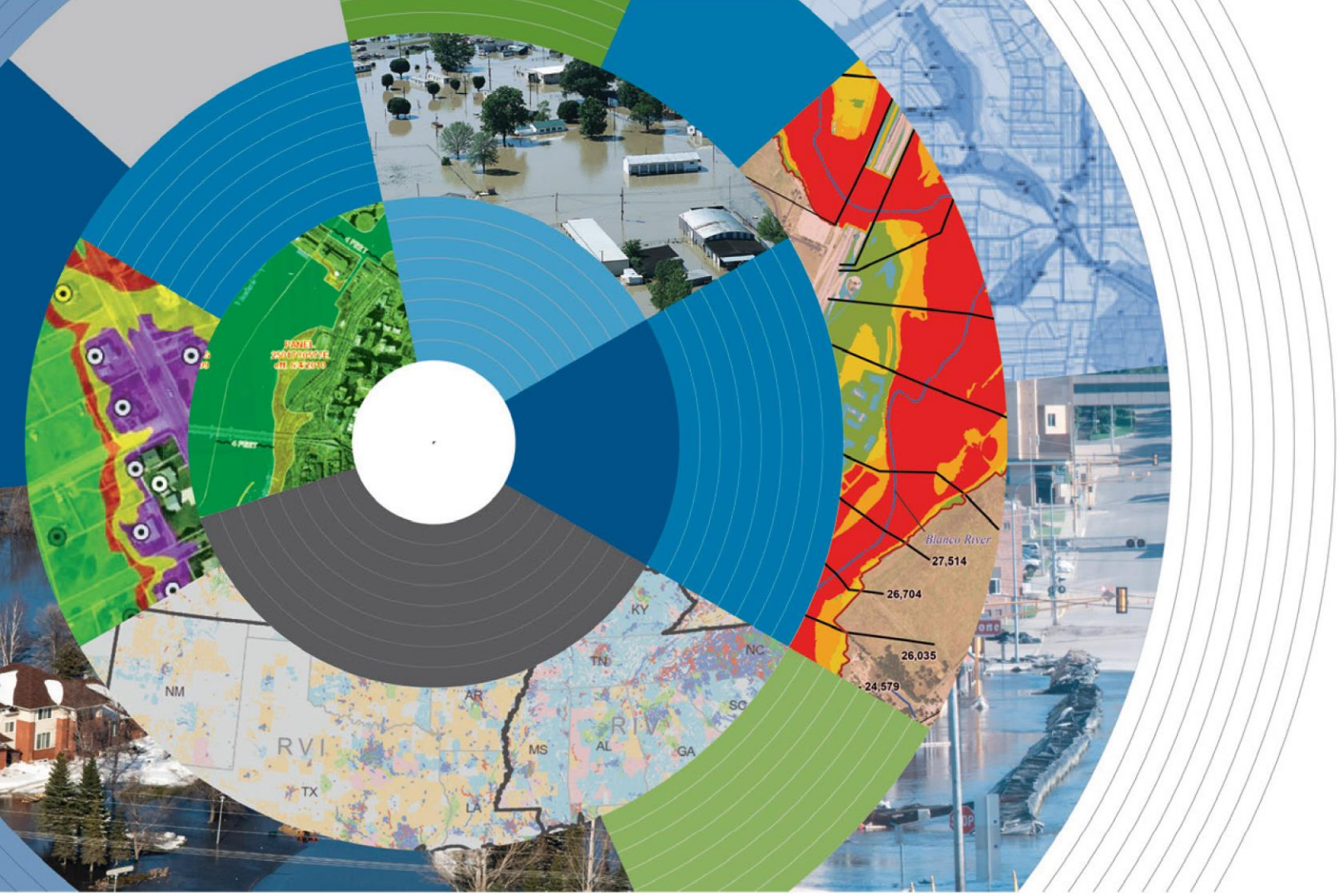


Flood Risk Report

Cedar Watershed

HUC8 12030107

October 2017

FEMA

Flood Risk Report History

Version Number	Version Date	Summary
v1.0	10/30/2017	Discovery, Base Level Engineering (BLE), and Flood Risk Report

Preface

The Department of Homeland Security, Federal Emergency Management Agency's (FEMA) Risk Mapping, Assessment, and Planning (Risk MAP) program provides states and local communities with flood risk information, datasets, risk assessments, and tools that they can use to increase their resilience to flooding and better protect their residents. By pairing accurate floodplain maps with risk assessment tools and planning and outreach support, Risk MAP transforms the traditional flood mapping efforts into an integrated process of identifying, assessing, communicating, planning for, and mitigating flood-related risks.

The Flood Risk Report (FRR) is one of the tools created though the Risk MAP program. A FRR provides non-regulatory information to help local officials, floodplain managers, planners, emergency managers, and others. Local along with Federal and state officials can use the information in the FRR to establish a better understanding of their flood risk, take steps to mitigate those risks, and communicate those risks to residents and local businesses.

The FRR serves as a guide when communities update local hazard mitigation plans, community comprehensive plans, and emergency operations and response plans. It is meant to communicate risk to officials and inform them of the modification of development standards, as well as assist in identifying necessary or potential mitigation projects. The FRR extends beyond community limits to provide flood risk data for the Cedar Watershed.

Flood risk is always changing, and studies, reports, or other sources may be available that provide more comprehensive information. This report is not intended to be the regulatory nor the final authoritative source of all flood risk data in the watershed. Rather, it should be used in conjunction with other data sources to provide a comprehensive picture of flood risk within the project area.

Contents

Executive Summary

The Flood Risk Report has two goals: (1) **to inform communities of their risks** related to certain natural hazards, and (2) **to enable communities to act to reduce their risk**. The information within this Risk Report is intended to assist Federal, state, and local officials with the following goals:

- **Communicate risk** – Local officials can use the information in this report to communicate with property owners, business owners, and other residents about risks and areas of mitigation interest.
- **Update local hazard mitigation plans and community comprehensive plans** – Planners can use risk information to develop and/or update hazard mitigation plans, comprehensive plans, future land use maps, and zoning regulations. For example, zoning codes can be changed to provide for more appropriate land uses in high-hazard areas.
- **Update emergency operations and response plans** – Emergency managers can identify high-risk areas for potential evacuation and low-risk areas for sheltering. Risk assessment information may show vulnerable areas, facilities, and infrastructure for which continuity of operations plans, continuity of government plans, and emergency operations plans would be essential.
- **Inform the modification of development standards** – Planners and public works officials can use information in this report to support the adjustment of development standards for certain locations.
- **Identify mitigation projects** – Planners and emergency managers can use this risk assessment to determine specific mitigation projects of interest. For example, a floodplain manager may identify critical facilities that need to be elevated or removed from the floodplain.

The North Central Texas Council of Governments (NCTCOG), Texas, became a FEMA Cooperating Technical Partner (CTP) in Fiscal Year 2004 (FY2004) and in FY2015 contracted with FEMA to provide Risk MAP Discovery and Base Level Engineering (BLE) products for the Cedar Creek Watershed, Texas. The project area covers the counties bounded by the Cedar Creek HUC-8 watershed: Henderson, Kaufman, Navarro, Rockwall, and Van Zandt. Maps covering the study area can be found in Appendix III of this report.

This Risk Report focuses on the FY2015 Risk MAP Discovery and BLE project. It showcases risk assessments, which analyze how a hazard affects the built environment, population, and local economy to identify mitigation actions and develop mitigation strategies.

The information in this Risk Report should be used to identify areas in need of mitigation projects and to support additional efforts to educate residents on the hazards that may affect them. The areas of greatest hazard impact are identified in the Areas of Mitigation Interest section of this report, which can serve as a starting point for identifying and prioritizing actions a community can take to reduce its risks.

About the FEMA Risk Mapping, Assessment, and Planning (Risk MAP) Program

Flood risk is continually changing over time due to factors such as new building and development and weather patterns. The goal of the Federal Emergency Management Agency's (FEMA) Risk MAP program is to work with Federal, state, tribal, and local partners to identify and reduce flood risk across communities. These projects are conducted using watershed boundaries, and bring together multiple

communities to identify broader mitigation actions and create consistency across the watershed. The program provides resources and support that are tailored to each community to help mitigate their risk and work towards a reduction in risk and future loss.

Through coordination and data sharing, the communities in the watershed work as partners in the mapping process. In addition to providing data, the communities can also provide insight into flooding issues and flood prevention within their areas. To prepare for a future study and assist in mitigation, FEMA provides a number of data sources, including information from the community, such as the following:

- Areas of repeated flooding and insurance claims
- Future development plans
- Areas of low water crossings
- High water marks from recent flooding events
- Areas of evacuation during high water
- Master drainage plans, flood risk reduction projects, and large areas of fill placement
- Local flood studies
- Other flood risk information

For more information about ways communities can take action or take advantage of available resources, please review the attached appendices.

FEMA provides communities with Base Level Engineering (BLE) data for select watersheds during the Risk MAP process. BLE is a form of hydrologic and hydraulic modeling which, when completed, can provide modeled flood hazard data in existing Zone As or where no effective flood hazard zone has been designated. Knowing the extent of flooding during the 1-percent-annual-chance flooding event supports risk reduction efforts and supports more resilient community planning. Completed BLE data is provided to watershed communities for planning, risk communication, floodplain management, and permitting activities, and to inform future flood study needs.

For information on BLE in the Cedar Watershed, see the Phase Zero: Investment section of this report or Appendix II: Base Level Engineering Report.

About the Cedar Watershed

The first FEMA flood hazard mapping within the Cedar watershed was released in the 1970s. As of 2017, all the participating communities in the Cedar watershed Discovery and BLE Risk MAP Project have modernized countywide Digital Flood Insurance Rate Maps (DFIRMs) and Flood Insurance Study (FIS) Reports. Over the years, the area has experienced rapidly increasing development and recurring severe floods. A recorded flooding event occurred in Kaufman County in 1976, with recurring floods approximately every 15 years. Flooding in Van Zandt County in 1977 and 1979 damaged local infrastructure. Rockwall County experienced severe flooding and damage in April 1985, while Henderson County recently experienced flooding-induced damage in April 1986.

In 2009, NCTCOG and the Texas Water Development Board (TWDB) created a Mapping Needs Assessment (MNA) study for the Upper Trinity River Basin, which included parts of the Cedar Creek watershed. The MNA project identified and prioritized the floodplain management needs of over 2,300 stream miles. In order to prioritize the floodplain management needs, NCTCOG and TWDB created a database of all the engineering flood studies in the Basin. In 2016 FEMA authorized NCTCOG to continue the work of the Mapping Needs Assessment by perform a Discovery and BLE Risk MAP Project Effort in the Cedar Creek watershed to gather local information, readily available data to determine project viability, and create Risk MAP products to assist in the movement of communities towards resilience.

Introduction

Flood Risk

Floods are naturally occurring phenomena that can and do happen almost anywhere. In its most basic form, a flood is an accumulation of water over a normally dry area. Floods become hazardous to people and property when they inundate an area where development has occurred, causing losses. Mild flood losses may have little impact on people or property, such as damage to landscaping or the accumulation of unwanted debris. Severe flood losses can destroy buildings and crops and cause severe injuries or death.

Calculating Flood Risk

It is not enough to simply identify where flooding may occur. Even if people know where a flood might occur, they may not know the level of flood risk in that area. The most common method for determining flood risk, also referred to as vulnerability, is to identify both the probability and the consequences of flooding:

> **Flood Risk** (or Vulnerability) **= Probability x Consequences**; where
>
> **Probability** = the likelihood of occurrence
>
> **Consequences** = the **estimated** impacts associated with the occurrence on life, property, and infrastructure

The probability of a flood is the likelihood that it will occur. The probability of flooding can change based on physical, environmental, and/or engineering factors. These factors will also have an effect on the area that is impacted by the flood, increasing or decreasing the size of the affected area. The ability to assess the probability of a flood, and the level of accuracy for that assessment, are also influenced by modeling methodology advancements, better knowledge, and longer periods of record for the water body in question.

The consequences of a flood are the estimated effects associated with its occurrence. Consequences relate to human activities within an area and how a flood affects the natural and built environment. It is important that individuals and communities have an accurate and current understanding of their risk because anyone can be vulnerable to flooding. Individuals that are located outside of the high-risk Special Flood Hazard Area (SFHA) file more than 20 percent of insurance claims and receive one-third of disaster assistance for flooding. Having an awareness of risk can allow communities and their residents to address the potential consequences. Understanding risk can also allow for long-term development planning, opportunities for revitalization efforts, and modifications in how interaction occurs with the existing risk.

Watershed Basics

Background

The Cedar watershed is located in North Texas and covers portions of Henderson, Kaufman, Navarro, Rockwall, and Van Zandt Counties. See Figure 1 for a location map of the Cedar watershed. The watershed encompasses 33 communities covering approximately 1,066 square miles.

The surrounding flat to rolling terrain in the Cedar Creek watershed is surfaced by sandy and clay loams that support water-tolerant hardwoods, conifers, and grasses. Native prairie grasses such as Indian grass, little blue stem, and big blue stem, cover most of the southern portion of the watershed. In the non-urbanized areas in the norther section of the watershed, pasture grasses such as Bermuda and Johnson grass are dominant. Forested areas include tree species such as mesquite, oak, pecan, hackberry, and elm, and woody shrubs, including American Beautyberry, hawthorn, and greenbriar.

The Cedar Creek watershed has over 100 dams which are primarily used for water supply. These dams provide other benefits such as irrigation for agriculture, recreation, and flood control purposes. These are owned either by the local government or local government agency. Others are privately owned dams. Most of these dams are low hazard dams. The largest dam is on the Cedar Creek Reservoir, the Joe B. Hogsett Dam, which was completed in 1965 and used mainly for water supply and flood control. While there are no known certified levees in the Cedar Creek watershed, small private levees may exist.

Intense, localized thunderstorms and frontal-type storms in spring and summer cause most of the flooding issues in Cedar watershed. Flash flooding occurs throughout the watershed, with the clay subsoils often eroding during large rain events. Unincorporated Rockwall County within the Cedar watershed has minimal flooding issues due to Soil Conservation Service (SCS) detention dams. In Henderson County, the City of Athens is the most susceptible for flood damage, as well as areas along Cedar Creek, North Twin Creek, and South Twin Creek. In Van Zandt County, the highest flood risk in Cedar Watershed occurs along Dry Branch near State Route 198.

In Kaufman County, historical flooding caused the US. Army Corps of Engineers to straighten sections of both Kings Creek and Big Brushy Creek in the 1950's. These two creeks remain the most significant flood risks in Kaufman County, with a 15 year interval between successive major flood events. The recent urbanization, especially in Rockwall County, has increased the runoff from storm events due to increased impervious surfaces. The flood damage potential along Lacy Fork will increase with suburban development near Cedar Creek Reservoir.

Cedar Creek is the primary drainage source, flowing centrally from the north as Muddy Cedar Creek and Rocky Cedar Creek, and then as Cedar Creek beginning near the Van Zandt-Kaufman County line to the confluence with the Trinity River in Navarro County in the southwest. Cedar Creek is fed by several tributaries including Brushy Creek, King's Creek, Little Cottonwood Creek, Rocky Cedar Creek, Allen Creek, Caney Creek, Lacy Creek, North Twin Creek, South Twin Creek, Clear Creek, and Walnut Creek.

Figure 1 provides an overview of the Cedar watershed and its geographic location within the state.

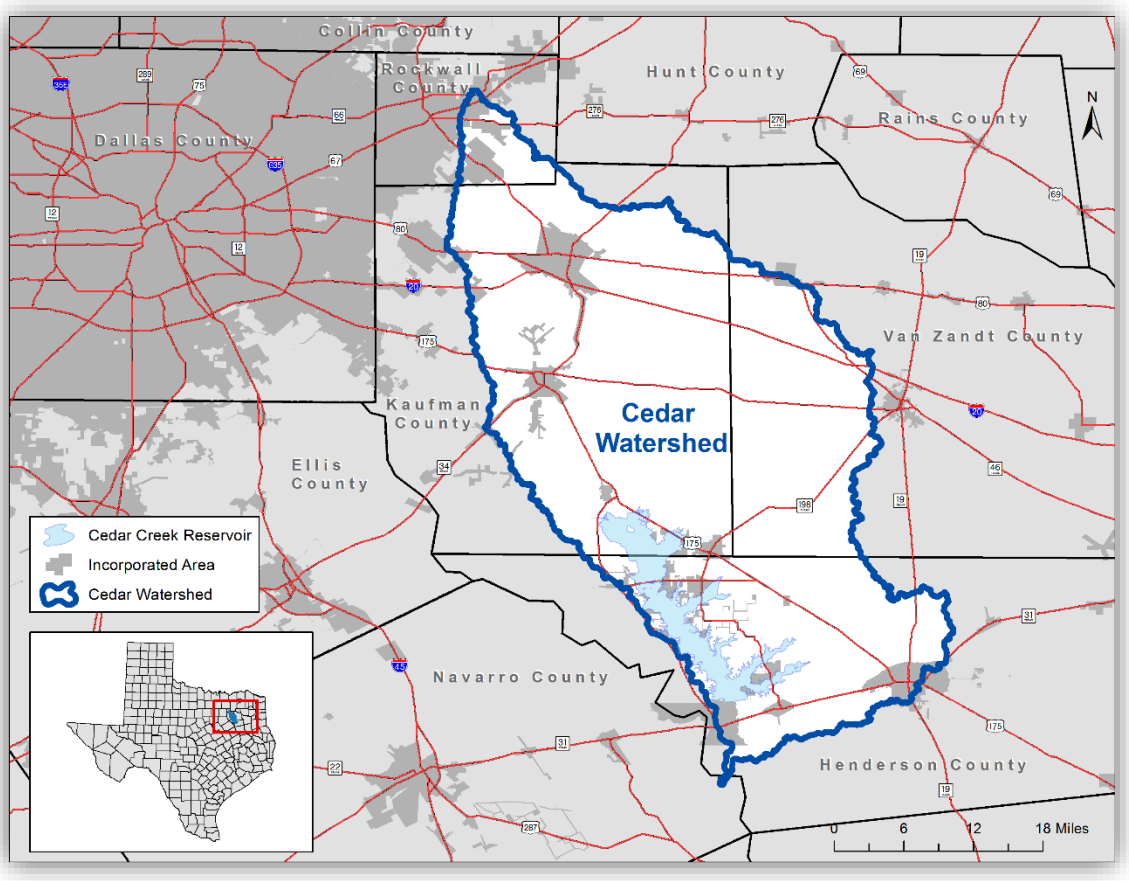


Figure 1: Overview map for the Cedar Watershed

Population

A review of land cover changes and population growth patterns in the watershed revealed that significant development occurred from 2000 to 2010 in the areas closest to the Dallas-Fort Worth Metroplex. The cities of Fate and Rockwall in Rockwall County and the cities of Forney and Oak Ridge in northwest Kaufman County all increased in population over 100 percent.

Since 2000, most communities within the Cedar Watershed have experienced population growth. However, seven communities (Caney City, City of Enchanted Oaks, City of Log Cabin, Town of Oak Grove, City of Tool, City of Trinidad, and unincorporated Rockwall County) have declined in population since 2000, with the City of Trinidad serving 18.5% fewer people. The City of Scurry was incorporated in 2003 and has seen little change in population since.

Excluding the combined areas of previously developed land and open water, roughly 900 mi^2 of the watershed still has the potential for new construction. Using the average annual growth rate for the cities and unincorporated county areas in the project area, the total population within the watersheds has the potential to rise an average 1.2 percent by 2021. Therefore, the probability is high that populated areas will expand and rural land will be developed.

To help mitigate the risk to areas where increased population and development are expected, communities can adopt (or exceed) the minimum standards of the National Flood Insurance Program

(NFIP). This is recommended as a proactive strategy to manage construction within the floodplain and avoid negative impacts to existing and future development.

Watershed Land Use

Cedar watershed is mainly rural with a handful of larger cities such as the City of Kaufman in Kaufman County and the City of Athens in Henderson County. Main land uses in the watershed include agriculture, livestock farming, and hunting tourism. Henderson County provides water sports and tourism on Cedar Creek Reservoir. Oil and gas extraction sites are plentiful throughout the watershed with the largest concentration in Navarro County. Light manufacturing is a prominent industry in Kaufman County. Although the watershed is largely rural at present time, it is currently experiencing steady growth due to lower housing costs for residents commuting to the City of Dallas and surrounding areas for employment.

Table 1: Population and Area Characteristics [1]

Risk MAP Project	Total Population in Study Area	Average % Population Growth/Yr (2010-2040)	Predicted Population (by 2021)	Land Area	Developed Area	Open Water
Cedar HUC-8 Watershed (HUC8 12030107)	109,617	57.5%	137,724	1,066 mi^2	104 mi^2	62 mi^2

National Flood Insurance Program Status and Regulation

In order to be a participant in the National Flood Insurance Program (NFIP), all interested communities must adopt and submit floodplain management ordinances that meet or exceed the minimum NFIP regulations. These regulations can be found in the Code of Federal Regulations and most of the community ordinance requirements are in Parts 59 and 60. The level of regulation depends on the level of information available and the flood hazards in the area. The levels are as follows:

- A: The Federal Emergency Management Agency (FEMA) has not provided any maps or data – 60.3(a)
- B: Community has maps with approximate A zones – 60.3(b)
- C: Community has a Flood Insurance Rate Map (FIRM) with Base Flood Elevations (BFE) – 60.3(c)
- D: Community has a FIRM with BFEs and floodways – 60.3(d)
- E: Community has a FIRM that shows coastal high hazard areas (V zones) – 60.3(e)

To help mitigate the risk to areas where increased population and development are expected, communities can adopt (or exceed) the minimum standards of the National Flood Insurance Program (NFIP). This is recommended as a proactive strategy to manage construction within the floodplain and avoid negative impacts to existing and future development.

[1] Data obtained from the U.S. Census Bureau; ESRI Demographic 5-year Projections; and National Land Cover Database

To increase mitigation efforts and community flood awareness through potentially discounted premium rates, an NFIP community that has adopted more stringent ordinances or is actively completing mitigation and outreach activities is encouraged to consider joining the Community Rating System (CRS). The CRS is a voluntary incentive-based program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. Flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions.

All communities within the project area, except for the Village of Grays Prairie, the City of Oak Grove, and the City of Post Oak Bend, have a level of regulation suitable for managing floodplains with mapped regulatory floodways and Base (1-percent-annual-chance) Flood Elevations (44 CFR 60.3(d)). The Village of Grays Prairie, the City of Oak Grove, and the City of Post Oak Bend do not participate in the NFIP and, therefore, do not have any regulation for managing floodplains with mapped regulatory floodways and Base (1-percent-annual-chane) Flood Elevations (44 CFR 60.3(d)).

Communities can review their current ordinances and reflect potential flood hazard changes by adopting updated ordinances early. This action can reduce future flood losses by affecting how substantial improvements or new construction are regulated.

Hazard Mitigation Plan

State and local governments must develop and adopt hazard mitigation plans in order to be eligible for certain types of funding. To remain eligible, communities need to update and resubmit their plans every 5 years for FEMA approval. Hazard mitigation plans are created to increase education and awareness, identify strategies for risk reduction, and identify other ways to develop long-term strategies to reduce risk and protect people and property. All communities in the watershed except for the Town of Talty in Kaufman County have hazard mitigation plans. As of July 2017, the Henderson County plan update was still in progress. The cities of Athens, Eustace, Gun Barrel City, Log Cabin, Malakoff, Seven Points, Star Harbor, Tool, and the towns of Enchanted Oaks and Payne Springs participate in the Henderson County Hazard Mitigation Plan. The cities of Forney, Kaufman, Kemp, Post Oak Bend, and the towns of Mabank, Oak Grove, Oak Ridge, Post Oak Bend, Scurry, and the Village of Grays Prairie participate in the Kaufman County Hazard Mitigation Plan. Fate, McLendon-Chisholm, and Rockwall participate in the Rockwall County Hazard Mitigation Plan. The Van Zandt County Hazard Mitigation Plan includes the City of Canton and the City of Wills Point. The plans effectively allow for FEMA to assess hazards identified through local, state, and federal partnerships and mitigation action items that communities have identified. These hazard mitigation plans were used in the compilation and preparation of this report.

Community Rating System

The Community Rating System (CRS) is a voluntary incentive-based program that recognizes and encourages community floodplain management activities that communities undertake in addition to the minimum requirements they must meet when joining the NFIP. Individuals that carry flood insurance in a community that participates in the CRS program can receive a discount on their flood insurance premium. Discounts can range from 5 to 45 percent. There are no communities in the Cedar watershed currently participating in CRS. Table 2 depicts NFIP and CRS participation status and provides an overview of the effective flood data availability.

Table 2: NFIP and CRS Participation [2]

Risk MAP Project	Participating NFIP Communities/ Total Communities	Number of CRS Communities	CRS Rating Class Range	Average Years since FIRM Update	Level of Regulations (44 CFR 60.3)
Cedar HUC-8 Watershed (HUC8 12030107)	30/33	0	N/A	7	44 CFR 60.3(d)

Dams

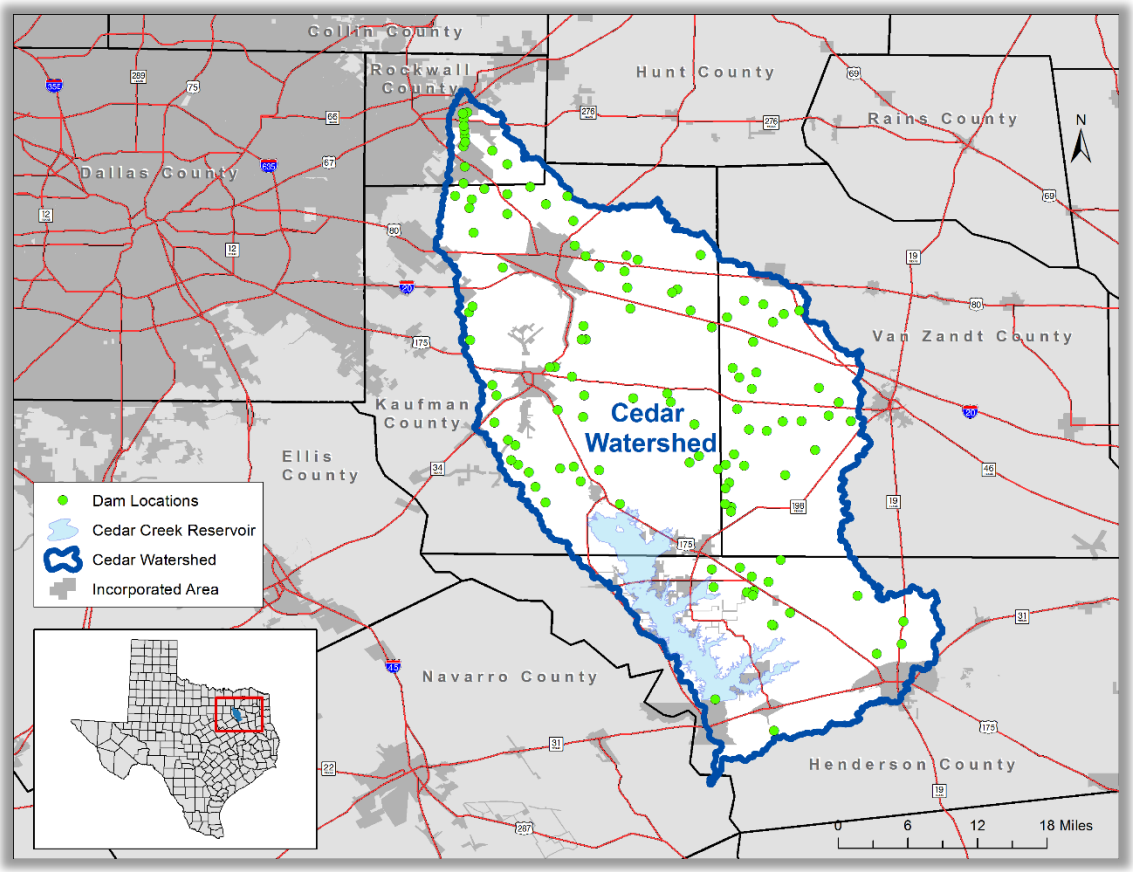


Figure 2: Dam Location Map for Cedar Watershed

The Cedar Creek watershed has abundant water resources. Several dams along the numerous streams in the watershed are used to maintain water storage and to control or divert flow.

As recorded by the USACE in the National Inventory of Dams and the DFIRM Structures, there are approximately 148 dams are within the watershed, and 48 of these are considered high-hazard dams.

[2] Data obtained from FEMA Community Information Systems.

For these dams, the owners and operators are required to develop and maintain Emergency Action Plans to reduce the risk of loss of life and property if the dam fails.

Table 3 provides the characteristics of the dams identified in the project area. Joe B. Hogsett Dam on Cedar Creek Reservoir is the largest dam in the watershed.

Table 3: Risk MAP Project Dam Characteristics[3]

Risk MAP Project	Total Number of Identified Dams	Number of Dams Requiring EAP	Percentage of Dams without EAP	Average Years since Inspection	Average Storage (acre-feet)
Cedar HUC-8 Watershed (HUC8 12030107)	148	48	68%	10	5,574

Flood Insurance Rate Maps (FIRMs)

The average age of the effective FIRMs within the Cedar Watershed is 7 years. The oldest effective maps are for Rockwall County, which are 9 years old and have an effective date of September 26, 2008. The newest FIRMs are dated July 3, 2012 and are for Kaufman County. As of 2017, all communities in the watershed have county-wide Effective DFIRMs.

[3] Data obtained from USACE National Inventory of Dams

Project Phases and Map Maintenance

Background

FEMA manages several risk analysis programs, including Flood Hazard Mapping, National Dam Safety, the Earthquake Safety Program, Multi-Hazard Mitigation Planning, and the Risk Assessment Program, all of which assess the impact of natural hazards and lead to effective strategies for reducing risk. These programs support the Department of Homeland Security's objective to "strengthen nationwide preparedness and mitigation against natural disasters."

FEMA manages the NFIP, which is the cornerstone of the national strategy for preparing American communities for flood hazards. In the nation's comprehensive emergency management framework, the analysis and awareness of natural hazard risk remains challenging. A consistent risk-based assessment approach and a robust communication system are critical tools to ensure a community's ability to make informed risk management decisions and take mitigation actions. Flood hazard mapping is a basic and vital component for a prepared and resilient nation.

> *Flood-related damage between 1980 and 2013 totaled $260 billion, but the total impact to our Nation was far greater—more people lose their lives annually from flooding than any other natural hazard.*
>
> *FEMA, "Federal Flood Risk Management Standard (FFRMS)" (2015)*

In Fiscal Year 2009, FEMA's Risk MAP program began to synergize the efforts of Federal, state, and local partners to create timely, viable, and credible information identifying natural hazard risks. The intent of the Risk MAP program is to share resources to identify the natural hazard risks a community faces and ascertain possible approaches to minimizing them. Risk MAP aims to provide technically sound flood hazard information to be used in the following ways:

- To update the regulatory flood hazard inventory depicted on FIRMs and the National Flood Hazard Layer
- To provide broad releases of data to expand the identification of flood risk (flood depth grids, water-surface elevation grids, etc.)
- To support sound local floodplain management decisions
- To identify opportunities to mitigate long-term risk across the nation's watersheds

How are FEMA's Flood Hazard Maps Maintained?

FEMA's flood hazard inventory is updated through several types of revisions.

Community-submitted Letters of Map Change. First and foremost, FEMA relies heavily on the local communities that participate in the NFIP to carry out the program's minimum requirements. These requirements include the obligation for communities to notify FEMA of changing flood hazard information and to submit the technical supporting data needed to update the FIRMs.

Although revisions may be requested at any time to change information on a FIRM, FEMA generally will not revise an effective map unless the changes involve modifications to SFHAs. Be aware that the best floodplain management practices and proper assessments of risk result when the flood hazard maps present information that accurately reflects current conditions.

> *Under the current minimum NFIP regulations, a participating community commits to notifying FEMA if changes take place that will affect an effective FIRM no later than 6 months after project completion.*
>
> *Section 65.3, Code of Federal Regulations*

Letters of Map Amendment (LOMAs). The scale of an effective FIRM does not always provide the information required for a site-specific analysis of a property's flood risk. FEMA's LOMA process provides homeowners with an official determination on the relation of their lot or structure to the SFHA. Requesting a LOMA may require a homeowner to work with a surveyor or engineering professional to collect site-specific information related to the structure's elevation; it may also require the determination of a site-specific BFE. Fees are associated with collecting the survey data and developing a site-specific BFE. Local surveying and engineering professionals usually provide an Elevation Certificate to the homeowner, who can use it to request a LOMA. A successful LOMA may remove the Federal mandatory purchase requirement for flood insurance, but lending companies may still require flood insurance if they believe the structure is at risk.

FEMA-Initiated Flood Risk Project. Each year, FEMA initiates a number of Flood Risk Projects to create or revise flood hazard maps. Because of funding constraints, FEMA can study or restudy only a limited number of communities, counties, or watersheds each year. As a result, FEMA prioritizes study needs based on a cost-benefit approach whereby the highest priority is given to studies of areas where development has increased and the existing flood hazard data has been superseded by information based on newer technology or changes to the flooding extent. FEMA understands communities require products that reflect current flood hazard conditions to best communicate risk and implement effective floodplain management.

Flood Risk Projects may be delivered by FEMA or one of its Cooperating Technical Partners (CTPs). The CTP initiative is an innovative program created to foster partnerships between FEMA and participating NFIP communities, as well as regional and state agencies. Qualified partners collaborate in maintaining up-to-date flood maps. In FEMA Region 6, which includes the State of Louisiana, CTPs are generally statewide agencies that house the State Floodplain Administrator. However, some Region 6 CTPs are also large River Authorities or Flood Control Districts. They provide enhanced coordination with local, state, and Federal entities, engage community officials and technical staff, and provide updated technical information that informs the national flood hazard inventory.

Risk MAP has modified FEMA's project investment strategy from a single investment by fiscal year to a multi-year phased investment, which allows the FEMA to be more flexible and responsive to the findings of the project as it moves through the project lifecycle. Flood Risk Projects are funded and completed in phases.

General Flood Risk Project Phases

Each phase of the Flood Risk Project provides both FEMA and its partner communities with an opportunity to discuss the data that has been collected and to determine a path forward. Local engagement throughout each phase enhances the opportunities for partnership, furthers the discussion on current and future risk, and helps identify local projects and activities to reduce long-term natural hazard risk.

Flood Risk Projects may be funded for one or more of the following phases:

- Phase Zero – Investment
- Phase One – Discovery
- Phase Two – Risk Identification and Assessment
- Phase Three – Regulatory Product Update

Local input is critical throughout each phase of a Flood Risk Project. More details about the tasks and objectives of each phase are included below.

Phase Zero: Investment

Phase Zero of a Flood Risk Project initiates FEMA's review and assessment of the inventories of flood hazards and other natural hazards within a watershed area. During the Investment Phase, FEMA reviews the availability of information to assess the current floodplain inventory. FEMA maintains several data systems to perform watershed assessments and selects watersheds for a deeper review of available data and potential investment tasks based on the following factors:

Availability of High-Quality Ground Elevation Data. FEMA reviews readily available and recently acquired ground elevation data. This information helps identify development and earth-moving activities near streams and rivers. Where necessary, FEMA may partner with local, state, and other federal entities to collect necessary ground elevation information within a watershed.

If high-quality ground elevation data is both available for a watershed area and compliant with FEMA's quality requirements, FEMA and its mapping partners may prepare engineering data to assess, revise, replace, or add to the current flood hazard inventory.

Mile Validation Status within Coordinated Needs Management Strategy (CNMS). FEMA uses the CNMS database to track the validity of the flood hazard information prepared for the NFIP. The CNMS database reviews 17 criteria to determine whether the flood hazard information shown on the current FIRM is still valid.

Communities may also inform and request a review or update of the inventory through the CNMS website at https://msc.fema.gov/cnms/. The CNMS Tool Tutorial provides an overview of the online tool and explains how to submit requests.

Local Hazard Mitigation Plans. Reviewing current and historic hazard mitigation plans provides an understanding of a community's comprehension of its flood risk and other natural hazard risks. The mitigation strategies within a local hazard mitigation plan provide a lens to local opportunities and underscore a potential for local adoption of higher standards related to development or other actions to reduce long-term risk.

Cooperating Technical Partner State Business Plans. In some states, a CTP generates an annual state business plan that identifies future Flood Risk Project areas that are of interest to the state. The Texas Water Development Board and the Texas Natural Resources Information System work to develop user-friendly data. In this project area, FEMA has worked closely with both entities to develop the project scope and determine the necessary project tasks.

Communities that have identified local issues are encouraged to indicate their data needs and revision requests to the State CTP so that they can be prioritized and included in the State Business Plans.

Possible Investment Tasks. After a review of the data available within a watershed, FEMA may choose to (1) purchase ground elevation data and/or (2) create some initial engineering modeling against which to compare the current inventory, also known as BLE modeling.

Phase One: Discovery

Phase One, the Discovery Phase, provides opportunities both internally (between the state and FEMA) and externally (with communities and other partners interested in flood potential) to discuss local issues with flooding and examine possibilities for mitigation action. This effort is made to determine where communities currently are with their examination of natural hazard risk throughout their community and to identify how state and Federal support can assist communities in achieving their goals.

The Discovery process includes an opportunity for local communities to provide information about their concerns related to natural hazard risks. Communities may continue to inform the project identification effort by providing previously prepared survey data, as-built stream crossing information, and engineering information.

For a holistic community approach to risk identification and mapping, FEMA relies heavily on the information and data provided at the local level. Flood Risk Projects are focused on identifying (1) areas where the current flood hazard inventory does not provide adequate detail to support local floodplain management activities, (2) areas of mitigation interest that may require more detailed engineering information than is currently available, and (3) community intent to reduce the risk throughout the watershed to assist FEMA's future investment in these project areas. Watersheds are selected for Discovery based on these evaluations of flood risk, data needs, availability of elevation data, Regional knowledge of technical issues, identification of a community-supported mitigation project, and input from Federal, state, and local partners.

Possible Discovery Tasks. Discovery may include a mix of interactive webinar sessions, conference calls, informational tutorials, and in-person meetings to reach out to and engage with communities for input. Data collection, interviews, and interaction with community staff and data-mining activities provide the basis for watershed-, community-, and stream-level reviews to determine potential projects that may benefit the communities. A range of analysis approaches are available to determine the extent of flood

risk along streams of concern. FEMA and its mapping partners will work closely with communities to determine the appropriate analysis approach, based on the data needs throughout the community. These potential projects may include local training sessions, data development activities, outreach support to local communities wanting to step up their efforts, or the development of flood risk datasets within areas of concern to allow a more in-depth discussion of risk.

Phase Two: Risk Identification and Assessment

Phase Two (Risk Identification and Assessment) continues the risk awareness discussion with communities through watershed analysis and assessment. Analyses are prepared to review the effects of physical and meteorological changes within the project watershed. The new or updated analysis provides an opportunity to identify how development has affected the amount of stormwater generated during a range of storm probabilities and shows how effectively stormwater is transported through communities in the watershed.

Coordination with a community's technical staff during engineering and model development allows FEMA and its mapping partners to include local knowledge, based on actual on-the-ground experience, when selecting modeling parameters.

The information prepared and released during Phase Two is intended to promote better local understanding of the existing flood risk by allowing community officials to review the variability of the risk throughout their community. As FEMA strives to support community-identified mitigation actions, it also looks to increase the effectiveness of community floodplain management and planning practices, including local hazard mitigation planning, participation in the NFIP, use of actions identified in the CRS Manual, risk reduction strategies for repetitive loss and severe repetitive loss properties, and the adoption of stricter standards and building codes.

FEMA is eager to work closely with communities and technical staff to determine the current flood risk in the watershed. During the Risk Identification and Assessment phase, FEMA would like to be alerted to any community concerns related to the floodplain mapping and analysis approaches being taken. During this phase, FEMA can engage with communities and review the analysis and results in depth.

Possible Risk Identification and Assessment Tasks. Phase Two may include a mixture of interactive webinars, conference calls, informational tutorials, and in-person meetings to reach out to and engage with communities for input. Flood Risk Project tasks may include hydrologic or hydraulic engineering analysis and modeling, floodplain mapping, risk assessments using Hazus-Multi Hazard software, and preparation of flood risk datasets (water-surface elevation, flood depth, or other analysis grids). Additionally, projects may include local training sessions, data development activities, outreach support to local communities that want to step up their efforts, or the development of flood risk datasets within areas of concern to allow a more in-depth discussion of risk.

Phase Three: Regulatory Products Update

If the analysis prepared in the previous Flood Risk Project phases indicates that physical or meteorological changes in the watershed have significantly changed the flood risk since the last FIRM was printed, FEMA will initiate the update of the regulatory products that communities use for local floodplain management and NFIP activities.

Delivery of the preliminary FIRM and Flood Insurance Study (FIS) report begins another period of coordination between community officials and FEMA to discuss the required statutory and regulatory steps both parties will perform before the preliminary FIRM and FIS report can become effective. As in the previous phases, FEMA and its mapping partners will engage with communities through a variety of conference calls, webinars, and in-person meetings.

Once the preliminary FIRMs are prepared and released to communities, FEMA will initiate the statutory portions of the regulatory product update. FEMA will coordinate a Consultation Coordination Officer meeting and initiate a 90-day comment and appeal period. During this appeal period, local developers and residents may coordinate the submittal of their comments and appeals through their community officials to FEMA for review and consideration.

FEMA welcomes this information because additional proven scientific and technical information increases the accuracy of the mapping products and better reflects the community's flood hazards identified on the FIRMs.

Communities may host or hold Open House meetings for the public. The Open House layout allows attendees to move at their own pace through several stations, collecting information in their own time. This format allows residents to receive one-on-one assistance and ask questions pertinent to their situations or their interests in risk or flood insurance information.

All appeals and comments received during the statutory 90-day appeal period, including the community's written opinion, will be reviewed by FEMA to determine the validity of the appeal. Once FEMA issues the appeal resolution, the associated community and all appellants will receive an appeal resolution letter and FEMA will revise the preliminary FIRM, if warranted. A 30-day period is provided for review and comment on successful appeals. Once all appeals and comments are resolved, the flood map is ready to be finalized.

After the appeal period, FEMA will send community leaders a Letter of Final Determination stating that the preliminary FIRM will become effective in 6 months. The letter also discusses the actions each affected community participating in the NFIP must take to remain in good standing in the NFIP.

After the preceding steps are complete and the 6-month compliance period ends, the FIRMs are considered effective maps and new building and flood insurance requirements become effective.

That is a brief general overview of a Flood Risk Project. The Flood Risk Report, which is described in the next section, will provide details on the efforts in the Cedar Watershed.

Phase Zero: Investment – 2017 Cedar Creek Watershed Risk MAP Project

The Cedar Creek watershed represents one of the dominant flooding sources in North Texas and lies in the "flash-flood alley" of Texas. Figure 3 shows the number of flash floods per county in Texas. The watershed impacts over 30 communities which includes approximately 109,000 people. The subject communities cover more than 1,000 square miles with over 300 square miles of mapped floodplain. Figure 3 shows an overview of flash flood risk in the Cedar Watershed. A vast majority of the floodplain in the Cedar watershed is in the unincorporated areas of Henderson, Kaufman, and Van Zandt counties. See Appendix III for figures showing floodplain mapping in the Cedar Creek watershed.

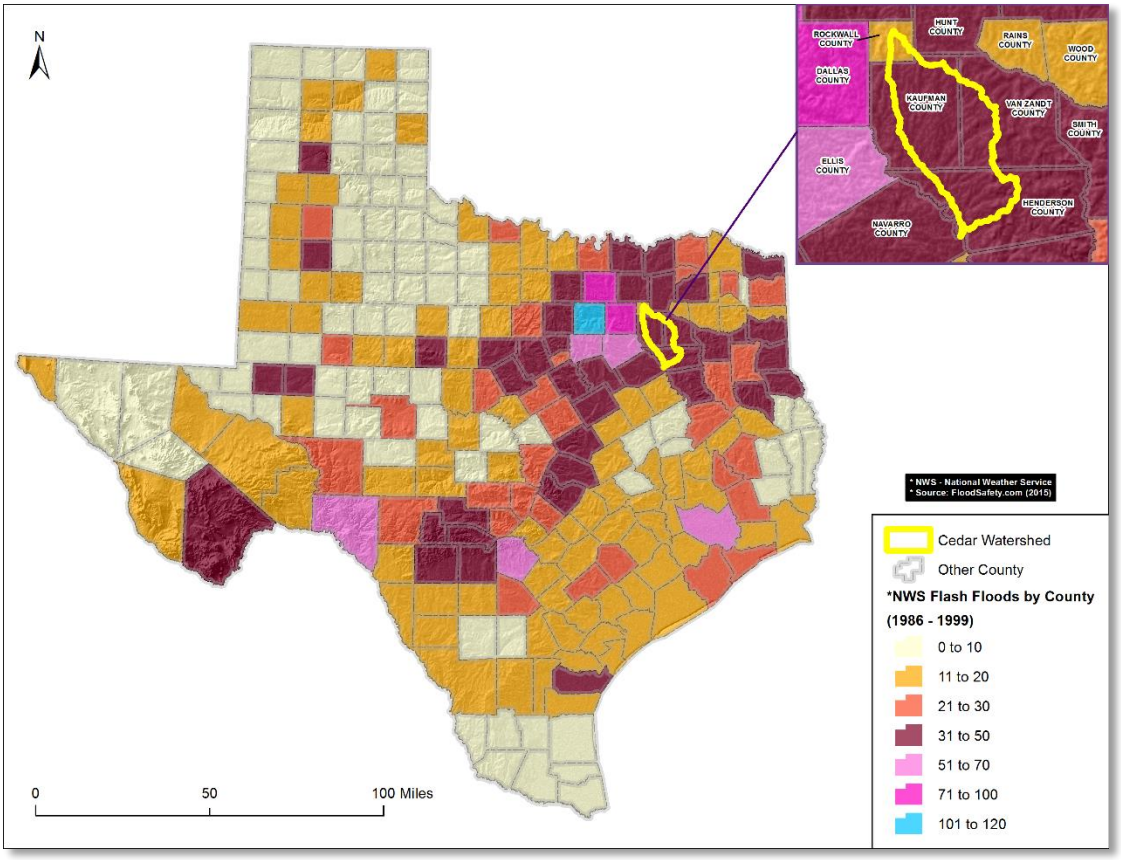


Figure 3: Flash Flood Incidents

All streams in the watershed are either direct or indirect tributaries to Cedar Creek. These streams drain 29 HUC-12 watersheds comprising 1,000 square miles of land. Flooding is highly dependent on rainfall and often flows tropical thunderstorm events hitting the watershed.

Throughout the watershed, annual rainfall totals exceeds the Texas average annual precipitation rate of 34 inches. There is an increase in rainfall from the eastern counties to the western counties, with an average rainfall of 38.9 inches in Kaufman County to 43.7 inches in Van Zandt County. Both the main stem of Cedar Creek and its many tributaries have several dams along their lengths, including the Joe B. Hogsett Dam in Henderson County and the Cedar Creek WS SCS Site 87A Dam in Kaufman County.

All FEMA Risk MAP Project life cycles begins with Phase Zero (Investment/Discovery), and the 2017 Cedar Creek watershed Project paves the way for the local communities to move towards resilience. FEMA selected and prioritized the watershed for BLE Investment and Discovery for the watershed with the overall goal of assisting the local governments in identifying flood risks and strengthening their ability to make informed decisions about reducing these risks. Figure 4 shows communities within the Cedar watershed.

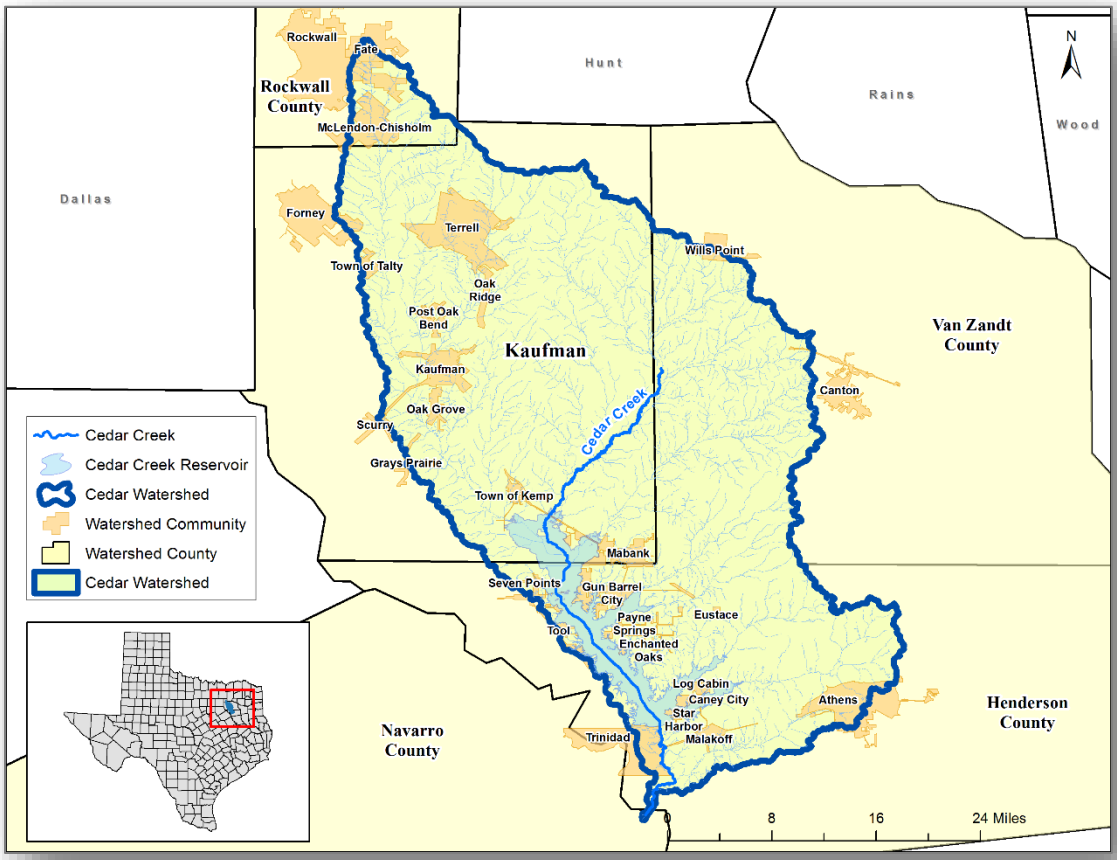


Figure 4: Overview of communities located within the Cedar Watershed.

Watershed Selection Factors

Many factors and criteria are reviewed for watershed selection: flood risk, the age of the current flood hazard data, population growth trends and potential for growth, recent flood claims, and disaster declaration history. The availability of local data and high-quality ground elevation data is reviewed for use in preparing flood hazard data. The CNMS database is reviewed to identify large areas of unknown or unverified data for streams. FEMA consults the State of Louisiana CTP, the State NFIP Coordinator, and the State Hazard Mitigation Officer when watersheds are identified for study.

Flood Risk. People who live along Cedar Creek and its tributaries are not strangers to flood events, and numerous flooding events are listed in the historical record. Kings Creek and Big Brushy Creek are the most significant flood risks in Kaufman County, despite channel straightening in the 1950s. These two creeks maintain approximately a 15 year interval between successive major flood events.

In light of the increasing runoff due to urbanization in these areas, especially near Brushy Creek in Rockwall County, people are concerned that the area's potential for flood damage still exists and may be increasing. Twice in the past ten years (both in 2016), counties in the Cedar Watershed have been declared major federal disaster areas due to damaging floods. Recently (June 2017), communities in Kaufman County experienced a flooding event which led to several damaged houses and overtopped roads.

These increasing development pressures in the Cedar Creek watershed will result in increased runoff and will require improved drainage system and mitigation activities.

Many additional flood related damages have been recorded in the various communities in the watershed. These flood events always cause extensive damage to local infrastructure and illustrate the ongoing threat for the Cedar watershed.

Growth Potential. Although the counties in Cedar watershed are largely rural, rapid urbanization is taking place in Rockwall County and northwestern Kaufman County along the major highways. Growth from 2000-2010 occurred most in the cities of Fate and Rockwall in Rockwall County and the cities of Forney and Oak Ridge in northwest Kaufman County.

Age of Current Flood Information. All counties in the Cedar Creek watershed have been updated to countywide DFIRMs and FIS reports as part of FEMA's Map Mod program that began in 2004. However, the hydrology and hydraulic models supporting the mapping currently shown in the FIRMs in these counties in the watershed have not been updated since the 1970s. Most of the mapping shown on these FIRMs are also Zone A floodplains with no readily available Base Flood Elevations (BFEs).

The combination of related severe floods, outdated flood information, and increasing development indicate that this watershed is in need of updated flood hazard information to support floodplain management activities.

Availability of High-Quality Ground Elevation Data. FEMA's data availability review indicated that high-quality ground elevation data was available for the majority of the basin. This data provides a great basis for preparing hydrologic and hydraulic modeling and helps identify development and earth-moving activities in the vicinity of the streams and creeks. The source and date of the Light Detection and Ranging (LiDAR) topographic data as of July 2017 in the Cedar Creek watershed coverage is shown in Figure 5. The available LiDAR data was collected by TWDB and NCTCOG between 2009 and 2015.

The TWDB – Texas Natural Resources Information System, the North Central Texas Council of Governments, and FEMA have also collected ground elevation data. The basin data was collected between 2009 and 2011.

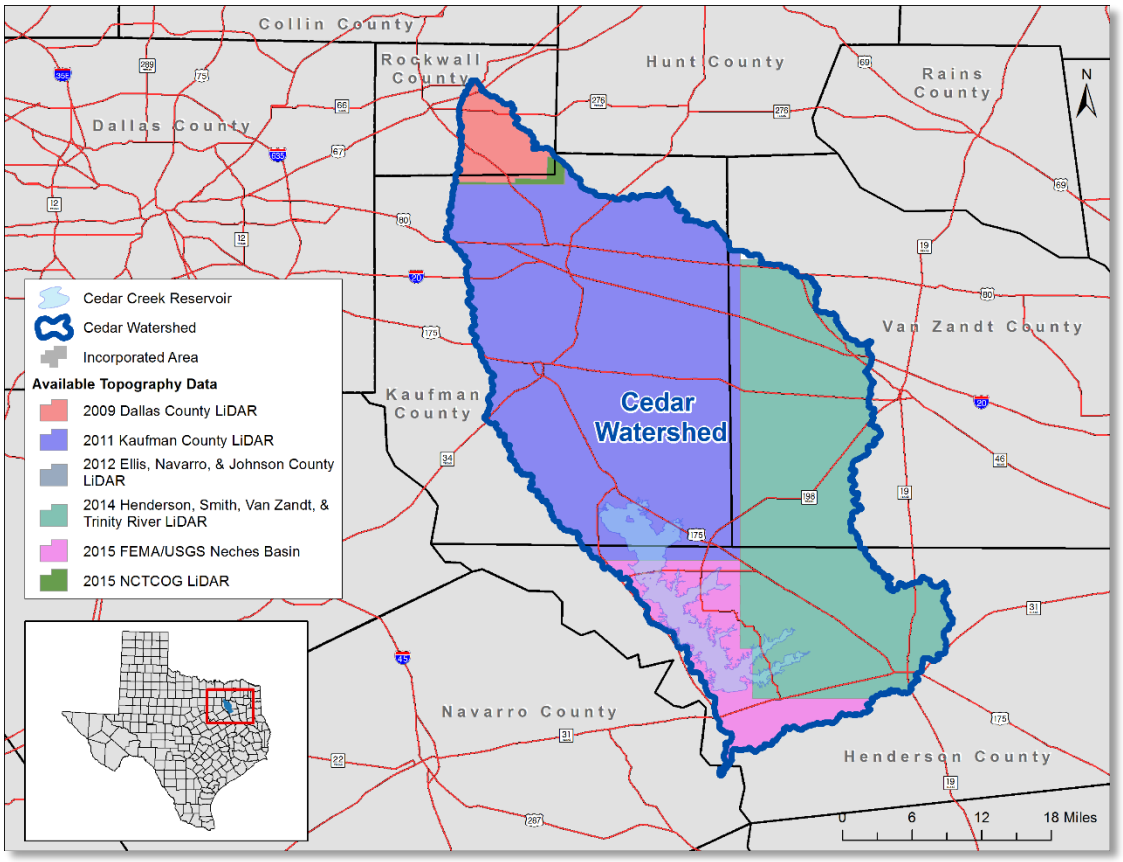


Figure 5: Availability of LiDAR data.

Coordinated Needs Management Strategy Database Review. The CNMS database indicates the validity of FEMA's flood hazard inventory. CNMS reviews 17 criteria to determine whether flood hazard information shown on the current FIRMs is still valid. Streams that are indicated as ***Unverified*** or ***Unknown*** in the database indicate that the information used to map the floodplains currently shown on the FIRM is inaccessible or that a complete evaluation of the critical and secondary CNMS elements could not be performed.

