701 North Congress Austin, TX 78711-2967	512/463-3255 512/463-7000 512/392-2830 John.Rissler@rrc.State.tx.us	
TEXAS DEPT. OF RURAL AFFAIRS Mr. Gus Garcia 1700 N. Congress Ave. Suite 220 Austin, TX 78711-2489	512/936-7876 512/936-6776 gus.garcia@orca.State.tx.us	Jerald Ferguson 512/936-6733 512/936-6776 jferguson@orca.State.tx.us
TEXAS DEPT. OF TRANSPORTATION Amy Ronnfeldt 125 East 11th Street Austin, TX 78701-2483	512/416-2328 512/416-3098 aronnfel@dot.State.tx.us	
TEXAS DEPT. OF INSURANCE Mr. Preston Wheeler 333 Guadalupe P.O. Box 149104, MC 11-1A Austin, TX 78714-9104	512/463-6617 512/305-8192 Preston.Wheeler@tdi.State.tx.us	Ms. Melissa Hield 512/463-6500
TEXAS FOREST SERVICE Mr. Justice Jones 1328 FM 1488 Conroe, TX 77384-3905	936/273-2261 903/756-7370 jjjones@tfs.tamu.edu	Mr. Lee McNeely 903/756-3133 903/756-7370 lmcneely@tfs.tamu.edu

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY Mr. Warrant Samuelson, P.E. P.O. Box 13087, MC174 12100 Park 35 Circle, Bldg. F Austin, TX 78711-3087	512/239-5195 wsamuels@tceq.state.tx.us	
TEXAS PARKS AND WILDLIFE DEPT. Mr. Tom Heger 4200 Smith School Road Austin, TX 78744-3292	512/389-4583 512/389-8059 Tom.Heger@tpwd.State.tx.us	Mr. Bob Spain 512/389-4635 512/389-8059
TEXAS GEOGRAPHIC SOCIETY Mr. Roddy Seekins Executive Director 1906 Glencliff Drive, Suite 300 Austin, TX 78704	512/507-8515 512/445-3394 Roddy@TexasGS.org	
TEXAS WATER DEVELOPMENT BOARD Mr. Gilbert Ward Hydrologist Research & Planning Funds Grants Management P.O. Box 13231 Austin, TX 78711-3231	512/463-6418 512/463-9893 gward@twdb.State.tx.us	
TEXAS FLOODPLAIN MANAGEMENT ASSOCIATION Mr. Roy D. Sedwick, CFM	512/496-0692 (cell) 512/473-3200 x2805 512/473-3551 roy.sedwick@lcra.org	
EMERGENCY MANAGEMENT ASSOCIATION OF TEXAS **vacant**		
NFIP/ FLOODPLAIN MGR Mr. Mike Segner Texas Water Dev. Board P.O. Box 13231 Austin, TX 78711-3231	512/463-3509 Mike.Segner@twdb.State.tx.us	
TEXAS TECH UNIVERSITY Ernst W. Kiesling, P.E., Ph.D. Senior Associate Dean Box 41023 Lubbock, TX 79409-1023	806/742-3451, Ext 235 806/742-3493 Ernst.kiesling@ttu.edu	

Attachment 5 (continued)

AGENDA
State Hazard Mitigation Team Meeting
Updating of the State Mitigation Plan
May 4, 2010

10:00am-10:15 Introductions

10:15-10:30 Discussion of the status of the State Hazard Mitigation Plan and what needs to be done to update the Plan

10:30-11:00 Discussion and input from State agencies on their roles and responsibilities within mitigation

11:00-11:15 Information about the HMGP applications from Greg Pekar

11:15-11:30 Questions and answers

11:30 Adjourn

Attachment 5 (continued)

State Hazard Mitigation Team (SHMT)
State Plan Update Meeting
May 4, 2010

NAME/ TITLE	AGENCY	OFFICE PHONE/ FAX NUMBER EMAIL ADDRESS
Warren Samuelson Manager Dam Safety Section	TCEQ	512/239-5195 wsamuels@tceq.state.Tx.us
Gilbert Ward grants coordinator	TWDB	512-463-6418 gward@twdb.state.tx.us
Michael Segner Director	TWDB	512 463 3509 Michael.segner@Twdb.state.TX.US
Tom Barnett Mitigation Specialist	TWDB	512/463-4209 thomas.barnett@twdb state.tx.us
Marsha Rutherford Mitigation Spec	TDEM	512-424-5489 marsha.rutherford@TXDPS.State.TX.US
Wendy Kirby Mitigation - Specialist	TDEM	512 424 5478 wendy.kirby@txdps.state.tx.us
Jim WEATHERFORD MITIGATION	GLO	512-463-2572 JIM.WEATHERFORD@GLO.STATE.TX.US

Attachment 5 (continued)

State Hazard Mitigation Team (SHMT)
State Plan Update Meeting
May 4, 2010

NAME/ TITLE	AGENCY	OFFICE PHONE/ FAX NUMBER EMAIL ADDRESS
Megan Leitsinger Mitigation Specialist	TDEM	424-5484 megan.Leitsinger@txdps.state.tx.us
Jonathon Dobbs Contractor	TDEM	424-2467 jonathon.dobbs@txdps.state.tx.us
Justin Jones	TFS ~~TDEM~~	936 546 8042 jjjones@tfs.tamu.edu
Amy Ronnfeldt Diane Venable	TXDOT	aronnfel@dot.state.tx.us 416-2328 416-3098
Roddy Seaking Exec. Dir.	TXGS	445-0494 Roddy@sbcglobal.Net
David Larner Contractor	TDEM	512-424-2397 david.larner@txdps.state.tx.us

Attachment 6

H2O Partners

Guide to Funding and Technical Assistance Programs

To Support Implementation of Hazard Mitigation Plans

Introduction

A major challenge faced by communities seeking comprehensive hazard-mitigation planning solutions is to secure funding in an era of constrained resources at all levels of government. A wide range of financial and technical assistance is available from the State of Texas and the Federal Government to protect communities from floods and other natural and man-made disasters and preserve and enhance the quality of water.

Regional watershed- or valley-wide approaches are increasingly recognized by State and Federal agencies as an efficient and effective method for planning and developing programs. Regional approaches provide:

- increased focus on areas of common risk;
- more comprehensive consideration of upstream-downstream effects of pollutants, flooding and corrective actions; and,
- greater efficiency, saving time and expense by eliminating the need for each separate local jurisdiction to devise its own approaches to the complex problems posed by hazards.

This guide is a tool for the cities and counties participating in hazard mitigation planning to use in leveraging State and Federal resources to support their efforts. It identifies and briefly describes funding programs available to help the jurisdictions improve water quality and mitigate, prepare for, respond to, and recover from natural and man-made disasters.

This guide is organized into two parts. The first includes State-authorized programs, and the second includes federally authorized programs. Programs are listed alphabetically by agency. The authority for each program is described, as are funding source, purpose, types of assistance and eligible projects, conditions of use, hazards or topics covered, matching requirements, application deadlines and contact points for further information.

Changes or corrections should be submitted to:

Laurel Lacy
H2O Partners, Inc.
4402 Lakeway Boulevard
Austin, Texas 78734-5019
LaurelLacy@aol.com
512-261-0705

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B. Federally Authorized Programs

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GUIDE TO FUNDING AND TECHNICAL ASSISTANCE PROGRAMS

TO SUPPORT IMPLEMENTATION OF HAZARD MITIGATION PLANS

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Texas Clean Rivers Program (CRP)	Texas Clean Rivers Act, 30 TAC 220, Subchapter A.	Texas Commission on Environmental Quality (TCEQ)	To maintain and improve the quality of surface water resources within each river basin in Texas. The Program is a partnership involving TCEQ, other State agencies, river authorities, regional entities, local governments, industry, and citizens. It uses a watershed management approach to identify and evaluate surface water quality issues, establish priorities for corrective action, and outline strategies to implement those actions. It encourages comprehensive and cooperative watershed planning; maintains basin-wide water quality monitoring; focuses on priority issues and addresses local initiatives; identifies, analyzes, and reports on water quality issues and potential causes of pollution; and identifies and evaluates alternatives for preventing and reducing pollution.	`	Only entities designated in the Act are eligible.	Water quality	No match required	The law mandates pass-through of funds to the River Authorities. There is no specific application process.	Linda Brookins, Project Manager, Watershed Management Team, TNRCC, 512-239-4625 lbrookin@tnrcc.State.tx.us www.tnrcc.State.tx.us/water/quality/nps

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Clean Water State Revolving Fund	Texas Administrative Code. Sections 375.1 – 375.4; and the Federal Water Pollution Control Act, as amended	Texas Water Development Board (TWDB)	To provide a perpetual fund to provide low interest loan assistance for the planning, design, and construction of wastewater treatment facilities; wastewater recycling and reuse facilities; collection systems; stormwater pollution control projects; and nonpoint source pollution control projects. There is a set-aside within the Clean Water State Revolving Fund for the Nonpoint Source Pollution Loan and Estuary Management Program.	Assistance is in the form of loans at below market interest rates, for a period not to exceed 20 years; or the purchase or refinance of bonds at below market rates; or guarantees or purchase of insurance for local debt obligations. Eligible projects include construction of waste treatment works and nonpoint source pollution control and abatement projects. For entities that are fully authorized to issue bonds, loans are in the form of purchase of bonds, rather than requiring entities to sell them on the open market. Eligible costs include: (a) preliminary planning to determine the feasibility of a project; (b) engineering, architectural, environmental, legal, title, fiscal, or economic studies; (c) the expense of any condemnation or other legal proceeding; (d) surveys, designs, plans, working drawings, specifications, procedures; and (e) the building of a project or the inspection or supervision of any of the foregoing items.	An approved Water Conservation Plan is required. The TWDB will also consider environment-al, social and economic impacts and whether the proposed action is or is not detrimental to the public welfare.	Water quality	No match required. However, funds received from the Clean Water State Revolving Fund may generally be used as a non-Federal match for Federal grants, such as the EPA Nonpoint Source Grant Program (Section 319).	After a Pre-application Conference, TWDB solicits proposed projects for an Intended Use Plan. Then, TWDB sends Notice of Avail-ability of Funds and solicits applications. Applicants are generally given 4 months from the Notice, or until August 31, whichever is sooner, to submit applications. Applications for Nonpoint Source projects are funded on a first-come, first-served basis until available funds are used.	Ignacio Madera, Jr., Deputy Executive Administrator, Office of Project Finance and Construction Assistance, 512-463-7509 Ignacio.madera @twdb.State. tx.us www.twdb. State.tx.us

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Research and Planning Fund Grants	Texas Water Code, Chapter 15	TWDB, Research and Planning Fund	To provide financial assistance for research and feasibility studies into practical solutions to water-related problems. The Fund provides for three grant programs: (1) Regional Planning for Water Supply and Wastewater Treatment and Collection program provides funding to prepare plans for regional water supply and wastewater facilities. (2) Water Research Grants are dedicated to enhancing planning, management, conservation, development or protection of Texas's water resources ; and (3) Flood Protection Planning Grants provide funds for regional flood protection planning, considering the needs of the entire watershed, including upstream or downstream effects of proposed solutions	Regional Planning for Water Supply and Wastewater Treatment and Collection Grants support preparation of plans to develop regional water supply and wastewater facilities. The facilities must be regional, i.e., systems that incorporate two or more service areas or serve an area involving two or more political subdivisions. Grants have been awarded for nonpoint source pollution control, ground-water protection and recharge, plumbing retrofit programs, reuse of surface water to increase the dependable supply of a reservoir, and watershed yield augmentation. Eligible activities under Flood Protection Planning include studies and analyses to identify problems resulting from or relating to flooding; determining views and needs of the affected public; identifying potential solutions; estimating benefits and costs of solutions (structural and nonstructural); evaluating environmental, social, and cultural factors; and recommending feasible solutions to flooding.	Flood Protection Planning Grants are only awarded to participating NFIP communities. Applicants must consider structural and non-structural flood protection measures; and plan for an entire watershed rather than localized drainage improvements.	Water quality, water supply, flooding	Grants for Regional Planning and Flood Protection are limited to 50% of total project costs, except in areas of high unemployment rates or low per-capita income. In-kind services may be used for any part of the local share. Grants may be awarded for up to 100% of the cost of a Water Research project.	As funds become available and needs are identified, TWDB publishes a notice in the *Texas Register*. Generally, applications for the Flood Protection Planning are due the first week of January.	For Flood Protection Planning: Gilbert Ward, TWDB, 512-463-6418 Gward@ twdb.State.tx.us For Water Research: William Mullican, TWDB. For Regional Planning, Phyllis Thomas, 512-463-3154 -------- www.twdb. State.tx.us

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
State Participation and Storage Acquisition Program	Texas Water Code, Chapter 363, 31 TAC 363, Subchapters A and F	TWDB	To help finance regional water or wastewater projects, including water storage facilities and flood retention basins; and to allow for "right sizing" of projects in consideration of future growth. Under this program, the State TWDB absorbs some of the initial costs of projects, but ultimately recovers the actual cash expenditure of funds used in providing assistance.	Assistance is in the form of sale, transfer or lease by the State of regional water and wastewater projects, including water storage acquisition and flood retention basins. The State assumes a temporary ownership interest in a regional project when local sponsors are unable to assume debt for the optimally sized facility. Loan payments that would have been required, if the assistance had been in the form of a loan, are deferred. Ultimately, the cost of funding is repaid to the State when the State's ownership interest is bought out. A Master Agreement will be established with the TWDB to govern the funding arrangements, including provisions for a defined source of revenue that will be used to purchase the State's portion of the facility.	Environment-al Review and an approved Water Conservation Plan are required. The project cannot be reasonably financed without State participation assistance, and the optimum regional development of the project cannot be reasonably financed without State participation.	Flooding, water supply	TWDB's participation is limited to a maximum of 50% of the project costs and to the portion of the project designated as excess capacity. The remaining costs of the project may be funded through other TWDB programs.	Application materials must be submitted by the first business day of the month preceding the month during which the applicant desires TWDB Board consideration. Completed applications are considered by the Board on the third Wednesday of each month.	Ignacio Madera, Jr., Deputy Executive Administrator, Office of Project Finance and Construction Assistance, 512-463-7509 Ignacio.madera @twdb.State. tx.us www.twdb. State.tx.us

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Texas Natural Resources Information System (TNRIS)	Texas Water Code	TWDB	To provide a clearinghouse and referral center for Texas natural resources information supplied by numerous State and Federal agencies, including the U.S. Census Bureau, the U.S. Geological Survey, the U.S. Federal Emergency Management Agency, and the Texas Department of Transportation.	Assistance is in the form of: (1) access to information through TNRIS's hub for direct electronic access or referral to State natural resources and census data; (2) Internet map services; and (3) technical assistance on Geographical Information Systems displays and Global Positioning Systems. TNRIS's Strategic Mapping Program (StratMap) produces large-scale computerized base map information documenting land features such as soils, elevation and hydrography, and man-made features including political boundaries and roadways. Data provided by StratMap can be used for hydrologic modeling, vegetation analysis, transportation routing, land use planning and management, environmental assessment and monitoring, and business applications. TNRIS has information that can assist in developing Hazard Mitigation Plans.	None	Natural resources information	No match required	N.A.	Director, Texas Natural Resources Information System, 512-463-8051 www.tnris.State.tx.us

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Texas Water Development Fund	Texas Water Code, Chapter 17	Texas Water Development Board, Development Fund II	To provide loans for the planning, design and construction of water supply, wastewater and flood control projects.	Loans are provided for the acquisition, improvement or construction of such water-related projects as water wells, retail distribution and wholesale transmission, pumping facilities, storage reservoirs and tanks, and water treatment plants. Financing is also provided for purchase of water rights, wastewater collection and treatment projects, and flood control projects. Flood control projects focus on basin- or watershed-wide analysis and projects that are regional in nature. Assistance includes loans for structural and nonstructural flood protection improvements such as construction of storm water retention basins, enlargement of stream channels, modification or reconstruction of bridges, acquisition of floodplain land for use in public open space, acquisition and removal of buildings located in a floodplain, relocation of residents, flood warning systems, control of coastal erosion, and the development of flood management plans.	An approved Water Conservation Plan is required.	Flood control, water supply and water quality	No match required	Applications must be submitted by the first business day of the month preceding the month during which the applicant desires consideration of the loan request by the TWDB.	Mark Hall, Manager, Central Texas Region, TWDB, 512-463-8498 Mark.Hall@ twdb.State.tx.u s www.twdb. State.tx.us

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Texas Coastal Management Program	Coastal Zone Management Act, Sections 306 and 306A	Texas Coastal Coordination Council, chaired by the Texas General Land Office.	For planning and implementation of projects that address environmental problems affecting the coastal area and that promote sustainable economic development.	Two types of funds are provided under this program. Section 306 Administrative Funds may be used for the administration of the Coastal Management Program, to include planning, mapping, geographic information systems, and research projects. Section 306A Funds may be used for projects that meet one or more of the following: (1) preservation or restoration of coastal natural resource areas; (2) redevelopment of deteriorating and underutilized urban waterfronts and ports; (3) provision of access to public beaches and other coastal areas and to coastal waters; and (4) development of a coordinated process among State agencies to regulate and issue permits for aquaculture facilities in the coastal zone. Section 306 eligible activities include acquisition or fee simple or other interest in land; low-cost construction projects; revitalization of deteriorating or underutilized urban waterfronts or ports; engineering designs, specifications; and educational, interpretive, and other management costs.		Coastal zone management	40% non-Federal cost share required.	Grant cycles to be announced in the Texas Register.	Melissa Porter, CMP Grants Manager, General Land Office, 512-475-1393 melissa.porter @glo.State. tx.us Kathy Smartt Contracts Specialist, General Land Office, 512-305-9151 Kathy.smartt @glo.State.tx. us

