FLOODPLAIN MANAGEMENT PLAN

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For

City of Fort Worth

Updated August 2021

Originally Published June 2016

ACKNOWLEDGEMENTS

The City of Fort Worth would like to acknowledge and thank all city staff, consultants, land owners, and residents who participated in the Floodplain Management Plan Stakeholder Planning Group that made the update of this document possible. The City would also like to thank all members of the public that provided feedback via questionnaires and/or social media. Input from the above mentioned parties was invaluable in updating this Floodplain Management Plan.

FMP Stakeholder Planning Group Members

Name	Representing
Bill Schur	Public
Clair Davis	Floodplain Management
Eric Fladager	Planning and Data Analytics
Erick Moreland	Local Insurance Agency
Gaye Reed	Real Estate
Jennifer Dyke	Stormwater Planning
Joe Schneider	Local Development Community
Joel McElhany	Parks and Community Services Department
La Wayne Hauser	Public
Libby Willis	Public
Linda Sterne	Stormwater Public Involvement
Maribel Martinez	Office of Emergency Management
Rick Kubes	Local Small Businesses/Public
Ron Shearer	Public
Tracey Cole	Local Lending Institution

TABLE OF CONTENTS

Table of Figures

Table of Tables

Table of Exhibits

APPENDICES

Appendix A: Efforts to Involve the Public

Runoff Newsletter
City of Fort Worth Website Screenshots
City of Fort Worth Facebook Post screenshots
City of Fort Worth Twitter Post Screenshots
City Hall Monthly Calendar

Public Meeting #1 Presentation

Responsess from the "Surveymonkey" Questionnaire
Meeting Minutes

Appendix B: Coordination with Other Communities and Agencies

Letter to Neighboring Communities and Applicable Agencies
Table B-1: Agencies and Communities Solicited for Information
Responses from Neighboring Communities and Agencies

Appendix C: Detailed Tables

Table C-1:	Summary of Comment Cards from Public Meeting #1
Table C-2:	Stream Velocities
Table C-3:	Completed Open Channel Studies
Table C-4:	Open Channel Studies in Progress
Table C-5:	Completed Storm Drain Improvement Studies
Table C-6:	Storm Drain Improvement Studies in Progress
Table C-7:	Completed Stormwater Capital Improvement Projects
Table C-8:	Insurance Claims and Payouts
Table C-9:	City of Fort Worth Stormwater Division Current and Potential Mitigation Activities

Appendix D: Repetitive Loss Areas Analysis Report

Appendix E: Supplementary Content on CD

Flood Insurance Study for Tarrant County, Texas

City of Fort Worth List of Critical Facilities

Flood Warning System Study

Operation and Maintenance Manual (for Fort Worth Levees)

CRS Self-Assessment Results

Public Meeting Presentation #1

Public Meeting Presentation #2

GIS data

EXECUTIVE SUMMARY

The purpose of this report is to document flood hazards and their impact on the City, identify possible mitigation actions, and create a Mitigation Action Plan with input from relevant stakeholders. Because this report was created in support of the National Flood Insurance Program (NFIP), it focuses on flooding within the FEMA floodplain. The City, however, recognizes that Fort Worth has significant urban flooding problems outside of the FEMA floodplain that warrant a similar effort.

This document begins with general background information about Fort Worth and is then organized into ten sections. These ten sections correspond with the ten steps explained in Section 510 of the *Community Rating System Coordinator's Manual* (*CRS Manual*) and are listed below:

1. Organize
2. Involve the Public
3. Coordinate with Other Agencies
4. Assess the Hazards
5. Assess the Problems
6. Set Goals
7. List Possible Activities
8. Create a Mitigation Action Plan
9. Adopt the Plan
10. Implement, Evaluate, and Revise the Plan

A Stakeholder Planning Group was formed from City staff, business representatives, and residents. This group met three separate times. In addition, two public meetings were held in an effort to gather input on the plan itself and flooding within the City of Fort Worth.

The problem assessment revealed there is a potential for $1.5 billion in property damage due to flooding within the FEMA floodplain in a 100-year flood event based on the HAZUS software results. The HAZUS results also showed that 83% of buildings within the 100-year floodplain do not have a flood insurance policy. The plan documents that the City's higher floodplain standards than required by NFIP have been effective at reducing flood insurance claims. The historical data shows that there was an 88% reduction in

the number of claims and an 84% reduction in total value of claims since the adoption of the floodplain regulations. The Stakeholder Planning Group and additional members of the City staff agreed upon goals to help guide the plan and develop mitigation actions.

A Mitigation Action Plan comprised of actions to reduce flood hazard impacts was created with the Stakeholder Planning Group. These actions coincide with the goals developed for this plan and are organized into the following six categories:

- Preventative Activities
- Property Protection
- Natural Resource Protection
- Emergency Services
- Structural Projects
- Public Information

Each activity or action was given a priority ranking, an estimated cost range, and a timeline. The Mitigation Action Plan is found starting on page 46.

This plan will provide the City with additional points in an effort to improve their Community Rating System (CRS) score.

SUMMARY OF CHANGES

The following changes have been made between the original June 2016 version and the updated August 2021 version. Minor formatting, wording, or grammatical changes are not identified in this list.

Introduction

- Freese and Nichols Inc. (FNI) was contracted to assist with the preparation of the original plan. City staff completed the updates for the 2021 version of the plan.

Background Information

- Updated Table 1: Fort Worth Land Area Breakdown by County
- Population estimates updated to show preliminary 2020 Census data.

Step 1. Organize

- Table for existing resources updated to reflect current documents
- Stakeholder Planning Group list updated to show those involved in the update process
- Stakeholder meeting information revised to show information on the meetings held for the update process

Step 2. Public Involvement

- Public meeting information revised to show information on the meetings held for the update process

Step 3. Coordination with Other Agencies

Step 4. Hazard Assessment

Step 5. Problem Assessment

Step 6. Goals

Step 7. Possible Activities

Step 8. Action Plan

Table 28 – Mitigation Action Plan

- 2016 Action Items that were removed because they were obsolete, ineffective, or associated with discontinued programs
    - 2.2.d – Perform a detailed review of flood insurance for City owned properties
    - 3.1 – Reverse Litter Program
    - 4.2.e – Expand Collaborative Adaptive Sensing of the Atmosphere (CASA) weather radar program
    - 5.2.a – Investigate the use of pipe bursting techniques
    - 6.3.a – Send Runoff Rundown bi-annually instead of annually
    - 6.3.d – Hold a large community event annually dedicated to Stormwater education
    - 6.3.i – Move City Flood Safety Awareness Week to October to be consistent with Texas Floodplain Management Association
    - 6.3.j – Hold a contest to design manhole lids and educational signage
    - 6.4.a – Continue to participate in Waterama
- 2016 Action Items that are substantially complete and reclassified as ongoing Stormwater Management Program activities
    - 1.2.a – Add open channel inspections to regular maintenance program
    - 1.2.c – Perform a channel inventory including type, condition and include in maintenance program
    - 1.3.a – Perform Repetitive Loss Area Analysis (RLAA) study
    - 1.4 – Continue enforcement of floodplain and stormwater regulations higher than National Flood Insurance Program (NFIP) standards
    - 1.4.c – Continue to participate in Corridor Development Certificate (CDC) program
    - 2.2.a – Provide link to the Federal Emergency Management Agency's (FEMA's) "Floodsmart" resources on City Website
    - 3.2.a – Maintain Fort Worth Nature Center & Reserve as nature preserve
    - 3.6 – Implement erosion control project from Geomorphic Assessments

- 4.3.a – Develop Standard Operating Procedures for Stormwater Field Operations on how to handle sandbag requests
- 4.3.b – Investigate grant funding available for emergency services
- 5.2.b – Develop a pipe rehabilitation program
- 5.2.c – Prioritize drainage studies and improvements to maximize flood risk reduction
- 5.5.d – Continue to pursue partnerships with the Fort Worth Independent School District to complete Stormwater projects on school sites
- 5.5.e – Identify opportunities for public and private partnerships to complete Capital Improvement Projects
- 6.2.b – Direct mail of FEMA flood protection information to targeted areas of high flood risk

- New Actions added into the 2021 Plan which were not in the 2016 Plan
  - 1.1 – Document "integrated Storm Water Management" (iSWM) participation & regional Stormwater requirements for Community Rating System (CRS) credit
  - 2.3.f – Investigate creation of grant program that could be used to assist property owners with private flooding assessments & solutions
  - 3.2.e – Document Parks & Recreation Department's 25' buffer from center of stream, 3 year no-mow policy for CRS credit
  - 4.2.g – Evaluate existing flood warning signs for improved effectiveness
  - 4.2.h – Promote the CASA Weather Radar App that is available now
  - 5.5.f – Coordinate and where possible participate with the North Central Texas Council of Governments (NCTCOG) Transportation Stormwater Initiative (TSI)
  - 6.2.c – Provide National Oceanic & Atmospheric Administration (NOAA) weather radios to targeted audiences
  - 6.2.d – Provide additional flood risk awareness signage – include City parks and Hazardous Roadway Overtopping Mitigation locations
  - 6.6.d – Create digital/online content to aid in better communicating flood risks

Step 9. Adoption of Action Plan

Step 10. Implementation, Evaluation, and Revision

Appendix A

- Revised to include the public meeting invites, notifications, presentation, survey, and meeting minutes from the 2021 update, replacing those from the 2016 meetings.

Appendix D

- Revised and renamed to include the Repetitive Loss Areas Analysis report.
- The CRS self-scoring was removed since it is not a required component of the FMP and unnecessary. Self-score does match actual credit amounts given during recertification of CRS.

INTRODUCTION

The City of Fort Worth prepared a city-wide Floodplain Management Plan (FMP) according to the FEMA *CRS Manual* Section 510. The purpose of this plan is to identify the flood risk within the City and propose a prioritized Mitigation Action Plan to reduce that risk. Additionally, the City this FMP is among the activities that earn CRS credits and improves the overall CRS classification which leads to reduced flood insurance rates.

The objectives of this FMP are as follows:

- Identify the City's flood hazard areas and address the community's flood hazards more effectively
- Produce a prioritized action plan of activities that will help mitigate the community's vulnerability to the hazard of flooding
- Recommend activities that provide appropriate solutions addressing the hazards of flooding faced by existing and new development
- Recommend activities that do not create conflicts with other flood hazard solutions and can be implemented in a cost effective manner
- Educate residents about flooding hazards, loss reduction measures, and the natural and beneficial functions of floodplains
- Build public and political support for projects that prevent new problems, reduce losses, and protect the natural and beneficial functions of floodplains
- Build a constituency that will implement the recommendations made for preventing and preparing for flood hazards

This document begins with general background information about Fort Worth and is then organized into ten sections. These ten sections correspond with the ten steps explained in Section 510 of the *CRS Manual* and are listed below:

Step 1. Organize

Step 2. Public Involvement

Step 3. Coordination with other Agencies

Step 4. Hazard Assessment

Step 5. Problem Assessment

Step 6. Goals

Step 7. Possible Activities

Step 8. Action Plan

Step 9. Adoption of the Action Plan

Step 10. Implementation, Evaluation, and Revision of the Action Plan

The plan was developed with significant input and direction from a Stakeholder Planning Group comprised of City staff and representatives from the public. More information about the Stakeholder Planning Group is available in the Step 1 section.

BACKGROUND INFORMATION

LOCATION

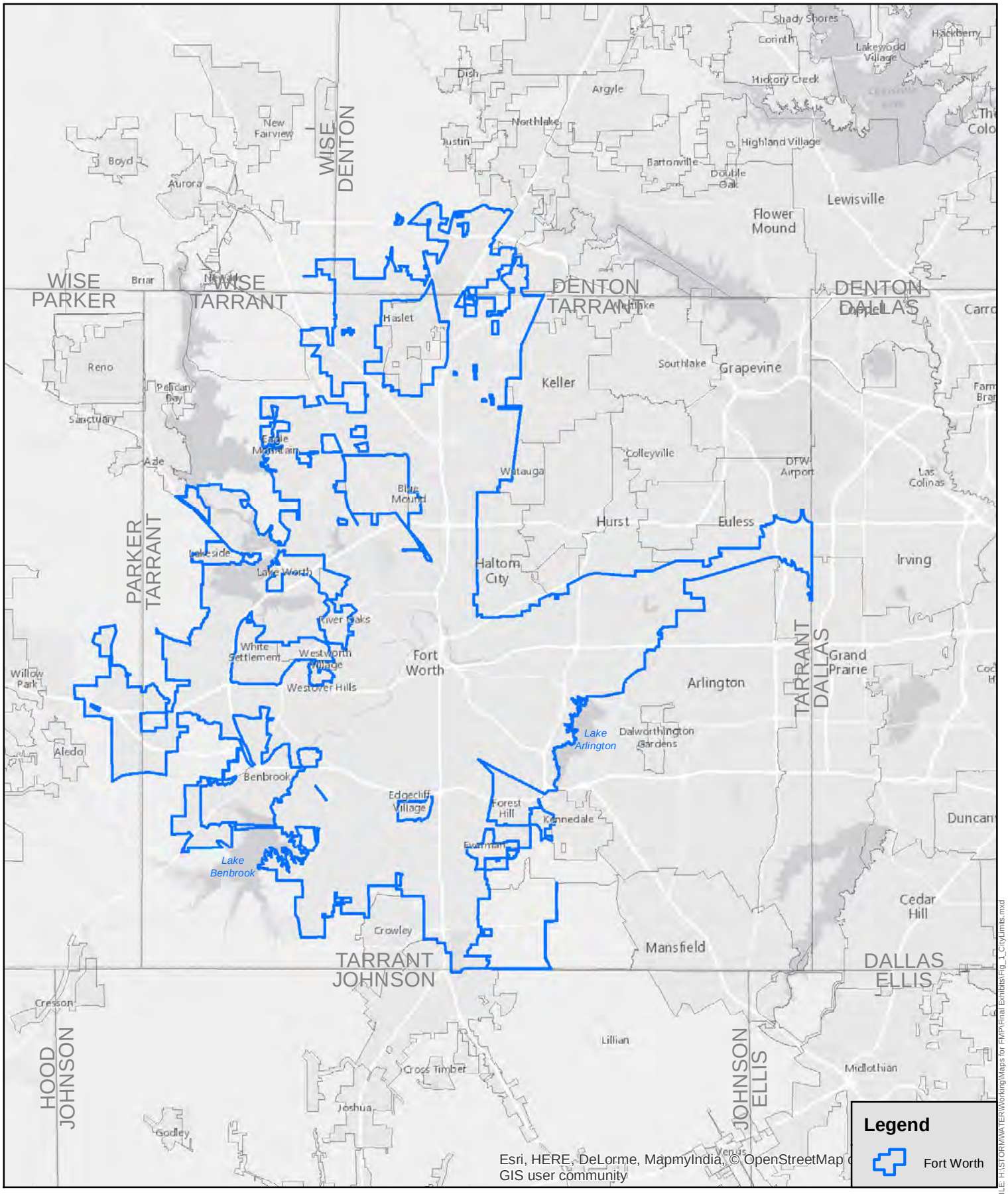
The City of Fort Worth lies approximately 35 miles west of Dallas in North Central Texas and primarily in the borders of Tarrant County, with outcrops in Denton, Parker, Johnson and Wise Counties. The City covers approximately 358 square miles and serves as the county seat for Tarrant County. Table 1 shows a breakdown of Fort Worth land area in the five counties mentioned above. Exhibit 1 shows a map of the city boundaries of Fort Worth in relation to Dallas and other surrounding cities.

Table 1: Fort Worth Land Area Breakdown by County

County	Square Miles	%
Denton	19.73	5.52%
Johnson	0.07	0.02%
Parker	9.15	2.56%
Tarrant	328.19	91.76%
Wise	0.51	0.14%
Total	**357.65**	**100%**

CLIMATE

The City's climate is humid subtropical with hot summers and winters with short periods of extreme cold. The area experiences a wide annual temperature range, according to the National Weather Service. The mean temperatures in the City range from 96° F in the summer and 35° F in the winter. On average, the City receives approximately 38 inches of precipitation annually.



RLE: H:\SFORMWATER\WorkingMaps for FMP\Final Exhibits\Fig_1_CityLimits.mxd

FREESE AND NICHOLS
4055 International Plaza
Suite 200
Fort Worth, Texas 76109
P: 817-735-7300 F: 817-735-7491
JOB: FT115220
DATE: 9/11/2015

City Limits

0 2.5 5 Miles

EXHIBIT 1

POPULATION

Fort Worth is the 13th largest city in the United States of America and the fifth largest in Texas. The City is estimated to have a population of 918,915 based on the preliminary 2020 Census data. In 2010, the population was recorded to be 741,206, which relates to a 24% growth in population from 2010-2020. The Texas Water Development Board (TWDB) projects the population to be 2,161,533 by 2060 in their *2011 Region C Water Plan*.

LAND USE

The City has a variety of land uses including residential, industrial, commercial, office, and recreational areas to meet the needs of the community and economy within the City. Refer to Exhibit 2 for a current and future land use overview of the City.

ECONOMY

Fort Worth, Texas was settled in 1849 as an U.S. Army outpost at the confluence of the West and Clear Forks of the Trinity River. The settlement was designed to protect settlers from Indian attacks. Fort Worth became the last major stop on the Chisholm Trail, a route to drive cattle from Texas to meat slaughter houses in Kansas. As a result, Fort Worth's economy was founded on the cattle business. The oil boom in the early 20th century also helped Fort Worth's economy grow.

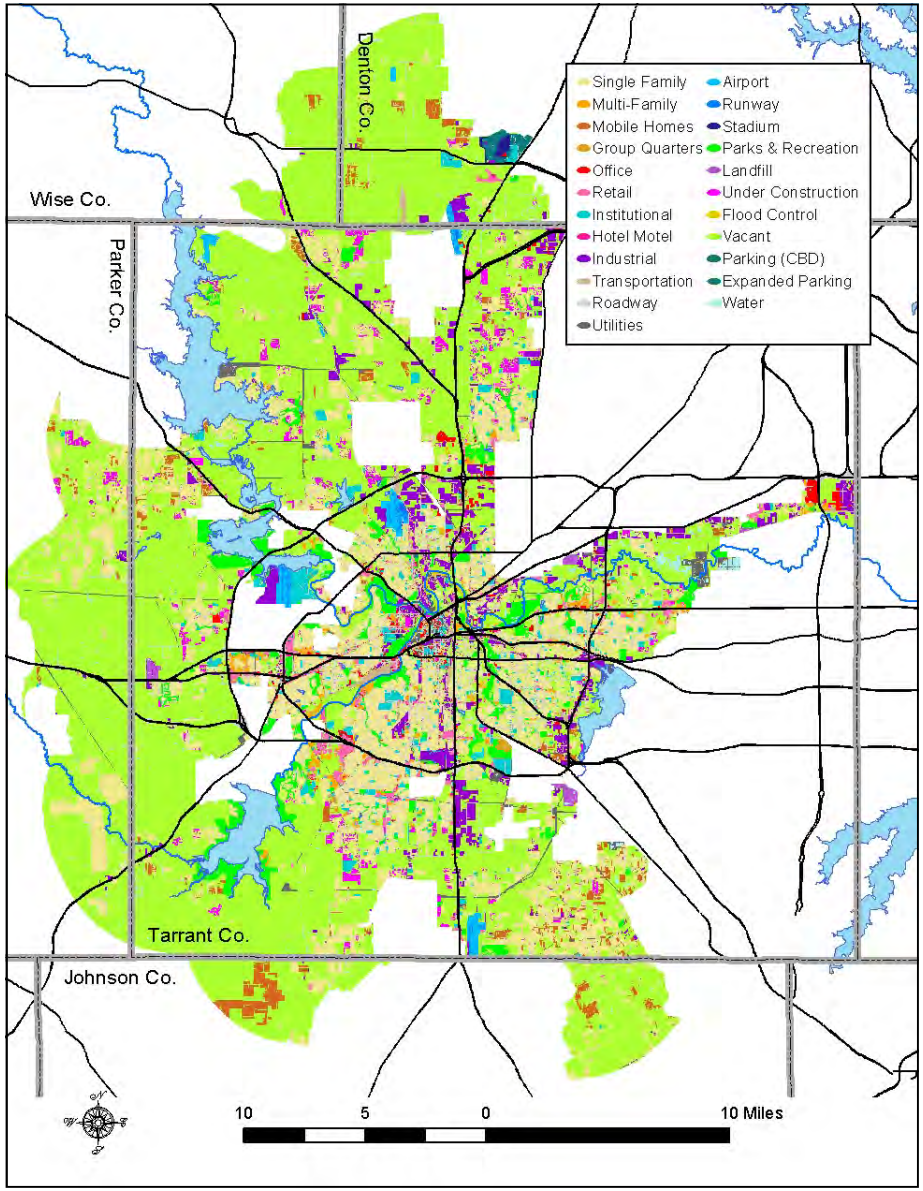
Today, the main industries in Fort Worth are educational services, health care, and social assistance as well as professional, scientific, management, administrative, and waste management services. Companies such as American Airlines, Burlington Northern Santa Fe Railway, Pier 1 Imports, Acme Brick, Justin Brands, GE Manufacturing Solutions, and RadioShack are headquartered in Fort Worth. The Fort Worth Zoo, Fort Worth Stockyards, Texas Cowboy Hall of Fame, and the City's many museums make tourism a strong part of Fort Worth's economy as well.

