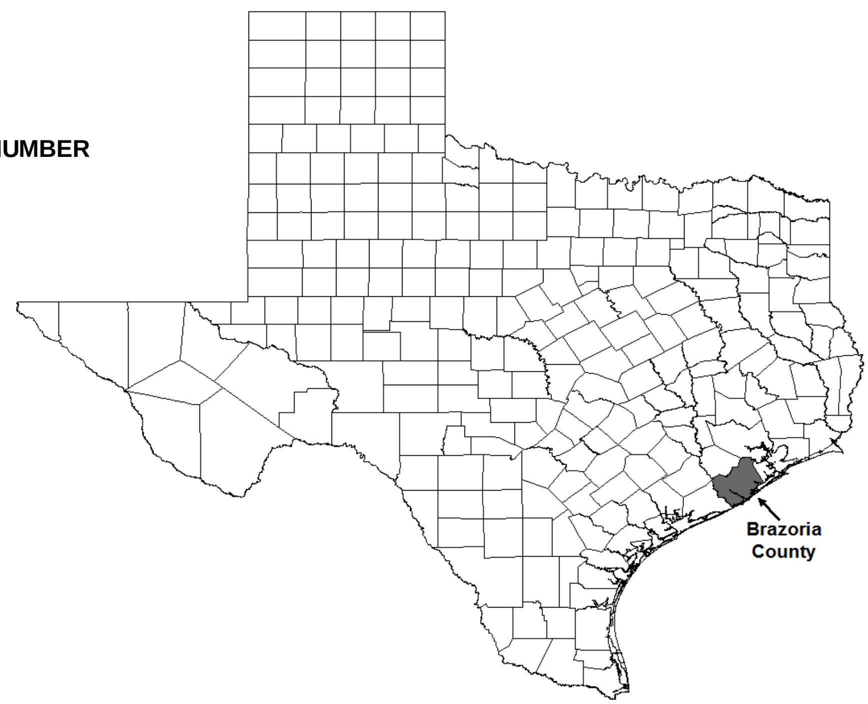
FLOOD INSURANCE STUDY

BRAZORIA COUNTY
TEXAS
AND INCORPORATED AREAS
VOLUME 1 OF 4

COMMUNITY NAME	COMMUNITY NUMBER
ALVIN, CITY OF	485451
ANGLETON, CITY OF	480064
BAILEY'S PRAIRIE, VILLAGE OF	480065
BONNEY, VILLAGE OF	481300
BRAZORIA, CITY OF	480066
BRAZORIA COUNTY, UNINCORPORATED AREAS	485458
BROOKSIDE VILLAGE, CITY OF	480067
CLUTE, CITY OF	480068
DANBURY, CITY OF	480069
FREEPORT, CITY OF	485467
HILLCREST VILLAGE, CITY OF	485478
HOLIDAY LAKES, TOWN OF	485517
IOWA COLONY, CITY OF	481071
JONES CREEK, VILLAGE OF	480072
LAKE JACKSON, CITY OF	485484
LIVERPOOL, CITY OF	480075
MANVEL, CITY OF	480076
OYSTER CREEK, CITY OF	481255
PEARLAND, CITY OF	480077
QUINTANA, TOWN OF	481301
RICHWOOD, CITY OF	485502
SANDY POINT, CITY OF	480071
SURFSIDE BEACH, CITY OF	481266
SWEENY, CITY OF	485512
WEST COLUMBIA, CITY OF	480081



REVISED: DECEMBER 30, 2020

Federal Emergency Management Agency

Flood Insurance Study Number
48039CV001A

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

This preliminary revised Flood Insurance Study contains profiles presented at a reduced scale to minimize reproduction costs. All profiles will be included and printed at full scale in the final published report.

Part or all of this Flood Insurance Study may be revised and republished at any time. In addition, part of this Flood Insurance Study may be revised by the Letter of Map Revision process, which does not involve republication or redistribution of the Flood Insurance Study. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current Flood Insurance Study components.

ATTENTION: On FIRM panels 0430, 0435, 0440, 0445, 0465, 0605, and 0610 the Angleton Levee; and on FIRM panels 0615, 0620, 0640, 0645, 0785, 0795, 0805, 0810, and 0815 the Freeport Hurricane Flood Protection Levee System; have not been demonstrated by the communities or levee owners to meet the requirements of Section 65.10 of the NFIP regulations in 44 CFR as it relates to the levee's capacity to provide 1-percent-annual-chance flood protection. The subject areas are identified on FIRM panels (with notes and bounding lines) and in the FIS report as potential areas of flood hazard data changes based on further review.

FEMA has updated the levee analysis and mapping protocols for non-accredited levees. Until such time as FEMA is able to initiate a new flood risk project to apply the new procedures, the flood hazard information on the aforementioned FIRM panel that are affected by the Angleton Levee and Freeport Hurricane Flood Protection Levee System are being added as a snapshot of the prior effective information presented on the FIRMs and FIS reports dated September 22, 1999 for Brazoria County, Texas and Incorporated Areas. As indicated above, it is expected that affected flood hazard data within the subject area could be significantly revised. This may result in floodplain boundary changes, 1-percent-annual-chance flood elevation changes, and/or changes to flood hazard zone designations.

The effective FIRM panels (and the FIS) will again be revised to update the flood hazard information associated with the Angleton and Freeport Levee Systems when FEMA is able to initiate and complete a new flood risk project to apply the updated levee analysis and mapping procedures.

Initial Countywide Flood Insurance Study Date Effective Date: June 5, 1989

First Revised Countywide Flood Insurance Study Date: May 4, 1992

Second Revised Countywide Flood Insurance Study Date: November 17, 1993

Third Revised Countywide Flood Insurance Study Date: September 22, 1999

Fourth Revised Countywide Flood Insurance Study Date: December 30, 2020

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Flood insurance Rate Maps

FLOOD INSURANCE STUDY
BRAZORIA COUNTY AND INCORPORATED AREAS, TEXAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and updates information on the existence and severity of flood hazards in the geographic area of Brazoria County, including the Cities of Alvin, Angleton, Brazoria, Brookside Village, Clute, Danbury, Freeport, Hillcrest Village, Iowa Colony, Lake Jackson, Liverpool, Manvel, Oyster Creek, Pearland (portions within Brazoria County), Richwood, Sandy Point, Surfside Beach, Sweeny, and West Columbia; the Towns of Holiday Lakes and Quintana; the Villages of Bailey's Prairie, Bonney and Jones Creek; and the unincorporated areas of Brazoria County (referred to collectively herein as Brazoria County), and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood-risk data for various areas of the community that will be used to establish actuarial flood insurance rates and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

Please note that the City of Pearland is geographically located in Brazoria, Fort Bend and Harris Counties. See the separately published FIS reports and Flood Insurance Rate Maps (FIRMs) for the countywide map dates and flood hazard information outside of Brazoria County.

In some States or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence, and the State (or other jurisdictional agency) will be able to explain them.

Please also note that FEMA has identified one or more levees in this jurisdiction that have not been demonstrated by the community or levee owner(s) to meet the requirements of 44 CFR Section 65.10 of the NFIP regulations (44CFR65.10) as it relates to the levee's capacity to provide 1-percent-annual-chance flood protection. As such, there are temporary actions being taken until such time as FEMA is able to initiate a new flood risk project to apply new levee analysis and mapping procedures. Please refer to the Notice to Flood Insurance Study Users at the front of this FIS report for more information.

1.2 Authority and Acknowledgements

The sources of authority for this FIS report are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

Information on the authority and acknowledgments for each of these studies compiled from their effective narratives is shown below:

Unincorporated Areas of Brazoria County:	The hydrologic and hydraulic analyses in the original study were prepared by Michael Baker, Jr., for the Federal Emergency Management Agency (FEMA). This work was completed in 1976. In a revision effective August 19, 1986, the hydrologic and hydraulic analyses for the sources studied by detailed methods, except the hydrologic and hydraulic analyses for Clear Creek and the hydrologic analysis for the Brazos River, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787; this work was completed in January 1983. The hydrologic and hydraulic analyses for Clear Creek were performed by the Harris County Flood Control District (HCFCD); this work was completed in January 1984. The hydrologic analysis for the Brazos River was prepared by Espey, Huston, & Associates; this work was completed in December 1985 and was used in the hydraulic analysis prepared by Woodward-Clyde Consultants.
City of Alvin:	The hydrologic and hydraulic analyses for the study effective July 19, 1982, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in December 1980. The revision effective July 16, 1987, reflects annexations by the City of Alvin from the unincorporated areas of Brazoria County.
City of Angleton:	The hydrologic and hydraulic analyses for the study effective July 5, 1982, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in February 1981.
Village of Bailey's Prairie:	The hydrologic and hydraulic analyses for the study effective December 15, 1983, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in June 1981.
Village of Bonney:	The hydrologic and hydraulic analyses for the study effective March 15, 1984, were prepared by Woodward-Clyde Consultants during the preparation of the Flood Insurance Study for the unincorporated areas of Brazoria County.
City of Brazoria:	The hydrologic and hydraulic analyses for the study effective December 15, 1983, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-47R7. This work was completed in June 1981.

City of Brookside Village:	The hydrologic and hydraulic analyses for the study effective November 1, 1984, were prepared by Bernard Johnson Incorporated for FEMA. This work was completed in May 1982. In a revision effective November 15, 1985, the hydrologic and hydraulic analyses for Clear Creek were prepared by the HCFCD; this work was completed in January 1984.
City of Clute:	The hydrologic and hydraulic analyses for the study effective December 7, 1976, were prepared by Turner, Collie, and Braden, Inc., Consulting Engineers, for FEMA. In a revision effective December 1, 1983, the hydrologic and hydraulic analyses for Oyster Creek were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in October 1981.
City of Danbury:	The hydrologic and hydraulic analyses for the study effective September 16, 198t, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in July 1980.
City of Freeport:	The community's FIRM became effective on November 17, 1970. The hydrologic and hydraulic analyses for a revision effective October 13, 1975 were prepared by Michael Baker Jr., Inc. In a revision effective January 17, 1986, the hydrologic and hydraulic analyses were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in January 1983.
City of Hillcrest Village:	The hydrologic and hydraulic analyses for the study effective June 19, 1982 were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in December 1980.
City of Iowa Colony:	The hydrologic and hydraulic analyses for the study effective May 17, 1982, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in August 1980. The revision effective August 19, 1986, reflects annexations by the City of Iowa Colony from the unincorporated areas of Brazoria County.
Village of Jones Creek:	The hydrologic and hydraulic analyses for the study effective June 5, 1985 were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in February 1983.
City of Lake Jackson:	The hydrologic and hydraulic analyses for the study effective July 3, 1985 were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in October 1981.

City of Liverpool:	The hydrologic and hydraulic analyses for the study effective June 5, 1985 were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in September 1982.
City of Manvel:	The hydrologic and hydraulic analyses for the study effective December 1, 1981, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in December 1980.
City of Oyster Creek:	The hydrologic and hydraulic analyses for the FIRM effective November 19, 1976 were prepared by Michael Baker Jr., Inc., and completed in September 1976.
City of Pearland:	The hydrologic and hydraulic analyses for the study effective July 5, 1984 for Clear Creek were prepared by Dewberry & Davis. This work was completed in June 1983.
	The hydrologic and hydraulic analyses for Marys Creek and Marys Creek By-Pass Channel were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in June 1981.
Town of Quintana:	The hydrologic and hydraulic analyses for the study effective June 5, 1985, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in January 1983.
City of Richwood:	The hydrologic and hydraulic analyses for the study effective July 28, 1972, were prepared by the U. S. Geological Survey (USGS) for FEMA, under InterAgency Agreement No. IAA-H-17-72.
	In a revision effective April 3, 1985, the hydrologic and hydraulic analyses for Oyster Creek and Bastrop Bayou were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in 1981.
City of Surfside Beach:	The hydrologic and hydraulic analyses for the study effective June 5, 1985, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in January 1983.
City of Sweeny:	The hydrologic and hydraulic analyses for the study effective December 1, 1982, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in June 1980.
City of West Columbia:	The hydrologic and hydraulic analyses for the study effective December 15, 1983, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in November 1981.

FIS Revisions:

Please refer to Section 10 for details on these revisions.

1.3 Coordination

The dates of the initial and final Consultation and Coordination Officer's (CCO) held for Brazoria County and the incorporated communities within its boundaries are shown in the Table 1.

Table 1 – CCO Meetings

Community Name	Initial CCO date	Final CCO Date
Unincorporated Areas of Brazoria County	September 1978	January 29, 1988
City of Alvin	May 1978	June 11, 1961
City of Angleton	May 1978	August 3, 1981
Village of Bailey's Prairie	May 1978	June 22, 1988
Village of Bonney	*	June 15, 1988
City of Brazoria	May 1978	June 21, 1988
City of Brookside Village	May 1978	October 26, 1982
City of Clute	May 1978	October 26, 1982
City of Danbury	May 1978	September 30, 1980
City of Freeport	September 1978	June 16, 1988
City of Hillcrest Village	May 1978	June 11, 1981
Town of Holiday Lakes	*	June 15, 1988
City of Iowa Colony	May 1978	May 28, 1981
Village of Jones Creek	May 1978	June 13, 1984
City of Lake Jackson	May 1978	June 20, 1988
City of Liverpool	May 1978	June 13, 1984
City of Manvel	May 1978	May 28, 1981
City of Oyster Creek	*	June 17, 1988
City of Pearland	May 1978	October 18, 1982
Town of Quintana	September 1978	June 14, 1984
City of Richwood	May 1978	October 26, 1982
City of Surfside Beach	September 1978	June 13, 1984
City of Sweeny	May 1978	June 22, 1988
City of West Columbia	May 1978	June 21, 1988

* - Data not Available

For the Flood Insurance Studies for the unincorporated areas of Brazoria County, the City of Freeport, the Town of Quintana, and the City of Surfside Beach, legal notices that announced the inception and objectives of the studies were placed in the local newspaper for a period of three weeks. Coordination in the development of these studies was obtained through the Bureau of Economic Geology, the City and Village of Freeport, the Village of Jones Creek, the City of Oyster Creek, Brazoria County, Brazosport Chamber of Commerce, the National Oceanic and Atmospheric Administration, the Texas Highway Department, the Texas State Department of Water Resources, the Galveston District of the USACE, the USGS, and the U. S. Natural

Resources Conservation Service (NRCS). The State Coordinator was involved with these studies through the Dallas Regional Office of FEMA.

The initial Consultation Coordination Officer (CCO) meeting was attended by representatives of FEMA, the community and the study contractor to explain the nature and purpose of Flood Insurance Studies and to identify the streams to be studied by detailed methods.

The results of the study were reviewed at the final CCO meetings which were attended by representatives of the communities and the study contractor. All problems raised at these meetings have been addressed in this study.

2.0 AREA STUDIED

2.1 Scope of Work

This FIS report covers the geographic area of Brazoria County, Texas, including the incorporated communities listed in Section 1.1. Table 2 "Scope of Study" lists the limits of study for flooding sources studied by detailed methods, and also flooding sources redelineated based on new topography in this revision dated December 30, 2020.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction.

Table 2 – Scope of Study

Detailed Study Streams*	Downstream Limit	Upstream Limit
Bastrop Bayou	Mile 4.0	Confluence of East and West Tributaries, Mile 21.7
Bastrop Bayou West Tributary	Confluence with Bastrop Bayou, Mile 21.7	Mile 24.9
Bastrop Bayou Ditch 1	Confluence with Bastrop Bayou East Tributary	2.6 miles upstream of Bastrop Bayou East Tributary
Bastrop Bayou Ditch 3	Confluence with Bastrop Bayou	1 mile upstream of SH-288
Chigger Creek	County Boundary, Mile 5.9	AT & SF Railway, Mile 8.6
Chigger Creek Bypass	Confluence with Chigger Creek, Mile 0.0	Divergence from Chigger Creek, Mile 1.5
Clear Creek (A100-00-00)	Mile 26.6	Mile 45.7
Cowart Creek and Cowart Creek Tributaries	Galveston/Brazoria County Boundary	Various locations
Hickory Slough	Confluence with Clear Creek	Mile 6.1
Marys Creek	Galveston/Brazoria County Boundary, Mile 2.0	Mile 10.8
Marys Creek Bypass Channel	County boundary, Mile 0.1	Divergence from Marys Creek, Mile 2.2
San Bernard River	FM 1301	Wharton/Fort Bend County Line

***Detailed Study Streams restudied in 3rd revision dated (December 30, 2020).

Table 2 – Scope of Study

Redelineated Streams	Downstream Limit	Upstream Limit
Austin Bayou	Confluence with Bastrop Bayou, Mile 0.0	Mile 27.5
Bastrop Bayou East Tributary	Confluence with Bastrop Bayou, Mile 21.7	Mile 26.9
Bell Creek	Confluence with San Bernard River, Mile 0.0	Mile 5.3
Brazos River	Mile 4.4	Mile 65.8
Brushy Bayou Lower Reach	Confluence with Austin Bayou, Mile 0.0	County Highway 212
Brushy Bayou Upper Reach	County Road 210, Mile 5.0	State Highway 288B
Cedar Lake Creek	Approximately 12,700 feet downstream of FM2611, Mile 7.6	Mile 17.3
Chocolate Bayou (100-00-00)	Approximately 9,000 feet upstream of FM 2004, Mile 1.7	Mile 34.8
Cocklebur Slough	Confluence with Cedar Lake Creek, Mile 0.0	Mile 14.7
Cow Creek	Confluence with Brazos River, Mile 0.0	Mile 8.2
Flores Bayou	Confluence with Austin Bayou, Mile 0.0	Mile 10.6
Halls Bayou	Mile 9.6	Mile 18.8
Linnville Bayou	Mile 6.6	Mile 26.2
Mound Creek	Confluence with San Bernard River Mile 0.0	Mile 8.9
Mustang Bayou	Approximately 5,000 feetdownstream of FM2004, Mile 6.6	Mile 41.8
North Hayes Creek (102-00-00)	Confluence with Chocolate Bayou, Mile 0.0	Mile 5.8
Oyster Creek	At FM523, Mile 4.5	Mile 82.8
Rancho Ditch	Confluence with Brushy Bayou	Approximately 1300 feet upstream of FM 523
Rancho Ditch South Fork	Confluence with Rancho Ditch	Approximately 2600 feet upstream of confluence with Rancho Ditch
San Bernard River	Confluence of Intracoastal Waterway, Mile 0.0	FM 1301
South Hayes Creek (103-00-00)	Confluence with Chocolate Bayou, Mile 0.0	Mile 7.1
Stevenson Slough	Confluence with San Bernard River, Mile 0.0	Mile 5.4
Varner Creek	Confluence with Brazos River, Mile 0.0	Mile 11.7
Varner Creek Diversion Channel	Confluence with Varner Creek	1.7 Miles upstream of Confluence with Varner Creek

Table 2 – Scope of Study

West Fork Chocolate Bayou (101-00-00)	Confluence with Chocolate Bayou, Mile 0.0	Mile 9.6

In the effective studies, areas of shallow flooding in the City of Brazoria southeast of the intersection of Alabama and Oak Streets and west of the intersection of FM 521 and State Route 36 were studied by detailed methods. These areas were determined based on actual flood observations, and the source of flooding may be due, in part, to inadequate storm drainage. Tidal flooding including its wave action was studied by detailed methods along the Gulf of Mexico and West Bay. In addition, floods caused by the overflow of Stevenson Slough in the western corner of the City of Sweeny extending downstream through the central part of the city and east to the corporate limits were studied by detailed methods.

In the first revision dated November 17, 1993, the following streams were updated: the Brazos River, for its entire riverine portion within the county; Brushy Bayou, from Mile 0.6 to Mile 4.3; Cocklebur Slough, from Mile 3.2 to Mile 4.5; Oyster Creek, for its entire riverine portion within the county; the San Bernard River, for its entire riverine portion within the county (1-percent-annual chance and 0.2-percent-annual-chance floods only); and Clear Creek, from Mile 26.6 to Mile 39.3. Floodways computed by the USACE were added in tidally-controlled areas for Bastrop Bayou, Cedar Lake Creek, Cocklebur Slough, Halls Bayou, Oyster Creek, and the San Bernard River; floodways computed by the USACE were added to riverine areas for the Brazos River, Brushy Bayou downstream of Mile 4.3, Cocklebur Slough downstream of Mile 4.5, Oyster Creek, and the San Bernard River. In addition, floodways computed by HCFCD for Clear Creek and by Woodward-Clyde Consultants for the remaining floodways were added in this revision. Depth criteria were added for portions of the Brazos River, Oyster Creek, and the San Bernard River. Furthermore, the change in flooding effects from the Brazos River is reflected on the profile for Varner Creek. Flooding effects from the Brazos River have been removed from the profile for Cow Creek since precise water-surface elevation data are not available for an area near the confluence of these two streams. The change in flooding effects from the San Bernard River is reflected on the profiles for Bell Creek, Mound Creek, and Stevenson Slough. Minor adjustments were made to the flood hazard boundaries to achieve a match between communities; tidal flooding within the City of Oyster Creek, which did not match the surrounding area, was deleted.

In some instances, such as for the City of Angleton, floodplain boundaries continue only to the corporate limits. This is because the original study of flood hazards in these communities was limited to flood hazards within the community itself and was not continued into the unincorporated areas of Brazoria County.

The second revision dated September 22, 1999 was carried out in order to remove flood hazard information for the portion of the City of Pearland located within Harris County.

2.2 Community Description

Brazoria County is part of the flat, rich coastal plain of south-eastern Texas. It has a land area of approximately 1,423 square miles. Brazoria County is bordered by Galveston County to the east, Harris County to the north, Fort Bend and Matagorda Counties to the west, and the Gulf of Mexico and West Bay to the south.

The 2010 population of Brazoria County was 313,166 (Reference 1). Phenomenal growth has been experienced in this community since 1940 due to the expansion of the Houston Metroplex and the increased chemical and offshore industries.

Major communities within the area are the Cities of Alvin, Danbury, Angleton, Pearland, Sweeny, and Brazosport. Municipalities in Brazosport include Brazoria, Clute, Freeport, Jones Creek, Lake Jackson, Oyster Creek, Quintana, Richwood, and Surfside Beach.

Brazosport is primarily industrial and is the population center of Brazoria County. Major natural resources of the area include natural gas, oil, oyster shells, and shrimp.

The Brazos River watershed extends in a southeastern direction from the high plains of eastern New Mexico across Texas to the Gulf of Mexico at Freeport. The watershed is approximately 640 miles long, with drainage areas of approximately 1,800 square miles in New Mexico and 42,800 square miles in Texas. The drainage area below Possum Kingdom Dam has the greatest significance with regard to the portion of the Brazos River affecting Brazoria County. Reservoirs with significant flood control storage in this drainage area are Whitney, Waco, Belton, Proctor, Stillhouse Hollow, Somerville, Granger, and North Fork.

The Oyster Creek watershed extends in a southern direction from Waller County to the Gulf of Mexico at Freeport. The watershed has a drainage area of approximately 250 square miles.

The Brazos River watershed has a relatively moderate climate during most of the year. The climate in Brazoria County during the summer is moderated by the prevailing cool southeasterly winds from the Gulf. Summers are long with high daytime and moderate nighttime temperatures; the average annual temperature ranges from the 70's (degrees Fahrenheit) in the coastal region to the high 50's in the upper portion of the Brazos River watershed. Normally, the winters are short and comparatively mild; the average minimum January temperature varies from the low 40's near the coast to the low 20's near the headwaters. During December, January, and February, the winds are generally northerly, but during the balance of the year southerly winds predominate.

Rainfall in the Brazos River basin varies widely in both seasonal occurrence and yearly mean depth. The mean annual precipitation is approximately 27.6 inches, varying from approximately 16 inches near the headwaters to 47 inches in the coastal region. Based on Waco runoff records, the year of greatest drought was 1917, when the average basin rainfall was only approximately 15 inches.

Snowfall in the lower reaches of the Brazos River is rare and makes no significant contribution to runoff. Thunderstorms are common throughout the spring, summer, and fall. Frequent hurricanes and tropical storms interrupt summer with high winds, heavy rainfall, and high storm surges.

The topography in Brazoria County is flat, with the Brazos River and Oyster Creek following a sinuous course. The overbank areas are generally obstructed by trees and brush. Man-made obstructions to flow include levees, highways, railroads, and irrigation canals. There is a large amount of interbasin flow exchange between the Brazos River and Oyster Creek basins. The larger floods on Oyster Creek are due to overflow from the Brazos River. There is significant overflow out of the Brazos River and Oyster Creek basins into Bastrop Bayou and Jones Creek and, to a lesser degree, into Austin and Flores Bayous.

2.3 Principal Flood Problems

The history of flooding within Brazoria County indicates that flooding may occur during any season of the year. Riverine flooding results primarily from overflow of the streams caused by rainfall runoff, ponding, and sheet flow. Storms occurring during the summer months are often associated with tropical storms moving inland from the Gulf of Mexico.

Thunderstorms are common throughout the spring, summer, and fall months. The frequent hurricanes and tropical storms interrupt the summer with high winds, heavy rainfall, and high storm surges. Flooding in Brazoria County results primarily from tidal surges from the hurricanes and tropical storms. The amount of flooding generated tor any given storm or hurricane is dependent on the characteristics and location of the storm. The following brief descriptions of several significant storms provide historic information to which coastal flood hazards and projected flood depths can be compared (References 2, 3, 4, 5, 6, 7, 8, and 9).

The hurricane of August 5-23, 1915, which had a radius of 32 miles, reached land near the mouth of the Brazos River. Maximum winds were reported to be 120 miles per hour (mph), and maximum tides were reported at various elevations ranging from 10.4 feet to 14 feet. It was estimated that crests of breaking waves reached heights of 21 feet at the Galveston seawall. Great quantities of water were thrown over the seawall and scour of pavement and building foundations caused extensive damage. This storm caused 275 deaths and a total of $56 million in damage.

The hurricane of August 30-31, 1942 was first discovered in the western portion of the Atlantic Ocean near the Windward Islands. It gained strength as it proceeded across the Caribbean Sea, and then was classified as a hurricane. The eye of the hurricane moved across Matagorda Island and passed over Seadrift as it moved inland. Maximum winds were estimated at 115 mph, and hurricane winds covered a diameter of 150 miles on the coastline. The maximum tide height reported was 14.7 feet at Matagorda (with reports of 11.8 feet at Freeport). Total damage for the hurricane amounted to $26.5 million, with $11.5 million in property damage and the rest in crop damage.

In August 1945, a tropical depression was first reported in the southwestern portion of the Gulf of Mexico, moving steadily north. It intensified to a hurricane as it moved toward the shore and tracked along the shoreline before finally moving across San Jose Island in the vicinity of Cedar Bay Pass. This severe hurricane affected a fairly wide area and caused extensive damage to property and crops between Corpus Christi and Houston. Maximum wind speeds occurring between Port Aransas and Matagorda were estimated at 100 to 135 mph. Water levels between 6.6 feet and 14.5 feet were generated in the Matagorda Bay and Lavaca Bay area. The hurricane caused extensive beach erosion throughout the affected area and severely eroded the western Matagorda Bay shores. Several miles of shoreline receded SO feet as a result of the hurricane. Total damage was estimated at over $20 million.

