

## EXECUTIVE SUMMARY

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Hazard mitigation planning for Harris County identifies ways to reduce risk from foreseeable natural hazards that may impact the county. Harris County prepared an initial hazard mitigation plan in 2015, with cities and special purpose jurisdictions in the county participating as partners in the plan. Since the completion of that plan, the County has continued to experience major growth in residential, commercial and infrastructure development.

Over the last five years, 70,390 development permits were issued in Harris County, and the number of residential properties increased by 13 percent. Over the last decade, population outside the Sam Houston Tollway grew faster than the area inside the tollway, adding to development across the county. Current and future development in hazard prone areas may increase risks, impacts and vulnerabilities of people and property in the county.

To address these changes, and to meet federal requirements for keeping hazard mitigation plans current, Harris County has completed the *2020 Harris County Multi-Hazard Mitigation Action Plan*—the first update to the initial 2015 plan. In preparing it, Harris County again partnered with local cities and special-purpose jurisdictions—38 planning partners in all. Such multi-jurisdictional planning allows these partners to pool resources and eliminate redundant activities within an area that has uniform risk exposure and vulnerabilities.

This hazard mitigation plan reduces risk for those who live in, work in, and visit Harris County. The resources and background information in the plan are applicable across the county, and the plan's goals and recommendations lay groundwork for local mitigation activities and partnerships.

## COMMUNITY INVOLVEMENT IN THE HAZARD MITIGATION PLAN UPDATE

This planning effort was led by a core planning team of staff from the Harris County Office of Homeland Security and Emergency Management (HCOHSEM) and consultant Tetra Tech, Inc. The broader Harris County community participated in the development of the update through the following activities:

- **Defining Stakeholders**—The team identified stakeholders to engage during the update. “Stakeholder” was defined as any person or entity that owns or operates facilities that would benefit from the mitigation actions of this plan or has a capability to support hazard mitigation actions.
- **Establishing the Planning Partnership**—The team identified eligible local governments to engage through this plan update process. Over 50 eligible local governments were identified by this screening process for additional outreach. Ultimately, 38 participated as full planning partners (see Table ES-1).
- **Forming the Steering Committee**—Harris County established a 32-member Steering Committee that represents the entire planning partnership to oversee the planning process.
- **Reviewing Previous Hazard Mitigation Plan and Existing Programs**—The planning team and Steering Committee reviewed the 2015 hazard mitigation plan, as well as all laws, ordinances and programs in effect within the county that can affect hazard mitigation actions.
- **Public Outreach**—The update effort included a website describing update activities, a survey distributed throughout the county to gather public input, the use of social media and informational bulletins to report on update activities, and public meetings to explain the update process and gather

feedback. More than 1,600 people completed surveys, and thousands attended the various public outreach events.

**Table ES-1. Hazard Mitigation Planning Partners Covered Under This Plan**

Harris County	City of Humble	City of Seabrook	Houston Independent School District
City of Baytown	City of Hunters Creek Village	City of Shoreacres	Huffman Independent School District
City of Bellaire	City of Jersey Village	City of Spring Valley Village	Pasadena Independent School District
City of Bunker Hill Village	City of Katy	City of Stafford	Houston Community College
City of Deer Park	City of La Porte	City of Taylor Lake Village	Lone Star College
City of El Lago	City of Missouri City	City of Tomball	University of Houston
City of Friendswood	City of Morgan's Point	City of Webster	Harris County Emergency Services District 12
City of Galena Park	City of Nassau Bay	City of West University Place	Texas Medical Center
City of Hedwig Village	City of Pasadena	Harris County Flood Control District	Harris County Hospital District (dba Harris Health System)
City of Hilshire Village	City of Piney Point Village		

## PLANNING AREA, HAZARDS OF CONCERN, AND RISK ASSESSMENT

The planning area for this hazard mitigation plan update was defined to consist of the unincorporated county, incorporated cities, and special-purpose districts within the greater Harris County metropolitan area, as well as portions of neighboring counties where any individual planning partners have jurisdiction. The Steering Committee considered the full range of natural hazards that could affect the planning area and then identified those that present the greatest concern.

