State of Texas CDBG Mitigation (CDBG-MIT) Action Plan:
Building Stronger for a Resilient Future

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1 EXECUTIVE SUMMARY

The Further Additional Supplemental Appropriations for Disaster Relief Requirements Act, 2018 (Division B, Subdivision 1 of the Bipartisan Budget Act of 2018, Pub. L. 115-123, approved February 9, 2018), made available $28 billion in Community Development Block Grant disaster recovery (CDBG-DR) funds, and directed the U.S. Department of Housing and Urban Development (HUD) to allocate not less than $12 billion for mitigation activities proportional to the amounts that CDBG-DR grantees received for qualifying disasters in 2015, 2016, and 2017.

HUD allocated $4,297,189,000 in CDBG mitigation (CDBG-MIT) funds to the state of Texas through their notice published in the Federal Register, 84 FR 45838 (August 30, 2019). The Texas General Land Office (GLO) has been designated by Governor Greg Abbott to administer CDBG-MIT funds on behalf of the state of Texas.

CDBG-MIT funds represent an opportunity to fund and carry out strategic and high-impact activities to mitigate disaster risks and reduce future losses in areas impacted by recent disasters. In their Federal Register notice, HUD defines mitigation as: “Those activities that increase resilience to disasters and reduce or eliminate the long-term risk of loss of life, injury, damage to and loss of property, and suffering and hardship, by lessening the impact of future disasters.”

Texans are at risk of significant natural disasters. According to the State of Texas Hazard Mitigation Plan (SHMP), Texas leads the nation in disaster declarations. The recent 2015 Floods, 2016 Floods, and Hurricane Harvey illustrate these risks.

The flooding events in 2018 and 2019, as well as Tropical Storm Imelda, further demonstrate that Texans have been and continue to be at risk of hazards such as hurricanes, tropical storms, depressions, and flooding. These funds will prove to be a long-lasting investment that increases the resiliency of communities throughout the state.

The State of Texas CDBG Mitigation Action Plan (the Action Plan) was developed to meet the HUD requirements outlined in their Federal Register notice, 84 FR 45838 (August 30, 2019). The Action Plan consists of a Mitigation Needs Assessment, a detailed use of funds, and an allocation budget.

The Mitigation Needs Assessment (the Assessment) was developed using the most recently updated SHMP (October 2018) to identify natural hazards; it provides a rationale for the state’s programs. This Assessment demonstrates that:

- Flooding, hurricanes, tropical storms, and tropical depressions have the greatest impact in Texas;
- Housing, infrastructure, and businesses are continuously impacted and are at risk; and
A variety of disasters can happen at any time and any place in Texas.

The Action Plan details the proposed use of all funds, including eligibility criteria, eligible applicants, and maximum award amounts. All state mitigation activities are required to address risks identified in areas affected by the 2015 Floods, 2016 Floods, and Hurricane Harvey.

Through this Action Plan, the GLO allocates funds to local governments and other eligible applicants for local and regional mitigation projects and mitigation planning. The GLO will implement state-run housing programs to reconstruct primary residences damaged by Hurricane Harvey with an eye toward increased resiliency.

This Action Plan considers and addresses critical mitigation needs over a large geographic area while maintaining as much local control as possible through several programs aimed at creating more resilient communities through improved infrastructure, housing, building and land use policies and practices, and hazard mitigation planning. Based on the Assessment, stakeholder outreach, past planning and recovery efforts, and public input, the GLO has created the following mitigation programs:

i. 2015 Floods State Mitigation Competition  
ii. 2016 Floods State Mitigation Competition  
iii. Hurricane Harvey State Mitigation Competition  
iv. Regional Mitigation Program (COG MODs)  
  v. Hazard Mitigation Grant Program (HMGP): Supplemental  
  vi. Coastal Resiliency Program  
  vii. Housing Oversubscription Supplemental  
  viii. Resilient Home Program  
  ix. Hazard Mitigation Plans  
  x. Resilient Communities Program  
  xi. Regional and State Planning

As required by the Notice, at least 50 percent of CDBG-MIT funds must be used to support activities that benefit LMI persons, and all programs will have an LMI priority.

HUD has identified Aransas, Brazoria, Chambers, Fayette, Fort Bend, Galveston, Hardin, Harris, Hays, Hidalgo, Jasper, Jefferson, Liberty, Montgomery, Newton, Nueces, Orange, Refugio, San Jacinto, San Patricio, Travis, Victoria, and Wharton Counties; 75979, 77320, 77335, 77351, 77414, 77423, 77482, 77493, 77979, and 78934 ZIP Codes as the “most impacted and distressed” areas (HUD MID) the Federal Register notice, 84 FR 45838 (August 30, 2019), and has required that at least 50 percent of the allocation must address identified risks within these areas. Up to 50
percent may address identified risks needs within the “most impacted and distressed” areas determined by the GLO.

Appendix A identifies the counties that received a federal disaster declaration in 2015 (DR-4223 and 4245), 2016 (DR-4266, DR-4269 and DR-4272), and Hurricane Harvey (DR-4332) and that were also identified as HUD MID Counties and ZIP Codes.

Figure 1-1: CDBG-MIT Eligible Areas

Data Source: FEMA Disaster Assistance County - https://www.fema.gov/disaster; HCDP CDBG Mitigation Federal Register Notice
Author: Texas General Land Office - Community Development and Revitalization Program
Projection: NAD 1983 Texas Statewide Mapping System
### Executive Summary – Total Allocation Budget

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<th>Programs</th>
<th>HUD Most Impacted and Distressed</th>
<th>State Most Impacted and Distressed</th>
<th>Total Allocation</th>
<th>% of Total Allocation</th>
<th>LMI Amount</th>
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<tbody>
<tr>
<td>2015 Floods State Mitigation Competition</td>
<td>$23,048,475</td>
<td>$23,048,475</td>
<td>$46,096,950</td>
<td>1.07%</td>
<td>$23,048,475</td>
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<td>2016 Floods State Mitigation Competition</td>
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<td>$73,840,380</td>
<td>$147,680,760</td>
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<td>$73,840,380</td>
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<td>Hurricane Harvey State Mitigation Competition</td>
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<td>$1,072,388,360</td>
<td>$2,144,776,720</td>
<td>49.91%</td>
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<td>Regional Mitigation Program</td>
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<td>$100,000,000</td>
<td>$500,000,000</td>
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<td>AACOG</td>
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<td>$76,927,000</td>
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<td>$38,463,500</td>
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<td>CTCOG</td>
<td>$10,765,000</td>
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<td>DETCOG</td>
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<td>$61,216,000</td>
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<td>Housing Oversubscription Supplemental</td>
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<td>8.94%</td>
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<td>$70,000,000</td>
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<td>Resilient Communities Program</td>
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<td>$50,000,000</td>
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<td>Regional and State Planning</td>
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<td>$107,429,725</td>
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<td>5.00%</td>
<td>N/A</td>
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<td>State Administration</td>
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<td>$107,429,725</td>
<td>$214,859,450</td>
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<td><strong>Total</strong></td>
<td><strong>$2,498,594,500</strong></td>
<td><strong>$1,798,594,500</strong></td>
<td><strong>$4,297,189,000</strong></td>
<td><strong>100%</strong></td>
<td><strong>$1,968,735,050</strong></td>
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2 MITIGATION NEEDS ASSESSMENT – STATE OF TEXAS

The state of Texas completed the following Mitigation Needs Assessment (the Assessment) to identify long-term needs and priorities for CDBG-MIT funding allocated as a result of 2015, 2016, and 2017 Texas Disasters. This Assessment takes into account a comprehensive set of data sources that cover multiple geographies and sectors and was completed according to guidelines set forth by HUD in its first CDBG-MIT Federal Register notice, 84 FR 45838 (August 30, 2019).

The information contained in the Assessment focuses on the statewide impacts and the impacts on the 140 CDBG-MIT eligible counties (see list in Appendix A). The information was compiled using federal and state sources, including information from FEMA, Texas Division of Emergency Management (TDEM), and other federal, state, and local agencies and data sources.

The GLO was able to gather information regarding the impacts of the 2015 and 2016 Floods and Hurricane Harvey; actions taken during and following the storms; and the risks and impacts on impacted communities. This Assessment includes specific details about needs in the eligible and most impacted and distressed communities. This includes risks to and impact on housing and infrastructure.

This Assessment has five main sections: (1) Impact of Prior Disasters; (2) Resiliency Solutions and Mitigation Priorities; (3) State Risks and Hazards Assessment; (4) A Review of State Reports, Studies, and Legislation; and (5) Hazards by County. Each section illustrates the variety of risks and immense impacts Texas communities face from natural hazards—particularly from flooding, hurricanes, tropical storms, and depressions. In demonstrating these risks and impacts, this Assessment provides a rationale for the state-administered mitigation programs detailed in the following chapters.

2.1 Cumulative Impacts of Disasters

2.1.1 THE 2015 FLOODS

On the nights of May 24–26, 2015, a slow-moving storm system dropped a tremendous amount of rain across much of Texas. The storm was preceded by more than a week of heavy rain that cumulated in record-breaking floods in areas that historically had not previously flooded (the National Weather Service has cited May 2015 as one of the wettest months in Texas history). Many areas reported tornado activity and record lightning strikes. The cities of Wimberley and

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San Marcos in Hays County were particularly hard hit; countywide, 321 homes were destroyed, with hundreds more heavily damaged.\(^2\) The Blanco River covered portions of Interstate 35.

During the first part of May, many locations across the state received well above normal rainfall that saturated soils. When the Memorial Day weekend arrived, much of the region was at least 2–4 inches (100–300 percent) above average. These conditions led to additional rains running-off directly into rivers, streams, and flash flood prone areas. Across Bandera, Kerr, Kendall, Blanco and far west portions of Comal and Hays counties 6-8 inches of rain fell with a maximum of 10 to 13 inches of rain falling across southern Blanco and northeast Kendall counties. The majority of this rain fell from Saturday afternoon into the overnight hours of early Sunday morning, leading to the rapid rise of the Blanco and San Marcos Rivers. The Blanco River at Wimberley rose from near 5 feet at 9 p.m. to near 41 feet by 1 a.m. One staggering statistic is that the river rose 5 feet every 15 minutes from 10:45 p.m. to 11:45 p.m. This equates to a 20-foot rise along the river within a 1-hour timeframe (Figure 3-1).\(^3\)

Figure 2-1:  Fischer Store Road Bridge (formerly) over the Blanco River.\(^4\)

Areas of Texas saw more than 20 inches of rainfall in a matter of days. About 8 million-acre feet of water flowed into the state’s reservoirs. Within 48 hours, enough water fell to supply the needs of a city of 8 million people for one year. The amount of water that fell over the 30-day period would put the state of Rhode Island under 10 feet of water, fulfill New York City’s water needs for 7 full years, or fill Lake Mead, the largest reservoir in the U.S., twice over.\(^5\)

The May floods killed 31 people—27 in Texas and 4 in Oklahoma.\(^6\) The President issued a major disaster declaration (FEMA-4223-DR) on May 29, 2015, after multiple state disaster declarations from the governor’s office.


Central and Eastern Texas were also hit by dangerous flooding in October of 2015 when rainfall patterns converged with remnants of Hurricane Patricia. In total, 22 counties were part of this disaster declaration (DR-4245).

For both disasters, there was a total of 16,253 approved applications for FEMA individual assistance. Total approved individual and households program assistance was $76,048,194. The total Public Assistance obligated was $209,596,310 for both disasters, with emergency work totaling $39,933,822 and permanent work totaling $157,709,665. Widespread flooding in 2015 could cost Texas upward of $3 billion, largely from damage to soaked roads and public infrastructure.⁷

**Figure 2-3: Hydrography for Blanco River at Wimberley.**

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2.1.2  THE 2016 FLOODS

The 2016 floods resulted from storms that extended from March through June, causing severe damage across almost half the state or 134,000 square miles.

The torrential rain event in March was a devastating blow to many Texas communities still trying to recover from the impact of the major 2015 floods. The continuous heavy rainfall on nearly saturated ground created excessive downstream flooding and record-breaking river crests. The record-setting devastation destroyed agricultural areas and homes and resulted in the closure of Interstate 10 along the Texas-Louisiana border that created lengthy delays for individuals, as well as major disruptions in the delivery of goods and services.8

On March 19, 2016, Texas received a Presidential disaster declaration (DR-4266) allowing for access to federal disaster assistance including debris removal and emergency protective measures.9 The extensive flooding effectively cut off access to entire communities. Thousands of Texans were forced to evacuate their homes and entire cities required mandatory evacuations. In Orange County, approximately 9,000 community members were evacuated while in Newton County, approximately 3,500 community members were evacuated, resulting in long-term sheltering needs for community members trying to recover and rebuild from the devastation. In Deweyville, the elementary school was flooded with over 5 feet of water that resulted in an estimated $12 million in damages; consequently, over 600 Deweyville students were out of school for a month while the community was without an elementary school.10

The Texas Division of Emergency Management’s Disaster Summary Outline (DSO) estimated that the state’s infrastructure was hard hit, with heavy damage to roads and multiple destroyed bridges. The swift flood waters carrying debris left many roads impassable, forcing many closures. Due to rain occurring upstream, downstream river levels continued to rise even after the rain stopped, causing even more damage and limiting community members’ ability to return to or have access to their homes. The Burr’s Ferry Bridge damage alone was so severe as to require a full closure, with subsequent extensive repairs to the bridge’s piers.

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9 “Texas—Severe Storms, Tornadoes, and Flooding, FEMA-4266-DR, Declared March 19, 2016,” FEMA, [https://www.fema.gov/media-library-data/1460556248725-fe01158557a973f761ab1f1a284c421e/FEMA4266DRTX(Expedited).pdf](https://www.fema.gov/media-library-data/1460556248725-fe01158557a973f761ab1f1a284c421e/FEMA4266DRTX(Expedited).pdf)
10 Ibid.
On April 17, 2016, Texas was hit with a sixth catastrophic rain event in a 12-month period, initiating a rare flash flood “emergency warning” by the National Weather Service’s Houston/Galveston Weather Forecast Office. The rare warning criteria was on target, given the consequences to a highly vulnerable population. The severe flooding greatly affected first responders’ abilities to assist community members and, in some instances, even required the rescue of first responders themselves. Parts of Southeast Texas received 10 inches or more of rain during a 24-hour period, with parts of northwest Harris County and Houston receiving up to 15 inches. The devastating floods covered seven counties. On April 25, 2016, Texas received a second Presidential disaster declaration (DR-4269) for the April flooding.

Figure 2-4: Burr’s Ferry Bridge SH 63 over the Sabine River.\textsuperscript{11}

\textsuperscript{11} Photography by Texas Department of Transportation.
Texas was hit by another intense round of devastating storms in May, a year after the historical 2015 Memorial Day flooding event. The storms occurred between May 26 and mid-June marking the third catastrophic storm event to impact Texas in 2016. This series of storms resulted in disaster declaration DR-4272. The effect of these storms continued to devastate communities as rain fell on supersaturated grounds in counties still recovering from the previous months’ floods and the flooding in 2015. Evacuation and search data provide an insight into the acute severity of these storms. Jointly, Texas Task Force 1 and the Texas Military Department made over 1,444 evacuations, 40 rescues, 520 assists, 618 wellness checks, and many victim recoveries. Texas Parks and Wildlife Department recorded 336 evacuations and 78 rescue assists. Mandatory evacuations were required in many counties, including Bastrop, Brazoria, Fort Bend, Hood, and Parker, along with voluntary evacuations throughout the disaster area.

On May 26 and 27, the Austin area received widespread rain of 6–8 inches, and in a corridor stretching from I-35 in Austin to just east of I-45, over 12 inches of rain was recorded. The evening of May 28 provided more hardships, as the Texas Hill Country received widespread heavy rains of 6–10 inches—leading to flash flooding and critical flood stages for many rivers, including the Frio, Medina, and Guadalupe. Emergency response to the rain event included evacuations at Jellystone Park and along the Frio River.\footnote{Ibid.} Rescue efforts continued as a large thunderstorm moved into the Texas Hill Country the evening of May 28; subsequently, record-breaking rainfall totals were noted, as well as rare cresting above flood stage levels of rivers and creeks.

The Memorial Day holiday again proved to be devastating. As heavy rains fell, renewed flash flooding necessitated water rescues during overnight hours. In Hood County, 10 inches of rain flooded and shut down many county roads. On the morning of June 2, this dangerous episode of flash flooding claimed the lives of nine brave soldiers in Fort Hood, as their Light Medium Tactical Vehicle was washed from a low-water crossing and overturned in swollen Owl Creek.\footnote{Michelle Tan, “Army releases names of all 9 soldiers killed in Fort Hood truck accident,” \textit{Army Times}, June 5, 2016, \url{https://www.armytimes.com/news/your-army/2016/06/05/army-releases-names-of-all-9-soldiers-killed-in-fort-hood-truck-accident/}}

South Texas was also severely impacted by the storms, as two confirmed EF-1 tornadoes wreaked havoc to homes and infrastructure within those communities. The Houston area alone was hit with as much as 8 inches of rain in 5 hours.

In Fort Bend County, the devastation to critical infrastructure included damage to bridges, roads, and levees due to the continuous flooding along the Brazos River, compounding effects from the 2015 declared disasters. It is estimated that 181 homes were destroyed in the county, with an additional 600 homes experiencing major damage.
2.1.3 Hurricane Harvey

In 2017, communities still working to recover from the severe 2015 and 2016 flooding events were impacted again. Hurricane Harvey, a regenerated tropical depression, made landfall on August 25, 2017, as a Category 4 hurricane, bringing with it extreme wind gusts and, in some places, up to 60 inches of rain in 5 days.\(^\text{17}\) The hurricane caused catastrophic flooding and at least 82 human fatalities,\(^\text{18}\) due in part to the weather system stalling over the Texas coast. The windspeeds recorded over South Texas may have been underestimated, especially near the coast and close to the eye of the hurricane, as many observation stations were disabled prior to its landfall; however,

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a peak wind gust of 152 mph (at 10 meters above ground level) was recorded at the Aransas County Airport in Rockport.\textsuperscript{19}

Although Hurricane Harvey made landfall twice in Texas, it is often regarded as three separate events: the initial landfall in Aransas County; unprecedented rainfall in the Houston metroplex and surrounding areas; and the second landfall on August 29, 2017, in Southeast Texas near the cities of Orange, Beaumont, and Port Arthur. These events caused not only wind damage but devastating widespread flooding.

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure27.png}
\caption{Track of Hurricane Harvey.\textsuperscript{20}}
\end{figure}


Quick Facts:

- At landfall, Hurricane Harvey was approximately 250 miles in diameter, with an eye 20 miles in diameter.
- Over 560,000 people evacuated in advance of the hurricane.
- Largest rainfall event in U.S. history.
- In Aransas, Nueces, Refugio, and San Patricio Counties, wind forces damaged 40,929 buildings, resulting in $4.58 billion in damage.
- As the hurricane stalled over the Houston metroplex, approximately one-third of Harris County was completely underwater.
The 49 CDBG-DR eligible counties affected by Hurricane Harvey cover 15 percent or 39,496 square miles of the land area in the state and contain approximately 32 percent of the state’s population. The land area affected is roughly the size of the state of Kentucky. Nearly 9 million Texans live in the affected counties.

The initial landfall caused severe wind damage (demonstrated by the number of windstorm damage insurance claims in red, Figure 3-9). This map also portrays the extent of NFIP claims in the northern section of the coast, where storm rains caused severe flooding in Houston and the surrounding areas. This graphic further demonstrates the two catastrophic characteristics of Hurricane Harvey: (1) hurricane-force winds and (2) a slow-moving storm bringing historic rainfall and flooding.

**Figure 2-9: Residential and Commercial Windstorm and Flood Damage Insurance Claims**
By the time the rain stopped, Hurricane Harvey had dumped almost a year’s worth of rainfall in a matter of days. So much rain fell during the hurricane that the National Weather Service had to update the color charts on their graphics in order to effectively map it (see figure below). Two additional shades of purple were added to represent rainfall totals for 20–30 inches and “greater than 40 inches” ranges.

According to the Texas Legislative Budget Board April 2019 report, more than 70 state agencies responding to Hurricane Harvey have been fiscally impacted in aggregate over $3.3 billion. This number does not account for potential significant state public school finance expenses primarily driven by facility damage costs and property value declines. Certain disaster-related costs are statutorily required through the Foundation School Program (FSP), which is the principal vehicle for distributing state aid to school districts to provide educational services. The statutorily required state cost for the 2020–21 biennium totals $715.1 million alone in increased state aid due to decreased property values during tax year 2018. The total fiscal impact to the state (i.e., actual and estimated) could reach $6.3 billion, not including education costs.24

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2.1.4 2018 & 2019 Floods and Tropical Storm

While the CDBG-MIT funds are designated for mitigation needs in the most impacted and distressed communities across the state for the 2015, 2016, and 2017 (Hurricane Harvey) disaster events, additional federal declarations have been made for Texas since 2017. In 2018, there were two federal disaster declarations: severe storms and flooding (DR-4377), which impacted three counties in South Texas; and severe storms and flooding (DR-4416), which was a Public Assistance declaration for a variety of counties in the Hill Country in Central Texas, as well as other counties in Texas.

In 2019, the Lower Rio Grande Valley in South Texas was once again hit with severe weather, resulting in another federal disaster declaration (DR-4454). Tropical Storm Imelda in the late summer of 2019 impacted a large swath of Southeast Texas and left affected community members without homes and infrastructure resulting in a federal disaster declaration (DR-4466). This is continued evidence for the need for mitigation measures against floods, hurricanes, tropical storms, and depressions, and other hazards that this Action Plan addresses.

**Figure 2-12: 2018 & 2019 Disaster Declared Counties**
2.2 CDBG Mitigation

Populations across Texas experience continued risk from a wide variety of hazards. Risk is defined as an individual or community’s exposure to danger and can be defined by the formulation of risk equaling the probability of a disruptive event, shock or stress, e.g., a hazard, multiplied by the consequences (exposure and vulnerability) or loss connected to the event occurrence. This conceptual definition of risk can be written out as: Risk = Hazard x Consequence.

![Figure 2-13: Risk](risk-conceptual-definition.png)

Over the past several years, government institutions, private and nonprofit sectors, and academia have evaluated the increased exposure to risk that populations face and are working to identify ways to mitigate against these risks. Traditionally, following a disaster and the immediate response and short-term recovery efforts, congressional appropriations are made to the U.S. Department of Housing and Urban Development (HUD) through the Community Development Block Grant program for long-term disaster recovery (CDBG-DR). These CDBG-DR funds are a mechanism for states and local communities to address their unmet recovery needs arising from events receiving a Presidential disaster declaration. These funds are typically used for infrastructure, housing recovery, and economic development and revitalization.

In response to the threat posed by future hazards and the difficulty that states and communities face in rebuilding following a major disaster, a congressional appropriation specifically targeted towards hazard mitigation was made in 2018. This appropriation was laid out in Public Law (Pub. L.) 115-123 and provided $28 billion in funding to 2015, 2016, and 2017 CDBG-DR grantees. Congress specified that these funds be used for two purposes: (1) to address unmet needs from

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qualifying 2017 disasters; and (2) to provide funding to grantees from 2015 through 2017 for mitigation activities. When these funds were appropriated, HUD’s CDBG program was identified as the mechanism through which these funds would be allocated to the impacted states and territories. HUD then made grantee allocation determinations and developed the subsequent Federal Register notice, 84 FR 45838 (August 30, 2019), outlining the rules and regulations for this first-ever CDBG mitigation (CDBG-MIT) funding stream.

To understand the shift in focus from HUD’s CDBG-DR program to this new CDBG-MIT program, it is important to define mitigation as it pertains to natural hazards. The Federal Emergency Management Agency (FEMA) defines mitigation as an effort to reduce loss of life and property by lessening the impact of disasters. Similarly, HUD defines mitigation as:

_Those activities that increase resilience to disasters and reduce or eliminate the long-term risk of loss of life, injury, damage to and loss of property, and suffering and hardship, by lessening the impact of future disasters._ —84 FR 45838 (August 30, 2019)

Figure 2-14:  The Aspects of Mitigation

For mitigation to be effective, communities and states must take action before future hazards strike. This is particularly true in a state like Texas that experiences such a wide range of natural hazards. By understanding local risks, communities can identify and invest in long-term interventions that ensure community well-being and safety.

Without these mitigation interventions, safety, financial security, and self-reliance are jeopardized. Effective mitigation efforts can break the cycle of disaster damage by removing people and
property from harm’s way and building systems that redirect or lessen the impact of natural hazards, not only saving lives but reducing future expenditures related to recovery. For example, a recently updated study by the National Institute of Building Sciences shows that federally funded mitigation grants, on average, can save a community and nation $6 in future disaster costs for every $1 spent on hazard mitigation. Additionally, the report also illustrates that, on average, investments made by local communities and homeowners in hazard mitigation measures that exceed standard building codes can save $4 for every $1 spent.  

Figure 2-15: Benefit-Cost Ratio of Mitigation

<table>
<thead>
<tr>
<th>Peril</th>
<th>Federally Funded</th>
<th>Beyond Code Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riverine Flood</td>
<td>7:1</td>
<td>5:1</td>
</tr>
<tr>
<td>Hurricane Surge</td>
<td>Too few grants</td>
<td>7:1</td>
</tr>
<tr>
<td>Wind</td>
<td>5:1</td>
<td>5:1</td>
</tr>
<tr>
<td>Earthquake</td>
<td>3:1</td>
<td>4:1</td>
</tr>
<tr>
<td>Wildland-Urban Interface Fire</td>
<td>3:1</td>
<td>4:1</td>
</tr>
</tbody>
</table>

Hazard mitigation is an important investment. Accordingly, the CDBG-MIT program will serve as a large-scale demonstration of the impact and effectiveness of a national hazard mitigation program whose approach is highly adaptable and flexible to help states and local communities begin, or continue, efforts to mitigate against a variety of hazards. The $4.29 billion directly allocated to the state of Texas as a HUD grantee will prove to be a long-lasting investment that increases the resiliency of communities throughout the state.

The Mitigation Needs Assessment and use of funds outlined in this Action Plan may align and leverage additional state and federal programs such as the National Flood Insurance Program (NFIP), the Hazard Mitigation Grant Program (HMGP), the Pre-Disaster Mitigation (PDM) Program (which will be transforming into the Building Resilient Infrastructure and Communities (BRIC) in 2020), as well as other state and local mitigation efforts.

2.3 Resiliency Solutions and Mitigation Priorities

Recognizing the state’s long and well-documented history of flooding, hurricanes, wildfires, and droughts brought recently into sharp focus by the flooding disasters of 2015 and 2016, together with the devastation of Hurricane Harvey, the CDBG-MIT funds will prove invaluable in helping to cover the additional costs of safeguarding housing and community infrastructure investments. Mitigation approaches can greatly reduce the cost of future damages by a ratio of 6:1. The success of this long-term recovery practice was seen firsthand during Hurricane Harvey when CDBG-DR resiliency-enhanced projects withstood Hurricane Harvey’s worst effects.

Single family home resiliency solutions are expected to add approximately 10 to 15 percent to the total cost per home; multifamily resiliency solutions add 15 to 20 percent to the total cost per project; and infrastructure resiliency solutions add 15 to 20 percent to the total cost per project. Resiliency solutions are varied and dependent on the respective area’s Threat and Hazard Identification and Risk Assessment.

Buyout programs support hazard mitigation, floodplain management goals, and resiliency by removing homeowners from the floodplain, thus eliminating vulnerability to future flooding situations. After homes are purchased, the structures are demolished or relocated. The land reverts to a natural floodplain, converts into a retention area, is retained as green space for recreational purposes, or becomes a component of ecosystem restoration or wetlands management practices. The buyout option serves multiple objectives and provides a resiliency option versus rebuilding within a floodplain, helping to prevent repetitive loss and extreme risk to human health and safety. Additionally, buyouts conducted in a timely manner prevent homeowners from making repairs and investing funds in properties that they then may not want to sell.

In the case of infrastructure resiliency solutions, improvements may include:

i. Elevating critical systems, facilities, and roadways above base flood elevation;

ii. Installing backup power generators for critical systems (water, sewer, etc.);

iii. Avoiding an increase in impervious cover by keeping projects in their original footprint and encouraging the use of building practices that allow for more pervious coverage;

iv. Incorporation of natural or green infrastructure strategies, such as wetland or land barriers, or mimicking such systems, e.g., using permeable pavements and amended soils to improve infiltration and pollutant removal;
v. Replanting with only native vegetation to preserve the natural environment;
vi. Stormwater management including installing retention basins, larger culverts and debris guards, and erosion control solutions;
vii. Back-up communication systems; and
viii. Supporting local community efforts to (1) enhance building codes and land use plans, (2) participate in multi-jurisdiction hazard mitigation plans to qualify for HMGP funds, and (3) participation in the NFIP.

2.4 Demographic Profile of Impacted Counties

The demographic profile data was generated using a wide range of data sets from the U.S. Census Bureau’s American Communities Survey from 2017, unless otherwise noted.

Quick Facts:

- The 140 CDBG-MIT eligible counties impacted by the 2015 Floods, 2016 Floods, and Hurricane Harvey cover 48.5 percent, or 130,279 square miles of the state.
- These counties contain approximately 77.4 percent of the state’s population, accounting for just over 21 million Texans.
- Since 2010, these counties have seen a 9 percent population increase totaling 1.8 million people.

Of the approximately 8.3 million housing units located in eligible counties, 54.8 percent are owner-occupied units, close to the statewide rate of 55.1 percent. The estimated median owner-occupied housing unit value and median household income are both lower in the eligible counties than the state as a whole. Median value of owner-occupied housing units in the eligible counties is $116,388—roughly $35,000 less than the statewide median value of $151,500. Median household income in the eligible counties is $50,014—approximately $7,000 less than the statewide average of $57,051. The poverty rate is nearly identical—16 percent—between the state and eligible counties.

The demographic differences between the state and eligible areas are minimal. The largest divergence is within the Hispanic or Latino population, which is currently at 38.9 percent for the state and 35.8 for the eligible area. Slight differences also exist among the percentage of African-Americans—12 percent for the state, 13.5 percent for the eligible area—and White, Non-Hispanic or Latino, where the state rate is 42.9 percent and the eligible area is 44.3 percent. The minority
population as a whole in all 140 eligible counties is approximately 55.7 percent—less than two percentage points lower than the statewide rate.

In the 140 eligible counties, the elderly account for 11.6 percent, while disabled persons under the age of 65 account for 6.7 percent of the population. These numbers are in line with state averages. The table below contains the full demographic profile for the state and eligible areas.

Table 2-1: Demographic Statistics for Texas and the 140 CDBG-MIT Eligible Counties, 2017 American Communities Survey

<table>
<thead>
<tr>
<th>Fact</th>
<th>Texas</th>
<th>140 CDBG-MIT Eligible Counties</th>
<th>Percent of Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population estimates</td>
<td>27,419,612</td>
<td>21,216,942</td>
<td>77.4% of Texas Population</td>
</tr>
<tr>
<td>Population, percent change – 2010–2017</td>
<td>12.78%</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td>Persons under 5 years, percent</td>
<td>7.23%</td>
<td>1,540,166</td>
<td>7.3% of Eligible Population</td>
</tr>
<tr>
<td>Persons under 18 years, percent</td>
<td>26.31%</td>
<td>2,349,074</td>
<td>11.1% of Eligible Population</td>
</tr>
<tr>
<td>Persons 65 years and over, percent</td>
<td>11.73%</td>
<td>2,470,171</td>
<td>11.6% of Eligible Population</td>
</tr>
<tr>
<td>White alone, percent</td>
<td>74.62%</td>
<td>15,501,777</td>
<td>73.1%</td>
</tr>
<tr>
<td>Black or African American alone, percent</td>
<td>11.99%</td>
<td>2,856,236</td>
<td>13.5%</td>
</tr>
<tr>
<td>American Indian and Alaska Native alone, percent</td>
<td>0.48%</td>
<td>92,874</td>
<td>0.4%</td>
</tr>
<tr>
<td>Asian alone, percent</td>
<td>4.51%</td>
<td>1,014,014</td>
<td>4.8%</td>
</tr>
<tr>
<td>Native Hawaiian and other Pacific Islander alone, percent</td>
<td>0.09%</td>
<td>15,762</td>
<td>0.1%</td>
</tr>
<tr>
<td>Two or more races, percent</td>
<td>2.56%</td>
<td>528,328</td>
<td>2.5%</td>
</tr>
<tr>
<td>Hispanic or Latino, percent</td>
<td>38.93%</td>
<td>7,590,578</td>
<td>35.8%</td>
</tr>
<tr>
<td>White alone, not Hispanic or Latino, percent</td>
<td>42.87%</td>
<td>9,395,007</td>
<td>44.3%</td>
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<tr>
<td>Housing units</td>
<td>10,932,870</td>
<td>8,263,936</td>
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<tr>
<td>Owner-occupied housing unit rate</td>
<td>55.14%</td>
<td>4,529,994</td>
<td>54.8% of Housing Units</td>
</tr>
<tr>
<td>Fact</td>
<td>Texas Estimates</td>
<td>140 CDBG-MIT Eligible Counties Estimates</td>
<td>Percent of Area</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>-----------------</td>
<td>------------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Median value of owner-occupied housing units</td>
<td>$151,500</td>
<td>$116,388</td>
<td></td>
</tr>
<tr>
<td>Median gross rent</td>
<td>$952</td>
<td>$765</td>
<td></td>
</tr>
<tr>
<td>With a disability, under age 65 years, percent</td>
<td>6.96%</td>
<td>1,426,209</td>
<td>6.7% of Eligible Population</td>
</tr>
<tr>
<td>Median household income (in 2017 dollars)</td>
<td>$57,051</td>
<td>$50,014</td>
<td></td>
</tr>
<tr>
<td>Persons in poverty, percent</td>
<td>16.00%</td>
<td>16.08%</td>
<td></td>
</tr>
<tr>
<td>Land area in square miles</td>
<td>268,596</td>
<td>130,279</td>
<td>48.5% of Texas</td>
</tr>
</tbody>
</table>
2.5 Low- and Moderate-Income Analysis

Of the 11,861 block groups within the 140 eligible counties, 5,072—representing approximately 43 percent—qualify as low and moderate income (LMI). The percentage of LMI individuals throughout the eligible counties is similar, at roughly 45 percent. The figure below identifies census block groups that have an LMI population of 51 percent or more for the 140 eligible counties using HUD’s 2019 LMI Summary Data (LMISD) for the state of Texas.27

Figure 2-16: Percentage of LMI Population by Block Group

2.6 State Risks and Hazards Assessment

The following sections identify and analyze all significant current and future disaster risks and impacts in the State of Texas Hazard Mitigation Plan (SHMP) and provide a substantive basis for the activities described in the Action Plan. The SHMP is a FEMA-approved plan authored and maintained by the Texas Division of Emergency Management (TDEM); it is the starting point for this State Risks and Hazards Assessment (the RHA) to identify Texas’ hazards. In addition to utilizing the SHMP, a variety of other data sources identified the hazards, risks, and impacts discussed throughout this RHA.

This RHA quantitatively evaluates the potential significant impacts and risks of the identified hazards that affect the following seven critical service areas (also known as FEMA’s Community Lifelines):

- Safety and Security
- Communications
- Food, Water, Sheltering
- Transportation
- Health and Medical
- Hazardous Material (Management)
- Energy (Power & Fuel)

The proposed programs in the Action Plan work to ensure that these critical lifeline areas are made more resilient and are able to (1) reliably function during and after future disasters; (2) reduce the risk of loss of life, injury, and property damage, and; (3) accelerate recovery following a disaster. Forecasted information gleaned from the SHMP is also presented for each hazard and pertains to potential property loss (in dollars), potential crop loss (in dollars), potential fatalities, and potential injuries.

This RHA articulates the top two hazards impacting Texas:

- Severe coastal and riverine flooding
- Hurricanes, tropical storms, and depressions
2.6.1  **STATE OF TEXAS HAZARD MITIGATION PLAN 2018**

FEMA requires states, tribes, and local governments to adopt and update their hazard mitigation plans every 5 years as a condition for receiving certain types of federal funding—including mitigation funding. The current SHMP, authored and regularly updated by TDEM, is the latest iteration to meet this requirement. The SHMP details 18 natural hazards that impact Texas.

| Table 2-2:  Top Natural Hazards in Texas |
|-------------|-----------------------------------------|
| Hazards in Texas                               |
| Severe Coastal Flooding                        |
| Hurricanes, Tropical Storms, and Depressions   |
| Drought                                         |
| Hailstorms                                      |
| Riverine Flooding                              |
| Tornadoes                                       |
| Wildfire                                        |
| Severe Winds                                    |
| Winter Weather                                  |
| Lightning                                       |
| Extreme Cold                                    |
| Extreme Heat                                    |
| Coastal Erosion                                 |
| Inland Erosion                                  |
| Land Subsidence                                 |
| Earthquakes                                     |

The SHMP provides an overview of each hazard together with its respective impacts on the state over time. The SHMP then ranks Texas hazards by the severity of the potential impact on the state. The top three natural hazards Texas faces in terms of economic impact are (1) severe coastal flooding; (2) hurricanes, tropical storms, and depressions; and (3) drought.

This RHA addresses each of the 18 natural hazards and their associated risks referenced in the SHMP while citing additional sources to quantify each hazard’s risks and impacts affecting FEMA’s seven community lifelines.
2.6.2 FEMA COMMUNITY LIFELINES

FEMA cites a total of seven community lifelines that enable the continuous operation of government and critical business during a disaster: (1) Safety and Security, (2) Communications (3) Food, Water and Sheltering, (4) Transportation, (5) Health and Medical, (6) Hazardous Materials and (7) Energy. Together these lifelines provide a framework for communities to prioritize and review critical services during a disaster. According to FEMA, community lifelines are designed to highlight priority response areas, enhance community-wide situational awareness, and strengthen coordination efforts among responders during a disaster.

FEMA’s community lifelines provide a framework for this RHA to discuss risks and impacts of Texas hazards. By describing lessons learned from past disasters in Texas through the frame of community lifelines, this RHA aims to ensure that CDBG-MIT funds go towards programs and activities that reduce the risk of loss of life, injury, and property damage, as well as accelerate recovery following a disaster.

Each lifeline is comprised of multiple components that can change based on a particular situation and hazard; these variable components reflect how each hazard uniquely affects the community. For instance, flooding and hurricanes strike quickly and need a variety of different types of first responders in a short amount of time, whereas a hazard like coastal erosion has the potential to occur over a long period of time and therefore the prioritization of first responders is not warranted.
2.6.2.1  *A Note on Housing Risks and Impacts*

The following are a detailed description of each of the 18 hazards and the different risks and impacts affecting each of the community lifelines. Although housing risks and impacts are not a direct component in FEMA’s seven community lifelines, throughout this RHA such risks and impacts are incorporated under the communications lifeline (FEMA includes economic impact under the communications lifeline). This RHA expands the economic impact discussion to include housing risks and impacts as that area, along with businesses, are consistently impacted by the identified hazards, particularly through flooding, hurricanes, tropical storms, and depressions.
2.6.3 **HURRICANES, TROPICAL STORMS, AND DEPRESSIONS**

Hurricanes, tropical storms, and depressions that impact Texas form over warm tropical waters in the Gulf of Mexico or the Atlantic Ocean. The warm, moist air over the ocean rises upward from near the surface, creating an area of lower air pressure. These areas of relative low pressure draw in new air from surrounding high-pressure areas. Quick cyclonic circulation then begins, and rain bands spin out from a wall of wind that surrounds a central area of low barometric pressure (the “eye”). Such storms can grow to 1000 miles in diameter and sustain winds near the eye that approach 200 miles an hour.

Tropical depressions are storms with winds less than 39 mph. When the observed winds surpass 39 mph but remain below 74 mph, the formation is classified a tropical storm. Once winds in excess of 74 mph are observed, a hurricane has officially formed. The Saffir-Simpson scale, presented below, is used to describe the intensity of a hurricane, based on wind speed, and ranging from Category 1 to Category 5.

<table>
<thead>
<tr>
<th>Saffir-Simpson Scale</th>
<th>Category</th>
<th>Sustained Wind Speeds</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>74 – 95 mph</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>96 – 110 mph</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>111 – 129 mph</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>130 – 156 mph</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>157 mph and above</td>
</tr>
</tbody>
</table>

**Table 2-4: Saffir-Simpson Wind Speed Scale**

2.6.3.1 **Texas Hurricane History**

Texas has been described as a state of extreme drought broken with occasional extreme flooding.\(^{28}\) This is phenomena is illustrated through the history of hurricanes, tropical storms, and depressions. Four of the seven wettest hurricanes in the U.S. have made landfall in Texas.\(^{29}\) Hurricane Harvey

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is the wettest hurricane to hit the U.S. with over 60.58 inches of rainfall recorded at Nederland, Texas.\(^{30}\) Tropical Storm Imelda is the fourth wettest in Texas with preliminary reports noting approximately 41 inches of rainfall recorded near Beaumont in September 2019.\(^{31}\)

### Table 2-5: Seven Wettest Hurricanes in U.S. History

<table>
<thead>
<tr>
<th>Name of Storm</th>
<th>Year</th>
<th>Highest Rainfall (in inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hurricane Harvey (Texas)</td>
<td>2017</td>
<td>60.58</td>
</tr>
<tr>
<td>Tropical Storm Lane (Hawaii)</td>
<td>2018</td>
<td>58</td>
</tr>
<tr>
<td>Hurricane Hiki (Hawaii)</td>
<td>1950</td>
<td>52</td>
</tr>
<tr>
<td>Tropical Storm Amelia (Texas)</td>
<td>1978</td>
<td>48</td>
</tr>
<tr>
<td>Hurricane Easy (Florida)</td>
<td>1950</td>
<td>45.2</td>
</tr>
<tr>
<td>Tropical Storm Claudette (Texas)</td>
<td>1979</td>
<td>45</td>
</tr>
<tr>
<td>Tropical Storm Imelda (Texas)</td>
<td>2019</td>
<td>40.79(^{32})</td>
</tr>
</tbody>
</table>

The severity of rain and wind of past hurricanes, tropical storms, and depressions have led to mass destruction and death throughout Texas. The Galveston Hurricane in 1900 is regarded as the deadliest natural disaster in American history; this Category 4 hurricane struck with winds above 135 mph and a 15-foot storm surge that left approximately 6,000 to 12,000 community members dead and 3,600 buildings destroyed.\(^{33}\)


\textbf{Figure 2-17: Timeline: Hurricanes/Storms Impacting Texas 2000 – 2019}

\begin{figure}
\begin{center}
\includegraphics[width=\textwidth]{timeline.png}
\end{center}
\end{figure}

2.6.3.2  Hurricanes Rita, Ike, Dolly, and Harvey

Hurricanes Rita, Dolly, Ike, and Harvey had an approximate total impact of $283 billion.\textsuperscript{38,39,40,41} Each storm presented different challenges, impacts, and risks to both Texas coastal communities and statewide residents.

Figure 2-18:  Galveston, Texas, during Hurricane Ike in 2008.\textsuperscript{42}

\textsuperscript{42} Photography by U.S Army Corps of Engineers.
Hurricane Rita

Hurricane Rita made landfall a week after Hurricane Katrina in September 2005 as a Category 3 hurricane along the Texas-Louisiana Coast. While, Houston was predicted to be in the direct path of Rita, the storm landed along the Sabine River, directly hitting the cities of Port Arthur and Beaumont. Hurricane Rita’s storm surge reached 15 feet, combined with 115 mph winds and rain to cause extensive flood and wind damage. Hurricane Rita left 19 people dead and caused $18.5 billion in total damages.43

Hurricanes Dolly and Ike

On July 8, 2008, Hurricane Dolly made landfall 80 miles south of Corpus Christi as a Category 1 hurricane with 80 mph winds and 2 to 3 feet of storm surge. Torrential rains came with this slow-moving storm. No deaths were reported; however, the state sustained over $1 billion in damages.

On September 13, 2008, Hurricane Ike made landfall as a Category 2 hurricane with winds of up to 110 mph and a 20-foot storm surge in the city of Galveston. This storm left 112 people dead with $30 billion in property damage and over $140 billion in economic losses. Due to these losses, Hurricane Ike is one of the most destructive hurricanes in U.S. history.44

Hurricane Harvey

Hurricane Harvey, initially a regenerated tropical depression, made landfall on August 25, 2017, as a Category 4 hurricane near Rockport, bringing with it triple-digit wind gusts and torrential rains; local rainfall totals in Southeast Texas ranged from 20 inches to over 60 inches over 7 days, making it the wettest hurricane in U.S. history.45 The hurricane caused catastrophic flooding and at least 82 human fatalities,46 due in part to the weather system stalling over the Texas coast for 6 days. The total impact of Hurricane Harvey reaches beyond $125 billion.

2.6.4 FEMA’S COMMUNITY LIFELINES FOR HURRICANES, TROPICAL STORMS, AND DEPRESSIONS

2.6.4.1 Safety and Security

Risks: The unpredictability and immensity of hurricanes, tropical storms, and depressions create the potential for chaotic response efforts and damage to public services and infrastructure. The scope of these types of hazards creates the potential need for thousands of first responders to aid impacted areas. On-the-ground responders, helicopter and boat rescues from federal and local teams, and nonprofit organizations are all a part of this potential need. An example of one of the local teams is the Texas A&M Engineering Extension Service’s Task Force 1; this one team has over 240 active responders including helicopter and water rescuers.47 A first responder nonprofit rescue group, TEXSAR, has 397 active members including 50 rescue boat operators, 138 ground responders, and 111 flood and swift water technicians.48 These two organizations are just two examples of the thousands of federal, state, and local first responders that deploy during hurricanes, tropical storms, and depressions.

Figure 2-19: Members of the South Carolina's Helicopter Aquatic Rescue Team and the Texas Task Force perform rescue operations in Port Arthur during Harvey.49

49 Photography by Staff Sergeant Daniel J. Martinez, U.S. Air National Guard.
While emergency management is highly organized throughout Texas, the total number and diversity of first responders needed during a hurricane, tropical storm or depression, creates the risk of disorganization. The state has identified a need for additional training and coordination among all partners and teams working on response efforts.⁵⁰

**Figure 2-20:** Texas National Guard members work with local responders in Victoria, Texas, during Hurricane Harvey.⁵¹

In addition to this vast first responders’ network, there is a complex network of government service providers and infrastructure in the path of hurricanes. In southwest Texas alone there are over 130 individual towns or cities that make up the Gulf Coast region; each community has its own city hall, school system, police department, correctional facilities, and other community services and infrastructure;⁵² these facilities each have the potential to sustain wind damage or flooding. These damages can prevent students from going back to school or delay government services for a sustained period.

**Impacts:** The potential for damage and disorganized response efforts may lead to economic losses as well as injuries and further loss of life. For example, the vast number of individuals working on rescue efforts made it difficult during Hurricane Harvey to coordinate rescue efforts throughout impacted communities. City halls and emergency management centers were flooded throughout

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⁵¹ Photography by Captain Martha Nigrelle, Army National Guard.
the impacted areas making response more challenging. Major roadways were flooded or blocked with debris during past hurricanes, tropical storms, and depressions.

Consequently, even if emergency centers or city halls were not flooded, responders could not reach these centers or put themselves in danger trying to do so. The command structure during of Hurricane Harvey was further challenged by confusion over assigned roles resulting from the inability of responders to reach their assigned destinations due to blocked or flooded roadways, and their subsequent replacement by those responders who did not face those obstacles.53

2.6.4.2 Communications

Risks: The severe winds that accompany hurricanes, tropical storms, or depressions have the potential to destroy powerlines, communication towers, and other similar equipment. This creates a situation where community members may not be able to reach out for help. Impacted communication systems may also impede first responders by impeding the flow of information between colleagues and disrupting coordinated efforts.

The vast network of responders after a hurricane, tropical storm, or depression bring a variety of communication systems and protocols to the impacted area, creating a potential for communication failure or confusion between different response groups. The variety of current social media platforms add to the potential confusion not only between responders, but with community members needing assistance.

These dual communication issues create the opportunity for misinformation to be spread, with vast amounts of critical information being shared, yet limited staff capacity to address community members’ concerns. With the rains and winds that accompany hurricanes, tropical storms, and depressions, this gap in communications between differing systems and protocols on the one hand, and the deluge of communication through social media on the other, creates the opportunity for uncertainty in prioritizing the provision of resources and rescue efforts and activities. This uncertainty has the potential to lead to responders venturing out into unknown wind or flooding conditions and community members not getting the assistance that they need when they are trapped in high water.

In addition to communication risk, the potential economic impact of hurricanes, tropical storms, and depressions can be compounded due to the vast number of industries that can be in the direct path of a hurricane, tropical storm, or depression, as well as any industries related to these major sectors inside and outside of the impacted areas. This may be particularly true of communities where there is a concentration of a particular industry. Along Texas’s Gulf Coast, the oil and gas

industry is dominant, with approximately 1 out of 3 jobs in the region in this industry. The flooding and high winds that come with hurricanes have the potential to damage oil refiners, close major ports in the region that export these products, and close or damage other major transportation infrastructure. Damage and closures can lead to a production halt or delay in the oil and gas industries, as well as all other goods that are imported or exported from these facilities. Adding to this complexity are personal property losses of community members in the impacted communities.

**Impacts:** During Hurricane Harvey, approximately 336,000 customers lost power, compared to 4.5 million customers during Hurricane Ike. During Hurricane Harvey, the Federal Communications Commission reported that three Texas counties had cellular outages greater than 80 percent. Power outages and cell site failures were due in part from the flooding of substations, water damage to related equipment, and downed powerlines throughout the impacted area.

Along with power outages, overwhelmed and incohesive communication systems lead to prolonged wait times for those in need. Hurricane Harvey overwhelmed traditional emergency systems, leading to individuals reaching out through non-traditional means. Community members could not reach 911 during Hurricane Harvey, due to the vast number of individuals trying to call, which led residents to call 311 and 211 instead; there were over 21,000 calls to 211 just in the city of Houston during the week of Hurricane Harvey. Community members also reached out through social media. This led to confusion over where to direct resources.

Along with community members calling for help, the Texas Department of Emergency Management was overwhelmed with calls from local government staff and officials needing assistance. Similarly, during Tropical Storm Imelda, the City of Beaumont’s police department was overwhelmed with 911 calls.

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58 “Hurricane Harvey Relief Fund Needs Assessment Phase One,” Rice University Kinder Institute for Urban Research, November 2017, [https://kinder.rice.edu/sites/g/files/bxs1676/f/documents/Phase1_PostHarveyAssessment_11130217-2.pdf](https://kinder.rice.edu/sites/g/files/bxs1676/f/documents/Phase1_PostHarveyAssessment_11130217-2.pdf)

59 Manny Fernandez, Margaret Toal, Rick Rojas, Sarah Mervosh, Nicholas Bogel-Burroughs, John Schwartz, Adeel Hassan, “Imelda Swamps Texas with Flooding Rain,” New York Times, September 20, 2019,
Major economic impacts were also seen during past storms including Hurricane Harvey, Ike, and Dolly. The total verified business loss from Hurricane Harvey was approximately $5.91 billion,\(^{60}\) approximately 14 oil refineries shut down during Hurricane Harvey accounting for over 17 percent of the nation’s gas refining capabilities. Ports in and around Houston shutdown for approximately a week accounting for more than $2.5 billion in economic losses alone.\(^{61}\) Hurricane Ike also had a large economic impact. During Hurricane Ike, approximately, 26 percent of the total Texas business establishments were in the path of the hurricane, with small locally owned business seeing much of the impact.

Figure 2-21: Bolivar Peninsula, Texas, after Hurricane Ike.\(^{62}\)

Along with the economic impacts, significant damage and destruction of homes are also a direct consequence of past hurricanes. Approximately 3.4 billion in total home damages were caused by Hurricane Ike. Additionally, approximately 109,045 applicants were approved for FEMA’s

\(^{60}\) “2017 Hurricane Harvey” Community Development and Revitalization, Texas General Land Office, accessed October 1, 2019,
\(^{61}\) Eye of the Storm, Report of the Governor’s Commission to Rebuild Texas, Texas A&M University System, November 2018, page 23,
\(^{62}\) Photography by National Weather Service, September 2008,
housing assistance program totaling over $20 million. In some instances, as in the case of the small town of Bridge City located along the Gulf Coast where only 14 of 3,400 homes remained inhabitable after Hurricane Ike, the entire housing stock of a community was destroyed.27

A similar situation was seen during Hurricane Harvey where over 300,000 homes were destroyed.84 892,263 individuals applied for FEMA’s Individual Assistance with 132,458 of these applicants having unmet needs.65 Hurricane Harvey also illustrates another way in which hurricanes impact housing – a decrease in affordable housing stock.66

Figure 2-22: Flooding in Port Arthur, Texas, during Hurricane Harvey.67

At present, the economic and housing impacts of Tropical Depression Imelda are still to be reported. As of September 19, 2019, Winnie, Texas reported approximately 500 to 2,000 homes

64 Pam Fessler, “At Least 100,000 Homes Were Affected by Harvey. Moving Back in Won't Be Easy,” NPR, September 1, 2017, https://www.npr.org/2017/09/01/547598676/at-least-100-000-homes-were-affected-by-harvey-moving-back-in-wont-be-easy
67 Photography by Staff Sergeant Daniel J. Martinez, U.S. Air National Guard.
were flooded due to the storm. Jefferson County reported that 50 households were waiting to be rescued as of September 19; Jefferson County homes that did not flood during Hurricane Harvey did so during Tropical Storm Imelda. As of September 24, 2019, impacted counties self-reported that there were over 5,000 homes affected and there was over $24.5 million in public infrastructure damage due to Tropical Storm Imelda (DR-4466).68,69

2.6.4.3 Food, Water, Sheltering

Risks: The deluge of water and high winds that come with hurricanes, tropical storms, and depressions have the potential to close grocery stores, destroy crops, and damage water and wastewater treatment plants and other critical infrastructure such as shelters and major roadways acting as evacuation routes. Debris in the roadways from severe winds and flood water cut off roadways or damage powerlines; this creates the potential for all types of businesses to close including grocery stores and restaurants. Water and wastewater treatment plans are susceptible to damage or are shut down due to overcapacity.

In terms of agriculture at risk, the SHMP identifies Texas as the state with the largest acreage of agricultural lands throughout the U.S., accounting for approximately 248,900 farms and ranches; together they generate approximately $20 billion in annual revenue.70 The SHMP also points to cattle and cotton as the top two agricultural commodities in the state. South and Southeast Texas are not only where a large proportion of crops such as cotton are grown, but also where distribution points and ports are located. Landfall of a hurricane, tropical storm, or depression in these regions could not only lead to crop losses but impede the movement of all types of products to market as distribution centers, major roadways, or ports are closed due to flooding or debris.

The current SHMP also speaks to the current availability and condition of emergency shelters in Texas. The SHMP discusses the state’s efforts to incorporate shelters at approximately 100 highway rest stops throughout the state.71 These auxiliary shelters do run the risk of flooding that impact highways during storms, which can render them inaccessible. In addition to these new

70 “Texas Ag Stats,” Texas Department of Agriculture, accessed, October 2, 2019, https://www.texasagriculture.gov/About/TexasAgStats.aspx
sheltering options, existing local shelters are becoming more critical during these large-scale weather events.