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Emergency Watershed Protection Program	Public Law 104-127, as amended; Public Law 81-516, as amended; and Public Law 95-334, as amended	U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS)	To provide relief from imminent hazards and reduce the threat to life and property in watersheds damaged by severe natural events. Hazards include floods and the products of erosion created by floods, fire, windstorms, earthquakes, drought, or other natural disasters.	Assistance includes technical and financial assistance to carry out emergency work such as debris removal from stream channels, road culverts, and bridge abutments; debris removal in upland areas following windstorms and tornadoes; reshaping and protection (hard and soft) of eroding stream banks; repair of damaged drainage facilities, levees and flood prevention structures; reseeding of burned or denuded areas; and promoting appropriate grazing practices under drought conditions to assist in watershed recovery.	Requires an imminent hazard or threat to life and property from severe natural events. However, a Presidential declaration of disaster is not required.	Multi-hazard, covering floods and erosion caused by floods, fire, windstorms, earthquakes, drought or other natural disasters.	No matching requirements for easements and technical assistance. 25% nonfederal match for other eligible measures.	Letter of request to NRCS is due 90 days from the date of the disaster.	Charles Melton Texas State Office, NRCS, 254-742-9848 www.nrcs.usda.gov
Watershed Protection and Flood Prevention Program	Watershed Protection and Flood Prevention Act, as amended (Public Law 83-566)	NRCS	To protect, develop, and utilize the land and water resources in small watersheds of 250,000 acres or less. The program is Federally assisted and locally led. Projects are aimed at watershed protection, flood prevention, agricultural and non-agricultural water management, water quality improvement, erosion and sediment reduction, fish and wildlife enhancement, and water supply.	Assistance includes financial and technical assistance for approved watershed projects. Technical assistance is provided in planning, designing and installing watershed improvements. Financial assistance is provided for watershed protection, flood prevention, agricultural water management, sedimentation control, and public water based fish, wildlife, and recreation. Local sponsors are required to obtain land rights and perform operation and maintenance on all works of improvement.		Floods, water quality and water supply	Cost share varies by purpose. No matching requirement for flood prevention; 50% required for agricultural and non-agricultural water management. Sponsors are responsible for land rights costs.	Projects that have watershed plans developed and approved by NRCS for operations are eligible for funding.	James Hailey, Assistant State Conservationist for Watersheds, Texas State Office, NRCS, 254-742-9871 James.hailey@tx.usda.gov www.nrcs.usda.gov

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Watershed Surveys and Planning	Watershed Protection and Flood Prevention Act, as amended (Public Law 83-566)	NRCS	To provide planning assistance to Federal, State and local agencies for the development of coordinated water and related land resources programs in watersheds and river basins. Emphasis is on flood damage reduction, erosion control, water conservation, preservation of wetlands, and water quality improvements.	Technical assistance is provided. Types of surveys and plans include watershed plans, river basin surveys and studies, watershed resource assessments, flood hazard and floodplain management studies. Special priority is given to upstream rural community flooding; water quality improvements from agricultural nonpoint sources; wetland preservation; and drought management and water supply for agricultural or rural communities.		Floods, erosion control, water supply and water quality	None.	None. Formal request for assistance is required. If purposes qualify for Public Law 83-566 funding, the application process for Federal assistance is required.	James Hailey, Assistant State Conservationist for Watersheds, Texas State Office, NRCS, 254-742-9871 James.hailey@tx.usda.gov www.nrcs.usda.gov
Wetlands Reserve Program	The FAIR Act of 1996	NRCS	To protect and restore wetlands by enabling landowners to sell easements which take wetlands out of production.	Assistance includes purchase by the Federal government of easements from landowners who have owned the land for one year and have farmed the wetlands, or prior converted wetlands. There are no repayment requirements. Landowners submit an intention to enter into the program through the USDA NRCS field office. NCRS, in consultation with the U.S. Fish and Wildlife Service, will determine eligibility and develop a wetland reserve plan of operation.		Wetlands protection	The Federal government provides a lump sum payment for easements; there is a 25% cost-share for wetland restoration.	Continuous sign-up	Doug Sharer, Texas State Office, NRCS, 254-742-9825 Doug.sharer@tx.usda.gov www.nrcs.usda.gov

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Disaster Relief/ Urgent Needs Fund of the Texas Community Development Program (Small Cities' CDBG Program)	Housing and Community Development Act of 1974, as amended	HUD	To rebuild viable communities impacted by a natural disaster or urgent, unanticipated needs posing serious threats to health and safety by providing decent housing, suitable living environments and economic opportunities. Funds are available to cities under 50,000 in population and to small rural communities located in counties that have a non-metropolitan population under 200,000.	Assistance includes Project Grants from the Disaster Relief/Urgent Needs Fund to address damages caused by natural disaster or to meet urgent water or sewer needs where there is an unanticipated, serious threat to health and safety. The focus is on projects that meet "basic human needs" such as safe and sanitary sewer systems, clean drinking water, adequate housing, drainage and flood control, passable streets, economic development and other eligible activities. This Fund may also be used for the nonfederal match for selected Federal disaster programs.	Disaster Relief Fund requires a disaster declaration by the President or Governor. Urgent Needs Fund requires an invitation to submit an application from a Committee composed of ORCA, TCEQ, and TWDB.	Multiple disasters, included in a State or Federal declaration.	Urgent needs funds require 10% non-Federal match for communities with a population less than 1,500; 20% for communities with populations over 1,500.	No specific deadline	Gus Garcia Office of Rural Community Affairs, 512-936-7876 (until August 2004), then Charlie Stone at 512-936-6737 Gus.garcia@ orca. State.tx.us www.orca.State .tx.us
Texas Community Development Program (Small Cities' Community Development Block Grant (CDBG) Program)	Housing and Community Development Act of 1974, as amended	U.S. Depart-ment of Housing and Urban Develop-ment (HUD)	To build viable communities by providing decent housing and suitable living environments, and by expanding economic opportunities, principally for Texans of low and moderate income. CDBGs provide resources to cities under 50,000 in population and to small rural communities located in counties that have a non-metropolitan population under 200,000. Projects meet "basic human needs" such as safe and sanitary sewer systems, clean drinking water, disaster relief and urgent needs, housing, drainage and flood control, passable streets, and economic development.	Assistance includes competitive grants awarded from several funds. The Planning/Capacity Building Fund provides up to $50,000 for planning to assess local needs, develop strategies to address them, and build or improve local capacity in low to moderate income communities. Emphasis is on public works and housing assistance planning. The Community Development Fund addresses public facility and housing needs, including sewer and water system improvements, street and drainage improvements, service projects and housing rehabilitation.		Flooding, water supply and water quality	A non-Federal match is required for Planning/ Capacity Building Fund, on a sliding scale based on population. No match required for the Community Development Fund, but availability of matching funds improves the likelihood of funding.	Availability of funding will be announced in the Texas Register.	Oraliv Cardenas Office of Rural Community Affairs, 512-936-7890 Ocardenas@ orca. State.tx.us www.orca.State .tx.us

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Drinking Water State Revolving Fund	Safe Drinking Water Act, Section 1452	U.S. Environ-mental Protection Agency (EPA) funded and administered in the State by TCEQ and the TWDB.	To finance projects for public drinking water systems that facilitates compliance with primary drinking water regulations or otherwise significantly furthers the health protection objectives of the Safe Drinking Water Act.	The Drinking Water State Revolving Fund provides loans at below market rates for up to 20 years, although disadvantaged communities may qualify for up to 30 years. Loans can be used for planning, design and construction of projects to upgrade or replace water supply infrastructure, to correct exceedances of Safe Drinking Water Act health standards, to consolidate water supplies and to purchase capacity in water systems. Loan proceeds may also be used to purchase land rights integral to the project. Under the Source Water Protection Program, an applicant may apply for a loan to purchase land or conservation easements, if the purpose of the purchase is to protect the source water of a public water system from contamination and to ensure compliance with national primary drinking water regulations. Loans may also be used o repair, replace, or relocate community water systems damaged by flooding.	An approved Water Conservation Plan and environment-al review are required. While the Drinking Water State Revolving Fund may be used to repair, replace or relocate systems damaged by flooding, a Presidential declaration of disaster is not required.	Water supply and quality	None. Local municipalities receive loans and make payments to the State Revolving Fund.	Prospective applicants submit information to TWDB for inclusion in an Intended Use Plan. TCEQ prioritizes proposed projects. Loan funds are distributed based on priority rating	Donna Miller, EPA Region VI, Dallas, 214-665-7130 Miller.donna@ epa.gov www.epa.gov -------- Ignacio Madera, Jr., TWBD, 512-463-8489, Ignacio.madera @twdb.State. tx.us ------- Anthony Bennett, TNRCC, 512-239-6020

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Nonpoint Source Grant Program	Federal Clean Water Act, Section 319	EPA TCEQ administers the non-agricultural nonpoint source program. The Texas State Soil and Water Conservation Board (TSSWCB) administer the agricultural and silvicultural nonpoint source program.	To support implementation of management measures and programs to address the problem of nonpoint source pollution through the identification of water quality problems, developing control strategies, and implementing activities or best management practices (BMPs) to prevent or abate nonpoint source pollution problems. Funding priorities are determined, in part, based upon rankings from two lists generated by TNRCC and approved by the U.S. Environmental Protection Agency. The first is a 1998 State of Texas Water Quality Inventory under Section 305(b) of the Clean Water Act. The second is a 2000 Clean Water Act, Section 303(d) list of Impaired Water Bodies.	Competitive grants are awarded for projects such as master planning, BMP implementation, nonregulatory and regulatory programs for enforcement, technical assistance, financial assistance, education, training, technology transfer, and water quality monitoring. Watershed management projects that comprehensively address the major sources of nonpoint source pollution affecting water quality will be given priority for funding. Projects that implement storm water permit requirements under the Texas Pollutant Discharge Elimination System (TPDES) program are not eligible for funding; however, storm water management activities not required by permit may be eligible for assistance.	To be eligible for funding, a project must target nonpoint source pollution in a watershed designated in the Nonpoint Source Assessment Report and be consistent with the State of Texas Nonpoint Source Management Program. EPA will not allow funding projects that implement conditions of a permit.	Water quality	A 40% non-Federal match is required, which may be in the form of in-kind services or expenditures. Clean Rivers Program funds may be used as a non-Federal match for the Nonpoint Source Grant Program and other Federal programs.		Linda Brookin, Project Manager, Watershed Management Team, TNRCC, 512-239-4625, lbrookin@tceq.State.tx.us www.tceq.State.tx.us/water/quality/nps
Water Protection Coordination Grants	Department of Defense and Emergency Supplement-al Appropriations for Recovery from and Response to Terrorist Attacks on the US Act of 2002 (P.L. 107-117)	EPA	Formula grants to support coordination activities on critical water infrastructure protection efforts that include work with water utilities as well as Federal, State, and local agencies.	Funded coordination activities include, but are not limited to: ensuring the quality of drinking water utility vulnerability assessments and related security enhancements; developing and overseeing emergency response and recovery plans; and, providing technical assistance, training and education.		Terrorism and its impact on water quality	No matching requirement.		Pat Minami, EPA Water Protection Task Force, Washington, D.C. 202-564-4654. minami.patricia@epa.gov

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Water Quality Cooperative Agreements	Clean Water Act, Section 104(b)(3)	EPA	For unique and innovative projects that address the requirements of the National Pollutant Discharge Elimination Systems (NPDES) program.	Assistance includes financial assistance through Cooperative Agreements with EPA for research, investigations, experiments, training, demonstrations, surveys and studies related to the causes, effects, extent, prevention, reduction, and elimination of water pollution. Special emphasis is placed on "wet weather" activities, i.e., storm water, sanitary sewer overflows, and concentrated animal feeding operations as well as projects that enhance the ability of the regulated community to deal with non-traditional pollution problems in priority watersheds.	Must address "wet weather" pollution discharge.	Water quality	5% minimum nonfederal matching requirement.		Teresita Mendiola, EPA Region VI, 214-665-7144 Mendiola.teresita@epa.gov www.epa.gov

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Watershed Initiative Grants	Clean Water Act, Section 104 (b)(3)	EPA	A competitive grant program to encourage the protection and restoration of water bodies using watershed approaches.	Up to 20 watersheds throughout the country will be selected by EPA under a competitive process to support promising watershed-based approaches to clean water. This initiative encourages Coalition-based strategies for attaining water quality standards and improving water resource protection and restoration at the watershed level. Typical grants will range from $300,000 to $1.3 million, depending on appropriations. Watersheds must be nominated by Governors or Tribal Leaders. Two nominations from each State are invited. Eligible activities include the conduct and promotion of the coordination and acceleration of activities such as demonstrations, training, education, experiment investigations, surveys, studies, and research relating to the cause, effect, extent, prevention, reduction, and elimination of water pollution.		Clean water on a watershed basis.	25% non-Federal matching requirement.		Brad Lamb, EPA Region VI, 214-665-6683, lamb.brad@ epa.gov
Wetlands Grants	Clean Water Act, Section 104(b)(3)	EPA	To encourage wetlands program development and build the capacity of States, Tribes, local governments or associations to effectively protect wetland and riparian resources.	Assistance includes Project Grants that are competitively awarded for development of plans and management tools for protection of wetlands resources; advancing the science and technical tools for evaluating, protecting, and restoring wetlands health; facilitating development of watershed stakeholder partnerships; and improving understanding of wetlands.		Flooding and water quality	25% nonfederal cost share		Tyrone Hoskins, EPA Region VI, 214-665-7187 Hoskins.tyrone @epa.gov EPA Wetlands Helpline at 800-832-7828 www.epa.gov

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Special Volunteer Programs) and Retired and Senior Volunteer Program (RSVP)		Corporation for National and Community Service	To strengthen communities and organizations in using service and volunteers to support public safety, public health and disaster relief and preparedness.	Financial assistance is available to support a volunteer program to support public safety, public health and disaster relief and preparedness. In the area of disaster relief and preparedness, volunteers may support immediate and long-term recovery efforts, as well as preparedness and mitigation. They may assist in disaster preparedness and mitigation, run emergency shelters, help law enforcement, provide food and shelter, manage donations, assess and repair damage, and help families and communities rebuild.		Multiple hazards	No minimum-matching requirement for Special Volunteer Programs, although grantees must provide a non-Federal contribution. For RSVP grants, there is a 10% match for the first year of the grant; 20% for the second year; and 30% for the third year.		Cee Cee Molineaux, Emergency and Homeland Security Coordinator, Corporation for National and Community Service, 202-606-5000 cmolineaux@ csn.gov www. nationalservice. org

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
All Hazards Emergency Operational Planning	2002 Supplement-al Appropriations Act for Further Recovery From and Response To Terrorist Attacks on the U.S. (P.L. 107-206)	Department of Homeland Security	To provide for all-hazards emergency operational planning.	This assistance is to conduct emergency operations updating for all hazards, with a special emphasis on incidents of terrorism, including use of weapons of mass destruction. Funds may also be used to incorporate inter- and intra-State mutual aid agreements, facilitate communication and interoperability protocols, establish a common incident command system, address critical infrastructure protection, conduct assessments to determine emergency planning priorities, address continuity of operations and government, and provide for effective use of volunteers in preparedness and response activities. A total of $100 million was available under the Supplemental Appropriations. States apply for the operations planning funds, and local governments are sub-grantees of the State. Funds are allocated to the states on the basis of population. Each State that receives grant funds will be required to pass along at least 75% of the funds to local governments.		Multiple hazards, with a special emphasis on incidents of terrorism.	No matching requirements		Dick Harmon Federal Emergency Management Agency (FEMA) Region VI Terrorism Preparedness, 940-898-5346 Dick.Harmon@ fema.gov --- Charlie Todd, Texas Engineering Extension Service, 979-458-6815

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Antiterrorism and Emergency Assistance Program	Victims of Crime Act of 1984 [42 U.S.C. §10601], as amended	Department of Homeland Security	To provide assistance programs for victim needs in the aftermath of an act of mass violence or terrorism occurring within and outside the United States and a compensation program for victims of international terrorism.	A. Crisis Response Grant - emergency/short-term to help rebuild adaptive capacities, decrease stressors, and reduce symptoms of trauma immediately following incident. B. Consequence Management Grant - Funding up to 18 months to help victims adapt to the trauma event and to restore the victims' sense of equilibrium. C. Criminal Justice Support Grant- Funding up to 36 months to help facilitate victim participation in an investigation and prosecution related to an act of terrorism or mass violence. D. Crime Victim Compensation Grant- Funding to reimburse victims for out-of-pocket expenses related to an act of terrorism or mass violence. E. Training and Technical Assistance- Funding to assist in identifying resources, assessing needs, coordinating services to victims, and developing strategies for responding to an act of terrorism or mass violence.		Terrorism or mass violence	No matching requirements		Department of Homeland Security, 1–800–421–6770 www.dhs.gov

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Assistance to Firefighters Grant	Defense Authori-zation Bill of 2001 (P.L. 106-398), as amended by Section 33 of the Fire Prevention and Control Act of 1974.	Department of Homeland Security	Competitively awarded project grants to provide direct assistance, on a competitive basis, to fire departments for the purpose of protecting the health and safety of the public and firefighting personnel against fire and fire-related hazards.	Grants may be used for (1) firefighter operations and firefighter safety, to include: training, wellness and fitness, firefighting equipment, personal protective equipment, and other equipment and supplies; (2) emergency medical services, emergency medical vehicles, training, equipment/props/supplies, transportation, contracts/consultants, and program personnel protecting the public from fire and fire-related hazards, including public awareness, public education, inspector certifications, building code development and enforcement, arson prevention and detection; (3) firefighting vehicles, including pumpers, engines, tankers/tenders, brush trucks/attack pumpers, rescue, quints, aerial apparatus, hazardous material, ambulance/transport, communications/command, foam units, boats, and equipment for the vehicle.		Fire hazard	$750 million available nationwide in FY 2004. Cost shares vary by population served by fire department. Applicants who protect a population of 50,000 or less have a 10% non-Federal cost share. Applicants who protect more than 50,000 have a 30% non-Federal cost share.	Will be announced in the Federal Register	Brian Cowan, Chief, Fire Grants Program Branch, DHS, Washington, D.C., 202-307-0052 Brian.cowan@dhs.gov