Table 2 summarizes the family median income in Fort Worth as compared to the family median incomes of Texas and the United States.

Table 2: U.S. Census Bureau 2010 Family Median Income

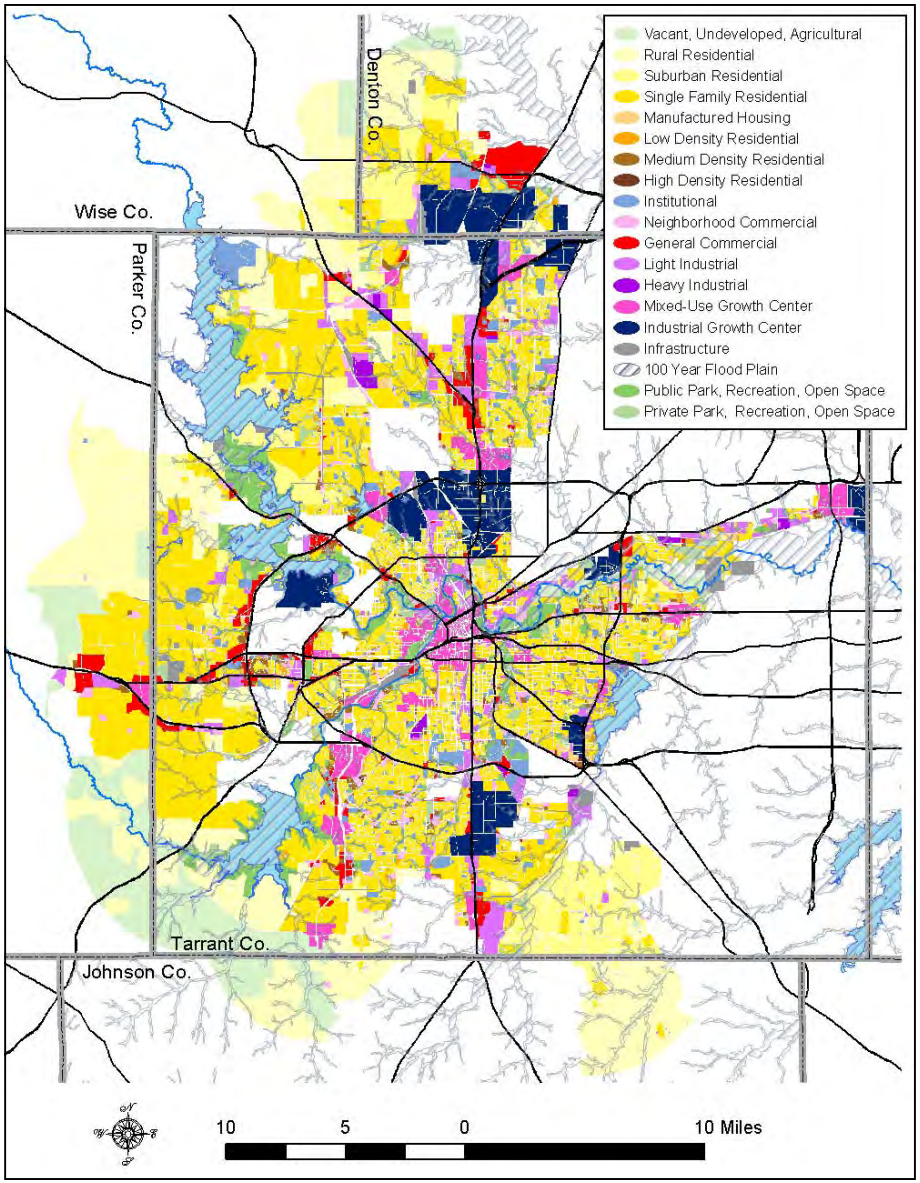
Fort Worth	$56,194
Texas	$58,929
United States	$62,735

Existing Land Use
City of Fort Worth and ETJ, 2005



The most prevalent existing land use is single-family. Much of the city and its ETJ is currently undeveloped. *(Source: North Central Texas Council of Governments, 2006.)*

Future Land Use Plan
City of Fort Worth and ETJ



A comprehensive plan shall not constitute zoning regulations or establish zoning district boundaries.

Land uses are planned for all land within the current city limits and for land in the ETJ that could be available for development over the next 20 years. See Appendix C for individual sector maps at a larger scale. *(Source: Planning and Development Department, 2011.)*

Future and Existing Land Use

(from City of Fort Worth's Comprehensive Plan)

EXHIBIT 2

NFIP PARTICPATION

The City began participating in FEMA's NFIP in 1980 and the CRS Program in 2012. The City is classified as a Category C repetitive loss community, and currently holds a Classification of 8 in the CRS Program. The CRS Program gives a classification from 1 to 10, where 1 is the best score a city can achieve within the CRS Program. Based on FEMA Repetitive Loss Records, the City has 44 repetitive loss properties (RLP). RLPs are those properties for which two or more claims of more than $1,000 have been paid by the NFIP within a 10-year rolling period since 1978. Nationwide RLP's represent only 1% of all the NFIP's insurance policies, but they have accounted for nearly one-third of the claim payments. Fort Worth's RLAs represent 0.5% of the flood insurance policies held in the city limits and account for approximately 17% of the paid insurance claims.

STEP 1. ORGANIZE

The first step in the FMP update process is to organize data and people before preparing the plan. Organization includes gathering and assessing the City's existing resources and relevant data to be incorporated into the plan. This step also involves forming a Stakeholder Planning Group of staff members and public representatives to assist in the update of the plan.

INCORPORATION OF EXISTING DATA

During the planning and development of the plan, various existing plans, studies, reports and technical information were reviewed and incorporated into the FMP, as shown in more detail in Table 3.

Table 3: Review and Incorporation of Existing Resources

Existing Resource	How Resource was Used
Citywide Dam Safety Assessment (City of Fort Worth 2011)	Step 4 to evaluate flood risk associated with Dams
National Flood Insurance Program Community Rating System Coordinator's Manual (FEMA 2017)	Used the ten steps of floodplain management (Section 510) as a guide to create the main body of this document and to guide the planning process.
Flood Insurance Study for Tarrant County, TX (FEMA 2009 and 2019)	Source for information about flooding sources including depths and velocities. Most of the discussion of past floods in Step 4 is from this document.
Hazard Mitigation Action Plan (HazMap) (City of Fort Worth last updated 2015)	Used for background information and in Step 4 to identify known flood hazards and evaluate levees

Existing Resource	How Resource was Used
CIP and Studies List (City of Fort Worth 2015)	Steps 4 and 7 to identify which areas have completed or planned studies and/or capital improvement projects
Flood Warning System Study (City of Fort Worth 2014)	Information from this study is incorporated into Step 4
Flood Insurance Claims (City of Fort Worth 2015)	Step 5 to identify flood problem areas
Critical Infrastructure/Key Resource Summary 06-26-15 (City of Fort Worth)	Step 5 to assess the flood risk to critical facilities
GIS Data from City of Fort Worth: 1. Repetitive Loss Areas/Properties (2015) 2. Most Recent SFHA Layer (2015) 3. Open Channel Study GIS Data 4. Dams and Levees 5. Zoning 6. Low Water Crossings 7. Building Footprints 8. Parcel Data 9. Bridge Inventory 10. Flood Warning System 11. Areas of Potential High Water 12. Drainage Complaints Database 13. Finished Floor Elevations where available	Steps 4 and 5 to perform analyses, create exhibits, and conduct HAZUS assessment
Runoff Rundown Newsletter (City of Fort Worth)	Step 2 for public outreach
Fort Worth Stormwater Management websites http://fortworthtexas.gov/stormwater/ http://fortworthtexas.gov/stormwater/floodplain/ https://mysidewalk.com/sidewalks/3128/fort-worth-tx	Steps 2 and 4 for public outreach and identifying problem areas
HAZUS software (FEMA)	Step 5 to perform problem assessment
Operation and Maintenance Manual West Fort-Clear Fork, Trinity River (USACE)	Step 4 for background information on levee systems
City of Fort Worth Floodplain Ordinance	Step 7 for review of possible activities
City of Fort Worth iSWM Criteria Manual for Site Development and Construction – September 29, 2015	Step 7 for review of possible activities

FLOODPLAIN MANAGEMENT PLAN STAKEHOLDER PLANNING GROUP

The City formed a Stakeholder Planning Group to participate in the update process of the FMP in order to provide input into the plan's content. The City staff selected members and stakeholders to represent comprehensive and diverse organizations and perspectives for the FMP update process. Members of the Stakeholder Planning Group represent various departments within the City as well as a variety of interests from the public. The Stakeholder Planning Group members were personally invited to join either by phone or email from the City Floodplain Administrator, Clair Davis. This group consisted of six (6) City staff members and nine (9) members from the public sector including residents, landowners, developers, small business owners, lending institutions, insurance agents, and real estate professionals. Many of the residents were invited because of their previous experiences with flooding and participation with the City's various committees. Table 4 lists the Stakeholder Planning Group members who accepted invitations to participate in the FMP update process.

Table 4: FMP Stakeholder Planning Group Members

Name	Department/Representation	Public/City Staff
La Wayne Hauser	Resident	Public
Libby Willis	Resident, League of Neighborhoods	Public
Rick Kubes	Resident and Small Business Owner	Public
Ron Shearer	Resident	Public
Bill Schur	Resident	Public
Erick Moreland	Insurance	Public
Gaye Reed	Real Estate	Public
Tracy Cole	Lending Institution	Public
Joe Schneider	Development Community	Public
Clair Davis	Floodplain Administrator	City Staff
Linda Sterne	Stormwater Public Involvement Officer	City Staff
Joel McElhany	Parks and Community Services Department	City Staff
Jennifer Dyke	Stormwater Planning	City Staff
Maribel Martinez	Office of Emergency Management	City Staff
Eric Fladager	Planning and Data Analytics	City Staff

The Stakeholder Planning Group played a crucial role in making decisions regarding the selection of FMP goals and hazards, developing mitigation goals and actions, and reviewing the document to provide comments. The Stakeholder Planning Group held three formal meetings outside of the City's Council meetings and separate from the public meetings discussed in the next section to discuss the information regarding each of the steps involved in the FMP. Stakeholder meeting notices were posted on the project

website, and the meetings were open to the public if they chose to participate. Additional coordination was performed with the Stakeholder Planning Group through email and phone to continue involvement throughout the development of the plan.

Table 5 summarizes the Stakeholder Planning Group meeting dates and topics covered at each meeting. A more detailed discussion of each meeting is included in this section, and all meeting minutes are included in Appendix A.

Table 5: Stakeholder Planning Group Meeting Dates and Steps Discussed

Meeting	Date	Steps Discussed
Meeting #1	March 26, 2021	Step 1: Organize Step 2: Involve the Public Step 3: Coordinate Step 6: Set goals
Meeting #2	May 21, 2021	Step 4: Assess the hazard Step 5: Assess the problem Step 7: Review possible activities Step 8: Draft an Action Plan
Meeting #3	July 16, 2021	Step 8: Draft an action plan Step 9: Adopt the plan Step 10: Implement, evaluate, revise Review Final Draft of FMP prior to adoption

Stakeholder Planning Group Meeting #1 – March 26, 2021

The first Stakeholder Planning Group meeting focused on introducing the FMP and its purpose. Steps 1 through 3 and Step 6 of the FMP were discussed in detail. Mr. Clair Davis of the City gave a presentation about the flooding history of Fort Worth, the NFIP, and the CRS. Many of the Stakeholder Planning Group members shared their personal flooding experiences. He discussed the purpose of a floodplain management plan and how it relates to the CRS and flood insurance. He also explained the role of the Stakeholder Planning Group. An open discussion was then held by the Stakeholder Planning Group to determine goals for the FMP. Some of the main points of this discussion are as follows:

- It is important to educate the public about flood risks, flood insurance, and what is not covered on homeowner's insurance.
- Floodplain development should consider future fully-developed conditions, not only existing conditions.

- Protect and use open property for ponds and parks, especially mapped floodplain areas.
- Social media should be used to gather ideas and comments from the rest of the public.

The timeline of the project and future meetings were also discussed. The identified next steps were to hold a public meeting, review the hazard assessment profile for the City, and prepare for the next Stakeholder Planning Group meeting.

Stakeholder Planning Group Meeting #2 – May 21, 2021

The second Stakeholder Planning Group meeting focused on reviewing Steps 4 through 8 of the FMP. Each stakeholder was provided with a copy of the 2016 FMP for their review and input. The hazard assessment, problem assessment, goals, and possible actions were discussed with the attending group members. The group offered suggestions for improvements on each part of the plan, and the suggestions are documented in the meeting minutes. The Stakeholder Planning Group also brainstormed and recorded ideas for the mitigation actions for each of the six types of possible activities listed in the *CRS Manual*. The meeting minutes, attendance sheet, and list of suggested mitigation activities are included in Appendix A.

Stakeholder Planning Group Meeting #3 – July 16, 2021

The third Stakeholder Planning Group meeting focused on reviewing Steps 9 and 10 as well as the overall draft of the plan. Each mitigation action in the plan along with the prioritization and cost was discussed with the group. Members expressed concerns that the plan is focused more on stormwater rather than the floodplain. It was mentioned that approximately 66% of the flood insurance claims are located outside of the floodplain, and therefore, mitigation actions regarding stormwater are necessary to reduce flood hazards within the community. The group offered additional suggestions regarding the mitigation plan documented in the meeting minutes included in Appendix A. Attendees are also listed in Appendix A.

STEP 2. PUBLIC INVOLVEMENT

The City's FMP update process allowed the opportunity for the public to be involved in the plan update. The City provided several avenues of public outreach and education during the plan update. The City also provided several opportunities throughout the update process for the public to submit comments.

PUBLIC MEETINGS

The City held two public meetings during the update process that were dedicated to educating the public about the FMP and receiving feedback from residents. These meetings were separate from the Stakeholder Planning Group meetings and routine City Council meetings. Table 6 summarizes the dates and discussion topics at each public meeting. Further descriptions can be found in the following paragraphs, and meeting presentations are included Appendix A.

Table 6: Public Meetings

Meeting	Date	Steps Discussed
Public Meeting #1	June 14, 2021	Steps 1-3, 6
Public Meeting #2	June 21, 2021	Steps 4-10 and Review of Draft Document

The first public meeting was held on Monday, June 14, 2021 at 6:30 p.m. virtually through Cisco Webex to follow social distancing protocols during the COVID pandemic. The meeting was advertised via Facebook, Twitter, and the City website. It was also posted on the City Hall weekly calendar of events and an announcement was sent out to all of the neighborhood associations. Appendix A documents the City's efforts to inform the public about this meeting and encourage participation. In attendance were seven (7) personnel from the City, and five (5) other attendees including residents, land owners, and business owners.

The public meeting involved a presentation given by the floodplain administrator, Mr. Clair Davis. He discussed an overview of Fort Worth's flooding history, participation in the NFIP, and the CRS program. He then discussed the purpose and process of developing a floodplain management plan. The full presentation is included on the CD in Appendix F.

Time was given for the public to voice their concerns and provide input to the plan development process. During the meeting, residents asked about plans for public engagement with citizens so they understand flood risk and the importance of reporting flood issues.

The second public meeting was held virtually through Cisco Webex on June 21, 2021 at 6:30 p.m. This meeting was advertised on Facebook, Twitter, the City's calendar, the City's website, and through the neighborhood associations similar to the first meeting. The efforts to publicize this meeting can be found

in Appendix A. In attendance were six (6) City staff, and four (4) other attendees including residents and landowners.

During this meeting, a brief review of the NFIP was given as well as the purpose of the FMP. The draft of the plan was summarized followed by a detailed discussion of the Mitigation Action Plan in Step 8. The attendees were then given the chance to make comments and ask questions. The residents voiced a desire for more outreach to the public and students.

PUBLIC OUTREACH

Several additional public outreach projects were completed to provide residents a chance to voice their concerns about flooding and provide suggestions on how to reduce flood risk in the City. Every resident with the desire to participate has had ample opportunity to learn about flood prevention and protection through the public meetings or public outreach projects. A total of five different outreach methods were utilized to promote public participation in the plan, including the City website, City news article, online questionnaires, a direct mail newsletter, a social media campaign, and neighborhood email blasts.

City Website

The City created a website dedicated to the FMP to provide information and an avenue to receive feedback and input from the community regarding the plan. A link to this website is listed on the City's Stormwater Management site and can be found at http://fortworthtexas.gov/stormwater/floodplain/. The website describes the FMP process, lists upcoming meetings and allows for the download of presentations and minutes from previous meetings, and draft documents for public review.

City News Article

The City of Fort Worth also posted an article on the City News website encouraging resident participation. The article can be found at the following link:

http://fortworthtexas.gov/citynews/default.aspx?id=141876.

The article gave a brief summary of the FMP effort, its purpose, and a link to the previously mentioned website as well as encouragement to attend a public meeting. City News is a weekly news update posted on the City website which is monitored by the media and distributed by email to all subscribers, including contacts for each of the citywide neighborhood associations.

Online Questionnaire

Survey questions were also posted by the City's Community Engagement team on "Nextdoor" page to provide the public with another opportunity to voice their experiences with flooding and provide suggestions for types of mitigation actions. The eight questions focused on gathering information about known flood hazards and public opinion about flooding in Fort Worth, asked what types of flood mitigation activities residents would support, and asked if the residents would support emergency services, structural projects, and public information activities to reduce flood risk within the City. The responses to these questions are found in Appendix A.

Direct Mail Newsletter

The City mailed an informational booklet entitled the *Runoff Rundown* to every resident with a Fort Worth mailing address. The booklet includes information about flood insurance, property protection, floodplain development requirements, flood safety, and other stormwater and floodplain topics. This booklet also directs the public to the city website for additional information regarding flood risk reduction. Runoff Rundown is intended to inform those who do not regularly visit the city website and those who do not use the internet, such as elderly residents. A mention of the FMP and a public meeting announcement was included in the August/September 2015 edition of the newsletter.

Social Media Campaign

The City conducted a social media campaign as an outreach project. Social media is a flexible and inexpensive way to reach a wide audience in a timely manner. The FMP was initially promoted through social media on the City's Facebook and Twitter accounts. The public meetings for the 2021 update were also advertised through the social media accounts. Documentation of the 2021 efforts are included in Appendix A.

STEP 3. COORDINATION WITH OTHER AGENCIES

There is a possibility that neighboring communities already conducted studies which included portions of local streams and stormwater infrastructure surrounding or within the Fort Worth city limits. These studies would likely have existing data, plans, or reports that would assist the City with this FMP and reduce the potential for duplicating flood protection efforts. There also may be flood protection activities

considered or implemented by other agencies that could impact the City. In an effort to glean additional information that could benefit the City, letters were sent to neighboring communities and local and regional agencies giving them an opportunity to be involved in the planning process and to provide input pertinent to the City's 2016 FMP. A total of 29 letters were sent out to communities/agencies. The letter is included in Appendix B. The people and organizations that received this letter of inquiry are listed in Table B-1 of Appendix B. Responses from these agencies are also included in Appendix B. Additional letters were not sent to communities or agencies as part of the 2021 updated plan.

STEP 4. HAZARD ASSESSMENT

This hazard assessment is composed of three parts: a discussion of past floods in the City, known flood hazards, and an assessment of the less-frequent flood hazards. The past floods are described based on historical records and recent events documented in the Flood Insurance Study (FIS) in conjunction with data provided by the City. The known flood hazards were identified through various sources such as studies, FEMA FIS data, and drainage complaints. Known flood hazards include flooding due to both streams and undersized storm drain infrastructure. Less frequent flood hazards include the dams and levees within the City.

In order to guide the hazard assessment process, a CRS Self-Assessment was completed for the City. Topics and answers to questions in the CRS Self-Assessment provided content included within this hazard assessment. The data from Tables 4.1, 4.2, and a large part of the GIS information on the exhibits found in this report were formed while completing the CRS Self-Assessment. The results from the CRS Self-Assessment can be found on the CD in Appendix E. In addition, a self-scoring evaluation was completed using the scoring breakdown found in the *CRS Manual*. The self-scoring can be found in Table D-1 of Appendix D.

DISCUSSION OF PAST FLOODS

The City has experienced a number of major flood events in its history. The following are brief descriptions of past flood events that have affected the City. Many of these descriptions are taken from the FEMA FIS for Tarrant County, TX (2009).

Large floods occurred in the Bear Creek Watershed in 1935, 1942, 1949, 1957, 1962, 1964, and 1966 (Reference 39). Other lesser floods have occurred, such as those on May 7, 1969 and June 1961. However, little definite information is available on them. The USGS has maintained a stream gaging station on Bear Creek at State Highway 26 (Old Highway 121) since 1966. The historical flood information on Big Bear and Little Bear Creeks was obtained from the Bear Creek floodplain information report published in 1971. Significant floods occurred in the Little Bear Creek Watershed seven times during the period from 1935 to 1966. The most substantial flood in this period occurred in September 1964.

Large floods occurred in the Big Fossil Creek Watershed in September 1900, May 1908, April 1922, September 1932, April 1942, May 1949, May 1957, October 1959, June 1961, September 1962, September 1964, March 1968, and October 1981. Heavy rains on April 26, 1958, resulted in flash flooding on Little Fossil Creek and caused a death by drowning at a low water crossing. Another flood-related drowning occurred on March 20, 1968 on Little Fossil Creek downstream of the City of Blue Mound, a small independent city inside the borders of Fort Worth.