Evacuation routes are also at risk of being flooded or blocked with debris. The SHMP does not describe the evacuation routes throughout the state, but there are approximately 130 major evacuation routes and 18 potential counter flow and EvacuLanes throughout Texas. These evacuation routes are concentrated in Southeast and South Texas to provide a way out for Texans evacuating from a hurricane, tropical storm, or depression; however, during past events, many of these routes became impassable or were overwhelmed with traffic that resulted in traffic jams.

**Impacts:** Loss of life, injuries, and economic losses are all potential consequences of closed or flooded grocery stores, water treatment facilities, shelters, damaged crops, and flooded or blocked evacuation routes. For example, during Hurricane Ike, 137 Walmarts, 40 Targets, 149 Burger Kings, and all Kroger stores were temporarily closed throughout the impacted area, while HEB had to permanently close a store in the city of Galveston due to extensive water damage from the hurricane. Although grocery stores and other businesses such as home improvement stores did need to shut down for a period of time, these types of stores often see a boost in activity right before and right after such events due to individuals rushing to prepare for the storm and then to purchase items to recover after a storm.

Wastewater treatment plants needed to close or were damaged due to past hurricanes as was the case during Hurricane Harvey where 40 waste water treatment plants were either offline or closed, and 61 public water drinking systems rendered inoperable.

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In the city of Conroe, the sole wastewater plant serving approximately 82,000 people flooded and closed during Hurricane Harvey. This plant typically treats around 5 million gallons of wastewater per day; during the 5 days the plant was down, wastewater flowed directly into the San Jacinto River. This is just one example of how waterways were impaired due to past hurricanes; the significant and wide-reaching effects of Hurricane Harvey and other past hurricanes on water quality is still being researched.

In addition to water quality challenges, past hurricanes had significant consequences for evacuations, agriculture and shelters. During Hurricane Rita, 72 people died trying to evacuate...
before the hurricane reached Texas; this affected the decision, during Hurricane Harvey, to not evacuate certain communities, such as the city of Houston.\textsuperscript{83} Finally, even though there were approximately 692 shelters operating during Hurricane Harvey, several shelters needed to be evacuated due to the shelters being inundated with flood water.

Within the agriculture sector, Texas AgriLife estimated that there was more than $200 million in crop losses from Hurricane Harvey.\textsuperscript{84}

2.6.4.4  Transportation

\textit{Risks:} Damage from hurricanes, tropical storms, and depressions can cause short and long-term effects to how people are able to move through and around an impacted area; wind-damaged transportation infrastructure, flooded streets, flooded personnel and shared vehicles, hampered public transportation systems, adjusted flight paths, and crippled rail lines can all affect the social and economic functions of a community and region. The movement of goods and services needed for the operational functions of commercial businesses can also be impacted by limited mobility options.\textsuperscript{6}

Rescue missions by ground transportation, waterway transportation, or aerial transportation may not be safe or viable depending on the level of flooding, wind variability, or debris inundation. Limited mobility, especially during heavy rain and high wind events caused by these storms, can also limit the ability of first responders to access people who are in need of potentially life-saving assistance. To that end, the State of Texas Emergency Assistance Registry (STEAR) program allows those who may not be able to evacuate or receive assistance on their own to register and allow local officials to know who they are and where they are in case of emergency.\textsuperscript{85} Elderly individuals who may have difficulty evacuating and may not be able to drive or have trouble taking public transit must be considered during large-scale evacuations; also critical to consider is the fact that there are over 3,100 nursing homes in Texas, a state with a growing elderly population.\textsuperscript{86}

Ports and inland waterways may also be impacted by storm surge and other factors associated with tropical weather systems to a point where tangible goods cannot be delivered and distributed.


\textsuperscript{84} “Texas agricultural losses from Hurricane Harvey estimated at more than $200 million,” AgriLife Today, October 27, 2017, \url{https://today.agrilife.org/2017/10/27/texas-agricultural-losses-hurricane-harvey-estimated-200-million/}

\textsuperscript{85} “State of Texas Emergency Assistance Registry (STEAR) – Public,” Texas Division of Emergency Management, \url{https://tdem.texas.gov/stear/}

\textsuperscript{86} “Homeland Infrastructure Foundation-Level Data (Nursing Homes),” United States Department of Homeland Security, \url{https://hifld-geoplatform.opendata.arcgis.com/datasets/nursing-homes}
Commercial transportation services to local communities is impaired if roads are impassable and air support is limited.\textsuperscript{87}

**Impacts:** During Hurricane Harvey, 781 roads across Southeast Texas were impassable at some point in time.\textsuperscript{88} This limited direct access to critical human services and the ability of first responders to access individuals who needed assistance. Conditions can also potentially hinder evacuation orders, as these are made by the chief elected official of a local government; the current SHMP notes that mandatory evacuations were issued for 779,000 people in Texas, with an additional 980,000 people evacuating voluntarily during Hurricane Harvey.\textsuperscript{89}

These numbers show the importance of incorporating mitigation and resiliency measures into ground transportation infrastructure before a storm hits. However, ground transportation was not the only form of mobility hampered during Hurricane Harvey. George Bush Intercontinental Airport (IAH) and William P. Hobby Airport (HOU), the two main airports in Southeast Texas, were closed for nearly one week; an estimated $32 million in revenue was lost during this time in the commercial airline industry.\textsuperscript{90} During the 2018 fiscal year, IAH averaged 113,715 daily passengers and HOU averaged 37,867 daily passengers.\textsuperscript{91} This shows the impact a 1-week closure can have on traveler thoroughfare through these airports. Other forms of aviation were also impacted during Harvey in a way that was not expected, which can be seen within the first 6 days after the storm hit. During this time period, the Federal Aviation Administration issued more than 40 authorizations for emergency drone activities above Houston and the surrounding area. The duties of these aerial drones ranged from inspecting roadways, checking railroad tracks, assessing the condition of water and wastewater plants, monitoring oil refineries, and evaluating power lines.\textsuperscript{92} In addition, state response personnel task forces eventually accounted for 841 rescues by air.\textsuperscript{93}


Maritime transportation, such as port and ship channel entry and exit, was drastically limited. In all, 23 Texas ports were closed during Harvey, including the Port of Corpus Christi, Port of Port Arthur, Port of Galveston, and many others. This also included the Port of Houston (Houston Ship Channel) which, in 2018, accounted for $339 billion in the state’s economic value, 20.6 percent of Texas’ gross-domestic product (GDP), and more than 1.35 million jobs across Texas. Nearly $5.7 billion in state and local tax revenues are generated by business activities related to the Port of Houston yearly. It is estimated that the closing of the Port of Houston, during and after Hurricane Harvey, equated to more than $2.5 billion in economic losses due to delays and cancelled transactions.

Figure 2-24: Evacuations during Hurricane Rita in Spring, Texas.

2.6.4.5 Health and Medical

Risks: The SHMP emphasizes that hurricanes, tropical storms, and depressions can pose significant threats to public health and safety. Hospitals and medical facilities face enormous pressure when a hurricane, tropical storm, or depression makes landfall, as medical emergencies become common occurrences and fatality management becomes critical. Hospital patients may face long wait times, difficulty being transported to a more adequate facility, or a complete lack of health care providers open to accepting patients. Community members, first responders, and general response crews face dangerous conditions in the context of tropical weather systems, as conditions during and following hurricanes can be uncomfortable and pose numerous health risks. Dangers such as high water, downed electrical power lines, and broken gas mains are major health and safety threats after hurricanes, together with consumption concerns stemming from a potentially contaminated food and water supply. Due to the evacuation of staff, public health advisories and reports of public health concerns may also be limited in their ability to reach the public. This issue during tropical weather systems is only compounded by power outages and a potential loss of communication signals and lines.

Impacts: Hurricane Harvey led the closure of 16 hospitals throughout Texas, necessitating the relocation of nearly 1,000 patients. After the direct impact of the storm, many local hospitals and clinics were either too damaged to operate or were too overwhelmed with patients to function. Driscoll Children’s Hospital, located in Corpus Christi, had to evacuate all 10 new-born babies in its neonatal intensive care unit several local emergency room services closing down as well. Lake Arthur Place, a nursing home and rehabilitation facility in Port Arthur, had to evacuate as it was reported that some community members had no other option but to stay in the flooded location for up to 24 hours. As Tropical Storm Imelda made landfall near Freeport in Southeast Texas during mid-September 2019, the Chambers County Office of Emergency Management posted on their Facebook page that the Riceland Hospital in Winnie had to be evacuated. During this same

event, a hospital in Beaumont was also flooded and evacuated, while two hospitals in Orange County—Christus St. Elizabeth and Baptist—were cut off by flood waters.\textsuperscript{104}

As a result of Tropical Storm Allison in 2001, the Texas Medical Center hospitals located in Houston lost $2 billion from flood damage; subsequently, $50 million was invested in storm mitigation measures to make the hospitals more resilient. When Hurricane Harvey hit, the Texas Medical Center was able remain operational due to lessons learned and the watertight floodgates that were installed after Allison to protect all basements and subterranean parking.\textsuperscript{105}

Fatality management, the process of properly recovering, handling, identifying, transporting, tracking, storing, and disposing of human remains and personal effects, especially during a tropical weather system, is vital in public health measures that need to be addressed before, during, and after landfall of a storm.\textsuperscript{106} Before Hurricane Rita, 73 people died in a chaotic evacuation before the storm even hit Texas. This number represents more than half of the 139 total deaths accredited to Rita and shows us that measures for fatality management must to be in place before the weather-related impacts of a storm are felt.

\textbf{Figure 2-25: Hurricane Harvey floodwaters approach Ben Taub Hospital in Houston.}\textsuperscript{107}

\begin{itemize}
\item \textsuperscript{106} “Capability 5: Fatality Management,” Centers for Disease Control, accessed October 4, 2019, \url{https://www.cdc.gov/cpr/readiness/00_docs/capability5.pdf}
\item \textsuperscript{107} Photograph by Andrew Kragie, \textit{Associated Press}, August 30, 2017, \url{https://www.washingtonpost.com/national/health-science/some-hospitals-evacuated-but-houstons-vaunted-medical-world-mostly-withstands-harvey/2017/08/30/2e9e5a2c-8d90-11e7-84c0-02cc069f2c37_story.html}
\end{itemize}
2.6.4.6 Hazardous Material (Management)

Risks: Hazardous material facilities are facilities involved in the production, storage, and/or transport of corrosives, explosives, flammable materials, radioactive materials, and toxins. Flooding, high wind, the movement of debris, storm surge, damaged marine vessels, and breached off-shore oil infrastructure can lead to movement of these materials away from their facilities.

There are 66 solid waste facilities within all counties that border the Gulf of Mexico or border the Gulf’s adjacent bays in Texas. This includes 30 solid waste facilities in Houston’s city limits alone and speaks to the importance of critically safeguarding the movement of potential hazardous materials during tropical weather events. If not contained correctly and efficiently, this can lead to impacts that can be felt on public and environmental health systems that may persist for years after a storm has made its immediate effects felt. The SHMP puts emphases on the importance of critical facility protection, including hazardous material storage and production facilities, being mitigated during hurricanes and similar weather events. The South Texas Nuclear Generating Station, a case in point, is one of three nuclear power stations in Texas. Located southwest of Bay City and roughly 3 miles from Matagorda Bay and 15 miles from the Gulf of Mexico, this nuclear power station could itself become a potential hazard during a hurricane event. However, during Hurricane Harvey, there were no reported issues at this location.

Impacts: During and after Hurricane Harvey, the EPA determined that 13 Superfund sites were flooded, and 11 separate Superfund sites were not accessible by response personnel. This lack of ground transportation access to the Superfund sites may prove consequential in the years to come, as the effects of hazardous material penetration into environmental ecosystems can take decades to fully manifest. Further, in the aftermath of Hurricane Harvey, reporters cataloged more than 266 hazardous spills and discharges on land, water, and the air. Roughly 500 chemical plants, 10 refineries, and more than 6,670 miles of intertwined oil, gas, and chemical pipelines were also located in the impact zone of Harvey, making this area of Texas the nation’s most significant energy corridor. At least 14 oil refineries, accounting for 17.6 percent of the nation’s gasoline refining capacity, shut down during Harvey. Nearly half a billion gallons of industrial wastewater,

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110 “Status of Superfund Sites in Areas Affected by Harvey,” United States Environmental Protection Agency, September 2, 2019, [https://www.epa.gov/newsreleases/status-superfund-sites-areas-affected-harvey](https://www.epa.gov/newsreleases/status-superfund-sites-areas-affected-harvey)

mixed with stormwater, leaked from a single chemical plant in Baytown on the upper shores of Galveston Bay. Benzene, vinyl chloride, butadiene and other known human carcinogens were among the dozens of tons of industrial toxic substances released into neighborhoods and waterways following the rain event with Harvey.112

2.6.4.7 Energy (Power & Fuel)

Risks: Hurricanes, tropical storms, and depressions can bring sustained wind damage and, eventually, downed power lines which lead to short and long-term power outages. Flooding events, associated with tropical systems, have been known to also bring power outages as substations and other critical power grid locations or equipment may be underwater or have limited access due to high water. Power outages can be deadly occurrences, especially during the summer and early fall heat that is seen during hurricane season in Texas. Critical facilities that are without power have their operations depreciated and are not able to provide potentially life-saving services. During the 2017 Hurricane Season, FEMA noted that they “faced challenges supplying limited temporary power generation capacity.”113 This highlights the need for states and local governments to have and invest in resilient power systems while also having an ability to provide temporary power resources. Without temporary power resources during a tropical weather event, lives will be put in danger and fuel capacity for individuals and first responders attempting to reach individuals in distress will be vulnerable. If fuel capacity is limited due to gas stations risk running low on fuel for personal and response vehicles, along with generators, evacuation and recovery for individuals is made much more difficult. With 18 percent of petroleum refineries in the United States located in Texas (as of 2015), impacts to the oil industry in the state are felt across the country through fuel capacity and availability factors.114

Impacts: According to the North American Electric Reliability Corporation, over 2 million customers’ power services were affected by Hurricane Harvey. Over 850 transmission structures were downed or damaged, over 6,200 distribution poles were also downed or damaged, and over 800 miles of transmission and distribution conductors had to be replaced. It was observed that over 90 substations were damaged and over 12,000 energy employees and contractors were utilized in

the restoration of Texas’ power grid during the aftermath of Harvey.¹¹⁵ Due to the impacts of the hurricane, about 4.4 million barrels of oil had to be taken temporarily offline, roughly 25 percent of the national capacity.¹¹⁶

Figure 2-26:  Downed utility lines near Taft, Texas, during Hurricane Harvey.¹¹⁷

2.6.5 SEVERE COASTAL AND RIVERINE FLOODING

Texas has been described as the state of severe droughts broken by occasional severe floods. While flooding effects the majority of communities throughout Texas, several types of flooding impact different areas of the state. While there are a variety of different terms used to categorize flooding in Texas, the state generally faces three general categories: storm surge or coastal flooding, riverine flooding, and stormwater flooding.\(^\text{118}\)

**Figure 2-27: Riverine flooding along the Brazos River during the May 2015 Floods.**\(^\text{119}\)

Storm surge is an abnormal rise in water levels in coastal areas over the regular tide due to storms winds waves and low atmospheric pressure. Storm surge can begin to occur a few days before a tropical system even makes landfall. Extreme coastal flooding, or the inundating of land areas along the coast, can occur particularly when storm surge occurs during the regular high tide.\(^\text{120, 121}\)

Further impacts may be seen if storm surge is combined with heavy participation creating compound flooding.\(^\text{122}\) Compound flooding occurs when rainfall is prevented from flowing into

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\(^\text{119}\) Photography by Roy Luck, May 2015, Richmond, Texas.


State of Texas CDBG-MIT Action Plan
the ocean during a storm surge, furthering inland flooding, or when extreme rainfall exasperates the effects of coastal flooding.123

**Figure 2-28: Storm Surge Explained**124

The SHMP describes riverine flooding, also known as fluvial flooding, as flooding that comes from water which has overtaken river banks, is localized, bears immediate impacts, and is also the most widely dispersed type of flooding in Texas. From 1996-2016, riverine flooding killed and injured more people than any other weather-related hazard in the state.

The Texas Water Development Board’s *State Flood Assessment* describes two types of riverine flooding—flash and slow rise flooding. Flash flooding may occur in any area where “rainfall intensity exceeds the infiltration capacity of the soil, causing rapid surface runoff,” whereas slow rise flooding occurs when a rain event upstream causes flooding further downstream where it was not raining.125

124 Graphic by Greater Houston Flood Mitigation Consortium, https://www.houstonconsortium.com/
Stormwater flooding, or urban flooding, occurs when local water drainage systems are overwhelmed with rainwater causing flood conditions. This effect is compounded by the increased impervious surfaces, such as asphalt and concrete, found in urban areas which increase the speed and volume of stormwater runoff.\footnote{126} While this type of flooding can be seen in rural areas, urban areas—by their definition—have more roads, residences, businesses, and other uses that increase the amount of impervious surface cover and thereby increase stormwater runoff. Implementing nature-based and green infrastructure flood mitigation projects are particularly effective in combatting urban flooding, as those interventions seek to mimic the flood mitigation services found in less developed areas. In addition, ensuring responsible floodplain and wetland management, while benefitting areas facing the threat of high winds and continued sea level rise, must be practiced for flood mitigation efforts.

The SHMP forecasts that from 2018-2023 the combination of severe coastal and riverine flooding will account for $6,871,390,942 in property losses, $247,575,854 in crop losses, 103 fatalities, and 1,918 injuries.

2.6.6 FEMA’S COMMUNITY LIFELINES FOR SEVERE COASTAL AND RIVERINE FLOODING

2.6.6.1 Safety and Security

*Risks:* In addition to the risks above in the hurricane, tropical storm, and depression section, the high and often fast-moving water accompanying flooding creates the potential for first responders to be injured during rescues and the potential for government services to be delayed or government facilities to sustain damages. This is particularly true for flash flood events or flooding during night; community members may not see water at night until it enters their vehicles or may not realize how quickly flood waters have risen, necessitating search and rescue operations that also put first responders at risk.\footnote{127} Between 2005-2014 3,256 swift water rescues were reported in 136 of Texas’s 254 counties; over half of these reported rescues were in counties in the Flash Flood Alley in Texas, reaching from Dallas to San Antonio.\footnote{128}

\footnote{126} “Green Infrastructure,” United States Environmental Protection Agency, accessed October 4, 2019, \url{https://www.epa.gov/green-infrastructure/manage-flood-risk}
\footnote{127} “Flood Safety,” City of Austin, Watershed Protection Department, accessed October 4, 2019, \url{http://www.austintexas.gov/department/flood-safety}
Compounding this risk is potential debris in flood water that could injure the individual needing assistance or the first responders, leading to potentially more responders needing to save both injured individuals. City halls, correctional facilities, schools, community centers and other government resources can be flooded leading to school closures, city services halting, and correctional facilities damaged or needing to be evacuated.

**Impacts:** An increase in injuries, deaths, and closures are all potential consequences from flooding. During the 2015 flash flood along the Blanco river, a firefighter drowned after being swept away in flood waters trying to rescue individuals; in the city of San Marcos police cars washed away and a police station flooded in the same 2015 flood.130 Two correctional facilities were evacuated during the 2016 floods; approximately 2,600 inmates were evacuated due to a prison riot sparked by a power outage from the storm.131 Furthermore, six people died during Hurricane Harvey when they were swept away during a boat rescue.132

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129 Photography by First Lt. Max Perez.
2.6.6.2 Communications

_Risks_: While the SHMP does not mention the risks to communication infrastructure, flood waters have the potential to damage telephone, internet, and other communications infrastructure throughout the impacted communities, as was seen during the 2015 and 2016 Texas Flooding when cell phone and internet services were limited in areas such as the city of Wimberly.\(^\text{133}\) These interruptions to telecommunications services can impede coordination of disaster response between first responders and emergency management coordinators, prevent those in harm’s way from communicating with emergency response services, and have long term economic impacts to residents, government, and businesses.

_Implacts_: The potential loss of telephone and internet services or power can limit resident’s ability to seek help and for potential rescuers to find individuals in need or understand how many people need to be rescued and what their situation is. The consequences of these limitations can include injury or loss of life. Power outages were widespread during May 2015 flooding in North Texas; Dallas County saw 6,700 customers without power, while Collin, Tarrant, Denton counties saw 1,000, 1,600, and 181 customers without power respectively;\(^\text{134}\) approximately 100,000 customers throughout Texas lost power during the 2015 floods.\(^\text{135}\)


The personal and economic loss from flooding is similar to that of hurricanes, tropical storms, and depressions, with individuals and families losing homes and communities losing businesses. During the 2015 flash floods along the Blanco river the city of Wimberly lost 350 homes.\textsuperscript{98,136} The June Flood of 2019 in the Rio Grande Valley destroyed 1,188 homes and FEMA’s individual assistance cost are estimated at $27.6 million.\textsuperscript{137} Further, the South Texas Floods in 2018 saw $1.9 million in approved SBA loans for businesses to repair or replace disaster-damaged property.\textsuperscript{139}

\textsuperscript{136} Photography by Texas Military Department.
\textsuperscript{137} “Causes and Consequences of the 2015 South Texas Floods in Texas,” University of Texas at San Antonio, January 2, 2019,\url{https://www.sciencedaily.com/releases/2018/01/180129085801.htm}
2.6.6.3 Food, Water, Sheltering

*Risks:* Flooding—like hurricanes, tropical storms, and depressions—has the potential to close grocery stores, impair water quality, damage crops and shelters, and block evacuation routes with flood water or debris.

Grocery stores may close during flooding due to floodwater inundating stores, power outages, or major distribution centers and routes closed due to flooding. Restaurants also have the potential to close during flood events due to similar effects of flooding or if water quality becomes impaired or water is shut off completely. Crop losses not only include crops that were yet to be harvested, but losses from the delay of planting the next crops or the loss of nutrients in the soil producing lower quality crops.141,142

Water quality may become impaired if water treatment plants are closed due to flooding as described above in the hurricane section, or debris, soil or silt overwhelm water treatment plants. Water quality in private wells may become impaired if wells are flooded or if a septic system near the well becomes flooded.143

140 Photography by 1st Lt Zachary West U.S. Army National Guard.
143 “More Free Testing Available for Private Water Well Owners Affected by Hurricane Harvey,” *AgriLife Today*, December 7, 2017,
Additionally, flood waters can cause power outages at shelters not equipped with generators and flood shelters throughout the impacted areas. Floodwaters may also make it difficult for community members to reach shelters.

**Impacts:** During October 2018 flooding, the City of Austin experienced a boil water notice for 7 days after flooding in the Llano Rivers brought massive amounts of silt and debris into Lake Travis, the source of drinking water for the city;\(^{144}\) approximately 880,000 Austin community members were impacted by this notice,\(^{145}\) with approximately 40 Austin restaurants closing or having limited menu options.\(^{146}\)

Again, the consequences of not having access to shelters or crop losses can include economic losses for the community as well as increased injuries or death. There was $14 million in crop losses due to the 2018 floods in Jim Wells County alone; this not only includes direct crop losses, but damage to agricultural buildings and equipment.\(^{147}\)

**Figure 2-32:** City of Austin Water Department Twitter account, “city-wide boil water notice,” October 2018 Flooding.\(^{148}\)

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\(^{147}\) Texas A&M AgriLife Extension- Jim Wells County email message to GLO, August 15, 2019.

\(^{148}\) “City-wide Boil Water Notice,” *Twitter*, City of Austin Water Department, October 22, 2019, [https://twitter.com/austinwater/status/1054279799718461440](https://twitter.com/austinwater/status/1054279799718461440).
2.6.6.4 Transportation

Risks: Flooding impacts have caused delays, damages, and fatalities on Texas’ transportation network. The SHMP notes that almost all deaths from flash flooding occur when drivers enter low water crossings during flood events, pointing to the need for mitigation measures to be taken at these locations to protect human life. While campaigns such as the Turn Around Don’t Drown campaign, developed by the Texas Flash Flood Coalition, is highly recognizable and successful in reinforcing its message, more must be done to mitigate the effects of flood related fatalities on Texas’ roads. Exploring the impacts of protective barriers on roadways at low water crossings to prevent motorists from driving through moving water is one mitigation strategy that is presented in the SHMP.

Local capital improvement plans can be used to identify opportunities for public works crews to mitigate roadway infrastructure from flood damage. It is important that both inland and coastal communities identify transportation infrastructure that is vulnerable to flooding as waters may take days to dissipate and cause delays to recreation and commercial business travel. Significant roadway infrastructure may also be especially undermined and damaged along river banks, compounded by soil erosion, as Texas suffers approximately 400 floods annually.149 These floods can be much more damaging to aging transportation infrastructure, especially infrastructure such as bridges which are often seen directly over rivers and have their integrity based in the soil which may become saturated to a point where stability comes into question. Throughout Texas, there are approximately 54,100 bridges (vehicle and non-vehicle) which represent almost 9 percent of the nation’s total bridge infrastructure.150

Impacts: About 75 percent of the state’s flood-related deaths occur in vehicles that travel Texas roads.151 As little as 6 inches of water can float away vehicles driving through flood waters—drivers should never attempt to cross a flooded roadway. Throughout the entire year of 2015, 25 vehicle-related flooding fatalities occurred in Texas that accounted for 22 percent of all flood-induced vehicle deaths for the United States.152

Further, transportation infrastructure damage caused by flooding is prevalent during such events. During the 2015 Memorial Day floods, the Fischer Store Road Bridge, located west of Wimberley

and directly over the Blanco River, was destroyed by flood waters.\textsuperscript{153} This 2015 flood event also saw the Blanco River overtake a portion of the heavily trafficked Interstate 35 corridor, just north of San Marcos, as all lanes remained closed until waters receded.\textsuperscript{154} During the 2016 Flooding events, a major economic business disruption occurred due to the closure of Interstate 10 along the Texas-Louisiana border, creating lengthy delays and the loss of a major transportation corridor.\textsuperscript{155}

When, in October 2018, flood waters rose levels of the Llano River to dangerous heights not seen since 1935, dramatic footage of the RM 2900 bridge collapse in Kingsland was widely shared on social media and brought to light the dangerous power flood waters can bring to transportation infrastructure. As a result of the RM 2900 bridge collapse, local community members had to travel an additional 45 minutes to navigate the 36-mile detour. This lasted from the time of the bridge collapse in October 2018 until the bridge was rebuilt and opened for public use in May 2019.\textsuperscript{156}

\textbf{Figure 2-33: Collapsed RM 2900 Bridge Detour Map, October 2018 Llano River Flood\textsuperscript{157}}

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2.6.6.5 Health and Medical

*Risks:* Floodwaters often contain infectious organisms, including intestinal bacteria, Hepatitis A Virus, and agents of typhoid, paratyphoid, and tetanus.\(^{158}\) Flooding events can cause contamination of public drinking water supplies and can lead to “boil water” notices if the drinking water has been found unsafe to consume. Food that has come into contact with floodwaters may also be unsafe to eat and may lead to health and medical concerns due to the fact that debris, sewage, oil, chemical waste, and other contaminants could have had contact with food or other items people have direct contact with. Public health concerns surrounding food and water consumption due to flooding must be followed with great care, as access to grocery stores, restaurants, and shelters may not be safe. Wildlife may be pushed to higher ground and pose a threat to the safety of humans with standing flood waters also becoming a breeding ground for mosquitoes which can then spread diseases and other potential medical concerns.

Individuals who are wading through floodwaters to either evacuate, find resources, or seek help face the potential of encountering debris which may not be visible under the water which can cause injury. Flooding can also pose health and medical risks when water infiltrates sewage facilities, as people and the environment are then also exposed to dangerous microbes and harmful bacteria.

*Impacts:* In April and May of 2016, 16.5 inches of rain caused the Brazos River to flood its banks, bringing flood-related devastation onto the surrounding counties. According to the Centers for Disease Control and Prevention, the floodwaters brought snakes, insects, and debris, killed six people, and led to more than 300 water rescues, hundreds of displaced persons, and the evacuation of two prisons in southeast Texas.\(^ {159}\) The SHMP documents that from 1996-2016, riverine flooding killed more than any other hazard during that same time period throughout Texas.\(^ {160}\) Therefore, medical resources and fatality management during and after flooding events must be managed and conducted respectfully and effectively.

2.6.6.6 Hazardous Material (Management)

*Risks:* Floodwaters may be contaminated by agricultural or industrial chemicals, or by hazardous materials. Flood cleanup response crews who must work near flooded industrial, chemical, waste, or polluted sites may also be exposed to hazardous materials that have contaminated the floodwater. This material may be difficult to see, as certain contaminates dissolve in water. Although different chemicals and other hazardous waste material cause different health effects, the signs and symptoms most frequently associated with hazardous material contact are headaches,


skin rashes, dizziness, nausea, excitability, weakness, and fatigue.¹⁶¹ Floodwaters have the strength to move and/or bury hazardous waste and chemical containers far from their normal storage places as well. Downstream locations must be aware and stay alert if an upstream hazardous material facility is inundated by floodwaters.

Impacts: Floodwaters were the main culprit of devastation during Hurricane Harvey, as the highest rainfall total amount reached 60.54 inches near Groves, adjacent to the Texas-Louisiana border. This is important to note because there are eight POL (Petroleum, Oil, and Lubricants) Pumping Stations—facilities that support the transportation of petroleum products from one location to another through transmission pipelines—within 15 miles of Groves.¹⁶² This makes this location one of the most concentrated in the United States. If infrastructure related to these stations is damaged due to flooding, large amounts of crude oil product could leak into local communities and damage homes and businesses. The locations of hazardous material sites, specifically Superfund sites, are vulnerable to disrupting human and natural health if these sites are flooded. A Superfund site is land that is contaminated by hazardous waste and identified by the EPA as a candidate for cleanup because it poses a risk to human health or the environment. During the massive rains and flooding of Hurricane Harvey, 13 Superfund sites were flooded—11 inaccessible by response personal due to flooded roadways and limited access points to these sites.¹⁶³ The 13 sites that were affected during the flooding event of Harvey were locations that were home to industrial waste from petrochemical companies, acid compounds, solvents, and pesticides.

The U.S. Oil Recovery Superfund location, which is the site of a former processing plant for petroleum waste located in Pasadena, was reported to have three large tanks completely submerged. These tanks were used to potentially store hazardous waste and the site was contaminated with potentially deadly chemicals. It is unknown how much material leaked from the tanks.¹⁶⁴

2.6.6.7 Energy (Power & Fuel)

*Risks:* Flooding events can bring wide-spread damage that can quickly impair local power grids. Floodwaters can down powerlines, limit access to gas and other fueling stations, and harm temporary power sources that are not properly protected. Overhead and underground electrical equipment can also be impacted by floodwaters. Substations, if inundated by floodwaters, often shut down to prevent major damage to high cost transformers, capacitors, switches, or other equipment. Texas has the most electric substations in the United States—4,208 electric substations in all. The next highest total California, with only 3,242.165

The return of electrical power after a flood can vary by flooding event and the damages caused by excess water. Restoration of power can be delayed for hours, days, or weeks depending on how long it takes the floodwaters to recede and the extent of damages. Estimating how long power may be out can also be difficult to predict if transportation corridors are impacted. Given the important of restoring power, energy providers may be inclined to come up with unique ways to restore service to their customers. From mobile substations to amphibious bucket trucks, restoration efforts must be able to adapt to the extent of each flooding event.166

According to the Department of Homeland Security, Texas is home to 31 oil refineries, accounting for nearly 20 percent of the nation’s total; damage to these facilities during a flooding event can cause a rise in gas prices and other goods, impacting the national economy.167

*Impacts:* Due to large amounts of rain during the months of May and June of 2015, portions of East Texas succumbed to torrential flooding conditions. The waters and tributaries of the Trinity River within portions of Liberty County experienced severe flooding for several weeks. The persistent high floodwater levels led to dangerous and hazardous conditions that made it unsafe for crews with the Sam Houston Electric Cooperative to restore power to nearly 100 power meters in Liberty County that were along the Trinity River. Due to high floodwaters, restoration of power was nearly impossible from the ground. Crews had to access the flooded areas of the lower Trinity River by boat and, days later, aerial support had to be brought in to help identify if the Electric Cooperative could make further attempts to restore power back to several customers.168

2.6.7 DROUGHT

The SHMP explains that drought is the consequence of a natural reduction in the amount of precipitation expected for a given area or region over an extended period of time, usually a season or more in length. Drought can occur anywhere in the state of Texas. Property damage from the contracting expansive soils is included in the drought-loss assessments as presented in the SHMP. The following description of drought measures comes from NOAA’s National Centers for Environmental Information article, “DROUGHT: Degrees of Drought Reveal the True Picture.”\(^{169}\)

It explains the measures of drought from the United States Drought Monitor (USDM). The USDM’s drought intensity scale is composed of five different levels:

- **D0**: abnormally dry, corresponds to an area experiencing short-term dryness that is typical with the onset of drought. This type of dryness can slow crop growth and elevate fire risk to above average. This level also refers to areas coming out of drought, which have lingering water deficits and pastures or crops that have not fully recovered.
- **D1**: moderate drought, corresponds to an area where damage to crops and pastures can be expected and where fire risk is high, while stream, reservoir, or well levels are low.
- **D2**: severe drought, corresponds to an area where crop or pasture losses are likely, fire risk is very high, water shortages are common, and water restrictions are typically voluntary or mandated.
- **D3**: extreme drought, corresponds to an area where major crop and pasture losses are common, fire risk is extreme, and widespread water shortages can be expected requiring usage restrictions.
- **D4**: exceptional drought, corresponds to an area experiencing extraordinary and widespread crop and pasture losses, fire risk, and water shortages that result in water emergencies.

There are generally four main types of drought: Meteorological, Agricultural, Hydrological, and Socioeconomic. The Texas Water Development Board provides a description of each:

- Meteorological drought—begins with a period of abnormally dry weather resulting in less than the long-term average rainfall for that period. It does not necessarily impact water supply.
- Agricultural drought—often follows or coincides with meteorological drought and can appear suddenly and cause rapid impacts to agriculture. It reduces soil moisture,

which decreases crop or range production, and increases irrigation demands. It often leads to drought disaster declarations and in many cases is an indicator of an impending hydrological drought.

- **Hydrological drought**—a period of below-average streamflow and water volume in aquifers and reservoirs, resulting in reduced water supplies.
- **Socioeconomic drought**—occurs when physical water needs affect the health, safety, and quality of life of the general public or when the drought affects the supply and demand of an economic product.\(^\text{170}\)

At the peak of the 2011 drought, a little over 80 percent of Texas was under D4 drought severity, as seen in the following figure and attributed to the USDM.

**Figure 2-34: September 6, 2011, U.S. Drought Monitor\(^\text{171}\)**


2.6.8 FEMA’S COMMUNITY LIFELINES FOR DROUGHT

2.6.8.1 Safety and Security

*Risks:* Droughts pose a unique challenge to first responders and government services. Unlike risks associated with flooding or hurricanes, tropical storms or depressions, the effects of droughts can occur over a significant period of time and may go unnoticed until there is obvious damage. Droughts have the potential to cause foundations to fracture; local governments, especially smaller or more rural communities, may face a significant financial investment when city halls’ or critical government buildings’ foundations crack—this is also true for local homes and businesses. If communities do not have the funds to fix these structural issues this may lead to further damage over time such as cracked water pipes or damaged heating and air conditioning systems. Additionally, the SHMP speaks to dust storms that may accompany prolonged droughts.172 This may lead to first responders unable to travel to impacted areas due to dangerous travel conditions with limited visibility.

*Impacts:* The potential for damage to government buildings from cracked foundations, and the potential for first responders to not reach individuals in need may lead to the consequences of increased injury or loss of life, and financial losses. In 2012 a dust storm, or a haboob, engulfed much of the South Plains, resulting in limited to zero visibility in the impacted areas. These conditions led to a 25-vehicle pileup with 1 fatality and at least 17 individuals sustaining injuries.173

2.6.8.2 Communications

*Risks:* Limited visibility associated with dust storms accompanying droughts limit not only local officials’ ability to assess current conditions or reach community members in need, but also community members ability to understand what situation they are in. Droughts are also often accompanied by high heat. High heat and drought could lead to power outages throughout the impacted community creating the potential for individuals to lose access to the telephone, internet service, or power.174

Droughts have the potential to cause substantial economic losses particularly in the agricultural industry through a lack of available water for irrigation and supplying livestock. This impacts a

variety of crops such as rice that depend on large releases of water from the lower Colorado River, as well as less water-intensive crops such as corn and cotton.

In addition to the immense agricultural risk, homes and businesses are at risk as well. Home and business foundations may crack during drought and are susceptible to the risks of wildfires. A variety of businesses also rely on water to function. Local restaurants may need to close due to the lack of water necessary for cooking or preparing food.

**Impacts:** The consequences to individuals or first responders losing internet or telephone capabilities, or community members’ inability to reach safety, include injuries, death, and financial loss. The 2011 drought in Texas accounted for more than $7.6 billion in agricultural losses. This number includes $3.23 billion in livestock losses, $750 million in lost hay, $2.2 billion in cotton crop loss, $736 million in corn crop loss, $314 million in wheat crop loss, and $385 million in sorghum crop loss. A specific example of the agricultural impacts during the 2011 drought is the effect on rice farmers. During the drought, rice farmers could not get enough water because they depend on reservoirs that became dry and then officials made the decision to not release irrigation water to rice farmers. This led to not only crop losses for 2011, but in future years as well. In 2011, Matagorda County planted about 22,000 acres of rice. But without water in 2012, that number fell to 2,100 acres. Further, approximately 3,000 homes were damaged due to the 2011 drought.

2.6.8.3  **Food, Water, Sheltering**

**Risks:** Prolonged drought conditions have the potential to stretch already limited water sources throughout the state to irrigate crops or provide water to livestock. Identical to the risks in the Communications lifeline above, limited water supplies can lead to a loss of current and future crop production, loss of revenue for industries associated with agriculture production, and increased mental health issues for farmers who are impacted by drought.

A lack of water is the crucial issue associated with droughts. During extreme or prolonged droughts entire communities may run out of water for drinking, irrigation, and all other uses. Water quality may also degrade due to drought—the high temperatures associated with drought may lower levels of dissolved oxygen in waterways harming fish and other aquatic animals that contribute to the

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health of local streams and water ways. Additionally, as droughts persist, coastal aquifers that are relied on for drinking water and irrigation do not recharge as fast leading to infiltration of salt water into those freshwater supplies.\textsuperscript{179}

**Figure 2-35:** The Blanco River during the 2011 drought. The Blanco River supplies water to nearby communities and ranches.\textsuperscript{180}

Drought conditions pose a significant risk to agriculture throughout the state of Texas and test the structural integrity of shelters. Similar to damage that city halls or other buildings may sustain, there is the potential for foundations to crack or for shelters to sustain other structural damage due to drought conditions. This not only poses a financial risk to local communities but may also lead to heat and water systems failing or malfunctioning during other hazards such as during an extreme heat event.

**Impacts:** A loss of water, crops, and shelters can lead to financial consequences and an increase in injuries and loss of life. During the 2011-2014 drought a number of communities were almost completely out of water. Public entities are required to report to the Texas Commission on Environmental Quality (TCEQ) if they think that their community will run out of water in the next 180 days. During the 2011–2014 drought, there were over 110 public water systems on the 180-

\textsuperscript{180} Photo by Earl McGehee, Blanco County, Texas.
The highest number of public water systems on the 180-day list at one time was 58 (November 2014 and February 2015).\textsuperscript{186}

The SHMP states that drought or abnormal dryness is forecasted to cause at least $3.86$ billion in crop losses with $3.1$ billion of these losses in the Texas Panhandle.\textsuperscript{181} In looking at past events, such as the 2011 drought in Texas that led to over $7$ billion just in agricultural losses, this projected number is conservative.

If a prolonged drought is accompanied by extreme heat, community members may need to seek shelter; however, drought conditions can damage air conditioning systems or a shelter’s foundation, leading to the closure of the shelter and reduction in sheltering options. The consequences of limited shelters may be increased injuries or deaths if community members have no or limited options to seek shelter from the heat or other hazard.

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\caption{Texas corn crops during 2013 severe drought conditions.\textsuperscript{182}}
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\textsuperscript{182} Photo by Bob Nichols, United States Department of Agriculture.
2.6.8.4 Transportation

Risks: Drought conditions have a limited effect on port and waterway transportation operations along the Texas coast, but can affect ground commercial and recreational transportation throughout the state. Drought can cause the contraction and expansion of surface pavement, road beds, and buried utilities along Texas roads that may be damaged more easily by the use of heavy vehicle traffic in urban and suburban areas. If transportation-related infrastructure such as pavements and other surface materials are in unsuitable conditions due to the contraction and expansion of soil and infrastructure-related elements caused by drought, such infrastructure may not be safe for travel or use without causing damage to vehicles or by putting people in danger. The SHMP notes that when bridges, highways, streets, and parking lots are built on expansive soils such as clay, they are especially vulnerable to damage during drought conditions.

Impacts: While areas throughout Texas are impacted by expansive soils, these areas are usually scarcely populated while others, especially those along the Interstate 35 Corridor, contain some of the fastest-growing and most populated jurisdictions in Texas. The SHMP notes that the cities of Austin and Dallas were among the top 10 in the country with the largest population growth; both are located along Interstate 35. The smaller cities of New Braunfels and Georgetown, and Frisco near Dallas, are listed among the top 10 fastest-growing smaller cities in the same report. To accommodate this growth, roadway systems must be built on vulnerable soil conditions at high risk during severe droughts.

2.6.8.5 Health and Medical

Risks: If, due to drought conditions, water utilities are either challenged or unavailable to deliver sufficient service and clean water to hospitals and other medical providers, loss of life could be a consequence. Broad-based healthcare emergency services such as firefighting, nursing, rehabilitation clinics, and other forms of health and medical services rely on water for systems that support patient care and general building and facility operations. Further examples that rely on the availability of water are water-based treatments, fire suppression, and the decontamination of potential biomedical hazardous materials. Costly, and potentially dangerous, patient movement may be required if a drought-stricken area is not able to provide water to local healthcare and medical facilities. Drought has also been known to cause a rise in public health advisories, as dust

183 Central Texas Extreme Weather and Climate Change Vulnerability Assessment of Regional Transportation Infrastructure, City of Austin and Capitol Area Metropolitan Planning Organization, January 2015, https://austintexas.gov/sites/default/files/files/CAMPO_Extreme_Weather_Vulnerability_Assessment_FINAL.pdf
clouds caused by a lack of rain can cause an illness known as “dust pneumonia” and other respiratory illness due to bad air quality.\textsuperscript{185}

\textit{Impacts:} In arid regions of Texas, such as the Panhandle and the western portion of the state, drought conditions can have a large effect on the health of the population. Lung and respiratory illnesses increase as air quality suffers, with particulate matter able to travel more easily which can irritate the throat and lungs while making breathing difficult, especially to those with asthma. According to the Environmental Defense Fund, over 2 million people in Texas have asthma, including every 1 in 13 adults and every 1 in 11 children.\textsuperscript{186}

\textbf{2.6.8.6 Hazardous Material (Management)}

\textit{Risks:} The United States Department of Homeland Security notes that “Food, paper, chemicals, refined petroleum, and primary metal manufacturers all use large amounts of water.”\textsuperscript{187} Throughout the production process of these materials, waste is generated and must be both handled and disposed of in a safe and legal manner. If drought has limited the ability for the production of specific products to be created, hazardous waste produced by such forms of industrial production may not be able to be handled and or cleaned in the most efficient way possible. If a drought-stricken area has hazardous particulate matter on the surface of the ground, from an industrial or natural event, a lack of rain could allow winds to pick up and move these particulates over a more widespread area.\textsuperscript{188}

\textit{Impacts:} The driest recorded year in Texas was 2011. During this time, drought devastated the state causing shortages in drinking water, and both economic and agricultural losses. The 2011 drought also caused considerable damage to infrastructure including sewer lines, roads, and other transport mediums that carry hazardous waste and hazmat material.\textsuperscript{189} While no leaks or spills were reported as a result of the 2011 drought, there was a heightened risk of hazardous material outflow into our environmental systems.


\textsuperscript{186} “Asthma in Texas,” Environmental Defense Fund, August 1, 2016, http://blogs.edf.org/texascleanairmatters/2016/08/01/asthma-in-texas/


\textsuperscript{188} Ibid.

2.6.8.7 Energy (Power & Fuel)

*Risks:* The availability of water is a key component for the operations of power plants and energy production systems throughout Texas. Droughts can impact all forms of energy production, as water is required throughout the production process, from cooling to cleaning, to generating steam. Water is also essential in cultivating crop resources for biofuels, turbine power, and the extraction of raw materials to fuel production of multiple energy forms.\(^{190}\) Because of the interconnection of water availability and the production of power, droughts can lead to blackouts and brownouts that can affect a wide range of critical functions.

*Impacts:* The United States Department of Energy’s Argonne National Laboratory noted in a study that severe drought could lead to the Texas Gulf Coast Basin losing 25 percent of its energy production.\(^{191}\) This is due to that region’s dependence on water for the cooling of local fossil-fuel resourced power plants. A severe drought could lead to power failures, gas shortages, and critical support function deficiencies; it would also place an economic burden on the state and especially those Gulf Coast communities that support these plants and are home to their staff.


2.6.9 HAILSTORMS

According to the SHMP, hailstorms can happen anywhere throughout Texas. Being a form of solid precipitation, hail consists of balls or irregular lumps of ice, each of which is called a hailstone. Hailstones usually measure between 5 millimeters (0.2 inches) and 15 centimeters (6 inches) in diameter and are generally associated with thunderstorms. Hail formation requires environments of strong, upward motion of air, like tornadoes, and freezing temperatures at lower altitudes. In the mid-latitudes, hail forms near the interiors of continents; in the tropics, it tends to be confined to high elevations.

![Figure 2-37: Hail Sizes by Inches](https://www.weather.gov/boi/hailsize)

<table>
<thead>
<tr>
<th>Estimating Size of Hail</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pea</td>
<td>0.25 inch</td>
</tr>
<tr>
<td>Penny or Dime</td>
<td>0.75 inch</td>
</tr>
<tr>
<td>Quarter</td>
<td>1.00 inch</td>
</tr>
<tr>
<td>Half Dollar</td>
<td>1.25 inches</td>
</tr>
<tr>
<td>Golf Ball</td>
<td>1.75 inches</td>
</tr>
<tr>
<td>Tennis Ball</td>
<td>2.50 inches</td>
</tr>
<tr>
<td>Baseball</td>
<td>2.75 inches</td>
</tr>
<tr>
<td>Grapefruit</td>
<td>4.00 inches</td>
</tr>
</tbody>
</table>

As described in the SHMP, hailstones form by colliding with supercooled water drops. Supercooled water will freeze on contact with ice crystals, frozen raindrops, dust, or some other nuclei. The storm's updraft then blows the forming hailstones up the cloud. As the hailstone ascends, it passes into areas of the cloud where the concentration of humidity and supercooled water droplets varies. When the hailstone moves into an area with a high concentration of water droplets, it captures the latter and acquires a translucent layer. Should the hailstone move into an area where mostly water vapor is available, it acquires a layer of opaque white ice.

The hailstone will keep rising in the thunderstorm until its mass can no longer be supported by the updraft; it then falls toward the ground while continuing to grow, based on the same processes, until it leaves the cloud. It will later begin to melt as it passes into air that is an above-freezing temperature.\(^{193}\) The SHMP notes that from 2018–2023, it is forecasted that hailstorm events will account for $2,521,001,724 in property losses, $166,637,326 in crop losses, 1 fatality, and 35 injuries.

2.6.10 FEMA’S COMMUNITY LIFELINES FOR HAILSTORMS

2.6.10.1 Safety and Security

*Risks:* Hailstorms have the potential to shatter windows, damage roofs, limit visibility, and leave debris in the right of way. These may cause first responders to take longer to reach community members in need or prevent responders reaching individuals in an impacted area altogether. In addition, these effects may damage government buildings leading to a financial loss for communities, a delay in government services, or delay school start times.

*Impacts:* While there have been no reported deaths in Texas due to hail in the last 19 years, in 2000 an individual was struck and killed by hail in Fort Worth while he was trying to reach shelter during a severe thunderstorm.\(^{194}\)

2.6.10.2 Communications

*Risks:* Similar to flooding, droughts, hurricanes, tropical storms, and depressions, hailstorms have the potential to damage critical infrastructure such as powerlines, internet and telephone infrastructure. The loss of communication infrastructure has several potential risks, including: increased response time for first responders to reach those in need; preventing individuals in need for calling for help; and a halt or delay in normal business operations.

Hail may damage vehicles and homes, creating a potential additional financial and economic loss for individuals and employers throughout an impacted community. In addition to damages to vehicles, homes and businesses can suffer significant damages; hail can break windows and damage roofs.

*Impacts:* The SHMP describes a series of tornadoes in Dallas County in 2012 that were accompanied by severe hail; approximately 29 people were injured during this event.\(^{195}\)


hailstorm in North Texas in 2018 generated approximately $1.4 billion in economic losses.\textsuperscript{196} In 2017, Texas ranked number one for total property loss from hail, including residences, at 1.3 million properties impacted.\textsuperscript{197}

Figure 2-38: East Dallas neighborhood during June 2012 hailstorm.

These examples provide a glimpse into the wide-reaching economic impacts of hailstorms. The potential for delayed response from first responders or community members not able to call for help may increase the likelihood of injuries or deaths, particularly when hailstorms are accompanied by severe thunderstorms, tornadoes, or flooding.

2.6.10.3 Food, Water, Sheltering

*Risks:* Hailstorms often accompany severe thunderstorms and tornadoes; the combination of potential flooding, high winds, and impact from large hail can lead to crop damages, a lack of sheltering options and the inability to reach shelters. Hailstorms not only bring the need for shelter for people, but for all types of personal and public vehicles. For individuals lacking a covered parking area, there is an additional concern over where to keep their vehicle during a hailstorm, and the potential for increased accidents if vehicles are on the road during a hailstorm. Police


\textsuperscript{197} “Top States for Home Hail Damage,” *Insurance Journal*, June 20, 2019, \url{https://www.insurance.com/coverage/home-hail-damage-insurance-claims}
vehicles, school buses and ambulances may not have a sheltered parking area; this may lead to significant damage and to delays in public services.

Impacts: The consequences of individuals trying to quickly find shelter during a hail storm may lead to increased accidents and an increase in injuries and financial losses for residents in impacted areas. Damage to public vehicles including ambulances, police vehicles, school busses and other local, state, or federal vehicles due to limited shelters, can delay public services, school start times, and response time for first responders leading to more accidents. In 2017 the Little Elm school district had 35 out of 48 school busses severely damaged by large hail; this led to a delay in children getting to school on time.198

2.6.10.4 Transportation

Risks: Hailstorms can cause direct damage to vehicles and transportation infrastructure. Personal vehicles are vulnerable to window and mirror damage while safety features such as cameras can also be impaired. The SHMP notes that when hail breaks the windows of personal vehicles, water damage from accompanying rains can render a vehicle unsalvageable.199 This level of damage can affect all modes of transportation including ground, aerial, and water modes. Hailstorms can also impair visibility and force the operators of vehicles to experience unsafe driving conditions. Depending on the size of the hail associated with a hailstorm, signage and other transportation support systems can be damaged. The functionality of traffic signals, such as traffic lights and pedestrian beacons, can be compromised or rendered unusable, with immediate repair not being an option due to human safety risks of crews during such a weather event.

Impacts: According to the National Insurance Crime Bureau (NICB), Texans filed the most hail damage insurance claims out of any other state. From January 1, 2016, to December 31, 2018, there were 2.9 million claims filed nationally because of hail; Texas accounted for more than 811,000 of these claims, most coming from damaged vehicles.200 The SHMP spotlights a hailstorm event at the Dallas-Fort Worth International Airport that damaged 110 airplanes on April 3, 2012.201

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201 Terry Maxon, “D/FW Airport says more than 110 airplanes there received hail damage,” Dallas Morning News, April 3, 2012, https://www.dallasnews.com/business/airlines/2012/04/03/d-fw-airport-says-more-than-110-airplanes-there-received-hail-damage/
2.6.10.5 Health and Medical

Risks: Hailstorms can bring widespread damage to infrastructure and personal property that may affect medical facilities and medical transport units. Further, due to its varying size, hail can pose a serious risk, sometimes fatal, to human health and safety. Hailstorms can be particularly dangerous for drivers, as operating a vehicle that is being hit by hail is extremely hazardous. During a hailstorm, first responders arrival time may be impeded due to weather conditions and the risk to their own lives. Windows can break and shatter glass throughout a dwelling. Roofs can become punctured and structural failures may occur, as well as water leaks. Individuals caught outside by a hailstorm are at risk of being pelted by hail that can produce lesions, contusions, and other bodily harm that may require medical attention.

Impacts: On May 5, 1995, hailstorms ravaged the Dallas-Fort Worth metroplex. Hail measuring the size of softballs interrupted a local outdoor event called Mayfest. Over 100,000 people were in attendance and were all caught outside when hail began to fall. More than 400 people were injured, 60 seriously, during this extreme weather event.203

2.6.10.6 Hazardous Material (Management)

*Risks:* Hail has the ability to penetrate protective structures and shelters, leading to high levels of property loss. This destructive capacity is illustrated in the SHMP property loss forecast for hail in Texas from 2019–2023 that estimated $2.52 billion in property losses, the third highest property loss forecast behind severe coastal flooding and hurricanes, tropical storms, and depressions.\(^{204}\) The potential for property damage from hail can also have a serious impact on the storage of hazardous materials. If hazardous material storage facilities are damaged and/or penetrated by large hail, leaks and other ruptures may occur and allow hazardous materials to spill out. In homes, large hail can damage ventilation caps on chimneys, furnaces, hot water heaters, etc., potentially exposing individuals to carbon monoxide and other hazardous gases.

*Impacts:* The SHMP notes that statewide from 1996–2016, Dallas County had the highest damage value impact caused by hailstorms. In the county, there are 23 Toxic Substances Control Act (TSCA) facilities, roughly 500 Toxic Release Inventory (TRI) facilities, and 12 solid waste facilities.\(^{205}\) Based on their location, these facilities are susceptible to hailstorm damage that could create leaks of material that may be hazardous to environmental and human health.

2.6.10.7 Energy (Power & Fuel)

*Risks:* Hailstorms are associated with powerful thunderstorms that bring high winds that can damage structures, heavy rains that bring the potential for flash flooding, and lightning strikes that carry the risk of electrocution. Because of this, it is difficult to track the degrees to which hail is solely responsible for power outages or other damage to an electric grid or fuel supply. However, hail can complicate the restoration of power to an area due to unforeseen damages to restoration vehicles, protective structures, or energy grid infrastructure itself. Any energy-related infrastructure that is outside and in the open has the risk of being damage or destroyed by hail, as the rate of speed that hail falls depends on the size of the hail itself. Marble-sized hail can fall at speeds around 20 mph, while hail the size of a baseball can exceed 100 mph.\(^{206}\)

*Impacts:* On April 19, 2015, a surprise storm produced 2-inch hailstones (between the size of a golf ball and tennis ball) in Tomball. During this event, motorists had to take shelter under the covering of a local gas and fueling station.\(^{207}\) In the image below, solar panels appear to be damaged by hail stones. This hailstorm event took place in the DFW Metroplex, near Wylie, and

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\(^{205}\) “Homeland Infrastructure Foundation-Level Data (Chemicals),” United States Department of Homeland Security, accessed September 18, 2019, [https://hifld-geoplatform.opendata.arcgis.com/search?groupId=ab41b78984f7434b9f0b78f2462f0f7d](https://hifld-geoplatform.opendata.arcgis.com/search?groupId=ab41b78984f7434b9f0b78f2462f0f7d)


damaged homes, personal vehicles, and energy production sources such as the solar panels that were fixed atop of this particular house.