The storm of October 2-3, 1949, originated in the Pacific Ocean near El Salvador, crossed Guatemala, moved north across the Gulf of Mexico, and reached land near Freeport. Maximum winds at Freeport were 135 mph, and tide levels were more than 11 feet. Property damage was $7 million, and the Texas rice crop was damaged to the extent of approximately $5 million.

Hurricane Carla, which hit the Texas coast on September 11, 1961, originated in the Caribbean Sea, and when it passed through the Yucatan Peninsula, the storm already had winds of 110 m.p.h. The large, unusually slow-moving hurricane strengthened, with its cyclonic winds covering the entire Gulf of Mexico. Carla moved inland near the Port O'Connor-Port Lavaca area. Maximum sustained wind velocities at Port Lavaca were estimated at 115 m.p.h. High-water marks indicate tide heights reached elevations of up to 22 feet at Port Lavaca as the storm swept across the barrier islands. The highest recorded elevations along the open coast were approximately 12.3 feet. This hurricane also spawned a rash of 26 tornadoes which took several lives in Texas and caused extensive damage. Although rainfall accompanying the hurricane was heavy in several local areas, the total volume of precipitation was not unusually high. At Freeport, the 4-day rainfall was approximately 10 inches. Carla is significant because of the large area that was affected, and the length of time the abnormal water levels prevailed. This hurricane flooded 402 square miles of Brazoria County, approximately 28 percent of the total land in the county. The total damage to the county was estimated at $75,001,000, of which $39,937,000 was due to tidal overflow.

Hurricane Beulah, which occurred on September 5-22, 1967, began harmlessly as a weak tropical depression east of the Windward Islands. Moving into warm Caribbean waters, the storm intensified to the category of a hurricane. Beulah was disrupted temporarily near Jamaica, then regained intensity and moved inland just east of Brownsville. Torrential rains fell in southern Texas and northeastern Mexico. Rainfall amounts ranged from 10 to 20 inches over much of the area. The total rainfall exceeded 30 inches in some areas. Although considerable damage resulted from strong winds and high tides, the majority of the destruction was due to torrential rains and resultant flooding. Some damage was also caused by tornadoes. Property damage in Brazoria County was minor, but Matagorda County experienced damage of approximately $745,000, and Palacios incurred total damage estimated at $241,000, 77 percent of which was attributable to tornadoes.

Hurricane Celia occurred on July 30-August 5, 1970. It was spawned from a depression which formed in the northwestern Caribbean Sea and crossed the Texas coastline midway between Corpus Christi and Aransas Pass. The highest tide at Matagorda was recorded at 4.1 feet. The hurricane did not produce the torrential rains and massive flooding that often accompany storms of this magnitude. Most of the destruction resulted from high winds, and the destruction in the area resembled the effects of a tornado more than those of a hurricane. Total damage caused by this storm was estimated at $470 million, with wind damage accounting for approximately $440 million of the total. The significance of Hurricane Celia was the extremely high winds, low storm surges, and little rainfall.

The greatest 24-hour rainfall recorded in the United States was 43 inches at Alvin, Texas (Reference 10).

In late July 1979, Tropical Storm Claudette brought 26 inches of rain in a 24-hour period. The severity of this disaster is underscored when compared with the 24-hour rainfalls of 10.8 inches recorded in Houston in 1943 and to the 14.4 inches recorded in Galveston in 1900. Other floods of record occurred in July 1939, October 1949, May 1957, June 1968, and June 1973.

Tropical Storm Charley made landfall on the middle Texas coast during the morning on August 22, 1998. Luckily, damage was minimal across the area, with beach erosion accounting for the damage estimates. Tides ran 2-3 feet above predicted astronomical levels. Most areas across SE Texas averaged 2-4 inches of rainfall, however locations to the coast received 4-6 inches. An unofficial report of 9 inches was reported at the mouth of the San Bernard River in Brazoria County. The peak recorded wind gust of 69 mph was measured at the Colorado River Locks in Matagorda County. However, most locations across the coast had gusts less than 46 mph.

On September 10, 1998, Rainfall from Tropical Storm Frances began affecting the coastal areas of Brazoria County, and conditions slowly spread inland. Over 4 inches of rain fell over all of the Houston/Galveston County Warning area. Over 10 inches of rain was common along the coastal counties of Matagorda, Brazoria, Galveston and Chambers and also over inland counties including Harris, Polk, San Jacinto and Washington. With tides already running 4 to 6 feet above normal, storm runoff from the rains was not able to easily discharge into the bays thus resulting in more widespread flooding of inland creeks and bayous. September 1998 was an active month with Tropical Storm Frances dumping 4 to 6 inches of rain over the region. Large areas received 8 to 10 inches of rain with some areas receiving more than 12 inches. The result was significant flooding in many areas. Flooding was exacerbated in many areas by tides 4 to 6 feet above normal. Significant rises occurred on the San Bernard River in Brazoria County from above Sweeny to the mouth on September 9th with flood stage exceeded on September 10th. This rise was mainly due to strong tidal influence. Significant rains began on September 10th and continued through the 12th. The majority of the rain occurred during the morning hours of September 11th as Frances made landfall.

Tropical Storm Allison formed in the northwest Gulf of Mexico during the early afternoon of June 5th, 2001, 80 miles south of Galveston. Allison moved northward, making landfall on the west end of Galveston Island less than 12 hours after forming. As Allison moved inland it caused two to three-foot tides. On the evening of the 5th a tornado briefly touched down in Brazoria county causing damage to one home in the Manvel area. Over the next five days Allison produced record rainfall that led to devastating flooding across Southeast Texas, killing 22 people and damaging over 48,000 homes, 70,000 automobiles and nearly 2,000 businesses.

Tropical Storm Fay moved inland on September 7, 2002 near Palacios and weakened to a tropical depression late that morning. Fay produced a total of five tornadoes along a path from Freeport in Brazoria County to near Hungerford in Wharton County. Flooding was significant in Brazoria, Matagorda and Wharton counties due to high tides and severe rainwater flooding. Between 10 and 20 inches of rain fell in an area from Freeport north-northwest to Boling in eastern Wharton County. The hardest hit area was near the community of Sweeny in southwest Brazoria County. In Brazoria County, over 1500 homes were flooded. Over 800 homes received damage from winds and tornadoes. Nearly 100 businesses and nearly 100 multi-family buildings were damaged. Nearly 500 cars were flooded. Fay caused an estimated $4.5M in property damage. The highest reported wind gust was in the town of Clute in Brazoria County where an 83-mph wind gust was recorded at 120 AM CDT on Saturday. The highest recorded tide level occurred at Jamaica Beach where the tide level reached 5.40 feet.

Hurricane Claudette made landfall along the middle Texas coast at Port O'Connor around 10:30 AM CDT on Tuesday, July 15, 2003. Claudette moved northwestward into the Gulf of Mexico on July 12th, then meandered over the central Gulf of Mexico on July 13th. A general north-northwestward motion followed on July 14th and Claudette slowly intensified during this time. Claudette reached hurricane strength on July 15th as it turned west-northwestward. This motion brought the center to the Texas coast at Port O'Connor that morning as a 90 mph Category 1 hurricane on the Saffir-Simpson Hurricane Scale. Damage was observed across most Southeastern Texas coastal counties. Major beach erosion was observed from High Island to Freeport. In Brazoria County, 2 single family homes were destroyed, 10 received major damage, and 39 received minor damage. 2 businesses were destroyed and 9 received major damage totaling $655,000. Total damage, including beach erosion, was estimated at $1.27 million. The highest recorded tide level, 6.99 feet above mean low-lower water, occurred in Freeport at the Brazos River levee

Flash Flooding on July 1, 2010: Widespread showers and thunderstorms developed across the coastal areas of southeast Texas in response to a surge of tropical moisture associated with the passage of Hurricane Alex through the northwestern Gulf of Mexico and into northern Mexico. Training of thunderstorms developed over portions of Brazoria County leading to widespread damage from flash flooding. 40 to 45 homes and businesses in the City of West Columbia were flooded, causing $1,300,000 in damage.

The northern and southern parts of the City of Alvin are affected by shallow flooding caused by ponding of runoff during heavy rains. Principal physical features that affect flooding in the southern part of the city are Brisco Canal, which blocks the passage of runoff southward, and its parallel ditch, C-1, which lacks the capacity to channel the runoff southeastward. In the northern part of the city, the movement of water eastward via Dickinson Bayou and its tributaries are slowed by the American Canal System.

A small flooded area in the City of Angleton is caused by overflow from Ditch No. 10 just north of State Route 35. There is also some shallow flooding within the city due to inadequate local drainage facilities.

Flooding along Briscoe Canal in the City of Manvel occurs as the result of ponding of runoff from a relatively large drainage area to the north of the canal and the insufficient conveyance capacity of ditch C-1, which runs parallel to Briscoe Canal.

USGS gaging station No. 08114000 on the Brazos River located in Fort Bend County at U.S. Route 59 in Richmond, Texas, was used in this study. It has a drainage area of 45,007 square miles and a period of record from 1903 to present. A USGS gaging station No. 08077000 exists at the State Route 15 Bridge crossing Clear Creek; however, there are no records of flood flows with recurrence intervals greater than 25 years at this gage.

2.4 Flood Protection Measures

Within this jurisdiction, there are one or more levees that have not been demonstrated by the communities or levee owner(s)to meet the requirements of 44 CFR Section 65.10 of the NFIP regulations as it relates to the levee’s capacity to provide 1-percent-annual-chance flood protection. Please refer to the Notice to Flood Insurance Study Users page at the front of this FIS report for more information.

The Angleton Levee extends from the Angleton Oil Field along the western flank of the City of Angleton, south to its intersection with Bastrop Bayou. This levee was constructed in the early 1900's to provide protection against flooding from Oyster Creek in the west. The Angleton Drainage District has also constructed conveyance channels and provides protection to the area.

In addition, the Dow Chemical Company has constructed a levee system that encircles their plants in Brazoria County. These levees are not accredited and thus, provide the community with some degree of protection against flooding, but are not expected to protect against the 1-percent-annual-chance storm.

A primary flood protection measure in Brazoria County is the Freeport Hurricane Flood Protection Levee System. This system was authorized by the Flood Control Act of October 1962, under which the USACE was instructed to rehabilitate, enlarge, and extend the levee system which was sponsored by the federal government and local interests. The existing levee begins at high ground near Lake Jackson, and then extends along the east bank of the Brazos River to the Intracoastal Waterway. Here, it turns east to the Freeport Harbor, encircles the Harbor and the Dow Barge Canal, turns north to Oyster Creek, and follows the west bank of Oyster Creek to high ground in the vicinity of Lake Barbara. The levee is approximately 53 miles long and provides protection to approximately 43 square miles of the Brazosport area. The elevation of the top of this levee varies from 15 to 21 feet. The levees in the system can be relied upon to provide some protection from flooding but are not expected to protect the area from a 1-percent-annual-chance storm.

The Velasco Drainage District maintains the East Bank of the Brazos River Levee. This levee was accredited by FEMA to provide protection against the 1-percent-annual-chance flood in July 2016. This levee provides some protection to areas of the Cities of Clute and Lake Jackson from flooding from the Brazos River.

The Varner Creek Utility District maintains the Columbia Lakes Levee System (near West Columbia) which was accredited by FEMA in August 2013. This levee system provides protection from the 1-percent annual chance flood from flooding from Varner Creek and the Varner Creek Diversion Channel.

Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan on the levee systems shown as providing protection in Brazoria County. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and flood-proofing or other protective measures. For more information on flood insurance, interested parties should visit http://www.fema.gov/national-flood-insurance-program.

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in the community, standard hydrologic and hydraulic study methods were used to determine the flood-hazard data required for this study. Flood events of a magnitude that is expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 1-percent-annual-chance flood in any 50-year period is approximately 40 percent (4 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

Note: Within this jurisdiction there are one or more levees that have not been demonstrated by the community or levee owner to meet the requirements of 44CFR 65.10 as it relates to the levee's capacity to provide 1-percent- annual -chance flood protection. Please refer to the Notice to Flood Insurance Study Users page at the front of this FIS report for more information.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the county.

3.1.1 New Detailed Study Streams

USGS Report 77-110, Technique for Estimating the Magnitude and Frequency of Floods in Texas, was used to develop the flood discharges for the streams studied by detailed methods in Brazoria County, with the exception of: the Brazos River; the 2-, 1-, and 0.2-percent-annual-chance flood discharges for Oyster Creek downstream of Harris Reservoir. Report 77-110 is a regional method based on regression analyses relating drainage area and channel slope to peak discharge by empirical equations developed for six designated regions in Texas.

Flood discharges for Mustang Bayou, generated using USGS Report 77-110, were checked in areas of urbanization using USGS Water Resources Investigations 3-73, Effects of Urbanization on Floods in the Houston, Texas, Metropolitan Area, a regional method based on-regression analyses (Reference 12). This method relates drainage area and percentage of impervious area to peak discharges by empirical equations developed for the Houston metropolitan area. Since the Alvin, Hillcrest Village, and Lake Jackson areas are geographically close to Houston and similar in drainage basin characteristics, this method was deemed suitable for application in those urbanized areas.

The 10-, 2-, and 1-percent-annual-chance discharges for Chocolate Bayou were generated from USGS Report 77-110. The 500-year discharges were determined by extrapolation of the peak discharge-frequency curve of the flood discharge computed for recurrence intervals up to the 1-percent-annual-chance. The peak discharges were adjusted based on the peak discharge-frequency estimates made for USGS gage No. 08078000 on FM1462.

The flood discharges for the San Bernard River upstream of mile 16.2, calculated using USGS Report 77-110, were adjusted to reflect a statistical analysis performed at USGS gaging station No. 08117500 near Boling.

The 10-, 2-, 1-, and 0.2-percent-annual-chance discharges for the Brazos River and the 2-, 1-, and 0.2-percent-annual-chance discharges for Oyster Creek downstream of Harris Reservoir were obtained using the FLOW SIM 10 computer program developed by the USACE (Reference 13). Initial hydrographs used in the FLOW SIM 10 model were obtained from the Flood Insurance Study for the unincorporated areas of Fort Rend County (Reference 14). In that study, the flood discharges for the Brazos River were determined using a frequency curve developed from data collected at the Richmond, Texas, gaging station in accordance with USGS Bulletin 17B (Reference l5). The initial hydrographs were then routed using the FLOW SIM 10 model and calibrated to the May 1957 flood on the Oyster-Brazos watershed.

FLOW SIM 10 is a two-dimensional modeling program that is especially effective for analyzing interbasin flow in low-lying areas. The program allows flow to be channel confined, using a one-dimensional unsteady flow analysis; without channels, using a totally two-dimensional approach; or a combination of both. The model developed for this study used a combination of both. The model is a series of 2-mile square grids covering the study area, with channels located at the top and right sides of the grids laid out in a best fit approximation. The model is supported by records of maximum stages reached at various locations along the Brazos River for several historical floods; these records were provided by the Brazosport Chamber of Commerce. The discharges computed in the FLOW SIM 10 model were used in a HEC-2 hydraulic model (Reference 16); when the alignment of the grid cells did not follow the natural slope of the ground, vectors were used to convert the two-dimensional FLOW SIM 10 flow into a one-dimensional HEC-2 flow.

The approximate analysis in the City of Freeport for flooding due to rainfall inside the areas protected by the Freeport levee system was utilized by FEMA from determinations made in the USACE study of Freeport and from historical data (Reference 20).

A summary of the drainage area-peak discharge relationships for the streams studied by detailed methods is shown in Table 3, "Summary of Discharges." No drainage area information is given for the Brazos River and Oyster Creek because, due to the interchange of flows between them, drainage area data are not applicable.

Table 3 – Summary of Discharges

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10% ANNUAL CHANCE	2% ANNUAL CHANCE	1% ANNUAL CHANCE	0.2% ANNUAL CHANCE
AUSTIN BAYOU					
At River Mile 0.0	119.75	4,740	7,613	8,791	11,600
At River Mile 5.94	107.85	4,450	7,130	8,230	10,800
At River Mile 5.82	103.47	4,320	6,910	7,960	10,400
At River Mile 10.23	65.60	3,620	5,960	6,930	9,200
At River Mile 15.19	55.28	3,337	5,520	6,434	8,598
At River Mile 17.17	52.61	3,273	5,432	6,338	8,479
At River Mile 17.9	49.81	3,200	5,325	6,219	8,329
At River Mile 17.94	46.85	3,063	5,080	5,926	7,927
At River Mile 19.37	45.37	3,068	5,125	5,992	8,036
At River Mile 20.61	43.78	3,062	5,149	6,033	8,108
At River Mile 20.75	41.15	2,919	4,884	5,714	7,666
At River Mile 20.79	38.59	2,788	4,649	5,432	7,278
At River Mile 21.99	37.33	2,790	4,684	5,486	7,368
At River Mile 22.84	35.29	2,706	4,546	5,325	7,154
At River Mile 22.89	33.47	2,606	4,365	5,107	6,853
At River Mile 24.36	31.76	2,568	4,323	5,067	6,813
At River Mile 24.76	28.93	2,416	4,055	4,748	6,378
At River Mile 25.27	26.66	2,303	3,863	4,522	6,071
At River Mile 25.8	24.64	2,231	3,760	4,407	5,927
At River Mile 25.83	20.91	1,985	3,314	3,872	5,191
At River Mile 27.78	18.67	1,921	3,245	3,805	5,121
BASTROP BAYOU AND BASTROP BAYOU WEST TRIBUTARY					
Approximately 7,000 feet downstream of CR 277	195.00	6,646	10,922	12,714	16,600
Approximately 6,000 feet upstream of CR 277	189.20	6,504	10,671	12,415	16,300
Above the confluence with Austin Bayou	64.60	3,020	4,670	5,323	6,800
Approximately 1,300 feet upstream of Compass Road	60.80	2,880	4,430	5,040	6,550
Approximately 2,300 feet upstream of Sandpiper Road	48.85	2,460	3,740	4,240	5,480
Approximately 3,900 feet upstream of FM 2004	35.22	2,110	3,240	3,690	4,790

Table 3 – Summary of Discharges

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10% ANNUAL CHANCE	2% ANNUAL CHANCE	1% ANNUAL CHANCE	0.2% ANNUAL CHANCE
BASTROP BAYOU AND BASTROP BAYOU WEST TRIBUTARY (continued)					
Approx. 5,200 feet downstream of Brazosport Blvd N	24.67	1,740	2,670	3,040	3,950
Approximately 3,800 feet upstream of CR 288	15.66	1,530	2,350	2,670	3,470
Approximately 7,300 feet downstream of TX 288	12.71	1,250	1,960	2,240	2,930
At Texas State Highway 288	10.37	1,050	1,610	1,830	2,370
At County Road 290	1.67	2,907	5,752	7,090	10,700
BASTROP BAYOU EAST TRIBUTARY					
At River Mile 21.65	5.69	690	1,020	1,140	1,460
At River Mile 25.03	1.92	340	490	550	690
At River Mile 26.7	1.05	230	320	350	430
BELL CREEK					
At River Mile 0	10.23	1,155	1,834	2,106	2,800
At River Mile 2.97	8.34	839	1,238	1,387	1,670
At River Mile 3.66	7.21	765	1,124	1,258	1,600
At River Mile 4.11	6.34	604	837	918	1,150
BRAZOS RIVER					
At River Mile 5	*	59,900	60,100	60,700	60,900
At River Mile 16	*	75,600	76,600	77,000	78,900
At River Mile 21	*	76,200	88,300	95,700	103,000
At River Mile 32	*	84,800	93,600	94,600	101,000
At River Mile 38	*	90,500	91,800	92,000	92,500
At River Mile 50	*	96,100	101,000	101,000	102,000
At River Mile 60	*	96,100	105,000	108,000	116,000
At River Mile 64	*	97,800	151,000	175,000	234,000
BRUSHY BAYOU					
Approximately 860 feet downstream of FM 523	18.50	1,758	2,550	2,823	3,892

* Data not available

Table 3 – Summary of Discharges

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10% ANNUAL CHANCE	2% ANNUAL CHANCE	1% ANNUAL CHANCE	0.2% ANNUAL CHANCE
BRUSHY BAYOU (continued)					
Approximately 1,300 feet upstream of Missouri Pacific Railroad	16.00	1,627	2,383	2,688	3,705
Approximately 850 feet upstream of State Highway 35	16.00	1,111	1,662	1,861	2,560
Just downstream of County Road 428	16.17	904	1,383	1,544	2,122
Just upstream of County Road 341	15.67	237	405	457	632
Approximately 400 feet upstream of FM 523	15.00	171	241	271	377
CEDAR LAKE CREEK					
At River Mile 2.12	48.00	2,500	3,900	4,500	5,900
At River Mile 4.38	46.00	2,500	3,800	4,300	5,700
At River Mile 6.19	41.00	2,400	3,800	4,400	5,700
At River Mile 9.17	36.00	2,300	3,700	4,200	5,500
At River Mile 9.89	28.00	2,000	3,100	3,500	4,600
At River Mile 11.19	25.01	1,700	2,600	3,000	3,900
CHIGGER CREEK					
At River Mile 5.65	*	551	869	1,056	1,759
At River Mile 6.33	*	117	205	264	490
At River Mile 7.75	*	87	218	276	520
At River Mile 7.8	*	467	844	1,060	1,779
At River Mile 8.58	*	411	874	1,083	1,856
CHIGGER CREEK BYPASS					
At River Mile 0.05	*	767	972	1,049	1,320
At River Mile 0.81	*	530	610	680	860
At River Mile 1.46	*	407	440	490	600
CHOCOLATE BAYOU (100-00-00)					
At River Mile 1.14	156.19	7,650	12,240	14,350	19,030
At River Mile 3.14	152.76	7,380	11,700	13,680	18,080

* Data not available

Table 3 – Summary of Discharges

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10% ANNUAL CHANCE	2% ANNUAL CHANCE	1% ANNUAL CHANCE	0.2% ANNUAL CHANCE
CHOCOLATE BAYOU (100-00-00) (continued)					
At River Mile 5.15	149.33	7,370	11,740	13,750	18,200
At River Mile 5.84	141.88	7,150	11,390	13,330	17,650
At River Mile 9.04	137.84	7,320	11,830	13,910	18,520
At River Mile 9.1	133.27	7,150	11,530	13,550	18,820
At River Mile 11.77	130.83	7,320	11,940	14,090	18,820
At River Mile 12.43	129.24	7,320	11,970	14,130	18,900
At River Mile 14.24	104.09	6,460	10,550	12,450	16,630
At River Mile 15.85	101.99	6,460	10,600	12,530	16,770
At River Mile 17.55	99.59	6,260	10,210	12,040	16,080
At River Mile 17.65	95.48	6,080	9,890	11,650	15,541
At River Mile 19.13	93.67	6,050	9,860	11,630	15,520
At River Mile 20.74	89.65	5,930	9,690	11,430	15,270
At River Mile 22.19	85.35	5,970	9,880	11,700	15,700
At River Mile 23.48	83.55	6,020	10,030	11,910	16,020
At River Mile 23.91	81.73	5,870	9,720	11,520	15,470
At River Mile 24.45	80.29	5,790	9,590	11,360	15,250
At River Mile 25.48	76.20	5,560	9,160	10,850	14,540
At River Mile 26.01	61.83	4,760	7,750	9,130	12,170
At River Mile 27.76	45.45	4,318	5,875	6,767	8,898
At River Mile 28.62	19.03	1,848	2,581	2,966	3,780
CLEAR CREEK					
Approximately 15,000 feet downstream of Dixie Farm Road	67.18	4,361	6,766	7,901	10,572
At confluence of Hickory Slough (HI100-00-00)	46.37	2,871	4,553	5,376	7,966
At stream mile 37.5	32.03	2,203	3,438	4,244	7,002
Downstream of SH 288	16.36	1,122	1,902	2,342	3,918
At stream mile 43.85	13.00	1,031	1,883	2,382	3,951
At Almeda Road (FM 521)	5.43	388	670	814	1,751
COCLKEBUR SLOUGH					
At River Mile 0	18.45	1,209	1,732	1,923	2,300
At River Mile 3.66	16.00	1,100	1,500	1,700	2,200
At River Mile 4.36	15.00	1,000	1,400	1,500	2,000

Table 3 – Summary of Discharges

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10% ANNUAL CHANCE	2% ANNUAL CHANCE	1% ANNUAL CHANCE	0.2% ANNUAL CHANCE
COCLKEBUR SLOUGH (continued)					
At River Mile 6.41	14.00	890	1,200	1,300	1,700
At River Mile 6.61	2.40	250	310	330	400
At River Mile 9.09	1.90	210	250	260	320
At River Mile 10.97	1.30	160	180	190	240
At River Mile 13.32	1.00	110	120	130	160
COW CREEK					
At River Mile 0.47	61.00	3,600	5,900	6,900	9,100
At River Mile 1.85	53.00	3,200	5,300	6,200	8,200
At River Mile 1.9	48.00	3,000	4,900	5,700	7,500
At River Mile 2.97	37.00	2,500	4,100	4,700	6,200
At River Mile 4	33.00	2,300	3,800	4,400	5,800
At River Mile 4.45	27.00	2,100	3,300	3,800	5,100
COWART CREEK					
At River Mile 3.29	16.6	2,138	3,451	4,117	6,026
At River Mile 4.97	10.63	1,031	1,615	1,934	2,927
At River Mile 5.16	5.2	526	807	977	1,535
At River Mile 7.27	3.35	333	381	402	478
FLORES BAYOU					
At River Mile 0	35.58	2,360	3,800	4,380	5,790
At River Mile 1.99	33.52	2,334	3,757	4,338	5,737
At River Mile 3.36	30.50	2,182	3,494	4,027	5,315
At River Mile 4.51	23.39	1,800	2,837	3,253	4,267
At River Mile 6.27	21.17	1,725	2,731	3,136	4,120
At River Mile 7.31	20.06	1,699	2,705	3,112	4,098
At River Mile 8.13	19.31	1,716	2,763	3,190	4,220
At River Mile 9.17	14.48	1,478	2,390	2,762	3,659
At River Mile 9.9	8.51	1,030	1,629	1,868	2,454
At River Mile 10.99	3.60	539	804	903	1,158
At River Mile 11.6	2.23	372	535	594	748
At River Mile 11.64	1.38	264	370	407	506

