

**Fort Bend County**

**LID**

Fort Bend County

Levee Improvement District No. 7

Hazard Mitigation Plan Update 2023

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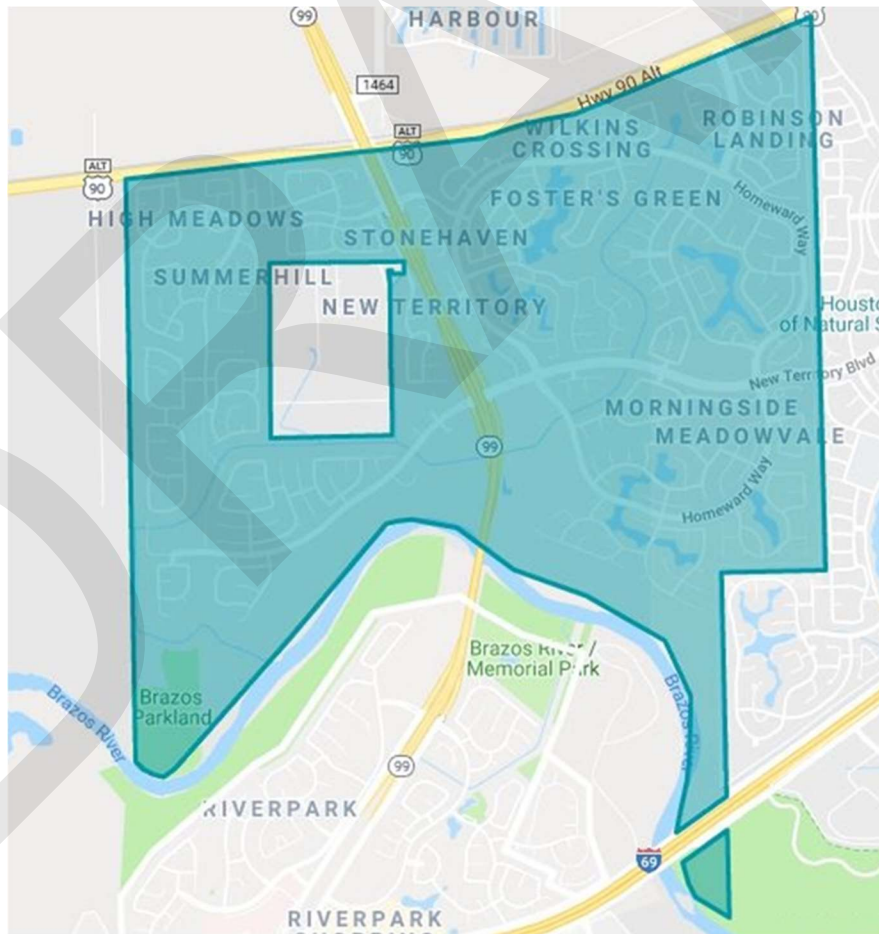
## List of Acronyms

BFE	Base Flood Elevation
CFR	Code of Federal Regulations
FBCLID	Fort Bend County Levee Improvement District
FBCMUD	Fort Bend County Municipal Utility District
FEMA	Federal Emergency Management Agency
DFIRM	Digital Flood Insurance Rate Map
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
HMP	Hazard Mitigation Plan
LID	Levee Improvement District
MPC	Mitigation Planning Committee
mph	Miles per Hour
NCEI	National Centers for Environmental Information
NFIA	National Flood Insurance Act
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
RL	Repetitive Loss
TDEM	Texas Division of Emergency Management
TWDB	Texas Water Development Board
USGS	U.S. Geological Survey

## Executive Summary

The Fort Bend County Levee Improvement District No. 7 (“the District”) undertook development of this update to its Hazard Mitigation Plan (Plan) because of the increasing awareness that natural hazards, especially flood hazards and the potential for levee failure, may affect people and property in the area. The District was created under the provisions of Article XVI, Section 59 of the Texas Constitution, and operates pursuant to Chapters 49 and 57 of the Texas Water Code, as amended, and Chapter 7808 of the Texas Special District Local Laws Code. The District was created to construct certain levee and drainage improvements to provide protection to the land and improvements of residential and commercial property owners in the New Territory subdivision, which is part of the City of Sugar Land, from flooding from the Brazos River.

The existing Hazard Mitigation Plan was reviewed and revised to expand upon District vulnerabilities to hazards and outline mitigation actions that help to reduce or avoid the impacts of hazards. Approval of the Plan Update will keep the District eligible for federal mitigation grant program funds administered by the State of Texas Division of Emergency Management (TDEM) and the Texas Water Development Board (TWDB). In this Plan Update, the Mitigation Planning Committee (MPC) re-assessed hazard vulnerabilities, reviewed the status of mitigation actions proposed in its original Hazard Mitigation Plan from 2018, and looked at what future mitigation actions need to be taken based on the vulnerabilities of the District and the residents within the boundary of the District. **Figure 1** shows the planning area for this Hazard Mitigation Plan.



**Figure 1 – Hazard Mitigation Study Area, Fort Bend County Levee Improvement District No. 7**

The District is susceptible to a range of hazards inherent to southeast Texas; however, the hazards considered in this Plan are limited to those impacting the District's ability to fulfil its purpose. According to the petition for its creation, the District was organized for the following purposes:

- 1) To construct and maintain levees and other improvements on, along, and contiguous to rivers, creeks, and streams within and adjacent to the District;
- 2) To reclaim land within the District from overflow from these streams;
- 3) To control and distribute the waters of rivers and streams within and adjacent to the District by straightening and otherwise improving them; and
- 4) To provide for the proper drainage and other improvement of the reclaimed land within the District.

Authority for the preparation of the Hazard Mitigation Plan is derived from Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), as amended; The National Flood Insurance Act of 1968 (NFIA), as amended; and Title 44 Code of Federal Regulations Section 201.6 (44 CFR 201.6).

# 1 The Planning Process

## 1.1 Introduction

The District's 2023 Hazard Mitigation Plan Update (Plan) builds on the District's original Hazard Mitigation Plan, developed and approved in 2018. The District undertook development of its original Hazard Mitigation Plan due to increasing awareness that natural hazards, especially flood hazards and the potential for a levee failure, may affect people and property in the area. The original plan identified District vulnerabilities to hazards and outlined mitigation actions that help to reduce or avoid the impacts of hazards. Approval of the Plan made the District eligible for federal mitigation grant program funds administered by the State of Texas Division of Emergency Management (TDEM) and the Texas Water Development Board (TWDB).

In this Plan Update, the Mitigation Planning Committee re-assessed hazard vulnerabilities, reviewed the status of mitigation actions proposed in its original Hazard Mitigation Plan from 2018, and looked at what future mitigation actions need to be taken based on the vulnerabilities of the District and the residents within the boundary of the District.

## 1.2 Authority & Current Capabilities

The District is a special purpose district of the State of Texas created under the provisions of Article XVI, Section 59, of the Texas Constitution, and operating pursuant to Chapters 49 and 57 of the Texas Water Code, as amended, and Chapter 7808 of the Texas Special District Local Laws Code.

The District was created to construct certain levee and drainage improvements to provide protection to the land and improvements of residential and commercial property owners in the New Territory subdivision, which is part of the City of Sugar Land, from flooding from the Brazos River. According to the petition for its creation, the District was organized for the following specific purposes:

- 1) To construct and maintain levees and other improvements on, along, and contiguous to rivers, creeks, and streams within and adjacent to the District;
- 2) To reclaim land within the District from overflow from these streams;
- 3) To control and distribute the waters of rivers and streams within and adjacent to the District by straightening and otherwise improving them; and
- 4) To provide for the proper drainage and other improvement of the reclaimed land within the District.

The District is governed by a five-member Board of Directors. Board members participated in the Hazard Mitigation Planning process. The Board holds a regular meeting once a month to manage and conduct the business and affairs of the District, and these meetings are open to the public pursuant to the Open Meetings Act, Chapter 551, Texas Government Code.

As is typical for smaller governmental agencies, the District contracts with consultants such as attorneys, engineers, auditors, bookkeepers, tax assessor-collectors, operators, and financial advisors. These consultants provide services, advice, and reports to assist the Board in managing the District.

The District, which encompasses the New Territory subdivision, operates and maintains approximately 3.75 miles of levees and other drainage facilities that include:

- Ellis Creek, an internal drainage channel that collects and conveys storm water runoff;
- Outfall structures where internal storm water drainage is discharged outside of the levee and into the Brazos River via an external drainage channel that is also operated and maintained by the District;

- One pump station (electric facility that pumps stormwater within the levee to the outside of the levee and into the external drainage channel during a combined river/rainfall flood event);
- Flap gates (gates preventing river water from entering New Territory); and
- Nine detention/retention ponds (artificial lakes that include a permanent pool of water and space to detain excess water).

The District also has the power (pursuant to a separate statute) to construct, maintain and operate a reclaimed water system, which is currently under construction, for purposes of providing a non-potable water source to the New Territory Residential Community Association, Inc. for irrigation of the common areas and make-up water to the lakes within New Territory.

In order to improve capabilities, the District actively participates in regional emergency planning exercises with adjacent cities, special districts, and County staff. Communication to residents occurs through many forms, including a District specific website which was launched in 2018. Furthermore, the District maintains and regularly updates its Emergency Action Plan (EAP), which establishes procedures and processes for the District to employ during a severe flood event. To address significant maintenance or upgrade needs, the District also administers a capital improvement program.

Authority for the preparation and updating of the Hazard Mitigation Plan is derived from Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), as amended; The National Flood Insurance Act of 1968 (NFIA), as amended; and Title 44 *Code of Federal Regulations* Section 201.6 (44 CFR 201.6). These require State and local governments to develop, formally adopt, and regularly update Hazard Mitigation Plans in order to be eligible for certain disaster mitigation grant funding sources.

It should be noted that, due to the District’s limited authority, the District is not a participant in the National Flood Insurance Program (NFIP). The land within the District’s levees is either within Fort Bend County or the City of Sugar Land; both entities are participants in the NFIP. The City of Sugar Land is the Floodplain Administrator for the area within the District boundaries.