Historical flood information on Marine Creek began in 1907; however, no stage elevation data are available. Large floods occurred on Marine Creek in 1908, April 1922, February 1938, April 1942, and 1957. The largest known flood occurred in April 1942, with an estimated discharge of 22,300 cubic feet per second (cfs).

Large floods are known to have occurred in April 1922 and May 1949 in the Mary's Creek Watershed. No estimate of the recurrence intervals of these floods is available.

Floodwaters from Calloway Branch caused damage to structures in October 1971, September 20, 1974, and in October 1981.

The USGS has maintained a gaging station on Sycamore Creek at the upstream side of Interstate Route 35W since 1969. From this source and the Texas Department of Highways and Public Transportation (TxDOT), it is known that major floods occurred in 1938, 1977, and 1979.

A search of the historical information indicates that large flows occurred on the West Fork Trinity River in May 1866, May 1908, April 1922, June 1941, May 1949, May 1957, and November 1981. The May 1866 flood caused considerable damage along the Trinity River, but no specific data related to this flood are available. The May 1908 flood produced a peak discharge of measured at 184,000 cfs in nearby Dallas County. Based on present conditions, a flood of this magnitude would have a recurrence interval of

approximately 500 years. No major floods have occurred on the Clear Fork of Trinity River in the Benbrook area since Lake Benbrook was put into operation in 1952.

Figure 1: Fort Worth on May 17, 1949

Recent Flood Events

Generally, the major floods experienced in Fort Worth are produced by heavy rainfall from frontal type storms which occur in the spring and summer months. Major flooding can be produced by the intense rainfall usually associated with localized thunderstorms. These thunderstorms may occur at any time during the year but are more prevalent in the spring and summer months. The topography of Fort Worth combined with the frequency of severe thunderstorms results in frequent flash flood events especially on small creeks and urban drainage systems. There have been 21 deaths in Fort Worth due to flash flooding on roadways between 1986 and 2018. Fort Worth is also close enough to the Gulf of Mexico that it can be affected by tropical storm systems on occasion. Some examples of this are Tropical Storm Hermine (2010), Tropical Storm Bill (2015), and Hurricane Harvey (2017). These storms often have lesser intensities but larger volumes of rainfall which can lead to river flooding.

Figure 2: Flooding on Western Ave – 1981

Figure 3: Flooding in Arlington Heights – 2004

Figure 4: Flooding in Seminary Hills – 2004

Figure 5: Flooding on Lubbock Ave - 2007

Between 1993 and 2006, the National Weather Service reported 155 flash flood events in Tarrant County. Minor flooding occurs frequently, especially during the spring and early summer. Recent significant events include:

- June 2000 - Rains up to 11 inches fell in a few hours on the far west side of the Fort Worth causing major damage to homes and streets.
- June 2004 - Significant flooding occurred in many other parts of the City following heavy rain. Homes, businesses, the Fort Worth Zoo, and electric utilities were affected by the flooding.
- June 2007 - Heavy rains damaged or destroyed several homes in far north Fort Worth.
- May 2015 - Several consecutive nights of heavy rain resulted in the Trinity River flooding many parts of the City. Heavy rain also overloaded and caused flooding in areas away from the rivers and creeks. Over a two-day period, there were 55 reported high water incidents, including 34 roads overtopping.
- September 2018 - Rainfall totaling 11.03 inches broke the previous monthly record for September set in 1932 (10.8 inches). Flash flooding was responsible for four deaths over 5 weeks, the majority of which involved cars being swept off of the roads.

These historical and recent flood events assist the City in knowing where there are flood hazards and the magnitude of damage a flood can cause. The next section describes known flood hazards within the City.

KNOWN FLOOD HAZARDS

The first step in mitigating flood concerns is knowing where those flood hazards exist, including the source, depth, velocity, and warning times. Flooding is one of the most common hazards affecting communities across the country. Flooding can impact areas ranging in size from small communities to large regions. Regardless of whether a flood occurs over a period of minutes or days, floods have significant probability of causing extensive property damage, disabling critical facilities, and threatening the safety of the public. Known sources of flooding within the City include rivers, streams, lakes, and storm drain infrastructure. Existing data, including FEMA Special Hazard Flood Zone areas, repetitive loss properties (RLP), drainage complaints, and studies identifying flooding outside of the FEMA floodplain were used to assess the flood hazard within the City. Exhibit 3 summarizes the known flood hazard areas on a map. The data in this map are also recorded in ArcGIS format so the City can easily access and update the information associated with the flood hazards.

Floodplains

Common sources of flooding include water from streams overtopping roadways or stream banks and backwater from streams reducing capacity of closed storm drain systems. Numerous streams and rivers flow through the City and pose a flood risk to nearby infrastructure. Many of the 100-year and 500-year floodplains are mapped on Federal Insurance Rate Map (FIRM) or studied by the City. The floodplains are one way to identify locations of known flood hazards due to riverine flooding. This section includes a discussion of the major streams through the City and their potential hazard to the City.

Major Streams

The West Fork of the Trinity River is conveyed from northwest to southeast through the center of the City. All other streams in Fort Worth are tributaries of the West Fork of the Trinity River. Some of the major tributaries are the Clear Fork of the Trinity River, Village Creek, Sycamore Creek, Mary's Creek, Big Bear Creek, and Big Fossil Creek. A complete list of streams can be found in the FEMA FIS for Tarrant County which is included on the CD in Appendix E.

Flood Insurance Rate Maps

The first reference for known flood hazards is the Special Flood Hazard Areas (SFHA) as identified by the FEMA FIRM. The SFHA shows the potential extents of the flood during a 100-year and 500-year storm event. Exhibit 3 shows the 100-year and 500-year FEMA floodplains within the Fort Worth city limits. Depths of flooding and velocities within the channel can be found in the FEMA FIS, and warning times vary for riverine flooding.

Structures in the Floodplain

The 100-year FEMA floodplain covers almost 50 square miles of land within the 350 square mile City. This area represents approximately 14% of the City within the 100-year FEMA floodplain. The 500-year flood

Hazard Assessment Map

EXHIBIT 3

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DATE: 9/11/2015

Legend

- City Limit
- Severe Repetitive Loss Property
- Repetitive Loss
- Drainage Complaints
- Public Meeting #1 Flood Reports
- Repetitive Loss Area

Floodplain Studies

- Open Channel Study Floodplains
- Storm Drain Planning Study Inundation
- 100 Yr FP
- 500 Yr FP

0 2.5 5
Miles

FILE: H:\STORMWATER\Working\Maps for FMP\Final Exhibits\Fig_3_HazardAssesment.mxd

covers approximately 73 square miles, or approximately 21% of Fort Worth's land area. FNI performed a GIS analysis of the existing structures within the SFHA. Planimetric data representing building footprints was intersected with the 1% SFHA (100-year floodplain) to identify the current number of buildings within the floodplain. Pre-FIRM or Post-FIRM refers to buildings constructed before 1980 or after 1980, respectively. Building age was identified by cross referencing the building footprint to parcel information from the Tarrant Appraisal District. Appraisal information, however, was not available for all properties. For areas without appraisal information, assumptions for the date of construction were made based on the surrounding areas where data are available. Table 7 summarizes the specific data concerning buildings located within the 100-year FEMA floodplain.

Table 7: Summary of Structures within the 100 Year FEMA Floodplain

Type of Building	Total	Pre-FIRM	Post-FIRM
All Buildings	5693	4086	1607
Single Family Homes	3615	2725	890
Mobile Homes	258	144	114
Multi-Family Buildings	722	461	261
Non-Residential Buildings	1098	756	342

Open Channel Studies

An additional reference for identifying riverine flooding hazard includes the 15 open channel studies the City has completed and the 20 open channel studies in progress. The name of each open channel study and a brief description for each completed and ongoing study can be found in Appendix C, Tables C-3 and C-4, respectively. Water surface elevations and velocities along each studied reach can be found in each of the studies available at the City. These studies were conducted to identify not only the existing conditions floodplains, but also floodplains assuming fully developed land use conditions. The studies assisted the city in developing a list of stormwater capital improvement project needs for the City. Six of these studies are completely or mostly located outside of the FEMA 100-year floodplain. Riverine flooding can occur due to flash floods, which leaves minimal warning times for nearby residents or people at risk within the mapped and unmapped floodplain areas. A further discussion on the City's warning system is included in this section starting on page 21.

Riverine Flooding caused by Reservoir Releases

Riverine flooding can also be impacted by releases from lakes upstream from Fort Worth. Eagle Mountain Lake and Benbrook Lake are controlled reservoirs, and Lake Worth is uncontrolled. Water released from

the controlled lakes can cause flooding along the receiving streams even during dry weather. Depths and velocities vary based on the amount of water released. The controlled lakes allow warning times up to 24 hours in advance to warn residents based on water release projections.

Properties surrounding and downstream of Lake Worth are subject to flooding with possibly less warning time than the other two lakes because it is uncontrolled. The uncontrolled release rates also limit the ability of the City to minimize impacts downstream. Release rates from other upstream lakes such as Eagle Mountain Lake and Bridgeport Lake will also affect the flooding depths and flow rates of Lake Worth. Lake Worth shows approximately 290 homes located within the 100-year FEMA flood pool. The depth of flooding surrounding Lake Wake Worth ranges from 1-6 feet. Velocities are assumed to be relatively low as rising water is controlled by the spillway elevation and release rates from the lake. Warning times for high water at Lake Worth vary based on lake levels, storm intensity and volume of runoff. If the lake is full, then the City can warn residents of potential spillway overtopping at future events, but flash flooding may cause minimal warning times.

Repetitive Loss Areas

Repetitive Loss Areas (RLAs) also assist the City in identifying known flood hazards inside and outside of the existing FEMA floodplains. There are 26 RLAs identified in the City of Fort Worth. A RLA is a portion of a community that includes repetitive loss properties and nearby properties that may be subject to similar flooding conditions. Each of these areas has at least one repetitive loss property. Two of the RLAs have been mitigated with infrastructure improvements. One of these mitigated areas is a neighborhood along Hulen Street just north of Willow Lake. The other mitigated area is neighborhood on the southern end of Warner Road just on the east side of the Fort Worth Zoo. Table 8 shows data relating RLAs to the 100-year floodplain. Within the city limits of Fort Worth, there are 44 repetitive loss properties, including six severe repetitive loss properties. A Repetitive Loss Property is any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling ten-year period, since 1978. A severe repetitive loss property is a property that received four or more claim payments of at least $5,000 or has received two or more claim payments where the total of the payments exceeds the total property value. Exhibit 3 in Appendix A shows the locations of the repetitive loss properties and areas.

Table 8: Repetitive Loss Area Summary

Repetitive Loss Properties (RLP)	44
RLP in 100-year floodplain	11
Severe Repetitive Loss Properties	6
Mitigated Repetitive Loss Properties	2
Repetitive Loss Areas (RLA)	26
Number of RLA in 100-year floodplain	14
Number of buildings in RLA	1081
Number of buildings in RLA and 100-year floodplain	772
Number of buildings in RLA but not 100-year floodplain	309

The statistics in Table 8 show that 75% (33 of 44) of the repetitive loss properties and 46% (12 of 26) of RLAs are outside of the 100-year floodplain. Theoretically, this means that a large portion of the flooding hazard is due to inadequate storm drain infrastructure, including undersized systems and small channels.

Two of the severe repetitive loss properties are in the Lake Worth 100-year flood pool; however, based on City input, these homes likely flood due to local drainage issues rather than the rising lake levels. The other four properties are located outside of the 100-year floodplain including three homes adjacent to each other in the vicinity of Texas Christian University and one home near Edgecliff Village. The location of these properties outside of the floodplain is further evidence of inadequate storm drain infrastructure creating flood hazard.

A Repetitive Loss Area Analysis (RLAA) was developed for each RLA identified in the City. This analysis activity provided the City with more detailed mitigation actions for each particular area. The RLAA and supporting documentation can be found in Appendix D.

Drainage Complaints and Storm Drain Studies

The City maintains a drainage complaint database (Storm Events GIS layer) and uses stormwater infrastructure and channel studies to identify known flood hazards. Residents report drainage complaints due to storm events using the stormwater assistance phone number available on the Stormwater Management webpage. The City keeps a record of these complaints within the “storm events” layer of their GIS data. Out of the recent (2009-2015) drainage complaints reported by police, fire department, and residents, 81% of these are located outside the FEMA floodplain and RLAs, as shown in Table 9. Most of these reported complaints include either vehicle damage due to flooding, home/property damage due to flooding, or flood waters overtopping roads. It was reported that several clogged storm drains also

resulted in flood hazards during storm events. The locations of each of these reported areas are shown in Exhibit 3.

Table 9: Drainage Complaint Summary (May 2009-May 2015)

Location	Number	Percentage
Inside 100-year Floodplain	105	18%
Inside Repetitive Loss Areas	10	2%
Outside Repetitive Loss Areas and 100-year Floodplain	461	80%
Total	571	100%

The source of flooding for the drainage complaints within the 100-year FEMA floodplain can be assumed to be riverine flooding, and the primary source for flooding outside the floodplain is assumed to be due to inadequate storm drain infrastructure. The statistics in Table 9 support the earlier observation from Table 8 that the source of many of the City's flooding problems is inadequate storm drain infrastructure outside the FEMA floodplain. These drainage complaints also assist the City in identifying areas in need of further investigation and studies.

In recent years, the City has conducted 10 storm drain or channel improvement studies in areas that have experienced flooding. There are 8 additional studies in progress. The name and a short description of each completed and ongoing study can be found in Appendix C in Tables C-5 and C-6 respectively. These studies are intended to identify the needed improvements to provide flood protection and to prioritize the Capital Improvement Plan.

In addition to the storm drain and open channel improvement studies, the City has completed 142 capital improvement projects related to stormwater between 2006 and 2015. A complete list of these projects with a brief description can be found Table C-7 in Appendix C.

Depths and velocities of flooding based on the drainage complaints in the storm events layer are unknown unless located within a studied area. The existing studies discuss the depths and velocities of flooding and can be found at the City by request. Flash flooding occurs in these areas because the storm drain systems cannot handle heavy rainfall in short time periods. Warning times during these storms is very minimal (less than 5 minutes), depending on rain forecasts.

Flood Warning System

Warning residents prior to a flood hazard is an important part of public safety during a storm event. The City monitors stream stage and precipitation depths at 53 locations near low water crossings. The stream gages trigger flashing warning signs to warn motorists of high water. These warning signs start flashing when triggered by flood waters reaching a pre-determined threshold. When flood waters reach this same threshold, the City is alerted and the public works crews begin deploying barricades at these locations where the roadway is likely to overtop. The locations of each of the Advance Warning System (AWS) gauges can be found in Exhibit 4. The flood warning system also includes five lake level monitors and two weather station sites.

The warning time for riverine flooding hazards can be sufficient in the case of controlled lake releases and depending on lake levels. Fort Worth's stream and lake monitors provide detailed information to know when to warn residents. However, there is little to no warning time of flash flooding along creeks and in the areas with inadequate storm drain infrastructure.

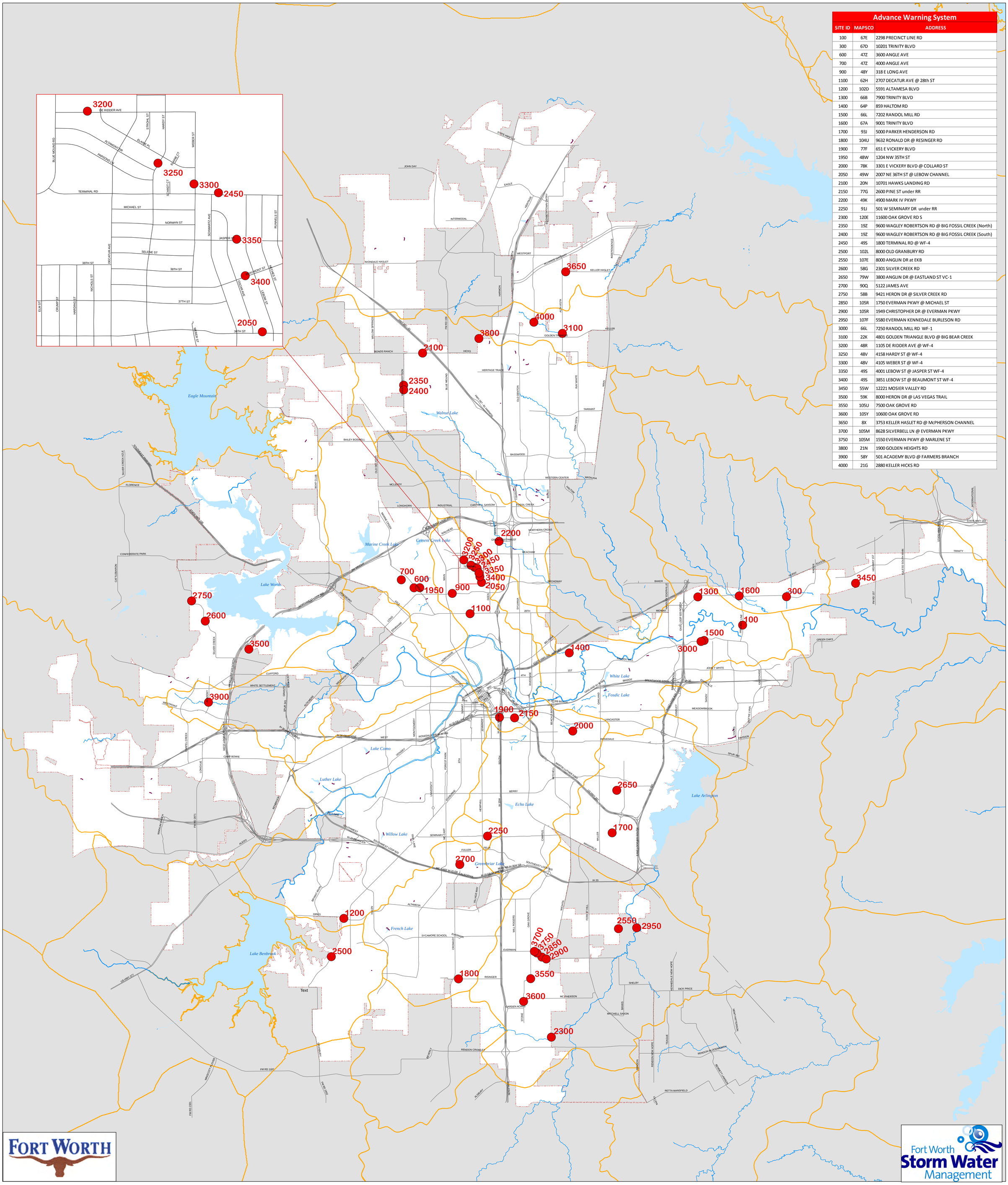
An extensive Flood Warning System Study was conducted in 2014 by AECOM for the City of Fort Worth. For further detail about the Fort Worth Flood warning system, see "Flood Warning System Study" on the CD in Appendix E.

