Shallow flooding is defined as flooding with an average depth of one to three feet in areas where a clearly defined channel does not exist, where the path of flooding is unpredictable and where velocity flow may be evident. This can occur for a variety of natural or human-caused reasons. Some areas of shallow flooding are identified on flood hazard maps – many are not. Shallow flooding is characterized by ponding or sheet flow. Ponding or overland ("sheet") flow when rainfall rates temporarily exceed the drainage capacity of an area. In overbank events, excess water from snowmelt, rainfall, or storm surge accumulates and overflows onto banks and adjacent floodplains. In ponding events, water temporarily accumulates in an area until normal drainage allows it to flow away. Overland or sheet flow floods occur when intense rainfall occurs, and water simply runs across the ground, in extreme cases at depths of more than a foot and at relatively high velocities. For additional information about floods visit NOAA's *Flood Monitor* page located at http://www.noaawatch.gov/floods.php.

See Section 5.4.3, Tornadoes, (Figure 5.4-13), which shows the basic wind speed map from the International Building Code. This map is used as part of the basis for designing buildings to withstand reasonably anticipated winds.[1] Fort Bend County falls within the area where the American Society of Civil Engineers (7-98) indicates a design wind speed of 200 mph. The County does not have minimum design wind speed requirements for the unincorporated areas. However, the municipalities within Fort Bend County have adopted individual building code requirements.

While the County has identified the physical dam locations, inundation maps are not yet developed for many dams within Fort Bend County and where they are, they are not readily available to the County and/or consultant. Where these inundation maps are developed, for security reasons, the owners and maintainers of these dams will not release the data. We have been working with Dam owners and with TCEQ to obtain as much data as possible to address this requirement but have not been successful in obtaining any further than storage capacity for many of the high hazard dams. We are identifying this requirement as a data deficiency in this plan and have added an action item associated with attempting to obtain this data for our next plan update.

As a practical matter, it is impossible to make a general statement about the vulnerability of the entire County to the dam failure hazard. However, based on the fact that there are only two dams with other than a "low" hazard classification, and that the two dams that are classified as high hazard have been inspected recently (and are part of a standardized dam safety program) it can be inferred that community-wide vulnerability to the hazard is relatively low.

Review of report titled *The Wildland Urban Interface (WUI) and the National Forests of East Texas (2007)* indicate that Fort Bend County is not particularly prone to wildfires because of the relative lack of fuel load – vegetation prone to burning – and the low-density nature of development in areas where there is fuel. Map 5.4-29 indicates that there is some WUI in the western part of the County, south of Highway 59.

Wildfire Threat is the likelihood of a wildfire occurring or burning into an area. Threat is derived by combining a number of landscape characteristics including surface fuels and canopy fuels, resultant fire

[1] American Society of Civil Engineers, 2002

behavior, historical fire occurrence, percentile weather derived from historical weather observations, and terrain conditions. These inputs are combined using analysis techniques based on established fire science.

The measure of wildfire threat used in the Texas Wildfire Risk Assessment (TWRA) is called Wildland Fire Susceptibility Index, or WFSI. WFSI combines the probability of an acre igniting (Wildfire Ignition Density) and the expected final fire size based on rate of spread in four weather percentile categories. WFSI is defined as the likelihood of an acre burning. Since all areas in Texas have WFSI calculated consistently, it allows for comparison and ordination of areas across the entire state. For example, a high threat area in East Texas is equivalent to a high threat area in West Texas.

To aid in the use of Wildfire Threat for planning activities, the output values are categorized into seven (7) classes. These are given general descriptions from Low to Very High threat (as defined in Table below). The threat map is derived at a 30 meter resolution. This scale of data was chosen to be consistent with the accuracy of the primary surface fuels dataset used in the assessment. To better illustrate the location of wildfire threat within the County, Figure 5-4-29-1 shows the entire County and by color, demonstrates classes of wildfire threat - if an incorporated area has a very high wildfire threat (as defined in Table 5-4-16-1) to a non-burnable threat. To help identify the map, Table 5-4-16-2 outlines the jurisdiction and provides its class (0-7)

Table 5-4-16-1
Wildfire Threat Acres in Fort Bend County based on WFSI

Class	Acres	Percent
0 Non-Burnable	226,076	39.9%
1 (low)	335,851	59.3%
2	4,902	0.9%
3 (moderate)	0	0.0%
4	0	0.0%
5 (high)	0	0.0%
6	0	0.0%
7 (very high)	0	0.0%
Total	566,829	100.00%

Figure 5.4-30

Texas Forest Service Wildfire Risk Assessment based on WFSI Index

Fort Bend County

Based on Figure 5.4-30, Table 5-4-16-2 lists the WFSI index for Fort Bend County unincorporated and for each of the incorporated areas that are participating in the plan. As indicated, most of the County is between 0 and 1 on the WFSI index, with a small portion of the County being at a WFSI index of 2 with 0 being non-burnable to 1 and 2 being low.