**Figure 2-40: Hail damage to residential solar panels.**

2.6.11 TORNADOES

From 1955-2015, Texas experienced 8,500 tornado events, roughly 14 percent of all tornadic activity that occurred in the United States during this period. The SHMP notes that tornadoes are not distributed equally across Texas but occur annually and are frequent in the northern two-thirds of Texas. The average annual dollar loss in Texas due to tornadoes is $108,896,168. The SHMP notes that from 2018-2023, it is forecasted that tornadoes will account for $650,692,305 in property losses, $23,115,327 in crop losses, 22 fatalities, and 382 injuries. Tornado mitigation efforts need to consider the use of safe rooms and enhanced wind engineering/construction techniques. According to FEMA, tornadoes are assigned a classification based on estimated wind speeds and related damage. The National Weather Service implemented the “Enhanced Fujita Scale,” or E-F Scale, in 2007 to classify tornadoes more consistently and accurately. Tornadoes with higher EF classifications produce stronger winds and cause more damage.

Table 2-6: Enhanced Fujita Scale with Expected Damages

<table>
<thead>
<tr>
<th>Category</th>
<th>Wind Gusts</th>
<th>Potential Damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>EF0</td>
<td>65 – 85 mph</td>
<td>Damage includes loss of roof-covering material (&lt;20%), gutters, and/or awnings; loss of vinyl or metal siding; tree branches broken; and shallow-rooted trees toppled.</td>
</tr>
<tr>
<td>EF1</td>
<td>86 – 110 mph</td>
<td>Damage includes broken glass in doors and windows; uplifted roof decks and significant loss of roof covering (&gt;20%); collapse of chimneys and garage doors; mobile homes pushed off foundations or overturned; and moving automobiles pushed off roads.</td>
</tr>
<tr>
<td>EF2</td>
<td>111 – 135 mph</td>
<td>Damage includes entire houses shifted off foundations; large sections of roof structures removed; mobile homes demolished; trains overturned; large trees snapped or uprooted; and cars lifted off ground and thrown.</td>
</tr>
<tr>
<td>EF3</td>
<td>136 – 165 mph</td>
<td>Damage includes collapse of most walls except small interior rooms; and most trees in forest uprooted.</td>
</tr>
<tr>
<td>EF4</td>
<td>166 – 200 mph</td>
<td>Damage includes well-constructed houses leveled; structures blown off weak foundations; and cars and other large objects thrown.</td>
</tr>
</tbody>
</table>

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2.6.12 FEMA’S COMMUNITY LIFELINES FOR TORNADOES

2.6.12.1 Safety and Security

Risks: The SHMP describes tornadoes as unpredictable and sudden hazards. This creates uncertainty for response teams as well as local, state, and federal officials in the impacted areas, and requiring a variety of first responder specialties. During the May 2019 extreme weather alert that included possible tornadoes across the state, eight state agencies were involved in response, providing first-responder resources such as Ambulance Strike Teams, Type 1 Mobile Medical Units, and AMBUSes.

Tornadoes often occur along with hurricanes, hail, and severe thunderstorms. These accompanying hazards may bring high water, sever hail, or lightning, compounding their potential damage. Tornadoes occurring during hurricanes are often weaker, yet more unpredictable. This leads to challenges for first responders conducting search and rescue as the threat of tornadoes increases the chance of injury or death. Heavy winds from tornadoes can fling debris, with the potential to damage roofs, windows or electrical systems leading to increased water damage or power outages at government facilities during a flood or hurricane event.

Impacts: With the variety of first responders needed, there is a greater chance for first responders to be injured especially during several hazards occurring at the same time. First responders may also be injured or prevented from reaching those in need because of potential debris in roadways leading to additional injuries or deaths.

Furthermore, damage to roofs, windows, electrical systems or other structural damage may lead to a financial loss for local, state or federal governments as well as a delay in public services. During the weekend of April 13, 2019, Franklin, Texas saw a vast amount of damage from these tornadoes.

<table>
<thead>
<tr>
<th>EF5</th>
<th>&gt;200 mph</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Damage includes strong frame houses lifted off foundations, carried a considerable distance, and disintegrated; automobile-sized missiles flown through the air in excess of 100 meters; trees debarked; and slabs swept clean.</td>
</tr>
</tbody>
</table>

with much of the southside of the town destroyed—including a housing authority, homes, and local businesses. During this same tornado event, debris blocked roadways preventing first responders from reaching impacted areas.\textsuperscript{215}

2.6.12.2 Communications

\textit{Risks:} Similar to the risks associated with hurricanes, the variety of first responders needed for a tornado event especially when tornadoes are expected along with other hazards, brings a variety of different communication protocols and equipment. This may lead to miscommunication and confusion over responders’ roles during a tornado. The unpredictability and suddenness of tornadoes may contribute to this miscommunication or confusion; first responders, community members, or local, state, or federal officials may think and state that a tornado is headed in a particular direction, but then the tornado changes course.

The heavy winds and flying debris during a tornado may damage power lines or cut off telephone or internet service, preventing those in need from getting help. During the severe thunderstorms and tornadoes throughout Texas in August 2019, 75,000 power outages were reported throughout the state.\textsuperscript{87}

Texas communities differ in their use of tornado sirens. Dallas uses tornado sirens, whereas other communities such as San Angelo and Houston do not. Houston sends out mass alerts similar to Amber Alerts where community members sign up to receive messages.\textsuperscript{216} This may lead to several issues. First, communities with sirens have seen residents confused over what to do when they hear the warning; communities are stressing to their residents that these sirens are not necessarily tornado specific and mean to find shelter as soon as possible. Second, communities with messaging systems rather than sirens run the risk of residents not knowing how to sign up for the service or not understanding that they need to sign up to receive the service.\textsuperscript{217} Third, communities without tornado sirens may instead encourage residents to watch the news, listen to the radio, or receive information through another mass medium; however, residents may not have access to the radio, broadcast news, or other media—particularly during power outages.\textsuperscript{218} Compounding these


\textsuperscript{217} Bill Hanna, “Severe Storms May Cause Sirens to Sound Wednesday, Do You Understand What That Means?” \textit{Fort Worth Star-Telegram}, April 17, 2019, \url{https://www.star-telegram.com/news/local/fort-worth/article229286689.html}

issues—even if sirens or alerts go off and are interpreted correctly—community members may ignore these warnings and instead go outside to spot the tornado rather than taking shelter.

The economic and housing impacts of tornadoes have the potential to devastate communities. The wind damage to homes and businesses can destroy homes, businesses and other infrastructure leading to financial and emotional loss for individuals and families as well as economic losses for communities.

**Impacts:** Confusion over what parts of the community are already or are going to be impacted may lead to a delay in response time for first responders leading to further injuries or deaths. This is compounded with the issue of potential limited telephone, internet, and power throughout the community; individuals may have limited ability to reach out for help, and when they do reach 911 or other emergency system first-responders, assistance may not be able to reach residents in time.

The recent EF3 tornado in Franklin, Texas, in 2019 provides an example of the impact tornadoes have on housing and businesses. 55 homes, a church, and four businesses were destroyed. The Robertson County Sheriff said that the damage is the worst he had seen in 23 years.\(^{219}\)

![Figure 2-41: Residential neighborhood after EF3 tornado hit Van, Texas, in 2015.\(^{220}\)](image)

\(^{220}\) Photo by National Weather Service-Fort Worth.
2.6.12.3 Food, Water, Sheltering

Risks: Tornadoes hitting farmland are often described as fortunate events because the tornado is less likely to harm people or infrastructure.\(^{221}\) However, tornadoes have the potential to destroy cropland and harm livestock in the tornado’s path, creating a financial, emotional, and economic impact for local farmers and the community.

Similar to risks to shelters during a hurricane, the high winds during tornadoes have the potential to substantially damage all types of infrastructure throughout the community including water treatment plants and shelters. Although, as mentioned in the hurricane section, the state is making a concerted effort to increase the number of shelters along highway rest stops, local shelters are still at-risk during tornadoes. Due to the frequency with which tornadoes occur in conjunction with other hazards such as flooding, local shelters may be unreachable or may be hazardous to travel to during dual events.

Impacts: Community members who are in the path of multiple hazards—including flooding and tornadoes—may either be uncertain about whether to travel to a shelter or shelter in place; this may lead to an increase in injuries if individuals decide to stay in place and are impacted by tornadoes, flooding, hail, or lightning, or decide to travel to shelters only to encounter flooding, debris or other hazards that prevent them from reaching a shelter in time. Agricultural areas that are impacted by tornadoes may lose a significant portion of crops or lose livestock. For example, an EF-3 tornado touched down in East Texas in April 2019, destroying a dairy farm—killing numerous cattle and destroying equipment.\(^{222}\)

2.6.12.4 Transportation

Risks: One of the most common themes between tornadoes and transportation is the idea to never try and outrun a tornado in a vehicle if the tornado is immediately nearby. However, if the tornado is not imminent, it is noted to use a vehicle to reach the nearest sturdy structure. While hiding under an overpass may seem like a secure location, tornadic winds are actually stronger in these openings, as they act as a channel for debris to fly through with risk of injury increasing. In moments of last resort, find a ditch or other lower elevation drainage conveyer usually found along transportation corridors and remain as low to the ground as possible.\(^{223}\)


Tornadoes bring substantial winds and can lift and throw any vehicle across large areas of land. If an individual cannot leave their vehicle, fastening the seatbelt and protecting vulnerable areas of the body is best practice. Tornadoes can also damage roadway signs and other transportation-associated infrastructure, and litter roads with debris that make them unsafe to travel during and after the tornadic activity. Debris caused by a tornado is one of the main reasons for transportation-related delays and roadways closures after a tornado hits an area. During a violent and sporadic weather event such as a tornado, public transportation service may also be delayed due to safety measures needing to take place. Even without a tornado touching down, tornado warnings themselves can lead to a pause in public and mass transit service.

**Impacts:** In April 2019, Cherokee County had three tornado touchdowns that closed multiple roads and left ground transportation in a precarious state. These tornadoes downed powerlines, left large trees scattered on highways, and closed school operations for Alto ISD. Portions of U.S. Highway 69 were closed due to live electrical lines on the roadway while sections of State Highway 21, State Highway 294, FM 752, and FM 275 were closed due to wide-spread scattered debris and trees blocking traffic, as result of the tornadic activity.

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225 “Alto cancels classes, several roads closed due to storm damage, debris,” *Jacksonville Progress*, April 13, 2019, [https://www.jacksonvilleprogress.com/news/alto-cancels-classes-several-roads-closed-due-to-storm-damage/article_f809d1d0-5e44-11e9-b570-a7eabcebaba0e.html](https://www.jacksonvilleprogress.com/news/alto-cancels-classes-several-roads-closed-due-to-storm-damage/article_f809d1d0-5e44-11e9-b570-a7eabcebaba0e.html)
2.6.12.5 Health and Medical

Risks: Due to the unpredictability of tornadoes, first responders and other medical personnel are critical to response and recovery efforts following these hazards. Medical surges—times when a large number of injured individuals are rushed to a hospital—are common during sporadic and unpredictable weather disasters. The commonality of tornadoes occurring with little to no warning while not following a predictable pattern can produce tornadic events that lead to quick and large spikes in the need for medical attentional for a large number of patients. Because of debris that is common with tornadoes, health and medical services may also have a difficult time reaching individuals in need as roadways and other transportation corridors may not be navigable. Roadway closures may also prove difficult for the safe movement of patients, along with the potential of evacuating medical locations that have been struck by a tornado.

Impacts: During a tornadic event that devastated portions of East Texas on April 29, 2017 it was reported by the East Texas Medical Center that 52 people were admitted to three different hospitals in the region. Out of the 11 deaths which occurred throughout the southern and midwestern portion of the United States during this weather event, 4 deaths could be attributed to the Canton-area tornadoes.\(^{227}\) In total, seven tornadoes touched down in the East Texas counties of Henderson,


\(^{227}\) Kurt Chirbas, Gemma DiCasimirro, Phil Helsel, and Daniella Silva, “11 Dead, Dozens Hurt After Tornadoes Hit Texas, South,” *NBC News*, April 29, 2017,
Hopkins, Rains, and Van Zandt. The strongest tornado reached EF-4 status and brought 180 mph winds along its track from Eustace to Canton.²²⁸

Figure 2-43: Destroyed home in Canton, April 2017 tornadoes.²²⁹

2.6.12.6 Hazardous Material (Management)

Risks: When a tornado destroys a residential, commercial, or other structure, whatever is inside of that structure is scattered throughout the area. Waste management and cleanup is a large undertaking which must take place following a tornado, as debris can lead to hazardous situations that threaten both environmental and human health and safety. The potential of hazardous material being scattered throughout an area is also significant after a tornado, as the path of the event is difficult to predict and, therefore, difficult to plan for; when it comes to removing or bolting down toxic material and substances, these acts can be an afterthought. However, limiting the potential of hazardous material to saturate waterways and ground soil can help protect natural resources.

Impacts: After a tornado impacted the Arlington area in 2012 by tearing off roofs, destroying garages, collapsing walls, and flattening homes and other structures, items that were being stored inside these buildings were left scattered. Some of the noted items that were thrown by the tornado

include herbicides, pesticides, fluorescent light builds, car and household batteries, motor oil, transmission fluid, and paint substances. All of these materials, if exposed, can be hazardous; hazmat crews were brought in the area to collect and clean the impacted locations. The tornado, just in Arlington alone, was responsible for producing 12,000 pounds of waste.\textsuperscript{230}

2.6.12.7 Energy (Power & Fuel)

Risks: Tornado strength winds can damage or destroy above-ground electric utilities during a tornadic event. Power outages are almost guaranteed, and energy grid infrastructure can become vulnerable when exposed to flying debris and high wind velocity associated with a tornado. Ultimately, anything that is power, or energy related that is not below ground can be damaged or destroyed. From above-ground fuel tanks and pipelines to power lines and transmission towers, infrastructure that is exposed can become unusable and leave thousands of individuals without electricity and other critical resources.

Impacts: On April 13, 2019, the city of Franklin was hit by an EF-3 tornado that left twelve individuals with injuries requiring treatment by medical officials. It was reported that a total of 55 homes were destroyed, an electrical transmission line destroyed, and an electrical distribution center was substantially damage.\textsuperscript{231} Franklin, located about 65 miles to the southeast of Waco, had a majority of their 1,500 residents without power for up to 72 hours as a result of the tornado.\textsuperscript{232} Robertson County Judge, Charles Ellison, was quoted as saying “we’ve lost about half of the south side of Franklin.”\textsuperscript{233}


\textsuperscript{231} “Tornado in Franklin destroys 55 homes, officials say,” \textit{The Eagle}, April 15, 2019, https://www.theeagle.com/news/local/tornado-in-franklin-destroys-homes-officials-say/article_3aeaf3e9-119a-4be4-93b4-0d17b5629020.html


Figure 2-44: Tornado damage in Franklin, April 2019.\textsuperscript{234}

\textsuperscript{234} Photograph by Rebecca Fledler, \textit{The Eagle}, April 13, 2019, 
2.6.13 SEVERE WINDS

The SHMP defines severe winds as widespread, long-lived, straight-line wind events that can occur alone or sometimes accompany other natural hazards including hurricanes and severe thunderstorms. Severe wind events can happen anywhere in the state of Texas. The SHMP notes that severe winds pose a threat to lives, property, and vital utilities primarily due to the effects of flying debris, downed trees or structures, and interactions with power lines. The most damage severe winds cause is to structures of light construction (i.e., manufactured homes).

The below Wind Zone Map illustrates the wind risk zones of the entire U.S. based on the highest expected wind speeds. The map takes into account all wind hazards including those associated with severe thunderstorms, tornadoes, and hurricanes. The zones are associated with the highest wind speed for that region. The map also displays special wind hazard-prone areas. Wind speeds draw a parallel to design specifications of a shelter or safe room. Typically, Texans require a shelter/saferoom to withstand 160–200 mph wind with a maximum expectance of 250 mph.235

The SHMP notes that from 2018–2023, it is forecasted that severe winds will account for $338,496,656 in property losses, $30,697,559 in crop losses, 12 fatalities, and 108 injuries.

2.6.14 FEMA’S COMMUNITY LIFELINES FOR SEVERE WINDS

2.6.14.1 Safety and Security

Risks: Severe winds can feature in all of the above hazards and have the potential to include all of the above hazard’s risks to government services and first responders. High winds alone can create unsafe driving conditions for first responders trying to reach community members, for community members trying to reach shelters, or for anyone trying to evacuate an impacted area. Winds also have the potential to damage public infrastructure, homes, businesses, and personal property—particularly by downing trees that fall on powerlines, buildings, or personal property. Winds may also exacerbate damage from other hazards; if winds damage a roof of a home, business, or other structure, water can intrude into the already damaged building, causing more damage. Strong

winds may damage power lines, hindering the continuation of public services for a prolonged period.

Impacts: Severe winds during the March 2019 thunderstorm in North Texas left more than 88,000 without power.237 Similarly, in Longview, 90 mph winds left widespread damage including 17,000 customers without electricity.238

2.6.14.2 Communications

Risks: Severe winds alone may create the potential for power to be cut off. As explained above, power outages can prevent community members or first responders from seeking community members in need or seeking help. Power outages can be problematic, especially if these outages are at airports. If the power shuts off during high winds, this could lead to air controllers having limited communication with airplanes.239,240 Similar to tornadoes, since high winds are associated with a variety of other potential hazards, this may lead to confusion over whether to stay in place during a wind event or travel to a local shelter.

Strong winds themselves can limit or halt travel not only for community members trying to get to work or school, but for freight and port traffic as well; this pause in commercial traffic has the potential to lead to significant economic impacts.

Impacts: Confusion over whether to stay in place or travel to a shelter may create a situation where increased injuries or deaths may occur. In April 2019, Lubbock County experienced a dust storm (a haboob) along with high winds of 65-80 km/h limiting visibility and causing numerous vehicle accidents.241

2.6.14.3 Food, Water, Sheltering

**Risks:** Since severe winds are often associated with hurricanes and thunderstorms the risks and impacts associated with hurricanes are often associated with severe winds. Severe winds may blow debris such as tree limbs, powerlines, and other large items into the roadway. This may block distribution routes or may cut off power throughout a particular area. This may block individuals needing to reach a shelter.

**Impacts:** During a severe wind event in June 2019, at least 80,000 customers lost power including at least a half a dozen grocery stores in Dallas; these grocery stores had to temporarily close.\(^{242}\)

2.6.14.4 Transportation

**Risks:** Much like tornadoes, severe wind can cause traffic delays and potentially damage transportation infrastructure, personal vehicles, and commercial vehicles. Traffic and road signs can succumb to high winds and fall to the ground. Vehicles which have a high center of gravity, including semi and delivery trucks, can be subject to powerful straight-line winds that may either lift or push these vehicles over. Severe winds can reduce the capacity of a roadway by littering roads with sand, wind-blown debris, and pushing standing water onto them making travel unsafe. During severe wind events, usually associated with thunderstorms, uprooted trees can also block and or damage transportation infrastructure. Windblown substances on roads can impact mobility by reducing the distance of visibility for a driver.\(^{243}\)

**Impacts:** An early June 2019 high-wind and thunderstorm event in Dallas left the city with 41 percent of its traffic signals not working properly, 496 of its traffic signals not having any communication capabilities or left inoperable, and 168 traffic signals flashing red which caused major traffic delays throughout the area.\(^{244}\)

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\(^{244}\) “Important storm update information,” city of Dallas, June 11, 2019, [http://www.dallascitynews.net/important-storm-update-information](http://www.dallascitynews.net/important-storm-update-information)
Health and Medical

**Risks:** Health and medical facilities, like all structures, are vulnerable to severe wind or other high wind events that come with hurricanes, tropical storms, and thunderstorms. Because high-profile vehicles are susceptible to being pushed over or flipped during severe wind events, the operators of ambulances and other large patient transport vehicles must be aware and cautious when attempting to move people, making sure not to risk injury to the patients or the first responders themselves. Downed power lines and scattered debris may leave roads and other access points unavailable in an attempt to reach patients as well. High winds can cause a delay in medical service due to debris and potential power outages from downed power lines. Hospitals with helicopter service can also be affected by windstorm events as air travel may not be a safe or viable option. Windstorm events, as noted earlier, can lead to low-visibility situations as well. If winds are not strong enough to detour a medical helicopter from reaching patients, visibility concerns may leave the same helicopter grounded.

**Impacts:** When a severe windstorm hit Abilene on May 2019, 62 community members of the Willow Springs Health and Rehabilitation Center had to be relocated due to unsafe facility conditions caused by 70 mph severe winds.246

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2.6.14.6 Hazardous Material (Management)

*Risks:* Severe winds have the ability to mangle what would appear to be sturdy and secure pipes, storage facilities, large transport vehicles, homes, and businesses. If wind damage has occurred to a home, especially a garage or storage shed that is holding household hazardous materials such as fuel, corrosive cleaners, pesticides, pool chlorine, paints, wood stains or varnishes, these items could then be exposed and leak into the environment.\(^{247}\) These leaks would prove to be a hazard to both human and environmental health for those in the immediate area or, if leaked into a river, a downstream junction. Private businesses that sell household hazardous materials, or businesses that store more corrosive chemicals, can succumb to the same damage and expose the potentially harmful materials if not protected from severe wind damage. Businesses who use large and high-profile vehicles, such as semi-trucks, to transport hazardous material also pose a risk as these types of vehicles can easily tip over if the severe winds are powerful enough.

*Impacts:* A hazardous spill on U.S. Highway 287, near Childress on June 8, 2018, allowed corrosive and acidic liquids to leak out of an overturned semi-truck. Severe winds caused the semi-truck to overturn and led to the hazardous material spill. This required a hazmat crew to address the hazard and forced traffic to be rerouted throughout the area.\(^{248}\)


2.6.14.7 Energy (Power & Fuel)

*Risks:* Severe winds can lead to trees, above ground structures, and other debris falling onto utility lines and other energy production and transmission infrastructure. Severe winds can also damage utility infrastructure itself, by snapping utility poles, bending transmission towers, and knocking transformers off their platforms.\(^250\) During severe wind events that cause power outages, homes and businesses can be left without power for days to weeks at a time. These power outages can have economic effects on businesses. Home and business property damage can also occur if utility infrastructure falls, due to the winds, onto home or business structures and material. Above ground power lines seem to be more susceptible to wind damage than other utility infrastructure and can lead to further hazards as live wires can be dangerous to be around and handle. For example, during high wind events, if a downed power line is still live and sparks a fire, high winds can greatly aid the fire by fueling and spreading its flames over large distances.\(^251\) This can put homes and


businesses who were not in the immediate area of the severe winds in levels of danger for a different kind of hazard.

**Impacts:** When Hurricane Harvey made landfall, near Rockport, peak wind gusts reached 152 mph. Due to the severe winds, 220,000 customers were without power throughout the Corpus Christi region. The highest concentration of power outages in this region were observed around the Aransas Pass-Rockport area. When power outages were at their peak, 47,000 customers were left without power in the immediate Aransas Pass-Rockport portion of the region. Most areas that were impacted were able to regain power between August 27, 2017 and September 2, 2017. Several locations in the Houston area that were inaccessible, due to severe flooding, were not restored until September 8.

2.6.15 WILDFIRE

In Texas, humans and their activities cause more than 90 percent of all wildfires. The SHMP defines wildfire as a sweeping and destructive burning conflagration and can be further categorized as wildland, interface, or intermix fires. The probability of wildfire is dependent on multiple conditions. These conditions include local weather, topographic factors, and the presence of natural vegetation which acts as fuel for the wildfire. While a variety of conditions can help predict the occurrence of wildfires, wildfire behavior can be unpredictable. The unpredictability of wildfires is due to the limited understanding of the ecological response to wildfire, limited or inaccurate data on local conditions, and limited prioritization of resources.

Nearly 18 million people (roughly 70 percent of the population of Texas), as of 2018, live within the wildland-urban interface, the largest at-risk population of any state in the nation. By 2050, Texas’ average number of days with high wildfire potential is projected to double from 40 to nearly 80 days a year.

Wildfires can result in and cause widespread damage to residential, commercial, and government-owned land and property. Loss of life and injury is also a concern with wildfires. From 1996–2016, the SHMP notes that there were 31 reported fatalities and 170 reported injuries attributed to wildfires throughout the state. The SHMP notes that from 2018-2023, it is forecasted that wildfires will account for $330,190,566 in property losses, $89,490,775 in crop losses, 15 fatalities, and 79 injuries. Wildfire mitigation efforts need to consider land-use plans that address density and quantity of development, as well as emergency access, landscaping and water supply considerations.

A wildfire’s potential intensity, known as the Fire Intensity, can be presented through a standard form of measurement known as the Fire Intensity Scale (FIS). This helps individuals determine the power of a wildfire while also giving an idea of the potential for harm and danger toward life and property. The FIS consists of 5 classes, where the minimum class is 1 and the highest class is 5. The SHMP presents the scale in the table below.

### Fire Intensity Scale (FIS) Classes

<table>
<thead>
<tr>
<th>Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1 - Very Low</td>
<td>Very small, discontinuous flames, usually less than 1 foot in length; very low rate of spread; no spotting. Fires are typically easy to suppress by firefighters with basic training and non-specialized equipment.</td>
</tr>
<tr>
<td>Class 2 - Low</td>
<td>Small flames, usually less than 2 feet long; small amount of very short-range spotting possible. Fires are easy to suppress by trained firefighters with protective equipment and specialized tools.</td>
</tr>
<tr>
<td>Class 3 - Moderate</td>
<td>Flames up to 8 feet in length; short-range spotting is possible. Fires hard to suppress; trained firefighters require support from aircraft or engines, dozers and plows to be effective. Increasing potential for harm or damage to life and property.</td>
</tr>
<tr>
<td>Class 4 - High</td>
<td>Large flames up to 30 feet in length; short-range spotting common; medium range spotting possible. Direct attack by trained firefighters, engines, and dozers is generally ineffective, indirect attack may be effective. Significant potential for harm or damage to life and property.</td>
</tr>
<tr>
<td>Class 5 – Very High</td>
<td>Very large flames up to 150 feet in length; profuse short-range spotting, frequent long-range spotting; strong fire-induced winds. Indirect attack marginally effective at the head of the fire. Great potential for harm or damage to life and property.</td>
</tr>
</tbody>
</table>

#### 2.6.16 FEMA’S COMMUNITY LIFELINES FOR WILDFIRE

**2.6.16.1 Safety and Security**

*Risks:* Similar to other hazards, wildfires particularly large wildfires need a wide variety of first responders. In 2011, the Texas A&M Forest Service mobilized 16,690 emergency responders, 244 bulldozers, 986 engines, and 255 aircraft from around the nation to respond to fires across the state. While response to wildfires is highly organized throughout the state—with multiple interlocal agreements between state, and federal resources—past events show that local first responders and agencies are understaffed and do not have the equipment to address large scale...
wildfires.\textsuperscript{261,262,263} This limited capacity to respond to wildfires increases the likelihood of miscommunication, first responder fatigue, and accidents. Compounding this lack of capacity is the increased likelihood of wildfires to reach across hundreds to thousands of acres and be sustained for days to weeks; rapid population growth and development in the wildland-urban interface are factors in this increase.\textsuperscript{264}

Along with the limited staff capacity, wildfires themselves are unpredictable; this unpredictability can cause first responders, particularly firefighters, to become entrapped, dehydrated, overheated, or wreck vehicles including trucks, helicopters and airplanes.\textsuperscript{265,266}

\textbf{Figure 2-48:} Texas National Guard assists with the 2011 Possum Kingdom Wildfire.\textsuperscript{267}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure2-48.jpg}
\end{figure}

\begin{itemize}
\item\textsuperscript{261} Sarah Rafique and Josie Musico, “Majority of Texas Fire Departments Staffed by Volunteer Firefighters,” \textit{Claims Journal}, December 7, 2016, \url{https://www.claimsjournal.com/news/southcentral/2016/12/07/275425.htm}
\item\textsuperscript{262} Karen Jackson, “Case Study of the 2015 Hidden Pines Wildland-Urban Interface Fire in Bastrop, Texas,” Bastrop County Office of Emergency Management, March 31, 2016, \url{https://www.co.bastrop.tx.us/upload/page/0027/docs/HPF_Case_Study_final_03312016.pdf}
\item\textsuperscript{263} Ross Ramsey, “For Fire Departments, More to State Budget Than Numbers,” \textit{Texas Tribune}, May 3, 2013, \url{https://www.texastribune.org/2013/05/03/more-texas-budget-numbers/}
\item\textsuperscript{264} “Fire Danger: Wildfire Risk,” Texas A&M Forest Service, accessed October 4, 2019, \url{https://tfsweb.tamu.edu/WildfireRisk/}
\item\textsuperscript{266} “Fighting Wildfires,” Centers for Disease Control, accessed October 4, 2019, \url{https://www.cdc.gov/niosh/topics/firefighting/}
\item\textsuperscript{267} Photography by SSG Malcom McClendon, Texas Military Department.
\end{itemize}
Impacts: First responder fatigue and illness, miscommunication, and accidents may all lead to an increase of injuries and deaths, along with increased financial loss to replace equipment or vehicles. A 2006 wildfire in four rural counties, Hutchinson, Roberts, Gray, and Donley counties, led to the death of a volunteer firefighter. The firefighter tried to drive a water truck away from oncoming flames, not knowing that another team had removed vegetation- creating soft soil; the truck slid on the soil leading to the truck crashing and the driver dying. In 2011 during the wildfires in Bastrop, two volunteer firefighters were trapped between two fires when they turned into the wrong driveway and had their truck stuck in sand.

2.6.16.2 Communications

Risks: Similar to hurricanes and tornadoes, the wide array of state and national first responders converging with local responders to fight large scale wildfires, creates communications challenges, because of the different communication equipment and protocols involved; these different methods of communication have the potential to lead to a lack of communication or miscommunication. Compounding the potential miscommunication, is that the majority of wildland in Texas is privately owned, creating communication challenges between private landowners, first responders, and federal officials. The unpredictability of wildfires may also lead to miscommunication, particularly between on the ground and air response teams.

The economic impact from wildfires is immense. Wildfires can destroy homes and local businesses, displacing employees and employers for a prolonged period of time. The timber industry, particularly in East Texas, represents approximately an $18 billion industry; wildfires destroy timber products that are the basis of this industry.

Impacts: The lack of communication or miscommunication may lead to increases in injuries, deaths, and financial loss as described above in the safety section. Fires throughout the state in 2011 destroyed over 3,000 structures including approximately 2,947 homes. It cost approximately $20 million to just clean up the debris just in Bastrop County. The 2011 wildfires

also destroyed over $1.6 billion worth of timber products, representing a potential $3.4 billion economic impact in East Texas. The Possum Kingdom Wildfire in 2011 destroyed over 249 homes, a restaurant and a church.

Figure 2-49: Homes on fire during the Possum Kingdom Wildfire in 2011.

2.6.16.3 Food, Water, Sheltering

Risks: Potable water quality has the potential to decrease after wildfires due to increased erosion, diminished reservoir capacity, and ash, debris, other chemicals settling on or floating into lakes and rivers. The treatment of contaminated water can also be costly and time consuming for local communities.

276 Photography by SSG Malcolm McClendon, The United States National Guard.
The unpredictability of how the wildfire may spread can create uncertainty in whether community members will follow an evacuation order for a particular area. Community members may stay behind after evacuations have been ordered assuming that they can defend their home or will not be in the path of the wildfires, but then need to evacuate suddenly when they realize they are in the wildfire’s path.\textsuperscript{280} Wildfires travel quickly with a fire taking less than half an hour to travel 2 miles resulting in the need for residents to quickly evacuate.\textsuperscript{124} This uncertainty inherent during evacuations coupled with the need for quick response times creates the potential for confusion between first responders, who may not know who has evacuated or who has stayed, potentially increasing the number of accidents than can occur if residents are trying to quickly leave their neighborhood.

**Impacts:** The impacts to the water supply after a wildfire can be long lasting and unpredictable. Over time, impaired water supply can lead to an increase of medical conditions, injuries, or loss of life. The suddenness and unpredictability of wildfires also creates an uncertainty of how many shelters are needed and where shelters should be placed. In 2011, 5,000 people had to be evacuated and dozens of shelters had to be set up in Bastrop County, including shelters for hundreds of animals.\textsuperscript{281,282} During the 2011 Bastrop County Complex fire, there was such a need for shelters that local hotels were utilized; some evacuees were sleeping outside of shelters on picnic tables.\textsuperscript{283}

### 2.6.16.4 Transportation

**Risks:** In Texas, wildfires can lead to large scale disruptions and delays across transportation networks. Roadways which either go through a wildfire or are near a wildfire may need to be closed due to safety concerns and issues concerning visibility. These closures affect all forms of ground transportation including cars and other personal vehicles, commercial vehicles and business delivery services, public transit providers, emergency services such as ambulance service and firefighters, and others. Renters and homeowners may also not be able to access their properties if wildfires caused a road closure. The same can be said about private businesses: if consumers cannot reach a business, then these locations cannot provide desired services. Road closures can also create traffic concerns on other roadways, as these arterials may be the only other option for entry and exit of an area. Risk of damage to local transportation infrastructure due to high levels of heat from fire or burning debris is also a concern. Smoke from a wildfire can lead

to unsafe travel conditions that may impact all forms of transportation including aerial, ground, and water through poor visibility and inhalation hazards.

Impacts: On September 4, 2011, wildfires in Travis County threatened the neighborhood of Steiner Ranch which has only 2 ways in and out for nearly 18,000 community members who call the neighborhood home.\(^{284}\) As flames and cinders drifted across RM 620 and made their way to nearby homes, evacuations took place.\(^{285}\) Due to the limited roadway entry and exit points for the neighborhood of, Travis County began to analyze the expansion of vehicular evacuation paths for Steiner Ranch.

Figure 2-50: Evacuations from Steiner Ranch in Travis County, 2011 Wildfire.\(^{286}\)

2.6.16.5 Health and Medical

Risks: Wildfires can damage health and medical structures, limit the admittance of patients and the movement of patients to those facilities by blocking roads and other transport modes, and restrict hospitals and other medical providers’ ability to receive assistance by limiting accessibility. If wildfires occur near large population areas, evacuations, the provision of shelters, and treatment of burns and smoke inhalation may be necessary. Increased business and housing development

\(^{284}\) “Steiner Ranch Demographics,” Point2Homes, accessed September 16, 2019, [https://www.point2homes.com/US/Neighborhood/TX/Austin/Steiner-Ranch-Deographics.html](https://www.point2homes.com/US/Neighborhood/TX/Austin/Steiner-Ranch-Deographics.html)


adjacent to or on wildfire-prone areas has also recently increased, placing more people at risk. The impact of wildfire smoke is also a large public health issue that can affect thousands of people and locations hundreds of miles away. The make-up of wildfire smoke usually consists of carbon dioxide, water vapor, carbon monoxide, particulate matter, hydrocarbons, nitrogen oxides, and trace elements. However, substances that are in the wildfire smoke can differ from wildfire to wildfire and are contingent on the fire’s temperature, fuel source, and the conditions of the surrounding wind.

Impacts: Wildfires took the lives of four individuals after burning nearly 500,000 acres of land throughout the Texas Panhandle in early March 2017. Three of those deaths occurred in Gray County, where one fatality was accredited to smoke inhalation and two fatalities were accredited to burns. In Ochiltree County, 500 animals were killed as three to five commercial hog barns burned to the ground. The smoke associated with the wildfires, measured by the Texas Commission on Environmental Quality (TCEQ), also affected the air quality for the Amarillo region with levels of sulfur dioxide measured as being unhealthy for sensitive groups.

2.6.16.6 Hazardous Material (Management)

Risks: Damages caused by a wildfire depends on the overall extent, size, heat levels, and other variables. Debris damage can include items from destroyed homes and businesses containing household waste, other structures holding waste, hazardous waste, green waste, or other personal and commercial property. Chemical storage facilities, if encroached upon by wildfire, can explode and cause harm to human and environmental health. These explosions, if large enough, can damage or destroy nearby homes and businesses while also effecting other critical operations and needs throughout an area. The smoke produced by a wildfire can contain hazardous material as chemicals and other substances can be engulfed by the fire and, as the chemicals or other hazardous material burn, travel with the winds over a widespread area. Once a fire has burned down or scorched a home, business, or other location, the ash and other debris may be contaminated and must be disposed of quickly and properly as to minimize the exposure of these substances.
materials to people and the environment. Commercial structures have been found to contain more hazardous substance and materials in its ash than residential structures and properties.293

**Impacts:** After a wildfire, debris and waste management is critical to cleaning hazardous material or substances which could have been spread or burned, reported by The Texas Commission on Environmental Quality.294

2.6.16.7 Energy (Power & Fuel)

**Risks:** Damaged power lines, also known as transmission lines, and other above ground electric utility infrastructure can create devastating wildfires if not mitigated properly. In 2011, for example, the Bastrop County Complex fire was reportedly caused by a number of loblolly pine trees falling onto a string of electrical lines.295 According to the Texas Wildfire Mitigation Project, power lines can spark wildfires through multiple mechanisms. Downed lines, vegetation contact, conductor slaps, repetitive faults, and apparatus failures are the most common ways power lines and utility infrastructure can lead to wildfires. As of 2015, there were nearly 26,000 miles of electric transmission lines, also known as power lines, throughout Texas.296

**Impacts:** The Bastrop County Complex fire, mentioned earlier and caused by downed electrical power lines, burned a total of 34,000 acres, lit 1,660 homes on fire, and killed two people while injuring 12 others. Another example of a much smaller wildfire caused by power lines occurred on May 8, 2018 as sparks from a power line in Big Spring caused a wildfire within its city limits. While no injuries or fatalities occurred, this fire was within 50 yards of a nearby apartment complex and threatened the lives of many people living there while the fire grew to a size of 15 acres. As a result of the fire, 1,600 homes and business were also without power for a period of time.297 In recent years, power lines have led to more than 4,000 wildfires in Texas.298

Figure 2-51: Bastrop County Complex fire smoke from Highway 71, 2011.\textsuperscript{299}

2.6.17 WINTER WEATHER

The SHMP discusses the impacts of severe winter weather including downed trees, widespread power outages, damaged property, and injury and death. The effect of severe winter storms on Texas is quite disruptive compared to other regions that normally experience severe winter weather. In Texas, a heavy snowfall for the state is an accumulation of 4 or more inches of snow in a 12-hour period. This amount of snow accumulation usually occurs in the northern half of the state and in the higher elevations of West Texas. Winter weather events from Del Rio to Port Arthur are relatively rare. The most severe snow event, blizzards, is most likely to occur in the Texas Panhandle and South Plains Regions.

The SHMP notes that an ice storm occurs when rain falls out of the warm 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. Damage can occur with half an inch of rain freezing on trees and utility wires; the damage increases if there are high winds. Based on this, an icing event is categorized as an ice storm at half an inch.

The size of Texas means that certain portions of the state are more vulnerable than others to severe winter weather. The SHMP points to the Texas Panhandle and North Central Texas region around Dallas and Texarkana as most vulnerable to severe winter storms. At the same time, these areas are better prepared for severe winter weather. The southern portions of the state are not as likely to incur severe winter weather, but when it does happen, the impacts are much stronger because the communities and governments are not as prepared. The SHMP notes that from 2018–2023, it is forecasted that winter weather will account for $100,081,159 in property losses, $3,572,851 in crop losses, 29 fatalities, and 319 injuries.

2.6.18 FEMA’S COMMUNITY LIFELINES FOR WINTER WEATHER

2.6.18.1 Safety and Security

Risks: The SHMP notes that while North Texas and the Panhandle are more likely than the rest of the state to see winter weather, when winter weather does impact southern Texas, communities are generally not as prepared as other communities in Texas. While TxDOT and local road crews do pretreat roads right before winter weather events, community officials often urge community members to simply stay off roads until it becomes warm enough for roads to clear of ice or snow.

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301 Ibid, page 189.
303 Meagan Flynn and Robert Downen, “The latest: Houston area braces for ice storm, potentially dangerous conditions,” Houston Chronicle, January 15, 2018,
At the same time, community members may not follow local officials directions and try to drive on icy roads leading to an increase in accidents due to residents unaccustomed to driving on snowy or icy roads or not seeing black ice on roadways.303 If community members do stay at home, they may not prepared for the cold conditions, or are concerned about high electric bills, leaving their heat off. Further, furnaces may break, or power outages may occur. Increased use of furnaces, fireplaces, and portable heaters increase the possibility of house fires or other infrastructure fires as well.304

All of these factors increase the likelihood that first responders need to travel during hazardous road conditions in order to address accidents, or residents needing assistance at home. In addition to first responders traveling on unsafe roads, winter weather may close government buildings and schools; these closures may delay public services.

**Impacts:** The consequences of residents traveling on icy roads is an increase in first responders or community members injuring themselves or dying. A firefighter died trying to respond to a weather-related accident after being struck by a vehicle in Dallas in 2014 during an ice storm.305 Additionally, the city of Houston saw freezing rain, ice, and snow on January 16, 2018. Despite Houston officials urging community members to stay home, there were over 300 car accidents in a 9-hour period on January 16; this compares to approximately 226 car accidents in a 24-hour period on a typical day in Houston.306 This same winter event prevented approximately 1.1 million students from attending school. During the first week of January 2019, Abilene saw up to 4 inches of snow, black ice, and temperatures below 30 degrees; the snowy and icy road conditions led to police responding to at least 90 accidents on January 3, 2019.307 In February 2016, a baby died due to a space heater being too close to other household items, causing a house fire.308

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307 Jesus Martinez, “Dallas-Fort Worth was spared snowfall, but other parts of Texas weren't so lucky,” Dallas Morning News, January 3, 2019, https://www.dallasnews.com/news/weather/2019/01/03/dallas-fort-worth-was-spared-snowfall-but-other-parts-of-texas-weren-t-so-lucky/
2.6.18.2 Communications

Risks: Winter weather can damage or destroy powerlines throughout impacted areas, because of ice accumulating on powerlines or trees falling over from the weight of ice accumulation on powerlines. Damaged or destroyed powerlines have the potential to lead to power outages throughout a particular area during winter weather events. Power outages can lead to community members not having access to internet or telephone, preventing community members from calling or reaching out for help. Lack of power also creates the potential for community members to lose heat, increasing the need for assistance.

Freezing to below freezing temperatures, ice, and snow may also lead to significant economic impacts. Along with government buildings and services and schools closing, road conditions increase the potential for businesses throughout the potential area to close as well for employees to not reach their place of work. The agriculture industry is particularly prone to the often brief winter weather events in Texas; a week of lower than average temperatures can destroy crops and injure or kill livestock.

Impacts: On December 6, 2011 an ice storm came through North Texas leaving approximately 45,000 customers throughout North Texas without power due to tree limbs and debris damaging powerlines and associated equipment.309

The SHMP describes the economic impact from the 2015 winter storm in North Texas in Lubbock County. The combined economic loss for businesses and commerce was $200 million. Direct losses from the storm were most significant to area ranchers and dairy farmers who suffered combined losses of at least $20 million. The USDA estimated 15,000 head of dairy cattle died from snow suffocation in the Texas Panhandle with similar numbers for non-dairy cattle.310

2.6.18.3 Food, Water, Sheltering

Risks: Sheltering or warming centers are an essential need during winter weather due to the potential for freezing to below freezing temperatures and power outages. However, the icy road conditions can make traveling to shelters difficult, creating a potential for community members to be uncertain whether they should stay in place or head to shelter.

Sudden power outages, particularly at night, may compound the confusion with community members thinking that they can stay in place, suddenly needing to find a shelter and traveling on hazardous roadways. Homeless individuals are particularly vulnerable to cold weather, with

individuals not knowing where temporary warming centers are located, or they may think that they can survive for one to two nights in the extreme cold.

**Impacts:** During the January 2018 winter storm in Houston, shelters saw an increase in those seeking shelter with just one temporary shelter housing 180 individuals in a night; most of the individuals seeking shelter were homeless individuals, but a few were individuals whose furnace quit working. 311 Two deaths were reported during the same cold weather event in Dallas in January 2018; the two individuals who died were homeless—one was found under an overpass and the other individual was found at a bus stop. 312

### 2.6.18.4 Transportation

**Risks:** Roadways, especially bridges, are susceptible to icing during winter weather events. When a transportation corridor is iced over, or covered in snow, this creates hazardous driving conditions which effect personal and commercial vehicles. Winter weather can create unpredictable and dangerous driving conditions and all travel is highly discouraged during these events. Aerial travel can also be impacted during winter weather events as visibility becomes limited. The icing of planes and other aircraft, along with runways, only make aerial flight more dangerous during these weather events and can produce cancelled flights. While rare, railroad track switches may also freeze as winter weather can disrupt the distribution of numerous goods and commercial material throughout Texas.

**Impacts:** February 2015 saw 600 flights cancelled at the Dallas-Fort Worth International Airport due to freezing rain and sleet. During November of the same year, the Dallas/Fort Worth metroplex, along with portions of the Texas Panhandle, experienced troubling ice storms which crippled transportation operations. This severe winter weather event lead to 120 car crashes near Amarillo and numerous semi-trucks jackknifed on Interstate 40 which caused the highway to close for 5 hours. 313 A similar event was seen in February 2015, as the picture below illustrates, winter weather induced wrecks near Amarillo. 314
2.6.18.5 **Health and Medical**

*Risks:* The occurrence of winter weather can present barriers to individuals trying to access health care and medical providers trying deliver care or reach patients who require help and assistance. Physical access to health care and medical providers is the main concern, as frozen precipitation can make roadways unsafe and potentially deadly to travel on for personal vehicle travel, public transit, and medical transport vehicles.\(^{316}\) Rescue missions may also be impacted by low-visibility and the potential of freezing mechanical equipment. As ice or snow accumulates on power lines, hospitals and other medical provider facilities can face power outages or blackout situations, potentially putting the lives of patients in life-threatening danger. Depending on the amount of snowfall or ice accumulation, hospitals may also need to turn their operations into what is best described as a hotel, as high numbers of hospital staff may be required to live at the hospital if they are unable to leave due to road conditions.\(^{317}\)

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Impacts: Since 2011, Texas has been the eighth most deadly state in the nation, and the first most deadly state in the southern portion of the U.S., for winter weather vehicle accidents.\textsuperscript{318} The SHMP specifically presents the story of two individuals who, while traveling in a car on December 27, 2015, lost their lives due to a combination of sleet, snow, and freezing rain covered roads around Lubbock. During this same winter weather event in the Texas Panhandle, medical personnel and other first responders conducted rescue missions for motorists who had been stuck in their vehicles for up to 32 hours due to snow drifts that blocked roads.\textsuperscript{319}

Figure 2-53: Vehicles stuck in snowdrifts near Amarillo during February 2013 blizzard.\textsuperscript{320}

2.6.18.6 Hazardous Material (Management)

Risks: Winter weather, and the association of freezing temperatures, can cause disruption, malfunction, and other consequences to refinery processes, infrastructure, and other facilities that may be required in handling potentially hazardous material and or waste. The transporting of hazardous material can also be put into risk, as winter weather can make roadways treacherous which can lead to spills and other accidents. Hazmat response teams can also be hindered, as roadway access is needed for their arrival. Snow, ice, and sleet can also make trains more

\textsuperscript{318} Doyle Rice, “Winter car accidents are a deadly weather hazard,”\textit{USA Today}, February 6, 2017, \url{https://www.usatoday.com/story/weather/2017/02/06/winter-fatal-car-accidents/97551588/}.
susceptible to derailments and cause hazardous material spills, depending on what the train is transporting. While the presence of snow can limit the spread of leaked material, as the snow may initially act as a barrier, continued snowfall can also cover up spills and other waste leaks which can limit the ability of response crews to find further spills.321

**Impacts:** During winter weather events, all forms of transportation can be treacherous due to slippery conditions and visibility concerns. Train derailments across the nation also appear to be more common during high accumulation times of snow and ice.

2.6.18.7 *Energy (Power & Fuel)*

**Risks:** Widespread power outages can result from snowfall and ice accumulation. Depending on the amount of snow or ice, transmission lines can be weighed down to a point where they collapse and are left in a state of needed repair. Further, snow, ice, and other winter weather accumulation can weigh down tree branches, causing them to snap and fall on top of above-ground energy infrastructure which can leave people without electricity for an extended period of time. Winter weather can also limit the physical access people have in order to reach gas and other fueling stations. The same can be said for the transportation and delivery of fuel to gas stations as roads can become impassable and unsafe to drive on. When winter weather effects roadways, oil refineries and other fuel production sectors, there may be reduction in the demand for their products, as vehicle use falls if roads cannot be used or accessed in a safe manner.322 Winter weather accumulation, due to the potential of power outages, can affect homes, businesses, schools, and other forms of service that is provided to individuals.

**Impacts:** During an ice storm in the Dallas/Fort Worth metroplex in December 2013, Oncor estimated that 500,000 customers lost power in the area. This loss of power was and remains one of the company’s largest power outages in North Texas’ power line network.323

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Figure 2-54: Downed power line during the 2013 ice storm in Paris, Texas.\footnote{\textit{North Texas Winter Storm: December 5-7\textsuperscript{th} 2013}, National Weather Service, NOAA, https://www.weather.gov/fwd/december72013}
2.6.19 LIGHTNING

The SHMP defines lightning as a massive electrostatic discharge between electrically charged regions within clouds, or between a cloud and the earth's surface. The SHMP identifies the Houston and Beaumont/Port Arthur areas, along with the Dallas-Fort Worth metroplex, as the most vulnerable when it comes to lightning strikes. The following NLDN CG Flash Data map presents the location of lightning strikes in Texas from 2005–2016.

Figure 2-55: Locations of lightning strikes in Texas (2005-2016)\textsuperscript{325}

The annual average financial loss due to lightning in Texas is $3,234,744, making this hazard the
tenth most financially costly in the state. The SHMP notes that from 2018–2023, it is forecasted
that lightning will account for $17,560,332 in property losses, $269 in crop losses, 15 fatalities,
and 64 injuries.

The National Lightning Safety Institute defines the different types of lightning, presented in the
following table and in the SHMP.326

<table>
<thead>
<tr>
<th>Forms of Lightning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lightning Form</strong></td>
</tr>
</tbody>
</table>
| Direct Strike | This is the most dangerous hazard, wherein the person or structure is in a direct path for
lightning currents. The magnitude of the current determines its effects. A typical
amperage of 20kA acting on a ground of 10 ohms creates 200,000V. A large strike can
attain 150kA levels. More than 50 volts will drive a potentially lethal current through the
body. |
| Side Strike | This hazard results from the breakup of the direct strike when alternate parallel paths of
current flow into the ground via a person or structure. When the initial current path offers
some resistance to current flow, a potential above-ground current develops and the
person or structure's resistance to ground becomes the alternate path of conduction. |
| Conducted Strike | This hazard occurs when lightning strikes a conductor which in turn introduces the current
into an area some distance from the ground strike point. Unprotected connected
equipment can be damaged, and personnel injured if they become an indirect path in
the completion of the ground circuit. |
| Structure Voltage Gradient | Current passing through two or more structures creates a momentary voltage differential.
Poor interconnect bonding may cause a completed circuit potential difference. The same
hazard is created, for example, by a person touching an ungrounded object while he or
she is grounded. The electrical circuit is completed through the person, sometimes with
fatal consequences. |
| Induced Effects | Lightning can induce electric field and magnetic field coupling into structures and into
wiring. Magnetic coupling is transformer action, and the common laws for transformers
prevail. |

326 State of Texas Hazard Mitigation Plan, Texas Division of Emergency Management, October 2018, page 195,
<table>
<thead>
<tr>
<th>Lightning Form</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steamer Conductor</td>
<td>The streamer hazard occurs when a lightning leader influences electric behavior of objects on the Earth. Even streamers which do not become a part of the main channel can contain significant amounts of current. Streamer current exposure can affect people and sensitive electronics.</td>
</tr>
<tr>
<td>Sequelae</td>
<td>These secondary effects are many. Forest and grass fires, explosive steam conditions in masonry, trees and other water-bearing objects, and consequences of the thunder clap startling a person into inadvertently throwing a switch are examples.</td>
</tr>
<tr>
<td>Step Voltage/Touch Voltage</td>
<td>This hazard occurs as a result of a lightning strike dissipating its energy through the ground. The ground current creates a voltage drop across the surface of the Earth. A person standing within several hundred feet from the lightning strike point can have several hundred volts generated between his or her feet. This hazard is identical to a person being grounded while touching two live wires, one with each hand.</td>
</tr>
</tbody>
</table>

2.6.20 FEMA’S COMMUNITY LIFELINES FOR LIGHTNING

2.6.20.1 Safety and Security

*Risks:* Lightning can accompany a variety of other hazards including hurricanes, severe thunderstorms, flood events, extreme heat, and wildfires, and accordingly is associated with all of risks posed by these hazards. Lightning on its own may significantly impact the safety and security of first responders and impact government buildings and services. Lightning striking buildings or homes or other infrastructure has the capacity to start fires which can spread to surrounding areas. If lightning occurs in conjunction with a severe thunderstorm, there is the potential for a flooding event to occur along with fires. High flood waters or debris in roadways from heavy winds may block or hinder first responders from getting to the fire.

*Impacts:* There are several recent incidents of first responders injured trying to save community members and homes from fires started by lightning. For example, during August 2018, three first responders in Frisco, Texas were injured fighting a house fire started by lightning.\(^{327}\) Similarly, two deputies were treated for smoke inhalation after running into a house fire started by lightening in Harris County on June 29, 2019. On July 10, 2019, lightning caused a house fire in Irving, Texas; two firefighters were treated for heat exhaustion.\(^{328}\)


2.6.20.2 Communications

*Risks:* Lighting can cause trees to topple into powerlines, hit power poles or related equipment directly, or lead to fires near powerlines, all with the potential to cut off power. The lack of power due to a lightning strike may compound issues related to another hazard’s communication risks.

House or other infrastructure fires require a quick response; this may lead to first responders or neighbors trying to get into the building to save individuals trapped inside or tell the community members that the building is on fire. Confusion may ensue during such events, as first responders may not know who is left inside.313

*Impacts:* Miscommunication or confusion may lead to an increase in injuries or death of first responders or community members.

2.6.20.3 Food, Water, Sheltering

*Risks:* Finding a safe shelter during a lightning event is a common source of confusion for community members. Community members, especially during thunderstorms, may try to seek shelter under trees, tents or pavilions to keep dry during a thunderstorm/lighting event.329, 330 However, these areas are not suitable, and are often more dangerous, than being out in the open during lightning. Individuals may assume that they have more time to find shelter than they actually do or assume that if the rain has stopped during a thunderstorm there are no longer safety issues.