Less-Frequent Flood Hazards

Inventory of Levees

Fort Worth has 22.1 miles of levees. The levees are designed to protect the city against a standard project flood event. All of the levees in Fort Worth have gravity outlets with no pump stations. Most of the levees are located along the West Fork and Clear Fork of the Trinity River in the west and central areas of the City within the Fort Worth Floodway. The Fort Worth Floodway is a federal project designation approved by Congress in 1945. This project in conjunction with Benbrook Reservoir was designed to provide the leveed areas of Fort Worth with reliable protection against high water levels in the West and Clear Forks of the Trinity River. The project involved channel improvements, construction and strengthening of levees, road relocations, sodding and seeding embankments, installation and modification of drainage structures, and modification of highway and railway bridges. The Fort Worth Floodway project was constructed between 1950 and 1970. There is also a section of levees along the Clear Fork of the Trinity River in the southwest area of the City. The locations of all the levees and dams in the City can be seen in

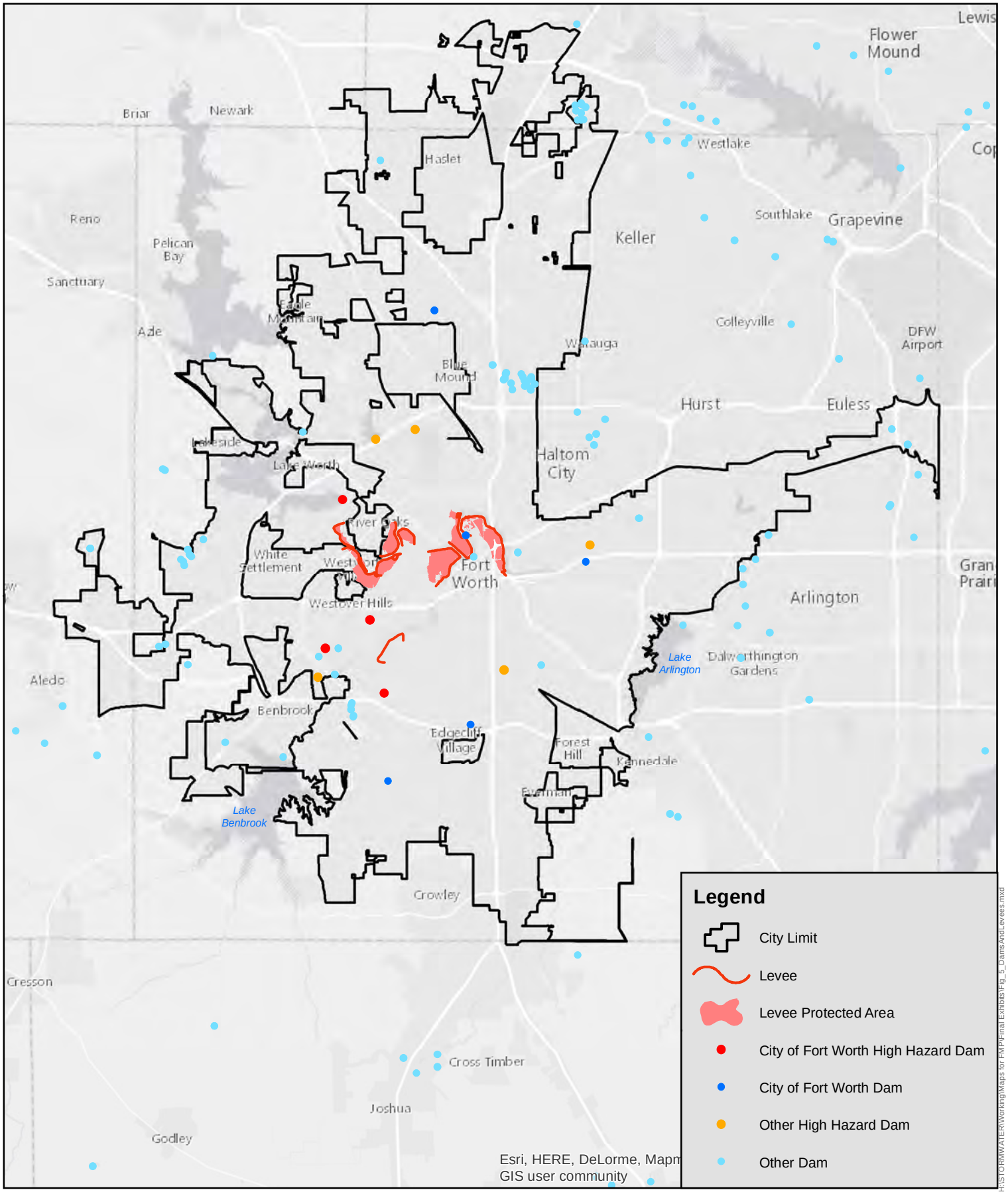
AWS Master Gauges



Advance Warning System		
SITE ID	MAPSCO	ADDRESS
100	67E	2298 PRECINCT LINE RD
300	67D	10201 TRINITY BLVD
600	47Z	3600 ANGLE AVE
700	47Z	4000 ANGLE AVE
900	48Y	318 E LONG AVE
1100	62H	2707 DECATUR AVE @ 28th ST
1200	102D	5591 ALTAMESA BLVD
1300	66B	7900 TRINITY BLVD
1400	64P	859 HALTOM RD
1500	66L	7202 RANDOL MILL RD
1600	67A	9001 TRINITY BLVD
1700	93J	5000 PARKER HENDERSON RD
1800	104U	9632 RONALD DR @ RESINGER RD
1900	77F	651 E VICKERY BLVD
1950	48W	1204 NW 35TH ST
2000	78K	3301 E VICKERY BLVD @ COLLARD ST
2050	49W	2007 NE 36TH ST @ LEBOW CHANNEL
2100	20N	10701 HAWKS LANDING RD
2150	77G	2600 PINE ST under RR
2200	49K	4900 MARK IV PKWY
2250	91J	501 W SEMINARY DR under RR
2300	120E	11600 OAK GROVE RD S
2350	19Z	9600 WAGLEY ROBERTSON RD @ BIG FOSSIL CREEK (North)
2400	19Z	9600 WAGLEY ROBERTSON RD @ BIG FOSSIL CREEK (South)
2450	49S	1800 TERMINAL RD @ WF-4
2500	102L	8000 OLD GRANBURY RD
2550	107E	8000 ANGLIN DR at EKB
2600	58G	2301 SILVER CREEK RD
2650	79W	3800 ANGLIN DR @ EASTLAND ST VC-1
2700	90Q	5122 JAMES AVE
2750	58B	9421 HERON DR @ SILVER CREEK RD
2850	105R	1750 EVERMAN PKWY @ MICHAEL ST
2900	105R	1949 CHRISTOPHER DR @ EVERMAN PKWY
2950	107F	5580 EVERMAN KENNEDALE BURLESON RD
3000	66L	7250 RANDOL MILL RD WF-1
3100	22K	4801 GOLDEN TRIANGLE BLVD @ BIG BEAR CREEK
3200	48R	1105 DE RIDDER AVE @ WF-4
3250	48V	4158 HARDY ST @ WF-4
3300	48V	4105 WEBER ST @ WF-4
3350	49S	4001 LEBOW ST @ JASPER ST WF-4
3400	49S	3851 LEBOW ST @ BEAUMONT ST WF-4
3450	55W	12221 MOSIER VALLEY RD
3500	59K	8000 HERON DR @ LAS VEGAS TRAIL
3550	105U	7500 OAK GROVE RD
3600	105Y	10600 OAK GROVE RD
3650	8X	3753 KELLER HASLET RD @ McPHERSON CHANNEL
3700	105M	8628 SILVERBELL LN @ EVERMAN PKWY
3750	105M	1550 EVERMAN PKWY @ MARLENE ST
3800	21N	1900 GOLDEN HEIGHTS RD
3900	58Y	501 ACADEMY BLVD @ FARMERS BRANCH
4000	21G	2880 KELLER HICKS RD

Prepared by Timothy B. Royer
Revised 03/20/15

Exhibit 4



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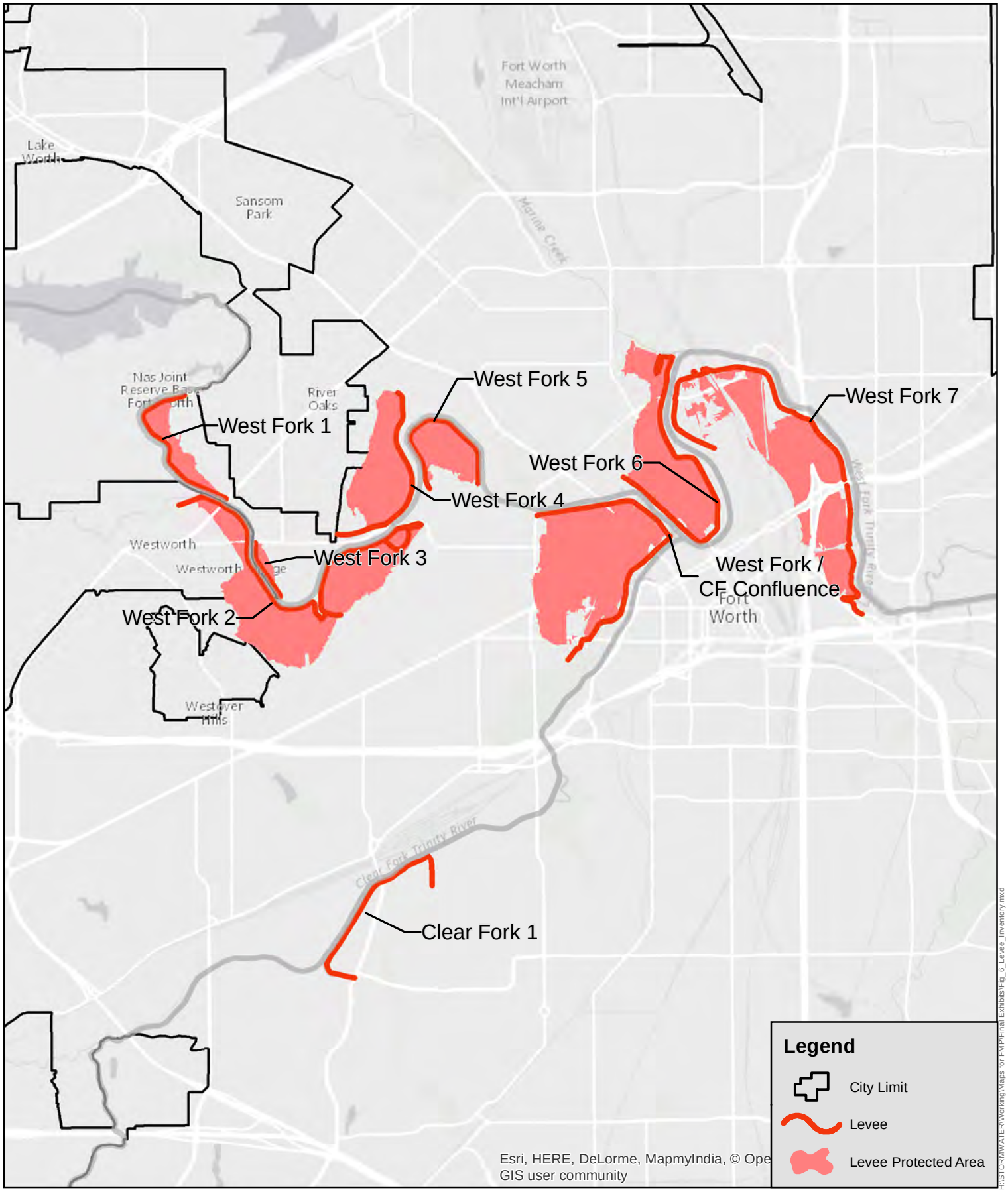
DATE: 12/2/2015

Dams and Levees

0 2.5 5 Miles

EXHIBIT 5



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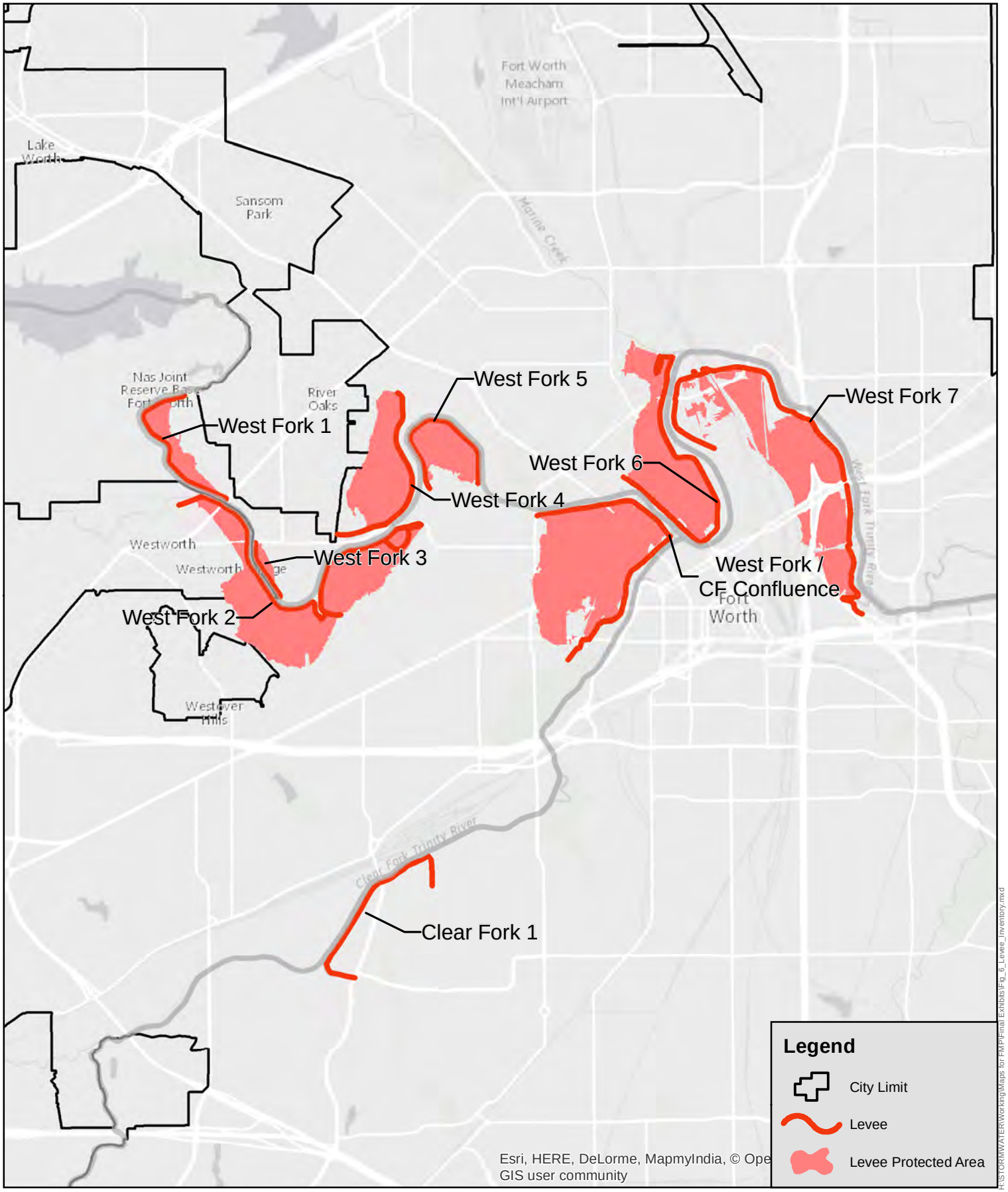
DATE: 9/14/2015

Levee Inventory

0 0.5 1 Miles

EXHIBIT 6



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JOB: FT115220
DATE: 9/14/2015

Levee Inventory

0 0.5 1 Miles

EXHIBIT 6

Exhibit 5. The areas of the City protected by levees are also shown in Exhibit 6. The levees are maintained by the Tarrant Regional Water District. Specific procedures for the operation and maintenance of the Fort Worth Floodway System is included in the *Fort Worth Floodway Operations and Maintenance Manual* found in the CD in Appendix E.

According to Fort Worth's Hazard Mitigation Action Plan a levee failure occurred in 1949 near 12th Street that exacerbated the effects of a flood on the Clear Fork of the Trinity River and had backed up the channel of the West Fork. It is very unlikely that the City will experience another levee failure based on the routine maintenance the levees receive by Tarrant Regional Water District. However, if there were a levee failure in the future, Table 10 shows the area in acres and number of buildings potentially affected and the names of specific areas most prone to damage. It also shows areas that would be susceptible to flood risk if the levees were not in place, or areas at risk of flooding if Fort Worth experiences a storm that exceeded the design criteria for the levees.

Table 10: Areas and Buildings Protected by Levees

Levee	Areas Protected	Area (Ac)	Residential Buildings	Non-Residential Buildings
West Fork 1	Streets to the west of Meandering Road and north of TX 183	87	231	0
West Fork 2	Burton Hills Skyacres/Pecan Drive	567	496	2
West Fork 3	Riverbend Neighborhood	18	17	0
West Fork 4	Streets to the east of Isbell Road and north of White Settlement Road	259	847	9
West Fork 5	Crestwood Neighborhood	140	239	0
WF/CF Confluence	Montgomery Plaza 7th Street, between University Dr. and Clear Fork White Settlement Road between University Dr. and Clear Fork	591	188	297
West Fork 6	Main Street, between North Side Dr and West Fork	360	22	145
West Fork 7	Greenway Neighborhood Rock Island Neighborhood	493	185	63
Total		2515	2225	516

The areas protected by levees seen in Exhibit 6 were delineated by comparing City of Fort Worth 2-foot contours to the base flood elevations on the upstream end of each levee section. Land use data from NCTCOG was then clipped to these areas to identify residential and non-residential areas. The last step

included clipping building footprints to the residential and non-residential areas protected by levees. The building footprints were compared with Bing Maps visual imagery and the insignificant footprints (sheds, garages, docks, etc) were deleted. The total number of building footprints was then counted and recorded in Table 10. It should be noted that this data does not including land or buildings protected by the levee along the Clear Fork of the Trinity River. The land behind this levee appears to be higher than the base flood elevations based on the City contours.

Inventory of Dams

There are 51 dams within the Fort Worth city limits. There are several other dams nearby such as Eagle Mountain Lake, Benbrook Lake, and Lake Bridgeport that would impact areas of Fort Worth if they were breached. Exhibit 5 in shows the location of each dam. The City owns and operates nine of these dams listed in Table 11. Detailed information on the dams owned by the City can be found in the "Citywide Dam Safety Assessment" in Appendix E.

Table 11: Dams Owned and Operated by City of Fort Worth

City of Fort Worth Dams	
1	Lake Como Dam
2	Luther Lake Dam
3	Lake Worth Dam
4	Fosdic Lake Dam
5	Willow Creek Lake Dam
6	North Side Drive Dam Number 3
7	French Lake Dam
8	Greenbriar Dam
9	Walnut Lake Dam

The other dams not listed in Table 11 are owned by private landowners, private companies, or Tarrant Regional Water District. In 2011, the City conducted a dam safety assessment for seven out of these nine dams. For more detail, please refer to Fort Worth's "Citywide Dam Safety Assessment" on the CD in Appendix E. Dams are also regularly inspected by Stormwater Maintenance Engineering.

The State of Texas has identified 11 dams in Fort Worth as high hazard dams. Completion of inundation studies for all high hazard dams in the county will determine the extent of the hazard. Table 12 shows the 11 high hazard dams and what areas would be most affected should a dam breach occur.

Table 12: High Hazard Dams

Name	Owner	Potentially Affected Areas
Bal Lake Dam	Jearl Walker	• Ridglea Hills Neighborhood
Cement Creek Dam	Tarrant Regional Water District	• Union Pacific and Burlington Northern • Industrial Area between NE 38th • Diamond Hill – Jarvis Neighborhood • Long Avenue Railway underpass
Eagle Mountain Lake Dam	Tarrant Regional Water District	• Homes and businesses around • River Oaks Water Treatment • Lakeland Neighborhood • North Lake Worth Neighborhood • Camp Carter Boy Scout Camp • Riverbend Neighborhood • Rockwood Golf Municipal Course • Crestwood Neighborhood
Echo Lake Dam	Tarrant County	• Morningside Neighborhood • Glencrest Neighborhood • Rolling Hills Neighborhood • Berryhill/Mason Heights Neighborhood
Lake Como Dam	City of Fort Worth	• Como neighborhood • Sunset Heights South Neighborhood • Vickery Blvd. • Union Pacific Railway
Lake Worth Dam	City of Fort Worth	• Camp Carter Boy Scout Camp • River Oaks Water Treatment • Rockwood Golf Municipal Course • Crestwood Neighborhood • Gateway Park
Luther Lake Dam	City of Fort Worth	• Ridglea Hills Neighborhood • River Hollow Neighborhood • Vickery Blvd. • Union Pacific Railway
Marine Creek Dam	Tarrant Regional Water District	• Loop 820 • Sansom Park • Marine Park • Northside Neighborhood • Belmont Terrace Neighborhood
Ridglea Country Club Estates Dam	James Buckley	• Ridglea Country Club Estates
White Lake Dam	Nolan Catholic High School	• White Lake Private School • White Lake Hills Neighborhood • Woodhaven Neighborhood
Willow Creek Lake Dam	City of Fort Worth	• Foster Park Neighborhood • Westcliff West Neighborhood

STEP 5. PROBLEM ASSESSMENT

The hazard assessment identified flooding sources such as riverine overtopping and storm drain deficiencies. Based on the assessment of SFHA and recent stormwater studies within the City, Fort Worth has a high vulnerability to flooding from these sources. There are also dams and levees within the City that could be a potential risk if any were to fail. There has never been a recorded dam failure in Fort Worth, and the levees have been significantly strengthened since the breach in 1949; therefore, Fort Worth has a low vulnerability to dam and levee failure. The problem assessment quantifies and assesses the potential damage and risk due to the known flood hazards identified in Step 4 using HAZUS software and GIS capabilities.

HAZUS SUMMARY

HAZUS-MH 2.2 software was used to estimate potential losses from a hypothetical 100-year flood event in Fort Worth. The software was used to determine flood impacts to life safety and public health, critical facilities and infrastructure, the community's economy and major employers, and the number and types of buildings affected by the FEMA 100-year floodplain.

The first step in the HAZUS analysis was to create a depth grid. This depth grid was a 10-foot digital elevation model (DEM) from LIDAR data and served as the base surface for the City. The base flood elevations (BFE) from the FEMA floodplain layer were compared to the DEM to determine water surface elevations (WSEL) for a 100-year flood. Raster datasets were created to represent the ground and the WSELs. The ground was then subtracted from the WSELs in order to obtain the depth grid representing depths of flooding due to the 100-year FEMA floodplain.

HAZUS has a comprehensive set of stock data with location and cost estimation formulas for buildings, utility infrastructure, transportation infrastructure, etc. However, HAZUS analysis is more accurate if local data is added to the stock data. A list of critical facilities was added using the Comprehensive Data Management System (CDMS) tool distributed by FEMA to update information in HAZUS. Tables from the stock data were extracted, and the local data was manipulated to match the same format as the stock data. The local data was then uploaded into HAZUS. Table 13 shows a summary of the local input that was affected during the HAZUS flood analysis. Exhibit 7 also shows a summary of the input.