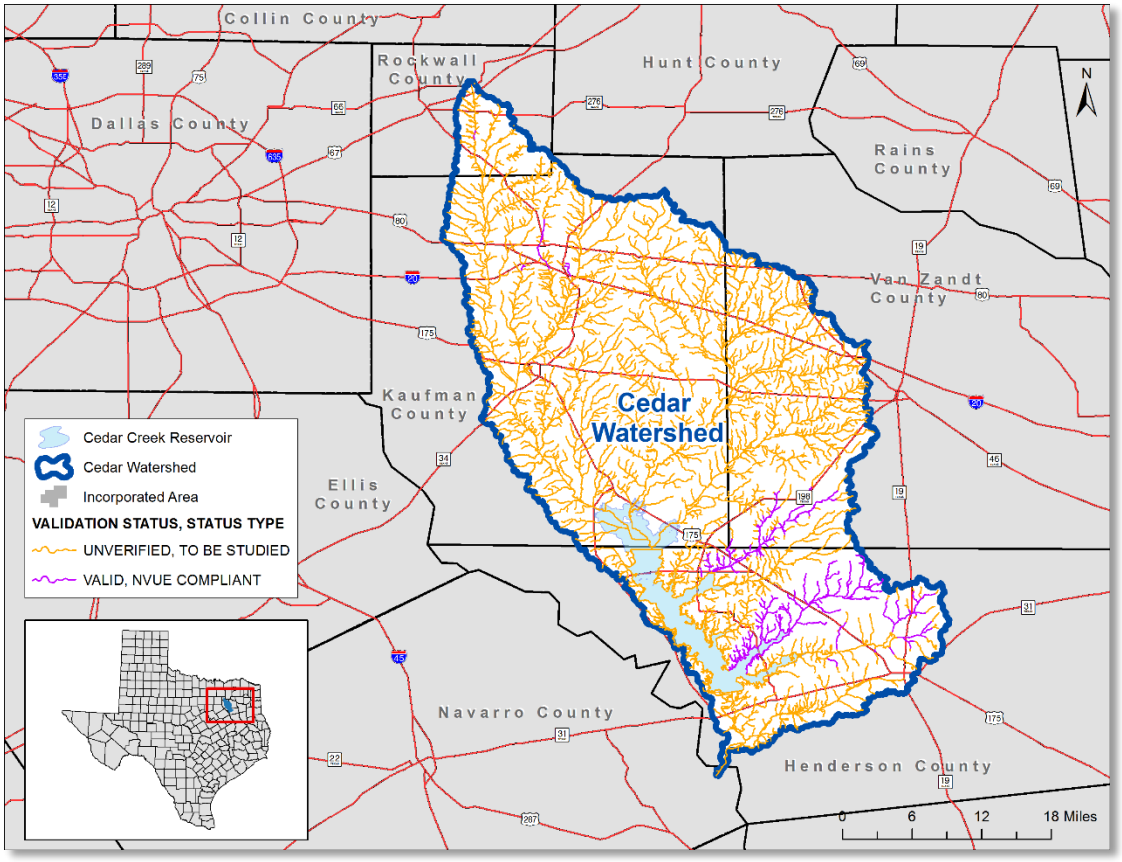


Figure 6: Overview of CNMS streams.

Unmapped Stream Coverage. FEMA also reviewed the current stream coverage and reviewed the areas against the National Hydrography Dataset (NHD). The NHD medium-resolution data inventoried by the U.S. Geological Survey (USGS) maps created at a 1:100,000 scale was used to review the watercourses within the Cedar HUC-8 watershed. Population centers of 1,000 or more were reviewed for additional mileage against the high-resolution data inventoried by the USGS Quadrangle maps created at a 1:24,000 scale. The intent of this review was to identify streams and watercourses and create a complete stream network for preparing Base-Level Engineering data.

Base-Level Engineering – Cedar Creek watershed (2017)

In 2017, FEMA through NCTCOG invested in BLE for the Cedar Creek watershed in Texas. Figure 7 shows the network of streams analyzed using the BLE approach.

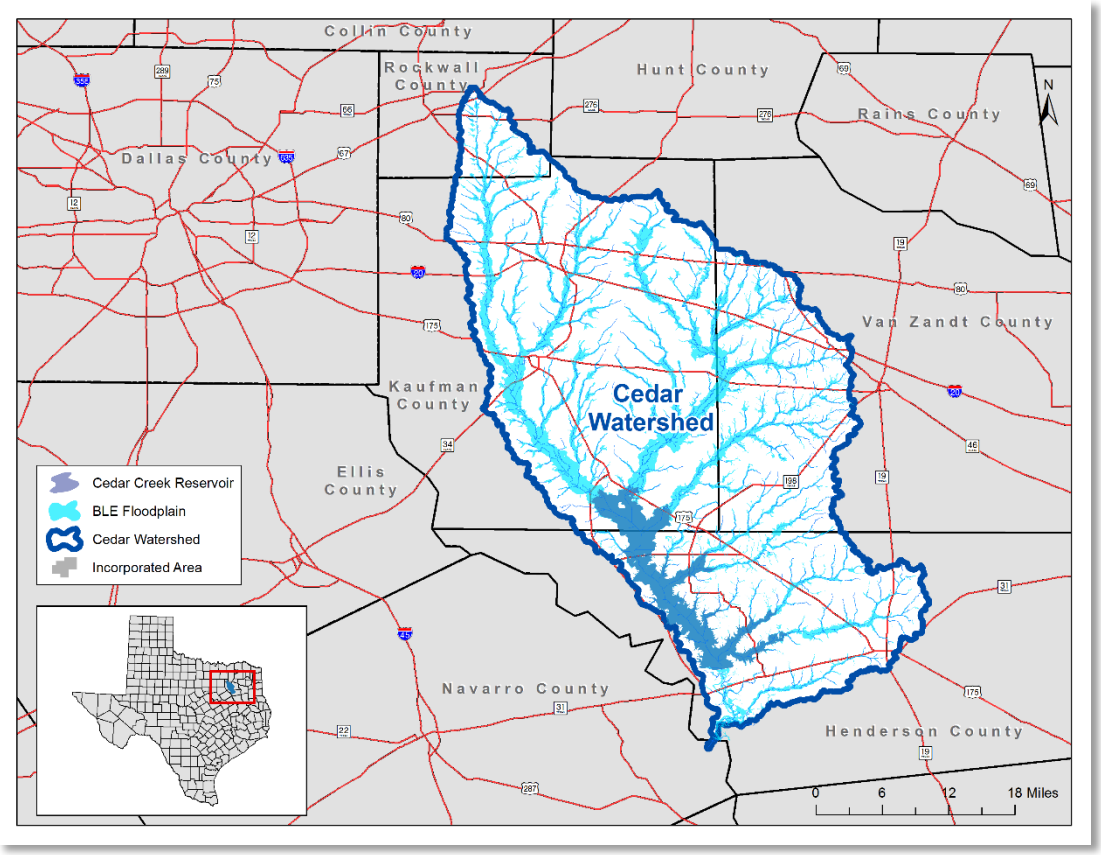


Figure 7: Overview BLE streams.

This approach prepares multi-profile hydrologic (how much water) and hydraulic (how is water conveyed in existing drainage) data for a large stream network or river basin to generate floodplain and other flood risk information for the basin area.

Base-Level Engineering provides an opportunity for FEMA to produce and provide non-regulatory flood risk information for a large watershed area in a much shorter period of time. The data prepared through Base-Level Engineering provides planning-level data that is prepared to meet FEMA's Standards for Floodplain Mapping.

FEMA Investment (2017). The Base-Level Engineering will provide the following items for use in the Cedar Watershed:

- Hydrology modeling (regression) flow values for the 10%, 4%, 2%, 1%, 1%+ and 0.2%, and 1%-frequencies
- Hydraulic (HEC-RAS) modeling for all study streams (for the same frequencies listed above)
- 10-, 1-, and 0.2-percent-annual-chance floodplain boundaries
- 1- and 0.2-percent-annual-chance Water Surface Elevation Grids
- 1- and 0.2-percent-annual-chance Flood Depth Grids
- HAZUS flood analysis for the watershed

- Point file indicating the location of culverts and inline structures that may be informed by local as-built information
- Flood Risk Map (See Appendix III)

The BLE approach will prepare flood hazard information for approximately 3,000 miles of stream, thus adding over 1,000 miles of supplementary flood hazard information for communities throughout the watershed. Once completed, the Base-Level Engineering information was published on FEMA's Estimated BFE viewer (http://apps.femadata.com/estbfe/) to allow communities to use for planning, risk communication, floodplain management, and permitting activities.

CNMS Validation and Assessment. The Base-Level Engineering results were compared to the current flood hazard inventory identified in the CNMS database. This assessment will allow FEMA and NCTCOG to compare this updated flood hazard information to the current effective floodplain mapping throughout the watershed. A key feature of this assessment also included the collection of Areas of Mitigation Interest layers containing suggested structure inventory for the Discovery collection efforts and flood hazard inventory assessments.

Post-Discovery Webinar and Community Coordination. FEMA and NCTCOG rolled out the BLE mapping and datasets to the communities in the Fall of 2017. The meetings were 1 hour webinars held on 21 September, 2017 and 26th September 2017. Communities were provided information and training to support the use of Base-Level Engineering for planning, floodplain management, permitting, and risk communication activities. FEMA will work with communities to review, interpret and incorporate the Base-Level Engineering information into their daily and future community management and planning activities.

Follow-On Phase Project Decisions. The Base-Level Engineering results and the current inventory was compared to identify any areas of significant change. If the results show large areas of change (expansions and contractions of the floodplain, increases and decreases of the computed BFEs, and increases in expected flow values) FEMA will continue to coordinate with the communities to identify the streams that should be considered if the FIRMs are updated.

To identify other streams for future refinement, community growth patterns and potential growth corridors should be discussed with FEMA. These areas of expected community growth and development may benefit from updated flood hazard information. Base-Level Engineering can be further refined to provide detailed study information for a FIRM update.

Areas of communities that were developed prior to 1970 (pre-FIRM areas) may include repetitive and severe repetitive loss properties. They may also be areas where re-development is likely to occur. Having updated flood hazard information before re-development and reconstruction activities take place may benefit communities by providing guidance to mitigate future risk.

FEMA will work with communities following the delivery of Base-Level Engineering to identify a subset of stream studies to be updated and included on the FIRMs. Communities may wish to review these possible areas and provide feedback once the Base-Level Engineering data has been received. Local communities can also refine Base-Level Engineering information and submit it through the Letter of Map Revision (LOMR) process to revise the existing flood hazard information and maintain the FIRMs throughout their community.

Phase One – Discovery: Cedar Creek Watershed (2017)

The 2017 NCTCOG Discovery project was about the "Discovery" of flood hazards and risks throughout the Cedar Creek watershed. Through the Discovery process, FEMA can determine which areas of the watershed may/will be funded for further flood risk identification and assessment in a collaborative manner while taking into consideration the information collected from local communities. Discovery initiates open lines of communication and relies on local involvement for productive discussions about flood risk. The process provides a forum for a watershed-wide effort to understand the interrelationships between upstream and downstream community flood risk throughout the watershed.

The Cedar Creek watershed 2017 Discovery project was completed through the following activities:

- Discovery Engagement Effort
- Data Gathering
- Discovery Meetings
- Watershed Findings and Prioritizations

All possible efforts were made to ensure that stakeholders understood Discovery and the Risk MAP process through emails, phone calls, newsletters, and a developed website created for this Discovery project.

Discovery Engagement Effort. NCTCOG held two (2) informational webinars on April 19 and April 24, 2017 for stakeholders in the watershed. A copy of the presentation is available in Appendix III.

The Pre-Discovery informational webinars were held to increase awareness of the Discovery process prior to the Discovery meetings so the stakeholders would be prepared to fully participate in the Discovery process. Six (6) stakeholders participated in the webinars. The goals of the Pre-Discovery webinars were to:

- Explain the Discovery process
- Explain why the NCTCOG was conducting Discovery in the Cedar watershed
- Explain FEMA's Risk MAP program and benefits
- To obtain information for Discovery in the watershed

In an effort to gain public awareness of the Cedar Discovery process, a Discovery newsletter was developed and distributed to all stakeholders. The newsletter contained information about FEMA's Risk MAP program, the Discovery process, details of the upcoming in-person Discovery meeting, the data collection process, and the Risk MAP process beyond Discovery.

The Discovery engagement process also included the development of a website for data collection. The website allowed participating stakeholders to view and update flood-related information about their community. It also allowed stakeholders to input mitigation concerns, mapping needs and requests on a web map.

Data Gathering. Most of the data collected from stakeholders through the website and at the Discovery meetings included information about local flood risk, flood hazards, mitigation plans, mitigation activities, flooding history, development plans, and floodplain management activities. Data was also collected from State and Federal organizations. Table 4 below summarizes the geospatial data collected.

Table 4: Geospatial Data Collection

Data Type	Data Source	Data Description
HUC Watershed Boundaries	USGS	HUC boundaries clipped to the Cedar HUC-8. Also includes HUC-10 and HUC-12.
Roadways and Railroads	TNRIS Stratmap	Transportation Lines
Jurisdictional Boundaries	TNRIS	Data includes City and County Boundaries
Current Effective Floodplain Information	FEMA DFIRMs	Data includes Floodplains, BFEs, and Cross Sections
Stream Lines	FEMA DFIRMs	Stream Centerlines from DFIRM
Locations of Letters of Map Revision (LOMRs)	FEMA	LOMRs incorporated into Effective DFIRM databases and LOMRs filed after Effective DFIRM dates for watershed counties
Coordinated Needs Management Strategy	FEMA	CNMS database dated June 30, 2017
Topography	TNRIS	List of the most current ground surface topography
HAZUS-based Average Annualized Loss Estimates	FEMA	2015 HAZUS AAL per Census Tract
Coverage of Known Risk Assessment Data	Texas Hazard Mitigation Package	Based on 2000 Census: Population Vulnerability to 1% Flood and Property Value Vulnerability to 1% Flood
Location of Dams	National Inventory of Dams	Dam locations with Emergency Action Plan (EAP) status
Stream Gauges	USGS	Stream Gauge locations
Flood Claims	NFIP	Total claims per jurisdiction
Repetitive Loss or Severe Repetitive Loss Locations	FEMA	RL/SRL locations from 1979 to 2015
Land Use	National Land Cover Database 2006 from TNRIS	Land Use data as of 2006, developed by USGS
Urban Cover	National Land Cover Database 2006 from TNRIS	Urban Cover is a field located in the Land Use
Census Tract Population Data	US Census Bureau	
Population Density	US Census Bureau	Population density based on 2010 Census
Congressional Areas	US Census Bureau	Congressional District Boundaries
High Water Marks	TNRIS	Historical high water marks obtained by TNRIS from USACE, FEMA Mitigation Team, USGS, and TxDOT
Low Water Crossings	TNRIS	Identified low water crossings in Texas with flooding source and road name

Discovery Meetings. Two In-person Discovery meetings were held in the watershed in a come-and-go format. The first Discovery meeting occurred on June 15, 2017 at 9 am at the City Hall, City of Terrell,

Texas. The second Discovery meeting occurred on June 20, 2017 at the City Hall, Gun Barrel City, Texas. Hosts of these meetings included FEMA, TWDB, NCTCOG, and Halff.

The main goals of the Discovery meetings were to gather additional flood risk data; discuss the community's flooding history, development plans, flood mapping needs, and flood risk concerns; discuss the vision for the watershed's future, and the importance of mitigation planning and community outreach.

The Discovery Meetings were held over a four (4) hour period. Community stakeholders were able to participate in the meetings when most convenient to them. Ambassadors assisted stakeholder attendees through various stations in an "open house" format. The stations included:

- *Texas Water Development Board (TWDB)* – information about available Federal and State Grant programs, Hazard Mitigation Planning, Emergency Action plans, as well as implementation of projects
- *Upper Trinity Regional Water District (UTRWD)* – discussion of current UTRWD projects in the region
- *United States Army Corps of Engineers (USACE)* – discussion of current USACE projects in the region
- *NCTCOG Programs* – information on NCTCOG programs available to stakeholders as well as answering NCTCOG questions from attendees
- *Laptops* – stakeholders were able to review, edit, or add information entered on the Discovery website.
- *Discovery Maps* – data collection process to capture information on identifying flood risk locations and problems, areas of growth or planned development, answering floodplain questions, and identifying map need locations.

The 2017 Cedar Creek Discovery project gathered 39 new mapping requests across 28 miles of stream.

Watershed Findings/Prioritizations. Following the Discovery meetings, the gathered mapping needs were prioritized similar to the 2009 Upper Trinity Basin MNA prioritization. The ranking is a combination of CNMS criteria and guidance from the TWDB. A score was calculated for each map need based on the criteria presented in Table 5.

Prioritization Rankings. Map needs with the Cedar watershed were documented from stakeholder comments and are listed in Table 7 under the category "Mapping Need". These needs may come from outdated stream studies, large-scale development along a stream, or alterations to a stream itself to reduce flooding risk. Approximately 38 miles of mapping needs were captured during the 2017 Cedar Discovery process. Pursuing studies along the entirety of requested miles would be cost prohibitive, so it was necessary for NCTCOG to reduce the list of potential stream projects. Table 6 lists the prioritization rankings for the Cedar Watershed based on the State of Texas' prioritization criteria.

Table 5: Prioritization Criteria

Criteria No.	Description	Weight
1	Population density	10
2	Population change	10
3	Predicted population growth	10
4	History of flood claims	10
5	Number of Letters of Map Change (LOMR/LOMA)	5
6	Available current topography	10
7	Age of technical data – hydrology	5
8	Age of technical data – hydraulics	5
9	Ability to leverage current studies	5
10	Potential for local funding	5
11	Potential for local "work in kind"	3
12	Previous contribution to a FEMA study	2
13	Stakeholder mapping request	10

Table 6: Cedar Watershed Prioritization Rankings (HUC-12 Watersheds)

HUC-8 Watershed	HUC-12 Watershed Group	Rank
Cedar	Lacy Fork – Cedar Creek Reservoir	High
	Persimmon Branch – Cedar Creek Reservoir	High
	Clear Creek – Cedar Creek Reservoir	High
	Upper Big Brushy Creek	High
	Middle Big Brushy Creek	Elevated
	Eagans Branch – Kings Creek	Elevated
	Town of Kemp – Cedar Creek Reservoir	Elevated
	Allen Creek – Cedar Creek	Elevated
	Caney Creek – Cedar Creek	Elevated
	Williams Creek – Cedar Creek	Elevated
	Kemp Lake – Cedar Creek Reservoir	Elevated
	Caney Creek – Cedar Creek Reservoir	Elevated

HUC-8 Watershed	HUC-12 Watershed Group	Rank
	Walnut Creek – Cedar Creek	Elevated
	Headwaters Big Cottonwood Creek	Elevated
	Prairie Creek – Cedar Creek Reservoir	Elevated
	South Twin Creek – Cedar Creek Reservoir	Elevated
	Lower Big Brushy Creek	Elevated
	Muddy Cedar Creek	Guarded
	North Twin Creek – Cedar Creek Reservoir	Guarded
	Caney Creek	Guarded
	Headwaters Caney Creek	Guarded
	Little Brushy Creek – Kings Creek	Guarded
Cedar	Dry Lacy Fork	Guarded
	High Point Creek	Low
	McAllister Slough – Cedar Creek	Low
	Rocky Cedar Creek	Low
	Little Cottonwood Creek – Kings Creek	Low
	Big Cottonwood Creek – Kings Creek	Low
	Headwaters Kings Creek	Low

The prioritization rankings listed in Table 6 will be used by FEMA to determine targeted action items, potential projects, and multi-year flood risk project plans within the Cedar watershed. Other Figures displaying the watershed-based prioritization and potential study streams are located in Appendix III.

Discovery Findings. The Discovery meetings held in June 2017 catalogued information about community concerns, known flooding locations, and areas of mitigation interest. The stakeholder comment distribution is shown in the tables and figures below.

Table 7: Cedar Comment Distribution by HUC-12 Watershed

HUC-12 Watershed	Comment Types						
	Flooding Risk	Flooding Risk/Mitigation Action	Mapping Concerns	Mapping Needs	Mitigation Actions - Identified	Mitigation Actions - Completed	Regulations
Allen Creek - Cedar Creek	0	0	0	0	1	1	0
Big Cottonwood Creek - Kings Creek	**No comments received**						
Caney Creek	**No comments received**						
Caney Creek - Cedar Creek	**No comments received**						
Caney Creek - Cedar Creek Reservoir	**No comments received**						
Clear Creek - Cedar Creek Reservoir	0	0	1	0	1	0	0
Dry Lacy Fork	**No comments received**						
Eagans Branch - Kings Creek	0	0	0	0	3	0	0
Headwaters Big Cottonwood Creek	**No comments received**						
Headwaters Caney Creek	**No comments received**						
Headwaters Kings Creek	3	0	3	0	2	1	0
High Point Creek	**No comments received**						
Kemp Lake - Cedar Creek Reservoir	0	0	0	1	0	0	0
Lacy Fork - Cedar Creek Reservoir	0	0	0	0	1	0	0
Little Brushy Creek - Kings Creek	**No comments received**						

HUC-12 Watershed	Comment Types						
	Flooding Risk	Flooding Risk/Mitigation Action	Mapping Concerns	Mapping Needs	Mitigation Actions - Identified	Mitigation Actions - Completed	Regulations
Little Cottonwood Creek - Kings Creek	**No comments received**						
Lower Big Brushy Creek	**No comments received**						
McAllister Slough - Cedar Creek	**No comments received**						
Middle Big Brushy Creek	**0**	**0**	**0**	**3**	**0**	**0**	**0**
Muddy Cedar Creek	No comments received						
North Twin Creek - Cedar Creek Reservoir	No comments received						
Persimmon Branch - Cedar Creek Reservoir	0	0	2	0	0	0	0
Prairie Creek - Cedar Creek Reservoir	No comments received						
Rocky Cedar Creek	No comments received						
South Twin Creek - Cedar Creek Reservoir	No comments received						
Town of Kemp - Cedar Creek Reservoir	3	0	0	0	0	0	1
Upper Big Brushy Creek	3	0	0	0	0	0	0
Walnut Creek - Cedar Creek	No comments received						
Williams Creek - Cedar Creek	1	0	0	0	0	0	0

Table 8: Stream Study Requests

Community	Stream
Rockwall County	Brushy Creek Tributary S
Rockwall County	Brushy Creek Tributary U (2requests)
Kaufman County	Caney Creek
Kaufman County	Eagans Branch
Kaufman County	Unnamed Stream (9 requests)
City Terrell	Unnamed Stream
East Texas Council of Governments	Unnamed Stream (3 requests)
Kaufman County	Wolf Creek

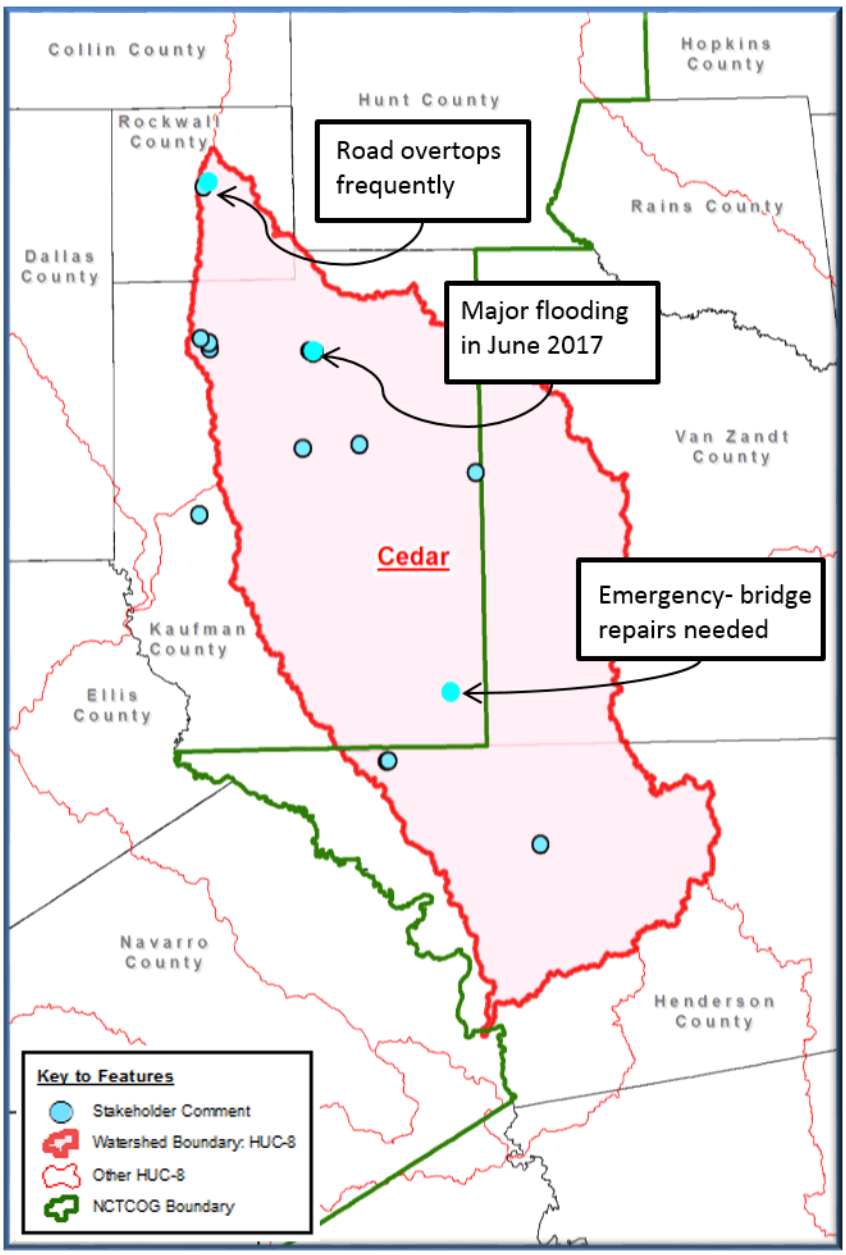


Figure 8: Stakeholder Comments.

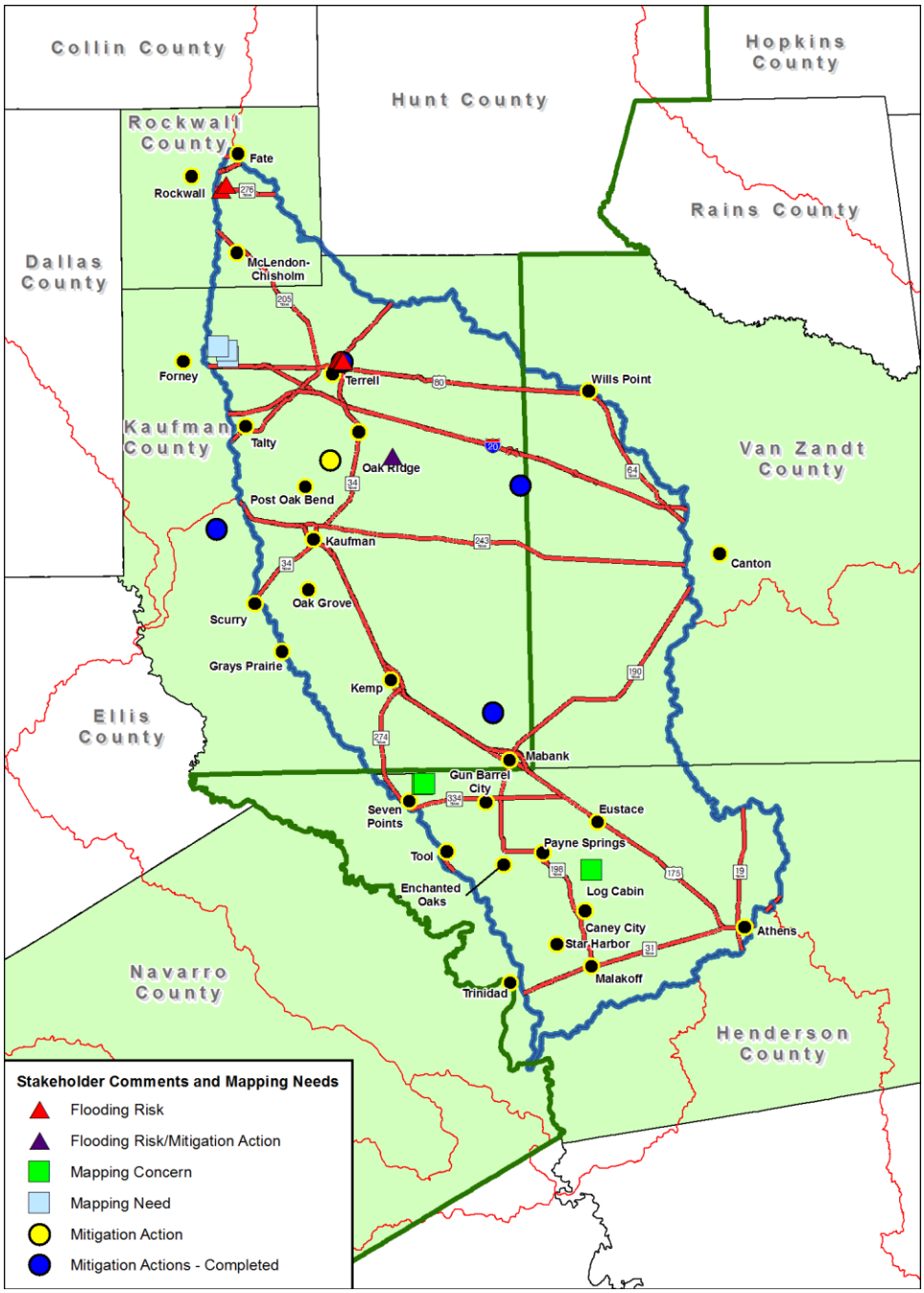


Figure 9: Stakeholder Comment Distribution.

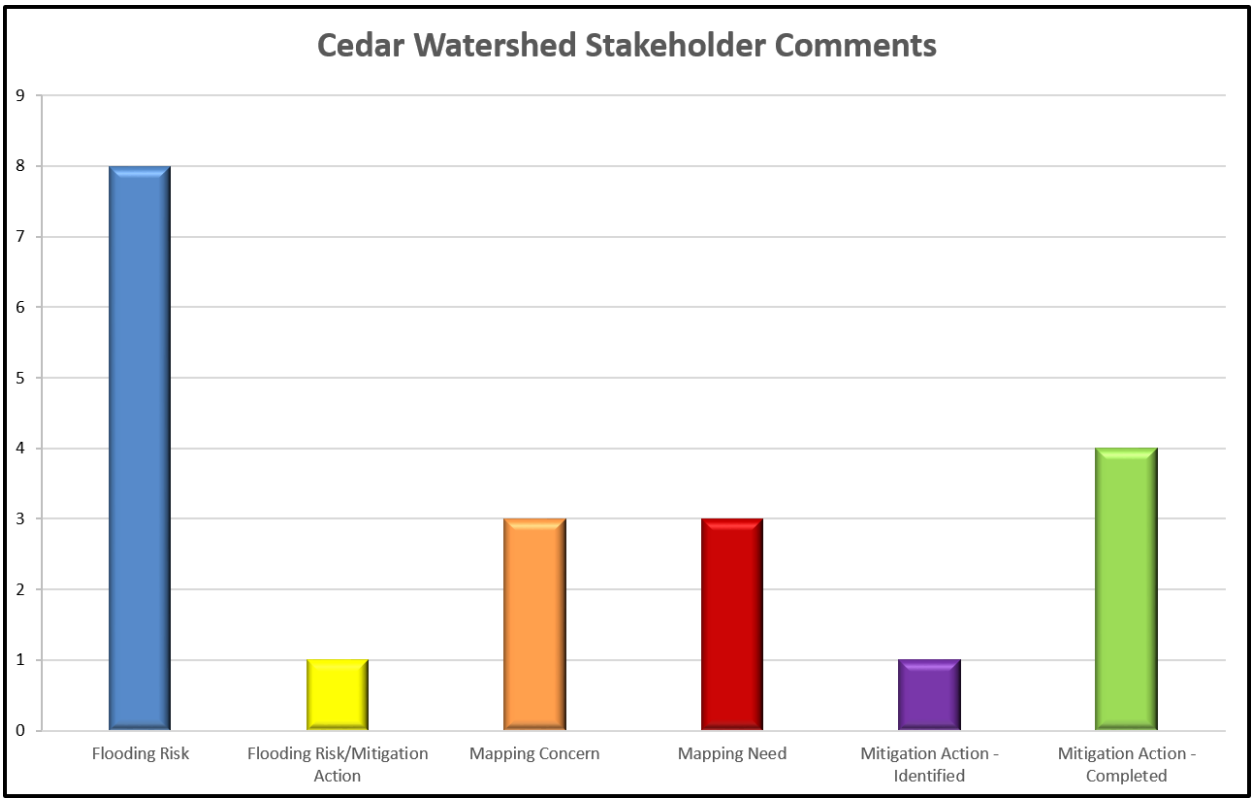


Figure 10: Stakeholder Comment Totals.

Appendix I: Community-Specific Reports

Cedar Watershed Community Overview Table

CID	Community	Total Community Population[1]	Percent of Population in Study Watershed	Total Community Land Area (sq. mi)	Percent of Land Area in Study Watershed	NFIP Participant
481174	HENDERSON COUNTY	42,886	25.7%	948.7	25.74%	Y
480324	CITY OF ATHENS	12,710	59.6%	16.7	59.6%	Y
481550	CANEY CITY	217	100%	1.1	100%	Y
481634	CITY OF ENCHANTED OAKS	326	100%	0.4	100%	Y
480327	CITY OF EUSTACE	991	100%	0.4	100%	Y
480328	GUN BARREL CITY	5,672	100%	5.8	100%	Y
481635	CITY OF LOG CABIN	714	100%	1.0	100%	Y
480414	TOWN OF MABANK	3,035	100%	6.0	100%	Y
480329	CITY OF MALAKOFF	2,324	100%	2.5	100%	Y
481555	TOWN OF PAYNE SPRINGS	767	100%	1.8	100%	Y
480332	CITY OF SEVEN POINTS	1,455	63.9%	1.9	63.9%	Y
481633	CITY OF STAR HARBOR	444	100%	0.5	100%	Y
481532	CITY OF TOOL	2,240	72.0%	2.2	72.0%	Y
480333	CITY OF TRINIDAD	886	39.6%	14.9	39.6%	Y
480411	KAUFMAN COUNTY	38,954	59.2%	8.4	59.2%	Y
480410	CITY OF FORNEY	14,661	10.5%	14.2	10.5%	Y
480302	VILLAGE OF GRAYS PRAIRIE	337	39.2%	1.2	39.2%	N
480407	CITY OF KAUFMAN	6,703	100%	807.5	100%	Y
480412	TOWN OF KEMP	1,154	100%	2.0	100%	Y
481533	TOWN OF OAK GROVE	603	100%	2.0	100%	N
481534	TOWN OF OAK RIDGE	495	100%	2.0	100%	Y
480399	TOWN OF POST OAK BEND	595	100%	2.0	100%	N
480241	TOWN OF SCURRY	681	20.1%	1.9	20.1%	Y
480468	TOWN OF TALTY	1,535	95.4%	1.8	1,535	Y
480416	CITY OF TERRELL	15,816	100%	19.7	15,816	Y
480950	NAVARRO COUNTY	15,911	0.0%	1086.1	15,911	Y
480543	ROCKWALL COUNTY	8,537	17.0%	29.7	8,537	Y
480544	CITY OF FATE	6,357	28.9%	7.5	6,357	Y
480546	CITY OF MCLENDON-CHISHOLM	1,373	85.1%	10.0	1,373	Y
480547	CITY OF ROCKWALL	37,490	16.8%	148.6	37,490	Y
481040	VAN ZANDT COUNTY	37,482	25.7%	859.4	37,482	Y
480632	CITY OF CANTON	3,581	2.2%	6.6	3,581	Y
480633	CITY OF WILLS POINT	3,524	40.9%	3.9	3,524	Y

[1]2010 United States Census Bureau Population Estimate

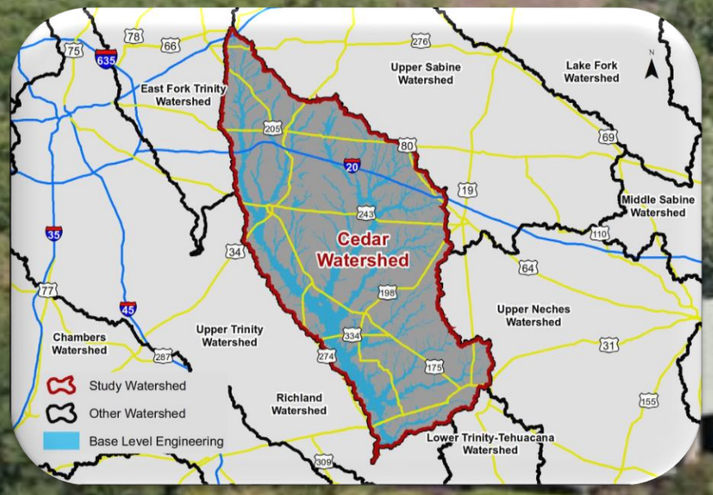
[1]US Census (2010)

Community-specific Flood Reports

RiskMAP
Increasing Resilience Together

CEDAR WATERSHED

KNOW YOUR RISK



1,065.6 sq. miles

in Risk MAP project extent

109,617

Population based on 2010 census

1.2% avg. expected population growth from 2010-2021

3

Total claims for structures repeatedly damaged by flood

$549K

in total severe repetitive loss

6.5

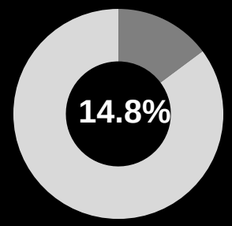
Average years since last effective FIRM

30 communities participating in the National Flood Insurance Program

CNMS Stream Miles

2331.7

Stream Miles Detailed Study

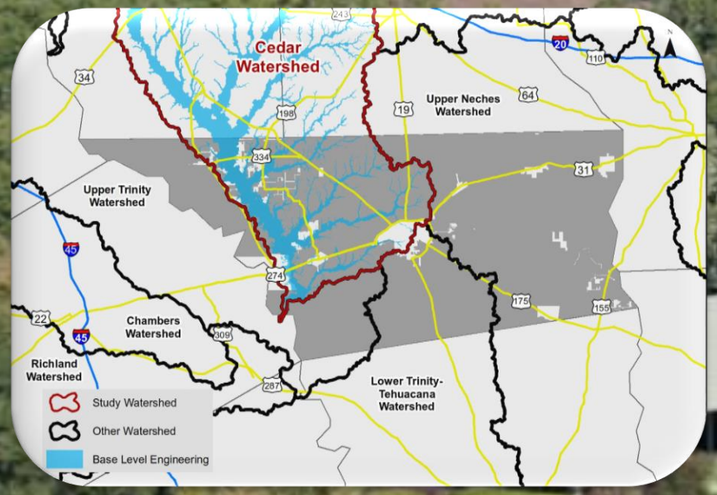


48 dams require **Emergency Action Plans**

RiskMAP
Increasing Resilience Together

HENDERSON COUNTY

KNOW YOUR RISK



250.5
Sq. Miles

of the community is in the watershed

11,041

Population based on 2010 census in the watershed

0.1% expected population growth from 2010-2021 in the watershed

194

policies totaling approximately $48,677,100 in coverage

0

claims for structures repeatedly damaged by flood in the watershed

$0

in severe repetitive loss in the watershed

30%

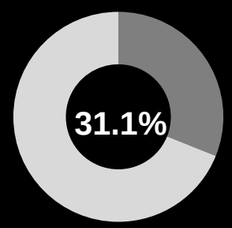
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

601.2

Stream Miles Detailed Study in the watershed



3

Flood-related presidential disaster declarations in your county

HENDERSON COUNTY

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is **awaiting approval.**

The hazard mitigation goals identified projects for:

- Regulate development and management of flood-prone areas
- Public awareness programs
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- Enable critical facility to remain operational in flood events
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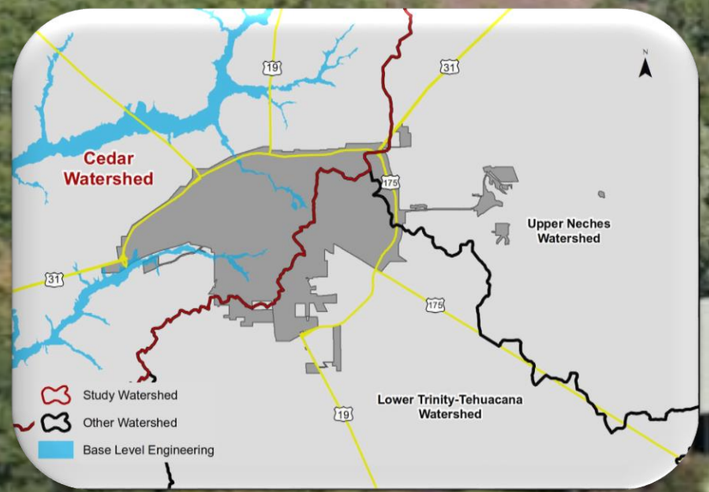
RiskMAP
Increasing Resilience Together

CITY OF ATHENS

KNOW YOUR RISK



10.0
Sq. Miles
of the community is in the watershed

7,570
Population based on 2010 census in the watershed

0.6% expected population growth from 2010-2021 in the watershed

14
policies totaling approximately $3,967,000 in coverage

0
claims for structures repeatedly damaged by flood in the watershed

$0
in severe repetitive loss in the watershed

74.5%
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed
9.5

Stream Miles Detailed Study in the watershed
49.9

3
Flood-related presidential disaster declarations in your county

CITY OF ATHENS

TAKE ACTION: Potential Next Step

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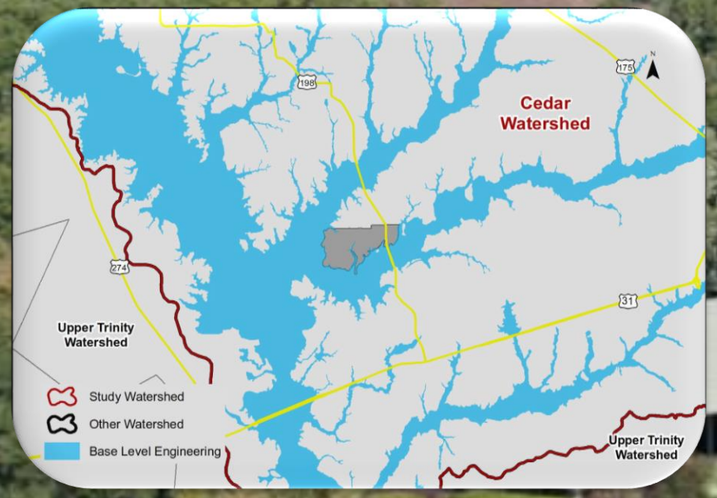
RiskMAP
Increasing Resilience Together

CANEY CITY

KNOW YOUR RISK



1.1
Sq. Miles

of the community is in the watershed

217

Population based on 2010 census in the watershed

0.1% expected population growth from 2010-2021 in the watershed

0

policies totaling approximately $0 in coverage

0

claims for structures repeatedly damaged by flood in the watershed

$0

in severe repetitive loss in the watershed

100%

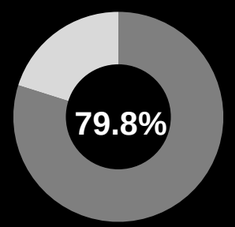
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

6.2

Stream Miles Detailed Study in the watershed



3

Flood-related presidential disaster declarations in your county

CANEY CITY

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is **awaiting approval.**

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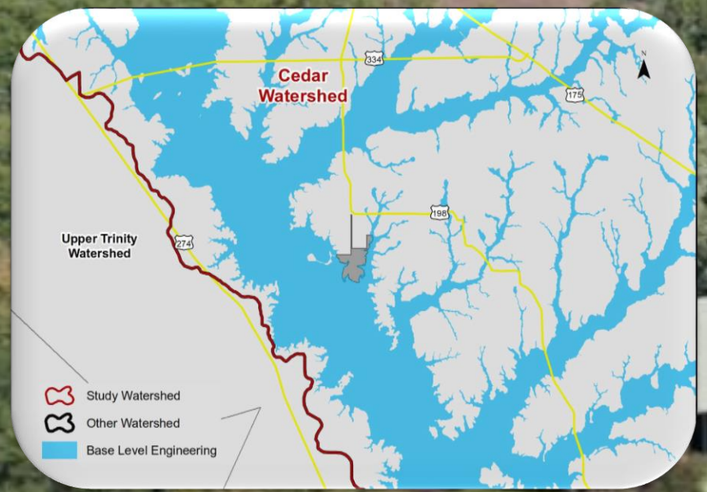
CITY OF ENCHANTED OAKS

KNOW YOUR RISK



0.4
Sq. Miles

of the community is in the watershed

326

Population based on 2010 census in the watershed

0.6% expected population growth from 2010-2021 in the watershed

4

policies totaling approximately $1,015,000 in coverage

0

claims for structures repeatedly damaged by flood in the watershed

$0

in severe repetitive loss in the watershed

100%

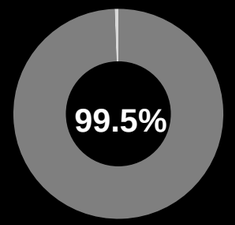
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

3.6

Stream Miles Detailed Study in the watershed



3

Flood-related presidential disaster declarations in your county

CITY OF ENCHANTED OAKS

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is **awaiting approval.**

The hazard mitigation goals identified projects for:

- Regulate development and management of flood-prone areas
- Public awareness programs
- Clear debris and excess vegetation from channels to ensure proper drainage
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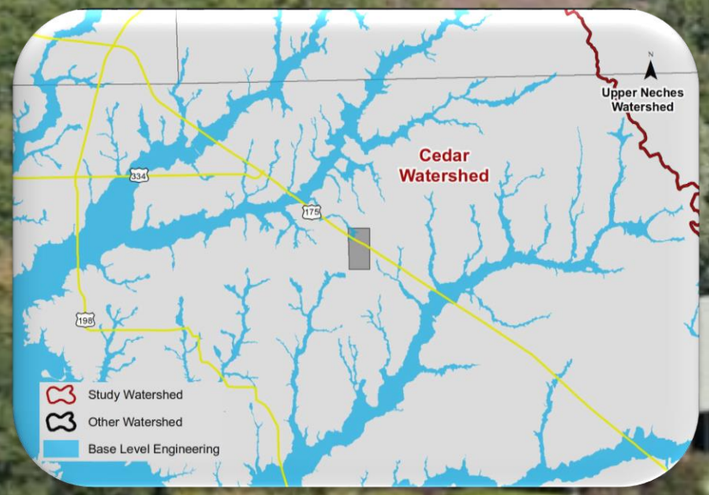
Increasing Resilience Together

CITY OF EUSTACE

KNOW YOUR RISK



0.4
Sq. Miles
of the community is in the watershed

991
Population based on 2010 census in the watershed

-0.8% expected population growth from 2010-2021 in the watershed

0
policies totaling approximately $0 in coverage

0
claims for structures repeatedly damaged by flood in the watershed

$0
in severe repetitive loss in the watershed

100%
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed
0.3

Stream Miles Detailed Study in the watershed
0.0%

3
Flood-related presidential disaster declarations in your county

CITY OF EUSTACE

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is **awaiting approval.**

The hazard mitigation goals identified projects for:

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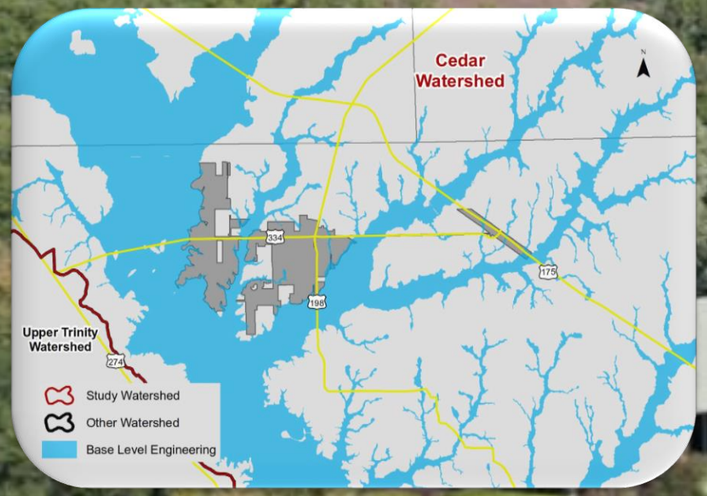
RiskMAP
Increasing Resilience Together

GUN BARREL CITY

KNOW YOUR RISK



5.8
Sq. Miles
of the community is in the watershed

5,672
Population based on 2010 census in the watershed

0.2% expected population growth from 2010-2021 in the watershed

33
policies totaling approximately $8,315,400 in coverage

0
claims for structures repeatedly damaged by flood in the watershed

$0
in severe repetitive loss in the watershed

100%
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed
18.9

Stream Miles Detailed Study in the watershed
58.4%

3
Flood-related presidential disaster declarations in your county

GUN BARREL CITY

TAKE ACTION: Potential Next Step

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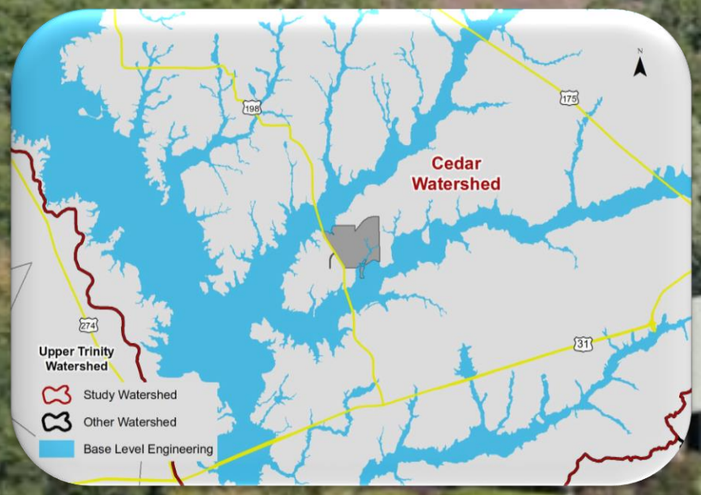
RiskMAP
Increasing Resilience Together

CITY OF LOG CABIN

KNOW YOUR RISK



1.0
Sq. Miles

of the community is in the watershed

714

Population based on 2010 census in the watershed

-0.1% expected population growth from 2010-2021 in the watershed

2

policies totaling approximately $700,000 in coverage

0

claims for structures repeatedly damaged by flood in the watershed

100%

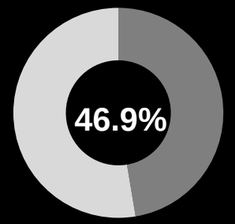
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

3.8

Stream Miles Detailed Study in the watershed



3

Flood-related presidential disaster declarations in your county

$0

in severe repetitive loss in the watershed

CITY OF LOG CABIN

TAKE ACTION: Potential Next Step

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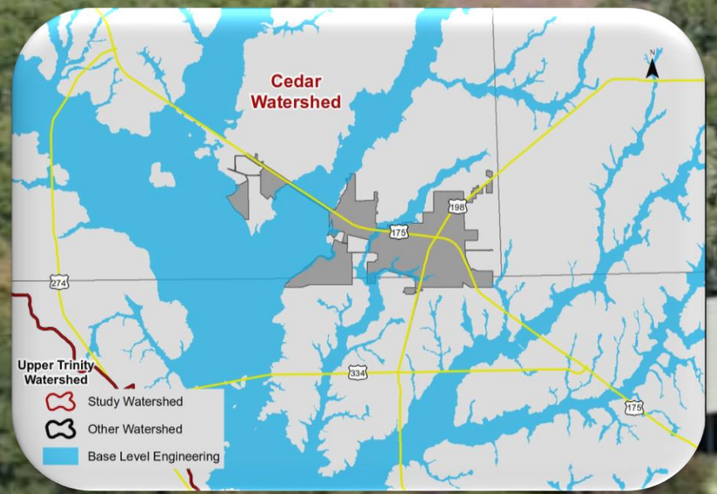
RiskMAP
Increasing Resilience Together

TOWN OF MABANK

KNOW YOUR RISK



6.0
Sq. Miles

of the community is in the watershed

3,035

Population based on 2010 census in the watershed

2.1% expected population growth from 2010-2021 in the watershed

5

policies totaling approximately $639,700 in coverage

2

claims for structures repeatedly damaged by flood in the watershed

$69K

in severe repetitive loss in the watershed

100%

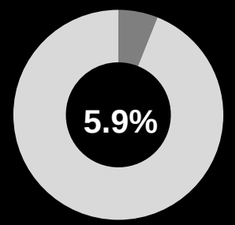
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

4.9

Stream Miles Detailed Study in the watershed



5

Flood-related presidential disaster declarations in your counties

TOWN OF MABANK

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is set to expire **December 12, 2020.**

The hazard mitigation goals identified projects for:

- Prohibit further development in open space flood-prone areas
- Installation of a warning system, barricades at low-water crossings, and permanent generators
- Public awareness programs
- Expand or replace culverts that do not adequately convey stormwater

FEMA's Hazard Mitigation Grant Program (HGMP), the Pre-Disaster Mitigation Grant (PDM), and TWDB's Flood Mitigation Assistance (FMA) Grant Program all fund localized Flood Risk Reduction Projects including reconstruction of culverts and drainage channels to limit the impact of stormwater on existing infrastructure. HMGP and PDM allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness,, sirens, or barricades at low-water crossings. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Texas Department of Public Safety's Emergency Management Forms and Publications[2] website. County emergency managers or the State Hazard Mitigation Officer may be contacted for additional information.

Texas Water Development Board's[3] Flood Protection (FP) Grant, Clean and Drinking Water State Revolving Fund (CWSRF), and Texas Water Development Fund (DFund) provide additional funding or loans for hazard mitigation planning and engineering designs. Both CWSRF and DFund are long term-fixed interest loans which can be used for building water quality and green infrastructure.

The minimum requirements for floodplain regulations are outlined in 44 Code of Federal Regulations 60.3, and local communities may choose to adopt more restrictive codes. FEMA Regional Office VI offers assistance in developing stricter codes, such as regulating construction or elevational changes in the floodplain.

1 https://www.fema.gov/hazard-mitigation-assistance.
2 https://www.dps.texas.gov/dem/downloadableforms.htm#hmgpgrants.
3. https://www.twdb.texas.gov/financial/programs/.

RiskMAP
Increasing Resilience Together

CITY OF MALAKOFF

KNOW YOUR RISK

2.5
Sq. Miles

of the community is in the watershed

2,324

Population based on 2010 census in the watershed

-0.6% expected population growth from 2010-2021 in the watershed

3

policies totaling approximately $805,000 in coverage

1

claim for structures repeatedly damaged by flood in the watershed

$480K

in severe repetitive loss in the watershed

100%

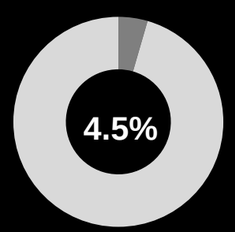
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

4.4

Stream Miles Detailed Study in the watershed



3

Flood-related presidential disaster declarations in your county

CITY OF MALAKOFF

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is **awaiting approval.**

The hazard mitigation goals identified projects for:

- Regulate development and management of flood-prone areas
- Public awareness programs
- Clear debris and excess vegetation from channels to ensure proper drainage
- Enable critical facility to remain operational in flood events
- Apply for funding to improve local dams and comply with national dam safety hazard reduction initiative

FEMA's Hazard Mitigation Grant Program (HGMP), the Pre-Disaster Mitigation Grant (PDM), and TWDB's Flood Mitigation Assistance (FMA) Grant Program all allow for retrofit existing structures and infrastructure, including public facilities, to flood-proof conditions. There may be eligibility, benefit cost analysis, and cost-share requirements. HMGP and PDM allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness,, or sirens. HMGP also offers funding for post disaster code enforcement, including debris removal strategies. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Texas Department of Public Safety's Emergency Management Forms and Publications[2] website. County emergency managers or the State Hazard Mitigation Officer may be contacted for additional information.

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The minimum requirements for floodplain regulations are outlined in 44 Code of Federal Regulations 60.3, and local communities may choose to adopt more restrictive codes. FEMA Regional Office VI offers assistance in developing stricter codes, such as regulating construction or elevational changes in the floodplain.