Table 3 – Summary of Discharges

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10% ANNUAL CHANCE	2% ANNUAL CHANCE	1% ANNUAL CHANCE	0.2% ANNUAL CHANCE
FREEPORT NORTH DRAINAGE AREA					
At Interceptor Ditch along South Levee near Pine Street	2.44	1,150	1,711	2,092	2,780
HALLS BAYOU					
At River Mile 0	60.00	3,569	5,959	6,952	9,001
At River Mile 7.4	43.21	3,209	5,306	6,183	8,188
At River Mile 10.66	39.98	2,620	4,270	4,950	6,570
At River Mile 10.8	31.13	2,230	3,590	4,150	5,480
At River Mile 12.75	27.95	2,220	3,640	4,230	5,670
At River Mile 13.48	26.16	2,210	3,660	4,270	5,710
At River Mile 13.55	23.03	2,020	3,320	3,860	5,150
At River Mile 15.05	17.94	1,830	3,060	3,570	4,790
At River Mile 15.44	12.97	1,480	2,450	2,850	3,810
At River Mile 15.5	11.12	1,320	2,170	2,520	3,360
At River Mile 16.44	9.86	1,220	1,990	2,310	3,070
At River Mile 16.48	6.83	940	1,500	1,730	2,280
At River Mile 17.93	5.18	830	1,340	1,540	2,040
At River Mile 18.22	2.33	490	770	880	1,160
HICKORY SLOUGH					
At River Mile 0	8.19	876	1,301	1,495	2,216
At River Mile 3.5	5.10	541	920	1,133	1,686
LINNVILLE BAYOU					
At River Mile 0	104.00	3,500	5,400	6,100	8,100
At River Mile 12.18	64.00	2,800	4,200	4,700	6,200
At River Mile 16.29	47.00	2,500	3,800	4,400	5,800
MARYS CREEK					
At River Mile 2.04	15.50	657	1,047	1,238	1,832
At River Mile 4.4	13.30	1,098	1,527	1,731	2,295
At River Mile 7.14	10.90	1,040	1,460	1,673	2,253
At River Mile 10.8	4.50	592	1,095	1,398	2,429

Table 3 – Summary of Discharges

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10% ANNUAL CHANCE	2% ANNUAL CHANCE	1% ANNUAL CHANCE	0.2% ANNUAL CHANCE
MARYS CREEK BYPASS CHANNEL					
At River Mile 0	*	803	1,051	1,129	1,265
MOUND CREEK					
At River Mile 0.25	42.00	2,800	4,700	5,500	7,200
At River Mile 6.25	30.00	2,300	3,700	4,300	5,700
MUSTANG BAYOU					
At River Mile 7.87	45.77	3,744	5,483	6,176	7,918
At River Mile 9.87	44.34	3,706	5,427	6,113	7,837
At River Mile 11.43	43.19	3,645	5,320	5,986	1,664
At River Mile 13.42	41.36	3,574	5,202	5,850	74,836
At River Mile 15.55	33.46	3,232	4,633	5,186	6,593
At River Mile 16.7	32.77	3,200	4,580	5,125	6,511
At River Mile 18.34	31.64	3,105	4,408	4,919	6,227
At River Mile 20.87	28.83	2,969	4,221	4,720	6,021
At River Mile 21.9	27.32	2,305	3,280	3,656	4,633
At River Mile 23.01	26.65	1,984	2,843	3,171	4,019
At River Mile 23.71	25.74	1,521	2,213	2,470	3,133
At River Mile 24.41	23.32	1,390	1,998	2,221	2,800
At River Mile 25.99	22.71	1,391	2,010	2,238	2,830
At River Mile 29.23	20.56	1,293	1,857	2,063	2,601
At River Mile 31.53	17.32	1,043	1,436	1,573	1,942
At River Mile 32.31	16.20	989	1,354	1,480	1,822
At River Mile 34.08	14.06	876	1,180	1,284	1,569
At River Mile 35.52	13.05	855	1,160	1,264	1,550
At River Mile 37.78	11.50	814	1,113	1,217	1,497
At River Mile 40.41	10.30	779	1,072	1,174	1,448
NORTH HAYES CREEK (102-00-00)					
At River Mile 0	7.38	855	1,132	1,238	1,506
At River Mile 1.09	6.51	773	1,013	1,104	1,334

* Data not available

Table 3 – Summary of Discharges

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10% ANNUAL CHANCE	2% ANNUAL CHANCE	1% ANNUAL CHANCE	0.2% ANNUAL CHANCE
NORTH HAYES CREEK (102-00-00) (continued)					
At River Mile 1.12	5.69	702	913	993	1,195
At River Mile 2	5.29	668	866	940	1,129
At River Mile 3.6	3.88	583	766	835	109
At River Mile 4.99	2.61	493	661	725	886
At River Mile 6.21	1.07	282	370	403	486
OYSTER CREEK					
At River Mile 4	*	4,100	4,400	4,400	4,400
At River Mile 17	*	5,600	5,800	5,800	5,900
At River Mile 25	*	6,800	6,800	6,800	6,800
At River Mile 36	*	1,500	14,000	17,900	22,000
At River Mile 49	*	3,620	16,200	23,400	38,900
At River Mile 58	*	3,000	15,400	22,700	38,100
At River Mile 68	*	2,210	13,900	22,000	42,100
At River Mile 82	*	160	1,040	1,500	4,090
POND 1 OF MUSTANG BAYOU					
Entire shoreline within community	*	*	57.0	*	
POND 2 OF MUSTANG BAYOU					
Entire shoreline within community	*	*	57.0	*	
RANCHO DITCH					
Approximately 1,250 feet upstream of FM 523	0.15	123	182	204	282
Approximately 500 feet upstream of the confluence with Brushy Bayou	0.26	153	225	253	349
RANCHO DITCH SOUTH FORK					
At the confluence with Rancho Ditch	0.11	37	45	50	69

* Data not available

Table 3 – Summary of Discharges

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10% ANNUAL CHANCE	2% ANNUAL CHANCE	1% ANNUAL CHANCE	0.2% ANNUAL CHANCE
SAN BERNARD RIVER					
Near Gulf of Mexico (River Mile 9.5)	965	16,500	26,500	29,000	35,400
Below Confluence of Mound Creek (River Mile 46)	874	16,700	27,000	29,600	36,700
2,000 ft. above Fort Bend/ Brazoria County Boundary (River Mile 62.5)	755	16,700	22,900	23,500	24,000
SOUTH HAYES CREEK (103-00-00)					
At River Mile 1.36	11.34	1,132	1,520	1,671	2,048
At River Mile 3.43	9.79	1,090	1,487	1,643	2,029
At River Mile 3.99	6.53	847	1,146	1,262	1,552
At River Mile 5.19	5.16	755	1,024	1,134	1,397
At River Mile 6.03	3.24	561	755	829	1,015
At River Mile 7.46	1.77	414	564	622	766
STEVENSON SLOUGH					
At River Mile 1.05	2.30	400	590	670	860
At River Mile 1.17	1.60	380	540	610	770
At River Mile 2.28	1.10	170	240	270	340
At River Mile 3.5	0.90	100	120	130	140
VARNER CREEK					
At River Mile 0.32	63.00	3,500	5,800	6,800	9,000
At River Mile 1.22	60.00	3,400	5,600	6,600	8,700
At River Mile 2.18	52.00	3,400	5,800	6,800	9,000
At River Mile 4.4	25.00	2,000	3,300	3,800	5,100
At River Mile 4.479	22.00	1,900	3,100	3,600	4,800
At River Mile 6.62	16.00	1,600	2,600	3,100	4,000
At River Mile 7.91	10.00	1,200	1,900	2,100	2,800
At River Mile 8.98	5.70	860	1,400	1,600	2,100
VARNER CREEK DIVERSION CHANNEL					
At confluence with Varner Creek	1.65	158	227	260	370

Table 3 – Summary of Discharges

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10% ANNUAL CHANCE	2% ANNUAL CHANCE	1% ANNUAL CHANCE	0.2% ANNUAL CHANCE
VELASCO DRAINAGE AREA					
At Interceptor Ditch along Dow Barge Canal Levee Near Velasco Boulevard	3.36	1,421	2,126	2,606	3,470
WEST FORK CHOCOLATE BAYOU (101-00-00)					
Just upstream of confluence with Chocolate Bayou	27.5	2,518	3,121	3,734	4,951
Approximately 1,600 feet upstream of County Road 67 (Manvel-Sandy Point Road)	23.1	1,931	2,702	3,131	3,999
Approximately 100 feet upstream of Highway 288	15.1	1,501	2,115	2,418	3,073
Approximately 1,300 feet upstream of Count y Road 81	9.0	1,004	1,318	1,470	1,783

* Data not available

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the FIRM.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the Flood Profiles (Exhibit 1) are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

Users should be aware that flood elevations shown on the Flood Insurance Rate Map (FIRM) represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data tables in the FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS in conjunction with the data shown on the FIRM.

Cross sections for the backwater analyses of the streams studied by detailed methods were obtained by field surveys. This surveying effort included data on the overbank areas and all bridge and culvert crossings. For the restudy of the San Bernard River performed by the USACE, some surveyed cross sections were extended using topographic data from appropriate USGS topographic maps (Reference 37).

Roughness coefficients used in the hydraulic computations were assigned on the basis of engineering judgment and field inspection of the stream and floodplain areas. Table 4 shows the channel and overbank "n" values for the streams studied by detailed methods.

Table 4 – Summary of Roughness Coefficients

Flooding Source	Roughness Coefficients					
	Channel			Overbanks		
Austin Bayou	0.051	to	0.065	0.04	to	0.06
Bastrop Bayou	0.040	to	0.040	0.050	to	0.100
Bastrop Bayou West Tributary	0.035	to	0.080	0.035	to	0.120
Bastrop Bayou East Tributary	0.040	to	0.050	0.060	to	0.100
Bell Creek	0.015	to	0.045	0.03	to	0.07
Brazos River	0.03	to	0.04	0.033	to	0.119
Brushy Bayou	0.012	to	0.115	0.035	to	0.12
Cedar Lake Creek	0.035	to	0.055	0.044	to	0.1
Chigger Creek	0.035	to	0.07	0.035	to	0.99
Chigger Creek Bypass	0.037	to	0.04	0.07	to	0.15
Chocolate Bayou (100-00-00)	0.035	to	0.085	0.035	to	0.085
Clear Creek	0.04	to	0.05	0.07	to	0.12
Cocklebur slough	0.012	to	0.055	0.043	to	0.071
Cow Creek	0.045	to	0.055	0.057	to	0.1
Cowart Creek	0.038	to	0.055	0.045	to	0.99
Cowart Creek Tributary 1	0.04	to	0.15	0.045	to	0.15
Cowart Creek Tributary 2	0.04	to	0.1	0.04	to	0.15
Flores Bayou	0.055	to	0.075	0.04	to	0.06
Halls Bayou	0.03	to	0.046	0.04	to	0.1
Hickory Slough	0.025	to	0.12	0.038	to	0.99
Linnville Bayou	0.04	to	0.061	0.035	to	0.092
Marys Creek	0.02	to	0.07	0.04	to	0.99
Marys Creek Bypass Channel	0.035	to	0.045	0.07	to	0.15
Mound Creek	0.055	to	0.091	0.055	to	0.088
Mustang Bayou	0.03	to	0.045	0.04	to	0.125
North Hayes Creek (102-00-00)	0.012	to	0.06	0.035	to	0.08
Oyster Creek	0.025	to	0.07	0.03	to	0.1
San Bernard River	0.03	to	0.05	0.05	to	0.15
South Hayes Creek (103-00-00)	0.05	to	0.075	0.035	to	0.04
Stevenson Slough	0.016	to	0.055	0.021	to	0.071
Varner Creek	0.036	to	0.046	0.018	to	0.096
West Fork Chocolate Bayou (101-00-00)		0.06			0.09	

Water-surface elevations of floods of the selected recurrence intervals were computed using the USACE HEC-2 step-backwater computer program (Reference 16); for the San Bernard River, the USACE 723-X6-L202A HEC-2 computer program was used to determine the water-surface elevations (Reference 38).

Starting water-surface elevations for Linnville Bayou, and West Fork Chocolate Bayou were calculated using coincident peaks. A known starting water-surface elevation equal to the mean tidal elevation was used for the analysis of Clear Creek. Starting water-surface elevations for all other streams studied by detailed methods were calculated using the slope/area method.

Certain structures on various streams in the county were not modeled in their respective hydraulic models, because they were determined to be hydraulically insignificant.

The area of 0.2-percent-annual-chance flooding to the west of the Brazos River at the confluence of Cow Creek reflects overflow of the 1-percent-annual-chance flood from the Brazos River. These overflows collect in Cow Creek and make their way back into the Brazos River. Cow Creek is shown as approximate flooding at this location because these overflows make the calculation of a flood elevation on Cow Creek difficult.

Several areas of the county experience shallow flooding. Oyster Creek overtops its high east banks midway through the county. The resulting shallow flooding is obstructed by the Angleton Levee which runs north to south, parallel to the creek. The levee forms the eastern limits of the shallow flooding area.

The area between Stevenson Slough and the San Bernard River east of Sweeny, Texas, experiences shallow flooding. This is a result of the waters of Stevenson Slough breaking over a high ridge along the east bank of the stream into an area which gradually slopes toward the San Bernard River. The eastern edge of the shallow flooding area meshes with the flooding of the San Bernard River. Shallow flooding is obstructed by the Missouri-Pacific Railroad to the south.

Hydraulic analyses were performed on Buffalo Camp Bayou, and it was determined that the flooding created by it is completely controlled by the flooding from the Brazos River and Oyster Creek. As a result, no profile is shown along Buffalo Camp Bayou.

3.3 Coastal Analyses

The hydraulic characteristics of coastal flood sources were analyzed to provide estimates of flood elevations for selected recurrence intervals. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown in the coastal data tables and flood profiles provided in the FIS Report.

This section was updated to reflect the 3rd Revision dated December 30, 2020.

3.3.1 Storm Surge Analysis and Modeling

For areas subject to coastal flood effects, the 10-, 2-, 1-, and 0.2-percent-annual-chance stillwater elevations were taken directly from a detailed storm surge study documented in *Flood Insurance Study: Coastal Counties, Texas Intermediate Submission 2 – Scoping and Data Review* prepared by the U.S. Army Corps of Engineers (Reference 73). This storm surge study was completed in November 2011 (Reference 73).

The Advanced Circulation (ADCIRC) model for coastal ocean hydrodynamics developed by the USACE was applied to calculate stillwater elevations for coastal Texas. The ADCIRC model uses an unstructured grid and is a finite element long wave model. It has the capability to simulate tidal circulation and storm surge propagation over large areas and is able to provide highly detailed resolution in areas of interest along shorelines, open coasts and inland bays. It solves three dimensional equations of motion, including tidal potential, Coriolis, and non-linear terms of the governing equations. The model is formulated from the depth-averaged shallow water equations for conservation of mass and momentum which result in the generalized wave continuity equation.

In performing the coastal analyses, nearshore waves were required as inputs to wave runup and overland wave propagation calculations, and wave momentum (radiation stress) was considered as contribution to elevated water levels (wave setup). The Steady State Spectral Wave (STWAVE) model was used to generate and transform waves to the shore for the Texas Joint Storm Surge (JSS) Study. STWAVE is a finite difference model that calculates wave spectra on a rectangular grid. The model outputs zero-moment wave height, peak wave period (Tp), and mean wave direction at all grid points and two-dimensional spectra at selected grid points. STWAVE includes an option to input spatially variable wind and storm surge field. Storm surge significantly alters wave transformation and generation for the hurricane simulations in shallow-flooded areas.

STWAVE was applied on five grids for the Texas JSS: NE, CE, SW, NEn, and CEn. Three large grids (NE, CE, SW) with offshore boundaries at depths near 100 feet (30 meters) encompassed the entire coast of Texas and applied the efficient half-plane version of STWAVE (which must approximately align with the shoreline). Two nested grids (NEn and CEn) covered Galveston Bay and Corpus Christi Bay and applied the fullplane version of STWAVE to allow generation of wind waves in all directions. Notably, memory requirements for the full-plane model precluded its use for the large grids with offshore boundaries. The input for each grid includes the bathymetry (interpolated from the ADCIRC domain), surge fields (interpolated from ADCIRC surge fields), and wind fields (interpolated from the ADCIRC wind fields, which apply land effects to the base wind fields). The wind and surge applied in STWAVE are spatially and temporally variable for all domains. STWAVE was run at 30-minute intervals for 93 quasi-time steps (46.5 hours).

The ADCIRC model computational domain and the geometric/topographic representation developed for the Joint Coastal Surge effort was designated as the TX2008 mesh. This provided a common domain and mesh from the Texas-Mexico border to western Louisiana, extends inland across the floodplains of Coastal Texas (to the 30- to 75-foot contour NAVD88), and extends over the entire Gulf of Mexico to the deep Atlantic Ocean. The TX2008 domain boundaries were selected to ensure the correct development, propagation, and attenuation of storm surge without necessitating nesting solutions or specifying ad hoc boundary conditions for tides or storm surge. The TX2008 computational mesh contains more than 2.8 million nodes and nodal spacing varies significantly throughout the mesh. Grid resolution varies from approximately 12 to15 miles in the deep Atlantic Ocean to about 100 ft. in Texas. Further details about the terrain data as well as the ADCIRC mesh creation and grid development process can be found in *Flood Insurance Study: Coastal Counties, Texas Intermediate Submission 2 – Scoping and Data Review* (Reference 73).

3.3.2 Statistical Analysis

The Joint Probability Method (JPM) is a simulation methodology that relies on the development of statistical distributions of key hurricane input variables such as central pressure, radius to maximum wind speed, maximum wind speed, translation speed, track heading, etc., and sampling from these distributions to develop model hurricanes. The resulting simulation results in a family of modeled storms that preserve the relationships between the various input model components but provides a means to model the effects and probabilities of storms that historically have not occurred.

Due to the excessive number of simulations required for the traditional JPM method, the JPM-Optimum Sampling (JPM-OS) was utilized to determine the stillwater elevations associated with tropical events. JPM-OS is a modification of the JPM method and is intended to minimize the number of synthetic storms that are needed as input to the ADCIRC model. The methodology entails sampling from a distribution of model storm parameters (e.g., central pressure, radius to maximum wind speed, maximum wind speed, translation speed, and track heading) whose statistical properties are consistent with historical storms impacting the region, but whose detailed tracks differ. The methodology inherently assumes that the hurricane climatology over the past 60 to 65 years (back to 1940) is representative of the past and future hurricanes likely to occur along the Texas coast.

A set of 446 storms (two sets of 152 low frequency storms + two sets of 71 higher frequency storms) was developed by combining the "probable" combinations of central pressure, radius to maximum winds, forward speed, angle of track relative to coastline, and track. Tracks were defined by five primary tracks and four secondary tracks. Storm parameters for synthetic storms are provided in Table 11 of *Flood Insurance Study: Coastal Counties, Texas Intermediate Submission 2 – Scoping and Data Review* (Reference 73). The estimated range of storm frequencies using the selected parameters was between the 10- and 0.2-percent-annual-chance storm events. The ADCIRC-STWAVE modeling system was validated using five historic storms: Hurricanes Carla (1961), Allen (1980), Bret (1999), Rita (2005), and Ike (2008).

3.3.3 Stillwater Elevations

The results of the ADCIRC model and JPM-OS provided 10-, 2-, 1-, and 0.2-percent-annual-chance stillwater elevations which include wave setup effects. Stillwater elevations are assigned at individual ADCIRC mesh nodes throughout the Texas coast. Triangular Irregular Networks (TINs) and raster datasets were built from these nodes for use in wave analysis and floodplain mapping.

An Independent Technical Review (ITR) was performed on the overall storm surge study process. This review process was performed in accordance with USACE regulations. The ITR team was composed of experts in the fields of coastal engineering and science and was engaged throughout the study. Appendix K of *Flood Insurance Study: Coastal Counties, Texas Intermediate Submission 2 – Scoping and Data Review* includes all comments received from the ITR panel, as well as responses to those comments (Reference 73).

Table 5 – Summary of Coastal Stillwater Elevations

Flooding Source and Location	Range of Stillwater Elevations (feet NAVD 88)			
	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Gulf of Mexico				
Transect B1	5.5 - 6.6	8.4 - 10.4	10.8 – 13.0	14.7 - 17.3
Transect B2	5.5 - 6.5	8.6 - 10.5	10.9 - 13.2	14.1 - 17.8
Transect B3	5.3 - 6.6	7.4 – 10.0	9.9 - 12.9	13.8 - 17.7

Table 5 – Summary of Coastal Stillwater Elevations

Flooding Source and Location	Range of Stillwater Elevations (feet NAVD 88)			
	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Transect B4	4.8 - 6.6	7.1 - 9.9	8.4 - 12.4	13.7 - 18.1
Transect B5	5.3 - 6.6	8.0 - 10.1	10.2 - 13.1	13.8 - 17.8
Transect B6	5.5 - 6.6	8.2 - 10	10.5 - 12.9	14.0 - 17.6
Transect B7	5.1 - 6.6	6.1 - 9.9	8.7 - 12.6	13.4 - 17.3
Transect B8	5.3 - 6.6	7.9 - 9.8	10.2 - 12.9	13.6 - 17.9
Transect B9	5.6 - 6.8	4.4 - 10.5	8.1 - 13.1	13.7 - 17.8
Transect B10	5.3 - 6.9	7.7 - 10.7	9.7 - 13.3	13.3 - 18.4
Transect B11	4.3 - 6.9	6.8 - 10.0	8.2 - 13.0	13.7 - 18.1
Transect B12	5.2 - 6.9	2.2 - 10.0	2.6 - 13.3	3.8 - 18.6
Transect B13	5.6 - 6.9	2.1 - 10.1	2.5 - 13.1	3.8 - 20.1
Transect B14	5.9 - 6.9	2.3 - 10.1	2.8 - 12.9	4.3 - 19.0
Transect B15	5.9 - 7.0	2.0 - 10.1	2.3 - 13.1	3.8 - 19.4
Transect B16	6.4 - 6.9	2.0 - 9.8	2.2 - 12.6	3.1 - 17.5
Transect B17	6.7 - 7.3	2.0 - 11.0	2.2 - 14.1	3.1 - 21.0
Transect B18	6.6 - 7.2	2.1 - 10.8	2.5 - 13.9	3.7 - 18.3
Transect B19	6.5 - 7.2	2.0 - 10.4	2.8 - 13.3	5.8 - 20.3
Transect B20	6.9 - 7.3	2.3 - 10.1	3.2 – 13.0	6.3 - 17.5
Transect B21	6.7 - 7.4	5.2 - 10.9	9.1 - 13.9	14.6 - 21.1
Transect B22	6.3 - 7.6	5.7 - 11.0	8.6 - 14.0	14.4 - 18.9
Transect B23	6.5 - 7.6	6.4 - 11.1	9.0 - 14.0	14.3 - 18.5
Transect B24	5.7 - 7.8	4.6 - 12.4	8.4 - 15.6	14.8 - 21.4
Transect B25	5.1 - 8.0	6.8 - 12.6	9.9 - 15.6	15.9 - 21.2
Transect B26	5.1 - 7.8	7.9 - 12.1	10.0 - 15.2	16.6 - 21.1
Transect B27	4.8 - 7.8	7.7 - 11.6	9.9 - 14.4	16.3 - 20.2
Transect B28	6.9 - 7.6	9.7 - 11.2	12.2 - 14.1	16.4 - 18.7
Transect B29	3.8 - 7.7	7.4 - 11.3	10.2 - 13.9	16.4 - 19.4
Transect B30	6.4 - 7.9	5.7 - 12.6	8.6 - 15.8	14.6 - 21.6
Transect B31	3.8 - 7.6	6.6 - 11.3	9.1 - 14.6	15.6 - 22.0
Transect B32	5.9 - 8.1	4.6 - 12.6	8.4 - 15.6	14.8 - 21.2
Transect B33	6.0 - 7.6	7.7 - 11.1	9.7 - 14.9	15.7 - 21.7
Transect B34	6.7 - 7.8	9.7 - 11.5	12 - 15.9	15.6 - 22.7
West Bay				
Transect B35	5.3 - 7.8	8.1 - 11.9	11.8 - 15.5	15.4 - 21.9
Transect B36	4.8 - 8.1	6.2 - 12.3	11.1 - 15.4	14.7 - 23.6
Transect B37	4.5 - 8.2	5.8 - 12.3	10.7 - 15.0	14.6 - 23.1
Transect B38	4.5 - 8.0	6.6 - 11.7	11.1 - 14.7	14.6 - 21.7
Transect B39	5.0 - 8.1	7.4 - 11.8	11.0 - 14.5	14.5 - 20.7
Transect B40	3.8 - 8.2	6.1 - 11.0	10.8 - 13.9	14.3 - 19.9

3.3.4 Wave Height Analysis

Using storm surge study results, wave height analysis was performed to identify areas of the coastline subject to overland wave propagation or wave runup hazards. Figure 1, "Transect Location Map", illustrates the location of transects in Brazoria County. Figure 2 shows a cross-section for a typical coastal analysis transect, illustrating the effects of energy dissipation and regeneration of wave action over inland areas. This figure shows the wave crest elevations being decreased by obstructions, such as buildings, vegetation, and rising ground elevations, and being increased by open, unobstructed wind fetches. Figure 1 also illustrates the relationship between the local stillwater elevations, the ground profile, and the location of the VE/AE Zone boundary at the limit of 3 feet breaking waves. This inland limit of the coastal high hazard area is delineated to ensure that adequate insurance rates apply, and appropriate construction standards are imposed, should local agencies permit building in this coastal high hazard area.

It has been shown in laboratory tests and observed in field investigations that wave heights as little as 1.5 feet can cause damage to and failure of typical Zone AE construction. Therefore, for advisory purposes only, a Limit of Moderate Wave Action (LiMWA) boundary has been added in coastal areas subject to wave action. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave.

The effects of wave hazards in the Zone AE between the Zone VE (or shoreline in areas where VE Zones are not identified) and the limit of the LiMWA boundary are similar to, but less severe than, those in Zone VE where 3-foot breaking waves are projected during a 1-percent-annual-chance flooding event.

In areas where wave runup elevations dominate over wave heights, such as areas with steeply sloped beaches, bluffs, and/or shore-parallel flood protection structures, there is no evidence to date of significant damage to residential structures by runup depths less than 3 feet. However, to simplify representation, the LiMWA was continued immediately landward of the VE/AE boundary in areas where wave runup elevations dominate.

Similarly, in areas where the Zone VE designation is based on the presence of a primary frontal dune or wave overtopping, the LiMWA was also delineated immediately landward of the Zone VE/AE boundary. The results of the wave height analysis are shown in Table 6, “Transect Data”.