Fort Worth Floodplain Management Plan

HAZUS Analysis: 100 Year Flood Input

EXHIBIT 7

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Legend

- City Limits
- 100 Year Depth Grid

Critical Facilities

- Airport Facilities
- Bus Facilities
- Care Facilities
- Emergency Centers
- Fire Stations
- Military
- Police Stations
- Schools
- Waste Water Facility

0 2.5 5
Miles

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Table 13: Summary of Local Data Input into HAZUS

Category	Dataset	Records Affected
Utility Systems	Waste Water Facilities	8
Transportation Systems	Railway Facilities	1
Transportation Systems	Bus Facilities	1
Transportation Systems	Airport Facilities	1
High Potential Loss Facilities	Military	3
Essential Facilities	School Facilities	91
Essential Facilities	Police Station Facilities	19
Essential Facilities	Medical Care Facilities	14
Essential Facilities	Fire Station Facilities	12
Essential Facilities	Emergency Operations Centers Facilities	24

After adding the local data, HAZUS was executed and the results were analyzed. Much of the data in this problem assessment came from a HAZUS analysis, including Tables 13, 14, and 16. It is important to realize that HAZUS evaluates data by census block and tract. Some of these blocks and tracts overlap into neighboring communities. This explains why some of the following tables include buildings outside of the Fort Worth city limits. The data from HAZUS should be viewed as high-level estimates. The data in Tables 13, 14, and 16 are estimates calculated by generalized HAZUS algorithms for each type of building. Several years of data collection concerning what items are kept in each building as well as the building materials would be necessary for a more accurate estimate.

LIFE SAFETY AND PUBLIC HEALTH

Flood hazards can have an impact on life safety and public health. Life safety is of primary concern to the City when determining flood risk. Roadway overtopping from creek crossings as well as roadway flooding can create hazards for drivers and potential loss of life if caught in deep water or shallow water with high velocities. Rising water from streams and storm drains can also create dangerous situations for the population. Public outreach and education of the dangers of high water as well as effective warning systems are paramount to protecting individuals.

Based on the HAZUS analysis, Table 14 shows an estimate of how many people would be displaced from homes and, of those people, how many would seek shelter from public facilities. Not everyone displaced

will seek shelter from public facilities. HAZUS estimates the number of displaced people seeking shelter based on income and age and assumes only a portion of the population that is displaced would need shelter.

Table 14: Shelter Needs

Number of Displaced People	26,382
Number of People Needing Short Term Shelter	21,186

Flooded areas and buildings can also create a risk to public health including mold that can form when buildings remain damp for an extended period of time. Black mold can especially create health hazards sometimes leading to hospitalization. Wet areas can also attract unwanted wildlife, such as snakes, that can be potentially harmful to humans. This is why it is important that the City provide shelter for displaced residents. Residents should have access to shelter so they do not have to stay in their flooded property. According to the estimate in Table 13, the City should be prepared to shelter about 22,000 people if a 100-year flood event should occur throughout the City. In 2005, during Hurricanes Katrina and Rita, Fort Worth processed approximately 35,000 people over a six week period to temporary shelters and apartment complexes. The City aims to shelter approximately 3,000-4,000 people in designated facilities at any given time and move them to temporary homes as soon as possible. If a large storm event occurred in Fort Worth, the Emergency Management Office (EMO) and the City would coordinate with neighboring communities to shelter displaced people as well.

CRITICAL FACILITIES AND INFRASTRUCTURE

The City developed an inventory of its critical facilities as part of their Hazard Mitigation Action Plan. Critical facilities include fire stations, police stations, medical buildings, schools, and other important buildings. A full list of these facilities is included on the CD in Appendix E. These facilities were analyzed along with the facilities identified with the general building stock from HAZUS to determine if they are vulnerable to flooding and the potential damage that may be expected should a 100-year flood occur.

HAZUS predicts that 22 critical facilities would be affected by a 100-year flood event. However, upon further inspection with GIS and aerial imagery, the list was narrowed to the 11 facilities shown in Table 15. Some of the facilities removed from the list were somewhat close to the floodplain, so HAZUS considers them damaged because the floodplain intersects the same parcel as the building. Other buildings were removed from the list simply because they were geocoded incorrectly in the HAZUS stock data. One other building which was removed from the list was a duplicate of the Fort Worth Police Training Division. Table 15 shows the type of facility, the predicted percent building and content damage, and a

prediction of days before the facility would be 100% functional again. HAZUS assumes that when the flood depth of a building reaches half a foot, the building must be evacuated and rendered non-functional. The building damage, content damage, and days before 100% functionality are determined as a function of the flooding depth. This data could be used by the City to make emergency plans regarding where displaced students could attend school while waiting for their own school to be renovated or reconstructed. This information could also be used similarly to make contingency plans for the other damaged facilities.

Table 15: Affected Critical Facilities

Name	Building Type	Functional	Building Damage	Content Damage	Days before 100% Functional
Seminary Hills Park Elementary	School	No	9.28%	65.11%	630
Woodway Elementary	School	No	8.99%	52.89%	480
Dunbar Middle	School	No	5.49%	29.72%	480
East Fort Worth Montessori Academy	School	No	6.71%	36.38%	480
Metro Opportunity	School	No	9.47%	65.88%	630
The White Lake School	School	Yes	1.14%	6.17%	480
Treetops School International	School	No	7.68%	43.14%	480
Cowtown Coliseum	Emergency Center	No	33.02%	100%	720
North Tarrant County Fire Department	Fire Station	No	10.94%	36.94%	480
Fort Worth Fire Station 20	Fire Station	No	6.81%	7.78%	480
Fort Worth Police Training Division	Police	No	11.80%	51.54%	480

Possible damage to roads leading to critical facilities are also of concern. Limited access to hospitals, fire stations and police stations can potentially be life threatening. Mold and other damage resulting from flooding can also impact these facilities financially and close them for extended periods of time placing a larger burden on other nearby facilities.

Damage to utilities, including electrical, potable water, and sewer could displace residents and create a financial burden on the City to repair the damaged facilities. Losing electrical power and water during the summer months could also increase the possibility of heat related illnesses for the elderly and infants.

COMMUNITY ECONOMY AND MAJOR EMPLOYERS

After matching employers from NCTCOG data to the 100-year floodplain, 10 employers were found to be located within the floodplain. Only 5 out of these 10 employers have floodplain insurance. Table 16 summarizes information concerning each of these employers, including the number of employees at the business. The names of these companies will remain anonymous in this report for privacy.

Table 16: Major Employers in the 100-year Floodplain

Sector	Employers	Employees
Manufacturing	3	352
Wholesale Trade	1	229
Retail Trade	1	240
Transportation/Warehousing	1	400
Professional/Scientific/Technical	1	100
Administrative/Waste Management	2	449
Accommodation/Food	1	127
Total	**10**	**1,897**

Based on Table 16, if a 100-year flood event occurred throughout the City, about 1,900 people would be unemployed. This number would most likely be higher because this analysis only considers some of the larger employers while several other small companies may also be impacted.

The HAZUS program has the ability to estimate the total economic loss for different flooding scenarios. HAZUS breaks down the results into two categories: direct building losses and business interruption losses. According to HAZUS, the direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents, and the building interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Table 17 shows the estimated losses for the buildings of Fort Worth due to both building damage and interruption of business. Exhibit 8 shows estimated economic losses in different regions of Fort Worth.

Legend

City Limits

Total Economic Loss by Census Block (in thousands of dollars)

- 1 - 500
- 501 - 1000
- 1001 - 2500
- 2501 - 5000
- 5001 - 10000
- 10001 - 20000
- 20001 - 50000

The total economic loss estimated for the flood is 1,589.42 million dollars, which represents 8.11% of the total replacement value of the scenario buildings.

Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user

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Fort Worth Floodplain Management Plan

HAZUS Analysis: 100 Year Flood Results

EXHIBIT 8

0 2.5 5
Miles

Table 17: Financial Building Losses

	Residential	Commercial	Industrial	Others	Total
Building Loss					
Building	$532,250,000	$127,820,000	$59,370,000	$12,060,000	$731,500,000
Content	$345,160,000	$295,130,000	$140,590,000	$43,120,000	$824,000,000
Inventory	$0	$8,220,000	$19,970,000	$300,000	$28,490,000
Subtotal	$877,410,000	$431,170,000	$219,930,000	$55,470,000	$1,583,980,000
Business Interruption					
Income	$20,000	$1,220,000	$10,000	$50,000	$1,300,000
Relocation	$650,000	$280,000	$10,000	$30,000	$970,000
Rental Income	$160,000	$190,000	$0	$10,000	$360,000
Wage	$50,000	$1,270,000	$10,000	$1,470,000	$2,810,000
Subtotal	$890,000	$2,970,000	$20,000	$1,570,000	$5,440,000
Total	**$878,300,000**	**$434,140,000**	**$219,950,000**	**$57,040,000**	**$1,589,420,000**

The HAZUS analysis indicates that flood damages could exceed $1.5 billion should a 100-year flood event occur. This is assuming that 100-year flood conditions were affecting the entire City at the same time. Since Fort Worth has a large land area, it is not likely the entire City would simultaneously experience 100-year flood conditions. It is important to remember that the HAZUS analysis is a high level estimate and should be treated accordingly.

HISTORICAL DAMAGE TO BUILDINGS

The NFIP began in 1978, and Fort Worth joined the program in 1980. Since then, there has been at least one paid flood insurance claim in Fort Worth every year except for 1984 and 2011. Figure 2 shows the number of flood insurance claims (paid and unpaid) in each year since 1978. Figure 3 shows the dollar amount paid out in flood insurance claims in each year since 1978. Table C-8 in Appendix C is a detailed table of the data in Figures 2 and 3.

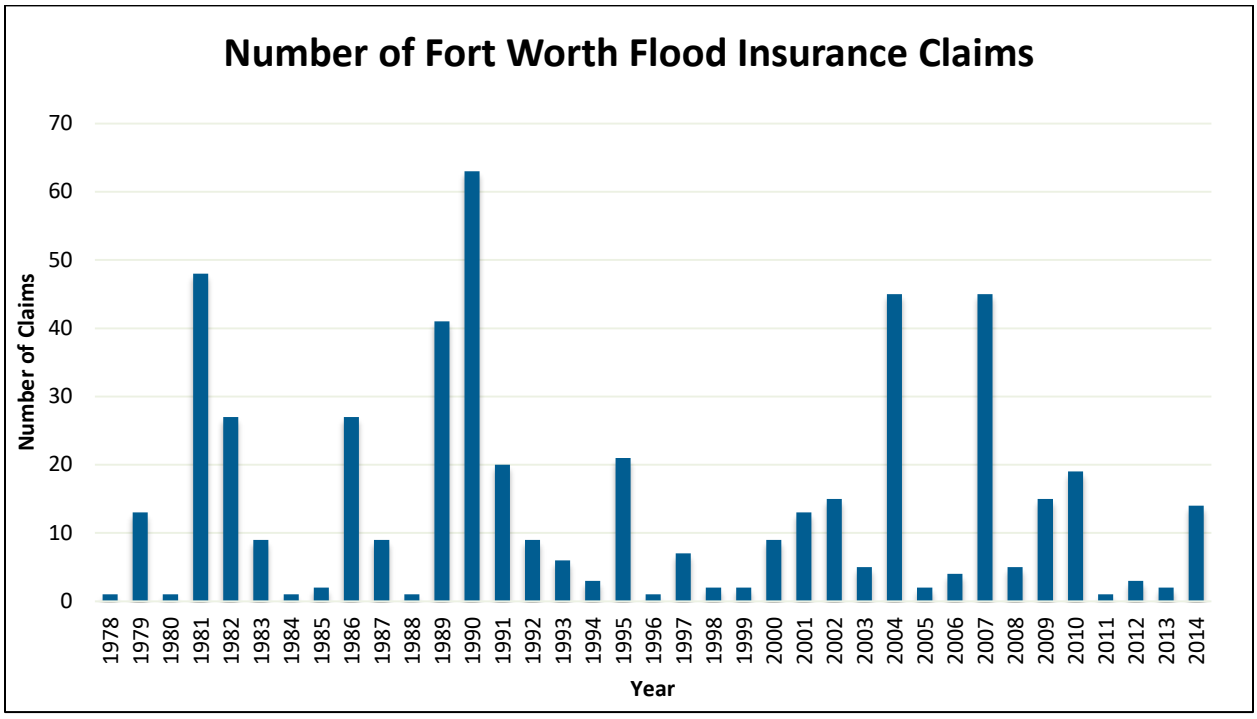


Figure 6: Fort Worth Flood Insurance Claim History

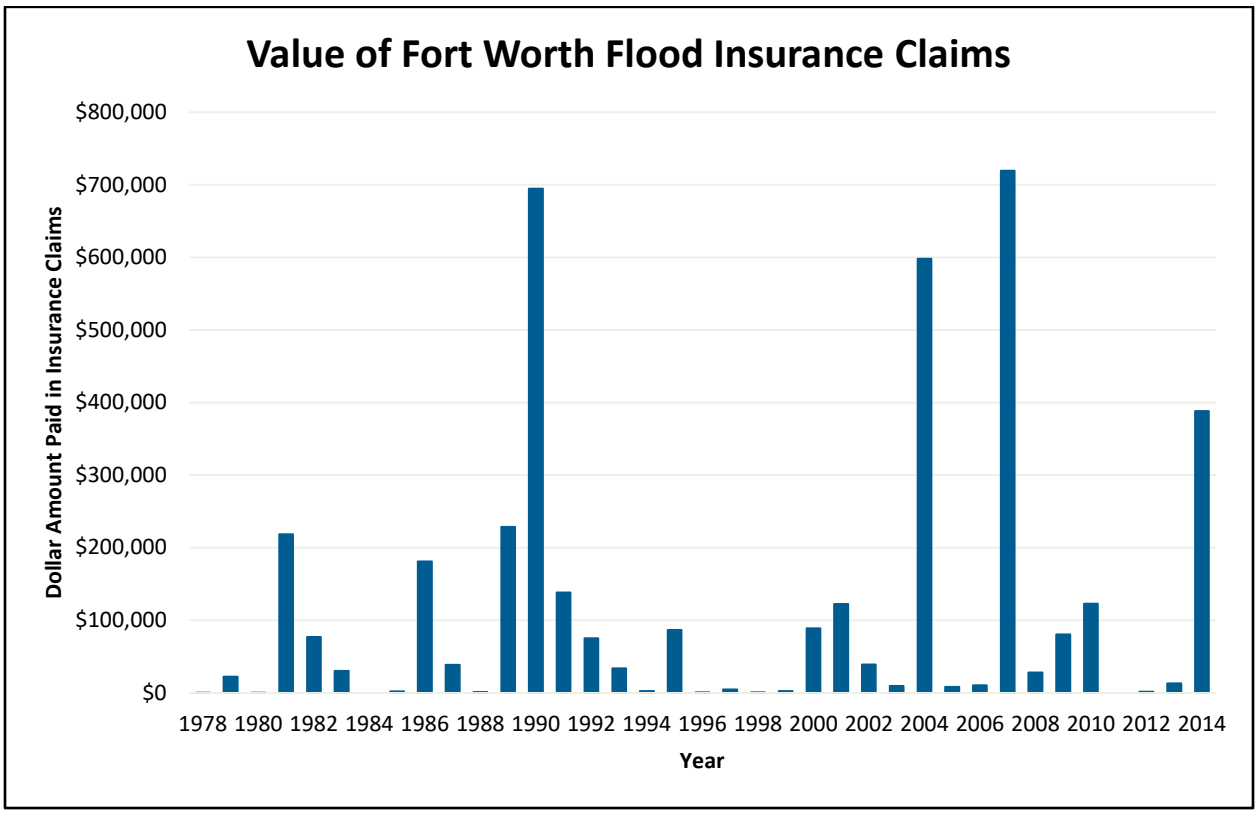


Figure 7: Fort Worth Paid Insurance Claims

As of June 2015, there are 2,411 active flood insurance policies in Fort Worth. Most of these are policies for single family homes. Table 18 summarizes the claims paid since 1978 and the dollar amount paid for different types of buildings.

Table 18: Insurance Information by Type of Building

	Policies	Paid Claims	Paid Losses
Single Family	1,942	304	$3,215,674
2-4 Family	31	41	$324,451
Other Residential	182	5	$18,638
Non Residential	256	36	$516,519
Total	2,411	386	$4,075,282

As mentioned before, the City joined the NFIP in 1980. Pre-FIRM refers to buildings constructed in or before 1980 while Post-FIRM refers to buildings constructed after 1980. Table 19 shows that most paid claims have been on Pre-FIRM structures, which means that the Fort Worth's ordinances and policies concerning building in the floodplain have been effective.

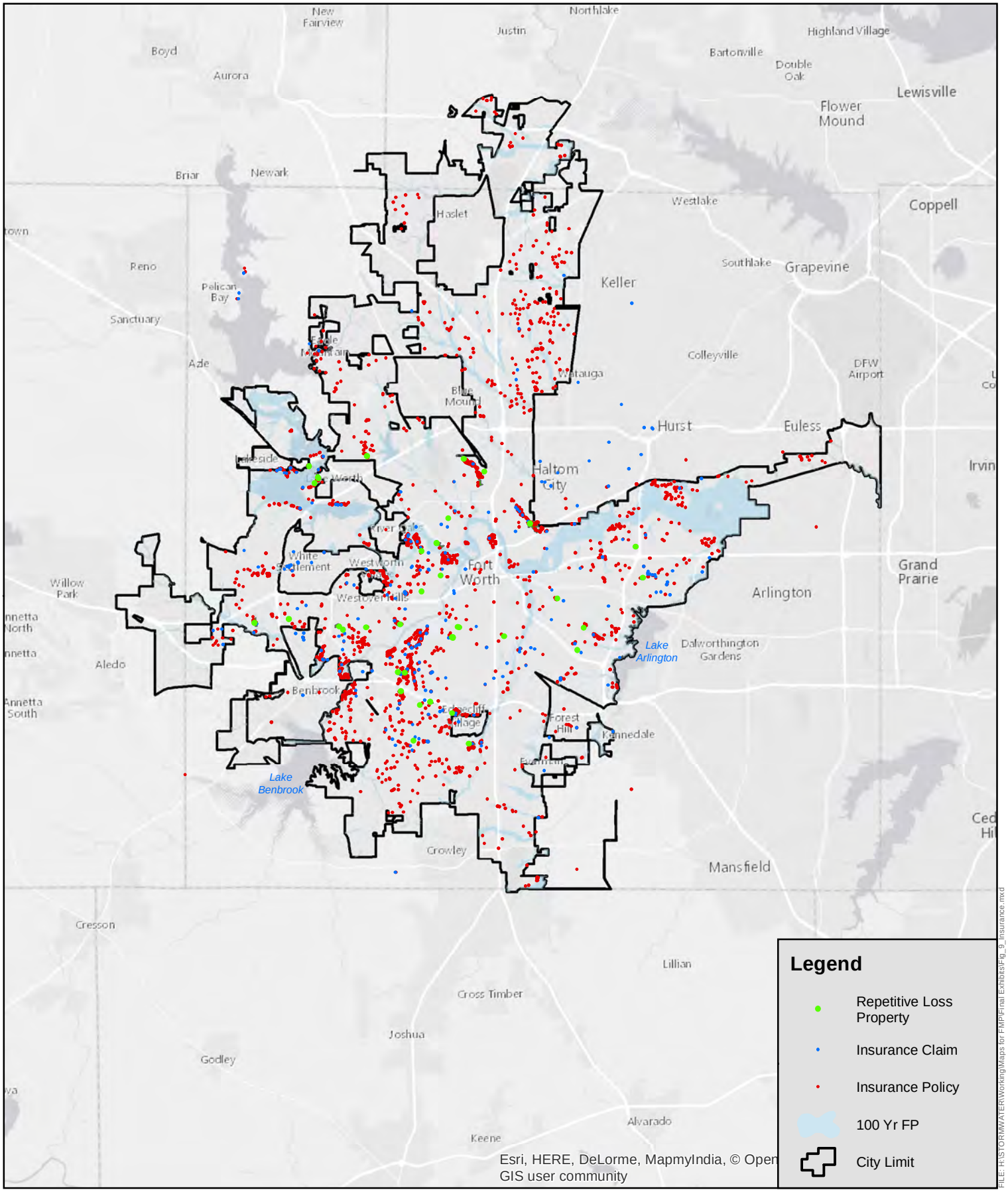
Table 19: Pre-FIRM/Post-FIRM Insurance Data

	Paid Claims	Paid Losses
Pre-FIRM	323	$3,414,216
Post-FIRM	38	$553,400

More than half of the paid insurance claims have been for properties outside of the 100-year floodplain as shown in Table 20. The data from Table 20 resulted from a GIS analysis. The results vary slightly from the data above in Figure 2 and Tables 17 and 18 because they count the properties that have received claims, not the total number of claims (i.e. some properties have had multiple claims at the same address). Table 20 is further evidence that inadequate storm drain infrastructure is a larger issue than riverine flooding in Fort Worth. The location of each policy and claim can be seen in Exhibit 9.

Table 20: Location of Insurance Claims

Fort Worth Flood Insurance Claims (1978-2015)		
Within 100-year Floodplain	116	34%
Outside Floodplain	221	66%
Within Repetitive Loss Areas	58	17%
RLA and 100-year Floodplain	23	7%
Outside Floodplain and RLA	186	55%
Total Number of Properties that have Received Claim Payments	337	100%



Flood Insurance Claims and Policies

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0 2.5 5 Miles

EXHIBIT 9

There are 2,288 active insurance policies currently in Fort Worth. Using this information, and the data above in Tables 7 and 8, an estimation of insured buildings in the 100-year floodplain and RLAs can be found in Tables 21 and 22 respectively.