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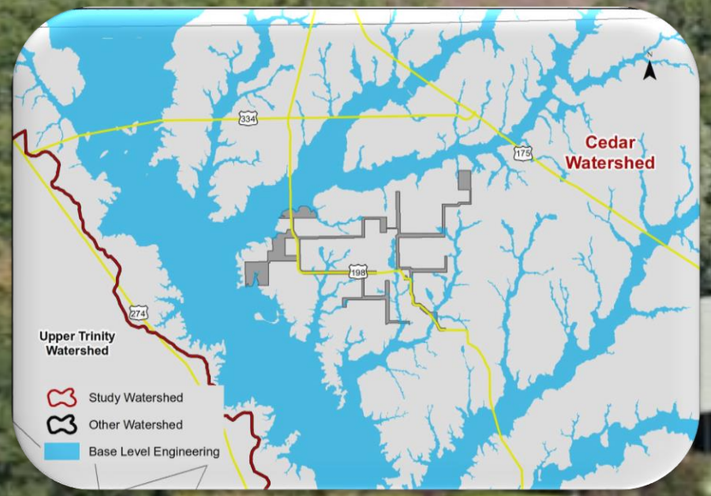
RiskMAP
Increasing Resilience Together

TOWN OF PAYNE SPRINGS

KNOW YOUR RISK



1.8
Sq. Miles

of the community is in the watershed

767

Population based on 2010 census in the watershed

0.3% expected population growth from 2010-2021 in the watershed

4

policies totaling approximately $1,260,000 in coverage

0

claims for structures repeatedly damaged by flood in the watershed

$0

in severe repetitive loss in the watershed

100%

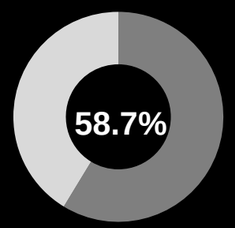
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

4.6

Stream Miles Detailed Study in the watershed



3

Flood-related presidential disaster declarations in your county

TOWN OF PAYNE SPRINGS

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is **awaiting approval.**

The hazard mitigation goals identified projects for:

- Regulate development and management of flood-prone areas
- Public awareness programs
- Clear debris and excess vegetation from channels to ensure proper drainage
- Enable critical facility to remain operational in flood events
- Apply for funding to improve local dams and comply with national dam safety hazard reduction initiative

FEMA's Hazard Mitigation Grant Program (HGMP), the Pre-Disaster Mitigation Grant (PDM), and TWDB's Flood Mitigation Assistance (FMA) Grant Program all allow for retrofit existing structures and infrastructure, including public facilities, to flood-proof conditions. There may be eligibility, benefit cost analysis, and cost-share requirements. HMGP and PDM allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness,, or sirens. HMGP also offers funding for post disaster code enforcement, including debris removal strategies. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Texas Department of Public Safety's Emergency Management Forms and Publications[2] website. County emergency managers or the State Hazard Mitigation Officer may be contacted for additional information.

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The minimum requirements for floodplain regulations are outlined in 44 Code of Federal Regulations 60.3, and local communities may choose to adopt more restrictive codes. FEMA Regional Office VI offers assistance in developing stricter codes, such as regulating construction or elevational changes in the floodplain.

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RiskMAP
Increasing Resilience Together

CITY OF SEVEN POINTS

KNOW YOUR RISK

1.2
Sq. Miles

of the community is in the watershed

930

Population based on 2010 census in the watershed

-0.8% expected population growth from 2010-2021 in the watershed

3

policies totaling approximately $796,000 in coverage

0

claims for structures repeatedly damaged by flood in the watershed

$0

in severe repetitive loss in the watershed

83.7%

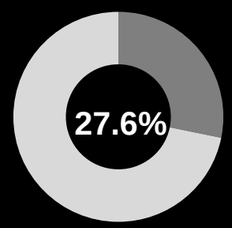
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

3.9

Stream Miles Detailed Study in the watershed



5

Flood-related presidential disaster declarations in your counties

CITY OF SEVEN POINTS

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is **awaiting approval.**

The hazard mitigation goals identified projects for:

- Regulate development and management of flood-prone areas
- Public awareness programs
- Clear debris and excess vegetation from channels to ensure proper drainage
- Enable critical facility to remain operational in flood events
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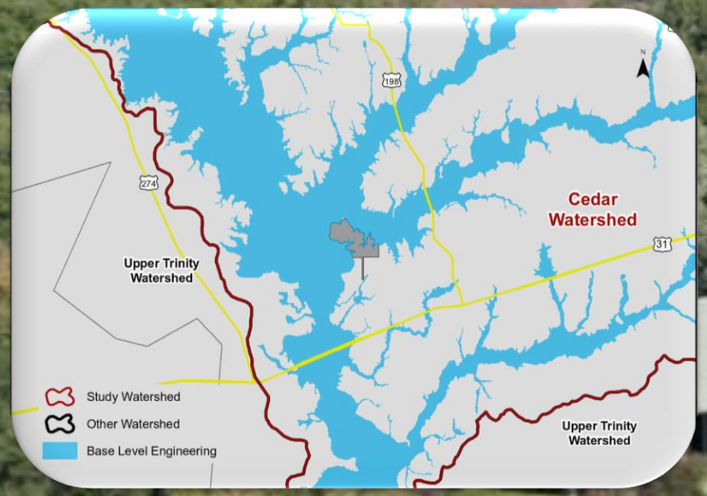
Increasing Resilience Together

CITY OF STAR HARBOR

KNOW YOUR RISK



0.5
Sq. Miles

of the community is in the watershed

444

Population based on 2010 census in the watershed

-0.2% expected population growth from 2010-2021 in the watershed

8

policies totaling approximately $2,210,000 in coverage

0

claims for structures repeatedly damaged by flood in the watershed

100%

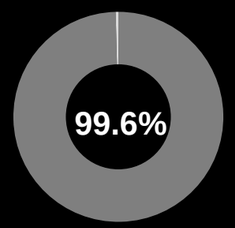
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

4.9

Stream Miles Detailed Study in the watershed



3

Flood-related presidential disaster declarations in your county

$0

in severe repetitive loss in the watershed

CITY OF STAR HARBOR

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is **awaiting approval.**

The hazard mitigation goals identified projects for:

- Regulate development and management of flood-prone areas
- Public awareness programs
- Clear debris and excess vegetation from channels to ensure proper drainage
- Enable critical facility to remain operational in flood events
- Apply for funding to improve local dams and comply with national dam safety hazard reduction initiative

FEMA's Hazard Mitigation Grant Program (HGMP), the Pre-Disaster Mitigation Grant (PDM), and TWDB's Flood Mitigation Assistance (FMA) Grant Program all allow for retrofit existing structures and infrastructure, including public facilities, to flood-proof conditions. There may be eligibility, benefit cost analysis, and cost-share requirements. HMGP and PDM allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness,, or sirens. HMGP also offers funding for post disaster code enforcement, including debris removal strategies. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Texas Department of Public Safety's Emergency Management Forms and Publications[2] website. County emergency managers or the State Hazard Mitigation Officer may be contacted for additional information.

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The minimum requirements for floodplain regulations are outlined in 44 Code of Federal Regulations 60.3, and local communities may choose to adopt more restrictive codes. FEMA Regional Office VI offers assistance in developing stricter codes, such as regulating construction or elevational changes in the floodplain.

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RiskMAP
Increasing Resilience Together

CITY OF TOOL

KNOW YOUR RISK

1.6
Sq. Miles

of the community is in the watershed

1,613

Population based on 2010 census in the watershed

-0.4% expected population growth from 2010-2021 in the watershed

11

policies totaling approximately $2,157,900 in coverage

0

claims for structures repeatedly damaged by flood in the watershed

$0

in severe repetitive loss in the watershed

100%

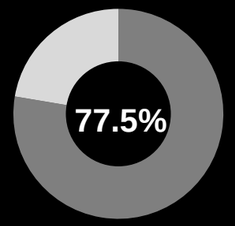
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

8.5

Stream Miles Detailed Study in the watershed



3

Flood-related presidential disaster declarations in your county

CITY OF TOOL

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is **awaiting approval.**

The hazard mitigation goals identified projects for:

- Regulate development and management of flood-prone areas
- Public awareness programs
- Clear debris and excess vegetation from channels to ensure proper drainage
- Enable critical facility to remain operational in flood events
- Apply for funding to improve local dams and comply with national dam safety hazard reduction initiative

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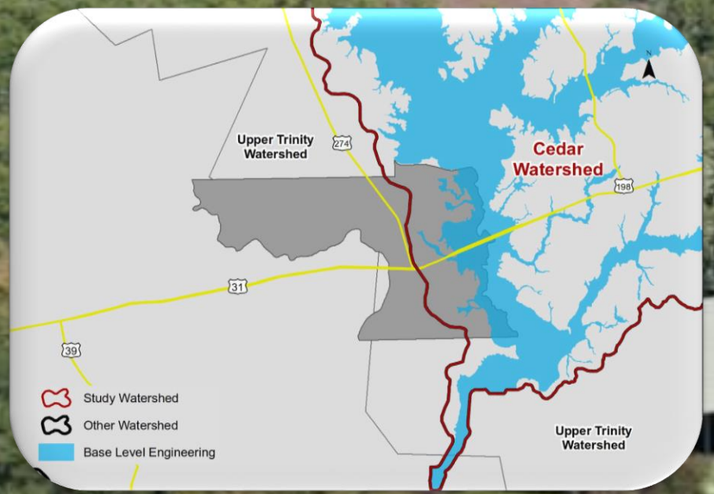
RiskMAP
Increasing Resilience Together

CITY OF TRINIDAD

KNOW YOUR RISK



5.9
Sq. Miles
of the community is in the watershed

351
Population based on 2010 census in the watershed

0.3% expected population growth from 2010-2021 in the watershed

3
policies totaling approximately $525,000 in coverage

0
claims for structures repeatedly damaged by flood in the watershed

$0
in severe repetitive loss in the watershed

29.8%
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed
20.4

Stream Miles Detailed Study in the watershed
0.0%

3
Flood-related presidential disaster declarations in your county

CITY OF TRINIDAD

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is **awaiting approval.**

The hazard mitigation goals identified projects for:

- Regulate development and management of flood-prone areas
- Public awareness programs
- Clear debris and excess vegetation from channels to ensure proper drainage
- Enable critical facility to remain operational in flood events
- Apply for funding to improve local dams and comply with national dam safety hazard reduction initiative

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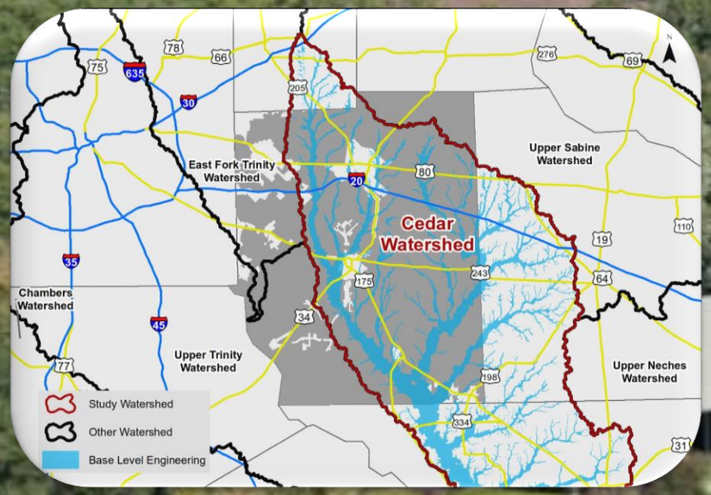
Increasing Resilience Together

KAUFMAN COUNTY

KNOW YOUR RISK



482.2
Sq. Miles

of the community is in the watershed

23,078

Population based on 2010 census in the watershed

1.6% expected population growth from 2010-2021 in the watershed

175
policies totaling approximately $46,917,500 in coverage

0
claims for structures repeatedly damaged by flood in the watershed

$0
in severe repetitive loss in the watershed

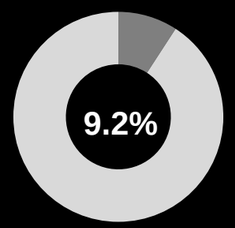
55.5%
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

978.5

Stream Miles Detailed Study in the watershed



2

Flood-related presidential disaster declarations in your county

KAUFMAN COUNTY

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is set to expire **December 12, 2020.**

The hazard mitigation goals identified projects for:

- Join Community Rating System (CRS) program
- Prohibit further development in open space flood-prone areas
- Create pre-disaster debris removal contracts
- Installation of a warning system, barricades at low-water crossings, and permanent generators

FEMA's Hazard Mitigation Grant Program (HGMP), the Pre-Disaster Mitigation Grant (PDM), and TWDB's Flood Mitigation Assistance (FMA) Grant Program all fund localized Flood Risk Reduction Projects including reconstruction of culverts and drainage channels to limit the impact of stormwater on existing infrastructure. There may be eligibility, benefit cost analysis, and cost-share requirements. HMGP and PDM allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness,, sirens, or barricades at low-water crossings. HMGP also offers funding for post disaster code enforcement, including debris removal strategies. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Texas Department of Public Safety's Emergency Management Forms and Publications[2] website. Participation in FEMA's Community Rating System[3] (CRS) reduces insurance premiums up to 45%, and FEMA will provide free technical assistance in designing and implementing programs designed to reduce flood damage. The State Hazard Mitigation Officer may be contacted for additional information.

Texas Water Development Board's[4] Flood Protection (FP) Grant, Clean and Drinking Water State Revolving Fund (CWSRF), and Texas Water Development Fund (DFund) provide additional funding or loans for hazard mitigation planning, Emergency Action plans for High Hazard dams, and other planning studies. Both CWSRF and DFund are long term-fixed interest loans which can be used for acquisition or flood-proofing insured structures, building water quality and green infrastructure.

The minimum requirements for floodplain regulations are outlined in 44 Code of Federal Regulations 60.3, and local communities may choose to adopt more restrictive codes. FEMA Regional Office VI offers assistance in developing stricter codes, such as regulating construction or elevational changes in the floodplain.

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3. https://www.fema.gov/community-rating-system.
4. https://www.twdb.texas.gov/financial/programs/.

RiskMAP
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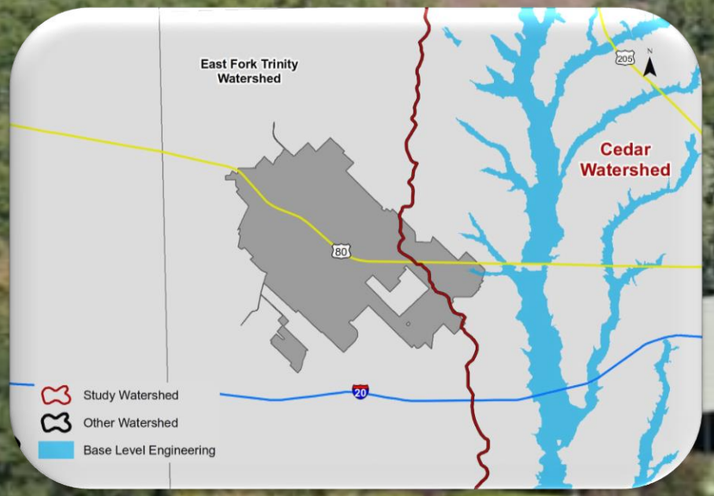
CITY OF FORNEY

KNOW YOUR RISK



1.5
Sq. Miles

of the community is in the watershed

1,538

Population based on 2010 census in the watershed

2.7% expected population growth from 2010-2021 in the watershed

33

policies totaling approximately $5,424,100 in coverage

0

claims for structures repeatedly damaged by flood in the watershed

$0

in severe repetitive loss in the watershed

1.8%

Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

2.7

Stream Miles Detailed Study in the watershed

0.0%

2

Flood-related presidential disaster declarations in your county

CITY OF FORNEY

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is set to expire **December 12, 2020.**

The hazard mitigation goals identified projects for:

- Prohibit further development in open space flood-prone areas
- Installation of a warning system, barricades at low-water crossings, and permanent generators
- Public awareness programs

FEMA's Hazard Mitigation Grant Program (HGMP) and Pre-Disaster Mitigation Grant (PDM) allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness,, sirens, or barricades at low-water crossings. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Texas Department of Public Safety's Emergency Management Forms and Publications[2] website. County emergency managers or the State Hazard Mitigation Officer may be contacted for additional information.

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RiskMAP
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VILLAGE OF GRAYS PRAIRIE

KNOW YOUR RISK

0.5
Sq. Miles
of the community is in the watershed

132
Population based on 2010 census in the watershed

1.3% expected population growth from 2010-2021 in the watershed

0
policies totaling approximately $0 in coverage

0
claims for structures repeatedly damaged by flood in the watershed

$0
in severe repetitive loss in the watershed

72.5%
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

X
Not participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed
0.3

Stream Miles Detailed Study in the watershed
0.0%

2
Flood-related presidential disaster declarations in your county

VILLAGE OF GRAYS PRAIRIE

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is **awaiting approval.**

The hazard mitigation goals identified projects for:

- Prohibit further development in open space flood-prone areas
- Installation of a warning system, barricades at low-water crossings, and permanent generators
- Public awareness programs
- Expand or replace culverts that do not adequately convey stormwater

FEMA's Hazard Mitigation Grant Program (HGMP), the Pre-Disaster Mitigation Grant (PDM), and TWDB's Flood Mitigation Assistance (FMA) Grant Program all fund localized Flood Risk Reduction Projects including reconstruction of culverts and drainage channels to limit the impact of stormwater on existing infrastructure. HMGP and PDM allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness,, sirens, or barricades at low-water crossings. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Texas Department of Public Safety's Emergency Management Forms and Publications[2] website. County emergency managers or the State Hazard Mitigation Officer may be contacted for additional information.

Texas Water Development Board's[3] Flood Protection (FP) Grant, Clean and Drinking Water State Revolving Fund (CWSRF), and Texas Water Development Fund (DFund) provide additional funding or loans for hazard mitigation planning and engineering designs. Both CWSRF and DFund are long term-fixed interest loans which can be used for building water quality and green infrastructure.

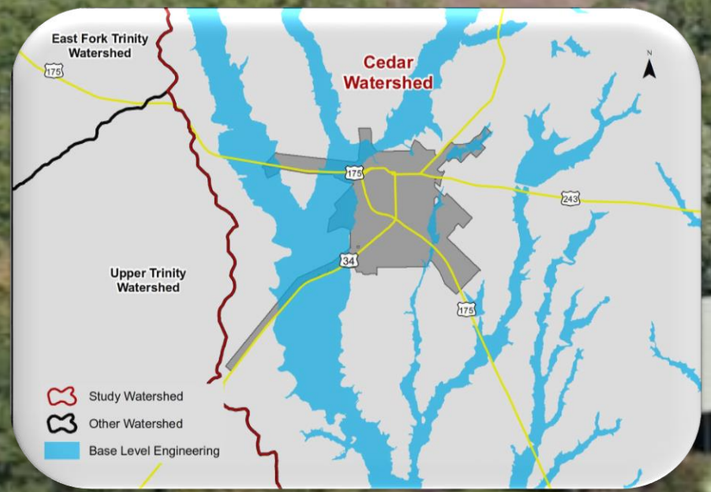
The minimum requirements for floodplain regulations are outlined in 44 Code of Federal Regulations 60.3, and local communities may choose to adopt more restrictive codes. FEMA Regional Office VI offers assistance in developing stricter codes, such as regulating construction or elevational changes in the floodplain.

1 https://www.fema.gov/hazard-mitigation-assistance.
2 https://www.dps.texas.gov/dem/downloadableforms.htm#hmgpgrants.
3. https://www.twdb.texas.gov/financial/programs/.

RiskMAP
Increasing Resilience Together

CITY OF KAUFMAN

KNOW YOUR RISK



8.4
Sq. Miles

of the community is in the watershed

6,703

Population based on 2010 census in the watershed

1.2% expected population growth from 2010-2021 in the watershed

3

policies totaling approximately $904,500 in coverage

0

claims for structures repeatedly damaged by flood in the watershed

$0

in severe repetitive loss in the watershed

100%

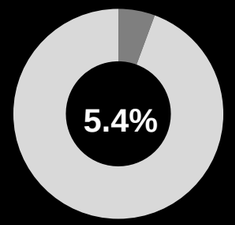
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

14.2

Stream Miles Detailed Study in the watershed



2

Flood-related presidential disaster declarations in your county

CITY OF KAUFMAN

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is set to expire **December 12, 2020.**

The hazard mitigation goals identified projects for:

- Prohibit further development in open space flood-prone areas
- Installation of a warning system, barricades at low-water crossings, and permanent generators
- Public awareness programs
- Develop mutual aid agreements in case of dam failures

FEMA's Hazard Mitigation Grant Program (HGMP) and Pre-Disaster Mitigation Grant (PDM) allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness,, sirens, or barricades at low-water crossings. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Texas Department of Public Safety's Emergency Management Forms and Publications[2] website. County emergency managers or the State Hazard Mitigation Officer may be contacted for additional information.

Texas Water Development Board's[3] Flood Protection (FP) Grant, Clean and Drinking Water State Revolving Fund (CWSRF), and Texas Water Development Fund (DFund) provide additional funding or loans for hazard mitigation planning and engineering designs. Both CWSRF and DFund are long term-fixed interest loans which can be used for building water quality and green infrastructure.

The minimum requirements for floodplain regulations are outlined in 44 Code of Federal Regulations 60.3, and local communities may choose to adopt more restrictive codes. FEMA Regional Office VI offers assistance in developing stricter codes, such as regulating construction or elevational changes in the floodplain.

Three communities in Kaufman County, City of Kaufman, the Town of Kemp, and the City of Terrell, will join in an mutual aid agreement for assistance following any dam failures.

1 https://www.fema.gov/hazard-mitigation-assistance.
2 https://www.dps.texas.gov/dem/downloadableforms.htm#hmgpgrants.
3. https://www.twdb.texas.gov/financial/programs/.

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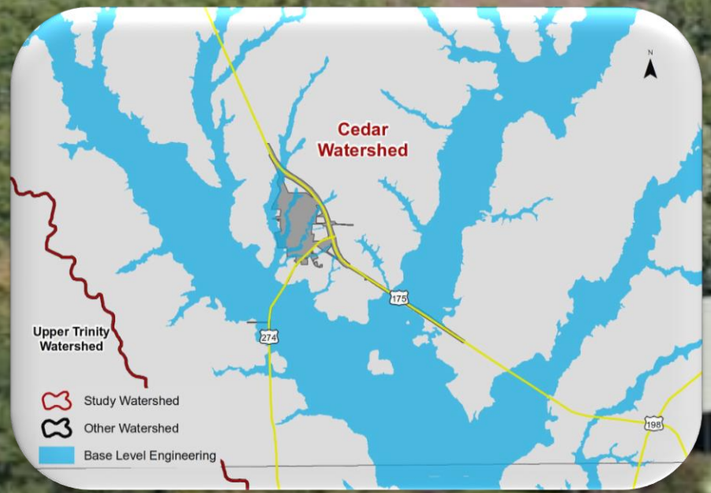
TOWN OF KEMP

KNOW YOUR RISK



2.0
Sq. Miles

of the community is in the watershed

1,154

Population based on 2010 census in the watershed

1.4% expected population growth from 2010-2021 in the watershed

7

policies totaling approximately $1,324,400 in coverage

0

claims for structures repeatedly damaged by flood in the watershed

$0

in severe repetitive loss in the watershed

100%

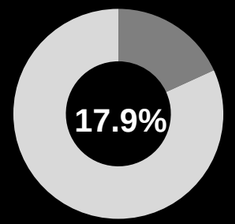
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

5.5

Stream Miles Detailed Study in the watershed



2

Flood-related presidential disaster declarations in your county

TOWN OF KEMP

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is set to expire **December 12, 2020.**

The hazard mitigation goals identified projects for:

- Prohibit further development in open space flood-prone areas
- Installation of a warning system, barricades at low-water crossings, and permanent generators
- Public awareness programs
- Develop mutual aid agreements in case of dam failures

FEMA's Hazard Mitigation Grant Program (HGMP) and Pre-Disaster Mitigation Grant (PDM) allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness,, sirens, or barricades at low-water crossings. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Texas Department of Public Safety's Emergency Management Forms and Publications[2] website. County emergency managers or the State Hazard Mitigation Officer may be contacted for additional information.

Texas Water Development Board's[3] Flood Protection (FP) Grant, Clean and Drinking Water State Revolving Fund (CWSRF), and Texas Water Development Fund (DFund) provide additional funding or loans for hazard mitigation planning and engineering designs. Both CWSRF and DFund are long term-fixed interest loans which can be used for building water quality and green infrastructure.

The minimum requirements for floodplain regulations are outlined in 44 Code of Federal Regulations 60.3, and local communities may choose to adopt more restrictive codes. FEMA Regional Office VI offers assistance in developing stricter codes, such as regulating construction or elevational changes in the floodplain.

Three communities in Kaufman County, City of Kaufman, the Town of Kemp, and the City of Terrell, will join in an mutual aid agreement for assistance following any dam failures.

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3. https://www.twdb.texas.gov/financial/programs/.

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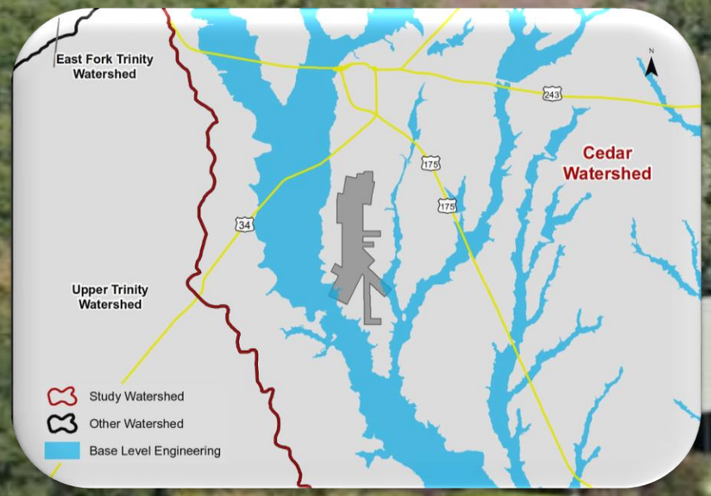
TOWN OF OAK GROVE

KNOW YOUR RISK



2.0
Sq. Miles
of the community is in the watershed

603
Population based on 2010 census in the watershed

2.7% expected population growth from 2010-2021 in the watershed

0
policies totaling approximately $0 in coverage

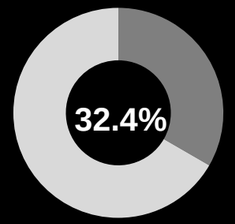
0
claims for structures repeatedly damaged by flood in the watershed

$0
in severe repetitive loss in the watershed

100%
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

X
Not participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed
2.7

Stream Miles Detailed Study in the watershed


2
Flood-related presidential disaster declarations in your county

TOWN OF OAK GROVE

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is **awaiting approval.**

The hazard mitigation goals identified projects for:

- Prohibit further development in open space flood-prone areas
- Installation of a warning system, barricades at low-water crossings, and permanent generators
- Public awareness programs
- Join the National Flood Insurance Program (NFIP)
- Expand or replace culverts that do not adequately convey stormwater

FEMA's Hazard Mitigation Grant Program (HGMP) and Pre-Disaster Mitigation Grant (PDM) FEMA's Hazard Mitigation Grant Program (HGMP), the Pre-Disaster Mitigation Grant (PDM), and TWDB's Flood Mitigation Assistance (FMA) Grant Program all fund localized Flood Risk Reduction Projects including reconstruction of culverts and drainage channels to limit the impact of stormwater on existing infrastructure. HMGP and PDM allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness,, sirens, or barricades at low-water crossings. The National Flood Insurance Program (NFIP) insures structures within the Special Flood Hazard Area, provides post-disaster assistance, and encourages local community regulation. More information about and about joining the NFIP[2] can be found on our website, as well as on the Texas Department of Public Safety's Emergency Management Forms and Publications[3] website. County emergency managers or the State Hazard Mitigation Officer may be contacted for additional information.

Texas Water Development Board's[4] Flood Protection (FP) Grant, Clean and Drinking Water State Revolving Fund (CWSRF), and Texas Water Development Fund (DFund) provide additional funding or loans for hazard mitigation planning and engineering designs. Both CWSRF and DFund are long term-fixed interest loans which can be used for building water quality and green infrastructure.

The minimum requirements for floodplain regulations are outlined in 44 Code of Federal Regulations 60.3, and local communities may choose to adopt more restrictive codes. FEMA Regional Office VI offers assistance in developing stricter codes, such as regulating construction or elevational changes in the floodplain.

1 https://www.fema.gov/hazard-mitigation-assistance.
2. https://www.fema.gov/media-library/assets/documents/13610.
3. https://www.dps.texas.gov/dem/downloadableforms.htm.
4. https://www.twdb.texas.gov/financial/programs/.

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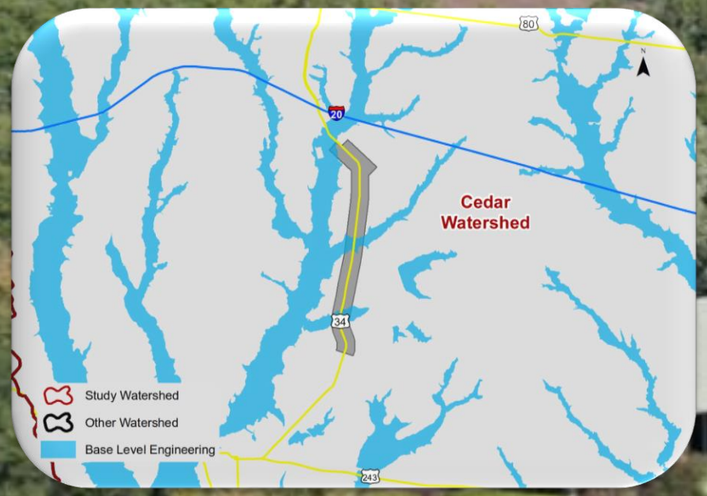
TOWN OF OAK RIDGE

KNOW YOUR RISK



2.0
Sq. Miles

of the community is in the watershed

495

Population based on 2010 census in the watershed

1.3% expected population growth from 2010-2021 in the watershed

2

policies totaling approximately $560,000 in coverage

0

claims for structures repeatedly damaged by flood in the watershed

$0

in severe repetitive loss in the watershed

100%

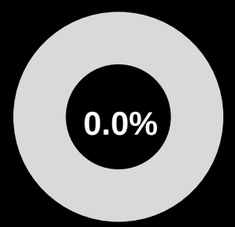
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

3.2

Stream Miles Detailed Study in the watershed



2

Flood-related presidential disaster declarations in your county

TOWN OF OAK RIDGE

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is **awaiting approval.**

The hazard mitigation goals identified projects for:

- Prohibit further development in open space flood-prone areas
- Installation of a warning system, barricades at low-water crossings, and permanent generators
- Public awareness programs
- Expand or replace culverts that do not adequately convey stormwater

FEMA's Hazard Mitigation Grant Program (HGMP) and Pre-Disaster Mitigation Grant (PDM) FEMA's Hazard Mitigation Grant Program (HGMP), the Pre-Disaster Mitigation Grant (PDM), and TWDB's Flood Mitigation Assistance (FMA) Grant Program all fund localized Flood Risk Reduction Projects including reconstruction of culverts and drainage channels to limit the impact of stormwater on existing infrastructure. HMGP and PDM allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness,, sirens, or barricades at low-water crossings. The National Flood Insurance Program (NFIP) insures structures within the Special Flood Hazard Area, provides post-disaster assistance, and encourages local community regulation More information about and about joining the NFIP[2] can be found on our website, as well as on the Texas Department of Public Safety's Emergency Management Forms and Publications[3] website. County emergency managers or the State Hazard Mitigation Officer may be contacted for additional information.

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4. https://www.twdb.texas.gov/financial/programs/.

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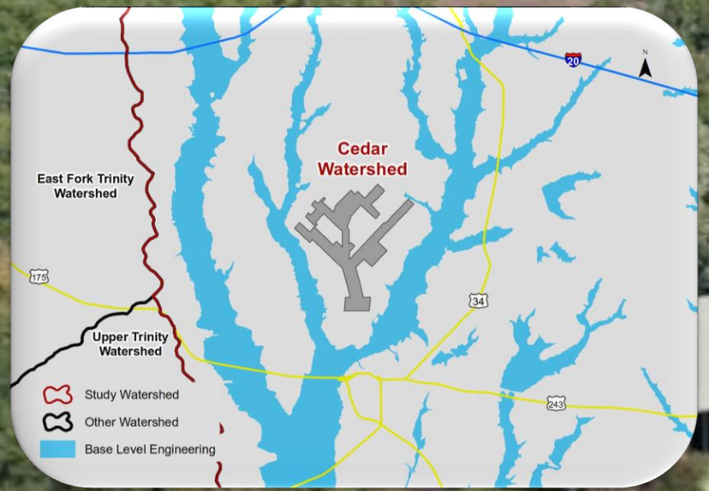
TOWN OF POST OAK BEND

KNOW YOUR RISK



2.0
Sq. Miles

of the community is in the watershed

595

Population based on 2010 census in the watershed

2.1% expected population growth from 2010-2021 in the watershed

0

policies totaling approximately $0 in coverage

0

claims for structures repeatedly damaged by flood in the watershed

$0

in severe repetitive loss in the watershed

X

The community does not contain flood-prone areas during a 1%-annual- chance storm event.

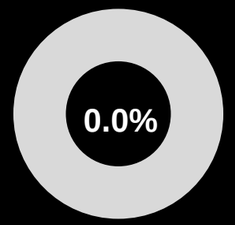
X

Not participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

2.1

Stream Miles Detailed Study in the watershed



2

Flood-related presidential disaster declarations in your county

TOWN OF POST OAK BEND

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is set to expire **December 12, 2020.**

The hazard mitigation goals identified projects for:

- Prohibit further development in open space flood-prone areas
- Installation of a warning system, barricades at low-water crossings, and permanent generators
- Public awareness programs
- Join the National Flood Insurance Program (NFIP)
- Expand or replace culverts that do not adequately convey stormwater

FEMA's Hazard Mitigation Grant Program (HGMP) and Pre-Disaster Mitigation Grant (PDM) FEMA's Hazard Mitigation Grant Program (HGMP), the Pre-Disaster Mitigation Grant (PDM), and TWDB's Flood Mitigation Assistance (FMA) Grant Program all fund localized Flood Risk Reduction Projects including reconstruction of culverts and drainage channels to limit the impact of stormwater on existing infrastructure. HMGP and PDM allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness,, sirens, or barricades at low-water crossings. The National Flood Insurance Program (NFIP) insures structures within the Special Flood Hazard Area, provides post-disaster assistance, and encourages local community regulation. More information about and about joining the NFIP[2] can be found on our website, as well as on the Texas Department of Public Safety's Emergency Management Forms and Publications[3] website. County emergency managers or the State Hazard Mitigation Officer may be contacted for additional information.

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1 https://www.fema.gov/hazard-mitigation-assistance.
2. https://www.fema.gov/media-library/assets/documents/13610.
3. https://www.dps.texas.gov/dem/downloadableforms.htm.
4. https://www.twdb.texas.gov/financial/programs/.

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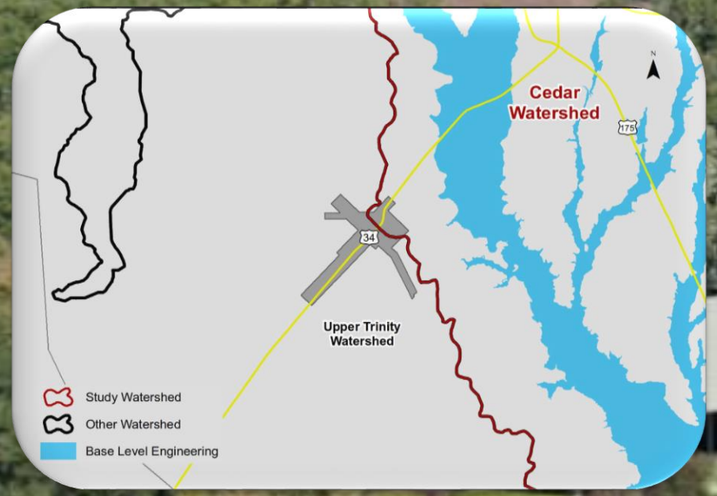
TOWN OF SCURRY

KNOW YOUR RISK



0.4
Sq. Miles

of the community is in the watershed

137

Population based on 2010 census in the watershed

1.5% expected population growth from 2010-2021 in the watershed

3

policies totaling approximately $589,700 in coverage

0

claims for structures repeatedly damaged by flood in the watershed

$0

in severe repetitive loss in the watershed

0.0%

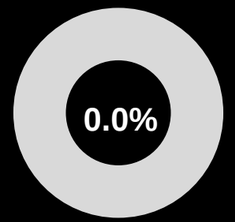
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

0.3

Stream Miles Detailed Study in the watershed



2

Flood-related presidential disaster declarations in your county

TOWN OF SCURRY

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is **awaiting approval.**

The hazard mitigation goals identified projects for:

- Prohibit further development in open space flood-prone areas
- Installation of a warning system, barricades at low-water crossings, and permanent generators
- Public awareness programs
- Implement tree trimming program
- Design, engineering, and installation of drainage utility infrastructure to minimize or reduce the impact of stormwater

FEMA's Hazard Mitigation Grant Program (HGMP), the Pre-Disaster Mitigation Grant (PDM), and TWDB's Flood Mitigation Assistance (FMA) Grant Program all fund localized Flood Risk Reduction Projects including reconstruction of culverts and drainage channels to limit the impact of stormwater on existing infrastructure. HMGP and PDM allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. HMGP and PDM allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness,, sirens, or barricades at low-water crossings. HMGP also offers funding for post disaster code enforcement, including community-wide tree trimming strategies. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Texas Department of Public Safety's Emergency Management Forms and Publications[2] website. County emergency managers or the State Hazard Mitigation Officer may be contacted for additional information.

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2 https://www.dps.texas.gov/dem/downloadableforms.htm#hmgpgrants.
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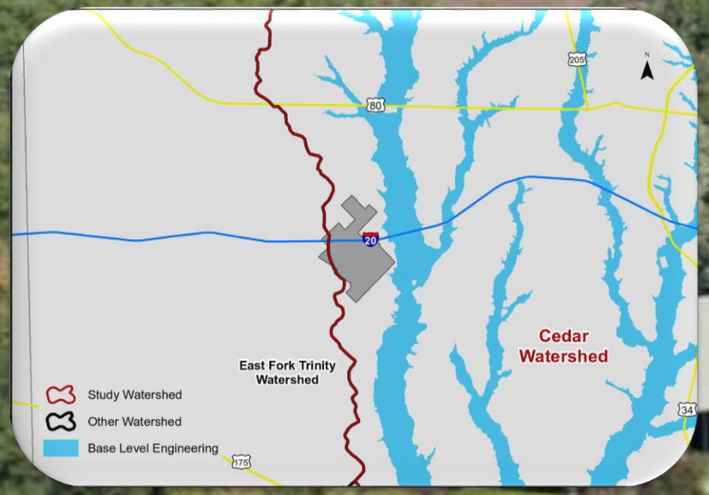
TOWN OF TALTY

KNOW YOUR RISK



1.7
Sq. Miles

of the community is in the watershed

1,464

Population based on 2010 census in the watershed

2.6% expected population growth from 2010-2021 in the watershed

2

policies totaling approximately $700,000 in coverage

0

claims for structures repeatedly damaged by flood in the watershed

$0

in severe repetitive loss in the watershed

The community does not contain flood-prone areas during a 1%-annual- chance storm evet.

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

2.0

Stream Miles Detailed Study in the watershed

0.0%

2

Flood-related presidential disaster declarations in your county

TOWN OF TALTY

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is **awaiting approval.**

The hazard mitigation goals identified projects for:

- Higher floodplain management standards
- Public awareness programs.
- Installation of a warning system and generators
- Acquisition of flood prone structures
- Design, engineering, and installation of drainage utility infrastructure to minimize or reduce the impact of stormwater

FEMA's Hazard Mitigation Grant Program (HGMP), the Hazard Mitigation Grant Program (HMGP), the Pre-Disaster Mitigation Grant (PDM), and TWDB's Flood Mitigation Assistance (FMA) Grant Program all allow for acquisition, demolition, relocation, or retrofits to existing structures and infrastructure. Additionally, these programs fund localized Flood Risk Reduction Projects including reconstruction of culverts and drainage channels to limit the impact of stormwater on existing infrastructure. HMGP and PDM allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. HMGP and PDM allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness, or sirens. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Texas Department of Public Safety's Emergency Management Forms and Publications[2] website. County emergency managers or the State Hazard Mitigation Officer may be contacted for additional information.

Texas Water Development Board's[3] Flood Protection (FP) Grant, Clean and Drinking Water State Revolving Fund (CWSRF), and Texas Water Development Fund (DFund) provide additional funding or loans for hazard mitigation planning and engineering designs. Both CWSRF and DFund are long term-fixed interest loans which can be used for acquisition or flood-proofing insured structures, and building water quality and green infrastructure. TWDB also funds the Severe Repetitive Loss (SRL) Grant, which can assist communities in engineering designs, acquisition or water-proofing of sever repetitive loss residential structures.

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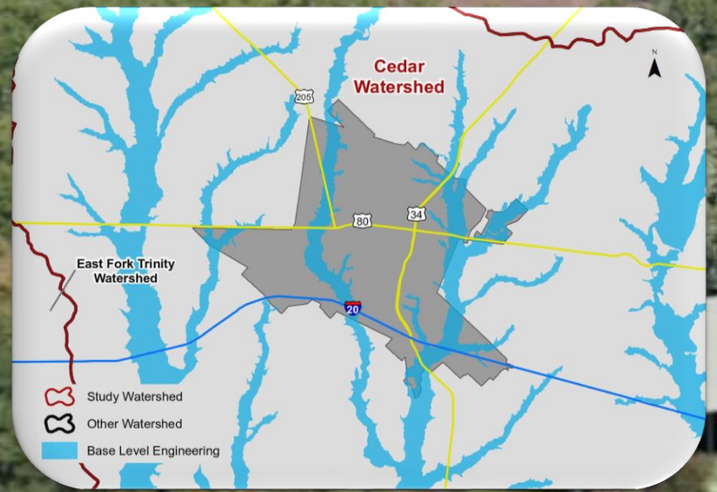
CITY OF TERRELL

KNOW YOUR RISK



19.7
Sq. Miles

of the community is in the watershed

15,816

Population based on 2010 census in the watershed

2.9% expected population growth from 2010-2021 in the watershed

23

policies totaling approximately $7,791,000 in coverage

0

claims for structures repeatedly damaged by flood in the watershed

$0

in severe repetitive loss in the watershed

100%

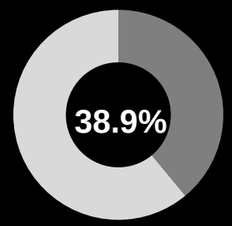
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

35.9

Stream Miles Detailed Study in the watershed



2

Flood-related presidential disaster declarations in your county

CITY OF TERRELL

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is set to expire **December 12, 2020.**

The hazard mitigation goals identified projects for:

- Acquisition of flood prone structures
- Installation of a warning system, barricades at low-water crossings, and permanent generators
- Public awareness programs
- Implement tree trimming program
- Design, engineering, and installation of drainage utility infrastructure to minimize or reduce the impact of stormwater
- Develop mutual aid agreements in case of dam failures

FEMA's Hazard Mitigation Grant Program (HGMP), the Pre-Disaster Mitigation Grant (PDM), and TWDB's Flood Mitigation Assistance (FMA) Grant Program all fund localized Flood Risk Reduction Projects including reconstruction of culverts and drainage channels to limit the impact of stormwater on existing infrastructure. HMGP and PDM allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. HMGP and PDM allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness,, sirens, or barricades at low-water crossings. HMGP also offers funding for post disaster code enforcement, including community-wide tree trimming strategies. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Texas Department of Public Safety's Emergency Management Forms and Publications[2] website. County emergency managers or the State Hazard Mitigation Officer may be contacted for additional information.

Texas Water Development Board's[3] Flood Protection (FP) Grant, Clean and Drinking Water State Revolving Fund (CWSRF), and Texas Water Development Fund (DFund) provide additional funding or loans for hazard mitigation planning and engineering designs. Both CWSRF and DFund are long term-fixed interest loans which can be used for building water quality and green infrastructure. TWDB also funds the Severe Repetitive Loss (SRL) Grant, which can assist communities in engineering designs, acquisition or water-proofing of sever repetitive loss residential structures.

The minimum requirements for floodplain regulations are outlined in 44 Code of Federal Regulations 60.3, and local communities may choose to adopt more restrictive codes. FEMA Regional Office VI offers assistance in developing stricter codes, such as regulating construction or elevational changes in the floodplain.

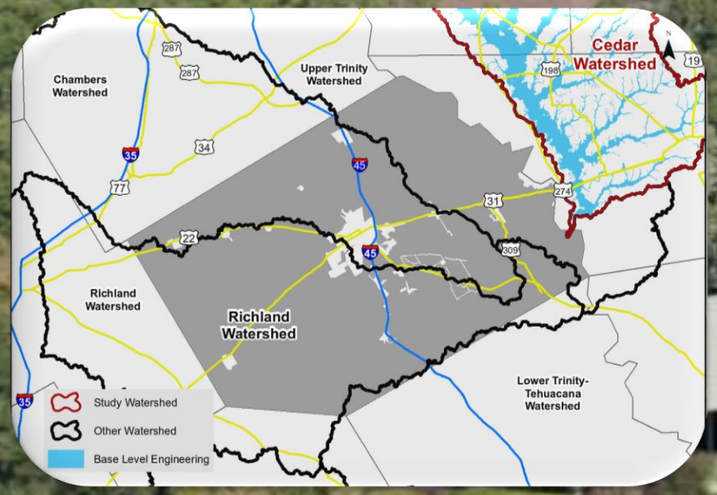
Three communities in Kaufman County, City of Kaufman, the Town of Kemp, and the City of Terrell, will join in an mutual aid agreement for assistance following any dam failures.

1 https://www.fema.gov/hazard-mitigation-assistance.
2 https://www.dps.texas.gov/dem/downloadableforms.htm#hmgpgrants.
3. https://www.twdb.texas.gov/financial/programs/.

RiskMAP
Increasing Resilience Together

NAVARRO COUNTY

KNOW YOUR RISK



0.2
Sq. Miles

of the community is in the watershed

3

Population based on 2010 census in the watershed

0.2% expected population growth from 2010-2021 in the watershed

65

policies totaling approximately $16,122,700 in coverage

0

claims for structures repeatedly damaged by flood in the watershed

$0

in severe repetitive loss in the watershed

0.0%

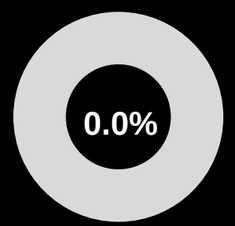
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

1.3

Stream Miles Detailed Study in the watershed



6

Flood-related presidential disaster declarations in your county

NAVARRO COUNTY

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is set to expire **July 8, 2020.**

The hazard mitigation goals identified projects for:

- Public awareness programs
- Installation of a warning system
- Complete new inundation studies of all high and moderate hazard dams within the county
- Implement voluntary building codes to mitigate flood damage in flood prone structures

FEMA's Hazard Mitigation Grant Program (HGMP) includes the 5% Initiative which is used for projects that may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness,, or sirens. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Texas Department of Public Safety's Emergency Management Forms and Publications[2] website. The State Hazard Mitigation Officer may be contacted for additional information.

Texas Water Development Board's[3] Flood Protection (FP) Grant, Clean and Drinking Water State Revolving Fund (CWSRF), and Texas Water Development Fund (DFund) provide additional funding or loans for dam studies and engineering plans. Both CWSRF and DFund are long term-fixed interest loans which can be used for acquisition or flood-proofing insured structures, and building water quality and green infrastructure.

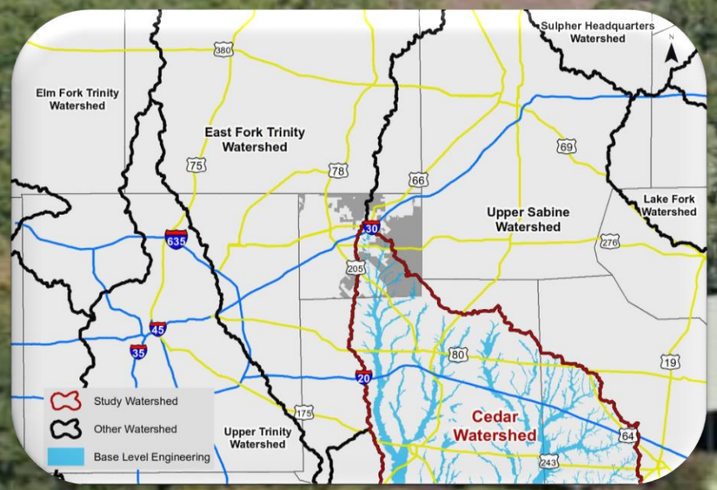
The minimum requirements for floodplain regulations are outlined in 44 Code of Federal Regulations 60.3, and local communities may choose to adopt more restrictive codes. FEMA Regional Office VI offers assistance in developing stricter codes, such as regulating construction or elevational changes in the floodplain.

1 https://www.fema.gov/hazard-mitigation-assistance.
2 https://www.dps.texas.gov/dem/downloadableforms.htm#hmgpgrants.
3. https://www.twdb.texas.gov/financial/programs/.

RiskMAP
Increasing Resilience Together

ROCKWALL COUNTY

KNOW YOUR RISK



20.5
Sq. Miles

of the community is in the watershed

1,453

Population based on 2010 census in the watershed

3.4% expected population growth from 2010-2021 in the watershed

36

policies totaling approximately $9,473,200 in coverage

0

claims for structures repeatedly damaged by flood in the watershed

$0

in severe repetitive loss in the watershed

10.7%

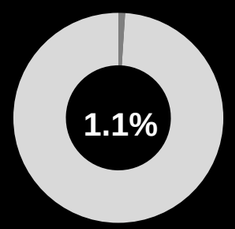
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

38.8

Stream Miles Detailed Study in the watershed



2

Flood-related presidential disaster declarations in your county

ROCKWALL COUNTY

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is **awaiting approval.**

The hazard mitigation goals identified projects for:

- Create a “Continuity of Operations” plan to limit county service interruptions in a natural hazard event
- Implement a debris removal plan before and after flood events
- Public awareness programs
- Installation of a warning system and generators

FEMA’s Hazard Mitigation Grant Program (HGMP) includes the 5% Initiative which is used for projects that may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness,, or sirens. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness, or sirens. HMGP also offers funding for post disaster code enforcement, including debris removal strategies. Information about FEMA’s HMA grants[1] can be found on our website, as well as on the Texas Department of Public Safety’s Emergency Management Forms and Publications[2] website. The State Hazard Mitigation Officer may be contacted for additional information.

“Continuity of Operations” planning aims to limit interruptions to critical government functions during and following a natural hazard event. Resources for creating this plan are available on the State Office of Risk Management’s website[3].

1. https://www.fema.gov/hazard-mitigation-assistance.
2. https://www.dps.texas.gov/dem/downloadableforms.htm#hmgpgrants.
3. https://www.sorm.state.tx.us/coop/texas-coop

RiskMAP
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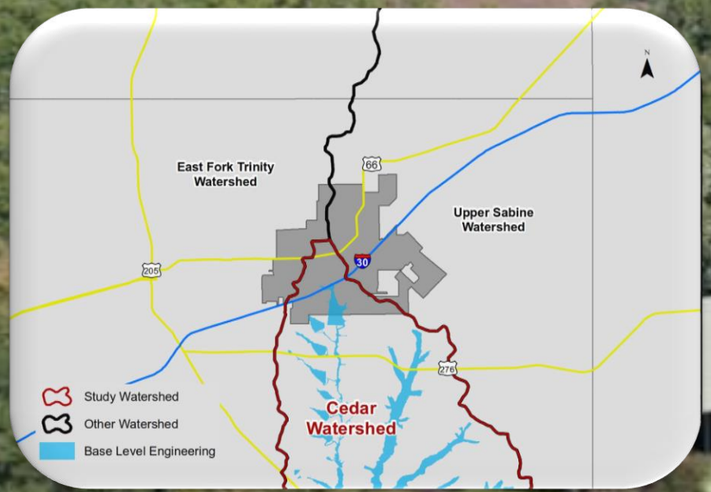
CITY OF FATE

KNOW YOUR RISK



2.2
Sq. Miles

of the community is in the watershed

1,836

Population based on 2010 census in the watershed

4.8% expected population growth from 2010-2021 in the watershed

18

policies totaling approximately $5,122,000 in coverage

0

claims for structures repeatedly damaged by flood in the watershed

$0

in severe repetitive loss in the watershed

24.5%

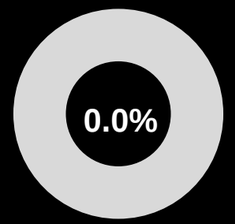
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

3.7

Stream Miles Detailed Study in the watershed



2

Flood-related presidential disaster declarations in your county

CITY OF FATE

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is **awaiting approval.**

The hazard mitigation goals identified projects for:

- Reduce development in open spaces of floodplain
- Enforce dual entry points in new construction
- Public awareness programs.
- Installation of a warning system and generators

FEMA's Hazard Mitigation Grant Program (HGMP) and the Pre-Disaster Mitigation Grant (PDM) allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness, or sirens. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Texas Department of Public Safety's Emergency Management Forms and Publications[2] website. County emergency managers or the State Hazard Mitigation Officer may be contacted for additional information.

Texas Water Development Board's[3] Flood Protection (FP) Grant, Clean and Drinking Water State Revolving Fund (CWSRF), and Texas Water Development Fund (DFund) provide additional funding or loans for hazard mitigation planning and engineering designs. Both CWSRF and DFund are long term-fixed interest loans.

The minimum requirements for floodplain regulations are outlined in 44 Code of Federal Regulations 60.3, and local communities may choose to adopt more restrictive codes. FEMA Regional Office VI offers assistance in developing stricter codes, such as regulating construction or elevational changes in the floodplain.

1 https://www.fema.gov/hazard-mitigation-assistance.
2 https://www.dps.texas.gov/dem/downloadableforms.htm#hmgpgrants.
3. https://www.twdb.texas.gov/financial/programs/.

RiskMAP
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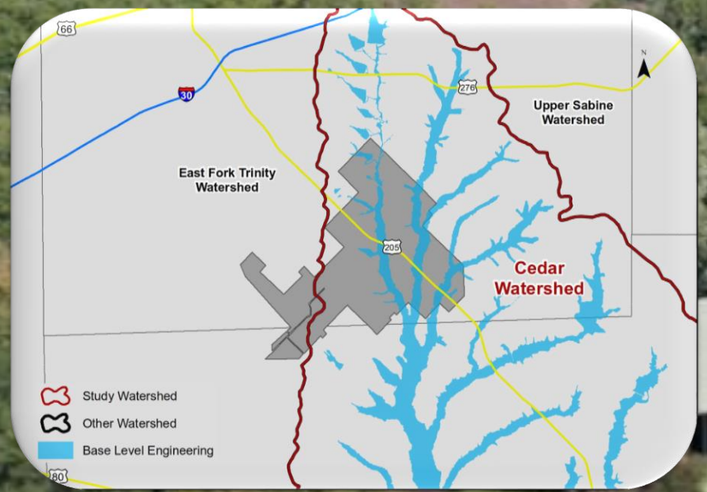
CITY OF MCLENDON-CHISHOLM

KNOW YOUR RISK



8.5
Sq. Miles

of the community is in the watershed

1,169

Population based on 2010 census in the watershed

2.2% expected population growth from 2010-2021 in the watershed

14

policies totaling approximately $3,981,400 in coverage

0

claims for structures repeatedly damaged by flood in the watershed

$0

in severe repetitive loss in the watershed

87.4%

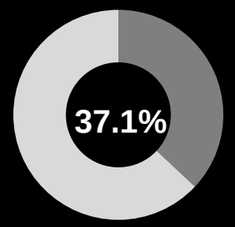
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

21.9

Stream Miles Detailed Study in the watershed



2

Flood-related presidential disaster declarations in your county

CITY OF MCLENDON-CHISHOLM

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is **awaiting approval.**

The hazard mitigation goals identified projects for:

- Public awareness programs
- Installation of a warning system and generators

FEMA's Hazard Mitigation Grant Program (HGMP) and the Pre-Disaster Mitigation Grant (PDM) allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness, or sirens. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Texas Department of Public Safety's Emergency Management Forms and Publications[2] website. County emergency managers or the State Hazard Mitigation Officer may be contacted for additional information.

Texas Water Development Board's[3] Flood Protection (FP) Grant, Clean and Drinking Water State Revolving Fund (CWSRF), and Texas Water Development Fund (DFund) provide additional funding or loans for hazard mitigation planning and engineering designs. Both CWSRF and DFund are long term-fixed interest loans.

1 https://www.fema.gov/hazard-mitigation-assistance.
2 https://www.dps.texas.gov/dem/downloadableforms.htm#hmgpgrants.
3. https://www.twdb.texas.gov/financial/programs/.