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Citizen Corps	Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C. 5121 - 5206	Department of Homeland Security	The Citizens Corp Program supports and promotes efforts to involve a wide range of volunteer groups in activities that enhance individual, community, and family preparedness and contribute to the strengthening of homeland security.	The FY 2004 Citizens Corp funds provide resources to State and local communities to: 1) bring together the leadership to form and sustain a Citizens Corp Council; develop and implement a plan for the community to engage all citizens in homeland security, community preparedness and family safety; 3) conduct public education and outreach to inform the public about their role in crime prevention, mitigation, emergency preparedness and public health measures and encourage personal responsibility and action; 4) develop and implement Citizens Corp programs offering training and volunteer opportunities to support Community Emergency Response Teams, Neighborhood Watch, Volunteers in Police Service, and Medical Reserve Program; and 5) coordinate Citizens Corp activities with other DHS funded programs and initiatives.		Multiple hazards	$1.826 million is available in Texas in 2004. No matching is required.	Local applications for Citizens Corp Program grants go through the Councils of Government. Contact the Criminal Justice Manager of your local Council of Government for the application deadline for 2004 funds.	Erin McCormack, Director of Criminal Justice Services, Texas Association of Regional Councils, (512) 472-9070, erin@txregionalcouncil.org www.txregionalcouncil.org/ www.citizencorps.gov
Community Emergency Response Teams (CERT)	Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C. 5121 - 5206	Department of Homeland Security	To assist State and local efforts to start or expand CERT training and activities that contribute to the strengthening of homeland security by enhancing individual, community, family, and workplace preparedness.	Localities receiving grants may use the funding for organizing, training, equipping, and maintaining CERTs.	CERT funds must be used for activities described in the CERT guidance materials.	Multiple hazards	No matching requirements. States are allocated funding on a formula based on legislation.	Contact the Criminal Justice Manager of your local Council of Government for the application deadline for 2004 funds.	Erin McCormack, Director of Criminal Justice Services, Texas Association of Regional Councils erin@txregionalcouncil.org www.txregionalcouncil.org/ (512) 472-9070

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
COPS Inter-operable Communica-tions Technology Program	Homeland Security Act of 2002, Public Law 107-296	Department of Homeland Security	To help communities develop effective interoperable communications systems for public safety and emergency service providers. Interoperable Communications Technology grants fund demonstration projects that explore uses of equipment and technologies to increase interoperability among the law enforcement, fire service, and emergency medical service communities. These projects are the result of thorough and rigorous planning, and demonstrate how new technologies and operating methods can help communities achieve interoperability.	- Interoperable communications equipment for multi-disciplinary and multi-jurisdictional public safety communications projects. - Providing local jurisdictions with the equipment or services they need to participate on larger public safety, commercial, or other shared networks. - Purchasing and deploying of portable gateway solutions. - Any other technology that can be demonstrated to significantly increase interoperability within the public safety community.	Local governments nominated by State or Territory government to submit an application.	Communications	Grant awards will require a 25 percent nonfederal cost share. The source of the match funds must be identified in the grant application.	States are asked to nominal local jurisdictions.	Department of Homeland Security, Office of Community Oriented Police Services (COPS) 202-282-8000 www.dhs. gov
Emergency Operations Center Funding	2002 Supplemental Appropriations Act for Further Recovery From and Response To Terrorist Attacks on the U.S. (P.L. 107-206)	Department of Homeland Security	To support development or improvement of Emergency Operating Centers (EOCs)	$56 million was made available nationwide under the 2002 Supplemental Appropriation. Funding is to be awarded in two phases. In the first phase, each State will be allocated $50,000 for an initial assessment of the hazards, vulnerabilities, and resultant risk to its existing EOC. If a State has already completed an assessment of its EOC, it may use the funds for assessments of local EOCs. Phase 2 grants are to address immediate EOC deficiencies nationwide and will require a 50% non-Federal cost share. Funding is allocated under Phase 2 based on several national priorities, including modifications to EOCs to support secure communications, new and retrofit construction, architectural and engineering services, and physical modifications to enhance security.		Multiple hazards, with a special emphasis on incidents of terrorism.	50% non-Federal cost share		Dee Dee Powell, Division of Emergency Management, Texas Department of Public Safety, (512) 424-2430

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Emergency Management Performance Grant (EMPG)	Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended, Titles II and VI.	Department of Homeland Security	To develop comprehensive, all-hazards emergency management at the State and local levels and to improve capabilities for emergency planning, preparedness, mitigation, response and recovery.	Assistance includes grant funding covering 13 key functional areas of emergency management, including: laws and authorities; hazard identification and risk assessment; hazard management; resource management; planning; direction, control and coordination; communications and warning; operations and procedures; logistics and facilities; training; exercises; public education and information; and finance and administration. As FEMA funding for the EMPG program has remained essentially level for the last several years, no jurisdictions were added to the program in FY 2001, FY 2002, and FY 2003. It is considered unlikely that jurisdictions will be added to the program in the coming years unless there is a significant increase in program funding.		Multiple hazards	50% nonfederal cost share	Target dates and any applicable deadlines are provided annually by the Division of Emergency Management, Texas Department of Public Safety.	Russ Lecklider, Division of Emergency Management, Texas Department of Public Safety, 512-424-2453 Russ.Lecklider @txdps. State.tx.us www.txdps. State. tx.us/dem
Fire Management Assistance Grants	Robert T. Stafford Disaster Relief and Emergency Assistance Act	Department of Homeland Security	To provide project grants and the provision of specialized services for the mitigation, management, and control of fires that threatens such destruction as would constitute a major disaster.	Grants are used for the mitigation, management and control of any fire on publicly (non-Federal) or privately owned forestland or grassland that threatens such destruction as would constitute a major disaster. This program replaces the former Fire Suppression Assistance Program. This program may cover pre-positioning of resources for up to 21 days.	The Governor or his Authorized Representative must request a fire management assistance declaration through the FEMA Regional Director in order to trigger assistance.	Forest or grassland fire hazard	May be a 25% non-Federal cost share if total eligible costs for the declared fire exceed certain thresholds.	Requests for a fire management assistance declaration and assistance must be submitted when fire is burning uncontrolled and threatens such destruction as would constitute a major disaster.	Curtis Carleton, FEMA, Response, and Recovery Directorate, Washington, D.C., 202-646-4535. Curtis.Carleton @dhs.gov

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
First Responder Counter-Terrorism Training Assistance	Omnibus Consolidated Appropriations Act of 1997 (P.L. 104-208)	Department of Homeland Security	Project grants to enhance the capabilities of first responders in managing the consequences of terrorist acts.	Training is provided through each of the 50 States through individual State fire training systems. The training is targeted to first responders, those who will come into contact with and will be forced to manage the consequences of terrorist acts.		Terrorist acts	No cost share is required.		John Kimball, National Fire Academy, FEMA, Emmitsburg, MD 301-447-1533 John.Kimball@dhs.gov
Flood Hazard Mapping Program	Code of Federal Regulations, Title 42, Chapter 50; April 30, 2002 Federal Register Notice	Department of Homeland Security	To identify, publish and update information on all floodprone areas of the United States in order to inform the public on flooding risks, support sound floodplain management, and set flood insurance premium rates. Because flood hazard conditions change over time due to natural and manmade changes in watersheds and floodplains, FEMA provides grant funds to designated Cooperating Technical Partners (CTPs) and others to develop up-to-date flood hazard data; provide maps and data in digital format; integrate FEMA's community and State partners into the process; and raise public awareness of flood risks.	Assistance includes financial assistance in the form of grants to Cooperating Technical Partners and other entities; and FEMA technical assistance, support and data. Financial assistance is provided for activities such as refinement of Zone A boundaries; hydrologic and hydraulic analyses and floodplain mapping; Digital Flood Insurance Rate Map (DFIRM) production; and re-delineation of floodplain boundaries using updated topographic data. FEMA technical assistance services are provided in the form of base map inventory; digital base map data sharing; DFIRM maintenance; hydrologic and hydraulic review; assessment of community mapping needs to support the Map Needs Update Support System; and technical standards agreements.	Generally, funding flows through Cooperating Technical Partners that have signed a formal agreement to work with FEMA.	Flooding	Cost shares are negotiated between FEMA and recipients; generally a 20% hard or soft match is sought.	Map needs should be included in FEMA's Mapping Needs Update Support System (MNUSS) database. Assistance is requested by letter to the FEMA Region.	Jack Quarles, Mitigation Division, FEMA Region VI, 940-898-5156; Jack.Quarles@dhs.gov www.dhs.gov

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Flood Mitigation Assistance Grants (FMA)	National Flood Insurance Reform Act of 1994	Department of Homeland Security	To assist States and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insured through the National Flood Insurance Program (NFIP). FMA Grants are aimed at reducing the number of repetitive loss structures insured through the NFIP. Emphasis is on reducing damage to properties that have experienced four or more losses, or that have experienced two or more losses where the cumulative payments exceed the property value.	Assistance includes Planning and Project Grants for participating NFIP communities. Planning Grants may be used to develop or update Flood Mitigation Plans. Project grants may be used for flood mitigation measures such as: acquisition of insured structures and real property; dry floodproofing of insured structures; and elevation of insured structures.	Only activities specified in a FEMA-approved Flood Mitigation Plan are eligible for an FMA Project Grant.	Flooding	25% nonfederal cost share, of which up to 12.5% may be provided as an in-kind contribution		Gilbert Ward, Texas Water Development Board, Research and Planning Fund, 512-463-6418 GWard@ twdb.State.tx.us www.twdb.State.tx.us
Flood Recovery Mapping	Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended	Department of Homeland Security	To provide funds from FEMA's Disaster Relief Fund to map areas affected by disaster in order to assist in the response and recovery efforts.	Assistance includes grants to Cooperating Technical Partners and other entities; and FEMA technical assistance, support and data. Recovery Maps can be quite detailed and the data collected as part of the recovery mapping process may ultimately be used in the process of developing or updating Flood Insurance Rate Maps.	Requires a Presidential declaration of disaster	Flooding	Cost shares negotiated between FEMA and recipients	No specific deadline	Jack Quarles, FEMA Region VI, 940-898-5156 Jack.Quarles@ dhs.gov www.dhs.gov

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Hazard Mitigation Grant Program (HMGP)	Robert T. Stafford Disaster Relief and Emergency Assistance Act, Section 404	Department of Homeland Security	To provide States and local governments financial assistance to permanently reduce or eliminate future damages and losses from natural hazards through safer building practices and improving existing structures and supporting infrastructure.	According to rules issued February 26, 2002 (44 CFR, Parts 201 and 206) and amended Oct. 1, 2002, to be eligible for HMGP Project Grants after November 1, 2004, a local jurisdiction must have in place a FEMA-approved local hazard mitigation plan. Assistance includes Planning Grants and Project Grants. Total grants to States equal up to 7.5% of obligations for Individual and Public Assistance. Project Grants are for acquisition of real property; relocation and demolition of structures; strengthening of existing structures; initial implementation of vegetation management programs; initial training of architects, engineers, building officials, etc. to facilitate the implementation of newly adopted State or local mitigation standards and codes; elevation of residential structures; elevation or dry flood-proofing of non-residential structures; and other activities that bring a structure into compliance with NFIP floodplain management requirements.	Post-disaster, covering all hazards. A Presidential Declaration of disaster is required.	Multiple hazards	25% non-Federal cost share, which can be a combination of cash, in-kind services, or materials.	Within 60 days of a disaster declaration, the State must submit a Letter of Intent to FEMA to participate in HMGP. New project proposals must be submitted for approval within 90 days after FEMA approves the State's hazard mitigation plan for the disaster.	Greg Pekar, Division of Emergency Management, Texas Department of Public Safety, 512-424-2454 Gregory.Pekar @txdps.State. tx.us www.soc.State. tx.us

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Hazardous Materials Assistance Program (CERCLA Implementa-tion)	Comprehensive Environ-mental Response, Compensation and Liability Act (CERCLA) of 1980, as amended	Department of Homeland Security	To provide technical and financial assistance through the States to support State, local, and tribal governments in oil and hazardous materials emergency planning and exercising. To enhance State, tribal and local governments capabilities to inter-operate with the National Response System. To support the Comprehensive Hazardous Materials Emergency Response-Capability Assessment Program.	Funds are to be used for planning, exercising and educational capabilities for dealing with oil and hazardous materials releases. Certain equipment purchases are not authorized.		Hazardous materials releases	The FEMA Regional PT office determines the allocation for each applicant, based on the proposal, the FEMA/EPA Interagency Agreement, and previous funding and accomplishments.		Preparedness Division Director, FEMA Region VI, 940-898-5104 --- Readiness, Response and Recovery Division, FEMA, Washington, D.C. 202-646-4542.
Hazardous Materials Training Program	Comprehensive Environ-mental Response, Compensation and Liability Act (CERCLA) of 1980, as amended	Department of Homeland Security	To make funding available to provide training in support of Tribal governments emergency planning, preparedness, mitigation, response and recovery capabilities. These programs must provide special emphasis on emergencies associated with hazardous chemicals.	Funds must be used for planning, exercising, and educational projects that will serve to enhance emergency management capabilities for dealing with oil and hazardous materials releases. Certain equipment purchases are not authorized.	Funds are available only to Federally-recognized Indian Tribal Governments.	Hazardous materials incidents	20% non-Federal match required		Preparedness Division Director, FEMA Region VI, 940-898-5104 --- Readiness, Response and Recovery Division, FEMA, Washington, D.C. 202-646-4542.

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Hurricane Local Grant Program	Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended	Department of Homeland Security	To enhance hurricane-related public awareness and education. This program is open to all incorporated cities and inter-jurisdictional emergency management agencies within the 22 counties in which hurricane risk areas have been identified by the State of Texas Department of Public Safety.	Assistance includes competitive grant awards. Eligible uses include one-time expenses for pamphlets, hurricane preparedness materials, hurricane-related computer software, and purchase of audio-visual equipment.		Hurricane hazards	In 2003 and subsequent years, a 50% non-Federal match may be instituted.		Mike Peacock Division of Emergency Management, Texas Department of Public Safety, 512-424-2597 Mike.Peacock @txdps.State.tx.us www.soc.State.tx.us
Law Enforce-ment Terrorism Prevention Program	U.S. Patriot Act	Department of Homeland Security	To provide law enforcement communities with enhanced capabilities for detecting, deterring, disruption, and preventing acts of terrorism.	Assistance in FY 2004 is provided for the following activities: 1) information sharing to preempt terrorist attacks; target hardening to reduce vulnerability of selected high value targets; 3) threat recognition to recognize the potential or development of a threat; 4) intervention activities to interdict terrorists before they can execute a threat; 5) interoperable communications; and 6) management and administration.		Terrorist attack	$26.079 million is available in Texas in FY 2004. There is no non-Federal matching requirement.	States are to obligate not less than 80% of the total grant amount to local units of government within 60 days after grant award to the State.	Charlie Todd, Texas Engineering Extension Service, 979-458-6815
National Dam Safety Program	Water Resources Development Act of 1996, Section 215	Department of Homeland Security	To encourage the establishment and maintenance of effective State programs intended to ensure dam safety, to protect life and property, and to improve State Dam Safety Programs.	Assistance includes Project Grants to States to establish and maintain effective Dam Safety Programs. While only States are eligible for financial assistance, the State program provides periodic inspections during dam construction; approval upon completion of dam construction; inspections at least every 5 years of all dams and reservoirs that would pose a significant threat to human life and property in case of failure; and a system of emergency procedures to use if a dam fails or if failure is imminent.	Pre-disaster, covering dam failures and resultant flooding hazards.	Flooding	50% nonfederal cost share required	October 1 of each year.	Chau Vo, State Dam Safety Officer, Texas Natural Resources Conservation Commission, 512-239-4763 Cvo@tceq. State.tx.us www.tceq.State. tx.us

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
National Flood Insurance Program (NFIP)	National Flood Insurance Act of 1968, as amended by the Flood Disaster Protection Act of 1973 and the National Flood Insurance Reform Act of 1994	Department of Homeland Security	To (1) provide financial protection by enabling persons to purchase insurance against physical damage to, or loss of, buildings and/or contents caused by floods, mudslide, or flood-related erosion; and (2) promote wise floodplain management practices in the Nation's flood-prone areas.	Assistance includes Federally backed insurance against flooding, available to individuals and businesses in communities that participate in the NFIP. Insurance is sold to the public through State licensed property and casualty insurance agents and brokers. Discounted premiums are available in communities that participate in the Community Rating System. Increased Cost of Compliance coverage provides up to $20,000 to help policyholders offset the costs associated with floodproofing, elevating, demolishing or relocating buildings that are substantially damaged or subject to repetitive flood loss. Local governments are encouraged to purchase insurance covering public facilities.	Pre-disaster covering losses from floods, mud-slides or flood-related erosion Insurance must be in effect for 30 days before coverage begins.	Flooding			Mike Howard, State NFIP Coordinator, Texas Natural Resources Conservation Commission, 512-239-6155 Mhoward@ tceq.State.tx.us www.tceq.State . tx.us