*Impacts:* Confusion of where to go during lightning events has the potential to increase accidents, injuries or deaths associated with lightning strikes. A roofer was in critical condition after he was struck by lightning during a thunderstorm on June 2, 2019. The roofer came inside during the rain but went back on the roof after the rain subsided when he was struck by lightning.331 In 2017, a man was killed by lightning in Midland, Texas sitting on a cinder block wall; he reportedly said “Oh it won’t strike here” right before he was struck.332

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2.6.20.4 Transportation

Risks: During a thunderstorm, lightning has been known to strike trees and cause branches and limbs to fall and block roadways and other transportation access points. Lightning strikes can also impact traffic control systems and other operations and maintenance aspects of the transportation network. Lightning strikes can affect these systems by either striking them or causing power outages in the immediate area. This can lead to traffic delays, traffic signals not functioning properly, pedestrian beacons being out of service, public transportation options being limited, and others. While the majority of airplanes and other aerial transportation devices are designed to handle lightning strikes, some crashes can be attributed to lightning. Lightning can also affect traffic control devices, different safety controls at airports, and general situational awareness and route options for pilots.

Impacts: As storms rolled into the Dallas-Fort Worth metroplex on May 11, 2016, lightning struck near the Dallas Area Rapid Transit’s (DART) station in downtown Carrollton. DART reported that two of its trains, along with necessary electrical equipment, were damaged. This lightning event limited DART’s public transportation capacity for several days after the event.


Figure 2-56: Crews work to repair the Carrollton DART rail line damaged by lightning.335
2.6.20.5 Health and Medical

*Risks:* The SHMP notes that lightning can cause injury and death throughout Texas. Most lightning deaths and injuries that people sustain are at golf courses, standing under trees, or near water, according to the National Weather Service.\(^{336}\) Depending on the type of lightning strike, the severity of injury varies case by case. The deadliest type of lightning strike—direct strikes—account for roughly 5 percent of lightning injuries. Ground current (50 percent), side flash (30 percent), and conduction (15 percent) strikes account for the rest of injuries attributed by lightning strikes.\(^{337}\)

*Impacts:* On August 26, 2014, in Bee Cave, 3 children were injured by a lightning strike during soccer practice at the Lake Travis Youth Association Field of Dreams. Witnesses to the accident told reporters that there was no indication of lighting, as there were no storms in the area and the sky was fairly clear.\(^{338}\) From 2008–2017, there were 20 lightning fatalities in Texas, the second highest number of lightning attributed deaths in the United States, behind Florida.\(^{339}\) From 1996 to 2016, lightning accounted for 5 percent of hazard-related deaths in Texas, tied with hurricanes, tropical storms, and depressions during the presented time period.\(^{340}\)

2.6.20.6 Hazardous Material (Management)

*Risks:* Lightning strikes can cause a great deal of damage and destruction to storage facilities and other structures that house hazardous materials and/or waste. If an explosion occurs, hazardous material can be scattered throughout an area and expose itself to human and environmental health functions. Even if the hazardous material does not physically reach an area on ignition or explosion, the possibility of the explosion placing these materials into a waterway can create effects felt downstream. If a fire occurs, the fumes from the fire can be lifted and carried across miles of land and, therefore, reach households and businesses which were not in the immediate vicinity of the lightning strike.

*Impacts:* On May 22, 2018, lightning struck and ignited a tank battery—a group of tanks connected to receive crude oil production from a nearby well or production lease that is then measured and tested before moving through the pipelines—near Hallsville. As a consequence of the oil fuel fire,


7 nearby acres caught on fire. On March 28, 2018, two oil tanks in Burleson County were struck by lightning; causing an explosion and fire. The fires were contained, but the fumes associated with the explosion and fire put nearby homes and businesses at risk.

**Figure 2-57:** Lightning ignited oil tanks in Burleson County in 2018.

2.6.20.7 Energy (Power & Fuel)

*Risks:* During a lightning event, electric equipment with power lines and at substations can be struck, causing power outages for extended periods of time. Lightning can also hit trees and other structures that may, in turn, fall onto utility infrastructure and cause power outages. Lightning strikes traveling through household and commercial devices can also cause fires if they are plugged into an outlet. Using surge protectors, or unplugging appliances and electronics during lightning events, can drastically reduce this from happening.

*Impacts:* On June 5, 2019, the city of College Station reported that a 138kV tie switch, located at a substation, had been struck by lightning. This lightning strike caused the substation to lose its ability to provide power to 8,770 customers.

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345 Kasey Tucker, “Storm causes power outages across College Station,” *KBTX-TV*, June 5, 2019, [https://www.kbtx.com/content/news/Storm-causes-power-outages-across-College-Station-510855431.html](https://www.kbtx.com/content/news/Storm-causes-power-outages-across-College-Station-510855431.html)
2.6.21 EXTREME COLD

The SHMP predicts that the number of days with maximum temperatures above freezing (32°F) throughout Texas are expected to decrease over time and will lead to a reduction in annual cold weather events every year. While extreme cold can happen anywhere in Texas, the Panhandle and other northern portions of the state experience the majority of extreme cold temperatures. In the Panhandle, extreme cold means days below 0°F, while in the Rio Grande Valley it means reaching temperatures below freezing.

The SHMP notes that from 2018–2023, it is forecasted that extreme cold will account for $2,972,052 in property losses, $514,705 in crop losses, 4 fatalities, and 1 injury.

The SHMP also notes that when dealing with extreme cold, the wind-chill effect is important to consider. The wind chill temperature is a measurement of how cold the wind makes the air feel to the human body. Since wind can dramatically accelerate heat loss from the body, a 30°F day could feel just as cold as a calm day with 0°F temperatures. Provided by the National Oceanic and Atmospheric Administration, the following chart depicts wind chill dependent on temperatures, wind speed, and exposure in minutes.346

![Wind Chill Chart](https://www.weather.gov/safety/cold-wind-chill-chart)

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2.6.22 FEMA’S COMMUNITY LIFELINES FOR EXTREME COLD

2.6.22.1 Safety and Security

*Risks:* Similar to winter weather, inexperience with extreme cold has the potential for Texans to be unprepared for the cold and its associated risks. Community members may not have additional clothing or household items such as heavier coats, boots, or blankets. Additionally, community members may not understand how to prepare for extreme cold such as leaving faucets dripping, properly maintaining space heaters, or bringing pets inside. Extreme cold events are often short lived in Texas as well; this has the potential to exacerbate risks, as community members may not want to invest in heavier coats or boots because they may think that the extreme cold will quickly dissipate. Some community members cannot afford to purchase heavier coats, boots, or other extreme cold essentials.

These assumptions and lack of understanding of how to prepare creates the potential for an increase in accidents and injuries, necessitating first responders to go out in to extreme cold and potential icy roads to respond to these events. Cold weather may also increase the likelihood of equipment malfunctions, such as fire hydrants frozen shut or frozen ladders and hoses; these malfunctions may all create the potential for further injury or accidents to community members or first responders.³⁴⁷

*Impacts:* In 2018, communities throughout Travis County saw temperatures below 28°F with icy roadways. These conditions led to several accidents throughout the area with one reported fatality. Major traffic delays were reported across the county. In addition to asking drivers to stay off the roads or slow down on roadways, TxDOT reminded drivers to slow down for crews on the road.³⁴⁸

2.6.22.2 Communications

*Risks:* Similar to extreme winter weather events, extreme cold may lead to power outages or brownouts due to the constant need for heat. Power outages impair residents’ ability to call for help if they are in danger. Also, first responders may be overwhelmed with calls that the electricity has gone out—having less capacity to address life threatening accidents or issues in the community.³⁴⁹ Since extreme cold is associated with extreme winter weather, there is the potential for icy road conditions or debris such as fallen tree limbs in the roadway. This may hinder first

³⁴⁷ Colleen Long and Carolyn Thompson, “For Firefighters, Bitter Weather Creates its Own Hazards,” *AP News*, January 7, 2018, [https://www.apnews.com/ad2994834d9046969e69336fe5b1c417](https://www.apnews.com/ad2994834d9046969e69336fe5b1c417)
responders from getting to community members in a timely fashion or may prevent them from reaching a community member.

**Impacts:** In 2018, over 20 counties in East Texas saw widespread power outages along with extreme cold, with over 20,000 reported outages. Harrison, Panola, Marion, Morris, Rusk, and Shelby Counties saw the majority of outages in East Texas during this event.

2.6.22.3 Food, Water, Sheltering

**Risks:** Sheltering or warming centers are an essential need during winter weather and extreme cold due to the potential for freezing temperatures and consequential power outages. Sudden power outages, particularly at night, may compound the confusion among community members thinking that they can stay in place, and suddenly realizing the need to find a shelter. Homeless individuals are particularly vulnerable to cold weather; however, homeless individuals may not know where temporary warming centers are located, or they may think that they can survive for one to two nights in the extreme cold.

**Impacts:** During the January 2018 winter storm in Houston, shelters saw an increase in those seeking shelter, with just one temporary shelter housing 180 individuals in a night; most of the individuals seeking shelter were homeless individuals, but a few were individuals whose furnace quit working.\(^{350}\) Two deaths were reported during the same cold weather event in Dallas in January 2018; the two individuals who died were homeless—one was found under an overpass and the other individual was found at a bus stop.\(^{351}\)

2.6.22.4 Transportation

**Risks:** While cold weather extremes in Texas are relatively rare and mild when compared to other portions of the country, there are a variety of transportation-related impacts that can be attributed to extremely cold temperatures. Extreme cold temperatures can present challenges which impact transportation operational systems, safety of transportation network users, airport closures and delays, equipment malfunctions, the potential for frozen fuel lines, and impacts to logistical schedules.\(^{352}\) Diesel and gasoline-powered engines may have to work harder and lead to more strains on the vehicles they are powering, as vehicle batteries can also become stressed. The fuel being used in vehicles can, if temperatures fall low enough, become a gel-like substance that can

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inhibit personal and commercial travel on roadways and rail lines. Extremely cold temperatures can also stress metal bridges and other hardened infrastructure on the transportation network.353

**Impacts:** In February 2011, during the events of Super Bowl XLV held at the AT&T Stadium in Arlington, freezing temperatures swept across the Dallas-Fort Worth metroplex. It was reported that 4 inches of ice and sleet fell in Arlington and, near the Dallas-Fort Worth International Airport in Grapevine, below-freezing temperatures stayed in the area for over 100 consecutive hours. At the airport, it was reported that flights were cancelled, numerous pipes froze, and ice sheets fell from overhangs and onto the airport’s monorail system.354

![Snow and ice covered AT&T Stadium in Arlington, February 2011.](image)

**Figure 2-59:** Snow and ice covered AT&T Stadium in Arlington, February 2011.355

### 2.6.22.5 Health and Medical

**Risks:** Extremely cold temperatures can pose a number of public health problems. Frostbite, hypothermia, heart problems, and other issues are common occurrences throughout times of low

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During cold spells, people also spend more time indoors and within close contact of other individuals, helping to spread illnesses such as colds, the flu, and respiratory illness.\textsuperscript{357} The use of generators, or other gasoline-powered tools, to supplement the heating of a home, business, or other structure needs to be closely monitored and ventilated properly during use as these machines produce carbon monoxide. Carbon monoxide deteriorates a person’s blood’s capability to deliver oxygen to body tissues and organs; it cannot be smelled or seen, so people often do not know that they are breathing in the gas in and fatal poisoning can happen within minutes.\textsuperscript{358}

**Impacts:** According to the University of Texas Health Science Center at Houston (UTHHealth) School of Public Health, across Texas’ 12 major metro areas from 1990 to 2011, cold temperatures were found to increase the risk of mortality by 5 percent per every 1-degree Celsius decrease of temperature in winter months. The highest percentage increase of mortality was seen in the Gulf Coast region, which saw risks increasing 3–8 percent dependent on the exact area.\textsuperscript{359}

2.6.22.6 **Hazardous Material (Management)**

**Risks:** During extreme cold events, the storage of chemicals and other hazardous material is sometimes an overlooked process. Within their storage containers, chemicals expand when they drop below their freezing point, which increases the probability that their container will rupture. If a container ruptures and leaks material, severe safety issues arise and the spill must be cleaned up correctly and quickly. Damage to the actual substance being held can also occur, as extreme cold can make chemicals more difficult to use.\textsuperscript{360} Proper storage of hazardous chemicals, especially during extreme cold events, can prevent individuals, the environment, and other functions from exposure to corrosive and other harmful contaminants.

**Impacts:** In January 2018, days of frigid temperatures swept across south and southeast Texas. As a result, oil refineries in Baytown and Corpus Christi were affected by the cold weather which led these locations to experience malfunctions, process abnormalities, and necessary flaring which can


\textsuperscript{358} “Carbon Monoxide and Generators,” Texas Department of State Health Services, May 20, 2015, https://www.dshs.state.tx.us/preparedness/factsheet_co2-generators.shtm


\textsuperscript{360} “Safe Chemical Storage in Cold or Freezing Weather,” Safety Storage Systems, accessed October 4, 2019, https://safetystoragesystems.co.uk/blog/chemical-storage-cold-weather/
signal unplanned operations interruptions.\textsuperscript{361} While no hazardous materials were released, there is a heightened risk of potential for these types of hazards during severe cold temperatures outbreaks.

2.6.22.7 Energy (Power & Fuel)

\textbf{Risks:} When temperatures reach extremely cold levels, the electric grid strains to keep up with the energy demands that are placed upon it. This strain is pushed further when aging electric infrastructure is being utilized. Severe cold temperatures can interfere with how certain mechanisms are able to operate, such as hydraulic lines, electromechanically support equipment, and sensors.\textsuperscript{362} Severe cold temperatures can disrupt oil refineries and other energy production operations throughout Texas as well. These locations, in Texas, are not as well equipped to handle cold snaps when compared to those located in colder parts of the country.

\textbf{Impacts:} During an extreme cold-snap throughout Texas in 2011, rolling blackouts were imposed for only the second time in the history of the state. The cold temperatures shut down 7,000 megawatts of power generators, about 8 percent of the installed capacity in Texas at the time. These blackouts impacted numerous homes and local businesses. Overall, it was reported that 1 million homes were left without power for up to an hour with local schools and businesses having to close as well.\textsuperscript{363}


2.6.23  EXTREME HEAT

Extreme Heat is a concern for all regions of Texas as this hazard is defined as a combination of very high temperatures and exceptional humid conditions. While Extreme Heat has not recently been directly attributed to a disaster declaration in Texas, Extreme Heat has led to Drought and Wildfire.\(^{364}\) The SHMP notes that Houston, Dallas, and Austin have all seen an increase in the annual number of days above 100°F since 1970. Texas currently averages more than 60 dangerous heat days a year; by 2050, the state is projected to see 115 such days a year, second only to Florida. In Texas, Extreme Heat leads to an average annual dollar loss of $39,276.\(^{365}\)

The SHMP notes that from 2018-2023, it is forecasted that extreme heat will account for $78,232 in property losses, $115,212 in crop losses, 105 fatalities, and 280 injuries.

2.6.24  FEMA’S COMMUNITY LIFELINES FOR EXTREME HEAT

2.6.24.1  Safety and Security

*Risks:* Extreme heat is also associated with drought and wildfire. Consequently, all of the risks associated with these hazard types are also associated with extreme heat. Extreme heat has the potential to exacerbate these risks as well. If first responders are trying to fight a wildfire during an extreme heat event there is the increased potential for heat stroke or other injuries.

Extreme heat itself poses risks to first responders. Community members who have been exposed to extreme heat may react by becoming more irritable or increase their consumption of alcoholic beverages to cool down, leading to dangerous confrontations with first responders.\(^{366,\ 367}\) Additionally, first responders themselves do not have the option of staying inside during heat events; they are constantly outside, often in dark and heavy uniforms and carrying heavy equipment outside during extreme heat, which can lead to dehydration, heat exhaustion, and heat stroke.\(^{214}\)

*Impacts:* On August 25, 2019, two firefighters were treated for heat exhaustion while addressing an apartment fire in Arlington; the heat index, at 105°F, and heavy equipment were both blamed


for their injuries.  

Similarly, in Houston on May 17, 2019 two firefighters were treated for heat exhaustion trying to contain an apartment fire. In Jefferson County, Texas on August 9, 2019 fire crews had to battle a storage shed fire in addition to a heat index of 105°F; this incident had no reported injuries largely because of the number of crew members, allowing for a team to go in while another team cooled off. First responders reportedly noted that if they did not have additional help that battling the fire would have been a “nightmare”.

2.6.24.2 Communications

Risks: Similar to extreme cold or winter weather events, extreme heat may lead to power outages or brownouts due to the need for constant air conditioning. Power outages can prevent individuals from calling emergency services for assistance. Also, first responders may be overwhelmed with calls that the electricity has gone out—having less capacity to address life-threatening accidents or issues in the community.

Impacts: A lack of communication and power have the potential to increase accidents, injuries, deaths, and financial loss for Texas communities.

2.6.24.3 Food, Water, Sheltering

Risks: Extreme heat is often associated with drought and wildfires. Consequently, the risk associated with these hazards have the potential to occur with extreme heat. Extreme heat, similar to drought, may have a significant impact on agriculture production throughout the state. In addition to the potential loss of crops, there is the potential for loss of productivity; farmers and all agricultural workers may have fewer hours in the day to work outside during extreme heat events and may have to work earlier in morning to avoid the heat.

373 Scott Waldman, “Precarious Life of Texas Farmworkers Becomes Riskier with Warming,” E&E News, Scientific American, April 23, 2018,
during extreme heat events with livestock producing lower quantities and quality milk. This may lead to significant economic loss for the state as well as lower the quantity and quality of food over time.

Along with the quality of agricultural products, water quality may be impacted as well. Increased temperatures lead to lower levels of dissolved oxygen in waterways harming fish and other aquatic animals that contribute to the health of local streams and water ways.

Similar to winter weather events and extreme cold events, sheltering in Texas is an essential need for extreme heat events; this is particularly true for homeless individuals, children, and people with chronic or mental illnesses, and pets.

**Impacts:** During the 2011 drought, the extreme heat in Texas “led to declines in crop conditions and abandonment of fields.” In 2011, wheat crop yields saw a 47 percent decline from previous years; sorghum saw a 60 percent decline in yields. Additionally, the Texas livestock industry saw a $3.23 billion loss. Water quality also was in jeopardy during the 2011 drought; along with less water generally, the high temperatures increased the pH levels in Texas waterways. On July 24, 2018, the city of Fort Worth opened an emergency shelter with 85 additional beds for the homeless to satisfy existing need.

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2.6.24.4 Transportation

**Risks:** Extreme high temperatures can buckle railroads and cause delays to the delivery and export of goods and services via these rail lines. Lines used for commercial and mass transit service may become unsafe for the transportation of people and other products due to heat related infrastructure failures. Other mass and public transit options may also become unsafe as high heat levels can lead to failures of air conditioning service on these buses and other modes of transit. As not all transit stops are covered and or protected from the heat, passengers waiting at bus and or rail stops risk a higher chance of being stricken by heat related illness as well. Extreme heat can also lead to airport runways and vehicular roadways to become susceptible to infrastructure deficits as the asphalt can deteriorate and lose its hardened texture. Further, operations and maintenance could be impacted as high temperatures lead to unsafe working conditions for construction crews and transportation related infrastructure becomes faulty due to extreme heat levels.

**Impacts:** Most roads throughout Texas have been paved with a Performance Grade (PG) pavement binder of 64-22. These grades are designed to withstand a 7-day period of a maximum ambient temperature of 108°F. TxDOT may, on occasion, pave their roads with PG 70-22 or PG-76-22 as well and notes that these pavement binder grades are designed to be sufficient over a 7-day period of maximum ambient temperatures of 119 and 130°F.

2.6.24.5 Health and Medical

**Risks:** The SHMP notes that heat-related deaths in Texas are projected to increase 1.1 percent per year. Heat stroke, heat exhaustion, heat cramps, and heat rash are just a few heat-related illnesses that are a direct cause of extreme heat and heat exposure in general. While heat-related health and medical issues can affect everybody, those who are elderly, very young, sick, and individuals who do not have access to air conditioning are the most severely impacted. The following table, courtesy of the National Oceanic and Atmospheric Administration (NOAA), presents the likelihood of heat disorders with prolonged exposure or strenuous activity.

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384 *Central Texas Extreme Weather and Climate Change Vulnerability Assessment of Regional Transportation Infrastructure,* Cambridge Systematics and ICF International, January 2015, [https://austintexas.gov/sites/default/files/files/CAMPO_Extreme_Weather_Vulnerability_Assessment_FINAL.pdf](https://austintexas.gov/sites/default/files/files/CAMPO_Extreme_Weather_Vulnerability_Assessment_FINAL.pdf)
387 “Heat Precautions,” Texas Department of State Health Services, accessed October 4, 2019, [https://www.dshs.state.tx.us/heat/](https://www.dshs.state.tx.us/heat/)
**Impacts:** The Texas Department of State Health Services notes that from 2003–2008, there were 263 deaths reported among Texas community members with exposure to excessive natural heat as the underlying cause of death. The SHMP also notes a heat event which occurred throughout the Dallas-Fort Worth Metroplex. This extreme heat event, during July 2011, lead to 27 heat-related deaths and many more heat-related illnesses. The warmest temperatures of the month occurred in these first 5 days with highs reaching 113 or 114°F.

**Figure 2-60: Heat and Humidity Danger**

<table>
<thead>
<tr>
<th>Temperature (°F)</th>
</tr>
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<tbody>
<tr>
<td>80</td>
</tr>
<tr>
<td>40</td>
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<tr>
<td>45</td>
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<td>50</td>
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<td>80</td>
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<td>85</td>
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<tr>
<td>90</td>
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<tr>
<td>95</td>
</tr>
<tr>
<td>100</td>
</tr>
</tbody>
</table>

**Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity**

- Caution
- Extreme Caution
- Danger
- Extreme Danger

### 2.6.24.6 Hazardous Material (Management)

**Risks:** Response personnel, especially those wearing chemical shielding clothing or hazmat related protective gear, are at risk of heat-related illness. These types of protective gear, due to their non-pervious material make-up, can lead to difficulty operating in extreme heat. High temperatures, like extreme cold, can also affect chemicals and chemical containment techniques. Because certain

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hazardous materials become unstable at varying temperatures, the risk of unsafe fumes or reactions happening also increase with an increase in temperatures. Standard ventilation measures may not be sufficient to handle a rise in temperature. Volatile chemicals, chemicals that evaporate easily, are viewed as the biggest safety risk when it comes to ambient temperature spikes.\textsuperscript{391}

\textit{Impacts:} On August 31, 2017, in the aftermath of Hurricane Harvey, the high for the day was in the high 80s throughout Southeast Texas and low 90s in isolated areas of the region.\textsuperscript{392} While these temperatures are not considered extreme in Texas during late August, these temperatures can be dangerous for volatile chemicals if their storage facility is not operating properly. On August 31, 2017, a tanker full of liquid organic peroxides burst into flames and exploded at the Arkema chemical plant in Crosby. Flooding from Hurricane Harvey had caused the cooling system, along with the backup generators, to fail. According to the Washington Post, “organic peroxide can be tailored to break up at 86 degrees Fahrenheit.”\textsuperscript{393} Once the chemical was in the process of breaking up and eventually decomposed, it reacted and lead to the explosion.

\textbf{Figure 2-61:}  Arkema chemical plant explosion in Crosby in 2017.\textsuperscript{394}


\textsuperscript{392} “William P. Hobby Airport, TX,” Airport Station for August 30, 2017, Weather Underground, \url{https://www.wunderground.com/history/daily/us/tx/houston/KHOU/date/2017-8-31}


2.6.24.7  Energy (Power & Fuel)

*Risks:* Much like during extreme cold weather events, extreme heat events strain the electric grid as it attempts to keep up with energy demands that are put on it. As people stay indoors to escape the heat, and their air conditioners work harder to maintain a comfortable temperature within the home, business, or other location, energy generation must keep up to meet the demand. In Texas, air conditioning systems are the largest user of energy in homes and businesses. During the summer months, up to 60 percent of a location’s total energy is going towards keeping up with air conditioning demands.\(^{395}\) Power outages and rolling blackouts can then, as a result of the excess energy usage, begin to occur throughout the state if energy consumption is not limited.

*Impacts:* During the week of August 12, 2019, high temperatures stressed Texas’ electrical grid to a point where rolling power outages almost occurred. The Electric Reliability Council of Texas (ERCOT), which delivers electricity to about 90 percent of the homes in Texas, said that “relentless triple-digit temperatures caused them to issue an Energy Emergency Alert for the first time in five and-a-half years.”\(^{396}\)

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2.6.25 ADDITIONAL NATURAL HAZARDS

The SHMP lists six additional natural hazards, separate from the weather-related hazard risks seen in earlier sections of this document. The additional natural hazards include the following:

- Coastal Erosion
- Inland Erosion
- Land Subsidence/Sinkhole
- Earthquakes
- Expansive Soils
- Dam/Levee Failure

Table 2-9: Additional Natural Hazard Definitions

<table>
<thead>
<tr>
<th>Additional Natural Hazard</th>
<th>SHMP Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coastal Erosion</td>
<td>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. Coastal erosion is linked to hurricane damage in that healthy coastal dunes and beaches help reduce impacts of hurricanes, tropical storms, and depressions and severe coastal flooding.</td>
</tr>
<tr>
<td>Inland Erosion</td>
<td>Inland erosion is the wearing-away of soil or removal of the banks of streams or rivers. It involves the breakdown, detachment, transport, and redistribution of soil particles by forces of water, wind, or gravity. Soil erosion on cropland is of particular interest because of its on-site impacts on soil quality and crop productivity, and its off-site impacts on water quantity and quality, air quality, and biological activity.</td>
</tr>
<tr>
<td>Land Subsidence/Sinkhole</td>
<td>Land Subsidence is the loss of surface elevation caused by subsurface movement of earth materials. The level of subsidence ranges from a broad lowering to collapse of land surface. An example of Land Subsidence is a sinkhole.</td>
</tr>
</tbody>
</table>
| Earthquakes                               | An earthquake is a sudden release of energy created by a movement along fault lines in the earth’s crust. Earthquakes produce three type of energy waves:  
  - Primary (P) waves have a push-pull type of vibration.  
  - Secondary (S) waves have a side-to-side type of vibration. |

Each of the six additional natural hazards pose their own specific risks and impacts to Texas, though not as severe as the weather-related hazard risks in the previous section of this document. Since the SHMP separates these additional hazards from those already presented, the additional hazards will not be presented through FEMA’s Community Lifelines format.

2.6.25.1 Coastal Erosion

At 367 miles, Texas has the 6th longest coastline in the United States. As described in the SHMP, coastal erosion can affect natural systems, coastal food supplies, Texas’ coastal tourism industry, and the viability of smaller towns up and down the Gulf of Mexico. The GLO manages coastal erosion by overseeing the expenditure of funds and documenting its progress to the state legislature in Coastal Erosion Planning and Response Act reports. Coastal erosion can affect the natural and built environment while specific impacts depend on topography, soils, building types, and construction material. Mitigation techniques include dune and beach restoration, building seawalls, and placing semi-permanent obstructions perpendicular to beaches. Coastal erosion mitigation actions have the benefit of helping reduce impacts from hurricanes and severe coastal flooding.

2.6.25.2 Inland Erosion

Similar to coastal erosion, inland erosion can affect the natural and built environment and is usually dependent on topography, soils, farming practices, engineering and construction types, and materials. Inland erosion can remove top soil, scour river banks, and collapse bridges and roads. Inland erosion can also result in the siltification (the pollution of water by particulate terrestrial clastic material, with a particle size dominated by silt or clay) of lakes and reservoirs, reducing their usefulness as flood control features and as sources of water supply. Mitigation efforts for inland erosion include improving farming methods and construction standards, installing groundwater recharge features, and channeling creeks.

2.6.25.3 Land Subsidence/Sinkhole

The majority of subsidence activity in Texas are caused by human activity, as presented in the SHMP. Mining and excessive groundwater removal from shallow aquifer systems can lead to land subsidence and sinkholes. Land that is located above shallow aquifer systems, or adjacent to areas of dissolved rocks, has a greater risk of experiencing subsidence. Sudden collapses of surface areas can damage and destroy homes, commercial buildings, and infrastructure, particularly roads and highways. Land subsidence can also increase coastal communities’ risk of inundation and saltwater intrusion from storm surge as regulating groundwater interaction is critical to mitigating this issue throughout the state.

2.6.25.4 Earthquakes

Texas’ earthquake risk is small in comparison to many other states, including California, Missouri, Montana, South Carolina, and Washington. The closest high hazard fault system to Texas is the New Madrid fault, which extends from Arkansas and Tennessee north through Missouri, Kentucky, and Illinois. El Paso and the Panhandle region are two areas of Texas that can expect earthquakes with magnitudes of about 5.5 - 6.0 to occur every 50 - 100 years. In south Central Texas the hazard is generally low, but small earthquakes can still occur. The largest earthquake to affect Texas occurred on May 3, 1887 and originated in Sonora, Mexico. The largest earthquake to originate in Texas, measuring at a magnitude 6, was on August 16, 1931 and caused severe structural damage in an around Valentine.399

2.6.25.5 Expansive Soils

Damages from expansive soils are most prevalent when periods of moderate to high precipitation are followed by drought and then again by periods of heavy rainfall. While all infrastructure is vulnerable to expansive soils, slab-on-grade structures are most likely to suffer damages. In addition, older structures built to less stringent building codes may be more susceptible to damages.

than new construction. Bridges, highways, streets and parking lots are especially vulnerable when they are constructed when clays are dry, such as during a drought, and then subsequent soaking rains swell the clay. However, there is little documentation of site-specific expansive soil past events from local, state, or national datasets. This makes it difficult to quantify damage on a statewide level, and the hazard poses no real threat to the public as there are no known injuries or fatalities.

2.6.25.6 Dam/Levee Failure

The SHMP notes that there are currently 7,310 dams and levees in Texas. This number includes federal dams, which are classified as high hazard, meaning if failure occurs it is likely there will be fatalities. This classification does not necessarily mean that these dams are in need of repair. The term high-hazard reflects the dam's potential for causing damage downstream should it fail, which is termed as dam inundation. In addition, there are 607 dams which are classified as significant hazard, meaning that there could possibly be loss of life if the dam should fail. Roughly 97 percent of Texas’ dams are made of earth, and most dams are privately owned and have low-hazard potential.
2.7 Hazards by County

2.7.1 Composite Disaster Index Overview

In order to gauge risks posed by various natural hazards to a state as geographically and climate diverse as Texas, the GLO partnered with the Center for Space Research (CSR) at UT Austin to conduct geospatial analyses of historical hazard damage across each of the state’s 254 counties. Analyzing 20 years of available data for seven natural hazard categories, CSR answered a basic question: for each respective county, what types of hazard damage, if any, have occurred and, reasonably, are likely to occur again? Through CSR’s analysis technique, hazard impacts were normalized and compared for the entire state at the county level; intensities of each hazard impact were mapped across the state and then weighted to produce a composite map that highlights the counties that are most frequently impacted by the most severe natural hazards over the past two decades. The data and maps generated through this effort are referred to as the Composite Disaster Index (CDI) and serve as one of the four factors used in the allocation methodology that determines the apportionment of funds in program competitions and regional allocations as applicable.

2.7.2 CDI Methodology

The CDI was developed using seven different representations of historical data selected to document the distribution of natural hazard damage across Texas’ 254 counties: 1) repetitive flood losses; 2) high winds from hurricanes; 3) wildfires; 4) major river flood crests; 5) tornado; 6) persistent drought conditions and; 7) hail. While accurate and well-structured data is available for many of these hazard indicators going back decades, the CDI uses data from the years 2001 to 2018, which are likely to be of the highest accuracy and best represents the climatic conditions facing Texas today.

To create the CDI, a uniform method was applied to represent the county-level data for each natural hazard category. For each hazard category (e.g., high winds from hurricanes, wildfires), the 25 counties that were impacted most frequently by that particular hazard were ranked in the top 10 percent, with the next 39 counties in the remainder of the top 25 percent. The following 127 counties fell in the midrange (25-75 percent) and experience an impact frequency that reflects the statewide average. The next 39 counties are occasionally affected and fall below the statewide average (bottom 25 percent), while the final 24 counties experience the least frequent impacts and form the bottom 10 percent. With this normalized ranking across the seven hazard categories complete, a composite index was created that combined the weighted impact of each hazard category for each county.
2.7.3 **HAZARD CATEGORIES**

The seven analyzed hazard types were chosen to represent the disaster profile of Texas due to the cumulative impact on the state’s population. These hazard types and their impacts are explained in greater detail below.

<table>
<thead>
<tr>
<th>Table 2-10: CDI Hazard Types</th>
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<tbody>
<tr>
<td><strong>Hazard Type</strong></td>
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<tr>
<td>Repetitive Loss (NFIP) from Flooding</td>
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<tr>
<td>Hurricane Winds</td>
</tr>
<tr>
<td>Wildfire</td>
</tr>
<tr>
<td>River Flood Crests</td>
</tr>
<tr>
<td>Tornado</td>
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<tr>
<td>Drought</td>
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<tr>
<td>Hail</td>
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</tbody>
</table>

2.7.3.1 *Repetitive Flood Losses*

Flooding from hurricane storm surge, tropical and non-tropical heavy rainfall events, and river floods following heavy rainfall in the upstream areas of river basins, cause the most destructive disasters in Texas. FEMA’s National Flood Insurance Program (NFIP) claims records of repetitive losses from floods available from 2000 to the current year provide excellent data to identify the counties most impacted by flooding. The distribution of counties in the top 10 percent shows the strong influence of coastal events, flash flooding downstream of the Texas Hill Country and urban flooding in the Dallas-Fort Worth region. River floods that follow the courses of the Colorado, Trinity, Red, Sabine and Rio Grande are also evident.
Hurricane Winds

The high wind speeds generated during the landfall of large tropical cyclones are second in their destructive impacts only to flood inundation. These impacts are assessed using geospatial data from the National Hurricane Center (NHC) that tracks hurricane wind speeds over given areas. Within the past two decades, the most severe wind damage in both the coastal region of Texas and adjacent interior counties occurred during the landfall of seven significant storms: Bret (1999), Claudette (2003), Rita (2005), Humberto (2007), Dolly (2008), Ike (2008) and Harvey (2017). By creating a composite of all of the wind field measurements contained in the NHC advisories issued for these seven storms, the areas most frequently impacted by hurricane-force and strong tropical storm-force winds can be identified. In the past 20 years, strong storms have had a greater impact along the upper Texas Gulf Coast and interior areas of East Texas, though the observed pattern could change with a shift of storm tracks toward south Texas.
Wildfires are prevalent in the more arid regions of the state, but may happen during harsh, prolonged drought periods in any region. Sensor observations from NASA satellites can detect and track the progress of wildfires as they burn. To create a geospatial representation of wildfire impacts in Texas, the thermal Radiative Fire Power (RFP) measurements from NASA’s Terra and Aqua MODIS instruments were collected from the NASA Fire Information for Resource Management System (FIRMS) database for the period from 2001 through 2018. A 600-megawatt RFP threshold was selected to isolate hot, active wildfires, and the number of thermal detections was normalized over areas of 100 square kilometers. The frequency of wildfires detected by satellite observations shows the expected pattern of counties in the top 10 percent occurring largely in western regions beyond the 100th meridian (from the eastern Panhandle continuing west). However, several outliers occur in other parts of the state. The outlier counties are strongly associated with wildfires that spread during the period of exceptional drought from 2011 to 2013 and include rangeland fires in Brooks County in south Texas; large forest fires in Marion and Cass Counties in Northeast Texas; and the Bastrop County Complex fire in Central Texas.
2.7.3.4 River Flood Crests

One way to measure the impact of river flooding takes into account the major river flood crests recorded at observation sites (typically automated river gauges) along river networks. National Weather Service data from their Hydrometeorological Automated Data System (HADS) sites includes historical crests dating back more than a century ago. The distribution of the top 10 percent of counties is comparable to that reflected in the repetitive flood loss map (but excludes the coastal impacts created by storm surge). Counties in this top 10 percent category include some rural locations with low populations that experience relatively high frequencies of major river flood crests.
Tornadoes are rare in many regions of the state but often cause catastrophic damage where they do strike. NOAA maintains several tornado databases of historical events, the most useful being the data set containing the chronology and track length records of tornadoes in the continental United States from 2001 to 2017, as represented in the well-structured DHS Homeland Infrastructure Foundation-Level Data (HIFLD). The tornado tracks crossing Texas were extracted from the HIFLD compilation, and the cumulative track lengths measured for each county. Next, the track length measurements were normalized by the surface areas of the counties. The county distribution of the normalized tornado tracks produces recognizable seasonal patterns of tornado impacts. Tornadoes in the spring and fall tend to occur during the turbulent passage of energetic low-pressure systems and cause more frequent strikes extending from Central Texas through Northeast Texas, as supercells form and train along the moving frontal boundary. During summer months, tornadoes tend to form along the highly energetic convergence zone of the subtropical jet over the Panhandle. The locations of counties indicated in the top 10 percent of tornado impacts mirrors aspects of the seasonal tornado climatology. It should be noted that many tornadoes form
along and near the coastline, particularly during tropical events; however, coastal tornadoes tend to be very weak and short-lived and thus do not generate long tracks.

**Figure 2-66: Tornadoes per Square Mile by County (2001-2017)**

_Drought_

Droughts often create the preconditions for wildfires and have additional impacts on stream flows, groundwater availability, reservoir storage, and agricultural production. A weekly comprehensive determination of drought conditions within counties is prepared nationally by groups of climate experts and presented in the products of the U.S. Drought Monitor (USDM) developed by the U.S. Department of Agriculture and NOAA. For the study, the USDM database compilations for county-level data were acquired from 2001 through 2018. Only areas of D3 (Extreme) and D4 (Exceptional) drought were used in the analysis, and the D4 designations were assigned twice the weight of areas having D3 conditions. The resulting map illustrates that western, more arid regions of the state are also more prone to extended drought. The locations of the top 10 percent of counties with drought impacts were also heavily influenced by the exceptional drought period that occurred from 2011 through 2013, a protracted dry spell that exceeded the “drought of record” experienced
in Texas during the 1950s. Regions most affected by this recent exceptional drought period include south Texas and counties on the Edwards Plateau; along the Rio Grande between Laredo and Del Rio; and in the Rolling Plains along the Red River.

**Figure 2-67: Drought: Weeks per Square Mile by County (2001-2018)**

2.7.3.7 **Hail**

Hailstorms are a frequent occurrence in Texas and affect all its regions. Hailstorms can cause massive damages to property, as an April 2016 storm did in Bexar County where hail peaking in size at 4.5 inches in diameter caused a record-breaking $1.6 billion in insurance losses ($560 million for automobile damage and $800 million for home damage).\(^{400}\) Texas hailstorm data indicates area hailstorms are most frequent in the north central and northwestern parts of the state, with a concentration in the Panhandle region.

Figure 2-68: Hailstorms per Square Mile by County (2001-2018)

Sources: County boundaries and land areas based on 2017 5-year American Community Survey. Hail data is from the National Weather Service (NWS).
2.7.4 **Composite Disaster Index Result**

The CDI combines the magnitude of these seven hazard categories across the county geographies of the state, producing a single representation of the composite disaster vulnerability of Texas counties. To accomplish this, the CDI assigns weighting factors linked to the degree of impact associated with different kinds of hazards. The weights for the seven hazard categories are presented in the table below. The weighting of these factors reflects the relative degree of impact these hazards have on property losses and human casualties. Flooding and hurricane winds have historically been the most lethal and damaging occurrences in the state, whereas the consequences of the other disaster impacts—while not trivial—are not as severe and long-lasting in most instances.

<table>
<thead>
<tr>
<th>Hazard Type</th>
<th>Weight Allocation</th>
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</thead>
<tbody>
<tr>
<td>Repetitive Loss (NFIP) from Flooding</td>
<td>35%</td>
</tr>
<tr>
<td>Hurricane Winds</td>
<td>25%</td>
</tr>
<tr>
<td>Wildfire</td>
<td>15%</td>
</tr>
<tr>
<td>River Flood Crests</td>
<td>10%</td>
</tr>
<tr>
<td>Tornado</td>
<td>10%</td>
</tr>
<tr>
<td>Drought</td>
<td>3%</td>
</tr>
<tr>
<td>Hail</td>
<td>2%</td>
</tr>
</tbody>
</table>

When mapped, the CDI illustrates the areas most vulnerable to natural hazards. As shown in the figure below, the Texas coast, particularly from Matagorda County east to the Beaumont-Port Arthur area, is at the greatest risk to impacts from natural hazards—primarily hurricane winds and flooding. Hardin County in Southeast Texas has the highest composite score of any Texas county. In addition, portions of Central, South Central, and South Texas are also highly vulnerable, as they are exposed to frequent flooding, tornadoes, and hurricane winds.
Figure 2-69: Composite Disaster Index (2001-2018)

Weight Allocations:
- Repetitive Loss from Flooding: 35%
- Hurricane Winds: 25%
- Wildfire: 15%
- River Flood Crests: 10%
- Tornadoes: 10%
- Drought: 3%
- Heat: 2%

Sources: 2017 5-year American Community Survey, National Flood Insurance Program (NFIP), National Weather Service (NWS), Hansen Site Data, National Hurricane Center (NHC), Homeland Infrastructure Foundation-Level Data (HFLD), MODIS Fire Detection from the Aqua & Terra Satellites, NOAA National Integrated Drought Information System (NIDIS).
2.8 Social Vulnerability Index

The Social Vulnerability Index (SoVI) measures the social vulnerability of counties across the United States — in particular, their vulnerability to environmental hazards. This index, developed by the University of South Carolina’s Hazards & Vulnerability Research Institute, synthesizes 29 socioeconomic variables which contribute to reduction in a community’s ability to prepare for, respond to, and recover from hazards. SoVI is a comparative metric that facilitates the examination of the differences in vulnerability among counties. It is a valuable tool because it graphically illustrates the geographic variation in social vulnerability, which in turn contributes greatly to response and recovery capabilities. SoVI shows where there is uneven capacity for disaster preparedness and response, and where resources might be used most effectively to reduce pre-existing vulnerability. The data sources for the development of SoVI come primarily from the United States Census Bureau. The SoVI data combines the best available data from both the 2010 U.S. Decennial Census and 5-year estimates from the American Community Survey (ACS). The below map demonstrates the SoVI for the 140 CDBG-MIT eligible counties in Texas.

The SoVI details above are further explained by some of the characteristics at the individual level that affect vulnerability. One of these characteristics is that of Socioeconomic Status which affects the ability of a community to absorb losses and be resilient to hazard impacts. This is due to the idea that wealth enables communities to absorb and recover from losses using insurance, social safety nets, and entitlement programs. Other factors used in SoVI relate to gender as well as race and ethnicity being that these factors impose language and cultural barriers and affect access to post-disaster funding. Additional factors used in SoVI are special-needs populations, social dependence (i.e. people who are totally dependent on social services for survival), education, family structure, occupation, and other demographic characteristics that help to define social vulnerability for communities and individuals.

Effectively addressing social vulnerability decreases both human suffering and the economic loss related to providing social services and public assistance after a disaster.
Figure 2-70: Social Vulnerability Index for CDBG-MIT Eligible Counties
2.9 Per Capita Market Value

While SoVI describes a community’s capacity to prepare for, respond to, and recover from hazards based on the socio-demographic composition of an area, another important consideration is a community’s financial capacity to fund disaster recovery and hazard mitigation activities. Financial capacity refers to the ability of a unit of local government to generate revenue to fund its operations and capital expenditures.

To analyze that capacity, the per capita market value—the market value of all property in a county divided by the county population—for all eligible counties was collected from the state comptroller’s office and used as a factor in the state allocation model, located in Appendix F.

In Texas, communities rely primarily on sales and property tax revenues to fund governmental activities. To compare the suitability of possible proxies for financial capacity in an allocation model, it is necessary to analyze the sources from which both sales and property taxes are generated: overall sales and the market value of property. Overall sales reflect local business conditions, particularly the number of businesses and the sales from those businesses. However, sales tax revenue can vary widely from year to year based upon factors outside of a jurisdiction’s control, including national and local economic conditions. This variability and its causes make sales tax revenue less desirable as a proxy for financial capacity. Market value of property, while also somewhat variable, is less so than sales tax and has the benefit of having a direct tie to the overall financial value of a community. That value is generated from the presence of government services and infrastructure, the business and job climate, local amenities, and the housing stock. In economic terms, those factors are less elastic, meaning they do not respond as quickly to changes in supply and demand, and thus serve as a superior metric for long-term financial capacity. Additionally, those factors encompass the perceived economic conditions of a community—the sole metric upon which sales and sales tax are based.

The map below shows the per capita market value for the 140 eligible counties.
Figure 2-71: Per Capita Market Value by County (2018 Valuations)
2.10 Review of State Reports, Studies, and Legislation

2.10.1 The Texas Coastal Resiliency Master Plan

The GLO released the *Texas Coastal Resiliency Master Plan* (Resiliency Plan) in 2017, with an updated iteration in 2019, to guide the GLO’s efforts in restoring, enhancing, and protecting the state’s coastal zone. The Resiliency Plan provides a framework to protect communities, infrastructure, and ecological assets from coastal hazards, including short-term direct impacts, as well as long-term gradual impacts. Through the Resiliency Plan, the GLO is working toward an adaptable planning process that accommodates changing coastal conditions, as well as evolving needs and preferences of Texas coastal communities.

*Figure 2-72: The Four Regions of the Texas Coastal Zone*
The Resiliency Plan pinpoints eight specific issues of concern that result from pressures exerted on the coastal environment from human activities and natural processes. The issues of concern addressed by the Resiliency Plan are:

- Coastal flood damage;
- Coastal storm surge damage;
- Gulf beach erosion and dune degradation;
- Bay shoreline erosion;
- Altered, degraded, or lost habitat;
- Impact on water quality and quantity;
- Impact on coastal resources; and
- Abandoned or derelict vessels, structures, and debris.

The Resiliency Plan identifies and proposes individual projects grouped into actions and strategies that produce measurable economic and ecological benefits to advance coastal resiliency. The Resiliency Plan calls for a balanced approach in managing coastal resources focused on community resiliency, ecological health, and economic growth by recommending projects ranging in type from nature-based (“green infrastructure”) to structural-based (“gray infrastructure”) to nonstructural-based projects, plans, policies, programs, and studies to employ a multiple lines of defense approach to coastal planning.

Figure 2-73: The Multiple Lines of Defense

The development of the Resiliency Plan has been a collaborative effort bringing together a wide range of planning considerations from a diverse set of coastal stakeholders. The projects recommended in the Resiliency Plan were vetted and prioritized through input from a Technical Advisory Committee comprised of researchers in many fields of coastal science; state and federal natural resource agency personnel; members of public, private, and non-governmental

401 Graphic courtesy of the U.S. Army Corps of Engineers.
organizations; local government representatives; and engineering and planning experts. After the application of an initial screening criteria, the Technical Advisory Committee evaluated all candidate projects based upon the level of benefit each project would provide to each issue of concern, the feasibility level of the project, and whether the project would be considered a priority given the current state of the coast. Projects offering co-benefits between hazard mitigation and ecological resiliency rank as those best suited for inclusion in the Resiliency Plan.

The GLO’s coastal master planning efforts began with a study released in 2012 titled *Shoring Up the Future for the Texas Gulf Coast*, which spotlighted the value and vulnerabilities of the state’s coastal areas. That planning endeavor has informed the continued and ongoing state coastal planning effort that has evolved into the Resiliency Plan and has since been used to coordinate work being done on the Texas coast with other state and federal projects. The U.S. Army Corps of Engineers (USACE), consulted the 2012 study during the early scoping phase of the *Coastal Texas Protection and Restoration Feasibility Study* and has continued coordination with the GLO through the completion of the 2019 Resiliency Plan. This collaborative approach has allowed for complementary elements between projects proposed in the GLO Resiliency Plan and the USACE study. Ongoing projects have been leveraged to inform the Resiliency Plan, such as the *Sabine Pass to Galveston Study*, a study also led by USACE in partnership with the GLO. The coastal storm risk management projects proposed through the *Sabine Pass to Galveston Study* are included in the prioritized projects in the Resiliency Plan. Another coastal planning effort that informed the Resiliency Plan is the GLO’s *Texas Coastal Infrastructure Study*, completed in 2016 to identify critical infrastructure assets that are most vulnerable to storm impacts. This study was accomplished through community outreach meetings with local officials to prioritize infrastructure needs in preparation for future storm events.

The GLO’s Coastal Resources division operates the state’s Coastal Erosion Planning and Response Act (CEPRA) program and the federal Coastal Management Program (CMP). These two programs offer funding opportunities to improve management of the state’s coastal zone. Supplemented with funding allocated to the State of Texas through the Gulf of Mexico Energy Security Act (GOMESA), the CEPRA and CMP programs have been utilizing the Resiliency Plan to prioritize funding to implement the projects that are best suited to improve Texas coastal resiliency. CMP, GOMESA, and CDBG-DR funds were also utilized to aid in the production of the Resiliency Plan. The Resiliency Plan has also been used to assist with informing the selection process for candidate projects to be implemented through the Texas portion of funding through the RESTORE Act – the funds available as a result of the settlement brought about after the Deepwater Horizon oil spill – by providing coastal stakeholder preferences gleaned from the Technical Advisory Committee to the RESTORE Council.
2.10.2 GOVERNOR’S COMMISSION TO REBUILD TEXAS

The destruction caused by Hurricane Harvey prompted a strong response from state lawmakers and political leaders. On September 7, 2017, Texas Governor Greg Abbott issued a proclamation creating the Governor’s Commission to Rebuild Texas (“the Commission”) to coordinate a statewide effort to help communities recover from Hurricane Harvey under the leadership of John Sharp, Chancellor of the Texas A&M University System (TAMUS). The Commission’s authorities and duties related to Hurricane Harvey recovery are broad, which put it in a unique position to influence disaster recovery reform efforts during Texas’ 86th Legislative Session.

The Commission’s report, ‘Eye of the Storm’ covered a wide range of disaster-related topics from debris removal to telecommunications. The report detailed a synopsis of the event and its impacts and a set of 44 policy recommendations for disaster response and recovery. The Commission’s report was significant as it detailed Governor Abbott’s disaster-related policy priorities, many of which were signed into law during the 86th Legislative Session, reforming disaster response and recovery in Texas. The report is organized around the following key topic areas:

i. Agency Coordination;
ii. Communication;
iii. Disaster Services;
iv. Planning;
v. Mitigation and Resilience;
vi. Technology and Data; and
vii. Training.

2.10.3 TEXAS AT RISK REPORT

The GLO released its after-action report, ‘Hurricane Harvey: Texas at Risk’, on August 25, 2018, one year after Hurricane Harvey made landfall. The report was inspired by the GLO’s experiences administering both the FEMA Direct Housing Mission and long-term CDBG disaster recovery programs in response to Hurricane Harvey and the lessons learned from it. The GLO was delegated the administration of the FEMA Direct Housing Mission, which aimed to place disaster survivors

in temporary housing. Direct Housing Missions are traditionally managed by FEMA. This mission was the first time FEMA partnered with a state agency to implement temporary housing.

The report focuses primarily on disaster housing and mitigation as a means of protecting lives and property from future disasters. The report includes 18 detailed policy recommendations for all levels of government, including but not limited to:

i. Improving building code standards;
ii. Expanding legal flexibility to leverage innovative housing solutions;
iii. Strengthening capacity building for local disaster recovery managers; and
iv. Encouraging data-sharing between governmental entities to better assist disaster survivors.

2.10.4 86TH TEXAS LEGISLATURE

Hurricane Harvey’s impact was geographically far-reaching and affected the districts of many state lawmakers, making disaster-related policy a high priority for many. Throughout the 86th legislative session, state lawmakers passed meaningful policy changes and made appropriations for disaster- and mitigation-related causes with potential impacts disaster recovery programs.

Following the release of the Eye of the Storm and Texas at Risk Reports, many state lawmakers filed bills based on the policy recommendations during the 86th Legislative Session. The Legislature took significant action to make disaster-related appropriations from various sources, primarily from the Economic Stabilization Fund (ESF or “Rainy Day Fund”). Steps were also taken to ensure increased cooperation between state governmental entities involved with disaster response, recovery, and mitigation.

The following bills related to those state-level recommendations were signed into law:

2.10.4.1 Business Advisory Council

- **SB 799**—Alvarado: Relating to the creation of a business advisory council to provide advice on economic recovery following a disaster.\(^{405}\)

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2.10.4.2 Flood Coordination and Planning

- **SB 7**—Creighton: Relating to flood planning, mitigation, and infrastructure projects.\(^{406}\)
- **SB 8**—Perry, et al: Relating to state and regional flood planning.\(^{407}\)

2.10.4.3 Disaster Recovery Institute for Training

- **SB 6**—Kolkhorst: Relating to emergency and disaster management, response, and recovery.\(^{408}\)

2.10.4.4 Capacity Strengthening Program for City and County Recovery Managers

- **HB 2305**—Morrison: Relating to a work group on enhancing the training and credentialing of emergency management personnel.\(^{409}\)

2.10.4.5 Flood Disclosures

- **SB 339**—Huffman: Relating to a seller's disclosure notice for residential property regarding floodplains, flood pools, or reservoirs.\(^{410}\)

2.10.4.6 Integration and Support of Public and Private Sector Philanthropic Programs

- **HB 3616**—Hunter: Relating to the establishment of a task force on faith-based programs that provide assistance during a disaster.\(^{411}\)

2.10.4.7 Disaster Programs Public Information Campaign

- **SB 285**—Miles: Relating to information and outreach regarding hurricane preparedness and mitigation.\(^{412}\)

2.10.4.8 *Indefinite Quantity Contracts*

- **SB 300**—Miles: Relating to indefinite quantity contracts for the provision of certain services to declared disaster areas following a natural disaster.\(^{413}\)

2.10.4.9 *Suspension of Regulatory Statutes After a Disaster*

- **HB 7**—Morrison: Relating to disaster preparation for state agencies and political subdivisions.\(^{414}\)

2.10.4.10 *Data Sharing/Disaster Case Management*

- **SB 6**—Kolkhorst: Relating to emergency and disaster management, response, and recovery.
- **HB 2330**—Wale: Relating to a study of an intake system and state case management system for state and federal disaster assistance.\(^{415}\)
- **HB 2340**— Dominguez: Relating to emergency and disaster management, response, and recovery.\(^{416}\)
- **HB 1307**—Hinojosa: Relating to the creation of a disaster case management system by the Texas Division of Emergency Management.\(^{417}\)

2.10.4.11 *Mandated Task Forces and Study Groups*

- **HB 5**—Phelan, et al: Relating to debris management and other disaster recovery efforts.\(^{418}\)
- **SB 289**—Miles: Relating to disaster recovery.\(^{419}\)


HB 6—Morrison, et al: Relating to disaster relief and recovery.\(^{420}\)

2.10.4.12 Disaster Committees

- **HB 5**—Phelan, et al: Relating to debris management and other disaster recovery efforts.
- **HB 6**—Morrison, et al: Relating to disaster relief and recovery.
- **HB 2325**—Metcalf, et al: Relating to information and communication of governmental and other entities regarding disasters and health and human services.\(^{421}\)
- **HB 2320**—Paul: Relating to services provided during and following a disaster.\(^{422}\)
- **SB 982**—Kolkhorst: Relating to the provision of disaster and emergency services, including health care services, to certain populations.\(^{423}\)
- **SB 984**—Kolkhorst: Relating to the suspension of certain local laws and property regulations by the governor during a declared state of disaster.\(^{424}\)

2.10.4.13 Reports, Plans, and Actions

- **HB 5**—Phelan, et al: Relating to debris management and other disaster recovery efforts.
- **HB 6**—Morrison, et al: Relating to disaster relief and recovery.
- **HB 2325**—Metcalf, et al: Relating to information and communication of governmental and other entities regarding disasters and health and human services.
- **SB 289**—Miles: Relating to disaster recovery.
- **HB 2320**—Paul: Relating to services provided during and following a disaster.
- **SB 982**—Kolkhorst: Relating to the provision of disaster and emergency services, including health care services, to certain populations.