Risk assessment is the process of estimating the potential loss of life, personal injury, economic injury, and property damage resulting from identified hazards. The risk assessments in this plan describe the risks associated with each identified hazard of concern. The following steps were used to assess the risk of each hazard:

- **Identify and profile each hazard**
- **Determine “exposure” to each hazard**—Exposure was assessed by overlaying hazard maps with an inventory of structures, facilities, and systems to decide which of them would be exposed to each hazard.
- **Assess the “vulnerability” of exposed facilities**—Vulnerability of exposed structures and infrastructure was evaluated by interpreting the probability of occurrence of each event and assessing potential damage to structures, facilities, and systems that are exposed to each hazard.

Table ES-2 summarizes the findings of the risk assessment.

## RISK RANKING

This update includes a risk ranking protocol for each planning partner, in which “risk” was calculated by multiplying probability by impact on people, property and the economy. The risk estimates were generated using methodologies promoted by the Federal Emergency Management Agency. The Steering Committee reviewed, discussed and approved the methodology and results. The countywide ranking results are listed in Table ES-3. All planning partners ranked risk for their own jurisdictions following the same methodology.

## MISSION STATEMENT, GOALS AND OBJECTIVES

Table ES-4 lists the mission statement, goals and objectives for this hazard mitigation plan update, as established by the Steering Committee.

**Table ES-2. Key Findings from Risk Assessment of Hazard of Concern**

Hazard of Concern	Key Risk Assessment Findings	
	Exposure	Vulnerability
<b>Coastal erosion</b>	Risk not assessed because no historical damage values could be identified for losses due to erosion within the planning area.	
<b>Dam or levee failure (failure of the Conroe Dam)</b>	<ul style="list-style-type: none"> <li>0.5% of total planning area population</li> <li>Structures valued at 0.5% of planning area total</li> <li>1.2% of all planning area critical facilities</li> </ul>	<ul style="list-style-type: none"> <li>Damage equal to 0.07% of total planning area property value</li> </ul>
<b>Drought</b>	<ul style="list-style-type: none"> <li>Entire planning area exposed</li> </ul>	<ul style="list-style-type: none"> <li>No quantitative loss estimates</li> </ul>
<b>Earthquake (500-year probabilistic event)</b>	<ul style="list-style-type: none"> <li>Entire planning area exposed</li> </ul>	<ul style="list-style-type: none"> <li>2 households displaced</li> <li>Damage equal to 0.5% of total planning area property value</li> </ul>
<b>Flooding (1% annual chance event)</b>	<ul style="list-style-type: none"> <li>8.9% of total planning area population</li> <li>Structures valued at 8.9% of planning area total</li> <li>23.0% of all planning area critical facilities</li> </ul>	<ul style="list-style-type: none"> <li>170,000 persons displaced</li> <li>Damage equal to 0.8% of total planning area property value</li> <li>1.4 million tons of debris to be removed</li> <li>Critical facilities structure damage equal to 9.9% of total value for exposed facilities</li> <li>Critical facilities content damage equal to 33.4% of total value for exposed facilities</li> </ul>
<b>Hurricane, coastal storm (20-year probabilistic event)</b>	<ul style="list-style-type: none"> <li>Entire planning area exposed</li> </ul>	<ul style="list-style-type: none"> <li>1,083 households displaced</li> <li>Damage equal to 0.2% of total planning area property value</li> <li>240,000 tons of debris to be removed</li> <li>Minor damage to 4% of critical facilities</li> <li>Moderate damage to 5.5% of critical facilities</li> <li>Severe damage to 0.4% of critical facilities</li> </ul>
<b>Mass movements</b>	Exposure and vulnerability are low to none, based on the lack of historical occurrence of these types of hazards and the planning area's proactive approach to mitigating subsidence issues starting in 1999.	
<b>Severe weather</b>	<ul style="list-style-type: none"> <li>Entire planning area exposed</li> </ul>	<ul style="list-style-type: none"> <li>No quantitative loss estimates</li> </ul>
<b>Tsunami</b>	Exposure and vulnerability are low to none, based on the lack of historical occurrence of tsunami	
<b>Wildfire (Moderate, high or very high wildfire ignition density zone)</b>	<ul style="list-style-type: none"> <li>0.7% of total planning area population</li> <li>Structures valued at 1.0% of planning area total</li> <li>0.4% of all planning area critical facilities</li> </ul>	<ul style="list-style-type: none"> <li>No quantitative loss estimates</li> </ul>