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Pre-Disaster Mitigation Grant Program (PDM)	Robert T. Stafford Act, Section 203, as amended by Section 102 of the Disaster Mitigation Act of 2000	Department of Homeland Security	To provide funding for States and communities for cost-effective hazard mitigation activities that complement a comprehensive hazard mitigation program and reduce injuries, loss of life, and damage and destruction of property. FEMA rules are in the Federal Register (February 26, 2002, 44 CFR 201 and 206) and amendments (October 1, 2002). These rules require that local governments have a FEMA-approved local hazard mitigation plan by November 1, 2004 to be eligible to receive project funding from the Hazard Mitigation Grant Program. For the Pre-Disaster Mitigation Grant program, plans must be approved by November 1, 2003 to remain eligible for project grants. Regional watershed- or basin-wide projects involving a number of jurisdictions will get favorable consideration in the selection process.	Assistance includes Planning and Project Grants. Eligible activities include planning, risk assessment, and implementation of cost-effective loss reduction measures. Eligible activities include: management costs, information dissemination, planning, technical assistance (including risk assessments and engineering and design studies), and cost-effective mitigation projects. Mitigation projects include any actions that result in elimination or long-term reduction of damages to public or private property from natural hazards, including: property acquisition or relocation; structural and non-structural retrofitting for wildfire, seismic, wind, or flood hazards; minor structural hazard control or protection projects such as vegetative and stormwater management (culverts, floodgates, retention basins); and localized flood control projects designed to protect critical facilities.	State and local plans are required prior to approval of project grants. Major flood control projects such as dikes, levees, floodwalls, groins, dams, jetties, beach nourishment, and waterway channelization are not eligible.	Multiple hazards	25% nonfederal cost share, except for small, impoverished communities which have a 10% cost share		Mary Evan, Division of Emergency Management, Texas Dept. of Public Safety, 512-424-2397 Mary.Evan@tx dps.State.tx. us www.txdps. State.tx.us/dem

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Public Assistance Grants (PA)	Robert T. Stafford Disaster Relief and Emergency Assistance Act	Department of Homeland Security	To provide supplemental assistance to States, local governments, political subdivisions of the State, Indian Tribes, and certain private non-profit organizations to meet emergency needs and repair infrastructure.	According to rules issued February 26, 2002 (44 Code of Federal Regulations, Parts 201 and 206), a local jurisdiction must have in place a FEMA-approved local hazard mitigation plan to be eligible for certain forms of PA grants after November 1, 2003. Assistance includes Project Grants for removal of wreckage and debris from private and public lands; performance of emergency protective measures; provision of emergency transportation and communications; and permanent restoration of eligible facilities.	Post-disaster, covering all hazards. A Presidential Declaration of disaster is required.	Multiple hazards	25% nonfederal cost share	A request must be submitted by the applicant within 30 days of the President's emergency or major disaster declaration.	Ben Patterson, PA Officer, Division of Emergency Management, Texas Department of Public Safety, 512-424-2876 Ben.Patterson @txdps.State.tx.us www.txdps. State. tx.us/dem

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Section 406 Hazard Mitigation Funding	Robert T. Stafford Disaster Relief and Emergency Assistance Act	Department of Homeland Security	To provide discretionary funding to add hazard mitigation measures to permanent work restoration under the PA grant program, in order to enhance a facility's ability to resist similar damage in future disaster events.	Section 406 Hazard Mitigation is a discretionary spending program to fund mitigation measures in conjunction with the repair of damaged facilities. The mitigation measures must be related to eligible disaster-related damages and must directly reduce the potential of future similar disaster damages to the eligible facility. Mitigation measures must be cost-effective. Examples include: dry floodproofing; elevation of electrical panels, machinery rooms, and emergency generators above base flood elevation; drainage structures; installing debris traps; dry floodproofing of pump stations; elevation of equipment and controls and dry or wet floodproofing of wastewater treatment plants; installation of shut-off valves so that damaged sections of underground pipelines can be isolated; strengthening base connections on above ground storage tanks; burying electric lines; and replacing damaged electrical poles with higher-class poles.	A Presidential Declaration of emergency or major disaster is required, with PA grant assistance provided. All hazards may be covered. Eligible work must be carried out in conjunction with the repair of disaster-related damages under the PA program.	Multiple hazards	25% nonfederal cost share	60 days after Presidential disaster declaration	Ben Patterson, PA Officer, Division of Emergency Management, Texas Department of Public Safety, 512-424-2876 Ben.Patterson @txdps.State.tx.us www.soc.State.tx.us

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
State and Local Domestic Preparedness Training Program	U.S.A. Patriot Act of 2001 (P.L. 107-56)	Department of Homeland Security	Project grants to members of the National Domestic Preparedness Consortium to provide training to State and local governments to enhance their capacity to respond to Weapons of Mass Destruction terrorism incidents, involving chemical, biological, nuclear, radiological, incendiary, and explosive devices.	Project grants are provided to members of the National Domestic Preparedness Consortium to provide training to State and local units of government. Consortium members include: the Energetic Materials Research and Test Center at the New Mexico Institute of Mining and Technology; Louisiana State University; the Nevada Test Site in the Department of Energy; and the National Emergency Response and Rescue Training Center at Texas A&M University. Over 30 different courses are offered. Past efforts have trained over 800,000 first responders. Courses are designed to increase awareness of terrorism threats and weapons of mass destruction among public officials, the public health and medical community, public safety and public works personnel, as well as provide intensive technician and operations courses that demonstrate the effects of and response to live agents, explosives and radiation.		Weapons of mass destruction terrorism incidents	No matching requirements.		Charlie Todd, Texas Engineering Extension Service, 979-458-6815

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
State Homeland Security Program	U.S. Patriot Act	Department of Homeland Security	To provide funds to enhance capability of State and local units of government to prevent, deter, respond to, and recover from incidents of terrorism involving chemical, biological, radiological, nuclear, and explosive weapons and cyber attacks. The funds support costs related to homeland security and emergency operations planning activities; the purchase of specialized equipment; the design, development and conduct of a State CBRNE and cyber security training programs and attendance at Office of Domestic Preparedness-sponsored courses; the design, development, conduct and evaluation of CBRNE and cyber security exercises; and other costs to implement the State Homeland Security Strategies. This program also provides certain funding to address agricultural security.	Funding may be used in any of five categories: 1) planning; 2) equipment acquisitions; 3) training; 4) exercise; 5) management and administration. Other than a 3% cap on Management and Administration funds, there are no restrictions on allocation of funds across these categories.		Terrorist events	$87.888 million is available in Texas for 2004. There is no non-Federal matching requirement.	States are to obligate not less than 80% of the total grant amount to local units of government within 60 days after grant award to the State.	Charlie Todd, Texas Engineering Extension Service, 979-458-6815

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Pre-Disaster Mitigation Loans	1999	U.S. Small Business Administration	A pilot program to provide low interest, fixed rate loans to small businesses for the purpose of implementing mitigation measures to protect property from disaster-related damage.	This program was developed in support of FEMA's Pre-Disaster Mitigation Grant program. It covers businesses located in eligible communities (determined by FEMA to include those participating in a pre-disaster mitigation program). The pilot program was authorized at $15 million for each of five fiscal years from 2000 through 2004. SBA loans will be funded on a first-come, first-serve basis. The mitigation measures must protect property or contents from damage that may be caused by future disasters and must conform to the priorities and goals of the State or local government's mitigation plan. Borrowers may obtain up to $50,000 per year at a fixed rate of interest of 4%. Examples of mitigation measures include building retaining walls, sea walls, grading and contouring, and structure retrofitting. Loans for post-disaster mitigation are also eligible for damaged primary residences.		Multiple hazards	No matching is required with this loan program.	Applications are funded on a first-come, first-serve basis.	U.S. Small Business Administration, Regional Office, Dallas

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Aquatic Ecosystem Restoration	Water Resources Development Act of 1996, Section 206	USACE	To restore degraded aquatic ecosystems.	Assistance includes all project-related costs for feasibility studies, planning, engineering, construction, supervision, and administration for adopted restoration projects.		Flooding and habitat restoration	35% non-Federal contribution is required for project costs.	No specific application deadline. Contact the appropriate District Engineer to assist with filing the correct documentation.	Mike Mocek, Deputy District Engineer, Ft. Worth Office, U.S. ACE, 817-886-1515 mocek@swf02.usace.army.mil www.usace.army.mil ------ Col. Leonard Waterworth, District Engineer, Galveston Offfice., 409-766-3001 Leonard.d.waterworth.col@swg02.usace.army.mil www.usace.army.mil

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Aquatic Habitat and Wetlands	Water Resources Development Act of 1992, Section 204	USACE	To protect, restore and create aquatic and/or wetland habitats associated with dredging for authorized projects.	Assistance includes studies and projects for the protection, restoration and creation of aquatic and/or wetland habitats associated with dredging for authorized projects.		Flooding and habitat restoration	No non-Federal match required for Initial Appraisal costs. 25% match required for Feasibility studies. 25% non-Federal cost share for project costs.	No specific application deadline. Contact the appropriate District Engineer to assist with filing the correct documentation.	Mike Mocek, Deputy District Engineer, Ft. Worth Office, U.S. ACE, 817-886-1515 mocek@swf02.usace.army.mil www.usace.army.mil ------ Col. Leonard Waterworth, District Engineer, Galveston Office, 409-766-3001 Leonard.d.waterworth.col@swg02.usace.army.mil www.usace.army.mil

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Beach Erosion Control Projects	River and Harbor Act of 1962	USACE	To control beach and shore erosion to public shores.	Assistance includes specialized services for the design and construction of beach erosion control projects, including project planning and erosion control projects.		Beach erosion control	No cost share required for the first $100,000 of planning study costs. Over $100,000, a 50% cost share is required. A cost share is required for project costs.	There is no specific application deadline. Contact the appropriate District Engineer to assist with filling the correct documentation.	Col. Leonard Waterworth, District Engineer, Galveston Office, 409-766-3001 Leonard.d.waterworth.col@swg02.usace.army.mil www.usace.army.mil

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Clearing and Snagging Projects	Flood Control Act of 1954, as amended, Section 208	USACE	Provides for channel clearing and excavation, with limited embankment construction by use of materials from the clearing operations only.	Assistance includes studies and projects for channel clearing and excavation.		Flooding	No match required for study costs under $40,000. Over $40,000 there is a 35% non-Federal cost share. 35% non-Federal cost share required for project costs, of which 5% is required in cash.	No specific application deadline. Contact the appropriate District Engineer to assist with filing the correct documentation.	Mike Mocek, Deputy District Engineer, Ft. Worth Office, U.S. ACE, 817-886-1515 mocek@swf02.usace.army.mil www.usace.army.mil ------ Col. Leonard Waterworth, District Engineer, Galveston Office, 409-766-3001 Leonard.d.waterworth.col@swg02.usace.army.mil www.usace.army.mil

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Emergency Advance Measures for Flood Prevention	Flood Control Act of 1941, as amended	USACE	To protect against loss of life or damages to property given an immediate threat of unusual flooding.	Assistance includes aid from USACE for removal of waterway obstructions, and work necessary to prevent dam failure and prepare for abnormal snowmelt. Work performed must be temporary in nature and have a favorable benefit/cost ratio.	Immediate threat of flooding. A Presidential disaster declaration is not required.	Flooding	No match required	The Governor of the affected State must request assistance under an immediate threat of flooding.	Mike Mocek, Deputy District Engineer, Ft. Worth Office, U.S. ACE, 817-886-1515 mocek@swf02.usace.army.mil www.usace.army.mil ----- Col. Leonard Waterworth, District Engineer, Galveston Office, 409-766-3001 Leonard.d.waterworth.col@swg02.usace.army.mil www.usace.army.mil

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Emergency Rehabilitation of Flood Control Works or Federally Authorized Coastal Protection Works	Flood Control Act of 1941, as amended	USACE	To assist in the repair and restoration of flood control works damaged by flood, or of federally authorized hurricane flood and shore protection works damaged by extraordinary wind, wave, or water action.	Assistance includes emergency repair or rehabilitation of flood control works damaged by flood, and restoration of federally authorized coastal protection structures damaged by extraordinary wind, wave, or water action. Assistance does not extend to major improvements of flood control or federally authorized coastal protection structures, nor to reimbursement of individuals or communities for funds expended in repair or rehabilitation efforts.	Post-disaster. A Presidential disaster declaration is not required.	Flooding, including coastal flooding	20% non-Federal cost share required, in cash or in-kind services	No specific application deadline. Contact the appropriate District Engineer to assist with filing the correct documentation.	Mike Mocek, Deputy District Engineer, Ft. Worth Office, U.S. ACE, 817-886-1515 mocek@swf02.usace.army.mil www.usace.army.mil ----- Col. Leonard Waterworth, District Engineer, Galveston Office, 409-766-3001 Leonard.d.waterworth.col@swg02.usace.army.mil www.usace.army.mil

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Emergency Streambank and Shoreline Protection	Flood Control Act, as amended, Section 14	USACE	To prevent erosion damages to public facilities by the emergency construction or repair of streambank and shoreline protection works.	Assistance includes studies and projects for the construction and repair of streambank and shoreline protection.	A Presidential disaster declaration is not required. However, the program emphasizes the emergency construction or repair needs.	Flooding, including coastal flooding	No cost share is required for the first $40,000 of study costs. After $40,000, a 35% non-Federal cost share is required. A 35% non-Federal cost share is required for project costs.	No specific application deadline. Contact the appropriate District Engineer to assist with filing the correct documentation.	Mike Mocek, Deputy District Engineer, Ft. Worth Office, U.S. ACE, 817-886-1515 mocek@swf02.usace.army.mil www.usace.army.mil --- Col. Leonard Waterworth, District Engineer, Galveston Office, 409-766-3001 Leonard.d.waterworth.col@swg02.usace.army.mil www.usace.army.mil

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Floodplain Management Services	Flood Control Act of 1960, as amended, Section 206	USACE	To promote appropriate recognition of flood hazards in land and water use planning and development through the provision of flood and floodplain related data, technical services and guidance.	Assistance includes General Technical Services and Planning Guidance. General Technical Services include development or interpretation of site-specific data on floodplain patterns, and provision of technical information on natural and cultural floodplain resources, and flood loss potentials. General Planning Guidance includes studies of floodplain delineation; flood hazard evaluation; dam break analysis; hurricane evacuation; flood warning/preparedness; comprehensive floodplain management; flood damage reduction; stormwater management; floodproofing; and an inventory of floodprone structures.		Flooding	No match required for services to State, regional and local governments and other non-Federal public agencies. 100% match required for services to other Federal agencies and the private sector.	No specific application deadline. Requests are made in the form of a letter to the District Engineer.	Mike Mocek, Deputy District Engineer, Ft. Worth Office, U.S. ACE, 817-886-1515 mocek@swf02.usace.army.mil www.usace.army.mil ----- Col. Leonard Waterworth, District Engineer, Galveston Office, 409-766-3001 Leonard.d.waterworth.col@swg02.usace.army.mil www.usace.army.mil

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Nonstructural Alternatives to Structural Rehabilitation of Damaged Flood Control Works	Public Law 84-99	USACE	This program provides a nonstructural alternative to the structural rehabilitation of flood control works damaged in floods or coastal storms.	Direct planning and construction assistance is provided to assist in the event of damage to an existing flood control work. The project must involve damaged flood control works eligible for rehabilitation under Public Law 84-99.	A Presidential disaster declaration is not required. However, damage to flood control works is required.	Flooding	The USACE may fund 100% of the project costs, up to a project-specific cap. Costs above the cap are the responsibility of the participating State, tribal, local and/or Federal agencies.	Normally, an application is due 30 days after a river returns to bankfull conditions.	Mike Mocek, Deputy District Engineer, Ft. Worth Office, U.S. ACE, 817-886-1515 mocek@swf02.usace.army.mil www.usace.army.mil --- Col. Leonard Waterworth, District Engineer, Galveston Office, 409-766-3001 Leonard.d.waterworth.col@swg02.usace.army.mil www.usace.army.mil

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Planning Assistance to States	Water Resources Development Act of 1974	Department of Defense (DOD), U.S. Army Corps of Engineers (USACE)	To assist States, local governments and other non-Federal entities in the preparation of comprehensive a plan for the development, utilization, and conservation of water and related land resources.	Assistance includes studies and technical assistance.		Flooding and water supply	50% non-Federal match required	No specific application deadline. Contact the appropriate District Engineer to assist with filing the correct documentation.	Mike Mocek, Deputy District Engineer, Ft. Worth Office, U.S. ACE, 817-886-1515 mocek@swf02.usace.army.mil www.usace.army.mil ------ Col. Leonard Waterworth, District Engineer, Galveston Office, 409-766-3001 Leonard.d.waterworth.col@swg02.usace.army.mil www.usace.army.mil

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Small Ecosystem Restoration	Water Resources Development Act of 1988, Section 1135	USACE	To restore degraded ecosystems through modifications to U.S. Army Corps of Engineers' structures and operations of Corps structures or implementation of measures in affected areas.	Assistance includes development of a Preliminary Restoration Plan and a Project Modification Report.		Flooding and ecosystem restoration	No non-Federal match required for development of a Preliminary Restoration Plan. A Project Modification Report requires a 25% non-Federal cost share.	No specific application deadline. Contact the appropriate District Engineer to assist with filing the correct documentation.	Mike Mocek, Deputy District Engineer, Ft. Worth Office, U.S. ACE, 817-886-1515 mocek@swf02.usace.army.mil www.usace.army.mil ------ Col. Leonard Waterworth, District Engineer, Galveston Office, 409-766-3001 Leonard.d.waterworth.col@swg02.usace.army.mil www.usace.army.mil

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Small Flood Control Projects	Flood Control Act of 1948, as amended, Section 205	USACE	To reduce flood damages through small flood control projects not specifically authorized by Congress.	Assistance includes studies and projects for the design and construction of small flood control projects by the USACE. Flood control projects are required to be feasible from an engineering perspective, self-contained, and economically justified. State or local government officials should consult the nearest District Engineer regarding specific problems and the possibility of a remedial project under this program.		Flooding	No cost share required for the first $100,000 of planning study costs. Over $100,000, a 50% cost share is required. A 35% cost share is required for project costs, of which 5% is in cash. The balance may consist of the provision of lands, easements, rights-of-way, and necessary relocations.	No specific application deadline. A letter to the District Engineer is required.	Mike Mocek, Deputy District Engineer, Ft. Worth Office, U.S. ACE, 817-886-1515 mocek@swf02.usace.army.mil www.usace.army.mil Col. Leonard Waterworth, District Engineer, Galveston Office, 409-766-3001 Leonard.d.waterworth.col@swg02.usace.-army.mil www.usace.army.mil

Program	Authority	Funding Source	Purpose	Types of Assistance and Eligible Projects	Condition	Hazards or Topics Covered	Matching Required	Application Deadlines	Contact
Small Navigation Projects	River and Harbor Act of 1980, Section 107	USACE	To improve navigation, including dredging of channels, widening of turning basins and construction of navigation aids.	Assistance includes studies and projects to aid navigation.		Flooding and navigation	No cost share required for the first $100,000 of study costs. Over $100,000, a 50% non-Federal match is required. 20% non-Federal cost share is required for project costs during construction and over a 30-year period.	No specific application deadline. Contact the appropriate District Engineer to assist with filing the correct documentation.	Mike Mocek, Deputy District Engineer, Ft. Worth Office, U.S. ACE, 817-886-1515 mocek@swf02.usace.army.mil www.usace.army.mil ------ Col. Leonard Waterworth, District Engineer, Galveston Office, 409-766-3001 Leonard.d.waterworth.col@swg02.usace.army.mil www.usace.army.mil

SECTION 8 – ANNEXES: ***The Hazard Mitigation Grant Program (HMGP) Administrative Plan may be found and downloaded from the following Web site:***
ftp://ftp.txdps.state.tx.us/dem/mitigation/mit_plan_xa.pdf

STATE OF TEXAS

HAZARD MITIGATION PLAN

ANNEX A

HAZARD MITIGATION GRANT PROGRAM
ADMINISTRATIVE PLAN

APPROVAL AND IMPLEMENTATION

This annex is hereby approved for implementation and supersedes all previous editions.