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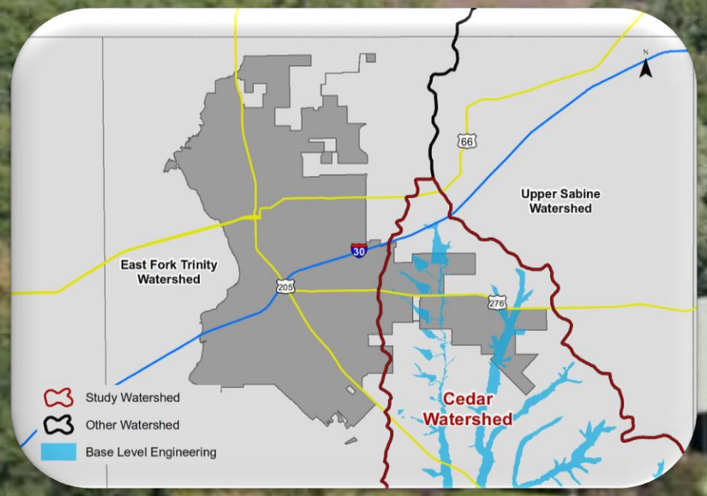
CITY OF ROCKWALL

KNOW YOUR RISK



5.0
Sq. Miles

of the community is in the watershed

6,300

Population based on 2010 census in the watershed

4.0% expected population growth from 2010-2021 in the watershed

124

policies totaling approximately $34,596,400 in coverage

0

claims for structures repeatedly damaged by flood in the watershed

$0

in severe repetitive loss in the watershed

21.5%

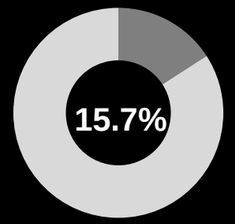
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

12.5

Stream Miles Detailed Study in the watershed



2

Flood-related presidential disaster declarations in your county

CITY OF ROCKWALL

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is **awaiting approval.**

The hazard mitigation goals identified projects for:

- Public awareness programs
- Installation of a warning system and generators
- Study and improve drainage utility infrastructure to minimize the impact of stormwater
- Channelize or restore streams
- Achieve “Stormready” Community certification
- Implement tree trimming program

FEMA’s Hazard Mitigation Grant Program (HGMP), the Pre-Disaster Mitigation Grant (PDM), and TWDB's Flood Mitigation Assistance (FMA) Grant Program all fund localized Flood Risk Reduction Projects including reconstruction of culverts and drainage channels to limit the impact of stormwater on existing infrastructure. HMGP and PDM allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. HMGP and PDM allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness,, sirens, or barricades at low-water crossings. HMGP also offers funding for post disaster code enforcement, including community-wide tree trimming strategies. The HMGP also provides financial assistance for flood reduction projects including stream channelization and restoration. Information about FEMA’s HMA grants[1] can be found on our website, as well as on the Texas Department of Public Safety’s Emergency Management Forms and Publications[2] website. County emergency managers or the State Hazard Mitigation Officer may be contacted for additional information.

Texas Water Development Board’s[3] Flood Protection (FP) Grant, Clean and Drinking Water State Revolving Fund (CWSRF), and Texas Water Development Fund (DFund) provide additional funding or loans for engineering designs. Both CWSRF and DFund are long term-fixed interest loans which can be used for building water quality and green infrastructure. CWSRF and Dfund, offers grant money for flood reduction projects including FIS updates.

The minimum requirements for floodplain regulations are outlined in 44 Code of Federal Regulations 60.3, and local communities may choose to adopt more restrictive codes. FEMA Regional Office VI offers assistance in developing stricter codes, such as regulating construction or elevational changes in the floodplain.

1 https://www.fema.gov/hazard-mitigation-assistance.
2 https://www.dps.texas.gov/dem/downloadableforms.htm#hmgpgrants.
3. https://www.twdb.texas.gov/financial/programs/.

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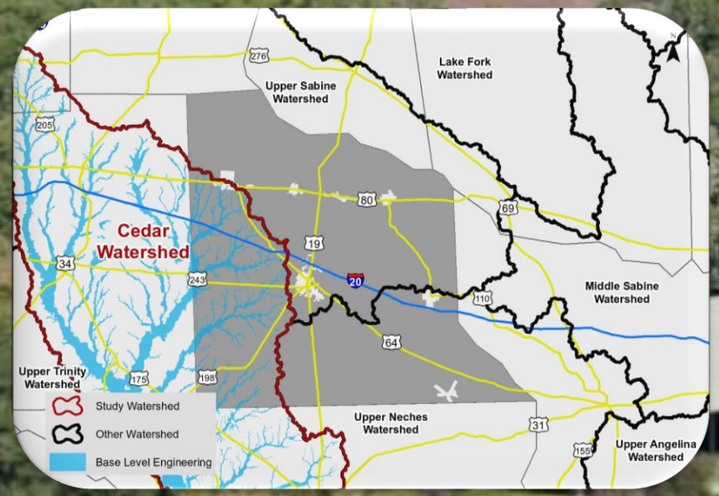
VAN ZANDT COUNTY

KNOW YOUR RISK



216.4
Sq. Miles

of the community is in the watershed

9,626

Population based on 2010 census in the watershed

0.3% expected population growth from 2010-2021 in the watershed

87

policies totaling approximately $17,526,400 in coverage

0

claims for structures repeatedly damaged by flood in the watershed

$0

in severe repetitive loss in the watershed

26.7%

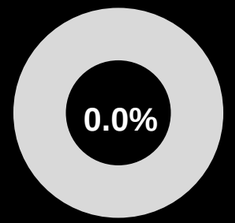
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

508.5

Stream Miles Detailed Study in the watershed



3

Flood-related presidential disaster declarations in your county

VAN ZANDT COUNTY

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is set to expire **October 30, 2017.**

The hazard mitigation goals identified projects for:

- Join Community Rating System (CRS) program
- Public awareness programs
- Installation of a warning system and generators
- Implement voluntary building codes or acquire flood prone structures
- Improve waste water treatment infrastructure to minimize or reduce the impact of stormwater
- Apply for funding to improve local dams

FEMA's Hazard Mitigation Grant Program (HGMP), the Hazard Mitigation Grant Program (HMGP), the Pre-Disaster Mitigation Grant (PDM), and TWDB's Flood Mitigation Assistance (FMA) Grant Program all allow for acquisition, demolition, relocation, or retrofits to existing structures and infrastructure. Additionally, these programs fund localized Flood Risk Reduction Projects including reconstruction of culverts and drainage channels to limit the impact of stormwater on existing infrastructure. HMGP and PDM allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. HMGP and PDM allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness,, sirens, or barricades at low-water crossings. HMGP also offers funding for post disaster code enforcement, including community-wide tree trimming strategies. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Texas Department of Public Safety's Emergency Management Forms and Publications[2] website. Participation in FEMA's Community Rating System[3] (CRS) reduces insurance premiums up to 45%, and FEMA will provide free technical assistance in designing and implementing programs designed to reduce flood damage. The State Hazard Mitigation Officer may be contacted for additional information.

Texas Water Development Board's[4] Flood Protection (FP) Grant, Clean and Drinking Water State Revolving Fund (CWSRF), and Texas Water Development Fund (DFund) provide additional funding or loans for dam studies and engineering plans. Both CWSRF and DFund are long term-fixed interest loans which can be used for acquisition or flood-proofing insured structures, and building water quality and green infrastructure. TWDB also funds the Severe Repetitive Loss (SRL) Grant, which can assist communities in engineering designs, acquisition or water-proofing of sever repetitive loss residential structures.

The minimum requirements for floodplain regulations are outlined in 44 Code of Federal Regulations 60.3, and local communities may choose to adopt more restrictive codes. FEMA Regional Office VI offers assistance in developing stricter codes, such as regulating construction or elevational changes in the floodplain.

1. https://www.fema.gov/hazard-mitigation-assistance.
2. https://www.dps.texas.gov/dem/downloadableforms.htm#hmgpgrants.
3. https://www.fema.gov/community-rating-system.
4. https://www.twdb.texas.gov/financial/programs/.

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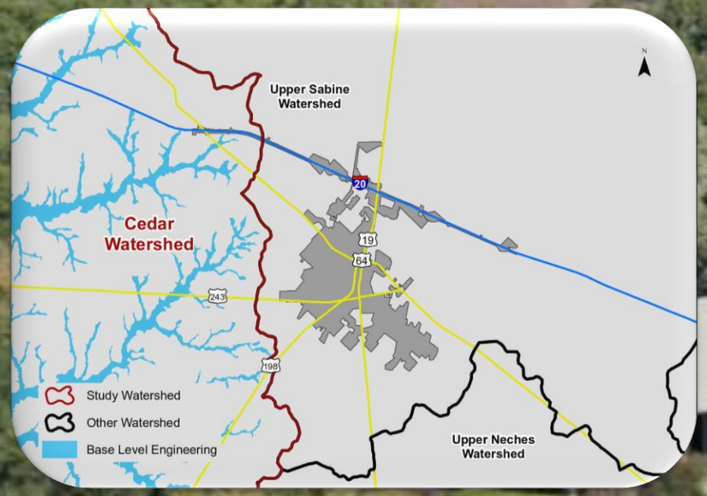
CITY OF CANTON

KNOW YOUR RISK



0.1
Sq. Miles

of the community is in the watershed

77

Population based on 2010 census in the watershed

0.3% expected population growth from 2010-2021 in the watershed

42

policies totaling approximately $4,369,300 in coverage

0

claims for structures repeatedly damaged by flood in the watershed

0.0%

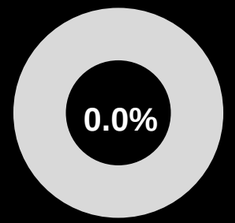
Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

0.1

Stream Miles Detailed Study in the watershed



3

Flood-related presidential disaster declarations in your county

$0

in severe repetitive loss in the watershed

CITY OF CANTON

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is set to expire **October 30, 2017.**

The hazard mitigation goals identified projects for:

- Higher floodplain management standards
- Public awareness programs
- Installation of a warning system and generators
- Implement voluntary building codes or acquire flood prone structures
- Improve waste water treatment infrastructure to minimize or reduce the impact of stormwater
- Apply for funding to improve local dams

FEMA's Hazard Mitigation Grant Program (HGMP), the Hazard Mitigation Grant Program (HMGP), the Pre-Disaster Mitigation Grant (PDM), and TWDB's Flood Mitigation Assistance (FMA) Grant Program all allow for acquisition, demolition, relocation, or retrofits to existing structures and infrastructure. Additionally, these programs fund localized Flood Risk Reduction Projects including reconstruction of culverts and drainage channels to limit the impact of stormwater on existing infrastructure. HMGP and PDM allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. HMGP and PDM allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness,, sirens, or barricades at low-water crossings. HMGP also offers funding for post disaster code enforcement, including community-wide tree trimming strategies. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Texas Department of Public Safety's Emergency Management Forms and Publications[2] website. County emergency managers or the State Hazard Mitigation Officer may be contacted for additional information.

Texas Water Development Board's[3] Flood Protection (FP) Grant, Clean and Drinking Water State Revolving Fund (CWSRF), and Texas Water Development Fund (DFund) provide additional funding or loans for dam studies and engineering plans. Both CWSRF and DFund are long term-fixed interest loans which can be used for acquisition or flood-proofing insured structures, and building water quality and green infrastructure. TWDB also funds the Severe Repetitive Loss (SRL) Grant, which can assist communities in engineering designs, acquisition or water-proofing of sever repetitive loss residential structures.

The minimum requirements for floodplain regulations are outlined in 44 Code of Federal Regulations 60.3, and local communities may choose to adopt more restrictive codes. FEMA Regional Office VI offers assistance in developing stricter codes, such as regulating construction or elevational changes in the floodplain.

1 https://www.fema.gov/hazard-mitigation-assistance.
2 https://www.dps.texas.gov/dem/downloadableforms.htm#hmgpgrants.
3. https://www.twdb.texas.gov/financial/programs/.

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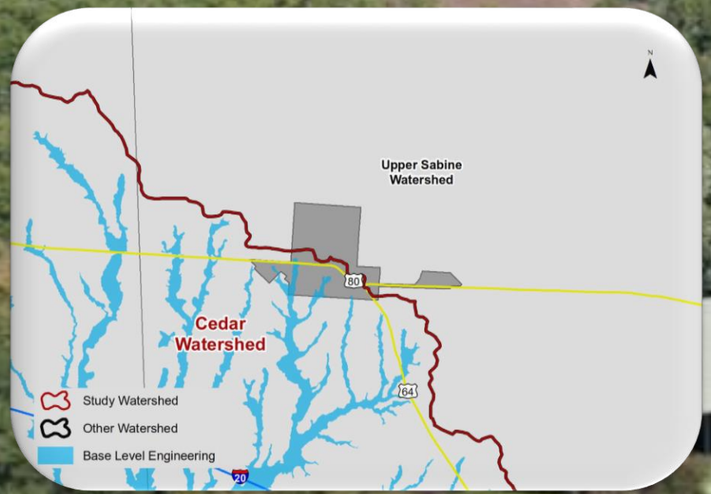
CITY OF WILLS POINT

KNOW YOUR RISK



1.6
Sq. Miles

of the community is in the watershed

1,443

Population based on 2010 census in the watershed

0.5% expected population growth from 2010-2021 in the watershed

13

policies totaling approximately $1,859,300 in coverage

0

claims for structures repeatedly damaged by flood in the watershed

$0

in severe repetitive loss in the watershed

48.6%

Of the community's flood-prone areas during a 1%-annual-chance storm event are located in Cedar watershed

Participating in the National Flood Insurance Program.

CNMS Stream Miles in the watershed

2.3

Stream Miles Detailed Study in the watershed

0.0%

3

Flood-related presidential disaster declarations in your county

CITY OF WILLS POINT

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan is **awaiting adoption.**

The hazard mitigation goals identified projects for:

- Public awareness programs
- Installation of a warning system and generators
- Implement voluntary building codes or acquire flood prone structures
- Improve waste water treatment infrastructure to minimize or reduce the impact of stormwater
- Apply for funding to improve local dams

FEMA's Hazard Mitigation Grant Program (HGMP), the Hazard Mitigation Grant Program (HMGP), the Pre-Disaster Mitigation Grant (PDM), and TWDB's Flood Mitigation Assistance (FMA) Grant Program all allow for acquisition, demolition, relocation, or retrofits to existing structures and infrastructure. Additionally, these programs fund localized Flood Risk Reduction Projects including reconstruction of culverts and drainage channels to limit the impact of stormwater on existing infrastructure. HMGP and PDM allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. HMGP and PDM allow for the funding of generators at critical facilities. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness,, sirens, or barricades at low-water crossings. HMGP also offers funding for post disaster code enforcement, including community-wide tree trimming strategies. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Texas Department of Public Safety's Emergency Management Forms and Publications[2] website. County emergency managers or the State Hazard Mitigation Officer may be contacted for additional information.

Texas Water Development Board's[3] Flood Protection (FP) Grant, Clean and Drinking Water State Revolving Fund (CWSRF), and Texas Water Development Fund (DFund) provide additional funding or loans for dam studies and engineering plans. Both CWSRF and DFund are long term-fixed interest loans which can be used for acquisition or flood-proofing insured structures, and building water quality and green infrastructure. TWDB also funds the Severe Repetitive Loss (SRL) Grant, which can assist communities in engineering designs, acquisition or water-proofing of sever repetitive loss residential structures.

The minimum requirements for floodplain regulations are outlined in 44 Code of Federal Regulations 60.3, and local communities may choose to adopt more restrictive codes. FEMA Regional Office VI offers assistance in developing stricter codes, such as regulating construction or elevational changes in the floodplain.

1 https://www.fema.gov/hazard-mitigation-assistance.
2 https://www.dps.texas.gov/dem/downloadableforms.htm#hmgpgrants.
3. https://www.twdb.texas.gov/financial/programs/.

Appendix II: Base Level Engineering Report

AECOM

Cedar Watershed, TX
Base Level Engineering (BLE) Results

September 2017

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CEDAR WATERSHED

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Version Number	Version Date	Summary Changes	Team/Author
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APPROVALS

This document requires the approval of the following persons:

Role	Name	Phone Extension	Title	Review Date	Approved Date
Project Manager	April Smith	512.457.7818	Project Manager	September 24, 2017	September 24, 2017

CLIENT DISTRIBUTION

Name	Title/Organization	Location
Halff Associates	Prime Consultant	Via FTP

Table of Contents

Executive Summary

North Central Texas Council of Government (NCTCOG) contracted AECOM, through Halff Associates' prime contract, to complete a Base Level Engineering (BLE) analysis for the Cedar HUC-8 watershed in North Central Texas, to support FEMA's Discovery process and validation of effective Zone A Special Flood Hazard Areas (SFHAs). The BLE process involves using best available data and incorporating automated techniques with traditional model development procedures to produce regulatory quality flood hazard boundaries for the 1-percent annual chance event as well as estimates of flood hazard boundaries for multiple recurrence intervals.

The source digital terrain data used for surface model development in support of hydrologic and hydraulic analysis as well as mapping activities were leveraged from various local, State and Federal partners. Details regarding the different datasets used are provided below in Section 1.1.

Flood discharges for this study were calculated using both United States Geological Survey (USGS) regression equations and gage analyses, where stream gages with sufficient records exist. Regression equations obtained from the USGS Scientific Investigations Report (SIR) 2009-5087, Regression Equations for Estimation of Annual Peak-Streamflow Frequency for Undeveloped Watersheds in Texas Using an L-moment-Based, PRESS-Minimized, Residual-Adjusted Approach (2009) were used. PeakFQ version 7.1 was used to perform Flood Frequency Analysis (FFA) for the two gages along Cedar Creek.

The Hydrologic Engineering Center's River Analysis System (HEC-RAS) program version 4.1 was used to compute water surface elevations on a stream by stream basis. All hydraulic models were computed using 1-D steady state analysis.

The stream mile network that was validated for these watersheds was compiled using FEMA's Community Needs Management Strategy (CNMS) inventory. CNMS is an inventory of flood hazard studies and flood hazard mapping needs for areas where a study is needed. This data is helpful for community officials in analyzing and depicting flood hazards to enhance the understanding of flood risks. Communities may use this information to make informed decisions on their planning and flood mitigation efforts. Table ES - 1 lists the stream miles associated with this validation analysis.

Table ES - 1: Summary of Stream Miles

Source	Cedar Stream Miles
CNMS	1,345.6
Total	**1,345.6**

The full inventory of Zone A studies in Cedar Watershed was classified in CNMS. Total miles validated in CNMS are summarized in Table ES - 2 and illustrated in Figure ES - 1 below.

Table ES - 2: Zone A Validation Results

Validation Status	Status Type	Cedar (miles)
VALID	BEING STUDIED	78.1
UNVERIFIED	BEING STUDIED	321.1
	TO BE STUDIED	384.6
UNKNOWN	TO BE ASSESSED	266.3
Total		1,050.1

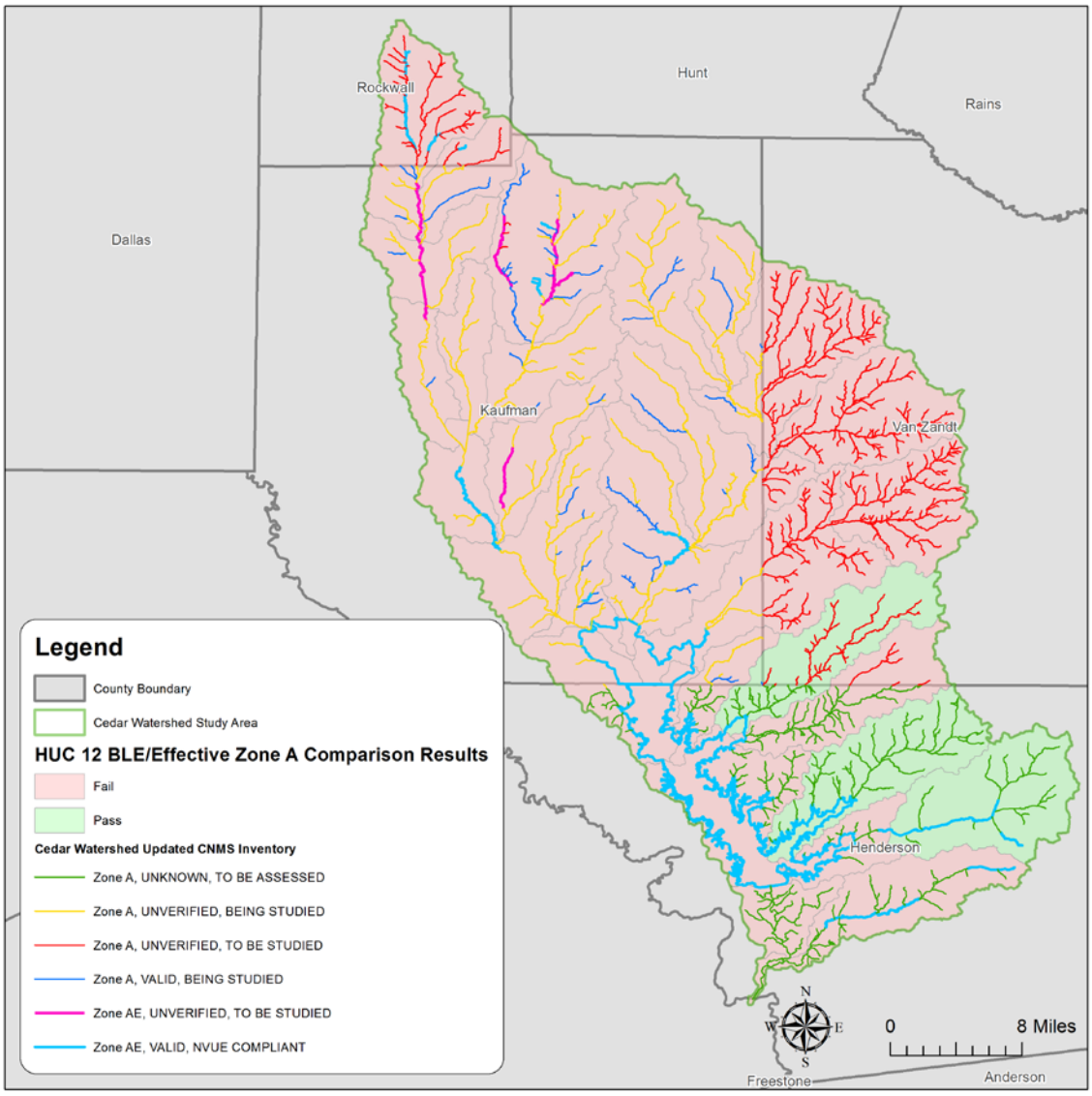


Figure ES - 1: Cedar Watershed CNMS Validation Results

An overall risk for each HUC-12 watershed was calculated using the National Flood Risk Percentages Dataset and its proportional area. The weighted risk was multiplied by the percentage of points in the watershed that failed the CNMS comparison to effective to determine the priority score. Figure ES - 2, below shows the range of the Cedar HUC-8 priority scores which can be used to initiate discussions during the Discovery phase.

For Cedar Watershed, Big Cottonwood Creek – Kings Creek HUC-12 was determined to have the highest priority score and the most need while Headwaters Caney Creek HUC-12 has the lowest score.

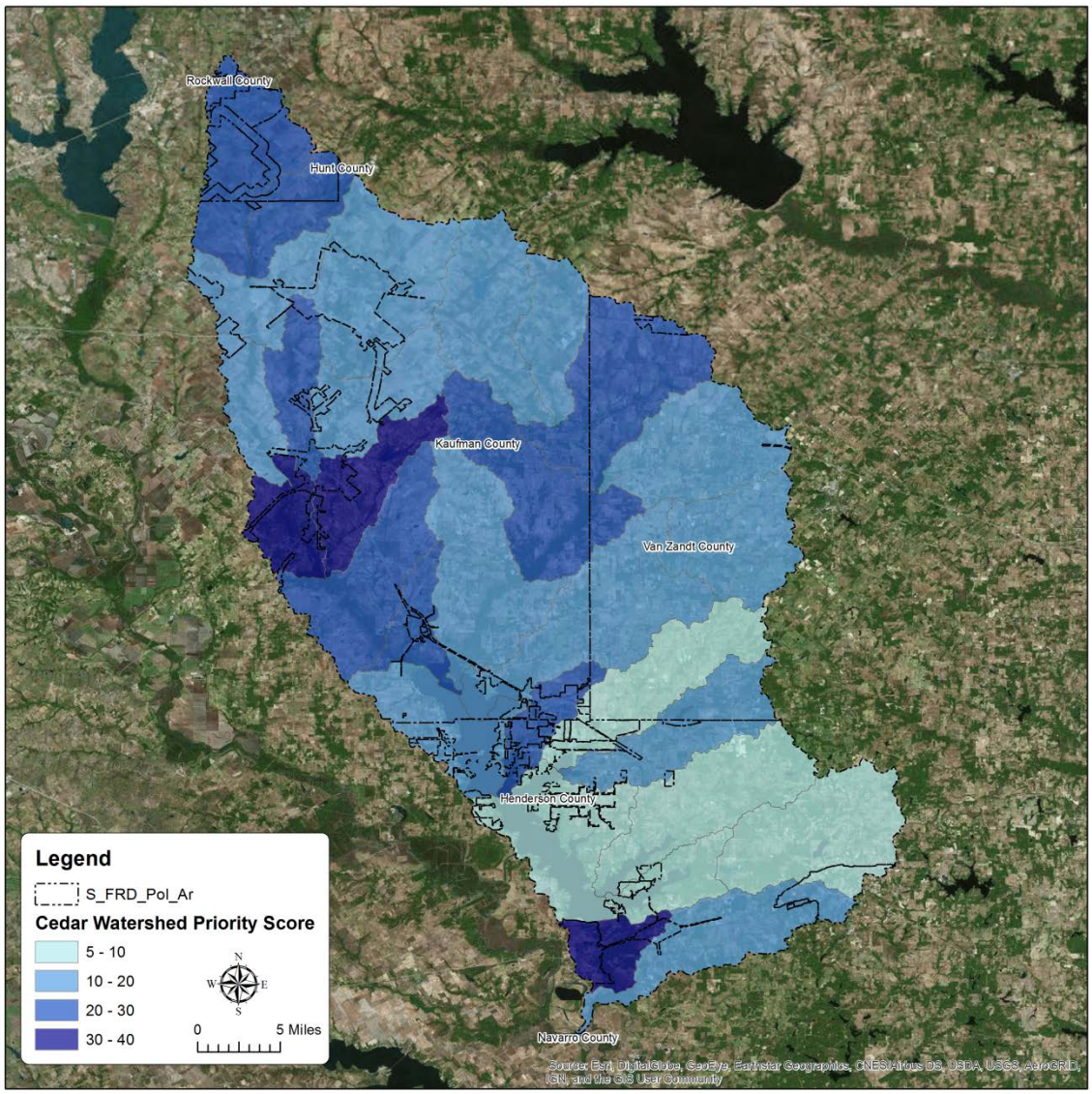


Figure ES - 2: Ranking of Cedar Watershed HUC-12s

Base Level Engineering (BLE) Methodology

Recent innovations and efficiencies in floodplain mapping have allowed the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) to develop a process called Base Level Engineering (BLE), which can be used to address current program challenges, including the validation of Zone A studies and the availability of flood risk data in the early stages of a Flood Risk Project. The BLE process involves using best available data and incorporating automated techniques with traditional model development procedures to produce regulatory quality flood hazard boundaries for the 1-percent annual chance event as well as estimates of flood hazard boundaries for multiple recurrence intervals. The cost for developing the data and estimates resulting from the BLE process are lower than standard flood production costs. The BLE results may be used for eventual production of regulatory and non-regulatory products.

As described in Title 42 of the Code of Federal Regulations, Chapter III, Section 4101(e), once every five years, FEMA must evaluate whether the information on Flood Insurance Rate Maps (FIRMs) reflects the current risks in floodprone areas. FEMA makes this determination of flood hazard data validity by examining flood study attributes and change characteristics, as specified in the Validation Checklist of the Coordinated Needs Management Strategy (CNMS) Technical Reference. The CNMS Validation Checklist provides a series of critical and secondary checks to determine the validity of flood hazard areas studied by detailed methods (e.g., Zone AE, AH, or AO). While the critical and secondary elements in CNMS provide a comprehensive method of evaluating the validity of Zone AE studies, a cost-effective approach for evaluating Zone A studies has been lacking.

In addition to the need for Zone A validation guidance, FEMA standards require flood risk data to be provided in the early stages of a Flood Risk Project. FEMA Program Standard SID #29 requires that during Discovery, data must be identified that illustrates potential changes in flood elevation and mapping that may result from the proposed project scope. If available data does not clearly illustrate the likely changes, an analysis is required that estimates the likely changes. This data and any associated analyses should be shared and results should be discussed with stakeholders.

An important goal of the BLE process is the scalability of the results. Scalability means that the results of a BLE analysis can not only be used for CNMS evaluations of Zone A studies, but can also be leveraged throughout the Risk MAP program. The data resulting from a BLE analysis can be updated as needed and used for the eventual production of regulatory and non-regulatory products, outreach and risk communication, and MT-1 processing. Leveraging this data outside the Risk MAP program may also be valuable to external stakeholders.

North Central Texas Council of Governments (NCTCOG) contracted AECOM, through Halff Associates' prime contract, to complete a Base Level Engineering (BLE) analysis for the Cedar HUC-8 watershed in North Central Texas, to support FEMA's Discovery process and validation of effective Zone A Special Flood Hazard Areas (SFHAs).

Study extents for Cedar Watershed include portions of Henderson County, Hunt County, Kaufman County, Rockwall County, Van Zandt County and include the following communities: Cities of Athens, Caney City, Canton, Eustace, Fate, Forney, Grays Prairie, Gun Barrel City, Kaufman, Kemp, Log Cabin, Mabank, Malakoff, Mclendon-chisholm, Payne Springs, Post Oak Bend, Rockwall, Scurry, Seven Points, Star Harbor, Talty, Terrell, Tool, Trinidad, and Willis Point; the Towns of Enchanted Oaks, Oak Grove and Oak Ridge. The study area consisted of three HUC-10 basins: Kings Creek – Cedar Creek Reservoir, Cedar Creek – Cedar Creek Reservoir and Cedar Creek Reservoir – Cedar Creek. Figure 1 shows the orientation of the Cedar HUC-10 basins with respect to the counties.

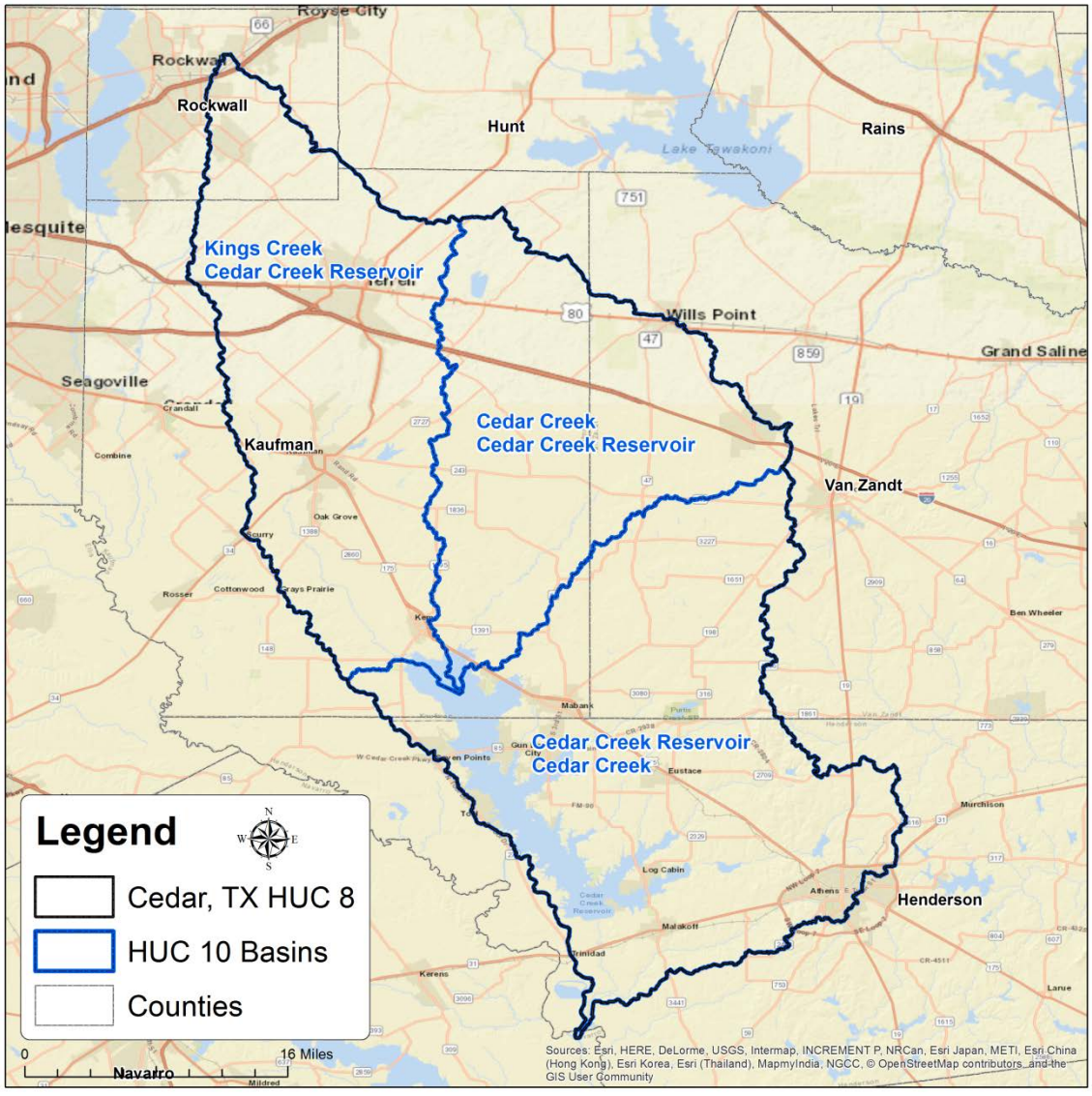


Figure 1: Cedar Watershed HUC-10 Basins

AECOM studied approximately 2,022 miles of stream reaches within the Cedar Watershed with a minimum drainage area tolerance of one square mile outside of population centers and one half square mile inside of population centers. Population centers were identified as having a population of greater than 1,000 people. The selection and extent of stream reaches studied was based upon the number of stream miles with minimum drainage area of one square mile (or one half square mile) and not the number of effective Zone A stream miles. Study reaches were extended above this threshold as appropriate to ensure all effective Zone A floodplain received an updated analysis. Topographic data used was from multiple sources was used to determine the hydrologic and hydraulic characteristics of the watershed. Topographic data used was obtained from the North Texas Council of Governments (NCTCOG), Texas Natural Resources Information System (TNRIS), and the United States Geological Survey (USGS). The following sections will summarize the BLE process and will discuss the results along with their recommended use.

1.1 Topographic Data

Documentation regarding leverage data and process including coverage, accuracy, acquisition dates, and source contact/agency are presented in the figures, tables and text within this section. All vertical accuracy specifications were obtained from the metadata or survey reports provided with the leverage datasets.

All available metadata, survey reports, and other leverage documentation are available with the source dataset. Figure 2 shows the extents of the Digital Terrain Model (DTM) data used for the HUC-8 watershed studied.

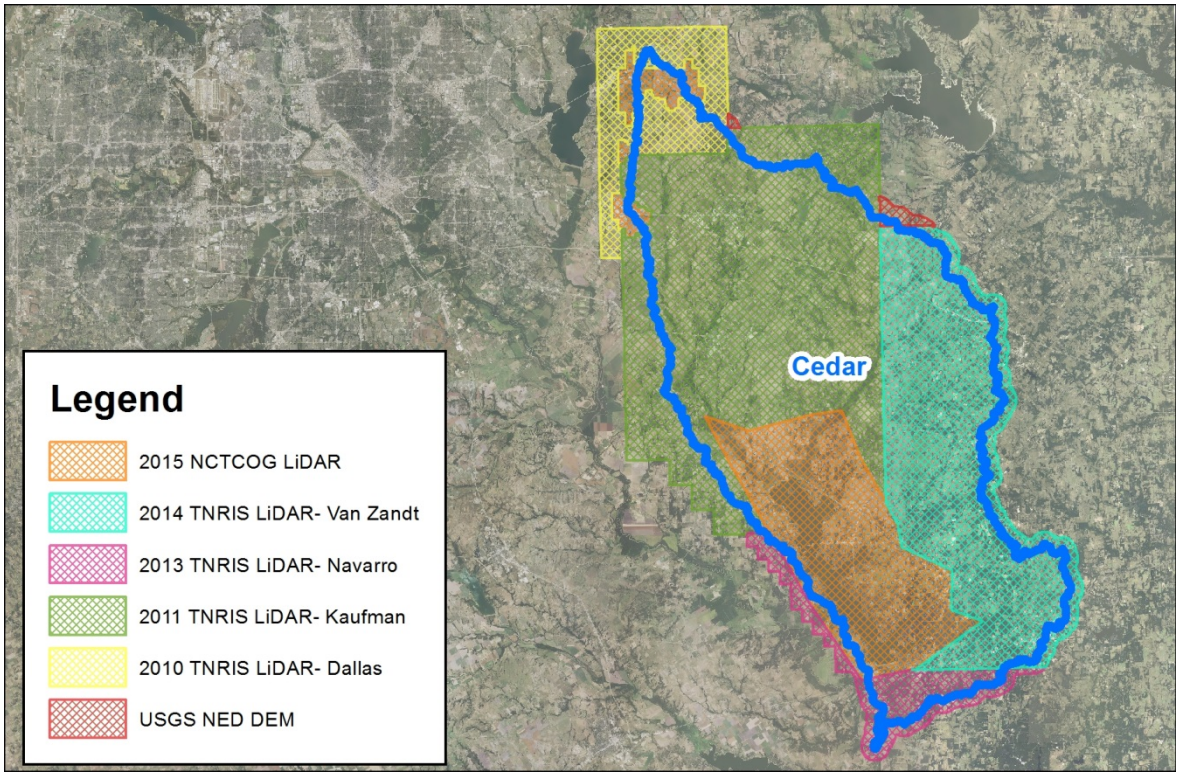


Figure 2: Extent of LiDAR Data for Cedar Watershed

1.1.1 Source Terrain Data

1.1.1.1 Cedar Watershed

1.1.1.1.1 2015 NCTCOG LiDAR

The NCTCOG Light Detection and Ranging (LiDAR) was acquired in 2015 by Woolpert Inc. The data density is 1 point per square meter (PPSM) with a 0.5 meter nominal point spacing (NPS). The data was compiled to meet 0.07 meters vertical accuracy at 95 percent confidence level which meets project accuracy specifications of the National Standard for Spatial Data Accuracy (NSSDA). This data was available as LiDAR point clouds in the American Society of Photogrammetry and Remote Sensing (ASPRS) common LiDAR Data Exchange Format (LAS 1.2).

1.1.1.1.2 2014 TNRIS LiDAR (Van Zandt County)

The TNRIS LiDAR data for Van Zandt County was acquired in 2014 by the Atkins North America team (Atkins, McKim & Creed, and Williams Aerial and Mapping Inc.). The data density is ranged from 4 PPSM to 8 PPSM with a 0.5 meter NPS. The data was compiled to meet 0.07 meters vertical accuracy at 95 percent confidence level which meets project accuracy specifications of the NSSDA. This data was available as LiDAR point clouds in the ASPRS common LiDAR Data Exchange Format (LAS 1.2).

1.1.1.1.3 2013 TNRIS LiDAR (Navarro County)

The TNRIS LiDAR data for Navarro County was acquired in 2013 by Gorrondona and Associates, Inc., Williams Aerial and Mapping, Inc., and McKim and Creed. The data density is 4 PPSM with a 0.5 meter NPS. The data was compiled to meet 0.07 meters vertical accuracy at 95 percent confidence level which meets project accuracy specifications of the NSSDA. This data was available as LiDAR point clouds in the ASPRS common LiDAR Data Exchange Format (LAS 1.2).

1.1.1.1.4 2011 TNRIS LiDAR (Kaufman County)

The TNRIS LiDAR data for Kaufman County was acquired in 2011 by Merrick & Company. The data density is 4 PPSM with a 0.5 meter NPS. The data was compiled to meet 18.5 cm vertical accuracy at 95 percent confidence level which meets project accuracy specifications of the NSSDA. This data was available as LiDAR point clouds in the ASPRS common LiDAR Data Exchange Format (LAS 1.2).

1.1.1.1.5 2010 TNRIS LiDAR (Dallas County)

The TNRIS LiDAR data for Dallas County was acquired in 2010 by Sanborn Map Company. The data density is 1 PPSM with a 1 meter NPS. The data was compiled to meet 0.07 meters vertical accuracy at 95 percent confidence level which meets project accuracy specifications of the NSSDA. This data was available as LiDAR point clouds in the ASPRS common LiDAR Data Exchange Format (LAS 1.2).

1.1.1.1.6 USGS NED DEM

The National Elevation Dataset (NED), a product of the USGS, is a seamless gridded dataset representing the best available raster elevation data available to the USGS for the conterminous United States, Alaska, Hawaii, and territorial islands. The NED is derived from diverse source data that are processed to a common coordinate system and unit of vertical measure. The NED serves the Cedar Watershed topographic data development by filling in as best available data where

there are gaps in the data sets listed above. This data was used to keep the project on schedule and was only used for a very small area in comparison to the overall HUC-8 watershed.

1.1.1.2 Terrain Data Processing

The Watershed Information System (WISE) software platform was utilized in order to create a digital surface model for each watershed's project area. This module allows source data from a variety of sources to be prioritized based on level of accuracy or preference of the user.

For the Cedar Watershed, the 2015 NCTCOG LiDAR LiDAR was highest priority with the 2014 TNRIS LiDAR for Van Zandt County prioritized second and 2013 TNRIS LiDAR for Navarro County, 2011 TNRIS LiDAR for Kaufman County and 2010 TNRIS LiDAR for Dallas County prioritized third, fourth and fifth. Lastly the USGS NED DEM data was used as the sixth data source for areas where LiDAR did not exist.

The DEMs created from the LiDAR datasets mentioned above were compiled in order of vertical accuracy into a mosaic dataset using ArcMap. From this mosaic, a tile index was created for the project area and the mosaic was clipped into 50,000-foot tiles, converted to asciis and imported into WISE Terrain Analyst (WTA). Visual inspection of the 10-foot DEMs was performed to ensure no voids and/or artifacts were present in the DEM. The DEM surface model was affirmed to be suitable for hydraulic takeoffs and supporting other hydraulic analyses.

Stream centerlines were manually digitized using the 10-foot DEMs as a source for horizontal alignment and vertical elevation. These stream centerlines are created for use in the hydraulic analysis, hydro-enforcement of the 50-foot DEMs, and visual reference on the FIRM products. Several routines were then used to take localized elevations from the source topographic data and apply them to the streams. This gave the stream vertices elevation information along the Z axis. The resulting elevations ensure that the streams are lower in elevation than any overbank sumps. A separate routine was then used to ensure that the elevations of these vertices descend in height down to an outfall. The final streams file is then "burned" into the 50-foot DEMs to force flow through structures while preventing it from jumping out of the channel banks.

After the DEM was imported, an additional 50-foot DEM was created from the same mosaic and tile index used for the 10-foot DEM. This 50-foot DEM was used for hydro enforcement of the project areas. Proprietary software was used to identify natural sinks, peaks and flat areas in the 50-foot DEM surface. Elevations of the cells in the DEM were algorithmically calculated and the best path to route flow was determined without filling sinks in the DEM. Once all calculations were completed, the flow was checked confirming that all drainage flows downstream correctly and is routed to outside of the HUC-8 basin.

In addition to the quantitative assessment of the source digital terrain, a qualitative visual inspection of the composite DEM was performed using a hillshade derived from the 10-foot DEM. The visual inspection indicated no unusual or non-terrestrial features were observed in the composite DEM assuring the surface files used for hydrologic and hydraulic analyses and floodplain mapping activities are sufficient for BLE analysis.

1.2 Hydrology

Flood discharges for this study were calculated using USGS regression equations and gage analysis, where stream gages with sufficient records exist. Scientific Investigations Report (SIR) 2009-5087, Regression Equations for Estimation of Annual Peak-Streamflow Frequency for

Undeveloped Watersheds in Texas Using an L-moment-Based, PRESS-Minimized, Residual-Adjusted Approach (2009) contains the most recent regression equations for Texas and was used as the basis for regression discharge calculations.

Table 1 shows the published equations used for this study. In these equations, Q_i represents peak streamflow for i-recurrence interval (annual chance exceedance (a.c.e.)) in cubic feet per second, P represents mean annual precipitation in inches, S represents dimensionless main-channel slope, Ω represents the OmegaEM parameter, and A is cumulative drainage area in square miles.

Table 1: Summary of Regression Equations (SIR 2009-5087)

Recurrence Interval	Equation[1]
$Q_{10\%}$	$P^{1.203}S^{0.403} \times 10^{[0.918\ \Omega\ +13.62-11.97A\^{}(-0.0289)]}$
$Q_{4\%}$	$P^{1.140}S^{0.446} \times 10^{[0.945\ \Omega\ +11.79-9.819A\^{}(-0.0374)]}$
$Q_{2\%}$	$P^{1.105}S^{0.476} \times 10^{[0.961\ \Omega\ +11.17-8.997A\^{}(-0.0424)]}$
$Q_{1\%}$	$P^{1.071}S^{0.507} \times 10^{[0.969\ \Omega\ +10.82-8.448A\^{}(-0.0467)]}$
$Q_{0.2\%}$	$P^{0.988}S^{0.569} \times 10^{[0.976\ \Omega\ +10.40-7.605A\^{}(-0.0554)]}$

[1] Variables:
Q_i peak flow for i recurrence interval (a.c.e.), in cubic feet per second;
P, Mean Annual Precipitation in Inches;
S, Main-channel slope (dimensionless);
Ω, OmegaEM parameter;
A, Cumulative Drainage Area in square miles

Discharges for the 1-percent plus and 1-percent minus a.c.e. were calculated as well. These values were computed by multiplying the $Q_{1\%}$ discharges by 0.30*log10, which is the mean residual standard error for the $Q_{1\%}$ equation.

The WISE computer program was used to delineate drainage basins in shapefile format using the 50-foot resolution DEM. Basin break points were set by the user with a sub-basin target area of one square mile in size. This criterion was adjusted for streams with larger drainage areas in order to avoid excessive and unnecessary discharge breaks. Break points were also set just upstream of stream confluences. Cumulative drainage area was determined based on these automated delineations performed by WISE in combination with a stream connectivity routine that defined the stream reach segments with upstream and downstream neighbors.

WISE was used to calculate the main-channel slope for each basin. An automated routine was used to determine the longest flowpath from the headwaters of a watershed to the outlet of the point of interest based on flowpaths developed from the 50-foot DEM. Using the longest flowpath, elevations for the endpoints were determined based on the 50-foot DEM. The slope was calculated by dividing the difference in elevation with the flowpath length. The result was expressed in unit less form.

In order determine mean annual precipitation and OmegaEM values for each sub-basin, a Python script was created and run in ESRI's ArcCatalog. The script batch processed the geoprocessing needed to assign mean annual precipitation values in inches and OmegaEM values to each sub-basin.

The mean annual precipitation values were determined based on a shapefile coverage obtained from the Texas Water Development Board and available for download from the following location: http://www.twdb.texas.gov/mapping/gisdata/doc/Precipitation_Shapefile.zip

The annual precipitation values reflect data for the climatological period 1981-2010 as recorded by the Natural Resources Conservation Service (NRCS).

From USGS SIR 2009-5087, the OmegaEM parameter is a generalized terrain and climate index that expresses relative differences in peak-streamflow potential. A shapefile was developed and populated with OmegaEM values based on Figure 2 in SIR 2009-5087. This shapefile was used to determine OmegaEM values on a sub-basin basis. For streams that crossed multiple OmegaEM values, a weighted OmegaEM parameter was calculated and then applied on a sub-basin basis.

Additionally, the Python script used all inputs from each sub-basin and calculated the appropriate discharge values using the regression equations. The resulting discharge values were appended to the sub-basin shapefile attribute table.

Flood Frequency Analyses (FFA) were performed following Bulletin 17B guidelines, using PeakFQ version 7.1, for two gages on Cedar Creek. All gages evaluated are listed in Table 2.

Table 2: USGS Stream Gages Used in Analyses

Gage ID	Flooding Source and Location	Computed Drainage Area (mi^2)	Published Drainage Area (mi^2)	Period of Record
08062650	Cedar Creek Reservoir Spillway Outflow near Trinidad, TX	1,007.3	1,007.0	1966-1982
08062800	Cedar Creek near Kemp, TX	189.2	189.0	1963-2015

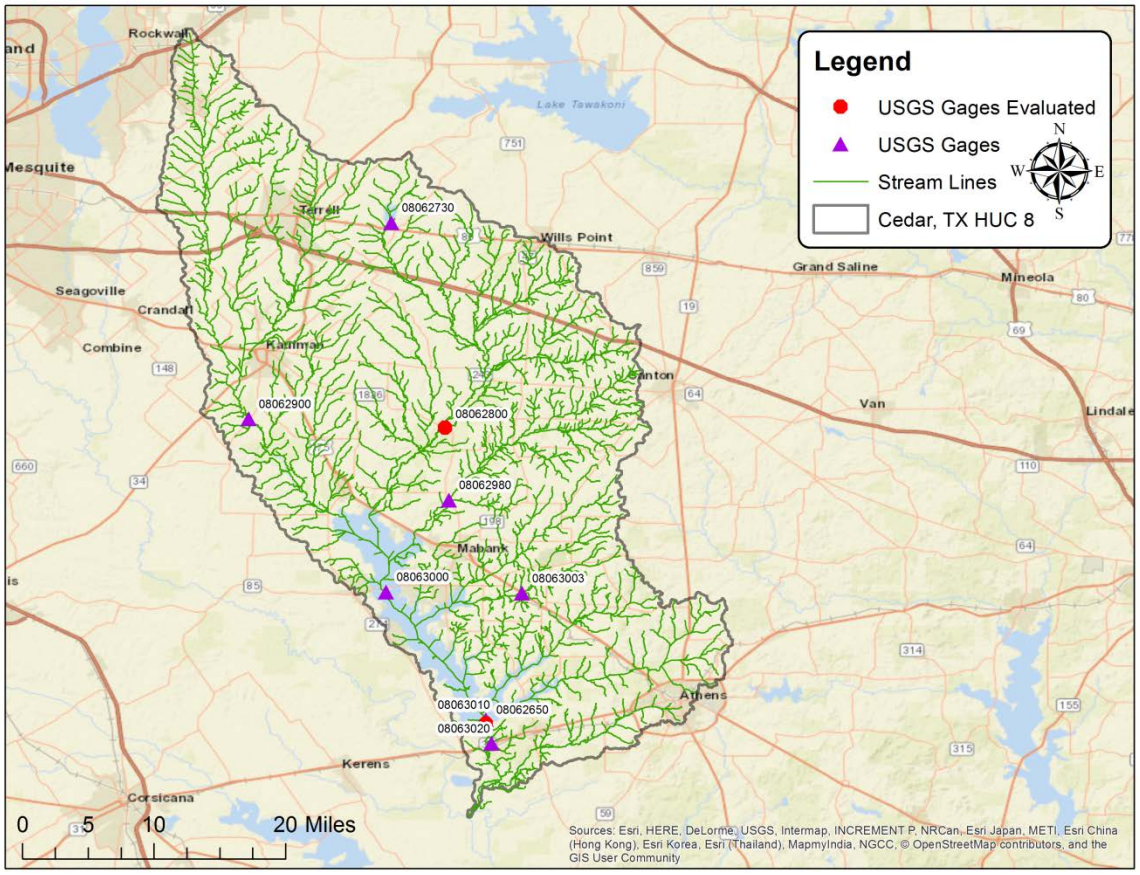


Figure 3: USGS Gage Stations within Cedar Watershed

No gage analyses were performed for Gage IDs 08063000 (Cedar Creek near Mabank, TX), 08062730 (New Terrell City Lake near Terrell, TX), 08062980 (Lacey Fork near Mabank, TX), 08063003 (South Twin Creek near Eustace, TX) or 08063020 (Cedar Creek at Trinidad, TX). The gage near Mabank was in use before the flood control structure was built in 1965 while Gage ID 08063020, and 08063003 have insignificant periods of record for peak streamflow. Gage ID 08063010, 08062980, and 08062730 are stage only gages and therefore, weren't used for discharge validation.

1.3 Hydraulics

The hydraulic approach used for this BLE analysis for the Cedar Watershed consisted of using the terrain model described in Section 1.1 in combination with hydrology input computed as described in Section 1.2 to establish water surface elevations using 1-D steady state analysis. The Hydrologic Engineering Center's River Analysis System (HEC-RAS) program version 4.1 was chosen as the computer model to compute water surface elevations on a stream by stream basis. The WISE computer program was used to establish model stream orientation, initial hydraulic cross section layout and stationing, assign n-values to cross sections, and to develop all input files for the HEC-RAS program. ESRI's ArcMap program was used to review and refine cross section layout orientation.

First pass cross section layout was performed using an automated routine in WISE based on the drainage area at the cross section location. A first draft model was created based on this initial

cross section layout and draft boundaries were developed. At this stage, a second pass inspection for cross section placement occurred. Significant refinement occurred during this step. To improve the hydraulic models, additional cross sections were added as needed to better define the BLE floodplain boundary. Cross sections were extended in locations where overtopping occurred. Orientation of cross sections was refined to improve on the perpendicular orientation to flow. Additional cross sections were added at floodplain constrictions and at downstream portions of tributaries to ensure a proper tie-in with receiving streams. Cross sections were adjusted to remove sections that intersected hydraulic crossings in the floodplain. For some of the largest studied streams, cross sections were laid out manually in order to have more reasonable spacing and better capture the constrictions in the floodplain.

Cross sections were not drawn on top of roadways or railroads but were placed at the upstream and downstream face of major roads and railroads. Ineffective flow stations were placed in the hydraulic models as appropriate to account for flow constrictions as well as at locations deemed by the engineer to be ineffective at conveying flow downstream.

Cross sections were drawn on dam tops for flood control identified dams in order to better represent ponded water upstream of the structures. It was assumed in doing this that the vast majority of the flow during a flood event would pass the spillway and that the hydraulic model would reasonably estimate flow across the spillway as represented in the hydraulic cross section. The elevations used in the modeling were checked against known elevations from past flooding events and effective Zone A boundaries and the results were determined reasonable.

Significant effort was made to start all tributaries below the receiving water surface elevations but this was not always achieved, particularly in wide, flat floodplains where small tributaries ran parallel to large streams or where road crossings or dams interfered with cross section alignments.

The relationship between drainage area and assigned channel geometry is shown in Table 3. These default values for dimensions and spacing are subject to change based on the details noted above as well as the judgment of the responsible engineer.

Table 3: Cross Section Default Parameters

Drainage area (upper limit)	XS Spacing	Channel Top Width	Channel Bottom Width	Channel Depth
1.0	500	4	3.5	0.5
2.0	500	6	4	0.5
4.0	500	11	8	0.5
8.0	500	14	10	0.5
10.0	500	17	13	0.5
15.0	600	20	16	0.5
20.0	600	25	20	0.5
25.0	600	25	20	0.5
30.0	600	25	20	0.5
40.0	600	31	25	0.5
50.0	600	31	25	1
75.0	750	40	30	1
100.0	750	50	42	1
150.0	1000	50	42	1
250.0	1000	50	42	2

Drainage area (upper limit)	XS Spacing	Channel Top Width	Channel Bottom Width	Channel Depth
500.0	1500	120	100	2
1000.0	2500	351	346	3
2000.0	4000	657	652	3
5000.0	4000	1575	1565	3

Manning's roughness coefficients (n-values) were determined using the 2011 National Land Cover Data (NLCD) dataset in combination with n-values from Chow (1959) and Calenda, et al. (2005). The association between the n-values and the NLCD Classification is shown in Table 4. Manning's n-value takeoffs were performed by WISE and the n-values were adjusted in some locations based on engineering judgment. N-values within channel banks were limited by the automated routine to a range of 0.030 to 0.070.

Table 4: Manning's "n" Roughness Based on 2011 NLCD Classification (Moore, 2011)

NLCD Classification	Minimum	Normal	Maximum	Source
Open Water	0.025	0.03	0.033	Chow 1959
Developed, Open Space	0.01	0.013	0.016	Calenda, et al. 2005
Developed, Low Intensity	0.038	0.05	0.063	Calenda, et al. 2005
Developed, Medium Intensity	0.056	0.075	0.094	Calenda, et al. 2005
Developed, High Intensity	0.075	0.1	0.125	Calenda, et al. 2005
Barren Land	0.025	0.03	0.035	Chow 1959
Deciduous Forest	0.1	0.12	0.16	Chow 1959
Evergreen Forest	0.1	0.12	0.16	Chow 1959
Mixed Forest	0.1	0.12	0.16	Chow 1959
Scrub/Shrub	0.035	0.05	0.07	Chow 1959
Grassland/Herbaceous	0.025	0.03	0.035	Chow 1959
Pasture/Hay	0.03	0.04	0.05	Chow 1959
Cultivated Crops	0.025	0.035	0.045	Chow 1959
Woody Wetlands	0.08	0.1	0.12	Chow 1959
Emergent Herbaceous Wetland	0.075	0.1	0.15	Chow 1959

The boundary condition used for the majority of the study streams was normal depth with a default value of 0.005 ft/ft. For streams with names in the National Flood Hazard Layer (NFHL) and streams with large drainage areas (generally greater than 8 square miles), the normal depth slope was calculated based on the HEC-RAS profile invert.