Table 21: Insurance Policies in the 100-year Floodplain

	Insured		Uninsured		Total
All buildings	986	17%	4707	83%	5693
Single Family	715	20%	2900	80%	3615
Mobile Home	1	0%	257	100%	258
Multi-Family	105	15%	617	85%	722
Non-Residential	165	15%	933	85%	1098

Table 22: Insurance Policies in Repetitive Loss Areas

	Total	Insured	
Buildings In RLA	1081	199	18%

Flood insurance policies were also compared to properties within the floodplain to determine the value of insured and uninsured property within the floodplain. Building improvement values from the Tarrant Appraisal District were used to develop the total property value at risk. The results are shown in Table 23.

Table 23: Property at Risk in the Floodplain by Dollar Value

	Residential	Non-Residential	Total
Insured	$228M	$112M	$340M
Uninsured	$695M	$456M	$1.15B
Total	$923M	$568M	$1.5B

Tables 20 and 21 show there are many people at risk for flooding that do not have insurance. There are also 909 properties with flood insurance policies that are not located within the repetitive loss areas or the 100-year floodplain. This could be because these property owners have experienced flooding caused by inadequate storm drain systems.

City owned buildings within the floodplain were also reviewed. There are 63 buildings in the 100-year floodplain, not including foreclosed homes, where the property ownership is recorded as City of Fort Worth. Of these, only 35 have current flood insurance policies. However, it is not clear without further investigation whether the remaining are actually insurable structures as several were located within parks and could be concession facilities or restrooms. It is also not clear whether they are all owned by the City.

In some cases the land could be owned by the City but under a lease to the building owner. Finally, the policy information does not have a policy holder name. In general, the City is considered to be self-insured and may not hold insurance policies on structures. In light of this analysis, it is recommended to perform a detailed review on flood insurance for City-owned properties.

STEP 6. GOALS

The City seeks to reduce and avoid long-term vulnerabilities of identified flood hazards within the City through mitigation actions developed in this plan. Developing specific goals for the plan provides future context for review of all floodplain management plans and preserves consistency with other non-flood related community goals, such as the 2015 City Hazard Mitigation Action Plan (HazMAP). The Stakeholder Planning Group reviewed the following City goals as identified in the City of Fort Worth Comprehensive Plan:

1. Make Fort Worth the nation's safest major city.
2. Improve mobility and air quality.
3. Create and maintain a clean, attractive city.
4. Strengthen the economic base, develop the future workforce, and create quality job opportunities.
5. Promote orderly and sustainable development.

The Stakeholder Planning Group also reviewed the mission and vision of the Stormwater Management Division to assist in guiding goals for the FMP. The Stormwater department is primarily responsible for flood risk reduction, so it is beneficial to incorporate their vision in the FMP goals.

Mission: To protect people and property from harmful stormwater runoff.

Vision: To be commonly recognized as an exceptionally effective and progressive municipal stormwater management program.

The goals for the FMP were then finalized with the Stakeholder planning group and align with the City's goals and Stormwater Management Department as summarized in Table 24. The mitigation strategies discussed in the following sections were crafted to achieve these goals.

Table 24: FMP Goals

FMP Goals		Linkages to City Goals
1.	Protect the health and safety of the public	Links to City goal 1, 5
2.	Facilitate sustainable growth	Links to City goals 4, 5
3.	Educate the public about flood risk, mitigation, and safety in Fort Worth	Links to City goal 1
4.	Reduce the adverse effects of flood events	Links to City goals 1, 2, 3, 4, 5
5.	Develop mitigation actions to address potential regulatory issues and provide regional solutions to flood issues	Links to City goals 5

STEP 7. POSSIBLE ACTIVITIES

There are multiple methods to provide mitigation for flooding. Some may be more effective or feasible based on a number of factors such as cost, benefits, and availability of resources. This section evaluates the possible activities to determine if they are appropriate actions for the City. These activities are listed below and evaluated in more detail:

1. Preventative activities
2. Property protection
3. Natural Resource Protection
4. Emergency services
5. Structural projects
6. Public information

These activities were discussed with the Stakeholder Planning Group and also presented to the public for input and comments on preference of types of activities at the first public meeting. The survey was described in Step 2 and included in the Appendix. Those comments and survey results were included in the considerations of each type of activity. The City of Fort Worth Stormwater Division met together on August 17, 2015 and discussed which mitigation activities are currently being implemented and which mitigation activities could potentially be implemented in the future. A full list of these mitigation activities is shown in Table C-9 in appendix C. This input assisted in shaping Steps 7 and 8 of the planning process.

PREVENTATIVE ACTIVITIES

Preventative activities generally include the regulation of development through planning and land acquisition. Table 25 lists a summary of existing ordinances and regulations that the City has adopted to prevent flooding within the floodplain.

Table 25: Existing Floodplain and Stormwater Ordinances and Regulations

Regulation or Ordinance Name
Floodplain Provisions Ordinance
Zoning Ordinance
Comprehensive Plan
International Building Codes
Integrated Stormwater Management Criteria Manual
Grading Ordinance
Subdivision Ordinance

The current floodplain regulations include higher standards than the minimum required NFIP regulations. These regulations are listed in the Zoning Ordinance, Floodplain Provisions Ordinance, and in the International Building Codes. For instance, Chapter 7, Division 4, § 7-350 of the Fort Worth Code of Ordinances states that developing in floodplain designated areas is prohibited unless a technical evaluation completed by a licensed professional engineer shows that there is no increase in flood levels as a result of the development. Section 3.7 of the Local Provisions of the Floodplain Provisions Ordinance also states that the minimum finished floor elevation for lots is 2-feet above the 100-year ultimate water surface elevation. This section also stipulates easement dedication for the ultimate 100-year floodplain and for natural creeks.

The integrated Storm Water Management (iSWM) Criteria Manual for Site Development and Construction provides guidance for development and capital improvement projects relating to stormwater impacts. The manual stipulates that any new or substantial construction for redevelopment must meet current criteria and that the development cannot cause adverse impacts downstream of the site. In other words, the developer must show that the proposed site does not increase discharges or water surface elevations. If a site does cause increases in discharges or water surface elevations, the developer must show that either the downstream infrastructure has capacity to accept the increase or that they provided detention

to offset their impact. The iSWM Criteria Manual also lists requirements for capital and development projects so that new infrastructure is built to a 100-year fully developed discharge.

The City's floodplain regulations have reduced flood hazards within the City, as evidenced by the claim reduction since NFIP participation in 1980 summarized in Table 26. Many of the claims are also located outside of the FEMA floodplain, as discussed in Steps 4 and 5.

Table 26: Pre- vs. Post- Insurance Claims

	Pre-FIRM (1978)	Post-FIRM (2015)	Total Percent Reduction in Claims
Number of Claims	321	38	88%
Cost of Damages	$3,365,846	$533,400	84%

The City also participates in the Corridor Development Certificate (CDC) program in an effort to protect and reduce flood potential along the Trinity River. In the mid-1980s, the population in the Dallas/Fort Worth area started increasing rapidly. A steering committee and a task force were formed by the cities and counties in the Trinity River Corridor in order to regulate construction in the floodplain. They published the first CDC manual in 1991, and there have been three updated editions since. The purpose of the CDC is to reduce the impacts of development in the floodplain from one community to the next. The CDC requirements are more stringent than those of the NFIP and requires no loss in valley storage or increase in water surface elevation along the Trinity River. A CDC permit includes review by U.S. Corps of Engineers, the City of Fort Worth, and other participating communities prior to approval of construction within the Trinity River Corridor.

Other preventative measures are taken through various departments within the City, including the Planning and Development Department and the Stormwater Department. The Planning and Development Department reviews all permit applications regarding platting and buildings. Any proposed plat is sent through a review process at the City to verify that the plans meet City criteria for floodplain requirements and easements, building codes, and stormwater infrastructure requirements. The Stormwater Department assists in preventative measures, including maintenance activities, to reduce the potential for clogged or ineffective storm drains and channels. Ongoing maintenance programs include the inlet program, dam inspections, maintenance agreement inspections, water quality device inspections and cleaning, and pre- and post-rain event inspections at 300 locations of known hazard areas.

Based on feedback from the first public meeting, residents are interested in preventative measures, including enhancing the maintenance program and creating further regulations for development and

downstream impacts. Current regulations for future development have been effective as indicated by the reduction in claims since NFIP participation and location of claims inside the floodplain versus outside. However, additional measures are warranted for redevelopment in Pre-FIRM neighborhoods and development upstream of older neighborhoods, even outside of the FEMA floodplain. Preventative activities are therefore included in the Mitigation Action Plan. These activities are relatively low in cost, but may require time from City staff for outreach to the Council and public to describe the need for further regulations and explain any new proposed changes.

PROPERTY PROTECTION

Property protection activities involve relocation, acquisition, building elevation, retrofitting, sewer backup protection, and insurance. These activities are typically performed on a lot-by-lot basis.

The City historically has not been involved in relocation and acquisition projects; however, this activity can be cost effective and is one of few activities that guarantees flood hazard risk reduction. The acquired properties then may be repurposed to open space for different City uses, such as parks, recreation areas, and stormwater detention. Alternatively, the City may provide more public outreach on how an individual property owner can perform activities such as building elevation and retrofit flood proofing and what type of funding is available for a resident to complete the project.

The water department regulates the sewer back up protection and provides 24-hour customer service to remove blockage of the pipe if it is City-owned. Regulations within the City codes also provide protection for sewer backups.

Flood insurance is another method of property protection. While the insurance does not prevent the property from flood damage, it reduces the economic impact on the landowner. The City currently participates in the NFIP with 2,288 insurance policies. The City strongly encourages floodplain insurance participation even if located outside of the FEMA floodplain. This method of flood prevention has been effective in reducing flood damage costs to residents. The cost of flood insurance to the City would just be that of its current buildings within the floodplain. The City would like to improve its communication with the public regarding flood insurance based on conversations with the planning group and public. Currently, there is a citywide mailer intended to enhance insurance awareness and knowledge. Letters are also sent to repetitive loss or frequently flooded areas to encourage insurance participation. The City intends to work to improve its CRS score so that flood insurance premiums for residents will decrease.

Property protection activities can provide cost-effective benefits from the City. Based on public and City input, mitigation actions were developed for property protection in Step 8.

NATURAL RESOURCE PROTECTION

There are several areas within the City that are preserved for the purpose of natural resource protection. These areas also provide flood risk reduction because there is less development within the floodplain and less risk for property damage. There are other benefits of natural floodplain functions including improved water quality in the receiving lakes and streams, habitat for wildlife, and recreation opportunities for residents. A primary example of effective natural resource protection in the City is the Fort Worth Nature Center and Refuge (FWNC&R), located adjacent to Lake Worth. The FWNC&R is a 3,000 acre preserve with 20 miles of hiking trails and diverse wildlife including buffalo, alligators, deer, and birds. The FWNC&R includes an area of approximately 1,100 acres of floodplain which is preserved for natural floodplain functions. Other portions of the City that are reserved for natural resource protection include City parks often located within the floodplain. These areas are dedicated open space and not developed.

The City promotes water quality improvements through their native grass planning program for channel maintenance. They also participate with the NCTCOG and with their native plant program to promote water conservation. Native plants provide benefits in lowering maintenance costs, attracting native wildlife, and improving water quality. Additionally, the City participates in the Reverse Litter Campaign and has a stormwater utility credit program for non-residential development to encourage green infrastructure.

Erosion and sediment control along creeks can help the City to maintain those creeks and reduce potential for property damage along them. The City currently performs geomorphological assessments for highly erosive areas to understand how the channel is operating now and how it might change in the future. Understanding these streams can help the City plan and prevent stream erosion from damaging properties.

The current methods of natural resource protection have been effective in providing the City with flood risk reduction and improving the environment for residents. The City may consider improving on these methods or adding new ones. For instance, establishing other open space areas along floodplains such as buffers and park development that would promote natural resource protections. The public also showed interest in adding park space and multi-purpose detention facilities during public meetings and through

surveys. Mitigation actions related to natural resource protection are included in Step 8 of this FMP as it is not only an effective method for flood risk reduction, but also to integrate multiple community benefits.

EMERGENCY SERVICES

Emergency services are measures that can be taken during a hazard event to minimize the impact to the community. The City has an Emergency Management Office (EMO) whose roles include preparation for natural disasters, mitigation of hazards, and assisting affected residents in recovering from natural disasters. The City Fire and Police Departments are available to perform emergency services during a flood event. The City also maintains a Flood Warning System, as summarized in Step 4, to communicate immediate flood danger with residents. The warning system assists the City in knowing when to barricade roads, evacuate homes, and warn residents of possible flood hazards. The City is continually monitoring and updating the flood warning equipment and technology based on the plan in Fort Worth's Flood Warning System Study (2014).

The EMO also monitors the Outdoor Warning System (OWS) and conducts weekly maintenance inspections to assess the system for any failures. The OWS notifies people within the City when severe weather conditions are likely to occur. They signify that people within the community, residents or visitors, should seek shelter. Alerts from the OWS and National Weather Service are also posted on the EMO website (http://fortworthtexas.gov/emo/). The City has multiple community buildings and large arenas for shelter that can be used as temporary shelter for people in severe storms or hazards.

The Fire and Police Departments are on duty for emergency safety response; however, for non-life threatening situations, residents may call the Stormwater Department as they have employees on-call 24 hours per day every day. The Stormwater Department has an Emergency Response Manual that provides detailed guidance for emergency management operations and procedures. This manual is included in Appendix E. Crews are instructed to barricade low water crossings and areas of high water using the High Water Warning System and calls or reports from residents. The High Water Warning System includes over 50 sites within the City. Emergency crews will respond to emergency work orders such as clogged culverts, items fallen into inlets, missing manhole lids, and road cave-ins. The Stormwater Department will also deliver sandbags upon request to properties that are flooding. However, it is the responsibility of every resident to protect his or her property if it may flood. The Stormwater Department also conducts pre- and post-rain event inspections at 300 locations of known areas with flooding issues, and uses social media and the City website to reach out to the public and warn of severe events.

The need for additional emergency stormwater response, including providing sandbags to residents, was one of the comments the residents brought forward at the public meeting. This shows that many residents may not be aware of the emergency services provided by Fort Worth's Stormwater department. Emergency management operations have been effective in reducing flood risk during events; however, there may be improvements to existing services or additional services the City could provide. Providing emergency services may be funded through the stormwater utility fee, and would have a cost to start the program and annually a cost to maintain it. Mitigation actions are therefore proposed to enhance the City's stormwater emergency services in Step 8.

STRUCTURAL PROJECTS

Structural projects are intended to redirect water away from an area using infrastructure such as levees, reservoirs, and other flood control measures. The City currently has a Capital Improvement Projects list developed based on stormwater studies that identified locations of flooding. A list of completed projects is included in Appendix C. Projects include regional and local detention, storm drain system improvements, and channel improvements. Areas where structural improvements have been constructed have successfully reduced flood risk in those neighborhoods as evidenced by resident reports and a reduction in insurance claims. The Capital Improvement Projects are funded through the City's Stormwater Utility Fee developed in 2006. Currently, the City is transitioning to a "pay go" program that limits the annual budget for Capital Improvement Projects to roughly $3.5 million; however, the City has identified over $1 billion in stormwater structural improvement needs. Structural projects may cost more than preventative and protection activities, but in areas where flooding is located outside of the floodplain or in Pre-FIRM or heavily developed areas, structural projects may be the most feasible and publically acceptable. Large multi-jurisdictional regional projects, such as detention along the Trinity River, were discussed among the Stakeholder Planning Group and internally at the City. These types of projects require extensive collaboration and likely outside funds to complete; therefore, they are not included in the final mitigation actions. However, mitigation actions involving structural projects based on the City's Capital Improvement Project list and funding availability are included in Step 8.

PUBLIC INFORMATION

Public education and outreach involves educating property owners and visitors about how to protect themselves and their property from hazards. The City's Stormwater Department has a public information Communications Officer who assists in communicating flood risk materials and information to the public

for the Stormwater Management Department. The City currently has numerous methods for distributing information and has multiple public outreach programs through the City and in partnerships with other organizations and communities.

Public Information Distribution Methods

The City currently distributes information to the public mailers, public meetings and events, and through electronic avenues such as the through social media, email, and the City websites. The *Runoff Rundown* newsletter publication is a mailer sent to each property owner through the water bill. The newsletter provides property owners with information regarding flood hazard mitigation, floodplain management, and other activities the City does to protect the public from flood hazards. The publication is sent annually, and an example of the newsletter is included in Appendix A.

Public meetings are held at each Capital Improvement Project and stormwater study to solicit input from residents on flood risk reduction as well as educate about existing flood risks in their communities.

The City website and stormwater website provide many tools and education materials for flood risk education and reduction. For example, residents can learn about upcoming public meetings on the City calendar. Information regarding flood insurance and current stormwater programs as well as contact information for City staff are also available on the website. Links to other hazard mitigation sites are included on the stormwater management website such as the FEMA hazard mitigation sites and KnoWhat2Do. These resources provide residents with information about flood risks and how to prevent loss of life and property.

Fort Worth uses multiple social media outlets to reach residents, including Facebook, twitter, “mySidewalk”, Nixle, Next Door, and a subscriber email database that includes a weekly City News email and quarterly Eco-Insider email. These outlets are used for two-way communication for the City and the public. The City uses them for public announcements, such as public meetings, as well as during storm events to warn residents of high water and potential flood risks. They are also used to obtain public input on City projects and flooding concerns.

The City also has a Community Engagement Office dedicated to communicating networks of city stakeholders, such as faith-based groups, neighborhood associations, schools and non-profit organizations vital to the success of city initiatives and programs. This office provides another avenue for

distributing information throughout the City and encouraging participation in flood risk education activities.

Public Information Activities

The City also participates in public information programs advertised through the outlets described in this section. One example is the "Turn Around, Don't Drown" campaign through the Texas Floodplain Managers Association (TFMA) to warn residents not to drive or walk through areas of high water. Other examples of programs through partnerships with other organizations, departments, and communities dedicated to flood risk reduction are included in Table 27.

Table 27: Public Outreach Programs in Partnership with other Organizations

Partnership Organization	Program	Goal
FEMA	Protect What Matters	Flood Risk Reduction
TRWD	Adopt an Inlet	Flood Risk Reduction
NCTCOG	Pet Waste Education	Water Quality
NCTCOG	Campaign to prevent lawn waste in storm drains	Water Quality
Fort Worth	Keep Fort Worth Beautiful	Water Quality
TFMA	Turn Around Don't Drown	Flood Risk Education

The Stormwater Department also performs public information activities that are City-sponsored. Flood protection assistance is provided, and data on historical flooding in neighborhoods, flood related data, and other information are available to residents by calling the Stormwater Management Department. The City is willing to assist residents with floodplain development permits, make site visits to review flooding and drainage issues, and provide advice on retrofitting activities. Areas of potential high water are currently shown on the Planning and Zoning website and flood mapping data is also available through the City or FEMA.

The Stormwater Department hosts the Neighborhood University to train neighborhood leaders in promoting flood safety and protection. The Stormwater department also participates in other community events led by the engagement office such as the Cowtown Cleanup, Earth Day, Yard Smart, Waterama, and other events such as speaking at school or civil groups. These events are used as a way to educate residents on the importance of stormwater flood protection, water quality and conservation. Other education oriented outreach programs include a stormwater utility credit for schools that provide flood

risk education during the school year. Adopt a creek and adopt an inlet programs also involve residents in improving water quality and flood protection.

The City's Police Department participates and runs a program called the Community Emergency Response Team (CERT). The program's goal is to provide residents with basic skills that they will need to respond to their community's immediate needs in the aftermath of an extreme disaster when emergency services may not be immediately available. Training is free and open to anyone living, working, or has a vested interested in the City.

The number of insurance policies have increased partly due to public outreach, but there are still many homes within and without of the floodplain at risk and do not have insurance. The City currently has an extensive outreach program, but questions from residents still arise as far as what to do during a flood and what assistance is available to residents. The City has also expressed the need to provide more information to the residents on flooding outside of the floodplain and on obtaining flood insurance policies. Public information is an effective and cost efficient way to prevent loss of life and property during a flood event. Funding for these projects is available through the City and some are inter-departmental. The City, therefore, plans to continue and improve upon its public information activities as listed in Step 8.

STEP 8. ACTION PLAN

The City and the Stakeholder Planning Group developed 26 mitigation actions as part of the FMP. These action items address all six categories identified in the Activity 510 of the *CRS Manual* and correspond to at least one of the FMP goals listed in Step 6. The mitigation actions are intended to reduce flood risk for existing properties and to protect new construction from the effects of flood hazards. The City plans to continue to perform the activities described in Step 7 as well as improve upon them and add new activities. The mitigation activities are summarized in Table 28 including the priority, cost, funding, timeframe for completion and responsible departments. The goals achieved by each action are also included in the table.

A few of the mitigation actions include acquiring property or designating open space areas through zoning and ordinances. The intended land use for the acquired properties depends on the mitigation action and is stipulated in Table 28 within the action description. These projects will be managed through the

Stormwater Department and shall include public outreach and participation. City-owned property shall be subject to existing ordinances and maintenance agreements.