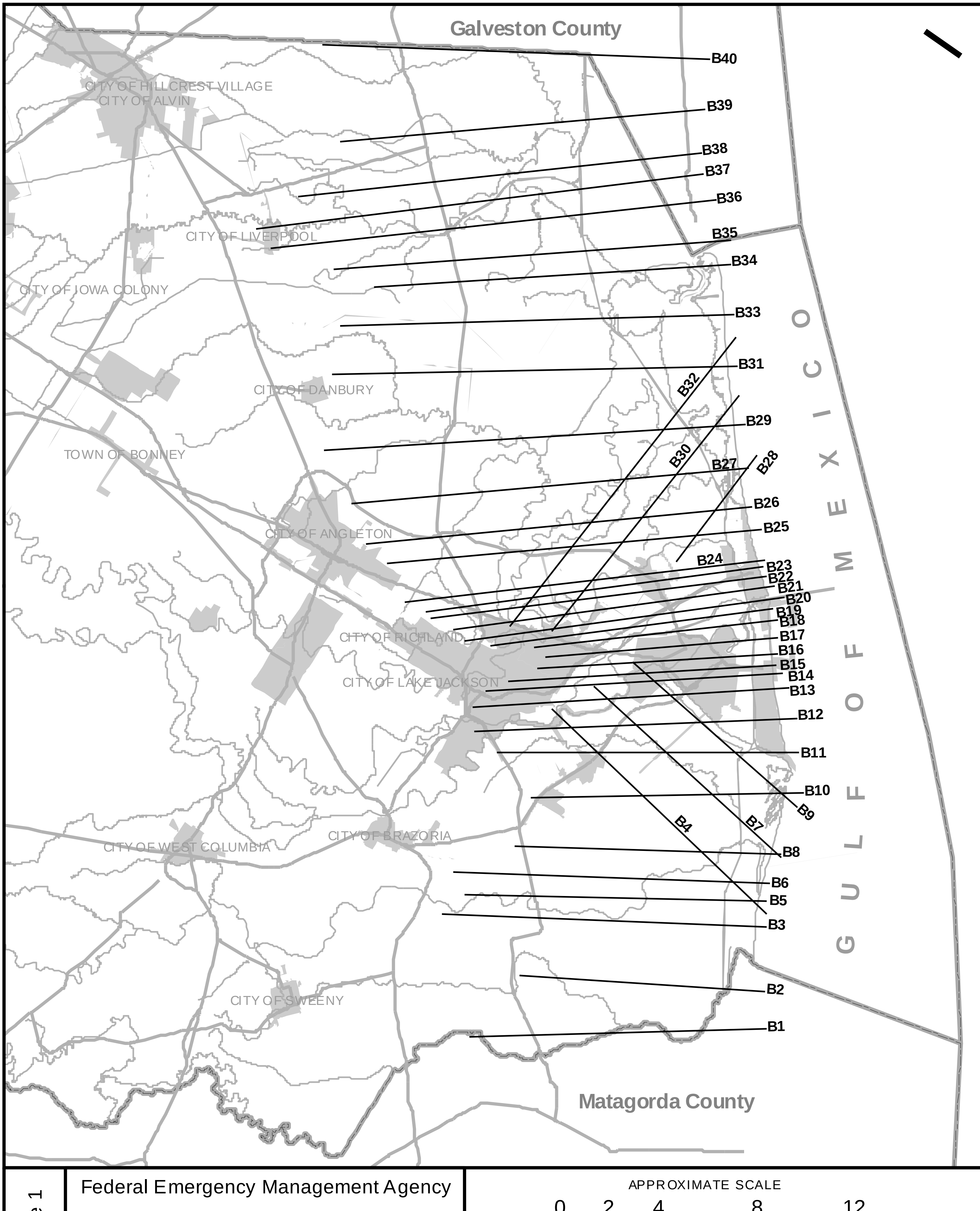

Figure 1

Federal Emergency Management Agency

BRAZORIA COUNTY, TX
AND INCORPORATED AREAS

TRANSECT LOCATION MAP

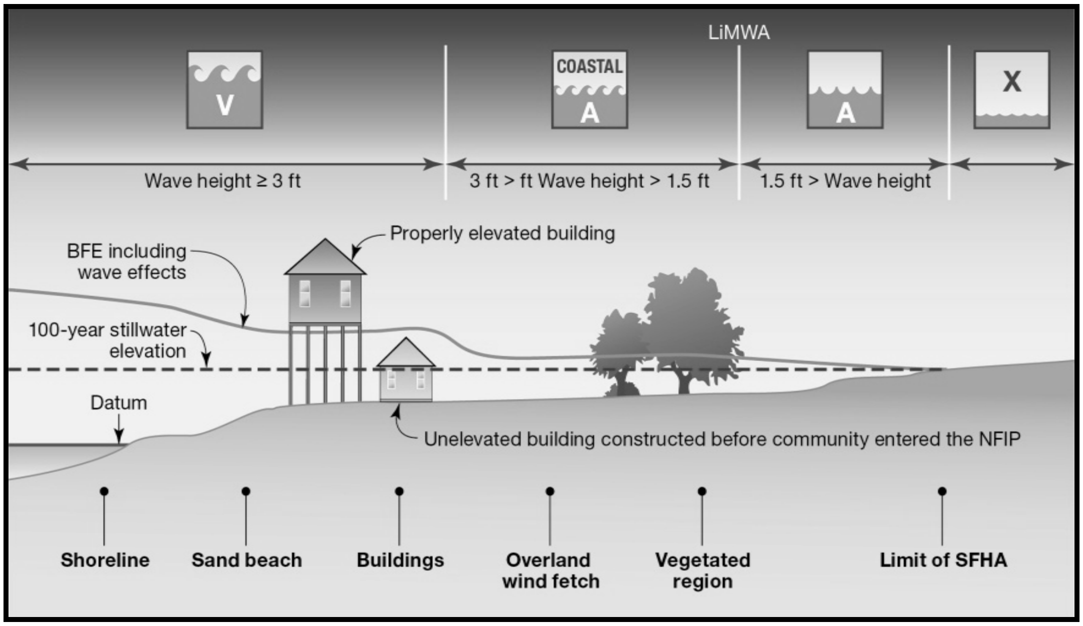

Figure 2 – Transect Schematic

Table 6 – Transect Data

Flooding Source and Location	Still Water Elevations 10% Annual Chance	Still Water Elevations 1% Annual Chance	Zone	Base Flood Elevation (Feet NAVD 88)
Gulf of Mexico				
Transect B1	5.5 - 6.6	10.8 – 13.0	AE	11-14
			VE	14-19
Transect B2	6.5 - 7.2	2.8 - 13.3	AE	11-14
			VE	13-19
Transect B3	3.8 - 7.7	10.2 - 13.9	AE	10-14
			VE	13-19
Transect B4	5.0 - 8.1	11.0 - 14.5	AE	1-14
			VE	13-19
Transect B5	3.8 - 8.2	10.8 - 13.9	AE	1-14
			VE	13-19
Transect B6	3.8 - 8.2	10.8 - 13.9	AE	11-14
			VE	13-19
Transect B7	3.8 - 8.2	10.8 - 13.9	AE	9-15
			VE	12-19
Transect B8	3.8 - 8.2	10.8 - 13.9	AE	10-14
			VE	12-19
Transect B9	3.8 - 8.2	10.8 - 13.9	AE	8-15
			VE	12-19

Table 6 – Transect Data

Flooding Source and Location	Still Water Elevations 10% Annual Chance	1% Annual Chance	Zone	Base Flood Elevation (Feet NAVD 88)
Gulf of Mexico				
Transect B10	5.3 - 6.9	9.7 - 13.3	AE	10-15
			VE	12-19
Transect B11	4.3 - 6.9	8.2 - 13.0	AE	1-15
			VE	13-19
Transect B12	5.2 - 6.9	2.6 - 13.3	AE	1-15
			VE	14-19
Transect B13	5.6 - 6.9	2.5 - 13.1	AE	3-15
			VE	14-19
Transect B14	5.9 - 6.9	2.8 - 12.9	AE	1-15
			VE	14-19
Transect B15	5.9 - 7	2.3 - 13.1	AE	1-15
			VE	13-19
Transect B16	6.4 - 6.9	2.2 - 12.6	AE	1-13
			VE	15-19
Transect B17	6.7 - 7.3	2.2 - 14.1	AE	1-16
			VE	4-19
Transect B18	6.6 - 7.2	2.5 - 13.9	AE	1-16
			VE	15-19
Transect B19	6.5 - 7.2	2.8 - 13.3	AE	3-15
			VE	15-19
Transect B20	6.9 - 7.3	3.2 - 13.0	AE	1-15
			VE	15-19
Transect B21	6.7 - 7.4	9.1 - 13.9	AE	9-16
			VE	15-19
Transect B22	6.3 - 7.6	8.6 – 14.0	AE	9-16
			VE	15-19
Transect B23	6.5 - 7.6	9.0 – 14.0	AE	9-16
			VE	15-19
Transect B24	5.7 - 7.8	8.4 - 15.6	AE	1-17
			VE	15-19
Transect B25	5.1 - 8.0	9.9 - 15.6	AE	1-18
			VE	15-19
Transect B26	5.1 - 7.8	10.0 - 15.2	AE	10-17
			VE	14-19
Transect B27	4.8 - 7.8	9.9 - 14.4	AE	10-16
			VE	15-19

Table 6 – Transect Data

Flooding Source and Location	Still Water Elevations 10% Annual Chance	1% Annual Chance	Zone	Base Flood Elevation (Feet NAVD 88)
Gulf of Mexico				
Transect B28	6.9 - 7.6	12.2 - 14.1	AE	14-16
			VE	15-19
Transect B29	3.8 - 7.7	10.2 - 13.9	AE	11-16
			VE	14-19
Transect B30	6.4 - 7.9	8.6 - 15.8	AE	9-17
			VE	14-19
Transect B31	3.8 - 7.65	9.1 - 14.6	AE	9-16
			VE	14-19
Transect B32	5.9 - 8.1	8.4 - 15.6	AE	9-18
			VE	14-19
Transect B33	6.05 - 7.6	9.7 - 14.9	AE	10-16
			VE	14-19
Transect B34	6.7 - 7.8	12.0 - 15.9	AE	13-18
			VE	14-19
West Bay				
Transect B35	5.3 - 7.8	11.8 - 15.5	AE	12-17
			VE	15-20
Transect B36	4.8 - 8.1	11.1 - 15.4	AE	1-17
			VE	14-20
Transect B37	4.5 - 8.2	10.7 – 15.0	AE	11-17
			VE	13-20
Transect B38	4.5 - 8.0	11.1 - 14.7	AE	13-16
			VE	13-21
Transect B39	5.05 - 8.1	11.0 - 14.5	AE	1-16
			VE	13-20
Transect B40	3.8 - 8.2	10.8 - 13.9	AE	1-16
			VE	13-20

3.3.5 Combined Probability Analysis

Certain areas are affected by both riverine and coastal flooding. These areas are identified on the Flood Profiles and in the Floodway Data Table in this report as Combined Probability or Combined Flooding areas. In these areas, for specific elevations, the recurrence intervals of separate events were added together to find the recurrence interval for the combined event.

The following equation was used:

$$TR_{combined} = \frac{1}{\left[\frac{1}{TR_{riverine}} + \frac{1}{TR_{surge}}\right]}$$

where $TR_{riverine}$ is the recurrence interval of the riverine event at a specific elevation, TR_{surge} is the recurrence interval of the tidal event at the same elevation, and $TR_{combined}$ is the recurrence interval of the combined riverine and tidal event at the same elevation.

3.4 Vertical Datum

All FIS reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum used for newly created or revised FIS reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD). With the completion of the North American Vertical Datum of 1988 (NAVD), many FIS reports and FIRMs are now prepared using NAVD as the referenced vertical datum.

Flood elevations shown in this FIS report and on the FIRM are referenced to the NAVD. No conversion was necessary as the average countywide conversion value was found to be less than +/- 0.1 foot. According to the FEMA Guidance on Vertical Datum Conversion, such a value allows for passive conversion between the two-vertical datum (Reference 78). These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the NGVD and NAVD, visit the National Geodetic Survey website at www.ngs.noaa.gov, or contact the National Geodetic Survey at the following address:

NGS Information Services, NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282
(301) 713-3242

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the Technical Support Data Notebook associated with the FIS report and FIRM for this community. Interested individuals may contact FEMA to access these data.

To obtain current elevation, description, and/or location information for benchmarks shown on this map, please contact the Information Services Branch of the NGS at (301) 713-3242 or visit their website at www.ngs.noaa.gov.

3.5 Effects of Land Subsidence

Base flood elevations shown on the FIRM and in this report were developed using benchmarks referenced to the NAVD. Brazoria County and Incorporated Areas are affected by land subsidence. Land subsidence is the lowering of the ground as a result of water, oil, and gas extraction, as well as other phenomena such as soil compaction, decomposition of organic material, and tectonic movement. Due to the presence of land subsidence in Brazoria County, some or all of the benchmarks used to develop the base flood elevations on the FIRM have subsided. Periodically, the NGS relevels some benchmarks to determine new elevations above the NAVD; however, not all benchmarks are releveled each time. A relatively extensive releveling was conducted in 1973, and less extensive relevelings were performed in 1978, 1987, 1995 and 2001.

The prevalence of land subsidence in the study area complicates the determination of the amount a given property lies above or below the base flood elevation. Complicating factors include determining which benchmark releveling to use to determine a property elevation and possible changes in flood hazards as a result of subsidence. Changes in flood hazards, caused by changed hydrologic and hydraulic conditions, could include increases or decreases in (1) depths of flooding, (2) the amount of land inundated, and (3) the intensity of wave action in coastal areas. The nature and extent of possible flood-hazard changes are different depending on the type of flooding (riverine, coastal, or combined riverine and coastal) present.

The need for more definitive information became evident as local governmental entities moved forward in planning for water-supply, drainage and flood-control, and ground-water regulation. To respond to the need for better information, a study was undertaken by the local entities primarily responsible for water supply and subsidence and flood control in the Houston metropolitan area - Fort Bend County Drainage District, HCFCD, Harris-Galveston Coastal Subsidence District (H-GCSD), and the City of Houston. The study, dated December 1986, is entitled "A Study of the Relationship Between Subsidence and Flooding." The effects of subsidence on flooding and the different methods used to account for land subsidence for riverine flooding are discussed below.

Riverine Flooding (inland flooding not associated with coastal flooding):

Subsidence within inland watersheds has little or no effect on flood depths when the entire watershed, including all hydraulic structures, subsides uniformly. However, differential subsidence (the presence of differing amounts of subsidence within a watershed) can cause changes in stream-channel slope and stream-valley geometry, which can result in changes in flood depths. Where stream-channel slopes are steepened (where there is more subsidence downstream than upstream), flood discharges usually increase and hydraulic efficiency, as measured by the amount of discharge for a given flood depth, increases. In this situation, the depth of flow usually decreases. The opposite is generally true where stream-channel slopes are flattened.

Other effects of land subsidence can include changes in cross-section floodplain geometry and changes in drainage-basin boundaries. Changes in cross-section geometry can affect conveyance, overbank storage, and flow diversions and result in localized changes in flood hazards. Changes in drainage basin boundaries affect the size of the drainage area and can result in changes in discharges and flood depths in the altered basins.

Brazoria County and Incorporated Areas are affected by relatively wide-scale, uniform subsidence with minor differential subsidence within individual watersheds. Flood depths remain relatively constant and base flood elevations generally subside as the ground subsides (see Figure 3).

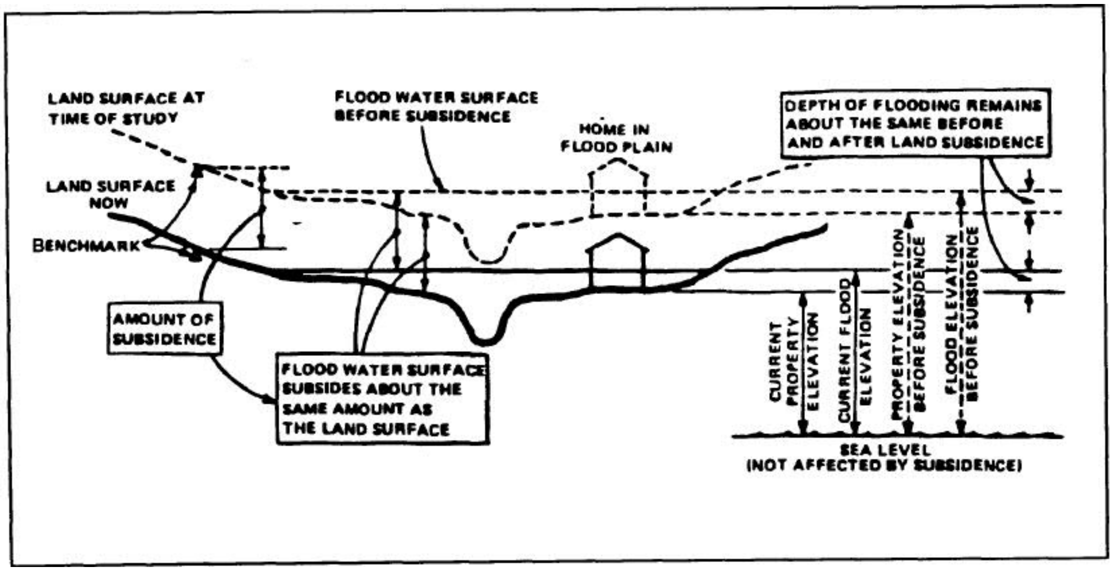

Figure 3 – Land Subsidence Schematic – Riverine Flooding

The local effects of subsidence may be adequately addressed, in the short term, by assuming that base flood elevations subside by the same amount the ground subsides. For floodplain management (setting lowest-floor elevations and regulating construction in the floodplain) and flood insurance (determining the amount the lowest floor of a structure lies above or below the base flood elevation) purposes, the effects of subsidence can be accounted for by determining ground and structure elevations using benchmark elevations with the same relevel date as the benchmarks used to develop the base flood elevations on the FIRM. No adjustment is necessary to the base flood elevations on the FIRM.

Elevation Reference Marks (ERMs) are used to assist in determining ground and structure elevations. These ERMs are either permanent benchmarks established by other Federal, state, or local agencies or reference marks established in the field during the time the Flood Insurance Study was conducted. The local city or county engineering or permitting department should be contacted to verify the compatibility of ERMs and benchmark elevations for use with the base flood elevations on the FIRM. (Note: More recent relevelings of ERMs or other benchmarks may be used with the base flood elevations on the FIRM; however, this may result in: 1) an underestimation of the amount a structure or property is above the base flood elevation, 2) an overestimation of the amount a structure is below the base flood elevation, or 3) problems tying in a revised hydraulic analysis to the Flood Insurance Study profile upstream and downstream of the revised reach.)

When reviewing development permit applications for new construction in areas subject to ongoing subsidence, and using the benchmarks on the FIRM or other benchmarks with the same relevel date as the base flood elevations, consideration should be given to setting the lowest-floor elevation above the base flood elevation by an amount associated with potential increases in flood depths as a result of past and future subsidence. In the absence of site-specific engineering data, elevating a structure by an additional 1.5 feet above the base flood elevation is recommended at this time. This recommendation is based on information on potential increases in flood depths due to worst-case scenarios of predicted future differential subsidence as discussed in the report entitled "A Study of the Relationship Between Subsidence and Flooding" (HCFCD, et al., December 1986). Alternatively, the elevations of more recent releveling of benchmarks could be used for ground surveying in setting lowest-floor elevations with the base flood elevations shown on the FIRM.

In watersheds where minor differential subsidence can be considered negligible in the short term, greater differentials in subsidence may occur over time and uniform subsidence assumptions may no longer be appropriate. Additionally, local conditions may produce changes in ground elevations that cannot always be predicted. As a result, more uncertainty is introduced with respect to potential changes in flood depth. The useful life of a Flood Insurance Study is limited, and the Flood Insurance Study must eventually be updated. When an entire watershed, or large portions of a watershed, is restudied and the effects of differential subsidence may be significant, it may be appropriate to relevel benchmark elevations at that time or use the most recently releveled benchmark elevations. The new or more recent benchmark elevations should be used for developing new topography and new cross-section data for hydrologic and hydraulic models.

When two streams with base flood elevations based on different releveling dates confluence, the backwater projected onto the tributary is at a different releveling date than the tributary riverine profile. When reviewing development permit applications for new construction in areas subject to ongoing subsidence, consideration should be given to setting the lowest-floor elevation above the base flood elevation by an amount associated with the potential increases in flood depths as a result of past and future subsidence. It is recommended that the elevations of the more recent releveling of benchmarks be used for ground surveying in setting lowest-floor elevations with the base flood elevations shown on the FIRM.

Coastal Flooding:

In areas subject to coastal flooding, storm surge elevations generally are not affected as the ground subsides. The changes in topography due to subsidence are minor compared to the overall size of the Gulf of Mexico and Galveston Bay, where storm surges are generated. However, as a result of subsidence, increases in flood depths and flooding of additional inland areas may occur. Base flood elevations may increase due to increased wave heights resulting from increased flood depths, and the A/V-zone boundary may be located farther inland than shown on the FIRM. For floodplain management and flood insurance purposes, increases in base flood elevations can usually be disregarded in the short term, and increases in flood depth must be taken into account by comparing the base flood elevation on the FIRM with current (at that time) and accurate (true elevation above NGVD within the limits of surveying accuracy) ground and structure elevations.

Information regarding the location and amount of subsidence is available from the H-GCSD in Friendswood, Texas, and the Fort Bend Subsidence District in Richmond, Texas. In areas affected by subsidence, benchmarks that have been installed with the foundation of the benchmark deep in the ground on a non-subsiding subterranean layer may provide stable benchmark elevations even though the surrounding ground is subsiding. Several of these types of benchmarks, referred to as "extensometers," are located within Brazoria County and Incorporated Areas. Information concerning the location and stability of these benchmarks may be obtained from the H-GCSD.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. To assist in this endeavor, each FIS report provides l-percent-annual-chance floodplain data, which may include a combination of the following: 10-, 2-, 1-, and 0.2-percent-annual-chance flood elevations; delineations of the 1- and 0.2-percent-annual-chance floodplains; and a 1-percent-annual-chance floodway. This information is presented on the FIRM and in many components of the FIS report, including Flood Profiles, Floodway Data tables, and Summary of Stillwater Elevation tables. Users should reference the data presented in the FIS report as well as additional information that may be available at the local community map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community. For each stream studied by detailed methods, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between Cross Sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000 with a contour interval of 5 feet and a scale of 1:4800 with a contour interval of 1 foot (Reference 37 and 42).

For the flooding associated with Brisco Canal and Ditch C-1 in the City of Alvin, a 1975 study prepared by Landev Engineers, Inc., was used as a guide in delineating floodplain boundaries in conjunction with information collected after the 1979 flooding associated with Tropical Storm Claudette (Reference 43).

For the tidal areas with wave action, the floodplain boundaries were delineated using the elevations determined at each transect; between transects, the boundaries were interpolated using engineering judgment, land-cover data, and the topographic data referenced above. The 1-percent-annual-chance floodplain was divided into whole-foot elevation zones based on the average wave envelope elevation in that zone. Where the map scale did not permit these zones to be delineated at one-foot intervals, larger increments were used.

For the streams studied by approximate methods, the boundary of the 1-percent-annual chance flood was delineated using the floodplain boundaries from the previously effective studies for the unincorporated areas of Brazoria County and the Cities of Alvin, Angleton, Freeport, and Liverpool (References 44, 45, 46, 47, and 48).

Shallow flooding zones have been delineated adjacent to the Brazos River, Marys Creek, and Oyster Creek. The extent of shallow flooding was determined using physical features, topographic maps, engineering judgment, and depths obtained from the FLOW SIM 10 model for the Brazos River/Oyster Creek watershed (References 37 and 13).

The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the FIRM. On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, AO, V, and VE), and the 0.2-percent-annual-chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 1- and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-percent-annual-chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 1-percent-annual-chance floodplain boundary is shown on the FIRM.

Within this jurisdiction there are one or more levees that have not been demonstrated by the community or levee owner(s) to meet the requirements of 44CFR Section 65.10 of the NFIP regulations as it relates to the levee's capacity to provide 1 percent annual chance flood protection. As such, the floodplain boundaries in this area were taken directly from the previously effective FIRM and are subject to change. Please refer to the Notice to Flood Insurance Study Users page at the front of this FIS report for more information on how this may affect the floodplain boundaries shown on the FIRM.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the base flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed for certain stream segments on the basis of equal-conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (see Table 7, Floodway Data). In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

Portions of the floodway widths for Cedar Lake Creek, Clear Creek, Cow Creek, Halls Bayou and Linville Bayou extend beyond the county boundary.

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body. Therefore, "Without Floodway" elevations presented in Table 7 for certain downstream cross sections of Bell Creek, Brushy Bayou, tributaries of Cowart Creek, Mound Creek, Stevenson Slough and Varner Creek are lower than the regulatory flood elevations in that area, which must take into account the 1-percent-annual-chance flooding due to backwater from other sources.

The area between the floodway and 1-percent-annual-chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation (WSEL) of the base flood more than 1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 4.