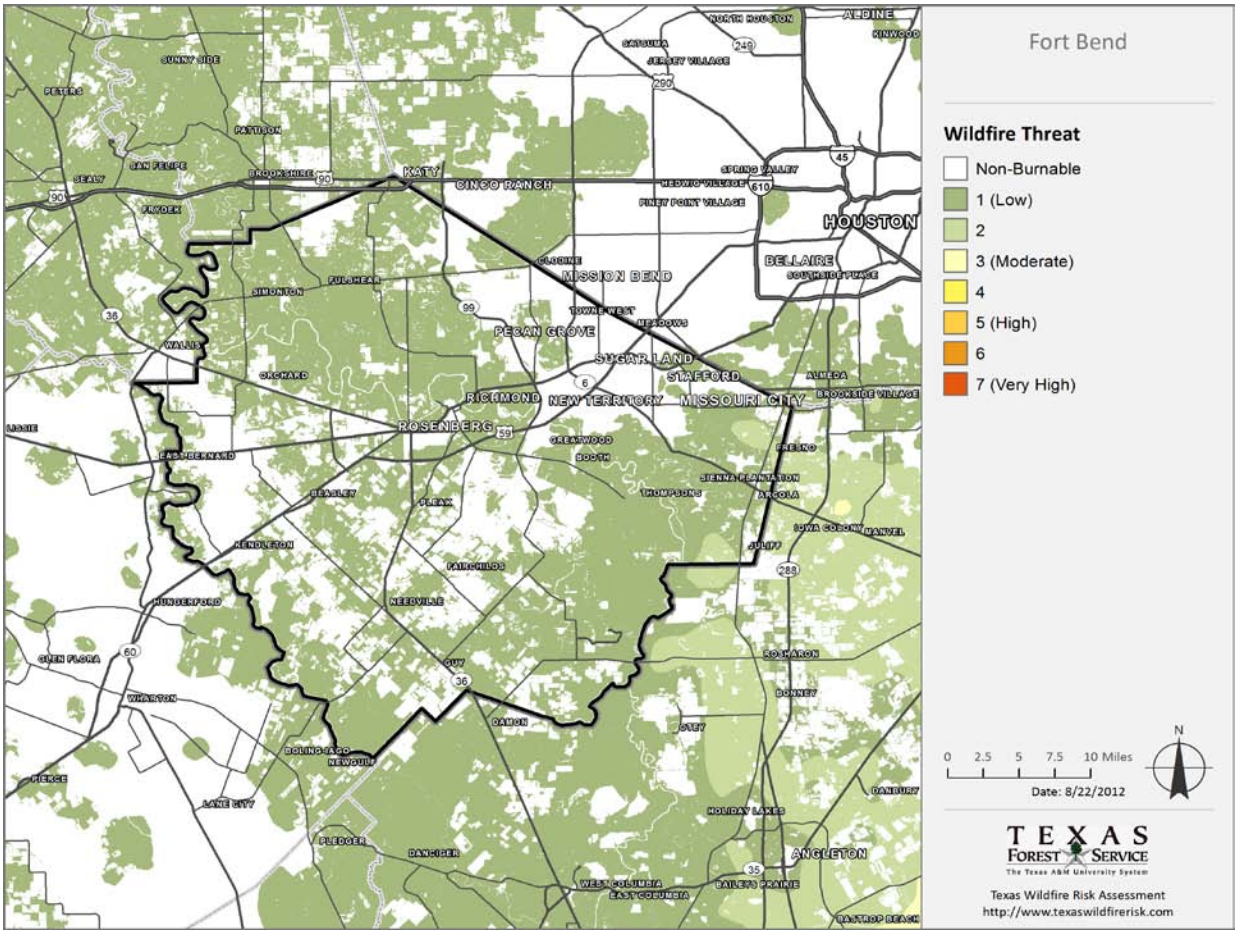


Table 5-4-16-2
WFSI index for Fort Bend County

Jurisdiction	WFSI	Jurisdiction	WFSI
Fort Bend County	0 - 2	Orchard	0 - 1
Arcola	0 - 1	Pleak	0 - 1
Beasley	0 - 1	Richmond	0 - 1
Fairchilds	0 - 1	Rosenberg	0 - 1
Fulshear	0 - 1	Simonton	0 - 1
Kendleton	0	Stafford	0 - 1
Meadows Place	0 - 1	Sugar Land	0 - 1
Missouri City	0 - 1	Thompsons	0 - 1
Needville	0 - 1	Weston Lakes	0 - 1

