11/29/2005

CITY OF BAYTOWN
FLOOD MITIGATION PLAN

PREPARED BY
CITY OF BAYTOWN FLOODPLAIN MITIGATION PLANNING COMMITTEE

HALFF ASSOCIATES, INC.
February 2005

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Utilizing Flood Mitigation Assistance Program (FMA) funding from the Texas Water Development Board (TWDB), the City of Baytown committed to developing a Flood Mitigation Plan to address flooding concerns within the community. The City selected Halff Associates, Inc., as a planning consultant to assist in the preparation of the Flood Mitigation Plan.

The City of Baytown is vulnerable to several natural and technological hazards that have been addressed in the Harris County All Hazards Mitigation Plan prepared by the Houston Galveston Area Council with Hazard Mitigation Grant Program (HMGP) funding administered by the Governors Division of Emergency Management (TxDEM). The Harris County All Hazards Plan was prepared to meet the requirements of the Disaster Mitigation Act of 2000 and to qualify Harris County and all participating communities that include the City of Baytown, for future Hazard Mitigation Grant Program (HMGP) funding. In order to address the specific flood hazards faced, the City of Baytown has also developed a Flood Mitigation Plan to satisfy the requirements of both the Flood Mitigation Assistance Program as administered through the TWDB and the Community Rating System (CRS) program as administered through the Federal Emergency Management Agency (FEMA).

Mitigation is characterized as a long-term, ongoing process. This plan seeks to address all flood hazards within the City of Baytown, in both Harris and Chambers Counties. It provides general guidance related to various flood hazards within the community and an overview of numerous mitigation efforts undertaken by the community. In addition, the plan identifies potential problematic conditions and outlines corrective actions that the City will undertake to remedy identified problems. Planning and implementation actions will be identified that are applicable to both pre-disaster and post disaster situations.

A Flood Mitigation Plan is more than just another planning document. It is a dynamic record of the community's recognition of its vulnerability to flood hazards, determination of the risks associated with flood effects, and commitment to reducing the long-term consequence of flooding. The Flood Mitigation Plan outlines the mitigation goals within the community, identifies risk reduction strategies for hazards that threaten the area, and discusses the ongoing risk reduction activities accomplished within the jurisdiction.

The City of Baytown Flood Mitigation Plan was developed by following the ten (10) step planning process outlined in the FEMA CRS Coordinators Manual as Floodplain Management Planning Criteria; the process was further expanded to include FMA planning requirements. TWDB and FEMA approval of the City of Baytown Flood Mitigation Plan qualifies the City of Baytown to receive federal funding through the FMA program for acquisition, relocation, and/or elevation of flood damaged properties.

The City of Baytown participates in the National Flood Insurance Program (NFIP); this allows flood insurance to be available throughout the community. FEMA has classified the City of Baytown as a Class Seven (7) within the CRS Program. This classification recognizes the City of Baytown's Floodplain Management Program as exceeding the basic requirements for

participation in the NFIP. The Class 7 rating reduces flood insurance premiums within the community as follows:

> All flood insurance policies within the City of Baytown receive a minimum of 5% reduction in annual premiums.
>
> All flood insurance policies for properties located within the designated Special Flood Hazard Area (Zones A1-A30, AE, A, AO, AH, V1-30, VE, and V) will receive 15% reduction in annual premiums.

A Flood Mitigation Planning Committee was formed consisting of City of Baytown employees, local citizens, and property owners. To assist in the planning effort the City of Baytown selected Halff Associates, Inc. to act as the planning consultant and coordinate with the Texas Water Development Board and "other agencies" during the preparation of the Plan. The City of Baytown Flood Mitigation Planning Committee members are as follows:

Kevin Byal, CFM	City of Baytown Chief Building Official
Gilbert Ward, PG	Texas Water Development Board
Scott Johnson	City of Baytown Parks Department
Dennis Wells	City of Baytown ITS Department
Mike Prewitt, CFM	City of Baytown Department of Public Works
Patty Fowler	City of Baytown Office of Emergency Management
Raquel Ponce	City of Baytown Building Services
John Ivey, PE, CFM	Consultant - Halff Associates, Inc.

The Flood Mitigation Planning Committee met monthly from June to December 2004 to prepare the City of Baytown Flood Mitigation Plan. Each committee member provided input and guidance in plan development. During the month of June, a mitigation planning questionnaire was posted on the City of Baytown website www.baytown.org. The questionnaire was posted in an effort to increase public involvement regarding floodplain management planning. On January 15, 2005 a notice was placed in the Baytown Sun announcing a public meeting to discuss the City of Baytown Flood Mitigation Plan. The public meeting was held on January 27, 2005 at the Baytown City Hall, City Council Chambers, 2401 market Street.

During the planning process, copies of the draft plan were submitted to outside organizations and "Other Agencies" for comment. The organizations contacted included the following: Association of Consulting Municipal Engineers (ACME), Bayou Preservation Association (BPA), Federal Emergency Management Agency (FEMA), Galveston Bay Foundation, Chambers County Engineer, Greater Houston Builders, Harris County Emergency Management, Harris County Flood Control District (HCFCD), Harris County Permits and Infrastructure; Harris-Galveston Subsidence District (HGCSD), Houston-Galveston Area Council (HGAC), Insurance Services Office (ISO), Society of American Military Engineers (SAME), Texas Department of Transportation (TxDOT), Governor's Division of Emergency Management (TxDEM), Texas General Land Office (GLO), Texas Parks and Wildlife Department (TPWD), Texas Commission on Environmental Quality (TCEQ), Texas Water Development Board (TWDB), Transtar, U.S.

Army Corps of Engineers (USACE), City of Houston, City of LaPorte, and City of Morgans Point. Of the agencies contacted, comments on the plan were received from:

Texas Commission on Environmental Quality
Texas Parks and Wildlife Department
Harris County Flood Control District
San Jacinto River Authority
Harris County
Governor's Division of Emergency Management
Bayou Preservation Association

Throughout the plan development process, the Committee reviewed the Harris County "All Hazards" Mitigation Plan and identified numerous hazards that the City of Baytown may encounter. Although flooding remains the primary concern and focus of the plan, each hazard was briefly discussed within the planning document. To clarify the extent to which the community is subject to flood events, the plan identifies the following: number and types of buildings located within the floodplain, the number of flood insurance policies held within the community, and the number of flood losses and repetitive loss properties within the City. The procedures for warning and evacuation during emergency events are also included in the plan. Critical facilities located within the community and their proximity to the floodplain in discussed. Finally, specific mitigation projects already completed within the community are recognized.

After assessing the hazards and reviewing potential alternatives, the Flood Mitigation Planning Committee established several flood mitigation goals for the City of Baytown. Current mitigation activities, CRS Program activities, and other Public Works, Parks Department and Emergency Management activities completed on an annual basis were identified. Documentation of each of the activities was included in the plan to receive appropriate CRS planning credits. Following identification of goals and activities, the Committee recommended nine actions to be undertaken or continued as part of the flood mitigation planning effort. The action items, responsible department and associated costs are identified as follows:

ACTION ITEM #1
Increase Awareness for the need to purchase Flood Insurance for properties located in the City of Baytown

The City of Baytown is subject to flooding from extreme coastal storms resulting from intense rainfall, storm surge from Galveston Bay, and overflows from Goose Creek. The City of Baytown is enrolled in the National Flood Insurance Program (NFIP) and flood insurance is available for all structures located in the City. FEMA has classified the City of Baytown as a Community Rating System (CRS) Class 7 Community and all flood insurance premiums for insured properties within the City are reduced based on the favorable CRS Rating. Flood insurance is a citizen's first line of defense to offset flood losses. The City of Baytown has instituted measures to make the City disaster resistant however the Flood Mitigation Planning Committee recommends that all structures and their contents located within the City be protected by flood insurance.

Based on NFIP reports there are 3,945 flood insurance policies in force within the City. Analyzing residential coverage only and based on an average of 2.7 persons per residence there are approximately 24,700 residential structures within the City and less than 16% are covered by flood insurance. The Flood Mitigation Planning Committee concurs with the recommendation in *Off the Charts – Tropical Storm Allison Public Report* published by the Harris County Flood Control District and FEMA that states, "Get flood insurance today and have a family flood preparedness plan".

The City of Baytown should continue to support public awareness efforts to inform citizens of the protection that can only be provided by purchasing flood insurance coverage for structures and their contents.

Responsibility:	City of Baytown Chief Building Official – to coordinate and host Flood Insurance Workshops NFIP Regional Office – to conduct Flood Insurance Workshops
Cost:	Staff time within existing budgets NFIP conducts workshops at no expense to local communities
Funding Sources:	FEMA (if required)
Timing:	Annual NFIP workshops are proposed in the Galveston Bay area
Beneficiary:	Homeowners Lenders Insurance Agents

ACTION ITEM #2

Harris County "All Hazards" Mitigation Plan Approval and Annual Plan Maintenance

Phase 1: Support the Houston Galveston Area Council (HGAC) planning efforts to receive approval from FEMA for the Harris County "All Hazards" Mitigation Plan to meet the requirements of the Disaster Mitigation Act of 2000 (DMA 2000).

Phase 2: Conduct annual reviews and updates of the Harris County "All Hazards" Mitigation Plan and coordinate with the Governor's Division of Emergency Management (TxDEM), Houston Galveston Area Council (HGAC), Harris County, the City of Houston, and other participating communities to meet the requirements of DMA 2000.

Phase 3: Incorporate the proposed mitigation actions developed for the City of Baytown Flood Mitigation Plan into the Harris County "All Hazards" Plan.

Responsibility:	City of Baytown Office of Emergency Management City of Baytown Chief Building Official
Cost:	Staff time within existing budgets

Funding Sources:	TWDB funding (75%) for FMA Projects TxDEM funding (75%) for HMGP Projects Funding from other sources (Harris County Commissioners Court) City of Baytown staff time (operating funds); Funding from other state and federal agencies
Timing:	Phase 1 – Estimated Harris County Plan Approval is early 2005 Phase 2 - Annual Plan reviews 2005 through 2010 Phase 3 – Phase Action Items into All Hazard Plan during annual plan reviews
Beneficiary:	All Citizens and property owners in the City of Baytown.

ACTION ITEM #3

Acquisition and Relocation of Repetitive Loss Properties

The City of Baytown's goal is to continue to reduce the number of Repetitive Loss Properties in the community by acquisition and relocation of floodprone properties.

Formal approval by FEMA of the Baytown Flood Mitigation plan will qualify the City to receive future Flood Mitigation Assistance (FMA) Program funding administered by the Texas Water Development Board. Approval by FEMA of the Harris County "All Hazards" Mitigation Plan will qualify the City of Baytown to receive Hazard Mitigation Grant Program (HMGP) funding administered by the Governor's Division of Emergency Management. The combination of FMA and HMGP funding will enable the City to utilize 75% Federal funding for projects involving design and construction of (small) flood protection measures; drainage improvements; and acquisition, elevation or relocation of repetitive loss and other floodprone properties.

Congress passed the Flood Insurance Reform Act of 2004 (Signed by President Bush June 30, 2004). The Flood Insurance Reform Act (FIRA) establishes a pilot program to mitigate the damages and costs associated with "Severe Repetitive Loss Properties". The regulations for the pilot program will not be finalized until December 31, 2004, six months after enactment of FIRA. The pilot program will target severe repetitive loss properties which are residential properties that have suffered four of more losses of $5,000 each or collectively losses at more than $20,000; or properties that had two or more claims that together exceed the value of the property. Based on FEMA's Non-Mitigated Repetitive Loss Property Summary dated June 30, 2004, there are 65 non-mitigated repetitive loss properties in the City of Baytown with a total of 166 losses with losses totaling $42,156,045 and an average loss of $12,988. Therefore, there will be repetitive loss properties located within the City that will be classified as severe repetitive loss properties and targeted for FEMA's pilot program.

It is a City of Baytown mitigation action goal to obtain funding from the Flood Mitigation Assistance (FMA) Program administrated by the Texas Water Development Board (TWDB); the Hazard Mitigation Grant Program (HMGP) administered by the Governor's Division of Emergency Management (TxDEM); FEMA's Flood Insurance Reform Act (FIRA) pilot program to mitigate severe repetitive loss properties, and/or other funding sources such as the Harris

County Commissioners Court, to acquire repetitive loss properties considered to be highest priority by the City of Baytown.

A total of 65 "non-mitigated" Repetitive Loss Properties have been identified in the City of Baytown. This action item includes an evaluation and prioritization of these 65 properties by coordinating with property owners that volunteer to participate and to take action to acquire these properties when funding becomes available.

Responsibility: City of Baytown Chief Building Official

Estimated Cost: Option 1 – Utilize HMGP and FMA Program funding for acquisition and relocation of 65 Repetitive Loss Properties:

65 Repetitive Loss Properties with an estimated value of $150,000 per property (average) requires a total of $9,750,000. The Federal portion for HMGP and FMA Program funding is 75% ($7,312,500) and the local or other share is 25% ($2,437,500).

Option 2 – Utilize Flood Insurance Reform Act 2004 (FIRA 2004) funding for acquisition and relocation of 65 Repetitive Loss Properties:

The cost share for "Severe Repetitive Loss" properties acquired using Flood Insurance Reform Act 2004 (FIRA 2004) funding may be revised to 90% Federal share and 10% Local share provided the State of Texas Mitigation Plan is approved as an "Enhanced Plan". Assuming all 65 properties were designated "Severe Repetitive Loss" properties, the Federal portion for acquisition utilizing FIRA 2004 funding is 90% ($8,775,000) and the local or other share is 10% ($975,000).

Demolition cost estimated for 65 properties is estimated as $1,300,000

Funding Sources:
Flood Mitigation Assistance (FMA) Program
Hazard Mitigation Grant Program (HMGP) – Post Disaster
Hazard Mitigation Grant Program - Pre Disaster Mitigation (PDM)
FEMA Flood Insurance Reform Act (FIRA) Pilot Program funding
FEMA/DHS – Disaster Response funding
NFIP Increased Cost of Compliance funds for elevation or demolition of structures ($20,000 per structure maximum is available)
Harris County Commissioners Court (as was the case following Tropical Storm Allison in 2001)
City of Baytown
Matching funds from homeowners that request buyouts

Timing:
2005 – Funding for Severe Repetitive Loss Properties funded by FIRA
2006 Buyout Project - Volunteer buyouts funded by FMA and HMGP
2007 Buyout Project - Volunteer buyouts funded by FMA and HMGP
2008 Buyout Project - Volunteer buyouts funded by FMA and HMGP

Beneficiary: Participating homeowners

ACTION ITEM #4
Improve CRS Rating

Coordinate with FEMA and their contractor, ISO, to conduct an annual review of the City of Baytown's CRS Activities. Submit CRS reports and applications to FEMA and the Insurance Services Office (ISO) to update the City of Baytown CRS classification from a Class seven (7) to a Class Five (5). Upon completion and approval of the Harris County All Hazards Mitigation Plan and the City of Baytown Flood Mitigation Plan, the City of Baytown can apply for additional CRS program credits that will improve their CRS classification. A Class 5 rating would result in an annual premium reductions up to twenty-five percent (25%) for all flood insurance policies on structures located in Special Flood Hazard Areas.

Responsibility: City of Baytown Building Inspection Department

Budget: Staff time within existing budgets

Funding Sources: No funding needed

Timing: 2005 Submit updated CRS Application
October 2005 - upgrade to CRS Class 6
October 2006 – upgrade to CRS Class 5
2007 – Annual review and upgrade if possible
2008 - Annual review and upgrade if possible
2009 - Annual review and upgrade if possible

Beneficiary: All policy holders in the City of Baytown

ACTION ITEM #5
Elevation Reference Marks

Coordinate with Harris County Flood Control District (HCFCD) to establish a city-wide Elevation Reference Mark (ERM) grid so that all areas within the City of Baytown have an updated (adjusted for subsidence) elevation reference mark located nearby. Obtain technical information regarding ERMs that have been evaluated, releveled and/or replaced based on NAVD 1988 as part of the Tropical Storm Allison Flood Recovery Project (TSARP). Utilize these updated ERMs for issuing permits for new construction within the City.

In 2004, the City of Baytown utilizing GPS established 30 new elevation bench marks throughout the City consisting of brass disks set in concrete monuments. This action item consists of evaluating the new Harris County DFIRMs to identify areas where additional reference marks are needed. Assuming 30 additional reference marks will be needed, the total cost is estimated to be $60,000 based on $2,000 cost per new reference mark.

Responsibility:	City of Baytown Public Works Department
Cost:	$60,000 ($2,000 per new reference mark)
Funding Sources:	FEMA/DHS funding City of Baytown Capital Improvement Program funding
Timing:	2005 Identify and establish needed ERM's 2006-2010 Establish new ERM's as needed
Beneficiary:	All construction within the City

ACTION ITEM #6

Initiate the recommended action for Acquisition of the three (3) highest priorities Storm Water Detention basins identified in the City of Baytown Master Drainage Plan

There are three (3) regional storm water detention basins identified in the City of Baytown Drainage Master Plan and recommended as highest priority for future Capital Improvement Projects (CIP) and discussed in a City Council workshop in November 1999 (see Plan Section 5.8 - Capital Improvement Plan). These three (3) recommended regional storm water basins are Cedar Bayou Basin Q8, Goose Creek Basin #7, and Spring Gully Basin #3 or #4. The Drainage Master Plan also includes a recommendation that the City of Baytown select one of the following three options for design, construction and financing of the three proposed storm water detention basins:

1.	Advance purchase and build regional detention facilities and recap fees from development using impact fees, or	$13,757,000
2.	Advance purchase land for regional detention facilities for future construction, or	$1,248,000
3.	Collect impact fees then build regional detention when sufficient monies are available with some increased risk of flooding until detention is built.	$13,757,000

The City Council has designated funding for acquisition of storm water detention sites and the Department of Public Works has identified and evaluated possible sites. Coordination with Harris County Flood Control District is ongoing to incorporate future regional storm water detention facilities into the overall Harris County Drainage Master Plan. There is a possibility that future regional detention facilities can become HCFCD projects or joint City of Baytown/HCFCD projects.

The City of Baytown Flood Mitigation Planning Committee recommends action on Drainage Master Plan Option #2, "Advance purchase of land for regional detention facilities". The City of Baytown Flood Mitigation Plan Action Items #7, #8 and #9, outlined below, address design and construction, over an estimated 20 year period, of future regional detention facilities in the three major watersheds.

Responsibility:	City of Baytown Public Works Department Harris County Flood Control District (HCFCD) Texas Parks and Wildlife Department (TPWD) U.S. Army Corps of Engineers/Galveston District (USACE)
Cost:	$1,248,000 advance purchase of regional detention facility sites
Funding Sources:	City of Baytown 2001 Bond Revenues City of Baytown Capital Improvement Program (CIP) funding Harris County Flood Control District Texas Parks and Wildlife Department (wildlife and wetland enhancement) TWDB – Flood Mitigation Assistance Program (Projects to protect repetitive Loss Properties) Land and Water Conservation Fund (LWCF) for acquisition of and development of State and local park and recreation areas adjacent to and dependent on Regional Stormwater Detention Facilities
Timing:	2005 Set aside funds to continue site evaluation and acquisition 2006 Coordination with HCFCD, TPWD and USACE to address funding for design and construction, environmental and engineering issues related to stormwater detention, wildlife habitat preservation, and wetland enhancement 2007 Begin negotiation with property owners for selected sites 2008 Initiate acquisition of site for 1st regional detention basin 2009 Coordination with HCFCD and TPWD for design
Beneficiary:	Property owners in Cedar Bayou, Goose Creek and Spring Gully watersheds

ACTION ITEM #7

Cedar Bayou Regional Storm Water Detention Facilities and Channel Improvements

The City of Baytown Master Drainage Plan completed in February 2002 identifies sixteen (16) regional storm water detention facilities needed throughout the 214 square mile Cedar Bayou Watershed for ultimate development of the watershed. To address immediate needs, eight of the sixteen regional storm water detention facilities are recommended for design and construction. The estimated total cost for the eight regional storm water detention facilities and supporting channel improvements is $147,942,000. An estimated Impact Fee of $8,250 per acre of development would be required to offset the cost of the recommended drainage improvements. The City of Baytown Department of Public Works will coordinate with HCFCD for the design and construction of needed drainage improvements and Harris County Commissioners Court action may be required to establish Impact Fees to finance design and construction should the proposed projects become HCFCD projects. The City should coordinate with the Texas Parks and Wildlife Department (TPWD) and US Army Corps of Engineers (USACE) to address environmental and engineering issues related to wildlife habitat preservation and wetland enhancement and incorporate environmental enhancements into the design and construction of

channel improvements and stormwater detention facilities. The City will seek TPWD funding to design and construct environmental enhancements.

Responsibility:	City of Baytown Public Works Department Harris County Flood Control District
Cost:	$147,942,000 estimated total cost (Drainage Master Plan, 2002)
Funding Sources:	Impact Fee ($8,250 per acre estimated in Drainage Master Plan HCFCD (Possibility of joint projects) FEMA Disaster Recovery funding (future disasters) HMGP- Funding from FEMA/TxDEM Texas Parks and Wildlife Department (wildlife and wetland enhancement) TWDB – Flood Mitigation Assistance Program (Projects to protect repetitive Loss Properties) Land and Water Conservation Fund (LWCF) for acquisition of and development of State and local park and recreation areas adjacent to and dependent on Regional Stormwater Detention Facilities
Timing:	Design and construction phased over 20 year period
Beneficiary:	Property owners in Cedar Bayou Watershed

ACTION ITEM #8

Goose Creek Regional Storm Water Detention Facilities and Channel Improvements

The City of Baytown Master Drainage Plan completed in February 2002 identifies eleven (11) regional storm water detention facilities needed throughout the 28 square mile Goose Creek Watershed for ultimate development of the watershed. To address immediate needs, seven of the eleven regional storm water detention facilities are recommended for design and construction. The estimated total cost for the seven regional storm water detention facilities and supporting channel improvements is $68,366,000. An estimated Impact Fee of $15,250 per acre of development would be required to offset the cost of the recommended drainage improvements The City of Baytown Department of Public Works will coordinate with HCFCD for the design and construction of needed drainage improvements and Harris County Commissioners Court action may be required to establish Impact Fees to finance design and construction should the proposed projects become HCFCD projects. The City should coordinate with the Texas Parks and Wildlife Department (TPWD) and US Army Corps of Engineers (USACE) to address environmental and engineering issues related to wildlife habitat preservation and wetland enhancement and incorporate environmental enhancements into the design and construction of channel improvements and stormwater detention facilities. The City will seek TPWD funding to design and construct environmental enhancements.