- **SB 986**—Kolkhorst: Relating to contract management standards and information for contracts related to emergency management.  
- **SB 563**—Perry: Relating to the reporting of information about the use of federal money for flood research, planning, and mitigation projects.  
- **HB 2794**—Morrison, et al: Relating to the administration of emergency management in this state.

2.10.4.14 Senate Bill 7

With the passage of Senate Bill 7, the Texas Legislature established the Texas Infrastructure Resiliency Fund (TIRF). Almost $1.6 billion is appropriated from the ESF to establish the TIRF legislation.

The TIRF, which will be administered by the Texas Water Development Board (TWDB) and overseen by the Texas Infrastructure Resiliency Fund Advisory Committee (“advisory committee”). Additionally, four accounts will be established under TIRF:

- **Floodplain Management Account**;
- **Hurricane Harvey Account**;
- **Flood Plan Implementation Account**; and
- **Federal Matching Account**.

2.10.4.15 Floodplain Management Account

This account provides funds for the TWDB to finance its functions to “aid, advise, and coordinate the efforts” of political subdivisions’ participation in FEMA’s National Flood Insurance Program (NFIP). This account also provides the TWDB financing for “any other activities” related to collecting flood information, flood planning, protection and mitigation, and outreach.

2.10.4.16 Hurricane Harvey Account

This account provides funds for the TWDB to finance flood projects related to Hurricane Harvey by making grants or low-interest loans to political subdivisions to provide matching funds for federal program participation, cover state and federal regulatory costs, and develop a hazard mitigation plan.

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Additionally, the bill requires that the TWDB “establish a point system for prioritizing flood projects for which money from the Hurricane Harvey Account is sought,” giving higher priority to projects that will have a “substantial effect.” Those projects that will have a “substantial effect” include those that:

- Are recommended or approved by the director of TDEM or the successor in function to that entity; and
- Meet an emergency need in a county where the governor has declared a state of disaster.

The TWDB can approve an application for financial assistance from TIRF that meets its criteria after approval from its executive director with input from the director of TDEM or the successor in function to that entity. This fund is set to expire on September 1, 2031 with the remaining balance to be transferred to the Flood Plan Implementation Account.

2.10.4.17 Flood Plan Implementation Account

This account is set up very similarly to the Hurricane Harvey Account described above, but is more inclusive in its description of flood projects “that will have a substantial effect” to include those that:

- Are funded partially through federal matching funds;
- Include a component that will increase water supply; and
- Contain any other factor the board deems relevant to resiliency.

It is likely this bill sets up the Flood Plan Implementation Account and Hurricane Harvey Account separately to expand its scope to cover projects relating to Hurricane Harvey and those associated with future disasters. The TWDB may use this account only to provide financing for projects included in the State Flood Plan and money from this account may be awarded to several eligible political subdivisions for a single flood project.

2.10.4.18 Federal Matching Account

This account can only be used by the TWDB to meet matching requirements for projects that are funded partially by the U.S. federal government, including those funded by USACE.

2.10.4.19 The Advisory Committee

The TIRF and its accounts will be overseen by the advisory committee, which is comprised of the same seven members that sit on the State Water Implementation Fund for Texas (SWIFT) Advisory Committee and the director of TDEM or the successor in function to that entity. The committee is comprised of the Texas Comptroller of public accounts, three state senators appointed by the lieutenant governor and three state representatives appointed by the House speaker. The co-
presiding officers of SWIFT’s committee will be the co-presiding officers of the proposed advisory committee for TIRF, and the director of TDEM or the successor in function to that entity will serve as a non-voting member. The advisory committee’s primary responsibility is to oversee the operation, function, and structure of TIRF, with the authority to adopt rules, procedures and policies to guide its use by the TWDB.428

Senate Bill 7 also creates the Flood Infrastructure Fund (FIF) as a special fund in the state treasury outside the general revenue fund contingent on the approval of a constitutional amendment by voters in November 2019.

The bill would allow TWDB to use the fund only:

- To make a loan to a political subdivision at or below market interest rates for a flood project;
- To make a grant or low- or zero-interest loan to an eligible political subdivision for a flood project to serve an area outside a metropolitan statistical area or an economically distressed area;
- To make a loan at or below market interest rates for planning and design costs, permitting costs, and other costs associated with state or federal regulatory activities related to a flood project;
- To make a grant to a political subdivision to provide matching funds for participation in a federal program for a flood project;
- As a source of revenue or security for the principal and interest payment on bonds issued by TWDB for purposes of the fund, if the bond proceeds would be deposited in the fund; and
- To pay the expenses of TWDB in administering the fund.429

2.10.4.20 State Flood Plan

Senate Bill 8 calls for the creation of a State Flood Plan (the Plan) to be prepared by TWDB every 5 years. The bill requires TWDB to “designate flood planning regions to each river basin.” The flood planning groups in each region are tasked with creating a regional report that will be compiled in the State Flood Plan.

The designated state agencies, including the GLO, are required to appoint a representative to serve as an “ex officio” member of each flood planning group (each river basin) established by the bill. The primary responsibility of these groups is to use of flood-related information to identify problems and propose solutions for their respective regional report.430

The Plan (first due by 2024) will include a(n):

- Evaluation of the condition and adequacy of flood control infrastructure on a regional basis;
- Statewide, ranked list of ongoing and proposed flood control and mitigation projects and strategies necessary to protect against the loss of life and property from flooding and a discussion of how those projects and strategies might further water development, where applicable;
- Analysis of completed, ongoing, and proposed flood control projects included in previous state flood plans, including which projects received funding;
- Analysis of development in the 100-year floodplain areas as defined by FEMA; and
- Legislative recommendation the TWDB considers necessary to facilitate flood control planning and project construction.

2.10.4.21 Senate Bill 500

Senate Bill 500, a major supplemental appropriations bill, would appropriate almost $2.8 billion from the Economic Stabilization Fund (ESF) for disaster recovery, including an $793 million to the TWDB to complete flood projects not covered by FEMA’s flood mitigation funding should the November ballot provision pass.431

Funds appropriated under Senate Bill 500 will go to state agencies for Hurricane Harvey relief, Medicaid, state employee retirement, and other purposes. Approximately $2.8 billion of these funds will be appropriated from the ESF and dedicated to expenses related to Hurricane Harvey, including:

- $1.54 billion to the Texas Education Agency’s Foundation School Program and other costs related to Hurricane Harvey;
- $61.4 million to public higher education institutions for Hurricane Harvey-related expenses;

- $673 million to TDEM for matching funds for FEMA programs;
- $245.6 million to Health and Human Services Commission, Texas Department of Criminal Justice, and the Texas Department of Public Safety (DPS) to replace funds diverted from these agencies to disaster assistance related to Hurricane Harvey;
- $227.8 to the GLO for the removal of vessels and structural repairs, full-time employees to build short-term housing in the absence of federal grants, and state matching funds for studies and projects planned by USACE;
- $17 million to the Texas Parks and Wildlife Department for necessary structural repairs related to damage from Hurricane Harvey; and
- $8.9 million to the Texas Workforce Commission for hurricane-related expenses.\(^{432}\)

2.10.4.22 *Senate Bill 289*

Senate Bill 289 created a local housing recovery plan framework to help local jurisdictions be more prepared for permanent housing construction and reconstruction following a disaster. The bill encourages, but does not require, that local jurisdictions develop housing recovery plans and submit them to the Hazard Reduction and Recovery Center at Texas A&M University (the Center) for certification. Once certified by the Center, the GLO is required to review the plan and consult with the Center and relevant local jurisdiction to ensure it meets the criteria established in the bill and either accept or deny the plan.\(^{433}\) In effect, the bill codifies increased coordination between local jurisdictions, TAMUS, and the GLO to help communities better prepare for housing recovery.


2.10.5 **State Studies**

Over the last several years, the state of Texas has been conducting a variety of efforts to plan for flooding and mitigate from future disasters. As noted above and below, the state has begun to take larger strides to work toward mitigation. Below is a brief summary of planning efforts not only at the GLO, but in other agencies across the state.

2.10.5.1 *Texas Water Development Board’s State Flood Assessment and State Flood Plan*

As stated through this Action Plan, in January 2019, the Texas Water Development Board (TWDB) published its *State Flood Assessment* for the state legislature. The report provides an initial assessment of flood risks, an overview of roles and responsibilities, an estimate of flood mitigation costs, and a synopsis of stakeholder views on the future of flood planning, mitigation, warning, and recovery. Additionally, the upcoming 2024 TWDB State Flood Plan (the Plan) will be based on regional flood plans developed by local stakeholders. It will focus on evaluating existing flood infrastructure and will include a statewide-ranked list of ongoing and proposed flood control and mitigation projects and strategies. The Plan will also include an analysis of development in the 100-year floodplain as defined by FEMA. In addition, the Plan will recommend legislative policy changes needed to facilitate planning and project implementation. Furthermore, a large part of the planning effort will include developing models and other technical tools that will assist local decisionmakers in evaluating potential solutions to flood issues.

2.10.5.2 *GLO Flood Studies within Combined River Basins*

From the $5.676 billion CDBG-DR funds awarded to the state of Texas after Hurricane Harvey, approximately $137 million was allocated toward funding planning studies, to help communities make informed decisions through the long-term recovery process and better prepare for future disasters. An unprecedented decision was made to retain this funding at the GLO and utilize it for regional studies. Previously, the majority of planning studies completed using allocated CDBG-DR funding were completed at the local level; however, the results of the studies were often counter-productive, as effort was not made to incorporate surrounding communities, thus sometimes alleviating one issue only to cause additional problems outside the study area.

During the first half of 2018, the GLO Community Development and Revitalization Research and Development team developed a list of planning study needs through public outreach efforts directed toward the 49 counties that received a presidential disaster declaration resulting from Hurricane Harvey. Outreach consisted of attending public meetings, accepting study topics through the general CDR email, and an online survey for elected officials representing the affected communities. The close of the survey in September 2018 formally concluded public outreach, at which time all responses were sorted, reviewed, and responded to. After vetting responses, the primary identified study need was flood control.
In consultation with the Center for Space Research at UT Austin, as after reviewing TWDB’s *State Flood Assessment*, the GLO determined that regionalization of the planning studies should be based on Texas’ major river basins (see the map below). To limit the total number of regional studies, river basins located within the Impacted Areas were combined, creating a total of three regional flood studies (see below map). Each regional study will take a holistic approach by looking at the entirety of the combined river basins (from their origin in North Texas to their output in the Gulf of Mexico). The reasoning behind this approach is that flood events and development upstream of the Impacted Areas often have a direct impact and contribution to flooding downstream. Multiple one-on-one and group meetings were conducted with state and federal agencies identified as stakeholders to discuss and refine the project scope. Identified stakeholders include but are not limited to: Texas A&M AgriLife Extension (AgriLife), Federal Emergency Management Agency (FEMA), GLO-Coastal, National Oceanic and Atmospheric Administration (NOAA), National Weather Service (NWS), Texas Department of Emergency Management (TDEM), Texas Natural Resources Information System (TNRIS), TWDB, Texas Department of Transportation (TxDOT), United States Army Corps of Engineers (USACE), and United States Geological Survey (USGS). Efforts are ongoing to continue coordination with the current stakeholders, as well as identify additional stakeholders. Local outreach is included in the scope of the project and will be handled separately for each region through the COGs and River Authorities.
Conducted in partnership with the GLO, the Coastal Texas Protection and Restoration and Feasibility Study is a long-term comprehensive coastal planning effort focused on coastal storm risk management and ecosystem restoration. As of late 2018, USACE has narrowed its list of viable projects to several storm risk management scenarios that provide a barrier system for the Houston-Galveston and Galveston Bay region, plus a suite of shoreline protection and habitat restoration projects along the Texas coast. Additionally, USACE will study the Buffalo Bayou and its tributaries, as well as the Houston Regional Watershed Assessment to determine solutions for local flood issues. Other USACE studies will consider resiliency solutions for the Brazos River in Fort Bend County and for the Guadalupe and San Antonio river basins.
2.10.6 ADDITIONAL HURRICANE HARVEY STUDIES

In addition to the proposed regional flood studies, four other planning studies that utilize Hurricane Harvey funding (excluding the previously mentioned studies that use a combination of funding from Hurricanes Ike and Harvey, and 2016 Flood) are either ongoing or soon to begin. The following is a list and brief summary of each study.

2.10.6.1 Hurricane Harvey Housing Impacts: 49 County Survey Top-line Findings

In June 2018 the Bureau of Business Research (BBR), an organized research unit of the IC2 Institute at The University of Texas at Austin, was asked by the GLO to prepare and administer a survey of unmet housing needs among community members and victims of the 49 Texas counties affected by Hurricane Harvey. The results of the survey, which was concluded in July 2018, helped the GLO determine the most appropriate type of housing assistance and method of communication with community members as it disburses CDBG-DR funds in impacted counties.

2.10.6.2 Disaster Recovery and Mitigation Data Management Plan

In June 2019, the University of Texas at Austin (UT) was selected to help the GLO design and deliver a database capable of housing and securing the state’s disaster data needs. UT will assist the GLO to establish the necessary framework and processes to collect, organize, process, analyze, and distribute disaster data for the state of Texas. The disaster database is a critical tool that will assist communities in the development of better disaster response, recovery and mitigation plans. Through the GLO’s planning efforts, Texas A&M University Systems was identified as the ideal long-term partner to house the disaster database.
2.10.6.3 Economic Development Strategy and Diversification Study

The purpose of this study, which should begin Fall 2019, is to develop strategies to expand the economy of coastal counties impacted by Hurricane Harvey beyond tourism to make them more resilient to future impacts while recovering. The need for the project is that Hurricane Harvey had a devastating effect on the primary economic source of revenue, tourism, for multiple counties along the Texas coastline. The study will specifically address deficiencies in the workforce and lost businesses by pairing small towns in the following counties: Aransas, Bee, Calhoun, Goliad, Jim Wells, Nueces, Refugio, San Patricio, and Victoria.

2.10.6.4 Disaster Recovery Alternative Housing Study

This study, beginning Fall 2019, will analyze and evaluate alternative housing options to determine if innovative solutions exist for accommodating disaster survivors, including those with low to moderate incomes, that are cost-effective, prudent, secure, and allow for faster construction. The study, as currently proposed, consists of two phases. In the first phase, Research and Development, the selected Provider will gather, analyze, and evaluate data relating to the resiliency of alternative housing options during extreme weather events to identify innovative solutions for sheltering disaster survivors that are cost-effective, safe, secure, and allow for expedited construction. Phase 2 will build upon the results of Phase 1 and involves the development of prototypes for several agreed-upon solutions and testing for feasibility of the prototypes during extreme weather events.
2.10.7 OTHER GLO STUDIES AND INITIATIVES

Prior to Hurricane Harvey, planning studies were included in the Infrastructure program and were locally run, with a few exceptions. Utilizing a portion of the funds allotted for planning studies from the Hurricane Ike award, multiple studies are ongoing or recently completed. The following is a summary of the studies.

2.10.7.1 Disaster Impact Visualization Study

Through a partnership with The University of Texas’ Center for Space Research, the GLO is utilizing planning study funds from Hurricanes Ike and Harvey, as well as 2016 Floods, to continue to build real-time visualizations of critical disaster data, including the Public MOVES Viewer, displaying historical satellite imagery from Hurricane Harvey and other events, giving communities the ability to observe events and make more informed planning decisions.434

2.10.7.2 Gulf Coast Community Protection and Recovery District (GCCPRD)

In 2013, GLO entered into an agreement with the GCCPRD to develop a storm surge suppression study in accordance with USACE standards. The study area consisted of the coastal areas around Brazoria, Chambers, Galveston, Harris, Jefferson, and Orange counties that could be impacted by future storm events. The study, which investigated options for reducing the vulnerability of the upper Texas coast to hurricane surge and flood damages, was completed in December 2018.435

434 MOVES (Modeling, Observation and Visualization for Emergency Support), Center for Space Research, University of Texas at Austin, accessed October 4, 2019, http://magic.csr.utexas.edu/public/views/
435 Gulf Coast Community Protection and Recovery District (GCCPRD), accessed October 4, 2019, https://gccprd.com
2.10.7.3 Evaluating the Effects of a Coastal Spine: National-Level Economic Ripple Effects of Storm Surge Events

In September 2017, the GLO utilized remaining Hurricane Ike funds to commission a study comprehensively assessing a coastal storm suppression system (aka coastal spine) proposed as a mitigation strategy. The report presents the results of a nation-wide economic study of storm surge impacts on the three counties along the Galveston Bay (Galveston, Harris, and Chambers) and explores how direct impacts on a specific sector(s) in bay communities affect the economy of TX as well as economies of other states and the nation as a whole in the long term, while capturing general equilibrium and multiplier effects. The project was completed in May 2019.436

2.10.7.4 Regional Drainage Data Collection and Oversight

Through a competitive bid process, the University of Texas-San Antonio (UTSA) was awarded a contract in April 2019 to gather and organize data focusing on regional oversight and the coordination of the drainage infrastructure in Hardin, Jasper, Jefferson, Newton, Orange, Tyler, Polk, Liberty, and Chambers Counties. They will perform community outreach activities, collect and analyze existing data, and inform local communities and community leaders, on behalf of the GLO, of recommended actions to take based on the data analysis. The study is expected to be completed by December 2019.

2.10.8 Federal, State, and Local Coordination & Mitigation Alignment

The GLO has been working with a variety of federal, state, and local partners. Given the geography of the 140-county area in Texas with its urban/rural diversity, the GLO worked to address needs and communications through a variety of channels. From an online mitigation survey to teleconference calls with councils of governments and multiple presentations across the state, the GLO has worked diligently to conduct regional and localized coordination and has aligned CDBG-MIT programs to complement and enhance the state’s mitigation efforts. Below is a summary of efforts taken with the GLO’s variety federal, state, and local partners.

2.10.8.1 Federal Coordination

Federal Emergency Management Agency

The GLO began working with the Federal Emergency Management Agency (FEMA) almost immediately following Hurricane Harvey in 2017. The GLO has had a solid presence at the Texas Recovery Office (TRO) previously the Joint Field Office. The GLO is in charge of the short-term housing mission for the state in partnership with FEMA.

The GLO has regular mitigation meetings at the TRO with FEMA, TDEM, and the TWDB to go over the status of projects and other mitigation efforts.

The Hazard Mitigation Branch and their Floodplain Management & Insurance section in particular assisted communities with damage assessment and conducted substantial damage assessments. This mitigation branch conducts NFIP information campaigns, community education and outreach, assists communities in identifying and developing opportunities for mitigation, and assisted TDEM in reviewing local mitigation plans to ensure jurisdictions were eligible for Harvey HMGP funding.

U.S. Environmental Protection Agency

Through the U.S. Environmental Protection Agency (EPA) and its Urban Waters Federal Partnership, the GLO has played a role in their workshops to deliver important information to local communities looking to mitigate from future disasters. The Urban Waters Federal Partnership connects communities, particularly those that are overburdened or economically distressed, with their area stakeholders by improving coordination among federal agencies and collaborating with community-led revitalization efforts to improve the Nation's water systems and promote economic, environmental and social benefits. The EPA partnership works to break down federal program silos to promote more efficient and effective use of federal resources through better coordination and targeting of federal investments; recognize and build on local efforts and leadership, by engaging and serving community partners. Over the last year, the GLO has attended and presented at approximately 5 EPA workshops across Texas.
U.S. Economic Development Administration

The GLO has been working with the U.S. Economic Development Administration (EDA) and has provided regular CDBG-MIT updates on its monthly Disaster Recovery Manager (DRM) calls. These DRM positions have been put in place through grant funds from the EDA to assist in the recovery following Hurricane Harvey. The DRMs are staff hired and managed by regional Councils of Governments and assist in long term disaster recovery efforts and mitigation. Additionally, the GLO participated in a regional EDA workshop to highlight the upcoming CDBG-MIT funds and inform local officials of the state’s mitigation efforts.

2.10.8.2 State Coordination

State Hazard Mitigation Team

When planning for state mitigation there is importance to involve a cross-section of stakeholders, particularly in the development of the State of Texas Hazard Mitigation Plan (SHMP). This includes the State Hazard Mitigation Team (SHMT), composed of representatives from state agencies, local and regional representatives, and non-governmental organizations with an interest in hazard mitigation. SHMT members provide program and funding information; identity mitigation strategies and opportunities, as well as actions taken since the previous State Hazard Mitigation Plan was approved; contribute subject matter expertise on hazard assessments; and comment on draft versions of the SHMP. Additionally, the SHMT covers both mitigation projects and funds across the state, as well as mitigation data and hazard information.

The SHMP requires regular review and evaluation and facilitation is coordinated through the Texas Division of Emergency Management with the SHMT to ensure proper implementation and to ensure that objectives are met and information regarding accomplishments and new initiatives are captured consistently. The GLO has three representatives (one from the Coastal division and two from the Community Development and Revitalization division) on the SHMT.

Texas Division of Emergency Management

The GLO has been working with the Texas Division of Emergency Management (TDEM) since late 2018 regarding mitigation on a consistent basis; in particular, with the State Hazard Mitigation Officer (SHMO) and the Hazard Mitigation Unit (the Mitigation Unit). The SHMO and the Mitigation Unit are in charge of a variety of efforts across the state. They are the state entity currently responsible for authoring and updating the SHMP. TDEM’s Preparedness Unit develops the state’s Emergency Management Plan.437

438 Ibid.
The Mitigation Unit focuses on reducing future disaster losses in Texas through the implementation of a variety of risk-reduction strategies. The group provides expertise and technical assistance in mitigation planning and in community administration of FEMA Hazard Mitigation Grant Program (HMGP) funds. This unit includes a headquarters element staffed by planners and mitigation grant coordinators responsible for the statewide implementation of the program. This unit also depends on regional mitigation grant coordinators which report to the regional TDEM assistant chiefs. These field staff work directly with local jurisdictions and sub-applicants to develop hazard mitigation projects and to assist sub-applicants in developing and managing mitigation grant applications as well as their Local Hazard Mitigation Action Plans (LHMAPs) that are developed and submitted to FEMA on a rolling basis (see figure below).\textsuperscript{439}

\textsuperscript{439} Ibid.
The Mitigation Unit provides the strategic vision, expressed in the SHMP, for efforts to reduce the long-term risk to Texas communities from all hazards. The SHMP is informed by LHMAPs and SHMT research while providing strategic guidance and statewide hazard risk assessments on hazard mitigation activities to state agencies and local governments.

TDEM’s Preparedness Unit mission in developing the Emergency Management Plan (EMP) is to support and enhance the state’s preparedness by developing and managing a comprehensive, all-hazards emergency operations plan that clarifies roles and helps coordinate resources before, during, and after an incident of state significance. The EMP consists of a Basic Plan, functional...
annexes in a variety of support functions, hazard annexes, and other support documents. Additionally, TDEM administers FEMA’s Pre-Disaster Mitigation (PDM) program, which will be changing over to the Building Resilient Infrastructure and Communities (BRIC) program in 2020, as well as the FEMA Public Assistance (PA) program and Hazard Mitigation Grant Program (HMGP).

To appropriately align with strategic mitigation efforts across the state, the GLO met with the Mitigation Unit starting in 2018 specifically to address the CDBG-MIT funding stream that Texas would be receiving. During these initial meetings, the GLO and the Mitigation Unit discussed the respective roles, responsibilities, and programs that each engages with. The Mitigation Unit is in charge of providing technical assistance for and reviewing Local Hazard Mitigation Action Plans, as well as authoring and updating the State of Texas Hazard Mitigation Plan. The SHMO and the Mitigation Unit meet regularly alongside FEMA and the TWDB with the GLO to inform them of project status as it relates to respective programs and the CDBG-DR programs and projects.

The Mitigation Unit is currently working to develop an enhanced SHMP. As detailed in the Use of Funds section of this Action Plan, the GLO will be partnering with TDEM to provide assistance in the development of the enhanced SHMP. The benefit of an enhanced plan vs. a standard one is an increase in the HMGP fund amount from 15 percent of a state’s total FEMA disaster grant award to 20 percent of the total disaster grant award.440

Additionally, this CDBG-MIT funding will help finance local community efforts to build out their LHMAPs. The GLO will also be working with TDEM on the identification of projects for funding under the HMGP Supplemental program.

**Texas Water Development Board**

Created in 1957, the mission of the Texas Water Development Board (TWDB) is to provide leadership, information, education, and support for planning, financial assistance, and outreach for the conservation and responsible development of water in Texas. Its mission is a vital part of Texas’ overall vision and the state’s mission and goals that relate to maintaining the viability of the state’s natural resources, health, and economic development.

To accomplish these goals, the TWDB provides water planning, data collection and dissemination, financial assistance, and technical assistance services. Currently the TWDB supports the development of regional water plans; provides loans to local governments for water supply projects including flood control projects; provides grants and loans for the water and wastewater needs of

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440 The HMGP fund amount available to a state, tribe, or territory is always a percentage of the total of FEMA’s disaster grant assistance provided to a state following a Presidential disaster declaration. See FEMA’s HMGP FAQ section, “How Much Money Is Available in the Hazard Mitigation Grant Program?” [https://www.fema.gov/hmgp-faqs](https://www.fema.gov/hmgp-faqs)
the state’s economically distressed areas; provides agricultural water conservation and water-related research and planning grants; maintains a centralized data repository of information on the state’s natural resources called the Texas Natural Resources Information System\textsuperscript{441} (TNRIS); and manages the Strategic Mapping\textsuperscript{442} (StratMap) initiative, among other statewide efforts. A full-time, three-member board appointed by the governor considers loan applications from eligible applicants, awards grants for water-related research and planning, and conducts other TWDB business such as approving the state water plan.

Using funding allocated by the 85th legislature, the TWDB developed the State Flood Assessment.\textsuperscript{443} This report provides an initial assessment of Texas’ flood risk, an overview of roles and responsibilities, an estimate of flood mitigation costs, and a synopsis of stakeholder views on the future of flood planning in the state. However, it does not seek to fund specific strategies or projects related to flood planning, mitigation, warning, or recovery. Preliminary findings summarized in the assessment are derived from stakeholder input and are organized according to three key pillars of comprehensive flood risk management: (1) mapping, (2) planning, and (3) mitigation.

Since 2007, the TWDB has been the designated state agency tasked with coordinating the National Flood Insurance Program (NFIP) within Texas. In this capacity the TWDB acts as the liaison between the federal component of the program and local communities, with the primary duty to provide guidance, outreach and education to the communities to assist in meeting the federal eligibility requirements for entrance into the NFIP and also assist the communities with maintaining their participating status.

The TWDB administers the Flood Protection Grant Program, which provides up to 50 percent state financial assistance to political subdivisions to: (1) conduct feasibility studies for an entire watershed to evaluate both structural and nonstructural solutions to flood hazards within the watershed; (2) engage in planning for or implementation of Flood Early Warning System(s); or (3) engage in planning for or implementing a Flood Response Plan. Additionally, the TWDB administers Flood Mitigation Assistance grants through the FEMA program that provides communities with up to 100 percent federal funds for 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.

As detailed in this Action Plan, Senate Bill 8 calls for the creation of watershed-based Regional Flood Plans by January 2023 and the first State Flood Plan by September 2024. The state plan will

\textsuperscript{441} Texas Natural Resources Information System (TNRIS), Texas Water Development Board, \url{https://tnris.org/}
\textsuperscript{442} Texas Strategic Mapping (StratMap), TNRIS, Texas Water Development Board, \url{https://tnris.org/stratmap/}
be prepared by TWDB every 5 years in consultation with Regional Flood Planning Groups as well as TDEM, TCEQ, the State Soil and Water Conservation Board, the Texas Department of Agriculture, Texas Department of Parks and Wildlife, and the GLO. A related bill, Senate Bill 7, created two new funds to be administered by the TWDB: The Flood Infrastructure Fund (FIF) and the Texas Infrastructure Resiliency Fund (TIRF).

The GLO is continually working to align flood mitigation efforts to be appropriately in step with the upcoming state flood planning process.

**Texas A&M University System**

The Texas A&M University System (TAMUS) has become a valuable partner during the development of the state’s long-term recovery and mitigation efforts. This system is one of the largest higher education institutions in the nation with a budget over $6.3 billion and 11 universities and multiple state agencies. Currently, the GLO is partnering with the Texas A&M Forest Service, the Texas A&M AgriLife Extension, and other extension services.

A major partner over this period has been through the AgriLife Extension and their Texas Community Watershed Partners. The Texas Community Watershed Partners (TCWP) provides education and outreach to local governments and citizens on the impacts of land use on risk reduction, watershed health and water quality. The TCWP operates on the Land Grant model of integrated university research, education, and extension. They engage the resources of Texas A&M University, and other universities in Texas and across the country, to put the tools of sustainability and resilience into the hands of Texas’ citizens. They further engage the research platforms of these universities to help solve critical issues. Additionally, the AgriLife Extension service has representatives in all 254 counties in Texas, providing the potential for direct localized outreach through these representatives.

The TCWP has worked to develop the Community Health and Resource Management (CHARM) mapping application which is an ArcGIS geographic information system (GIS) tool that utilizes CommunityViz software. This application gives local officials, stakeholders, and citizens the power to map and analyze current risks and growth with real-time feedback. When used with additional hardware, CHARM forms a powerful and interactive planning tool for engaging the public and gathering their values about the community’s future. The mapping application is supported with a library of mapping data about urbanization, natural hazards, critical facilities, and natural resources. The CHARM application can leverage local community knowledge for better long-term planning, and is an ideal tool for communities, local agencies, and project teams. It is during CHARM workshops that this hardware and application come together to inform local communities and decision makers in identifying planning impacts and risk reduction opportunities and strategies.
Through the exploration of the state’s mitigation efforts, the TCWP and their CHARM service was identified as potential partners. The GLO engaged TCWP and have now established a solid relationship where collaboration and coordination help align, not only statewide mitigation objectives, but hyper-localized mitigation planning and disaster preparation. The GLO looks forward to further partnership with TCWP and has begun the integration of their tools to reach the variety of CDBG-MIT eligible counties across the state.

In addition to the TCWP, TAMU has a variety of other institutes, programs and research that align with the GLO’s mission. These include:

- **Hazard Reduction and Recovery Center (HRRC):** HRRC is an interdisciplinary institute of architects, planners, sociologists, policy analysts, economists, landscape architects, and engineers; these researchers focus on hazard analysis, emergency preparedness and response, disaster recovery, and hazard mitigation. HRRC aims to increase the understanding of the impacts that hazards have on humans and the environment through their research.

- **Texas Target Communities:** This service-learning program provides planning services to Texas communities including technical assistance, training, and public engagement workshops. Faculty and students partner together to provide these services with the aim to create sustainable communities across Texas.

- **The Institute for Sustainable Communities:** Similar to the HRRC, the Institute for Sustainable Communities aims to produce transformative research that offers solutions for more sustainable and vibrant communities. They helped author *Beyond the Basics: Best Practices in Local Mitigation Planning*, which provides advice to local communities on how to write effective Hazard Mitigation Plans.

- **Community Resilience Collaborative:** This collaborative is between the Texas Sea Grant College Program and Texas Target Communities. The Collaborative provides small grants for resiliency research and provides technical assistance for planning, outreach, and education aimed at coastal communities, particularly resource managers, land use planners, and emergency managers who deal with hazard mitigation.

TAMU represents just one of the varieties of current and potential partnerships the GLO hopes to strengthen or form with higher education institutions throughout Texas.

**Texas Water Infrastructure Coordination Committee**

The Texas Water Infrastructure Coordination Committee (TWICC) provides information on funding eligibility or technical assistance to water systems facing infrastructure or compliance issue and has taken a stronger role in helping communities across the state access both disaster recovery and mitigation funding. TWICC is a collaborative effort by state and federal government
agencies and technical assistance providers promoting an efficient process for affordable, sustainable, and innovative funding strategies for water and wastewater infrastructure projects that protect public health and safety. The GLO has been attending regular TWICC meetings to provide insight and updates on the upcoming CDBG-MIT funding stream and to keep members apprised of disaster recovery and mitigation programs.

2.10.8.3 Local Coordination

Councils of Governments

The state of Texas has a total of 24 councils of governments (COGs), regional councils or commissions that are comprised of a variety of all 254 counties, cities and special districts. COGs are political subdivisions of the state under Chapter 391 of the Texas Local Government Code. These councils were organized to guide unified development, service delivery and improve efficiency within regions. COGs are authorized to conduct planning; assist local governments in implementing plans; contract with local, state, and federal governments and other public and private agencies to provide community services; and assist local governments in solving governmental problems. COGs also serve as intermediaries among federal, state, and local governments while reviewing and commenting on applications for federal and state grants-in-aid and solid waste permits. While activities vary among regions, typically activities include planning for economic growth, water supply and water quality, air quality, transportation, emergency preparedness, implementing regional homeland security strategies, implementing criminal justice strategies and law enforcement training, maintaining and improving regional 911 systems, and the delivery of social services.

For example, each COG is a federally designated economic development district (EDD) under U.S. Economic Development Administration (EDA). The multijurisdictional entities help lead locally based, regionally driven economic development planning processes that leverage the involvement of the public, private and nonprofit sectors to establish a strategic blueprint for regional collaboration. This strategic blueprint is known as a Comprehensive Economic Development Strategy (CEDS) and is a plan for regional economic development.

In addition, COGs help the Office of the Governor prioritize and implement the Homeland Security Grant Program (HSGP), which plays an important role in the implementation of the National Preparedness System by supporting the building, sustainment and delivery of core capabilities essential to achieving the National Preparedness Goal of a secure and resilient nation. They also work to prioritize and administer the Texas Department of Agriculture’s non-entitlement Community Development Block Grant funds.
The Texas Association of Regional Council (TARC) is the statewide association of COGs, whose members are focused on enhancing quality of life through regional strategies, partnerships and solutions. TARC helps regional councils effectively assist local governments throughout Texas by sharing best practices, educating the public, and representing councils before local, state, and federal agencies and legislators. Since 1973, TARC has worked to strengthen the capabilities of the member councils while providing a forum for the exchange of ideas. TARC is governed by a policy board of local elected officials, including county judges, commissioners, mayors and city council members from the regions.

The GLO has maintained a close relationship with TARC and has conducted a variety of outreach efforts following the notice tied to the CDBG-MIT funds. Twenty-three (23) of the 24 COGs in Texas has a CDBG-MIT eligible county. Over the last year, the GLO has held stakeholder workshops and teleconference calls with almost all 23 COGs across the state and has presented at the quarterly TARC membership meetings to inform participants of the mitigation funding. This effort has been comprehensive to ensure mitigation alignment across the vast geography of Texas. The GLO will maintain this relationship with the COGs and TARC for the life of all CDBG-MIT programs described in this Action Plan.
Voluntary Organizations Active in Disaster/OneStar Foundation

The GLO has been working with the OneStar Foundation to engage the state’s Voluntary Organizations Active in Disasters (VOADs) over the last several years. The OneStar Foundation, originally created as the Texas Center for Volunteer Action in 1976, is recognized state-wide as the voice of the volunteer, nonprofit, and faith-based neutral convener and a respected business partner to foundations, state agencies, and the business community tied to disaster response, recovery, and mitigation. In anticipation of the CDBG-MIT program, the GLO worked with the OneStar Foundation to ensure that the notification materials and relevant surveys were disseminated to all relevant VOADs and other organizations.
3 GENERAL REQUIREMENTS

3.1 Coordination of Mitigation Projects and Leverage

The GLO mitigation programs advance resilience to current and future hazards. Each mitigation program aligns with other planned federal, state, regional, or local capital improvements. Each proposed project application must describe how the proposed projects will: (a) Advance long-term resilience; (b) align with other planned capital improvements; and (c) promote community-level and regional (e.g., multiple local jurisdictions) planning for current and future disaster recovery efforts and additional mitigation investments.

The GLO will encourage subrecipients to leverage CDBG-MIT funds with funding provided by other federal, state, local, private, and nonprofit sources to utilize the limited CDBG-MIT funds to the fullest possible extent. The GLO will report on leverage funds in the Disaster Recovery Grant Reporting System (DRGR) system.

Funds may be used for matching requirements, share, or contribution for any other federal program when used to carry out an eligible CDBG-MIT activity. This includes programs or activities administered by the FEMA or USACE. By law, (codified in the HCD Act as a note to 105(a)), the amount of CDBG-MIT funds that may be contributed to a USACE project is $250,000 or less.

3.2 Displacement of Persons and/or Entities

To minimize the displacement of persons and/or entities that may be affected by the activities outlined in this Action Plan, the GLO will coordinate with other state agencies, local governments, and local non-profit organizations to ensure minimal displacement. However, should any proposed projects cause the displacement of people, the GLO will ensure the requirements set forth under the Uniform Relocation Assistance (URA) and Real Property Acquisition Policies Act, as amended, are met.

The relocation assistance requirements at section 104(d)(2)(A) of the Housing and Community Development Act (HCDA) and 24 CFR 42.350 are waived to the extent that they differ from the requirements of the URA and implementing regulations at 49 CFR part 24, as modified by the notice for activities related to disaster recovery. Without this waiver, disparities exist in relocation assistance associated with activities typically funded by HUD and FEMA (e.g., buyouts and relocation). Both FEMA and CDBG funds are subject to the requirements of the URA; however, CDBG funds are subject to Section 104(d), while FEMA funds are not. The URA provides that a displaced person is eligible to receive a rental assistance payment that covers a period of 42 months. By contrast, Section 104(d) allows a lower-income displaced person to choose between the URA rental assistance payment and a rental assistance payment calculated over a period of 60 months. This waiver of the Section 104(d) requirements ensures uniform and equitable treatment.
by setting the URA and its implementing regulations as the sole standard for relocation assistance under the Federal Register notice.

The GLO will follow its Residential Anti-displacement and Relocation Assistance Plan (RARAP). The GLO will take the following steps and require subrecipients and developers to minimize the direct and indirect displacement of persons from their homes: Plan construction activities to allow tenants to remain in their units as long as possible, by rehabilitating empty units or buildings first; where feasible, give priority to rehabilitation of housing, as opposed to demolition, to avoid displacement; adopt policies to identify and mitigate displacement resulting from intensive public investment in neighborhoods; adopt tax assessment policies, such as deferred tax payment plans, to reduce impact of increasing property tax assessments on lower income owner-occupants or tenants in revitalizing areas; or target only those properties deemed essential to the need or success of the project.

3.3 Maximum Assistance

The maximum amount of assistance available to subrecipients under the GLO’s mitigation program will be the maximum allocated to the HUD most impacted and distressed areas. For all housing and buyout activities, the GLO’s housing guidelines establish housing assistance maximums. A waiver request must be submitted to the GLO if a subrecipient’s housing assistance maximums exceed the GLO amounts. The GLO will evaluate each housing assistance waiver request for cost effectiveness. The GLO will consider exceptions for maximum awards when necessary to reasonably accommodate a person with disabilities.

3.4 Natural Infrastructure

The GLO will encourage projects that incorporate nature-based solutions and natural or green infrastructure in the selection and/or design of CDBG-MIT projects. The GLO will encourage subrecipients to consider natural infrastructure during the project selection process (e.g., alternatives and benefit-cost analysis). The Coastal Resiliency Program will select projects from the Texas Coastal Master Resiliency Plan. The Texas Coastal Master Resiliency Plan calls for a balanced approach in managing coastal resources focused on community resiliency, ecological health, and economic growth by recommending projects ranging in type from nature-based (“green infrastructure”) to structural-based (“gray infrastructure”) to nonstructural-based projects, plans, policies, programs, and studies to employ a multiple lines of defense approach to coastal planning.
3.5 Protection of People and Property

3.5.1 Quality Construction Standards

The GLO will require both quality inspections and code compliance inspections on all projects. Site inspections will be required on all projects to ensure quality and compliance with building codes. The GLO will encourage and support subrecipients’ efforts to update and strengthen local compliance codes to mitigate hazard risks due to sea level rise, high winds, storm surge, and flooding where applicable. In the project application, subrecipients will submit an explanation of both current and future planned codes to mitigate hazard risks. The GLO will provide technical guidance on hazard mitigation code examples.

All rehabilitation (meets the definition of substantial improvement), reconstruction, or new construction must meet an industry-recognized standard that has achieved certification under at least one of the following programs: (1) ENERGY STAR (Certified Homes or Multifamily High-Rise), (2) Enterprise Green Communities, (3) LEED (New Construction, Homes, Midrise, Existing Buildings Operations and Maintenance, or Neighborhood Development), or (4) ICC–700 National Green Building Standard. For rehabilitation of non-substantially damaged residential buildings, the GLO will follow the guidelines to the extent applicable as specified in the HUD CPD Green Building Retrofit Checklist. For infrastructure projects, the GLO will encourage, to the extent practicable, implementation of green building practices.

3.5.2 Housing Contractors Standards

The GLO will establish standards in the request for qualifications for housing contractors and will encourage subrecipients to do the same. The standards will include, but are not limited to, information on the company’s (1) organizational structure and capabilities, (2) ability to perform, (3) recent construction projects completed or underway over the past 5 years, (4) performance and payment bond capacity, (5) financial statements for the past two years, (6) evidence of insurance coverage, and (7) business registrations, certifications, and licenses.

To ensure full and open competition, subrecipients are required to follow federal procurement and contract requirements outlined in 2 CFR 200.318 – 200.326. The GLO will monitor subrecipient procurement. The GLO will require a warranty period post-construction for housing; all work performed by the contractor will be guaranteed for a period of 1 year.
3.6 Operation and Maintenance Plans

Each proposed project must identify in the project application the plan for the long-term operation and maintenance of infrastructure and public facility projects funded with CDBG-MIT funds. The proposed project application must describe how it will fund long-term operation and maintenance for CDBG-MIT projects.

3.7 Cost Verification

For infrastructure projects the GLO will rely on licensed engineers responsible for project budget justification, construction code requirements, and CDBG-MIT project funding maximums. The GLO will encourage subrecipients to consider the costs and benefits of the project when selecting CDBG-MIT eligible projects. The GLO may use an independent, qualified third-party architect, construction manager, or other professional (e.g., a cost estimator) to verify the planned project costs and cost changes to the contract (e.g., change orders) during implementation are reasonable. The proposed projects undergo application review which includes a cost verification. Each identified covered projects will be required to conduct a benefit cost analysis (BCA).

For housing activities, the GLO housing guidelines outlines applicable housing maximum spending caps to service as cost control measures.

3.8 Elevation Standards

The GLO will apply the following elevation standards to new construction, repair of substantial damage, or substantial improvement of structures located in an area delineated as a flood hazard area or equivalent in FEMA’s data source identified in 24 CFR 55.2(b)(1). All structures, as defined under 44 CFR 59.1, designed principally for residential use and located in the 100-year (or 1 percent annual chance) floodplain that receive assistance for new construction, repair of substantial damage, or substantial improvement, as defined under 24 CFR 55.2(b) (10), must be elevated with the lowest floor, including the basement, at least 2 feet above the annual floodplain elevation. Mixed-use structures with no dwelling units and no residents below the annual floodplain must be elevated or floodproofed in accordance with FEMA floodproofing standards under 44 CFR 60.3(c)(3)(ii) or successor standard, at least 2 feet above the annual floodplain.

Applicable state, local, and tribal codes and standards for floodplain management that exceed these requirements, including elevation, setbacks, and cumulative substantial damage requirements, will be followed.

The GLO has established elevation costs caps at $60,000 for elevation of single family homes in coastal counties, and $35,000 for non-coastal counties. These elevation costs caps were established considering elevation costs associated with past GLO CDBG-DR housing rehabilitation/reconstruction programs. Elevation costs higher than these established caps will require a waiver request to the GLO. Elevation requirements are taken into consideration when
determining whether to rehabilitate or reconstruct a home. Generally, a home will be reconstructed when home repair costs are greater than $65,000, an exception to this may include a home that has been determined eligible on the National Register of Historic Places. The GLO may re-evaluate its elevation costs caps during implementation based on average costs associated with elevating single family homes and on a case by case basis as needed.

Nonresidential structures must be elevated to the standards described in this paragraph or floodproofed, in accordance with FEMA floodproofing standards at 44 CFR 60.3(c)(3)(ii) or successor standard, up to at least two feet above the 100-year (or 1 percent annual chance) floodplain. All Critical Actions, as defined at 24 CFR 55.2(b)(3), within the 500-year (or 0.2 percent annual chance) floodplain must be elevated or floodproofed (in accordance with the FEMA standards) to the higher of the 500-year floodplain elevation or 3 feet above the 100-year floodplain elevation. If the 500-year floodplain or elevation is unavailable, and the Critical Action is in the 100-year floodplain, then the structure must be elevated or floodproofed at least 3 feet above the 100-year floodplain elevation. Critical Actions are defined as an ‘‘activity for which even a slight chance of flooding would be too great, because such flooding might result in loss of life, injury to persons or damage to property.’’ For example, Critical Actions include hospitals, nursing homes, police stations, fire stations and principal utility lines.

The GLO has not established elevation cost caps for multifamily rental developments and infrastructure (public facilities, public improvements, and/or nonresidential structures). To evaluate reasonable elevation costs, the GLO will rely on licensed engineers responsible for project budget justification, construction code requirements, and CDBG-MIT project funding maximums. The GLO will encourage subrecipients to consider the costs and benefits of the project when selecting CDBG-MIT eligible projects.

### 3.9 Appeals Processes

The GLO responds to complaints and appeals in a timely and professional manner to maintain a quality level of operations. The GLO’s appeals processes apply to appeals received from homeowners, contractors, cities, counties, housing authorities, and other entities. The GLO will respond to homeowners by coordinating with the applicable subrecipient and/or housing contractor to resolve issues.

A record of each complaint or appeal that the GLO receives is kept in an information file. When a complaint or appeal is received, the GLO will respond to the complainant or appellant within 15 business days where practicable. For expediency, the GLO will utilize telephone communication as the primary method of contact; email and postmarked letters will be used as necessary to document conversations and transmit documentation.

Information about the complainant’s rights and how to file a complaint shall be printed on all program applications, guidelines, the GLO public website, and subrecipients’ websites in all local
languages, as appropriate and reasonable. Procedures for appealing a GLO decision on a complaint shall be provided to complainants in writing as part of the complaint response.

### 3.10 Dam and Levee Requirements

As stated in the Federal Register Notice, 84 FR 45838 (August 30, 2019), CDBG-MIT funds are prohibited from being used to enlarge a dam or levee beyond the original footprint of the structure that existed prior to the disaster event. The GLO will ensure that if subrecipients use CDBG-MIT funds for levees and dams, the subrecipients will (1) register and maintain entries regarding such structures with the U.S. Army Corps of Engineers (USACE) National Levee Database or National Inventory of Dams, (2) ensure that the structure is admitted in the USACE PL 84–99 Program (Levee Rehabilitation and Improvement Program), and (3) ensure the structure is accredited under the FEMA NFIP. The GLO will upload into the DRGR system the exact location of the structure and the area served and protected by the structure and maintain file documentation demonstrating that the grantee has conducted a risk assessment prior to funding the flood control structure and that the investment includes risk reduction measures.

### 3.11 Program Income

Any program income earned as a result of activities funded under this grant will be subject to alternate requirements of 24 CFR 570.489(e), which defines program income. Program income generated under individual contracts with the subrecipients will be returned to the GLO. At the GLO’s discretion, program income could be allowed to remain with a community to continue mitigation efforts.

### 3.12 Monitoring Standards

The GLO provides program-wide oversight and monitoring activities for all applicable CDBG and related federal requirements in its administration of the CDBG-MIT Program. The GLO will provide technical assistance to recipients from the application stage through the completion of the projects to ensure that funds are appropriately used for the CDBG-MIT activities, as well as meeting one of the national objectives. The state shall coordinate with the Indian tribe with jurisdiction over the tribal area when providing CDBG-MIT assistance to beneficiaries in tribal areas.

The GLO will monitor all contract expenditures for quality assurance and to prevent, detect, and eliminate fraud, waste, and abuse as mandated by Executive Order (EO) RP 36, signed July 12, 2004, by the Governor of Texas. The GLO will particularly emphasize mitigation of fraud, abuse, and mismanagement related to accounting, procurement, and accountability which may also be investigated by the State Auditor’s Office (SAO). In addition, the GLO and the grantees are subject to Uniform Guidance Standards of 2 CFR 200, which encompasses the review of compliance with program requirements and the proper expenditure of funds by an independent Certified Public
Accountant (CPA) or by the SAO. Reports from the SAO’s office will be sent to the Office of the Governor, the Legislative Committee, and the GLO.

The GLO has an internal audit staff that performs independent internal audits of programs and can perform such audits on these programs and grantees. The GLO also has an independent auditing staff that reports directly to the Commissioner of the GLO and the Chief Clerk. The GLO will utilize a monitoring plan and risk assessment to specifically ensure that the recovery allocation is carried out in accordance with state and federal laws, rules, and regulations, as well as the requirements set forth in the Federal Register notices. The monitoring plan will also include duplication of benefits review to ensure compliance with the Stafford Act. GLO shall attend and require subrecipients to attend fraud related training provided by HUD OIG to assist in the proper management of CDBG-MIT grant funds. The state shall establish and maintain such records as maybe necessary to facilitate review and audit by HUD of the state’s administration of CDBG-MIT funds, under 24 CFR 570.493. For fair housing and equal opportunity (FHEO) purposes, as applicable, GLO records shall include data on the racial, ethnic, and gender characteristics of persons who are applicants for, participants in, or beneficiaries of the program.

3.13 Broadband Infrastructure

As required by the Federal Register notice, 84 FR 45838 (August 30, 2019), any new construction or substantial rehabilitation, as defined by 24 CFR 5.100, of a building with more than four rental units will include installation of broadband infrastructure, as defined in 24 CFR 5.100, except where the grantee documents that: (1) the location of the new construction or substantial rehabilitation makes installation of broadband infrastructure infeasible; (2) the cost of installing broadband infrastructure would result in a fundamental alteration in the nature of its program or activity or in an undue financial burden; or (3) the structure of the housing to be substantially rehabilitated makes installation of broadband infrastructure infeasible.

3.14 Section 3 Compliance

For applicable funded programs, the GLO and its subrecipients will ensure compliance with all pertinent Section 3 regulations to the greatest extent possible, including providing training, employment, contracting, and other economic opportunities to low-income and very low-income persons, especially recipients of government assistance for housing and to businesses that provide economic opportunities to low- and very low-income persons. Additional details can be found in Section 3 policy and procedures.
4 STATE ADMINISTERED MITIGATION PROGRAM

4.1 Action Plan

As required by HUD’s Federal Register notice, 84 FR 45838 (August 30, 2019), this Action Plan describes the method of distribution (MOD) of CDBG-MIT funds and the descriptions of specific programs or activities that the GLO will carry out directly. The Mitigation Needs Assessment (the Assessment) for this Action Plan was conducted to inform and direct the development and prioritization of all mitigation activities outlined in this Action Plan. In addition, the GLO conducted an extensive stakeholder outreach effort that involved consulting with affected citizens, local governments, state and regional agencies, and public housing authorities to assess the mitigation needs of individual communities.

This Action Plan outlines the following:

i. The eligible affected areas and subrecipients;
ii. Criteria for eligibility;
iii. The methodology used to distribute funds to those subrecipients;
iv. Activities for which funding may be used; and
v. Program requirements, including non-duplication of benefits.

The Action Plan also defines how all funded activities address necessary expenses related to the creation or restoration of resilient infrastructure, the reconstruction of resilient housing, and general efforts to make communities more resilient.

4.2 Connection to Mitigation Needs Assessment

As required by HUD’s Federal Register notice, 84 FR 45838 (August 30, 2019), the GLO will allocate at least 50 percent of the funds to address mitigation needs within HUD-identified “most impacted and distressed” areas:
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<th>HUD MID Counties</th>
<th>2015 Floods</th>
<th>2016 Floods</th>
<th>Hurricane Harvey</th>
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<tr>
<td>Hidalgo County</td>
<td>Harris County</td>
<td>Chambers County</td>
<td></td>
</tr>
<tr>
<td>Travis County</td>
<td>Montgomery County</td>
<td>Fayette County</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Newton County</td>
<td>Fort Bend County</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HUD MID ZIP Codes</th>
<th>2015 Floods</th>
<th>2016 Floods</th>
<th>Hurricane Harvey</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>75979 (Tyler County)</td>
<td>77320 (Walker County)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>77335/77351 (Polk County)</td>
<td>77414/77482 (Matagorda County)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>77423/77493 (Waller County)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Up to 50 percent of the allocation may be used to address mitigation needs in those counties that received a 2015 Floods (DR-4223 and DR-4245), 2016 Floods (DR-4266, DR-4269 and DR-4272), or Hurricane Harvey (DR-4332) Presidential disaster declaration but were not classified as HUD MID; these counties are classified as State MID (grantee-identified MID areas).

Additional areas within counties not explicitly classified as HUD MID or State MID may also serve as locations of CDBG-MIT funded activities if it can be demonstrated that the expenditure of CDBG-MIT funds in that area will measurably mitigate risks in either a HUD MID or State MID area (e.g., upstream water retention projects to reduce downstream flooding in an eligible MID area).

This Action Plan considers and addresses critical mitigation needs over a large geography while maintaining as much local control as possible through several programs aimed at creating more resilient communities through improved infrastructure, housing, building and land use policies and practices, and hazard mitigation planning. Through the Assessment, the GLO identified the need for and developed the following programs:

i. Local and Regional Mitigation:
   a. State Mitigations Competitions;
   b. Regional Mitigation Program (COG MODs);
   c. Hazard Mitigation Grant Program (HMGP): Supplemental; and
   d. Coastal Resiliency Program.

ii. Housing:
   a. Housing Oversubscription Supplemental; and
   b. Resilient Home Program.

iii. Planning:
   a. Hazard Mitigation Plans;
      b. Resilient Communities Program; and
      c. Regional and State Planning.
These programs were developed to meet CDBG-MIT, federal, and state requirements and regulations, as well as to fund mitigation activities that protect against loss of life and property as efficiently and expeditiously as possible. Public service activities including housing and legal counseling, public outreach, and education may need to be utilized to complement several of these programs.

While the majority of funds are allocated to various local and regional mitigation activities—which will encompass any non-planning and non-housing projects—assistance to homeowners through the reconstruction of homes will comprise more than thirteen (13) percent of the total allocation. Both the Housing Oversubscription Supplemental Program and the Resilient Home Program will allow the GLO to assist homeowners impacted by Hurricane Harvey to inhabit new homes that are proven to match or exceed HUD’s requirements, creating more resilient communities that recover more quickly from the next disaster event.