### 1.3 The Mitigation Planning Committee

The Mitigation Planning Committee (MPC) was established to direct the Hazard Mitigation Plan Update. The MPC members are identified in **Table 1**. After reviewing the existing Plan, including re-assessing hazards and determining the status of the previously included mitigation actions, the MPC oversaw the development of the plan update, incorporated public involvement and input, and scheduled all meetings. The MPC determined that in addition to the small committee that would steer the planning process, a larger group of interested and potentially effected individuals called “Stakeholders” would be included in the planning process to discuss the planning process, submit proposed mitigation actions, review drafts and provide comments at critical points in the development of the Plan. Once the Plan was drafted, the MPC reviewed the contents with the District Board of Directors for their comment and approval.

**Table 1 – Mitigation Planning Committee**

Team Member	Job Title	Organization
Nathan Bedee	Director	FBCLID7
Jim Grotte	Director	FBCLID7
Phil Martin	Project Manager for the District	Mike Stone Associates, Inc.
Kane Mudd	Engineer for the District	LJA Engineering, Inc.
Chris Skinner	Attorney for the District	Schwartz, Page & Harding, L.L.P



Team Member	Job Title	Organization
Matthew Reed	Attorney for the District	Schwartz, Page & Harding, L.L.P
Michael Willet	Communications for the District	Touchstone District Services
Jeff Perry	Operator for the District	Levee Management Services, LLC
Tyson Duncan	LID7 BRECP EOR	AECOM
Ed Panuska	Mitigation Planning Consultant	AECOM

A Stakeholder Meeting was held on April 24, 2023 through an online webinar to introduce the District’s planning process and request Stakeholder involvement and input. Stakeholders were also invited to the public meeting and were requested to provide feedback through email or by telephoning the District. The Stakeholder group invited to participate included the individuals and entities listed in **Table 2**. See **Appendix B** for invitations and presentations from the Stakeholder Involvement process.

**Table 2 – Stakeholders**

Member	Title	Organization
Michael Walker	Executive Director	New Territory Residential Community Association
Robert Wilson	Senior Drainage Engineer	City of Sugar Land
Robert Valenzuela	Assistant City Manager	City of Sugar Land
Mark Poland	Chief of Police	City of Sugar Land Police Department
Gabe Lavine	Administrator	City of Sugar Land Office of Emergency Management
Greg Babst	Emergency Management Coordinator	Fort Bend County Emergency Operations
Rodney Grimmer	Senior Planning Coordinator	Fort Bend County Emergency Operations
Stacy Slawinski	County Engineer	Fort Bend County
Jeff Janecek	Assistant Chief Engineer	Fort Bend County Drainage District
Mike Stone	General Manager and Chief Operating Officer	Fort Bend County Toll Road Authority
Craig Kalkomey	Engineer for FBCLID2	LJA Engineering, Inc.
Jason Kelly	Engineer for FBCLID17	LJA Engineering, Inc.
Michael Rusk	Engineer for FBCLID11	LJA Engineering, Inc.
Michael Rusk	Engineer for FBCLID10	LJA Engineering, Inc.
Wallace Trochesset	Engineer for FBCMUD 121	LJA Engineering, Inc.
Dave Scott	Presiding Officer	Brazos River Authority
David Collinsworth	General Manager	Brazos River Authority

## 1.4 Public Involvement

Consistent with District's standard objective to inform and involve citizens, and to fulfill the public involvement requirements of the mitigation planning programs, the District solicited input, notified, and invited residents to participate in the mitigation planning process. Regular and special session board meetings, which are open to and well attended by members of the public, are typically held twice a month.

In particular, the development and review of the Plan was on the officially published agenda and was discussed in detail at Board meetings on March 2, 2023, April 6, 2023, April 18, 2023, and May 4, 2023. See **Appendix B** for details of these meetings.

The public had an opportunity to review the draft Plan when the document was posted on the District's website at <http://www.fbclid7.com/>. Prior to placing the document online, at the May 4, 2023 Board Meeting the District announced that the draft Plan would be available for review and comments would be taken at the May 16, 2023 Public Board Meeting, and that this meeting was open to the public and all stakeholders. See **Appendix B** for the May 16<sup>th</sup> meeting agenda.

Prior to the Public Meeting, a press release was prepared informing the public about the Hazard Mitigation Planning process and urging the public to be involved. It also provided the time, date, and location of the Public Meeting. The notice was published on the District Website, in addition to the official published agenda for the Board Meeting. The press release and website post advertising the Public Meeting are included in **Appendix B** of this Plan.

On May 16, 2023 the Public Meeting was held to consider comments on the draft Plan and to solicit additional public input. At the meeting, the District provided comment forms for any members of the public to formally submit a comment. The attendee list and sign-in sheet from the Public Meeting are included in **Appendix B** of this Plan.

All input received was reviewed and considered for incorporation into this Plan.

## 1.5 Review and Incorporation of Existing Plans, Studies, Reports, and Technical Information

Other planning documents can be used as a valuable resource for integrating information related to hazard mitigation into the District's Plan. As part of the development of the Plan, other plans, studies, and reports that are applicable to the natural hazards discussed in the Plan were reviewed and incorporated where applicable.

The specific plans, studies and reports used for informational purposes along with a discussion on how they were incorporated into the Plan, are listed below.

- **Fort Bend County Levee Improvement District (FBCLID) No. 7 Emergency Action Plan (adopted in August 2017)**. This plan was used to understand the procedures and field operations that are to be undertaken by the District during events outside of normal operational parameters.
- **Fort Bend County Hazard Mitigation Plan (HMP) Update (2018)**. The plan was used as a reference for hazards as they pertain to the District's jurisdictional area. The Mitigation Action worksheet used in the Fort Bend County HMP was used for Mitigation actions in the District's Plan so that all projects have the same format.
- **City of Sugar Land Hazard Mitigation Plan Update (2020)**. The plan was used as a reference for hazards as they pertain to the District's jurisdictional area, and to identify key Stakeholders.
- **Fort Bend County Flood Insurance Rate Map (FIRM - 2014)**. The Flood Insurance Rate Maps (FIRMs) prepared by the Federal Emergency Management Agency (FEMA) offer the best overview of flood risks.

FIRMs are used to regulate new development and to control the substantial improvement and repair of substantially damaged buildings. Fort Bend County FIRMs were reviewed and included in the Plan to develop a floodplain map identifying the 100-year floodplain.

- **Fort Bend County Flood Insurance Study (FIS, 1997).** The most recent FIS revised study is dated June 5, 1997. These studies were reviewed as part of the draft Plan. Information describing the flood hazards was added to **Section 2**.
- **State of Texas Hazard Mitigation Plan Update (2018).** The State HMP update was reviewed and considered while developing this Plan. The mitigation strategies and mitigation goals are referenced in **Section 3.2** of this Plan.

## 1.6 Plan Adoption and Continued Public Involvement

Upon adoption of this Plan Update, the public will be notified of any substantial changes to the document between 2023 and the next scheduled Plan update in 2028. Any changes proposed by the MPC considered significant will be distributed to the Stakeholders. The Stakeholders will be encouraged to review the changes and provide comments on any proposed plan revisions.

The District will involve the public in the plan maintenance process and during the next Plan update in 2028, using the same methods as the plan development. The public will be notified when the revision process is started and will be provided the opportunity to review and comment on changes to the Plan and prioritize action items. It is expected that a combination of informational public meetings, draft documents posted on the website, and public Board of Director meetings will be undertaken.

The District's Hazard Mitigation Plan will be posted on the District's website and notices of its availability will be distributed to the Federal and State agencies, Fort Bend County, all identified stakeholders, as well as in a public notice.

## 1.7 Plan Monitoring, Evaluating and Updating

The MPC determined that monitoring and evaluation of the hazard mitigation process, and the Plan specifically, would be best accomplished with annual meetings. Upon adoption in 2018, the MPC will meet on an annual basis to discuss varying aspects of the hazard mitigation process, including assessing progress to date, reviewing the process for updating the Plan, the need for continued public involvement, risk assessment evaluation, and review of mitigation actions to determine if any significant changes are warranted. This will occur during a regular or special session of the Board of Directors and include the general public and any interested stakeholders. In addition, the Chairman may convene a separate meeting of the appropriate District, City of Sugar Land, and County departments to discuss and determine progress, and to identify obstacles to progress, if any, related to the hazard mitigation process. Upon recommendation of the Board of Directors, the District's mitigation planning consultant will implement necessary additional planning actions, and/or updates to the Plan.

In addition to annual meetings, as another way to ensure the plan stays current, the Chairman will convene meetings after damage-causing natural hazard events to review the effects of such events. Based on those effects, updates to the mitigation priorities listed in **Table 12** may be made or additional event-specific actions identified.

In summary, the District will initiate Plan reviews and updates based on the following:

1. The recommendation of the Chairman or on its own initiative, the District Board may initiate a Plan review at any time;
2. At approximately the 1-year anniversary of the Plan's adoption, and every year thereafter;

3. After natural hazard events that appear to significantly change the apparent risk to District assets, operations, and/or citizens;
4. When activities of the District, County, or the State significantly alter the potential effects of natural hazards on District assets, operations and/or citizens. Examples include completed mitigation projects that reduce risk, or actions or circumstances that increase risk; or
5. When new mitigation opportunities or sources of funding are identified.

In addition to the circumstances listed above, revisions that warrant changing the text of this Plan or incorporating new information may be prompted by a number of circumstances, including identification of specific new mitigation projects, completion of several mitigation actions, or requirements for qualifying for specific funding.

Major comprehensive review of the hazard mitigation planning process and revisions to this Hazard Mitigation Plan will be considered on a 5-year cycle. After being updated in 2023, the Plan will enter its next review cycle sometime in 2028. The MPC will be convened to conduct the comprehensive evaluation and revision. The MPC will also consider whether it is preferable to include the District as a participant in a regional Plan update (Fort Bend County or City of Sugar Land), instead of as a stand-alone Plan update.