Responsibility:	City of Baytown Public Works Department Harris County Flood Control District

Cost:	$68,366,000 estimated total cost (Drainage Master Plan, 2002)
Funding Sources:	Impact Fee ($15,250 per acre estimated in Drainage Master Plan HCFCD (Possibility of joint projects) FEMA Disaster Recovery funding (future disasters) HMGP- Funding from FEMA/TxDEM Texas Parks and Wildlife Department (Wildlife and wetland enhancement) TWDB – Flood Mitigation Assistance Program (Projects to protect repetitive Loss Properties) Land and Water Conservation Fund (LWCF) for acquisition of and development of State and local park and recreation areas adjacent to and dependent on Regional Stormwater Detention Facilities
Timing:	Design and construction phased over 20 year period
Beneficiary:	Property owners in Goose Creek Watershed

ACTION ITEM #9

Spring Gully Regional Storm Water Detention Facilities and Channel Improvements

The City of Baytown Master Drainage Plan completed in February 2002 identifies four (4) regional storm water detention facilities needed throughout the 5 square mile Spring Gully Watershed for ultimate development of the watershed. To address immediate needs, two of the four regional storm water detention facilities are recommended for design and construction. The estimated total cost for the two regional storm water detention facilities and supporting channel improvements is $8,774,000. An estimated Impact Fee of $16,850 per acre of development would be required to offset the cost of the recommended drainage improvements. The City of Baytown Department of Public Works will coordinate with HCFCD for the design and construction of needed drainage improvements and Harris County Commissioners Court action may be required to establish Impact Fees to finance design and construction should the proposed projects become HCFCD projects. The City should coordinate with the Texas Parks and Wildlife Department (TPWD) and US Army Corps of Engineers (USACE) to address environmental and engineering issues related to wildlife habitat preservation and wetland enhancement and incorporate environmental enhancements into the design and construction of channel improvements and stormwater detention facilities. The City will seek TPWD funding to design and construct environmental enhancements.

Responsibility:	City of Baytown Public Works Department Harris County Flood Control District
Cost:	$8,774,000 estimated total cost (Drainage Master Plan, 2002)
Funding Sources:	Impact Fee ($16,850 per acre estimated in Drainage Master Plan HCFCD (Possibility of joint projects) FEMA Disaster Recovery funding (future disasters) HMGP- Funding from FEMA/TxDEM

	Texas Parks and Wildlife Department (Wildlife and wetland enhancement) TWDB – Flood Mitigation Assistance Program (Projects to protect repetitive Loss Properties) Land and Water Conservation Fund (LWCF) for acquisition of and development of State and local park and recreation areas adjacent to and dependent on Regional Stormwater Detention Facilities
Timing:	Design and construction phased over 20 year period
Beneficiary:	Property owners in Spring Gully Watershed

INTRODUCTION

The City of Baytown Flood Mitigation Plan is a cooperative effort between the City of Baytown, the Texas Water Development Board (TWBD), Harris County Flood Control District (HCFCD), the Federal Emergency Management Agency (FEMA) and others. The City of Baytown is located in both Harris and Chambers Counties along Galveston Bay. The City of Baytown is bordered by unincorporated Harris County and the City of Mont Belvieu (Chambers County) to the north; unincorporated Harris County to the west; unincorporated Harris County and the cities of La Porte and Morgans Point to the south; and Chambers County to the east.

Based on the Texas City Officials Directory published by the Texas Municipal League, 2004-2005 Edition, the City of Baytown has a current population of 67,360. The Houston Metropolitan Area has an estimated population of 4,938,556. The growth rate in the Houston Metropolitan Area is one of the fastest in the nation. Such rapid growth places enormous pressure on local communities.

The City of Baytown fronts Galveston Bay with coastal elevations ranging from sea level to 14 feet. In addition to coastal storms the area is vulnerable to several natural and technological hazards. In order to address the hazards faced, the city in cooperation with the Houston Galveston Area Council (HGAC) has prepared the Harris County "All Hazards" Mitigation Plan. The city of Baytown has also prepared an Emergency Management Plan composed of a basic plan and functional annexes to support the basic Plan. The assignments of responsibility for content and update to the functional annexes are as follows:

Annex	Title	Responsibility
A	Warning	Communications Director
B	Communications	Communications Director
C	Shelter	Parks Director
D	Radiological	Fire Chief
E	Evacuation	Emergency Management Coordinator
F	Fire and Rescue	Fire Chief
G	Law Enforcement	Chief of Police
H	Health and Medical	Health Director
I	Emergency Public Information	City Manager
J	Damage Assessment	Chief Building Official
K	Public Works / Engineering	Director of Public Works
L	Utilities	Director of Public Works
M	Resource Management	City Manager
N	EOC Direction and Control	City Manager
O	Human Services	Human Resources
P	Hazard Mitigation	Engineering Director
Q	Hazardous Materials	Fire Chief
R	Search and Rescue	Fire Department
S	Transportation	Public Works
T	Donations Management	Purchasing Director
U	Legal	City Attorney

V Terrorism Police Department

The City of Baytown Flood Mitigation Plan is a "stand alone" plan but draws from and references many of the annexes found in both the City of Baytown *Emergency Management Plan and the Harris County "All Hazards" Mitigation Plan.*.

The most frequent disaster events that have impacted the Houston Galveston Area are widespread flooding events. Within the last ten (10) years, Harris County, including the City of Baytown, have received Presidential Disaster Declarations for extreme flooding events related to Tropical Storm Allison (2001), Tropical Storm Frances (1998) and the October 1994 Southeast Texas Flood.

In addition to flooding from coastal storms, natural hazards such as severe weather, extreme temperature variations, and winter weather pose risk to the City of Baytown. The City of Baytown is located in the center of one of the largest petrochemical centers and ports in the World, therefore, hazardous conditions may develop from hazardous material accidents, transportation accidents, terrorism or civil disorder. Through proper identification of hazards faced and assessment of the capability of the city to respond to those hazards, the City of Baytown plans to improve the overall disaster preparedness within the community. By developing and implementing a Flood Mitigation Plan, in conjunction with emergency management planning, the City of Baytown will achieve this goal.

PURPOSE

Mitigation is characterized as a long-term, on-going process. This plan seeks to address flood hazards within the City of Baytown, in both Harris and Chambers Counties. It provides general guidance related to flood hazards within the community and an overview of mitigation efforts undertaken by the city. In addition, the plan identifies potential problematic conditions and outlines corrective actions that the city will undertake to remedy the identified problems. Planning and implementation actions will be identified that are applicable to both pre-incident and post-incident situations.

The adverse impact of flood hazards can be directly affected by mitigation actions accomplished prior to the occurrence of an emergency situation. Effective post-event mitigation actions can also reduce the risk of repeat disasters. Therefore, mitigation planning and implementation activities are an on going process and integral part of the comprehensive emergency management program.

Reference Documents for this plan include:

City of Baytown Capital Improvement Plan
City of Baytown Community Assistance Visit (CAV) Report (1998)
City of Baytown Community Rating System Application
City of Baytown Comprehensive Land Use Plan
City of Baytown Master Drainage Plan (February 2002)
City of Baytown Emergency Management Plan
City of Baytown Flood Damage Prevention Ordinance

City of Baytown Flood Insurance Study and FIRMs
City of Baytown Repetitive Loss Plan
FEMA/Harris County Flood Control District Tropical Storm Allison Flood Recovery Project to produce DFIRMs for Harris County and the City of Baytown
FEMA/Harris County Flood Control District "Off the Charts" Tropical Storm Allison Report
FEMA/NFIP flood insurance policy and claims records
Harris County All Hazards Mitigation Plan (2004)
Harris County Flood Insurance Study and FIRMs (1996, 2000, 2004-Preliminary)
Harris County Map Needs Assessment by Harris County Flood Control District
Harris Galveston Coastal Subsidence District Studies, Plans, and Measurements
National Weather Service Storm Evacuation Map for the Galveston Bay Area
National Weather Service Tropical Storm Allison Flood Report (2001)
NPDES Joint Task Force (City of Houston, Harris County and TxDOT)
The City of Baytown Nature Center and Wetlands Education Center website and publications
Flood Mitigation Assistance and Hazard Mitigation Grant Projects in Harris and Chambers Counties
Governor's Division of Emergency Management/Texas A&M University Evacuation Study

COMMUNITY SPECIFIC INFORMATION

Geology

The City of Baytown is located in Southeast Texas in an area described in the Physiographic Map of Texas as the "Gulf Coastal Plain". Elevation ranges from 0 feet above sea level to 300 feet above sea level in this region. The City of Baytown is located on lands ranging from an elevation of sea level along the coast, to approximately 30 feet above sea level.

The area is a nearly flat stratum with deltaic sand and mud soils. According to the Harris County Flood Insurance Study, the soils within the City of Baytown are clayey and loamy. Soils are characterized by low infiltration rates and high runoff potential. The Land Resource Map of Texas identifies soils in the area as expansive clay and mud. The soils are locally silty and calcareous.

Description of the City

Baytown is a large coastal city located in both Harris and Chambers Counties with an estimated population of 67,360 based on the 2004-2005 Texas Municipal League Officials Directory. The community borders on Galveston Bay, the San Jacinto River and the Houston Ship Channel.

Transportation

The Houston William P. Hobby Airport, served by eight carriers, is twenty-two (22) miles to the southwest of the community. The George Bush Intercontinental Airport is twenty seven (27) miles to the Northwest.

The City of Baytown borders the Houston Ship Channel and the Port of Houston. The port is located just a few hours sailing time from the Gulf of Mexico. The port, ranked first in the United States in foreign waterborne commerce ranks second in total tonnage. The Port of Houston is ranked eighth globally.

Interstate Highway 10 lies along the northern portion of the City while State Highway 146 passes through the city from south to north. State Highway 225 (La Porte/Pasadena Freeway) connects the City of Baytown to La Porte, Pasadena and Houston.

Economic Profile

Harris County is the highest industrialized county in Texas that includes the Nations largest concentration of petrochemical plants, and home to the Port of Houston, the largest U S wheat-exporting port and among the top U S ports in the value of foreign trade and total tonnage. The City of Baytown is second only to the City of Houston for waterfront area along the Houston Ship Channel and the Port of Houston.

Climate

The climate of the area is sub-tropical. Mild winters and warm summer's best characterize the climate. The average summer temperature ranges from a high of 90°F to a low of 74°F. The average winter temperature ranges from a high of 62°F to a low of 42°F. The area receives an average number of two hundred seventy-five (275) days per year of sunshine. Average rainfall per year is thirty-eight inches. Rainfall is abundant and evenly distributed throughout the year. Hurricane season, spanning from June to November, usually produces the heaviest rainfall events.

HISTORY OF FLOODING WITHIN THE CITY OF BAYTOWN

As described in the April 20, 2000 Harris County Flood Insurance Study (FIS), the City of Baytown, Harris and Chambers Counties, is subject to intense local thunderstorms of short duration, general storms extending over periods of several days, and torrential rainfall associated with hurricanes and other tropical disturbances. Flooding results from tidal surge along Galveston Bay caused by hurricanes, tropical storms, and stream overflow.

After devastating floods of 1929 and 1935, the City of Houston issued a plea to Congress and secured a commitment for federal flood control assistance. In 1937, the Texas Legislature created the Harris County Flood Control District (HCFCD) and designated the Harris County Commissioners Court as the governing body. Through the past 65 years, the HCFCD has acted as the local sponsor for numerous federal flood control projects to protect the lives and property of local citizens. The City of Baytown is an active partner with the HCFCD, the Port of Houston and the U.S. Army Corps of Engineers (USACE). The result has been the Greater Houston Ship Channel Project and other multi-objective projects that provide flood protection and maximize the use of public lands.

The following are major tropical storm and hurricane events that have produced severe flooding and structural damage along the Texas Gulf Coast:

- September 16-20, 1854
- June 1-5, 1871
- June 8-10, 1871
- September 8-18, 1875
- August 19-24, 1879
- June 21-25, 1880
- June 13-15, 1886
- June 18-16, 1888
- July 4-6, 1888
- July 3-8, 1891
- October 2-7, 1895
- September 10-13, 1897
- September 20-28, 1898
- September 7-10, 1900, “Galveston Great Storm”
- July 21, 1909
- August 16-17, 1915
- September 14, 1919
- August 12-15, 1932
- July 21-27, 1933
- August 26 – September 1, 1934
- October 11-17, 1938
- September 19-25, 1940
- September 11-16, 1941
- September 16-25, 1941
- August 30, 1942
- July 25-29, 1943
- August 24-29, 1945
- August 15-27, 1947
- September 27 – October 26, 1949
- July 27, 1957 – Hurricane Audrey
- July 24-25, 1959 – Hurricane Debra
- September 11, 1961 – Hurricane Carla
- September 16, 1963 – Hurricane Cindy
- August 6, 1964 – Tropical Storm Abby
- August 2-5, 1970 – Hurricane Celia
- September 12-17, 1970 – Tropical Storm Felice
- September 1-7, 1973 – Tropical Storm Delia
- July 25, 1979 – Tropical Storm Claudette
- August 30, 1979 – Tropical Storm Elena
- August 3-10, 1980 – Hurricane Allen
- September 4-7, 1980 – Tropical Storm Danielle
- August 15-18, 1983 – Hurricane Alicia
- June 23, 1986 – Hurricane Bonnie
- August 9-17, 1987
- June 24-July 1, 1989 – Tropical Storm Allison
- July 30-August 3, 1989 – Hurricane Chantal

- October 12-16, 1989 – Hurricane Jerry
- March 5, 1992 – Houston Area Flood
- October 15-20, 1994 - Southeast Texas Flood
- July 28-August 2, 1995 – Tropical Storm Dean
- September 1998 – Tropical Storm Frances
- June 5-10, 2001 – Tropical Storm Allison

In 1961, Hurricane Carla hit the shores of Texas. Carla caused tides of over 20 feet in coastal bays and produced stillwater elevations of 14-16 feet along the western shoreline of Galveston Bay and 14-19 feet in the San Jacinto River along Buffalo Bayou. Approximately 1.7 million acres of coastal land were inundated with over 300,000 people evacuated during this storm.

Tropical Storm Claudette made landfall on the upper Texas coast July 24, 1979. The storm brought 45 inches of rain to an area near Alvin, Texas, contributing to more than $600 million in damages. Claudette produced the United States 24-hour rainfall record of 43 inches.

In 1983, Hurricane Alicia was the first hurricane to make landfall on the United States mainland since 1980. Rainfall amounts exceeded 5 inches in most places, and the east side of Houston received almost 11 inches. The highest storm surge was a 12-foot reading at the City of Seabrook on Galveston Bay. Alicia's fast movement inland minimized severe freshwater flooding, and most damage was the result of wind and storm surge or a combination of the two. The $2 billion in damages made Alicia the costliest hurricane in Texas history.

In September 1998, Tropical Storm Frances, and a localized thunderstorm that followed later in the same month, resulted in widespread flooding and a Presidential declared disaster for the Harris County Area including the City of Baytown. FEMA established a Disaster Field Office in Baytown to assist in the flood recovery effort. There was considerable damage to docks, piers and waterfront structures along Galveston Bay.

During the period from June 5 to June 10, 2001, Tropical Storm Allison produced flooding throughout Southeast Texas, Louisiana, and across the eastern United States. Rainfall rates in the Houston area exceeded both the 100 and 500-year rainfall rates resulting in over 50,000 homes flooded. Damages were estimated at $5 Billion and prompted a Presidential disaster declaration for 30 counties in Texas. The City of Baytown suffered only minor losses during Tropical Storm Allison as compared to other communities in Harris County and adjacent areas.

1.0 HOW THIS PLAN WAS PREPARED (CRS Activity 511.1)

The City of Baytown has initiated a series of floodplain planning activities to provide better services to the people that live and work in the area. Drainage system improvements have been incorporated into the City of Baytown Capital Improvement Plan. Parallel with the City of Baytown planning efforts are the Watershed Master Plans, Flood Protection Project Design, and Construction by Harris County Flood Control District (HCFCD). In February 2004 the City of Baytown began selection procedures for a consultant to assist the City to prepare a Flood Mitigation Plan following requirements established by the Texas Water Development Board (TWDB).

In 1991, the City of Baytown initiated the planning effort to prepare and submit a Community Rating System (CRS) Application to the Federal Emergency Management Agency (FEMA). The CRS application included preparation of a Repetitive Loss Plan. The Federal Insurance Administration (FIA) provided valuable documentation to locate and map Repetitive Loss Properties in the City of Baytown. On October 1, 1991 the City of Baytown received a CRS Class 9 Rating from FEMA which was updated on October 1, 1992 to CRS Class 8, and on October 1, 2001 to CRS Class 7 Rating. Currently there are only three (3) communities in Texas that have received a higher rating than the City of Baytown.

1.1 ORGANIZE TO PREPARE THE PLAN

In April 2004, the City Council approved procedures for preparation of a flood mitigation plan for the City of Baytown. In May 2004, the City of Baytown Flood Mitigation Planning Committee was formed.

On May 11, 2004 the City of Baytown Flood Mitigation Plan Committee held its first organizational meeting. The committee is composed of representatives from various city departments dealing with planning, code enforcement, emergency operations, public works, engineering, parks and recreation, environmental services. The committee also includes members representing the public. The committee is assigned to oversee the activities of a consultant Halff Associates, Inc. hired by the City of Baytown to prepare the Flood Mitigation Plan. Committee members include:

Kevin Byal	Building Services	kjbyal@baytown.org
Gilbert Ward	Texas Water Development Board	gward@twdb.state.tx.us
Scott Johnson	Parks Department	sjohnson@baytown.org
Dennis Wells	ITS Department	djwells@baytown.org
Mike Prewitt	Public Works	mdprewitt@baytown.org
Patty Fowler	Emergency Management	prfowler@baytown.org
Raquel Ponce	Building Services	rponce@baytown.org
John Ivey	Halff Associates	JIvey@FortWorth.Halff.com

The City of Baytown Flood Mitigation Planning Committee Chairman and “Planner in Charge” is:

Kevin Byal, CBO, CFM
City of Baytown Chief Building Official/Floodplain Administrator
Voice (281) 420-6544 and FAX (218) 837-2418

1.2 FLOOD MITIGATION PLAN SCHEDULE, INVOLVE THE PUBLIC AND COORDINATE WITH OTHER AGENCIES (CRS ACTIVITY 511.1, 511.2, AND 511.3)

The overall schedule of plan activities for the development, implementation, evaluation and adoption of the City of Baytown Flood Mitigation Plan following the ten (10) planning steps as described in CRS Activity 511.1 through 511.10:

The proposed work schedule and planning steps to be accomplished under this project include the following:

Date	Project Action
June 2001	Tropical Storm Allison causes significant flooding throughout Harris and Chambers Counties
October 2001	FEMA rates the City of Baytown as a CRS Class 7 Community
June 2002	Harris County Flood Control District Published "Off the Charts" as a post flood report to Tropical Storm Allison
September 2003	The City of Baytown submitted an application to TWDB for funding to prepare a Flood Mitigation Assistance Plan
February 2004	The TWDB approved the FMA Plan applications.
April 2004	Halff Associates, Inc. selected as consultant to assist in preparation of the plan.
May 11, 2004	Initial meeting of the Flood Mitigation Planning Committee. Organize to prepare the Plan (511.1) Coordinate the proposed planning effort with the City of Baytown Project Manager. FEMA will award additional CRS points if s individual is a professional planner.
June 23, 2004	Flood Mitigation Planning Committee Meeting #2 A. Recommendations on methods to involve the Public (511.2) 1. Documents will be prepared for future City Council Meetings to involve the public in the planning process and to establish a method for the public to provide input into the planning process. 2. A Floodplain Management Plan Questionnaire was prepared for distribution to the public as a utility bill insert. B. Coordination with other agencies (511.3) The City of Baytown initiated efforts to take advantage of

coordination meetings held with Harris County Flood Control District, the Association of Municipal Consulting Engineers (ACME), the Harris County Flood Control Task Force, Gulf Coast Emergency Management Association and others. The recommended coordination effort will be itemized so it can be incorporated into the current routine City of Baytown coordination activities.

July 15, 2004 — Flood Mitigation Planning Committee Meeting #3
Assess the Hazard (511.4)
Incorporate City of Baytown CRS assessments and other hazards/project information that may be available.

August 16, 2004 — Flood Mitigation Planning Committee Meeting #4

A. Assess the Problem (511.5)
1. Incorporate risk assessment information available from TWBD, TxDEM, FEMA, Houston Galveston Area Council and others.
2. Assist the City of Baytown Flood Mitigation Planning Committee to review and assess problems.

B. Set goals (511.6)

Set goals and establish a schedule for the Plan including TWBD Flood Mitigation Plan requirements and future improved CRS ratings

September 16, 2004 — Flood Mitigation Planning Committee Meeting #5

A. Review possible activities (511.7)
1. Summarize Harris County Emergency Operations Center and TRANSTAR activities that meet the objectives of the CRS Activity 511 Floodplain Management Plan and TWDB Flood Mitigation Plan requirements. Explore similar Galveston County activities.
2. Review the City of Baytown Flood Damage Prevention Ordinance and suggest potential improvements.

B. Draft an flood mitigation plan (511.8) and submit to "Other Agencies" for comment. Draft the action plan based on the CRS requirement to address a minimum of two (2) of the required six (6) categories:

1. Preventive activities
2. Property protection
3. Natural resource protection
4. Emergency services
5. Structural support
6. Public information

October 21, 2004 — Committee Meeting #6

A. Review Draft Flood Mitigation Plan.
B. Finalize Goals and Action Items
C. Finalize preparation for the Public meeting to present the plan.