As noted above, the GLO recognizes that a comprehensive response to the threats and impacts of natural hazards involves the implementation of well-considered local and regional mitigation activities in the form of infrastructure projects, buyouts of homes in the floodplain, and other interventions that are vital for the protection, resiliency, and viability of communities. Accordingly, sixty-eight (68) percent of the funds will address hazard mitigation needs related to local and regional mitigation activities.

Planning encompasses a wide array of activities that ensure that policies and practices are developed and implemented to reduce impacts from future natural hazards. These activities will be focused on regional approaches to planning in addition to specific local solutions that promote sustainable mitigation planning and policy informed by an evaluation of short- and long-term hazard risk. These activities will involve: (1) the creation of FEMA-approved Local Hazard Mitigation Plans; (2) local land use, zoning, and comprehensive plans; (3) regional planning studies; and (4) the adoption of building codes and floodplain ordinances that reduce the risk of future hazard impacts.

The GLO has allocated five (5) percent for administrative costs, including contract administration, compliance monitoring, and the provision of technical assistance to applicants and subrecipients. Based on experience, it is expected that some subrecipients will need direct support implementing their programs; therefore, the GLO is allocating three (3) percent for project delivery. Providing direct support to subrecipients will help ensure that programs are implemented as efficiently and expeditiously as possible.

At least 50 percent of all program funds will benefit LMI persons.

As required, a Mitigation Needs Assessment (the Assessment) was completed to identify long-term risks and investment priorities for CDBG-MIT funding allocated as a result of the 2015 Floods, 2016 Floods, and Hurricane Harvey. The Assessment takes into account a comprehensive
set of data sources that cover multiple geographies and sectors. The Assessment includes specific details about hazard risks within the eligible most impacted and distressed communities, and includes details for housing, infrastructure, and land use. The Assessment may be amended as additional information becomes available or existing information is updated.
## 4.3 Program Budget

![Program Budget Table](attachment:image)

<table>
<thead>
<tr>
<th>Programs</th>
<th>HUD Most Impacted and Distressed</th>
<th>State Most Impacted and Distressed</th>
<th>Total Allocation</th>
<th>% of Total Allocation</th>
<th>LMI Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015 Floods State Mitigation Competition</td>
<td>$23,048,475</td>
<td>$23,048,475</td>
<td>$46,096,950</td>
<td>1.07%</td>
<td>$23,048,475</td>
</tr>
<tr>
<td>2016 Floods State Mitigation Competition</td>
<td>$73,840,380</td>
<td>$73,840,380</td>
<td>$147,680,760</td>
<td>3.44%</td>
<td>$73,840,380</td>
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<tr>
<td>Hurricane Harvey State Mitigation Competition</td>
<td>$1,072,388,360</td>
<td>$1,072,388,360</td>
<td>$2,144,776,720</td>
<td>49.91%</td>
<td>$1,072,388,360</td>
</tr>
<tr>
<td>Regional Mitigation Program</td>
<td>$400,000,000</td>
<td>$100,000,000</td>
<td>$500,000,000</td>
<td>11.64%</td>
<td>$250,000,000</td>
</tr>
<tr>
<td>AACOG</td>
<td>$12,805,000</td>
<td>$12,805,000</td>
<td>$25,610,000</td>
<td>2.56%</td>
<td>$6,402,500</td>
</tr>
<tr>
<td>BVCOG</td>
<td>$12,805,000</td>
<td>$12,805,000</td>
<td>$25,610,000</td>
<td>2.56%</td>
<td>$6,402,500</td>
</tr>
<tr>
<td>CAPCOG</td>
<td>$10,729,000</td>
<td>$10,729,000</td>
<td>$21,458,000</td>
<td>2.15%</td>
<td>$5,364,500</td>
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<tr>
<td>CBCOG</td>
<td>$11,623,000</td>
<td>$11,623,000</td>
<td>$23,246,000</td>
<td>4.48%</td>
<td>$11,194,000</td>
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<tr>
<td>CTCOG</td>
<td>$2,900,000</td>
<td>$2,900,000</td>
<td>$5,800,000</td>
<td>0.58%</td>
<td>$1,450,000</td>
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<tr>
<td>DETCOG</td>
<td>$14,384,000</td>
<td>$14,384,000</td>
<td>$28,768,000</td>
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<td>$17,206,000</td>
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<tr>
<td>GCRPC</td>
<td>$16,139,000</td>
<td>$16,139,000</td>
<td>$32,278,000</td>
<td>6.88%</td>
<td>$17,206,000</td>
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<tr>
<td>HGAC</td>
<td>$18,550,000</td>
<td>$18,550,000</td>
<td>$37,100,000</td>
<td>4.48%</td>
<td>$18,550,000</td>
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<tr>
<td>SETRPC</td>
<td>$61,216,000</td>
<td>$61,216,000</td>
<td>$122,432,000</td>
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<td>$30,608,000</td>
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<tr>
<td>HMGP: Supplemental</td>
<td>$85,000,000</td>
<td>$85,000,000</td>
<td>$170,000,000</td>
<td>3.96%</td>
<td>$85,000,000</td>
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<tr>
<td>Coastal Resiliency Program</td>
<td>$100,000,000</td>
<td>-</td>
<td>$100,000,000</td>
<td>2.33%</td>
<td>$50,000,000</td>
</tr>
<tr>
<td>Housing Oversubscription Supplemental</td>
<td>$400,000,000</td>
<td>$80,000,000</td>
<td>$480,000,000</td>
<td>11.84%</td>
<td>$280,000,000</td>
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<tr>
<td>Resilient Home Program</td>
<td>$100,000,000</td>
<td>$100,000,000</td>
<td>$200,000,000</td>
<td>4.76%</td>
<td>$50,000,000</td>
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<tr>
<td>State Project Delivery</td>
<td>$128,915,670</td>
<td>$128,915,670</td>
<td>$257,831,340</td>
<td>6.01%</td>
<td>$128,915,670</td>
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<tr>
<td>Hazard Mitigation Plans</td>
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<td>$15,000,000</td>
<td>$30,000,000</td>
<td>0.70%</td>
<td>N/A</td>
</tr>
<tr>
<td>Resilient Communities Program</td>
<td>$100,000,000</td>
<td>$100,000,000</td>
<td>$200,000,000</td>
<td>4.76%</td>
<td>$50,000,000</td>
</tr>
<tr>
<td>Regional and State Planning</td>
<td>$214,859,450</td>
<td>$214,859,450</td>
<td>$429,718,900</td>
<td>10.02%</td>
<td>N/A</td>
</tr>
<tr>
<td>State Administration</td>
<td>$214,859,450</td>
<td>$214,859,450</td>
<td>$429,718,900</td>
<td>10.02%</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$2,498,594,500</td>
<td>$1,798,594,500</td>
<td>$4,297,189,000</td>
<td>100%</td>
<td>$1,968,735,050</td>
</tr>
</tbody>
</table>
4.4 GLO Use of Funds

4.4.1 2015 Floods State Mitigation Competition

The GLO will conduct a mitigation competition to address risks in the 2015 Floods HUD MID and State MID areas. Eligible applicants will include units of local government (cities and counties), Indian Tribes, and Councils of Governments. Entities may coordinate activities and submit a joint project that crosses jurisdictional boundaries. The city of Houston and the city of San Marcos are ineligible to apply for the 2015 Floods State Mitigation Competition. (The city of Houston and the city of San Marcos each received a direct HUD CDBG-MIT allocation related to the 2015 flooding events.) Each applicant may submit a total of two applications, whether applying as the lone applicant or jointly with another jurisdiction(s). Each application must consist of one project. Depending on demand, no applicant will be awarded for their second application until all successful eligible applicants have been awarded funding at least once. If an applicant is eligible for multiple competitions, the same project(s) cannot be submitted in each competition. If a project is a phase of a larger project, the phase of the project submitted must be viable as a stand-alone project. Applicants are encouraged to incorporate nature-based solutions, including natural or green infrastructure, into their proposed projects.

The GLO reserves the option to delay award(s) to ensure that at least fifty (50) percent of funds benefit LMI persons and at least fifty (50) percent of funds address identified risks in the 2015 Floods HUD MID areas (counties).

4.4.1.1 Connection to Identified Risk:

As outlined in Mitigation Needs Assessment, severe coastal/riverine flooding, storms, and tornadoes are among the top risks to which Texas has the greatest exposure. Each proposed project must mitigate against one of these identified risks.

4.4.1.2 Allocation Amount: $46,096,950

  i. At least fifty (50) percent of funds must address identified risks in the 2015 Floods HUD MID areas (counties); and

  ii. Up to fifty (50) percent of funds may address identified risks in the 2015 Floods State MID counties.

4.4.1.3 Award Amount:

  i. Maximum Amount: $10,000,000

  ii. Minimum Amount: $3,000,000
4.4.1.4 **Eligible Applicants:** Units of local government (cities and counties), Indian Tribes, and Councils of Governments

4.4.1.5 **Eligible Activities:** All activities allowed under CDBG-MIT; HCDA Section 105(a)(1-5), 105(a)(7-9), and 105(a)(11), including but not limited to:

i. Flood control and drainage improvements, including the construction or rehabilitation of stormwater management system;

ii. Infrastructure improvements (such as water and sewer facilities, streets, provision of generators, removal of debris, bridges, etc.);

iii. Natural or green infrastructure;

iv. Communications infrastructure;

v. Public facilities;

vi. Buyouts or Acquisition with or without relocation assistance, down payment assistance, housing incentives, and demolition;

vii. Activities designed to relocate families outside of floodplains;

viii. Public service within the 15 percent cap (e.g., housing counseling, legal counseling, job training, mental health, and general health services);

ix. FEMA Hazard Mitigation Grant Program (HMGP) cost share for CDBG-MIT eligible project;

x. Economic development (assistance to businesses for the installation of disaster mitigation improvements and technologies; financing to support the development of technologies, systems and other measures to mitigate future disaster impacts; “hardening” of commercial areas and facilities; and financing critical infrastructure sectors to allow continued commercial operations during and after disasters); and

xi. Nonresidential structures must be elevated to the standards described in this paragraph or floodproofed, in accordance with FEMA floodproofing standards at 44 CFR 60.3(c)(3)(ii) or successor standard, up to at least two feet above the 100-year (or 1 percent annual chance) floodplain. All Critical Actions, as defined at 24 CFR 55.2(b)(3), within the 500-year (or 0.2 percent annual chance) floodplain must be elevated or floodproofed (in accordance with the FEMA standards) to the higher of the 500-year floodplain elevation or 3 feet above the 100-year floodplain elevation. If the 500-year floodplain or elevation is unavailable, and the Critical Action is in the 100-year floodplain, then the structure must be elevated or floodproofed at least 3 feet above the 100-year floodplain elevation. Critical Actions are defined as an “activity for which even a slight chance of flooding would be too great, because such flooding might result in loss of life, injury to
persons or damage to property.’’ For example, Critical Actions include hospitals, nursing homes, police stations, fire stations and principal utility lines.

4.4.1.6 Ineligible Activities

i. Emergency response services. Emergency response services shall mean those services that are carried out in the immediate response to a disaster or other emergency in order to limit the loss of life and damage to assets by state and local governmental and nongovernmental emergency public safety, fire, law enforcement, emergency response, emergency medical (including hospital emergency facilities), and related personnel, agencies, and authorities.

ii. CDBG-MIT funds may not be used to enlarge a dam or levee beyond the original footprint of the structure that existed prior to the disaster event. CDBG-MIT funds for levees and dams are required to:
   a. Register and maintain entries regarding such structures with the USACE National Levee Database or National Inventory of Dams;
   b. Ensure that the structure is admitted in the USACE PL 84–99 Rehabilitation Program (Rehabilitation Assistance for Non-Federal Flood Control Projects);
   c. Ensure the structure is accredited under the FEMA NFIP; and
   d. Maintain file documentation demonstrating a risk assessment prior to funding the flood control structure and documentation that the investment includes risk reduction measures.

iii. Funds may not be used to assist a privately owned utility for any purpose. A private utility, also referred to as an investor-owned utility, is owned by private investors and is for-profit as opposed to being owned by a public trust or agency (e.g., a coop or municipally owned utility);

iv. Buildings and facilities used for the general conduct of government (e.g., city halls, courthouses, and emergency operation centers);

v. By law, (codified in the HCD Act as a note to 105(a)), the amount of CDBG-MIT funds that may be contributed to a USACE project is $250,000 or less;

vi. Section 582 of the National Flood Insurance Reform Act of 1994, as amended, (42 U.S.C. 5154a) prohibits flood disaster assistance in certain circumstances. In general, it provides that no federal disaster relief assistance made available in a flood disaster area may be used to make a payment (including any loan assistance payment) to a person for ‘‘repair, replacement, or restoration’’ for damage to any personal, residential, or commercial property if that person at any time has received federal flood disaster assistance that was conditioned on the person first having
obtained flood insurance under applicable federal law and the person has subsequently failed to obtain and maintain flood insurance as required under applicable federal law on such property. No disaster assistance may be provided for the repair, replacement, or restoration of a property to a person who has failed to meet this requirement;

vii. If the property is purchased through the use of eminent domain, the ultimate use of that property may not benefit a particular private party and must be for a public use; eminent domain can be used for public use, but public use shall not be construed to include economic development that primarily benefits private entities; and

viii. Incentive payments to households that move to disaster-impacted floodplains.

4.4.1.7 Project Eligibility:

i. Meets the definition of mitigation activities;

ii. Addresses identified current and future risks; mitigation related to severe coastal and riverine flooding, storms, tornadoes;

iii. Meets the definition of a CDBG-eligible activity under title I of HCDA or otherwise pursuant to a waiver or alternative requirement;

iv. Meets a CDBG national objective;

v. Includes a plan for the long-term funding and management of the operations and maintenance of the project; and

vi. Cost verification controls must be in place to assure that construction costs are reasonable and consistent with market costs at the time and place of construction.

4.4.1.8 Program Guidelines for Residential Buyout or Acquisition Activities (Only):

Each subrecipient will develop guidelines in accordance with CDBG-MIT requirements and regulations to set maximum assistance amounts, target area locations, Disaster Risk Reduction Area, and additional eligibility requirements. Guidelines must be posted for public comment before use. The GLO must approve all guidelines. Subrecipients are required to develop and follow a RARAP. Subrecipients may adopt program guidelines used for the local buyout and acquisition program under administered under the State of Texas Plan for Disaster Recovery: Hurricane Harvey for $5.676 billion in CDBG-DR funding.

To conduct a buyout or an acquisition, the subrecipient must establish criteria in its policies and procedures to designate the area subject to the buyout, pursuant to the following requirements:

In a Disaster Risk Reduction Area:
i. The hazard must have been caused or exacerbated by the Presidentially declared disaster for which the grantee received its CDBG-MIT allocation;

ii. The hazard must be a predictable environmental threat to the safety and well-being of program beneficiaries, as evidenced by the best available data (e.g., FEMA RL Data) and science;

iii. The Disaster Risk Reduction Area must be clearly delineated so that HUD and the public may easily determine which properties are located within the designated area. The distinction between buyouts and other types of acquisitions is important, because subrecipient may only redevelop an acquired property if the property is not acquired through a buyout program (i.e., the purpose of acquisition was something other than risk reduction). When properties are not acquired through a buyout program, the purchase price must be consistent with applicable uniform cost principles (and the pre-disaster FMV may not be used); and

iv. In carrying out acquisition activities, subrecipient must ensure they are in compliance with their long-term redevelopment and FEMA Approved Hazard Mitigation plans.

4.4.1.9  Selection Criteria:

Table 4-2:  2015 Floods Competition Scoring Criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Maximum Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>County Composite Disaster Index</td>
<td>10 Points Possible</td>
</tr>
<tr>
<td>Rank 5</td>
<td>10 Points</td>
</tr>
<tr>
<td>Rank 4</td>
<td>8 Points</td>
</tr>
<tr>
<td>Rank 3</td>
<td>5 Points</td>
</tr>
<tr>
<td>Rank 2</td>
<td>2 Points</td>
</tr>
<tr>
<td>Rank 1</td>
<td>0 Points</td>
</tr>
<tr>
<td>Social Vulnerability Index</td>
<td>10 Points Possible</td>
</tr>
<tr>
<td>Rank 5</td>
<td>10 Points</td>
</tr>
<tr>
<td>Rank 4</td>
<td>8 Points</td>
</tr>
<tr>
<td>Rank 3</td>
<td>5 Points</td>
</tr>
<tr>
<td>Rank 2</td>
<td>2 Points</td>
</tr>
<tr>
<td>Rank 1</td>
<td>0 Points</td>
</tr>
<tr>
<td>Per Capita Market Value</td>
<td>10 Points Possible</td>
</tr>
<tr>
<td>Rank 5</td>
<td>10 Points</td>
</tr>
<tr>
<td>Criteria</td>
<td>Maximum Points</td>
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<td>----------------------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>8 Points</td>
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<td>0 Points</td>
<td></td>
</tr>
<tr>
<td>Rank 1</td>
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</tr>
<tr>
<td>LMI National Objective</td>
<td>20 Points Possible</td>
</tr>
<tr>
<td>Project meets LMI national objective</td>
<td>20 Points</td>
</tr>
<tr>
<td>Project does not meet LMI national objective</td>
<td>0 Points</td>
</tr>
<tr>
<td>Project Identified in Local Adopted Plan</td>
<td>5 Points Possible</td>
</tr>
<tr>
<td>Project identified in local adopted plan</td>
<td>5 Points</td>
</tr>
<tr>
<td>Project not identified</td>
<td>0 Points</td>
</tr>
<tr>
<td>Management Capacity</td>
<td>15 Points Possible</td>
</tr>
<tr>
<td>No prior or current CDBG contracts with GLO (proposed grant management plan)</td>
<td>15 Points</td>
</tr>
<tr>
<td>Past performance on contract(s) (completed on schedule)</td>
<td>15 Points</td>
</tr>
<tr>
<td>Performance on open contract(s) (on schedule)</td>
<td>15 Points</td>
</tr>
<tr>
<td>Plan for maintaining or improving grant management</td>
<td>5 Points</td>
</tr>
<tr>
<td>Contract(s) out of compliance</td>
<td>0 Points</td>
</tr>
<tr>
<td>Project Impact</td>
<td>25 Points Possible</td>
</tr>
<tr>
<td>Cost per persons benefiting</td>
<td>15 Points</td>
</tr>
<tr>
<td>Percentage of persons benefiting within jurisdiction(s)</td>
<td>10 Points</td>
</tr>
<tr>
<td>Leverage</td>
<td>5 Points Possible</td>
</tr>
<tr>
<td>Non-CDBG Leverage (a minimum value of 1% of the CDBG-MIT funds requested)</td>
<td>5 Points</td>
</tr>
<tr>
<td>Tie-breaker: Poverty Rate</td>
<td></td>
</tr>
</tbody>
</table>

*More details on scoring criteria will be available in the application guidelines.*
4.4.1.10 National Objectives: UNM, LMI, low/mod buyout

4.4.1.11 (LMB), and low/mod incentive; at least fifty (50) percent of funds must benefit LMI persons.

4.4.1.12 AFFH Review:

All proposed projects will undergo AFFH review by the GLO before approval. Such review will include assessments of (1) a proposed project’s area demography, (2) socioeconomic characteristics, (3) housing configuration and needs, (4) educational, transportation, and health care opportunities, (5) environmental hazards or concerns, and (6) all other factors material to the AFFH determination. Applications should show that projects are likely to lessen area racial, ethnic, and low-income concentrations, and/or promote affordable housing in low-poverty, nonminority areas in response to natural hazard-related impacts.

4.4.1.13 Timeline: The proposed program start date is one month after HUD’s approval of this Action Plan. The proposed end date is 4 years from the start date of the program.
4.4.2  2016 FLOODS STATE MITIGATION COMPETITION

The GLO will conduct a mitigation competition to address risks in the 2016 Floods HUD MID and State MID areas. Eligible applicants will include units of local government (cities and counties), Indian Tribes, and Councils of Governments. Entities may coordinate activities and submit a joint project that crosses jurisdictional boundaries. Each applicant may submit a total of 2 applications, whether the applying as the lone applicant or jointly with another jurisdiction(s). Each application must consist of one project. Depending on demand, no applicant will be awarded for their second application until all successful eligible applicants have been awarded funding at least once. If an applicant is eligible for multiple competitions, the same project(s) cannot be submitted in each competition. If a project is a phase of a larger project, the phase of the project submitted must be viable as a stand-alone project. Applicants are encouraged to incorporate nature-based solutions, including natural or green infrastructure, into their proposed projects.

The GLO reserves the option to delay award(s) to ensure that at least fifty (50) percent of funds benefit LMI persons and at least fifty (50) percent of funds address identified risks in the 2016 Floods HUD MID areas (counties).

4.4.2.1  Connection to Identified Risk:

As outlined in Mitigation Needs Assessment, severe coastal/riverine flooding, storms, and tornadoes are among the top risks to which Texas has the greatest exposure. Each proposed project must mitigate against one of these identified risks.

4.4.2.2  Allocation Amount: $147,680,760

i.  At least fifty (50) percent of funds must address identified risks in the 2016 Floods HUD MID areas (counties);

ii. Up to fifty (50) percent of funds may address identified risks in the 2016 Floods State MID counties;

4.4.2.3  Award Amount:

i. Maximum Amount: $10,000,000

ii. Minimum Amount: $3,000,000
4.4.2.4 Eligible Applicants: Units of local government (cities and counties), Indian Tribes and Councils of Governments

4.4.2.5 Eligible Activities: All activities allowed under CDBG-MIT; HCDA Section 105(a) (1-5), 105(a) (7-9), and 105(a)(11), including but not limited to:

i. Flood control and drainage improvements, including the construction or rehabilitation of stormwater management system;

ii. Infrastructure improvements (such as water and sewer facilities, streets, provision of generators, removal of debris, bridges, etc.);

iii. Natural or green infrastructure;

iv. Communications infrastructure;

v. Public facilities;

vi. Buyouts or Acquisition with or without relocation assistance, down payment assistance, housing incentives, and demolition;

vii. Activities designed to relocate families outside of floodplains;

viii. Public service within the 15 percent cap (e.g., housing counseling, legal counseling, job training, mental health, and general health services);

ix. FEMA Hazard Mitigation Grant Program (HMGP) cost share for CDBG-MIT eligible project;

x. Economic development (assistance to businesses for the installation of disaster mitigation improvements and technologies; financing to support the development of technologies, systems and other measures to mitigate future disaster impacts; “hardening” of commercial areas and facilities; and financing critical infrastructure sectors to allow continued commercial operations during and after disasters); and

xi. Nonresidential structures must be elevated to the standards described in this paragraph or floodproofed, in accordance with FEMA floodproofing standards at 44 CFR 60.3(c)(3)(ii) or successor standard, up to at least two feet above the 100-year (or 1 percent annual chance) floodplain. All Critical Actions, as defined at 24 CFR 55.2(b)(3), within the 500-year (or 0.2 percent annual chance) floodplain must be elevated or floodproofed (in accordance with the FEMA standards) to the higher of the 500-year floodplain elevation or 3 feet above the 100-year floodplain elevation. If the 500-year floodplain or elevation is unavailable, and the Critical Action is in the 100-year floodplain, then the structure must be elevated or floodproofed at least 3 feet above the 100-year floodplain elevation. Critical Actions are defined as an “activity for which even a slight chance of flooding would be too great, because such flooding might result in loss of life, injury to
persons or damage to property.’’ For example, Critical Actions include hospitals, nursing homes, police stations, fire stations and principal utility lines.

4.4.2.6 Ineligible Activities

i. Emergency response services. Emergency response services shall mean those services that are carried out in the immediate response to a disaster or other emergency in order to limit the loss of life and damage to assets by state and local governmental and nongovernmental emergency public safety, fire, law enforcement, emergency response, emergency medical (including hospital emergency facilities), and related personnel, agencies, and authorities;

ii. CDBG-MIT funds may not be used to enlarge a dam or levee beyond the original footprint of the structure that existed prior to the disaster event. CDBG-MIT funds for levees and dams are required to:
   a. Register and maintain entries regarding such structures with the USACE National Levee Database or National Inventory of Dams;
   b. Ensure that the structure is admitted in the USACE PL 84–99 Rehabilitation Program (Rehabilitation Assistance for Non-Federal Flood Control Projects);
   c. Ensure the structure is accredited under the FEMA NFIP; and
   d. Maintain file documentation demonstrating a risk assessment prior to funding the flood control structure and documentation that the investment includes risk reduction measures.

iii. Funds may not be used to assist a privately owned utility for any purpose. A private utility, also referred to as an investor-owned utility, is owned by private investors and is for-profit as opposed to being owned by a public trust or agency (e.g., a coop or municipally owned utility);

iv. Buildings and facilities used for the general conduct of government (e.g., city halls, courthouses, and emergency operation centers);

v. By law, (codified in the HCD Act as a note to 105(a)), the amount of CDBG-MIT funds that may be contributed to a USACE project is $250,000 or less;

vi. Section 582 of the National Flood Insurance Reform Act of 1994, as amended, (42 U.S.C. 5154a) prohibits flood disaster assistance in certain circumstances. In general, it provides that no federal disaster relief assistance made available in a flood disaster area may be used to make a payment (including any loan assistance payment) to a person for ‘‘repair, replacement, or restoration’’ for damage to any personal, residential, or commercial property if that person at any time has received federal flood disaster assistance that was conditioned on the person first having
obtained flood insurance under applicable federal law and the person has subsequently failed to obtain and maintain flood insurance as required under applicable federal law on such property. No disaster assistance may be provided for the repair, replacement, or restoration of a property to a person who has failed to meet this requirement;

vii. If the property is purchased through the use of eminent domain, the ultimate use of that property may not benefit a particular private party and must be for a public use; eminent domain can be used for public use, but public use shall not be construed to include economic development that primarily benefits private entities; and

viii. Incentive payments to households that move to disaster-impacted floodplains.

4.4.2.7 Project Eligibility:

i. Meets the definition of mitigation activities;

ii. Addresses identified current and future risks; mitigation related to severe coastal and riverine flooding, storms, tornadoes

iii. Meets the definition of a CDBG-eligible activity under title I of HCDA or otherwise pursuant to a waiver or alternative requirement;

iv. Meets a CDBG national objective;

v. Includes a plan for the long-term funding and management of the operations and maintenance of the project;

vi. Cost verification controls must be in place to assure that construction costs are reasonable and consistent with market costs at the time and place of construction.

4.4.2.8 Program Guidelines for Residential Buyout or Acquisition Activities (Only):

Each subrecipient will develop guidelines in accordance with CDBG-MIT requirements and regulations to set maximum assistance amounts, target area locations, Disaster Risk Reduction Area, and additional eligibility requirements. Guidelines must be posted for public comment before use. The GLO must approve all guidelines. Subrecipients are required to develop and follow a RARAP. With respect to the buyout of properties, an “intended, planned, or designated project area,” as referenced at 49 CFR24.101(b)(1)(ii), shall be an area for which a clearly defined end use has been determined at the time that the property is acquired, in which all or substantially all of the properties within the area must be acquired within an established time period as determined by the grantee or acquiring entity for the project to move forward. Subrecipients may adopt program guidelines used for the local buyout and acquisition program under administered under the State of Texas Plan for Disaster Recovery.

In a Disaster Risk Reduction Area:
i. The hazard must have been caused or exacerbated by the Presidentially declared disaster for which the grantee received its CDBG-MIT allocation;

ii. The hazard must be a predictable environmental threat to the safety and well-being of program beneficiaries, as evidenced by the best available data (e.g., FEMA RL Data) and science; and

iii. The Disaster Risk Reduction Area must be clearly delineated so that HUD and the public may easily determine which properties are located within the designated area. The distinction between buyouts and other types of acquisitions is important, because subrecipient may only redevelop an acquired property if the property is not acquired through a buyout program (i.e., the purpose of acquisition was something other than risk reduction). When properties are not acquired through a buyout program, the purchase price must be consistent with applicable uniform cost principles (and the pre-disaster FMV may not be used)

iv. In carrying out acquisition activities, subrecipient must ensure they are in compliance with their long-term redevelopment and FEMA Approved Hazard Mitigation plans.

4.4.2.9 Selection Criteria:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Maximum Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>County Composite Disaster Index</td>
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<td>Rank 5</td>
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<tr>
<td>LMI National Objective</td>
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<td>Project meets LMI national objective</td>
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<td>Project Identified in Local Adopted Plan</td>
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<td>No prior or current CDBG contracts with GLO (proposed grant management plan)</td>
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<td>Percentage of persons benefiting within jurisdiction</td>
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</tr>
<tr>
<td>Leverage</td>
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<td>Non-CDBG Leverage (a minimum value of 1% of the CDBG-MIT funds requested)</td>
<td>5 Points</td>
</tr>
<tr>
<td>Tie-breaker: Poverty Rate</td>
<td></td>
</tr>
</tbody>
</table>

*More details on scoring criteria will be available in the application guidelines.*

4.4.2.10 **National Objectives:** UNM, LMI, low/mod buyout (LMB), and low/mod incentive; at least fifty (50) percent of funds must benefit LMI persons.

4.4.2.11 **AFFH Review:**

All proposed projects will undergo AFFH review by the GLO before approval. Such review will include assessments of (1) a proposed project’s area demography, (2) socioeconomic characteristics, (3) housing configuration and needs, (4) educational, transportation, and health
care opportunities, (5) environmental hazards or concerns, and (6) all other factors material to the AFFH determination. Applications should show that projects are likely to lessen area racial, ethnic, and low-income concentrations, and/or promote affordable housing in low-poverty, nonminority areas in response to natural hazard-related impacts.

4.4.2.12 *Timeline:* The proposed program start date is 1 month after HUD’s approval of this Action Plan. The proposed end date is 4 years from the start date of the program.
4.4.3 Hurricane Harvey State Mitigation Competition

The GLO will conduct a mitigation competition to address risks in the Hurricane Harvey HUD MID and State MID areas. Entities may coordinate activities and submit a joint project that crosses jurisdictional boundaries. Each applicant may submit a total of 3 applications, whether they are applying as the lone applicant or jointly with another jurisdiction(s). Each application must consist of one project. Depending on demand, no applicant will be awarded for their subsequent application until all successful eligible applicants have been awarded funding at least once. If an applicant is eligible for multiple MIT-program competitions (e.g., 2015 or 2016 Competitions), the same project(s) cannot be submitted in each competition. If a project is a phase of a larger project, the phase of the project submitted must be viable as a stand-alone project. Applicants are encouraged to incorporate nature-based solutions, including natural or green infrastructure, into their proposed projects.

The competition may be comprised of multiple distinct rounds wherein applicants will submit a proposed project for each round that will be scored against the other submittals from that round.

The GLO reserves the option to delay award(s) to ensure that at least fifty (50) percent of funds benefit LMI persons and at least fifty (50) percent of funds address identified risks in the Hurricane Harvey HUD MID areas (counties and zip codes).

4.4.3.1 Connection to Identified Risk:

As outlined in Mitigation Needs Assessment, hurricanes/tropical storms/tropical depressions, and severe coastal/riverine flooding are the top two severe risks to which Texas has the greatest exposure. Each proposed project must mitigate against one of these identified risks.

4.4.3.2 Covered Projects:

Defined as an infrastructure project having a total project cost of $100 million or more, with at least $50 million of CDBG funds, regardless of source (CDBG-DR, CDBG-MIT, or CDBG). When a Covered Project is proposed, the action plan or substantial amendment must include a description of the project and the information required for other CDBG-MIT activities (how it meets the definition of a mitigation activity, consistency with the Mitigation Needs Assessment provided in the grantee’s action plan, eligibility under section 105(a) of the HCDA or a waiver or alternative requirement, and national objective, including additional criteria for mitigation activities). Additionally, the action plan must describe how the Covered Project meets additional criteria for national objectives for Covered Projects including: consistency with other mitigation activities in the same MID area; demonstrated long-term efficacy and sustainability of the project including its operations and maintenance; and a demonstration that the benefits of the Covered Project outweigh the costs. There may be a delay in award of any Covered Project to add project details in a subsequent substantial amendment.
4.4.3.3 Allocation Amount: $2,144,776,720

i. At least fifty (50) percent of funds must address identified risks in the Hurricane Harvey HUD MID areas (counties and zip codes);

ii. Up to fifty (50) percent of funds may address identified risks in the Hurricane Harvey State MID counties; and

iii. Additional areas within counties not explicitly cited as eligible may also become locations of Hurricane Harvey CDBG-MIT funded activities if it can be demonstrated how the expenditure of CDBG-MIT funds in that area will measurably mitigate risks identified within an eligible area (e.g., upstream water retention projects to reduce downstream flooding in an eligible area). Applicants may come from outside of the Hurricane Harvey HUD MID and State MID areas but must enter into an interlocal agreement or memorandum of understanding with a Hurricane Harvey HUD MID or State MID governmental entity representing an area that the project measurably mitigates.

4.4.3.4 Award Amount:

i. Maximum Project Amount: $100,000,000

ii. Minimum Project Amount: $5,000,000

4.4.3.5 Eligible Applicants:

i. Units of local government (cities and counties);

ii. Indian tribes;

iii. Councils of governments;

iv. State agencies;

v. Service districts including, but not limited to:
   a. municipal utility districts;
   b. water control and improvement districts;
   c. special utility districts;
   d. flood and drainage districts; and
   e. navigation districts.

vi. Port authorities; and

vii. River authorities.
4.4.3.6 Eligible Activities: All activities allowed under CDBG-MIT; HCDA Section 105(a) (1-5), 105(a) (7-9), and 105(a)(11), including but not limited to:

i. Flood control and drainage improvements, including the construction or rehabilitation of stormwater management system;

ii. Infrastructure improvements (such as water and sewer facilities, streets, provision of generators, removal of debris, bridges, etc.);

iii. Natural or green infrastructure;

iv. Communications infrastructure;

v. Public Facilities;

vi. Buyouts or Acquisition with or without relocation assistance, down payment assistance, housing incentives, and demolition;

vii. Housing incentives;

viii. Activities designed to relocate families outside of floodplains;

ix. Public service within the 15 percent cap (e.g., housing counseling, legal counseling, job training, mental health, and general health services);

x. FEMA Hazard Mitigation Grant Program (HMGP) cost share for CDBG-MIT eligible project;

xi. Economic development (assistance to businesses for the installation of disaster mitigation improvements and technologies; financing to support the development of technologies, systems and other measures to mitigate future disaster impacts; ‘‘hardening’’ of commercial areas and facilities; and financing critical infrastructure sectors to allow continued commercial operations during and after disasters); and

xii. Nonresidential structures must be elevated to the standards described in this paragraph or floodproofed, in accordance with FEMA floodproofing standards at 44 CFR 60.3(c)(3)(ii) or successor standard, up to at least two feet above the 100-year (or 1 percent annual chance) floodplain. All Critical Actions, as defined at 24 CFR 55.2(b)(3), within the 500-year (or 0.2 percent annual chance) floodplain must be elevated or floodproofed (in accordance with the FEMA standards) to the higher of the 500-year floodplain elevation or 3 feet above the 100-year floodplain elevation. If the 500-year floodplain or elevation is unavailable, and the Critical Action is in the 100-year floodplain, then the structure must be elevated or floodproofed at least 3 feet above the 100-year floodplain elevation. Critical Actions are defined as an ‘‘activity for which even a slight chance of flooding would be too great, because such flooding might result in loss of life, injury to
persons or damage to property.’’ For example, Critical Actions include hospitals, nursing homes, police stations, fire stations and principal utility lines.

4.4.3.7 *Ineligible Activities*

i. Emergency response services. Emergency response services shall mean those services that are carried out in the immediate response to a disaster or other emergency in order to limit the loss of life and damage to assets by state and local governmental and nongovernmental emergency public safety, fire, law enforcement, emergency response, emergency medical (including hospital emergency facilities), and related personnel, agencies, and authorities;

ii. CDBG-MIT funds may not be used to enlarge a dam or levee beyond the original footprint of the structure that existed prior to the disaster event. CDBG-MIT funds for levees and dams are required to:
   a. Register and maintain entries regarding such structures with the USACE National Levee Database or National Inventory of Dams;
   b. Ensure that the structure is admitted in the USACE PL 84–99 Rehabilitation Program (Rehabilitation Assistance for Non-Federal Flood Control Projects);
   c. Ensure the structure is accredited under the FEMA NFIP; and
   d. Maintain file documentation demonstrating a risk assessment prior to funding the flood control structure and documentation that the investment includes risk reduction measures.

iii. Funds may not be used to assist a privately owned utility for any purpose. A private utility, also referred to as an investor-owned utility, is owned by private investors and is for-profit as opposed to being owned by a public trust or agency (e.g., a coop or municipally owned utility);

iv. Buildings and facilities used for the general conduct of government (e.g., city halls, courthouses, and emergency operation centers);

v. By law, (codified in the HCD Act as a note to 105(a)), the amount of CDBG-MIT funds that may be contributed to a USACE project is $250,000 or less;

vi. Section 582 of the National Flood Insurance Reform Act of 1994, as amended, (42 U.S.C. 5154a) prohibits flood disaster assistance in certain circumstances. In general, it provides that no federal disaster relief assistance made available in a flood disaster area may be used to make a payment (including any loan assistance payment) to a person for ‘‘repair, replacement, or restoration’’ for damage to any personal, residential, or commercial property if that person at any time has received federal flood disaster assistance that was conditioned on the person first having
obtained flood insurance under applicable federal law and the person has subsequently failed to obtain and maintain flood insurance as required under applicable federal law on such property. No disaster assistance may be provided for the repair, replacement, or restoration of a property to a person who has failed to meet this requirement;

vii. Funding shall not be used to reimburse homeowners, businesses or entities (other than grantees, local governments, and subrecipients described above) for mitigation activities completed prior to the applicability date of the federal register notice;

viii. If the property is purchased through the use of eminent domain, the ultimate use of that property may not benefit a particular private party and must be for a public use; eminent domain can be used for public use, but public use shall not be construed to include economic development that primarily benefits private entities; and

ix. Incentive payments to households that move to disaster-impacted floodplains.

4.4.3.8 Project Eligibility:

i. Meets the definition of mitigation activities;

ii. Addresses identified current and future risks; mitigation related to hurricanes, tropical storms, and depressions, and severe coastal/riverine flooding;

iii. Meets the definition of a CDBG-eligible activity under title I of HCDA or otherwise pursuant to a waiver or alternative requirement;

iv. Meets a CDBG national objective;

v. Includes a plan for the long-term funding and management of the operations and maintenance of the project; and

vi. Cost verification controls must be in place to assure that construction costs are reasonable and consistent with market costs at the time and place of construction.

4.4.3.9 Program Guidelines for Residential Buyout or Acquisition Activities (Only):

Each subrecipient will develop guidelines in accordance with CDBG-MIT requirements and regulations to set maximum assistance amounts, target area locations, Disaster Risk Reduction Area, and additional eligibility requirements. Guidelines must be posted for public comment before use. The GLO must approve all guidelines. Subrecipients are required to develop and follow a RARAP. Subrecipients may adopt program guidelines used for the local buyout and acquisition program under administered under the State of Texas Plan for Disaster Recovery: Hurricane Harvey for $5.676 billion in CDBG-DR funding. With respect to the buyout of properties, an “intended, planned, or designated project area,” as referenced at 49 CFR24.101(b)(1)(ii), shall be an area for which a clearly defined end use has been determined at the time that the property is acquired, in which all or substantially all of the properties within the area must be acquired within
an established time period as determined by the grantee or acquiring entity for the project to move forward.

In a Disaster Risk Reduction Area:

i. The hazard must have been caused or exacerbated by the Presidentially declared disaster for which the grantee received its CDBG-MIT allocation;

ii. The hazard must be a predictable environmental threat to the safety and well-being of program beneficiaries, as evidenced by the best available data (e.g., FEMA RL Data) and science;

iii. The Disaster Risk Reduction Area must be clearly delineated so that HUD and the public may easily determine which properties are located within the designated area. The distinction between buyouts and other types of acquisitions is important, because subrecipient may only redevelop an acquired property if the property is not acquired through a buyout program (i.e., the purpose of acquisition was something other than risk reduction). When properties are not acquired through a buyout program, the purchase price must be consistent with applicable uniform cost principles (and the pre-disaster FMV may not be used); and

iv. In carrying out acquisition activities, subrecipient must ensure they are in compliance with their long-term redevelopment and FEMA-approved Hazard Mitigation plans.

4.4.3.10 Selection Criteria:

**Table 4-4: Hurricane Harvey Competition Scoring Criteria**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Maximum Points</th>
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<tbody>
<tr>
<td>County Composite Disaster Index</td>
<td>10 Points Possible</td>
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<tr>
<td><strong>Rank 5</strong></td>
<td>10 Points</td>
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<td><strong>Rank 4</strong></td>
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<tr>
<td><strong>Rank 1</strong></td>
<td>0 Points</td>
</tr>
<tr>
<td>Social Vulnerability Index</td>
<td>10 Points Possible</td>
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<td><strong>Rank 5</strong></td>
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<td>Criteria</td>
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<td><strong>Rank 1</strong></td>
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<td>Per Capita Market Value</td>
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<td>Tie-Breaker: Poverty Rate</td>
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*More details on scoring criteria will be available in the application guidelines.*
4.4.3.11 National Objectives: UNM, LMI, low/mod buyout (LMB), and low/mod incentive; at least fifty (50) percent of funds must benefit LMI persons.

4.4.3.12 AFFH Review:

All proposed projects will undergo AFFH review by the GLO before approval. Such review will include assessments of (1) a proposed project’s area demography, (2) socioeconomic characteristics, (3) housing configuration and needs, (4) educational, transportation, and health care opportunities, (5) environmental hazards or concerns, and (6) all other factors material to the AFFH determination. Applications should show that projects are likely to lessen area racial, ethnic, and low-income concentrations, and/or promote affordable housing in low-poverty, nonminority areas in response to natural hazard-related impacts.

4.4.3.13 Timeline: The proposed program start date is 1 month after HUD’s approval of this Action Plan. The proposed end date is 10 years from the start date of the program.
4.4.4 REGIONAL MITIGATION PROGRAM (COG MODs)

Under the Regional Mitigation program (COG MODs), each COG region impacted by Hurricane Harvey has been allocated funds. Each COG will develop a local MOD for allocation of funds to local units of government and Indian tribes. The GLO encourages the prioritization of regional investments with regional impacts in risk reduction for hurricanes, tropical storms and depressions, flooding, wind and other hazards to develop disaster-resistant infrastructure; upgrading of water, sewer, solid waste, communications, energy, transportation, health and medical, and other public infrastructure to address specific, identified risks; financing multi-use infrastructure; and green or natural mitigation infrastructure development.

Due to the nature of this activity, this program will be administered by the GLO, with local units of governments (cities and counties) as subrecipients.

The MOD developed through the COGs allows for the opportunity for local quantifiable factors for the distribution of funds. Given the size of the impacted area, how disaster impact each region differently, and the risks in each region, local control through a regional approach is vital for a comprehensive mitigation approach.

The GLO will provide training, written guidance, and required forms to the impacted COGs for the development of the local MODs. Each COG will be provided data sets produced by the GLO to inform the MOD. Variances from these data sets will be allowable upon approval from the GLO. Data sets provided by the GLO may contain information at the county, city, and/or ZIP code level.

Local MOD guidelines will require that each COG follow a citizen participation process. Each COG is required to publish notice of any public hearings prior to holding the hearings. Notices shall be published in all newspapers of record for all eligible counties in the region, posted on the COG website, and provided to all eligible cities, counties, and Indian tribes in the region. Hearings must fully comply with the Texas Open Meetings Act.

The GLO will review and provide preliminary approval to each MOD prior to its posting by the COG for public comment. The MOD shall be posted on the COG’s website for public comment prior to formal submission to the GLO. The public comment period shall be no less than 15 days. Each comment shall be responded to and any changes made to the MOD shall be noted in the response section for GLO review. The GLO will set the due date for completion of the MODs.

Upon completion, the GLO will review and approve MOD submissions by each COG. All MODs will be wholly reviewed to ensure that each COG provides a detailed description of the methodology used to allocate and prioritize funds within their regions. If the MOD is not approved, the GLO will provide feedback to the COG, including specific issues.
The GLO used census data, the composite disaster index (CDI), SoVI, and property tax data from the state comptroller’s office to distribute funds to the impacted COG regions. The MOD distribution factors establish a balance between the risk faced by communities from natural hazards, the vulnerability of the population in eligible communities, the financial capacity to recover, and the relative population. The methodology for the distribution and calculation is located the Appendix F.

4.4.4.1 Connection to Identify Risk:

As outlined in Mitigation Needs Assessment, hurricanes/tropical storms/tropical depressions, and severe coastal/riverine flooding are the top two severe risks Texas experiences. Each proposed project must mitigate against one of these identified risks.

4.4.4.2 Allocation Amount: $500,000,000

i. At least fifty (50) percent of funds must address identified risks in the Hurricane Harvey HUD MID areas (counties and HUD MID zip codes counties);

ii. Up to fifty (50) percent of funds may address identified risks in the Hurricane Harvey State MID areas (counties); and

iii. Additional areas within counties not explicitly cited as eligible may also become locations of CDBG-MIT funded activities if it can be demonstrated how the expenditure of CDBG-MIT funds in that area will measurably mitigate risks identified within an eligible area (e.g., upstream water retention projects to reduce downstream flooding in an eligible area).

4.4.4.3 Maximum Award Amount:

The maximum award will be determined by the local MOD.

4.4.4.4 Eligible Entities: Units of local government (cities and counties) and Indian Tribes

4.4.4.5 Local MOD Requirements:

i. Each COG will facilitate the MOD process with GLO support;

ii. Establish objective criteria for allocation of funds to eligible entities or activities;

iii. Citizen participation process;

iv. Develop a citizen participation plan;

v. GLO will review and provide preliminary approval to MOD prior to COG’s public comment period;

vi. Conduct a minimum of two (2) public hearings prior to finalizing the MOD;
vii. One (1) public hearing shall be a “Public Planning Meeting;”

viii. Ensure a public comment period of at least 15 days;

ix. Implement a minimum of $3,000,000 in CDGB-MIT funds to any local entity receiving funding through the MOD;

x. Ensure a minimum percentage of funds are allocated to Hurricane Harvey HUD MID Counties and ZIP codes;

xi. Facilitate local prioritization through the MOD;

xii. Connection to regional mitigation needs assessment and risk;

xiii. Identify set asides for regional mitigation priorities and regional projects;

xiv. Identify Covered Project(s);

xv. A plan to meet the 50 percent LMI benefit requirement; and

xvi. Establish any additional parameters for eligibility beyond what is required by HUD or the GLO.

4.4.4.6 Eligible Activities: All activities allowed under CDBG-MIT; HCDA Section 105(a) (1-5), 105(a) (7-9), and 105(a)(11), including but not limited to:

i. Flood control and drainage improvements, including the construction or rehabilitation of stormwater management system;

ii. Infrastructure improvements (such as water and sewer facilities, streets, provision of generators, removal of debris, bridges, etc.);

iii. Natural or green infrastructure;

iv. Communications infrastructure;

v. Public facilities;

vi. Buyouts or Acquisition with or without relocation assistance, down payment assistance, housing incentives, and demolition;

vii. Activities designed to relocate families outside of floodplains;

viii. Public service within the 15 percent cap (e.g., housing counseling, legal counseling, job training, mental health, and general health services);

ix. FEMA Hazard Mitigation Grant Program (HMGP) cost share for CDBG-MIT eligible project;

x. Economic development (assistance to businesses for the installation of disaster mitigation improvements and technologies; financing to support the development of technologies, systems and other measures to mitigate future disaster impacts;
‘‘hardening’’ of commercial areas and facilities; and financing critical infrastructure sectors to allow continued commercial operations during and after disasters); and

xi. Nonresidential structures must be elevated to the standards described in this paragraph or floodproofed, in accordance with FEMA floodproofing standards at 44 CFR 60.3(c)(3)(ii) or successor standard, up to at least two feet above the 100-year (or 1 percent annual chance) floodplain. All Critical Actions, as defined at 24 CFR 55.2(b)(3), within the 500-year (or 0.2 percent annual chance) floodplain must be elevated or floodproofed (in accordance with the FEMA standards) to the higher of the 500-year floodplain elevation or 3 feet above the 100-year floodplain elevation. If the 500-year floodplain or elevation is unavailable, and the Critical Action is in the 100-year floodplain, then the structure must be elevated or floodproofed at least 3 feet above the 100-year floodplain elevation. Critical Actions are defined as an ‘‘activity for which even a slight chance of flooding would be too great, because such flooding might result in loss of life, injury to persons or damage to property.’’ For example, Critical Actions include hospitals, nursing homes, police stations, fire stations and principal utility lines.

4.4.4.7 Ineligible Activities:

i. Emergency response services. Emergency response services shall mean those services that are carried out in the immediate response to a disaster or other emergency in order to limit the loss of life and damage to assets by state and local governmental and nongovernmental emergency public safety, fire, law enforcement, emergency response, emergency medical (including hospital emergency facilities), and related personnel, agencies, and authorities;

ii. CDBG-MIT funds may not be used to enlarge a dam or levee beyond the original footprint of the structure that existed prior to the disaster event. CDBG-MIT funds for levees and dams are required to:

   a. Register and maintain entries regarding such structures with the USACE National Levee Database or National Inventory of Dams;

   b. Ensure that the structure is admitted in the USACE PL 84–99 Rehabilitation Program (Rehabilitation Assistance for Non-Federal Flood Control Projects);

   c. Ensure the structure is accredited under the FEMA NFIP; and

   d. Maintain file documentation demonstrating a risk assessment prior to funding the flood control structure and documentation that the investment includes risk reduction measures.
iii. Funds may not be used to assist a privately owned utility for any purpose. A private utility, also referred to as an investor-owned utility, is owned by private investors and is for-profit as opposed to being owned by a public trust or agency (e.g., a coop or municipally owned utility);

iv. Buildings and facilities used for the general conduct of government (e.g., city halls, courthouses, and emergency operation centers);

v. By law, (codified in the HCD Act as a note to 105(a)), the amount of CDBG-MIT funds that may be contributed to a USACE project is $250,000 or less;

vi. Section 582 of the National Flood Insurance Reform Act of 1994, as amended, (42 U.S.C. 5154a) prohibits flood disaster assistance in certain circumstances. In general, it provides that no federal disaster relief assistance made available in a flood disaster area may be used to make a payment (including any loan assistance payment) to a person for “repair, replacement, or restoration” for damage to any personal, residential, or commercial property if that person at any time has received federal flood disaster assistance that was conditioned on the person first having obtained flood insurance under applicable federal law and the person has subsequently failed to obtain and maintain flood insurance as required under applicable federal law on such property. No disaster assistance may be provided for the repair, replacement, or restoration of a property to a person who has failed to meet this requirement;

vii. If the property is purchased through the use of eminent domain, the ultimate use of that property may not benefit a particular private party and must be for a public use; eminent domain can be used for public use, but public use shall not be construed to include economic development that primarily benefits private entities; and

viii. Incentive payments to households that move to disaster-impacted floodplains.

4.4.4.8 *Program Guidelines for Residential Buyout or Acquisition Activities (Only):*

Each subrecipient will develop guidelines in accordance with CDBG-MIT requirements and regulations to set maximum assistance amounts, target area locations, Disaster Risk Reduction Area, and additional eligibility requirements. Guidelines must be posted for public comment before use. The GLO must approve all guidelines. Subrecipients are required to develop and follow a RARAP. Subrecipients may adopt program guidelines used for the local buyout and acquisition program under administered under the State of Texas Plan for Disaster Recovery: Hurricane Harvey for $5.676 billion in CDBG-DR funding. With respect to the buyout of properties, an “intended, planned, or designated project area,” as referenced at 49 CFR 24.101(b)(1)(ii), shall be an area for which a clearly defined end use has been determined at the time that the property is acquired, in which all or substantially all of the properties within the area must be acquired within
an established time period as determined by the grantee or acquiring entity for the project to move forward.

To conduct a buyout in a Disaster Risk Reduction Area, the subrecipient must establish criteria in its policies and procedures to designate the area subject to the buyout, pursuant to the following requirements:

i. The hazard must have been caused or exacerbated by the Presidentially declared disaster for which the grantee received its CDBG-MIT allocation;

ii. The hazard must be a predictable environmental threat to the safety and well-being of program beneficiaries, as evidenced by the best available data (e.g., FEMA RL Data) and science;

iii. The Disaster Risk Reduction Area must be clearly delineated so that HUD and the public may easily determine which properties are located within the designated area. The distinction between buyouts and other types of acquisitions is important, because subrecipient may only redevelop an acquired property if the property is not acquired through a buyout program (i.e., the purpose of acquisition was something other than risk reduction); and

iv. In carrying out acquisition activities, subrecipient must ensure they are in compliance with their long-term redevelopment plans.

4.4.4.9 Project Eligibility:

i. Meets the definition of mitigation activities;

ii. Addresses the current and future risks identified; Mitigation related to Hurricanes, Tropical Storms and Tropical Depressions, and Severe Coastal and Riverine Flooding;

iii. Meets the definition of a CDBG-eligible activity under title I of HCDA or otherwise pursuant to a waiver or alternative requirement;

iv. Meets a CDBG national objective;

v. Includes a plan for the long-term funding and management of the operations and maintenance of the project; and

vi. Cost verification controls must be in place to assure that construction costs are reasonable and consistent with market costs at the time and place of construction.
4.4.4.10 National Objectives: UNM, LMI, low/mod buyout (LMB), and low/mod incentive; at least fifty (50) percent of funds must benefit LMI persons.

4.4.4.11 AFFH Review:

All proposed projects will undergo AFFH review by the GLO before approval. Such review will include assessments of (1) a proposed project’s area demography, (2) socioeconomic characteristics, (3) housing configuration and needs, (4) educational, transportation, and health care opportunities, (5) environmental hazards or concerns, and (6) all other factors material to the AFFH determination. Applications should show that projects are likely to lessen area racial, ethnic, and low-income concentrations, and/or promote affordable housing in low-poverty, nonminority areas in response to natural hazard-related impacts.

4.4.4.12 Timeline:

The proposed program start date is 1 month after HUD’s approval of this Action Plan. The proposed end date is 6 years from the start date of the program.
4.4.5 **HAZARD MITIGATION GRANT PROGRAM (HMGP): SUPPLEMENTAL**

The Hazard Mitigation Grant Program (HMGP) is one of the three FEMA Hazard Mitigation Assistance (HMA) grant programs. HMGP is administered by the Texas Division of Emergency Management (TDEM). The HMGP supports cost-effective post-disaster projects and is the longest running mitigation program among the three FEMA grant programs. FEMA defines hazard mitigation measures as any sustainable action taken to reduce or eliminate long-term risk to people and property from future disasters. The purpose of the HMGP is to help communities implement hazard mitigation measures following a Presidential disaster declaration in areas requested by the governor. The HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act.