## **1.8 Incorporating Mitigation Plan Requirements into Other Local Planning Mechanisms**

The District intends to integrate this Hazard Mitigation Plan into other local planning efforts through the following process and framework.

For activities associated with District infrastructure, the District will plan for these activities during their standard annual budgeting process and within their existing planning mechanisms, including the District Capital Improvement Plan and Emergency Action Plan. The District will also work with the stakeholders identified in this planning effort to make sure elements of this plan are incorporated in any other plans that are outside the jurisdiction of the district such as Capital Improvement Plans, Master Drainage plans, Emergency Action Plans, etc. The District will designate specific Board meetings to discuss this ongoing effort and invite the Stakeholders to attend and participate in the process of integrating this Plan into the existing planning mechanisms. This includes participation by the District in other regional efforts related to the Brazos River and floodplain mapping and flood mitigation in Fort Bend County.

## 2 Hazard Assessment

### 2.1 Overview of Risks

Natural hazards can cause damage and losses (including physical damage, indirect and economic losses, and injuries and deaths) when the hazard occurs or impacts people and property. Once hazards are identified, the level of risk exposure for people and property can be determined to show how “at risk” a planning area is. When the full range of possible natural hazards is reviewed, it becomes apparent that some events occur frequently and some are extremely rare. Some hazards impact large numbers of people to a limited degree, while others may cause significant damage to a small, localized area.

The National Oceanic and Atmospheric Administration’s (NOAA) and the National Centers for Environmental Information, (NCEI, formerly the National Climatic Data Center), collect and maintain certain hazard data in summary format, indicating injuries, deaths, and estimated damages. The data presented in this plan are for Fort Bend County, where the District is located, to demonstrate the potential for natural hazards in the District. According to a query of the NCEI database for “Fort Bend County, Texas”, 336 weather events were reported between January 1950 and April 2023 (the most recent search date available). Fort Bend County has experienced:

- 111 significant severe thunderstorms with high winds (four of which had greater than 60 knot winds),
- 1 hurricane and 4 tropical storms,
- 48 floods/flash floods,
- 1 strong wind event,
- 2 heavy rain events,
- 9 winter weather/wind chill/ice events,
- 69 hail events,
- 17 lightning events,
- 62 tornadoes and funnel clouds,
- 4 severe droughts, and
- 8 extreme heat waves.

The NCEI estimates that the damage from these events totals \$8.45 billion.

### 2.2 District Hazards

The District is susceptible to a range of hazards inherent to southeast Texas; however, for the reasons outlined below, the District has determined the most appropriate and useful approach to developing its Hazard Mitigation Plan is to eliminate certain hazards from the detailed risk assessment in the Plan. The three reasons for eliminating certain hazards are:

- 1) The eliminated hazards are not significant enough to warrant detailed vulnerability assessment and loss estimation;
- 2) The District’s mission and jurisdictional authority are explicitly limited to activities related to drainage and levees (although the organization does have the authority to complete actions to protect and mitigate damage to its own facilities); and

3) Assets and populations that are potentially exposed to hazards are part of an existing mitigation plan with actions to address hazards outlined in their HMPs. Fort Bend County and the City of Sugar Land have the authority and the responsibility to sponsor mitigation activities for their constituent populations and communities. The District will continue to coordinate with the County and City to ensure mitigation actions are developed and implemented, aiming to reduce or eliminate any opposition or redundancy between the jurisdictions.

The District’s specific assets considered in this Plan include: a reused water system, the levee along the west and south sides of the District, several channels (Ellis Creek, Ditch O), nine of the 12 lakes within the District, the storm water pump station and the external channel (including various flap gates and sluice gates). See **Figure 2** for the location of District assets. However, along with these fixed assets, the District also has responsibilities to provide proper drainage within the levee system as well as to maintain the levee’s ability to provide flood protection. This plan will consider the impact of hazards on the District’s ability to meet those responsibilities.



**Figure 2 – Location of District Assets**

The MPC evaluated the District’s risk exposure to natural hazards and the ability of the District to regulate and prepare for such events, as outlined in **Section 1.2**. Based on the District’s limited authority when it comes to managing hazards other than flood and the lack of occurrences and/or the limited effect that certain hazards have on the District’s assets, the following hazards have been eliminated from consideration and no mitigation action items are associated with them:

- Severe Winter Storms,
- Earthquake,
- Land Subsidence,
- Wildfire,
- Coastal Erosion,
- Pandemic,
- Hailstorms,
- Extreme Heat,
- Expansive Soils,
- Drought,
- Tornado,
- Thunderstorm Winds,
- Lightning.

The District hazards addressed as part of this plan are:

- Hurricanes and Tropical Storms,
- Flood, and
- Levee Failure

The MPC reviewed each hazard and assigned a probability of occurrence based on the experience of the MPC members and an understanding of the hazards, as outlined in the hazard profiles in **Sections 2.5** through **2.8**. The probability categories are shown in **Table 3**.

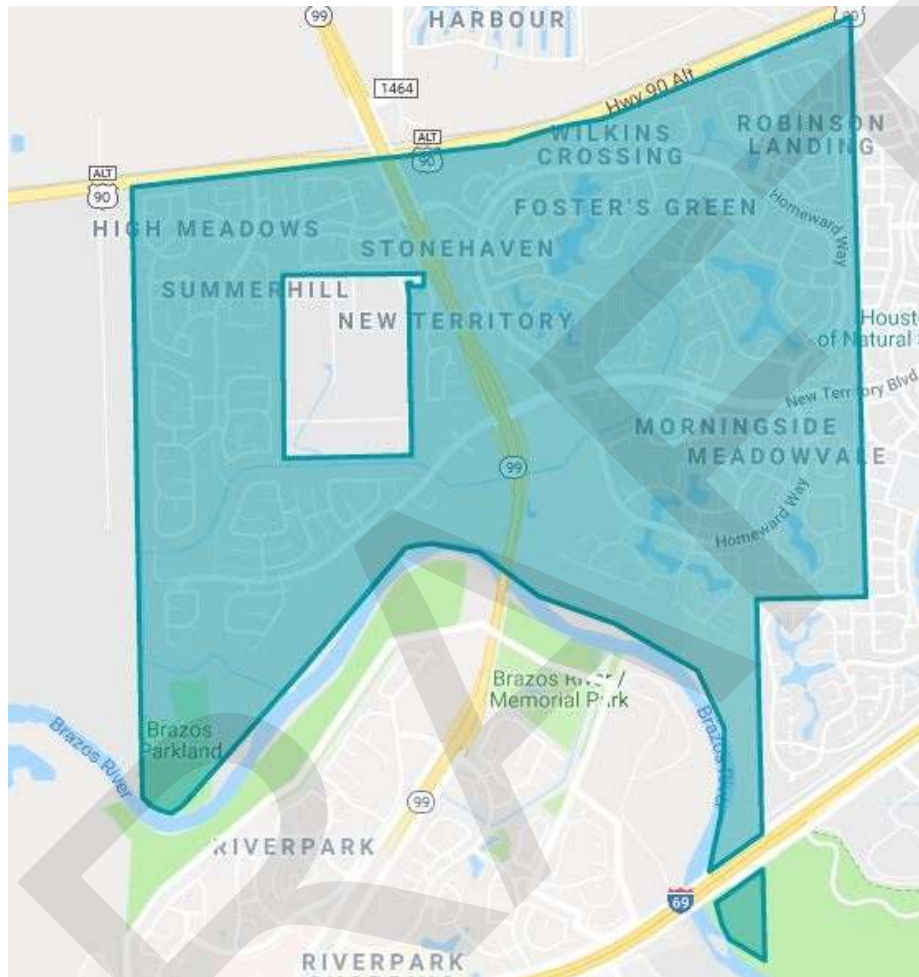
**Table 3 – Hazard Probability**

<p><b>Probability:</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> High: Event probable in next year.</li> <li><input type="checkbox"/> Medium: Event probable in next 5 years</li> <li><input type="checkbox"/> Low: Event possible in next 10 years.</li> </ul>
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### **2.3 Geography, Climate, and Population**

The District is located in southeast Texas within the boundaries of New Territory, a master-planned community and a Census Designated Place (CDP). The district consists of approximately 3.8 square miles which lies entirely within Fort Bend County. The City of Richmond is the Fort Bend County seat. The largest city in the county is the City of Sugar Land. In November 2016, the Sugar Land city council voted in favor of annexing

New Territory. The annexation was effective December 12, 2017. **Figure 3** is a map identifying the boundary area for the District.



**Figure 3 – Planning Area: Fort Bend County Levee Improvement District No. 7**

Fort Bend County is located in the Texas Coastal Plain and is relatively flat. Ground surface elevations (not including the levees) across the district have little variance, with the highest elevations reaching 87 feet above sea level. Annual average rainfall in the county is 51 inches. The District is bordered on the north by US 90A, to the south by the Brazos River.

According to the United States Census Bureau, the estimated 2016 population within New Territory CDP was 15,843 residents. This is a 4.3 percent increase from the 2010 census data, which was the last Census data available prior to New Territory’s annexation by the City of Sugar Land. **Table 4** summarizes the 2010 census population within the Plan area.



**Table 4 – 2010 Population of Plan Area**

Jurisdiction	2010 Population	Estimated Vulnerable or Sensitive Populations		2010 Population Density per square mile
		Elderly (Over 65)	Below Poverty Level	
New Territory (CDP)	15,186	457	683	3,996

**2.4 Past Disaster Declarations**

FEMA maintains records on Federally Declared Disasters, dating back to 1953. Data on Presidential Disaster Declarations characterize some natural disasters that have affected the area. In 1965, the Federal government began to maintain records of events determined to be significant enough to warrant declaration of a major disaster by the President of the United States. Presidential Disaster Declarations are made at the county level and are not specific to any one city or sub-area. Between 1983 and 2023 there were 19 disasters involving a severe storm, hurricane, or flooding declared in Fort Bend County; those disasters are listed in **Table 5**. The “Disaster Type” in **Table 5** is either EM (Emergency) or DR (Major Disaster).