	D. Make recommendations on procedures to adopt the plan (511.9) Prepare a schedule of activities leading to City Council approval of the Plan Draft plan submitted to "Other Agencies" for review with comments requested by November 30, 2004.
December 8, 2004	Committee Meeting #7 Reviewed comments received from "Other Agencies" Reviewed and revised the proposed Action Items
January 13, 2005	City Council Work Session to review the Plan
January 24, 2005	Public Meeting Announcement published in the Baytown Sun
January 27, 2005	Public Meeting to present the plan.
February 10, 2005	City Council Ordinance No. 9997 formally adopted the Plan.
February 17, 2005	Procedures implemented to evaluate and revise the plan (511.10) **Proposed Actions**
March 2005	Submit the adopted plan to TWDB, FEMA and ISO.
March 2005	City Mitigation Action Team responds to comments from TWDB, FEMA and ISO.
October 2005	ISO CRS Verification Visit.
January 2006	Year One Plan Evaluation
April 2006	City Approved for CRS rating of 06
January 2007	Year Two Plan Evaluation
April 2007	City Approved for CRS rating of 05
January 2008	Year Three Plan Evaluation
January 2009	Year Four Plan Evaluation
January 2010	Year Five Plan Evaluation and Plan Update

1.3 PUBLIC MEETING

On January 15, 2005 a notice was placed in the Baytown Sun that there would be a public meeting to discuss the Flood Mitigation Plan. The Public Meeting was held on January 27, 2005 in the City of Baytown City Council Chambers. The Flood Mitigation Plan was approved by the

City Council during the regular council meeting on February 10, 2005. Copies of the public notice and Ordinance adopting the Plan are included in Attachment B.

1.4 FLOOD MITIGATION PLAN QUESTIONNAIRE

A Flood Mitigation Plan questionnaire was developed during Flood Mitigation Plan Committee Meeting #1 and finalized at Committee Meeting #2. The questionnaire requesting input was posted on the City of Baytown website www.baytown.org and no responses were received related to the proposed Plan. The questionnaire, Public Notices and related newspaper articles are provided in Plan Attachments "B" and "C".

The questionnaire posted on the City of Baytown website is shown below:

2/28/05

FLOOD MITIGATION PLAN
QUESTIONNAIRE
COMMUNITY RATING SYSTEM (CRS) PROGRAM

The City of Baytown has participated in the National Flood Insurance Program (NFIP) since 1974. The purpose of the program is to regulate development within special flood hazards areas, which in turn, allows citizens within the City of Baytown to purchase flood insurance at an affordable rate. In 1991, in recognition of the City of Baytown's excellent floodplain management program, the City entered the Federal Emergency Management Agency (FEMA) Community Rating System (CRS) program.

The CRS Program recognizes those community floodplain management programs, such as the City of Baytown, that exceed the minimum criteria of the NFIP. In October 2001, the City was upgraded to a CRS classification of 7, which will allow up to 15% reduction in flood insurance premiums. The City's goal is to obtain a CRS 6 classification, which will allow up to 20% reduction in premiums. To accomplish this task, we need your assistance.

Please take a few minutes to identify your flooding concerns using this Questionnaire and return it to the Inspection Division by August 1, 2004. Questionnaires are also available on the City's web site at www.baytown.org. The Inspection Division will review the completed questionnaires and your recommendations will be incorporated into the City's Flood Mitigation Plan scheduled for completion in January 2005.

Current City of Baytown Flood Insurance Coverage

- Coverage $637,982,400.00
- Policies in Force 4,052
- Premium Paid $1,364,679.00
- Claims Paid $57,673,168.00.

YOUR INPUT IS IMPORTANT!!!!!

1. Please rank from #1 to #5 with #1 being your major hazard concern:
   - Flooding _____
   - Erosion _____
   - Hurricane _____
   - Fire _____
   - Subsidence _____
2. Do you live in a designated flood hazard area? ___ Yes ___No ___ Unknown
3. Do you currently carry flood insurance? ___ Yes ___No
4. Would you voluntarily evacuate during a declared disaster event if requested by local authority? ___Yes ___No
5. Has your home ever flooded? ___Yes ___No
6. What recommendations would you like to make for the authors of the City's Flood Mitigation Plan?
7. Name and Address – Optional:

Please complete the questionnaire and mail to: Kevin J. Byal, Chief Building Official, City of Baytown, PO Box 424, Baytown, Texas 77522-0424.
Your input is important. This questionnaire will provide valuable insight in developing the goals and objectives for the City of Baytown's Flood Mitigation Plan.

1.5 COORDINATION WITH OTHER AGENCIES

The City of Baytown approached flood mitigation planning in two phases. Initially, the city developed a core Flood Mitigation Plan Committee comprised of individuals employed by the city and representatives from the general public. Additionally, the city enlisted the assistance of individuals selected to participate from a variety of "Other Agencies". Representation consists of auxiliary agencies, surrounding jurisdictions, and various levels of governmental departments – local, state, and federal.

1.6 MEETINGS WITH OTHER AGENCIES TO REVIEW COMMON PROBLEMS

Representatives from the City of Baytown Mitigation Flood Planning Committee met with the following agencies to discuss the development of the Flood Mitigation Plan and to discuss the common hazards the affect the surrounding communities:

Texas Water Development Board
Texas Commission on Environmental Quality
Harris County Flood Control District

1.7 ESTABLISHING GOALS

On May 11, 2004, the Flood Mitigation Plan Committee met to discuss and outline a plan to establish goals. In addition, the committee discussed the public questionnaire to be distributed. The Harris County All Hazards Mitigation Plan was prepared by the Houston Galveston Area Council with input from the City of Baytown and other communities in Harris County. The goals and objectives of the Harris County All Hazards Mitigation Plan were reviewed during the planning process to help identify flood mitigation goals to be addressed in the Flood Mitigation Plan.

On June 23, 2004, the Flood Mitigation Plan Committee met to establish and finalize the goals and objectives for the City of Baytown. The City of Baytown Flood Mitigation Plan Goals are described in Section 4.0 of this Plan.

1.8 DISTRIBUTION OF DRAFT ACTION PLAN

On October 29, 2004, Halff Associates, Inc. (planning consultant) submitted the initial draft of the Flood Mitigation Plan to the Flood Mitigation Plan "Other Agencies" for review with comments and recommendations requested by November 30, 2004. These agencies were requested to review common problems, development policies, mitigation services, inconsistencies and conflicts in policies, plans, programs, and regulations. They were also requested to review to community's needs, goals, and plans for the area.

Recommendations and comments were received from:
San Jacinto River Authority
Harris County Flood Control District

Texas Parks and Wildlife Department
Texas Commission on Environmental Quality
Governor's Division of Emergency Management
Bayou Preservation Association

2. ASSESS THE HAZARD (CRS ACTIVITY 511.4)

The City of Baytown has experienced emergencies and disasters in the past and expects that emergencies and disaster will occur in the future. Due to location and geographic features, the City of Baytown is vulnerable to the damaging effects of certain hazards that include but are not limited to: hurricanes and tropical storms; extreme heat; flash flood; severe thunderstorm; tornado; winter weather; lightning; hazardous substance releases; power/utility outages; fire/explosion; building/structure collapse; mass casualty incidents; transportation accidents; terrorism/sabotage; hostage situation; and attack (conventional, nuclear, biological, chemical).

Natural disasters and emergencies affect the city more often than other types of emergencies and disasters. Of the natural disasters that have occurred, flooding is by far the most common event to affect the area. Damaging flood events have occurred within the city on average, at least once each year.

2.1 MAP OF KNOWN FLOOD PRONE AREAS.

The flood hazards for the City of Baytown were initially identified in 1970 by the Federal Insurance Administration and published as Flood Hazard Boundary Maps. In the early 1980's a county-wide flood insurance study was initiated by FEMA for Harris County and all areas within the County. The initial FIRMs were published as individual community FIRMs and later combined into the Harris County (county-wide) FIRM. The Flood Insurance Studies (FIS) and related mapping published for the City of Baytown is listed below:

July 14, 1970	City of Baytown Flood Hazard Boundary Map
September 28, 1982	City of Baytown Flood Insurance Study and FIRMs
March 4, 1987	City of Baytown Flood Insurance Study and FIRMs
September 28, 1990	Harris County and Incorporated Area FIS and FIRMs
September 30, 1992	Harris County and Incorporated Area FIS and FIRMs
November 6, 1996	Harris County and Incorporated Area FIS and FIRMs
April 20, 2000	Harris County and Incorporated Area FIS and FIRMs

The nine (9) Harris County FIRM Panels that show flood hazards within the City of Baytown are as follows:

Panel Number	Date	Map Scale
48201C0745K	April 20, 2000	1 inch = 1000 feet
48201C0755J	November 6, 1996	1 inch = 1000 feet
48201C0760J	November 6, 1996	1 inch = 1000 feet
48201C0765J	November 6, 1996	1 inch = 1000 feet
48201C0770J	November 6, 1996	1 inch = 1000 feet
48201C0935J	November 6, 1996	1 inch = 1000 feet
48201C0955J	November 6, 1996	1 inch = 1000 feet
48201C0960J	November 6, 1996	1 inch = 1000 feet
48201C0970J	November 6, 1996	1 inch = 1000 feet

On September 30, 2004, FEMA published Preliminary Harris County and Incorporated Areas Digital Flood Insurance Rate Maps as a result of the Tropical Storm Allison Flood Recovery Project. These DFIRMs are being reviewed by the City of Baytown and formal comments will be submitted to FEMA.

Map Needs Assessment

In 1994, the Mapping Needs Assessment Process was established by FEMA to identify and prioritize community map update needs in accordance with Section 575 of the *National Flood Insurance Reform Act* of 1994. Since May of 1997, more than 11,700 communities have been contacted for map update needs. Information regarding mapping needs is collected by FEMA in the Mapping Needs Update Support System (MNUSS).

The Federal Emergency Management Agency (FEMA), in 1997, designed a plan to modernize the Nations' map inventory. Over time, the objective is to eliminate the existing backlog of outdated maps and to convert all Flood Insurance Rate Maps (FIRMs) to a digital format. One of the key objectives of the modernization plan is to increase local involvement in, and ownership of, the flood mapping process. The Cooperating Technical Partner (CTP) concept was developed specifically to accomplish this goal. Under the CTP initiative, FEMA enters into agreements with technically capable community partners to produce agreed-upon products that supplement ongoing FEMA mapping efforts.

On July 31, 2000, the Harris County Flood Control District (HCFCD) became the second community within the State of Texas to enter into a Cooperating Technical Partner (CTP) Agreement with FEMA. The first Activity Agreement generated under this partnership was to conduct a Countywide Needs Assessment for Harris County including all 35 incorporated communities (City of Baytown included) and unincorporated areas within the County. This CTP Activity established the basis for FEMAs Map Needs Update Support System (MNUSS) Database in Harris County.

The current Harris County Flood Insurance Rate Map (FIRM) published by FEMA April 20, 2000, includes all incorporated and unincorporated areas within Harris County. The Harris County FIRM is a product of the Houston/Harris County Metropolitan Flood Insurance Study that was initiated by the Galveston District, US Army Corps of Engineers (USACE) in 1976. FEMA published the Study as twenty-two (22) individual community Flood Insurance Studies and FIRMs during the period from 1980 to 1985. In September 1990, FEMA combined all of the individual community FIRMs into the Harris County, Texas and Incorporated Areas Flood Insurance Study and countywide FIRM. FEMA revised the Harris County (county-wide) FIRM on September 30, 1992, November 6, 1996, and April 20, 2000. The April 20, 2000, Harris County FIRM includes 34 incorporated communities, five (5) Municipal Utility Districts (MUD), one (1) Drainage District and the unincorporated areas of Harris County.

Based on input from the City of Baytown and the other 34 individual communities in Harris County, Community Map Needs Assessment Forms were prepared and submitted to FEMA to be incorporated into the FEMA MNUSS Data Base. The City of Baytown Map Needs Assessment Forms are included in Plan Attachment "D".

The City of Baytown participated with all other communities in Harris County and submitted recommendations to FEMA regarding the accuracy of current FIRMs. On March 1st and 2nd, 2001, Draft Map Needs Assessment Forms were reviewed during the two day Map Needs Assessment Workshop hosted by the Harris County Flood Control District (HCFCD) where FEMA, TCEQ, Houston-Galveston Area Council (HGAC) and the Harris-Galveston Coastal Subsidence District (HGCSD) as well as representatives from the 35 Harris County Communities discussed mapping needs. The Needs Assessment Form is a "fill-in-the-blank" document designed to provide data requested by FEMA to be entered into FEMA's MNUSS Data Base. Utilizing information from the FIRM published by FEMA, the Harris County Flood Control District Designation and Common name for each stream, if known, was entered on the form. Seven area fields were identified not including the notes/comments summary. The top of each community form included the Community Population in 1990, and 2000, and net change from 1990 and 2000. Changes in population density imply changes in the hydrologic and hydraulic conditions. The seven fields listed on the form include:

1. Stream listing and FIRM Panel Number
2. Physical Changes that have occurred since the FIRM effective date.
3. Does your community posses FEMA's current FIS computer model and if not, are you interested in acquiring and/or supporting acquisition of the model?
4. What type of Flood Data Update is needed?
5. What is the source of flooding in your community?
6. What computer model updates are needed in your community?
7. Does the FIRM Base Map need to be updated in your community?

The final section of the Map Needs Assessment Form is the Community Notes and Comments section that addresses individual community map needs and flood insurance study updates that are needed. As defined in Task No. 1 of the Cooperating Technical Partner Agreement with FEMA, the HCFCD submitted the completed Map Needs Assessment Forms to FEMA in September 2001 and assisted FEMA in entering the data into the MNUSS Database. While the individual community Map Needs Assessment forms are "stand alone" documents, the HCFCD consolidated the input for the 35 individual communities into a Harris County Map Needs Assessment Summary Report that was submitted to FEMA in October 2001 with a copy submitted to each community.

Community Workshops were held at HCFCD on March 1st and 2nd, 2001. Individual Community Information Packets were distributed by HCFCD containing the Map Needs Assessment Form for each community that was partially completed to assist in preparing the Community submittal to FEMA. Published data such as the stream designated numbers, stream names (if known), FIRM Panel dates, FIRM Panel numbers, and subsidence data, as published by the Harris-Galveston Coastal Subsidence District (HGCSD), was entered on each Community Needs Assessment Form. This allowed each community to concentrate on the remaining seven data fields requested by FEMA. Each community was requested to review the Map Needs Assessment Form and enter the missing data. The two (2) Community Coordination Meetings held on March 1st and March 2nd, 2001 to discuss the Maps Needs Assessment Project provided the opportunity to discuss mapping and watershed issues with adjacent communities and to

identify mapping needs throughout each watershed. The City of Baytown Map Needs Assessment Form is included in Attachment D of this Plan.

Immediately following the devastating flooding in June of 2001, the National Weather Service (NWS) produced the Tropical Storm Allison Storm Report that includes valuable information related to flooding within the City of Baytown. Public access to the document is provided through the web at www.srh.noaa.gov/hgx/projects/allison01.htm

In June 2001, the Tropical Storm Allison Flood Recovery Project (TSAFRP) was initiated by FEMA and the Harris County Flood Control District to produce a "Post Event" Report and to initiate a countywide study effort to update the 142 FIRMs in Harris County. The flood maps for the City of Baytown within Harris County will be included in the Tropical Storm Allison Flood Recovery Project. This remapping effort does not include the portion of the City of Baytown located in Chambers County.

Tropical Storm Allison Flood Recovery Project

Following the devastation following Tropical Storm Allison in June 2001, FEMA initiated the Tropical Storm Allison Flood Recovery Project (TSARP). A major product of TSARP is the development of Digital Flood Insurance Rate Maps for Harris County that includes the City of Baytown. The 3-year multimillion dollar mapping project was funded by a cooperative venture between FEMA and the Harris County Flood Control District. The product is state-of-the-art digital mapping of all flood hazard areas within Harris County. The TSARP remapping effort includes:

County-wide LIDAR mapping
GPS surveying for over 1300 miles of streams and bayous
Establishing over 900 new permanent Elevation Reference Marks (monuments)
New hydrology and Hydraulics for all 22 watersheds within Harris County
Development of new state-of-the-art computer models for all flood hazard areas
Production of approximately 144 DFIRMs covering all of Harris County

FEMA and Harris County Flood Control District published "Off the Charts, Tropical Storm Allison Public Report" and the National Weather Service posted the "Tropical Storm Allison Flood Report" on www.srh.noaa.gov/hgx documenting one of the most devastating flood events that occurred on the Texas Gulf Coast.

The following (existing) Harris County FIRM panels covering the City of Baytown were reviewed by the Flood Mitigation Planning Committee in preparation for the release of the new digital FIRMs produced as part of the tropical Storm Allison Flood Recovery Project:

Current FIRMs	Issue date	VE Zones	AE Zones
745K	4/20/2000	Crystal Bay	
		Burnett Bay	
			Spring Gully
			Goose Creek

Current FIRMs	Issue date	VE Zones	AE Zones
755J	11/6/1996	None	Cedar Bayou McGee Gully Buck Gully
760J	11/6/1996	None	Cedar Bayou McGee Gully
765J	11/6/1996	None	Goose Creek East Fork Goose Creek Cary Bayou
770J	11/6/1996	None	Cedar Bayou Cary Bayou Horsepen Bayou
935J	11/6/1996	Crystal Bay Galveston Bay	San Jacinto River
955J	11/6/1996	Galveston Bay	Goose Creek Cedar Bayou Cedar Bayou Diversion Channel Pine Gully
960J	11/6/1996	Galveston Bay	Cedar Bayou
970J	11/6/1996	Galveston Bay	Cedar Bayou

Coastal High Hazard Areas (Zone VE) are delineated on five (5) of the nine (9) FIRMs for areas within the City of Baytown. Riverene flood hazard areas (Zone AE) are shown on all nine FIRM panels published for the City of Baytown. Due to the close proximity to Galveston Bay the majority of riverene hazard areas are tidal influenced or subject to combined probability flooding where the storm surge from the receiving bay combined with the riverene flood elevation establishes the base flood elevation. The Harris County Flood Insurance Study Volume 1 dated April 20, 2000, describes the coastal analyses conducted for the coastal areas of the City of Baytown including Galveston Bay, Tabbs Bay, Black Duck Bay, Mitchell Bay, Scott Bay, Crystal Bay, and Burnett Bay. FEMA established the 10-, 50-, 100-, and 500- year flood elevations in Galveston Bay. A wave action analysis was also conducted by FEMA to determine wave height, which is the distance from the trough to the crest of the wave. Areas of coastline subject to significant wave attack are referred to as coastal high hazard zones. The US Army Corps of Engineers conducted the initial Harris County Flood Insurance Study and established

the 3-foot breaking wave as the criterion for identifying the limit of coastal high hazard zones. Wave heights were computed along "transects" which were located perpendicular to the average mean coastline. The "transects" for areas within the City of Baytown include:

Flooding Source	Stillwater Elevation 10-Year	100-Year	Zone	Base Flood Elevation (Feet NGVD)
Galveston Bay				
Transects 30-32	5.3	12.2	VE	14-17
			AE	12-14
Transects 33-35	5.4	12.6	VE	15-19
San Jacinto River				
Transect 36	5.4	12.4	VE	15-16
Transects 37-40	5.4	12.3	VE	14-15
Transect 41	5.3	11.8	VE	14-15
			AE	12-14
Transects 42-47	5.3	11.8	VE	14-15
Transects 48-49	5.3	11.7	VE	14-15
Transects 50-52	5.3	11.6	VE	14-15
			AE	12-14

The coastal high hazard areas noted above are identified on the Harris County Flood Insurance Rate Map panels that include the City of Baytown.

The new Harris County DFIRM effort did not include a new coastal flooding analysis of flooding from Galveston Bay. The coastal flooding elevations (base flood elevations) established from the previous Harris County Flood Insurance Studies were remapped based on LIDAR mapping and NAVD 1988 elevations generated by the Tropical storm Allison Flood Recovery Project (TSARP). Adjustments were expected in coastal areas due to subsidence that occurred since the original Harris County Flood Insurance Study was performed based on NGVD 1929 releveled in 1973 and 1987.

FEMA published the Preliminary FIRMs for Harris County and Incorporated Areas dated September 30, 2004, which were reviewed by the City of Baytown Flood Mitigation Planning Committee on October 21, 2004. Even though digital orthophoto LIDAR mapping was developed as part of the Tropical Storm Allison Flood Recovery Project, the Preliminary FIRMs

are vector based digital maps that resemble the 1996/2000 Harris County vector based FIRMs, and meet FEMA new mapping criteria. Base flood elevations (BFEs) have been revised on many streams with higher and lower BFEs of one to two feet. Floodplain boundaries have been revised for most streams in the City of Baytown which was expected due to the availability of higher accuracy LIDAR mapping. Floodways for the most part are very similar to the previously designated floodways. The Preliminary FIRMs were compared to the 1996 and 2000 vintage FIRMs and changes are noted in italics below:

New FIRMs	**Preliminary FIRM Date**	**VE Zones**	**AE Zones**	***Changes***
745L	9/30/2004	Crystal Bay		*Minor FP Boundary Changes*
		Burnett Bay		*Minor FP Boundary Changes*
			Spring Gully	*Lower BFE's*
			Goose Creek	*Lower BFE's*
			Spring Gully Diversion – *Addition to FIRM*	
755L	9/30/2004	None	Cedar Bayou	*Lower BFE's*
			McGee Gully	*Lower BFE's*
			Buck Gully	*Renamed Clawson Ditch*
760L	9/30/2004	None	Cedar Bayou	*Minor FP Boundary Changes*
			McGee Gully	*Higher BFE's*
765L	9/30/2004	None	Goose Creek	*Higher BFE's*
			East Fork Goose Creek – *Higher & Lower BFE's*	
			Cary Bayou	*Lower BFE's*
770L	9/30/2004	None	Cedar Bayou	*Lower BFE's*
			Cary Bayou	*Lower BFE's*
			Horsepen Bayou – *Lower BFE's*	
			McGee Gully	*Lower BFE's*
935L	9/30/2004	Crystal Bay		*Minor FP Boundary Changes*
		Galveston Bay		*Minor FP Boundary Changes*
			San Jacinto River-	*Minimal Changes*
955L	9/30/2004	Galveston Bay		*Minor FP Boundary Changes*
			Goose Creek	*Minor FP Boundary Changes*
			Cedar Bayou	*Minor FP Boundary Changes*
			Cedar Bayou Diversion Channel- *Minor FP Boundary Changes*	
			Pine Gully	*Minor FP Boundary Changes*

New	**Preliminary**	**VE**	**AE**	
FIRMs	**FIRM Date**	**Zones**	**Zones**	***Changes***
960L	9/30/2004	Galveston Bay		*Minor FP Boundary Changes*
			Cedar Bayou	*Higher BFE's*
970L	9/30/2004	Galveston Bay		*Minor FP Boundary Changes*
			Cedar Bayou	*Minor FP Boundary Changes*

2.2 KNOWN HAZARDS

The City of Baytown is exposed to many hazards; all of which have the potential for disrupting the community, causing damage, and creating casualties. The City of Baytown Emergency Management Basic Plan identifies the major hazards that the City of Baytown is most likely to face. Possible natural hazards include hurricanes, tornadoes, and flash flooding. There is also the threat of war-related incidents such as a nuclear, biochemical, or conventional attack. Other disaster situations could develop from hazardous material accidents, transportation accidents, terrorism, or civil disorder. In the 2003-2004 timeframe, the Harris County "All Hazards" Mitigation Plan was prepared by the Houston Galveston Area Council (HGAC) addresses known hazards throughout Harris County including the City of Baytown. The City of Baytown participated in the HGAC planning effort and provided technical information to be included in the Harris County Plan. The Harris County All Hazards Mitigation Plan includes mitigation actions that were reviewed by the City of Baytown Mitigation Planning Committee during the planning for the City of Baytown Flood Mitigation Plan.