PRIORITIZATION

Each mitigation action was prioritized based on the same **STAPLE+E** criteria listed in the 2015 HazMAP plan for prioritizing mitigation actions, as listed below:

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.

Technical - Mitigation actions are technically most effective if they provide long term reduction of losses and have minimal secondary adverse impacts.

Administrative - Mitigation actions are easier to implement if the jurisdiction has the necessary staffing and funding.

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.

Legal - It is critical that the City have the legal authority to implement and enforce a mitigation action.

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. It is difficult to perform a numerical analysis on the benefit of many of the mitigation actions (such as public outreach), so only a general cost-benefit analysis was completed for each action by considering the funds available, cost of the project, and overall benefit to the City.

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 City's environmental goals, have mitigation benefits while being environmentally sound.

Based on the criteria above, actions were assigned a High, Moderate, or Low priority according to the following definitions:

High Priority – Action should be implemented as soon as possible. This action will immediately reduce the risk to life and property. Vulnerability will be reduced. Community and political support is high. Funding is available.

Medium Priority – Action should be implemented in the near future. Lives and property will be protected. Community and political support is high. Funding may be available.

Low Priority – Action should be implemented over the long term. Cost of the project may render it unfeasible. There may be political, historical, or environmental issues.C-9 in appendix C summarizes these actions.

Table 28: Mitigation Action Plan

Summary of Mitigation Actions							FMP Goals				
	Mitigation Action	Priority	Cost Range	Potential Funding Source	Timeframe for Completion from Plan Adoption	Responsible Department	Protect Health & Safety	Facilitate Sustainable Growth	Educate Public	Reduce Adverse Impacts	Regulatory & Regional Solutions
1	**Preventative Activities**										
1.1	**Continue Ongoing Preventative Activities**										
	• Floodplain mapping- FEMA and potential areas of high water • Drainage system maintenance • Vegetation maintenance program • Dam inspections • Maintenance agreement inspections • Bridge inspections • Pre and post rain event inspections on 300 locations (known areas of issues) • Water quality device inspections and cleaning • Maintain a GIS inventory of stormwater assets • Using the potential areas of high water information to make better planning decisions • Development review/iSWM criteria • Inlet marker program • Enhanced floodplain regulations, including dedication of 100-year fully developed floodplain • Open channel inspection program (FORMERLY 1.2.a) • Maintain a channel inventory including type, condition (FORMERLY 1.2.c) • Maintain a CCTV program for pipe inspections (FORMERLY 1.2.d) • Add to and improve stormwater inventory and GIS data (FORMERLY 1.3.a) • Perform Repetitive Loss Area Analysis study for all RLA'S (Section 512 of the CRS Manual) (FORMERLY 1.3.e) • Continue enforcement of floodplain and stormwater regulations higher than NFIP standards (FORMERLY 1.4) • Continue enforcement of floodplain and stormwater regulations higher than NFIP standards (FORMERLY 1.4.c) • Document "integrated Storm Water Management" (iSWM) participation & regional stormwater requirements for Community Rating System (CRS) credit (NEW FOR 2021)	High	$500K-$1M	SWU	Ongoing	Stormwater	x	x		x	
1.2	**Continue and enhance stormwater maintenance program**										
1.2.a	Include criticality (business risk exposure) information for prioritizing maintenance actions and planning activities (FORMERLY 1.2.b)	High	<$500K	SWU	0-3 years	Stormwater	x			x	x

	Mitigation Action	Priority	Cost Range	Potential Funding Source	Timeframe for Completion from Plan Adoption	Responsible Department	Protect Health & Safety	Facilitate Sustainable Growth	Educate Public	Reduce Adverse Impacts	Regulatory & Regional Solutions
1	**Preventative Activities**										
1.3	**Expand Floodplain Mapping and Data Availability**										
1.3.a	Create flood risk overlays for areas outside the FEMA floodplain that are subject to flooding and develop local regulations for these areas (FORMERLY 1.3.b)	Medium	<$500K	SWU	5-10 years	Stormwater	x		x	x	x
1.3.b	Make flood study models available to the public online (FORMERLY 1.3.c)	Medium	<$500K	SWU	0-5 years	Stormwater	x		x	x	
1.3.c	Make flood study mapping available to the public online (FORMERLY 1.3.d)	Medium	<$500K	SWU	0-5 years	Stormwater	x		x	x	
1.4	**Enhanced Regulatory Standards**	High	<$500K	SWU	Ongoing	Stormwater	x	x		x	x
1.4.a	Evaluate and develop city-wide valley storage regulations to reduce future flooding. Consider similar regulations currently in place at other cities (Dallas, Grand Prairie, Arlington, etc.)	Medium	<$500K	SWU	0-5 years	Stormwater	x	x	x	x	x
1.4.b	Evaluate and develop flood risk management & prevention regulations for areas outside FEMA floodplains that utilize best available data.	Medium	<$500K	SWU	0-5 years	Stormwater	x	x	x	x	x
1.5	**Expand Open Space Preservation**										
1.5.a	Coordinate open space opportunities with flood control needs for new developments, repetitive loss areas, and tax foreclosed properties	Medium	<$500K	SWU	5-10 years	Stormwater/P&D/PACS		x		x	
1.6	**Complete Update of the Stormwater Criteria Manual**	High	<$500K	SWU	0-5 years	Stormwater	x	x		x	

	Mitigation Action	Priority	Cost Range	Potential Funding Source	Timeframe for Completion from Plan Adoption	Responsible Department	Protect Health & Safety	Facilitate Sustainable Growth	Educate Public	Reduce Adverse Impacts	Regulatory & Regional Solutions
2	**Property Protection**										
2.1	**Continue Ongoing Property Protection Actions**										
	• Maintenance agreements • Citywide mailer to enhance insurance awareness and knowledge • Letters to Repetitive Loss Areas (RLA) or frequently flooded areas • Sewer back up protection (water department) • Provide link to Floodsmart on city website (FORMERLY 2.2.a)	High	<$500k	SWU	Ongoing	Stormwater	x	x	x	x	
2.2	**Increase Flood Insurance Participation**										
2.2.a	Refine statistics to prioritize which areas to target for insurance outreach (FORMERLY 2.2.b)	High	<$500K	SWU	0-3 years	Stormwater			x	x	
2.2.b	Hold workshops in prioritized areas to encourage residents to purchase flood insurance (FORMERLY 2.2.c)	High	<$500K	SWU	0-5 years	Stormwater			x		
2.3	**Encourage Relocation, Acquisition & Building Elevation Projects**										
2.3.a	Develop a voluntary property acquisition plan and program	High	$500K-$1M	SWU/Grants	0-5 years	Stormwater	x			x	x
2.3.b	Pursue grants to complete property acquisition projects	High	<$500K	SWU/Grants	0-5 years	Stormwater	x			x	
2.3.c	Develop public education on funding for property retrofitting & building elevation	Low	<$500K	SWU	0-10 years	Stormwater			x	x	
2.3.d	Assist property owners with grant applications for improvements	Low	<$500K	SWU/Grants	Ongoing	Stormwater			x	x	
2.3.e	Develop a program to assist property owners with elevation & relocation projects for residential structures	Medium	<$500K	SWU/ICC/FEMA	0-5 years	Stormwater	x			x	
2.3.f	Investigate creation of grant program that could be used to assist property owners with private flooding assessments & solutions (NEW FOR 2021)	Medium	<$500K	SWU/ICC/FEMA	0-5 years	Stormwater	x			x	x

	Mitigation Action	Priority	Cost Range	Potential Funding Source	Timeframe for Completion from Plan Adoption	Responsible Department	Protect Health & Safety	Facilitate Sustainable Growth	Educate Public	Reduce Adverse Impacts	Regulatory & Regional Solutions
3	**Natural Resource Protection**										
3.1	**Continue Ongoing Natural Resource Protection Actions**										
	• Native grass planting program for channel and detention maintenance • Native plant program participate with Water Conservation and NCTCOG • Stormwater credit program for non-residential • iSWM review for erosion and sediment control • Geomorphological assessments for highly erosive areas • Maintain FWNC&R as nature preserve (FORMERLY 3.2.a) • Place "no mow" signs in appropriate locations and establish native grass and other "Green Zones" (FORMERLY 3.2.c) • Implement erosion control projects from Geomorphic Assessments (FORMERLY 3.6)	High	<$500k	SWU	Ongoing	Stormwater	x	x	x	x	x
3.2	**Maintain Current Natural Preserved areas**										
3.2.a	Maintain parks to preserve open space within the floodplain (FORMERLY 3.2.b)	High	<$500K	PACS	Ongoing/None	PACS		x			
3.2.b	Train park staff on maintenance practices that facilitate natural preservation (FORMERLY 3.2.d)	High	<$500K	SWU/PACS	0-3 years	Stormwater/PACS		x	x		
3.2.c	Document Parks & Recreation Department's 25’ buffer from center of stream, 3 year no-mow policy for CRS credit (NEW FOR 2021)	High	<$500K	SWU/PACS	0-3 years	Stormwater/PACS	x		x	x	
3.4	**Develop regulations focused on natural area preservation**										
3.4.a	Develop watershed protection plans and ordinances that require floodplain buffers and water quality protection zones such as Lake Worth Watershed Protection project	Low	<$500K	Water	0-10 years	Stormwater/Water		x			x
3.4.b	Provide economic incentives for developers to preserve natural areas	Medium	<$500K	SWU	0-10 years	Stormwater/P&D		x			x
3.4.c	Explore opportunities for tourism/education grants and tie into recreation functions	Low	<$500K	PACS	0-10 years	Stormwater/Parks/TRVA		x			
3.4.d	Dedicate more area to natural preservation by acquiring open space within the floodplain (rather than easement dedication)	Low	$500K-$1M	SWU/PACS	0-10 years	Stormwater		x			x
3.5	**Expand Water Quality Regulations and Education**										
3.5.a	Incorporate Green Infrastructure Practices into development practices as much as practicable to improve water quality	Medium	<$500K	SWU	0-5 years	Stormwater		x			x
3.5.b	Expand existing native grass planting program	Medium	<$500K	SWU	0-5 years	Stormwater		x			x

	Mitigation Action	Priority	Cost Range	Potential Funding Source	Timeframe for Completion from Plan Adoption	Responsible Department	Protect Health & Safety	Facilitate Sustainable Growth	Educate Public	Reduce Adverse Impacts	Regulatory & Regional Solutions
4	**Emergency Services**										
4.1	**Continue Ongoing Emergency Services**										
	• Pre and post rain event inspections on 300 locations (known areas of issues) • Block streets that become flooded- barricade list • Current high water warning system (50+ sites) • Identify flooding level of service for major road crossings • Nixle, twitter, Facebook, City website- social media • Protect critical facilities and flood prone areas from debris by expanding the maintenance program to include trash pick-up (including bulk) prior to forecasted large events • Expand sandbag program for residents and provide public outreach on when they are available and how they can be obtained (FORMERLY 4.3.a) • Investigate grant funding available for emergency services (FORMERLY 4.3.b)	High	<$500k	SWU	Ongoing	Stormwater	x	x	x	x	
4.2	**Expand Flood Warning System**										
4.2.a	Expand Flood Warning System based on recommendations from Fort Worth Flood Warning System Study	Medium	$500K-$1M	SWU	0-5 years	Stormwater/EMO	x		x	x	
4.2.b	Expand subscription based program for text and email severe weather warnings and encourage participation to all residents through workshops and the Runoff Rundown Newsletter	High	<$500K	SWU	Ongoing	Stormwater/EMO	x		x	x	
4.2.c	Expand Social Media program during flood events	Medium	<$500K	SWU	0-5 years	Stormwater/EMO	x		x	x	
4.2.d	Develop online mapping of current road closures, detours, etc. during flood events possibly through Waze through City website	Medium	<$500K	SWU/Grants	0-5 years	Stormwater/EMO	x		x	x	
4.2.e	Develop program for real time flood forecasting and integrate with CASA radar (FORMERLY 4.2.f)	Medium	<$500K	SWU	0-5 years	Stormwater/EMO	x		x	x	
4.2.f	Evaluate existing flood warning signs for improved effectiveness (NEW FOR 2021)	High	<$500K	SWU	0-5 years	Stormwater/EMO	x			x	
4.2.g	Promote the CASA Weather Radar App that is available now (NEW FOR 2021)	Medium	<$500K	SWU	0-5 years	Stormwater/EMO	x			x	

	Mitigation Action	Priority	Cost Range	Potential Funding Source	Timeframe for Completion from Plan Adoption	Responsible Department	Protect Health & Safety	Facilitate Sustainable Growth	Educate Public	Reduce Adverse Impacts	Regulatory & Regional Solutions
5	**Structural Projects**										
5.1	**Continue Ongoing Structural Projects**										
	• Low water crossings • Regional stormwater detention with multi-use amenities • Local stormwater detention • Pipe system improvements • Partnership with Ft Worth ISD for regional stormwater detention • TRWD coordination with regional agencies such as TRWD, USACE, NWS, etc. • Incorporate Green Infrastructure in City facilities and projects as feasible • Open channel improvements • Ongoing maintenance • Coordination with other City departments on drainage requirements for City projects • Continue to study flood prone areas and incorporate new studies into current CIP program • Develop a pipe rehabilitation program (FORMERLY 5.2.b) • Prioritize drainage studies and improvements to maximize flood risk reduction (FORMERLY 5.2.c) • Continue to pursue partnerships with FWISD to complete stormwater projects on school sites (FORMERLY 5.2.d) • Identify opportunities for public and private partnerships to complete CIPs (FORMERLY 5.2.e)	High	>$1M	SWU	Ongoing	Stormwater	x	x	x	x	x
5.2	**Reduce flood risk through Storm Drain Capital Improvement Projects**	**High**	**$1M - $2M**	**SWU**	**Annually**	**Stormwater**	x	x		x	x
5.3	**Reduce flood impacts through detention**										
5.3.a	Investigate opportunities to retrofit existing HOA or wet ponds for flood control	Medium	<$500K	SWU	0-5 years	Stormwater	x	x		x	x
5.3.b	Perform study to determine locations ideal for regional detention	Medium	<$500K	SWU	0-5 years	Stormwater	x			x	x
5.3.c	Construct local and regional stormwater detention facilities in flood prone areas	Medium	>$1M	SWU	5-10 years	Stormwater	x			x	x
5.3.d	Evaluate modifications to Lake Worth spillway to allow for more flexible discharge	Low	<$500K	SWU/TRWD/Water	5-10 years	Stormwater	x			x	x
5.3.e	Investigate opportunities to increase valley storage within the Trinity River Floodplain, including regional solutions with regional agencies and adjacent communities	Low	>$1M	SWU/TRWD/USACE	5-10 years	Stormwater	x			x	x
5.4	**Reduce flood risk at hazardous road crossings**										
5.4.a	Develop a plan to upgrade existing low water crossings to improve service levels	Medium	<$500K	SWU	0-10 years	Stormwater	x			x	x
5.4.b	Increase capacity of existing culverts and bridges to City criteria	High	<$500K	SWU	Ongoing	Stormwater	x			x	

	Mitigation Action	Priority	Cost Range	Potential Funding Source	Timeframe for Completion from Plan Adoption	Responsible Department	Protect Health & Safety	Facilitate Sustainable Growth	Educate Public	Reduce Adverse Impacts	Regulatory & Regional Solutions
5	**Structural Projects**										
5.5	**Pursue partnerships to complete stormwater projects**										
5.5.a	Develop collaborative program between the stormwater and parks departments to create opportunities for flood protection and recreation in open spaces	High	<$500K	SWU	0-5 years	Stormwater/Parks	x			x	x
5.5.b	Develop collaborative program between the stormwater and water departments to create collaborative program for utility and stormwater upgrades	High	<$500K	SWU	0-5 years	Stormwater/Water	x			x	x
5.5.c	Create a system for development incentives for improving city storm water infrastructure	Medium	<$500K	SWU	0-5 years	Stormwater	x			x	x
5.5.d	Coordinate and where possible participate with the North Central Texas Council Of Governments (NCTCOG) Transportation Stormwater Initiative (TSI) (NEW FOR 2021)	High	$500K-$1M	SWU / TSI	0-10 years	Stormwater/TPW	x	x		x	x

	Mitigation Action	Priority	Cost Range	Potential Funding Source	Timeframe for Completion from Plan Adoption	Responsible Department	Protect Health & Safety	Facilitate Sustainable Growth	Educate Public	Reduce Adverse Impacts	Regulatory & Regional Solutions
6	**Public Information**										
6.1	**Continue Ongoing Public Information Activities**										
	• Making the public aware of areas of potential high water through the planning & zoning website • Stormwater educational materials Curriculum developed with school districts • Yard Smart twice a year (fall and spring) • Information Booth annually at Mayfest • Inlet marker program and Adopt a Creek programs • School credit program to reduce SW utility fees • West Nile education • Partnership programs: FEMA in Protect What Matters, TRWD in adopt an inlet program, COG in campaign to not have lawn companies not blow waste into storm drains and pet waste education, internally partner with office of emergency management on know what to do program (Turn Around Don't Drown), internally with keep Fort Worth Beautiful to promote protecting water quality • Partner with TRWD on Trinity Trash Bash • LIDs- rain barrel sales in partnership with BRIT and with several internal departments (ENV and Water), native plants through COG and Water Department Water Conservation Group and ENV • City website, City news that media can check to mine for stories, opportunistic stories with media to promote SW program, water bill inserts (City Times), twice a year paid water bill insert • Community Engagement Office- direct link to 200+ neighborhood associations- attend meetings and give our message on our behalf, host twice a year Neighborhood University to train neighborhood leaders with our message (flood safety, protection, etc.), outreach at community events- Cowtown cleanup, Earth Day, Yard Smart twice a year, and many smaller ones such as speaking at school groups, civic groups, boy scouts, etc. • Social media- use Facebook, twitter, City website, “mySidewalk”, Nixle, Next Door, subscriber email database - once a week City News email blast and quarter Eco Insider email • Hold events to feature specific projects (and share messaging) • Mail of annual newsletter to water subscribers and rate payers • Direct mail of FEMA flood protection information to targeted areas of high flood risk (FORMERLY 6.2.b)	High	<$500k	SWU	Ongoing	Stormwater	x		x	x	
6.2	**Create targeted outreach programs**										
6.2.a	Target meetings in extreme regions (far north, newly annexed areas, etc.) to share messaging	High	<$500K	SWU	0-5 years	Stormwater	x		x	x	
6.2.b	Provide National Oceanic & Atmospheric Administration (NOAA) weather radios to targeted audiences (NEW FOR 2021)	Medium	<$500K	SWU	0-5 years	Stormwater	x		x	x	
6.2.c	Provide additional flood risk awareness signage - include City parks and Hazardous Roadway Overtopping Mitigation locations (NEW FOR 2021)	Medium	<$500K	SWU	0-5 years	Stormwater	x		x	x	

	Mitigation Action	Priority	Cost Range	Potential Funding Source	Timeframe for Completion from Plan Adoption	Responsible Department	Protect Health & Safety	Facilitate Sustainable Growth	Educate Public	Reduce Adverse Impacts	Regulatory & Regional Solutions
6	**Public Information**										
6.3	**Provide additional outreach to community regarding flood risk**										
6.3.a	Augment Runoff Rundown with electronic notes, improve outreach locations (FORMERLY 6.3.b)	Medium	<$500K	SWU	0-5 years	Stormwater					
6.3.b	Create Facebook group for stormwater	Medium	<$500K	SWU	0-5 years	Stormwater	x		x	x	
6.3.c	Participate in Mayfest, home and garden show, and Main Street Art Festival with Flood Risk Educational Material	Medium	<$500K	SWU	0-5 years	Stormwater	x		x	x	
6.3.d	Expand use of “mySidewalk” and “Next Door” to solicit input from community (FORMERLY 6.3.e)	Medium	<$500K	SWU	0-5 years	Stormwater	x		x	x	
6.3.e	Expand adopt-an-inlet and adopt-a-creek programs (FORMERLY 6.3.f)	Medium	<$500K	SWU	0-5 years	Stormwater	x		x	x	
6.3.f	Continue to hold public meetings during stormwater capital improvement projects (FORMERLY 6.3.g)	High	<$500K	SWU	Ongoing	Stormwater	x		x	x	
6.3.g	Become more active in flood awareness week through additional social media outlets and community events (formerly 6.3.h)	Medium	<$500K	SWU	0-5 years	Stormwater	x		x	x	
6.3.i	Develop paid advertisements through Public Service Announcements to educate the public about flood insurance and flood risk (FORMERLY 6.3.k)	Medium	<$500K	SWU	0-5 years	Stormwater	x		x	x	
6.4	**Improve education of flood risk to schools and youth**										
6.4.a	Participate in school events: -Stormwater management projects that tie into Water Quality program -Create a calendar with children’s drawings related to flood risk and water quality -Billboard competition -Riverside plan for retrofitting school event in November -Career Days	High	<$500K	SWU	0-5 years	Stormwater	x		x	x	
6.4.b	Expand curriculum to other ISDs in Fort Worth	Medium	<$500K	SWU	0-5 years	Stormwater	x		x	x	
6.5	**Educate the public about Environmental Protection and Water Quality**										
6.5.a	Install interpretive signage in appropriate areas to discuss natural resource protection, stormwater systems, etc. Add educational signage to regional projects as appropriate	Medium	<$500K	SWU	0-5 years	Stormwater	x	x	x	x	
6.6	**Provide technical assistance to the public on how to interpret flood data**										
6.6.a	Establish policy papers to interpret grey areas or guidance based on experience (Development Review Group function)	Medium	<$500K	SWU	0-5 years	Stormwater	x		x	x	
6.6.b	Hold regularly scheduled sessions to discuss stormwater related topics such as LID, water quality, development review subjects, etc.	Medium	<$500K	SWU	0-5 years	Stormwater	x	x	x	x	
6.6.c	Provide direct link to floodplain management staff through the stormwater website	High	<$500K	SWU	0-5 years	Stormwater	x		x	x	
6.6.d	Create digital / online content to aid in better communicating flood risks (NEW FOR 2021)	High	<$500K	SWU	0-5 years	Stormwater	x		x	x	

STEP 9. ADOPTION OF ACTION PLAN

A resolution was presented to the City Council on August 2, 2021. After review, the City Council decided to adopt this plan on October 18, 2021. A copy of the resolution has been included on the CD in Appendix E.