December 22, 2005	< ORIGINAL SIGNED>
Date	Jack Colley, Chief Emergency Management Division

SECTION 9 - APPENDICES

Appendix A

The following is the State of Texas repetitive loss mitigation strategy prepared by the Texas Water Development Board (TWDB).

BACKGROUND

The appendix has been prepared to address certain Federal requirements that would allow the State of Texas to receive an increased Federal cost share of up to 90 percent for mitigation grants funded under the Severe Repetitive Loss (SRL) program. Meant to serve as a stand-alone document in this regard, this appendix will provide detail concerning the State's flood risk as it pertains to repetitive loss properties and will present mitigation strategies to reduce future losses to repetitive loss properties and severe repetitive loss properties. When appropriate, reference will be made back to certain sections or attachments of the State Hazard Mitigation Plan to provide additional information relating to the State's program capabilities.

FEMA has defined "repetitive loss property" to mean any property which has two or more flood insurance claims of $1,000 or more within a 10-year period. The definition of "severe repetitive loss properties", which is set forth in Title 44 Code of Federal Regulations (CFR) §79.2, includes single or multifamily residential properties that are covered under an NFIP flood insurance policy and that meet the following criteria:

1) properties that have incurred flood-related damage for which 4 or more separate claims payments have been made, with the amount of each claim (including building and contents payments) exceeding $5,000, and with the cumulative amount of such claims payments exceeding $20,000; or

2) properties for which at least two separate claims payments (building payments only) have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the building.

In both instances, at least two of the claims must have been within 10 years of each other; claims made within 10 days of each other are counted as a single claim.

In order to be eligible for an increased Federal cost share of up to 90% under the SRL program, the State Mitigation Plan must meet the repetitive loss requirements identified in 44 CFR §201.4 (c)(3)(v). The FEMA-approved plan must identify the specific actions that the State has taken to reduce the number of repetitive loss properties, must include those properties identified as being severe repetitive loss properties, and must specify how the State intends to reduce the number of repetitive loss properties in the future. As explained in the most recent FEMA guidance documentation for the SRL program, this requirement supplements the risk assessment and mitigation strategy portions of the plan required under 44 CFR s201.4(c)(2) and (3) by specifically identifying goals, capabilities, and actions that will reduce the number of repetitive loss properties, including severe repetitive loss properties.

The mitigation strategy is based on the State's risk assessment as required under 44 CFR §201.4(c)(3)(ii). Therefore, the State must address repetitive loss structures in its risk assessment, where applicable. For example, in its overview of Estimating Potential Losses by Jurisdiction under 44 CFR §201.4(c)(2)(iii), the State may analyze potential losses to repetitive loss properties based on estimates provided in local risk assessments. The plan should refer generally to geographic areas where concentrations of repetitive loss properties are located for the purpose of identifying and prioritizing areas for mitigation projects. Alternatively, the plan may list the number of repetitive loss properties with aggregate repetitive loss data.
Pursuant to 44 CFR §201.4(c)(3)(i), the State's hazard mitigation goals must support the selection of activities to mitigate and reduce potential losses to structures susceptible to flood damage, including repetitive loss properties. In addition, the State and local capability assessments required under 44 CFR §201.4(c)(3)(ii) must include an evaluation of policies, programs, and capabilities that allow for the mitigation of repetitive losses from flood damage. The State must also describe those specific actions that it has implemented to mitigate repetitive losses, and specifically those actions taken to reduce the number of severe repetitive loss properties as a subset of all repetitive loss properties in the State. Finally, based on the findings of the risk assessment, the State must identify those actions in the statewide mitigation strategy that will specifically address repetitive loss properties, including those that are severe repetitive loss properties. These requirements supplement the mitigation actions requirement set forth in 44 CFR §201.4(c)(3)(iii). Mitigation actions should be tied to the State's hazard mitigation goals and objectives and should address the means to achieve them. Moreover, mitigation activities should have been identified during the planning process, and local plans should be consistent with such State-wide activities.

As part of the mitigation strategy, the plan must also identify any the current funding sources, including any potential funding sources that will be pursued in order to fund proposed mitigation actions for repetitive loss properties. This supplements the identification of funding requirement established in 44 CFR §201.4 (c)(3)(iv).

The State plan must describe the strategy to be taken to ensure that local jurisdictions with severe repetitive loss properties take actions to reduce the number of these properties, including the development of local mitigation plans. This supplements the Coordination of Local Mitigation Planning portion of the plan described in 44 CFR §201.4(c)(4). At a minimum, the State must include severe repetitive loss in the description of its process for providing funding and address the technical assistance that may be provided to prepare these mitigation plans pursuant to 44 CFR §201.4(c)(4)(i), and the State must also furnish its criteria for prioritizing communities that have such properties for purposes of future planning and project grant assistance in accordance with 44 CFR §201.4(c)(4)(iii). Other strategies for encouraging local communities to mitigate severe repetitive loss properties should be demonstrated through specific actions identified in the Mitigation Strategy.

RISK ASSESSMENT

In order to adequately identify and profile the flood hazards that occur throughout Texas, a general overview of the physical character of the State is necessary. A State the size of Texas, which contains over 267,000 square miles making up roughly 7 per cent of the contiguous United States, exhibits varied characteristics in both climate and physiography. The following sections provide a description of the general physiography and climate of the State, as well as its population characteristics as they apply to an assessment of risks associated with the flood hazard.

PHYSIOGRAPHY

Four principal physiographic regions of the Central United States occur in Texas (Figure 2-1). The Basin and Range Province of the Rocky Mountains extends into Far West Texas and includes the Davis and Guadalupe Mountains, the Big Bend area, and the Upper Rio Grande Valley. The Great Plains lies to the east and flanks the Rocky Mountains. The Great Plains include the panhandle area of Texas (High Plains), and extend into the plateau areas located as far south as the Rio Grande River and the Balcones Escarpment. The Interior Lowlands Region lies adjacent to and east of the Great Plains extending from Canada south into north-central Texas. The boundary of the Interior Lowlands in Texas is marked by the Caprock Escarpment along its western perimeter, the Balcones Escarpment along its eastern limit, and the northern extent of the plateau area and Llano Basin of Central Texas along its southern boundary. Lastly, the Gulf Coastal Plain covers the eastern third of the State, and is bounded along the west by the Balcones Escarpment from the Rio Grande River near the City of Del Rio, eastward to near San Antonio where the trend turns roughly north by north-east towards north-central Texas extending past the Dallas area and across the Red River (Jordan, et. al, 1984; Texas Almanac, edited by Alvarez, 2006). The physiographic regions are reflective of the underlying geology of the State, which also serves as the parent material from which the properties of specific soil groups are derived. In addition, the boundaries of the physiographic regions correspond to the primary Ecoregions of Texas denoting areas exhibiting similarities in ecological and biological diversity (after McMahon, et al., 2001 as modified by Texas Parks and Wildlife Dept., 2004).

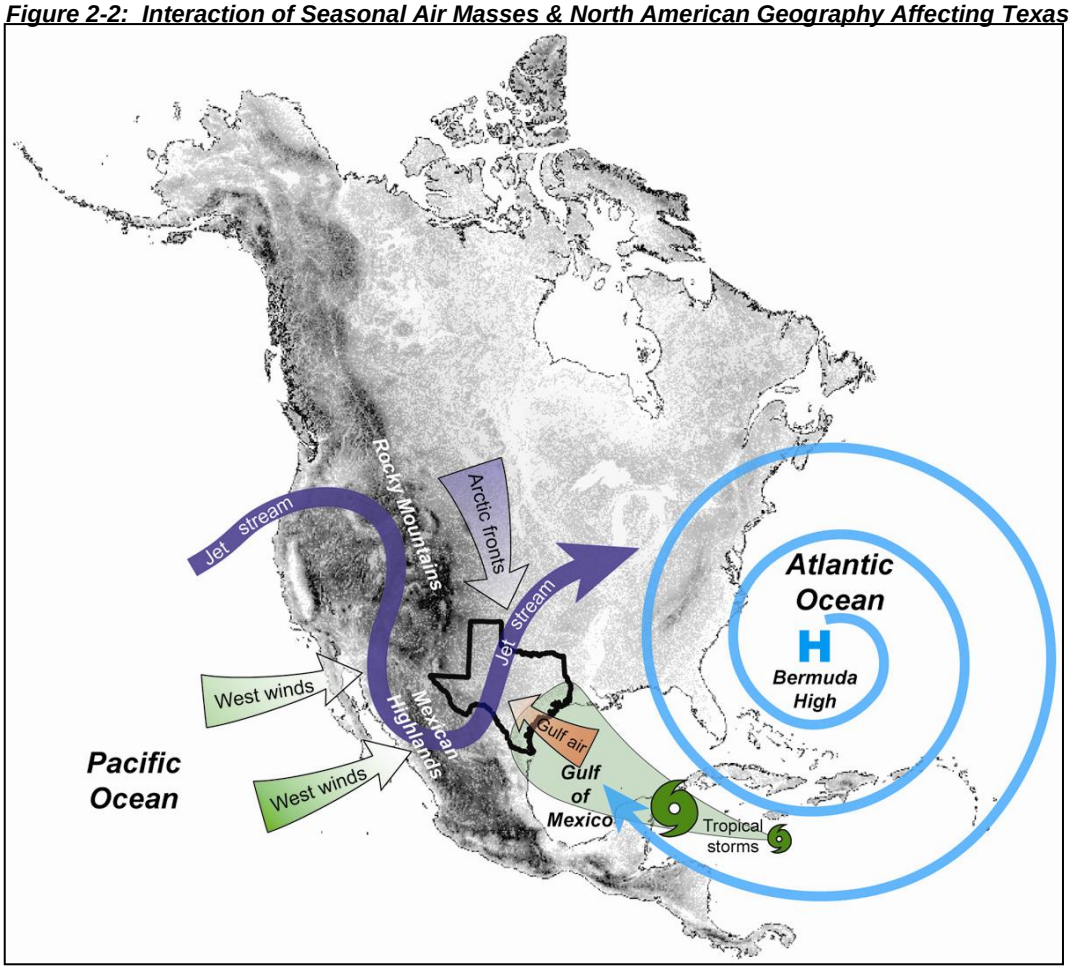
Figure 2-1: Physiographic Map of Texas

CLIMATE

Texas climate is as varied as its landscape. Variability is due primarily to interactions between the State's unique geographic location and the movement of seasonal air masses, such as arctic fronts, subtropical west winds, the jet stream, tropical storms and a subtropical high pressure system known

as the Bermuda High (Figure 2-2). The Gulf of Mexico is a dominant geographical feature, moderating temperatures along the Gulf Coast and providing the major source of moisture for the State. The Rocky Mountains direct the arctic cold fronts southerly into the State during the late fall, winter and early spring months. Pacific moisture is carried into the State by subtropical depressions moved eastward by the "westerlies" during the summer. During the spring and fall months, warm, dry air from the high plains of northern Mexico is pulled into the State by the jet stream where it collides with humid air from the Gulf of Mexico being funneled in by the western limb of the Bermuda High resulting in the formation of severe thunderstorms and tornadoes (TWDB, 2007; Bomar, 1995; Slade and Patton, 2003).

Figure 2-2: Interaction of Seasonal Air Masses & North American Geography Affecting Texas Climate



Source: Texas Water Development Board, 2007

POPULATION

In order to evaluate the level of risk associated with a particular hazard, the geographical characteristics of the hazard in terms of the statistical nature of its occurrence in a particular area, as well as, the aerial expanse of the hazard affects is required. In addition, risk itself will be relative to the population that will be exposed to the hazard and its effects. This section describes the population throughout the State in terms of existing population (most recent numbers), past population changes, and future population projections. Existing population and current trends are based on the year 2000 census (source: U.S Census Bureau); however, additional data, as available, was also used in the analysis. Population projections are provided in the 2007 State Water Plan developed by the Texas

Water Development Board (TWDB, 2007) and are based upon TWDB analysis. The State's population in 2000, based on census data, was 20,851,820. Between the 1990 and the 2000 census, Texas population experienced nearly a 23% growth rate. Data projections through 2006 indicated that the population would continue to demonstrate an increase to 23,507,783, based on a growth rate of 12.7%. Population trends can be described in various ways depending on how the data is compiled; for example, trends can be based on evaluations performed at the city or county level, or by using Metropolitan Statistical Areas (MSAs), which are stand-alone metropolitan areas comprised of one or more counties. Alternatively, an analysis of population trends can be based on Primary Metropolitan Statistical Areas (PMSAs) or Consolidated Metropolitan Statistical Areas (CMSAs). CMSAs are metropolitan areas with a population of more than one million and are comprised of two or more PMSAs (Texas Almanac, edited by Alvarez, 2006).

Of the 254 counties in Texas, population ranges from a minimum in Loving County of less than 100 people, to Harris County which has a population of more than 3.4 million people. In terms of population growth or decline (from 1990 to 2000), Collin County represents the highest growth rate in Texas at over 50%, while the largest decline was exhibited by Terrell County of about 15%. Population data can also be compiled by Council of Government (COG) Region. Of the 24 COG regions, the greatest recent growth rates have been occurring within the South Texas and Lower Rio Grande Valley COGs with an increase of approximately 30%.

In terms of assessing or evaluating risks, population statistics compiled by PMSA or MSA are very useful, but proposing mitigation strategies would require the evaluation of populations at the city and county level, or perhaps even further based on individual watersheds or neighborhoods, depending on the specific hazard. Data indicates that there are five PMSA and MSA areas with populations of greater than 1 million, six MSAs with populations ranging from 250,000 to 1 million, and 15 MSAs ranging from 100,000 to 250,000 in population. Listed below are the higher population centers of the State along with their associated counties:

Population of greater than 1,000,000

- Houston PMSA (Chambers, Fort Bend, Harris, Liberty, Montgomery and Waller counties)
- Dallas PMSA (Collin, Dallas, Denton, Ellis, Henderson, Hunt, Kaufman and Rockwall counties)
- Fort Worth PMSA (Hood, Johnson, Parker and Tarrant counties)
- San Antonio MSA (Bexar, Comal, Guadalupe and Wilson counties)
- Austin MSA (Bastrop, Caldwell, Hays, Travis and Williamson counties)

Population of 250,000 to 1,000,000

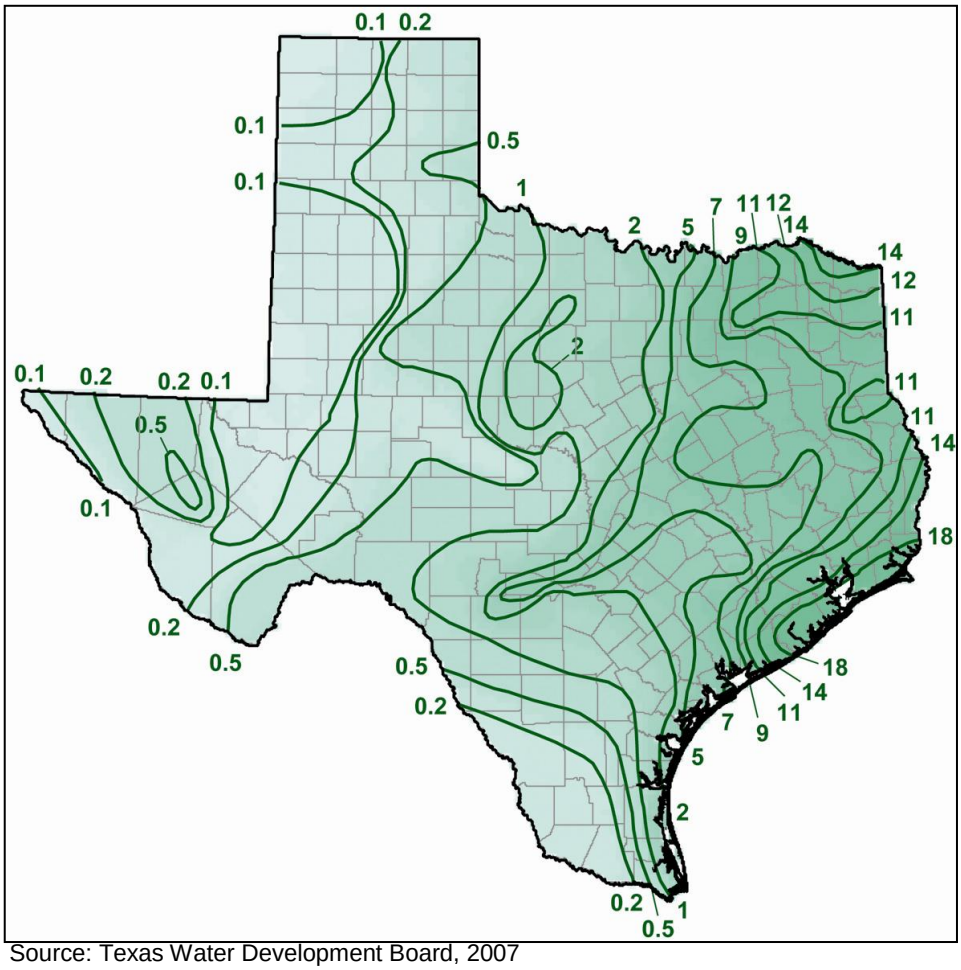
- El Paso MSA (El Paso County)
- McAllen MSA (Hidalgo County)
- Beaumont MSA (Hardin, Jefferson and Orange counties)
- Corpus Christi MSA (Nueces and San Patricio counties)
- Brownsville MSA (Cameron County)
- Killeen MSA (Bell and Coryell counties)

RIVER BASINS OF TEXAS

As provided in an excerpt from the 2007 State Water Plan, *Water for Texas: 2007*, prepared by the Texas Water Development Board (TWDB, 2007), there are 15 major river basins within the State and eight coastal basins, each with varying hydrological regimes and water supply capabilities. Each of the basins has several unique features, both climatic (such as precipitation and evaporation), as well as physiographic (geology, slope, soil type, vegetation and land use practices), which contribute to the

nature of runoff from the basins (Figure 2-3). Table 2.1 provides a summary of the major river basins and includes the pertinent watershed area, river length and average flow.