While the location of the wildfire is throughout the County, the threat is low to none as defined in Table 5-4-16-1.

Severity of the Wildfire Hazard

The frequency and severity of wildfires depends on both weather and human activity. In the planning area, severity has historically been low, and duration a matter of hours to a few days. However, Fort Bend County is at some risk for wildfire year-round (categorized above as low). There is always the possibility that a wildfire will take place in or around the County, and wildfires can spread quickly and may affect areas of the County in a very short period of time. Continued growth and development throughout the County have increased the threat to the built environment from wildfire.

In Fort Bend County, the peak time for wildfires is during the summer months, extending into fall. That is the time of year when all of the factors contributing to fires are present. These factors include extreme heat, drought, and continuous gusty winds. A second peak time for wildfires is several weeks to a month following a very hard freeze. The freezing temperatures kill field vegetation. If little or no rainfall has occurred, the potential for rapid combustion is very high. When the limited rainfall is combined with gusty winds following the passage of a cold front (typically with very low humidity) there is the potential for a major wildfire.

Impact on Life and Property

As mentioned above, the risk of wildfires in unincorporated Fort Bend County and the incorporated areas is low and is spread throughout the County. This risk is predominately to open space or low- to medium-density residential land uses. Residential structures are mostly wood-frame buildings with masonry veneer, although older structures may be unreinforced masonry, and there are numerous structures with wood or vinyl siding. Non-residential structures include a range of building types, with the most common being lightly engineered steel-frame low-rise. Many of these are masonry tilt-wall exteriors. There are no records of deaths or injuries and no recorded loss of property from wildfires in the planning area. Because the County

does not maintain data about vegetated areas, fuel loads and the types of structures potentially exposed to wildfire, it is not possible to assess impacts with any certainty, particularly when risks from this hazard are also related to weather conditions, which are inherently unpredictable. However, it is possible to state generally that potential wildfire impacts to the large majority of the County and incorporated areas within are low. Using the Texas Forest Service Wildfire Threat scale shown on the map on page 5-73 above, with Non-burnable (0) to Very High (7), Fort Bend County ranges from 0 – 2, with the majority of the County and incorporated areas within being either Non-burnable (0) or Low (1).

Like most such areas, Fort Bend County has very good fire detection and suppression capabilities. Coupled with relatively low fuel loads and limited interface between potential fuel and the built environment, this also suggests that the wildfire hazard is low (see above). This is borne out by research on the NCDC database and the planning team, which show a very low incidence of wildfires. If wildfire risk appears to be increasing for any reason, the County will consider trying to obtain more information about fuel loads and interface areas, but at this point, this is not a high priority.

Occurrences of the Wildfire Hazard

The NCDC indicated there have been no wildfire incidents between 1950 and August, 2010 in Fort Bend County, although this is likely a function of reporting to the NCDC more so than a lack of any events. Other sources indicate that recent wildfire events in Fort Bend County have occurred in 2009 and 2010. The events are summarized below.

- August 9, 2009. A brush wildfire near FM 359 and Hunt Road burned between 400 and 800 acres, and threatened several homes near Fulshear. Extremely dry conditions, thick underbrush, and strong winds helped the fire spread quickly. At the height of the blaze a dozen fire departments from Fort Bend, Harris, Waller and Austin Counties had approximately 75 firefighters working to suppress the fire. The Texas Forest Service assisted with helicopter water drops.
- October 28, 2010. A wildfire occurred on State Highway (SH) 99 between Pleak Road and Morton Road in Fort Bend County. Dry conditions, low humidity, and 30 m.p.h. winds helped spread the fire. Between 75 and 85 firefighters from 12 departments responded to the event. The fire burned between 200 and 220 acres but was quickly contained. There were no injuries or property damage. Texas Department of Transportation (TXDOT) temporarily closed all lanes due to visibility concerns caused by the smoke from the fire.