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Amoco Drive Overflow								
A	2,731[1]	320	624	0.8	42.1	42.1	43.1	1.0
B	4,572[1]	280	920	0.5	42.7	42.7	43.6	0.9
Austin Bayou								
A	1,400[2]	1,954	7,233	1.2	*	4.5	5.5	1.0
B	6,600[2]	3,445	16,291	0.5	*	4.9	5.9	1.0
C	12,000[2]	2,978	10,667	0.8	*	5.2	6.2	1.0
D	17,800[2]	1,403	6,632	1.3	*	6.1	7.0	0.9
E	26,400[2]	1,647	7,390	1.2	*	7.4	8.4	1.0
F	31,900[2]	1,533	8,796	0.9	*	8.3	9.2	0.9
G	35,900[2]	2,237	9,497	0.8	*	8.6	9.5	0.9
H	41,900[2]	1,195	8,810	0.9	11.9[3]	8.9	9.9	1.0
I	47,800[2]	1,833	9,326	0.9	11.9[3]	9.2	10.2	1.0
J	53,100[2]	692	7,827	1.6	11.9[3]	9.8	10.8	1.0
K	57,200[2]	789	5,057	1.4	11.9[3]	10.6	11.6	1.0
L	61,500[2]	1,527	7,477	0.9	11.9[3]	11.2	12.2	1.0
M	63,000[2]	655	3,566	1.9	12.2[3]	11.5	12.5	1.0
N	64,600[2]	1,054	4,640	1.5	12.5[3]	12.1	13.1	1.0
O	67,100[2]	1,994	10,650	0.7	12.8[3]	12.5	13.5	1.0
P	72,300[2]	2,102	8,745	0.7	12.8[3]	12.8	13.8	1.0
Q	75,900[2]	600	4,112	1.6	13.4[3]	13.3	14.2	0.9
R	77,200[2]	269	2,329	2.8	14.0	14.0	14.7	0.1
S	81,200[2]	843	5,015	1.3	15.1	15.1	15.9	0.8
T	87,000[2]	376	3,185	2.0	16.5	16.5	17.4	0.9
U	90,900[2]	638	3,308	1.9	17.6	17.6	18.6	1.0
V	95,800[2]	212	1,955	3.0	19.3	19.3	20.3	1.0

[1] Feet above confluence with Cowart Creek Tributary 1

[2] Feet above confluence with Bastrop Bayou

[3] Elevation calculated using combined probability analysis

*Controlled by tidal flooding-see Flood Insurance Rate Map for applicable elevations

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

AMOCO DRIVE OVERFLOW - AUSTIN BAYOU

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Austin Bayou (Continued)								
W	100,600[1]	276	1,737	3.4	20.9	20.9	21.9	1.0
X	100,700[1]	1,450	6,395	0.9	21.2	21.2	22.1	0.9
Y	104,400[1]	901	4,060	1.5	21.8	21.8	22.7	0.9
Z	107,300[1]	1,300	6,980	0.9	22.2	22.2	23.1	0.9
AA	109,500[1]	1,350	8,829	0.6	22.3	22.3	23.2	0.9
AB	111,900[1]	850	1,715	3.2	23.1	23.1	23.9	0.8
AC	113,600[1]	550	2,338	2.3	24.5	24.5	25.5	1.0
AD	119,500[1]	700	5,066	1.1	27.1	27.1	27.8	0.7
AE	119,800[1]	556	3,213	1.6	27.3	27.3	28.1	0.8
AF	122,300[1]	1,150	4,336	1.2	27.9	27.9	28.8	0.9
AG	125,800[1]	818	3,095	1.6	28.9	28.9	29.9	1.0
AH	130,200[1]	953	4,865	0.9	29.8	29.8	300.1	0.9
AI	133,000[1]	973	3,860	1.2	30.1	30.1	31.0	0.9
AJ	136,100[1]	810	2,221	2.0	31.3	31.3	32.2	0.9
AK	137,100[1]	893	3,826	1.0	31.5	31.5	32.5	1.0
AL	139,700[1]	916	3,013	1.3	32.2	32.2	33.2	1.0
AM	142,600[1]	531	1,847	2.1	33.3	33.3	34.3	1.0
AN	145,400[1]	865	2,831	1.3	34.9	34.9	35.9	1.0
Bastrop Bayou								
A	7,656[2]	3,280	12,484	1.0	*	4.1	5.1	1.0
B	11,520[2]	546	3,147	3.9	*	4.8	5.8	1.0
C	15,187[2]	886	5,617	2.2	*	6.3	7.0	0.7
D	20,153[2]	5,346	21,818	0.6	*	6.9	7.6	0.7
E	25,045[2]	10,734	60,006	0.1	*	7.0	7.7	0.7
F	29,788[2]	10,367	55,214	0.1	*	7.0	7.7	0.7

[1] Feet above confluence with Bastrop Bayou
[2] Feet above confluence with Intracoastal Waterway

* Controlled by tidal flooding-see Flood Insurance Rate Map for applicable elevations

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

AUSTIN BAYOU - BASTROP BAYOU

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Bastrop Bayou (continued)								
G	34,175	6,818	49,396	0.2	*	7.0	7.7	0.7
H	37,861	3,358	15,727	0.5	*	7.0	7.8	0.8
I	42,295	3,258	11,173	0.7	*	7.1	7.9	0.8
J	45,385	4,312	16,691	0.4	*	7.4	8.0	0.6
K	49,595	685	4,488	1.6	*	7.7	8.2	0.5
L	52,805	825	3,820	1.9	*	8.0	8.6	0.6
M	56,254	350	2,572	2.9	*	8.7	9.5	0.8
N	59,380	301	3,159	2.3	*	9.2	10.0	0.8
O	61,340	356	3,337	2.2	*	9.5	10.2	0.7
P	64,389	400	3,691	2.0	*	9.9	10.6	0.7
Q	66,720	273	2,794	2.2	*	10.2	10.8	0.6
R	71,345	237	2,259	2.8	*	10.9	11.5	0.6
S	75,014	221	2,256	2.8	*	11.8	12.2	0.4
T	75,533	272	2,205	2.8	11.9[2]	11.9	12.4	0.5
U	80,159	208	2,264	2.8	13.2[2]	13.2	13.7	0.5
V	84,155	202	2,013	3.1	14.2[2]	14.2	14.8	0.6
W	84,585	284	2,393	2.6	14.1[2]	14.4	15.0	0.6
X	92,201	1,694	5,699	1.2	16.0[2]	16.0	16.7	0.7
Y	97,045	3,217	7,367	0.9	17.4[2]	17.4	18.3	0.9
Bastrop Bayou West Tributary								
Z	107,431	766	2,566	1.7	20.8	20.8	21.5	0.7
AA	108,885	848	2,341	1.9	21.4	21.4	22.4	1.0
AB	112,905	1,288	5,848	0.8	23.2	23.2	24.1	0.9
AC	116,326	1,935	8,061	0.6	23.4	23.4	24.3	0.9

[1] Feet above confluence with Intracoastal Waterway
[2] Elevation computed using combined probability analysis

* Controlled by tidal flooding-see Flood Insurance Rate Map for applicable elevations

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

BASTROP BAYOU – BASTROP BAYOU WEST TRIBUTARY

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Bastrop Bayou West Tributary (Continued)								
AD	119,197[1]	1,349	5,702	0.8	23.7	23.7	24.5	0.8
AE	124,519[1]	1,234	43,698	1.2	26.4	26.4	27.1	0.7
Bastrop Bayou East Tributary [5]								
A	118,600[1]	200	553	2.1	18.6	18.6	19.3	0.7
B	120,100[1]	180	719	1.6	19.0	19.0	19.7	0.7
C	121,000[1]	152	767	1.5	19.3	19.3	19.9	0.7
D	127,600[1]	63	371	1.5	22.1	22.1	22.3	0.2
E	130,800[1]	62	333	1.7	23.3	23.3	23.6	0.3
F	132,200[1]	71	336	1.6	23.6	23.6	24.0	0.4
G	135,100[1]	281	719	0.5	23.7	23.7	24.3	0.6
H	138,900[1]	68	335	1.0	24.0	24.0	24.6	0.6
I	142,100[1]	50	253	1.2	24.1	24.1	24.7	0.6
Bastrop Bayou Ditch 3								
A	3,737[4]	140	†	†	17.6	17.6	17.6	0.0
B	8,400[4]	682	†	†	19.9	19.9	19.9	0.0

[1] Feet above confluence with Intracoastal Waterway
[2] Feet above confluence with San Bernard River
[3] Elevation computed without consideration of backwater from San Bernard River
[4] Feet above confluence with Bastrop Bayou
[5] These cross section lie within an area that has not been updated on the FIRM at this time due to the presence of levees that have not been demonstrated to meet the requirements of NFIP Regulation Section 65.10. Please refer to the Notice to Flood Insurance Study Users page at the front of this FIS for more information.
† Data Not Available

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

BASTROP BAYOU WEST TRIBUTARY – BASTROP BAYOU EAST TRIBUTARY – BASTROP BAYOU DITCH 3

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Bastrop Bayou Ditch 1								
A	1,228[1]	1,166	†	†	22.6	22.6	22.6	0.0
B	2,445[1]	1,863	†	†	22.8	22.8	22.8	0.0
C	3,245[1]	1,127	†	†	23.0	23.0	23.0	0.0
D	5,361[1]	1,722	†	†	23.4	23.4	23.4	0.0
E	6,508[1]	1,676	†	†	[3]	23.4[3]	23.4[3]	0.0
F	8,713[1]	1,157	†	†	[3]	23.5[3]	23.5[3]	0.0
G	10,063[1]	822	†	†	[3]	23.7[3]	23.7[3]	0.0
Bell Creek								
A	2,600[2]	95	615	3.4	26.0	10.8[4]	10.9	0.1
B	4,800[2]	90	558	3.8	26.0	13.4[4]	13.4	0.0
C	6,700[2]	166	1,118	1.9	26.0	14.5[4]	14.5	0.0
D	8,600[2]	51	275	7.7	26.0	15.3[4]	15.3	0.0
E	9,800[2]	106	632	3.3	26.0	18.5[4]	18.5	0.0
F	10,900[2]	128	494	4.3	26.0	20.1[4]	20.1	0.0
G	13,730[2]	172	789	2.7	26.0	24.0[4]	24.1	0.1
H	16,230[2]	137	857	1.6	26.0	24.5[4]	24.8	0.3
I	17,720[2]	274	1,281	1.1	26.0	24.6[4]	24.9	0.3
J	20,090[2]	192	501	2.5	26.0	25.1[4]	25.7	0.6
K	22,190[2]	200	836	1.1	30.3	30.3	31.0	0.7
L	24,480[2]	83	170	5.4	30.6	30.6	31.2	0.6
M	25,700[2]	346	973	0.9	32.3	32.3	33.3	1.0
N	28,000[2]	127	436	2.1	33.2	33.2	34.1	0.9

[1] Feet above confluence with Bastrop Bayou East Tributary
[2] Feet above confluence with San Bernard River
† Data Not Available
[3] Flooding Controlled by Bastrop Bayou West Tributary. Elevations computed with out consideration of flooding being controlled by Bastrop Bayou
[4] Elevation computed without consideration of backwater from San Bernard River

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

BASTROP BAYOU DITCH 1 – BELL CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Brazos River								
A	4.8	633	10,842	5.5	*	7.9	8.0	0.1
B	5.7	615	11,588	5.2	*	9.2	9.3	0.1
C	6.5	566	12,773	4.7	*	10.0	10.1	0.1
D	7.5	572	12,348	4.9	10.9	10.9	11.0	0.1
E	8.6	417	10,336	5.9	12.3	12.3	12.4	0.1
F	9.5	412	10,490	6.2	13.5	13.5	13.7	0.2
G	10.2	452	13,552	4.8	14.4	14.4	14.6	0.2
H	10.8	495	19,307	3.4	14.8	14.8	15.0	0.2
I	11.7	410	14,448	4.5	15.0	15.0	15.3	0.3
J	12.5	748	14,749	5.6	15.8	15.8	16.1	0.3
K	13.1	725	18,276	5.2	16.6	16.6	16.9	0.3
L	13.8	513	16,477	5.5	17.7	17.7	17.9	0.2

[1] Miles above confluence with Intracoastal Waterway

* Controlled by tidal flooding-see Flood Insurance Rate Map for applicable elevations

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

BRAZOS RIVER

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Brushy Bayou								
A	0.76[1]	557	1,302	0.5	*	6.7	7.7	1.0
B	1.32[1]	162	425	1.4	*	7.2	8.2	1.0
C	1.97[1]	60	223	2.3	11.6[3]	9.0	9.9	0.9
D	2.86[1]	520	1,005	0.4	11.6	11.6	12.6	1.0
E	3.69[1]	24	49	3.3	11.9	11.9	12.9	1.0
F	4.17[1]	18	94	0.5	13.2	13.2	13.9	0.7
G	26,850[2]	99	4,148	1.6	18.6	18.6	19.4	0.8
H	30,603[2]	103	807	3.4	19.4	19.4	20.2	0.8
I	32,150[2]	139	1,032	2.6	19.9	19.9	20.6	0.7
J	35,950[2]	76	430	4.3	21.3	21.3	21.7	0.4
K	36,025[2]	82	522	2.9	23.0	23.0	23.2	0.2
L	42,175[2]	68	358	3.1	24.4	24.4	24.5	0.1
M	45,500[2]	64	284	1.6	25.0	25.0	25.1	0.1
N	48,900[2]	69	294	1.6	26.7	26.7	26.8	0.1
O	49,550[2]	72	240	1.9	26.9	26.9	26.9	0.0
P	50,990[2]	137	363	0.7	27.3	27.3	27.4	0.1
Q	51,600[2]	57	177	1.5	27.5	27.5	27.5	0.0
R	53,550[2]	85	104	1.3	28.5	28.5	28.5	0.0
S	55,350[2]	28	34	0.8	29.8	29.8	30.0	0.2

[1] Miles above confluence with Austin Bayou
[2] Feet above confluence with Austin Bayou
[3] Elevation computed using combined probability analysis
* Controlled by tidal flooding-see Flood Insurance Rate Map for applicable elevations

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

BRUSHY BAYOU

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Cedar Lake Creek								
A	29,050[1]	184/50[2]	1,441	3.2	*	8.1	9.1	1.0
B	31,690[1]	2,615/100[2]	12,916	0.4	*	8.4	9.4	1.0
C	34,594[1]	2,493/479[2]	9,639	0.5	*	8.5	9.5	1.0
D	38,765[1]	3,217/2,000[2]	13,238	0.4	*	8.6	9.6	1.0
E	41,299[1]	253/190[2]	2,355	2.0	*	8.8	9.8	1.0
F	43,200[1]	196/140[2]	2,059	2.2	*	8.8	9.8	1.0
G	44,750[1]	273/170[2]	2,542	1.8	*	9.0	9.9	0.9
H	45,950[1]	265/145[2]	2,437	1.8	*	9.2	10.1	0.9
I	47,550[1]	241/135[2]	2,242	2.0	*	9.4	10.3	0.9
J	49,150[1]	236/140[2]	2,346	1.9	*	9.6	10.4	0.8
K	50,950[1]	244/155[2]	2,331	1.9	*	9.9	10.7	0.8
L	52,580[1]	208/140[2]	1,632	2.8	11.6[4]	10.1	10.8	0.7
M	55,100[1]	243/175[2]	2,265	1.9	12.0[4]	10.6	11.2	0.6
N	57,400[1]	221/180[2]	2,339	1.8	12.6[4]	11.0	11.5	0.5
O	59,800[1]	246/180[2]	2,394	1.8	12.5[4]	11.3	11.8	0.5
P	62,600[1]	202/100[2]	2,436	1.8	12.8[4]	11.6	12.1	0.5
Q	64,700[1]	178/100[2]	2,185	2.0	12.8[4]	11.9	12.2	0.3
R	66,500[1]	187/95[2]	2,123	2.1	12.9[4]	12.1	12.4	0.3
S	69,500[1]	155/130[2]	1,753	2.5	13.1[4]	12.4	12.8	0.4
T	71,500[1]	161/100[2]	1,975	2.2	13.3[4]	12.8	13.1	0.3
U	74,400[1]	123/110[2]	1,682	2.6	13.7[4]	13.4	13.7	0.3
V	77,700[1]	349/100[2]	1,935	2.3	14.3[4]	14.2	14.6	0.4
W	80,400[1]	319/160[2]	1,779	2.4	14.9	14.9	15.4	0.5
X	82,400[1]	226/150[2]	1,340	3.1	15.8	15.8	16.5	0.7
Y	84,200[1]	421/280[2]	2,231	1.6	16.5	16.5	17.3	0.8

[1] Feet above confluence with Intracoastal Waterway

[2] Width/width within county boundary

* Controlled by tidal flooding-see Flood Insurance Rate Map for applicable

[4] Elevation computed using combined probability analysis

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

CEDAR LAKE CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Cedar Lake Creek								
Z	86,000[1]	325/110[2]	1,094	3.2	17.1	17.1	18.1	1.0
AA	87,400[1]	349/200[2]	2,016	1.7	17.7	17.7	18.7	1.0
AB	88,300[1]	189/90[2]	1,380	2.5	18.0	18.0	19.0	1.0
AC	89,700[1]	174/50[2]	1,774	2.0	18.7	18.7	19.6	0.9
AD	91,100[1]	119/80[2]	1,362	2.2	19.1	19.1	20.0	0.9

[1] Feet above confluence with Intracoastal Waterway

[2] Width/width within county boundary

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

CEDAR LAKE CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Chigger Creek								
I	36,090[1]	420	735	1.3	37.4	37.4	38.4	1.0
J	40,649[1]	406	1,008	0.3	37.8	37.8	38.7	0.9
K	43,620[1]	328	407	0.7	38.7	38.7	39.3	0.6
L	47,910[1]	451	1,461	1.9	40.8	40.8	41.4	0.6
M	51,500[1]	764	1,524	0.6	41.3	41.4	42.4	1.0
N	56,132[1]	147	487	0.6	41.9	41.9	42.9	1.0
O	56,640[1]	105	541	0.4	44.7	44.7	45.3	0.6
P	58,240[1]	71	458	1.0	44.8	44.8	45.4	0.6
Q	58,500[1]	100	2,660	0.5	45.0	45.0	45.5	0.5
Chigger Creek Bypass								
A	2,088[2]	75	306	3.4	35.0	35.0	35.1	0.1
B	4,000[2]	68	393	2.4	37.5	37.5	37.5	0.0
C	5,950[2]	81	371	2.3	38.1	38.1	38.5	0.4
D	7,620[2]	200	690	1.2	38.7	38.7	39.6	0.9
Chocolate Bayou (100-00-00)								
A	11,720[3]	465	5,732	2.4	*	3.8	4.8	1.0
B	17,820[3]	309	3,921	3.5	*	4.8	5.7	0.9
C	20,410[3]	327	4,139	3.3	*	5.3	6.2	0.9
D	23,620[3]	216	4,153	3.3	*	6.0	6.8	0.8
E	25,770[3]	213	4,107	3.3	*	6.3	7.1	0.8
F	30,850[3]	215	3,491	3.8	*	7.1	7.9	0.8
G	33,650[3]	249	3,311	4.0	*	7.9	8.6	0.7

[1] Feet above confluence with Clear Creek

[2] Feet above confluence with Chigger Creek

[3] Feet above FM 2004

* Controlled by tidal flooding-see Flood Insurance Rate Map for applicable elevations

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

CHIGGER CREEK – CHIGGER CREEK BYPASS – CHOCOLATE BAYOU (100-00-00)

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Chocolate Bayou (100-00-00) (continued)								
H	37,100	284	3,203	4.3	*	9.1	9.8	0.7
I	42,200	600	4,439	3.1	*	10.7	11.5	0.8
J	47,200	700	3,701	3.8	*	12.9	13.8	0.9
K	53,300	1,200	7,360	1.9	16.7[2]	16.5	17.5	1.0
L	55,800	1,024	8,862	1.6	17.5[2]	17.2	18.2	1.0
M	58,100	1,119	9,693	1.5	18.2[2]	17.8	18.7	0.9
N	65,500	2,050	8,661	1.6	19.8	19.8	20.7	0.9
O	72,300	1,400	8,114	1.6	21.9	21.9	22.9	1.0
P	77,000	1,365	9,132	1.4	23.0	23.0	24.0	1.0
Q	83,700	1,350	4,177	3.0	23.8	23.8	24.8	1.0
R	90,600	946	7,065	1.7	24.9	24.9	25.9	1.0
S	94,800	737	7,104	1.6	26.3	26.3	27.3	1.0
T	97,200	1,088	8,805	1.3	27.4	27.4	28.3	0.9
U	101,600	1,740	14,553	0.8	28.0	28.0	28.9	0.9
V	109,300	1,600	8,946	1.3	29.2	29.2	30.1	0.9
W	117,600	2,400	1,996	6.0	33.1	33.1	34.1	1.0
X	122,100	2,928	17,391	0.7	34.5	34.5	25.4	0.9
Y	127,600	3,072	24,075	0.5	34.7	34.7	35.6	0.9
Z	133,600	1,338	7,028	1.5	35.2	35.2	36.1	0.9
AA	138,500	3,169	12,972	0.7	36.8	36.8	37.8	1.0
AB	143,100	1,453	7,397	1.1	37.9	37.9	38.9	1.0
AC	151,230	2,903	14,507	0.8	39.6	39.6	40.6	1.0
AD	155,820	1,603	4,190	1.2	39.7	39.7	40.7	1.0
AE	158,740	553	1,785	2.2	40.3	40.3	41.3	1.0
AF	160,000	580	2,515	1.6	40.7	40.7	41.6	0.9

[1] Feet above FM 2004

[2] Elevations computed using combined probability analysis

* Controlled by tidal flooding-see Flood Insurance Rate Map for applicable elevations

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

CHOCOLATE BAYOU (100-00-00)

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Chocolate Bayou (100-00-00) (continued)								
AG	162,400[1]	491	1,192	2.3	42.0	42.0	43.0	1.0
AH	164,880[1]	223	860	2.6	42.8	42.8	43.6	0.8
AI	167,560[1]	120	732	2.0	44.1	44.1	44.9	0.8
AJ	170,690[1]	288	723	2.1	45.2	45.2	46.1	0.9
AK	172,230[1]	174	687	1.9	45.8	45.8	46.6	0.8
AL	176,100[1]	523	1,391	1.2	47.3	47.3	48.2	0.9
AM	180,710[1]	320	874	1.7	49.9	49.9	50.7	0.8
AN	184,750[1]	242	421	1.9	51.6	51.6	52.6	1.0
Clear Creek[4]								
DF	143,429[2]	109/85[3]	1,305	4.1	30.7	30.7	31.1	0.5
DG	144,315[2]	1,478/919[3]	7,111	0.8	31.4	31.4	32.2	0.7
DH	145,837[2]	1,076/83[3]	5,407	1.0	32.1	32.1	32.8	0.7
DI	147,716[2]	443/56[3]	2,866	1.9	33.6	33.6	34.3	0.7
DJ	149,742[2]	769/234[3]	7,234	0.7	35.1	35.1	35.8	0.7
DK	151,243[2]	888/500[3]	4,261	1.3	35.5	35.5	36.2	0.6
DL	152,591[2]	1,055/800[3]	5,574	1.0	36.2	36.2	36.9	0.7
DM	153,811[2]	1,320/110[3]	6,832	0.8	36.6	36.6	37.3	0.7
DN	155,128[2]	472/80[3]	3,162	1.7	36.9	36.9	37.8	0.8
DO	156,374[2]	679/200[3]	3,071	1.8	37.6	37.6	38.4	0.8
DP	158,160[2]	909/450[3]	3,951	1.4	38.3	38.3	39.0	0.8
DQ	160,102[2]	181/0[3]	4,176	1.3	39.1	39.1	39.8	0.7
DR	161,060[2]	661/590[3]	4,927	1.1	39.6	39.6	40.3	0.7
DS	162,398[2]	478/146[3]	3,271	1.6	40.0	40.0	40.9	0.8
DT	163,802[2]	660/104[3]	4,228	1.3	40.5	40.5	41.4	0.9

[1] Feet above FM 2400
[2] Feet above confluence with Galveston Bay
[3] Width/width within county boundary
[4] Clear Creek (A100-00-00)

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

CHOCOLATE BAYOU (100-00-00) - CLEAR CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Clear Creek[3] (continued)								
DU	165,236	756/344	4,738	1.1	41.0	41.0	41.9	0.9
DV	166,626	780/494	4,580	1.2	41.3	41.3	42.2	0.9
DW	168,067	643/436	5,318	1.0	41.5	41.5	42.4	0.9
DX	169,549	1,664/999	7,948	0.7	41.7	41.7	42.6	0.9
DY	170,703	2,267/964	7,828	0.7	41.8	41.8	42.7	0.9
DZ	171,706	2,269/1,133	8,632	0.6	42.0	42.0	42.8	0.9
EA	173,104	1,158/572	5,399	1.0	42.1	42.1	43.0	0.9
EB	174,559	1,855/1,416	10,786	0.5	42.2	42.2	43.1	0.9
EC	175,962	2,572/1,555	12,742	0.4	42.3	42.3	43.2	0.9
ED	177,942	2,601/1,270	10,300	0.5	42.4	42.4	43.3	0.9
EE	179,279	1,815/625	6,169	0.9	42.6	42.6	43.5	0.9
EF	180,698	1,233/398	3,705	1.2	43.0	43.0	43.9	0.9
EG	181,536	1,457/670	5,138	0.8	43.3	43.3	44.2	0.9
EH	182,509	1,466/1,017	6,241	0.7	43.5	43.5	44.5	1.0
EI	183,605	2,080/1,722	7,450	0.6	43.8	43.8	44.8	1.0
EJ	185,606	740/271	3,989	1.1	44.6	44.6	45.5	0.9
EK	186,898	1,127/816	5,115	0.8	45.0	45.0	45.9	0.8
EL	188,163	846/304	5,607	0.8	45.1	45.1	46.0	0.9
EM	189,402	158/79	1,228	3.5	45.4	45.4	46.3	0.9
EN	189,526	673/429	3,589	1.2	46.1	46.1	47.0	0.9
EO	190,634	917/146	6,008	0.7	46.3	46.3	47.2	0.9
EP	191,949	2,091/1,443	9,341	0.5	46.3	46.3	47.3	0.9
EQ	192,944	2,076/1,159	9,849	0.4	46.4	46.4	47.3	0.9
ER	194,562	1,594/1,347	5,489	0.8	46.6	46.6	47.5	0.9
ES	195,886	1,964/1,752	7,432	0.6	46.7	46.7	47.6	0.9
ET	197,191	1,656/1,420	6,137	0.7	46.9	46.9	47.8	0.9

[1] Feet above confluence with Galveston Bay

[2] Width/width within county boundary

[3] Clear Creek (A100-00-00)

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

CLEAR CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)[2]	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Clear Creek[3] (continued)								
EU	198,575	1,076/889	4,365	1.0	47.2	47.2	48.1	0.9
EV	199,968	1,799/1,907	6,078	0.8	47.5	47.5	48.4	0.9
EW	201,419	2,197/2,058	6,259	0.7	47.8	47.8	48.7	0.9
EX	202,849	1,741/1,708	4,499	0.9	48.1	48.1	49.0	0.9
EY	204,505	1,617/1,065	7,642	0.6	48.2	48.2	49.2	0.9
EZ	205,916	1,601/738	6,030	0.7	49.3	49.3	49.9	0.6
FA	207,044	1,764/701	3,908	1.0	49.7	49.7	50.4	0.6
FB	208,586	2,335/51	5,358	0.8	50.3	50.3	51.0	0.7
FC	209,668	2,328/63	5,509	0.7	50.5	50.5	51.2	0.8
FD	211,227	1714/100	2,380	1.6	51.1	51.1	52.0	0.9
FE	212,736	1,179/150	4,005	1.0	51.7	51.7	52.4	0.8
FF	213,802	1,525/30	3,830	1.0	52.1	52.1	53.0	0.8
FG	215,408	2,113/25	7,898	0.3	52.5	52.5	53.4	0.9
FH	216,969	2,800/19	5,988	0.4	52.6	52.6	53.4	0.9
FI	218,474	2,012/44	2,571	0.9	52.9	52.9	53.8	0.9
FJ	219,890	1,276/35	2,419	1.0	53.8	53.8	54.7	0.8
FK	221,402	1,161/36	3,954	0.6	54.3	54.3	55.2	0.8
FL	223,668	189/435	2,790	1.1	55.4	55.4	56.2	0.9
FM	225,036	1,302/32	4,069	0.6	56.2	56.2	57.0	0.8
FN	226,431	2,013/35	4,703	0.5	56.3	56.3	57.2	0.9
FO	227,359	1,083/140	3,593	0.7	56.4	56.4	57.3	0.9
FP	228,828	1,198/495	2,991	0.8	56.8	56.8	57.7	0.9
FQ	230,159	1,106/883	3,307	0.7	57.6	57.6	58.4	0.8
FR	231,533	1,413/1,205	4,750	0.5	57.9	57.9	58.7	0.9
FS	233,000	487/508	1,486	0.7	58.0	58.0	58.9	0.9
FT	234,461	1,249/880	3,945	0.3	59.1	59.1	59.8	0.7
FU	236,609	880/0	1,899	0.6	59.4	59.4	60.2	0.8

[1] Feet above confluence with Galveston Bay [2] Width/width within county boundary [3] Clear Creek (A100-00-00)