**Table ES-3. Hazard Risk Ranking**

Hazard Ranking	Hazard Event	Total Score	Category <sup>a</sup>
1	Hurricane and Coastal Storms	51	High
	Severe Weather	51	High
2	Flood	36	High
3	Wildfire	24	Medium
4	Earthquake	16	Medium
5	Coastal Erosion	6	Low
	Drought	6	Low
	Dam Failure	6	Low
	Mass Movements	6	Low
	Tsunami	6	Low

a. Scores of 30 or greater are rated as "high," scores of 15 to 29 are "medium," and scores of less than 15 are "low"

**Table ES-4. Mission Statement, Goals and Objectives**

Mission Statement	Goals	Objectives
<p>Develop and maintain a comprehensive pre- and post-disaster hazard mitigation program. The Mission Statement is guided by the effective use of technology and data, improved communications and warning, the purchase of necessary equipment, sound planning, the adoption of codes, enhanced transportation networks, expanded education and outreach efforts, strengthened public facilities and infrastructure, the utilization/enhancement of natural resources, the consideration of future hazard conditions and the implementation of projects designed to reduce the vulnerability of individuals, families, households, businesses, infrastructure and critical facilities to the negative effects of natural and human-caused hazards.</p>	<ol style="list-style-type: none"> <li>1. Expand warning systems and local warning capabilities among departments and between jurisdictions.</li> <li>2. Improve and coordinate data collection efforts to fully maximize the intent of the efforts and to improve the mitigation capabilities of the county and all jurisdictions.</li> <li>3. Enhance education strategies to improve the dissemination of information to the public regarding hazards, including the steps that can be taken to reduce their impact.</li> <li>4. Improve the capabilities of local government officials to reduce or eliminate hazards that cause loss of life, inflict injuries, cause property damage and to improve the protection of natural resources.</li> <li>5. Work to improve and coordinate existing local plans, codes and regulations to reduce the impacts of natural hazards.</li> <li>6. Implement property protection measures to reduce the effects of natural hazards throughout the county, including measures that reduce or eliminate repetitive loss occurrences.</li> <li>7. Investigate and implement a range of structural projects that will reduce the effects of natural hazards on public and private property throughout the county.</li> <li>8. Investigate and implement a range of nature-based solutions and utilize and enhance natural resources and their ability to reduce the impacts from natural hazards</li> </ol>	<ol style="list-style-type: none"> <li>1. Improve and expand systems that provide warning and emergency communications to the whole community</li> <li>2. Implement wildfire mitigation and watershed protection strategies through local, state, tribal, federal and private partnerships.</li> <li>3. Improve understanding of the locations, potential impacts, and linkages among threats, hazards, vulnerability, and measures needed to protect life safety and health.</li> <li>4. Reduce the impacts of hazards on individuals with disabilities and others with access and functional needs.</li> <li>5. Coordinate state and local efforts to reduce greenhouse gas emissions and implement climate adaptation strategies through hazard mitigation plans and actions.</li> <li>6. Control access and provide buffers to maximize resource protection where possible.</li> <li>7. Encourage all state, regional and local hazard mitigation projects and planning programs to protect the environment and promote implementation of sustainable mitigation and climate resilience actions.</li> <li>8. Support hazard mitigation measures that promote and enhance natural processes and minimize adverse impacts on the ecosystem.</li> <li>9. Encourage all cities, counties, special districts, Councils of Governments and tribal organizations to develop, adopt, and implement local hazard mitigation principles that may be integrated with local comprehensive plan safety elements, local coastal plans, facilities master plans, and other local plan initiatives.</li> <li>10. Advance community resilience through preparation, adoption, and implementation of state, regional and local multi-hazard mitigation plans and projects.</li> <li>11. Encourage projects that simultaneously reduce risk while increasing resilience and sustainability.</li> <li>12. Manage new and existing development in high hazard areas, especially those known to be repetitively damaged.</li> <li>13. Support the protection of vital and essential records, and strengthening or replacement of buildings, infrastructure, and lifelines to minimize post-disaster disruption and facilitate short-term and long-term recovery.</li> <li>14. Through the enforcement of relevant federal, State and local regulations, sustain life and property protection measures for all communities and structures located in the greater Harris County region.</li> <li>15. Promote disaster resistant development.</li> </ol>