Figure 2-3: Annual Average Runoff from Precipitation in Inches



Source: Texas Water Development Board, 2007

Table 2-1: Features of Major River Basins in Texas

River Basin	Total Area (Sq Mi)	Area in Texas (Sq Mi)	River Length (Miles)	Length in Texas (Mi)	Average Flow (Ac Ft/Yr)
Brazos	45,573	42,865	840	840	6,074,000
Canadian	47,705	12,865	906	213	196,000
Colorado	42,318	39,428	865	865	1,904,000
Cypress	3,552	2,929	90	75	493,700
Guadalupe	5,953	5,953	409	409	1,422,000
Lavaca	2,309	2,309	117	117	277,000
Neches	9,937	9,937	416	416	4,323,000
Nueces	16,700	16,700	315	315	539,700
Red	93,450	24,297	1,360	695	3,464,000
Rio Grande	182,215	49,387	1,896	889	645,500
Sabine	9,756	7,570	360	360	5,864,000
San Antonio	4,180	4,180	238	238	562,700
San Jacinto	3,936	3,936	85	85	1,365,000
Sulphur	3,767	3,580	222	222	932,700
Trinity	17,913	17,913	550	550	5,727,000

IDENTIFYING AND PROFILING THE HAZARD

A review of past Federal declarations and available local mitigation action plans will demonstrate that the State Hazard Mitigation Plan addresses the risks associated with the following fourteen hazards to which Texas is vulnerable: floods, tornadoes, hurricanes, drought, wildfires, coastal erosion, dam or levee failures, earthquakes, expansive soil, extreme heat, hailstorms, land subsidence, severe winter storms and windstorms. Of the 81 federally-declared disasters from 1953 to 2007, Texas received 77 Federal declarations due to the following hazards; 30 due to floods; 20 due to the occurrence of hurricanes or tropical storms; sixteen due to tornadoes; six due to drought; and five due to wildfire. Only the risks associated with the flood hazard (including flooding associated with hurricane/tropical storms) will be discussed in this appendix. Additional detail concerning the flood hazard, as well as other hazards, including potential exposure, can be found in Texas Hazards Analysis (at www.thmp.info an online digital geographic data resource for hazard analysis in Texas). The Texas Hazard Mitigation Package (THMP) is organized so that users can quickly assess their potential exposure to natural hazards by viewing summary maps depicting the historical frequency of those hazards by county. Data presents relative risk for these hazards. For assistance with this Web site, please contact Mr. Craig Eissler of the Texas Geographical Society at craig@geo-techvp.com.

As hydrologic analysis demonstrates, runoff is the portion of rainfall which, in combination with other factors, may contribute to the stream flow of any surface drainage way. When runoff exceeds the carrying capacity of the stream or drainage, flooding occurs. Runoff is a product of two major groups of factors, climate and physiography. An understanding of the interrelation of these factors, as well as site specific data pertaining to these factors, is necessary in evaluating the flood hazard of an area, and in assessing mitigation strategies for that area. Climatic factors may include precipitation, evaporation, transpiration and interception. Physiographic factors would include the characteristics of the watershed such as size, shape and slope of the basin's drainage area, the general land use within

the basin, and may also include characteristics of the drainage way itself such as the geometry of the channel.

Historically, floods are one of the most frequently occurring, destructive and costly natural hazards facing Texas, constituting over 90% of the disaster damage that has been experienced in the State. Few areas in the State are completely free from the threat of floods. Moreover, the statistical probability exists that a greater flood could occur in any given area than that which has occurred in the past. Flooding can occur during any season of the year. Winter and early spring floods are typically caused by the seasonal rainfall patterns while summer floods (except for those associated with hurricanes and tropical storms) are caused by super-cell thunderstorms that generally affect only small, localized areas. Floods may be caused by large-scale weather systems that can generate prolonged rainfall events, by locally intense thunderstorms, or by coastal storms such as hurricanes and tropical storms. The Central Texas area is considered to be one of the three most flash flood-prone regions in the world, due primarily to a combination of climatic factors and the specific physiography of the area. Damage due to flooding can range from water damage to structures and their contents to the complete destruction of the structures with a total loss of all contents. Roads and infrastructure may be undermined and damaged. Riverbank erosion, injury and loss of life are additional consequences of flooding incidents. On the average, Texas suffers approximately 400 floods annually, more than twice the number of the second-highest State (ascertained by local data relating to events resulting in damages of at least $50,000). Since 1953, Texas has had 30 Federal disaster declarations as a result of flooding events. Between 1978 and 2000, an estimated $1.4 billion in flood insurance claims were filed in Texas, and an estimated $5 billion in uninsured flood damages occurred.

The most obvious tool a local entity can utilize to assess the risks associated with flood hazard is to review the FIRM created by FEMA. These were created and exist on an individual county basis. It is not the intent at this time to include a State-wide review of the existing local FIRM maps, to conduct a "mapping needs" assessment for all the counties, or even a status of FEMA's Map Modernization activities. Instead the State wishes to recognize the importance of this tool in assessing flood hazards. Future updates to this plan may provide a more detailed assessment of the flood hazard mapping activities.

Another useful tool in assessing the relative risk associated with the flood hazards would include a review of the location of Repetitive Loss (RL) structures. A general discussion of the number and location of RL structures, as well as Severe Repetitive Loss (SRL) properties, is provided in the following sub-section.

REPETITIVE LOSS (AND SEVERE REPETITIVE LOSS) PROPERTIES

Repetitive Loss (RL) and Severe Repetitive Loss (SRL) data is available and is based on flood insurance damage claim by property and by community. This information will not necessarily be indicative of the total damage associated with any particular event, but may demonstrate the relative risk by depicting a concentration of data in particular geographic locations. As noted earlier, the term "repetitive loss" is defined by FEMA to include any property which has had two or more flood insurance claims of $1,000 or more in a 10-year period. Severe repetitive loss properties are a sub-set of repetitive loss properties; this term is defined as including any property which has had either four or more claims of $5,000 per claim, or at least two claims with combined claims exceeding the market value of the property.

The most recent data from FEMA and the NFIP (through December 2007) shows roughly 16,200 RL properties within the State, which are located in 142 of the State's 254 counties. A breakdown of the

statewide data indicates that approximately 40% of the RL properties are located in Harris County. Nearly 70% of the entire RL list occurs within Harris County and the three counties contiguous to Harris County, Galveston, Brazoria and Montgomery counties. Total flood insurance claim payments associated with RL properties is approximately $1.14 billion State-wide; payments on claims arising from Harris County RL properties accounts for nearly 55% of the total State-wide RL payments.

Not surprising, the occurrence of SRL properties throughout the State seem to mirror the occurrence of RL properties. Of the 16,200 RL properties statewide, 1,238 (or 8%) are SRL properties. These properties are located in 54 of the 254 counties of the State. Again, Harris County has the greatest number of SRL properties with 815 or 66% of the total number of SRL properties; with Harris, Galveston, Brazoria and Montgomery counties accounting for 82% of the total number of SRL properties State-wide. Claims associated with SRL properties State-wide total approximately $195 million, nearly 20% of the total RL claims payments.

Assessing Local Vulnerabilities And Estimating Losses—County-Level Loss Estimates For RL And SRL Properties

For purposes of this appendix, several local hazard mitigation plans were reviewed. These plans were developed for those communities with the greatest numbers of repetitive loss structures. In addition, summaries of local and multi-jurisdictional plans referenced in the State Hazard Mitigation Plan were reviewed and evaluated. For example, local plans prepared for City of Houston, City of Beaumont, Jefferson County Drainage District 6 and unincorporated Harris County, as well as multi-jurisdictional plans prepared for Harris County and most of its incorporated communities (excluding City of Houston, but including Harris County Flood Control District), Houston-Galveston Area Council of Governments and the Southeast Texas Regional Planning Commission, were utilized as a basic resource to evaluate the local vulnerability and loss estimates associated with the assessment of risks due to flooding and repetitive loss structures. In addition, FEMA has provided summaries of calculated avoidable damages of all the severe repetitive loss properties within the State which proved to be invaluable in evaluating local risks when used in combination with local vulnerability data. In general, local jurisdictional plans for the primary repetitive loss communities have identified flood prone areas and general occurrences, or pockets, of repetitive loss properties as part of their risk assessments. Table 2-2 provides a data summary by county of repetitive loss and severe repetitive loss data. Figures 2-4 and 2-5 provide a visual representation of the data statewide.

Table 2-2: Repetitive Loss Data Compiled by County

COUNTY	BUILDING PAYMENTS	CONTENTS PAYMENTS	TOTAL RL PAYMENTS	LOSSES	NUMBER OF RL PROPERTIES	TOTAL SRL PAYMENTS	NUMBER OF SRL PROPERTIES
ANDERSON	3,018.09	0.00	3,018.09	2	1		
ANGELINA	1,136,773.32	342,947.20	1,479,720.52	74	25	145,686.70	1
ARANSAS			3,210,915.70	202	66	278,571.24	2
ATASCOA	72,442.03	18,759.73	91,201.76	4	1	91,201.76	1
AUSTIN			793,554.59	27	12		
BAILEY			95,780.51	4	2		
BANDERA	622,898.10	209,727.86	832,625.96	34	15	91,228.64	1
BASTROP			440,566.90	14	5	155,620.56	1
BAYLOR	13,096.37	8,307.24	21,403.61	2	1		
BEE			371,604.87	15	5		
BELL	455,033.74	179,397.13	634,430.87	45	20		
BEXAR	3,348,933.46	1,747,276.89	4,823,210.35	283	110	451,756.89	2
BLANCO	39,497.02	147.50	39,644.52	2	1		
BOWIE			738,055.84	53	14	286,950.00	2
BRAZORIA	46,674,038.63	16,247,415.77	62,921,454.40	3,674	1,342	9,922,562.01	63
BRAZOS			453,296.00	43	16	149,169.00	1
BROOKS	414,999.88	147,594.65	562,594.53	28	7		
BROWN			3,119,299.10	109	41	148,721.73	1
BURLESON	9,821.45	0.00	9,821.45	2	1		
BURNET			611,543.43	30	10		
CALDWELL			305,280.26	10	5		
CALHOUN			665,109.13	75	34		
CAMERON	3,003,333.68	1,995,016.40	4,998,350.08	332	134		
CASS	97,761.51	77,235.23	174,996.74	6	3		
CHAMBERS			1,312,694.70	127	48	50,420.53	1
CHEROKEE	92,691.11	0.00	92,691.11	6	3		
CLAY	155,918.05	302,584.46	458,502.51	5	2		
COLLIN	557,534.20	202,537.73	760,071.93	46	17		
COLORADO	45,251.89	9,608.07	54,859.96	4	2		
COMAL			13,586,079.76	180	86	3,319,520.84	14
COOKE			2,661,731.80	101	35	332,472.90	2
DALLAS	8,430,048.97	3,375,900.64	11,805,949.61	565	206	1,605,721.77	10
DAWSON	41,022.47	10,000.00	51,022.47	4	2		
DENTON	540,422.37	128,959.43	669,381.80	48	18	103,508.20	1
DEWITT			1,579,918.40	76	27	263,308.12	3
DUVAL	23,417.08	0.00	23,417.08	2	1		
EASTLAND	32,331.59	8,134.83	40,466.42	2	1		
ECTOR			169,714.60	8	4		
EL PASO	317,559.82	134,431.26	451,991.08	25	8		
ELLIS			243,835.99	19	8		
FANNIN			25,518.09	6	3		
FAYETTE			589,261.29	14	6		
FISHER	48,067.57	7,258.13	55,325.70	2	1		
FORT BEND	3,472,060.63	855,250.25	4,327,310.88	218	85	358,385.09	2
GAINES	11,763.18	1,773.25	13,536.43	3	1		
GALVESTON	58,241,311.89	26,301,775.67	84,543,087.56	6,357	2,187	12,419,944.51	100
GOLIAD			181,974.34	4	2		
GONZALES			2,055,962.50	59	25	155,656.79	2
GRAY	86,272.16	1,442.94	87,715.10	2	1		
GRAYSON			3,801,860.90	154	48	78,454.51	1
GREGG			569,731.19	55	17	169,835.81	1
GRIMES	12,766.13	2,656.65	15,422.78	2	1		
GUADALUPE			53,185,197.00	926	397	11,225,637.93	37
HALL	13,278.57	3,199.00	16,477.57	2	1		
HAMILTON			30,892.08	4	2		
HARDIN	7,527,225.67	2,375,307.72	9,902,533.34	466	146	1,882,751.16	11
HARRIS	454,824,106.71	169,011,817.03	623,835,923.74	21,670	6,607	127,507,263.16	815
HARRISON			526,212.94	32	14		
HASKELL			380,974.37	50	20		

COUNTY	BUILDING PAYMENTS	CONTENTS PAYMENTS	TOTAL RL PAYMENTS	LOSSES	NUMBER OF RL PROPERTIES	TOTAL SRL PAYMENTS	NUMBER OF SRL PROPERTIES
HAYS			1,605,826.20	67	32		
HENDERSON			486,165.17	7	2		
HIDALGO	1,453,114.74	408,427.18	1,861,541.92	203	82	105,886.98	1
HOCKLEY	23,870.03	275.00	24,145.03	2	1		
HOOD	259,133.97	63,565.66	322,699.63	15	6	71,116.16	1
HOPKINS	143,341.32	8,681.48	152,022.80	11	5		
HOWARD	32,895.93	14,122.10	47,018.03	2	1		
HUNT			224,543.12	8	4		
JACKSON			437,543.60	29	12		
JASPER			611,265.48	31	13		
JEFFERSON	32,644,684.49	11,575,223.85	44,219,908.34	2587	890	4,392,109.58	37
JIM WELLS			257,987.85	24	10		
JOHNSON			787,555.90	35	19	152,675.06	2
JONES			3,253,491.40	171	61	118,733.58	2
KAUFMAN			100,250.05	17	4	45,085.01	1
KENEDY	29,811.67	0.00	29,811.67	2	1		
KENDALL			967,172.66	34	13	41,830.55	1
KERR			230,329.07	16	8		
KLEBERG			158,615.06	32	10		
LAMAR	6,975.92	0.00	6,975.92	2	1		
LAMPASAS			104,847.75	4	2		
LAVACA	83,715.70	27,069.86	110,785.56	13	3		
LEE	134,796.02	21,522.05	156,318.07	2	1		
LIBERTY	8,509,590.17	3,101,779.31	11,611,369.48	636	236	774,416.59	6
LIMESTONE			822,219.29	73	27	68,655.89	1
LIVE OAK			386,109.65	21	10		
LLANO	215,113.73	44,189.77	259,303.50	23	11		
LUBBOCK			64,840.97	9	5		
MADISON	84,423.31	4,396.31	88,819.62	8	2		
MARION			177,596.58	14	5	66,767.25	1
MATAGORDA			5,165,539.60	404	144	583,321.76	5
MAVERICK			70,496.29	7	3		
MCLENNAN	544,537.59	132,475.31	677,012.90	53	15		
MEDINA			145,804.86	9	4		
MENARD			70,183.76	8	4		
MIDLAND	107,214.03	41,537.67	148,751.70	9	4		
MONTAGUE	316,338.63	80,617.48	396,956.11	22	10	76,564.07	1
MONTGOMERY	54,150,951.18	20,661,898.07	74,812,849.25	2,883	977	8,154,765.29	43
NACOGDOCHES	599,883.06	177,734.43	777,617.49	65	23		
NAVARRO	97,138.17	22,112.23	119,250.40	10	4		
NEWTON	449,215.48	125,630.51	574,845.99	36	13	219,862.51	3
NOLAN			27,604.36	4	2		
NUECES	6,688,181.76	2,474,712.33	9,162,894.09	598	215	91,245.65	1
ORANGE	10,298,470.06	3,096,388.37	13,394,858.43	831	265	2,132,803.88	16
PALO PINTO			293,389.22	21	10	86,172.98	1
PANOLA	18,169.37	16,493.97	34,663.34	3	1		
PARKER			686,917.38	36	14	233,602.21	1
POLK			1,999,866.00	60	22	462,158.76	3
POTTER			164,496.82	25	12		
RANDALL			254,262.03	28	10		
REAL			418,655.80	24	11		
ROCKWALL	12,389.99	215,539.39	227,929.38	6	2		
RUSK			136,367.23	13	5		
SAN JACINTO	1,280,042.72	448,512.59	1,728,555.31	118	49	44,222.31	1
SAN PATRICIO	2,563,249.53	1,045,667.22	3,608,916.75	245	150	229,959.75	2
SAN SABA	8,121.42	0.00	8,121.42	2	1		
SHACKELFORD	11,173.49	0.00	11,173.49	2	1		
SMITH			796,109.73	49	12		
SOMERVILLE			383,644.47	27	9	85,151.73	1
STARR	25,176.08	11,183.36	36,359.44	4	2		
STEPHENS	23,710.46	8,894.66	32,605.12	6	1		
TARRANT	9,242,109.86	4,074,865.84	13,316,975.70	597	221	1,607,813.99	10