**Table 5 – Declared Emergencies and Major Disasters in Fort Bend County**  
(Source: FEMA, Disaster Declaration Summary Database)

Disaster Number	Declaration Date	Disaster Type	Title	Incident Begin Date	Incident End Date	Declared County/ Area
4586	2/19/2021	DR	SEVERE WINTER STORMS	2/11/2021	2/21/2021	Fort Bend County
3554	2/14/2021	EM	SEVERE WINTER STORM	2/11/2021	2/21/2021	Fort Bend County
3540	8/24/2020	EM	TROPICAL STORMS MARCO AND LAURA	8/23/2020	8/27/2020	Fort Bend County
3530	7/26/2020	EM	HURRICANE HANNA	7/25/2020	7/31/2020	Fort Bend County
4485	3/25/2020	DR	COVID-19 PANDEMIC	1/20/2020		Fort Bend County
3458	3/13/2020	EM	COVID-19	1/20/2020		Fort Bend County
4332	8/25/2017	DR	HURRICANE HARVEY	8/23/2017	9/15/2017	Fort Bend County
4272	6/11/2016	DR	SEVERE STORMS AND FLOODING	5/22/2016	6/24/2016	Fort Bend County

Disaster Number	Declaration Date	Disaster Type	Title	Incident Begin Date	Incident End Date	Declared County/ Area
4269	4/25/2016	DR	SEVERE STORMS AND FLOODING	4/17/2016	4/30/2016	Fort Bend County
4223	5/29/2015	DR	SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS AND FLOODING	5/4/2015	6/22/2015	Fort Bend County
1791	9/13/2008	DR	HURRICANE IKE	9/7/2008	10/2/2008	Fort Bend County
3294	9/10/2008	EM	HURRICANE IKE	9/7/2008	9/26/2008	Fort Bend County
3290	8/29/2008	EM	HURRICANE GUSTAV	8/27/2008	9/7/2008	Fort Bend County
3277	8/18/2007	EM	HURRICANE DEAN	8/17/2007	9/5/2007	Fort Bend County
2639	5/26/2006	FM	LAKE OLYMPIA FIRE	5/26/2006		Fort Bend County
1624	1/11/2006	DR	EXTREME WILDFIRE THREAT	11/27/2005	5/14/2006	Fort Bend County
1606	9/24/2005	DR	HURRICANE RITA	9/23/2005	10/14/2005	Fort Bend County
3261	9/21/2005	EM	HURRICANE RITA	9/20/2005	10/14/2005	Fort Bend County
3216	9/2/2005	EM	HURRICANE KATRINA EVACUATION	8/29/2005	10/1/2005	Fort Bend County
1439	11/5/2002	DR	SEVERE STORMS, TORNADOES AND FLOODING	10/24/2002	11/15/2002	Fort Bend County
1379	6/9/2001	DR	TX-TROPICAL STORM ALLISON-06-06-2001	6/5/2001	6/20/2001	Fort Bend County

Disaster Number	Declaration Date	Disaster Type	Title	Incident Begin Date	Incident End Date	Declared County/ Area
3142	9/1/1999	EM	EXTREME FIRE HAZARDS	8/1/1999	12/10/1999	Fort Bend County
1257	10/21/1998	DR	TX-FLOODING 10/18/98	10/17/1998	11/15/1998	Fort Bend County
1239	8/26/1998	DR	TROPICAL STORM CHARLEY	8/22/1998	8/31/1998	Fort Bend County
1041	10/18/1994	DR	SEVERE THUNDERSTORMS AND FLOODING	10/14/1994	11/8/1994	Fort Bend County
930	12/26/1991	DR	SEVERE THUNDERSTORMS	12/20/1991	1/14/1992	Fort Bend County
689	8/19/1983	DR	HURRICANE ALICIA	8/18/1983	8/20/1983	Fort Bend County

## 2.5 Hurricanes and Tropical Storms

There are three types of tropical cyclones defined by NOAA: hurricanes, tropical storms, and tropical depressions. **Table 6** lists the criteria for each classification.

**Table 6 – Classification of Tropical Cyclones**

Stage of Development	Criteria
Tropical Depression (development)	Maximum sustained surface wind speed is < 39 mph
Tropical Storm	Maximum sustained wind speed ranges 39 - <74 mph
Hurricane	Maximum sustained surface wind speed 74 mph+
Tropical Depression (dissipation)	Decaying stages of a cyclone in which maximum sustained surface wind speed has dropped below 39 mph

### 2.5.1 Location of Hurricanes and Tropical Storms

The hazard of hurricanes and tropical storms is expected to affect the District uniformly. The District is on the Texas Gulf Coast; while it does not share a border with the Gulf, the southernmost part of the county is only 48 miles from the coastline. Past occurrences of hurricanes and tropical storms, including the list of previous hurricanes and tropical storms that have impacted the District are discussed in **Section 2.5.3**.

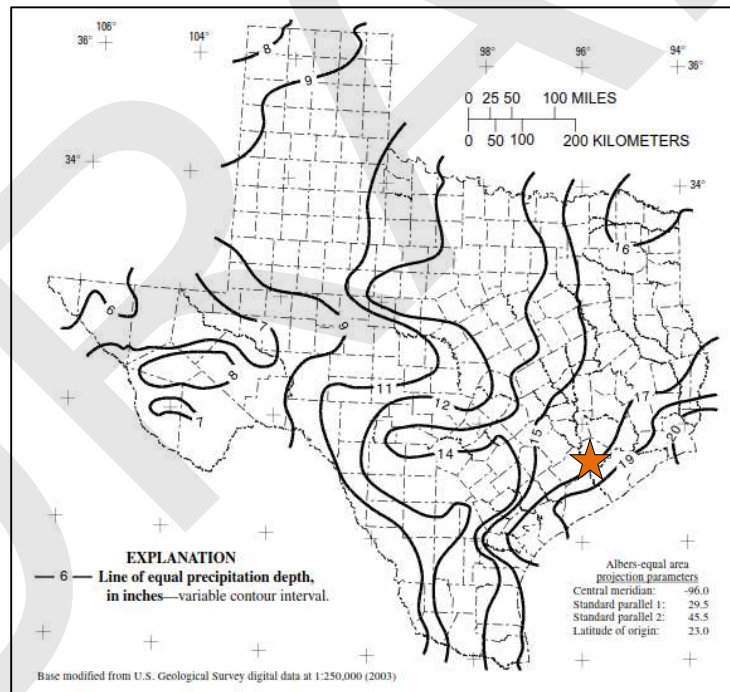
### 2.5.2 Extent of Hurricanes and Tropical Storms

Hurricanes are classified into five categories according to the Saffir-Simpson Hurricane Wind Scale, as shown in **Table 7**.

**Table 7 – Saffir/Simpson Hurricane Wind Scale**

Storm Category	Central Pressure	Sustained Winds	Storm Surge	Potential Damage
1	> 980 mbar	74 - 95 mph	4 – 5 feet	Minimal
2	965 – 979 mbar	96 - 110 mph	6 – 8 feet	Moderate
3	945 – 964 mbar	111 – 130 mph	9 – 12 feet	Extensive
4	920 – 944 mbar	131 – 155 mph	13 – 18 feet	Extreme
5	< 920 mbar	> 155 mph	> 18 feet	Catastrophic

Tropical storms and hurricanes are common in the planning area, and storms of any magnitude are very likely to occur in any given year. The District should anticipate and prepare for Category 5 and Category 4 hurricanes. Tropical storms tend to have longer durations, producing prolonged wet and saturated conditions, which can lead to flooding, and volumes of rain beyond the design capacity of drainage structures as was witnessed during Hurricane Harvey. **Figure 4** shows the precipitation predicted by the U.S. Geological Survey (USGS) for a 100-year storm (1% Annual Chance) with 7-day duration in Fort Bend County to be approximately 17-inches.



★ Approximate location of the District

**Figure 4 – Depth of Precipitation for 100-Year Storm for 7-Day Duration in Texas (Source: USGS Rainfall Atlas)**

### 2.5.3 Historical Hurricanes and Tropical Storms

Significant historical hurricane and tropical storm events that had a direct path through Fort Bend County are summarized in **Table 8**.

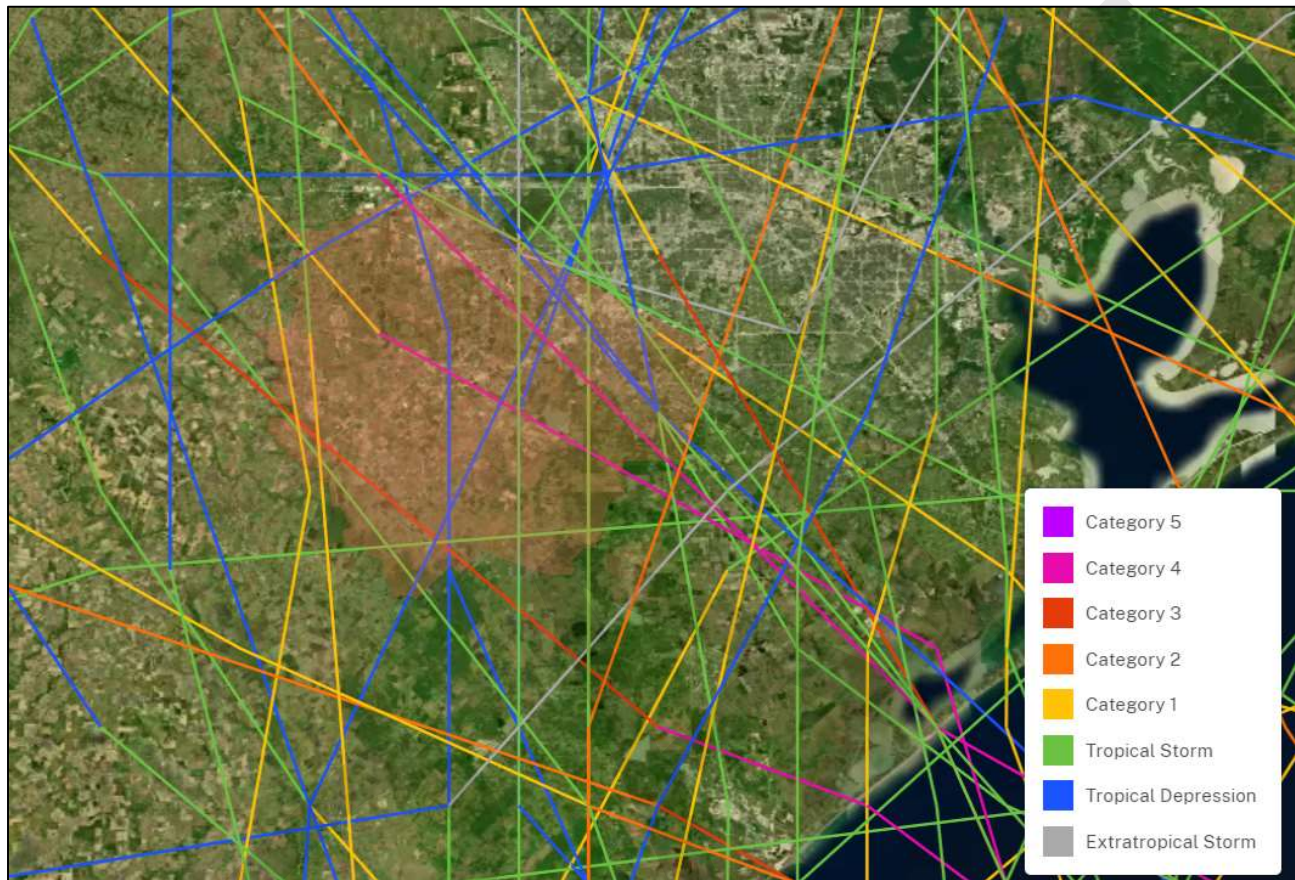
**Table 8 – Damage-Causing Historical Hurricane and Tropical Storm Events in Fort Bend County from 1998-2023**