In terms of probability, although future incidents may occur more frequently due to the increase in human activity in forested areas, there is no acceptable mechanism to assign a probability to site-specific fire occurrences. With a total of two wildfire events between 1950 and 2010, Fort Bend County experiences a wildfire event on average every 30 years. The two events have occurred over a period of 60 years, which calculates to 3% annual probability of future wildfire occurrences. Based on historical data, the probability of future events occurring in Fort Bend County is considered Low. See Table 5.4-1 for the definition of high, medium and low probability of occurrence. The majority of wildfires that do occur, will burn less than 10 acres before they are fully contained. However, as indicated in the historical occurrences highlighted above, in extreme cases, where conditions are favorable, wildfires could burn as many as 800 acres and threaten residential and mixed use structures before being fully contained. As noted, wildfire incidents are directly related to weather patterns and antecedent conditions, and thus probabilities are dynamic.

Severity and Extent of the Drought Hazard

A drought's severity depends on numerous factors, including duration, intensity, and geographic extent as well as regional water supply demands by humans and vegetation. The severity of drought can be aggravated by other climatic factors, such as prolonged high winds and low relative humidity.[2] Due to its multi-dimensional nature, drought is difficult to define in exact terms and also poses difficulties in terms of comprehensive risk assessments.

Texas is divided into ten climatic areas that range from substantially heavy precipitation through semi-arid to arid climates. Most of Texas is prone to periodic droughts of differing degrees of severity. One reason is the State's proximity to the High Plains (the Great American Desert region) of the southwestern United States. In every decade of this century, Texas has fallen victim to one or more serious droughts. The severe-to-extreme drought that affected every region of the State in the early to mid-1950s was the most serious in recorded U.S. history. As a practical matter, the extent of the drought hazard (meaning the potential severity) is impossible to estimate. However, recent trends seem to indicate that droughts may become more severe (moving from Fort Bend County's current "Near Normal" PDSI rating (-1.9 to +1.9) closer to PDSI "Severe Drought" rating (-3.0 or -3.9). The potential for an increase in the extent of droughts is equal over the entire County-wide planning area.

One method used by scientists to calculate the severity and duration of a drought is the Palmer Drought Severity Index (PDSI). The PDSI indicates the prolonged and abnormal moisture deficiency or excess and indicate general conditions, not local variations caused by isolated rain. The PDSI is an important climatological tool for evaluating the scope, severity, and frequency of prolonged periods of abnormally dry or wet weather.[3]

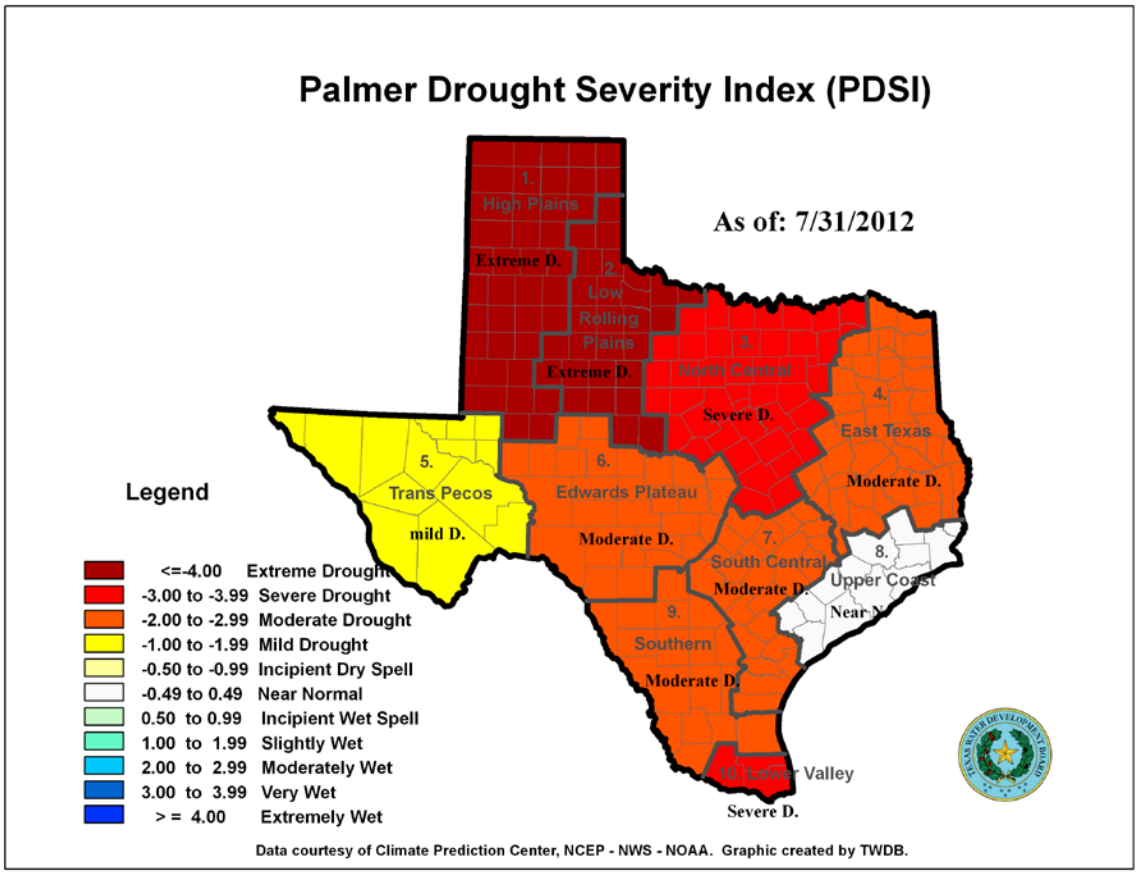
The equation for the PDSI was empirically derived from the monthly temperature and precipitation scenarios of 13 instances of extreme drought in western Kansas and central Iowa and by assigning an index value of -4 for these cases. Conversely, a +4 represents extremely wet conditions. From these values, 7 categories of wet and dry conditions can be defined. Table 5.4-17 identifies the values used to define the PDSI.[4]