STEP 10. IMPLEMENTATION, EVALUATION, AND REVISION

MONITORING AND EVALUATING THE PLAN

The FMP is intended to be the primary guide for implementing and prioritizing flood risk reduction mitigation actions in the City. To remain relevant, the plan must first be implemented by the City, evaluated regularly, and revised as changes occur. The Floodplain Administrator will monitor and lead future planning efforts with the Stakeholder Planning Group formed in Step 2 of the plan development. The same group or a successor group with similar membership intends to continue assisting the City with future changes and mitigation planning. The Stakeholder Planning Group will meet once every year prior to October 1 to evaluate the plan progress and effectiveness of current action items. The following items are suggested to be discussed during the meeting:

- Record occurrences of flood hazard events within the City since adoption of the plan.
- Provide an update on any mitigation actions that have been implemented and/or completed.
- Provide suggestions or concerns about experiences and efforts to implement the action in this plan. These suggestions should be documented and revisited during the City's plan update.
- Make minor adjustments to the plan as additional information becomes available.
- Discuss and assess the plan's overall effectiveness at achieving the goals.

The Floodplain Administrator shall take the comments from the Stakeholder Planning Group meeting to prepare an annual evaluation report on progress towards plan implementation. This report shall be submitted to the City Council, released to the media, and made available to the public through the outlets described in the Step 2 Public Outreach section.

UPDATING THE PLAN

The *CRS Manual* requires that the FMP be formally reviewed and updated every five years prior to October 1 of the fifth year of plan adoption. The Floodplain Administrator will be responsible for preparing the

formal update to the plan. The formal review and update of the plan should be started 12-18 months before the end of the fifth year in order to allow time for public comments and responses to be addressed.

The general process for updating the plan shall be as follows:

1. City Floodplain Administrator begins the process with a meeting with the Stakeholder Planning Group formed in Step 2. This meeting will be similar to the annual meeting to evaluate overall performance and progress of the plan.
2. The City shall review any new studies, reports, and technical information and incorporate into the plan as necessary. The review will also include the City's needs, goals, and plans for the area that have been published since the plan was prepared.
3. The hazard and problem assessment sections shall be reviewed and revised to reflect new data.
4. The Stakeholder Planning Group shall evaluate the FMP goals and determine if they are still appropriate. Revisions will be made accordingly.
5. The City shall revise the action plan based on projects that have been completed, dropped, or changed since the FMP adoption.
6. The City will meet a second time with the Stakeholder Planning Group to finalize revisions and updates to the FMP.
7. The City shall hold a public meeting to discuss the update FMP.
8. The updated plan shall be adopted by City Council.

This process is meant to be a guide, and there may be additions when the plan updates occur. The City will continue to seek public participation through the same outreach methods as the development of the plan by their social media outlets, Runoff Rundown, and City website pages. The Stakeholder Planning Group shall also be involved in reviewing and updating the plan. Any revisions and plan updates shall be formally adopted through a resolution by the City Council.

Appendix A

Efforts to Involve the Public

Fort Worth
Storm Water
Management

inside:

Flood Insurance

Property Protection

Improvement Requirements

runoff *Rundown*

FORT WORTH STORM WATER MANAGEMENT DIVISION

The mission of the City of Fort Worth's Storm Water Management Division is to protect people and property from harmful storm water runoff. Education and prevention are valuable and proven tools that help can help communities become resistant to these natural disasters.

The City of Fort Worth recognizes that its entire community can be susceptible to flooding, not just those structures located within Special Flood Hazard Areas (SFHA's). The following information is being provided to help inform property owners located within the SFHA, flood prone areas, and also all property owners within the City of Fort Worth.

Flood Information

Residents of Fort Worth can obtain flood information concerning flooding, flood maps, mandatory flood insurance purchase requirements, and flood zone determinations from the City of Fort Worth's Transportation and Public Works Department (Storm Water Management Division) located at City Hall or by calling 817-392-6261.

Elevation certificates of some properties located in the Special Flood Hazard Areas (SFHA's) are on file in the Engineering Vault of the Transportation and Public Works Department located in City Hall. Copies of the available elevation certificates are available upon request.

Real time river gauge information can be obtained through the following website: www.usgs.gov.

A publication of the City of Fort Worth Transportation and Public Works Department
Storm Water Management Division

Fort Worth Storm Water Management

Flood Insurance

The purchase of federal flood insurance is highly recommended. Basic homeowner's insurance policies don't cover damage from floods. The City of Fort Worth participates in the National Flood Insurance Program (NFIP), which means that federally subsidized flood insurance is available to everyone in the City. Keep in mind that there is a 30-day waiting period before a policy becomes effective. Some people have purchased flood insurance because it was required by the bank or loan company when they obtained a mortgage or home improvement loan. Usually these policies just cover the building's structure and not the contents. Remember that a flood insurance policy must be renewed each year.

Mandatory Purchase Requirement: The mandatory purchase requirement applies to all forms of federal or federally related financial assistance for buildings located in a Special Flood Hazard Area (SFHA). This requirement affects loans and grants for the purchase, construction, repair or improvement of any publicly or privately owned buildings in a SFHA, including machinery, equipment, fixtures and furnishings contained in such buildings. If a building is located in a SFHA, the agency or lender is required by law to require the recipient to purchase a flood insurance policy on the building.

NATIONAL FLOOD INSURANCE PROGRAM

Community Rating System

The National Flood Insurance Program's Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed minimum requirements.

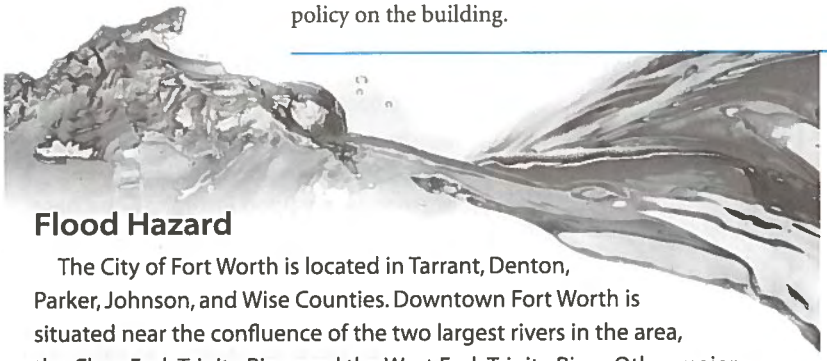
The City of Fort Worth is entering the CRS in the fall of 2011, and this will result in reduced flood insurance premium costs for homes or businesses in the floodplain. The three goals of the CRS are to reduce flood losses, facilitate accurate insurance ratings and to promote the awareness of flood insurance.

Flood insurance facts

> Affordable federal flood insurance is available to anyone living in Fort Worth who wants it, whether they are in a floodplain or not.
> Homeowner's insurance rarely, if ever, covers damage from floods.
> Typical flood insurance policies in Fort Worth for homes outside the floodplain run $200 to $300 per year.
> If you want to know if your home or business is in a floodplain, call 817-392-6261.

For more information about flood insurance contact:

> www.FortWorthTexas.gov
> www.fema.gov/nfip
> Your insurance agent.
> Customer Service for the City of Fort Worth's Storm Water Management Division at 817-392-6261.



Flood Hazard

The City of Fort Worth is located in Tarrant, Denton, Parker, Johnson, and Wise Counties. Downtown Fort Worth is situated near the confluence of the two largest rivers in the area, the Clear Fork Trinity River and the West Fork Trinity River. Other major streams in Fort Worth include Mary's Creek, Marine Creek, Sycamore Creek, Village Creek, Dry Branch Creek, Little Fossil Creek, Big Fossil Creek, and White's Branch.

Flooding in Fort Worth is typically produced by heavy rainfall from frontal type storms that occur during the spring and fall months. Flash floods are the most common type of flooding in Fort Worth. A flash flood is a rapid rise of water along a stream or low lying area as a result of an intense amount rainfall in a short period of time. Fort Worth has also experienced a number of major flood events since its settlement in 1849. Historical information indicates that significant floods occurred in Fort Worth in May 1866, May 1908, April 1922, February 1938, June 1941, April 1942, May 1949, May 1957, August 1974, July 1975, November 1981, May 1989, and May 1990.

Flood Protection Assistance

Concerned residents and the general public can obtain information on flood protection assistance from the City of Fort Worth's Transportation and Public Works Department Storm Water Management Division by calling 817-392-6261. Flood protection assistance, flood related data, data on historical flooding in neighborhoods and other information provided by the City of Fort Worth is site specific, so inquirers can relate the flood threat to their problems.

List of Services Provided:

- Make site visits to review flooding and drainage and problems and provide one-on-one advice to property owners.
- Provide assistance with floodplain development permits, determination of Base Flood Elevations (BFE) and general information on all flood insurance and floodplain mapping procedures and forms.
- Provide advice and assistance on retrofitting techniques, such as elevating buildings above flood levels or the Base Flood Elevation, dry flood proofing and wet flood proofing.

Property Protection

Rather than wait for a flood to occur, you can act now to protect your property from flood damage. Various alternatives are available to help minimize flooding. If the floor level of your property or structure is lower than the Base Flood Elevation (BFE) located on the City's Flood Insurance Rate Map (FIRM), consider ways to prevent flooding from occurring, such as retrofitting your building. "Retrofitting" means altering your building to eliminate or reduce flood damage. Retrofitting measures include:

> Elevating the building so that flood waters do not enter or reach any damageable portion of it,
> Constructing barriers out of fill or concrete between the building and flood waters,
> "Dry flood proofing" to make the building walls and floor watertight so water does not enter,
> "Wet flood proofing" to modify the structure and locate the contents so that when flood waters enter the building there is little or no damage, and
> Preventing basement flooding from sewer backup or sump pump failure.

There are several good references on retrofitting in the Fort Worth Central Library located at 500 W. Third St. Many of these will inform you about retrofitting techniques and help you decide which is best for you.

Natural and Beneficial Functions

The City of Fort Worth is a beautiful place to live, work and play. The floodplains and adjacent waters are important assets that form complex physical and biological systems. When floodplains are preserved in their natural state, they provide open space areas for parks, bike paths and wildlife conservation.

Floodplains also reduce the severity of floods by conveying storm water runoff, providing flood storage and conveyance, reducing flood velocities, flood peaks and minimizing sedimentation. The natural vegetation in the floodplain improves the water quality of the lakes and rivers of Fort Worth by slowing down storm water runoff, which allows sediments and other impurities to settle out.

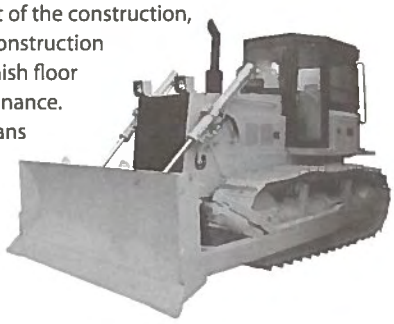
Floodplain Development Permit Requirements

All development within the City of Fort Worth requires local and state permits. Contact the City of Fort Worth's Planning and Development Department at 817-392-2222 for advice before you build, fill, place a manufactured home or otherwise develop.

The zoning ordinance, Floodplain Provisions Ordinance and the International Building Codes have special provisions regulating construction and other developments within floodplains. Without these provisions, affordable flood insurance through the National Flood Insurance Program (NFIP) would not be available to property owners in the City of Fort Worth. Any development in the floodplain without a permit is illegal. Such activity can be reported to the Storm Water Management Division's Customer Service at 817-392-6261.

Substantial Improvement Requirements

What is substantial improvement? The NFIP requires that if the cost of any reconstruction, rehabilitation, addition or other improvement to a structure exceeds 50% of the market value of the structure before the start of the construction, the improvements must conform to or meet the same construction requirements as a new building and satisfy minimum finish floor requirements specified in the Floodplain Provisions Ordinance.



What is substantial damage? Substantial damage means damage of any origin sustained by a building or structure when the cost of restoring the building to its pre-damaged condition would equal or exceed 50% of the market value of the building before the damage occurred. Substantial damage is determined regardless of the actual repair work performed.

The City of Fort Worth requires by ordinance that any substantial improvement or substantial damage improvement must have a building permit. Building permits can be obtained at the Planning and Development Department located at City Hall or by calling 817-392-2222.

Drainage System Maintenance

The City of Fort Worth's Storm Water Management Field Operations crews work hard to maintain the drainage systems throughout the city. It is illegal in the City of Fort Worth to dump any type of debris into a stream, river or drainage ditch. This debris can become entangled in culverts, shallow streambeds, or drainage ditches and impede drainage causing the flow of water to back up. Residents of Fort Worth should also keep drainage ditches on their property free of debris, foliage and vegetation that would impede the flow of water. Debris dumping should be reported to the City of Fort Worth's Code Compliance Department by calling 817-392-1234.

FORT WORTH

City of Fort Worth
Transportation and Public Works Department/Storm Water Management
1000 Throckmorton Street
Fort Worth, TX 76102

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Fort Worth
Storm Water
Management

Visit us online at
www.FortWorthTexas.gov/tpw/stormwater

Flood Safety

Turn Around, Don't Drown

> Learn the safest route from your home or business to higher, safer ground, but stay tuned to reports of changing flood conditions.

> If emergency officials tell you to evacuate or leave your home, go immediately to a safe shelter, hotel or relative's house.

> Turn of all utilities, gas and electricity at the main switch. Stay away from power lines and electrical lines. Be alert for gas leaks.

> Do not walk through flowing water. Drowning is the number one cause of flood related deaths. Currents can be deceptive; just six inches of moving water can knock you off your feet!

> Do not drive through a flooded area. More people drown in their cars than in any other location. Vehicles also push water into homes and cause additional property damage.

Important Useful Websites

www.fema.gov
www.noaa.gov
www.floods.org
www.usgs.gov
www.nws.noaa.gov
www.weather.gov
www.FortWorthTexas.gov/tpw/stormwater

Flood Warning System

The Emergency Alert System will notify City of Fort Worth residents via local radio and TV, if flooding is imminent and if evacuation of the City is advised.

Additionally, the NOAA Weather Station Radio broadcasts weather information including warnings, watches, forecasts, and other hazard information at 162.550 MHz 24 hours a day, 7 days a week from the National Weather Service Office in North Central Texas. The local contact number is 817-429-2631. Please call in reference to evacuation notices, procedures and shelters.

Floodplain Management Plan Public Meetings

The City's Floodplain Management Plan is due for its 5 year update, and two public meetings are being held in June to receive input from Fort Worth residents.

The current Floodplain Management Plan (FMP) can be found on the city's website at the bottom of this page:

https://www.fortworthtexas.gov/departments/tpw/stormwater

June 14, 2021 at 6:30 p.m.

The meeting will be conducted via Webex. The meeting number (access code) is **182 446 0289;** the password is **Stormwater**. Agenda topics:

- Background on floodplain management.
- Floodplain Management Plan topics overview with a focus on Steps 1, 2, 3 and 6:
- Step 1 – Organize the plan.
- Step 2 – Involve the public.
- Step 3 – Coordinate with other agencies.
- Step 6 – Set goals.
- Next steps.

June 21, 2021 at 6:30 p.m.

The meeting will be conducted via Webex. The meeting number (access code) is **182 115 1979**; the password is **mMMmWUqz732**. Agenda topics:

- Background on floodplain management.
- Plan topics overview with a focus on steps 4, 5, 7 and 8.
- Step 4 – Assess the hazard(s).
- Step 5 – Assess the risk(s).

Event Snapshot

Cost
Free

Social Media

Related Information

WebEx Meeting 1, June 14, 2021

WebEx Meeting 2, June 21, 2021

Floodplain Management June 14 and 21 Meeting Flyer (PDF, 177KB)

City Website Page that Encourages Public Involvement

- Step 7 – Review mitigation alternatives.
- Step 8 – Draft an action plan.
- Next steps.

To help provide input, residents are encouraged to answer a survey related to floodplain management and flooding. Use a smart phone and click on the QR code to access the survey.

Or use this link to answer a survey

When

Past event dates

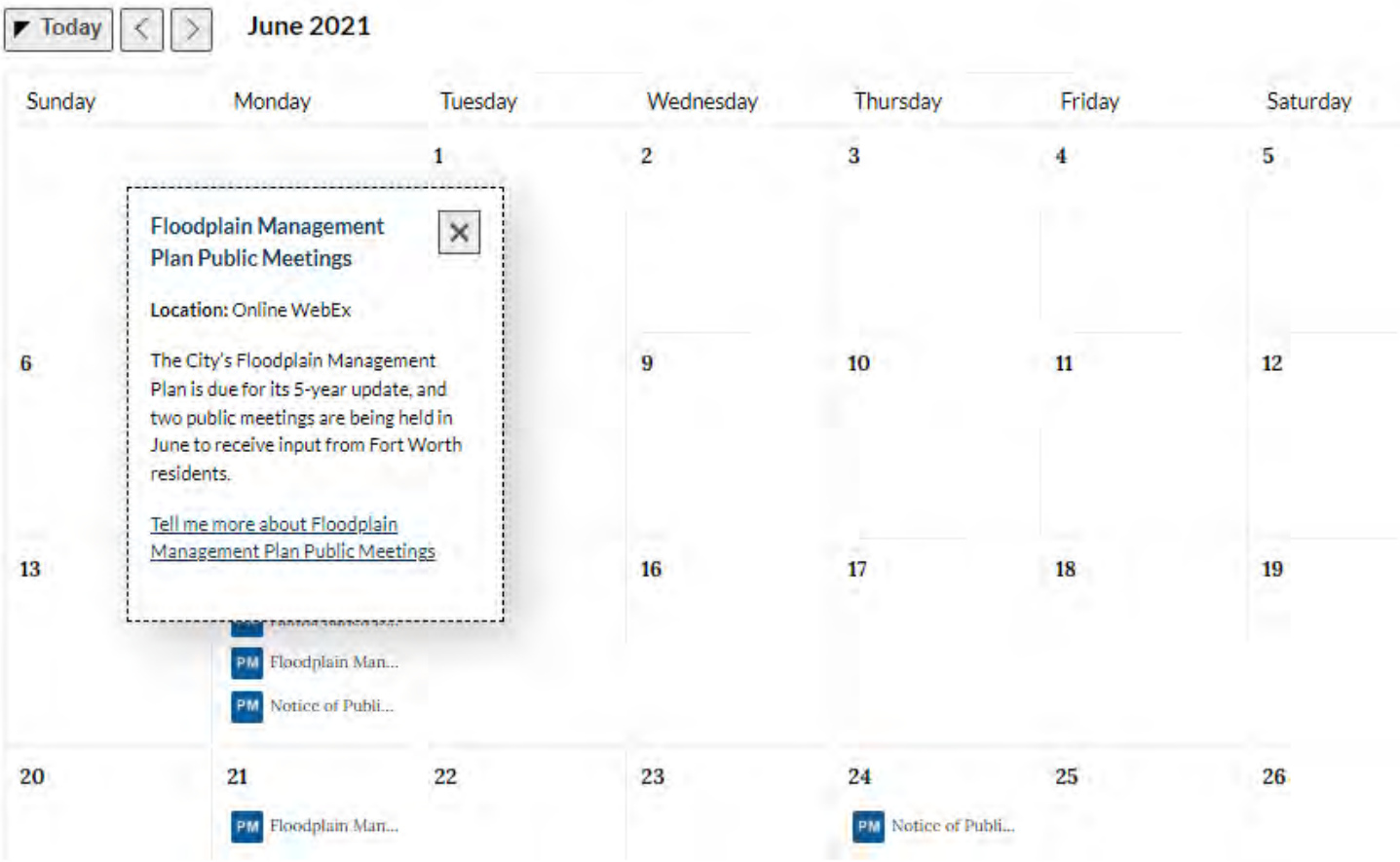
Monday, June 14, 2021 | 06:30 PM - 08:30 PM
Monday, June 21, 2021 | 06:30 PM - 08:30 PM

Tagged as:

Public Meetings Public Safety

City Website Page that Encourages Public Involvement

Posting About Both Public Meetings on City of Fort Worth and City of Fort Worth Stormwater Facebook Pages



City Hall Monthly Calendar Showing Public Meeings on June 14th and 21st

Survey posted on Surveymonkey Website from City Twitter Account

Survey posted on Surveymonkey Website from City NextDoor Account