1.4 Quality Control

Following the initial BLE analysis in each watershed, the flood hazard area delineations created by the BLE process were reviewed for areas where the results were not ideal.

QC results indicated that some of the models should be extended to cover the scope of effective flood hazard data. Those streams were extended farther upstream to match the extents of the SFHA data.

Typical manual editing resulting from reasonability checks included adding cross-sections, adjusting orientation of cross sections, trimming cross sections and reduction of the default "V" angle of cross sections. Examples of default "V" angled cross sections are shown in Figure 4. It is

estimated that 50 percent of cross-sections were adjusted in some work areas while other areas did not require as much editing. Other examples of manual editing included adding cross-sections at confluence areas (see Figure 5 below), modification to improve perpendicular orientation at the channel, adjustment of discharge breaks to better represent flow addition points, revisions to dam spillways and dam tops, and revisions to n-values.

A major component of the QC process was an automated check that identified locations where the 1-percent a.c.e profile was crossed by another frequency or by the 1-percent plus or 1-percent minus profile. Significant effort was made to reasonably resolve all of these instances. Another automated check identified locations where there was a drawdown of greater than 0.5 foot on the 1-percent a.c.e. water surface profile. This check is particularly useful for identifying errors in the model such as a channel that is too wide, a poorly placed cross section, or a need for additional cross sections. Again, significant effort was made to reasonably resolve these drawdown situations.

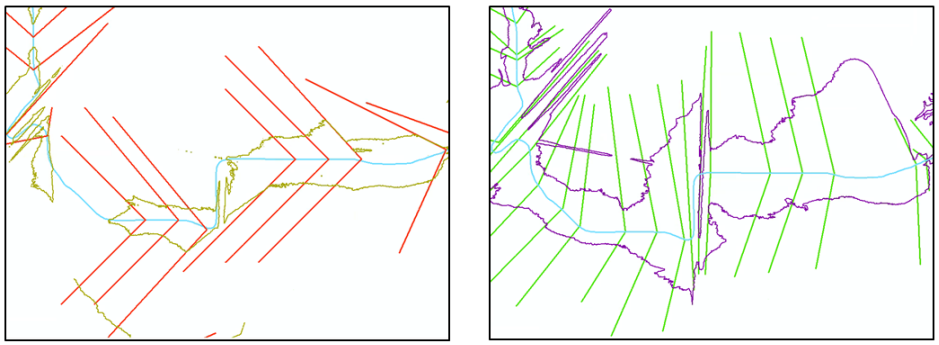


Figure 4: Default "V" angle cross-sections automated by WISE (left). Manually edited cross-sections to more accurately capture terrain (right). Resulting flood boundaries shown in gold (left) or purple (right) for clarity.

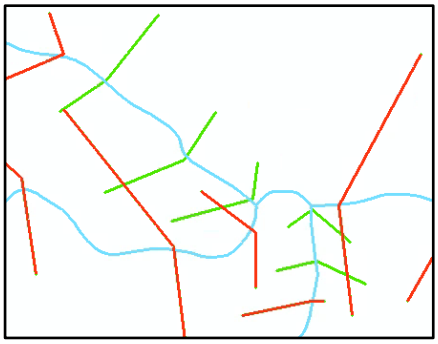


Figure 5: Manually added cross-sections (green) to improve accuracy of tie-ins at confluences.

1.5 One-percent Special Flood Hazard Area Delineation

The 1-percent and 0.2-percent boundaries were mapped using a routine that develops water surface elevation grids based on the 10-foot cell size DEM developed from the LiDAR dataset used for this project (See Section 1.1). This product was converted to a polygon for cleaning. The cleaning routine involved manual inspection of the polygons to identify and remove areas of disconnected flooding. In general, areas with a size of less than 5,000 square feet were removed and all others were investigated to determine whether they should be considered as potentially part of the SFHA. This investigation was aided by the ground DEM and aerial imagery. Manual adjustments to the polygons were made to account for spillways on dams which could not be

accurately modeled using HEC-RAS as well as disconnected areas along the flooding source that should reasonably be connected.

Following the removal of disconnected flooding areas and other boundary adjustments, the small islands in the floodplain were filled. Islands with a size between roughly 5,000 and 30,000 square feet were inspected and, in general, islands that were less than 10,000 square feet were filled.

Once the island filling process was complete, the water surface raster mapping routine was run and set to conform to the polygon boundary. This ensures that the water surface raster and the floodplain boundary are consistent with each other. The depth raster product was created at the end of the process by performing a raster subtraction with the water surface elevation raster and the ground DEM.

Challenges

Challenges encountered during BLE analyses will vary based on available data on which to run the analysis. The watershed analyses presented challenges as summarized in the following paragraphs.

As noted in Section 1.2 above, there are a significant number of dams on tributaries to Cedar Creek. Hydrologic results from regression calculations were not adjusted to take into account the impact of these structures. Further investigation should be conducted when upgrading these models.

As noted in Section 1.3 above, significant effort was made to start all tributaries below the receiving water surface elevations but this was not always achieved, particularly in wide, flat floodplains where small tributaries ran parallel to large streams or where road crossings or dams interfered with cross section alignments.

Parallel streams with shared floodplains were modeled by moving the combined discharge upstream to the cross section that begins the shared floodplain.

Results and Recommendations

The BLE results for this study produced a SFHA that compares reasonably well with the effective SFHA in some cases and narrower in other cases. These boundaries provide an additional estimated SFHA in areas that do not currently have an SFHA mapped. These results provide context for flood risk communication as part of the Discovery process, and should be verified through community work map meetings before being applied to a regulatory product.

Maps showing the BLE results are included as Appendix A.

3.1 CNMS Validation of Effective Zone A SFHA

The inventory of Zone A studies (1,050.17 miles) in the Cedar watershed were classified in CNMS with validation status of "UNKNOWN", "UNVERIFIED", "VALID" miles, and with status type of "TO BE ASSESSED" and "TO BE STUDIED". The following is a summary of the results of the CNMS validation assessment for the effective Zone A studies in the study area. Initial Assessment checks A1-A3 were evaluated for the CNMS inventory of Zone A studies.

INITIAL ASSESSMENT A1 – SIGNIFICANT TOPOGRAPHY UPDATE CHECK

This check involves determining whether a topographic data source is available that is significantly better than what was used for the effective Zone A modeling and mapping. For the study area in Cedar Watershed TX, the effective Zone A topographic data leveraged a variety of sources, but primarily based upon USGS 24K map products. The topography listed in Section 1.1 above represents a significant improvement from the effective Zone A topographic source.

INITIAL ASSESSMENT A2 – CHECK FOR SIGNIFICANT HYDROLOGY CHANGES

This check involves first determining whether new regression equations have become available from the USGS since the date of the effective Zone A study. If newer regression equations exist for the area of interest, then an engineer must determine whether these regression equations would significantly affect the 1-percent annual chance flow.

The source for the effective Zone A study areas located in Henderson, Kaufman, and Van Zandt Counties in TX is unknown due to the lack of effective data. It is known that the study analyses for these counties were performed prior to the most recent publication SIR 2009-5087, *Regression Equations for Estimation of Annual Peak-Streamflow Frequency for Undeveloped Watersheds in Texas Using an L-moment-Based, PRESS-Minimized, Residual-Adjusted Approach* (2009)

Rockwall County effective Zone As were developed using the publication WRIR 96-4307, *Regional Equations for Estimation of Peak-Streamflow Frequency for Natural Basins in Texas* (1997).

Due to the lack of study data, the significant impact that the updated regression equations would have on the 1-percent annual chance flow in Cedar Watershed TX is unknown.

INITIAL ASSESSMENT A3 – CHECK FOR SIGNIFICANT DEVELOPMENT

This check involves using the National Urban Change Indicator (NUCI) dataset to assess increased urbanization in the watershed of the Zone A study. If the percentage of urban area within the HUC-12 watershed containing the effective Zone A study is 15% or more, and has increased by 50% or more since the effective analysis, the study would fail this check. Although the NUCI data

provide year-to-year changes in urbanization, the NLCD also is needed to establish a baseline of urban land cover for this analysis. The check for significant development in this watershed was completed by evaluating percentage of urban change at the HUC-12 level. Of the 29 HUC-12 polygons within the study area, none show a percentage of 15% or more urban area, thus none have applicable significant development.

Table 5: Zone A Initial Assessment Results

Assessment Check	Pass / Fail	Notes
A1 – Topography	Fail	Topographic described in Section 1.1 is significantly better than effective topographic source.
A2 – Hydrology	Pass	Newer Regression Equations published in 2009 are available for studies located in Henderson, Kaufman, Rockwall, and Van Zandt Counties, TX. The significant impact the newer regression equations would have on the 1-percent annual chance flow is unknown.
A3- Development	Pass	0 of the 29 HUC-12s fail.

VALIDATION CHECK A4 – CHECK OF STUDIES BACKED BY TECHNICAL DATA

Zone A studies that pass all initial assessment checks described above may be categorized as "Valid" in the CNMS Inventory only if the effective Zone A study is supported by modeling or sound engineering judgment and all regulatory products are in agreement. If the effective Zone A study passes all initial assessment checks, but is not supported by modeling, or if the original engineering method used is unsupported or undocumented, a comparison of the BLE results and effective Zone A's is performed. Streams located in Henderson, Kaufman, Rockwall, and Van Zandt Counties have been marked as fail in the A4 check due to lack of evidence in the FIS report and on FEMA's Mapping Information Platform (MIP) detailing study methods.

VALIDATION CHECK A5 – COMPARISON OF BLE AND EFFECTIVE ZONE A

The BLE /effective Zone A comparison method leverages the existing Floodplain Boundary Standard (FBS) certification procedures described in FEMA SID 113, but with a slight modification. This modified FBS comparison approach uses the 1-percent plus and 1-percent minus flood profiles and horizontal and vertical tolerances described in FEMA's Automated Engineering guidance document dated May 2016. For the comparison of BLE and effective Zone A in the Texas study area, the following vertical and horizontal tolerances were used to conduct the modified FBS procedure. One point was placed every 200 feet along the floodplain boundaries for comparison.

Vertical Tolerance: +/- 10 feet (one-half contour interval of assumed effective topographic source).
Horizontal Tolerance: +/- 75 feet (standard horizontal tolerance for BLE comparison testing).

Of the 856 modeled BLE streams in the study area, 811 were found to correspond (within the tolerance limits) with effective Zone A flood zones. Comparison results are summarized to the individual reach level. Streams where the percentage of passing FBS sample points is greater than or equal to 85% are marked as "Pass", otherwise marked as "Fail".

VALIDATION RESULTS

Based on the validation assessments and BLE comparison results described above, the CNMS inventory of Zone A studies in the Cedar Watershed study area has been updated, with 384.6 miles categorized as UNVERIFIED – TO BE STUDIED, 321.1 miles categorized as UNVERIFIED – BEING STUDIED, 266.3 miles categorized as UNKNOWN – TO BE ASSESSED and 78.1 miles categorized as VALID – BEING STUDIED. Total miles in each of these categories are summarized in Table 6 and illustrated in Figure 6 below. It should be noted that due to the lack of effective digital data in this watershed approximately 17% of the HUC-12s have no data to evaluate.

Table 6: Zone A Validation Results

Validation Status	Status Type	Cedar (miles)
VALID	BEING STUDIED	78.1
UNVERIFIED	BEING STUDIED	321.1
	TO BE STUDIED	384.6
UNKNOWN	TO BE ASSESSED	266.3
Total Miles		1,050.1

Table 7: BLE Comparison Results

HUC-12 Watershed		Total FBS points	Fail	Pass	%Pass	BLE Comparison Pass? (>85%)	Priority Score
Watershed Name	Watershed Number						
Cedar	All Streams	53,971	13,146	40,825	76%	Fail	
Allen Creek-Cedar Creek	120301070203	4,423	1,526	2,897	65%	Fail	27.1
Big Cottonwood Creek-Kings Creek	120301070108	468	225	243	52%	Fail	39.9
Caney Creek	120301070204	3,299	706	2,593	79%	Fail	17.1
Caney Creek-Cedar Creek	120301070310	1,258	196	1,062	84%	Fail	10
Caney Creek-Cedar Creek Reservoir	120301070309	431	73	358	83%	Fail	8.5
Clear Creek-Cedar Creek Reservoir	120301070307	2,847	384	2,463	87%	Pass	6.5
Dry Lacy Fork	120301070301	4,053	735	3,318	82%	Fail	14.2
Headwaters Big Cottonwood Creek	120301070109	1,229	477	752	61%	Fail	31
Eagans Branch-Kings Creek	120301070106	1,236	220	1,016	82%	Fail	14.1
Headwaters Caney Creek	120301070308	1,244	108	1,136	91%	Pass	5.1
Headwaters Kings Creek	120301070105	2,332	508	1,824	78%	Fail	15.5
High Point Creek	120301070102	1,060	270	790	75%	Fail	22.9
Kemp Lake-Cedar Creek Reservoir	120301070206	2,251	549	1,702	76%	Fail	19
Lacy Fork-Cedar Creek Reservoir	120301070302	3,829	844	2,985	78%	Fail	15.7
Little Brushy Creek-Kings Creek	120301070107	909	296	613	67%	Fail	26.3

HUC-12 Watershed		Total FBS points	Fail	Pass	%Pass	BLE Comparison Pass? (>85%)	Priority Score
Watershed Name	Watershed Number						
Little Cottonwood Creek-Kings Creek	120301070110	2,021	575	1,446	72%	Fail	22.8
Lower Big Brushy Creek	120301070104	636	154	482	76%	Fail	19.8
McAllister Slough-Cedar Creek	120301070311	1,338	652	686	51%	Fail	33.3
Middle Big Brushy Creek	120301070103	871	186	685	79%	Fail	17.9
Muddy Cedar Creek	120301070201	1,916	568	1,348	70%	Fail	16.9
North Twin Creek-Cedar Creek Reservoir	120301070305	2,303	272	2,031	88%	Pass	6.9
Persimmon Branch-Cedar Creek Reservoir	120301070303	608	113	495	81%	Fail	12.6
Prairie Creek-Cedar Creek Reservoir	120301070304	1,085	355	730	67%	Fail	22.4
Rocky Cedar Creek	120301070202	1,338	407	931	70%	Fail	19.3
South Twin Creek-Cedar Creek Reservoir	120301070306	2,607	480	2,127	82%	Fail	10.5
Town of Kemp-Cedar Creek Reservoir	120301070111	948	269	679	72%	Fail	21.6
Upper Big Brushy Creek	120301070101	3,266	859	2,407	74%	Fail	23.7
Walnut Creek-Cedar Creek	120301070312	1,462	332	1,130	77%	Fail	13.7
Williams Creek-Cedar Creek	120301070205	2,703	807	1,896	70%	Fail	23.9

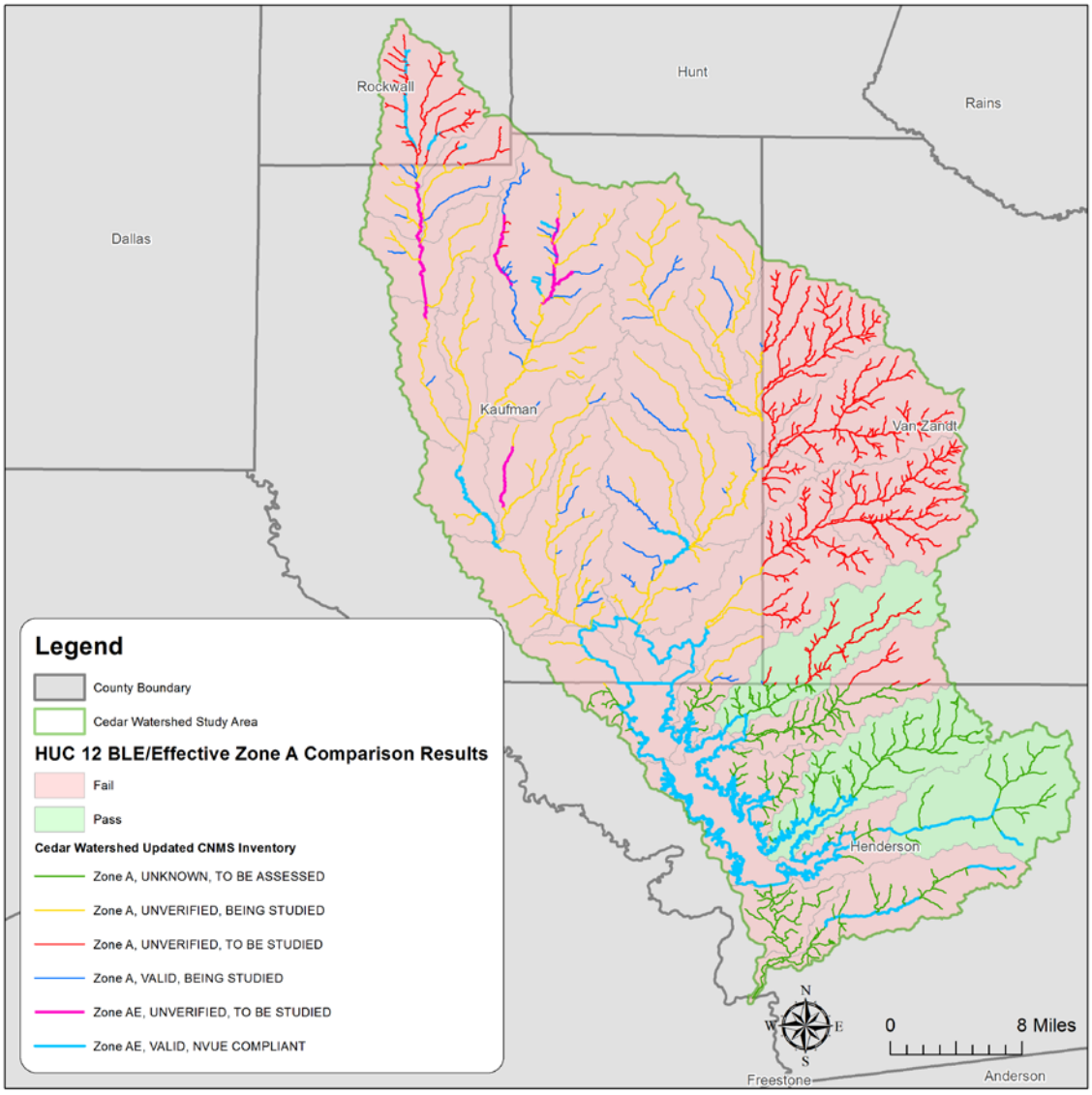


Figure 6: Cedar Watershed CNMS Validation Results

An overall risk for each HUC-12 watershed was calculated using the National Flood Risk Percentages Dataset and its proportional area. The weighted risk was multiplied by the percentage of points in the watershed that failed the CNMS comparison to effective to determine the priority score. Figure 7 below shows the range of the Cedar HUC-8 priority scores which can be used to initiate discussions during the Discovery phase.

For Cedar Watershed, Big Cottonwood Creek – Kings Creek HUC-12 was determined to have the highest priority score and the most need while Headwaters Caney Creek HUC-12 has the lowest score.

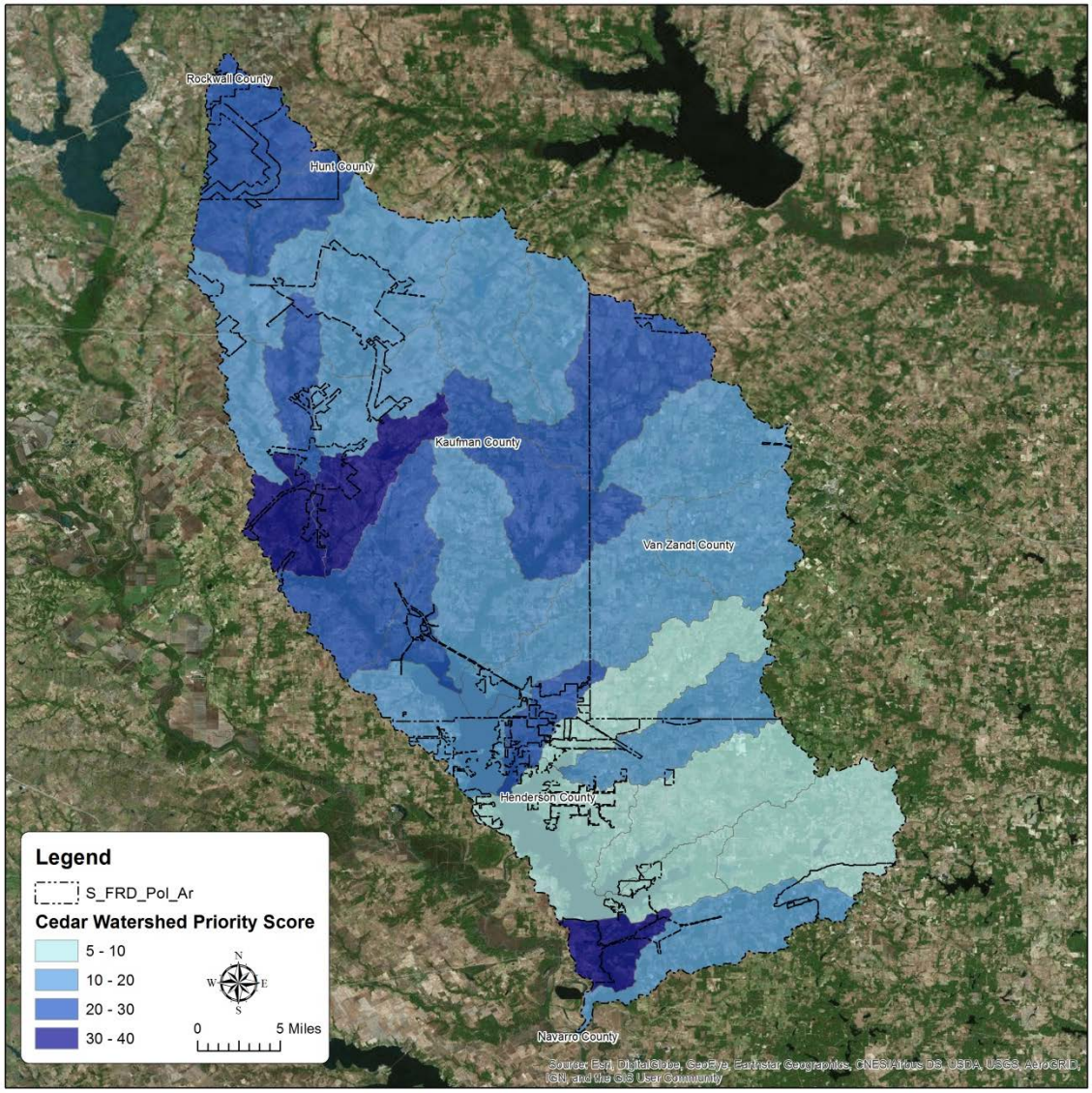


Figure 7: Ranking of Cedar Watershed HUC-12s

3.2 Flood Risk Analysis

An advanced flood risk analysis was performed using the updated 1-percent-annual-chance grid (known as 'refined' grid) created for this project. The loss analysis uses 2010 census data and the subsequent results are stored in the L_RA_Results table.

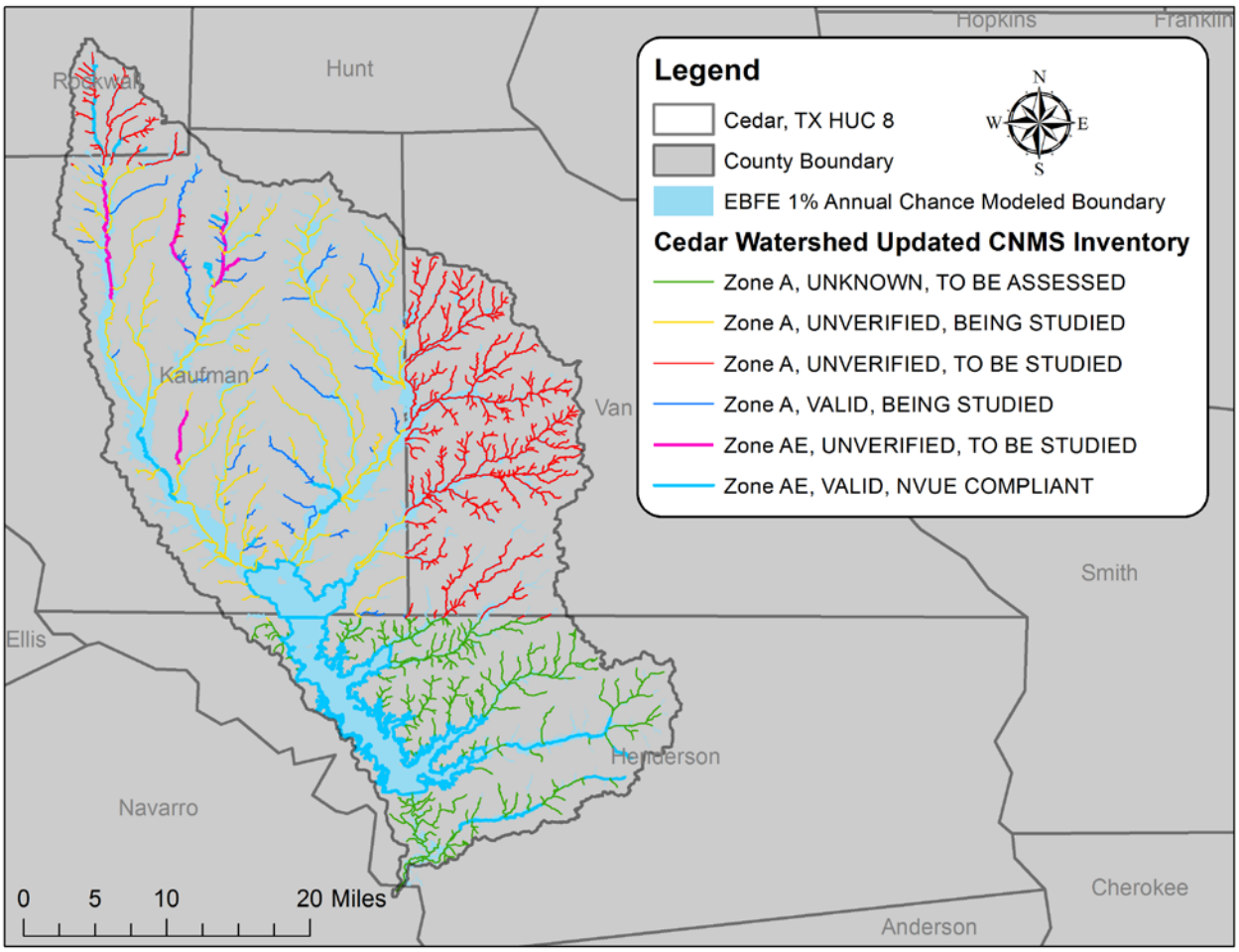
Hazus version 4.0 was used for the loss analysis.

The losses are reported via census blocks. It is important to note that Hazus version 4.0 uses dasymetric census blocks. Dasymetric mapping removes undeveloped areas (such as areas covered by other bodies of water, wetlands, or forests) from the Census blocks, changing their shape and reducing their size in these areas. For more information on dasymetric data visit FEMA's Media Library for the Hazus-MH Data Inventories: Dasymetric vs. Homogenous, or Hazus 3.0 Dasymetric Data Overview.

References

1. Watershed Concepts, a Division of Hayes, Seay, Mattern & Mattern. *Watershed Information System (WISE),* Version 4.1.0. 2008
2. Asquith, William H. and Roussel, Meghan C., 2009, Regression Equations for Estimation of Annual Peak-Streamflow Frequency for Undeveloped Watersheds in Texas Using an L-moment-Based, PRESS-Minimized, Residual-Adjusted Approach: U.S. Geological Survey Scientific Investigations Report 2009–5087.
3. USGS, "Estimating Magnitude and Frequency of Floods Using PeakFQ Program: USGS Fact Sheet", 2006.
4. USGS. Multi-Resolution Land Characteristics Consortium. *National Land Cover Database 2011*. (http://www.mrlc.gov/nlcd2011.php).
5. Chow, Ven T. "Development of Uniform Flow and It Formulas." *Open Channel Hydraulics*. Caldwell, NJ: Blackburn, 1959. 109-113. Print.
6. U.S. Army Corps of Engineers, Hydrologic Engineering Center. (January 2010). HEC-RAS River Analysis System, Version 4.1.0. Davis, California.
7. FEMA, "Guidance for Flood Risk Analysis and Mapping – Automated Engineering", May 2016. (https://www.fema.gov/media-library-data/1469144112748-f3c4ecd90cb927cd200b6a3e9da80d8a/Automated_Engineering_Guidance_May_2016.pdf).
8. Texas Precipitation – Average monthly and annual precipitation for the climatological period 1981-2010. Data from NRCS. Retrieved October 2015 from (http://www.twdb.texas.gov/mapping/gisdata.asp).
9. Texas Water Development Board, Cedar Creek Reservoir (Trinity River Basin), http://www.twdb.texas.gov/surfacewater/rivers/reservoirs/cedar_creek_trinity/index.asp

Appendix A BLE Maps



Appendix III: Additional Data

Discovery Figures

Figure 01:

HUC Locator Map

CEDAR WATERSHED

October 31, 2017

FEMA

North Central Texas Council of Governments

Hunt County
Rockwall County
Rains County
Van Zandt County
Dallas County
Kaufman County
Ellis County
Navarro County
Henderson County

Fate
Rockwall
McLendon-Chisholm
Forney
Terrell
Wills Point
Talty
Post Oak Bend
Oak Ridge
Canton
Kaufman
Scurry
Oak Grove
Grays Prairie
Kemp
Mabank
Seven Points
Gun Barrel City
Eustace
Tool
Payne Springs
Enchanted Oaks
Log Cabin
Athens
Caney City
Star Harbor
Malakoff
Trinidad

WATERSHED LOCATOR
STATE OF TEXAS

NCTCOG Boundary

Map Symbology

- Cedar Creek
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lakes
- Cedar Watershed Discovery County
- County Boundaries

0 6 12 Miles

N

Figure 02:
Federal House Congressional Districts

CEDAR WATERSHED

October 31, 2017

FEMA

North Central Texas Council of Governments

Rockwall

Hunt County

Rockwall County

Rains County

District 4

Dallas County

Van Zandt County

Kaufman

Kaufman County

District 5

Canton

Ellis County

Navarro County

Henderson County

Athens

District 6

Corsicana

U.S. House District Representatives

District 4: Rep. John Ratcliffe (R)
District 5: Rep. Jeb Hensarling (R)
District 6: Rep. Joe Barton (R)

Senators

Sen. John Cornyn (R)
Sen. Ted Cruz (R)

WATERSHED LOCATOR
STATE OF TEXAS

NCTCOG Boundary

Map Symbology

- County Seat
- Cedar Creek
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lakes
- Cedar Watershed Discovery County
- County Boundaries

Federal House Districts (2017)

- District 4
- District 5
- District 6

0 6 12 Miles

N

Figure 03:
State House Congressional Districts

CEDAR WATERSHED

October 31, 2017

FEMA

North Central Texas Council of Governments

Rockwall

Hunt County

Rockwall County

Rains County

District 33

Dallas County

Kaufman

Kaufman County

District 4

District 2

Van Zandt County

Canton

Ellis County

Navarro County

District 10

Athens

Henderson County

Corsicana

District 8

State House District Representatives

District 2: Rep. Dan Flynn (R)
District 4: Rep. Stuart Spitzer (R)
District 8: Rep. Byron Cook (R)
District 10: Rep. John Wray (R)
District 33: Rep. Scott Turner (R)

WATERSHED LOCATOR
STATE OF TEXAS

NCTCOG Boundary

Map Symbology

- County Seat
- Cedar Creek
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lakes
- Cedar Watershed Discovery County
- County Boundaries

State House Districts (2017)

- District 2
- District 4
- District 8
- District 10
- District 33

0 6 12 Miles

N

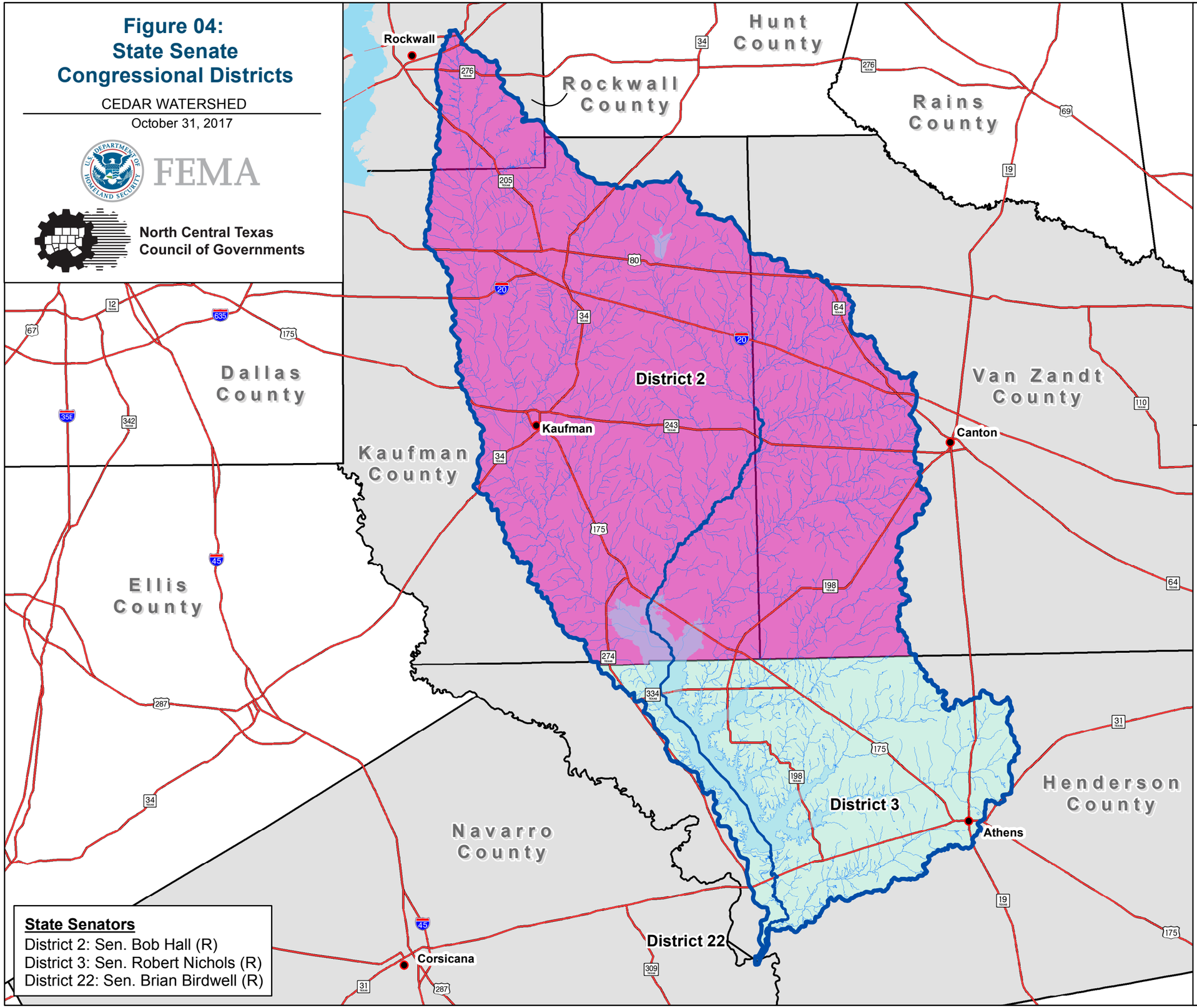
Figure 04:
State Senate Congressional Districts

CEDAR WATERSHED

October 31, 2017

FEMA

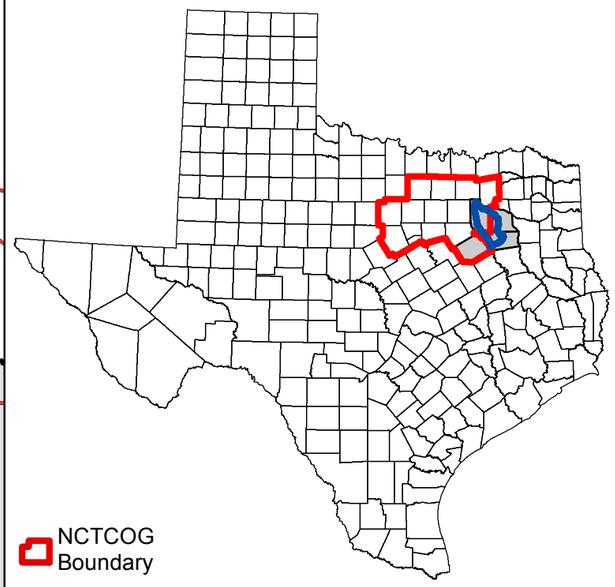
North Central Texas Council of Governments



State Senators

District 2: Sen. Bob Hall (R)
District 3: Sen. Robert Nichols (R)
District 22: Sen. Brian Birdwell (R)

WATERSHED LOCATOR
STATE OF TEXAS



Map Symbology

- County Seat
- Cedar Creek
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lakes
- Cedar Watershed Discovery County
- County Boundaries

State Senate Districts (2017)

- District 2
- District 3
- District 22

0 6 12 Miles

N

Figure 05:

Population Density

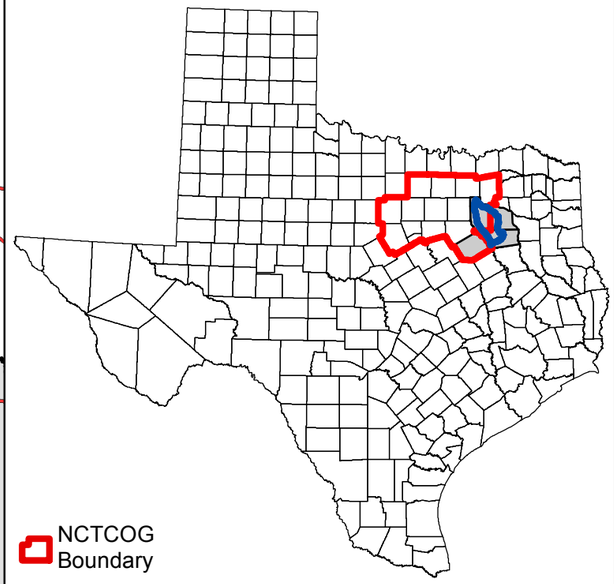
CEDAR WATERSHED

October 31, 2017

FEMA

North Central Texas Council of Governments

WATERSHED LOCATOR
STATE OF TEXAS



NCTCOG Boundary

Map Symbology

- Cities
- Cedar Creek
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lakes
- Cedar Watershed Discovery County
- County Boundaries

Population Density (2010)

- Very Low
- Low
- Medium
- High

*Data as of May 2017

CNMS Stream Status*

- Unverified, To Be Studied
- Valid, NVUE Compliant

0 6 12 Miles

N

Figure 06:

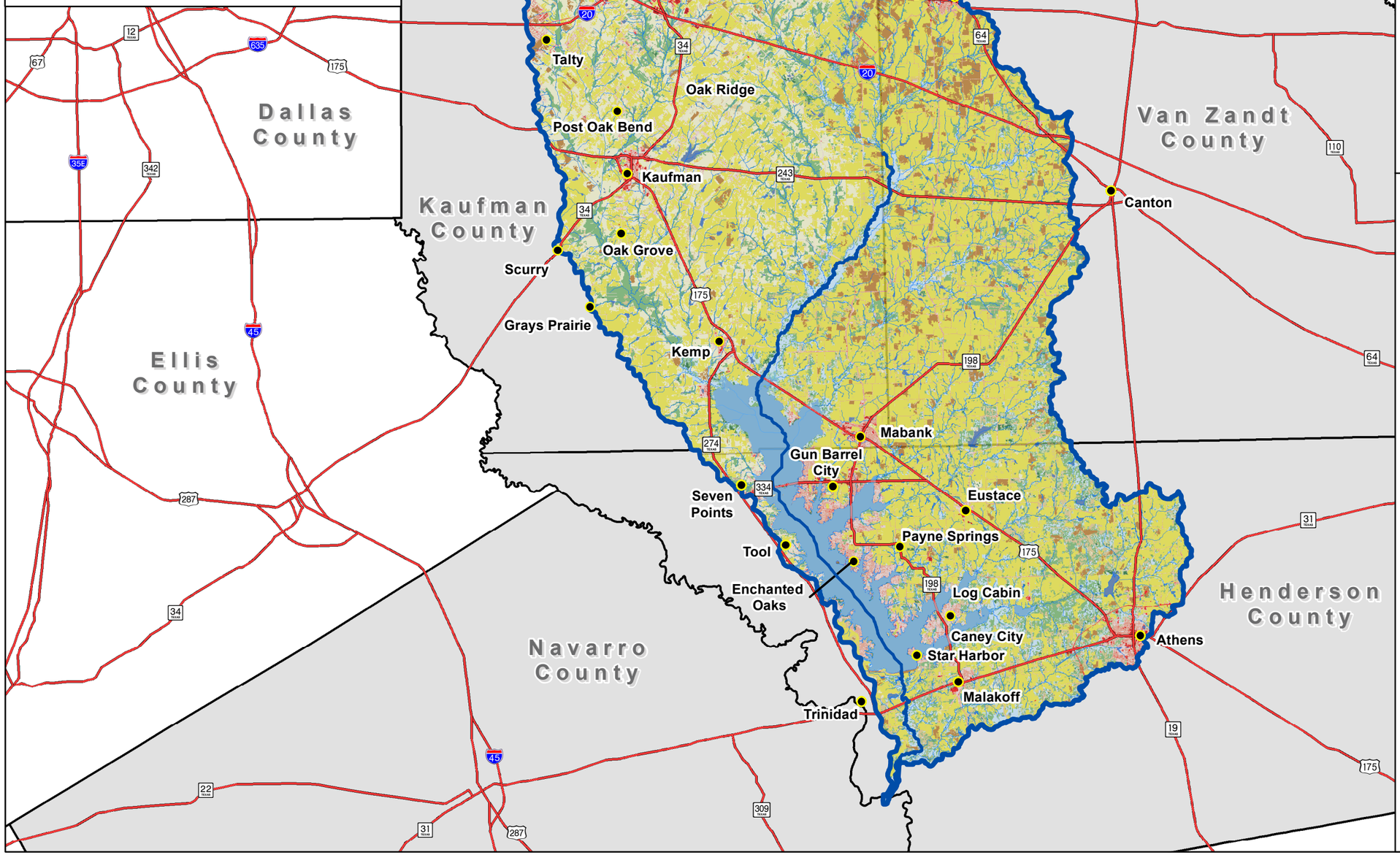
Land Use

CEDAR WATERSHED

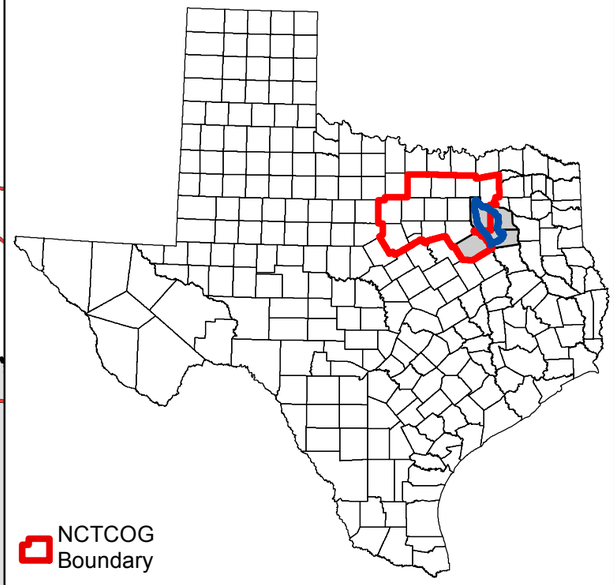
October 31, 2017

FEMA

North Central Texas Council of Governments



WATERSHED LOCATOR STATE OF TEXAS



Map Symbology

- Cities
- Cedar Creek
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lakes
- Cedar Watershed Discovery County
- County Boundaries

Landuse (2011 NLCD)*

- Open Water
- Developed Open Space
- Developed Low Intensity
- Developed Medium Intensity
- Developed High Intensity
- Barren Land
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrubs
- Grassland
- Pasture
- Cultivated Crops
- Woody Wetlands
- Herbaceous Wetlands

*NLCD is National Land Cover Dataset, created by the U.S. Geological Survey.

0 6 12 Miles

N

Figure 07:

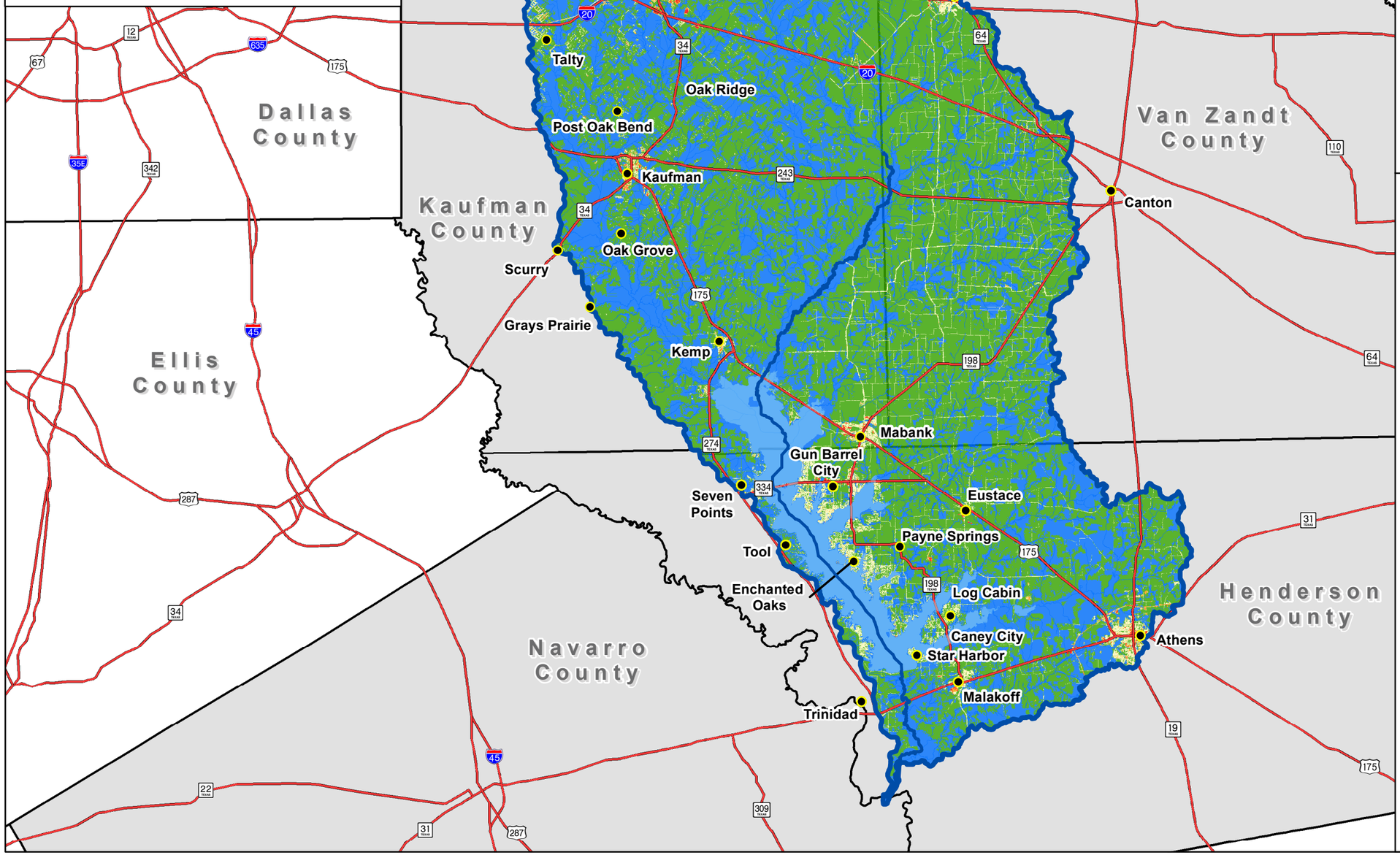
Urban Cover

CEDAR WATERSHED

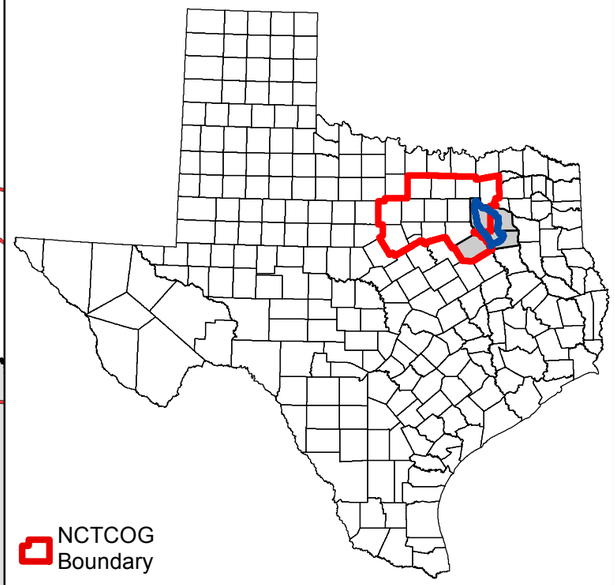
October 31, 2017

FEMA

North Central Texas Council of Governments



WATERSHED LOCATOR
STATE OF TEXAS



NCTCOG Boundary

Map Symbology

- Cities
- Cedar Creek
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lakes
- Cedar Watershed Discovery County
- County Boundaries

Urban Cover (2011 NLCD)*

- 1 - Undeveloped
- 2 - Farmland
- 3 - Developed, Low Intensity
- 4 - Developed, Medium Intensity
- 5 - Developed, High Intensity

*NLCD is National Land Cover Dataset, created by the U.S. Geological Survey.

0 6 12 Miles

N

Figure 08:

Population Change

CEDAR WATERSHED

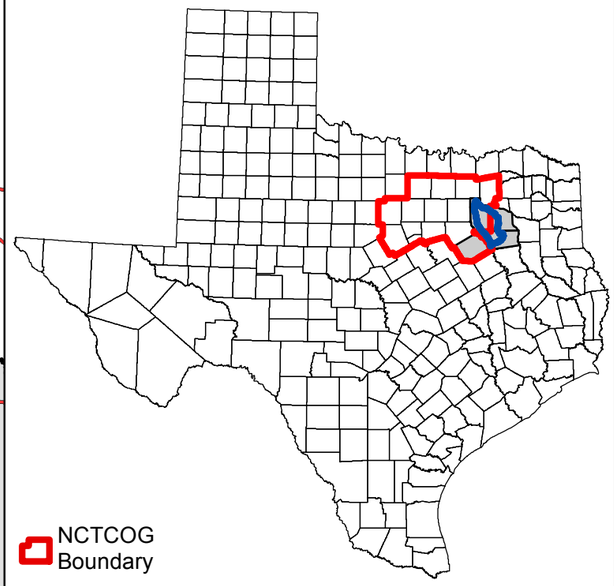
October 31, 2017

FEMA

North Central Texas Council of Governments

State Senators
District 2: Sen. Bob Hall (R)
District 3: Sen. Robert Nichols (R)
District 22: Sen. Brian Birdwell (R)

WATERSHED LOCATOR
STATE OF TEXAS



Map Symbology

- Cities
- Cedar Creek
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lakes
- Cedar Watershed Discovery County
- County Boundaries

Percent Population Change (2000-2010)*

- 0 - 25%
- 25 - 50%
- 50 - 75%
- 75 - 100%
- More than 100%

*Source: 2000, 2010 U.S.