Year	Storm Name	Category	FBC Property Damage
1998	Frances	Tropical Storm	\$100,000
2001	Allison	Tropical Storm	\$7,740,000
2002	Fey	Tropical Storm	\$4,500,000
2008	Ike	Category 2	\$400,000,000
2017	Harvey	Category 4	\$8,000,000,000
<b>Totals</b>			<b>\$8,412,340,000</b>

This information was extracted from the NCEI Storm Events Database, which summarizes “the occurrence of storms and other significant weather phenomena having sufficient intensity to cause loss of life, injuries, significant property damage, and/or disruption to commerce”. Other hurricanes and tropical storms have occurred in Fort Bend County but may not be listed in the database. Significant past events include:

- Hurricane Harvey, 2017.** This hurricane was a Category 4 storm with estimated sustained winds of 130-mph at landfall. Fifty inches of rain is the high-end estimated rainfall total from the National Hurricane Center as Harvey passed over Texas. Some parts of Texas received nine days of continuous rainfall. Harvey produced numerous tornadoes and severe flooding over portions of Fort Bend County. Total damages of this storm in Fort Bend County, as reported by the NCEI database, were \$8 billion.
- Hurricane Ike, 2008.** This hurricane made landfall on Galveston Island as a Category 2 hurricane with estimated sustained winds of 110 mph. An estimated 10-in to 20-in of rain fell across the southeast Texas region. At the time, Ike was the third-costliest of any Atlantic hurricane and resulted in \$37.5 billion in damages, with only hurricanes Sandy (2012) and Katrina (2005) estimated higher. There were pockets of damage from the storm in Fort Bend County, with eastern part of the county hardest hit. An estimated 200 roofs sustained damage, and there were three indirect fatalities due to carbon monoxide poisoning. The resulting damage from Hurricane Ike in Fort Bend County was estimated at \$400 million.
- Tropical Storm Allison, 2001.** Allison moved inland less than 12 hours after forming just off the west end of Galveston Island. Allison made its initial landfall on Galveston Island during the evening of June 5, and during the next five days produced record rainfall that led to devastating flooding across portions of Southeast Texas. Heavy rain, totaling 8 to 12 inches, occurred over the Sugar Land-Stafford area of Fort Bend on June 7. The resulting damage from Allison in Fort Bend County was estimated at \$7.74 million.

**Figure 5** shows hurricane tracks that have passed over Fort Bend County since 1871, according to NOAA.



**Figure 5 – Historical Hurricanes and Tropical Storms in Fort Bend County**

**2.5.4 Probability of Hurricanes and Tropical Storms**

Based on historical data, the probability of the District being affected by hurricanes and tropical storms is medium. This is comparable to the vulnerability described in the 2018 HMP.

<b>Probability:</b>	
<input type="checkbox"/>	High: Event probable in next year.
<input checked="" type="checkbox"/>	Medium: Event probable in next 5 years
<input type="checkbox"/>	Low: Event possible in next 10 years.

**2.5.5 Impact and Vulnerability related to Hurricanes and Tropical Storms**

The District’s mission and jurisdictional authority are explicitly limited to activities related to levee improvement, and protecting the integrity of the levees. Therefore, the District only has the authority to mitigate the effect of hurricanes and tropical storms on District-owned facilities and personnel. Hurricanes can cause a significant threat to buildings and equipment as they could be struck by flying debris, falling trees/branches, utility lines,

and poles as well as sustain damage from the wind. District specific assets that are vulnerable to Hurricanes include the storm water pump station, the reclaimed water system, the outfall structure, and several detention facilities. However, considering the long warning time associated with Hurricanes and Tropical storms, the District will do its best to warn personnel, and coordinate protecting its equipment, if possible.

Since the District's main focus is on activities related to levees, the hazard of hurricanes and tropical storms has an emphasis on the secondary hazard of subsequent flooding that can occur during and after these events and the mitigation actions for flood will serve to mitigate the effects of all the hazards that contribute to flooding. The flood elements, including inundation depths experienced from severe storms, hurricanes, tropical storms, and other large rain events are discussed in **Section 2.6**.

## 2.6 Flood

A flood is an overflow of a large amount of water, beyond its normal limits, over what is normally dry land.

The District's levee system protects the New Territory neighborhood from the Brazos River 100-year floodplain, which puts it at risk for a flood event. Flooding is a naturally occurring event, but becomes hazardous when the public, infrastructure, and property are affected. Historically, floods are, and continue to be the most frequent, destructive, and costly natural hazard facing the District.

### 2.6.1 Types of Flooding

Flash Flood Events – According to the National Weather Service, a flash flood is flooding that begins within 6 hours, and often within 3 hours, of the heavy rainfall (or other cause). Flash floods can be caused by a number of things but are most often due to extremely heavy rainfall from thunderstorms. Flash floods can occur due to dam or levee breaks, and/or mudslides (debris flow). The intensity of the rainfall, the location and distribution of the rainfall, the land use and topography, vegetation types and growth/density, soil type, and soil water-content all determine just how quickly the flash flooding may occur, and influence where it may occur. Urban areas are also prone to flooding in short timespans and, sometimes, rainfall (from the same storm) over an urban area will cause flooding faster and more severe than in the suburbs or countryside. The impervious surfaces in the urban areas do not allow water to infiltrate the ground, and the water runs off to the low spots very quickly. Flash flooding occurs so quickly that people are caught off-guard. Their situation may become dangerous if they encounter high, fast-moving water while traveling. If people are at their homes or businesses, the water may rise quickly and trap them, or cause damage to the property without them having a chance to protect the property.

Riverine Flooding – Riverine flooding occurs when water rises out of the banks of the waterway, which is a common cause of flooding in the District. Flooding along waterways is a function of both precipitation levels and water run off volumes that drain from larger watersheds which can often be predicted in advance. In the District's jurisdiction, the larger riverine systems will experience a flood crest 24 hours or longer after the storm event begins. Within the District, riverine flooding is caused by either tropical storms or large fronts moving across Texas. These systems can take more than a day to pass, giving ample opportunity for large amounts of rain to fall over large areas. It should be noted, that in instances of high-water levels on the Brazos River, the District relies on its storm water pump station to control the level of floodwaters within the leveed areas.

Flooding due to Levee Failure – In the event of a levee breach or levee failure, the subsequent flooding would be disastrous and potentially far worse than any naturally occurring flood. The flooding could occur across the entire Levee Improvement District (LID) boundary, including over 4,600 residential lots. Aside from the flooding being expansive within the LID study area, due to the topography, the flooding duration would be on the order of days, rather than a typical flash flood or riverine flooding scenario.

Pump Failure – Pumps are operated and maintained by the District in order to prevent flooding during rain events when the Brazos River is high and gravity flow cannot occur. If the pumps experience any

malfunction, or fail to operate, there could be resultant flooding within the LID Boundary. Similar to levee failure, the flooding duration would be on the order of days.

### 2.6.2 Location of Flooding

The area within the levees is protected from riverine flooding as long as the water level in the Brazos River is lower than the elevation of the levee where it ties back to natural ground, and as long as the pump station is operational and not surcharged or damaged.

The Special Flood Hazard Area is an area studied and defined by FEMA as an area subject to flooding in the 100-year event. The Digital Flood Insurance Rate Map (DFIRM) data provided by FEMA for the District shows the following flood hazard areas:

- **Zone A:** Areas subject to inundation by the 1-percent-annual-chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown. Mandatory flood insurance requirements and floodplain management standards apply.
- **Zone X:** Moderate risk areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent-annual-chance flood by a levee. No BFEs or base flood depths are shown within these zones.

Although the District is surrounded by the Brazos River 100-year flood plain, only the drainage ditches and amenity lakes within the District are designated as “at risk” during the 100-year event (Zone A). All remaining land within the District is designated as “area with reduced flood risk due to levee” by FEMA.

It is important to note that the DFIRM does not include all possible sources of flooding in the District, and therefore the DFIRM only helps understand a portion of the risk exposure for the District. Locations of flood zones in the District based on the Digital Flood Insurance Rate Map (DFIRM) from FEMA are illustrated in **Figure 6** below. This map became effective as of April 2, 2014.