The flood mitigation action plan outlines mitigation goals, identifies a risk reduction strategy for flood hazards that threaten the area, and discusses the ongoing risk reduction activities undertaken within the jurisdiction. The mitigation action plan further details what is to be done, how much it will cost, who will be responsible for the action, how it will be funded and provides an implementation schedule. Once the flood mitigation plan is complete, it will supplement the Hazard Mitigation annex (Annex P) to the Emergency Management Plan.

The City of Baytown recognizes that the community will continue to be exposed to and subject to the impact of hazards. Furthermore, it is possible for a major disaster to occur at any time and at any place. In many cases dissemination of warning to the public and implementation of increased readiness measures may be possible. Still, some emergency situations occur with little or no warning. The following paragraphs identify many of the hazards that the City of Baytown may potentially encounter.

Severe Thunderstorms/Hail/Lightning

Thunderstorms are a frequent occurrence within the City of Baytown. They may occur year round; however, the peak season is in the spring of each year. They occur most often between the hours of noon and 10:00 PM. Thunderstorms may be associated with lightning, hail, tornado, and flash flooding conditions. These storms are also capable of producing straight-line winds and microburst with extreme power. Thunderstorms kill more people in the United States than any other phenomenon.

The heavy rains associated with thunderstorms often cause flash flooding events within the community. Due to the flat terrain, flash flooding within the community renders streets impassable. Flash flooding events at times cause waters to rise to the point of impacting businesses and residences. In the aftermath of thunderstorm activity, it is not uncommon to find floodwaters in businesses and homes.

Lightning is a secondary effect of electrification within a thunderstorm cloud system. Lightning damage results from four effects of the lightning strike: electrocution of humans and animals; vaporization of materials along the path of the strike; fire caused by the high temperature produced by the strike; and a sudden power surge that can damage electrical and electronic equipment. Millions of dollars of direct and indirect damages result from lightning strikes on electric utility substations and distribution lines. While property damage is the major hazard associated with lightning, it should be noted that lightning strikes kill more people each year than either tornadoes or hurricanes.

Hurricane/Tropical Storm

The hurricanes and tropical storms combine size and intensity to become one of Earth's greatest and most awesome weather vehicles of death and destruction. In addition to hurricanes and tropical storms, damage may be caused by tornadoes that are created from the storms. The Texas coast is not immune from damages from such storms. Hurricane season lasts over a six-month period from June 1 to November 30. Most hurricanes occur in August, September, and October.

Hurricanes are tropical cyclones in which winds reach constant speeds of 74 miles per hour or more and blow in a large spiral around a relatively calm center. Hurricanes are essentially giant whirlwinds in which air moves in a large tightening spiral around a center of extreme low pressure. Near the center, hurricane winds may gust to more than 200 miles per hour.

While hurricane winds are responsible for much of the damage, the storm surge and torrential rains accompanying hurricane landfall are responsible for most deaths. Historically, drowning has been the greatest cause of hurricane deaths. The storm surge raises wave heights and increases tides. Torrential rains because both flash flooding and sustained flooding in the area.

Tropical storms are weather events similar to hurricanes but sustained winds in these storms are between thirty-nine (39) and seventy-three (73) miles per hour. Tropical storms can affect an area by dropping large amounts of rain over a sustained period of time. Again, flash flooding and sustained flooding are the most deadly aspects of tropical storms.

The City of Baytown lies along the Texas Coast in an area with a thirty-seven percent (37%) chance of a hurricane, extreme hurricane or tropical storm occurring in any given year. A listing of Hurricanes and Tropical Storms that have impacted the City of Baytown and the Texas Gulf Coast may be found in the Introduction/History of Flooding Section of this Plan.

The City of Baytown participates in annual training exercises related to hurricane/tropical storm events. On April 24, 2002, the City of Baytown participated in the Hurricane Gregg Exercise along with other Upper Texas Coast Communities.

Tornado

Texas is “tornado capital” with an average of 153 tornadoes touching down each year. Baytown is located along the Texas Gulf Coast and this area of the state receives on average twenty (20) or more tornadoes per year. Tornadoes may occur in any month and at any hour of the day, but they occur most often in late spring and early summer during late afternoon and evening hours.

According to National Weather Service records, Harris County has experienced one hundred (100) tornadoes from 1950 to 2002. Of the recorded storms, twelve (12) deaths were reported and three hundred twelve (312) injuries were reported. Damages from these storm events totaled $499.2 million.

Tornadoes within the City of Baytown have been infrequent, usually associated with hurricanes or other severe weather storms. Although the potential for a devastating tornado causing extensive damage to life and property exists, tornadoes within the community have been short-lived and only moderate in strength. Touchdown of a tornado usually is expected less than once a year.

Winter Storms

Winter storms when they strike can paralyze the city creating hazardous travel conditions, causing major utility outages for extended periods and increasing the potential for illness and loss of life. Generally, the winter storm season runs from late November to mid-March. The City of Baytown has an emergency plan in place to manage such a weather situation providing shelter areas if necessary. Additionally, city crews are responsible for maintaining transportation routes in the event of such weather.

The City of Baytown has sustained damage from ice storms. While infrequent, they have affected the entire city restricting travel, interrupting electrical power and causing water mains to break.

Drought/Wildfire

Drought is often thought of as a condition of climatic dryness that is severe enough to reduce soil moisture and water supplies below the requirements necessary to sustain normal plant, animal, and human life. In Texas, the term is further divided into agricultural and hydrologic drought. Agricultural drought is a dry period of sufficient duration and intensity that crop and animal agriculture are markedly affected. Hydrologic drought is a long-term condition of abnormally dry weather that ultimately leads to the depletion of surface and ground water supplies. During hydrologic drought, a significant reduction in flow of rivers, streams and springs is noticed.

The City of Baytown is located in the Upper Coast Climactic division. As such, the city is subject to periods of drought. Within the last one hundred ten (110) years, this area has experienced eleven (11) periods of drought. The City of Baytown and adjacent communities along Galveston Bay have transitioned to surface water sources to reduce ground water withdrawal, thus reducing the rate of subsidence. This dependency on surface water supplies can result in water shortages during dry or drought conditions.

During periods of drought, dry conditions, high temperature and low humidity set the stage for wildfires. Wildfires may spread quickly, affecting large areas of the city in a short amount of time. However records from 1950 to the present indicate that neither Harris nor Chambers Counties have experienced extensive wildfire conditions. Most wildfires have been small in size and contained by local resources.

The least annual rainfall on record is 17.66 inches in 1917. The highest temperature on record is 109 degrees on September 4, 2000. The daily record high temperature from mid-June to early-September ranges from 100 to 105 degrees. In over 100 years of records, on less than ten (10) days have temperatures been recorded above 105 degrees.

Utility Disruption/Shortage

Extreme weather is a frequent visitor to the Baytown area. During extreme weather conditions, the city may experience water main breaks attributable to the weather and increased demand for water.

A utility crisis could be precipitated from any of the hazards discussed previously or from other mechanisms. Many of the assistance programs that the community offers rely on the presence of utilities. If the utility fails, so do many of the potential mitigation activities.

Fire

There are five (5) Fire Stations located throughout the City of Baytown. Structure fires and other fire events occur within the community on a regular basis. The City has implemented variety of techniques and fire safety programs to help prevent the occurrence of fire within the community. The Fire Marshal has implemented numerous fire prevention programs to mitigate fire hazards.

Eighty-five (85) fire personnel on three (3) shifts that serve the City of Baytown.

Hazardous Materials Incidents

Hazardous materials are commonly used, transported, and produced in the local area; hence, hazmat incidents may occur here. Highway and pipeline transportation of hazardous materials presents a serious threat to the population. Within the City of Baytown, several pipeline companies operate pipelines that cross through the City. Both the City of Baytown Department of Public Works and the Fire Department maintain a listing of pipeline companies that operate pipelines within the City. Emergency contact information and phone numbers are kept on file in these departments. Products such as ethane, natural gas, crude oil, gasoline, ethylene, propane, methane, and propylene are carried through pipelines ranging from six (6) to thirty (30) inches in diameter. Pipelines pose the hazard of explosion, fire, toxic release and contamination. Road transportation of hazardous cargo occurs along Interstate Highway 10 (IH-10) and State Highway 146.

The Houston Ship Channel is 52 miles long and the City of Baytown fronts along the area that includes the Exxon/Mobil Baytown Refinery, Chevron/Phillips Chemical and Bayer Chemical. Directly across the Ship Channel from the City of Baytown is the DuPont, Conoco and Dow Chemical USA facilities. HAZMAT incidents along the Ship Channel near the City of Baytown pose a major risk.

The City of Baytown Fire Department has a hazardous materials squad capable of containing a large hazardous materials spill. The fire department is equipped with basic personal protective equipment and limited supplies for hazardous materials incidents. The City partners with adjacent communities and regulated facilities/hazardous materials transportation companies to augment the City of Baytown resources in the event of a hazardous materials incident. Specifically in the event of an incident, the regulated facility/hazardous materials transportation company is responsible for the following actions: timely notification of the incident to local officials and other agencies as required by state and federal law; to provide accident assessment information to local emergency responders; recommend to local responders mechanisms for containing the release and protecting the public; emergency response as outlined in company or facility emergency plans to minimize the consequences of a release; assist local responders as outlined in mutual aid agreements; provide follow-up status reports on an incident until it is resolved; and to clean up or arrange for the cleanup of hazmat spills for which the company is responsible.

Transportation Accidents

Interstate Highway 10 passes near and State Highway 146 passes through the City of Baytown.

Major railroad lines parallel State Highway 146 and pass through the City of Baytown.

The Houston William P. Hobby Airport, served by eight carriers, is twenty-two (22) miles to the west of the community. The George Bush Intercontinental Airport is twenty seven (27) miles to the northwest.

The City of Baytown lies in close proximity to the Port of Houston. The Port of Houston is a 52-mile long complex of diversified public and private facilities. The port is located just a few hours sailing time from the Gulf of Mexico. The port, ranked first in the United States in foreign waterborne commerce ranks second in total tonnage. The Port of Houston is ranked eighth globally.

Transportation infrastructure, such as roads, bridges, ports and airports may sustain damage during emergency situations, making it difficult to use some of the transportation assets that are available. When carrying out emergency transportation activities, immediate needs must be considered, followed by continuing requirements. Immediate transportation needs normally involve the evacuation of people, including residents of special facilities, from risk areas. Continuing transportation needs typically involve the movement of relief supplies, equipment, and emergency workers during response and recovery operations.

Terrorism

The threat of terrorism has received significant media attention during the last few years. Terrorism attacks in New York City and Washington, DC have heightened public concern. Efforts have been made within the City of Baytown to mitigate public concern and fear associated with terrorism incidents.

The City of Baytown has developed a plan for responding to weapons of mass destruction events within the community. The Emergency Management Plan for the community contains a terrorism annex. Detailed information regarding terrorism planning efforts within the City is addressed within the Terrorism Annex, Annex V of the All Hazards Emergency Management Plan.

2.3 FLOOD EVENTS

As listed in the Governor's Division of Emergency Management (TxDEM) Hazards Analysis, historically floods are and continue to be one of the most frequent destructive and costly natural hazards. Floods are a natural and recurrent event. Floods take place every year and in all seasons. Flooding events are usually broken into three different categories: flash floods, riverine floods, and tidal floods. Given the present knowledge, the size, time and place of floods cannot be predicted more than a few hours in advance.

The following are major tropical storm and hurricane events have produced severe flooding and structural damage along the Texas Gulf Coast. Several of the storms identified resulted in damages within the City of Baytown:

- September 16-20, 1854
- June 1-5, 1871
- June 8-10, 1871
- September 8-18, 1875
- August 19-24, 1879
- June 21-25, 1880
- June 13-15, 1886
- June 18-16, 1888
- July 4-6, 1888
- July 3-8, 1891
- October 2-7, 1895
- September 10-13, 1897
- September 20-28, 1898
- September 7-10, 1900, "Galveston Great Storm"
- July 21, 1909
- August 16-17, 1915
- September 14, 1919
- August 12-15, 1932
- July 21-27, 1933
- August 26 – September 1, 1934
- October 11-17, 1938
- September 19-25, 1940
- September 11-16, 1941
- September 16-25, 1941
- August 30, 1942
- July 25-29, 1943
- August 24-29, 1945

- August 15-27, 1947
- September 27 – October 26, 1949
- July 27, 1957 – Hurricane Audrey
- July 24-25, 1959 – Hurricane Debra
- September 11, 1961 – Hurricane Carla
- September 16, 1963 – Hurricane Cindy
- August 6, 1964 – Tropical Storm Abby
- August 2-5, 1970 – Hurricane Celia
- September 12-17, 1970 – Tropical Storm Felice
- September 1-7, 1973 – Tropical Storm Delia
- July 25, 1979 – Tropical Storm Claudette
- August 30, 1979 – Tropical Storm Elena
- August 3-10, 1980 – Hurricane Allen
- September 4-7, 1980 – Tropical Storm Danielle
- August 15-18, 1983 – Hurricane Alicia
- June 23, 1986 – Hurricane Bonnie
- August 9-17, 1987
- June 24-July 1, 1989 – Tropical Storm Allison
- July 30-August 3, 1989 – Hurricane Chantal
- October 12-16, 1989 – Hurricane Jerry
- March 5, 1992 – Houston Area Flood
- October 15-20, 1994 - Southeast Texas Flood
- July 28-August 2, 1995 – Tropical Storm Dean
- September 1998 – Tropical Storm Frances
- June 5-10, 2001 – Tropical Storm Allison

Detailed information relating to hurricanes, tropical storms, and flash flooding events was gathered from the National Climactic Data Center, a division of the National Weather Service.

2.4 STORM SURGE HAZARDS

The City of Baytown is truly a waterfront community. The City boarders on the following waterways:

Galveston Bay
Cedar Bayou
Ash Lake
Trinity Bay
Tabbs Bay
Black Duck Bay
Mitchell Bay
Scott Bay
Crystal Bay and
Burnett Bay,
Goose Lake
Goose Creek, and

San Jacinto River (Houston Ship Channel)

The City of Baytown and the Harris County Flood Control District (HCFCD) address storm surge flooding and erosion that occurs in coastal areas and on streams and drainage ways in the City. Due to the general flat stream gradients in the City and surrounding areas, riverine erosion is not considered to be a major problem.

Waterfront areas along Trinity Bay, Tabbs Bay, Black Duck Bay, Mitchell Bay, Scott Bay, Crystal Bay, and Burnett Bay are located in Zone VE and Zone AE and are subject to coastal surge flooding and erosion. Many industrial facilities in the City of Baytown have constructed earthen levees for protection from coastal storm surge flooding.

2.5 SUBSIDENCE

Areas within Harris, Galveston and Chambers Counties have a history of subsidence with measurements dating from 1908. Land subsidence is defined in the Harris County Flood Insurance Study as "the lowering of the ground as a result of water, oil, gas extraction, as well as other phenomena such as soil compaction, decomposition of organic material, and tectonic movement". The prevalence of land subsidence complicates the determination of the amount a given property lays above or below the base flood elevation. Subsidence has a major impact on floodplain mapping and determining the actual elevation of benchmarks and structures. Subsidence is a major concern and perhaps the most important factor when determining if a restudy is needed to update floodplain mapping.

The Harris Galveston Coastal Subsidence District (HGCSD) was created by the Texas Legislature in May, 1975, by the passage of HB 552 which states that "…this act is to provide for the regulation of the withdrawal of ground-water…for the purposes of ending subsidence…". The HGCSD in cooperation with the U.S. Geological Survey (USGS), installed, maintains and monitors borehole extensometers to measure subsidence. The HGCSD provides valuable information on their website (www.subsidence.org). The following information regarding extensometers was provided on their web page. "An extensometer is a deep well that has a casing with slip joints surrounding a center pipe that is set into a plug at the bottom of the casing. As the ground compacts, the casing moves down, while the center pipe remains stationary. This compaction causes more and more of the center pipe to be exposed above the surface of the ground and a chart recorder attached to the center pipe measures these changes."

The Harris-Galveston Coastal Subsidence District 27th Annual Groundwater Report dated December 31, 2003, shows subsidence information for two extensiometers located in Baytown, Extensiometer LJ-65-16-930 (Baytown - shallow), with depth of 431 feet, has measured subsidence from 1975 to 2003. Compaction, in feet, at this extensiometer is approximately 0.6 feet for this time period. Extensiometer LJ-65-16-931 (Baytown - deep), depth 1,475 feet, has measured subsidence from 1974 to 2003. Compaction, in feet, at this extensiometer is approximately 1.0 feet for this time period, however, the Baytown site recorded a slight rise (negative subsidence) of 0.012 feet in 2003.

The Harris-Galveston Coastal Subsidence District also monitors subsidence at GPS-PAM subsidence monitor sites. The District operates eight Global Positioning System (GPS) Port-A-Measure (PAM) trailers to record land surface elevation changes throughout Harris, Galveston, Fort Bend, Brazoria, Montgomery, and Chambers Counties. Each trailer is equipped with a GPS receiver and is moved on a weekly basis to 4 permanent sites and records elevation data every 30 seconds. The data is collected by the District and processed by the National Geodetic Survey (NGS), then reported back to the District as a subsidence rate for a given time period. The NGS considers the data to be accurate to +/- one centimeter, with a 95% confidence level. The GPS-PAM 28 Site is located in Chambers County on Cedar Bayou near the City of Baytown. Subsidence at GPS-PAM 28 from January to December 2003 was measured as 0.034 feet of compaction.

The following passage, "Effects of Land Subsidence", published in the Harris County Flood Insurance Study Report Volume 1 of 7 dated April 20, 2000 is included in this report to familiarize the reader with this important issue.

Effects of Land Subsidence

Base flood elevations shown on the FIRM and in this report were developed using benchmarks referenced to the NGVD. Harris 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 Harris County, some or all of the benchmarks used to develop the base flood elevations on the FIRM have subsided. Since 1973, the Harris Galveston Coastal Subsidence District has funded and coordinated a benchmark releveling effort with the NGS to determine new elevations above the NGVD; 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, and 1995. The original FIS reports for Harris County and Incorporated Areas, published in the mid-1980s, were referenced primarily to the 1973 benchmark releveling. Subsequent revisions to the FIRM and FIS report were performed using either the original releveling (1973) or more recent NGS relevelings. Flooding sources for which the data were revised using more recent relevelings are listed below under Riverine Flooding.

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.

Historically, subsidence was initially concentrated near the early development and industrial areas along the Houston Ship Channel. The Ship Channel serves as the primary conduit for floodwaters for much of the Harris County area. Subsidence in some coastal areas has lowered ground elevations relative to sea level where the effects on flooding are obvious - more

permanently inundated land from normal daily tides and more land subject to flooding from tidal surges associated with tropical storms. Prior to the mid 1970's, subsidence patterns generally increased the gradient of tributaries to the Ship Channel, which was believed to actually benefit inland drainage and flooding.

Although the rate of coastal subsidence has been slowed, new ground-water wells to support the water-supply needs of increased western urban growth in Harris and Fort Bend Counties has resulted in continued inland subsidence. Inland subsidence toward the west (western Harris County and Fort Bend County) has the potential to adversely affect stream gradients. The long term success of reduced coastal subsidence rates is dependent upon the ground water withdrawal regulations remaining in force. The long term impact of subsidence across watersheds extending from Galveston Bay to western portions of Harris County is not known.

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, subsidence and flood control in the Houston metropolitan area – Harris County Flood Control District (HCFCD), Harris-Galveston Coastal Subsidence District (HGCSD), 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 each type of flooding (riverine, coastal, and combined riverine and coastal) 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, over bank 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.

The Tropical Storm Allison Flood Recovery Project, initiated in 2001, includes a major remapping and surveying effort. The Harris County Flood Insurance Rate Maps scheduled for publication in mid 2003 (delayed to mid 2004) will include detailed topographic information to allow evaluation of the impact of subsidence within the 22 watersheds that drain Harris County. This detailed mapping will allow engineers and scientists to accurately define subsidence rates and define watershed and floodplain boundaries. The 1996 and 2000 Harris County Flood

Insurance Study reports stated that flood depths remain relatively constant and base flood elevations generally subside as the ground subsides (see Figure 5). Therefore 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 at the benchmark used to develop the base flood elevations on the FIRM. (See below for benchmark relevel dates used for different flooding sources.) No adjustment is necessary to the base flood elevations on the FIRM.