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

CLEAR CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Cocklebur Slough								
A	0.08[1]	318	1,108	1.7	*	6.2	7.2	1.0
B	0.50[1]	875	2,386	0.8	*	7.2	8.2	1.0
C	1.68[1]	1,511	3,550	0.5	*	7.9	8.9	1.0
D	2.52[1]	1,838	4,038	0.5	*	8.4	9.4	1.0
E	3.49[1]	679	1,875	1.0	*	10.8	11.8	1.0
F	3.98[1]	1,340	3,611	0.4	*	11.2	12.2	1.0
G	23,750[2]	842	1,655	0.9	*	11.6	12.6	1.0
H	27,550[2]	603	1,376	0.9	*	12.8	13.8	1.0
I	30,550[2]	236	804	1.6	*	14.7	15.3	0.6
J	32,210[2]	245	926	1.4	16.0[3]	15.9	16.2	0.3
K	33,160[2]	191	591	2.2	16.7[3]	16.6	16.9	0.3
L	35,160[2]	216	556	0.6	17.9	17.9	18.4	0.5
M	38,260[2]	183	418	0.8	18.4	18.4	19.0	0.6
N	42,755[2]	39	245	1.1	21.8	21.8	22.6	0.8
O	44,900[2]	106	546	0.5	21.9	21.9	22.9	1.0
P	46,450[2]	107	418	0.6	21.9	21.9	22.9	1.0
Q	48,250[2]	102	339	0.8	22.6	22.6	23.2	0.6
R	50,470[2]	152	303	0.9	22.7	22.7	23.5	0.8
S	52,630[2]	221	395	0.5	23.1	23.1	23.8	0.7
T	54,030[2]	108	210	0.9	23.5	23.5	24.0	0.5
U	56,230[2]	108	331	0.6	23.5	23.5	24.0	0.5
V	58,440[2]	128	126	1.5	24.0	24.0	24.4	0.4
W	61,030[2]	34	88	1.5	25.3	25.3	25.7	0.4
X	62,980[2]	205	466	0.3	25.3	25.3	25.9	0.6
Y	65,460[2]	88	371	0.4	25.4	25.4	26.3	0.9

[1] Miles above confluence with Cedar Lake Creek

[2] Feet above confluence with Cedar Lake Creek

* Controlled by tidal flooding-see Flood Insurance Rate Map for applicable

[3] Elevation computed using combined probability analysis

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

COCKLEBUR SLOUGH

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Cocklebur Slough (continued)								
Z	68,010[1]	87	66	2.0	25.4	25.4	26.3	0.9
AA	70,840[1]	149	588	0.2	25.4	25.4	26.4	1.0
AB	74,030[1]	166	592	0.2	25.5	25.5	26.5	1.0
AC	77,480[1]	130	245	0.5	27.9	27.9	28.0	0.1
Cow Creek								
A	2,480[2]	217/43[3]	2,084	3.3	†	29.6[4]	30.6	1.0
B	5,410[2]	137/91[3]	1,340	4.6	†	32.0[4]	32.5	0.5
C	9,260[2]	94/53[3]	987	6.3	†	35.2[4]	35.4	0.2
D	12,620[2]	120/61[3]	1,256	4.5	50.6	38.1[4]	38.2	0.1
E	15,320[2]	96/48[3]	993	5.6	50.6	41.0[4]	41.2	0.2
F	19,070[2]	353/0[3]	2,072	2.3	50.6	44.4[4]	45.0	0.6
G	23,240[2]	287/112[3]	1,746	2.5	50.6	46.4[4]	47.3	0.9
H	30,140[2]	309/193[3]	1,637	2.3	50.6	50.3[4]	51.2	0.9
I	31140[2]	1052/987[3]	4,477	0.8	50.7	50.7	51.6	0.9
J	33,190[2]	450/160[3]	2,263	1.7	51.1	51.1	52.0	0.9
K	35,260[2]	547/90[3]	2,489	1.5	51.9	51.9	52.8	0.9
L	37,700[2]	527/136[3]	2,574	1.5	52.8	52.8	53.7	0.9
M	39,400[2]	628/366[3]	2,680	1.4	53.4	53.4	54.4	1.0
N	42,900[2]	907/471[3]	4,468	0.9	54.5	54.5	55.5	1.0

[1] Feet above confluence with Cedar Lake Creek
[2] Feet above confluence with Brazos River
[3] Width/width within county boundary
[4] Flooding controlled by Brazos River
† Data Not Available

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

COCKLEBUR SLOUGH - COW CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Cowart Creek								
A	21,447[1]	230	1,555	1.7	32.2	32.2	33.1	0.9
B	26,049[1]	120	830	2.5	35.1	35.1	35.5	0.4
C	29,883[1]	99	553	1.8	37.0	37.0	37.3	0.3
D	32,573[1]	78	315	2.2	38.6	38.6	38.8	0.2
E	35,390[1]	88	299	1.9	40.5	40.5	40.5	0.0
F	38,620[1]	159	379	1.1	42.8	42.8	42.8	0.0
G	40,902[1]	135	278	1.5	44.2	44.2	44.5	0.3
H	46,645[1]	320	588	0.6	46.5	46.5	47.2	0.7
I	49,507[1]	316	392	0.7	47.0	47.0	47.8	0.8
J	51,840[1]	387	446	0.8	48.3	48.3	49.0	0.7
K	55,661[1]	241	324	0.9	50.4	50.4	50.8	0.4
L	58,240[1]	273	309	1.3	52.7	52.7	53.0	0.3
M	60,461[1]	147	476	0.6	54.1	54.1	54.3	0.2
Cowart Creek Tributary 1								
A	875[2]	99	409	3.5	31.2	29.4[3]	29.4	0.0
B	2,435[2]	148	590	2.2	32.7	32.7	32.8	0.1
C	4,415[2]	88	503	2.4	34.6	34.6	34.7	0.1
D	6,135[2]	68	361	3.0	36.3	36.3	36.6	0.3
E	7,410[2]	57	338	2.8	38.6	38.6	39.1	0.5
F	9,601[2]	55	303	2.5	39.2	39.2	40.0	0.8
G	20,140[2]	52	333	1.2	42.7	42.7	43.5	0.8
H	22,488[2]	109	476	0.8	42.8	42.8	43.7	0.9
I	24,840[2]	130	366	1.0	43.2	43.2	44.1	0.9
J	25,630[2]	79	294	0.9	43.5	43.5	44.3	0.8

[1] Feet above confluence with Clear Creek

[2] Feet above confluence with Cowart Creek

[3] Elevation computed without consideration of backwater effect from Cowart Creek

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

COWART CREEK – COWART CREEK TRIBUTARY 1

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Cowart Creek Tributary 2								
A	570[1]	87	223	4.1	36.4	33.4[3]	33.5	0.1
B	3,095[1]	102	290	2.6	36.8	36.8	37.0	0.2
C	5,080[1]	92	388	1.6	40.4	40.4	41.1	0.7
D	7,465[1]	81	516	2.0	41.4	41.4	42.3	0.9
E	8,309[1]	360	453	1.4	41.8	41.8	42.6	0.8
F	9,055[1]	433	359	1.9	42.0	42.0	42.9	0.9
G	9,850[1]	523	1,723	0.4	42.8	42.8	43.7	0.9
H	10,695[1]	983	1,819	0.4	42.8	42.8	43.8	1.0
I	12,750[1]	544	921	0.9	43.2	43.2	44.1	0.9
J	14,460[1]	87	688	2.0	43.6	43.6	44.6	1.0
K	15,940[1]	700	1,619	0.7	44.3	44.3	45.2	0.9
L	16,605[1]	723	1,573	0.7	44.6	44.6	45.4	0.8
M	18,180[1]	528	1,560	0.8	45.0	45.0	45.9	0.9
N	19,070[1]	515	1,305	0.9	45.2	45.2	46.2	1.0
O	26,365[1]	116	298	2.2	48.7	48.7	49.7	1.0
Cowart Creek Tributary 2-1								
A	2,178[2]	250	588	0.6	43.0	43.0	44.0	1.0
B	3,003[2]	215	482	0.6	43.1	43.1	44.1	1.0
C	4,324[2]	238	424	0.6	43.4	43.4	44.2	0.8
D	6,103[2]	278	288	0.9	43.6	43.6	44.4	0.8
E	7,607[2]	185	286	0.9	44.5	44.5	45.0	0.5
F	10,023[2]	72	196	0.8	44.9	44.9	45.7	0.8
G	11,876[2]	130	178	0.6	46.1	46.1	46.4	0.3

[1] Feet above confluence with Cowart Creek

[2] Feet above confluence with Cowart Creek Tributary 2

[3] Elevation computed without consideration of backwater effect from Cowart Creek

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

COWART CREEK TRIBUTARY 2
COWART CREEK TRIBUTARY 2-1

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Cowart Creek Tributary 2-1 (continued)								
H	13,493[1]	29	36	2.3	48.0	48.0	48.1	0.1
I	15,003[1]	46	44	1.3	49.2	49.2	49.5	0.3
Cowart Creek Tributary 2-2								
A	3,304[1]	43	114	1.2	46.6	46.6	47.5	0.9
B	4,398[1]	38	96	1.4	47.1	47.1	47.9	0.8
C	5,903[1]	39	88	1.5	48.7	48.7	49.4	0.7
D	7,504[1]	43	112	1.1	49.4	49.4	50.2	0.8
Cowart Creek Tributary 2 Overflow 1								
A	1,233[2]	250	464	0.4	43.4	43.4	44.0	0.6
B	2,491[2]	80	174	0.9	44.0	44.0	44.8	0.8
Cowart Creek Tributary 2 Overflow 2								
A	1,370[3]	230	394	0.5	41.1	41.1	41.9	0.8
B	3,035[3]	270	477	0.4	42.3	42.3	43.1	0.7
C	3,988[3]	275	553	0.4	42.5	42.5	43.4	0.9

[1] Feet above confluence with Cowart Creek Tributary 2

[2] Feet above confluence with Cowart Creek Tributary 2-1

[3] Feet above confluence with Cowart Creek Tributary 1

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

COWART CREEK TRIBUTARY 2-1 – COWART CREEK TRIBUTARY 2-2 – COWART CREEK TRIBUTARY 2 OVERFLOW 1 – COWART CREEK TRIBUTARY 2 OVERFLOW 2

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Cowart Creek Tributary 3								
A	1,346[1]	362	729	0.4	46.4	46.4	47.3	0.9
B	3,313[1]	311	499	0.5	46.6	46.6	47.5	0.9
C	4,922[1]	253	1,431	0.1	46.8	46.8	47.6	0.8
D	6,831[1]	144	482	0.2	46.8	46.8	47.7	0.9
E	8,427[1]	102	301	0.3	46.9	46.9	47.7	0.8
F	10,441[1]	60	78	0.9	47.4	47.4	48.0	0.6
G	11,637[1]	55	35	1.4	47.9	47.9	48.3	0.4
Flores Bayou								
A	5,500[2]	123	1,214	3.6	11.9[3]	11.1[4]	12.1	1.0
B	10,400[2]	935	5,320	0.8	14.3	14.3	15.2	0.9
C	15,900[2]	598	3,031	1.3	17.5	17.5	18.5	1.0
D	21,100[2]	1,183	2,981	1.1	19.4	19.4	20.4	1.0
E	26,300[2]	866	3,207	1.0	20.8	20.8	21.8	1.0
F	26,400[2]	359	2,123	1.5	21.1	21.1	22.0	0.9
G	28,500[2]	893	3,233	1.0	21.7	21.7	22.7	1.0
H	29,500[2]	1,226	5,357	0.6	21.8	21.8	22.8	1.0
I	32,500[2]	129	768	4.1	22.2	22.2	23.1	0.9
J	35,400[2]	855	3,232	1.0	23.8	23.8	24.8	1.0
K	38,600[2]	1,121	3,681	0.8	24.7	24.7	25.6	0.9
L	41,600[2]	275	1,840	1.7	25.6	25.6	26.2	0.6
M	44,100[2]	412	1,427	1.9	26.1	26.1	26.9	0.8
N	47,200[2]	469	1,558	1.8	27.9	27.9	28.9	1.0
O	48,400[2]	967	3,893	0.7	28.3	28.3	29.2	0.9
P	51,900[2]	1,145	3,763	0.5	28.4	28.4	29.3	0.9
Q	55,700[2]	67	191	9.8	29.7	29.7	29.7	0.0

[1] Feet above confluence with Cowart Creek
[2] Feet above confluence with Austin Bayou
[3] Elevation computed using combined probability analysis
[4] Elevation computed without consideration of backwater from Austin Bayou

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

COWART CREEK TRIBUTARY 3 – FLORES BAYOU

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Halls Bayou								
A	16,855	3,084	9,704	0.7	*	4.0	5.0	1.0
B	20,551	484	2,841	2.3	*	4.5	5.5	1.0
C	24,247	502	3,262	2.0	*	5.5	6.5	1.0
D	27,837	1,213	5,711	1.1	*	6.1	7.1	1.0
E	31,586	792/125[2]	5,079	1.3	*	6.5	7.5	1.0
F	35,018	1,478/150[2]	7,479	0.9	*	6.8	7.8	1.0
G	38,767	3,641/1780[2]	14,777	0.4	*	7.0	8.0	1.0
H	42,516	1,841	8,941	0.6	*	7.1	8.1	1.0
I	45,631	475	3,119	1.7	*	7.3	8.3	1.0
J	49,274	489	3,544	1.5	*	7.9	8.9	1.0
K	50,700	279	2,147	2.3	*	9.0	10.0	1.0
L	53,500	329	3,433	1.4	*	9.2	10.2	1.0
M	56,300	350	3,079	1.6	*	9.4	10.4	1.0
N	60,100	352	3,422	1.2	*	9.6	10.6	1.0
O	65,000	146	1,787	2.4	*	9.9	10.8	0.9
P	69,700	123	1,383	3.1	12.0[3]	11.4	12.1	0.7
Q	73,200	100	1,211	3.2	13.3[3]	12.9	13.6	0.7
R	75,000	110	1,296	3.0	14.1[3]	13.9	14.6	0.7
S	77,500	222	2,273	1.6	14.5	14.5	15.1	0.6
T	80,800	107	1,243	2.3	14.9	14.9	15.5	0.6
U	85,100	76	641	3.6	15.9	15.9	16.5	0.6
V	90,900	48	335	5.2	21.7	21.7	21.7	0.0
W	93,400	73	447	3.4	24.8	24.8	25.0	0.2
X	94,700	74	1,009	1.5	27.1	27.1	27.8	0.7
Y	99,000	169	872	1.0	27.3	27.3	28.1	0.8

[1] Feet above confluence with Halls Lake

[2] Width/width within county boundary

[3] Elevation computed using combined probability analysis

* Controlled by tidal flooding-see Flood Insurance Rate Map for applicable elevations

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

HALLS BAYOU

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Harkey Road Overflow								
A	359[1]	156	303	0.7	50.4	50.4	51.4	1.0
B	1,332[1]	186	370	0.6	51.4	51.4	52.3	0.9
Hickory Slough								
A	6,607[2]	251	694	2.0	44.8	44.8	45.6	0.8
B	7,635[2]	250	661	2.2	46.6	46.6	47.2	0.6
C	8,778[2]	370	768	1.8	46.8	46.8	47.6	0.8
D	9,785[2]	300	1,078	1.3	47.5	47.5	48.0	0.5
E	14,489[2]	633	1,966	0.7	48.6	48.6	49.1	0.5
F	18,545[2]	243	786	1.6	49.4	49.4	50.0	0.6
G	19,289[2]	219	548	2.3	50.1	50.1	50.4	0.3
H	26,376[2]	450	657	1.5	52.4	52.4	52.9	0.5
I	32,014[2]	218	671	1.0	54.2	54.2	54.7	0.5

[1] Feet above confluence with Cowart Creek Tributary 2

[2] Feet above confluence with Clear Creek

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

HARKEY ROAD OVERFLOW – HICKORY SLOUGH

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Linnville Bayou								
A	35,050[1]	596/400[2]	4,098	1.5	27.4	27.4	28.4	1.0
B	41,890[1]	788/280[2]	5,007	1.2	28.4	28.4	29.4	1.0
C	52,690[1]	549/380[2]	5,278	1.2	29.7	29.7	30.6	0.9
D	57,810[1]	305/160[2]	2,880	2.1	30.5	30.5	31.4	0.9
E	64,450[1]	172/90[2]	2,554	1.8	32.3	32.3	33.1	0.8
F	68,450[1]	482/110[2]	3,524	1.3	32.8	32.8	33.6	0.8
G	72,060[1]	393/90[2]	4,450	1.1	33.1	33.1	34.0	0.9
H	77,360[1]	975/100[2]	7,131	0.7	33.3	33.3	34.2	0.9
I	81,880[1]	489/210[2]	4,210	1.1	33.6	33.6	34.5	0.9
J	84,590[1]	1002/180[2]	7,464	0.6	34.1	34.1	35.0	0.9
K	86,270[1]	682/475[2]	3,357	1.3	34.4	34.4	35.3	0.9
L	91,770[1]	1084/1010[2]	3,563	1.2	35.9	35.9	36.9	1.0
M	99,920[1]	1177/930[2]	4,464	1.0	37.9	37.9	38.9	1.0
N	103,020[1]	978/130[2]	6,257	0.7	38.4	38.4	39.4	1.0
O	105,230[1]	1104/750[2]	5,983	0.7	38.6	38.6	39.6	1.0
P	109,030[1]	1281/930[2]	5,576	0.8	38.9	38.9	39.9	1.0
Q	112,030[1]	942/520[2]	3,720	1.2	39.4	39.4	40.3	0.9
R	117,410[1]	935/500[2]	3,885	1.1	40.6	40.6	41.6	1.0
S	120,550[1]	976/580[2]	4,023	1.1	41.3	41.3	42.3	1.0
T	123,650[1]	121/80[2]	1,434	3.1	42.2	42.2	43.2	1.0
U	126,650[1]	751/130[2]	3,325	1.3	43.3	43.3	44.3	1.0
V	127,460[1]	957/250[2]	3,683	1.2	43.5	43.5	44.5	1.0
W	130,560[1]	475/140[2]	2,540	1.7	44.2	44.2	45.2	1.0
X	134,310[1]	179/80[2]	1,724	2.6	45.7	45.7	46.7	1.0
Y	138,490[1]	140/90[2]	1,930	2.3	46.7	46.7	47.7	1.0

[1] Feet above confluence with Caney Creek
[2] Width/width within county boundary

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

LINNVILLE BAYOU

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Marys Creek								
J	12,705	96	568	2.7	32.9	32.9	32.9	0.0
K	14,463	146	607	2.4	34.4	34.4	34.6	0.2
L	16,845	100	519	2.7	36.4	36.4	36.6	0.2
M	19,082	126	576	2.3	38.0	38.0	38.2	0.2
N	21,546	300	866	1.5	40.4	40.4	40.5	0.1
O	22,841	175	809	2.9	41.3	41.3	41.3	0.0
P	25,089	114	813	2.9	42.4	42.4	42.6	0.2
Q	27,493	126	896	2.5	43.5	43.5	43.7	0.2
R	31,163	168	1,406	1.5	44.8	44.8	45.0	0.2
S	35,706	189	1,132	1.6	45.7	45.7	46.0	0.3
T	38,408	114	718	2.4	47.0	47.0	47.2	0.2
U	41,495	453	1,343	1.3	48.0	48.0	48.5	0.5
V	46,441	188	1,251	1.4	49.0	49.0	49.9	0.9
W	52,024	1,172	841	1.6	51.3	51.3	52.2	0.9
X	54,972	94	658	2.3	52.2	52.2	52.9	0.7
Y	57,698	124	835	1.7	52.9	52.9	53.5	0.6

[1] Feet above confluence with Clear Creek

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

MARYS CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Marys Creek Bypass Channel								
A	254[1]	96/62[6]	380	5.1	29.1	29.1	29.1	0.0
B	868[1]	101	435	4.4	30.5	30.5	30.5	0.0
C	2,191[1]	121	532	3.5	32.0	32.0	32.0	0.0
D	4,792[1]	132	388	4.2	34.2	34.2	34.2	0.0
E	6,454[1]	144	426	3.5	36.8	36.8	36.8	0.0
F	8,045[1]	123	396	3.7	38.2	38.2	38.2	0.0
G	8,834[1]	169	456	3.0	38.9	38.9	39.0	0.1
H	10,471[1]	132	401	3.3	40.9	40.9	40.9	0.0
I	11,507[1]	90	749	1.7	41.3	41.3	41.3	0.0
J	12,396[1]	152	761	1.6	41.3	41.3	41.3	0.0
McLean Road Overflow								
A	595[2]	230	542	0.3	47.3	46.3[5]	47.3	1.0
B	1,445[2]	100	173	0.8	48.1	48.1	48.9	0.8
Mound Creek								
A	1,100[3]	107	1,532	3.6	30.7	18.7[4]	19.7	1.0
B	2,410[3]	383	3,353	1.6	30.7	19.3[4]	20.3	1.0
C	4,910[3]	211	2,688	2.0	30.7	20.2[4]	21.2	1.0
D	6,180[3]	578	4,155	1.3	30.7	20.6[4]	21.6	1.0
E	7,500[3]	365	3,185	1.7	30.7	20.8[4]	21.8	1.0
F	9,000[3]	134	2,219	2.2	30.7	21.2[4]	22.2	1.0
G	12,630[3]	200	1,772	2.7	30.7	22.4[4]	23.4	1.0
H	14,580[3]	226	1,860	2.6	30.7	24.2[4]	25.2	1.0
I	18,080[3]	186	1,892	2.5	30.7	29.0[4]	29.9	0.9
J	20,880[3]	614	4,090	1.2	30.7	30.7	31.7	1.0

[1] Feet above confluence with Marys Creek
[2] Feet above confluence with Cowart Creek Tributary 2
[3] Feet above confluence with San Bernard River
[4] Elevation computed without consideration of backwater from San Bernard River
[5] Elevation computed without consideration of backwater effect from Cowart Creek Tributary 2
[6] Width/width within county boundary

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

MARYS CREEK BYPASS CHANNEL – MCLEAN ROAD OVERFLOW – MOUND CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Mound Creek (continued)								
K	23,030[1]	287	2,382	2.0	31.7	31.7	32.7	1.0
L	25,100[1]	80	1,372	3.1	33.9	33.9	34.9	1.0
M	26,830[1]	297	2,428	1.8	35.7	35.7	36.5	0.8
N	28,580[1]	292	2,614	1.6	36.9	36.9	37.7	0.8
O	31,230[1]	249	2,316	1.9	38.1	38.1	39.0	0.9
P	33,330[1]	371	3,065	1.4	39.1	39.1	40.1	1.0
Q	35,730[1]	493	3,134	1.4	40.2	40.2	41.2	1.0
R	37,380[1]	276	1,954	2.2	41.6	41.6	42.6	1.0
S	40,020[1]	387	2,900	1.5	43.8	43.8	44.8	1.0
T	42,630[1]	434	2,898	1.5	45.2	45.2	46.2	1.0
U	45,030[1]	619	2,455	1.8	46.7	46.7	47.7	1.0
V	46,910[1]	756	3,829	1.1	47.5	47.5	48.5	1.0
Mustang Bayou								
A	34,700[2]	1,120	4,388	1.4	*	12.6	13.5	0.9
B	37,900[2]	1,712	6,207	1.0	*	13.1	14.0	0.9
C	41,500[2]	900	4,773	1.3	*	13.5	14.5	1.0
D	45,800[2]	706	3,259	1.9	*	14.2	15.2	1.0
E	52,100[2]	1,693	6,577	0.9	*	15.2	16.2	1.0
F	56,600[2]	116	1,311	4.6	16.2[3]	16.0	17.0	1.0
G	60,400[2]	97	1,244	4.8	18.3[3]	18.2	19.0	0.8
H	64,800[2]	73	1,133	5.2	21.1	21.1	21.7	0.6
I	68,000[2]	85	1,298	4.5	22.8	22.8	23.5	0.7
J	70,900[2]	1,052	4,783	1.2	23.6	23.6	24.5	0.9
K	73,700[2]	533	2,260	2.3	24.2	24.2	25.1	0.9
L	77,800[2]	124	1,451	3.6	25.8	25.8	26.5	0.7
M	78,700[2]	246	1,685	3.1	27.3	27.3	27.8	0.5

[1] Feet above confluence with San Bernard River

[2] Feet above confluence with Chocolate Bay

[3] Elevation computed using combined probability analysis

* Controlled by tidal flooding-see Flood Insurance Rate Map for applicable elevations

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

MOUND CREEK - MUSTANG BAYOU

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Mustang Bayou (continued)								
N	79,500	278	2,003	2.6	28.2	28.2	28.8	0.6
O	80,100	581	2,774	1.9	28.3	28.3	29.0	0.7
P	82,100	371	2,249	2.3	28.7	28.7	29.5	0.8
Q	85,400	88	1,273	4.0	29.3	29.3	30.2	0.9
R	86,500	842	4,504	1.1	30.2	30.2	31.0	0.8
S	88,200	764	4,602	1.1	30.7	30.7	31.5	0.8
T	90,200	162	1,939	2.5	31.3	31.3	32.1	0.8
U	91,300	600	2,796	1.8	31.7	31.7	32.6	0.9
V	94,000	100	1,149	4.3	32.3	32.3	33.2	0.9
W	96,800	300	3,133	1.6	33.3	33.3	34.3	1.0
X	100,200	83	969	4.9	34.0	34.0	35.0	1.0
Y	101,400	390	2,092	2.3	34.9	34.9	35.8	0.9
Z	103,300	89	1,002	4.7	35.5	35.5	36.4	0.9
AA	104,900	86	996	4.7	36.9	36.9	37.6	0.7
AB	106,700	218	1,419	3.3	38.2	38.2	38.8	0.6
AC	108,400	147	1,247	3.8	38.9	38.9	39.6	0.7
AD	110,200	105	1,654	2.9	40.8	40.8	41.6	0.8
AE	113,000	74	791	4.6	41.3	41.3	42.2	0.9
AF	113,800	77	1,011	3.6	42.2	42.2	43.0	0.8
AG	116,200	123	1,418	2.2	42.8	42.8	43.6	0.8
AH	116,700	115	1,584	2.0	42.9	42.9	43.7	0.8
AI	117,750	111	1,310	2.4	43.4	43.4	44.3	0.9
AJ	118,950	220	1,718	1.8	43.9	43.9	44.7	0.8
AK	120,000	639	2,896	1.1	44.0	44.0	44.8	0.8
AL	120,700	454	2,429	1.3	44.5	44.5	45.2	0.7
AM	121,500	625	3,520	0.9	44.7	44.7	45.5	0.8
AN	123,000	943	4,652	0.5	44.8	44.8	45.6	0.8

[1] Feet above confluence with Chocolate Bay

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

MUSTANG BAYOU

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Mustang Bayou (continued)								
AO	125,300	182	1,228	2.0	46.5	46.5	46.8	0.3
AP	127,300	502	2,838	0.8	46.6	46.6	47.1	0.5
AQ	128,900	409	2,059	1.1	46.7	46.7	47.4	0.7
AR	130,300	178	592	3.8	46.7	46.7	47.6	0.9
AS	131,150	40	433	5.2	47.5	47.5	48.5	1.0
AT	133,200	218	1,465	1.5	48.5	48.5	49.4	0.9
AU	134,850	316	1,883	1.2	48.7	48.7	49.6	0.9
AV	136,100	118	881	2.5	48.9	48.9	49.9	1.0
AW	137,200	360	1,467	1.5	49.1	49.1	50.1	1.0
AX	139,800	526	3,234	0.6	49.4	49.4	50.4	1.0
AY	140,400	549	3,325	0.6	49.5	49.5	50.5	1.0
AZ	142,200	838	4,586	0.4	49.5	49.5	50.5	1.0
BA	142,600	607	3,458	0.6	49.6	49.6	50.6	1.0
BB	145,200	206	1,146	1.8	49.7	49.7	50.7	1.0
BC	145,800	223	1,294	1.6	49.9	49.9	50.9	1.0
BD	148,600	276	1,608	1.3	50.8	50.8	51.6	0.8
BE	151,800	344	1,867	1.1	51.2	51.2	52.0	0.8
BF	156,300	168	861	1.8	51.8	51.8	52.6	0.8
BG	158,600	93	671	2.3	52.4	52.4	53.1	0.7
BH	161,200	143	744	2.1	53.2	53.2	54.0	0.8
BI	164,700	554	2,066	0.8	53.6	53.6	54.4	0.8
BJ	166,600	472	2,027	0.8	53.8	53.8	54.6	0.8
BK	168,200	460	1,658	0.9	53.9	53.9	54.8	0.9
BL	170,800	234	1,065	1.4	56.3	56.3	57.3	1.0
BM	173,200	300	1,004	1.3	57.0	57.0	57.7	0.7
BN	175,600	67	357	3.6	58.8	58.8	59.4	0.6
BO	176,800	133	850	1.5	59.1	59.1	59.9	0.8