Regional floodplain mapping efforts are ongoing. As part of the regular, annual review process for this Plan, the MPC will seek out preliminary and revised floodplain maps to determine their impacts on the District.



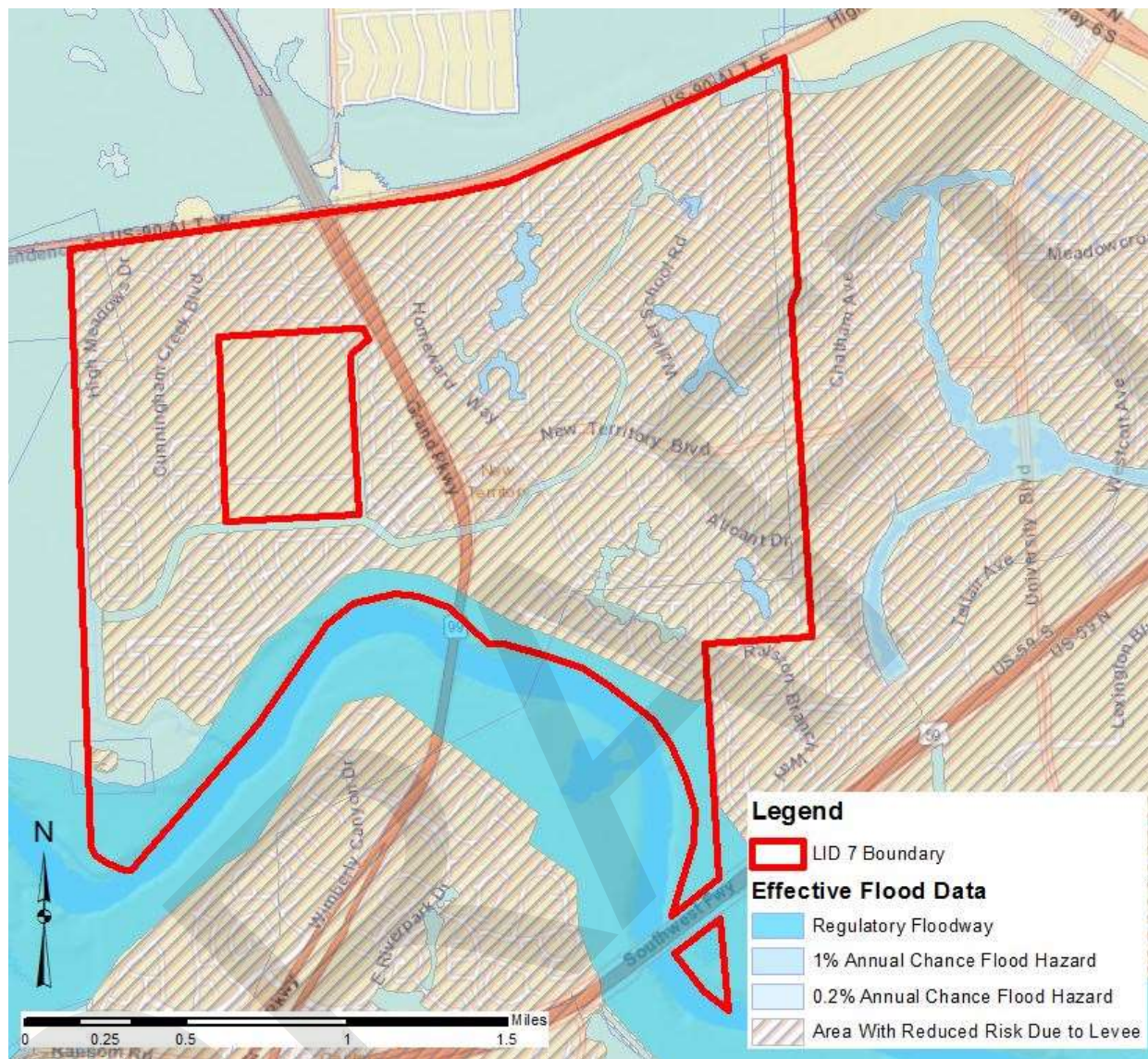


Figure 6 – FEMA Effective Floodplains

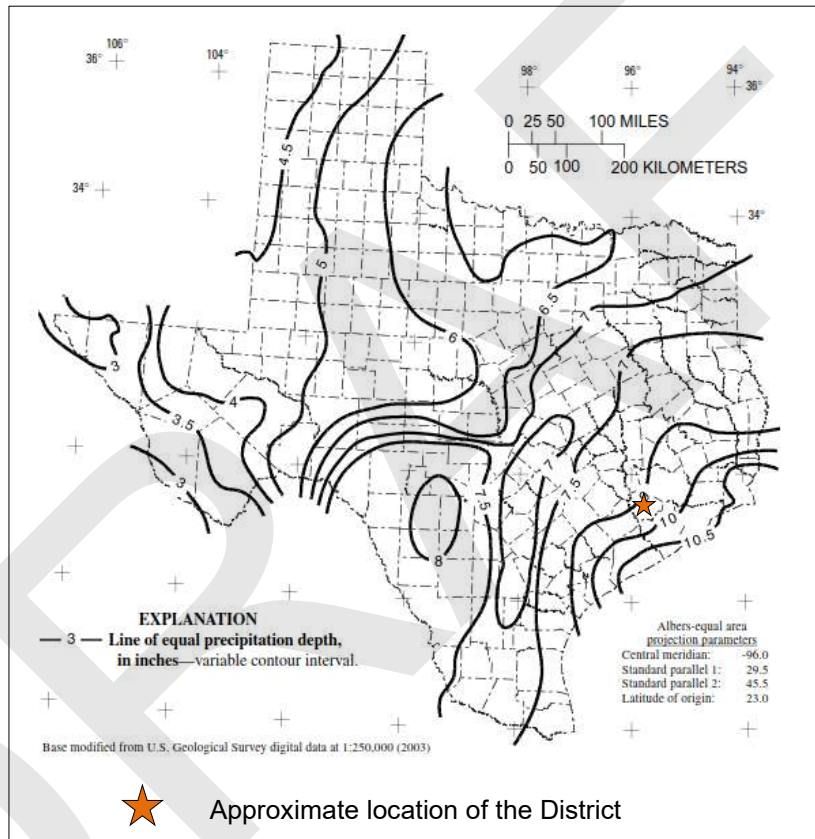
**2.6.3 Previous Occurrences of Flooding**

The Effective FEMA Flood Insurance Study (FIS) for Fort Bend County, dated December 21, 2017, notes there have been several significant flood events from 1899 through 1998. Reports on historic flooding show that major storms or floods in the area occurred in 1899, 1900, 1913, 1915, and 1929. The flood of 1899 and the storm of 1900 caused much damage to Fort Bend County. Crops, stock, and lives were lost during these two events. The City of Richmond suffered some of the greater losses. Four to five feet of water was seen for several days, and in some places for a stretch of land seven miles wide. The floods of 1913 and 1929 left water covering large portions of the Cities of Rosenberg and Richmond. It was reported that during the 1913 flood, the waters of the Brazos, San Bernard, and Colorado Rivers met below Rosenberg. Some recent flood events noted in the FIS, as well as subsequent events include:

- **May 7<sup>th</sup>, 2019, Flash Flooding** – A severe band of storms resulted in extreme rainfall amounts that caused widespread street flooding, blocking many roads in the area and flooding many stranded vehicles. Some areas within Fort Bend County received over seven inches of rain in a four-hour period. A maximum of nine inches of rain was reported in certain areas, with as much as 2.5 inches of rain falling within a thirty-minute span. The storm event impacted a large portion of the Brazos River watershed and put the river into flood stage.
- **August 26, 2017, Hurricane Harvey** – This hurricane was a Category 4 with estimated sustained winds of 130 mph at landfall. The main threat from Hurricane Harvey was flooding due to excessive precipitation. Fifty inches of rain is the top-end forecast rainfall amount mentioned by the National Hurricane Center with Harvey through its odyssey near/over Texas. Some parts of Texas received 9 days of rain. Interstates, critical facilities, infrastructure and hundreds of properties were flooded. Within the District, a few structures were damaged due to the pumps being unable to keep up with the rate and amount of precipitation accumulated within the LID boundary.
- **May 27-June 10, 2016, Memorial Day Flooding** – After 20 inches of rain, the water level in the Brazos River reached record heights, and Fort Bend County was added to Presidentially-declared disaster DR-4272. Mostly low to moderate income areas (about 1,200 homes total) were impacted by the disaster.
- **April 18-22, 2016, Tax Day Floods** – This storm front produced nine to 11 inches of rain in 12 hours. Within Fort Bend County, this incident caused flash and street flooding, Barker Reservoir flooding, and river flooding along the Brazos and San Bernard Rivers.
- **May 29, 2015, Memorial Day Flood** – This storm front produced eight to ten inches of rainfall in the vicinity of Fort Bend County. Depending on the location in the Houston area, it ranged from a 2-year to a 500-year frequency storm. The water level in the Brazos River reached record heights.
- **September 12-13, 2008, Hurricane Ike** – This hurricane made landfall on Galveston Island as a Category 2 hurricane with estimated sustained winds of 110 mph. An estimated 10-in to 20-in of rain fell across the southeast Texas region. At the time, Ike was the third-costliest of any Atlantic hurricane and resulted in \$37.5 billion in damages, with only hurricanes Sandy (2012) and Katrina (2005) damages estimated higher. The resulting damage from Ike in Fort Bend County was estimated at \$400 million. Total damages were estimated to be at least \$1.3 billion across southeast Texas.
- **June 7, 2001, Tropical Storm Allison** – Allison moved inland less than 12 hours after forming just off the west end of Galveston Island. Allison made its initial landfall on Galveston Island during the evening of June 5, and during the next five days produced record rainfall that led to devastating flooding across portions of Southeast Texas. Heavy rain, 8 to 12 inches, occurred over the Sugar Land-Stafford area of Fort Bend on June 7. The resulting damage from Allison in Fort Bend County was estimated at \$7.74 million.
- **October 1998, Southeast Texas Flood** – This flood event occurred across parts of south Texas and southeast Texas. The storm that caused it was one of the costliest in the recorded meteorological history of the United States, bringing rainfall of over 20 inches to some parts of southeast Texas, including the Sugar Land Area, and causing over \$750 million in damages.
- **October 1994, Southeast Texas Flood** – This flood was the deadliest southeast Texas weather event since 1983's Hurricane Alicia. Heavy rains began falling late afternoon of October 16<sup>th</sup> across Burleson, Brazos, Grimes, and Washington counties. On the night of the 17<sup>th</sup> and on the 18<sup>th</sup>, rains continued to slide further south and began afflicting people in Jackson, Wharton, Matagorda, Brazoria, and portions of Fort Bend counties. Total rainfall from the entire storm generally ranged from 10 to 20 inches with Liberty recording 30.50 inches during the storm. Over 13,000 people had to be evacuated during the floods and over 22,000 homes received flood damage. Total damage to homes and businesses was approximately \$800 million while another \$100 million was done to roads and bridges throughout southeast Texas.