The state has the primary responsibility for prioritizing, selecting, and administering state and local hazard mitigation projects. *HMGP provides up to 75 percent of the eligible costs associated with hazard mitigation projects selected for funding. Selected subrecipients must contribute at least 25 percent of the total project costs, known as match or non-federal share. Eligibility to participate in the HMGP requires jurisdictions to have a FEMA-approved Local Hazard Mitigation Action Plan (LHMAP). There are a variety of other requirements as well, including current participation in the NFIP for all projects located in a mapped special flood hazard area. Projects to protect either public or private property are eligible for HMGP funding and can include the following:

- **Acquisition/demolition/elevation of flood-prone structures;**
- **Community and individual safe room programs;**
- **Retrofitting facilities (flood proofing, high wind, seismic, etc.);**
- **Small-scale structural hazard control/protection projects;**
- **Emergency generators; and**
- **Post-disaster code enforcement.**

Limited funding is also available for the following:

- **Initiative projects such as public awareness, enhanced hazard information systems, enhanced warning capabilities, etc.; and**
- **Development of state and local HMPs, including studies to enhance a community’s understanding of risk (examples: dam inundation studies, flood studies).**

Following Hurricane Harvey (DR-4332), the state of Texas received over $800 million for HMGP funds. As part of the program, a Notice of Intent (NOI) was initiated by TDEM to conduct a pre-screening on projects that may be considered. Following the NOI process, TDEM identified potential applicants and asked that HMGP applications be submitted. TDEM then reviewed the HMGP project applications and the state selected projects to fund.
This HMGP Supplemental will provide CDBG-MIT funding for HMGP projects that were unable to receive funding through the HMGP program. Each of these projects will meet the HUD definition for mitigation as well as the additional requirements of a CDBG-MIT project. Housing activities will meet and follow CDBG-MIT requirements. This program will prioritize projects that meet the low and moderate income national objective and projects that are in the Hurricane Harvey HUD MID areas. The 25 percent non-federal cost share is not required for the HMGP Supplemental.

Due to the nature of these activities and the complexities of CDBG-MIT rules and regulations, this program will be administered by the GLO with applicants as subrecipients.

Under this HMGP Supplemental, the GLO will work closely with TDEM in the selection of projects based on the criteria outlined below. Once project selections have been made, the GLO will post the list of selected projects on the recovery.texas.gov website.

Projects selected for funding will need to submit supplemental application materials to verify CDBG-MIT eligibility.

4.4.5.1 Connection to Identified Risk:

As outlined in Mitigation Needs Assessment, hurricanes/tropical storms/tropical depressions, and severe coastal/riverine flooding are the top two severe risks Texas experiences. The Hurricane Harvey HMGP funding in 2017 required communities to address risks identified in their Local Hazard Mitigation Action Plans.

4.4.5.2 Covered Projects:

Defined as an infrastructure project having a total project cost of $100 million or more, with at least $50 million of CDBG funds, regardless of source (CDBG-DR, CDBG-MIT, or CDBG). The action plan or substantial amendment must include a description of the project and the information required for other CDBG-MIT activities (how it meets the definition of a mitigation activity, consistency with the Mitigation Needs Assessment provided in the grantee’s action plan, eligibility under section 105(a) of the HCDA or a waiver or alternative requirement, and national objective, including additional criteria for mitigation activities). Additionally, the action plan must describe how the Covered Project meets additional criteria for national objectives for Covered Projects (described in V.A.13. below) including: consistency with other mitigation activities in the same MID area; demonstrated long-term efficacy and sustainability of the project including its operations and maintenance; and a demonstration that the benefits of the Covered Project outweigh the costs.
4.4.5.3 Allocation Amount: $170,000,000

i. At least fifty (50) percent of funds must address mitigation efforts in the Hurricane Harvey HUD MID areas (counties and ZIP codes); and

ii. Up to fifty (50) percent of funds may address mitigation efforts in the Hurricane Harvey State MID counties and counties minus the HUD MID ZIP codes.

4.4.5.4 Maximum Award Amount: $170,000,000

4.4.5.5 Eligible Entities: FEMA HMGP eligible applicants.

4.4.5.6 Eligible Activities: All activities allowed under CDBG-MIT; HCDA Section 105(a) (1-5), 105(a) (7-9), and 105(a)(11), 105(a) (24-25), including but not limited to:

i. Buyouts;

ii. Relocation Assistance with buyout activities;

iii. Demolition with buyout activities;

iv. Housing incentives;

v. Activities designed to relocate families outside of floodplains;

vi. Flood control and drainage improvements, including the construction or rehabilitation of stormwater management system;

vii. Infrastructure improvements (such as water and sewer facilities, streets, provision of generators, removal of debris, bridges, etc.);

viii. Natural or green infrastructure;

ix. Communications infrastructure;

x. Public facilities; and

xi. Nonresidential structures must be elevated to the standards described in this paragraph or floodproofed, in accordance with FEMA floodproofing standards at 44 CFR 60.3(c)(3)(ii) or successor standard, up to at least two feet above the 100-year (or 1 percent annual chance) floodplain. All Critical Actions, as defined at 24 CFR 55.2(b)(3), within the 500-year (or 0.2 percent annual chance) floodplain must be elevated or floodproofed (in accordance with the FEMA standards) to the higher of the 500-year floodplain elevation or 3 feet above the 100-year floodplain elevation. If the 500-year floodplain or elevation is unavailable, and the Critical Action is in the 100-year floodplain, then the structure must be elevated or floodproofed at least 3 feet above the 100-year floodplain elevation. Critical Actions are defined as an “activity for which even a slight chance of flooding would be too great, because such flooding might result in loss of life, injury to
persons or damage to property.’’ For example, Critical Actions include hospitals, nursing homes, police stations, fire stations and principal utility lines.

4.4.5.7 **Ineligible Activities:**

i. Properties that served as second homes at the time of the disaster, or following the disaster, are not eligible for rehabilitation assistance or incentives;

ii. Rehabilitation/reconstruction of homes located in the floodway;

iii. Rehabilitation/reconstruction of a house in which:
   a. The combined household income is greater than 120 percent AMI or the national median;
   b. The property was located in a floodplain at the time of the disaster; and
   c. The property owner did not maintain flood insurance on the damaged property, even when the property owner was not required to obtained and maintain such insurance.

iv. Incentive payments to households that move to disaster-impacted floodplains;

v. CDBG-MIT funds may not be used to enlarge a dam or levee beyond the original footprint of the structure that existed prior to the disaster event. CDBG-MIT funds for levees and dams are required to:
   a. Register and maintain entries regarding such structures with the USACE National Levee Database or National Inventory of Dams;
   b. Ensure that the structure is admitted in the USACE PL 84-99 Rehabilitation Program (Rehabilitation Assistance for Non-Federal Flood Control Projects);
   c. Ensure the structure is accredited under the FEMA NFIP; and
   d. Maintain file documentation demonstrating a risk assessment prior to funding the flood control structure and documentation that the investment includes risk reduction measures.

vi. Projects already funded by FEMA HMGP;

vii. Funds may not be used to assist a privately owned utility for any purpose. A private utility, also referred to as an investor-owned utility, is owned by private investors and is for-profit as opposed to being owned by a public trust or agency (e.g., a coop or municipally owned utility);

viii. Buildings and facilities used for the general conduct of government (e.g., city halls, courthouses, and emergency operation centers);
ix. By law, (codified in the HCD Act as a note to 105(a)), the amount of CDBG-DR funds that may be contributed to a USACE project is $250,000 or less;

x. Section 582 of the National Flood Insurance Reform Act of 1994, as amended, (42 U.S.C. 5154a) prohibits flood disaster assistance in certain circumstances. In general, it provides that no Federal disaster relief assistance made available in a flood disaster area may be used to make a payment (including any loan assistance payment) to a person for “repair, replacement, or restoration” for damage to any personal, residential, or commercial property if that person at any time has received federal flood disaster assistance that was conditioned on the person first having obtained flood insurance under applicable federal law and the person has subsequently failed to obtain and maintain flood insurance as required under applicable federal law on such property. No disaster assistance may be provided for the repair, replacement, or restoration of a property to a person who has failed to meet this requirement; and

xi. If the property is purchased through the use of eminent domain, the ultimate use of that property may not benefit a particular private party and must be for a public use; eminent domain can be used for public use, but public use shall not be construed to include economic development that primarily benefits private entities.

4.4.5.8 Program Requirements:

i. Project has been submitted to TDEM for HMGP funding related to Hurricane Harvey and;

ii. Be in a 2017 Hurricane Harvey CDBG-DR eligible county;

iii. Meets the definition of mitigation activities;

iv. Address the current and future risks identified in the Mitigation Needs Assessment;

v. Be CDBG-eligible activities under Title I of HCDA or otherwise pursuant to a waiver or alternative requirement;

vi. Meet a national objective;

vii. Plan for the long-term operation and maintenance; and

viii. Have cost verification controls must be in place to assure that construction costs are reasonable and consistent with market costs at the time and place of construction.

4.4.5.9 Program Guidelines for Residential Buyout (Only):

Each subrecipient will develop guidelines in accordance with CDBG-MIT requirements and regulations to set maximum assistance amounts, target area locations, Disaster Risk Reduction
Area, and additional eligibility requirements. Guidelines must be posted for public comment before use. The GLO must approve all guidelines. Subrecipients are required to develop and follow a RARAP. Subrecipients may adopt program guidelines used for the local buyout and acquisition program administered under the State of Texas Plan for Disaster Recovery: Hurricane Harvey for $5.676 billion in CDBG-DR funding.

To conduct a buyout in a Disaster Risk Reduction Area, the subrecipient must establish criteria in its policies and procedures to designate the area subject to the buyout, pursuant to the following requirements:

i. The hazard must have been caused or exacerbated by the Presidentially declared disaster for which the grantee received its CDBG-MIT allocation;

ii. The hazard must be a predictable environmental threat to the safety and well-being of program beneficiaries, as evidenced by the best available data (e.g., FEMA RL Data) and science;

iii. The Disaster Risk Reduction Area must be clearly delineated so that HUD and the public may easily determine which properties are located within the designated area. The distinction between buyouts and other types of acquisitions is important, because subrecipients may only redevelop an acquired property if the property is not acquired through a buyout program (i.e., the purpose of acquisition was something other than risk reduction); and

iv. In carrying out acquisition activities, subrecipients must ensure they are in compliance with their long-term redevelopment plans.

4.4.5.10 Selection Criteria:

i. Projects must meet the definition of mitigation activities;

ii. Priority will be given to projects that meet the low and moderate income national objective;

iii. Projects that have a Benefit Costs Analysis (BCA) of over one (1), with projects that have higher BCAs being ranked higher; and

iv. Priority will be given to applicants that did not receive HMPG funding.

4.4.5.11 National Objectives: LMI, UNM, low/mod buyout (LMB), and low/mod incentive; at least fifty (50) percent of funds must benefit LMI persons.

4.4.5.12 AFFH Review:

All proposed projects will undergo AFFH review by the GLO before approval. Such review will include assessments of (1) a proposed project’s area demography, (2) socioeconomic
characteristics, (3) housing configuration and needs, (4) educational, transportation, and health care opportunities, (5) environmental hazards or concerns, and (6) all other factors material to the AFFH determination. Applications should show that projects are likely to lessen area racial, ethnic, and low-income concentrations, and/or promote affordable housing in low-poverty, nonminority areas in response to natural hazard-related impacts.

4.4.5.13  Timeline:

The proposed program start date is 3 months after HUD’s approval of this Action Plan. The proposed end date is 4 years from the start date of the program.
4.4.6 COASTAL RESILIENCY PROGRAM

The GLO Coastal Resources division conducts ongoing coastal planning efforts through the Texas Coastal Resiliency Master Plan (Resiliency Plan) as described in Mitigation Needs Assessment. The Tier 1 projects recommended in the Resiliency Plan advance multifaceted, long-term resilience to identified coastal hazard risks through a combination of green infrastructure, gray infrastructure, and nonstructural measures. The prioritized projects in the Resiliency Plan were evaluated by regional Technical Advisory Committees comprised of coastal science researchers; state and federal natural resource agency personnel; members of public, private, and non-governmental organizations; local government representatives; and engineering and planning experts. The Resiliency Plan leverages project recommendations from other various federal, state, and local planning studies and informs federal and state funding approaches to enact long-term coastal resiliency.

4.4.6.1 Connection to Identified Risk:

As outlined in Mitigation Needs Assessment, hurricanes/tropical storms/tropical depressions, and severe coastal/riverine flooding are the top two severe weather-related hazard risks Texas experiences, with coastal erosion as an additionally identified natural-hazard risk. The Coastal Resiliency Program will specifically address mitigation measures to these risks along coastal areas of Texas. Once project selections have been made, the GLO will post the list of selected projects on the recovery.texas.gov website.

Example project types eligible to be implemented through this Coastal Resiliency Program include wetland protection and/or shoreline stabilization; beach nourishment and dune restoration; regional infrastructure improvements; land acquisitions; and oyster reef enhancements—all of which further mitigation.

4.4.6.2 Allocation Amount: $100,000,000

i. At least fifty (50) percent of funds must address identified risks in the Hurricane Harvey HUD MID areas (counties and ZIP codes); and

ii. Up to fifty (50) percent of funds may address identified risks in the Hurricane Harvey State MID counties and counties minus its HUD MID ZIP codes.

4.4.6.3 Maximum Award Amount: $60,000,000

4.4.6.4 Eligible Entities:

i. Units of local government (cities, towns, and counties);

ii. State agencies;

iii. Non-governmental organizations;
iv. Navigation districts; and
v. Port authorities.

4.4.6.5 Eligible Activities: All activities allowed under CDBG-MIT; HCDA Section 105(a) (1-5), 105(a) (7-9), and 105(a)(11), including but not limited to:

i. Flood control and drainage improvements, including the construction or rehabilitation of stormwater management system;

ii. Infrastructure improvements (such as water and sewer facilities, streets, shoreline armoring, etc.);

iii. Natural or green infrastructure;

iv. Land acquisitions and buyouts; and

v. Nonresidential structures must be elevated to the standards described in this paragraph or floodproofed, in accordance with FEMA floodproofing standards at 44 CFR 60.3(c)(3)(ii) or successor standard, up to at least two feet above the 100-year (or 1 percent annual chance) floodplain. All Critical Actions, as defined at 24 CFR 55.2(b)(3), within the 500-year (or 0.2 percent annual chance) floodplain must be elevated or floodproofed (in accordance with the FEMA standards) to the higher of the 500-year floodplain elevation or 3 feet above the 100-year floodplain elevation. If the 500-year floodplain or elevation is unavailable, and the Critical Action is in the 100-year floodplain, then the structure must be elevated or floodproofed at least 3 feet above the 100-year floodplain elevation. Critical Actions are defined as an “activity for which even a slight chance of flooding would be too great, because such flooding might result in loss of life, injury to persons or damage to property.” For example, Critical Actions include hospitals, nursing homes, police stations, fire stations and principal utility lines.

4.4.6.6 Ineligible Activities:

i. Emergency response services. Emergency response services shall mean those services that are carried out in the immediate response to a disaster or other emergency in order to limit the loss of life and damage to assets by state and local governmental and nongovernmental emergency public safety, fire, law enforcement, emergency response, emergency medical (including hospital emergency facilities), and related personnel, agencies, and authorities.

ii. CDBG-MIT funds may not be used to enlarge a dam or levee beyond the original footprint of the structure that existed prior to the disaster event. CDBG-MIT funds for levees and dams are required to:
a. Register and maintain entries regarding such structures with the USACE National Levee Database or National Inventory of Dams;

b. Ensure that the structure is admitted in the USACE PL 84–99 Rehabilitation Program (Rehabilitation Assistance for Non-Federal Flood Control Projects);

c. Ensure the structure is accredited under the FEMA NFIP; and

d. Maintain file documentation demonstrating a risk assessment prior to funding the flood control structure and documentation that the investment includes risk reduction measures.

iii. Funds may not be used to assist a privately owned utility for any purpose. A private utility, also referred to as an investor-owned utility, is owned by private investors and is for-profit as opposed to being owned by a public trust or agency (e.g., a coop or municipally owned utility).

iv. Buildings and facilities used for the general conduct of government (e.g., city halls, courthouses, and emergency operation centers) are ineligible for funding.

v. By law, (codified in the HCD Act as a note to 105(a)), the amount of CDBG-MIT funds that may be contributed to a USACE project is $250,000 or less.

vi. Section 582 of the National Flood Insurance Reform Act of 1994, as amended, (42 U.S.C. 5154a) prohibits flood disaster assistance in certain circumstances. In general, it provides that no federal disaster relief assistance made available in a flood disaster area may be used to make a payment (including any loan assistance payment) to a person for “repair, replacement, or restoration” for damage to any personal, residential, or commercial property if that person at any time has received federal flood disaster assistance that was conditioned on the person first having obtained flood insurance under applicable federal law and the person has subsequently failed to obtain and maintain flood insurance as required under applicable federal law on such property. No disaster assistance may be provided for the repair, replacement, or restoration of a property to a person who has failed to meet this requirement.

vii. If the property is purchased through the use of eminent domain, the ultimate use of that property may not benefit a particular private party and must be for a public use; eminent domain can be used for public use, but public use shall not be construed to include economic development that primarily benefits private entities.

4.4.6.7 Project Eligibility:

i. Be a Tier 1 project identified in the 2019 Texas Coastal Resiliency Master Plan;
ii. Meet the definition of mitigation activities;

iii. Address identified current and future risks;

iv. CDBG-eligible activities under title I of HCDA or otherwise pursuant to a waiver or alternative requirement;

v. Meet a national objective;

vi. Includes a plan for the long-term funding and management of the operations and maintenance of the project; and

vii. Cost verification controls must be in place to assure that construction costs are reasonable and consistent with market costs at the time and place of construction.

4.4.6.8 Selection Criteria:

i. Meet the eligibility criteria;

ii. Prioritize projects that meet the LMI national objective;

iii. Prioritize projects in HUD MID counties and zip codes; and

iv. Prioritize projects that address the protection of FEMA lifelines.

4.4.6.9 National Objectives: LMI and UNM; at least fifty (50) percent of funds must benefit LMI persons.

4.4.6.10 AFFH Review:

All proposed projects will undergo AFFH review by the GLO before approval. Such review will include assessments of (1) a proposed project’s area demography, (2) socioeconomic characteristics, (3) housing configuration and needs, (4) educational, transportation, and health care opportunities, (5) environmental hazards or concerns, and (6) all other factors material to the AFFH determination. Applications should show that projects are likely to lessen area racial, ethnic, and low-income concentrations, and/or promote affordable housing in low-poverty, nonminority areas in response to natural hazard-related impacts.

4.4.6.11 Timeline:

The proposed program start date is immediately after HUD’s approval of this Action Plan. The proposed end date is 5 years from the start date of the program.
4.4.7 HOUSING OVERRSUBSCRIPTION SUPPLEMENTAL

The Hurricane Harvey Homeowner Assistance Program (HAP) is a state-run housing program administered under the State of Texas Plan for Disaster Recovery: Hurricane Harvey for $5.676 billion in CDBG-DR funding. For additional details of this housing recovery program, please refer to the state action plan on the GLO’s recovery website. Homeowners located within the city of Houston and Harris County remain ineligible for participation in the state-run HAP.

At present, the HAP program is oversubscribed, with the number of HAP applications for assistance exceeding the available program funds needed to move forward with reconstruction of damaged homes. Consequently, HAP applicants eligible for assistance are being waitlisted until further funding becomes available. To remedy HAP fund deficiencies so that waitlisted homeowners may continue in the state’s recovery process, additional CDBG-MIT funding is being allocated.

4.4.7.1 Connection to Identified Risk:

As outlined in Mitigation Needs Assessment, hurricanes/tropical storms/tropical depressions, and severe coastal/riverine flooding are the top two severe risks to which Texas has the greatest exposure.

HAP is a housing recovery action with consequential mitigation benefit: more resilient residents and homes make for a more resilient community against the inevitable next hurricane or flooding event. As recently demonstrated in Tropical Storm Imelda, homes built and elevated under the GLO HAP program were able to withstand floodwaters that inundated communities. It is imperative that qualifying homeowners for HAP receive recovery assistance so that residential resilience is aggregated with other mitigation actions that local, county, and regional stakeholders undertake with CDBG-MIT funds, together with other funds, to form a comprehensive mitigation effort.

These CDBG-MIT funds will assist homeowners requiring elevation or storm hardening. For homes located inside the floodplain, the GLO elevates the lowest floor, including the basement, at least 2 feet above the base flood elevation or the high-water mark, whichever is higher. For homes located outside the designated floodplain, the GLO elevates homes at least 2 feet above the high-water mark. Additionally, the GLO will assist homes located in windstorm areas by ensuring the properties meet windstorm building code requirements.

Additional resilience and mitigation measures for Harvey damaged homes include International Residential Code 2012 (with windstorm provisions), green building standards and Resilient Home Construction Standards.
4.4.7.2 Allocation Amount: $400,000,000

i. Based on demand, priority will be given to Hurricane Harvey HUD MID areas with a goal of at least eighty (80) percent of funds going towards those areas.

ii. Up to twenty (20) percent of funds may address unmet need and identified risks in the Hurricane Harvey impacted counties minus their “most impacted” ZIP codes.

4.4.7.3 Maximum assistance:

i. Reconstruction with or without elevation: Local composite builder bid amount based on procured builders and the builder’s house plans based on household size.

ii. Elevation costs caps at $60,000 for elevation of single family homes in coastal counties, and $35,000 for non-coastal counties. Elevation costs caps at $60,000 for elevation of single family homes in coastal counties, and $35,000 for non-coastal counties. The GLO may re-evaluate its elevation costs caps during the implementation based on average costs associated with elevating single family homes and on a case-by-case basis as needed. The GLO may re-evaluate its elevation costs caps during the implementation based on average costs associated with elevating single family homes and on a case-by-case basis as needed.

iii. Storm hardening and hazard mitigation related construction activities: Local composite builder bid amount based on procured builders and builder’s house plans based on household size and other construction related expenses determined to be cost reasonable.

4.4.7.4 Eligible Activities: Housing activities allowed under CDBG-MIT; HCDA Section 105(a)(1), 105(a) (3-4), 105(a)(8) 105(a)(11), 105(a)(18), and 105(a)(25), include but are not limited to:

i. Single family owner-occupied reconstruction;

ii. Hazard mitigation;

iii. Elevation;

iv. Relocation Assistance;

v. Public service within the 15 percent cap (e.g., housing counseling, legal counseling, job training, mental health, and general health services); and

vi. Other activities associated with the recovery of single family housing stock impacted.

4.4.7.5 Ineligible Activities:

i. Forced mortgage payoff;
ii. Incentive payments to households that move to disaster-impacted floodplains;

iii. Properties that served as second homes at the time of the disaster, or following the disaster, are not eligible for rehabilitation assistance or housing incentives;

iv. Rehabilitation/reconstruction of homes located in the floodway;

v. Rehabilitation/reconstruction of a house in which the three below criteria are met:

vi. The combined household income is greater than 120 percent AMI or the national median;

vii. The property was located in a floodplain at the time of the disaster; and

viii. The property owner did not maintain flood insurance on the damaged property, even when the property owner was not required to obtain and maintain such insurance.

ix. Section 582 of the National Flood Insurance Reform Act of 1994, as amended, (42 U.S.C. 5154a) states that no federal disaster relief assistance made available in a flood disaster area may be used to make a payment (including any loan assistance payment) to a person for “repair, replacement, or restoration” for damage to any personal, residential, or commercial property if that person at any time has received federal flood disaster assistance that was conditional on the person first having obtained flood insurance under applicable federal law and the person has subsequently failed to obtain and maintain flood insurance as required under applicable federal law on such property. The program may not provide disaster assistance for the repair, replacement, or restoration of a property to a person who has failed to meet this requirement.

x. Homeowners located within the city limits of Houston and/or within Harris County are ineligible to participate in the state HAP. The city of Houston and Harris County are implementing their own programs.

4.4.7.6 Eligibility Criteria for Assistance:

i. Home must have been owner-occupied at the time of the storm and still owned by the owner at the time of the storm;

ii. Home must have served as primary residence;

iii. Home must be located in a Hurricane Harvey CDBG-DR eligible county;

iv. Home must have sustained damage from Hurricane Harvey;

v. Duplication of benefits review;

vi. Construction costs must be reasonable and consistent with market costs at the time and place of construction;
vii. All household members over the age of 18 must be current on payments for child support;

viii. Applicant must furnish evidence that property taxes are current, have an approved payment plan, or qualify for an exemption under current laws;

ix. Home must be environmentally cleared;

x. Property owners receiving disaster assistance that triggers the flood insurance purchase requirement have a statutory responsibility to notify any transferee of the requirement to obtain and maintain flood insurance in writing and to maintain such written notification in the documents evidencing the transfer of the property, and the transferring owner may be liable if he or she fails to do so;

xi. Subrogation Agreement: Assisted homeowners must agree to a limited subrogation of any future awards related to Hurricane Harvey to ensure duplication of benefits compliance. This is an agreement to repay any duplicative assistance if other disaster assistance for the same purpose later is received;

xii. Unsecured Forgivable Promissory Note;

xiii. Assisted homeowners are required to maintain principal residency in the assisted property for 3 years. Cash-out refinancing, home equity loans or any loans utilizing the assisted residence as collateral are not allowed for 3 years. A violation of this policy will activate the repayment terms of the Note;

xiv. Taxes are to be paid and in good standing for the properties assisted. Homeowners may be on a payment plan, but it needs to be submitted to the subrecipient or state as applicable; and

xv. Insurance must be maintained at the assisted property. Hazard, flood (if applicable), and windstorm (if applicable) will be monitored for the 3-year note period.

4.4.7.7 National Objectives: LMI and UNM. At least 70 percent of these program funds must be spent on LMI eligible projects.

4.4.7.8 Housing Guidelines:

The GLO will follow the housing guidelines that provide operational details on the eligibility requirements, housing assistance caps, construction standards, accessibility requirements, visitability standards, reporting requirements, and other program requirements. The housing guidelines were posted for public comment before adoption.

4.4.7.9 Needs Assessment:

The GLO conducted a local needs assessment. The local needs assessment and analysis of HUD/FEMA demographic IA data recommended the proportions of funding that should be set
aside to benefit each LMI and non-LMI economic group. The GLO in partnership with the University of Texas at Austin conducted a housing needs survey over the entire disaster impacted counties. The survey assessed remaining unmet housing needs resulting from Hurricane Harvey. The needs assessment determined the activities to be offered, the demographics to receive concentrated attention, identify disabled, “special needs,” and vulnerable populations, and target areas to be served. The needs assessment also included an assessment of the types of public services activities that may be needed to complement the program, such as housing counseling, legal counseling, job training, mental health, and general health services. The needs assessment set goals within the income brackets similar to the housing damage sustained within the impacted areas. Deviations from goals will be evaluated by the GLO before the Program may move forward.

4.4.7.10  Risk Assessment:

HAP is a housing recovery action with consequential mitigation benefit: more resilient residents and homes make for a more resilient community against the inevitable next hurricane or flooding event. It is imperative that qualifying homeowners for HAP receive recovery assistance so that residential resilience is aggregated with other mitigation actions that local, county, and regional stakeholders, undertake with CDBG-MIT funds and other funds to form a comprehensive mitigation effort.

4.4.7.11  Affirmative Marketing Outreach Plan:

The GLO is committed to AFFH through established affirmative marketing policies. The GLO will continue to coordinate with HUD-certified housing counseling organizations in this effort. Affirmative marketing efforts are guided by an affirmative marketing plan, based on HUD regulations. The ongoing goal is to ensure that outreach and communication efforts reach eligible homeowners from all racial, ethnic, national origin, religious, familial status, the disabled, “special needs,” gender groups, and vulnerable populations.

4.4.7.12  AFFH Review:

The program underwent AFFH review. Such review included assessments of (1) a proposed project’s area demography, (2) socioeconomic characteristics, (3) housing configuration and needs, (4) educational, transportation, and health care opportunities, (5) environmental hazards or concerns, and (6) all other factors material to the AFFH determination. Applications should show that projects are likely to lessen area racial, ethnic, and low-income concentrations, and/or promote affordable housing in low-poverty, nonminority areas in response to natural hazard-related impacts.
4.4.7.13  **Timeline:**

The proposed program is a continuation of a current GLO program; accordingly, the start date is immediately after HUD’s approval of this Action Plan. The proposed end date is 3 years from the start date of the program.
4.4.8 **RESILIENT HOME PROGRAM**

The Resilient Housing Program (RHP) will replace owner-occupied single family homes damaged by Hurricane Harvey with a reconstructed home that meets additional resiliency and mitigation standards required of the RHP. In addition to providing housing for those whose homes were seriously damaged during Hurricane Harvey, this program will serve as a showcase for more resilient residential construction practices and provide the opportunity to disseminate these practices through the residential construction industry on a scale larger than previously attempted.

The RHP will be run through the GLO as a sub-category of its HAP program. Eligible participants will be drawn from the GLO’s existing waiting list of eligible HAP applicants. The GLO may directly administer this program in these areas or use the support of outside parties to serve homeowner assistance needs.

Currently, the number of HAP applications for assistance exceeds the available program funds needed to move forward with reconstruction of damaged homes. Consequently, HAP applicants eligible for assistance are waitlisted until further funding becomes available. To remedy HAP fund deficiencies so that waitlisted homeowners may continue in the state’s recovery process, additional CDBG-MIT funding is being allocated through both the HAP Supplemental Program and the RHP. Homeowners located within the city of Houston and Harris County remain ineligible for participation in the state-run HAP.

**4.4.8.1 Connection to Identified Risk:**

As outlined in Mitigation Needs Assessment, hurricanes/tropical storms/tropical depressions, and severe coastal/riverine flooding are the top two severe risks to which Texas has the greatest exposure.

The RHP will serve a two-fold function: (1) providing high quality, durable, sustainable, and mold-resistant housing to those impacted by Hurricane Harvey; and (2) demonstrating the cost effectiveness of enhanced resiliency features in residential construction on a large scale to protect against the inevitable next storm or flooding event. By building homes to a higher standard than conventional construction practices on the scale proposed by this program, the RHP will bring those more resilient building practices into the mainstream where they can scale-up and become cost-competitive with conventional building practices.

**4.4.8.2 Allocation Amount: $100,000,000**

i. Based on demand, priority will be given to Hurricane Harvey HUD MID areas with a goal of at least eighty (80) percent of funds going towards those areas.

ii. Up to twenty (20) percent of funds may address unmet need and identified risks in the Hurricane Harvey impacted counties minus their “most-impacted” ZIP codes.
4.4.8.3 **RHP Home Construction Requirements:**

Requirements will be based on GLO resiliency standards, to be promulgated through a competitive procurement process to identify qualified home builders.

4.4.8.4 **Maximum assistance:**

i. Reconstruction with or without elevation: Local composite builder bid amount based on procured builders and the builder’s house plans based on household size.

ii. Elevation costs caps at $60,000 for elevation of single family homes in coastal counties, and $35,000 for non-coastal counties. The GLO may re-evaluate its elevation costs caps during the implementation based on average costs associated with elevating single family homes and on a case-by-case basis as needed.

iii. Storm hardening and hazard mitigation related construction activities: Local composite builder bid amount based on procured builders and builder’s house plans based on household size and other construction related expenses determined to be cost reasonable.

4.4.8.5 **Eligible Activities: Housing activities allowed under CDBG-MIT; HCDA Section 105(a)(1), 105(a) (3-4), 105(a)(8) 105(a)(11), 105(a)(18), and 105(a)(25), include but are not limited to:**

i. Single family owner-occupied reconstruction;

ii. Hazard mitigation;

iii. Elevation;

iv. Relocation Assistance;

v. Public service within the 15 percent cap (e.g., housing counseling, legal counseling, job training, mental health, and general health services); and

vi. Other activities associated with the recovery of single family housing stock impacted.

4.4.8.6 **Ineligible Activities:**

i. Forced mortgage payoff;

ii. Incentive payments to households that move to disaster-impacted floodplains;

iii. Properties that served as second homes at the time of the disaster, or following the disaster, are not eligible for rehabilitation assistance or housing incentives;

iv. Rehabilitation/reconstruction of homes located in the floodway;

v. Rehabilitation/reconstruction of a house in which the three below criteria are met:
a. The combined household income is greater than 120 percent AMI or the national median;

b. The property was located in a floodplain at the time of the disaster; and

c. The property owner did not maintain flood insurance on the damaged property, even when the property owner was not required to obtain and maintain such insurance.

vi. Section 582 of the National Flood Insurance Reform Act of 1994, as amended, (42 U.S.C. 5154a) states that no federal disaster relief assistance made available in a flood disaster area may be used to make a payment (including any loan assistance payment) to a person for “repair, replacement, or restoration” for damage to any personal, residential, or commercial property if that person at any time has received federal flood disaster assistance that was conditional on the person first having obtained flood insurance under applicable federal law and the person has subsequently failed to obtain and maintain flood insurance as required under applicable federal law on such property. The program may not provide disaster assistance for the repair, replacement, or restoration of a property to a person who has failed to meet this requirement;

vii. Emergency response services. Emergency response services shall mean those services that are carried out in the immediate response to a disaster or other emergency in order to limit the loss of life and damage to assets by state and local governmental and nongovernmental emergency public safety, fire, law enforcement, emergency response, emergency medical (including hospital emergency facilities), and related personnel, agencies, and authorities; and

viii. Homeowners located within the city limits of Houston and/or within Harris County are ineligible.

4.4.8.7 Eligibility Criteria for Assistance:

i. Home must have been owner-occupied at the time of the storm and still owned by the owner at the time of the storm;

ii. Home must have served as primary residence;

iii. Home must be located in a Hurricane Harvey CDBG-DR eligible county;

iv. Home must have sustained damage from Hurricane Harvey;

v. Duplication of benefits review;

vi. Construction costs must be reasonable and consistent with market costs at the time and place of construction;
vii. All household members over the age of 18 must be current on payments for child support;

viii. Applicant must furnish evidence that property taxes are current, have an approved payment plan, or qualify for an exemption under current laws;

ix. Home must be environmentally cleared;

x. Property owners receiving disaster assistance that triggers the flood insurance purchase requirement have a statutory responsibility to notify any transferee of the requirement to obtain and maintain flood insurance in writing and to maintain such written notification in the documents evidencing the transfer of the property, and the transferring owner may be liable if he or she fails to do so;

xi. Subrogation Agreement: Assisted homeowners must agree to a limited subrogation of any future awards related to Hurricane Harvey to ensure duplication of benefits compliance. This is an agreement to repay any duplicative assistance if other disaster assistance for the same purpose later is received;

xii. Unsecured Forgivable Promissory Note;

xiii. Assisted homeowners are required to maintain principal residency in the assisted property for 3 years. Cash-out refinancing, home equity loans or any loans utilizing the assisted residence as collateral are not allowed for 3 years. A violation of this policy will activate the repayment terms of the Note;

xiv. Taxes are to be paid and in good standing for the properties assisted. Homeowners may be on a payment plan, but it needs to be submitted to the subrecipient or state as applicable; and

xv. Insurance must be maintained at the assisted property. Hazard, flood (if applicable), and windstorm (if applicable) will be monitored for the 3-year note period.

4.4.8.8 National Objectives: LMI and urgent need. At least 70 percent of these program funds must be spent on LMI-eligible projects.

4.4.8.9 Housing Guidelines:

The GLO will follow the housing guidelines that provide operational details on the eligibility requirements, housing assistance caps, construction standards, accessibility requirements, visitability standards, reporting requirements, and other program requirements. The housing guidelines were posted for public comment before adoption.

4.4.8.10 Needs Assessment:

The GLO conducted a local needs assessment. The local needs assessment and analysis of HUD/FEMA demographic IA data recommended the proportions of funding that should be set
aside to benefit each LMI and non-LMI economic group. The GLO, in partnership with the University of Texas at Austin, conducted a housing needs survey over the entire disaster impacted counties. The survey assessed remaining unmet housing needs resulting from Hurricane Harvey. The needs assessment determined the activities to be offered, the demographics to receive concentrated attention, identified disabled, “special needs,” and vulnerable populations, and target areas to be served. The needs assessment also included an assessment of the types of public services activities that may be needed to complement the program such as housing counseling, legal counseling, job training, mental health, and general health services. The needs assessment set goals within the income brackets similar to the housing damage sustained within the impacted areas. Deviations from goals will be evaluated by the GLO before the Program may move forward.

4.4.8.11 Risk Assessment:

HAP is a housing recovery action with consequential mitigation benefit: more resilient residents and homes make for a more resilient community against the inevitable next hurricane or flooding event. It is imperative that qualifying homeowners for HAP receive recovery assistance so that residential resilience is aggregated with other mitigation actions that local, county, and regional stakeholders, undertake with CDBG-MIT funds and other funds to form a comprehensive mitigation effort. By building homes to a higher standard than conventional construction practices on the scale proposed by this program, the RHP will bring those more resilient building practices into the mainstream where they can scale-up and become cost-competitive with conventional building practices.

4.4.8.12 Affirmative Marketing Outreach Plan:

The GLO is committed to AFFH through established affirmative marketing policies. The GLO will continue to coordinate with HUD-certified housing counseling organizations in this effort. Affirmative marketing efforts are guided by an affirmative marketing plan, based on HUD regulations. The ongoing goal is to ensure that outreach and communication efforts reach eligible homeowners from all racial, ethnic, national origin, religious, familial status, the disabled, "special needs," gender groups, and vulnerable populations.

4.4.8.13 AFFH Review:

The program underwent AFFH review. Such review included assessments of (1) a proposed project’s area demography, (2) socioeconomic characteristics, (3) housing configuration and needs, (4) educational, transportation, and health care opportunities, (5) environmental hazards or concerns, and (6) all other factors material to the AFFH determination. Applications should show that projects are likely to lessen area racial, ethnic, and low-income concentrations, and/or promote affordable housing in low-poverty, nonminority areas in response to natural hazard-related impacts.
4.4.8.14 *Timeline:*

The proposed program start date is immediately after HUD’s approval of this Action Plan. The proposed end date is 6 years from the start date of the program.
4.4.9 HAZARD MITIGATION PLANS

The GLO is partnering with the Texas Division of Emergency Management (TDEM) to provide CDBG-MIT funds for the development of an enhanced State of Texas Hazard Mitigation Plan (enhanced SHMP), as well as providing funds for the development of Local Hazard Mitigation Action Plans (LHMAP) for eligible areas.

A FEMA-approved enhanced state mitigation plan documents a state’s ongoing commitment to hazard mitigation, the ongoing proactive efforts to implement a comprehensive hazard mitigation program across the state, and the coordinated effort of the state to reduce losses, protect life and property, and create safer communities. Approval of an enhanced state mitigation plan makes a state eligible for assistance up to 20 percent for estimated aggregate amounts of a disaster, compared with 15 percent for states without an enhanced plan. The enhanced SHMP will be developed and maintained by TDEM’s Hazard Mitigation Section. CDBG-MIT funds may be leveraged with TDEM funds provided by FEMA.

The state enhanced hazard mitigation plan should serve as the framework for the local hazard mitigation action plans within that state. The purpose of these plans is to gather a wide range of stakeholders and the public in a planning process to identify local policies and actions—based on an assessment of hazards, vulnerabilities, and risks—that can be implemented over the long term to reduce risk and future losses from hazards. By engaging in this planning process, communities not only identify risks and prioritize investments and interventions, but also build partnerships by involving citizens, organizations, and businesses, and increase awareness of threats and hazards, as well as their risks.

4.4.9.1 Connection to Identified Risk:

Through the creation and adoption of an enhanced SHMP and LHMAPs, the state and its units of local government will communicate priorities to both state and federal officials while aligning risk reduction strategies across jurisdictions with community objectives.

4.4.9.2 Allocation Amount: $30,000,000

4.4.9.3 Maximum Award Amount: $100,000 for LHMAPs.

4.4.9.4 Eligible Entities: TDEM, FEMA HMGP eligible entities located within any CDBG-MIT county.

4.4.9.5 Eligible Activities:

i. Development of the enhanced SHMP;
ii. Development or update of a LHMAP, including studies to enhance a community’s understanding of risk (examples: dam inundation studies, flood studies, wildfire studies); and

iii. Cost Share.

4.4.9.6 Ineligible Activities:

Those activities not expressly identified under Eligible Activities

4.4.9.7 Program Requirements:

i. LHMAPs must meet all criteria and requirements of 44 CFR 201.6 and must be approved by TDEM and FEMA.

ii. Applicants that receive funding and adopt approved LHMAPs may apply again to this program in the year prior to the expiration of the LHMAP, provided the application is made within the timeline outlined below and funds remain.

4.4.9.8 Timeline:

Because local hazard mitigation action plans operate on a 5-year cycle, the application period will remain open for six (6) years, with a proposed start date six (6) months after HUD’s approval of this Action Plan and until funds are exhausted.
4.4.10 RESILIENT COMMUNITIES PROGRAM

The GLO supports the adoption of policies that both reflect local and regional priorities and will have long-lasting effects on community risk reduction. Accordingly, the Resilient Future Communities Program will fund the development, adoption, and implementation of modern and resilient building codes and flood damage prevention ordinances to ensure that structures built within the community can withstand future hazards.

Building codes are the primary mechanism for communities to regulate the design and construction of new buildings and the renovation of existing buildings. At a minimum, codes reflect a community’s accepted requirements for ensuring the safety of a building occupants and people in proximity to buildings. Many communities rely on model building codes as the basis for their locally adopted code. These model building codes are developed through a national consensus process to efficiently leverage national experts, respond to the latest research findings, identify and incorporate new technology and processes, and support economies of scale.

Flood damage prevention ordinances provide the framework regulating what can be built in a floodplain, limited changes to the flows of waterways, and ensuring buildings are constructed at or above the base flood elevation. Adoption of a flood damage prevention ordinance, or some equivalent enforcement mechanism, is required for participation in FEMA’s National Flood Insurance Program (NFIP). Adoption of higher regulatory standards—for instance, mandating construction at two feet or greater above base flood elevation—can make a community eligible to participate in the NFIP Community Rating System (CRS), which can reduce the flood insurance premiums for a community’s property owners.

Land use and comprehensive plans, along with the zoning codes that often accompany them, take community goals and aspirations and formalize them into actionable policies that determine what can be built within a certain jurisdiction and where it can be built. Land use and comprehensive plans themselves serve as guiding documents that provide the framework by which regulatory structures are created—by themselves these plans have regulatory authority. Zoning codes take the ideas outlined in the land use and comprehensive plans and formalize those ideas into legally binding ordinances that ultimately shape how and where a community develops. Creating land use and comprehensive plans that incorporate hazard mitigation considerations within their framework helps cities and towns to develop in a manner that reduces the risk to future hazards.

GLO may use the adoption of codes, ordinances, and/or plans in this program as scoring criteria in other CDBG-MIT programs.
4.4.10.1 Connection to Identified Risk: This program encourages communities to look at all their identified risks in a comprehensive manner and integrate mitigation measures in each activity they undertake.

4.4.10.2 Allocation Amount: $100,000,000

4.4.10.3 Maximum Award Amount: $300,000 per applicant

4.4.10.4 Eligible Entities:

i. Units of local government, including cities, counties, and tribal governments located within a CDBG-MIT eligible area.

4.4.10.5 Eligible Activities:

i. Development, adoption, and implementation of Building Codes that meet or exceed the standards set forth in the International Residential Code 2012 (IRC 2012);

ii. Development, adoption, and implementation of a Flood Damage Prevention Ordinance that meets CDBG-MIT requirements of at least 2 feet above base flood elevation;

iii. Development, adoption, and implementation of a Zoning Ordinance based upon a land use plan or comprehensive plan;

iv. Development and adoption of forward-looking Land Use Plans that integrate hazard mitigation plans;

v. Development and adoption of forward-looking Comprehensive Plans that integrate hazard mitigation plans; or

vi. Public Service activities focused on education and outreach campaigns designed to alert communities and beneficiaries to opportunities to further mitigate identified risks through insurance, best practices, and other strategies. Public information activities leading to CRS credit accrual and CRS eligibility are eligible under this activity.

4.4.10.6 Ineligible Activities:

i. Activities not expressly listed under the Eligible Activities section are prohibited.

4.4.10.7 Program Requirements:

i. Building Codes:

a. Adopted building code must meet or exceed IRC 2012.
b. Adoption of selected building code must be complete within 12 months of grant award. Failure to adopt within that timeframe will result in the forfeiture of grant funds and repayment.

ii. Flood Damage Prevention Ordinance:
   a. Adopted ordinance must meet CDBG-MIT requirements of at least two feet above base flood elevation.
   b. Adoption of flood damage prevention ordinance must be complete within 12 months of grant award. Failure to adopt within that timeframe will result in the forfeiture of grant funds and repayment.

iii. Zoning Ordinance:
   a. Adopted ordinance must be based on an adopted Land Use or Comprehensive Plan that was written within the last five (5) years of the date of application for this program.
   b. Adoption of approved zoning ordinance must be complete within 12 months of grant award. Failure to adopt within that timeframe will result in the forfeiture of grant funds and repayment.

iv. Land Use Plans:
   a. Land Use Plan must be forward-looking and integrate the relevant portions of the local hazard mitigation plan, if one exists.
   b. Land Use Plan must identify local hazard risks and explain how the plan mitigates against those risks.
   c. Land Use Plans must be accompanied by a Zoning Ordinance that codifies the land use plan.
   d. Adoption of approved Land Use Plan and Zoning Ordinance must be complete within 18 months of grant award. Failure to adopt within that timeframe will result in the forfeiture of grant funds.

v. Comprehensive Plans:
   a. Adopted Comprehensive Plans must include: (1) a Population Study that provides a population estimate and population projection for the next 20 years; (2) a Housing Study that describes the composition of the existing housing stock, including total number of units, number of single family and multifamily units, and vacancy rates, as well as a projection for the number of future housing units needed ten (10) years from the date of the plan and the composition of those units (e.g., single family, multifamily); (3) a Land Use Study/Plan that describes the land use of every parcel within the jurisdiction and includes a future land use map that accounts for future
population changes; (4) a Zoning Ordinance that codifies the Land Use Plan; and (5) an Infrastructure Study and Capital Improvement Plan that describes the water, wastewater, drainage, and streets systems, including length, width, materials, and condition or age (if available), as well as proposed prioritized improvements to those systems.

b. Plan must identify local hazard risks and explain how the plan mitigates against those risks.

c. Adoption of approved Comprehensive Plan and Zoning Ordinance must be complete within 24 months of grant award. Failure to adopt within that timeframe will result in the forfeiture of grant funds and repayment.

vi. Public service activities:

a. Must be focused on education and outreach campaigns designed to alert communities and beneficiaries to opportunities to further mitigate identified risks through insurance, best practices and other strategies; and

b. Public information activities conducted with the intent of earning CRS credits must meet the requirements for those activities within the CRS Coordinator’s Manual.444

4.4.10.8 Eligibility/Selection Criteria:

i. Applicant/beneficiary must be located within a CDBG-MIT county;

ii. Applicant must be a unit of local government, Indian tribe, or any other entity that has the legal authority to adopt and enforce the code, ordinance, or plan for which funding was requested (i.e., most counties do not have the authority to adopt or enforce zoning ordinances);

iii. Applicants must demonstrate the capacity to administer grant funds and complete the selected project on time or describe how they will procure assistance to do so;

iv. Applicants must list and describe existing building codes, ordinances, and local and/or regional plans (if applicable)—including county or regional level hazard mitigation plans—and how those existing regulations and planning efforts will inform the project for which funding was requested; and

v. Applications will be processed on a first-come, first-served basis.

4.4.10.9 Activities should:

i. Promote sound, sustainable long-term mitigation planning informed by a post-disaster evaluation of hazard risk, especially land-use decisions that reflect responsible flood plain management and take into account future possible extreme weather events and other natural hazards and long-term risks;

ii. Coordinate with local and regional planning efforts to ensure consistency, and promote community-level and/or regional (e.g., multiple local jurisdictions) mitigation planning;

iii. Integrate mitigation measures into all activities and achieve objectives outlined in regionally or locally established plans and policies that are designed to reduce future risk to the jurisdiction; and

iv. Result in buildings that are more resilient to the impacts of natural hazards.

4.4.10.10 AFFH Review:

All proposed activities will undergo AFFH review by the GLO before approval. Such review will include assessments of (1) area demography, (2) socioeconomic characteristics, (3) housing configuration and needs, (4) educational, transportation, and health care opportunities, (5) environmental hazards or concerns, and (6) all other factors material to the AFFH determination. Applications should show that activities are likely to lessen area racial, ethnic, and low-income concentrations, and/or promote affordable housing in low-poverty, nonminority areas in response to natural hazard-related impacts.

4.4.10.11 Timeline

The proposed program start date is six (6) months after HUD’s approval of this Action Plan. The proposed end date is six (6) years from the start date of the program.
4.4.11 REGIONAL AND STATE PLANNING

The GLO is committed to the purposes of planning in the areas that are eligible for CDBG-MIT funds, and to the completion of some of the projects identified as a result of the studies. Because of the vast scope of the eligible area and the recurring nature of disasters throughout the state, the GLO may concentrate on regional approaches in addition to specific local solutions to promote sound mitigation practices. In order to provide an efficient and effective method of selecting and executing planning studies, the GLO will work with Texas universities, state agencies, federal agencies, regional planning and oversight groups—including councils of governments, river authorities, and drainage districts—and/or vendors (terms which shall include, but not limited to other governmental entities, and non-profit and for profit firms, entities, and organizations) to conduct studies with CDBG-MIT funds. The GLO has previously utilized a local community input process that included public meetings, requests for information, listening sessions, and written surveys that helped determine the specific needs for planning studies. This process pointed to the need for more regional-based planning studies.

For the CDBG-MIT funds, the GLO will utilize similar input methods to identify current study needs. Accordingly, opportunities for regionalized studies will be prioritized and the GLO will identify qualified experts for specific tasks identified. Studies may include, but are not limited to, flood control, drainage improvement, resilient housing solutions, homelessness, surge protection, economic development, infrastructure improvement or other efforts to mitigate risks and future damages and establish plans for comprehensive recovery efforts. Communities may recommend studies to be completed, but all planning funds will be administered by the GLO. The GLO will make all final determinations regarding planning studies and coordinate with Texas universities, state agencies, federal agencies, and/or vendors to identify scopes, the parameters of the planning efforts, and the type of data that they will gather. This approach will ensure planning studies that are conducted in different regions can be consolidated and analyzed, and that consistency and accuracy in data gathering is achieved. Further amendments may convert a portion of these planning funds to execute specific projects contemplated or developed through the planning process.

The state is working to develop and maintain a secure database system that documents the impact of past disasters and provides analytical data assessing natural hazard risks, including anticipated effect of future extreme weather events and other natural hazards. This will enable the state to improve its disaster information, analytics capabilities, and foster communication, collaboration, and information gathering amongst relevant state agencies that have a role in disaster response and recovery. Additionally, the data gathered will inform both the state and local communities of possible solutions that plan for and create a more resilient landscape in the state of Texas.

The state is also working with key federal agencies to develop more accurate flood mapping and modeling techniques. The current mapping and modeling techniques are insufficient to conduct a
detailed cost-benefit analysis of mitigation proposals. The state will work jointly with federal partners to develop the necessary technology and models to more accurately predict and mitigate future damages.

The GLO may develop a planning competition that entities in CDBG-MIT counties may apply for in a future action plan amendment or move funds to other mitigation eligible uses as need dictates.

The requirements at 24 CFR 570.483(b)(5) or (c)(3), which limit the circumstances under which the planning activity can meet a low- and moderate-income national objective, will not apply to CDBG-MIT planning activities; instead, the state will comply with 24 CFR 570.208(d)(4) when funding mitigation, planning-only grants, or directly administering planning activities that guide mitigation in accordance with the Appropriations Act. In addition, the types of planning activities the state may fund or undertake will be consistent with those of entitlement communities identified at 24 CFR 570.205, which may include support for local and regional functional land-use plans, master plans, historic preservation plans, comprehensive plans, community recovery plans, resilience plans, development of building codes, zoning ordinances, and neighborhood plans.

4.4.11.1 Allocation Amount: $214,859,450

4.4.11.2 Eligible Activities: Planning activities allowed under CDBG-MIT; HCDA section 105(a)(12)

   i. Eligible planning, urban environmental design, and policy-planning-management-capacity building activities as listed in 24 CFR 570.205.

4.4.11.3 Ineligible Activities:

   i. Activities not listed in 24 CFR 570.205, HCDA 105(a)(12).

4.4.11.4 Activities should:

   i. Promote sound, sustainable mitigation planning informed by an evaluation of hazard risk, especially land-use decisions that reflect responsible flood plain management and take into account future possible extreme weather events and other natural hazards and long-term risks;

   ii. Coordinate with local and regional planning efforts to ensure consistency, and promote community-level and/or regional (e.g., multiple local jurisdictions) post-disaster recovery and mitigation planning;

   iii. Integrate mitigation measures into rebuilding activities and achieve objectives outlined in regionally or locally established plans and policies that are designed to reduce future risk to the jurisdiction;

   iv. Consider the costs and benefits of the project;
v. Ensure that activities will avoid disproportionate impact on vulnerable populations such as, but not limited to, families and individuals that are homeless or at risk of homelessness, the elderly, persons with disabilities, persons with alcohol or other drug addiction, persons with HIV/AIDS and their families, and public housing residents.

vi. Ensure that activities create opportunities to address economic inequities facing local communities;

vii. Align investments with other planned state or local capital improvements and infrastructure development efforts, and work to foster the potential for additional infrastructure funding from multiple sources, including existing state and local capital improvement projects in planning, and potential private investment; and

viii. Employ adaptable and reliable technologies to guard against premature obsolescence of infrastructure.

4.4.11.5 Timeline

The proposed program start date is immediately after HUD’s approval of this Action Plan. The proposed end date is twelve (12) years from the start date of the program.

4.4.12 Administrative Funds

State administrative costs including subrecipient administration costs will not exceed five (5) percent, $214,859,450. Planning and administrative costs combined will not exceed 20 percent. The provisions outlined under 42 U.S.C. 5306(d) and 24 CFR 570.489(a)(1)(i) and (iii) will not apply to the extent that they cap state administration expenditures and require a dollar-for-dollar match of state funds for administrative costs exceeding $100,000. Additionally, the provisions outlined under 42 U.S.C. 5306(d)(5) and (6) will not apply; instead, the aggregate total for administrative and technical assistance expenditures will not exceed 5 percent of the grant amount plus 5 percent of program income generated by the grant. The state will limit its spending to a maximum of 15 percent of its total grant amount on planning costs.

The GLO will retain the full 5 percent allocated for administrative costs associated with the CDBG-MIT allocation for purposes of oversight, management, and reporting. All subrecipients are allowed to spend up to 12 percent of program amounts for costs directly related to implementation of housing-related mitigation activities and 6 percent for all other mitigation activities. For mitigation awards less than $1 million, refer to guidance found on the GLO’s recovery website, http://recovery.texas.gov/. Engineering and design activities will be capped at 15 percent of the total project award unless special services are necessary; in such cases, the GLO must review and approve the request.
The GLO will use administrative funds across the 2015 Floods, 2016 Floods, and Hurricane Harvey CDBG-DR grants, together with this CDBG-MIT grant, without regard for a particular disaster appropriation from which the funds originated. The amount of grant administration expenditures for each of the aforementioned grants will not exceed 5 percent of the total grant award for each grant (plus 5 percent of program income).

4.5 Location

All CDBG-MIT funded activities under this Action Plan will occur within the disaster-declared counties of FEMA DR-4223 and DR-4245 (2015 Floods); DR-4266, DR-4269, DR-4272 (2016 Floods); and DR-4332 (Hurricane Harvey). An aggregated list of the total 140 eligible counties for CDBG-MIT funds appears in the appendix.