COUNTY	BUILDING PAYMENTS	CONTENTS PAYMENTS	TOTAL RL PAYMENTS	LOSSES	NUMBER OF RL PROPERTIES	TOTAL SRL PAYMENTS	NUMBER OF SRL PROPERTIES
TAYLOR	329,929.28	43,199.71	373,128.99	9	4		
TOM GREEN	21,777.25	0.00	21,777.25	4	2		
TRAVIS	11,757,786.67	2,980,127.51	14,737,914.18	517	199	2,283,874.32	10
TRINITY	319,536.98	114,057.02	433,594.00	26	10	138,582.34	1
TYLER			1,023,727.90	49	20		
UPSHUR	22,791.49	1,990.00	24,781.49	2	1		
UVALDE	935,746.00	128,548.58	1,064,294.58	15	7		
VAL VERDE	4,511.50	0.00	4,511.50	2	1		
VICTORIA			3,620,596.30	123	44	1,152,894.25	6
WALKER			1,407,034.90	102	36	91,629.18	1
WALLER			1,615,692.10	68	24		
WASHINGTON	12,163.47	3,759.15	15,922.62	6	2		
WEBB			841,090.41	46	16	202,999.22	2
WHARTON			1,423,137.80	73	31	57,040.58	1
WICHITA	3,140,923.77	1,171,205.96	4,312,129.73	358	122		
WILLACY			446,137.16	37	18		
WILLIAMSON	1,544,813.69	532,266.27	2,077,079.96	120	42	251,742.02	1
WILSON			445,631.43	15	7		
WISE			132,433.65	10	5		
YOUNG			267,300.46	27	10		
ZAVALLA			23,028.27	6	2		
TOTAL			1,139,066,424.14		16,199 Located in 142 counties	195,218,033.30	1,238 Located in 54 counties

Non-mitigated property data
* -- Unincorporated County
** -- Includes data from more than one community

Figure 2-4: Repetitive Loss Properties by County

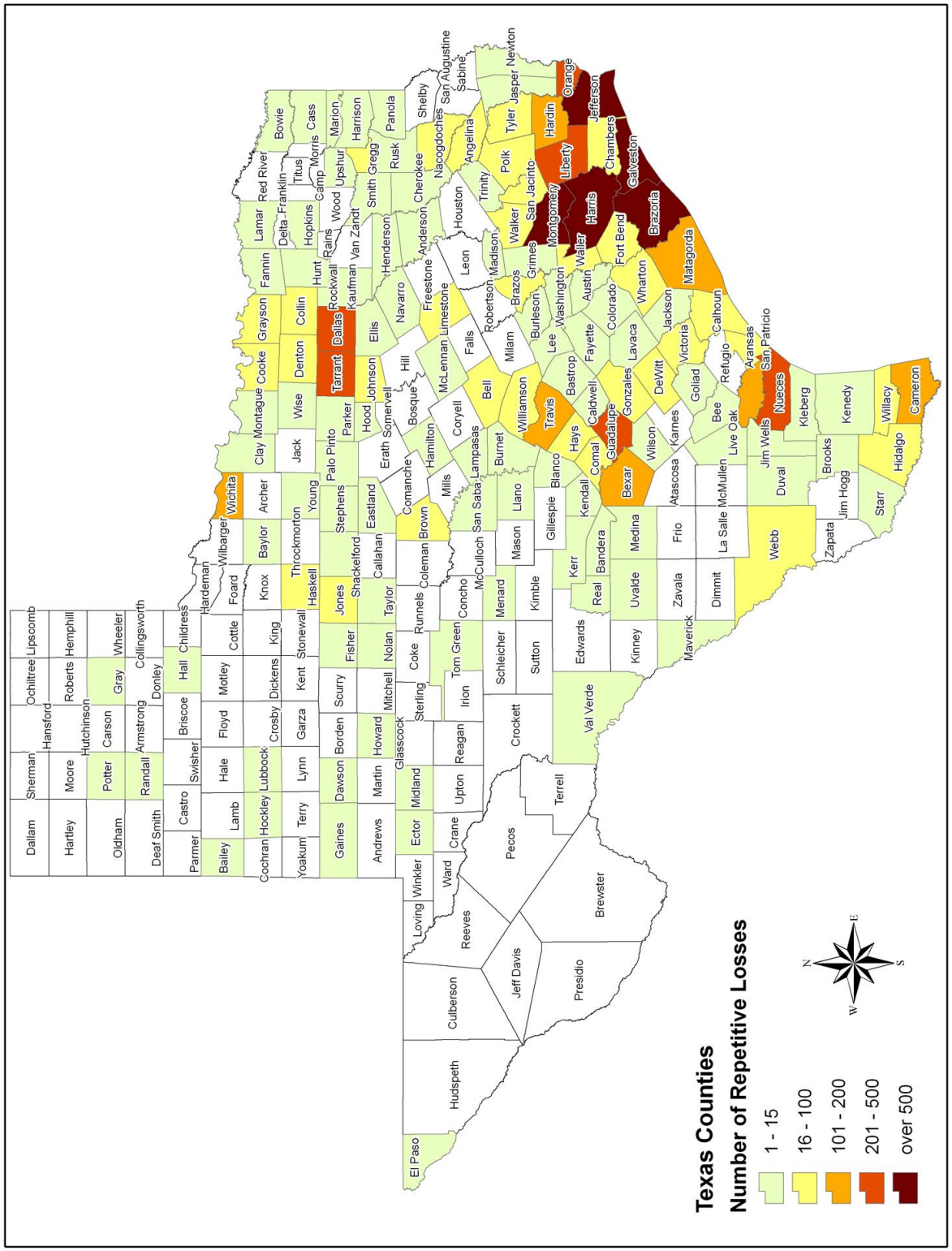
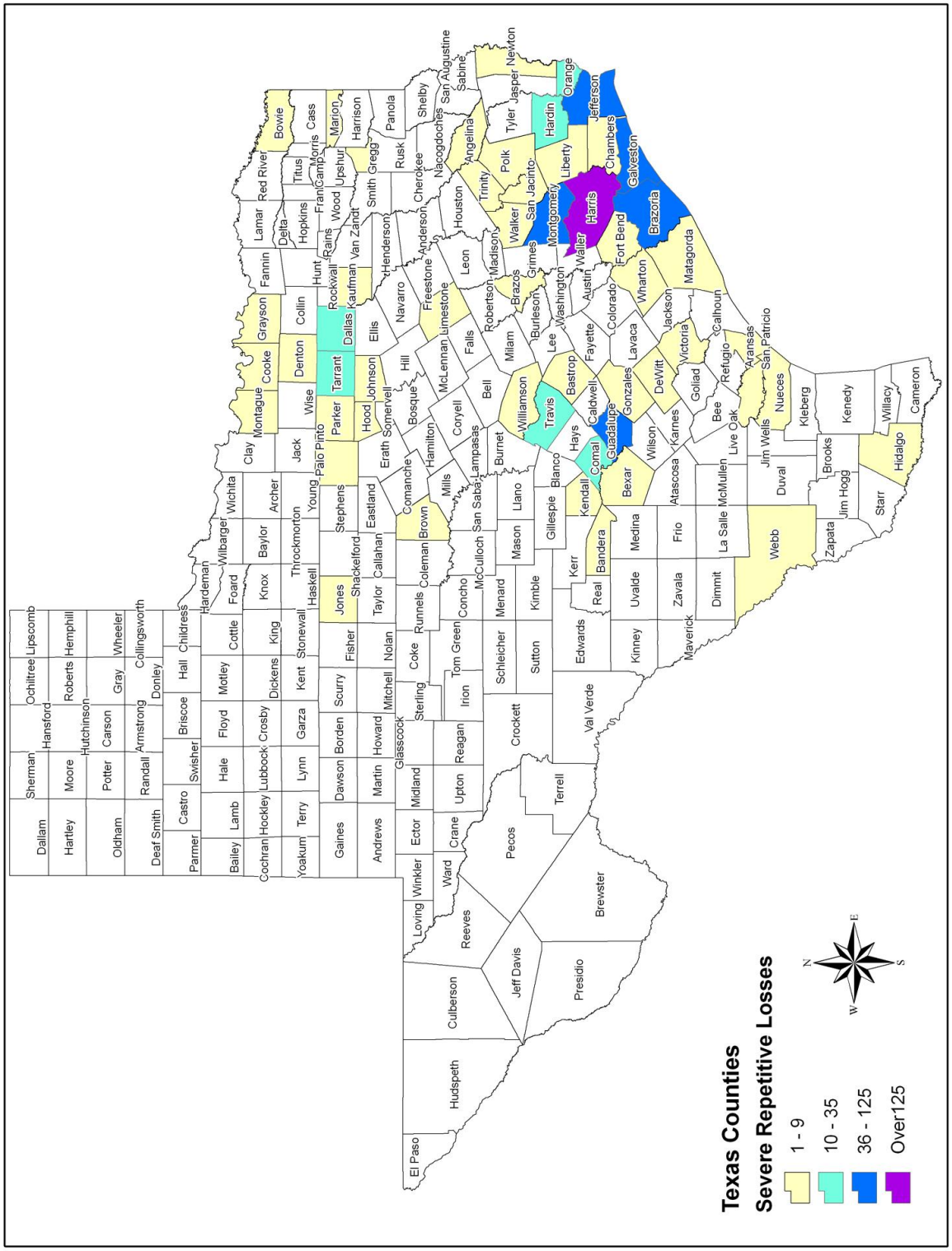


Figure 2-5: Severe Repetitive Loss Properties by County



In the future, the TWDB will coordinate with TDEM and local repetitive loss communities as local plans are updated. The TDEM staff will ensure that the updates to local plans will include an evaluation of repetitive loss and severe repetitive loss properties existing within their jurisdiction. More data will be added for the next State Mitigation Plan update in 2010 as local jurisdictions turn in their plans and risk assessment data to TDEM and/or update their local mitigation plans. The standard procedure for the preparation of local and multi-jurisdictional mitigation plans is described in the Risk Assessment portion of the State Hazard Mitigation Plan and will not be repeated in this appendix.

MITIGATION STRATEGIES

Mitigation strategies should be developed based on the risk assessment performed on a particular hazard in a specific area. Goals and strategies relating to flood hazards, as well as mitigating the risks associated with these hazards for repetitive loss properties have been identified in the State Plan. Federal regulations and FEMA guidance provide that in order to meet its requirements, the Plan must include an evaluation of those policies that allow for the mitigation of repetitive losses from flood damage. State mitigation policies, as well as pertinent laws, regulation and related programs are adequately addressed within the State Hazard Mitigation Plan and are therefore not further discussed in detailed in this appendix.

HAZARD MITIGATION GOALS

Hazard mitigation is defined as "any action taken to eliminate or reduce the long-term risk to life and property from natural and human-caused hazards." It is viewed as a long-term, on-going management process that consists of a variety of both pre-incident and post-incident actions. Effective mitigation, in fact, is characterized by requirements for both planning and implementation activities. Mitigation is a complementary part any effective comprehensive emergency management program and to be effective any hazard mitigation effort must have identifiable goals. These goals, as provided in the State Hazard Mitigation Plan, are as follows:

- to reduce or eliminate hazardous conditions that cause the loss of life;
- to reduce or eliminate hazardous conditions that inflict injuries;
- to reduce or eliminate hazardous conditions that cause property damage; and
- to reduce or eliminate hazardous conditions that degrade important natural resources.

These hazard mitigation goals were assessed during the 2007 update of the State Mitigation Plan. The assessment began with the TDEM Mitigation Staff reviewing the goals and the progress that has been made since 2004 to achieve them. The efforts of TDEM to educate emergency management professionals by holding TDEM Mitigation Workshops in combination with continued State participation in the Hazard Mitigation Grant Program (HMGP) and the Pre-Disaster Mitigation (PDM) grant program, have allowed the State to successfully advance mitigation activities.

The TWDB continues to coordinate with TDEM staff concerning the TWDB's administration of the Flood Mitigation Assistance (FMA) program, as well as its implementation of the Severe Repetitive Loss (SRL) program. The goals associated with these two programs are focused directly at a specific hazard, floods, rather than at the broader, multi-hazard goals addressed in the State Plan. The program goals for both the FMA program and the SRL program are directed at reducing the number of repetitively or substantially damaged structures and the associated claims on the National Flood Insurance Fund, with the SRL program specifically addressing those structures identified as severe repetitive loss properties by FEMA. In addition, by administering the FMA program the TWDB has attained the programs goals by reducing or eliminating claims under the NFIP through mitigation

activities. It is through the implementation of local mitigation projects that the State achieves its goals. Therefore, the State continues to support the various Federal grant programs so that reimbursement monies may reach the local communities, thereby providing incentive to communities to implement proposed mitigation activities.

STATE CAPABILITY ASSESSMENT

The purpose of the State Hazard Mitigation Plan is to motivate State governmental agencies, as well as the public and private sectors, to minimize the effects of hazards by establishing priorities for hazard mitigation programs. The State has funding programs that are available to communities that need assistance with mitigation planning and implementation. These funds primarily come from the Federal government through FEMA mitigation programs such as the Hazard Mitigation Grant Program (HMGP), the Pre-Disaster Mitigation (PDM), and from flood mitigation programs under the National Flood Insurance Program (NFIP) which include the Flood Mitigation Assistance (FMA) program, the Severe Repetitive Loss (SRL) program, and the Repetitive Flood Claim (RFC) program (see Attachment 7 to the State Hazard Mitigation Plan: "Funding Guide" for a complete listing of all funding programs).

Specific to the SRL and the FMA programs, additional information with regard to the Texas Water Development Board (TWDB) has been provided in the following section, expanding on the State Capability Assessment provided in the State Hazard Mitigation Plan. The TWDB has successfully coordinated flood mitigation activities with several of the larger RL communities of the State. As RL numbers within these communities decrease, the TWDB will initiate communication with other communities with RL and SRL properties while and in addition to working with any communities who may voluntarily approach the TWDB for assistance to proactively address their RL problems through planning and project implementation. FEMA's Web Data Exchange database of RL and SRL structures, organized by jurisdiction, will be utilized in order to prioritize applications and track program successes. The State Hazard Mitigation Plan contains additional detail concerning the TDEM Capability Assessment associated with their administration of the HMGP, PDM and RFC programs; this information will not be duplicated in this appendix.

TEXAS WATER DEVELOPMENT BOARD (TWDB)

The TWDB is the State agency charged with collecting and disseminating water-related data, assisting with regional planning, preparing the State Water Plan which addresses the development of the State's water resources, and administering cost-effective financial assistance programs for the construction of water supply, wastewater treatment, flood control and agricultural water conservation projects.

The TWDB administers two FEMA grant programs, the Flood Mitigation Assistance (FMA) program and the Severe Repetitive Loss (SRL) program, both of which provide pre-disaster mitigation funds annually to eligible communities of the State. Project grants for specific eligible activities are available under both programs. Planning grants are also available under FMA for communities to prepare (or update) the flood hazard portion of the community's Hazard Mitigation Plan. Both programs reimburse a portion of TWDB expenses to administer the programs and manage contracts for grants awarded. FMA and SRL grants are 75% Federal and 25% local cost share, with the TWDB serving as the pass through agency for all funds. The TWDB has prepared this appendix so that it is eligible for an increase in the Federal share of the program from 75% to 90%.

The TWDB also provides flood protection planning grants from the State's Research and Planning Fund. These grants are available to political jurisdictions to develop flood protection plans that will

cover entire watersheds, major or minor, to evaluate the flood hazard within those watersheds and to develop structural and nonstructural measures which will effectively mitigate the risks due to those identified flood hazards. Flood protection planning grants are 50-50 cost share between the State and local jurisdictions and are awarded annually through a solicitation request for applications with $1 million available each year for award.

The TWDB also administers the Fund Development Program, the purpose of which is to provide loans for the planning, design, and construction of water supply, wastewater, and flood control projects. Structural flood protection improvements may include construction of storm water retention basins, the enlargement of stream channels public beach re-nourishment, the control of coastal erosion, and the modification or reconstruction of bridges. Non-structural flood protection improvements may include the acquisition of floodplain properties for use as public open space, the acquisition and removal of buildings located within a floodplain, the relocation of those residents inhabiting buildings removed from a floodplain, for flood warning systems, and for the development of floodplain management plans. An environmental review is conducted for all construction projects.