0 6 12 Miles

N

Figure 09:

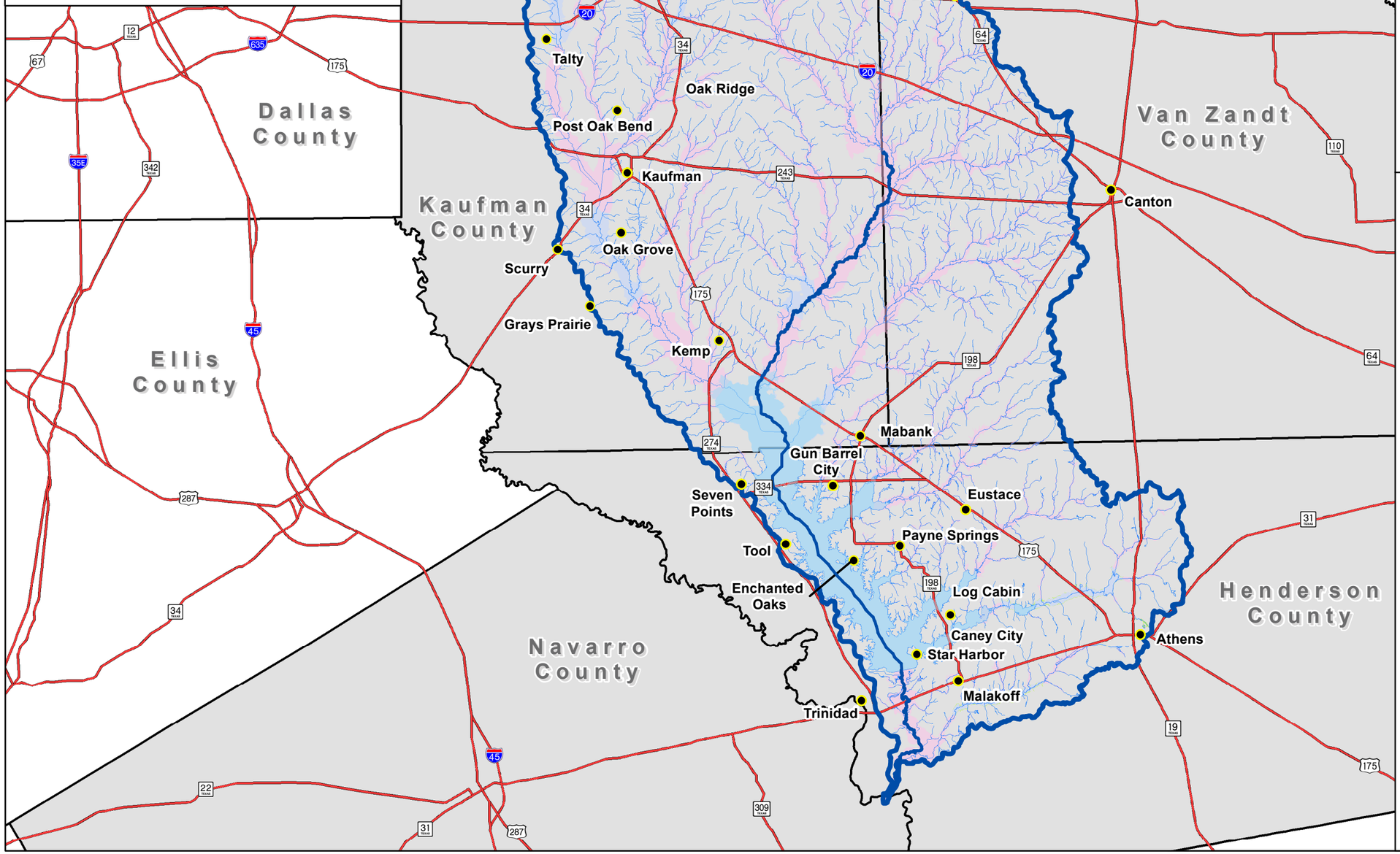
Flood Hazard Map

CEDAR WATERSHED

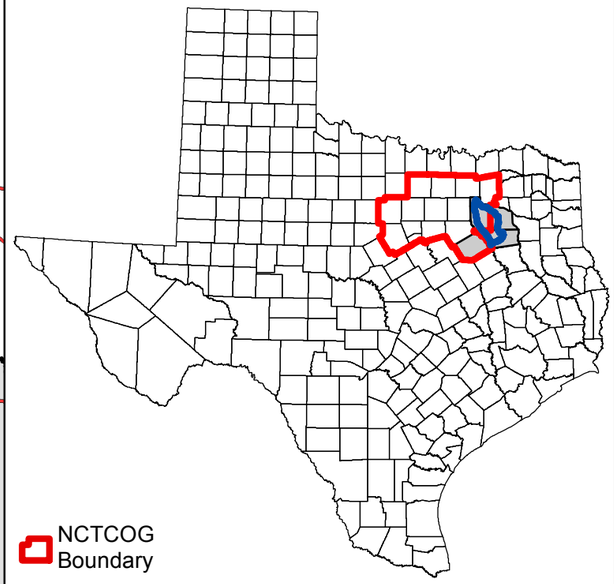
October 31, 2017

FEMA

North Central Texas Council of Governments



WATERSHED LOCATOR
STATE OF TEXAS



NCTCOG Boundary

Map Symbology

- Cities
- Cedar Creek
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lakes
- Cedar Watershed Discovery County
- County Boundaries

Effective FEMA Floodplains (2016)

- Zone A (100-Yr, Approximate)
- Zone AE (100-Yr, Detailed)
- Zone X (500-Yr, Detailed)

0 6 12 Miles

N

Figure 10:

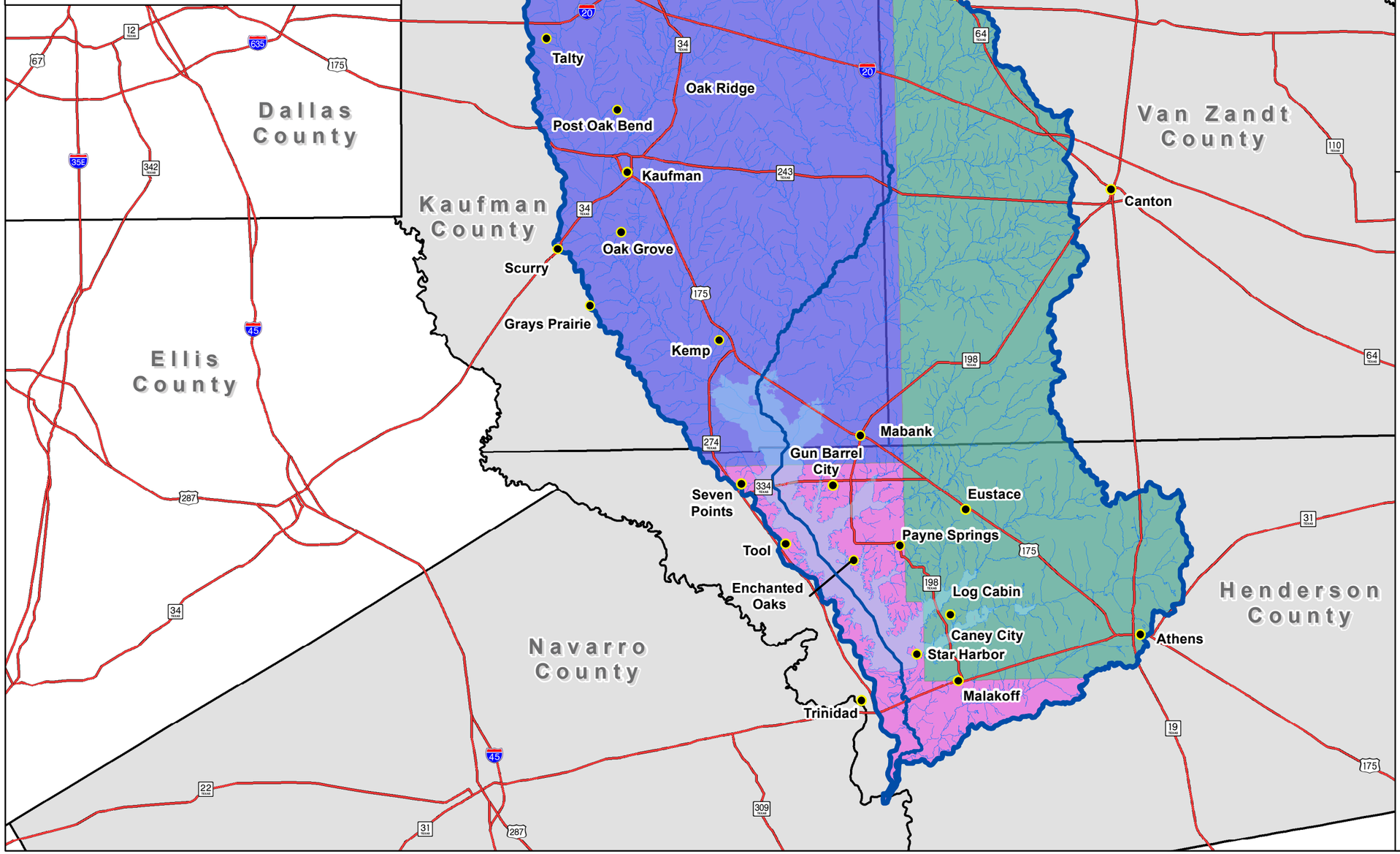
Topographic Data

CEDAR WATERSHED

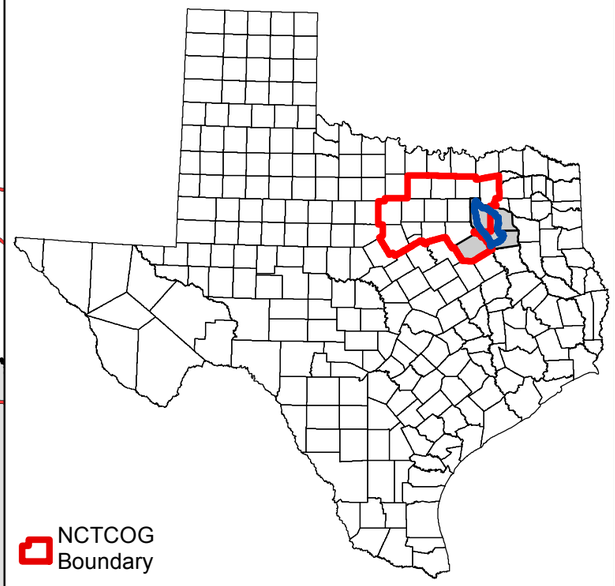
October 31, 2017

FEMA

North Central Texas Council of Governments



WATERSHED LOCATOR
STATE OF TEXAS



Map Symbology

- Cities
- Cedar Creek
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lakes
- Cedar Watershed Discovery County
- County Boundaries

Available Topography Data

- 2009 Dallas County LiDAR
- 2011 Kaufman County LiDAR
- 2012 Ellis, Navarro, & Johnson County LiDAR
- 2014 Henderson, Smith, Van Zandt, & Trinity River LiDAR
- 2015 FEMA/USGS Neches Basin
- 2015 NCTCOG LiDAR

0 6 12 Miles

N

Figure 11:
High Water Marks & Low Water Crossings

CEDAR WATERSHED

October 31, 2017

FEMA

North Central Texas Council of Governments

Fate
Rockwall
McLendon-Chisholm
Forney
Terrell
Wills Point
Talty
Oak Ridge
Post Oak Bend
Kaufman
Canton
Oak Grove
Scurry
Grays Prairie
Kemp
Mabank
Gun Barrel City
Seven Points
Eustace
Payne Springs
Tool
Enchanted Oaks
Log Cabin
Caney City
Star Harbor
Athens
Malakoff
Trinidad

Hunt County
Rockwall County
Rains County
Van Zandt County
Kaufman County
Dallas County
Ellis County
Navarro County
Henderson County

WATERSHED LOCATOR
STATE OF TEXAS

NCTCOG Boundary

Map Symbology

- Cities
- High Water Mark
- Low Water Crossing
- Cedar Creek
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lakes
- Cedar Watershed Discovery County
- County Boundaries

0 6 12 Miles

N

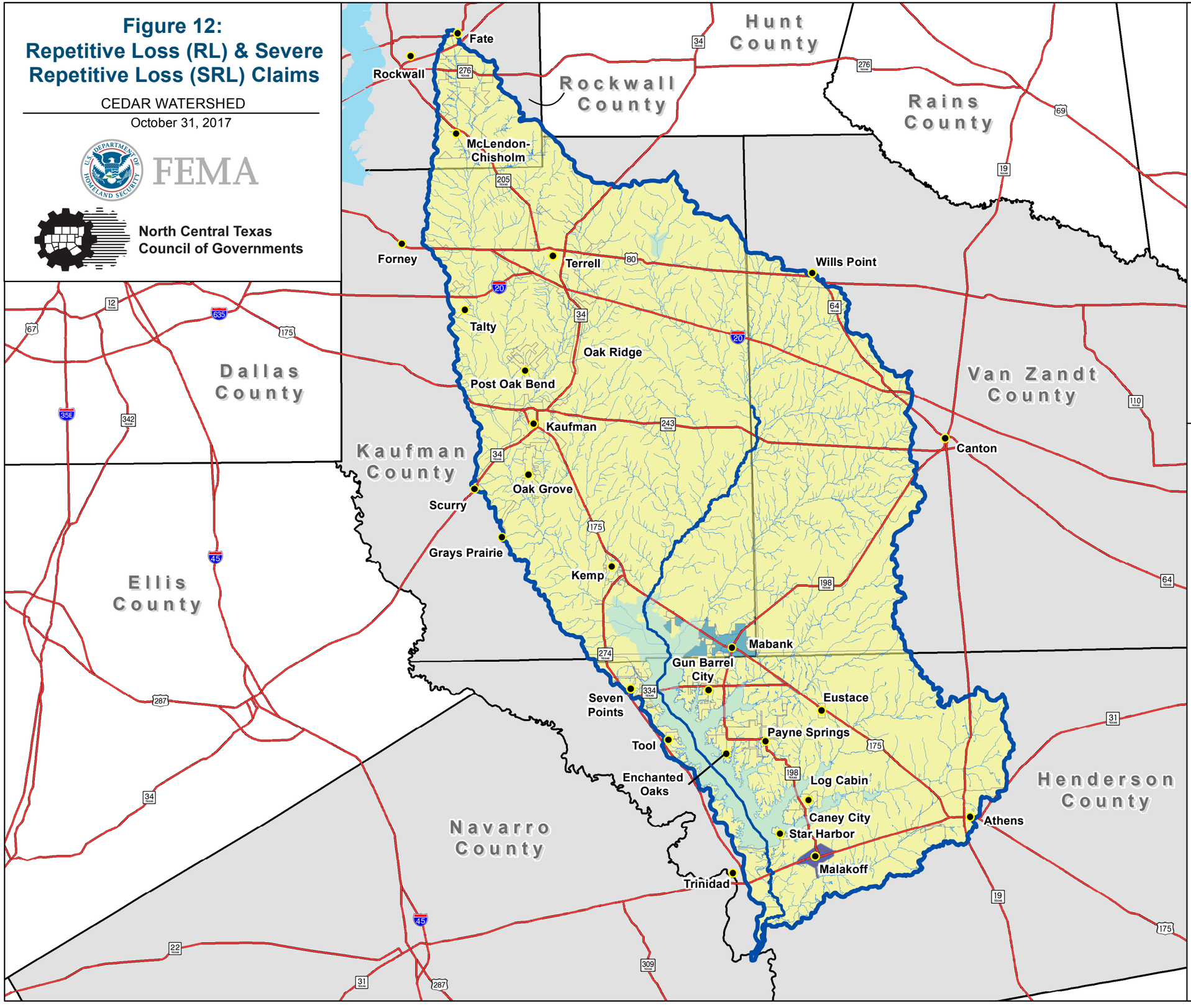
Figure 12:
Repetitive Loss (RL) & Severe Repetitive Loss (SRL) Claims

CEDAR WATERSHED

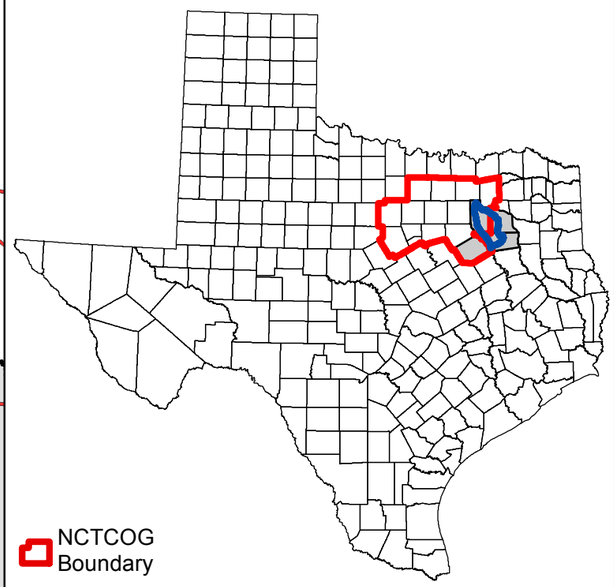
October 31, 2017

FEMA

North Central Texas Council of Governments



WATERSHED LOCATOR
STATE OF TEXAS



Map Symbology

- Cities
- Cedar Creek
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lakes
- Cedar Watershed Discovery County
- County Boundaries

Total RL/SRL Claims (2015 FEMA)

- 0
- 4
- 6

0 6 12 Miles

N

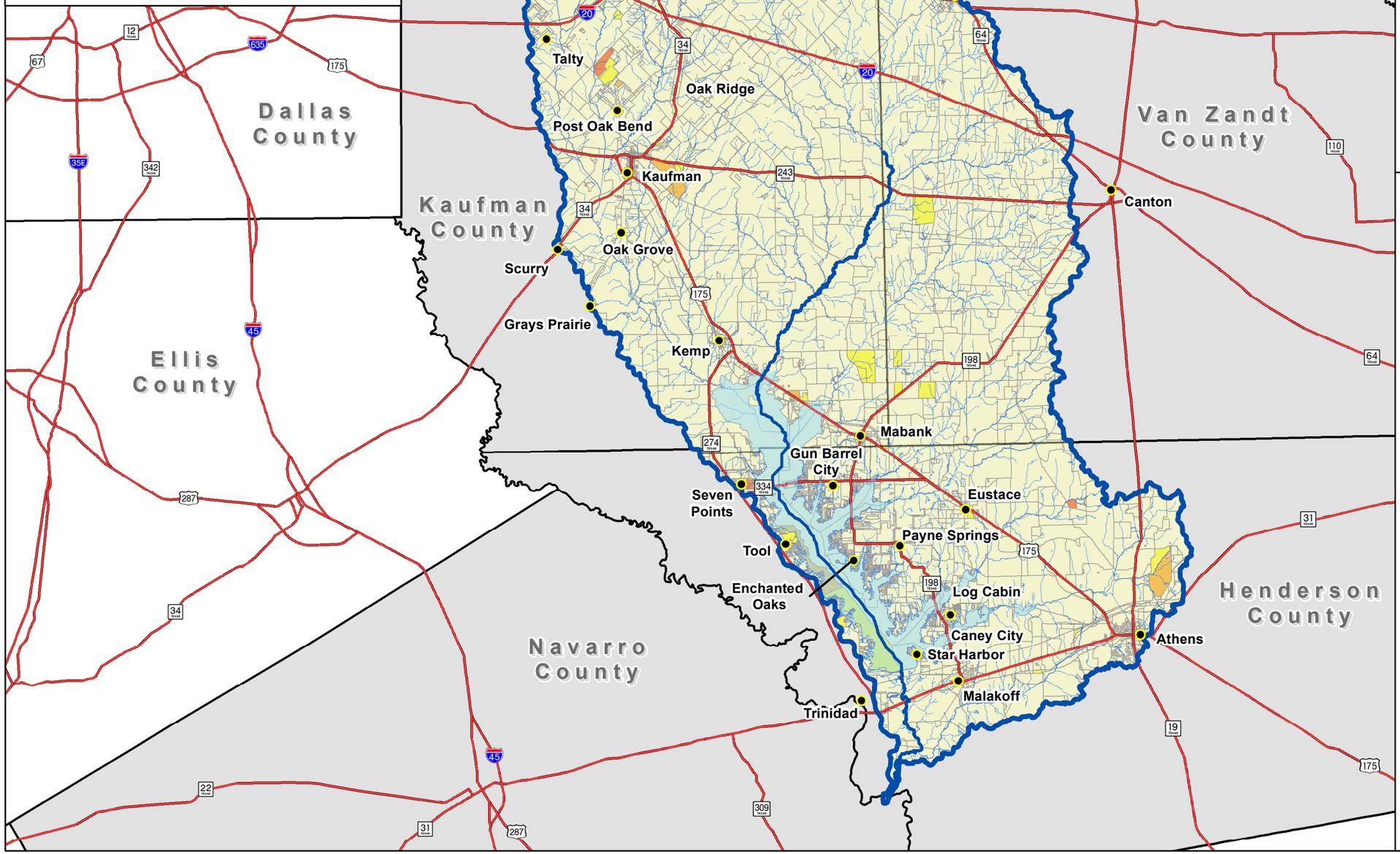
Figure 13: Flood Risk - Potential Losses

CEDAR WATERSHED

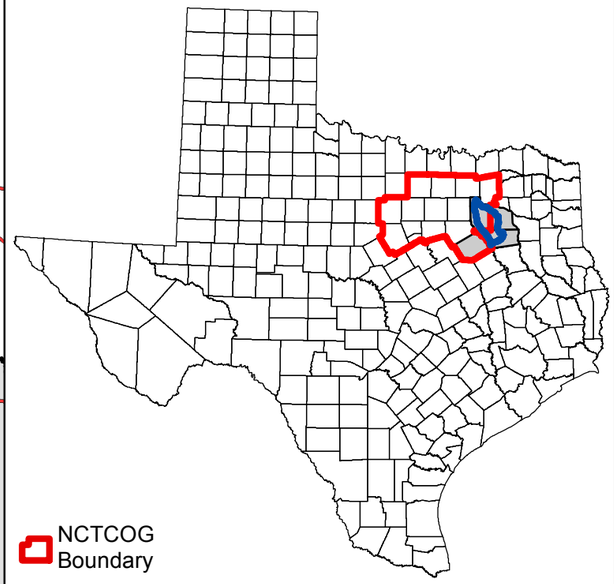
October 31, 2017

FEMA

North Central Texas Council of Governments



WATERSHED LOCATOR
STATE OF TEXAS



NCTCOG Boundary

Map Symbology

- Cities
- Cedar Creek
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lakes
- Cedar Watershed Discovery County
- County Boundaries

Flood Risk*

- Very Low
- Low
- Medium
- High
- Very High

*Note: Flood Risk data source is FEMA 2010 HAZUS Average Annualized Loss (AAL) Study

0 6 12 Miles

N

Figure 14:

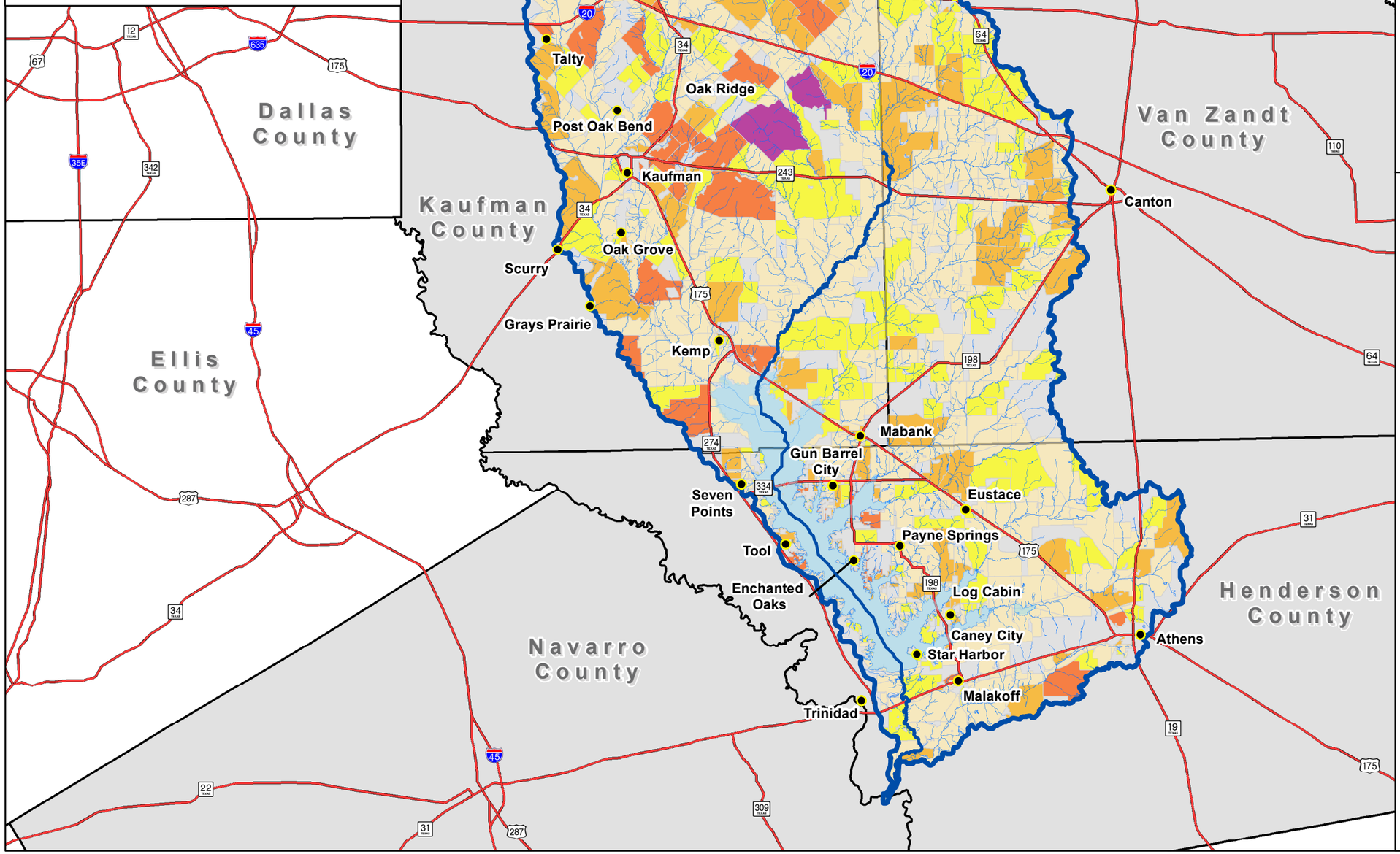
Population Vulnerability

CEDAR WATERSHED

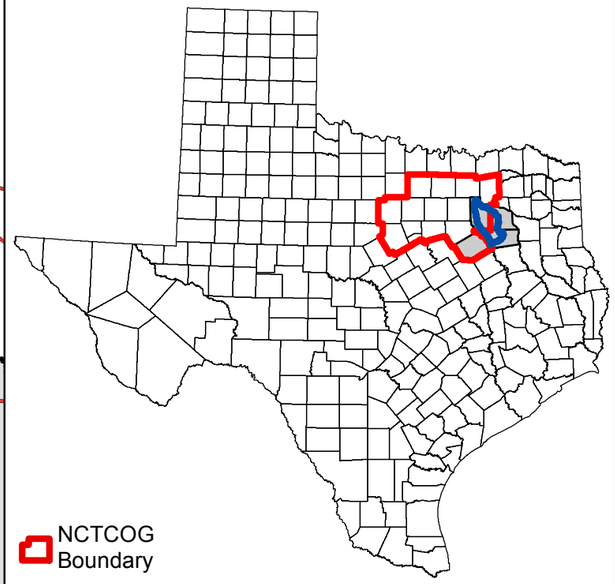
October 31, 2017

FEMA

North Central Texas Council of Governments



WATERSHED LOCATOR
STATE OF TEXAS



Map Symbology

- Cities
- Cedar Creek
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lakes
- Cedar Watershed Discovery County
- County Boundaries

Population Vulnerability to 1% Flood (2012 Texas Hazard Mitigation Package)

- Very Low
- Low
- Medium
- High
- Very High

0 6 12 Miles

N

Figure 15:
HUC - 12 Watershed Priorizations

CEDAR WATERSHED

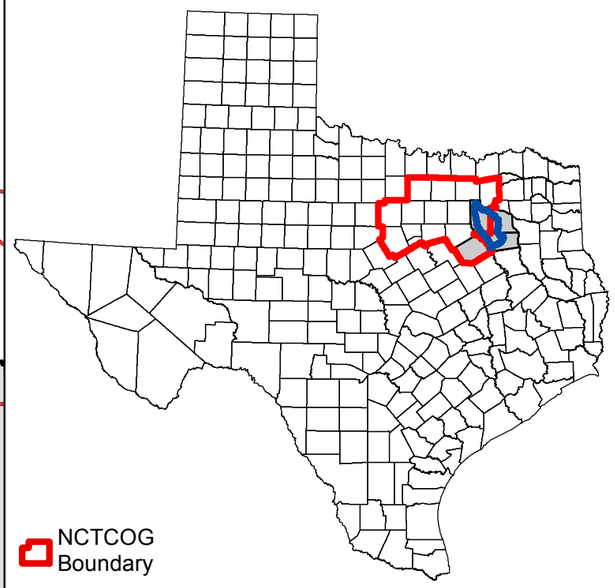
October 31, 2017

FEMA

North Central Texas Council of Governments

State Senators
District 2: Sen. Bob Hall (R)
District 3: Sen. Robert Nichols (R)
District 22: Sen. Brian Birdwell (R)

WATERSHED LOCATOR STATE OF TEXAS



Map Symbology

- Cities
- Cedar Creek
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lakes
- Cedar Watershed Discovery County
- County Boundaries

HUC-12 Watershed Prioritizations

- Moderate (General Risk)
- Elevated (Significant Risk)
- High

0 6 12 Miles

N

Figure 16:
Communities Rating System (CRS) Eligible Communities Map

CEDAR WATERSHED

October 31, 2017

FEMA

North Central Texas Council of Governments

Hunt County
Rockwall County
Rains County
Dallas County
Van Zandt County
Kaufman County
Ellis County
Navarro County
Henderson County

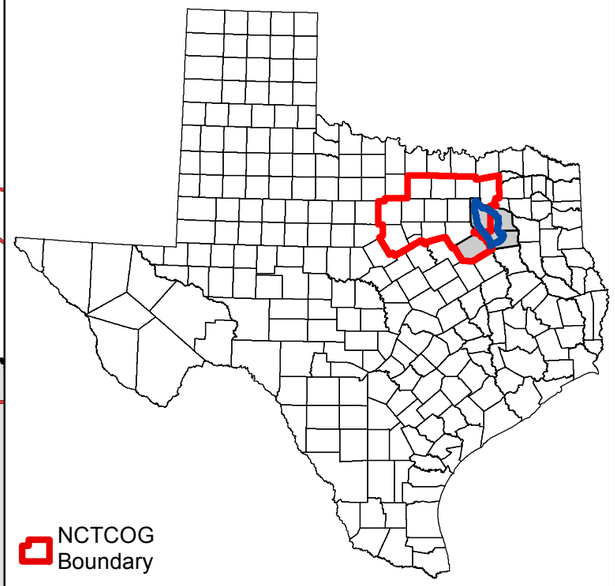
Fate
Rockwall
McLendon-Chisholm
Forney
Terrell
Wills Point
Talty
Oak Ridge
Post Oak Bend
Kaufman
Canton
Oak Grove
Scurry
Grays Prairie
Kemp
Mabank
Gun Barrel City
Seven Points
Eustace
Payne Springs
Tool
Enchanted Oaks
Log Cabin
Caney City
Star Harbor
Athens
Malakoff
Trinidad

Cedar Watershed

Community Name & NIFP Policies	
Caney City-0	City of Wills Point-13
City of Athens-18	Gun Barrel City-33
City of Canton-42	Town of Kemp-7
City of Enchanted Oaks-4	Town of Mabank-5
City of Eustace-0	Town of Oak Grove-0
City of Fate-18	Town of Oak Ridge-2
City of Forney-33	Town of Payne Springs-4
City of Kaufman-3	Town of Post Oak Bend-0
City of Log Cabin-2	Town of Scurry-3
City of Malakoff-3	Town of Talty-2
City of McLendon-Chisholm-14	Village of Grays Prairie-0
City of Rockwall-124	*Henderson County-194
City of Seven Points-3	*Kaufman County-175
City of Star Harbor-8	*Navarro County-65
City of Terrell-23	*Rockwall County-36
City of Tool-11	*Van Zandt County-87
City of Trinidad-3	

1-"Denotes the Unicorporated areas of the county
2-The NFIP Policy Statistics numbers are based on the "As of 3/31/2017"
Policies In-Force for each city and county.

WATERSHED LOCATOR
STATE OF TEXAS



NCTCOG Boundary

Map Symbology

- Cities
- Cedar Creek
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lakes
- Cedar Watershed Discovery County
- County Boundaries

CRS Class

- Communities Not Participating

0 6 12 Miles

N

Figure 17: Stream Study Requests

CEDAR WATERSHED

October 31, 2017

FEMA

North Central Texas Council of Governments

Fate
Rockwall
McLendon-Chisholm
Forney
Terrell
Wills Point
Talty
Oak Ridge
Post Oak Bend
Kaufman
Canton
Oak Grove
Scurry
Grays Prairie
Kemp
Mabank
Gun Barrel City
Seven Points
Eustace
Payne Springs
Tool
Enchanted Oaks
Log Cabin
Caney City
Star Harbor
Athens
Malakoff
Trinidad

Hunt County
Rockwall County
Rains County
Van Zandt County
Dallas County
Kaufman County
Ellis County
Navarro County
Henderson County

WATERSHED LOCATOR STATE OF TEXAS

NCTCOG Boundary

Map Symbology

- Cities
- Stream Study Requests
- Cedar Creek
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lakes
- Cedar Watershed Discovery County
- County Boundaries

0 6 12 Miles

N

Discovery Communities			
Community Name	**CID**	**Total Flood Area Sq. Mi.***	**Percent of Floodplain within Community**
Henderson County	480130	434.8	30
Athens, City of	480324	1	74.5
Caney City, Town of	481550	0.1	100
Enchanted Oaks, City of	481634	0.1	100
Eustace, City of	480327	0.1	100
Gun Barrel City, City of	480328	0.8	100
Log Cabin, City of	481635	0.1	100.0
Mabank, Town of	480414	0.5	100
Malakoff, City of	480329	0.6	100
Payne Springs, Town of	481555	0.2	100
Seven Points, City of	480332	0.3	83.7
Star Harbor, City of	481633	0.1	100
Tool, City of	481532	0.2	100
Trinidad, City of	480333	13.4	29.8
Kaufman County	480411	199.1	55.5
Forney, City of	480410	1.5	1.8
Grays Prarie, Village of	480302	0.0	72.5
Kaufman, City of	480407	1.7	100
Kemp, Town of	480412	0.5	100
Mabank, Town of	480414	0.5	100
Oak Grove, Town of	481533	0.1	100
Oak Ridge, Town of	481534	0.3	100
Post Oak Bend, Town of	480399	0.0	N/A
Scurry, Town of	480241	0.1	0
Seven Points, City of	480332	0.3	83.7
Talty, Town of	480388	0.0	N/A
Terrell, City of	480416	4.1	100
Navarro County	480950	282.9	0.0
Rockwall County	480543	33.2	10.7
Fate, City of	480544	0.6	24.5
McLendon-Chisholm, City of	480546	1.8	87.4
Rockwall, City of	480547	3.7	21.5
Van Zandt County	481040	266.9	26.7
Canton, City of	480632	3.2	0.0
Wills Point, City of	480633	0.7	48.6

***Floodplain area in Cedar Watershed only.**

Collin

Hunt

Rockwall

Dallas

Kaufman

Ellis

Van Zandt

Navarro

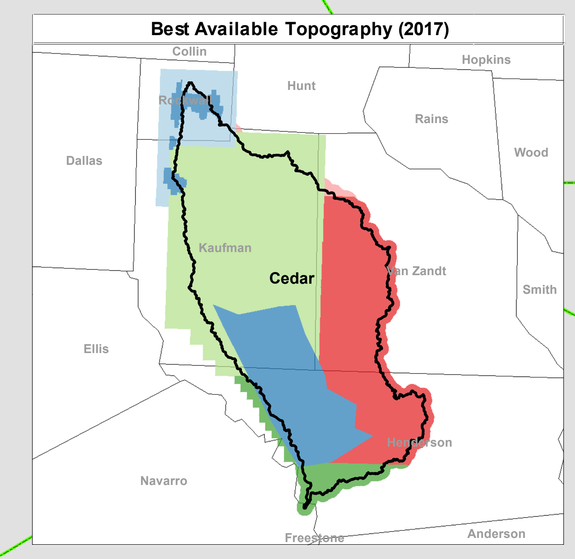
Henderson

NEW TERRELL CITY LAKE

CEDAR CREEK RESERVOIR-TRINITY

FOREST GROVE RESERVOIR

Best Available Topography (2017)



Best Available Topography- as of June 2017	
Elevation Data	**County/Counties**
NCTCOG LiDAR, 2015	Henderson, Kaufman, Rockwall, Van Zandt
TNRIS LiDAR, 2014	Henderson, Van Zandt
TNRIS LiDAR, 2013	Henderson, Navarro
TNRIS LiDAR, 2011	Henderson, Hunt, Kaufman, Van Zandt
TNRIS LiDAR, 2009	Hunt, Kaufman, Rockwall
USGS Topo	Hunt, Van Zandt
NCTCOG-North Central Texas Council of Governments	
TNRIS-Texas Natural Resources Information System	
USGS-United States Geological Survey	

N

0 2.5 5 10 Miles

Map Symbology

- USGS Gages
- LOMC
- High Water Marks
- Low Water Marks
- Dams
- Lake
- City Boundaries
- County Boundaries
- Cedar Watershed

Transportation

- Interstate Highway
- US Highway
- State Highway
- Railroads

Effective Streams Study Type*

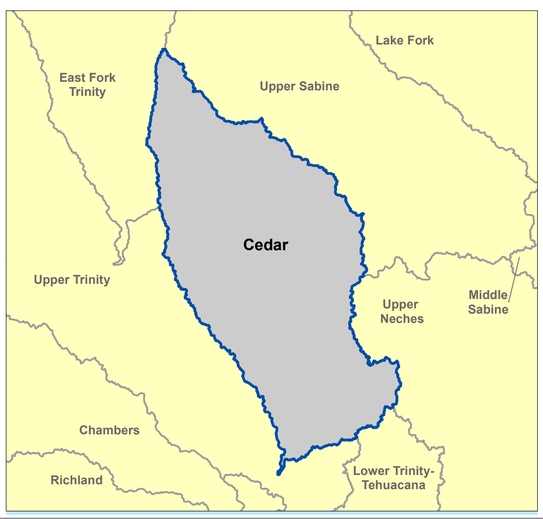
- Zone AE (New/Revised Detailed, SFHA w/ High Risk)
- Zone A (Approximate, SFHA w/ Low Risk)
- Zone X (Unshaded, X-Zones, Areas of Minimal Flood Risk)

Effective FEMA Floodplains*

- Floodway
- Zone AE (100-Year, Detailed)
- Zone A (100-Year, Approximate)
- Zone X500 (500-Year, Detailed)

***Data as of May 2017**

WATERSHED LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

Discovery Map

CEDAR WATERSHED, TEXAS

Stream Miles:	2,332
Zone AE Miles:	346
Zone A Miles:	1288
Zone X Miles:	698
Population:	109,617

HUC-8 Code
12030107

FEMA

Collin

Hunt

Rockwall

Dallas

Kaufman

Ellis

Van Zandt

Navarro

Henderson

Discovery Communities			
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Canton, City of	480632	3.2	0.0
Wills Point, City of	480633	0.7	48.6

***Floodplain area in Cedar Watershed only.**

County	CID	Population[1]	Total Losses[2]	Closed Losses[2]	Open Losses[2]	CWOP Losses[2]	Total Payments[2]	Current FEMA DFIRM Status	Effective Date
Henderson	480130	78,532	71	52	1	18	$ 1,941,250.37	Effective	4/5/2010
Kaufman	480411	103,350	44	32	0	12	$ 660,860.63	Effective	7/3/2012
Navarro	480175	47,735	100	83	1	16	$ 2,546,572.83	Effective	6/5/2012
Rockwall	480543	78,337	34	21	0	13	$ 506,415.05	Effective	9/26/2008
Van Zandt	481040	52,579	24	18	0	6	$ 613,892.15	Effective	12/17/2010

[1] 2010 Census Data

[2] FEMA Loss Statistics from 1978 to present (http://bsa.nfipstat.fema.gov/reports/1040.htm)

Total Losses-All losses submitted regardless of the status.

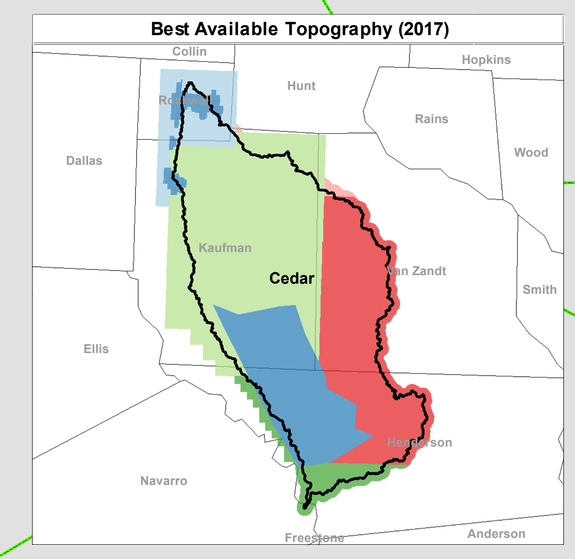
Closed losses-Losses that have been paid.

Open losses-Losses that have not been paid in fill.

CWOP-losses-Losses that have been closed without payment.

Total payments-Total amount paid on losses.

Best Available Topography (2017)



Best Available Topography- as of June 2017	
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TNRIS LiDAR, 2013	Henderson, Navarro
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USGS-United States Geological Survey	

N

0 2.5 5 10 Miles

Map Symbology

- USGS Gages
- LOMC
- High Water Marks
- Low Water Marks
- Dams
- Lake
- City Boundaries
- County Boundaries
- Cedar Watershed

Transportation

- Interstate Highway
- US Highway
- State Highway
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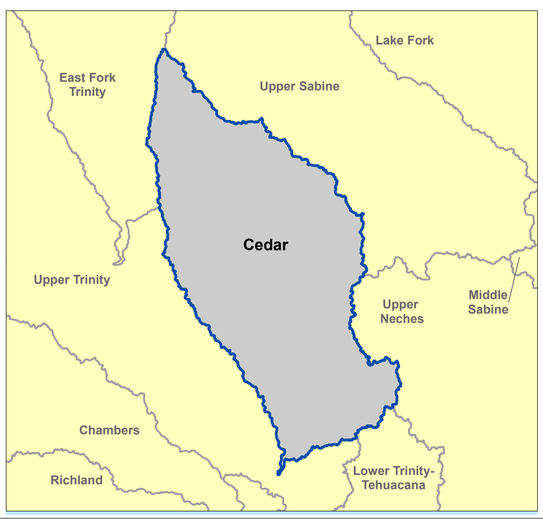
- Zone X (Unshaded, X-Zones, Areas of Minimal Flood Risk)

Effective FEMA Floodplains*

- Floodway
- Zone AE (100-Year, Detailed)
- Zone A (100-Year, Approximate)
- Zone X500 (500-Year, Detailed)

***Data as of May 2017**

WATERSHED LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

Discovery Map

CEDAR WATERSHED, TEXAS

Stream Miles:	2,332
Zone AE Miles:	346
Zone A Miles:	1288
Zone X Miles:	698
Population:	109,617

HUC-8 Code
12030107

FEMA

Hunt

Rockwall

Rains

Dallas

Kaufman

Van Zandt

Ellis

Henderson

Navarro

Anderson

N

0 2.5 5 10 Miles

Map Symbology

- USGS Gages
- LOMC
- High Water Marks
- Low Water Marks
- Dams
- Lake
- City Boundaries
- County Boundaries
- Watershed Boundary

Transportation

- Interstate Highway
- US Highway
- State Highway
- Railroads

Effective FEMA Floodplains*

- Floodway
- Zone AE (100-Year, Detailed)
- Zone A (100-Year, Approximate)
- Zone X500 (500-Year, Detailed)

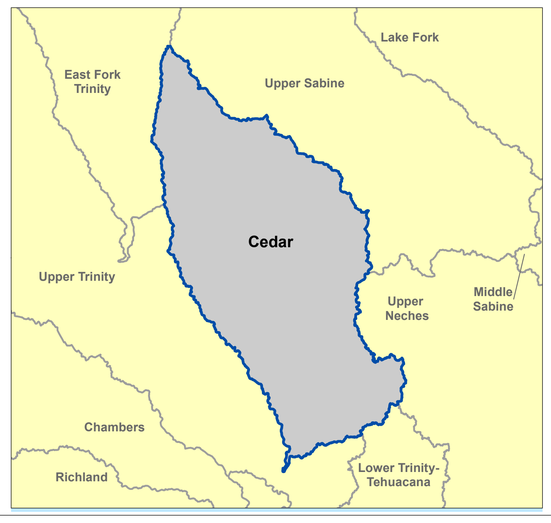
CNMS Stream Status*

- Unverified, To Be Studied
- Valid, NVUE Compliant

CNMS Validation Stauts Definitions	
Assessed	Unmapped Streams or streams not part of FEMA's SFHA inventory that have been investigated and considered for study in current and/or future Fiscal Years (FYs).
Unverified	Stream has not passed the Critical and Secondary Element checks (At least one critical or four or more secondary change conditions flagged) and may either be assigned resources for restudy in current and/or future FYs.
Vaild	Streams considered New, Vaildated, or Updated Engineering (NVUE) compliant (zero critical and fewer than four secondary elements flagged).
To Be Studied	Mapped streams that need to be studied and are planned for a future FY or unmapped streams prioritized to be mapped with an SFHA.

***Data as of May 2017**

WATERSHED LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

Discovery Map

CEDAR WATERSHED, TEXAS

Stream Miles:	2,332
Zone AE Miles:	346
Zone A Miles:	1288
Zone X Miles:	698
Population:	132,752

HUC-8 Code
12030107

FEMA

2017 NCTCOG Discovery

Cedar Watershed

HUC-12 Prioritizations

Legend

- Potential Study Streams
- Other Streams
- Major Highways
- Non-Cedar Watershed Discovery County
- Cedar Watershed County Boundaries

Cedar HUC12s - Prioritization Rank

- Moderate
- Elevated
- High

Rockwall County

Hunt County

Rains County

Van Zandt County

Kaufman County

Ellis County

Navarro County

Henderson County

Fate

Rockwall

Brushy Creek

Upper Big Brushy Creek

McLendon-Chisholm

High Point Creek

Multi-Year Funding - Community-wide Hydrology & Hydraulic Models

Headwaters Kings Creek

Forney

Terrell

Middle Big Brushy Creek

Big Brushy Creek

Kings Creek

Muddy Cedar Creek

Rocky Cedar Creek

Wills Point

Talty

Lower Big Brushy Creek

Little Brushy Creek-Kings Creek

Oak Ridge

Eagans Branch-Kings Creek

Post Oak Bend

Allen Creek-Cedar Creek

Caney Creek

Canton

Kaufman

Headwaters Big Cottonwood Creek

Williams Creek-Cedar Creek

Big Cottonwood Creek-Kings Creek

Scurry

Oak Grove

Dry Lacy Fork

Little Cottonwood Creek-Kings Creek

Grays Prairie

Kemp Lake-Cedar Creek Reservoir

Town of Kemp-Cedar Creek Reservoir

Cedar Creek

Cedar Creek - Connectivity Model

Lacy Fork-Cedar Creek Reservoir

Multi-Year Funding - Community-wide Hydrology & Hydraulic Models

Kemp

Persimmon Branch-Cedar Creek Reservoir

Mabank

North Twin Creek-Cedar Creek Reservoir

Persimmon Branch

Prairie Creek-Cedar Creek Reservoir

Gun Barrel City

South Twin Creek-Cedar Creek Reservoir

Seven Points

Tool

Eustace

Clear Creek-Cedar Creek Reservoir

Payne Springs

Caney Creek-Cedar Creek

Enchanted Oaks

Headwaters Caney Creek

Log Cabin

Caney City

Caney Creek-Cedar Creek Reservoir

Athens

Multi-Year Funding - Community-wide Hydrology & Hydraulic Models

Star Harbor

Walnut Creek-Cedar Creek

Malakoff

Trinidad

McAllister Slough-Cedar Creek

Pre-Discovery Webinar Slides

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North Texas Discovery

"Capturing a More Complete Picture of Your Watershed"

Pre-Discovery Webinars
April 19, 2017
April 24, 2017

HALFF

Introduction

- NCTCOG:
  - Edith Marvin – EMarvin@nctcog.org
  - Mia Brown – MBBrown@nctcog.org
  - Kori Mullen - KMullen@nctcog.org
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  - Manuel Razo – Manuel.Razo@twdb.texas.gov
  - Michael Segner – Michael.Segner@twdb.texas.gov

AGENDA

- Overview of Risk MAP
- NCTCOG Discovery Activities
- Discovery Overview
- 2017 NCTCOG Discovery Watersheds
    - Cedar and Denton Watersheds
    - Pre-Discovery Activities
    - Discovery Activities
    - Post-Discovery Activities
- Data Gathering Website and Walk-through

FEMA's Risk MAP Program

- Risk Mapping, Assessment, and Planning
  - Provides communities with flood information and tools they can use to enhance their mitigation plans and take action to better protect their citizens.
  - Risk MAP Vision
    - **ACTION-driven**, not **MAP-driven** through local understanding and ownership of risk

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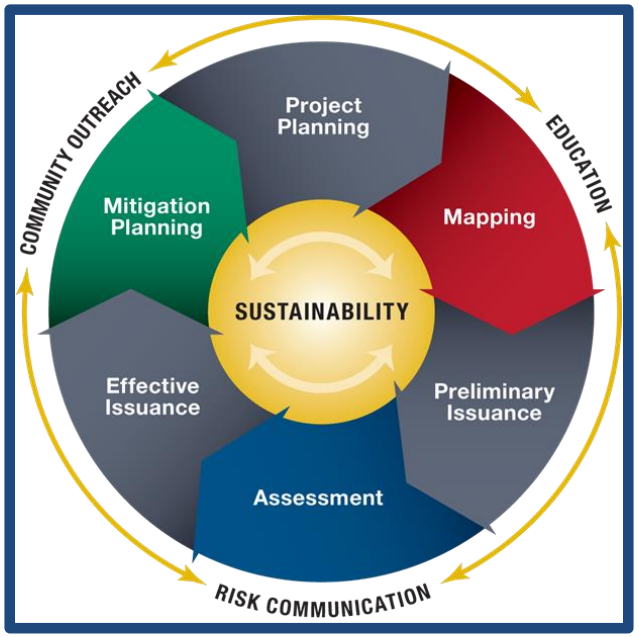
FEMA's Risk MAP Program

- Risk MAP offers opportunities to change the way FEMA and Local communities interact
- Empowering communities
  - Reduce Future Losses
    - Implementing Mitigation Actions
  - Reduce Your Risks
    - All Hazard Mitigation Planning
    - Look for Grant Opportunities
  - Insure Your Risks
    - The National Flood Insurance Program (NFIP)
  - Communicate Effectively about Risk



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Discovery

Overview

- *Capture a more complete picture of your watershed by working closely with local communities…*

Watershed Selected for Discovery	Community Engagement / Data Collection	Discovery Meeting	Post-Meeting Coordination / Scope Refinement
• **Selection Criteria:** •Risk •Need •Elevation data availability •Regional knowledge •CTP/State input	•**Develop watershed partnerships** •**Discovery Newsletter** •**Pre-Discovery community visits** •**Gather all available data** •Data needs •Issues / Concerns •Areas of Mitigation	•**Review / validate watershed for project areas** •**Provide information** •Mapping •Mitigation Planning •Grants •NFIP Compliance •**Comprehensive understanding of risk in the watershed**	•**Once data is collected** •FEMA will coordinate with State/NCTCOG on proposed scope refinement •Selected Projects – move toward Kick off meeting •Non-Selected Projects – engaged for potential mitigation actions, mitigation plan updates, and/or mitigation technical assistance

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Discovery Community Engagement

Overview

What information are we interested in?

FEMA ENGAGEMENT WITH STAKEHOLDERS AND DATA COLLECTION

Review of all available data begins the process…

Risk Identification and Communication

- Low water crossings?
- Large areas of fill placement?
- Future development areas?
- Capital improvement projects?
- Channelization projects?
- Large reservoirs? O&M plan?
- Flood risk reduction projects?
- Digital stream inventory?
- Digital building stock?
- High water marks from recent flooding event?
- Elevation data? LiDAR?
- Local flood studies?

Mitigation Planning and Mitigation Actions

- Approved hazard mitigation plan?
- Local evacuation plans?
- Current land use plan?
- Future land use plan?
- Drainage master plan(s)?
- Flood reduction projects?
- Culvert enlargement projects?
- Areas of evacuation during high water?
- Local HAZUS runs?
- Digital parcel boundaries?

Engage:

- U.S. Geological Service
- U.S. Army Corps of Engineers
- U.S. Environmental Protection Agency
- State NFIP coordinator
- State Hazard Mitigation Officer
- State floodplain management associations
- State emergency management associations
- Local elected officials
- Regional authorities
- Local floodplain administrators
- Local emergency management officials
- Local levee districts
- Watershed groups
- Special interest groups
- Local business and commerce entities
- CTPs

NFIP Community Actions

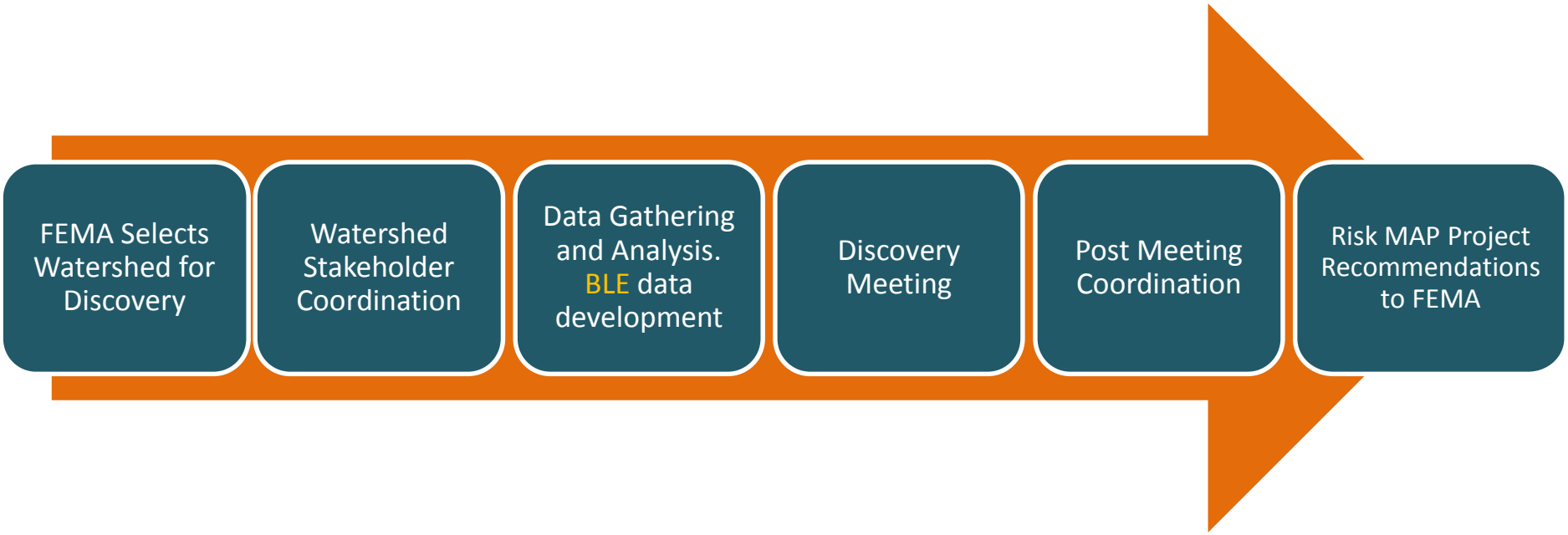
- Participating in the NFIP?
- Community assistance meetings?
- Community Rating System (CRS)?
- Repetitive loss properties?
- Areas of insurance claims?
- Community assistance visits?
- Community assistance calls?
- Active Letters of Map Change (LOMCs)?
- Recent disaster? Declared?
- Data from PDAs?

Community Benefits and Grant Opportunities

- Grant administration plan?
- Ongoing grant projects?
- Hard projects? (infrastructure)
- Soft projects? (outreach/education)
- Targeted buy-out areas?
- Elevation projects planned?
- Pre-Disaster Mitigation (PDM) grants?
- Severe Repetitive Loss (SRL) grants?
- Grants in need of engineering info?
- Post-disaster 404 projects?
- Post-disaster 406 projects?