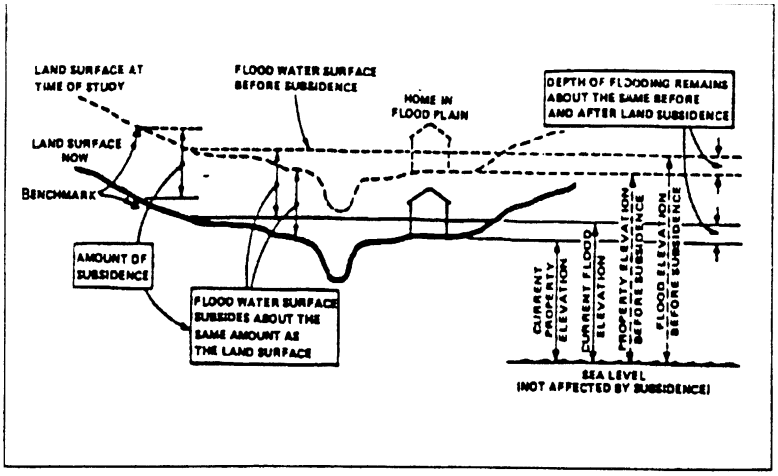

Figure 5. Land Subsidence Schematic - Riverine Flooding

The data for riverine flooding sources shown on the FIRM are referenced to the 1973 benchmark releveling, with the exception of the

The location and description of Elevation Reference Marks (ERMs) are provided on the current Harris County FIRM to assist in determining ground and structure elevations. These ERMs are either permanent benchmarks established by other Federal, state, or local agencies or temporary reference marks established in the field during the time the FIS was conducted. Because these ERMs were used or established at the time the base flood elevations were determined, the ERMs and base flood elevations should be based on the same releveling and are therefore compatible to use together. Generally, the ERMs closest to a flood-prone area are compatible for use with the base flood elevations on the FIRM. However, this may not be the case where two floodplains are within close proximity of each other and the base flood elevations for each flooding source are based on different relevelings. Other benchmarks of third-order accuracy or higher not shown on the FIRM may be used provided the relevel date of the benchmark is the same as the relevel date associated with the base flood elevations. 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 FIS 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 ERM elevations 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 upon 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, including the 1995 releveling, 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 an FIS is limited and the FIS 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 insurances purposes, increases in base flood elevations usually can 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 (see Figure 6).

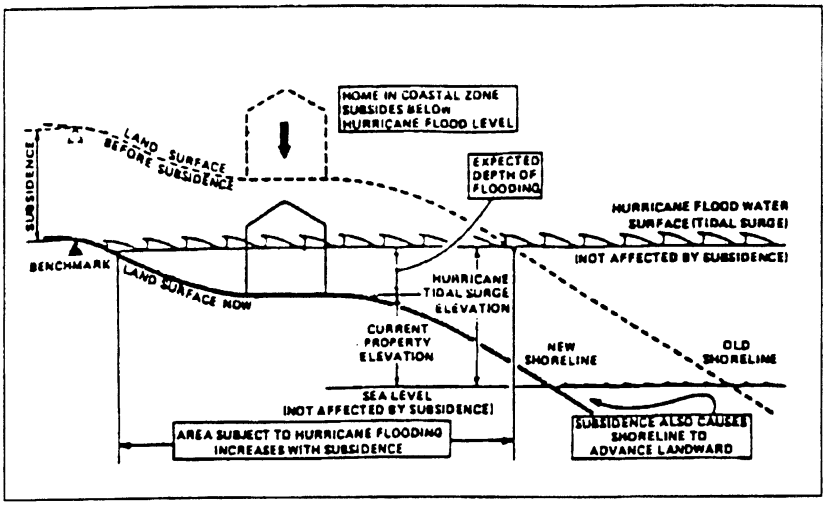

Figure 6. Land Subsidence Schematic - Hurricane/Tidal Surge Flooding

Because coastal base flood elevations generally are not affected by subsidence, the relevel date of benchmarks used to develop onshore topography is not an important factor in determining base flood elevations. However, using the elevation of ERMs on the FIRM is not sufficient for floodplain management and flood insurance purposes if an area has experienced significant subsidence (0.5 foot or more) since the relevel date of the ERM. Current and accurate ground and structure elevations above the NGVD must be obtained by field surveys or other appropriate methods. Using outdated ERMs would result in (1) setting the lowest-floor elevations below the base flood elevation, and (2) an improper determination of the amount an existing structure lies above or below the base flood elevation. The error introduced is the same as the amount the land has subsided since the relevel date of the ERM used.

When reviewing development permit applications for construction in areas subject to ongoing subsidence, a community should consider setting the lowest-floor elevation above the base flood elevation by an amount equal to expected future subsidence plus any expected increase in wave heights. In addition, a community should consider the potential flood risks when regulating construction in non-Special Flood Hazard Areas (SFHAs) that are adjacent to coastal flood zones and may be susceptible to coastal flood inundation due to subsidence. Requirements in these non-SFHAs should include setting the lowest-floor elevation at or above the base flood elevation shown in the adjacent coastal flood zone.

Combined Riverine and Coastal

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. As subsidence occurs in these areas, the depth of riverine flooding tends to remain constant, while the depth of coastal flooding increased. For floodplain management and flood insurance purposes, criteria used in coastal areas should be applied in areas of combined riverine and coastal flooding.

Information regarding the location and amount of subsidence is available from the HGCSD in Friendswood, Texas, and the Fort Bend Subsidence District in Richmond, Texas. Subsidence information is available for periods of record including 1906-1943, 1943-1964, 1964-1973, 1973-1978, 1978-1987, and 1987-1995. 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 Harris County and Incorporated Areas. Information concerning the location and stability of these benchmarks may be obtained from the HGCSD.

FEMA Form 8l-31, "Elevation Certificate and Instructions", is used to provide elevation information necessary to ensure compliance with applicable community floodplain management ordinances, to determine the proper insurance premium rate, and to support a request for a FEMA Letter of Map Change. The instructions for completing Item 4, Section C, of the Elevation Certificate and Instructions in part state: "In areas experiencing ground subsidence, the most recently adjusted reference mark elevations must be used for reference level elevation determinations. " The information in this report supersedes the instructions for Item 4, Section C, of the Elevation Certificate and Instructions for Harris County and Incorporated Areas.

The Harris-Galveston Coastal Subsidence District (HGCSD) is the recognized expert in subsidence in this area. The HGCSD maintains a website www.subsidence.org and publishes annual reports that are utilized by communities and agencies in Harris and Galveston Counties. The network of borehole extensometers maintained by HGCSD has been documented as the only stable and reliable benchmarks in Harris County. Real time elevation information is available on line through the HGCSD website. Of particular importance is HGCSD's documentation of measured subsidence for the period from 1973 to 2003. Communities within Harris County have experienced from 0.5 feet to 4.0 feet of subsidence for the period from 1973 to 2003. The majority of the 142 Harris County Flood Insurance Rate Map Panels are based on 1973 datum and do not reflect the 28 years of subsidence that has occurred. The Harris County FIRM Panels referenced in the April 20, 2000 publication include flood elevations referenced to the 1973, 1978 and 1987 datum. A complete restudy of Harris County was initiated in June 2001 as a flood recovery effort after Tropical Storm Allison. The restudy includes utilization of the National Geodetic Survey (NGS) releveling of approximately two hundred (200) 1st Order Bench Marks to NAVD 1988.

All of the major streams in the City of Baytown (Cedar Bayou, San Jacinto River, and Goose Creek) are subject to combined probability flooding from riverine and coastal/tidal flooding. The City of Baytown has established "higher standard" elevation requirements for new and

substantially improved construction that compensates for the subsidence that has occurred. The lowest floor of new construction located in Zones AE and VE areas must be elevated a minimum of eighteen inches above the base flood elevation published on the FIRM. The City also requires that only elevation reference marks adjusted for subsidence be used to determine elevations for new construction. These requirements that compensate for subsidence complies with the National Flood Insurance Program (NFIP) Regulations Section 60.22 (11) that recommend the community compensate for subsidence predicted to occur in a ten-year period.

2.6 ELEVATION REFERENCE MARKS

The City of Baytown is mapped as part of the Harris County (county-wide) Flood Insurance Rate Maps that were originally published September 28, 1990 and revised September 30, 1992, November 6, 1996 and April 20, 2000. The Harris County FIRMs are being updated again into Digital Flood Insurance Rate Map (DFIRM) format that will be published in late 2004 as part of the Tropical Storm Allison Flood Recovery Project.

In 2004, the city of Baytown Department of Public Works recognized that the existing Elevation Reference Marks (ERM's) in the City shown on the Harris County FIRMs were established in the late 1970's and early 1980's and were unreliable. Many of the existing ERM's had been destroyed and all were referenced to NGVD 1929 and had not been releveled to reflect subsidence that has occurred. In 2004, the City established thirty (30) new ERM's throughout the City that consist of brass disks set in concrete monuments and established using Global Position Surveying (GPS) and reference to NAVD 1988 to meet the latest FEMA mapping and elevation specifications.

The City of Baytown Mitigation Planning Committee evaluated the ERM coverage throughout the City to identify areas where additional ERM's are needed.

Currently there are sixty-six (66) ERM's located within the City of Baytown, Texas as shown on the Harris County Flood Insurance Rate Map. The table below shows the location and description of each ERM along with the corresponding Harris County Flood Insurance Rate Map panel as published by the Federal Emergency Management Agency (FEMA).

FIRM Panel #	FIRM Date	ERM No.	NGVD Datum	Description
745- 17 RMs				
48201C0745	4/20/00	694	1929	Chiseled square on bridge floor
48201C0745	4/20/00	695	1929	Chiseled square on bridge abutment
48201C0745	4/20/00	701	1929	Railroad spike
48201C0745	4/20/00	702	1929	Railroad spike
48201C0745	4/20/00	703	1929	Disk set in concrete headwall
48201C0745	4/20/00	704	1929	1-inch gage
48201C0745	4/20/00	705	1929	Disk set in bridge abutment
48201C0745	4/20/00	706	1929	Railroad spike
48201C0745	4/20/00	709	1929	Chiseled square on concrete curb

FIRM Panel #	FIRM Date	ERM No.	NGVD Datum	Description
48201C0745	4/20/00	710	1929	Disk set in top of steel rod
48201C0745	4/20/00	711	1929	Disk set in wall
48201C0745	4/20/00	714	1929	Chiseled X on bridge
48201C0745	4/20/00	715	1929	Chiseled square on concrete headwall
48201C0745	4/20/00	717	1929	Chiseled square in headwall
48201C0745	4/20/00	718	1929	Chiseled square in curb
48201C0745	4/20/00	863	1929	Chiseled square in headwall
48201C0745	4/20/00	868	1929	Disk set vertically in wall
755 – X RMs				
48201C0755	11/6/96	719	1929	Chiseled X on bridge
48201C0755	11/6/96	720	1929	Chiseled X on Concrete Culvert
48201C0755	11/6/96	728	1929	Railroad spike
48201C0755	11/6/96	733	1929	Brass USC&GS disk on headwall
48201C0755	11/6/96	734	1929	Chiseled square on concrete drain culvert
760- 3 RMs				
48201C0760	11/6/96	729	1929	Railroad spike
48201C0760	11/6/96	737	1929	Railroad spike
48201C0760	11/6/96	738	1929	Chiseled square on concrete drain pipe
765- 15 RMs				
48201C0765	11/6/96	721	1929	Chiseled X on concrete headwall
48201C0765	11/6/96	722	1929	Chiseled square in concrete culvert
48201C0765	11/6/96	723	1929	Chiseled square on top of culvert
48201C0765	11/6/96	724	1929	Chiseled square in concrete sewer cap
48201C0765	11/6/96	730	1929	Chiseled square on concrete culvert
48201C0765	11/6/96	731	1929	Chiseled square on concrete culvert
48201C0765	11/6/96	732	1929	3.5-inch brass USC&GS disk on headwall
48201C0765	11/6/96	735	1929	1.5-inch chiseled square on curb
48201C0765	11/6/96	739	1929	3-inch brass USC&GS disk in concrete headwall
48201C0765	11/6/96	740	1929	Brass USC&GS disk in ground
48201C0765	11/6/96	746	1929	Railroad spike
48201C0765	11/6/96	747	1929	3-inch brass USC&GS disk in concrete headwall
48201C0765	11/6/96	864	1929	Chiseled square on curb
48201C0765	11/6/96	872	1929	Chiseled square on curb
48201C0765	11/6/96	875	1929	3-inch brass disk in concrete headwall
770- 12 RMs				
48201C0770	11/6/96	736	1929	Railroad spike
48201C0770	11/6/96	741	1929	Chiseled square on concrete drain pipe
48201C0770	11/6/96	742	1929	Railroad spike
48201C0770	11/6/96	743	1929	Chiseled square in concrete drain pipe
48201C0770	11/6/96	744	1929	Chiseled square in concrete drain pipe
48201C0770	11/6/96	745	1929	Chiseled square in concrete drain pipe

FIRM Panel #	FIRM Date	ERM No.	NGVD Datum	Description
48201C0770	11/6/96	746	1929	3.5-inch HCFCD Disk set in bridge
48201C0770	11/6/96	748	1929	3.5-inch HCFCD Disk set in bridge
48201C0770	11/6/96	876	1929	Chiseled square on concrete drain pipe
48201C0770	11/6/96	877	1929	2.5-inch brass disk set in headwall
48201C0770	11/6/96	878	1929	Point set in concrete post
48201C0770	11/6/96	879	1929	Railroad spike
935- 1 RM				
48201C0935J	11/6/96	972	1929	Disk set in concrete abutment
955- 14 RMs				
48201C0955J	11/6/96	865	1929	Chiseled X on top of 4-inch bolt
48201C0955J	11/6/96	866	1929	Chiseled square on median
48201C0955J	11/6/96	867	1929	Chiseled square on top of sewer cap
48201C0955J	11/6/96	869	1929	Chiseled square on curb
48201C0955J	11/6/96	870	1929	Brass disk in curb
48201C0955J	11/6/96	871	1929	Point set in concrete foundation
48201C0955J	11/6/96	873	1929	Chiseled square on curb
48201C0955J	11/6/96	874	1929	Chiseled square on curb
48201C0955J	11/6/96	881	1929	Chiseled square on bridge abutment
48201C0955J	11/6/96	882	1929	Brass disk in concrete monument
48201C0955J	11/6/96	883	1929	Chiseled square on concrete fence
48201C0955J	11/6/96	884	1929	Point on concrete culvert
48201C0955J	11/6/96	885	1929	Brass disk in concrete monument
48201C0955J	11/6/96	886	1929	Brass USC&GS disk in concrete monument
960- 3 RMs				
48201C0960J	11/6/96	880	1929	Chiseled square on concrete drain pipe
48201C0960J	11/6/96	882	1929	Brass disk in concrete headwall
48201C0960J	11/6/96	883	1929	Brass USC&GS disk in concrete headwall
970- 1 RM				
48201C0970J	11/6/96	884	1929	Brass USC&GS disk in concrete post

THE CITY OF BAYTOWN FLOOD MITIGATION COMMITTEE EVALUATED THE 71 ERM'S LOCATED WITHIN THE CITY AND DESCRIBED ON THE HARRIS COUNTY FIRMS. ONLY 22 ERM'S ARE CONSIDERED TO BE PERMANENT MARKS AND THE REMAINING 49 ERM'S ARE CONSIDERED TO BE TEMPORARY. THE NEW HARRIS COUNTY DFIRMS SHOW A TOTAL OF 52 NGS MONUMENTS THAT HAVE BEEN RELEVELED TO NAVD 1988 AS PART OF THE TROPICAL STORM ALLISON FLOOD RECOVERY PROJECT. IN 2004, THE CITY OF BAYTOWN DEPARTMENT OF PUBLIC WORKS ESTABLISHED 30 NEW ERM'S USING GPS PROCEDURES AND INSTALLING PERMANENT ERM'S REFERENCED TO NAVD 88 CONSISTING OF BRASS DISKS SET IN CONCRETE MONUMENTS.

THE COMMITTEE RECOMMENDS THAT A MIMIMUM OF 30 NEW PERMANENT ERM'S BE ESTABLISHED WITHIN THE CITY TO SUBBLEMENT THE ERMS SHOWN ON THE NEW FIRMS.

3. ASSESS THE PROBLEM (CRS ACTIVITY 511.5)

The City of Baytown enrolled in the NFIP Emergency Program on July 17, 1970 and the NFIP Regular Program on July 1, 1974 based upon Texas Commission on Environmental Quality (TCEQ) records. The Pre-FIRM (Flood Insurance Rate Map) date for structures within the City is July 1, 1974, based upon the City of Baytown Flood Insurance Study (FIS). Current FIRM requirements were established with two separate FIRMs, the Harris County FIRM dated November 6, 1996 and the Harris County FIRM dated April 20, 2000. The current Harris County Flood Insurance Rate Maps that include a portion of the City of Baytown are accessible to the public via the Internet at www.fema.gov

The Federal Emergency Management Agency (FEMA) has classified the City of Baytown as a Category "C" Repetitive Loss Community, therefore as a condition of participation in the Community Rating System (CRS) Program, FEMA requires a Category "C" community to adopt a floodplain management plan that addresses all hazards within the community and not limited to only repetitive loss areas. On October 1, 2001, FEMA upgraded the City to a Class Seven (7) Community Rating System (CRS) Community. As a CRS Class 7 community, flood insurance policies for all properties located within the City of Baytown receive a 5% reduction for annual flood insurance premiums and policies for properties located within the Special Flood Hazard Areas receive a 15% reduction for annual flood insurance premiums.

3.1 DISCUSSION OF THE NUMBER AND TYPE OF BUILDING SUBJECT TO THE HAZARDS.

Based on FEMA Community Information System records the City of Baytown has 3,945 flood insurance policies in force with coverage totaling $638,704,100. The City of Baytown has evaluated FEMA records to determine which areas of the city have received flood insurance claims. Based upon FEMA Community Information System records, 1,820 flood claims have been paid for losses totaling $25,679,103. Based on an average flood damage claim of $14,109, there is strong justification to purchase flood insurance for flood-prone properties located within the city.

The current annual flood insurance premium for the 3,945 policies in force in the City of Baytown is $1,338,543. The CRS Rating of 7 results in a 15% annual flood insurance premium reduction for properties located in the Special Flood Hazard Area. If all 3,945 policies were for properties located in the SFHA the annual premium savings would be $200,781. The Goals of the City of Baytown Flood Mitigation Plan is to improve the CRS rating to CRS Class 5. A CRS 5 classification would result is a maximum of 25% annual premium savings for properties located in the SFHA and could be as much as $334,635 per year. A CRS Rating is a 5-year rating and the total savings over the 5-year period could be as high as $1,673,000.

3.2 STRUCTURES THAT HAVE RECEIVED FLOOD INSURANCE CLAIMS.

The City of Baytown has experienced twenty-nine (29) flooding events in the last twenty-two (22) years according to FEMA Repetitive Loss Records. FEMA classifies a Repetitive Loss Property as a property (or structure) that has received two or more paid flood insurance claims that exceed $1,000.00 each. Based on NFIP Repetitive Loss Summary for the State of Texas

dated June 30, 2004, the City of Baytown has a total of 166 Repetitive Loss Properties that have suffered 471 flood losses totaling $8,948,311.13 with an average loss payment of $18,998.54. Due to mitigation actions by the City of Baytown with assistance from FEMA, the US Army Corps of Engineers, and individual homeowners, the total non-mitigated Repetitive Loss Properties in the City of Baytown is 65 Repetitive Loss Properties that have suffered 166 flood losses totaling $2,156,045.63 with an average loss payment of $12,988.23.

The Flood Insurance Reform Act (FIRA) of 2004 was signed into law June 30, 2004. The FIRA initiates a five-year pilot program to assist local communities with mitigating damage and loss to "severe repetitive loss properties". Residential one to four unit severe repetitive loss properties are ones that: 1) have been the subject to four of more separate claims valued at more than $5,000 each and collectively valued at more than $20,000; or 2) properties with two or more claims the total value of which exceeds the value of the property. Multifamily properties with five or more units also are covered by the mitigation program and will be designated according to a definition of "severe repetitive loss" for multifamily property established by FEMA through regulations.

The pilot program will provide funding to state and local governments to fund mitigation activities. The mitigation offers may include elevation, relocation, demolition, rebuilding, flood-proofing and purchasing property. The FIRA establishes a formula for distribution of federal mitigation funds to state and local governments, provided the state or local governments match 25% of the federal funding granted. The state and local government matching funds requirement can be reduced to 10% at the discretion of FEMA if the state has an approved mitigation plan and the Director of FEMA determines that the state has taken action to reduce the number of severe repetitive loss properties. The Governor's Division of Emergency Management (TxDEM) prepared and submitted the Texas Mitigation Plan to FEMA to comply with the Disaster mitigation Act of 2000 requirements. The Texas Mitigation Plan was prepared as an "enhanced" plan and addresses specific issues such as severe repetitive loss properties. If the Texas Mitigation Plan prepared by TxDEM is approved by FEMA it should reduce the local governments match to 10% for mitigation of severe repetitive loss properties.

The City of Baytown developed a Repetitive Loss Plan as required for participation in the CRS Program. The Repetitive Loss Plan has been reviewed and updated annually by the City of Baytown as required for participation in the CRS Program. It is important to note that flooding has damaged additional properties but exact records are not known because the properties and losses were not covered by flood insurance. Neither FEMA nor the TxDEM has records that indicate all flooded properties within the City.

3.3 PLAN AND PROCEDURES FOR WARNING AND EVACUATION

The Emergency Management Plan for the City of Baytown outlines the plans and procedures for warning and evacuation during incidents, emergencies and disasters. As outlined in the emergency management plan, detailed information is described below.

Warning

The primary objective of a warning system is to notify key officials of emergency situations and disseminate timely and accurate warnings to the population at risk. The City of Baytown acknowledges that the need to warn the public of impending danger may arise at any time. In order to reduce loss of life and property, adequate and timely warning must be provided. Appropriate action-oriented information must be supplied to citizens.

A warning period will be available for most emergency situations. However, the amount of lead-time will vary from hazard to hazard. Proper use of a warning period will save lives, reduce injuries and protect property. The most common warnings issued are those for severe weather. Other local hazards that may call for warnings are hazardous materials incidents from fixed facilities and/or transportation sources as well as radiological incidents and urban fires. Warnings will be issued when an event might endanger life or property.