[1] Feet above confluence with Chocolate Bay

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

MUSTANG BAYOU

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Mustang Bayou (continued)								
BP	180,000[1]	211	854	1.5	59.6	59.6	60.5	0.9
BQ	184,200[1]	284	1,044	1.2	60.5	60.5	61.3	0.8
BR	186,000[1]	388	1,065	1.2	61.0	61.0	61.9	0.9
BS	187,600[1]	548	2,294	0.6	62.0	62.0	62.9	0.9
BT	190,700[1]	355	1,047	1.2	62.5	62.5	63.3	0.8
BU	192,500[1]	400	1,899	0.7	62.8	62.8	63.6	0.8
BV	196,200[1]	267	1,272	1.0	63.2	63.2	64.0	0.8
BW	199,618[1]	120	885	1.4	63.4	63.4	64.3	0.9
BX	202,707[1]	240	1,745	0.7	63.6	63.6	64.6	1.0
BY	205,252[1]	224	1,622	0.8	63.8	63.8	64.6	0.8
BZ	206,733[1]	136	1,568	0.8	63.9	63.9	64.7	0.8
CA	208,651[1]	241	1,580	0.8	64.1	64.1	64.9	0.8
CB	211,745[1]	233	1,526	0.8	64.2	64.2	65.0	0.8
CC	215,182[1]	96	531	2.2	65.5	65.5	66.0	0.5
CD	216,611[1]	73	399	2.9	66.7	66.7	66.9	0.2
CE	217,399[1]	68	399	2.9	67.5	67.5	67.6	0.1
CF	218,900[1]	65	563	2.1	68.2	68.2	68.9	0.7
CG	220,800[1]	139	780	1.5	68.4	68.4	69.1	0.7

[1] Feet above confluence with Chocolate Bay

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

MUSTANG BAYOU

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
North Hayes Creek (102-00-00)								
A	3,240	277	1,231	0.9	37.2	37.2	38.1	0.9
B	3,640	194	929	1.2	37.2	37.2	38.2	1.0
C	6,770	45	290	3.4	38.7	38.7	39.6	0.9
D	7,270	45	319	3.1	39.9	39.9	40.7	0.8
E	10,600	269	630	1.5	41.8	41.8	42.7	0.9
F	13,400	177	526	1.8	43.4	43.4	44.3	0.9
G	14,300	205	593	1.6	44.0	44.0	44.9	0.9
H	17,362	285	715	1.2	44.8	44.8	45.8	1.0
I	19,713	81	379	2.2	47.4	47.4	48.4	1.0
J	22,410	344	955	0.9	48.2	48.2	49.2	1.0
K	26,340	386	582	1.2	48.8	48.8	49.8	1.0
L	27,990	190	470	1.5	49.3	49.3	50.2	0.9
M	30,400	88	237	1.7	51.1	51.1	51.9	0.8

[1] Feet above confluence with Chocolate Bayou

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

NORTH HAYES CREEK (102-00-00)

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Oyster Creek								
A	1.1[1]	453	2,989	1.6	*	3.1	4.1	1.0
B	2.2[1]	492	3,077	1.5	*	3.6	4.4	0.8
C	3.0[1]	350	2,018	2.3	*	4.0	4.7	0.7
D	5.5[1]	301	2,298	2.3	*	5.2	5.7	0.5
E	7.0[1]	171	1,439	3.8	*	6.6	6.9	0.3
F	8.3[1]	196	1,684	1.3	*	8.4	8.6	0.2
G	9.4[1]	241	1,810	3.1	*	9.5	9.7	0.2
H	11.8[1]	362	2,649	2.2	10.8	10.8	11.1	0.3
I	15.0[1]	122	1,897	3.1	12.6	12.6	13.0	0.4
J	17.5[1]	192	2,058	2.8	13.9	13.9	14.2	0.3
K	21.3[1]	213	2,441	2.4	15.8	15.8	16.0	0.2
L	22.0[1]	205	2,480	2.5	16.2	16.2	16.4	0.2
M	23.1[1]	218	2,498	2.6	16.7	16.7	16.9	0.2
N	25.6[1]	206	2,264	3.3	17.9	17.9	18.0	0.1
O	27.2[1]	165	1,951	4.3	19.6	19.6	19.7	0.1
P	29.6[1]	337	4,205	2.6	22.2	22.2	23.0	0.8
Q	32.4[1]	236	3,124	2.9	25.0	25.0	25.8	0.8
R	34.5[1]	247	3,672	3.6	26.0	26.0	26.7	0.7

[1] Miles above confluence with Intracoastal Waterway
* Controlled by Tidal Flooding – See Flood Insurance Rate Map for applicable elevations.

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

OYSTER CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Pearland Sites Road Overflow 1								
A	1,573[1]	190	446	0.1	47.0	46.9[6]	48.0	1.1
B	2,429[1]	190	362	0.2	47.0	47.0	48.0	1.0
Rancho Ditch								
A	1,420[2]	87	507	0.5	26.4	26.4	26.4	0.0
B	5,100[2]	73	273	0.9	26.5	26.5	26.5	0.0
C	10,600[2]	39	89	2.3	28.1	28.1	28.1	0.0
Rancho Ditch South Fork								
A	453[3]	33	108	0.5	28.3	28.2	28.3	0.0
B	2,943[3]	19	7	3.5	28.7	28.7	28.7	0.0
San Bernard River								
A	0.73[4]	4,658	25,488	1.3	*	6.5	7.5	1.0
B	3.78[4]	12,297	49,182	0.7	*	8.1	9.1	1.0
C	5.72[4]	9,794	48,583	0.7	*	8.5	9.5	1.0
D	7.85[4]	5,157	29,074	1.2	*	9.0	10.0	1.0
E	52,800[5]	3,149	15,147	2.1	*	10.6	11.6	1.0

[1] Feet above confluence with Cowart Creek Tributary 2
[2] Feet above confluence with Brushy Bayou
[3] Feet above confluence with Rancho Ditch
[4] Miles above confluence with Intracoastal Waterway
[5] Feet above confluence with Intracoastal Waterway
[6] Elevation computed without consideration of backwater effect from Cowart Creek Tributary 2
* Controlled by tidal flooding-see Flood Insurance Rate Map for applicable elevations

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

PEARLAND SITES ROAD OVERFLOW 1 – RANCHO DITCH – RANCHO DITCH SOUTH FORK – SAN BERNARD RIVER

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
South Hayes Creek (103-00-00)								
A	30,20[1]	195	689	2.4	35.7	35.7	36.7	1
B	62,70[1]	528	1,258	1.3	37.8	37.8	38.5	0.7
C	79,00[1]	665	1,510	1.1	38.4	38.4	38.9	0.5
D	98,70[1]	30	270	6.1	40.9	40.9	41.7	0.8
E	116,50[1]	523	1,665	1	42.1	42.1	43.1	1
F	142,20[1]	535	659	2.5	43.3	43.3	43.8	0.5
G	181,30[1]	256	885	1.9	45.6	45.6	46.4	0.8
H	208,80[1]	63	424	3	46.4	46.4	47.3	0.9
I	242,00[1]	96	840	1.3	48.1	48.1	48.7	0.6
J	247,70[1]	35	296	3.8	48.5	48.5	48.9	0.4
K	287,20[1]	309	743	1.1	50.8	50.8	51.7	0.9
L	303,20[1]	152	566	1.5	51.6	51.6	52.5	0.9
M	321,20[1]	292	932	0.9	52.2	52.2	53.1	0.9
N	348,10[1]	321	769	0.8	53.6	53.6	54.6	1
O	372,60[1]	54	158	3.9	54.6	54.6	55.5	0.9

[1] Feet above confluence with Chocolate Bayou

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

SOUTH HAYES CREEK (103-00-00)

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Stevenson Slough								
A	5,640[1]	79	350	1.9	23.6	18.1[2]	19.1	1.0
B	6,260[1]	8	93	7.2	23.6	20.2[2]	20.8	0.6
C	7,800[1]	13	114	5.4	23.6	22.3[2]	22.7	0.4
D	8,010[1]	53	266	2.3	25.0	25.0	25.6	0.6
E	9,060[1]	207	1,412	0.4	25.2	25.2	26.2	1.0
F	10,810[1]	52	306	2.0	26.2	26.2	27.0	0.8
G	12,145[1]	41	254	2.4	26.8	26.8	27.8	1.0
H	13,485[1]	115	632	0.4	27.0	27.0	28.0	1.0
I	13,723[1]	119	565	0.5	27.0	27.0	28.0	1.0
J	14,089[1]	53	185	1.5	27.1	27.1	28.1	1.0
K	14,501[1]	143	554	0.5	27.2	27.2	28.2	1.0
L	14,731[1]	75	214	1.0	27.2	27.2	28.2	1.0
M	15,432[1]	75	182	1.5	28.0	28.0	28.6	0.6
N	15,693[1]	33	124	2.2	28.3	28.3	29.2	0.9
O	16,047[1]	89	192	1.4	28.9	28.9	29.8	0.9
P	16,513[1]	75	217	1.2	29.6	29.6	30.4	0.8
Q	17,984[1]	34	111	1.2	30.3	30.3	31.2	0.9
R	18,220[1]	145	566	0.2	31.8	31.8	32.6	0.8
S	18,420[1]	145	567	0.2	31.8	31.8	32.6	0.8
T	20,148[1]	88	343	0.4	31.9	31.9	32.7	0.8
U	21,290[1]	274	1,968	0.1	36.6	36.6	37.4	0.8
V	21,760[1]	586	2,518	0.1	36.6	36.6	37.4	0.8
W	22,290[1]	140	967	0.1	36.6	36.6	37.4	0.8
X	24,982[1]	218	1,642	0.1	36.7	36.7	37.5	0.8
Y	26,682[1]	202	850	0.2	36.7	36.7	37.5	0.8
Z	28,582[1]	189	1,336	0.1	36.7	36.7	37.6	0.9

[1] Feet above confluence with San Bernard River

[2] Elevation computed without consideration of backwater effects from San Bernard River

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

STEVENSON SLOUGH

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Varner Creek								
A	9,364[1]	120	1,287	5.5	28.9	27.2[2]	27.3	0.1
B	11,313[1]	175	1,729	4.1	29.0	28.6[2]	28.8	0.2
C	13,106[1]	171	1,737	4.1	29.9	29.9	30.2	0.3
D	14,652[1]	180	1,619	4.4	31.2	31.2	31.5	0.3
E	15,891[1]	405	3,430	2.1	31.9	31.9	32.4	0.5
F	19,450[1]	1,670	12,240	0.6	32.0	32.0	32.9	0.9
G	20,550[1]	1,962	15,601	0.4	32.5	32.5	33.1	0.6
H	23,250[1]	1,119	9,989	0.4	32.5	32.5	33.2	0.7
I	25,350[1]	798	8,371	0.4	32.5	32.5	33.2	0.7
J	29,950[1]	997	8,468	0.4	32.5	32.5	33.2	0.7
K	32,250[1]	475	3,306	0.9	32.6	32.6	33.4	0.8
L	35,050[1]	665	4,925	0.6	32.6	32.6	33.5	0.9
M	37,450[1]	416	2,367	1.3	32.8	32.8	33.7	0.9
N	40,100[1]	280	1,273	2.4	33.8	33.8	34.8	1.0
O	41,800[1]	389	1,691	1.2	34.4	34.4	35.4	1.0
P	43,320[1]	137	963	2.2	34.6	34.6	35.6	1.0
Q	46,830[1]	221	1,135	1.4	37.5	37.5	37.9	0.4
R	49,510[1]	208	627	2.6	38.2	38.2	38.7	0.5
S	52,020[1]	100	661	2.4	40.6	40.6	41.3	0.7
T	54,500[1]	168	851	1.9	41.6	41.6	42.4	0.8
U	57,910[1]	151	677	2.4	43.4	43.4	44.2	0.8
V	62,000[1]	222	762	2.1	46.6	46.6	47.6	1.0

[1] Feet above confluence with Brazos River

[2] Elevation computed without consideration of backwater effects from Brazos

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

VARNER CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
West Fork Chocolate Bayou (101-00-00)								
A	2,296[1]	1,550	6,005	0.6	39.6	38.9[2]	39.9	1.0
B	5,350[1]	1,743	4,546	0.7	39.6	39.1[2]	40.1	1.0
C	8,145[1]	1,689	3,987	1.1	39.6	39.5[2]	40.4	0.9
D	9,228[1]	1,450	3,154	1.0	39.9	39.9	40.6	0.7
E	13,112[1]	714	1,944	2.8	42.4	42.4	43.0	0.6
F	17,689[1]	585	2,262	1.2	44.9	44.9	45.8	0.9
G	19,848[1]	665	1,756	1.5	45.4	45.4	46.3	0.9
H	23,540[1]	516	1,423	1.7	47.2	47.2	48.0	0.8
I	27,674[1]	850	1,688	1.5	49.8	49.8	50.6	0.8
J	32,070[1]	850	1,923	1.3	51.7	51.7	52.5	0.8
K	35,420[1]	925	1,726	1.2	53.0	53.0	53.6	0.6
L	38,370[1]	840	1,693	1.2	53.9	53.9	54.6	0.7
M	40,330[1]	501	1,370	1.0	54.3	54.3	55.1	0.8
N	44,440[1]	261	931	1.8	55.8	55.8	56.7	0.9
O	48,370[1]	220	567	1.4	57.3	57.3	58.2	0.9
P	50,985[1]	185	504	1.2	58.0	58.0	59.0	1.0

[1] Feet above confluence with Chocolate Bayou
[2] Elevation computed without consideration of backwater effect from Chocolate Bayou

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

FLOODWAY DATA

WEST FORK CHOCOLATE BAYOU (101-00-00)

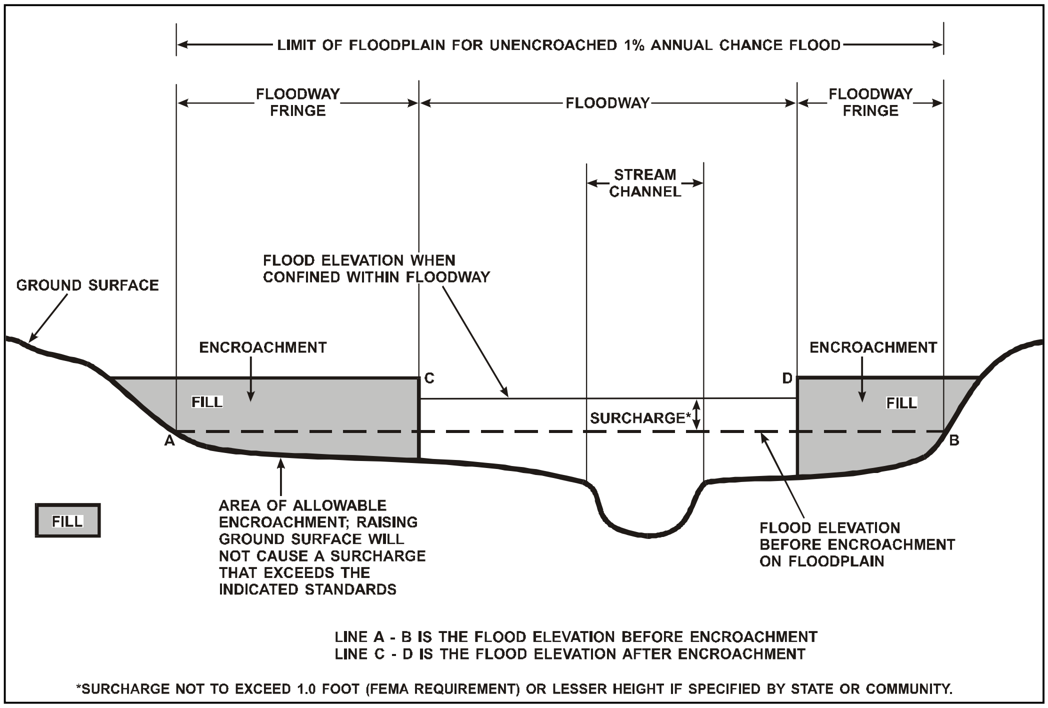

Figure 4 – Floodway Schematic

5.0 INSURANCE APPLICATIONS

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS report by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base (l-percent-annual-chance) flood elevations (BFEs) or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS report by detailed methods. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to areas of 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to areas of 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 1-percent-annual-chance coastal floodplains that have additional hazards associated with storm waves. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 0.2-percent-annual-chance floodplain, areas within the 0.2-percent-annual-chance floodplain, areas of I-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile (sq. mi.), and areas protected from the base flood by levees. No BFEs or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The FIRM is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 1-percent-annual-chance floodplains that were studied by detailed methods, shows selected whole-foot BFEs or average depths. Insurance agents use zones and BFEs in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 1- and 0.2-percent-annual-chance floodplains, floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

The countywide FIRM presents flooding information for the entire geographic area of Brazoria County. Previously, FIRMs were prepared for each incorporated community and the unincorporated areas of the County identified as flood-prone. This countywide FIRM also includes flood-hazard information that was presented separately on Flood Boundary and Floodway Maps (FBFMs), where applicable. Historical data relating to the maps prepared for each community are presented in Table 9, "Community Map History."

Within this jurisdiction there are one or more levees that have not been demonstrated by the community or levee owner(s) to meet the requirements of 44CFR Section 65.10 of the NFIP regulations as it relates to the levee’s capacity to provide 1-percent-annual-chance flood protection. Please refer to the Notice to Flood Insurance Study Users page at the front of this FIS report for more information on how this may affect the FIRM.

7.0 OTHER STUDIES

This study revises and updates the previous FIS and FIRMs for Brazoria County and its incorporated communities.

Studies are currently being performed in Harris, Fort Bend, Galveston and Matagorda Counties. The City of Pearland is located in Brazoria, Fort Bend and Harris Counties. Therefore, Flood Insurance Study users should refer to this study and the countywide study for Harris and Fort Bend Counties for the complete analysis of flood hazards in Pearland.

This FIS report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the NFIP.

This is a multi-volume FIS. Each volume may be revised separately, in which case it supersedes the previously printed volume. Users should refer to the Table of Contents in Volume 1 for the current effective date of each volume; volumes bearing these dates contain the most up-to-date flood hazard data.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting:

Federal Insurance and Mitigation Division
FEMA Region VI, Federal Regional Center, Room 206
800 North Loop 288
Denton, Texas 76201-3698

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE	FIRM EFFECTIVE DATE	FIRM REVISION DATE
Alvin, City of	February 19, 1972	None	February 19, 1972	July 1, 1974 October 31, 1975 June 11, 1976 September 28, 1979 March 24, 1981 July 19, 1982 July 16, 1987
Angleton, City of	June 21, 1974	July 1, 1974	June 10, 1977	January 27, 1978 July 5, 1982
Bailey's Prairie, Village of	November 8, 1974	October 22, 1976	December 15, 1983	
Bonney, Village of	May 8, 1971	None	May 8, 1971	July 1, 1974 June 10, 1977 March 15, 1984
Brazoria, City of	January 9, 1974	May 21, 1976	December 15, 1983	
Brazoria County, Unincorporated Areas of	May 8, 1971	None	May 8, 1971	July 1, 1974 June 10, 1977 October 27, 1978 October 1, 1983 August 19, 1986
Brookside Village, City of	June 28, 1974	June 18, 1976	November 1, 1984	November 15, 1985
Clute, City of	May 10, 1974	None	December 7, 1976	December 1, 1983

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE	FIRM EFFECTIVE DATE	FIRM REVISION DATE
Danbury, City of	May 24, 1974	June 11, 1976	September 16, 1981	
Freeport, City of	November 17, 1970	None	November 17, 1970	July 1, 1974 July 11, 1975 October 31, 1975 January 17, 1986
Hillcrest Village, City of	March 17, 1972	None	March 17, 1972	July 1, 1974 April 11, 1975 July 19, 1982
Holiday Lakes, Town of[1]	May 8, 1971	None	May 8, 1971	July 1, 1974 June 10, 1977 October 27, 1978 October 1, 1983 August 19, 1986
Iowa Colony, City of	July 2, 1976	None	May 17, 1982	August 19, 1986
Jones Creek, Village of	May 24, 1974	January 2, 1976	June 5, 1985	
Lake Jackson, City of	July 7, 1972	None	July 7, 1972	July 1, 1974 July 25, 1975 March 18, 1977 July 3, 1985
Liverpool, City of	November 26, 1976	None	June 5, 1985	

[1] Flood Hazard information previously shown on Brazoria County's Flood Insurance Rate Map and Flood Insurance Study

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE	FIRM EFFECTIVE DATE	FIRM REVISION DATE
Manvel, City of	December 20, 1974	None	December 1, 1981	
Oyster Creek, City of	May 8, 1971	None	November 19, 1976	
Pearland, City of	January 31, 1975	August 13, 1976	July 5, 1984	
Quintana, Town of	May 8, 1971	None	May 8, 1971	July 1, 1974 June 10, 1977 June 5 , 1985
Richwood, City of	July 28, 1972	None	July 28, 1972	July 1, 1974 July 18, 1975 November 28, 1975 January 16, 1976 November 24, 1981 December 1, 1983 April 3, 1985
Sandy Point, City of[1]	May 8, 1971	None	May 8, 1971	July 1, 1974 June 10, 1977 October 27, 1978 October 1, 1983 August 19, 1986

[1] Flood Hazard information previously shown on Brazoria County's Flood Insurance Rate Map and Flood Insurance Study

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE	FIRM EFFECTIVE DATE	FIRM REVISION DATE
Surfside Beach, City of	May 8, 1971	None	May 8, 1971	July 1, 1974 June 10, 1977 June 5, 1985
Sweeny, City of	December 23, 1971	None	December 23, 1971	July 1, 1974 August 22, 1975 December 1, 1982
West Columbia, City of	June 14, 1974	January 16, 1976	December 15, 1983	

[1] Flood Hazard information previously shown on Brazoria County's Flood Insurance Rate Map and Flood Insurance Study

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

9.0 BIBLIOGRAPHY AND REFERENCES

1. U. S. Department of Commerce, Bureau of the Census, 2010 Census of Population and Housing, Washington, D.C., U. S. Government Printing Office, 2010.

2. U. S. Army Corps of Engineers, Galveston District, Flood Insurance Study, Sabine Lake to Matagorda Bay, Texas, Volume I, Galveston, Texas, May 1970.

3. U. S. Army Corps of Engineers, Galveston District, Flood Insurance Study, Main Report, Galveston, Texas, March 1979.

4. U. S. Army Corps of Engineers, Galveston District, Report on Hurricane Carla, September 9-12, 1961, Galveston, Texas, January 1962.

5. U. S. Army Corps of Engineers, Galveston District, Report on Hurricane Celia, July 30-August 5, 1970, Galveston, Texas, February 1971.

6. U. S. Army Corps of Engineers, Galveston District, Report on Hurricane Beulah, September 8-21, 1967, Galveston, Texas, September 1968.

7. U. S. Army Corps of Engineers, Galveston District, Texas Coast Hurricane Study, Galveston, Texas, March 1979.

8. Texas A & M University, Hurricanes on the Texas Coast: Description and Climatology; The Destruction; and Survival and Recovery, College Station, Texas, March 1975.

9. Texas A & M University, Transportation Institute, prepared for the Texas Coastal and Marine Council, Texas Hurricane Evacuation Study, College Station, Texas, September 1978.

10. U. S. Army Corps of Engineers Topographic Laboratories, "Weather Extremes Around the World," Fort Belvoir, Virginia, 1984.

11. U. S. Department of the Interior, Geological Survey, Water Resources Investigations 77-110, Open-File Report, Technique for Estimating the Magnitude and Frequency of Floods in Texas by E. E. Schroeder and B. C. Massey, Washington, D.C., 1977.

12. U. S. Department of the Interior, Geological Survey, Water Resources Investigations 3-73, Effects of Urbanization_ on Floods in the Houston, Texas, Metropolitan Area by Steven L. Johnson and Douglas M. Sayre, Austin, Texas, April 1973.

13. U. S. Army Corps of Engineers, Southwest Division, FLOW SIM 10, An Interbasin Riverine Flow Program by B. R. Bodine, Galveston, Texas.

14. Federal Emergency Management Agency, Flood Insurance Study, Fort Bend County and Incorporated Areas, Texas (Unpublished).

15. U. S. Department of the Interior, Geological Survey, Office of Water Data Collection, Interagency Advisory Committee on Water Data, "Guidelines for Determining Flood Flow Frequency," Bulletin 17B, Reston, Virginia, Revised September 1981.

16. U. S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, User's Manual, Davis, California, August 1979.

17. U. S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-1 Flood Hydrograph Package, Generalized Computer Program, Davis, California, October 1970 and September 1981.

18. U. S. Department of Agriculture, Soil Conservation Service, Technical Release No. 55, Urban Hydrology for Small Watersheds, Washington, D.C., January 1975.

19. U. S. Department of Agriculture, Soil Conservation Service, National Engineering Handbook, Section 4, Hydrology, Washington, D.C., August 1982.

20. U. S. Army Corps of Engineers, Galveston District, Freeport and Vicinity, Texas, Hurricane Flood Protection, Hydrology and Hydraulics, Interior Drainage, Galveston, Texas, June 1965.

21. U. S. Department of Commerce, Environmental Science Services Administration, Technical Memorandum WBTM, Hydro 11, Joint Probability Method of Tide Frequency Analysis by V. A. Myers, Washington, D.C., April 1970

22. U. S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, Computer Tape of Digitized Storm Information from 1.886 through 1977, Asheville, North Carolina, National Climatic Center.

23. U. S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, Tropical Cyclones of the North Atlantic Ocean, 1871 to 1977, Asheville, North Carolina, National Climatic Center, June 1978.

24. U. S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, Technical Report NWS-15, Some Climatological Characteristics of Hurricanes and Tropical Storms, Gulf and East Coasts of the United States by P. Ho, R. W. Schwerdt, and H. V. Goodyear, Washington, D.C., May 1975.

25. U. S. Department of Commerce, National Hurricane Research Project, Survey of Meteorological Factors Pertinent to Reduction of Loss of Life and Property in Hurricane Situations, Report No. 5, Washington, D.C., March 1957.

26. U. S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, Monthly Weather Review, Abstracts of Previous Year Hurricane Season, Washington, D.C., Bimonthly issues from 1964 to 1977.