Additional areas within counties not explicitly cited as eligible may also become locations of CDBG-MIT funded activities if it can be demonstrated how the expenditure of CDBG-MIT funds in that area will measurably mitigate risks identified within an eligible area (e.g., upstream water retention projects to reduce downstream flooding in an eligible area).

4.6 National Objectives

HUD has waived the criteria for the established CDBG urgent need national objective as provided at 24 CFR 570.208(c) and 24 CFR 570.483(d), and instead has created a new national objective: urgent need mitigation (UNM). For CDBG-MIT activities where UNM is cited as the national objective being fulfilled, the state will demonstrate that the activity:

i. Addresses the current and future risks as identified in the state’s Mitigation Needs Assessment of most impacted and distressed areas; and

ii. Will result in a measurable and verifiable reduction in the risk of loss of life and property.

For CDBG-MIT activities, HUD has also directed grantees to not rely on the national objective criteria for elimination of slum and blighting conditions without approval from HUD, because this national objective generally is not appropriate in the context of mitigation activities.

All of the state’s mitigation activities under this grant will meet a national objective for either (1) urgent need mitigation (UNM), or (2) benefitting low- to moderate-income persons (LMI). At least 50 percent of CDBG-MIT funds will be used to support activities that benefit LMI persons, and all programs and projects will have an LMI priority.
5 Citizen Participation – State Mitigation Action Plan

The primary goal of this citizen participation plan is to stimulate more robust citizen involvement in the state’s recovery and mitigation processes. The citizen participation plan was developed based on the requirements outlined in HUD’s notice (the Notice) published in the Federal Register: 84 FR 45838 (Friday, August 30, 2019).

The Notice states:

“To permit a more robust process and ensure mitigation activities are developed through methods that allow all stakeholders to participate, and because citizens recovering from disasters are best suited to ensure that grantees will be advised of any missed opportunities and additional risks that need to be addressed, provisions of 42 U.S.C. 5304(a)(2) and (3), 42 U.S.C. 12707, 24 CFR 570.486, 24 § 91.105(b) and (c), and 24 CFR 91.115(b) and (c), with respect to citizen participation requirements, are waived and replaced by the requirements below. These revised requirements mandate public hearings (the number of which is based upon the amount of a grantee's CDBG-MIT allocation) across the HUD-identified MID areas and require the grantee to provide a reasonable opportunity (at least 45 days) for citizen comment and ongoing citizen access to information about the use of grant funds.”

The most current version of the citizen participation plan will be placed on the GLO’s recovery website at recovery.texas.gov.

5.1 Public Hearings

The requirements for CDBG-MIT grantees mandate a minimum number of public hearings in the HUD-identified MID areas; for Texas, the minimum number is four. The GLO will hold a total of 6 public hearings in the HUD MID areas, three of which will be held prior to publication of the action plan for public comment on the GLO’s website. All public hearings were held:

- In a different location to ensure geographic balance and maximum accessibility;
- In facilities that are physically accessible to persons with disabilities; and
- In compliance with civil rights requirements.

Archival recordings made during one or more of the hearings will be posted on the GLO’s mitigation webpage(s) navigable from its recovery website.
<table>
<thead>
<tr>
<th>Public Hearing</th>
<th>Date</th>
<th>HUD/State MID County</th>
<th>Location</th>
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</thead>
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<tr>
<td>1 Pre-Action Plan Publication</td>
<td>September 26, 2019 at 12:00 p.m.</td>
<td>HUD MID County (Travis County)</td>
<td>Texas State Capitol Auditorium, E1.004 1100 Congress Avenue, Austin, Texas, 78701</td>
</tr>
<tr>
<td>2 Pre-Action Plan Publication</td>
<td>October 1, 2019 at 12:00 p.m.</td>
<td>HUD MID County (Jefferson County)</td>
<td>Jefferson County Courthouse 1149 Pearl Street Beaumont, Texas, 77701</td>
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<tr>
<td>3 Pre-Action Plan Publication</td>
<td>October 2, 2019 at 12:00 p.m.</td>
<td>HUD MID County (Nueces County)</td>
<td>Del Mar College Center for Economic Development, 106 3209 S. Staples Street Corpus Christi, Texas 78411</td>
</tr>
<tr>
<td>4 Public Comment Period</td>
<td>TBD</td>
<td>HUD MID County</td>
<td>TBD</td>
</tr>
<tr>
<td>5 Public Comment Period</td>
<td>TBD</td>
<td>HUD MID County</td>
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</tr>
<tr>
<td>6 Public Comment Period</td>
<td>TBD</td>
<td>HUD MID County</td>
<td>TBD</td>
</tr>
</tbody>
</table>
5.2 Publication

Before the GLO adopts the Action Plan for this grant or any substantial amendment to the Plan, the GLO will publish the Action Plan or amendment on the GLO’s recovery website: recovery.texas.gov. The topic of disaster mitigation will be navigable by citizens from the GLO’s recovery website homepage.

The GLO and/or subrecipients will notify affected citizens of the published Action Plan or substantial amendment to the Action Plan through electronic mailings, press releases, statements by public officials, media advertisements, public service announcements, newsletters, contacts with neighborhood organizations, and/or through social media.

The GLO will ensure that all citizens have equal access to information about the Action Plan’s programs, including persons with disabilities and limited English proficiency (LEP). The GLO will ensure that program information is available in the appropriate languages for the geographic area served by the jurisdiction. For assistance in ensuring that this information is available to LEP populations, recipients should consult the Final Guidance to Federal Financial Assistance Recipients Regarding Title VI, Prohibition Against National Origin Discrimination Affecting Limited English Proficient Persons, published on January 22, 2007, in the Federal Register (72 FR 2732).

The Action Plan in its entirety will be translated to Spanish, Vietnamese, Chinese, Korean, and Arabic. The languages selected were selected based on the entire CDBG-MIT eligible area (CDBG-DR declared counties for the 2015 Floods, the 2016 Floods, and Hurricane Harvey) and a natural break in the numbers of Limited English Proficiency individuals. Recognizing there may be a need for individuals to have access to the document in additional languages, the GLO will be contracting with a translation service to provide personalized translations of the Action Plan upon request. Any public places that work directly in Action Plan programs available to private individuals will carry signage detailing this service in applicable languages. The GLO website will include similar notations.

Subsequent to publication of the Action Plan, the GLO will provide a reasonable opportunity for public comment of at least 45 days and have a method(s) for receiving comments. For substantial amendments to the Action Plan, the GLO will provide a reasonable opportunity for public comment of at least 30 days and have a method(s) for receiving comments. Citizens with disabilities or those who need technical assistance can contact the GLO office for assistance, either via: TDD 512-463-5330 or TX Relay Service 7-1-1.
The GLO will take comments via USPS mail, fax, or email:

**Mail:**  
Texas General Land Office  
Community Development and Revitalization  
P.O. Box 12873  
Austin, TX 78711-2873

**Fax:**  
(512) 475-5150

**Email:**  
cdr@recovery.texas.gov

**Website:**  
www.recovery.texas.gov

### 5.3 Consideration of Public Comments

The GLO will consider all oral and written comments regarding the Action Plan or any substantial amendment. A summary of the comments received and the GLO's response to each located in the Appendix will be submitted to HUD with the Action Plan or substantial amendment.

### 5.4 Citizen Advisory Committee

The GLO will form a citizen advisory committee (CAC) that will meet in an open forum twice a year in order to provide increased transparency of all CDBG-MIT fund activities. During each open forum, the CAC will solicit and respond to public comments regarding the GLO’s mitigation activities in order to better inform the GLO’s current and planned mitigation projects and programs.

### 5.5 Citizen Complaints

The GLO will provide a timely written response to every citizen complaint. The response will be provided within fifteen (15) working days of the receipt of the complaint, when practicable. Complaints regarding fraud, waste, or abuse of government funds should be forwarded to the HUD OIG Fraud Hotline (phone: 1-800-347-3735 or email: hotline@hudoig.gov).

### 5.6 Substantial Amendment

As additional information and funding becomes available through the grant administration process, amendments to this Action Plan are expected. Prior to adopting any substantial amendment to this Action Plan, the GLO will publish the proposed amendment on the GLO’s recovery website and will afford citizens, affected local governments, and other interested parties a reasonable opportunity to examine the Action Plan or amendment’s contents. At a minimum, the following modifications will constitute a substantial amendment:

1. The addition of a CDBG-MIT Covered Project;
ii. A change in program benefit or eligibility criteria;

iii. The addition or deletion of an activity; or

iv. The allocation or reallocation of more than $25 million or a change constituting more than 20% of a program’s budget.

5.7 Non-substantial Amendment

The GLO will notify HUD when it makes any action plan amendment that is not substantial. HUD will be notified at least five (5) business days before the amendment becomes effective. HUD will acknowledge receipt of the notification of non-substantial amendments via email within five (5) business days. Once effective, the non-substantial amendment to the Plan will be posted on the GLO’s recovery website.

5.8 Community Consultation

Since the April 2018 announcement of CDBG mitigation funding to Texas, the GLO began to think about its upcoming role in mitigation activities related to the 2015 and 2016 flood events, and Hurricane Harvey. The GLO began to elicit feedback from local officials and interested parties throughout the 140 counties located in 23 of the 24 councils of governments in the state, including meetings, conference calls, and regional trips to impacted communities. These trips have included stakeholder input sessions, where permissible, with seven of the nine COGs located in the Harvey most impacted and distressed areas.

On February 20, 2019 the GLO launched a digital survey through the service Survey Monkey to gauge the disaster recovery and mitigation needs of communities throughout the 140 eligible counties. Elected officials, representatives of local, regional, and state agencies, public housing representatives, private sector, and non-profits focused on housing, disaster recovery, and the needs of low-income and vulnerable populations were contacted and encouraged to complete the survey. The survey was also hosted on the GLO recovery website, www.recovery.texas.gov, and was included in a two-page brochure that GLO staff distributed at stakeholder input sessions, public workshops, and conferences.

The survey was closed on September 20, 2019 at which point the survey had 416 respondents from across the state. The results of the survey are located in the appendix.

A cumulative list of community consultation is in the appendix.

5.9 Public Website

The GLO will maintain a public website that provides information accounting for how all grant funds are used and managed/administered, including: (1) links to all action plans; (2) action plan amendments; (3) CDBG-DR and CDBG-MIT program policies and procedures; (4) performance
reports; (5) citizen participation requirements; and (6) activity/program information for activities described in the respective action plans, including details of all contracts and ongoing procurement policies.

The GLO will make the following items available on recovery.texas.gov: (1) the action plans (including all amendments); (2) each Quarterly Performance Report (QPR) as created using the DRGR system; (3) procurement, policies and procedures; (4) executed CDBG-DR and CDBG-MIT contracts; and (5) status of services or goods currently being procured by the GLO (e.g., phase of the procurement, requirements for proposals, etc.).

In addition to the specific items listed above, the GLO will maintain a comprehensive website, recovery.texas.gov, regarding all disaster recovery activities assisted with these funds. The website will be updated in a timely manner to reflect the most up-to-date information about the use of all CDBG-DR and CDBG-MIT funds and any changes in policies and procedures, as necessary. At a minimum, updates will be made on a monthly basis.

5.9.1 COUNCILS OF GOVERNMENTS WEBSITES FOR REGIONAL MITIGATION PROGRAM MODS

i. Alamo Area Council of Governments (AACOG): www.aacog.com
iii. Capital Area Council of Governments (CAPCOG): www.capcog.org
iv. Coastal Bend Council of Governments (CBCOG): www.cbcog98.org
v. Central Texas Council of Governments (CTCOG): www.ctcog.org
viii. Houston-Galveston Area Council (H-GAC): www.h-gac.com
ix. South East Texas Regional Planning Commission (SETRPC): www.setrpc.org

xx.
5.10 Application Status and Transparency

For applications received for CDBG-MIT assistance, the GLO will provide multiple methods of communication, including information posted on its website and a toll-free number to call to determine the status of their application for assistance.

In instances where the GLO seeks to competitively award CDBG-MIT funds, eligibility requirements will be published on the GLO’s recovery website and, for CDBG-MIT funds, on the GLO’s mitigation webpage(s) for such funding, together with all criteria to be used in the selection of applications for funding (including the relative importance of each criterion) and the time frame for consideration of applications. The GLO will maintain documentation to demonstrate that each funded and unfunded application was reviewed and acted upon in accordance with the published eligibility requirements and funding criteria cited in HUD’s relevant notice published in the Federal Register.

5.11 Waivers

The Appropriations Act authorizes the Secretary to waive or specify alternative requirements for any provision of any statute or regulation that the Secretary administers in connection with the obligation by the Secretary, or use by the recipient, of these funds, except for requirements related to fair housing, nondiscrimination, labor standards, and the environment. HUD also has regulatory waiver authority under 24 CFR 5.110, 91.600, and 570.5.

Grantees may request additional waivers and alternative requirements from the Department as needed to address specific needs related to their mitigation activities. Grantee requests for waivers and alternative requirements must be accompanied by relevant data to support the request and must demonstrate to the satisfaction of the Department that there is good cause for the waiver or alternative requirement.
6 APPENDICES

6.1 Appendix A: CDBG-MIT Eligible and Most Impacted and Distressed (MID) Counties and ZIP Codes

Figure 6-1: Eligible CDBG-MIT Counties
Figure 6-2: CDBG-MIT Most Impacted ZIP Codes

CDBG Mitigation:
HUD Most Impacted and Distressed ZIP Codes

- Council of Governments
- HUD MID ZIP Codes
- HUD MID
- State MID
- County
- Coastal Bay

City Limit

State of Texas CDBG-MIT Action Plan
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### Table 6-1:  CDBG-MIT Eligible Counties by Declared Disaster

<table>
<thead>
<tr>
<th>County</th>
<th>2015</th>
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6.2 Appendix B: Certifications – State of Texas

24 CFR 91.225 and 91.325 are waived. Each grantee receiving a direct allocation of CDBG-MIT funds must make the following certifications with its action plan:

a. The grantee certifies that it has in effect and is following a residential anti-displacement and relocation assistance plan in connection with any activity assisted with CDBG-MIT funding.

b. The grantee certifies its compliance with restrictions on lobbying required by 24 CFR part 87, together with disclosure forms, if required by part 87.

c. The grantee certifies that the action plan is authorized under state and local law (as applicable) and that the grantee, and any entity or entities designated by the grantee, and any contractor, subrecipient, or designated public agency carrying out an activity with CDBG-MIT funds, possess(es) the legal authority to carry out the program for which it is seeking funding, in accordance with applicable HUD regulations and this notice. The grantee certifies that activities to be undertaken with CDBG-MIT funds are consistent with its action plan.

d. The grantee certifies that it will comply with the acquisition and relocation requirements of the URA, as amended, and implementing regulations at 49 CFR part 24, except where waivers or alternative requirements are provided for CDBG-MIT funds.

e. The grantee certifies that it will comply with section 3 of the Housing and Urban Development Act of 1968 (12 U.S.C. 1701u) and implementing regulations at 24 CFR part 135.

f. The grantee certifies that it is following a detailed citizen participation plan that satisfies the requirements of 24 CFR 91.115 or 91.105 (except as provided for in notices providing waivers and alternative requirements for this grant). Also, each local government receiving assistance from a state grantee must follow a detailed citizen participation plan that satisfies the requirements of 24 CFR 570.486 (except as provided for in notices providing waivers and alternative requirements for this grant).

g. State grantee certifies that it has consulted with affected local governments in counties designated in covered major disaster declarations in the non-entitlement, entitlement, and tribal areas of the state in determining the uses of funds, including the method of distribution of funding, or activities carried out directly by the state.

h. The grantee certifies that it is complying with each of the following criteria:

(1) Funds will be used solely for necessary expenses related to mitigation activities, as applicable, in the most impacted and distressed areas for which the President declared a major disaster in 2015, 2016, or 2017 pursuant to the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1974 (42 U.S.C. 5121 et seq.).
(2) With respect to activities expected to be assisted with CDBG-MIT funds, the relevant action plan has been developed to give priority to activities that will benefit low- and moderate-income families.

(3) The aggregate use of CDBG-MIT funds shall principally benefit low- and moderate-income families in a manner that ensures that at least 50 percent (or another percentage permitted by HUD in a waiver published in an applicable Federal Register notice) of the CDBG-MIT grant amount is expended for activities that benefit such persons.

(4) The grantee will not attempt to recover any capital costs of public improvements assisted with CDBG-MIT funds by assessing any amount against properties owned and occupied by persons of low- and moderate-income, including any fee charged or assessment made as a condition of obtaining access to such public improvements, unless: (a) CDBG-MIT funds are used to pay the proportion of such fee or assessment that relates to the capital costs of such public improvements that are financed from revenue sources other than under this title; or (b) for purposes of assessing any amount against properties owned and occupied by persons of moderate income, the grantee certifies to the Secretary that it lacks sufficient CDBG funds (in any form) to comply with the requirements of clause (a).

i. The grantee certifies that the grant will be conducted and administered in conformity with title VI of the Civil Rights Act of 1964 (42 U.S.C. 2000d), the Fair Housing Act (42 U.S.C. 3601-3619), and implementing regulations, and that it will affirmatively further fair housing.

j. The grantee certifies that it has adopted and is enforcing the following policies, and, in addition, must certify that they will require local governments that receive grant funds to certify that they have adopted and are enforcing:

(1) A policy prohibiting the use of excessive force by law enforcement agencies within its jurisdiction against any individuals engaged in nonviolent civil rights demonstrations; and

(2) A policy of enforcing applicable state and local laws against physically barring entrance to or exit from a facility or location that is the subject of such nonviolent civil rights demonstrations within its jurisdiction.

k. The grantee certifies that it (and any subrecipient or administering entity) currently has or will develop and maintain the capacity to carry out mitigation activities, as applicable, in a timely manner and that the grantee has reviewed the respective requirements of this notice. The grantee certifies to the accuracy of its Public Law 115-56 Financial Management and Grant Compliance certification checklist, or other recent certification submission, if approved by HUD, and related supporting documentation referenced at section V.A.1.a of this notice and its implementation plan and capacity assessment and related submissions to HUD referenced at section V.A.1.b.

m. The grantee certifies that it will not use CDBG-MIT funds for any activity in an area identified as flood prone for land use or hazard mitigation planning purposes by the state, local, or tribal government or delineated as a Special Flood Hazard Area (or 100-year floodplain) in FEMA’s most current flood advisory maps, unless it also ensures that the action is designed or modified to minimize harm to or within the floodplain, in accordance with Executive Order 11988 and 24 CFR part 55. The relevant data source for this provision is the state, local, and tribal government land use regulations and hazard mitigation plans and the latest-issued FEMA data or guidance, which includes advisory data (such as Advisory Base Flood Elevations) or preliminary and final Flood Insurance Rate Maps.

n. The grantee certifies that its activities concerning lead-based paint will comply with the requirements of 24 CFR part 35, subparts A, B, I, K, and R.

o. The grantee certifies that it will comply with environmental requirements at 24 CFR part 58.

p. The grantee certifies that it will comply with applicable laws.

Warning: Any person who knowingly makes a false claim or statement to HUD may be subject to civil or criminal penalties under 18 U.S.C. 287, 1001 and 31 U.S.C. 3729.
### 6.3 Appendix C: Program Expenditures

#### Table 6-2: Timeline of Expenditures by Program

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State of Texas CDBG-MIT Action Plan
### 2015 Floods State Mitigation Competition
- **Allocations**: $46,096,950
- **Q1**: $ -
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- **Q3**: $ -
- **Q4**: $ -

### 2016 Floods State Mitigation Competition
- **Allocations**: $147,680,760
- **Q1**: $ -
- **Q2**: $ -
- **Q3**: $ -
- **Q4**: $ -

### Hurricane Harvey State Mitigation Competition
- **Allocations**: $2,144,776,720
  - **Q1**: $107,238,836
  - **Q2**: $107,238,836
  - **Q3**: $107,238,836
  - **Q4**: $107,238,836

### Regional Mitigation Program
- **Allocations**: $500,000,000
- **Q1**: $ -
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### Resilient Communities Program
- **Allocations**: $400,000,000
- **Q1**: $ -
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- **Q4**: $ -

### Resilient Home Program
- **Allocations**: $100,000,000
- **Q1**: $ -
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### Hazard Mitigation Plans
- **Allocations**: $30,000,000
  - **Q1**: $1,050,000
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### Resilient Communities Program
- **Allocations**: $100,000,000
  - **Q1**: $3,500,000
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### Regional and State Planning
- **Allocations**: $214,859,450
  - **Q1**: $4,297,189
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### State Project Delivery
- **Allocations**: $128,915,670
  - **Q1**: $3,912,609
  - **Q2**: $3,912,609
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  - **Q4**: $3,912,609

### State Administration
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  - **Q1**: $4,297,189
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  - **Q4**: $4,297,189

**Grand Total**
- **2015 Floods State Mitigation Competition**: $147,680,760
- **Q1**: $124,295,823
- **Q2**: $124,295,823
- **Q3**: $124,295,823
- **Q4**: $124,295,823
- **Remaining Funds**: $4,297,189,000
- **Q1**: $1,585,119,881
- **Q2**: $1,460,824,058
- **Q3**: $1,336,528,234
- **Q4**: $1,212,232,411

### 2016 Floods State Mitigation Competition
- **Allocations**: $500,000,000
- **Q1**: $3,500,000
- **Q2**: $3,500,000
- **Q3**: $3,500,000
- **Q4**: $3,500,000

### Resilient Communities Program
- **Allocations**: $100,000,000
- **Q1**: $1,050,000
- **Q2**: $1,050,000
- **Q3**: $1,050,000
- **Q4**: $1,050,000

### Regional and State Planning
- **Allocations**: $400,000,000
- **Q1**: $3,500,000
- **Q2**: $3,500,000
- **Q3**: $3,500,000
- **Q4**: $3,500,000

### Resilient Home Program
- **Allocations**: $100,000,000
- **Q1**: $1,050,000
- **Q2**: $1,050,000
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- **Q4**: $1,050,000

### Hazard Mitigation Plans
- **Allocations**: $30,000,000
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**Grand Total**
- **2016 Floods State Mitigation Competition**: $147,680,760
- **Q1**: $102,097,384
- **Q2**: $102,113,459
- **Q3**: $102,097,384
- **Q4**: $781,628,360
- **Remaining Funds**: $4,297,189,000
- **Q1**: $883,725,744
- **Q2**: $985,839,204
- **Q3**: $1,087,936,588
- **Q4**: $79,898,945

### 2025
- **Allocations**: $4,297,189,000
- **Q1**: 4,297,189,000
- **Q2**: 1,087,936,588
- **Q3**: 985,839,204
- **Q4**: 883,725,744
- **Remaining Funds**: 791,628,360

### 2026
- **Allocations**: $4,297,189,000
- **Q1**: 4,297,189,000
- **Q2**: 1,087,936,588
- **Q3**: 985,839,204
- **Q4**: 883,725,744
- **Remaining Funds**: 791,628,360

### 2027
- **Allocations**: $4,297,189,000
- **Q1**: 4,297,189,000
- **Q2**: 1,087,936,588
- **Q3**: 985,839,204
- **Q4**: 883,725,744
- **Remaining Funds**: 791,628,360
### 2015 Floods State Mitigation Competition
- **Q1:** $46,096,950
- **Q2:** $- $-
- **Q3:** $- $-
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### 2016 Floods State Mitigation Competition
- **Q1:** $147,680,760
- **Q2:** $- $-
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### Hurricane Harvey State Mitigation Competition
- **Q1:** $2,144,776,720
  - **Q2:** $42,895,534
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### Regional Mitigation Program
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### HMGP: Supplemental
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### Coastal Resiliency Program
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### Housing Oversubscription Supplemental
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### Resilient Home Program
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### Hazard Mitigation Plans
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### Resilient Communities Program
- **Q1:** $100,000,000
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### State Project Delivery
- **Q1:** $128,915,670
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### 2028 Total
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- **Remaining Funds:** $4,297,189,000

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Figure 6-3: Projected Expenditures by Program
Figure 6-4: Remaining Funds Timeline
6.4 Appendix E: Consultations – State of Texas

6.4.1 Mitigation Survey

On February 20, 2019, the GLO launched a digital survey through the online service Survey Monkey to gauge the disaster recovery and mitigation needs of communities throughout the 140 eligible counties. Elected officials, representatives of local, regional, and state agencies, public housing representatives, private sector, and nonprofits focused on housing, disaster recovery, and the needs of low-income and vulnerable populations were contacted and encouraged to complete the survey. The survey was also announced on the GLO’s recovery website, www.recovery.texas.gov, and was included in a two-page brochure that GLO staff distributed at stakeholder input sessions, public workshops, and conferences.

At the survey’s end on September 20, 2019, a total of 416 respondents from across the state had provided valuable input. The results of the survey are included below in the following charts and graphs.
Q3: Which county are you associated with?

Answered 388  Skipped 28
(Minimum number of responses to register on chart: 4)

Q5: What is the current status of your community’s Local Hazard Mitigation Plan?

Answered 377  Skipped 39
Q6: What is your biggest barrier to implementing hazard mitigation projects?

Answered: 389 Skipped: 27

- Funding: 77.58%
- Capacity/staffing: 11.05%
- Legal impediments (e.g., property rights, regulatory barriers): 3.34%
- Other (please specify): 8.23%

Q7: Please indicate which staff members your jurisdiction currently employs:

Answered: 368 Skipped: 48

- Personnel skilled in Geographic Information Systems (GIS): 35.47%
- Environmental scientists: 36.85%
- Land surveyors: 15.22%
- Grant managers: 36.14%
- Floodplain managers/administrators: 45.20%
- Emergency managers: 53.80%
- Engineers: 41.58%
- Public works officials: 52.72%
- Planners: 41.85%
Q8: What methods does your jurisdiction use to communicate the threat of potential incoming natural hazards? [Select all that apply]

Answered 379  Skipped 37

- Internet: 73.35%
- Television: 40.63%
- Text: 55.15%
- Phone calls: 55.13%
- Social Media: 81.27%
- Reverse 911: 32.72%
- Siren/alarm: 25.86%
- Radio: 36.15%
- Other (please specify): 15.40%

Q9: How does your community inform residents that their property is located in a FEMA-designated floodplain? [Select all that apply]

Answered 387  Skipped 29

- Other (please specify): 15.25%
- I don’t know: 24.83%
- We do not notify residents of their proximity to a floodplain: 20.63%
- Sending digital notification (text, email) to affected residents: 4.29%
- Mailing notification to affected residents: 8.53%
- Posting FIRM Maps in public locations (e.g., city hall, county courthouse, library): 23.24%
- Web-based flood maps: 41.86%
Q10: Taking into consideration your community’s past experiences with natural hazards, please rate, on a scale from 1 to 4, your community’s interest in pursuing the following activities:

Answered: 390  Skipped: 26

Local Plans and Regulations

Education and Awareness Programs

Preparedness, Coordination, and Response Actions

Structure and Infrastructure Projects

Q11: If additional, limited funding becomes available, please rate the following mitigation activities according to your community’s current priorities:

Answered: 389  Skipped: 27

- Strengthen emergency services
- Replace bridges and causeways
- Prevent development in floodplains through M&A
- Improve community awareness
- Fortify critical facilities
- Maintenance of vulnerable utilities
- Natural flood-mitigation features
- Evacuation plan
Q12: Which, if any, planning, mitigation, or protection activities has your community or jurisdiction implemented recently (i.e., in the past 5 years)? [Select all that apply]

Answered: 389  Skipped: 27

Constructing fire breaks
Controlled burns of overgrown vegetation
Encouraging purchase of flood insurance (i.e., participation in the NFIP; Fema-requiring policy)
Levees, flood walls, or related infrastructure
Local drainage improvements
Natural hazard/disaster warning system
Property elevation
Regional or local detention and/or retention...
Updated building codes
I don't know

Q13: Which, if any, planning, mitigation, or protection activities has your community or jurisdiction identified as needed but not yet implemented? [Select all that apply]

Answered: 385  Skipped: 31

Constructing fire breaks
Construction of a community-based shelter
Controlled burns of overgrown vegetation
Dry basin removal
Encouraging purchase of flood insurance (i.e., participation in the NFIP; Fema-requiring policy)
Flood-proofing/flood resistant levees, flood walls, or related infrastructure
Legal Environmental Improvements
Legal drainage improvements
Municipal/federal disaster awareness training/safety education
Natural hazard/disaster warning system
Property elevation
Proactive shoreline management
Recreational or non-compliant structures
Regional or local detention and/or retention basins
Repetitive losses, etc., areas and other areas of concern...
Updated building codes
Updated land development ordinances
I don't know
Other (please specify)
Q14: Are you currently, or have you in the past, coordinated with regional partners (neighboring communities and regional organizations such as councils of governments) to develop and implement hazard mitigation activities?

Answered: 353  Skipped: 23

- Yes: 60.56%
- No: 19.55%
- I don’t know: 19.34%

Q15: If your Local Hazard Mitigation Plan was completed prior to your community experiencing flooding in 2015–2017, are your prioritized mitigation activities still aligned with your community’s needs?

Answered: 350  Skipped: 26

- Yes, our priorities are still aligned with the community’s needs: 35.23%
- No, our community’s needs have changed: 10.28%
- I don’t know: 27.69%
- N/A: 19.74%
- If your community’s needs have changed, please describe how they have changed: 3.68%
Q16: Which of the following describes your funding sources for natural hazard/disaster mitigation activities? [Select all that apply]

- General Fund: 43.09%
- Bond Program: 14.33%
- Grant Funding: 57.80%
- Impact/Permitting Fees: 5.37%
- Special Tax Districts: 3.07%
- We do not have a local funding source for mitigation activities: 21.40%
- I don't know: 14.83%
- Other (please specify): 6.05%

Answered: 391  Skipped: 25
### 6.4.2 CONSULTATIONS

#### Table 6-3: 2019 GLO Mitigation Outreach Efforts

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<th>Purpose</th>
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<td>CAPCOG Round Table</td>
<td>CAPCOG county and city officials</td>
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<td>State Agencies Program Discussion</td>
<td>FEMA, TDEM, TCEQ, TWDB, FEMA, SBA</td>
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<td>GCRPC</td>
<td>Various local officials</td>
<td>Discussed Hurricane Harvey progress and needs</td>
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<td>Aransas County Brief</td>
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<td>Senate Finance Hearing</td>
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<td>Housing Work Group</td>
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<td>County, city, state, and federal official</td>
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<td>FEMA, SHMO, TDEM, TWDB</td>
<td>Promoted upcoming mitigation grant, discussed HMGP and FMA</td>
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<td>TWICC Meeting</td>
<td>TWDB, US EPA, TDA, TPUC, USACE, TRWA, USDA, Texas Secretary of State, TML, TCEQ</td>
<td>Discussed CDBG-MIT funding, need for outreach and communication across the state</td>
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<td>Security and Sustainability Forum</td>
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<td>Texas Emergency Management Conference</td>
<td>Representatives of local, regional, and state government</td>
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<td>AACOG Stakeholder Outreach</td>
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<td>4/25</td>
<td>Senate Intergovernmental Affairs</td>
<td>Various state elected officials</td>
<td>Updates on Hurricane Harvey progress, funding, and timelines</td>
</tr>
<tr>
<td>4/25</td>
<td>UT Law School Land Use Conference</td>
<td>Land use attorneys at UT Law School</td>
<td>Discussed when and if to rebuild after disasters</td>
</tr>
<tr>
<td>4/25</td>
<td>DETCOG Stakeholder Outreach</td>
<td>County judges, emergency management coordinators, and city administrators</td>
<td>Promoted awareness of upcoming mitigation grant, GLO mitigation survey, knowledge of HUD mitigation grant (timeline, allocation amounts per disaster)</td>
</tr>
<tr>
<td>4/26</td>
<td>CBCG Stakeholder Outreach</td>
<td>County judges, emergency management coordinators, and city administrators</td>
<td>Promoted awareness of mitigation grant, discussed local current mitigation strategies</td>
</tr>
<tr>
<td>Date</td>
<td>Meeting</td>
<td>Parties Represented</td>
<td>Purpose</td>
</tr>
<tr>
<td>---------</td>
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<td>--------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>4/26</td>
<td>City of Houston</td>
<td>Housing and Community Development Department staff</td>
<td>Discussed upcoming mitigation grant</td>
</tr>
<tr>
<td>4/29-4/30</td>
<td>CHARMM Workshop</td>
<td>Local community leaders from in around Refugio County</td>
<td>Presented on the upcoming CDBG-MIT Funds</td>
</tr>
<tr>
<td>5/1</td>
<td>CAPCOG Stakeholder Outreach</td>
<td>County judges, emergency management coordinators, and city administrators</td>
<td>Promoted awareness of mitigation grant, discussed local current mitigation strategies</td>
</tr>
<tr>
<td>5/1</td>
<td>Texas A&amp;M Agricultural Extension</td>
<td>Service email to all counties in Texas</td>
<td>Promoted awareness of mitigation grant, discussed local current mitigation strategies</td>
</tr>
<tr>
<td>5/2</td>
<td>Email to Non-Harvey Impacted COG Executive Directors</td>
<td>Service email to all counties</td>
<td>Promoted awareness of mitigation grant, discussed local current mitigation strategies</td>
</tr>
<tr>
<td>5/3</td>
<td>ETCOG Conference Call</td>
<td>ETCOG staff, GLO-CDR Policy Development team</td>
<td>Promoted awareness of mitigation grant, discussed local current mitigation strategies</td>
</tr>
<tr>
<td>5/6</td>
<td>Elected Officials Call</td>
<td>County and city officials</td>
<td>Hurricane Harvey Brief</td>
</tr>
<tr>
<td>5/6</td>
<td>H-GAC Conference Call</td>
<td>HGAC staff, GLO-CDR Policy Development team</td>
<td>Promoted awareness of mitigation grant, discussed local current mitigation strategies</td>
</tr>
<tr>
<td>5/7</td>
<td>Cameron County Parks Department Call</td>
<td>Cameron County Parks staff (Joe Vega), GLO-CDR Policy Development team</td>
<td>Promoted awareness of mitigation grant, discussed local current mitigation strategies</td>
</tr>
<tr>
<td>5/7</td>
<td>SPAG Call</td>
<td>SPAG staff (Tommy Murillo), GLO-CDR Policy Development team</td>
<td>Promoted awareness of mitigation grant, discussed local current mitigation strategies</td>
</tr>
<tr>
<td>5/7</td>
<td>STDCCOG Conference Call</td>
<td>STDCCOG staff (Juan Rodriguez), GLO-CDR Policy Development team</td>
<td>Promoted awareness of mitigation grant, discussed local current mitigation strategies</td>
</tr>
<tr>
<td>5/8</td>
<td>BVCOG Stakeholder Outreach</td>
<td>County judges, emergency management coordinators, and city administrators</td>
<td>Promoted awareness of upcoming mitigation grant, GLO mitigation survey, knowledge of HUD mitigation grant- timeline, allocation amounts per disaster</td>
</tr>
<tr>
<td>5/9</td>
<td>HCTCOG Conference Call</td>
<td>HCTCOG homeland security and emergency management staff</td>
<td>Promoted awareness of upcoming mitigation grant, GLO mitigation survey, knowledge of HUD mitigation grant- timeline, allocation amounts per disaster</td>
</tr>
<tr>
<td>5/9</td>
<td>NCTCOG Conference Call</td>
<td>North Central Texas COG emergency preparedness supervisor</td>
<td>Answered questions regarding the upcoming mitigation grant and mitigation survey</td>
</tr>
<tr>
<td>5/10</td>
<td>PRPC Conference Call</td>
<td>PRPC homeland security coordinator and emergency management coordinator</td>
<td>Answered questions regarding the upcoming mitigation grant and mitigation survey</td>
</tr>
<tr>
<td>Date</td>
<td>Meeting</td>
<td>Parties Represented</td>
<td>Purpose</td>
</tr>
<tr>
<td>--------</td>
<td>-------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>5/13</td>
<td>City of Roma Call</td>
<td>Representative from the City of Roma</td>
<td>Answered questions regarding the upcoming mitigation grant and mitigation survey</td>
</tr>
<tr>
<td>5/15</td>
<td>Texas Recovery Office Integrated Recovery Coordination Partner Call</td>
<td>Federal, state, and nonprofit staff and local officials</td>
<td>Promoted awareness of upcoming mitigation grant, GLO mitigation survey, knowledge of HUD mitigation grant- timeline, allocation amounts per disaster</td>
</tr>
<tr>
<td>5/15</td>
<td>SETRPC Stakeholder Outreach</td>
<td>Representatives of local governments - county judges, emergency management coordinators, and city administrators</td>
<td>Promoted awareness of upcoming mitigation grant, GLO mitigation survey, knowledge of HUD mitigation grant- timeline, allocation amounts per disaster</td>
</tr>
<tr>
<td>5/17</td>
<td>NCTCOG Call - Follow Up</td>
<td>Staff from the NCTCOG</td>
<td>Discussed information on CDBG-MIT funds and potential eligible activities</td>
</tr>
<tr>
<td>5/20-5/21</td>
<td>Harvey Readiness for Resilience Workshop</td>
<td>Community leaders, stakeholders, and technology partners</td>
<td>Discussed post-Harvey regional project directions and funding opportunities</td>
</tr>
<tr>
<td>5/21</td>
<td>HGAC Stakeholder Outreach</td>
<td>County judges, emergency management coordinators, and city administrators</td>
<td>Promoted awareness of upcoming mitigation grant, GLO mitigation survey, knowledge of HUD mitigation grant- timeline, allocation amounts per disaster</td>
</tr>
<tr>
<td>5/22</td>
<td>BVCCOG Stakeholder Outreach</td>
<td>Representatives of local governments within BVCOG service area including emergency management coordinators</td>
<td>Promoted awareness of upcoming mitigation grant, GLO mitigation survey, knowledge of HUD mitigation grant- timeline, allocation amounts per disaster</td>
</tr>
<tr>
<td>5/23</td>
<td>U.S. Green Building Council</td>
<td>Council Staff</td>
<td>Discussed resilience and disaster preparedness</td>
</tr>
<tr>
<td>5/23</td>
<td>CTCOG Stakeholder Outreach</td>
<td>County judges, emergency management coordinators, and city administrators</td>
<td>Promoted awareness of CDBG-MIT funding, participation in the GLO mitigation survey, GLO role in administering CDBG-DR grants</td>
</tr>
<tr>
<td>5/23</td>
<td>TWICC</td>
<td>TWDB, US EPA, TDA, TPUC, USACE, TRWA, USDA, Texas Secretary of State, TML, TCEQ</td>
<td>Presented on CDBG-MIT funding, provided emphasis on the need for outreach</td>
</tr>
<tr>
<td>5/21-5/24</td>
<td>UT Rio Grande Valley Stormwater Conference</td>
<td>Hidalgo, Cameron, and Willacy Counties</td>
<td>Discussed possible uses of CDBG-MIT funds</td>
</tr>
<tr>
<td>6/4</td>
<td>Texas Citizen Planner Workshop-Galveston County</td>
<td>Representatives from local governments in Galveston County, TAMU AgriLife staff</td>
<td>Promoted awareness of mitigation grant, participation in the mitigation survey, GLO-CDR role in administering CDBG-DR grants</td>
</tr>
<tr>
<td>6/6</td>
<td>TARC-Austin</td>
<td>Executive Directors of Texas Regional Councils</td>
<td>Promoted awareness of mitigation grant, participation in the mitigation survey, GLO-CDR role in administering CDBG-DR grants</td>
</tr>
<tr>
<td>6/7</td>
<td>Disaster Impact Task Force</td>
<td>Various state agencies, COGs, and local elected officials</td>
<td>Discussed possible uses of CDBG-MIT funds</td>
</tr>
<tr>
<td>Date</td>
<td>Meeting</td>
<td>Parties Represented</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------</td>
<td>----------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>6/12</td>
<td>Inaugural 2019 Interstate Summit</td>
<td>Representatives of state and local governments from Texas, Louisiana, Arkansas, and Mississippi</td>
<td>Participated in summit addressing flooding challenges across jurisdictions and align state efforts across state boundaries</td>
</tr>
<tr>
<td>6/14</td>
<td>Calhoun County Meeting</td>
<td>Various County and City officials</td>
<td>Discussed Hurricane Harvey progress and needs</td>
</tr>
<tr>
<td>6/19</td>
<td>USACE &amp; InFRM Coordination</td>
<td>UT Center for Space Research, USACE, FEMA, USGS, NWS</td>
<td>Discussed state and regional planning efforts related to recovery and mitigation</td>
</tr>
<tr>
<td>6/24</td>
<td>EPA Urban Waters Harvey Resiliency Workshop</td>
<td>Representatives from state and local governments</td>
<td>Attended workshop on funding streams related to recovery and mitigation</td>
</tr>
<tr>
<td>6/27</td>
<td>Texas Citizen Planner Workshop - Rockport</td>
<td>Representatives from local governments - Aransas, Nueces, and San Patricio county area, TAMU AgriLife staff, CBCOG staff</td>
<td>Promoted awareness of CDBG-MIT funding, participation in the GLO mitigation survey, GLO role in administering CDBG-DR grants</td>
</tr>
<tr>
<td>6/27</td>
<td>Texas Citizen Planner Workshop - Cameron County</td>
<td>Representatives from local governments - Cameron county area, TAMU AgriLife staff, and other city and state agencies.</td>
<td>Promoted awareness of CDBG-MIT funding, participation in the GLO mitigation survey, GLO role in administering CDBG-DR grants</td>
</tr>
<tr>
<td>7/8</td>
<td>NCTCOG Mitigation Congressional Roundtable</td>
<td>NCTCOG, congressional representatives- North Central Texas Area, TWDB, TxDOT, HUD,</td>
<td>Discussed efforts being undertaken by North Central Texas regarding flood mitigation and presented on upcoming CDBG-MIT funding</td>
</tr>
<tr>
<td>7/8</td>
<td>Hidalgo and Cameron Counties</td>
<td>County Officials</td>
<td>Discussed flooding and possible uses of upcoming CDBG-DR and MIT funds</td>
</tr>
<tr>
<td>7/9</td>
<td>Readiness for Resiliency - Houston</td>
<td>Local governments – H-GAC, private sector entities, and Texas AgriLife staff</td>
<td>Promoted awareness of CDBG-MIT funding, participation in the GLO mitigation survey, GLO role in administering CDBG-DR grants</td>
</tr>
<tr>
<td>7/11</td>
<td>Readiness for Resiliency - Port Aransas</td>
<td>Representatives from local governments- Coastal Bend area, private sector entities, and Texas AgriLife staff</td>
<td>Promoted awareness of CDBG-MIT funding, participation in the GLO mitigation survey, GLO role in administering CDBG-DR grants</td>
</tr>
<tr>
<td>7/11</td>
<td>Interagency Coordination Meeting</td>
<td>TDA, TCEQ, TDEM, TPWD, TWDB, GLO</td>
<td>Discussed uses of multiple funding sources for flood mitigation</td>
</tr>
<tr>
<td>7/16</td>
<td>Capital Area Regional Flood Management Planning Workshop</td>
<td>CAPCOG, US EPA, FEMA, floodplain administrators</td>
<td>Presented on CDBG-MIT funding</td>
</tr>
<tr>
<td>Date</td>
<td>Meeting</td>
<td>Parties Represented</td>
<td>Purpose</td>
</tr>
<tr>
<td>------</td>
<td>---------</td>
<td>---------------------</td>
<td>---------</td>
</tr>
<tr>
<td>7/16</td>
<td>BVCOG Economic Disaster Resiliency Workshop</td>
<td>Representatives from local governments, BVCOG staff, representatives from local and federal government</td>
<td>Promoted awareness of CDBG-MIT funding, participation in GLO mitigation survey, GLO role in administering CDBG-DR grants</td>
</tr>
<tr>
<td>7/17</td>
<td>TDEM/GLO Mitigation Meeting</td>
<td>TDEM and the GLO</td>
<td>Discussed alignment of CDBG-MIT funding and FEMA HMGP, PDM, and enhanced hazard mitigation plan</td>
</tr>
<tr>
<td>7/17</td>
<td>TRO Coordination Partner Call</td>
<td>FEMA, TPW, THC, UE EDA, US EDA - RD, TWDB, TDA, TDEM</td>
<td>Discussed recovery and mitigation efforts</td>
</tr>
<tr>
<td>7/18</td>
<td>GLO/NPS Meeting</td>
<td>NPS, FEMA, and GLO</td>
<td>Discussed NPS’s programs tied to recovery and mitigation in Texas</td>
</tr>
<tr>
<td>7/22</td>
<td>NCTCOG Transportation Director Meeting</td>
<td>NCTCOG and GLO</td>
<td>Discussed NCTCOG’s flood planning efforts</td>
</tr>
<tr>
<td>7/23</td>
<td>FEMA Region 6 - Denton</td>
<td>FEMA, TDEM, and Non-Profit staff</td>
<td>Promoted awareness of CDBG-MIT funding, participation in GLO mitigation survey, GLO role in administering CDBG-DR grants</td>
</tr>
<tr>
<td>7/24</td>
<td>TWICC</td>
<td>TWDB, US EPA, TDA, TPUC, USACE, TRWA, USDA, Texas Secretary of State, TML, TCEQ</td>
<td>Presented on CDBG-MIT funding</td>
</tr>
<tr>
<td>8/6</td>
<td>LRGVDC Conference Call</td>
<td>LRGVDC Staff</td>
<td>Answered questions regarding upcoming mitigation grant and survey</td>
</tr>
<tr>
<td>8/8</td>
<td>Montgomery/Galveston Counties</td>
<td>County and City Officials</td>
<td>Discussed upcoming mitigation funding opportunities</td>
</tr>
<tr>
<td>8/12</td>
<td>TIGR Training</td>
<td>2015 Floods, 2016 Floods, and Hurricane Harvey subrecipients</td>
<td>Discussed upcoming mitigation funding opportunities</td>
</tr>
<tr>
<td>8/13</td>
<td>State Mitigation Partners Summit</td>
<td>Various state agency officials</td>
<td>Discussed regional floodplain initiatives</td>
</tr>
<tr>
<td>8/21</td>
<td>Texas State Hazard Mitigation Team</td>
<td>SHMO, TDEM, TCEQ, Texas A&amp;M Forest Service, Texas State Climatologist, and TWDB</td>
<td>Updates on CDBG-MIT funds, HMGP and BRIC update, state agencies updates, and Coastal Resiliency Plan</td>
</tr>
<tr>
<td>8/23</td>
<td>State Mitigation Partners Coordination Symposium</td>
<td>SHMO, TDEM, TWDB, and FEMA</td>
<td>Discussed state flood planning initiatives, mitigation programs, opportunities to maximize mitigation funding streams</td>
</tr>
<tr>
<td>8/26</td>
<td>Texas Hurricane Season Talk</td>
<td>General public</td>
<td>Facebook Live discussion on hurricane season in Texas: how to be ready, recover, and mitigation activities</td>
</tr>
<tr>
<td>8/26</td>
<td>Hurricane Harvey in Review</td>
<td>Coastal Bend Officials</td>
<td>Discussed Hurricane Harvey progress and needs</td>
</tr>
<tr>
<td>9-4/9-5</td>
<td>TAC Conference</td>
<td>Texas county officials and staff</td>
<td>Overview of CDBG-MIT Federal Register notice and rules and regulations</td>
</tr>
<tr>
<td>Date</td>
<td>Meeting</td>
<td>Parties Represented</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------</td>
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<td>------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>9/6</td>
<td>GLO-CDR Mitigation Webinar</td>
<td>Eligible communities, public housing authorities, flood and drainage districts, Indian tribes, private sector</td>
<td>Discussed CDBG-MIT notice and regulations tied to Texas allocation</td>
</tr>
<tr>
<td>9/10</td>
<td>FEMA Mitigation Bootcamp</td>
<td>FEMA and State Mitigation Coordinators</td>
<td>Presented on CDBG-MIT funding and Coastal Resiliency Master Plan</td>
</tr>
<tr>
<td>9/13</td>
<td>Meeting with Federal and State Agencies</td>
<td>Federal and state agencies active in disaster recovery and mitigation</td>
<td>Overview of the CDBG-MIT Federal Register notice, provided an overview of planning activities underway and proposed</td>
</tr>
<tr>
<td>9/16</td>
<td>Mitigation Planning Outreach</td>
<td>Federal and state agencies active in disaster recovery and mitigation</td>
<td>Overview of the CDBG-MIT Federal Register notice, provided an overview of planning activities underway and proposed</td>
</tr>
<tr>
<td>9/26</td>
<td>Mitigation Public Hearing-Austin</td>
<td>General public</td>
<td>Overview of CDBG-MIT Federal Register notice and rules and regulations, accepted oral and written public comments</td>
</tr>
<tr>
<td>10/1</td>
<td>Mitigation Public Hearing-Beaumont</td>
<td>General public</td>
<td>Overview of CDBG-MIT Federal Register notice and rules and regulations, accepted oral and written public comments</td>
</tr>
<tr>
<td>10/2</td>
<td>Mitigation Public Hearing-Corpus Christi</td>
<td>General public</td>
<td>Overview of CDBG-MIT Federal Register notice and rules and regulations, accepted oral and written public comments</td>
</tr>
<tr>
<td>10/4</td>
<td>Texas Municipal League</td>
<td>City officials and staff</td>
<td>Overview of CDBG-MIT Federal Register notice and rules and regulations, accepted oral and written public comments</td>
</tr>
<tr>
<td>10/9</td>
<td>Elected Officials Call</td>
<td>County, city, state, and federal officials</td>
<td>Hurricane Harvey and CDBG-MIT Brief</td>
</tr>
</tbody>
</table>
6.5 Appendix F: Regional Methods of Distribution

6.5.1 Council of Governments Method of Distribution Methodology

In order to determine the distribution funds for the COG MOD program for counties impacted by Hurricane Harvey, the GLO designed an allocation methodology that accounts for risks to natural hazards, social vulnerability, financial capacity, and population. These four factors form the basis for a weighted sum model that results in a final relative factor that determines the amount of funds to be allocated to each eligible county. Throughout this discussion it should be noted that HUD MID and State MID allocations are split, with 80 percent of funds going towards ’s HUD MID areas, and 20 percent going to State MID areas; as a result, the calculations described below were performed separately for HUD MID and State MID areas. This section of the appendices explains the rationale for the use of each factor, the source of data for that factor, and the calculations performed to generate the MOD.

6.5.1.1 Composite Disaster Index (CDI)

As described in State Mitigation Needs Assessment, the CDI was developed by the Center for Space Research at UT Austin using seven different representations of historical data selected to document the distribution of natural hazard damage across Texas’ 254 counties: 1) repetitive flood losses; 2) high winds from hurricanes; 3) wildfires; 4) major river flood crests; 5) tornado; 6) persistent drought conditions and; 7) hail. The CDI uses data from the years 2001 to 2018, which are likely to be of the highest accuracy and best represents the climatic conditions facing Texas today.

To create the CDI, a uniform method is applied to only the 140 eligible counties to represent the county-level data for each natural hazard category. For each hazard category (e.g., high winds from hurricanes, wildfires), the 14 counties that were impacted most frequently by that particular hazard are ranked in the top 10 percent, with the next 21 counties in the remainder of the top 25 percent. The following 69 counties fall in the midrange (25-75 percent) and experience an impact frequency that reflects the statewide average. The next 22 counties are occasionally affected and fall below the statewide average (bottom 25 percent), while the final 14 counties experience the least frequent impacts and form the bottom 10 percent. With this normalized ranking across the seven hazard categories complete, those rankings are then multiplied by a weighted factor used to represent the frequency and severity of the hazard type. The weights for each disaster type are:
Table 6-4: CDI Hazard Weights

<table>
<thead>
<tr>
<th>Hazard Type</th>
<th>Weight Allocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repetitive Loss (NFIP) from Flooding</td>
<td>35%</td>
</tr>
<tr>
<td>Hurricane Winds</td>
<td>25%</td>
</tr>
<tr>
<td>Wildfire</td>
<td>15%</td>
</tr>
<tr>
<td>River Flood Crests</td>
<td>10%</td>
</tr>
<tr>
<td>Tornado</td>
<td>10%</td>
</tr>
<tr>
<td>Drought</td>
<td>3%</td>
</tr>
<tr>
<td>Hail</td>
<td>2%</td>
</tr>
</tbody>
</table>

This results in a composite score for each county that serves as the raw CDI factor included in the allocated methodology. This number was is normalized to represent a percentage of the total by dividing the county composite score by the sum of the composite score for all counties.

6.5.1.2 Social Vulnerability Index (SoVI)

The second factor in the allocation model is the Social Vulnerability Index. The Social Vulnerability Index (SoVI) measures the social vulnerability of counties across the United States—in particular, their vulnerability to environmental hazards. This index, developed by the University of South Carolina’s Hazards & Vulnerability Research Institute, synthesizes 29 socioeconomic variables which contribute to reduction in a community’s ability to prepare for, respond to, and recover from hazards. SoVI is a comparative metric that facilitates the examination of the differences in vulnerability among counties. SoVI shows where there is uneven capacity for disaster preparedness and response, and where resources might be used most effectively to reduce pre-existing vulnerability. The data sources for the development of SoVI come primarily from the United States Census Bureau. The SoVI data combines the best available data from both the 2010 U.S. Decennial Census and 5-year estimates from the American Community Survey (ACS).

Because SoVI scores can result in both a positive and negative number, the first step taken to utilize this number as a weighted factor is to turn all SoVI scores into positive numbers. This is accomplished by subtracting the lowest SoVI score of all counties (which is a negative number) from the SoVI score of a particular county, and then adding 1. This ensure that the lowest score in the range is at least 1. This positive SoVI is then normalized to represent a percentage of the total by dividing the county score by the sum of the score for all counties.
The third factor in the allocation model is Per Capita Market Value (PCMV) which is utilized as a proxy to gauge the financial capacity of a unit of local government to generate revenue to fund its operations and capital expenditures. To calculate per capita market value, GLO obtained the tax levy data set for all counties in Texas for 2018 from the State Comptroller’s Office. This dataset includes the market value of all properties in every county in Texas, along with the taxable value of land and effective tax rates. Population data for each county from the most recently available

6.5.1.3 Financial Capacity (Per Capita Market Value)

American Communities Survey is included and used to generate the per capita market value—the market value of all property in a county divided by the county population. Because the purpose of the PCMV is to give greater weight to areas with lower financial capacity, and thus lower PCMV, the model turns the straight PCMV into a relative factor, which is accomplished by dividing the sum of all the PCMV for every county by the PCMV for the particular county; the smaller the PCMV the larger the factor. This number is then normalized to represent a percentage of the total by dividing the county factor score by the sum of the factor for all counties.

6.5.1.4 County Population

The final factor for the allocation model is county population which was obtained from the U.S Census Bureau’s most recent American Communities Survey data. As with the other factors, the population is normalized to represent a percentage of the total by dividing the county population by the sum of the population for all considered counties.

6.5.1.5 Allocation Model Weights

These four factors are then each given a weight—30 percent for the CDI, 30 percent for SoVI, 20 percent for PCMV, and 20 percent for population—that is multiplied by the respective score for each county and each factor to create a Combined Adjustment Factor (CAF). The CAF is then multiplied by the total program amount—having already split the counties into HUD MID and State MID allocations that split the program amount 80 percent to 20 percent—to arrive at the final allocation for the respective county.

The county values are then grouped by Council of Government and rounded to the nearest $1,000 to arrive at the COG MOD allocation.