A limited warning system is in use by the City of Baytown. Periodic reviews of the system will be made and plans for improvement formulated as necessary and feasible. A public awareness program has also been developed outlining the warning system and warning process.

The primary warning point for most warnings is the Texas Department of Public Safety Area Warning Center located in Houston, Texas. Upon notification of an emergency situation, the Department of Public Safety Area Warning Center will inform local warning points (LWP). The LWP for the City of Baytown is the Baytown Police Department, which is manned 24 hours per day. Upon receipt of the information, the LWP verifies warning information where necessary and disseminates pertinent information to specific local officials and departments. Once warnings are received and where necessary, verified, the LWP will disseminate appropriate information through available communication channels. Warnings will continue until such time they are no longer required.

The Mayor of the City of Baytown has overall responsibility for warning however the Mayor relies heavily on the City Manager and Emergency Management Coordinator to carry out this function. The Chief of Police assists the Emergency Management Coordinator by coordinating the warning system operations with other local agencies. The City identifies electronic news media as the primary source of emergency information for the general public. Local radio and television stations broadcast Emergency Alert System (EAS) messages when requested by local government officials. To effectively utilize the EAS, local governments and broadcasters coordinate the procedures used to transmit warning messages and instructions from the government to the broadcasters. Additionally, the National Oceanic and Atmospheric Administration (NOAA) Weather Radio station will broadcast weather watches and warnings issues by the National Weather Service (NWS). Weather radios are activated when such messages are broadcast.

Receipt of Warning

The LWP Receives Warnings from the National Warning System (NAWAS), a 24-hour nationwide, dedicated, multiple line telephone warning system linking federal agencies and the states that is used to disseminate civil emergency warnings. The NAWAS is a voice

communications system operated by FEMA. The warnings that are disseminated include: attack warnings, fallout warnings, or natural/technological warnings.

The Texas Warning System (TAWAS) is a state level extension of NAWAS. It consists of a dedicated telephone warning system linking the state warning point (in Austin) with other regional warning centers throughout the state. Once a national warning is received at TAWAS, it is transmitted via teletype messages on the Texas Law Enforcement Telecommunications System (TLETS) to the LWP. TAWAS also disseminates warning messages from the Governor or other key state officials to appropriate regions within the state.

The NWS disseminates weather forecasts, watches, and warnings via the NOAA Weather Wire Service. The NOAA service is a satellite communications system that broadcasts to specialized receiver terminals. The following are among a few of the weather messages that are provided: flood and flash flood watches and warnings, severe weather watches and warnings, tornado watches and warnings, and tropical weather watches and warnings.

Finally, the City of Baytown has developed a warning diagram for warning dissemination officials. Contained in Annex A of the Emergency Management Plan, the diagram outlines general warning dissemination procedures.

Dissemination of Warning

The LWP has a variety of means to broadcast warnings to the public. The City of Baytown presently has no outdoor warning system and therefore must rely on the use of mobile sirens, public address systems, EAS and door-to-door notification. Within the limits of the authority delegated, the LWP will determine if a warning needs to be issued and mechanism of dissemination.

The City of Baytown participates in the Greater Harris County 9-1-1 Emergency Network Early Warning System (NEWS). This is an area-wide early warning (alert) system to inform citizens of emergencies such as severe weather or other hazardous situations. NEWS utilizes the 9-1-1 database, which is the most accurate database available to the community. This database is updated multiple times each day, and includes both published and non-published telephone numbers. The early warning system is capable of making 1,152 simultaneous calls.

All commercial radio and television stations and cable television companies must participate in the Emergency Alert System (EAS) as a condition of licensing. These organizations must broadcast presidential warnings and may broadcast state and local warnings as well. The stations are encouraged to broadcast all warning messages, however, ultimately the decision for broadcast lies with the broadcaster.

The public may be warned by route alerting using vehicles equipped with sirens and public address systems. The Emergency Management Plan has identified police and fire vehicles to be used for this purpose. Response personnel going door-to-door may also deliver warnings. While each of the methods is effective in warning delivery, the methods are labor-intensive, time-consuming activities. These methods may be considered ineffective for warning large areas.

The NWS, USACE and the HCFCD have established a network of rain and flood detection devices for the purposes of early warning. In the event of excessive rain, the NWS in conjunction with the HCFCD will issue warnings where necessary.

Evacuation

A wide variety of emergency situations might require an evacuation of portions of the local area. Limited evacuations of a specific geographic area might be needed as a result of a hazardous materials transportation accident, major fire, natural gas leak, or localized flash flooding. Large-scale evacuation could be required in the event of a major hazardous materials spill, terrorist attack, extensive flooding, or hurricane.

While Texas has no mandatory evacuation law, the Mayor of the City of Baytown in cooperation with the City manager and Emergency Management Coordinator may recommend evacuation of a threatened area. Once a disaster declaration has been issued, actions may be taken to control re-entry into a stricken area. Additionally, the movement of people and occupancy of buildings within the disaster area may also be controlled.

Evacuation is one means of protecting the public from the effects of a hazard. In this instance, protection is achieved when persons are physically moved away from the hazard. The City of Baytown recognizes the benefits of evacuation and has therefore developed evacuation procedures for the community.

The decision to evacuate is decided upon by the Emergency Management Coordinator. The Emergency Management Coordinator will evaluate the need for evacuation, plan for evacuation, and coordinate support for the evacuation effort. During times that evacuations must be conducted because of incidents that occur without warning, evacuations may have to be planned quickly and carried out with available resources.

The Mayor, City Manager or Emergency management Coordinator will normally advise the public to evacuate a hazard area. In situations where rapid evacuation is critical to the continued health and safety of the population, the on-scene senior official may advise the public in the immediate vicinity to evacuate. In the case of hazardous materials spills or fire, the senior fire official will make the evacuation recommendation. During floods, the evacuation notice will generally be initiated after evaluation and recommendation of the Emergency Management Coordinator. For slowly developing emergency situations, advance warning should be given to affected residents as soon as it is clear evacuation may be required.

Persons to be evacuated should be given as much warning time as possible. For slow moving events, the evacuation notice should be given to affected residents if it appears that hazardous conditions may warrant such action. Citizens should be advised that the request to evacuate may occur with thirty minutes notice or less.

All warning modes will be utilized to direct the affected population to evacuate. Wherever possible, the warning will be given on a direct basis as well as through the media. The use of law enforcement and fire emergency vehicles moving through the affected area with sirens and public address systems is usually effective. However, if used, this procedure should be

communicated to the public in advance to reduce confusion concerning vehicle usage. In addition, door-to-door notifications and Greater Harris County 9-1-1 Emergency Network Early Warning System (NEWS) will be utilized when necessary.

Law enforcement personnel will sweep the evacuated area to ensure all persons have been advised of the evacuation and have responded accordingly. Persons who refuse to follow evacuation instructions will be left alone until all who are willing to leave have been provided for. If time permits, further efforts will be made to persuade those remaining to evacuate.

The public information officer will ensure that evacuation information is disseminated to the media on a timely basis. Instructions to the public identifying traffic routes to be followed, location of temporary reception centers as well as situation updates will be issued as information becomes available. When the incident that generated the need for evacuation is resolved, evacuees must be advised when it is safe to return to the area.

City of Baytown and the many Texas communities located along the Texas Gulf Coast take hurricane evacuation seriously. The Texas Division of Emergency Management (TxDEM) in partnership with the Texas A&M Hazard Reduction and Recovery Center has prepared Storm Evacuation Maps for each segment along the Gulf of Mexico including inlets, bays and affected areas. The hurricane evacuation information is accessible by the public on the web at: www.hurricanes.tamu.edu and www.baytown.org.

The TxDEM Evacuation Map for the Houston/Galveston Study Area includes the City of Baytown. The Evacuation Maps are published and distributed by public-private partnerships. The maps are made available to the public by businesses such as Radio and TV Stations, Randall's Food Stores, Walgreens Pharmacy, and other local businesses located throughout the community.

In a letter dated June 7, 2002, the Texas Division of Emergency Management informed the City of Baytown that Evacuation Time Estimates (ETEs) for hurricane evacuations in the area were revised. For the Baytown area, evacuation estimates for a Category 5 storm were raised to twenty (20) hours. The revised times incorporate risk area population data from the 2000 Census and the results of a 2001 behavior study of the residents of the Texas coast. The TxDEM is confident that the new methodology for determining ETEs is a more accurate portrayal of what people will do an how long the evacuation process will take.

In the letter from TxDEM the factors impacting evacuation times were identified as follows: increases in population, increases in the number of vehicles used for evacuation, evacuee preparation time, sympathetic evacuation, and traffic modeling. Most areas within the Houston/Galveston Metropolitan area have experienced increases in population as a result of the 2000 Census figures. The increase in population subsequently increases the time necessary for evacuation. With an increased population, the number of vehicles used for evacuation has also increased. In a behavioral study conducted in 2001, respondents indicated that they had more vehicles per capita than in previous surveys, of which they intend to take with them when they evacuate. When evaluating evacuation time, the behavioral study found that evacuation preparation time exceeds previous estimates. Most individuals were assumed to evacuate within

three hours of an evacuation notice being delivered. Realistically, the behavioral study indicated evacuees would evacuate within four to six hours of receipt of the evacuation notice.

Evacuation traffic is a major concern for the City of Baytown. The City of Baytown website www.baytown.org includes the evacuation routes from Baytown into the adjacent areas. The primary evacuation options within the City of Baytown include SH 146 north, Interstate 10 east and west, and SH 225 west to connect to both Beltway 8 north and IH-45 north.

The Hazard Reduction and Recovery Center at Texas A&M University study, *Hurricane Evacuation Time Estimates for the Texas Gulf Coast*, March 2002, includes evacuation route system estimates for Harris East (GSA4) and Chambers West (SSA1) for areas within the City of Baytown.

Evacuation routes for Harris East (GSA4) include IH10/Belt Road 8, IH10/Belt Road 610, SH 146 and US 90. The total capacity of GSA4 is estimated as 4,900 vehicles/hour.

Evacuation routes for Chambers West (SSA1) include SH 61, IH10/FM 563 and SH 146. The total capacity of SSA1 is estimated as 1,600 vehicles/hour.

The seriousness of evacuation is described in the Hazard Reduction and Recovery Center at Texas A&M University study of Hurricane Evacuee Estimates and Destinations. For Harris County the estimated evacuees (persons) are as follows:

Cat 1 Storm	Cat 2 Storm	Cat 3 Storm	Cat 4 Storm	Cat 5 Storm
78,361	123,876	185,501	212,094	219,796

For Harris County the estimated evacuees (vehicles) are as follows:

Cat 1 Storm	Cat 2 Storm	Cat 3 Storm	Cat 4 Storm	Cat 5 Storm
42,477	67,101	100,482	114,887	119,059

It is understood that portions of Harris County will evacuate to the north, west and east and not pass through the City of Baytown. However areas in Galveston and Brazoria Counties will travel evacuation routes through the City of Baytown.

It is understandable that the latest evacuation time estimates for areas within the City of Baytown are considerably longer due to population increases in the Texas Gulf Coast region.
Based upon responses to the Flood Mitigation Plan Questionnaire distributed by the City, the majority of citizens would evacuate voluntarily if requested by law enforcement or a representative of the City.

3.4 CRITICAL FACILITIES

The City of Baytown Flood Mitigation Planning Committee has identified facilities critical to the fulfillment of city services as well as facilities that are vulnerable to the impact of disaster. A map illustrating the location of critical and vulnerable facilities is located in Attachment "F" of this plan. The following locations are listed as vulnerable facilities with their approximate flood zone identified:

Facility	Address	Flood Zone
City Hall	2401 Market	Zone X Unshaded
Fire Department Headquarters	201 E. Wye Drive	Zone X Unshaded
Fire Station 1	4723 Garth	Zone X Unshaded
Fire Station 2	2320 Market	Zone X Unshaded
Firs Station 3	3311 Massey-Tompkins	Zone X Unshaded
Fire Station 4	910 E. Fayle	Zone X Unshaded
Fire Station 5	7210 Bayway	Zone X Unshaded
Police Department	3200 N. Main	Zone X Unshaded
Lee College	Lee Drive @ Market St.	Zone X Unshaded
Robert E. Lee Senior Hi School	1809 Market	Zone X Unshaded
Ross Sterling High School	300 W. Baker	Zone X Unshaded
Baytown Junior High	7707 Bayway Dr.	Zone X Unshaded
Horace Mann Junior High	310 S. Hwy 146	Zone X Unshaded
Cedar Bayou Junior High	2610 Cedar Bayou Road	Zone X Unshaded
Alamo Elementary	1801 Austin	Zone X Unshaded
Ashbel Smith Elementary	403 E. James	Zone X Unshaded
Austin Elementary	3022 E. Massey Tompkins	Zone X Unshaded
Bowie Elementary	2200 Clayton	Zone X Unshaded
Carver Jones Elementary	South Pruett	Zone X Unshaded
Crockett Elementary	4500 Barkaloo	Zone X Unshaded
De Zavala Elementary	305 Tri-City Beach Road	Zone X Unshaded
Lamar Elementary	816 N. Pruett	Zone X Unshaded
Pumphrey Elementary	4901 Fairway Dr.	Zone X Unshaded
San Jacinto Elementary	2615 Virginia	Zone X Unshaded
Travis Elementary	100 Robin Road	Zone X Unshaded
San Jacinto Methodist Alexander Campus	1700 James Bowie Drive	Zone X Unshaded
San Jacinto Methodist Hospital	4401 Garth Road	Zone X Unshaded

Fire Stations

The City of Baytown Department is headquartered at 201 E. Wye Drive with five (5) fire stations located throughout the City and manned by professional fire fighters. Fire Station locations are:

Station 1	4723 Garth
Station 2	2320 Market
Station 3	3311 Massey-Tompkins
Station 4	910 E. Fayle
Station 5	7210 Bayway

The Baytown Fire Department provides fire protection services within the community.

The Baytown Fire Department also provides Emergency Medical first responder services. Fire Department representatives respond to medical calls but do not provide patient transport. The Baytown Department of Health provides patient transport to the appropriate medical facility.

Hospitals
There is one major hospital, San Jacinto Methodist, located within the city limits.

Schools
There are eleven (11) elementary, three junior high, two high schools and Lee College locate within the City of Baytown.

Business/Industry
The business opportunities within Baytown are enhanced by its location. The community boasts a reputation for refining and its' petrochemical center. The Houston Ship Channel is 52 miles long and the City of Baytown fronts along the area that includes the Exxon/Mobil Baytown Refinery, Chevron/Phillips Chemical and Beyer Chemical. Directly across the Ship Channel from the City of Baytown is the DuPont, Conoco and Dow Chemical USA facilities. The close proximity to the Port of Houston, the Intercoastal Waterway and IH10 makes the City a gateway for enterprise.

3.5 WETLANDS, RIPARIAN AREAS, AND SENSITIVE AREAS

Wetlands, a natural resource, are a key mitigation tool in the fight against rising floodwaters. Wetlands diminish wave action, therefore controlling erosion. They also allow sediment to settle out of storm water, therefore improving water quality. When wetlands are used for construction, the above-mentioned benefits are lost; water flow is restricted causing greater flooding; and valuable property is lost causing an increase in flood insurance rates.

The City of Baytown has developed 730 acres of parks, wildlife refuge areas, and outdoor recreational facilities. There are 35 facilities consisting of walking trails, picnic tables, swimming pools, tennis courts, ball fields, boat ramps, and outdoor recreation areas. The City has invested extensively in its local parks system. Baytown is the home of the nationally famous Baytown Nature Center consisting of over 400 areas of nature preserve with wetlands, transitional zones, oak motts and wetlands. The Nature Center is home for numerous butterflies, dragonflies, damselflies, wildflowers, mammals, aquatic organisms and over 315 species of birds thriving in this unique area.

The Eddie V. Gray Wetlands Education and Recreation Center is located at 1724 Market Street in Baytown. The 14,000 square foot facility is situated on the banks of Goose Creek. The Wetlands Center was opened in 1998 and offers a variety of educational and recreational programs including a computer lab, science lab, and numerous exhibits and aquariums. It is an official stop on the Great Gulf Coast Birding Trail. The Eddie V. Gray Wetlands Education and Recreation Center is dedicated to increasing awareness, appreciation and understanding of wetlands, the environment, and cultural history through environmental education and environmental recreation.

3.6 CAPITAL IMPROVEMENT PROJECTS

Drainage Master Plan

The City of Baytown Drainage Master Plan was completed in February 2002 and identifies drainage improvement projects needed for the ultimate development of the watersheds within the City. The Master Plan also identifies drainage improvements planned by Harris County Flood Control District that impact the City of Baytown.

The Drainage Master Plan addresses the three major watersheds that drain the City of Baytown:
Cedar Bayou – 214 square miles
Goose Creek – 28 square miles
Spring Gully – 5 square miles

Recommended drainage improvements for each watershed are described in the Master Drainage Plan with the estimated total cost for recommended drainage improvements summarized as:

Cedar Bayou – $260,507,000 or $1,902 per acre total and $8,250 per developable acre
Goose Creek – $115,684,000 or $6,456 per acre total and $15,250 per developable acre
Spring Gully - $16,331,000 or $16,850 per developable acre

Capital Improvement Plan recommendations for each watershed are described in the Drainage Master plan as follows:

Cedar Bayou – Sixteen (16) regional detention facilities were identified Q1 to Q16. To address immediate needs design and construction of eight (8) Basins, Q1, Q5, Q6, Q7, Q8, Q9, Q11 and Q15 are recommended. The following tributary channels will need to be improved to convey flows to the recommended basins: Q111, Q112, Saw Pit, Q114, Q118 and Q119. The associated cost is as follows:

Recommended Cedar Bayou Regional Detention Facilities:

	Volume (ac-ft)	Estimated Total Cost ($)
Basin Q1	1050	$20,776,000
Basin Q5	585	$12,085,000
Basin Q6	450	$13,572,000
Basin Q7	170	$ 5,420,000

Basin Q8	835	$16,788,000
Basin Q9	425	$10,606,000
Basin Q11	1705	$43,239,000
Basin Q15	255	$ 7,122,000
Sub total eight basins		$129,608,000

Recommended Channel Improvements to Cedar Bayou Tributaries:

Channel	Estimated Total Cost
Q111	$ 45,000
Q112	$3,744,000
Saw Pit Gully	$2,664,000
Q114-00-00	$4,465,000
Q114-01-00	$ 192,000
Q114-02-00	$ 670,000
Q114-02-01	$ 78,000
Q114-02-02	$ 61,000
Q114-03-00	$ 71,000
Q114-04-00	$ 100,000
Q114-05-00	$ 553,000
Q118-00-00	$2,150,000
Q118-03-00	$1,712,000
Q119-00-00	$1,829,000
Subtotal channel imp.	$18,334,000

The estimated total cost for eight regional drainage facilities and supporting channel improvements for the Cedar Bayou Watershed is $147,942,000.

The Drainage Master Plan includes the recommendation that an Impact Fee of $8,250 an acre be assessed for future development in Cedar Bayou watershed to offset the recommended drainage improvements.

Goose Creek – Eleven (11) regional detention facilities were identified O1 to O11. To address immediate needs design and construction of seven (7) Basins O4, O5, O6, O7, O8, O9 and O10 are recommended. The following tributary channels will need to be improved to convey flows to the recommended basins: O129, O105, O114, O113, O128, and O120. The associated cost is as follows:

Recommended Goose Creek Regional Detention Facilities:

	Volume (ac-ft)	Estimated Total Cost ($)
Basin O4	950	$19,870,000
Basin O5	560	$12,100,000
Basin O6	280	$ 6,903,000
Basin O7	420	$ 9,751,000
Basin O8	80	$ 2,774,000
Basin O9	185	$ 5,151,000

Basin O10	265	$ 6,597,000
Sub total seven basins		$63,146,000

Recommended Channel Improvements to Goose Creek Tributaries:

Channel	Estimated Total Cost	
O129-00-00	$ 0	(no proposed improvements)
O105-00-00	$1,945,000	
O105-09-00	$ 316,000	
O105-10-00	$ 122,000	
O114-00-00	$1,020,000	
O113-00-00	$ 217,000	
O128-00-00	$1,012,000	
O120-00-00	$1,608,000	
Subtotal channel imp.	$5,220,000	

The estimated total cost for seven regional drainage facilities and supporting channel improvements for the Goose Creek Watershed is $68,366,000.

The Drainage Master Plan includes the recommendation that an Impact Fee of $15,250 an acre be assessed for future development in Goose Creek watershed to offset the recommended drainage improvements.

Spring Gully - Four (4) regional detention facilities were identified 1 to 4. To address immediate needs design and construction of two (2) Basins: 3 and 4 are recommended. The following tributary channels will need to be improved to convey flows to the recommended basins: O202, and O203. The associated cost is as follows:

Recommended Spring Gully Regional Detention Facilities:

	Volume (ac-ft)	Estimated Total Cost ($)
Basin 3	190	$5,066,000
Basin 4	70	$2,667,000
Sub total two basins		$7,733,000

Recommended Channel Improvements to Spring Gully Tributaries:

Channel	Estimated Total Cost
O202-00-00	$ 478,000
O203-00-00	$ 563,000
Subtotal channel imp.	$1,041,000

The estimated total cost for two regional drainage facilities and supporting channel improvements for the Spring Gully Watershed is $8,774,000.

The Drainage Master Plan includes the recommendation that an Impact Fee of $16,850 an acre be assessed for future development in Spring Gully watershed to offset the recommended drainage improvements.