### 2.6.4 Extent of Flooding

Flooding in Fort Bend County can result from the various types of flooding described in **Section 2.6.1**. Because of the flatness of the terrain, many inland areas are characterized by FEMA as shallow flooding during heavy rainfall. Flooding is most common after a short duration of heavy precipitation, with the typical rain total of nine inches for a 1% Annual Chance 6-hour rainfall, as shown in **Figure 7**. Flood magnitude is measured by flood depth in feet or inches. Flooding in the event of a levee failure could result in flood depths up greater than 5 feet for the 100 year rain event. In the event of pump failure, depending on the storm event, flooding could be shallow and expansive, but lasting for days.



**Figure 7 – Depth of Precipitation for 100-Year, 6-Hour Duration: Approximately 9 Inches (Source: USGS Rainfall Atlas)**

### 2.6.5 Probability of Flooding

- Probability:**
- High: Event probable in next year.
  - Medium: Event probable in next 5 years
  - Low: Event possible in next 10 years.

Based on past events and the predicted precipitation, the probability of large rainfall events within the District's boundary is designated as highly likely. Fort Bend County has experienced 28 floods over a 10-year period, giving a frequency of two to three flood events per year. However, the protection provided by the levees and the pump stations make the probability of structural flooding within the District boundary relatively low.

**2.6.6 Impact and Vulnerability Related to Flooding**

Similar to the 2018 HMP, the impact of floods on the Plan area is not typical because of the protection provided by the levees. Typically, the District's flat topography and proximity to the Brazos River would make it prone to flooding. However, with the protection provided by the levees and internal pump station, the study area is likely only vulnerable if one of the following events were to occur:

- Levee failure due to breach;
- Levee failure due to river levels exceeding the elevation of the ends of the levee; or
- Failure or surcharge of the pump station.

The potential impacts of flooding include direct damages to structures and their contents, displacement of residents and businesses, and disruption of government services (including roads and infrastructure).

The District's vulnerability to floods is considered relatively high if one of the situations listed above occurs. If a flood event occurs, the entire study area could be inundated, including potentially several thousand residential structures. The District would be unable meet its responsibility to provide for the present and long term drainage needs in the planning area. **Table 9** shows the Critical Facilities protected by the District's levees and therefore vulnerable to flooding. Note that within the area protected by the District's levees, only one structure has ever been flooded; that incident occurred during Hurricane Harvey in 2017.

**Table 9 – Critical Facilities Protected by the Levee in LID No. 7**

Critical Facilities	Number
Schools	3
Banks	3
Grocery Stores	2
Gas Stations	2
Water and Wastewater Facilities	4

**2.6.7 NFIP Repetitive Loss structures**

As of April 2023, no Repetitive Loss (RL) structures were located within the boundary of the District.

**2.7 Levee Failure**

A levee is a man-made structure; usually an earthen embankment designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water to provide protection from temporary flooding.

Levee failure is a collapse or breach in the earthen structure resulting in the uncontrolled release of water, often resulting in floods that can exceed the 100-year floodplain boundaries. The breach may occur gradually or suddenly. The most dangerous breaches happen quickly, usually during high water. The District is bounded

by a “u-levee” rather than a “ring levee”. In this situation the levee could fail if water levels in the adjacent Brazos River or Bullhead Bayou are high enough to flow around the end of the levee.

Many factors could lead to the earthen levees being damaged, and therefore compromised. Examples include erosion from strong river currents, impacts from debris carried by floodwaters, and even impacts from large objects such as boats or barges that collide with and gouge the levee. Some animals are known to burrow in levees, creating holes that enable water to pass through, and ultimately weakening the structure. Any of these weaknesses can lead to a levee breach.

### **2.7.1 Levee Failure Location**

The District is responsible for operation and maintenance of the levees protecting the District. The potential levee failure locations can be assumed to be anywhere along the levees shown in **Figure 8**. The levee within the study area is approximately 3.75 miles long and approximately nine feet high. Particular consideration should be given to the ends of the levees, where water from the adjacent river has the potential to flow around the levee and into the protected neighborhoods.

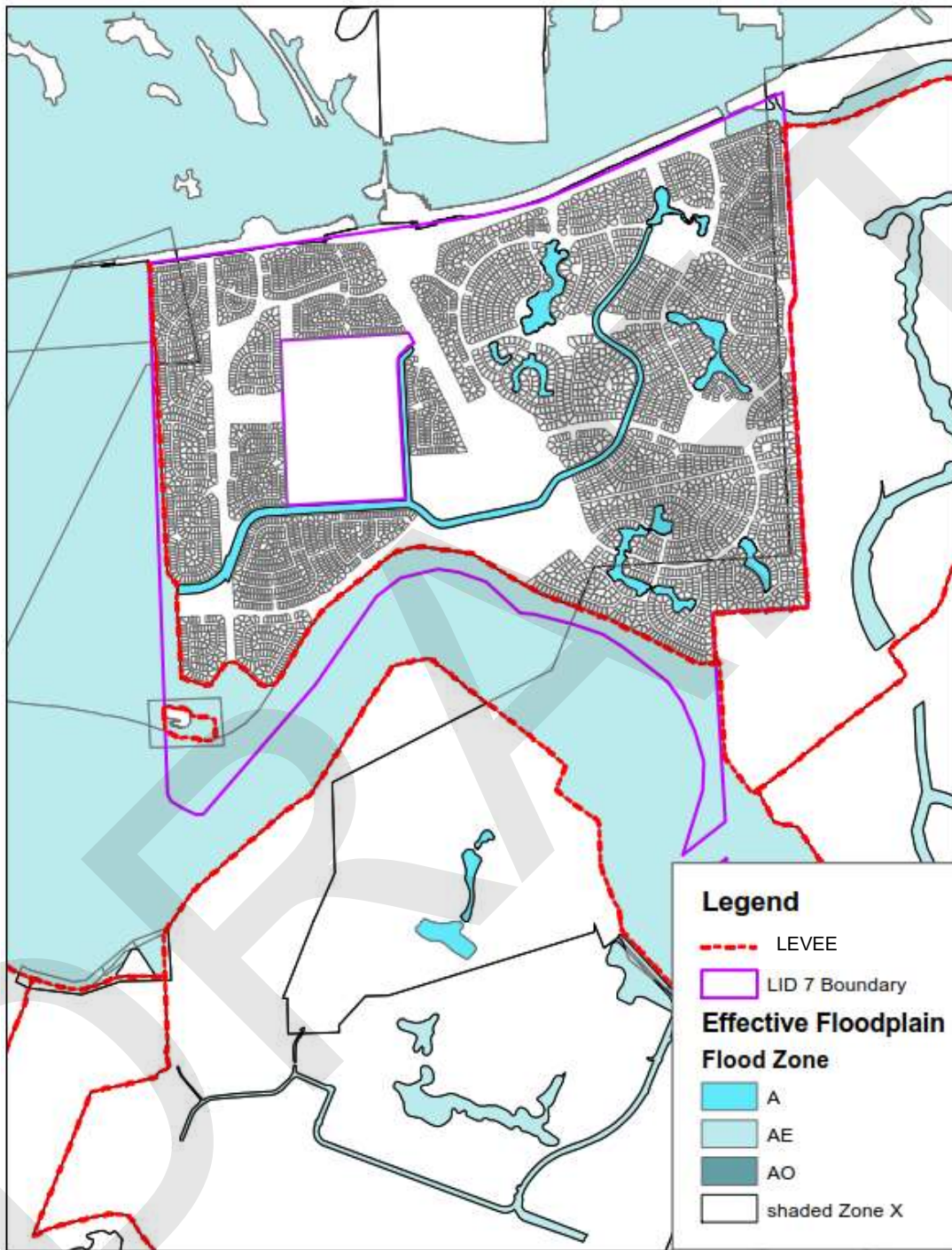


Figure 8 – Location of Levees in the Vicinity of FBCLID No. 7.

NOTE: No levee on North Side.

### 2.7.2 Extent of Levee Failure

The extent of levee failure can be determined by assessing the amount of area being protected by the levee, i.e. a greater amount of area being protected offers greater possibility for damage in the event of a failure. In the study area, there are more than 4,600 residences that could potentially be flooded if the levees failed, making the extent of flooding approximately 3.4 square miles. Flood magnitude is measured by flood depth in feet or inches. Based on existing models produced by the Brazos River Authority, the depth of flooding in the event of a levee failure can be expected to be greater than 5 feet throughout portions of the District.

### 2.7.3 Probability and Historical Levee Failure

<p><b>Probability:</b></p> <p><input type="checkbox"/> High: Event probable in next year.</p> <p><input type="checkbox"/> Medium: Event probable in next 5 years</p> <p><input checked="" type="checkbox"/> Low: Event possible in next 10 years.</p>
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There are no historical levee breaches on record associated with the District's levee system; however, this hazard is still considered a possibility, in particular because recent large storm events have caused significant erosion of the banks of the Brazos River, causing it to migrate closer to the levee. There is also concern about the lack of protection on the north side of the District. The u-shape of the existing levee causes vulnerability, since the area protected by the District levees would be inundated if the water level in the Brazos River or Bullhead Bayou were to rise far enough to flow into the neighborhood from the north side. Seasonal flooding as well as cyclical droughts can degrade the levee condition, and the ability to function as the primary flood protection measure.