27. Tetra Tech, Inc., prepared for the-Federal Emergency Management Agency, Coastal Flooding Handbook, Parts I, II, and III, Pasadena, California, May 1980, Revised November 1980.

28. National Academy of Sciences, Methodology for Calculating Wave Action Effects Associated with Storm Surges, Washington, D.C., 1977.

29. Federal Emergency Management Agency, Federal Insurance Administration, Computer Program for Determining Wave Height Elevations for Flood Insurance Studies, Washington, D.C., January 1981

30. U. S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey, Nautical Charts, Scale 1:40,000: Chart 11322, October 1976; Chart 11331, August 1977.

31. U. S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey, Nautical Charts, Scale 1:40,000: Chart 11309, March 1978.

32. U. S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey, Nautical Charts, Scale 1:50,000: Chart 11317, February 1978.

33. U. S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey, Nautical Charts, Scale 1:80,000, Bathymetric Interval 2 Meters: Chart 11313, June 1976; Chart 11316, November 1977; Chart 11321, February 1978; Chart 11323, January 1978; Chart 11332, December 1977.

34. U. S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey, Nautical Charts, Scale 1:460,732, Bathymetric Interval 2 Meters: Chart 11300, May 1978.

35. U. S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey, Outer Continental Shelf Resource Management Maps, Scale 1:250,000, Bathymetric Interval 2 Meters: East Breaks, 1975; Bouma Bank, 1978; Garden Banks, 1975.

36. U. S. Department of the Interior, Geological Survey, Topographic-Bathymetric Maps, Scale 1:250,000, Bathymetric Interval 2 Meters: Bay City, Texas, 1974; Houston, Texas, 1968; Beeville, Texas, 1956; Corpus Christi, Texas, 1956; Port Arthur, Texas, 1978.

37. U. S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 5 Feet: Pearland, Texas, 1982; Juliff, Texas, 1963, Photorevised 1974; Manvel, Texas, 1956, Photorevised 1974; Algoa, Texas, 1956, Photorevised 1974; Hitchcock, Texas, 1964, Photorevised 1974; Mustang Bayou, Texas, 1963, Photorevised 1974; Liverpool, Texas, 1963, Photorevised 1974; Rosharon, Texas, 1963, Photorevised 1974; Otey, Texas, 1953; Damon, Texas, 1953; Guy, Texas, 1953, Photorevised 1980; Danciger, Texas, 1952, Photorevised 1980; West Columbia, Texas, 1951, Photorevised 1980; East Columbia, Texas, 1952; Angleton, Texas, 1963,

Photorevised 1974; Danbury, Texas, 1963, Photorevised 1974; Hoskins Mound, Texas, 1963, Photorevised 1974; Sea Isle, Texas, 1963, Photorevised 1974; San Luis Pass, Texas, 1963, Photorevised 1974; Christmas Point, Texas, 1965, Photorevised 1974; Oyster Creek, Texas, 1963, Photorevised 1974; Lake Jackson, Texas, 1963, Photorevised 1974; Brazoria, Texas, 1952, Photorevised 1972; Sweeny, Texas, 1952, Photorevised 1972; Ashwood, Texas, 1952, Photorevised 1980; Bay City N.E., Texas, 1952, Photorevised 1972; Cedar Lane, Texas, 1952, Photorevised, 1972; Cedar Lane N.E., Texas, 1952, Photorevised 1972; Jones Creek, Texas, 1963, Photorevised 1974; Freeport, Texas, 1964, Photorevised 1974; Cedar Lakes East, Texas, 1964, Photorevised 1974; Cedar Lakes West, Texas, 1952, Photorevised 1972; Almeda, Texas, 1982, Photorevised 1969; Friendswood, Texas, 1982; Thompsons, Texas, 1959, Photorevised 1980.

38. U. S. Army Corps of Engineers, Hydrologic Engineering Center, Computer Program 723-X6-L202A, HEC-2, Water Surface Profiles, (IBMPC-XT version), Davis, California, 1985.

39. Federal Emergency Management Agency, Flood Insurance Study, Harris County and Incorporated Areas, Texas, Washington, D.C., June 18, 2007.

40. U. S. Army Corps of Engineers, Galveston District, Guidelines for Identifying Coastal High Hazard Zones, Galveston, Texas, June 1975.

41. Bovay Engineers, Inc., Aerial Photographs of Coastal Areas of Brazoria, Matagorda, and Jackson Counties, Scale 1:12,000, October 1978.

42. City of Brazoria, Texas, Sanitary Sewer Improvements, "As Built," Scale 1:4,800, Contour Interval 1 Foot, November 1964.

43. Landev Engineers, Inc., of Houston, Texas, Proposed Flood-Prone Area Maps, Brazoria County, Texas, May 1975.

44. Federal Emergency Management Agency, Flood Insurance Study, Unincorporated Areas of Brazoria County, Texas, Washington, D.C., August 19, 1986.

45. Federal Emergency Management Agency, Flood Insurance Study, City of Alvin, Brazoria County, Texas, Washington, D.C., July 16, 1987.

46. Federal Emergency Management Agency, Flood Insurance Study, City of Angleton, Brazoria County, Texas, Washington, D.C., July 5, 1982.

47. Federal Emergency Management Agency, Flood Insurance Study, City of Freeport, Brazoria County, Texas, Washington, D.C., January 17, 1986.

48. Federal Emergency Management Agency, Flood Insurance Study, City of Liverpool, Brazoria County, Texas, Washington, D.C., June 5, 1985.

49. U. S. Army Corps of Engineers, Galveston District, prepared for Brazoria County Conservation and Reclamation District No. Three, Flood Plain Information, Chocolate Bayou, Brazoria County, Texas, Galveston, Texas, 1971.

50. U. S. Army Corps of Engineers, Galveston District, Flood Plain Information, Brazos River, Fort Bend County, Texas, Galveston, Texas, February 1972.

51. U. S. Army Corps of Engineers, Galveston District, prepared for Harris Soil and Water Conservation District, Houston, Texas, Special Flood Hazard Information, Clear Creek, Brazoria, Fort Bend, Galveston, and Harris County, Texas, Galveston, Texas, February 1972.

52. U.S. Army Corps of Engineers, Galveston District, Survey Report on San Bernard River, Texas Flood Control, Galveston, Texas, 1971.

53. U.S. Army Corps of Engineers, Coastal Engineering Research Center, Technical Memorandum No. 26, Hurricane Surge Frequency Estimated for the Gulf Coast of Texas, Fort Belvoir, Virginia, February 1969.

54. Woodward-Clyde Consultants, Flood Insurance Study, Wave Overtopping Analysis, Freeport and Vicinity, Texas, Houston, Texas, January 1983.

55. Federal Emergency Management Agency, Flood Insurance Study, Unincorporated Areas of Matagorda County, Texas, Washington, D.C., December 4, 1985.

56. Federal Emergency Management Agency, Flood Insurance Study, Unincorporated Areas of Galveston County, Texas, Washington, D.C., October 1, 1983.

57. U.S. Army Corps of Engineers, Galveston District, Freeport and Vicinity, Texas, Hurricane Flood Protection, Supplement No. 1 to Design Memorandum No. 2B, Hydrology and Hydraulics, Interior Drainage, Galveston, Texas, November 1965.

58. U.S. Army Corps of Engineers, Galveston District, Freeport and Vicinity, Texas, Hurricane Flood Protection, Supplement No. 2 to Design Memorandum No. 2B, Hydrology and Hydraulics, Interior Drainage, Galveston, Texas, May 1966.

59. Bernard Johnson Engineers, Inc., City of Freeport South Side Drainage Study, Houston, Texas, May 1970.

60. Bernard Johnson Engineers, Inc., City of Freeport Velasco Area Drainage Study, Houston, Texas, March 1969.

61. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-1 Flood Hydrograph Package, Generalized Computer Program, Davis, California, September 1990.

62. Dannenbaum Engineering Corporation, Clear Creek Regional Flood Control Plan, Hydraulic Baseline Report, prepared for the Harris County Flood Control District and Texas Water Development Board, July 1990, Revised September 1991.

63. Dannenbaum Engineering Corporation, Marys Creek Hydraulic Model Update, submitted to the City of Pearland, June 1995, Updated May 1997.

64. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water-Surface Profiles, Generalized Computer Program, User's Manual, Davis, California, May 1991.

65. Dannenbaum Engineering Corporation, Exhibit 1: Reference Work Map, Scale 1:6,000, April 1997.

66. Dannenbaum Engineering Corporation, Exhibit 1: Reference Work Map - CW104-00-00, Scale 1:6,000, April 1998.

67. Federal Emergency Management Agency, Flood Insurance Study, Harris County, Texas and Incorporated Areas, Washington, D.C., June 18, 2007.

68. Federal Emergency Management Agency, Flood Insurance Study, Fort Bend County, Texas and Incorporated Areas, Washington, D.C., Unpublished.

69. Federal Emergency Management Agency, Flood Insurance Study, City of Friendswood, Texas, Washington, D.C., September 22, 1999.

70. Federal Emergency Management Agency, Flood Insurance Study, City of League City, Texas, Washington, D.C., September 22, 1999.

71. Federal Emergency Management Agency and Texas Water Development Board, Brazoria County LiDAR Topographic Data, dated July 2006.

72. Upper Bastrop Bayou Flood Protection Plan Study, for the City of Lake Jackson, prepared by RUST Lichliter/Jameson, dated December 1995.

73. U.S. Army Corps of Engineers (USACE). November 15, 2011. Flood Insurance Study: Coastal Counties, Texas Intermediate Submission 2 – Scoping and Data Review.

74. U.S. Department of the Army, Corps of Engineers, Hydrologic Engineering Center, HEC-RAS River Analysis System, Version 4.1.0, Davis, California, November 2002.

75. Houston Galveston Area Council, Aerial Imagery, dated 2008.

76. Request for Conditional Letter of Map Revision for Bastrop Bayou, Brazoria County, Texas, for City of Lake Jackson, prepared by RUST Lichliter/Jameson, dated November 1996.

77. U.S. Department of the Army, Corps of Engineers, Hydrologic Engineering Center, HEC-HMS River Analysis System, Version 3.1.3, Davis, California, November 2002.

78. Federal Emergency Management Agency, Guidance Document 24, Vertical Datum Conversion, Washington, D.C., May 2014

79. Texas Water Development Board, San Bernard Watershed (Combined Technical Support Data Notebook: Survey, Hydrology, Hydraulics and Floodplain Mapping), June 30, 2015.

10.0 REVISION DESCRIPTIONS

This section has been added to provide information regarding significant revisions made since the original FIS report and FIRM was printed. Future revisions may be made that do not result in the republishing of the FIS report. All users are advised to contact the Community Map Repository to obtain the most up-to-date flood hazard data.

10.1 First Revision (May 4, 1992)

Updated Coastal Information on panels 770 and 790.

10.2 Second Revision (November 17, 1993)

This study was revised to incorporate the effects of new flood-hazard data for areas protected by the City of Freeport levee system. The Freeport North and Velasco Drainage Areas were studied by detailed methods. The Freeport South Drainage Area was studied by approximate methods. The revision to these flooding sources was completed by S.E. Huey Company, for FEMA under Contract No. EMW-90-C-3130. The study was completed in September 1991.

An initial CCO meeting was held on February 21, 1991, and attended by representatives of the City of Freeport, the Velasco Drainage District, and S.E. Huey Company.

A final CCO meeting was held on December 1, 1992, and attended by representatives of FEMA, Brazoria County, and the City of Freeport.

The Freeport North and South and Velasco Drainage Areas are surrounded by hurricane-protection levees and rely on pumped discharge for drainage during periods of heavy rainfall.

The Freeport North Drainage Area is protected from interior flooding by the East Freeport, West End, and Pine Street Pump Stations. The Velasco Drainage Area is protected from interior flooding by the North Freeport and old Velasco and new Velasco Pump Stations. Hurricane-protection levees surround both drainage areas, affording protection from the 1-percent-annual-chance storm. Hurricane-protection levees provide 3 feet of freeboard above the 1-percent-annual-chance year storm elevation.

The U.S. Army Corps of Engineers (USACE), Galveston District, prepared Snyder's unit-hydrograph coefficients for the Freeport North and Velasco Drainage Areas (Reference 20). Using these coefficients in the HEC-1 computer program (Reference 17), peak flows were computed for each drainage area. Reservoir routing was performed for both drainage areas using only the diesel pumping capacities of the pump stations serving each area (References 57 and 58). Results of the hydrologic analyses are shown in Table 3, "Summary of Discharges."

Reservoir routing was performed for the Freeport North and Velasco Drainage Areas using storage volumes provided by Bernard Johnson Engineers, Inc. (References 59 and 60). The rainfalls for the 10-, 2-, 1-, and 0.2-percent-annual-chance storms associated with normal tides are higher than those occurring during high tides. Because the Velasco Drainage Area has gravity drainage via four 48-inch reinforced-concrete pipes during storms with normal tides, a 1-percent-annual-chance rainfall associated with high tides, and no gravity discharge was run as a comparison. Results of the hydraulic analyses are shown in Table 10, "Summary of Non-Coastal Elevations."

Flood boundaries for the Freeport North and Velasco Drainage Areas were delineated using topographic maps at a scale of 1:12,000, with a contour interval of 0.5 foot (References 59 and 60). The approximate boundary for the Freeport South Drainage Area was delineated using topographic maps at a scale of 1:24,000, with a contour interval of 5 feet (Reference 37).

This study also incorporates a Letter of Map Revision (LOMR) dated August 6, 1990, for the unincorporated areas of Brazoria County, Texas. The basis for the revision is the construction of the Dow Chemical levee located along the Brazos River near River Mile 8.0 in Brazoria County. This LOMR was issued to change the flood-hazard zone designation of the area enclosed by the levee from Zone AE to Zone X and to reflect the most up-to-date corporate limits for the City of Lake Jackson.

Table 9 – Summary of Non-Coastal Stillwater Elevations

	PEAK ELEVATIONS (Feet, NAVD)			
FLOODING SOURCE AND LOCATION	**10% ANNUAL CHANCE**	**2% ANNUAL CHANCE**	**1% ANNUAL CHANCE**	**0.2% ANNUAL CHANCE**
FREEPORT NORTH DRAINAGE AREA	-2.55	-2.33	0.04	0.97
POND 1 OF MUSTANG BAYOU **Entire Shoreline within Community**	*	*	57.0	*
POND 2 OF MUSTANG BAYOU **Entire Shoreline within Community**	*	*	57.0	*
VELASCO DRAINAGE AREA	0.66	1.74	2.23	3.01

*Data Not Available

10.3 Third Revision (September 22, 1999)

This study was revised to incorporate updated hydrologic and hydraulic information to reflect existing watershed conditions along the entire reach of Clear Creek, Chigger Creek, Chigger Creek Bypass, Cowart Creek, Hickory Slough, Marys Creek, and Marys Creek Bypass Channel.

The hydrologic analyses were completed using the USACE HEC-1 computer program (Reference 61). The revised HEC-1 analyses for Clear Creek, Chigger Creek, Chigger Creek Bypass Channel, Cowart Creek, and Hickory Slough, dated August 1991, were included in a report entitled "Clear Creek Regional Flood Control Plan, Hydraulic Baseline Report" (Reference 62). The revised HEC-1 analyses for Marys Creek and Marys Creek

Bypass Channel, dated August 1991, were included in a report entitled "Marys Creek Hydraulic Model Update" (Reference 63).

The discharges increased and decreased compared to the previously determined discharges as a result of the updated watershed conditions. A summary of the revised drainage area-peak discharge relationships for Clear Creek, Chigger Creek, Chigger Creek Bypass, Cowart Creek, Hickory Slough, Marys Creek, and Marys Creek Bypass Channel is shown in Table 3, "Summary of Discharges."

The revised hydraulic analyses for Clear Creek, Chigger Creek, Chigger Creek Bypass Channel, and Hickory Slough, dated October 28, 1991; Marys Creek and Marys Creek Bypass Channel, dated April 1997, revised December 1997; and Cowart Creek and Cowart Creek Tributary, dated April 1998, were prepared through the use of the USACE HEC-2 computer program (Reference 64). Cross sections for the backwater analyses were obtained from field surveys, highway plans, and aerial photographs. Roughness coefficients (Manning's "n" values), shown in Table 4, used in the hydraulic computations were chosen by engineering judgment and based on field observations of the stream and floodplain areas.

Floodplain boundaries were delineated using USGS topographic maps at a scale of 1:24,000, with a contour interval of 5 feet (Reference 37), except for Marys Creek and Marys Creek Bypass Channel, which were delineated using "Exhibit 1: Reference Work Map," at a scale of 1:6,000, prepared by Dannenbaum Engineering Corporation, dated April 1997, revised December 1997(Reference 65), and Cowart Creek, upstream of the Atchison, Topeka, and Santa Fe Railway, and Cowart Creek Tributary, which were delineated using "Exhibit 1: Reference Work Map - CW104-00-00," at a scale of 1:6,000, also prepared by Dannenbaum Engineering Corporation, and dated April 1998 (Reference 66).

The Flood Insurance Studies for Harris County, Texas and Incorporated Areas; Fort Bend County, Texas and Incorporated Areas; the City of Friendswood, Texas; and the City of League City, Texas (References 67, 68, 69, and 70, respectively), were updated concurrently with this study. The results of those studies are in complete agreement with the results of this study.

Table 7, "Floodway Data," and Exhibit 1, "Flood Profiles," were also revised to reflect changes as a result of the restudy.

10.4 Fourth Revision (December 30, 2020)

This countywide revision was performed by Comprehensive Flood Risk Resources and Response Joint Venture (CF3R), for FEMA under contract number EMT-2002-CO-0049. All the work was completed in February 2012.

Additional work was performed by the Risk Assessment, Mapping, and Planning Partners (RAMPP) under Contract No. HSFEHQ-09-D-0369. This work was completed in September 2016.

Base map information shown on this FIRM was derived from multiple sources. Base map files were provided in digital format by Texas Natural Resources Information Systems (TNRIS) StratMap, National Oceanic and Atmospheric Administration (NOAA), National Geodetic Survey (NGS), Velasco Drainage District, and the Brazoria County Appraisal District.

The projection used in the preparation of the FIRM was Texas State Plane South Central Zone (FIPS zone 4204). The horizontal datum was NAD83, GRS 1980 spheroid. The vertical datum is NAVD88.

Within this jurisdiction there are one or more levees that have not been demonstrated by the community or levee owner(s) to meet the requirements of 44CFR Section 65.10 of the NFIP regulations as it relates to the levee's capacity to provide 1-percent-annual-chance flood protection. Please refer to the Notice to Flood Insurance Study Users page at the front of this FIS report for more information on how this may affect the FIRM.

For this revision, the initial CCO meeting was held on April 21, 2008, and was attended by representatives of FEMA, CF3R, Texas Water Development Board, county and community officials, other interested agencies and citizens.

The results of the study were reviewed at the final CCO meeting held on September 19, 2017 and attended by representatives of FEMA, Texas Water Development Board, county and community officials, other interested agencies and citizens. All problems raised at that meeting have been addressed in this study.

A significant part of this revision reflects new coastal analysis conducted to establish the 1-percent-annual-chance and the 0.2-percent-annual-chance wave height elevations based on stillwater elevations from a detailed storm surge study performed with the Advanced Circulation model for Coastal Ocean Hydrodynamics (ADCIRC) by the U.S. Army Corps of Engineers (USACE) in 2011 for 17 counties spanning the coast of Texas. The discussion of this coastal analysis is documented in the revised Section 3.3 "Coastal Analysis."

This revision also includes new hydraulic studies for Bastrop Bayou and Bastrop Bayou West Tributary. The hydrologic analysis for this study was based on the 1995 Upper Bastrop Bayou Flood Protection Study (Reference 72) which quantifies the Brazos River and Oyster Creek overflow into Bastrop Bayou watershed. This study was revised based on new hydrologic and hydraulic analysis conducted by RAMPP in 2016 to correct issues identified by the community.

The hydrologic and hydraulic analyses for Clear Creek watershed, prepared by the Harris County Flood Control District (HCFCD) dated June 18, 2007, were also incorporated into this revision. Funding to update flood hazard areas was provided by the Clear Creek Watershed Steering Committee (CCWSC) and the City of Pearland. Streams affected by this flood hazard area update include: Cowart Creek and its tributaries, Hickory Slough, Chigger Creek and Marys Creek.

Portions of the San Bernard Watershed Study were incorporated for the San Bernard River between FM 1301 and the Fort Bend / Wharton County line. This was conducted by HALFF for the Texas Water Development Board (TWDB) in 2015.

In addition, the flood hazard boundaries for other detailed study streams were redelineated on the new Light Detection and Ranging (LiDAR) topographic data collected in 2005. The flood hazard boundaries for enhanced approximate studied streams (Zone A streams) were remapped based on new studies. The redelineation of effective flood hazard areas was not contained along sections of Linnville Bayou, Stephenson Slough and Brushy Bayou resulting in unusually large floodplains for small discharges. For these sections the prior effective mapping was maintained.

Approved LOMRs were also incorporated into this revision as shown in Table 11, "Incorporated LOMRs." Information from the LOMRs were used to update profiles and other tables as needed.

For this study some stream names were changed for what was published previously. Those stream name changes are reflected in Table 12.

Table 10 – Incorporated LOMRs for Third Revision

LOMC	Case No.	Effective Date	Flooding Source	Community
102	05-06-0340P	12/14/2004	Brushy Bayou	City of Angleton, Brazoria County
LOMR	08-06-2457P	10/13/2009	Ditch 21	City of Angleton
LOMR	08-06-0819P	10/29/2009	Clear Creek	City of Pearland
LOMR	10-06-1185P	08/26/2010	Chocolate Bayou, West Fork Chocolate Bayou	City of Iowa Colony, City of Manvel, Brazoria County
LOMR	12-06-1432P	08/29/2013	Varner Creek	City of West Columbia, Brazoria County
LOMR	15-06-1613P	09/28/2015	West Fork Chocolate Bayou	City of Iowa Colony City of Manvel, Brazoria County
LOMR	14-06-3203P	07/31/2015	Unnamed Tributary to Mustang Bayou Pond 1 of Mustang Bayou Pond 2 of Mustang Bayou	City of Pearland
LOMR	15-06-2038P	3/18/2016	Clear Creek	City of Pearland
LOMR	17-06-3110P	6/29/2018	Mustang Bayou	City of Manvel City of Pearland Brazoria County

Table 11 – Stream Name Changes

Previous Name	**Current Name**
Chocolate Bayou	Chocolate Bayou (100-00-00)
Unnamed Tributary to Chocolate Bayou	North Hayes Creek (102-00-00)
Hayes Creek	South Hayes Creek (103-00-00)
West Fork Chocolate Bayou	West Fork Chocolate Bayou (101-00-00)

Hydrologic analyses for Bastrop Bayou and its tributaries were originally based on the Upper Bastrop Bayou Flood Protection Study, upon which a Bastrop Bayou CLOMR request was submitted to FEMA. The report and the CLOMR had been reviewed and accepted by the City of Lake Jackson and by the Velasco Drainage District. A georeferenced HEC-RAS (version 4.1.0) (Reference 74) model was developed for Bastrop Bayou and Bastrop Bayou West Tributary based on current stream alignments and Brazoria County LiDAR Data. A HEC-RAS model was also created for Bastrop Bayou East Tributary. Cross-sections were cut on the LiDAR topography and were supplemented with survey data in the channel. Roughness coefficients (Manning's "n") were estimated based on field investigations, field photographs and 2008 aerial imagery (Reference 75). A normal depth downstream boundary condition was used. Ineffective flow stations were placed to isolate areas with inactive flows. Additionally, the coastal effects on Bastrop Bayou were evaluated through the use of a combined probability model. To accurately represent the flows under State Highway 288 a split flow model was developed in HEC-RAS. Based on the new split flow model the floodways on Bastrop Bayou West Tributary and Bastrop Bayou East Tributary were revised.

Previous hydrologic models for the Clear Creek watershed in Harris County were developed as a part of the Tropical Storm Allison Recovery Project (TSARP). To maintain consistency across the watershed, similar methodology was applied to the affected streams in Brazoria and Galveston Counties. Existing hydrologic data was converted from HEC-1 models to HEC-HMS models. The hydrologic models were updated to reflect current flood hazard flow conditions in the watershed. The effective model did not consider areas of significant ponding in the study area. Updates to the sub-watershed delineation were made using aerial photography, LiDAR data, storm sewer data, and limited field reconnaissance.

The flood discharges for Clear Creek were determined by the HCFCD using the USACE HEC-HMS computer program (Reference 77). The process of the HEC-HMS program includes inputting and distributing the precipitation, determining the subbasin outflow hydrograph from unit hydrograph methods, computing rainfall and excess values, and routing hydrographs by hydrologic methods. Equations to compute Clark's unit hydrograph parameters of time of concentration (Tc) and attenuation constant (R) were optimized from a regression analysis evaluating historic storm events obtained at various gages. Urbanization rates were taken into account by separating the above data into three categories: (1) undeveloped, (2) partially developed, and (3) developed conditions. Ponding, caused by extensive rice farming in the western and southern portions of the county, was taken into account by the development of a relationship between the percentage of ponding and R. This relationship was obtained from the NRCS Technical Release 55 (Reference 18). A method was developed to account for areas that have been urbanized but that are also served by on-site detention. The Green & Ampt method was utilized to approximate runoff losses.

Hydrologic analysis for the San Bernard River watershed was updated using HEC-GeoHMS extending from the headwaters of the San Bernard River in Austin County to the Gulf of Mexico. Modified-Puls routing was applied on the San Bernard River from the Boling Gauge to the Gulf of Mexico. Discharges changed slightly from the historic values published in previous FIS, however these changes are likely the result of increased development and different modeling methodologies (Reference 79).

Hydraulic analyses for Clear Creek and its tributaries were adopted from the FIS for Harris County and Incorporated Areas (Reference 39). Water-surface elevations were computed using the HEC-RAS 3.0.1 program.

The effective hydraulic model was converted from HEC-2 to HEC-RAS (3.1.1). LiDAR data provided by the City of Pearland and the City of Friendswood was incorporated in the bank areas. Because there was concern that LiDAR data may not accurately represent the topography of the channel, effective channel data was incorporated into the LiDAR developed cross sections. The vertical datum of the effective model had to be adjusted to match the vertical datum used for LiDAR data collection. Manning's values were updated to reflect current land cover based on aerial photography and field reconnaissance. When necessary a combination of LiDAR data and field reconnaissance was used to update structure data in the study area.

Hydraulic Analysis for the Upper San Bernard River upstream of FM 1301 into Wharton County was conducted using HEC-RAS 4.1.0 with an unsteady flow regime. Updates including new cross sections, the latest topographic data, incorporation of 2008 survey data for the Bridge at FM 1301 and other structures upstream (Reference 79). Floodplain mapping at the confluence of Cedar Creek was modified to match the latest topographic data and revised floodplains along the San Bernard River.

Floodway models were developed for Clear Creek, Cowart Creek and its tributaries, Hickory Slough, Chigger Creek and Marys Creek.

Table 3, "Summary of Discharges", Table 4 "Summary of Roughness Coefficients", Table 7, "Floodway Data," and Exhibit 1, "Flood Profiles," were also revised to reflect changes as a result of the restudy.