Table 5.4-17
Palmer Drought Severity Index
(Source: NOAA, National Weather Service - Climate Prediction Center)

Palmer Drought Severity Index
-4.0 or less (Extreme Drought)
-3.0 or -3.9 (Severe Drought)
-2.0 or -2.9 (Moderate Drought)
-1.9 to +1.9 (Near Normal)
+2.0 or +2.9 (Unusual Moist Spell)
+3.0 or +3.9 (Very Moist Spell)
+4.0 or above (Extremely Moist)

[2] FEMA, 1997
[3] NOAA. NWS. Climate Prediction Center. Drought Indices – Explanation.
[4] NOAA. NWS. Climate Prediction Center. Drought Indices – Explanation.

Figure 5.4-31
Palmer Drought Severity Index (PDSI)



Reviewing the Texas Water Development Board's summary of drought in Texas using PDSI, Fort Bend County is *Near Normal* according to the PDSI scale (-0.49 to 0.49).

Table 5.4-21
Hail Size Summary for Fort Bend County
Between 1950 and August, 2010
(Source: NOAA/NCDC)

Size of Hail	Number of Events
0.75	41
0.88	4
1.00	19
1.50	6
1.75	11
2.00	1
2.75	3

With a total of 85 hailstorms, Fort Bend County experiences a significant hail storm event on average slightly more than one hail storm per year. The 85 events have occurred over a period of 60 years which equates to an annual expected probability of 100%, although this figure applies to the entire County, so site-specific probability is much lower. Based on historical records from the NCDC database the future probability of hail storms in Fort Bend County is considered high. See Table 5.4-1 for the definition of high, medium and low probability of occurrence. Although the probability is high, the impact on life in the County and property damage is considered minor. Definition of minor is less than $250,000 in damages, no deaths, and less than 10 injuries. Hail storms throughout the County, to include the incorporated areas, will cause minor injuries to persons (due to being hit by hail), dings and dents in automobiles, damage to housing siding, and damage to roof shingles on residential, commercial, and industrial structures.

Based on the nine events between 1996 and August, 2010, an excessive heat event occurs on average approximately once every 1.5 years. The nine excessive heat events have occurred over a period of 14 years, an approximate 65% annual probability of future excessive heat occurrences. Based on historical records from the NCDC database the future probability of extreme heat events occurring in Fort Bend County is high. See Table 5.4-1 for the definition of high, medium and low probability of occurrence. Although the probability is high, the impact on life and property in the County and all incorporate areas is considered minor. Definition of minor is less than $250,000 in damages, no deaths, and less than 10 injuries. During excessive heat events, injury or death may occur to elderly persons, small children, infants and the chronically ill who do not have adequate cooling units in their homes (to include heat stroke and dehydration). However, the NCDC reported no known deaths or injuries from excessive heat in the planning area.