The Texas Natural Resources Information System (TNRIS) is a division of the TWDB and is responsible for producing, archiving, and distributing geographic data to agencies, businesses, and the public. TNRIS supports hazard mitigation planning and implementation in three ways: (a) TNRIS provides data to organizations for planning or response activities; (b) TNRIS actively assists the TWDB by developing, locating, and preparing data for a specific needs and/or projects; and (c) TNRIS updates the State Critical Facility Database for TDEM Mitigation. TNRIS has collected significant base map data which is available to communities as well as to the public. This data includes digital aerial photographs, soil surveys, and transportation, political boundaries, surface water, and elevation maps and data. TNRIS also has census data, historical aerial photos, and paper maps from different State and local agencies. TNRIS is capable of providing personnel to the State Operations Center to assist with data management for tropical storm and emergency preparedness events. For example, TNRIS provided personnel to the FEMA field office during the Space Shuttle Columbia recovery to assist field crews with data integration and organization as well as map production.

With the passage of Senate Bill 1436, Acts of the 80th legislature, R.S. (2007), the duties of the State Coordinator for the National Flood Insurance Program (NFIP) were transferred from the Texas Commission on Environmental Quality (TCEQ) to the TWDB. Not only were the responsibilities associated with the NFIP transferred to the TWDB, a State Floodplain Account with $6.1 million appropriation each biennium was established. The Texas Department of Insurance will transfer $3.05 million each year from its maintenance tax revenues to this account which will be controlled by the TWDB. About half of this funding will be for mapping-oriented products and mapping assistance, while the remainder will go to fund additional staff positions and associated overhead and travel expenses to help achieve the State's goals of enhancing floodplain management practices and management of the NFIP throughout the State. The flood mitigation staff at TWDB has increased from the 2.5 TCEQ and 1.5 TWDB staff prior to the passage of the legislation, to 12 full-time positions. The additional staff will be used to administer the new Severe Repetitive Loss Program, but primarily will enable the State to expand the NFIP State Coordinator duties which consist of Community Assistance Visits (CAVs), Community Assistance Contacts (CACs), and conducting the statewide Floodplain Management 101 workshops.

The CAV is a scheduled visit to an NFIP community for the purpose of conducting a comprehensive assessment of the community's floodplain management program and evaluating its knowledge and understanding of the requirements of the NFIP. The purpose of the CAV is also to assist the community in understanding NFIP requirements when program deficiencies are discovered. The

CAC is a brief visit to establish and maintain contact with a NFIP community for the purpose of offering assistance and determining if any problems or issues exist, if necessary. The CAC also provides the means to enhance working relationships with NFIP communities and to create a greater awareness of the NFIP and its requirements. The Floodplain Management 101 workshops will be offered to local officials and other interested parties and will cover the NFIP and various flood loss reduction techniques and strategies, such as the Community Rating System. Standard training modules on the Texas Water Code, Elevation Certificates, FEMA requirements, community awareness, map reading, permitting, and ordinance comprehension is covered as appropriate. The local assistance of these staff will also enable review and coordination of Federal funding programs to the repetitive loss communities, as well as the local hazard mitigation planning requirements.

The following table summarizes Federal assistance programs administered by the TDEM and the TWDB which provide financial assistance to local entities, program assistance integral to the mitigation of RL and SRL properties.

Program	**Hazard Mitigation Grant Program (HMGP)**
Purpose	-Provides funding assistance to reduce or eliminate future risks to lives and property damage due to natural hazards or vulnerability to future damages
Funding	-Post-disaster, amount available dependent upon disaster damages (percentage of IA and PA requests)
Effectiveness	-Yes. Projects *may* be directed towards reducing losses associated with RL or SRL properties
Recent funding	-Three disaster declarations in 2007, HMGP grant funding amounts unavailable
Program	**Pre-Disaster Mitigation (PDM) Program**
Purpose	-Provides funding for planning/risk analysis, or for mitigation projects to reduce or eliminate the effects of hazards
Funding	-Annual, national competition for funding consideration
Effectiveness properties	-Yes. Projects *may* be directed towards reducing losses associated with RL or SRL
Recent funding	-For FY2005, Planning (4) and projects (10), $20.3 million
Program	**Repetitive Flood Claims (RFC) Program**
Purpose	-Provides funding assistance to reduce or eliminate the long term risk of flood damage specifically to RL structures
Funding	-Annual allocation to the State. Restricted to applications from communities who are not eligible under other grant programs, or cannot meet the local share requirements
Effectiveness	-Yes. Specific to RL properties
Recent funding	-New program. Funding allocation and awards unavailable
Program	**Flood Mitigation Assistance (FMA) Program**
Purpose	-Provides funding for flood mitigation planning, or projects to reduce or eliminate the flood risk to structures insured under the NFIP
Funding	-Annual allocation to the State. Competitive application process, prioritization of applications consider RL properties, and the project's cost effectiveness

Effectiveness	-Yes. Application prioritization specific to RL properties
Recent funding	-Planning (FY2005-2007) $167,500 awards; Project (FY2007) $6,312,890
Program	**Severe Repetitive Loss (SRL) Grant Program**
Purpose	-Provides funding for projects to reduce or eliminate the flood risk to SRL properties
Funding	-Annual allocation to the State. Competitive application process, prioritization of applications consider SRL properties and the project's cost effectiveness
Effectiveness	-Yes. Specific to SRL properties
Recent funding	-Newly implemented program, approximately $24 million available

SPECIFIC ACTIONS TWDB HAS TAKEN TO REDUCE NUMBER OF REPETITIVE LOSS PROPERTIES

The following paragraphs are specific to the mitigation program administered by the TWDB. Over the years, there have been numerous projects and millions of dollars of funding administered by the TDEM; however, at the time the projects were performed, repetitive loss properties were not a specified priority of the programs and therefore were not tracked. TDEM staff is able to review many of these completed contracts however, to determine the nature of RL (and SRL) properties that may have also been mitigated as part of the project. For instance, TDEM staff have determined that for projects completed since 2002, 333 RL properties have been mitigated utilizing funding under the HMGP, 169 RL structures mitigated utilizing PDM program funds, and 1 RL structure mitigated using RFC program funding (a determination of SRL status of these RL properties had not been completed as of yet). The TWDB will continue to coordinate with TDEM in order to create a database of specific properties and to evaluate projects conducted utilizing funding assistance from TDEM- administered programs, as it applies to the mitigation of RL properties and SRL properties.

The TWDB has administered FEMA's FMA program since 1997. The TWDB has utilized FMA available funding to reduce the flood risks associated with repetitive loss properties. All funding allocated to the State under FMA has been utilized to the fullest extent. The TWDB has prioritized applications submitted for consideration under FMA, as those projects directly effecting structures that are on FEMA's RL list to be the highest priority. Cost-effectiveness is the second priority when evaluating applications under the program. To date six FMA contracts totaling $5,234,670 have been successfully completed with Harris County and Harris County Flood Control District that allowed for the buyout and removal of 51 repetitive loss properties. In addition to those projects, contracts have also been completed under the FMA program with the cities of Grand Prairie for $98,092 (for the buyout and removal of one RL property), Denton for $147,065 (for the buyout and removal of two RL properties) and Travis County for $557,300 (for the buyout and removal of four RL properties). Two additional contracts are currently in progress with Harris County and Harris County Flood Control District for additional total funding of $4,595,853 (for the buyout and removal of an additional 46 RL properties), and one contract with the City of Mansfield for $125,625 (for the buyout and removal of one RL property).

Also under FMA, since 2004 eleven projects have been funded in the Beaumont area for total Federal funding in an amount of just less than $19 million. These projects, structural in nature, were developed and funded because of their demonstrated mitigation results, and technically feasible, environmentally sound, and cost effective actions. All eleven projects include minor structural activities such as detention, channelization, bridge or culvert enlargement or modification. Some of these projects have been completed, some are in various stages of implementation and some have just been initiated. To summarize, these projects are protecting over 7,000 residential, commercial and

public structures. An estimated 200 of these structures are RL properties, with 25 of these properties being SRL properties. Based on FEMA data, these projects will significantly reduce the risks due to flooding associated with nearly 25% of the RL properties existing in Jefferson County and will reduce the number of SRL properties by around 50%.

Mitigation Strategies For Rl And Srl Properties—How Texas Intends To Reduce Number Of Rl And Srl Properties

Reducing the risks due to flooding associated with RL and SRL properties is a top priority for the State of Texas. Several actions specific to achieving these mitigation goals have been identified and include the following:

- Encouraging the mitigation of RL and SRL properties at the local level is important in achieving the State goal of reducing flood losses and specifically decreasing claims associated with RL and SRL properties. This will be accomplished through direct communication with community leaders, as well as through numerous training and education programs conducted by TDEM and TWDB staff throughout the year;
- All mitigation programs, including the FMA program and the SRL program, will be promoted in RL communities by the TWDB flood mitigation staff as part of their NFIP State Coordination activities, CAVs and CACs, as well as workshops performed by staff;
- The TWDB and the TDEM will continue to coordinate those program activities that both agencies administer that are associated with floodplain management and the mitigation of risks due to flooding;
- Substantially damaged homes that are in the floodplain/floodway are the first priority in the HMGP Administration Plan. As of this date, consideration will also be given to SRL properties. TDEM has updated its HMGP and PDM Administration Plans to reflect that fact that the State is giving funding priority to projects associated with reducing the number of RL and SRL properties;
- As HMGP and PDM funding becomes available, TDEM will specifically encourage RL and SRL communities to apply for assistance to fund projects which will address RL and SRL properties within their jurisdiction;
- TDEM added the Repetitive Flood Claim (RFC) grant program during 2007. TDEM will continue to promote this program among the RL communities of the State in order to identify and acquire structures located in the floodplain that have experienced repetitive flood loses under the NFIP;
- TDEM will review all projects funded under the HMGP and the PDM programs to evaluate RL and SRL properties which may have been mitigated. Results of this evaluation will be added to the database of mitigated properties maintained by FEMA;
- The TWDB will continue to administer the FMA program to implement cost effective, environmentally sound projects which will substantially reduce the risks due to flooding and the associated flood insurance claims under the NFIP. Projects which directly affect RL properties will continue to receive top priority;
- The TWDB will administer the SRL grant program as of January 2008. The primary goal is to better identify and acquire structures located in the flood plain that have experienced severe repetitive losses. Under the SRL program, the TWDB intends to undertake similar strategies to implement the program as with the FMA program. Initial efforts will be made with the already established contacts in Harris County and Jefferson County. Projects to reduce the number of SRL properties would naturally be the highest priority. FEMA's Web Data Exchange database of RL and SRL structures, organized by jurisdiction, will be utilized in order to prioritize applications and track program successes;

- TWDB will coordinate with TDEM and repetitive loss communities as necessary to ensure that as local plans are updated, RL and SRL properties existing within their jurisdiction will be evaluated and mitigation actions directed towards these properties will be identified as part of the local plan update;
- When requested, the TWDB will provide technical assistance to repetitive loss communities to review and evaluate the occurrence of RL and SRL properties within their jurisdiction.
- Additional identification of specific actions or projects the State is considering to mitigate SRL and RL properties include;
    - Acquisition of real property from property owners, and demolition or relocation of buildings to convert the property to open space in perpetuity;
    - Demolition or relocation of structures to areas outside of the floodplain or Mitigation reconstruction, which is the demolition and rebuilding of structures, is permitted when traditional elevation cannot be implemented;
    - Minor Localized Flood Reduction Projects to lessen the frequency or severity of flooding and decrease predicted flood damages. For projects funded under the Flood Mitigation Assistance (FMA) program, at least 50 percent of the structures directly benefiting from the mitigation activity must be insured under the National Flood Insurance Program (NFIP). For projects funded under the Severe Repetitive Loss (SRL) program, at least 50 percent of the structures directly benefiting from this mitigation activity must be SRL properties;
    - Elevation of existing structures to at least base flood levels, or higher if required by local ordinance, and must utilize techniques in accordance with FEMA requirements;
    - Flood-proofing of existing non-residential structures in accordance with the FEMA SRL Pilot Program Guidance.

Projects funded under the SRL program are limited to those activities that specifically reduce or eliminate flood damages to severe repetitive loss properties. Specific mitigation actions that the State intends to implement to mitigate repetitive loss and severe repetitive loss properties include:

ACTION ITEM # 1

Reduce the number of RL and SRL properties through acquisition of real property from property owners, and demolition or relocation of buildings to convert the property to open space in perpetuity. The State will accomplish this action item by assisting local communities in obtaining mitigation grants through the Severe Repetitive Loss (SRL) and Flood Mitigation Assistance (FMA) grant programs. All projects requested to be funded under SRL and FMA grant programs will be reviewed by TWDB to determine if the project is cost-effective, environmentally sound and technically feasible.

ACTION ITEM #2

Reduce the number of RL and SRL properties through demolition or relocation of structures to areas outside of the floodplain, or through mitigation reconstruction. The State will accomplish this action item by assisting local communities in obtaining mitigation grants through the Severe Repetitive Loss (SRL) and Flood Mitigation Assistance (FMA) grant programs. All projects requested to be funded under SRL and FMA grant programs will be reviewed by TWDB to determine if the project is cost-effective, environmentally sound and technically feasible.

ACTION ITEM #3

Reduce the number of RL and SRL properties through minor localized flood reduction projects to lessen the frequency or severity of flooding and decrease predicted flood damages. The State will accomplish this action item by assisting local communities in obtaining mitigation grants through the

Flood Mitigation Assistance (FMA) and Severe Repetitive Loss (SRL) grant programs. For projects funded under the FMA program, at least 50 percent of the structures directly benefiting from the mitigation activity must be insured under the National Flood Insurance Program (NFIP). For projects funded under the Severe Repetitive Loss (SRL) program, at least 50 percent of the structures directly benefiting from this mitigation activity must be SRL properties. All projects requested to be funded under SRL and FMA grant programs will be reviewed by TWDB to determine if the project is cost-effective, environmentally sound and technically feasible.

ACTION ITEM #4

Reduce the number of RL and SRL properties through the elevation of existing structures to at least the base flood elevations, or higher if required by local ordinance, and must utilize techniques in accordance with FEMA requirements. The State will accomplish this action item by assisting local communities in obtaining mitigation grants through the Severe Repetitive Loss (SRL) and Flood Mitigation Assistance (FMA) grant programs. All projects requested to be funded under SRL and FMA grant programs will be reviewed by TWDB to determine if the project is cost-effective, environmentally sound and technically feasible.

As detailed earlier in Section 2.5, the counties of Harris, Galveston, Brazoria and Montgomery account for 82% of the total number of SRL properties State-wide and nearly 70% of the entire RL properties State-wide. Therefore, RL and SRL properties located in these four counties will receive the highest prioritization of the above mentioned action items when and if the local jurisdiction applies for grants to mitigate their RL and SRL properties. Current applications for the SRL grant program for the fiscal year 2008 reflect a high interest from the local jurisdictions in this geographic area.

An evaluation of the local jurisdiction will be conducted by the State to determine the effectiveness of the proposed mitigation project, and the evaluation will include the availability of local staff to complete the project on-time, previous experience with similar grants and projects, and the availability of local funds to meet the local match share.

Each of the above mentioned activities contributes to the overall mitigation strategy to reduce or eliminate hazardous conditions that result in the loss of life, inflict injuries, causes property damage and/or degrades important natural resources by eliminating people and structures from the known hazard area of the 100-year floodplain or to elevate such structures within the floodplain to a height greater than the expected base flood elevation.

PLAN MAINTENANCE PROCESS AND TECHNICAL ASSISTANCE

The State Hazard Mitigation Plan establishes a detailed process for maintaining and updating the State Plan, including procedures to review the effectiveness of mitigation policies, goals and actions identified in the Plan. Sections 4 and 6 of the State Hazard Mitigation Plan describe the processes to be used in evaluating the effectiveness of the Plan and in amending the Plan when necessary. These sections of the Plan also address the TDEM's technical assistance capabilities and coordination procedures with communities (or coalition of local entities formed for multi-jurisdictional planning purposes) that will enable them to prepare and amend their local hazard mitigation action plans. Provided within this section of the appendix will be maintenance activities specific to goals, programs and mitigation actions associated with the flood hazard risk, and RL or SRL properties. Procedures implemented to evaluate actions directed at the mitigation of RL and SRL properties, and results of that evaluation, will be part of these activities.

FEMA's Web Data Exchange database will form the basis for prioritizing applications for financial assistance, for developing program marketing efforts, and for tracking the successes of projects funded by these programs. Data will be maintained and organized on a community basis to ease prioritization and tracking efforts. Specific addresses of RL and SRL properties in all RL communities will be provided to the TWDB NFIP coordinators for those communities lying within each coordinators particular area of responsibility (the State has been divided geographically and the TWDB has assigned their staff responsibility for NFIP coordination within specific areas of the State). Efforts within the RL communities will be *prioritized* based not only on the numbers of RL and SRL properties occurring within their jurisdictions, but also on estimates of avoidable damages calculated by FEMA for specific RL properties. Efforts within the RL communities will be prioritized based not only on the numbers of RL and SRL properties occurring within their jurisdictions, but also on estimates of avoidable damages calculated by FEMA for specific RL properties. Data will be reviewed quarterly as part of the TWDB reporting responsibilities under the FMA and the SRL programs, and TWDB will coordinate with FEMA as necessary to update the Web Data Exchange. The TWDB will coordinate with TDEM to ensure that both agencies are effectively utilizing staff to efficiently promote the various funding programs available to the RL communities within the State, and to provide technical assistance to those communities when requested. Finally, the TWDB will also coordinate with TDEM to ensure that plan preparation (and updates) includes an assessment of RL and SRL properties within specific RL communities.

SECTION 10 - REFERENCES

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This concludes the State of Texas Hazard Mitigation Plan, created in 2004 and updated in 2007 and 2010 by the Mitigation Section of the Texas Division of Emergency Management and the State Hazard Mitigation Team. For questions or concerns, please contact the Mitigation Section at the contact information below.

Texas Department of Public Safety
Division of Emergency Management
Mitigation Section
P.O. Box 4087
Austin, Texas 78773
(512) 424-2429 Phone
(512) 424-5683 Phone
(512) 424-5959 Fax