There were three (3) storm water detention basins identified in the City of Baytown Drainage Master Plan and recommended as highest priority for future Capital Improvement Projects (CIP) and discussed in a City Council workshop in November 1999 (see Plan Section 5.8 - Capital Improvement Plan). These three (3) basins are Cedar Bayou Basin Q8, Goose Creek Basin #7, and Spring Gully Basin #3 or #4. The Drainage Master Plan includes a recommendation that the City of Baytown select one of the following three options for design, construction and financing of the three proposed storm water detention basins:

1.	Advance purchase and build regional detention facilities and recap fees from development using impact fees.	$13,757,000
2.	City can advance purchase land for regional detention for developer to construct needed mitigation on regional site	$1,248,000
3.	City can collect impact fees then build regional detention when sufficient monies are available with some increased risk of flooding until detention is built.	$13,757,000

Harris County Flood Control District Projects

The City of Baytown Drainage Master Plan (February 2002) includes a summary of HCFCD proposed projects for watersheds that impact the City of Baytown:

> Three (3) proposed projects in the Cedar Bayou Watershed over the period from 2002 to 2008 total $1.25 million.
>
> Eleven (11) proposed tasks or projects are planned for the Goose Creek Watershed totaling $11.55M million.

3.7 IMPACT OF FLOODING

There are eight (8) Harris County Flood Insurance Rate Map (FIRM) Panels that show flood hazards within the City of Baytown:

Panel Number	Date	Map Scale
48201C0745K	April 20, 2000	1 inch = 1000 feet
48201C0760J	November 6, 1996	1 inch = 1000 feet
48201C0765J	November 6, 1996	1 inch = 1000 feet
48201C0770J	November 6, 1996	1 inch = 1000 feet
48201C0935J	November 6, 1996	1 inch = 1000 feet
48201C0955J	November 6, 1996	1 inch = 1000 feet
48201C0960J	November 6, 1996	1 inch = 1000 feet
48201C0970J	November 6, 1996	1 inch = 1000 feet

Coastal High Hazard Areas (Zone VE) are delineated on five (5) of the eight (8) FIRMs for areas within the City of Baytown. Riverine flood hazard areas (Zone AE) are shown on all eight FIRM panels published for the City of Baytown. Due to the close proximity to Galveston Bay the majority of riverine hazard areas are tidal influenced or subject to combined probability flooding

where the storm surge from the receiving bay combined with the riverene flood elevation establishes the base flood elevation. The Harris County Flood Insurance Study Volume 1 dated April 20, 2004, describes the coastal analyses conducted for the coastal areas of the City of Baytown including Galveston Bay, Tabbs Bay, Black Duck Bay, Mitchell Bay, Scott Bay, Crystal Bay, and Burnett Bay. FEMA established the 10-, 50-, 100-, and 500- year flood elevations in Galveston Bay. A wave action analysis was also conducted by FEMA to determine wave height, which is the distance from the trough to the crest of the wave. Areas of coastline subject to significant wave attack are referred to as coastal high hazard zones. The US Army Corps of Engineers conducted the initial Harris County Flood Insurance Study and established the 3-foot breaking wave as the criterion for identifying the limit of coastal high hazard zones. Wave heights were computed along "transects" which were located perpendicular to the average mean coastline. The "transects" for areas within the City of Baytown include:

Flooding Source	Stillwater Elevation 10-Year	100-Year	Zone	Base Flood Elevation (Feet NGVD)
Galveston Bay				
Transects 30-32	5.3	12.2	VE	14-17
			AE	12-14
Transects 33-35	5.4	12.6	VE	15-19
San Jacinto River				
Transect 36	5.4	12.4	VE	15-16
Transects 37-40	5.4	12.3	VE	14-15
Transect 41	5.3	11.8	VE	14-15
			AE	12-14
Transects 42-47	5.3	11.8	VE	14-15
Transects 48-49	5.3	11.7	VE	14-15
Transects 50-52	5.3	11.6	VE	14-15
			AE	12-14

The coastal high hazard areas noted above are identified on the Harris County Flood Insurance Rate Map panels that include the City of Baytown.

The new Harris County DFIRM effort did not include a new coastal flooding analysis of flooding from Galveston Bay. The coastal flooding elevations (base flood elevations) established from the previous Harris County Flood Insurance Studies were remapped based on LIDAR

mapping and NAVD 1988 elevations generated by the Tropical storm Allison Flood Recovery Project (TSARP). Adjustments were expected in coastal areas due to subsidence that occurred since the original Harris County Flood Insurance Study was performed based on NGVD 1929 releveled in 1973 and 1987.

The City of Baytown Flood Damage Prevention Ordinance addresses special requirements for development within Zone VE.

The City of Baytown is mitigating the impact of flooding within the community. The current flooding impact is greatly reduced from what it was ten years ago. Cooperative projects and coordination with the Harris County Flood Control District for channel improvement projects, dredge streams and bayous, construct regional storm water detention facilities and to improve drainage system maintenance, are active projects to reduce future flood losses.

Participation in the CRS program recognizes the City efforts to minimize flood losses. City officials continue to encourage the purchase of flood insurance as a mitigation measure for individuals within the community. Flood insurance policies are available to all residents of the City of Baytown. Since the City of Baytown participates in the CRS program, flood insurance policy holders pay reduced premiums.

4. GOALS (CRS ACTIVITY 511.6)

Through implementation of the following activities, hazard mitigation will be realized to reduce the threat to citizen's health and safety, and to reduce property damage caused by natural hazards. Flood mitigation planning will improve the lives of the citizens of Baytown, the environment, and the appearance of the City.

CRS Activities

1. Update FEMA's Repetitive Loss List annually and submit data to FEMA.
2. Improve CRS Classification annually with a goal to achieve a FEMA Class 5.

Drainage Projects

1. Support the Harris County Flood Control District's (HCFCD) efforts to design and construct regional stormwater detention facilities and channel improvement projects in the City of Baytown.
2. Secure funding for design and construction of drainage improvement projects identified in the February 2002 City of Baytown Master Drainage Plan.

Floodplain Management

1. Evaluate the remaining (non-mitigated) Repetitive Loss Properties within the City for future Flood Mitigation Assistance (FMA) and Hazard Mitigation Grant Program (HMGP) Projects focused on acquisition, relocation and elevation projects.
2. Establish additional Elevation Reference Marks to create city-wide coverage based on NAVD 88.
3. Encourage local citizens and business owners to purchase flood insurance on both the structure and contents of properties located within the City of Baytown.
4. Monitor elevation of nearby extensometers. Review subsidence (elevation) measurements, rates, technical reports and publications available from the Harris-Galveston Coastal Subsidence District (HGCSD).
5. Revise the City of Baytown building requirements if necessary to minimize flood damage to new construction.
6. Review the current City of Baytown Flood Damage Prevention Ordinance and evaluate the current requirement to elevate new construction a minimum of 18 inches above the Base Flood Elevation.
7. Coordinate with FEMA and revise the City of Baytown Flood Damage Prevention Ordinance to reference the new DFIRMs developed as part of the Tropical Storm Allison Flood Recovery project. (timing will depend on resolution of map appeals by FEMA)

Property Protection

1. Increase Awareness for the need to purchase Flood Insurance for properties located in the City of Baytown

   The City of Baytown is subject to flooding from extreme coastal storms resulting from intense rainfall, storm surge from Galveston Bay, and overflows from San Jacinto River, Cedar Bayou and Goose Creek. The City of Baytown is enrolled in the National Flood

Insurance Program and flood insurance is available for all structures located in the City. FEMA has classified the City of Baytown as a Community Rating System (CRS) Community and all flood insurance premiums for insured properties within the City are reduced based on the favorable CRS Rating. Flood insurance is a citizen's first line of defense to offset flood losses. The City of Baytown has instituted measures to make the City disaster resistant however the Flood Mitigation Planning Committee concurs with the recommendation made by Harris County Flood Control District that all structures and their contents located within Harris County be protected by flood insurance.

The City of Baytown should continue to support public awareness efforts to inform citizens of the protection that can only be provided by purchasing flood insurance coverage for structures and their contents.

2. Conduct an annual evaluation of FEMA's Repetitive Loss List to prioritize and identify potential acquisition/relocation and elevation projects. Submit repetitive loss update information to FEMA.

3. Prepare Cost Estimates for future acquisition/relocation and elevation projects.

4. Educate the public on elevation of structures in addition to acquisition and relocation of flood prone structures. Utilize FMA and HMGP funding to elevate structures in lieu of acquisition.

5. Conduct an annual evaluation and update of the Harris County "All Hazards Mitigation Plan" and cooperate with the Governor's Division of Emergency Management (TxDEM), Harris County, the City of Houston and other communities that participated in the development of the county-wide mitigation plan. (This is a five-year effort to conduct annual plan evaluations)

6. In response to the Flood Insurance Reform Act of 2004, cooperate with FEMA for the pilot program to mitigate "Severe Repetitive Loss Properties" located in the City of Baytown.

5. REVIEW OF POSSIBLE ACTIVITIES (CRS ACTIVITIES 511.7)

In the 2003-2004 timeframe, the Harris County "All Hazards" Mitigation Plan was prepared by the Houston Galveston Area Council (HGAC) addresses known hazards throughout Harris County including the City of Baytown. The City of Baytown participated in the HGAC planning effort and provided technical information to be included in the Harris County Plan. The Harris County All Hazards Mitigation Plan includes mitigation actions that were reviewed by the City of Baytown Mitigation Planning Committee during the planning for the City of Baytown Flood Mitigation Plan. The City of Baytown Flood Mitigation Planning Committee evaluated the following activities to be included in the Flood Mitigation Plan:

5.1 PREVENTIVE ACTIVITIES (CRS ACTIVITY 511.7.A)

Open Space Preservation

The City of Baytown has developed an extensive 730 acres of parks, wildlife refuge areas, and outdoor recreational facilities. There are 35 facilities consisting of walking trails, picnic tables, swimming pools, tennis courts, ball fields, boat ramps, and outdoor recreation areas. The City has invested well in its local parks system. Baytown is the home of the nationally famous Baytown Nature Center consisting of over 400 areas of nature preserve with wetlands, transitional zones, oak motts and wetlands. The Nature Center is home for numerous butterflies, dragonflies, damselflies, wildflowers, mammals, aquatic organisms and over 315 species of birds thriving in this unique area.

The Eddie V. Gray Wetlands Education and Recreation Center is located at 1724 Market Street in Baytown. The 14,000 square foot facility is situated on the banks of Goose Creek. The Wetlands Center was opened in 1998 and offers a variety of educational and recreational programs including a computer lab, science lab, and numerous exhibits and aquariums. It is an official stop on the Great Gulf Coast Birding Trail. The Eddie V. Gray Wetlands Education and Recreation Center is dedicated to increasing awareness, appreciation and understanding of wetlands, the environment, and cultural history through environmental education and environmental recreation.

Floodplain Regulations

The City of Baytown has adopted floodplain management regulations that exceed the minimum requirements for participation in the National Flood Insurance Program. Detailed information relating to floodplain management activities may be found in the Land Development Code, Chapter 110 Floods adopted by the City of Baytown. The City of Baytown requires that all new construction and substantial improved structures to be elevated a minimum of 18 inches above the Base Flood Elevation posted on the FIRM. The City of Baytown also requires that all construction be referenced to "approved" Elevation Reference Marks that have adjusted for subsidence.

Stormwater Management

The City of Baytown Department of Public Works is responsible for the design, construction and maintenance of the storm drainage system within the City. City ordinance requires that prior to development, an analysis must be submitted identifying by plan and profile the means and

methods of draining the subdivision. Details showing all existing and proposed subdivision drainage structures, the means and methods of connecting the proposed drainage system into the city's existing system, and the impact the development will have on major outfall drainage structures are required. Further detailed information relating to stormwater management may be found in the City of Baytown Code Division 3, Stormwater Drainage. The City of Baytown Master Drainage Plan, February 2000, compared the City of Baytown's stormwater design criteria with the requirements of the City of Houston and Harris County. The Baytown Master Drainage Plan (February 2002) includes a recommendation that the City consider adopting the Harris County requirements for major ditch and structure design to require 100-year design when a regional detention facility exists or is proposed for the area.

Drainage System Management

The City of Baytown works in conjunction with the Harris County Flood Control District (HCFCD) to design, construct, and maintain drainage systems within the community.

Harris County Flood Control District (HCFCD) is currently constructing a regional storm water detention facility on Goose Creek near West Lynchburg-Cedar Bayou Road. This facility will decrease the risk of flooding in areas within the City of Baytown.

The City of Baytown Master Drainage Plan completed in 2002 identifies needed drainage improvements within the City. These needed improvements have been incorporated into Capital Improvement Program projects to be designed and constructed by the City of Baytown Department of Public Works. The Department of Public Works maintains the City's storm drainage system to reduce the risk of flooding within the City and to comply with the Non Pollution Discharge Elimination System (NPDES) requirements.

Subsidence

As recommended in FEMA/NFIP regulation 60.22, subsidence is monitored within the community. The City of Baytown maintains a technical relationship the Harris-Galveston Coastal Subsidence District (HGCSD) and the Harris County Flood Control District (HCFCD). The relationship allows the city to utilize current subsidence measurements in the area and the NGS/HGCSD re-leveled benchmarks for construction. The City of Baytown has been an active participant for the Tropical Storm Allison Flood Recovery Project (TSARP) and the development of new Digital Flood Insurance Rate Maps (DFIRMs) based on NAVD 1988.

5.2 PROPERTY PROTECTION (CRS ACTIVITY 511.7.B)

Relocation / Acquisition

The City of Baytown has a long history of successful acquisition and relocation projects beginning with the Brownwood Subdivision Project where the City worked closely with the Federal Insurance Administration (now FEMA), the US Army Corps of Engineers, and individual homeowners to acquire 177 properties utilizing Section 1362 of the Flood Disaster Protection Act of 1973. The Brownwood Project was completed ion September 1985. Since then the City has actively pursued reducing the number of Repetitive Loss Properties located within the City. The City of Baytown did not suffer major damage during Tropical Storm Allison in 2001 which resulted in one of the largest acquisition and relocation projects in the Nation. Harris

County, the Cities of Houston, Friendswood, Jersey Village and others initiated a major fast-track acquisition (Buyout) project where the Harris County Commissioners Court provided the required 25% local matching funds needed to receive Hazard Mitigation Grant Program (HMGP) funding. A property must receive substantial damage to be eligible for HMGP funding and there were no substantially damaged structures in the City of Baytown resulting from Tropical Storm Allison. The City of Baytown has reduced the number of Repetitive Loss Properties from 166 properties to only 65 "non-mitigated" Repetitive Loss Properties. In response to future flood events, the City is prepared to launch acquisition and relocation projects to mitigate properties that are substantially damaged and to take advantage of both Flood Mitigation Assistance (FMA) Program and HMGP grant funds. In the event of a future Presidential Declared Disaster, and if HMGP grant funds are made available, repetitive loss properties will be evaluated for potential relocation and/or acquisition projects.

Building Elevation

Requirements are contained within the City of Baytown Flood Damage Prevention Ordinance to require that new construction and substantial improvement of residential structures shall have the lowest floor, including basement, elevated a minimum of eighteen (18) inches above the base flood elevation.

In lieu of relocation and/or acquisition, a structure may be elevated to minimize flood losses. Various grant and other alternative funding sources may be available for elevation projects. The repetitive loss list, maintained by the Building Inspection Department, is periodically reviewed and evaluated for potential elevation projects.

Floodproofing

The City of Baytown ordinance allows for floodproofing of commercial, industrial or other nonresidential structures. The structure must be floodproofed a minimum of eighteen (18) inches above the base flood elevations as shown on the latest FEMA FIRM. In addition, a registered professional engineer or architect shall develop and/or review the structural design, specifications, and plans for the construction, and shall certify that the design and methods of construction are in accordance with accepted standards of practice. The floodplain administrator for the community maintains records of all certificates.

Sewer Backflow Protection

The City of Baytown has adopted regulations relating to backflow prevention. Detailed information regarding backflow prevention is contained in the Code of Ordinances for the City of Baytown. The backflow prevention requirements are designed to prevent the contamination of potable water within the community.

Insurance

The Flood Mitigation Committee recommends that the City continue insurance awareness and outreach programs to encourage citizens to purchase flood insurance policies. The newly awarded CRS Rating of seven (7) provides a discount of up to fifteen-percent (15%) to flood insurance policies held within the city limits.

5.3 NATURAL RESOURCE PROTECTION (CRS ACTIVITY 511.7.C)

Wetlands Protection

The City of Baytown has an established history of wetland protection beginning with the Brownwood Subdivision Acquisition and Relocation (Buyout) Project that involved FEMA and the US Army Corps of Engineers. The US Army Corps of Engineers prepared the Texas Coast Hurricane Study in 1979 to investigate the feasibility of reducing flood damages to long reaches of the Texas Coast that included the City of Baytown. The Corps evaluated both structural and nonstructural alternatives and determined that permanent evacuation of 750 acres of land containing 450 residences would be the recommended alternative which was subsequently authorized by Congress.

The Brownwood Subdivision was the subject of a Section 1362 Buy-Out Mitigation Project as a direct result of studies completed in 1974 and 1979. Phase One of the Project was completed in 1985 and included one hundred seventy seven (177) properties and the evacuation of the corresponding land area. This area was converted to a wetland/bird sanctuary and now part of the Baytown nature Center described earlier in this report.

A consortium of 200 companies joined the City of Baytown, Exxon, ARCO, FEMA and the SBA to sponsor the Brownwood Marsh Restoration Project. Due to these efforts the Baytown Nature Center now contains over 400 acres of nature preserve.

Erosion and Sediment Control

The City of Baytown and Harris County Flood Control District (HCFCD) address erosion that occurs on streams and drainage ways in the City. Due to the general flat stream gradients in the City and surrounding areas, riverine erosion is not considered to be a major problem. The shoreline within the community, predominately privately owned, is eroding.

A mixture of commercial, industrial and residential development lies along the coastal areas within the City of Baytown. Waterfront areas along Galveston Bay, located in Zone VE, are subject to coastal surge flooding and erosion. Coastal areas along Galveston Bay and the San Jacinto River (Houston Ship Channel) are subject to damage from tides during coastal storms.

Within the City of Baytown, there are currently no structural mitigation protection projects to alleviate coastal erosion problems however the City of Baytown prepared the Master Drainage Plan in 2000 that addresses drainage issues throughout the City. Recommendations from the Drainage Master Plan have been incorporated into the City of Baytown Capital Improvement Program and the Harris County Flood Control, District Long Range Plan.

Best Management Practices

The City of Baytown Code of Ordinances outlines the best management practices for the City.

5.4 EMERGENCY SERVICES (CRS ACTIVITY 511.7.D)

Flood Warning

The City of Baytown Emergency Management Plan describes warning procedures in depth in Annex A – Warning. The City of Baytown Emergency Management Coordinator maintains the Emergency Management Plan. Copies of the Emergency Management Plan are on hand at the Emergency Operations Center.

A brief description of warning measures that the City currently has in place may be found in section 3.3 of this plan.

Flood Response

The City of Baytown Emergency Management Plan outlines specific response procedures in the event of disaster. Disaster response activities are addressed in both the basic plan and numerous functional annexes. The City of Baytown Emergency Management Coordinator and copies of the Emergency Management Plan are maintained at the Emergency Operations Center. The Emergency Management Plan is updated on a routine basis per state requirements.

Critical Facilities Protection

The City of Baytown Flood Mitigation Planning Committee has identified the critical facilities located within the community. A listing of the critical facilities may be found in Section 3.4 of this plan.

The City of Baytown has established working relationships with engineering consultants that can assist the city during disaster response operations and to initiate disaster recovery activities. The City has also executed contracts with emergency response providers to supply emergency equipment such as generators, pumps, portable or package wastewater treatment plan equipment and other vehicles, equipment, and services that may be required for emergency operations and disaster recovery.

5.5 STRUCTURAL PROJECTS (CRS ACTIVITY 511.7.E)

Flood Protection Projects

The City of Baytown works in conjunction with the Harris County Flood Control District on a variety of projects. For more discussion on the flood control structures located within the community, refer to Section 3.7 - Impact of Flooding in this plan.

The City of Baytown has identified thirty-one (31) proposed regional stormwater detention facilities in the Drainage Master Plan:

Cedar Bayou Watershed	Sixteen (16) Regional Detention Facilities
Goose Creek Watershed	Eleven (11) Regional Detention Facilities
Spring Gully Watershed	Four (4) Regional Detention Facilities

Diversions/Channel Modifications/Storm Sewers
The Cedar Bayou Diversion Channel divers a major portion of the Cedar Bayou flood flows thereby preventing downstream damages. This diversion is shown on the Harris County Flood Insurance Rate Map.

Shoreline Preservation
A major portion of the City of Baytown shoreline lies along the Houston Ship Channel and not within the control of the City. However the US Army Corps of Engineers has initiated the Ship Channel widening and deepening project to improve the Houston Ship Channel.

No shoreline protection projects were identified in the City of Baytown Master Drainage Study.

5.6 PUBLIC INFORMATION (CRS ACTIVITY 511.7.F)

Map Information
The Chief Building Officer allows for the public to view the most current FIRM map available. Citizens may contact the Building Department to schedule a time to view the maps with an employee or they may stop by the office to view the maps without employee assistance. The Building Department also provides the phone number to obtain the FIRM map from the FEMA – FDMC upon request. Additionally, city officials supply the website address to obtain to FEMA's electronic FIRM website where citizens may view FIRMs on the web.

Outreach Projects
The City of Baytown, a FEMA CRS Class 7 community, participates in outreach projects throughout the year. Annually the Chief Building Official submits articles related to floodplain management issues for inclusion in local newspapers. The articles are supplied to help raise citizen awareness to floodplain management efforts within the community.

Real Estate Disclosure
The City of Baytown has a working relationship with the local Real Estate Industry and the Houston Board of Realtors in regards to floodplain management. An informational memo is sent out to the realtors, lenders, and insurance agents detailing the services provided by the Building Department. It is a violation of State law to not notify a potential buyer that a home has flooded or is in the floodplain.

Library
The City of Baytown maintains a Flood Protection Reference Library located in the Public Library at Public Library Avenue. Reference materials and other literature related to floodplain management and participation in the NFIP are available for review. The Flood Insurance Study, Flood Insurance Rate Maps and other City, Harris County, and/or FEMA documents are available there for reference as well. Some of the reference materials include topics such as: retrofitting floodprone properties, flood protection, elevation of floodprone structures, protective barriers and emergency measures to minimize flood damages. Citizens are encouraged to review the literature on a periodic basis.