Discovery Steps

Overview



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Base Level Engineering(BLE)

Overview

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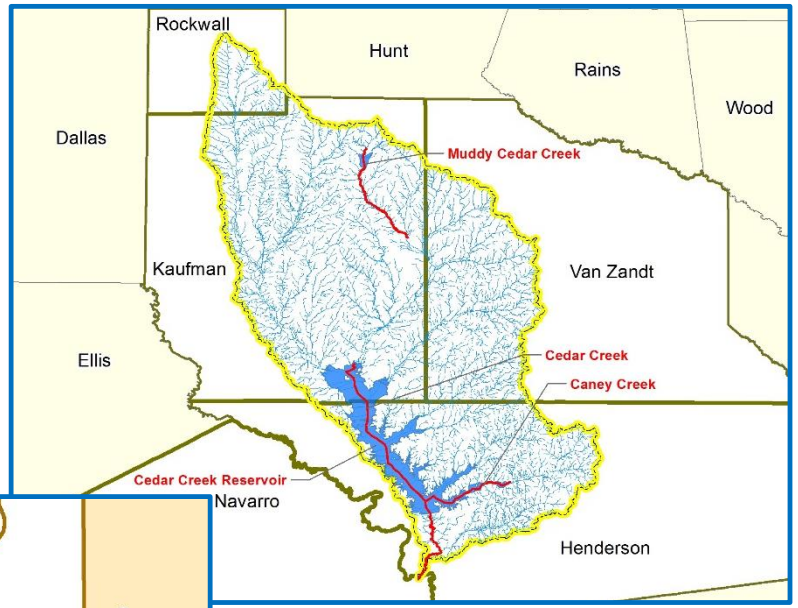
Base Level Engineering(BLE)

Overview

Large Scale Automated Engineering (LSAE) Process

- BLE is best used at a larger scale (HUC8)
- LiDAR must be Available
- Model Review and Adjustments
- Gage Review included in hydrology



Key Features

- Regulated Stream(s)
- BLE Streams
- Lakes and Reservoirs

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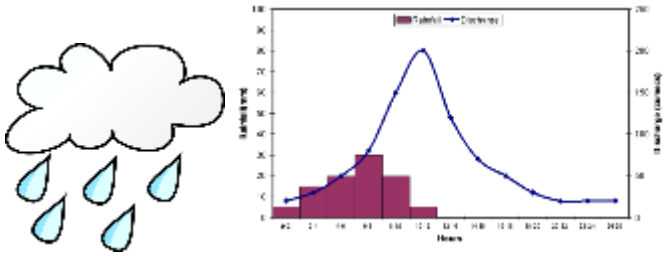
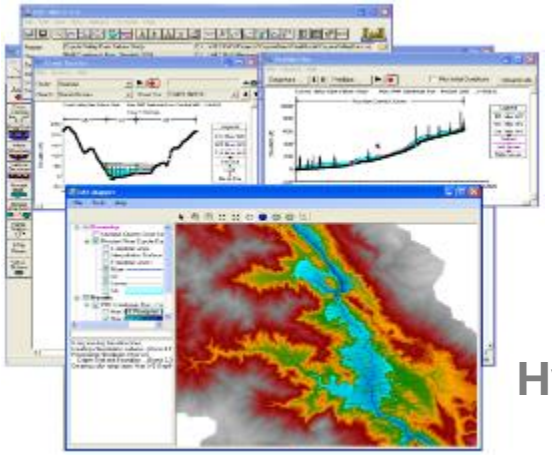
Base Level Engineering(BLE)

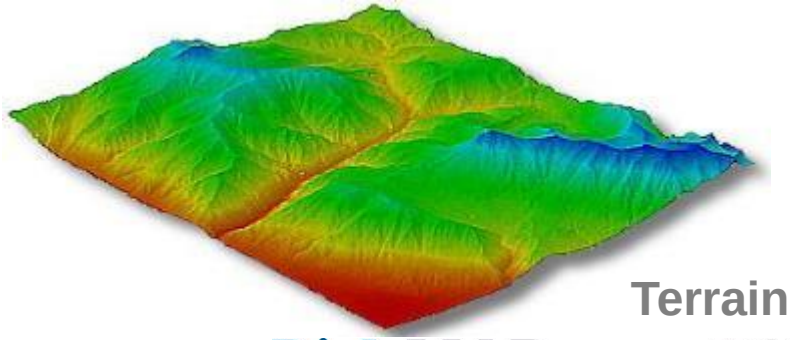
MODELING



Hydrology

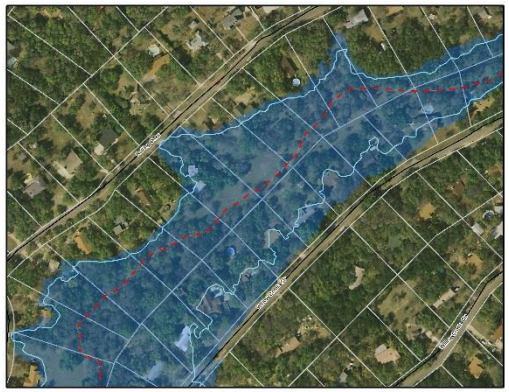


Hydraulics



Terrain

Overview



Mapping

OUTPUTS

- Hydrology modeling (Regression) flows w/gage analysis
- Hydraulic modeling (HEC-RAS) for 10%, 4%, 2%, 1% and 0.2% storm events
- 10%, 1% and 0.2% floodplain boundaries
- Areas of Expanded Flood Risk
- Depth and Analysis Grids
- Flood Risk Assessment

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Base Level Engineering(BLE)

Overview

- Building Block for Future Model Refinement

- Creates a data-based starting point for conversations about existing flood risk

CHEAPER

DATA FOR REVIEW

COLLABORATIVE

FASTER

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NCTCOG Discovery Activities

2004-2008 FEMA Map Modernization → **2009** Map Needs Assessment → 2012 Partnered with FEMA for CTP Grant → 2013 Discovery → 2017 Discovery

- 2009 TWDB/NCTCOG Map Needs Assessment (MNA) documented…
  - 1,291 new mapping needs
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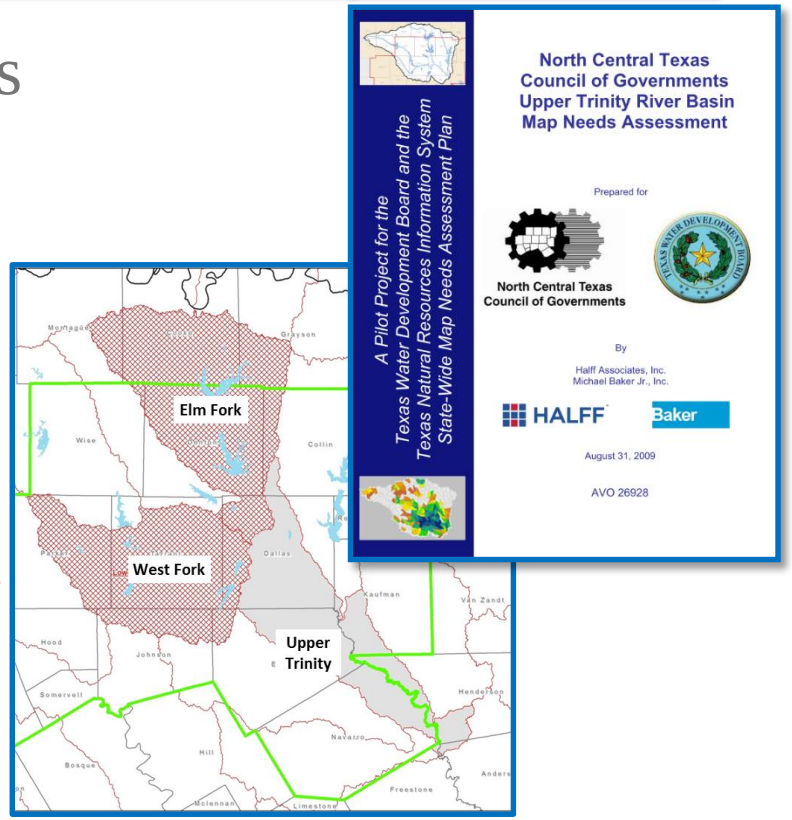

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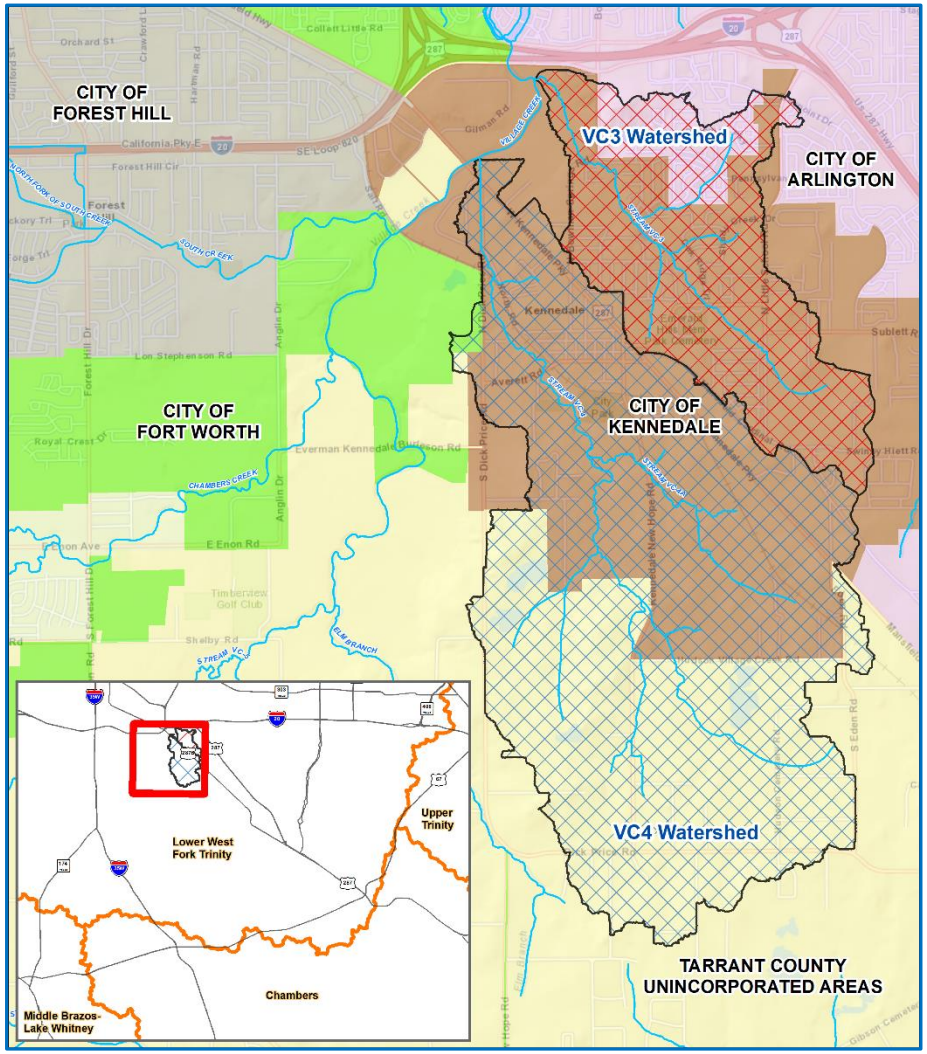
Example Post-Discovery Projects

2013

2013 Village Creek Study – Kennedale

- New H&H and Mapping for 13 streams
- Flood Risk Products including Flood Risk Assessment

Major Highways
Streams
HUC - 8 Boundaries
NCTCOG FY13 Study Watersheds
VC3
VC4



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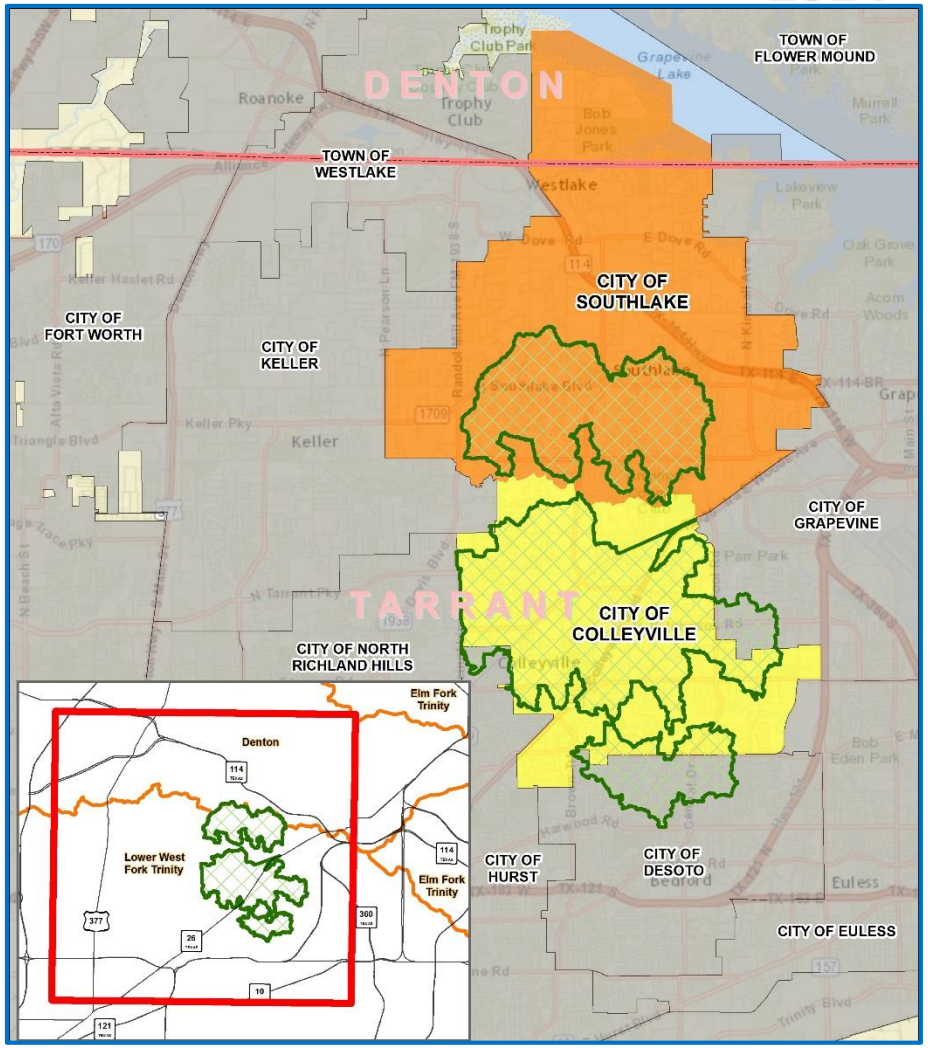
Example Post-Discovery Projects

2014

2014 Bear Creek Study – Southlake and Colleyville

- New H&H and Mapping for 19 streams (Colleyville) and 8 streams (Southlake)
- Flood Risk Products including Flood Risk Assessment



Major Highways
HUC - 8 Boundaries
Study Watershed Boundary
County Boundary
Other Cities

FY14 Participating Cities

Colleyville
Southlake

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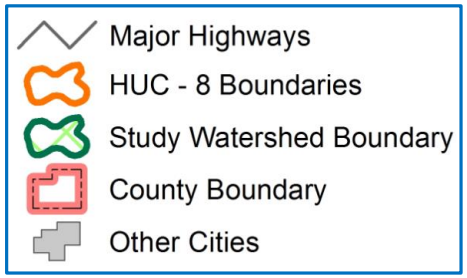
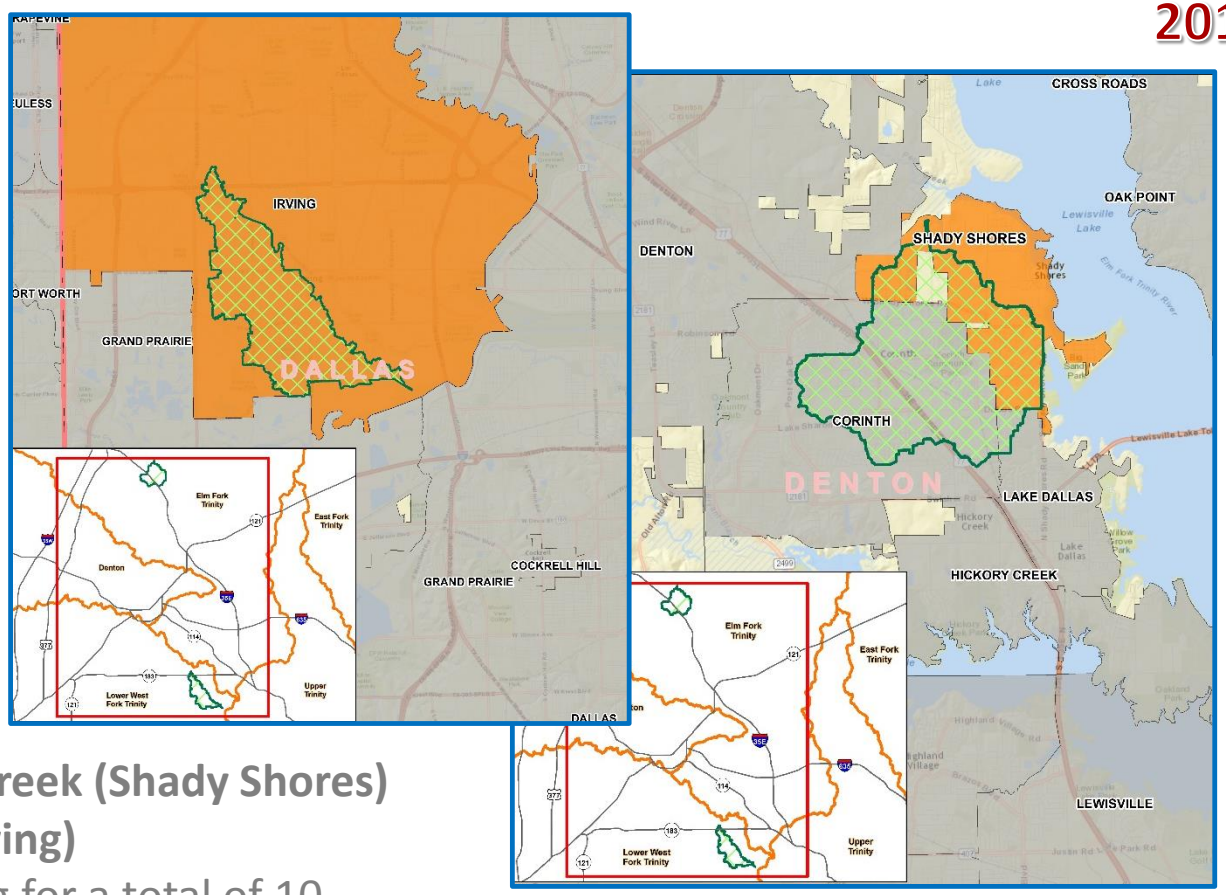
Example Post-Discovery Projects

2015





2015 Study – Lynchburg Creek (Shady Shores) and West Irving Creek (Irving)

- New H&H and Mapping for a total of 10 streams
- Flood Risk Products including Flood Risk Assessment

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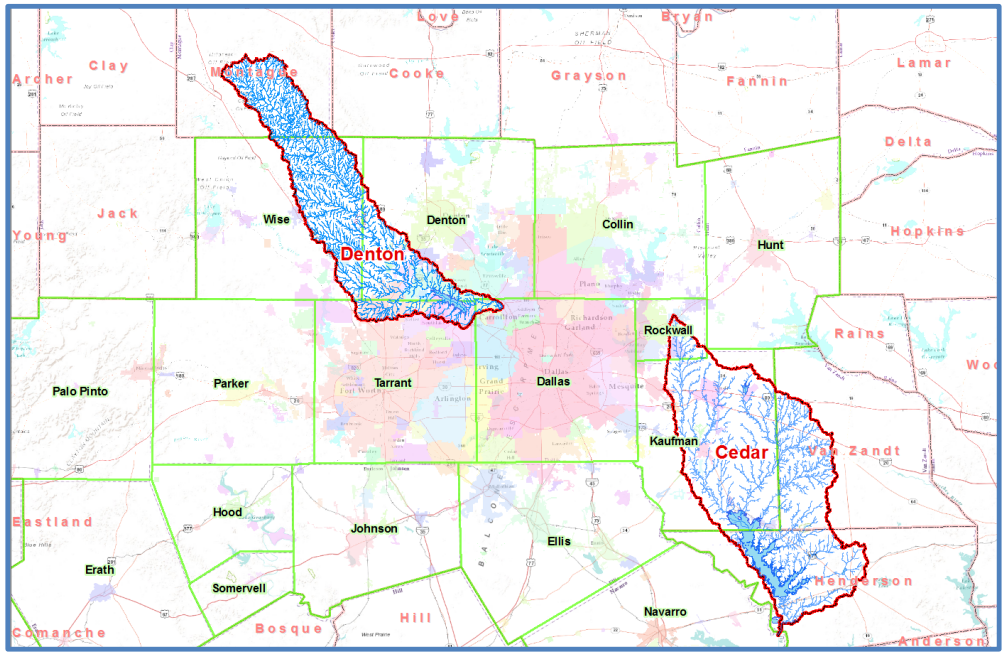
2017 North Texas Discovery

NCTCOG Leading Cedar and Denton Watersheds

- Goals:
  - Provide information
    - Mitigation planning and actions
    - Risk Communication
  - Gather information
    - Local flood risks and hazards
    - Current mitigation



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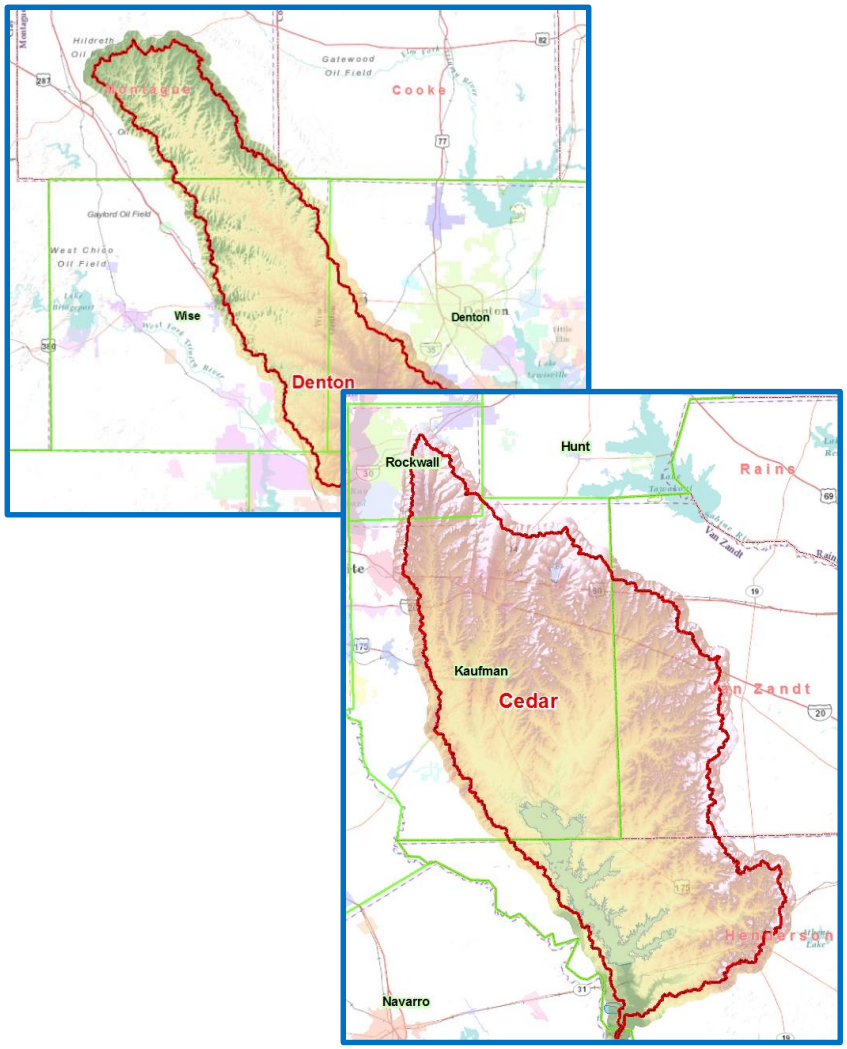
Discover the Data

Pre-Discovery Activities

- Watershed
- Communities
- Geospatial Data

Examples of data to collect:

- Base map: Boundaries, Hydrography, Transportation
- Flood study needs, risk, elevation data
- Flooding issues, historical flooding, disasters
- Mitigation activities, grant projects, plans
- CRS, CAVs
- Local development, floodplain management plans
- Regional watershed plans
- Infrastructure: culverts, dams, bridges, levees
- Building footprints or parcel data



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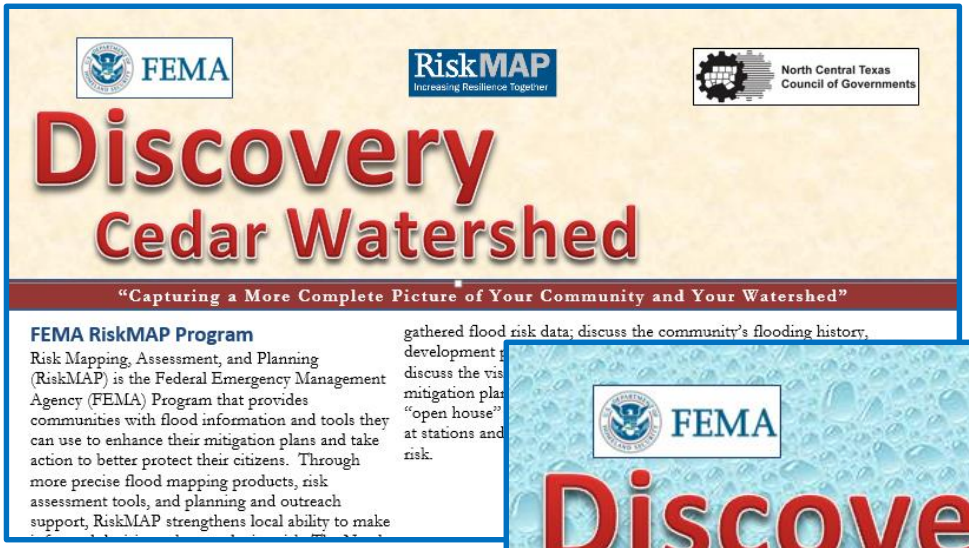
Discovery Newsletter Coming …

Pre-Discovery Activities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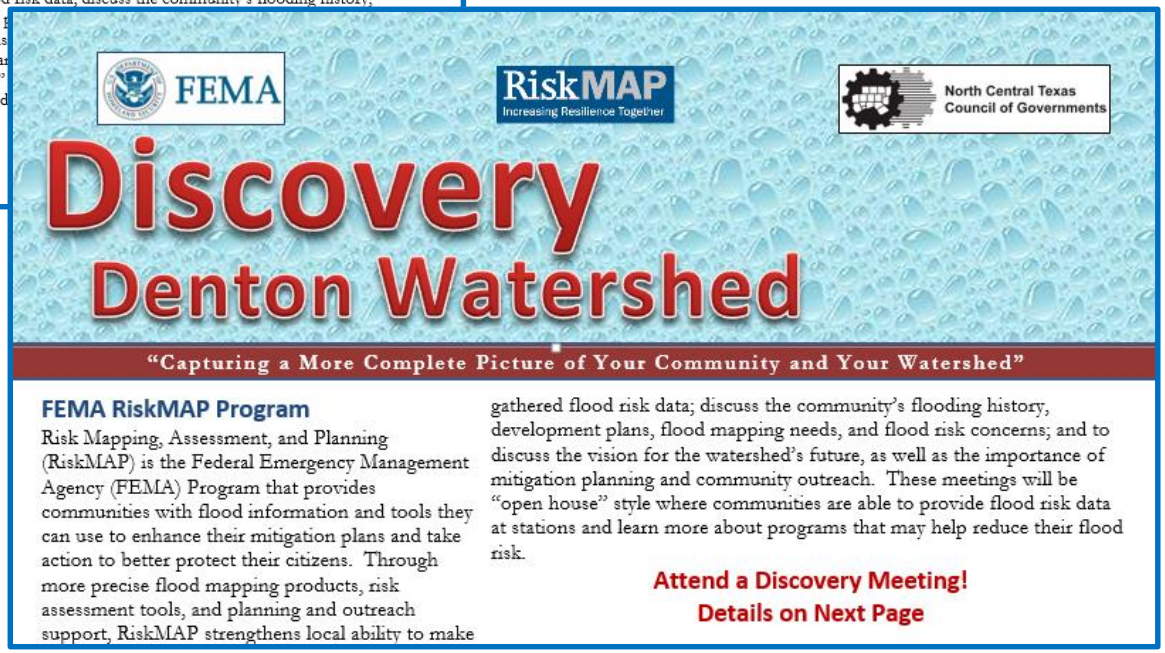
Discovery
Cedar Watershed

"Capturing a More Complete Picture of Your Community and Your Watershed"

FEMA RiskMAP Program

Risk Mapping, Assessment, and Planning (RiskMAP) is the Federal Emergency Management Agency (FEMA) Program that provides communities with flood information and tools they can use to enhance their mitigation plans and take action to better protect their citizens. Through more precise flood mapping products, risk assessment tools, and planning and outreach support, RiskMAP strengthens local ability to make

gathered flood risk data; discuss the community's flooding history, development p
discuss the vis
mitigation plan
"open house"
at stations and
risk.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Denton Watershed

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gathered flood risk data; discuss the community's flooding history, development plans, flood mapping needs, and flood risk concerns; and to discuss the vision for the watershed's future, as well as the importance of mitigation planning and community outreach. These meetings will be "open house" style where communities are able to provide flood risk data at stations and learn more about programs that may help reduce their flood risk.

Attend a Discovery Meeting!
Details on Next Page

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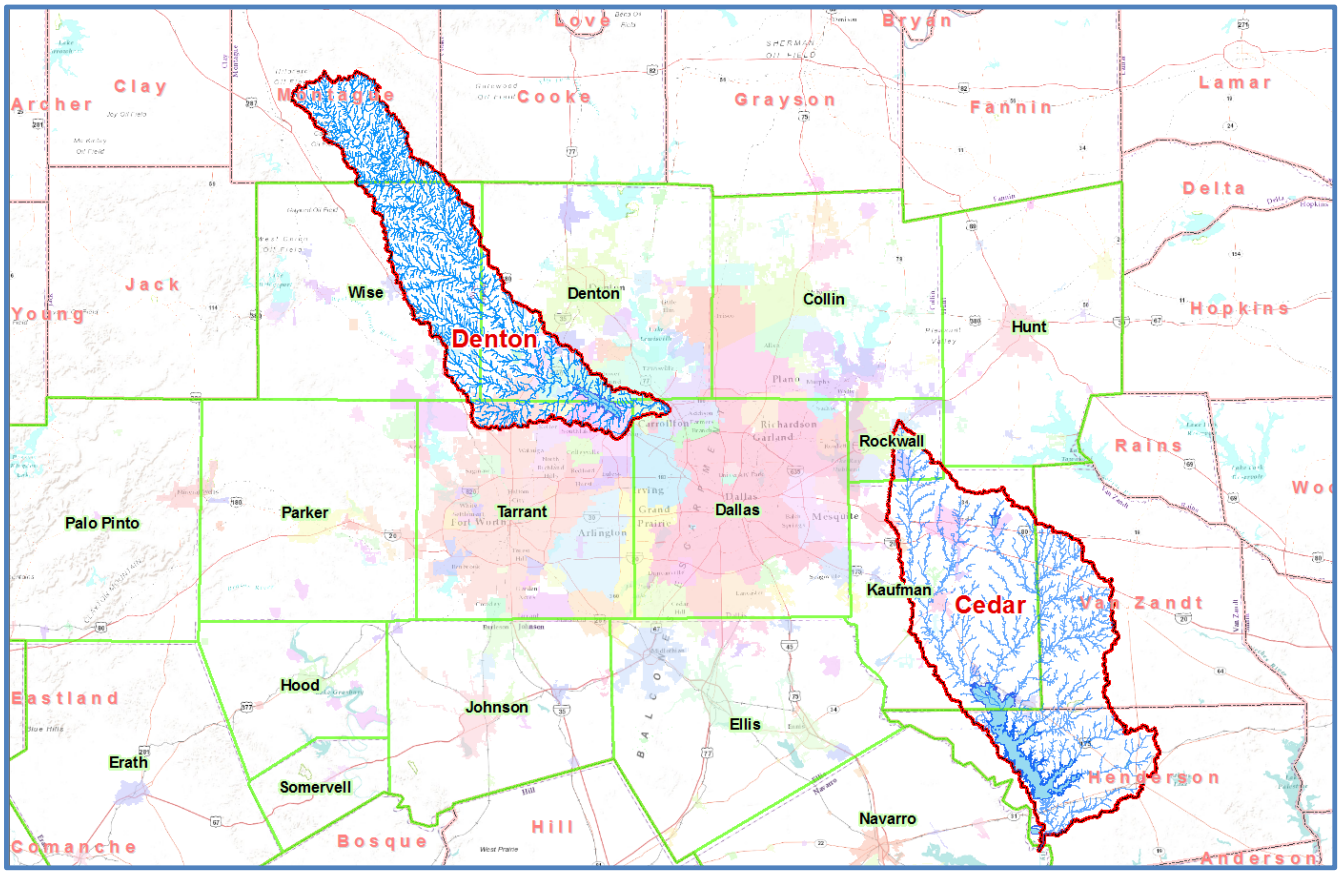
Discovery Meetings Coming …

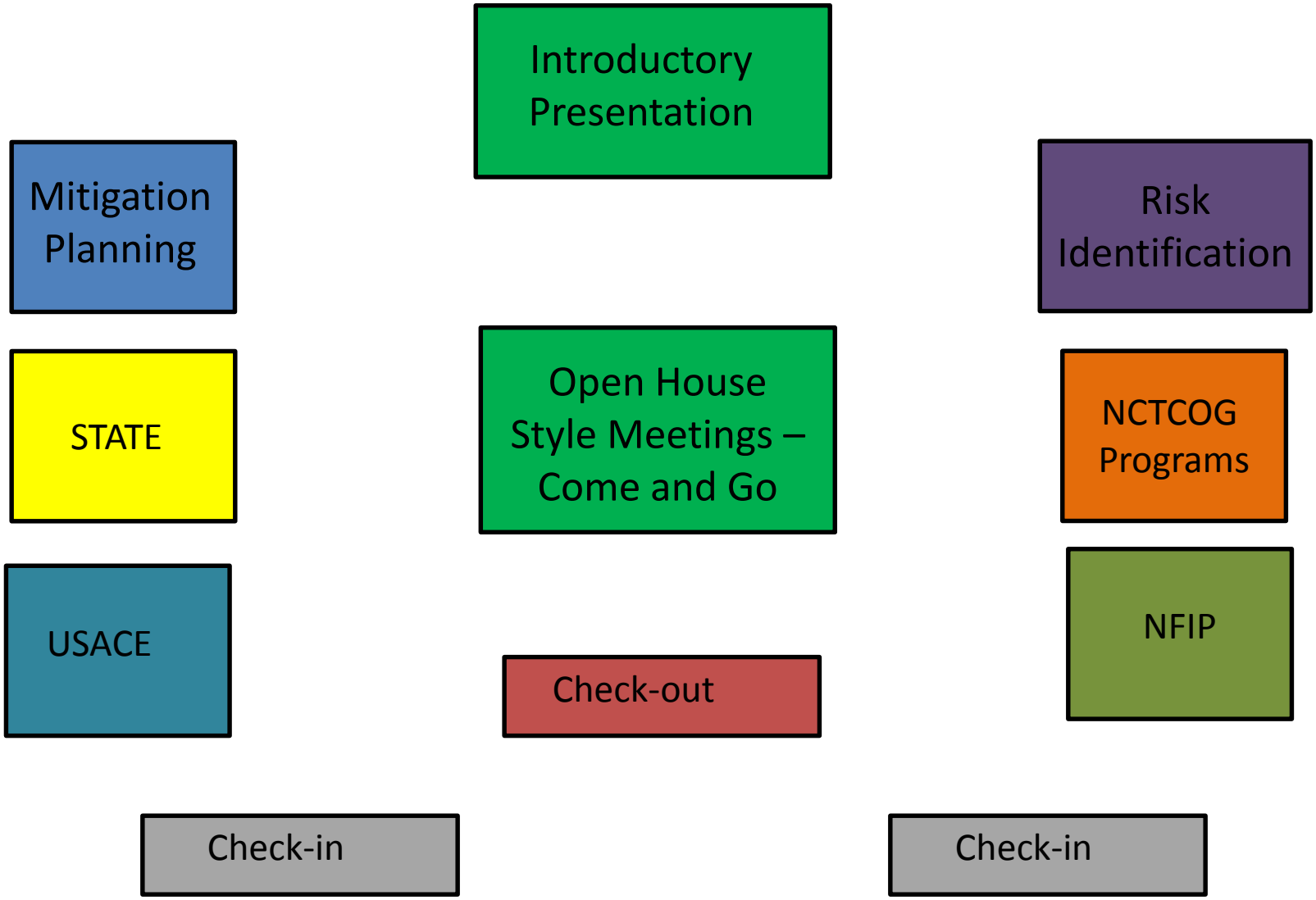
Pre-Discovery Activities

- Discovery Meetings in Mid to Late June
- All community stakeholders are encouraged to attend



Discovery Meetings - Layout & Format

Discovery Activities



Discovery Meetings – What to Expect

Discovery Activities

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Who Should Come?

Discovery Activities

- Community Officials Including:
  - Leaders, Floodplain Administrators, City Engineers, Watershed Organizations, Planners, Emergency Managers, and GIS specialists
- Federal, State, and Regional Agencies
- Other locally identified stakeholders concerned with flood risks or hazard mitigation

What Do I Bring?

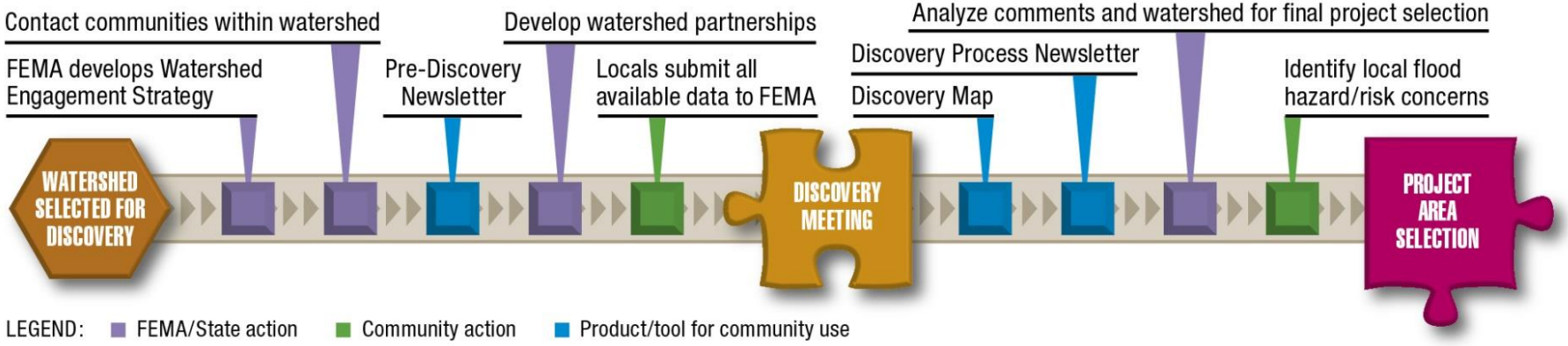
Discovery Activities

- Knowledge of Flood Risks and Past Flooding in your Community
- Hazard Mitigation Projects – Identified, In Progress, or Complete?
- Master Drainage Plan(s), floodplain studies – completed or identified as needs
- Questions or Concerns regarding your current Digital Flood Insurance Rate Maps – Flood Study Needs
- Current Flood Risk Communication Process
- Dams and Levees – Questions or Concerns
- GIS data

Post-Discovery Actions

Post-Discovery Activities

- Post-Discovery Actions
  - Analyze data collected
  - Review findings with NCTCOG
  - Preliminary project selections provided to communities
  - Evaluate community input
  - Discovery Report



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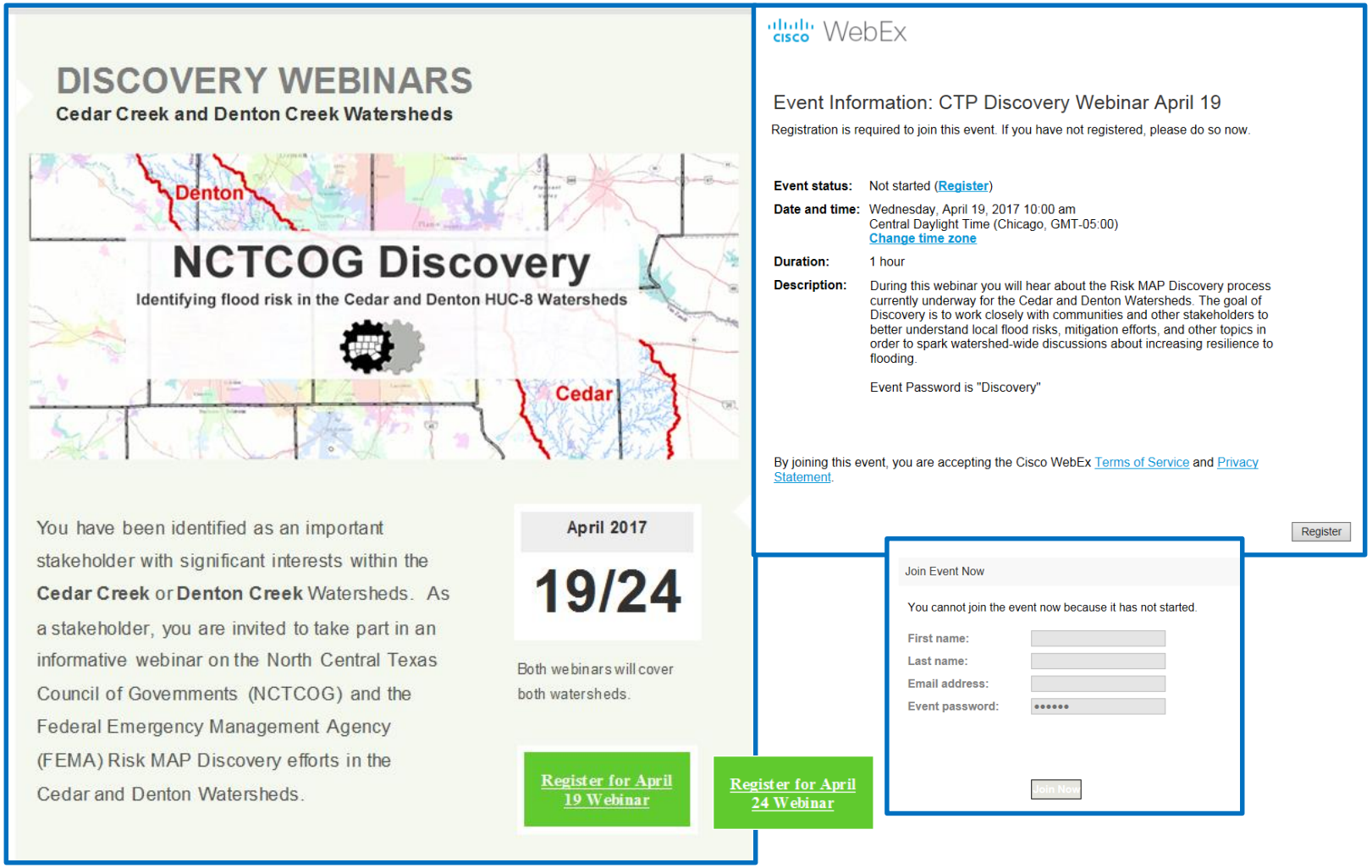
Webinar Info



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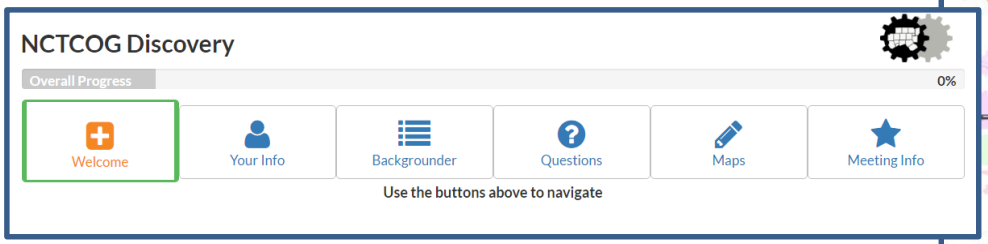
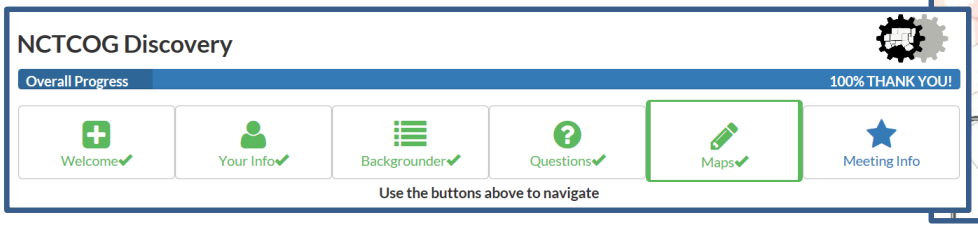
Pre-Discovery Data Gathering

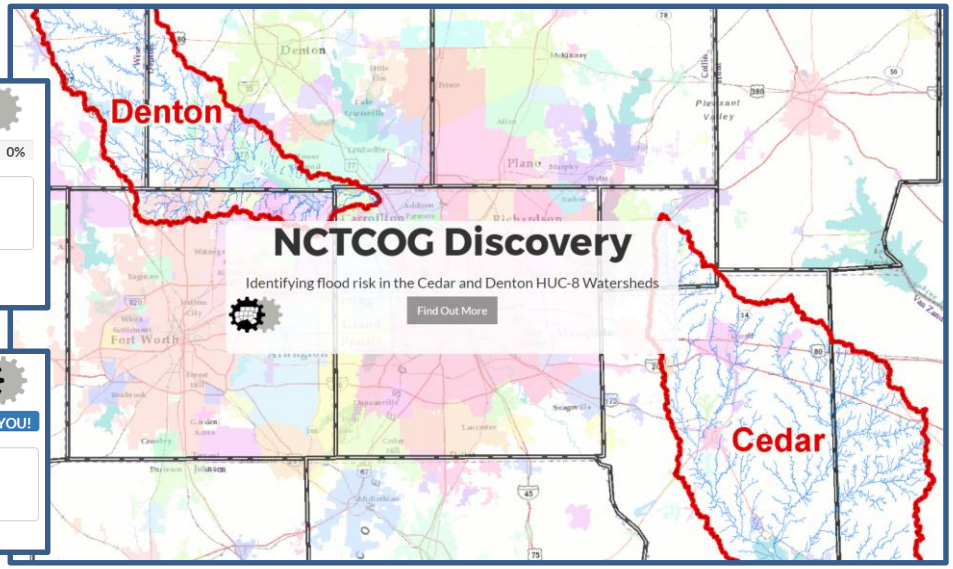
https://nctcogdiscovery.halff.com

Login: EMAIL ADDRESS

Password: NCTCOG_2017!







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Questions

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Discovery Findings Webinar Slides

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North Texas Discovery Findings

Cedar and Denton Watersheds

"Capturing a More Complete Picture of Your Watershed"

September 21, 2017

September 26, 2017

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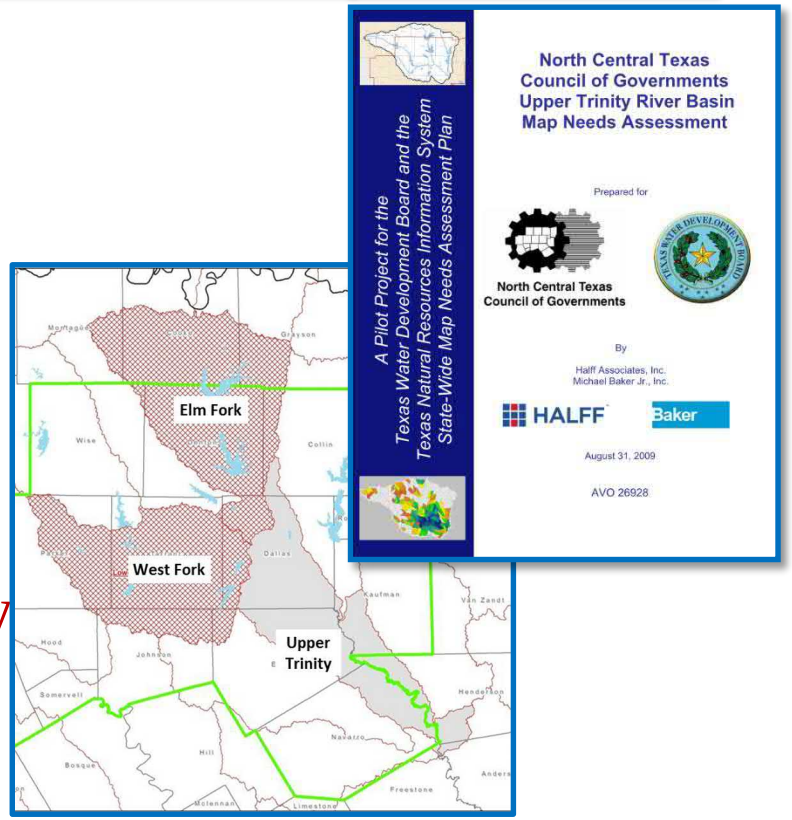

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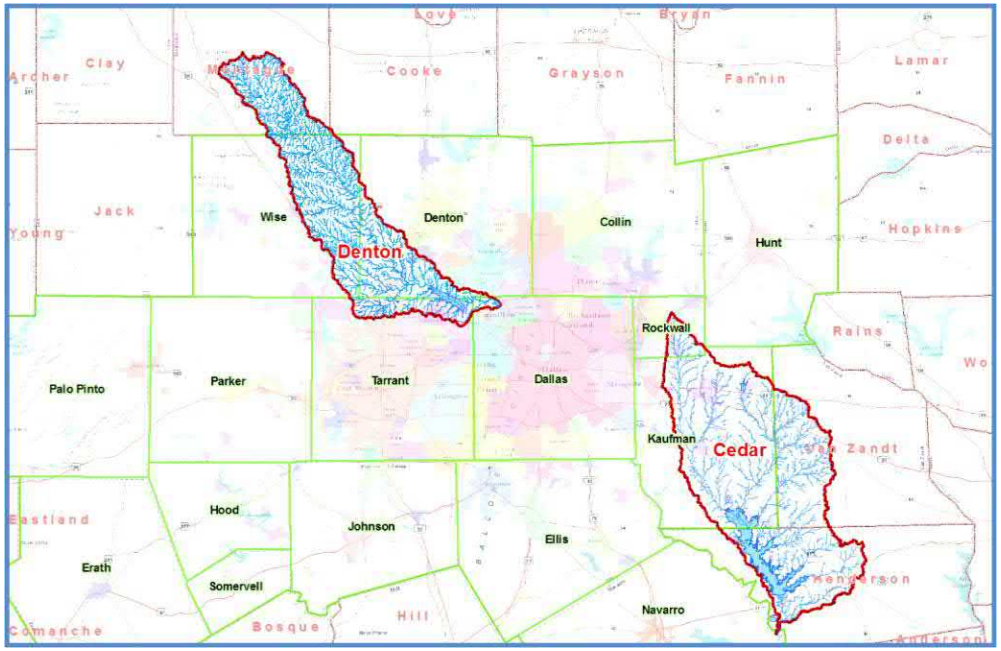
North Central Texas Council of Governments

2017 North Texas Discovery

NCTCOG Leading Cedar and Denton Watersheds

- Goals:
  - Provide information
    - Mitigation planning and actions
    - Risk Communication
  - Gather information
    - Local flood risks and hazards
    - Current mitigation



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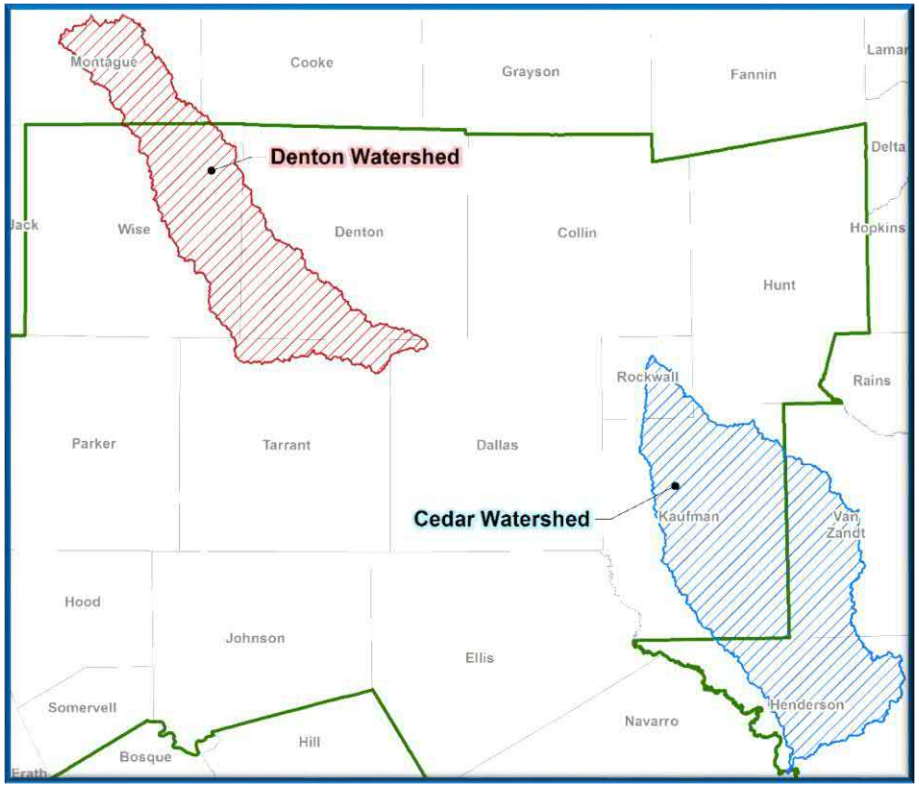
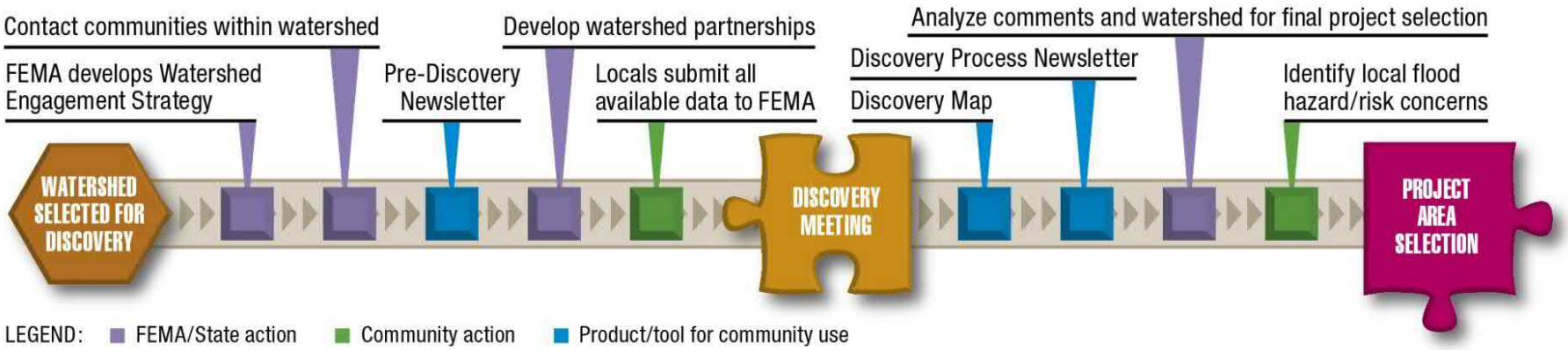
Discovery Findings

Cedar and Denton Watersheds





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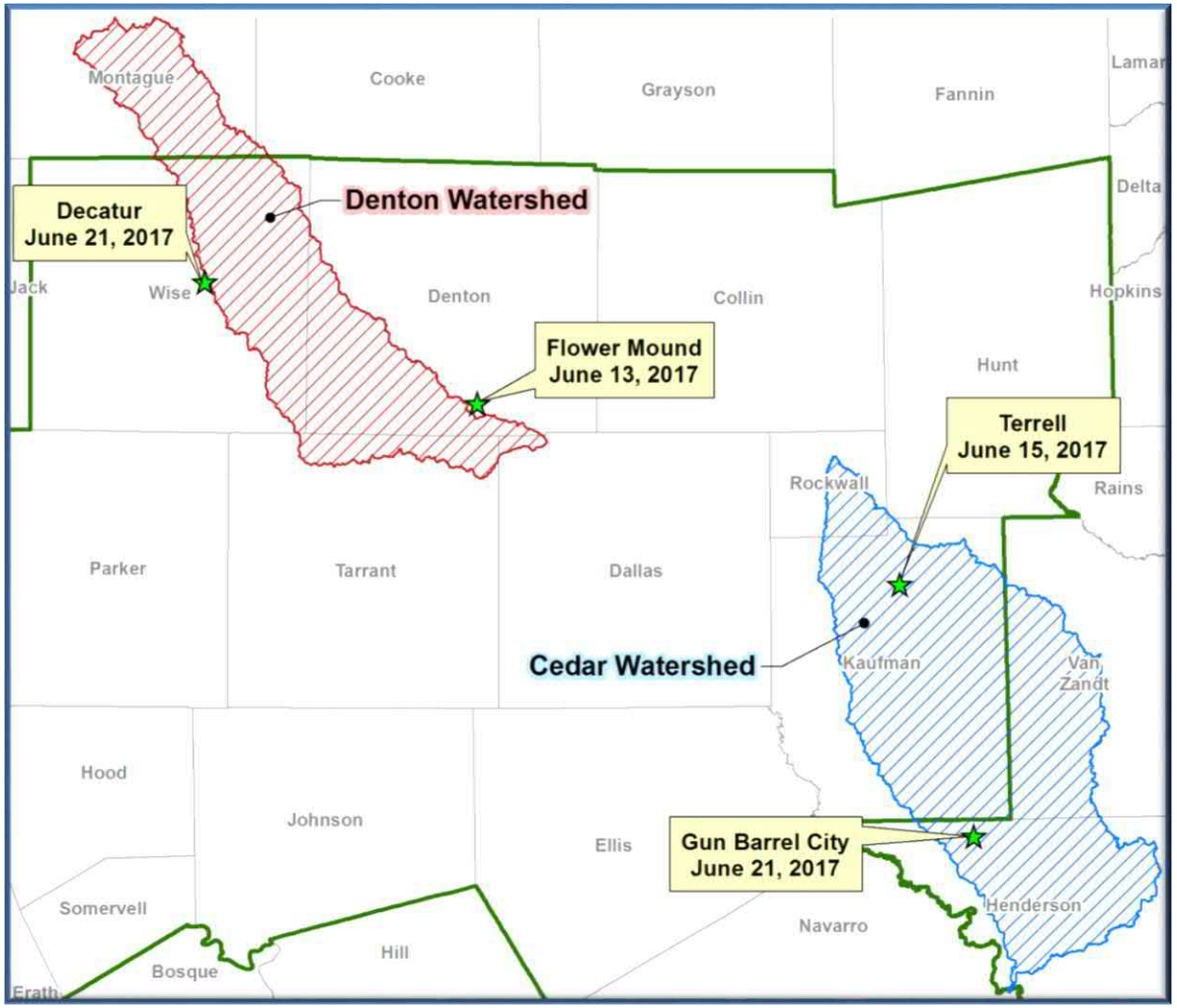
2017 Discovery Meetings