### 2.7.4 Impact and Vulnerability Related to Levee Failure

As was the case in the 2018 HMP, levee failure is the most significant hazard for the District to assess and be prepared for, as it has the potential to make the highest impact on the District's jurisdiction, and study area. All 4,600 parcels are vulnerable to flood damage in the event of levee failure. As the District's responsibility is flood protection, levee failure presents a very substantial secondary hazard of flooding in the event of a levee failure. More details on subsequent flooding found in **Section 2.6.1**.

The Levees must maintain accreditation with FEMA for the area to be shown on the map as a Shaded Zone X, a non-special flood hazard area. The loss of accreditation would change the Zone X to a Zone A which would return the entire area to a FEMA "floodplain". Within the study area there are more than 4,600 resident parcels currently protected by the levee shown in **Figure 8**, above.

## 3 Mitigation Strategy

### 3.1 District Mitigation Goals

State and federal guidance and regulations pertaining to mitigation planning require the development of a mitigation goal statement that is consistent with other goals, mission statements, and vision statements. In developing the goal statement for the first iteration of the HMP, the District reviewed FEMA's national mitigation goals, several examples of goal statements from other states and communities, and the State of Texas' Mitigation Goal.

#### 3.1.1 Mitigation Goal Statement

The mitigation goals of the District are:

1. To protect public health, safety, and welfare;
2. To reduce losses due to hazards by identifying hazards, minimizing exposure of citizens and property to hazards, and increasing public awareness and involvement;
3. To seek solutions to potential levee safety risks and existing flooding problems;
4. To have shovel ready projects prepared for implementation if/when funding is available through the FEMA Hazard Mitigation Grant Program.

The District's mitigation goals remain unchanged from the previous iteration of the Plan.

### 3.2 State of Texas Mitigation Goals

The Texas Division of Emergency Management is designated by the Governor as the State's coordinating agency for disaster preparedness, emergency response, and disaster recovery assistance. TDEM also is tasked to coordinate the State's natural disaster mitigation initiatives and administer grant funding provided by FEMA. A key element in that task is the preparation of the State of Texas Hazard Mitigation Plan. The State's 2018 HMP update includes a series of mitigation goals, which augmented and expanded upon the mitigation goals from previous HMP iterations.

1. Goal 1 – Save lives and reduce public risk exposure from natural, technological, and human-caused hazard events.
2. Goal 2 – Reduce or prevent damage to public and private property from natural, technological, or human-caused hazard events.
3. Goal 3 – Empower units of local government to understand and effectively manage public risk exposure through the development of comprehensive mitigation action plans.
4. Goal 4 – Enhance the quality of vulnerability and risk assessments through the development and collection of data.
5. Goal 5 – Reduce adverse environmental, natural resource, and economic impacts from natural, technological, and human-caused hazard events.
6. Goal 6 – Empower citizens to make risk-informed decisions through public education and outreach activities.
7. Goal 7 – Enhance coordination between local, state, tribal, and federal agencies to understand the impact of hazards in Texas and develop policies and strategies to effectively manage risk.
8. Goal 8 – Reduce the number of Repetitive Loss and Severe Repetitive Loss properties through acquisition of real property from property owners, and demolition or relocation of buildings to convert the property to open space.



### 3.3 Federal Mitigation Goal

The Federal Emergency Management Agency’s mitigation strategy is set forth in a document originally prepared in the late 1990s. This strategy is the basis on which FEMA implements mitigation programs authorized and funded by the U.S. Congress. The national mitigation goal statement is as follows:

- To engender fundamental changes in perception so that the public demands safer environments in which to live and work; and
- To reduce, by at least half, the loss of life, injuries, economic costs, and destruction of natural and cultural resources that result from natural disasters.

### 3.4 Previous Mitigation Actions

In the 2018 HMP, the District identified 13 actions and initiatives to reduce hazard vulnerabilities and improve mitigation capabilities. During the 2023 Update process, progress on the previous mitigation actions was evaluated by the MPC. **Table 10** provides the evaluation.

**Table 10 – Previous Mitigation Actions**

Action #	Mitigation Action	Hazard	Status	Include in 2023 HMP Update?	Comments
1	Pump Station Electrical Improvements	Flood, Hurricane, & Tropical Storms	Completed	N/A	
2	Northeast / Northwest Levee Improvements	Flood, Hurricane, & Tropical Storms, Levee Failure	In Progress	Yes	To be combined with North Levee Closure project (Item 8 in this table). Project is currently in preliminary engineering. Timeframe for project will is 5-10 years to completion.
3	Outfall Channel Erosion Control Project	Flood, Hurricane, & Tropical Storms, Levee Failure	In Progress	Yes	
4	Procure Additional Temporary Pumping Capacity	Flood, Hurricane, & Tropical Storms	Completed	N/A	
5	Maintain Ownership of Tiger Dams	Flood, Hurricane, & Tropical Storms, Levee Failure	Completed	N/A	
6	Integrate Emergency Notification System Through City of Sugar Land	Flood, Hurricane, & Tropical Storms, Levee Failure	N/A	No	LID7 was annexed by City of Sugar Land and is now part of its emergency notice system, additional information is now being distributed through the website.

Action #	Mitigation Action	Hazard	Status	Include in 2023 HMP Update?	Comments
7	Maintain Website to Disseminate Public Information	Flood, Hurricane, & Tropical Storms, Levee Failure	Completed	N/A	
8	North Levee Closure Project	Flood, Hurricane, & Tropical Storms, Levee Failure	In Progress	Yes	For 2023 HMP Update, this project will be combined with the Northeast/Northwest Levee Improvements project (Item 2 in this table) as part of the District's broader levee improvements.
9	Pump Station Capacity Enhancement Project	Flood, Hurricane, & Tropical Storms	In Progress	Yes	Anticipated completion date December 2023
10	Internal Detention Basin Project	Flood, Hurricane, & Tropical Storms	In Progress	Yes	Currently in plan approval phase, construction by end of 2023.
11	Brazos River Erosion Control Project	Flood, Hurricane, & Tropical Storms, Levee Failure	In Progress	Yes	Anticipated completion Fall 2024
12	Raise the Existing Levee	Flood, Hurricane, & Tropical Storms, Levee Failure	N/A	No	Original project was to provide additional freeboard, but recent studies (need to reference) indicate this might no longer be a priority.
13	Drainage System Capacity Restoration	Flood, Hurricane, & Tropical Storms	N/A	Yes	Engineer and operator to evaluate yearly on when to commence the project

### 3.5 Identifying Priority Actions

Each action item identifies an appropriate lead agency for each action, cost effectiveness, a schedule for completion and suggested funding sources. For this Plan, the MPC considered the “STAPLEE” methodology to prioritize mitigation actions. STAPLEE assesses actions based on six general criteria: Social, Technical, Administrative, Political, Legal, Economic, and Environmental. The criteria for prioritization are listed on each individual Mitigation Action Worksheet, in **Appendix F. Table 11** describes the STAPLEE methodology.

**Table 10 – STAPLEE Methodology**

STAPLEE	Criteria Explanation
S – Social	Mitigation actions are acceptable to the community if they do not adversely affect a particular segment of the population, do not cause relocation of lower income people, and if they are compatible with the community’s social and cultural values.
T – Technical	Mitigation actions are technically most effective if they provide long-term reduction of losses and have minimal secondary adverse impacts.
A – Administrative	Mitigation actions are easier to implement if the jurisdiction has the necessary staffing and funding.
P – Political	Mitigation actions can truly be successful if all stakeholders have been offered an opportunity to participate in the planning process and if there is public support for the action.
L – Legal	It is critical that the jurisdiction or implementing agency have the legal authority to implement and enforce a mitigation action.
E – Economic	Budget constraints can significantly deter the implementation of mitigation actions. Hence, it is important to evaluate whether an action is cost-effective, as determined by a cost benefit review, and possible to fund.
E – Environmental	Sustainable mitigation actions that do not have an adverse effect on the environment, that comply with Federal, State, and local environmental regulations, and that are consistent with the community’s environmental goals, have mitigation benefits while being environmentally sound.

### 3.6 District Mitigation Actions

All District Mitigation Actions were reported on Mitigation Action Worksheets consistent with associated worksheets to provide further detail, seen in Appendix F. A summary table of all proposed mitigation actions is shown in **Table 12**. For more detailed descriptions and evaluation of each Mitigation Action, see worksheets in **Appendix F**.

**Table 11 – Proposed District Mitigation Actions**

Number	Mitigation Action	Hazard	Estimated Cost	Time (years)
1	North / Northeast / Northwest Levee Improvements	Flood, Hurricane & Tropical Storms, Levee Failure	\$25,200,000	Ongoing
2	Outfall Channel Erosion Control Project	Flood, Hurricane & Tropical Storms, Levee Failure	\$5,00,000	Ongoing
3	Pump Station Capacity Enhancement Project	Flood, Hurricane & Tropical Storms	\$28,000,000	Ongoing
4	Internal Detention Basin Project	Flood, Hurricane & Tropical Storms	\$13,800,000	Ongoing
5	Brazos River Erosion Control Project	Flood, Hurricane & Tropical Storms, Levee Failure	\$60,000,000	Ongoing
6	Drainage System Capacity Restoration	Flood, Hurricane & Tropical Storms	\$4,200,000	5 – 10 years

Number	Mitigation Action	Hazard	Estimated Cost	Time (years)
7	Pump Station in High Meadows	Flood, Hurricane & Tropical Storms	TBD	5-10 years

The costs shown in **Table 12** are preliminary planning-level estimates of construction cost, and may not include all costs associated with each action. If and when each project advances, the actual costs of each action may increase or decrease. Providing that funding is available and with the approval of the Board of Directors, the Attorney and the Engineer will be responsible for administering and implementing the various proposed mitigation actions.