24	Due to the data deficiency identified as part of the Dam Failure Risk Assessment, work with dam owners and TCEQ to encourage the development of inundation maps for all high hazard dams within the planning area. When and if available, this data will be used for the next plan update to complete a more thorough risk assessment, to include extent and impact of potential dam failures. Priority: Low to medium.	Floodplain Administrator	Little or no cost other than staff time, because the study/studies are the responsibility of TCEQ and/or dam owners	Likely to start in 2014	Dam failure	Not independ-ently cost-effective	Initiated in 2011 HMP

+

As noted in Item 3 above, the County intends to conduct a periodic review of the HMP to ensure the document remains current and accurately represents risks to the jurisdiction, and the County's mitigation priorities. The Fort Bend Office of Emergency Management (OEM) is responsible for initiating the update process. The Mitigation Planning Committee (MPC) is responsible for carrying out a detailed review of all sections of the HMP, with particular focus on the Hazard Identification, Vulnerability and Loss Estimation and Mitigation Strategies sections. OEM will work with the MPC to assign specific individuals and/or departments to review various sections of the document, based on technical expertise. These individuals or department representatives will review the HMP in specific subject areas, and make recommendations to the Committee regarding updates. The MPC will then determine the most appropriate person and/or mechanism to complete the update. After the updates are completed, the MPC will review the document, make any final edits. In cases where there are significant departures from the HMP (as determined by OEM), the MPC may at its discretion request that the County Commissioners re-approve and re-adopt the HMP.

Major comprehensive review of and revisions to the *Fort Bend County Hazard Mitigation Plan Update* will be considered on a five-year cycle. Adopted in 2011, the Plan will enter its next review cycle sometime in 2015, with adoption of revisions anticipated in 2016. The MPC will be convened to conduct the comprehensive evaluation and revision to include the identification and prioritization of additional mitigation action items, as required.

10.6 Continued Public Involvement

Upon adoption of the 2011 Plan update, the public will be notified of any substantial changes to the document between 2011 and the next scheduled Plan update in 2016. This will be accomplished by placing a legal notice in the local newspaper and via an announcement on the County's web site. Comments and feedback will be solicited, and collected via telephone call, email and regular mail. The comments will be considered by the MPC as part of the update process, and will be incorporated as that body deems appropriate. Any changes proposed by the MPC considered significant will be distributed to the list of stakeholders identified in Table 4.4-2. The Stakeholders will be encouraged to review the changes and provide comments on any proposed plan revisions.

Resolution # _____

WHEREAS Fort Bend County Texas has experienced natural hazards that result in public safety hazards and damage to private and public property;

WHEREAS Fort Bend County had a FEMA approved hazard mitigation plan. FEMA requires that hazard mitigation plans be updated and re-adopted every five years.

WHEREAS the hazard mitigation planning process and the update process set forth by the State of Texas and the Federal Emergency Management Agency offers the opportunity to consider natural hazards and risks, and to identify mitigation actions to reduce future risk;

WHEREAS the Texas Division of Emergency Management provided federal mitigation funds to support the update to the mitigation plan;

WHEREAS an update to the *Hazard Mitigation Plan* has been developed by the Mitigation Planning Committee;

WHEREAS the updated *Hazard Mitigation Plan* includes a prioritized list of mitigation actions including activities that, over time, will help minimize and reduce safety threats and damage to private and public property, and

NOW THEREFORE BE IT RESOLVED by the Fort Bend County Commissioners Court that:

1. The updated *Hazard Mitigation Plan* is hereby adopted as an official plan of Fort Bend County.

2. The Fort Bend County departments identified in the Plan are hereby directed to pursue implementation of the recommended high priority activities that are assigned to their departments.

3. Any action proposed by the Plan shall be subject to and contingent upon budget approval, if required, which shall be at the discretion of the Commissioners Court, and this resolution shall not be interpreted so as to mandate any such appropriations.

4. The Fort Bend County Emergency Management Coordination is designated to coordinate with other offices and shall periodically report on the activities, accomplishments, and progress, and shall prepare an annual progress report to be submitted to the Texas Division of Emergency Management. The status reports shall be submitted by July 1of each year.

PASSED by the Fort Bend County Commissioners Court, this _____ day of _____, 2012.