## MITIGATION ACTION PLANS

Catalogs of hazard mitigation best practices were developed that present a broad range of action alternatives to be considered for use by the planning partners. One catalog was developed for each hazard of concern. The alternatives include actions that will mitigate current risk from hazards and actions that will help reduce risk from changes in the impacts of these hazards resulting from climate change.

Hazard mitigation actions recommended in this plan were selected from an analysis of the alternatives presented in the catalogs. Each planning partner selected appropriate mitigation actions to establish an individual mitigation action plan for its jurisdiction. Actions were selected based on an analysis of the planning partner's ability to implement the action and general feasibility. The combined action plans of the 38 planning partners include a total of 750 actions for mitigating hazard risks in the Harris County planning area. The planning partners have prioritized the actions in their action plans and can begin to implement the highest-priority actions over the next five years.

## PLAN IMPLEMENTATION AND MAINTENANCE

The effectiveness of the hazard mitigation plan depends on its effective implementation and incorporation of the outlined action items as needed into each partner's existing plans, policies, and programs. Harris County will have lead responsibility for overseeing the plan implementation and maintenance strategy. Plan implementation will be a shared responsibility among all planning partnership members and agencies identified as lead agencies in the jurisdiction-specific action plans.

A formal implementation and maintenance process will ensure that the hazard mitigation plan remains an active and relevant document and that the planning partners maintain their eligibility for applicable funding sources. The plan maintenance process includes a schedule for monitoring and evaluating the plan annually and producing an updated plan every five years. The plan maintenance matrix shown in Table ES-5 provides a synopsis of responsibilities for the overall plan maintenance strategy.

**Table ES-5. Plan Maintenance Matrix**

Task	Approach	Timeline	Lead Responsibility	Support Responsibility
<b>Monitoring-Progress Reporting</b>	Preparation of status updates and action implementation tracking as part of submission for annual progress report.	January to January of each calendar year or upon full update to comprehensive plan or major disaster	Jurisdictional points of contact	Jurisdictional implementation lead
<b>Evaluation</b>	Annual progress reports will be evaluated by an oversight steering committee annually	Finalized progress report completed by March 1 of each year	HCOHSEM	Jurisdictional points of contacts
<b>Update</b>	Reconvene the planning partners, at a minimum, every 5 years to guide a full review and revision of the plan.	Every 5 years or upon full update to comprehensive plan or major disaster	HCOHSEM and oversight steering committee	Jurisdictional points of contacts
<b>Grant Monitoring and Coordination</b>	Monitor grant funding opportunities via agency notifications, state associations and post-disaster response	Ongoing	HCOHSEM	Jurisdictional points of contacts
<b>Plan Integration</b>	Create a linkage between the hazard mitigation plan and individual jurisdictions' comprehensive plans or similar plans	Ongoing as opportunities for integration become available, or according to timelines identified in individual actions plans	Jurisdictional points of contact	Jurisdictional implementation lead

Task	Approach	Timeline	Lead Responsibility	Support Responsibility
<b>Continuing Public Involvement</b>	Keep the website maintained and receive comments through it over the course of the plan. Planning partners will maintain links to the website. County-wide progress report will be posted to the website.	Ongoing. Progress reports to be posted annually.	HCOHSEM will maintain the overall website and post the progress report annually. Each planning partner will provide a link to the website and may post individual progress reports.	HCOHSEM and jurisdictional implementation lead