Technical Assistance

As a community service, the City of Baytown Building Department provides the following services regarding Flood Rate Map Determinations: reading the FIRM in response to telephone calls, helping a person who walks into the office to read the FIRM, and response to written inquiries.

Environmental Education

The City of Baytown Nature Center contains three important environmental training facilities:

Exxon Mobil Learning Trail created through funding from Exxon Mobil, is located in the Wetlands Center's 9,000 square-foot Living Lab. It features a marine debris display, numerous taxidermy exhibits and a variety of hands-on games and experiments. Wetland Center staff members use the Exxon Mobil Learning Trail to teach visitors and students about the importance of wetlands and about the various animals that rely upon them.

Bayer Science Lab, made possible by donations from Bayer Corporation, features 15 microscopes. The lab is also home to several aquariums and to a large insect collection. The Wetlands Center staffers use this lab primarily with students. The students use the microscopes to learn more about the smaller organisms of the food web.

Rotary Club Computer Lab includes five PC's and three Macintosh computers, funded by the Rotary Club of Baytown. The computers feature environmentally-oriented educational games and CD-ROM's for kids. Each computer also includes an extensive list of internet research links. In addition, the Computer Lab is home to the Wetland Center's library and teacher resources.

The Bayou Preservation Association and Galveston Bay Foundation routinely conduct public education programs throughout the Galveston Bay area.

6. DRAFT ACTION PLAN (CRS ACTIVITY 511.8)

The City of Baytown Flood Mitigation Plan is maintained by the Building Inspection Division. The Chief Building Official is responsible for retaining copies of the plan, coordinating review of the plan, and any future updates to the plan.

The City of Baytown Flood Mitigation Planning Committee discussed various mitigation activities that the community could undertake to increase preparedness levels. The actions identified below were determined to be the most appropriate actions given the current community resources and hazard vulnerabilities.

ACTION ITEM #1

Increase Awareness for the need to purchase Flood Insurance for properties located in the City of Baytown

The City of Baytown is subject to flooding from extreme coastal storms resulting from intense rainfall, storm surge from Galveston Bay, and overflows from Goose Creek. The City of Baytown is enrolled in the National Flood Insurance Program (NFIP) and flood insurance is available for all structures located in the City. FEMA has classified the City of Baytown as a Community Rating System (CRS) Class 7 Community and all flood insurance premiums for insured properties within the City are reduced based on the favorable CRS Rating. Flood insurance is a citizen's first line of defense to offset flood losses. The City of Baytown has instituted measures to make the City disaster resistant however the Flood Mitigation Planning Committee recommends that all structures and their contents located within the City be protected by flood insurance.

Based on NFIP reports there are 3,945 flood insurance policies in force within the City. Analyzing residential coverage only and based on an average of 2.7 persons per residence there are approximately 24,700 residential structures within the City and less than 16% are covered by flood insurance. The Flood Mitigation Planning Committee concurs with the recommendation in *Off the Charts – Tropical Storm Allison Public Report* published by the Harris County Flood Control District and FEMA that states, "Get flood insurance today and have a family flood preparedness plan".

The City of Baytown should continue to support public awareness efforts to inform citizens of the protection that can only be provided by purchasing flood insurance coverage for structures and their contents.

Responsibility:	City of Baytown Chief Building Official – to coordinate and host Flood Insurance Workshops NFIP Regional Office – to conduct Flood Insurance Workshops
Cost:	Staff time within existing budgets NFIP conducts workshops at no expense to local communities
Funding Sources:	FEMA (if required)

Timing: Annual NFIP workshops are proposed in the Galveston Bay area

Beneficiary: Homeowners
Lenders
Insurance Agents

ACTION ITEM #2
Harris County "All Hazards" Mitigation Plan Approval and Annual Plan Maintenance

Phase 1: Support the Houston Galveston Area Council (HGAC) planning efforts to receive approval from FEMA for the Harris County "All Hazards" Mitigation Plan to meet the requirements of the Disaster Mitigation Act of 2000 (DMA 2000).

Phase 2: Conduct annual reviews and updates of the Harris County "All Hazards" Mitigation Plan and coordinate with the Governor's Division of Emergency Management (TxDEM), Houston Galveston Area Council (HGAC), Harris County, the City of Houston, and other participating communities to meet the requirements of DMA 2000.

Phase 3: Incorporate the proposed mitigation actions developed for the City of Baytown Flood Mitigation Plan into the Harris County "All Hazards" Plan.

Responsibility: City of Baytown Office of Emergency Management
City of Baytown Chief Building Official

Cost: Staff time within existing budgets

Funding Sources: TWDB funding (75%) for FMA Projects
TxDEM funding (75%) for HMGP Projects
Funding from other sources (Harris County Commissioners Court)
City of Baytown staff time (operating funds);
Funding from other state and federal agencies

Timing: Phase 1 – Estimated Harris County Plan Approval is early 2005
Phase 2 - Annual Plan reviews 2005 through 2010
Phase 3 – Phase Action Items into All Hazard Plan during annual plan reviews

Beneficiary: All Citizens and property owners in the City of Baytown.

ACTION ITEM #3
Acquisition and Relocation of Repetitive Loss Properties

The City of Baytown's goal is to continue to reduce the number of Repetitive Loss Properties in the community by acquisition and relocation of floodprone properties.

Formal approval by FEMA of the Baytown Flood Mitigation plan will qualify the City to receive future Flood Mitigation Assistance (FMA) Program funding administered by the Texas Water Development Board. Approval by FEMA of the Harris County "All Hazards" Mitigation Plan will qualify the City of Baytown to receive Hazard Mitigation Grant Program (HMGP) funding administered by the Governor's Division of Emergency Management. The combination of FMA and HMGP funding will enable the City to utilize 75% Federal funding for projects involving design and construction of (small) flood protection measures; drainage improvements; and acquisition, elevation or relocation of repetitive loss and other floodprone properties.

Congress passed the Flood Insurance Reform Act of 2004 (Signed by President Bush June 30, 2004). The Flood Insurance Reform Act (FIRA) establishes a pilot program to mitigate the damages and costs associated with "Severe Repetitive Loss Properties". The regulations for the pilot program will not be finalized until December 31, 2004, six months after enactment of FIRA. The pilot program will target severe repetitive loss properties which are residential properties that have suffered four of more losses of $5,000 each or collectively losses at more than $20,000; or properties that had two or more claims that together exceed the value of the property. Based on FEMA's Non-Mitigated Repetitive Loss Property Summary dated June 30, 2004, there are 65 non-mitigated repetitive loss properties in the City of Baytown with a total of 166 losses with losses totaling $42,156,045 and an average loss of $12,988. Therefore, there will be repetitive loss properties located within the City that will be classified as severe repetitive loss properties and targeted for FEMA's pilot program.

It is a City of Baytown mitigation action goal to obtain funding from the Flood Mitigation Assistance (FMA) Program administrated by the Texas Water Development Board (TWDB); the Hazard Mitigation Grant Program (HMGP) administered by the Governor's Division of Emergency Management (TxDEM); FEMA's Flood Insurance Reform Act (FIRA) pilot program to mitigate severe repetitive loss properties, and/or other funding sources such as the Harris County Commissioners Court, to acquire repetitive loss properties considered to be highest priority by the City of Baytown.

A total of 65 "non-mitigated" Repetitive Loss Properties have been identified in the City of Baytown. This action item includes an evaluation and prioritization of these 65 properties by coordinating with property owners that volunteer to participate and to take action to acquire these properties when funding becomes available.

Responsibility: City of Baytown Chief Building Official

Estimated Cost: Option 1 – Utilize HMGP and FMA Program funding for acquisition and relocation of 65 Repetitive Loss Properties:
65 Repetitive Loss Properties with an estimated value of $150,000 per property (average) requires a total of $9,750,000. The Federal portion for HMGP and FMA Program funding is 75% ($7,312,500) and the local or other share is 25% ($2,437,500).

Option 2 – Utilize Flood Insurance Reform Act 2004 (FIRA 2004) funding for acquisition and relocation of 65 Repetitive Loss Properties:

The cost share for "Severe Repetitive Loss" properties acquired using Flood Insurance Reform Act 2004 (FIRA 2004) funding may be revised to 90% Federal share and 10% Local share provided the State of Texas Mitigation Plan is approved as an "Enhanced Plan". Assuming all 65 properties were designated "Severe Repetitive Loss" properties, the Federal portion for acquisition utilizing FIRA 2004 funding is 90% ($8,775,000) and the local or other share is 10% ($975,000).

Demolition cost estimated for 65 properties is estimated as $1,300,000

Funding Sources: Flood Mitigation Assistance (FMA) Program
Hazard Mitigation Grant Program (HMGP) – Post Disaster
Hazard Mitigation Grant Program - Pre Disaster Mitigation (PDM)
FEMA Flood Insurance Reform Act (FIRA) Pilot Program funding
FEMA/DHS – Disaster Response funding
NFIP Increased Cost of Compliance funds for elevation or demolition of structures ($20,000 per structure maximum is available)
Harris County Commissioners Court (as was the case following Tropical Storm Allison in 2001)
City of Baytown
Matching funds from homeowners that request buyouts

Timing: 2005 – Funding for Severe Repetitive Loss Properties funded by FIRA
2006 Buyout Project - Volunteer buyouts funded by FMA and HMGP
2007 Buyout Project - Volunteer buyouts funded by FMA and HMGP
2008 Buyout Project - Volunteer buyouts funded by FMA and HMGP

Beneficiary: Participating homeowners

ACTION ITEM #4
Improve CRS Rating

Coordinate with FEMA and their contractor, ISO, to conduct an annual review of the City of Baytown's CRS Activities. Submit CRS reports and applications to FEMA and the Insurance Services Office (ISO) to update the City of Baytown CRS classification from a Class seven (7) to a Class Five (5). Upon completion and approval of the Harris County All Hazards Mitigation Plan and the City of Baytown Flood Mitigation Plan, the City of Baytown can apply for additional CRS program credits that will improve their CRS classification. A Class 5 rating would result in an annual premium reductions up to twenty-five percent (25%) for all flood insurance policies on structures located in Special Flood Hazard Areas.

Responsibility: City of Baytown Building Inspection Department

Budget: Staff time within existing budgets

Funding Sources: No funding needed

Timing: 2005 Submit updated CRS Application
October 2005 - upgrade to CRS Class 6
October 2006 – upgrade to CRS Class 5
2007 – Annual review and upgrade if possible
2008 - Annual review and upgrade if possible
2009 - Annual review and upgrade if possible

Beneficiary: All policy holders in the City of Baytown

ACTION ITEM #5
Elevation Reference Marks

Coordinate with Harris County Flood Control District (HCFCD) to establish a city-wide Elevation Reference Mark (ERM) grid so that all areas within the City of Baytown have an updated (adjusted for subsidence) elevation reference mark located nearby. Obtain technical information regarding ERMs that have been evaluated, releveled and/or replaced based on NAVD 1988 as part of the Tropical Storm Allison Flood Recovery Project (TSARP). Utilize these updated ERMs for issuing permits for new construction within the City.

In 2004, the City of Baytown utilizing GPS established 30 new elevation bench marks throughout the City consisting of brass disks set in concrete monuments. This action item consists of evaluating the new Harris County DFIRMs to identify areas where additional reference marks are needed. Assuming 30 additional reference marks will be needed, the total cost is estimated to be $60,000 based on $2,000 cost per new reference mark.

Responsibility: City of Baytown Public Works Department

Cost: $60,000 ($2,000 per new reference mark)

Funding Sources: FEMA/DHS funding
City of Baytown Capital Improvement Program funding

Timing: 2005 Identify and establish needed ERM's
2006-2010 Establish new ERM's as needed

Beneficiary: All construction within the City

ACTION ITEM #6
Initiate the recommended action for Acquisition of the three (3) highest priority Storm Water Detention basins identified in the City of Baytown Master Drainage Plan

There are three (3) regional storm water detention basins identified in the City of Baytown Drainage Master Plan and recommended as highest priority for future Capital Improvement Projects (CIP) and discussed in a City Council workshop in November 1999 (see Plan Section 5.8 - Capital Improvement Plan). These three (3) recommended regional storm water basins are Cedar Bayou Basin Q8, Goose Creek Basin #7, and Spring Gully Basin #3 or #4. The Drainage

Master Plan also includes a recommendation that the City of Baytown select one of the following three options for design, construction and financing of the three proposed storm water detention basins:

1.	Advance purchase and build regional detention facilities and recap fees from development using impact fees, or	$13,757,000
2.	Advance purchase land for regional detention facilities for future construction, or	$1,248,000
3.	Collect impact fees then build regional detention when sufficient monies are available with some increased risk of flooding until detention is built.	$13,757,000

The City Council has designated funding for acquisition of storm water detention sites and the Department of Public Works has identified and evaluated possible sites. Coordination with Harris County Flood Control District is ongoing to incorporate future regional storm water detention facilities into the overall Harris County Drainage Master Plan. There is a possibility that future regional detention facilities can become HCFCD projects or joint City of Baytown/HCFCD projects.

The City of Baytown Flood Mitigation Planning Committee recommends action on Drainage Master Plan Option #2, "Advance purchase of land for regional detention facilities". The City of Baytown Flood Mitigation Plan Action Items #7, #8 and #9, outlined below, address design and construction, over an estimated 20 year period, of future regional detention facilities in the three major watersheds.

Responsibility:	City of Baytown Public Works Department Harris County Flood Control District (HCFCD) Texas Parks and Wildlife Department (TPWD) U.S. Army Corps of Engineers/Galveston District (USACE)
Cost:	$1,248,000 advance purchase of regional detention facility sites
Funding Sources:	City of Baytown 2001 Bond Revenues City of Baytown Capital Improvement Program (CIP) funding Harris County Flood Control District Texas Parks and Wildlife Department (wildlife and wetland enhancement) TWDB – Flood Mitigation Assistance Program (Projects to protect repetitive Loss Properties) Land and Water Conservation Fund (LWCF) for acquisition of and development of State and local park and recreation areas adjacent to and dependent on Regional Stormwater Detention Facilities
Timing:	2005 Set aside funds to continue site evaluation and acquisition 2006 Coordination with HCFCD, TPWD and USACE to address funding for design and construction, environmental and engineering issues related

to stormwater detention, wildlife habitat preservation, and wetland enhancement
2007 Begin negotiation with property owners for selected sites
2008 Initiate acquisition of site for 1st regional detention basin
2009 Coordination with HCFCD and TPWD for design

Beneficiary: Property owners in Cedar Bayou, Goose Creek and Spring Gully watersheds

ACTION ITEM #7
Cedar Bayou Regional Storm Water Detention Facilities and Channel Improvements

The City of Baytown Master Drainage Plan completed in February 2002 identifies sixteen (16) regional storm water detention facilities needed throughout the 214 square mile Cedar Bayou Watershed for ultimate development of the watershed. To address immediate needs, eight of the sixteen regional storm water detention facilities are recommended for design and construction. The estimated total cost for the eight regional storm water detention facilities and supporting channel improvements is $147,942,000. An estimated Impact Fee of $8,250 per acre of development would be required to offset the cost of the recommended drainage improvements. The City of Baytown Department of Public Works will coordinate with HCFCD for the design and construction of needed drainage improvements and Harris County Commissioners Court action may be required to establish Impact Fees to finance design and construction should the proposed projects become HCFCD projects. The City should coordinate with the Texas Parks and Wildlife Department (TPWD) and US Army Corps of Engineers (USACE) to address environmental and engineering issues related to wildlife habitat preservation and wetland enhancement and incorporate environmental enhancements into the design and construction of channel improvements and stormwater detention facilities. The City will seek TPWD funding to design and construct environmental enhancements.

Responsibility: City of Baytown Public Works Department
Harris County Flood Control District

Cost: $147,942,000 estimated total cost (Drainage Master Plan, 2002)

Funding Sources: Impact Fee ($8,250 per acre estimated in Drainage Master Plan
HCFCD (Possibility of joint projects)
FEMA Disaster Recovery funding (future disasters)
HMGP- Funding from FEMA/TxDEM
Texas Parks and Wildlife Department (wildlife and wetland enhancement)
TWDB – Flood Mitigation Assistance Program (Projects to protect repetitive Loss Properties)
Land and Water Conservation Fund (LWCF) for acquisition of and development of State and local park and recreation areas adjacent to and dependent on Regional Stormwater Detention Facilities

Timing: Design and construction phased over 20 year period

Beneficiary: Property owners in Cedar Bayou Watershed

ACTION ITEM #8
Goose Creek Regional Storm Water Detention Facilities and Channel Improvements

The City of Baytown Master Drainage Plan completed in February 2002 identifies eleven (11) regional storm water detention facilities needed throughout the 28 square mile Goose Creek Watershed for ultimate development of the watershed. To address immediate needs, seven of the eleven regional storm water detention facilities are recommended for design and construction. The estimated total cost for the seven regional storm water detention facilities and supporting channel improvements is $68,366,000. An estimated Impact Fee of $15,250 per acre of development would be required to offset the cost of the recommended drainage improvements The City of Baytown Department of Public Works will coordinate with HCFCD for the design and construction of needed drainage improvements and Harris County Commissioners Court action may be required to establish Impact Fees to finance design and construction should the proposed projects become HCFCD projects. The City should coordinate with the Texas Parks and Wildlife Department (TPWD) and US Army Corps of Engineers (USACE) to address environmental and engineering issues related to wildlife habitat preservation and wetland enhancement and incorporate environmental enhancements into the design and construction of channel improvements and stormwater detention facilities. The City will seek TPWD funding to design and construct environmental enhancements.

Responsibility: City of Baytown Public Works Department
Harris County Flood Control District

Cost: $68,366,000 estimated total cost (Drainage Master Plan, 2002)

Funding Sources: Impact Fee ($15,250 per acre estimated in Drainage Master Plan
HCFCD (Possibility of joint projects)
FEMA Disaster Recovery funding (future disasters)
HMGP- Funding from FEMA/TxDEM
Texas Parks and Wildlife Department (Wildlife and wetland enhancement)
TWDB – Flood Mitigation Assistance Program (Projects to protect repetitive Loss Properties)
Land and Water Conservation Fund (LWCF) for acquisition of and development of State and local park and recreation areas adjacent to and dependent on Regional Stormwater Detention Facilities

Timing: Design and construction phased over 20 year period

Beneficiary: Property owners in Goose Creek Watershed

ACTION ITEM #9
Spring Gully Regional Storm Water Detention Facilities and Channel Improvements

The City of Baytown Master Drainage Plan completed in February 2002 identifies four (4) regional storm water detention facilities needed throughout the 5 square mile Spring Gully Watershed for ultimate development of the watershed. To address immediate needs, two of the four regional storm water detention facilities are recommended for design and construction. The estimated total cost for the two regional storm water detention facilities and supporting channel improvements is $8,774,000. An estimated Impact Fee of $16,850 per acre of development would be required to offset the cost of the recommended drainage improvements. The City of Baytown Department of Public Works will coordinate with HCFCD for the design and construction of needed drainage improvements and Harris County Commissioners Court action may be required to establish Impact Fees to finance design and construction should the proposed projects become HCFCD projects. The City should coordinate with the Texas Parks and Wildlife Department (TPWD) and US Army Corps of Engineers (USACE) to address environmental and engineering issues related to wildlife habitat preservation and wetland enhancement and incorporate environmental enhancements into the design and construction of channel improvements and stormwater detention facilities. The City will seek TPWD funding to design and construct environmental enhancements.

Responsibility:	City of Baytown Public Works Department Harris County Flood Control District
Cost:	$8,774,000 estimated total cost (Drainage Master Plan, 2002)
Funding Sources:	Impact Fee ($16,850 per acre estimated in Drainage Master Plan HCFCD (Possibility of joint projects) FEMA Disaster Recovery funding (future disasters) HMGP- Funding from FEMA/TxDEM Texas Parks and Wildlife Department (Wildlife and wetland enhancement) TWDB – Flood Mitigation Assistance Program (Projects to protect repetitive Loss Properties) Land and Water Conservation Fund (LWCF) for acquisition of and development of State and local park and recreation areas adjacent to and dependent on Regional Stormwater Detention Facilities
Timing:	Design and construction phased over 20 year period
Beneficiary:	Property owners in Spring Gully Watershed

7. ADOPT THE PLAN (CRS ACTIVITY 511.9)

In accordance with CRS requirements, the City of Baytown Flood Mitigation Plan must be an official plan of the community and not an internal staff proposal. As such, the City Council must formally adopt the plan and later amendments to the plan in order to receive CRS credits for planning efforts.

Ordinance No. 9997 adopted by the City of Baytown City Council on February 10, 2005, formally adopted the City of Baytown Flood Mitigation Plan. A copy of Ordinance No. 9997 is attached to this Plan.

8. IMPLEMENTATION, EVALUATION AND REVISION OF PLAN (CRS ACTIVITY 511.10)

8.1 PROCEDURES FOR IMPLEMENTING, EVALUATING AND REVISING THE PLAN

The City of Baytown Flood Mitigation Planning Committee will monitor implementation of the Plan and conduct periodic and annual reviews to evaluate the effectiveness of the Plan as scheduled in CRS Section 511.2 and 511.3. Following formal City Council adoption of the plan, the City of Baytown Flood Mitigation Plan will be implemented as outlined in previous sections.

The Chief Building Official and Flood Mitigation Planning Committee Planner-in-Charge, Kevin Byal, CFM, will be responsible for ensuring the Flood Mitigation Plan is reviewed in a timely manner. Other Flood Mitigation Planning Committee members will provide assistance and expertise for plan review when requested by the Planner-in-Charge.

8.2 IMPLEMENTATION, EVALUATION AND REVISION OF THE PLAN (CRS ACTIVITY 511.10)

Upon completion of Annual Plan Reviews, the Committee will prepare a Plan Review Report to result in a revision to the Plan based on input from the public, other agencies, and City Staff. The City of Baytown Flood Mitigation Plan will be resubmitted to the City Council for approval only as required by FEMA to meet CRS Requirements.

Following the recommendations of the City of Baytown Flood Mitigation Planning Committee, the City of Baytown City Council adopted Ordinance No. 9997 on February 10, 2005, adopting the Flood Mitigation Plan.

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Kevin J. Byal, CFM
Chief Building Official
Mitigation Planning Committee Planner-in-Charge