Cedar and Denton Watersheds

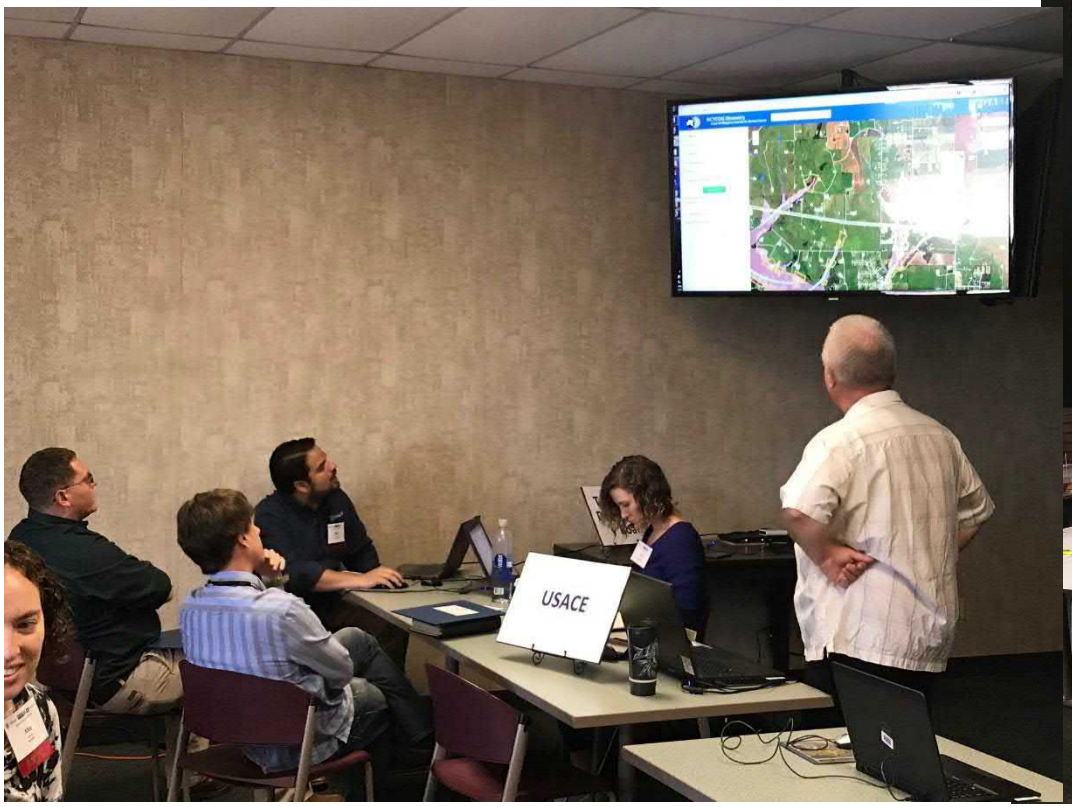
4 Discovery Meetings in June 2017

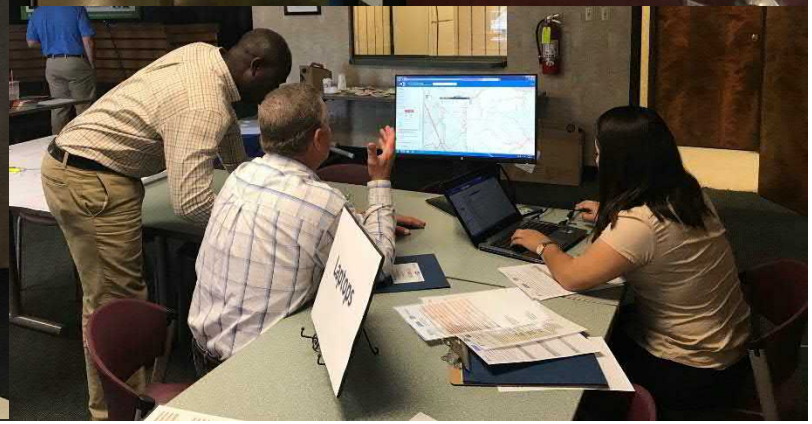


2017 Discovery Meetings

Cedar and Denton Watersheds

Come-and-Go
Open House
Meetings





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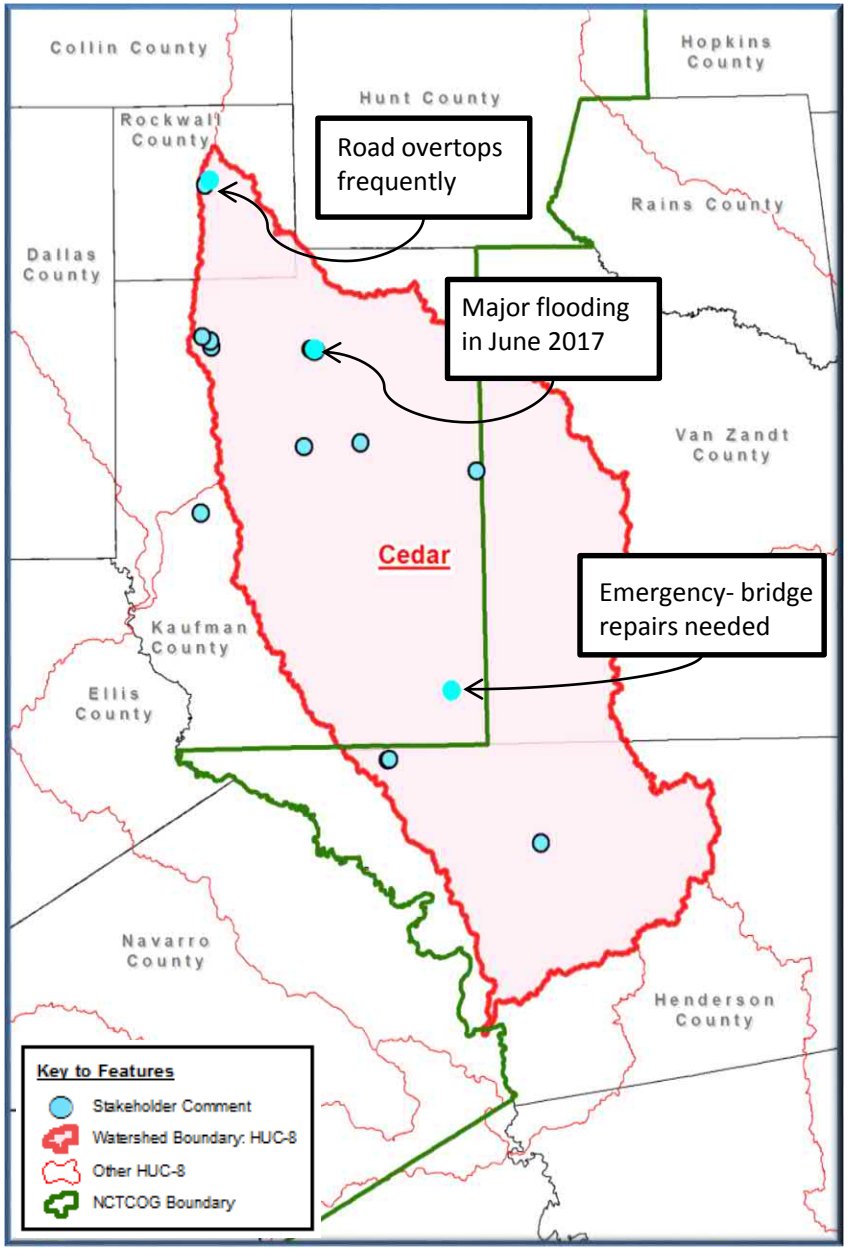
Discovery Findings

Meeting Results: Cedar



- Community concerns
- Known Flooding locations
- Areas of Mitigation Interest

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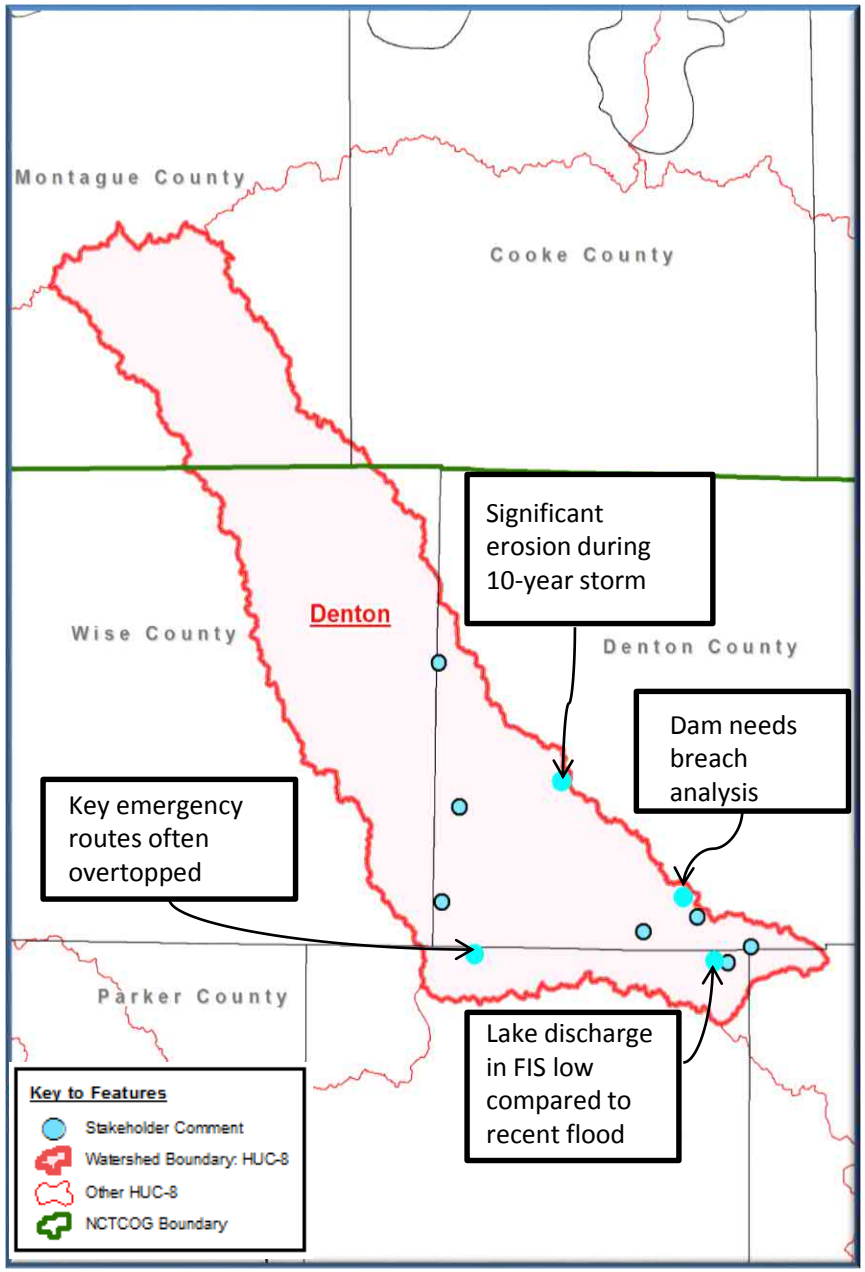
Discovery Findings

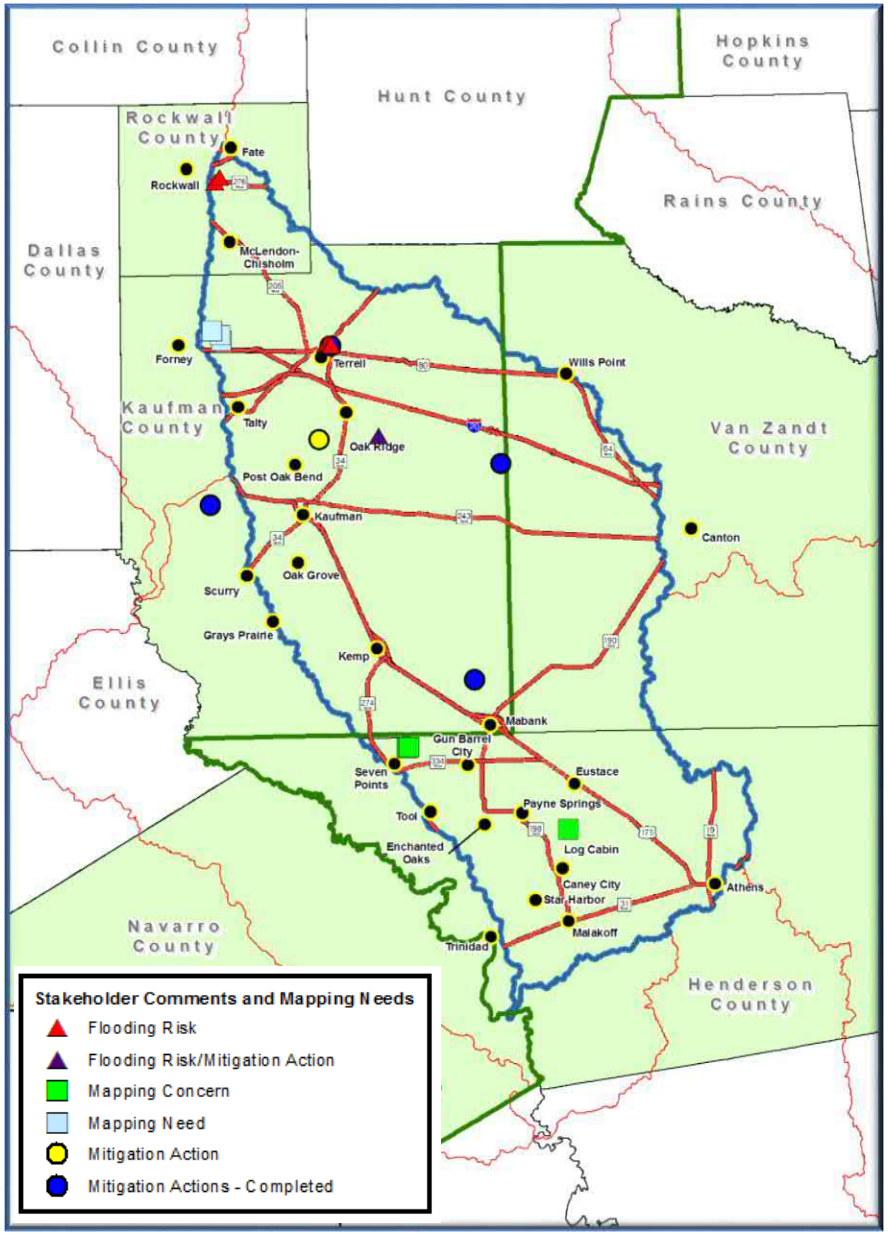
Meeting Results: Denton



- Community concerns
- Known Flooding locations
- Areas of Mitigation Interest

Discovery Findings

Meeting Results: Cedar



Stakeholder Comment Distribution

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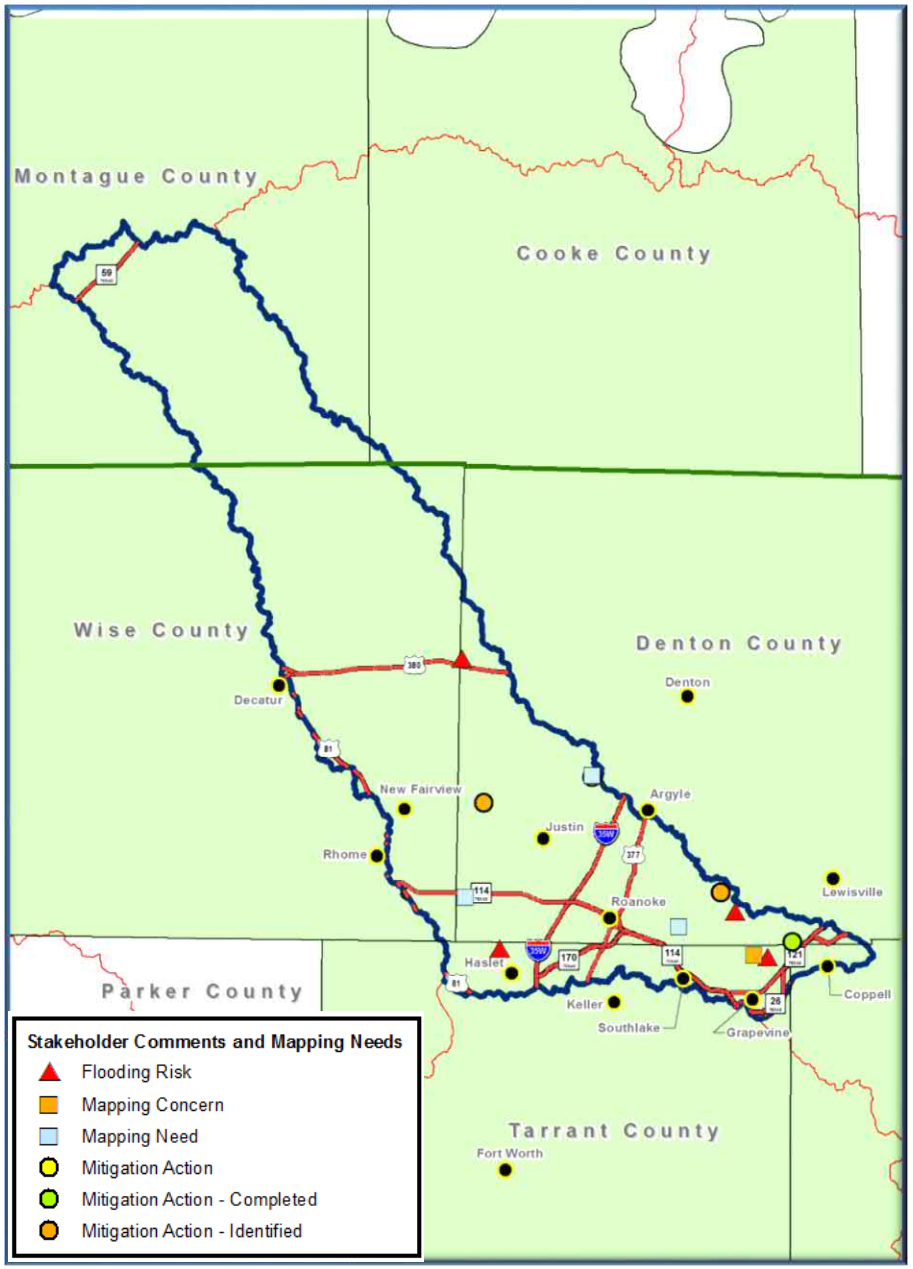
Discovery Findings

Meeting Results: Denton



Stakeholder Comment Distribution

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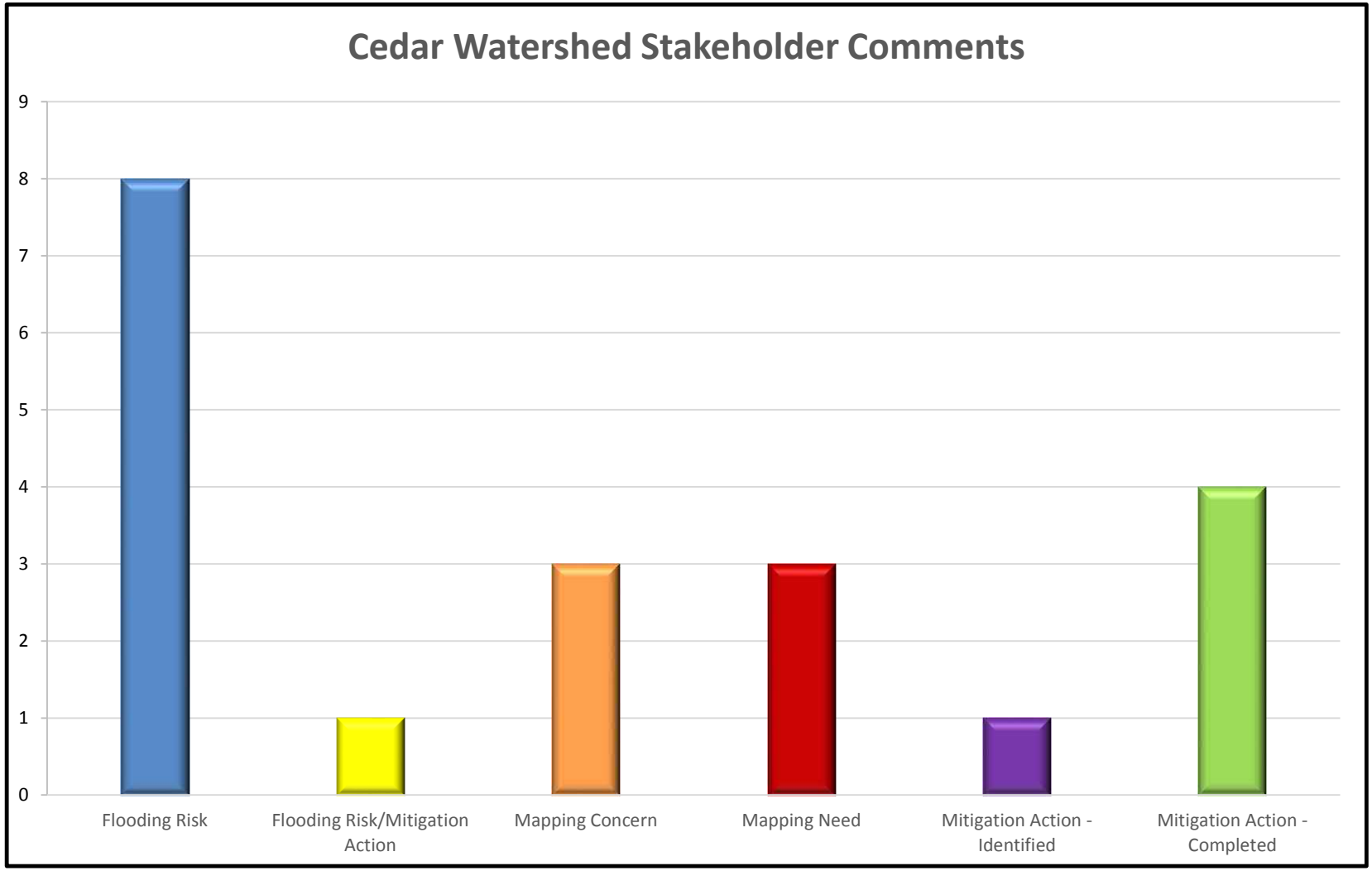
Discovery Findings

Meeting Results: Cedar



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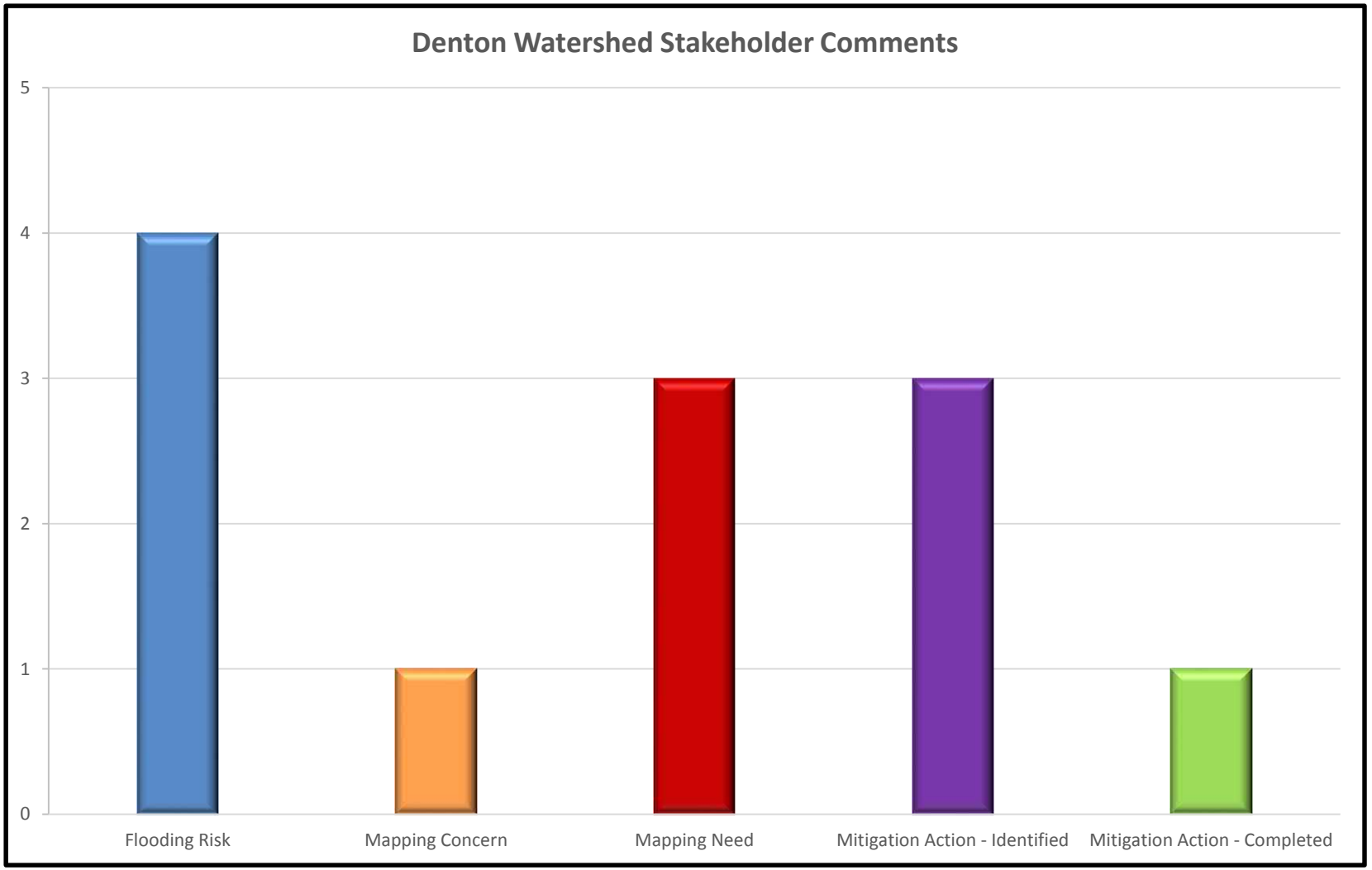
Discovery Findings

Meeting Results: Denton



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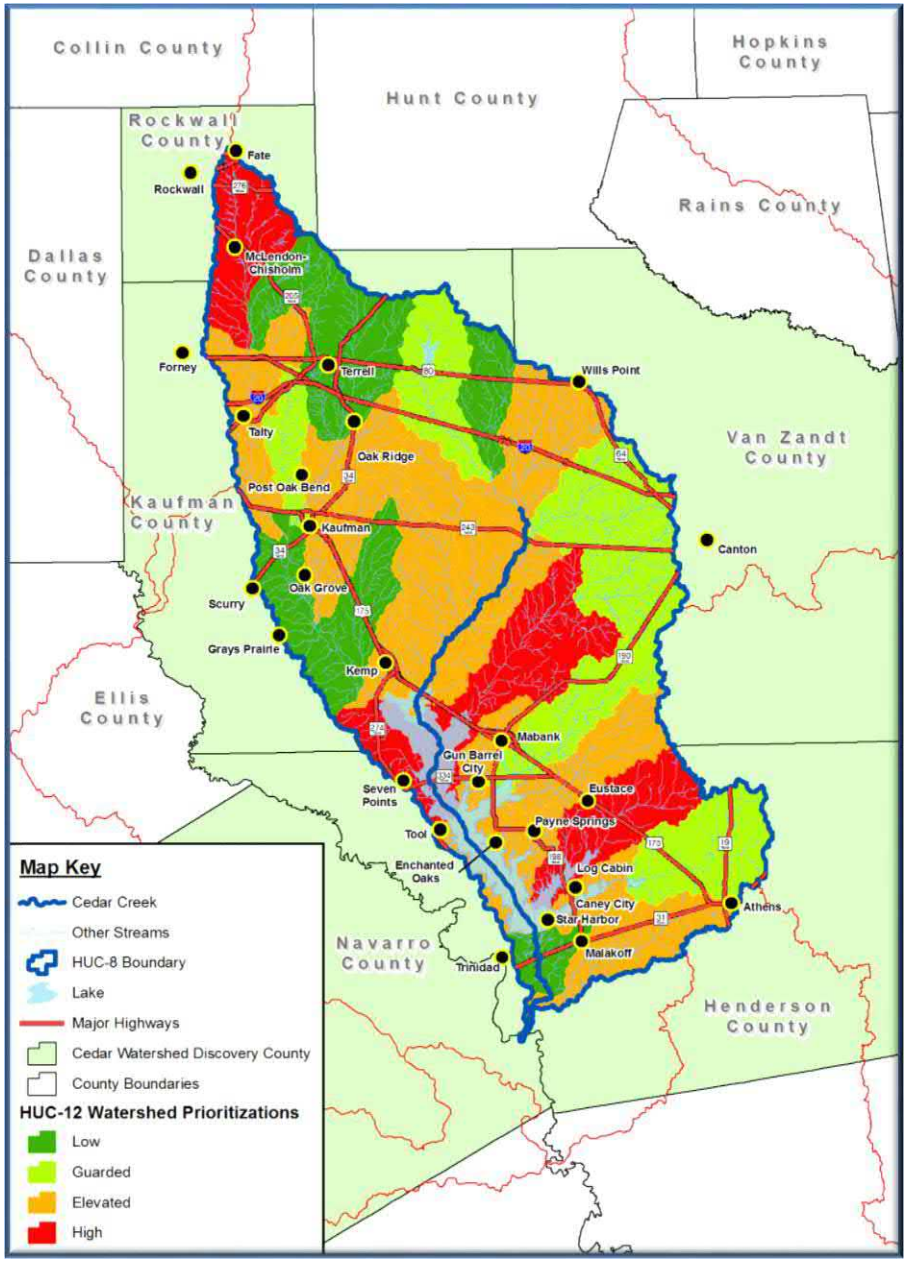
Discovery Findings

Meeting Results: Cedar



- Cedar HUC-12 sub-watersheds Prioritization

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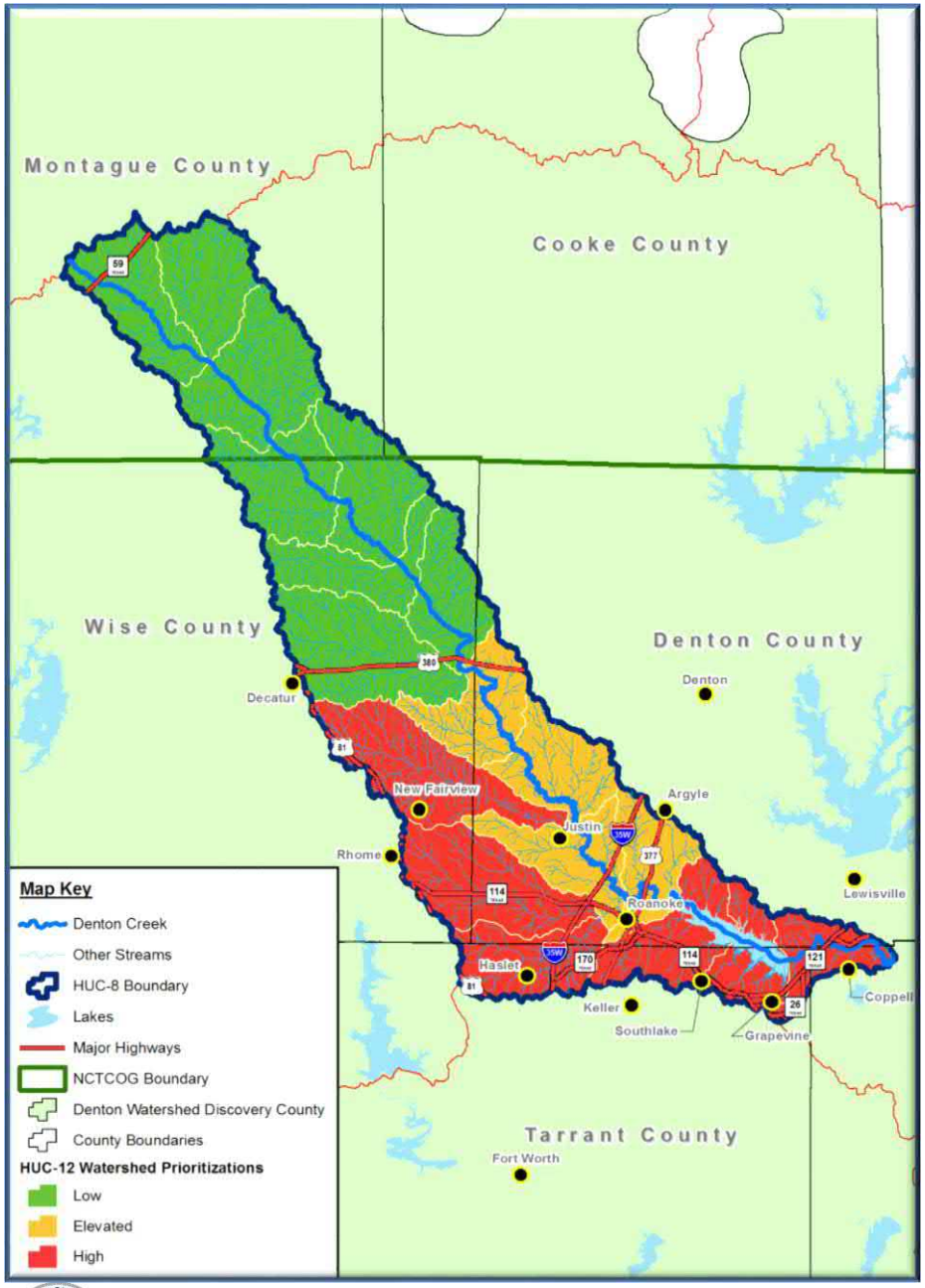
Discovery Findings

Meeting Results: Denton



- Denton HUC-12 sub-watersheds Prioritization

Base Level Engineering(BLE)

What is it?

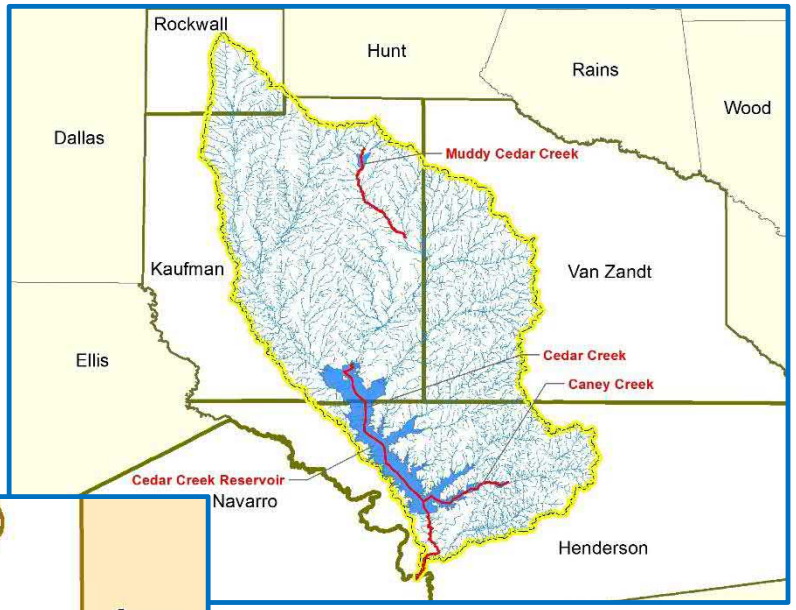
Large scale automated engineering process to identify flood risks for an entire watershed.

- **Uses:**
  - High resolution ground elevation data
  - Automated hydrologic and hydraulic modeling
- **To create:**
  - Baseline modeling equivalent to Zone A floodplains
  - Scalable models that can be further refined
  - Watershed-wide flood risk data for Immediate use

Base Level Engineering(BLE)

Overview

- BLE is best used at a larger scale (HUC8)
- LiDAR must be Available
- Model Review and Adjustments
- Gage Review included in hydrology



Key Features

- Regulated Stream(s)
- BLE Streams
- Lakes and Reservoirs

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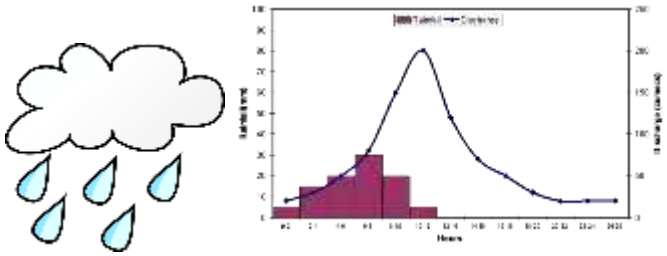
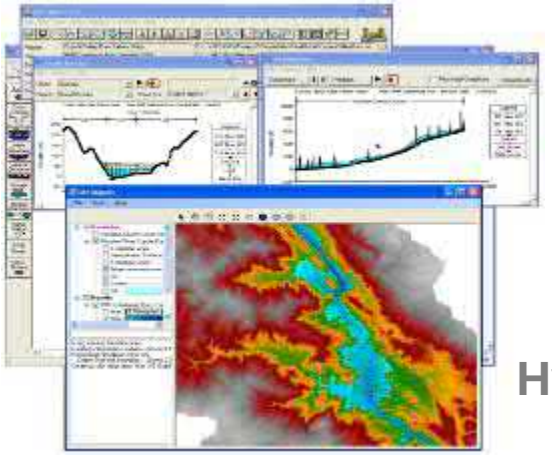
Base Level Engineering(BLE)

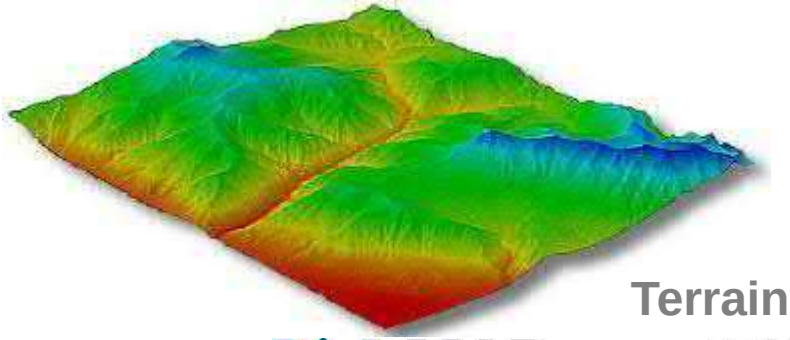
MODELING



Hydrology



Hydraulics



Terrain

Overview

Mapping

OUTPUTS

- Hydrology modeling (Regression) flows w/gage analysis
- Hydraulic modeling (HEC-RAS) for 10%, 4%, 2%, 1% and 0.2% storm events
- 10%, 1% and 0.2% floodplain boundaries
- Areas of Expanded Flood Risk
- Depth and WSEL Grids (1% and 0.2%)
- Flood Risk Assessment

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Base Level Engineering(BLE)

Overview

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Base Level Engineering(BLE)

Applications

- Building Block for Future Model Refinement

- Creates a data-based starting point for conversations about existing flood risk.

- Assists FEMA in understanding where current FIRM does not adequately identify flood risk

COST-EFFECTIVE

DATA FOR REVIEW

COLLABORATIVE

FASTER

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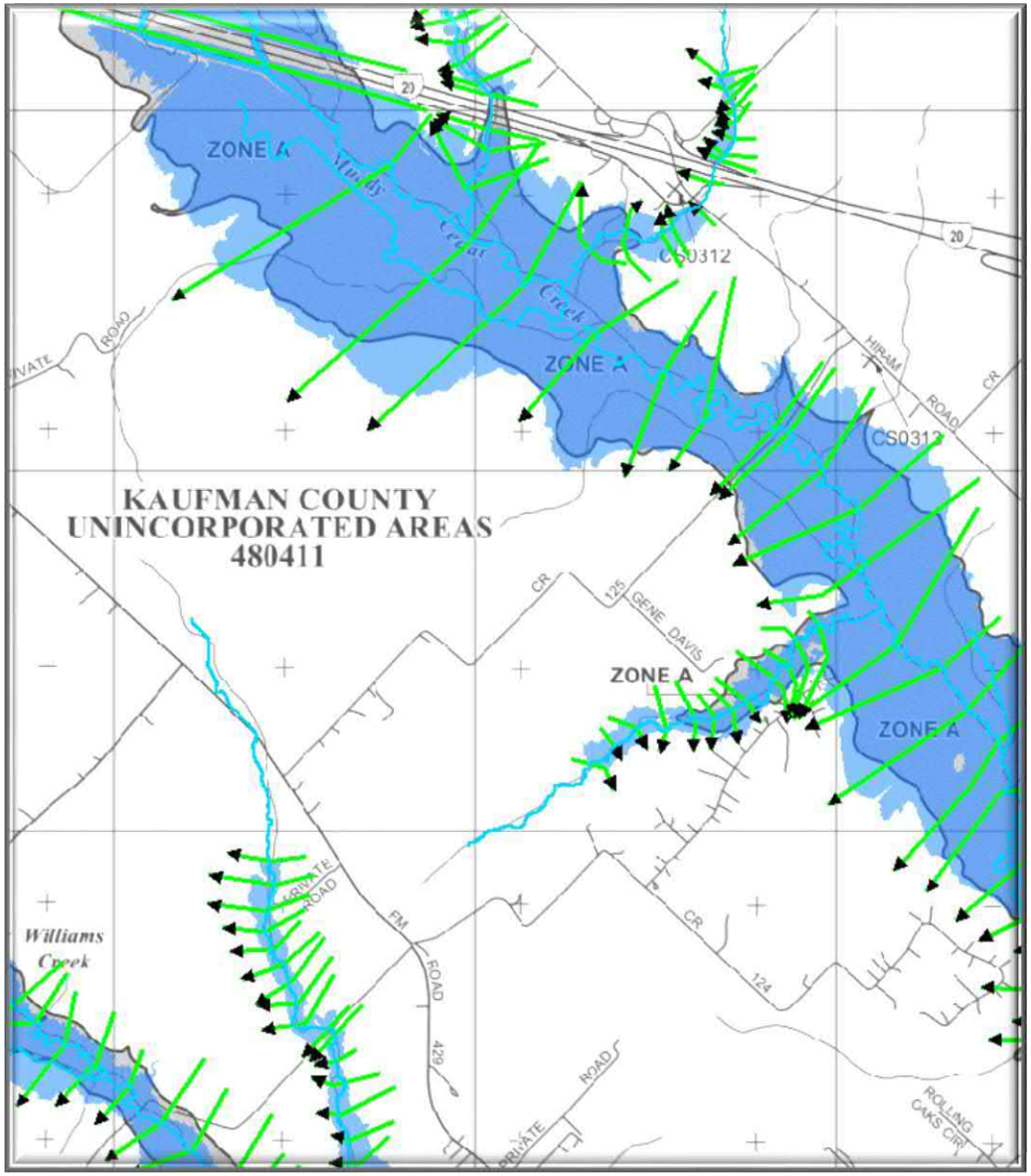
BLE Products

Mapping



- Model-backed

Key to Features

- BLE Model Stream
- BLE Cross Section
- BLE Mapping: 100-Year

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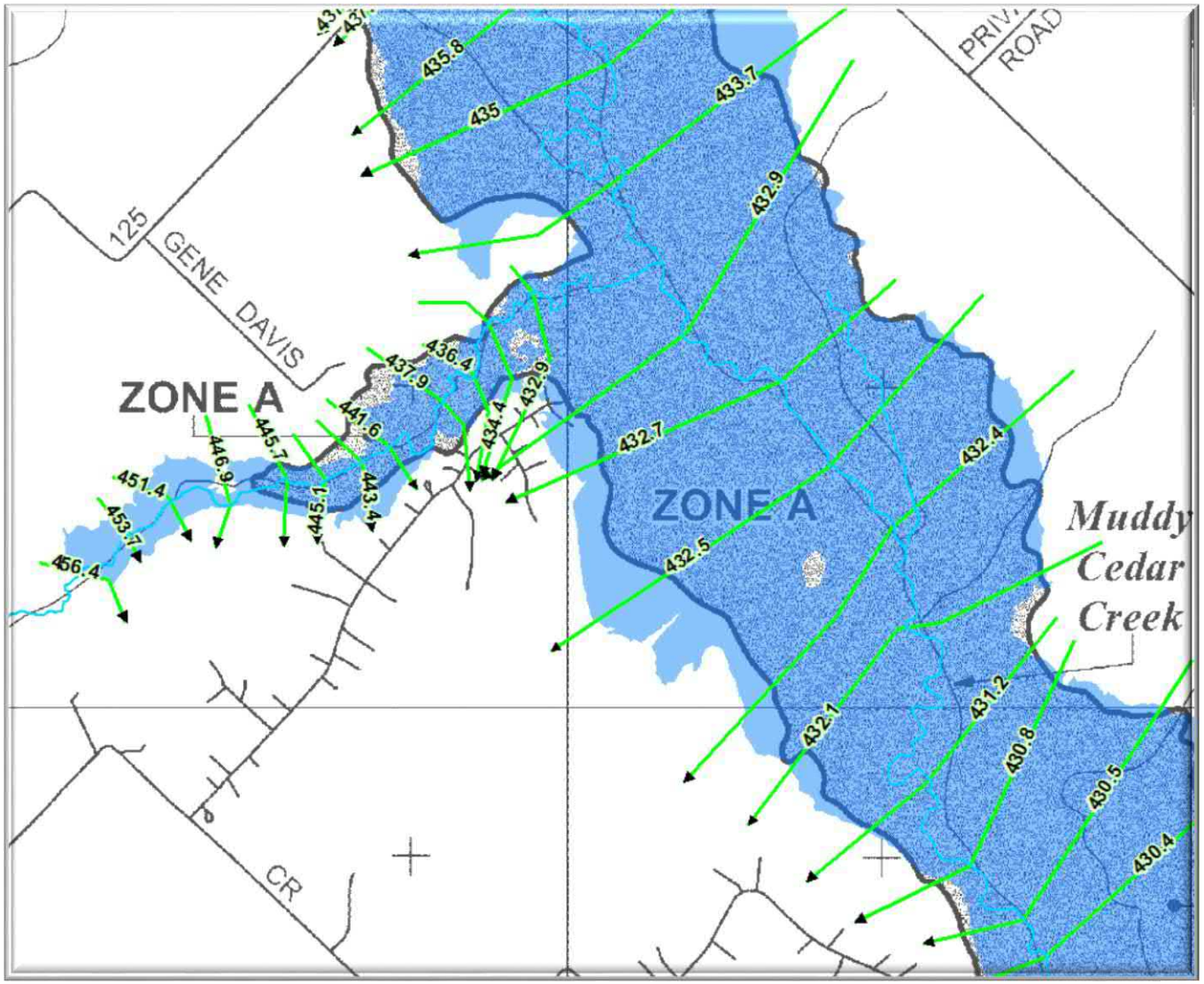
Mapping



- Cross Sections with WSELs
- Estimated BFEs

Key to Features

- BLE Model Stream
- BLE Cross Section
- BLE Mapping: 100-Year

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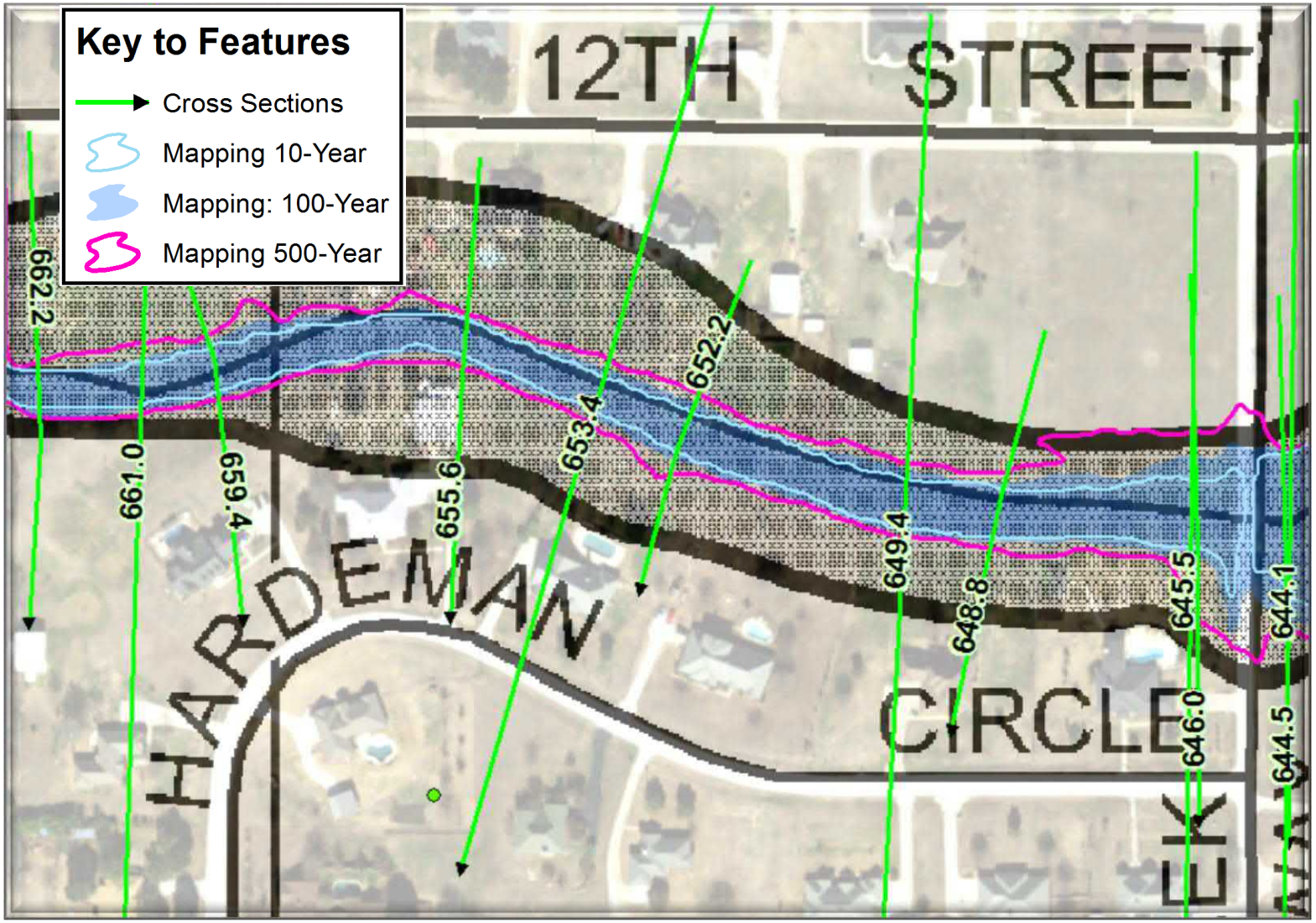
Mapping



10%, 1% and 0.2% floodplain boundaries Estimated BFEs

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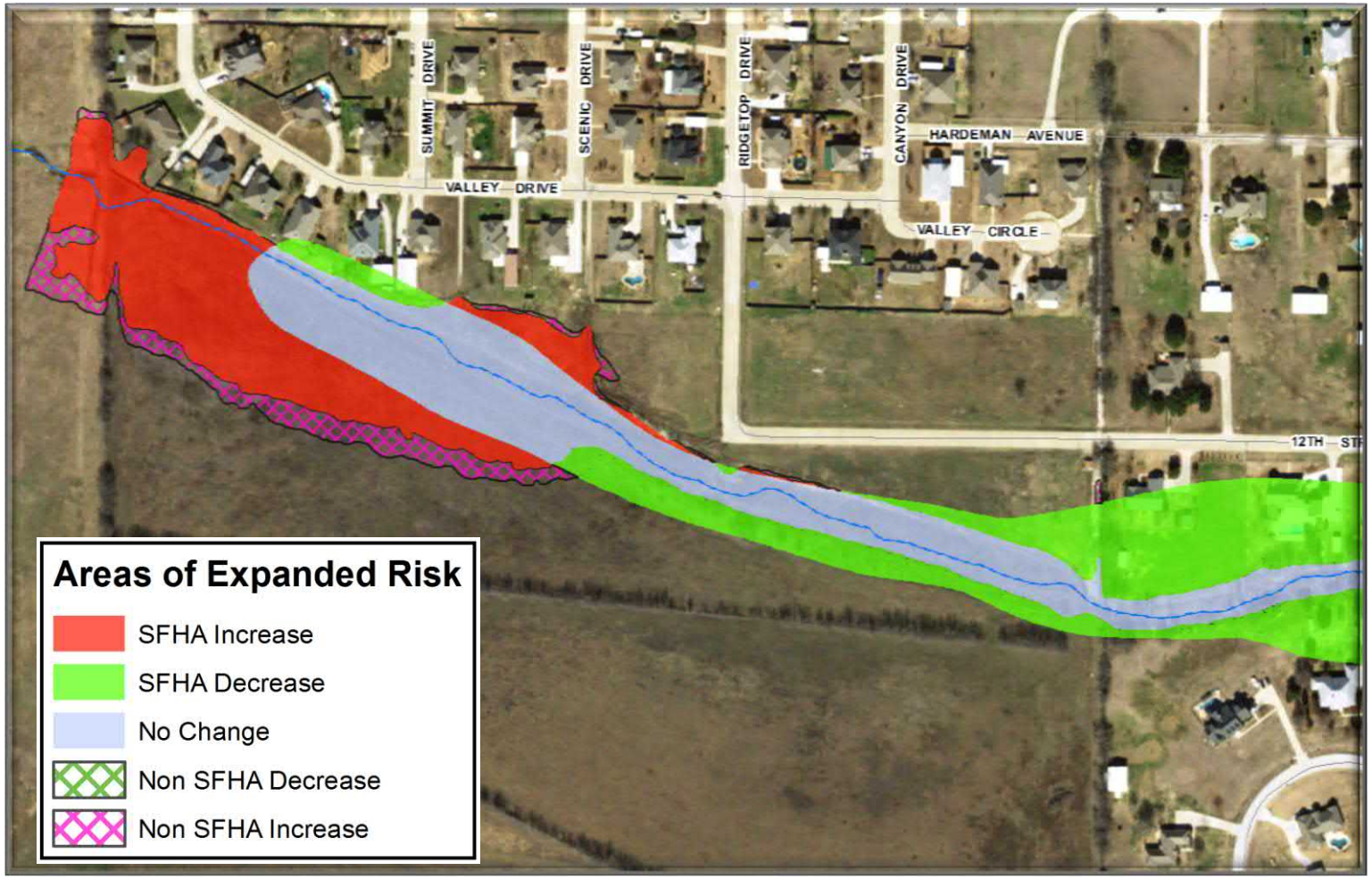
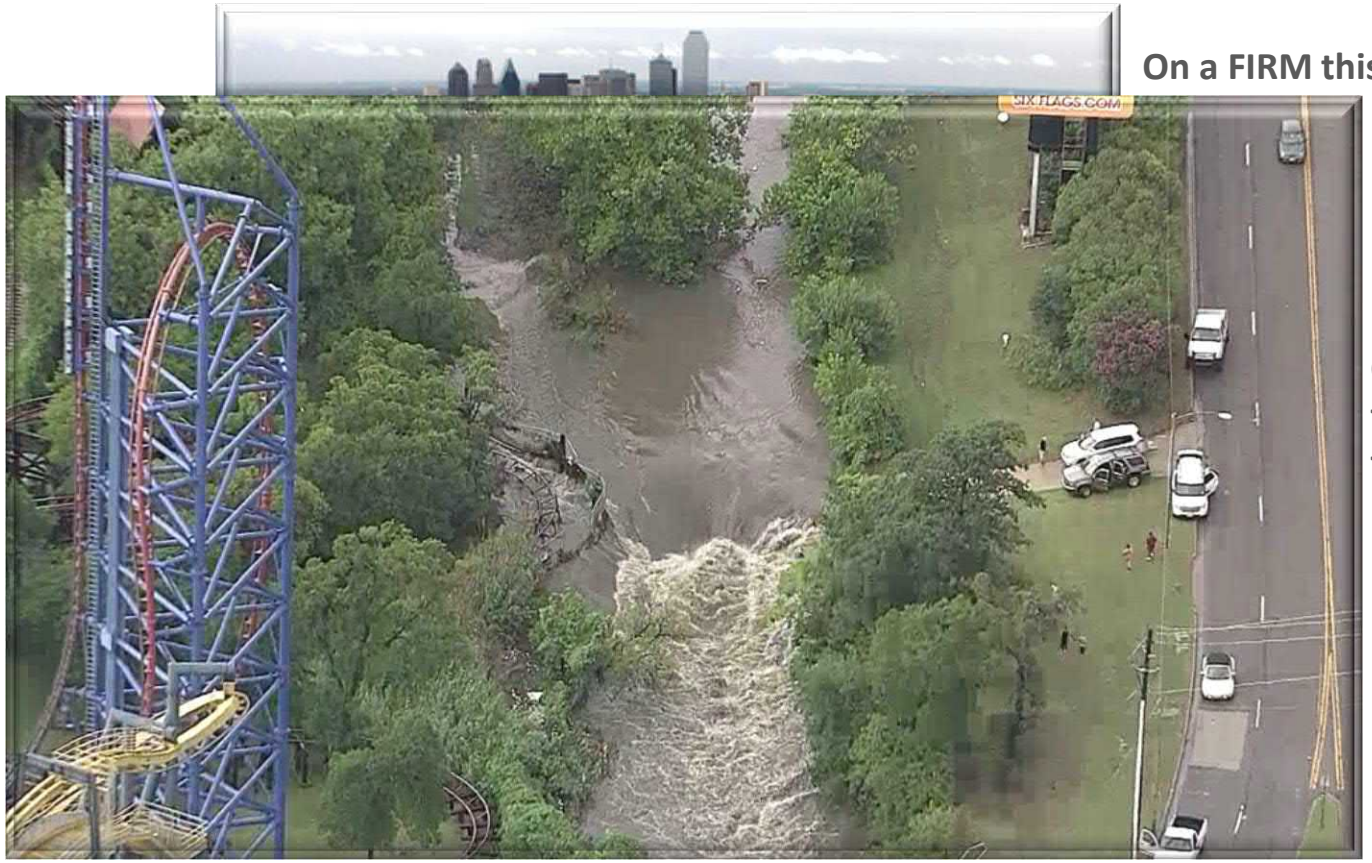
Mapping



- Horizontal changes between old and new mapping

BLE Products

Depth Grids



On a FIRM this type of flooding

On a FIRM this type of flooding and this type of flooding have the same horizontal extent

Is the risk the same?

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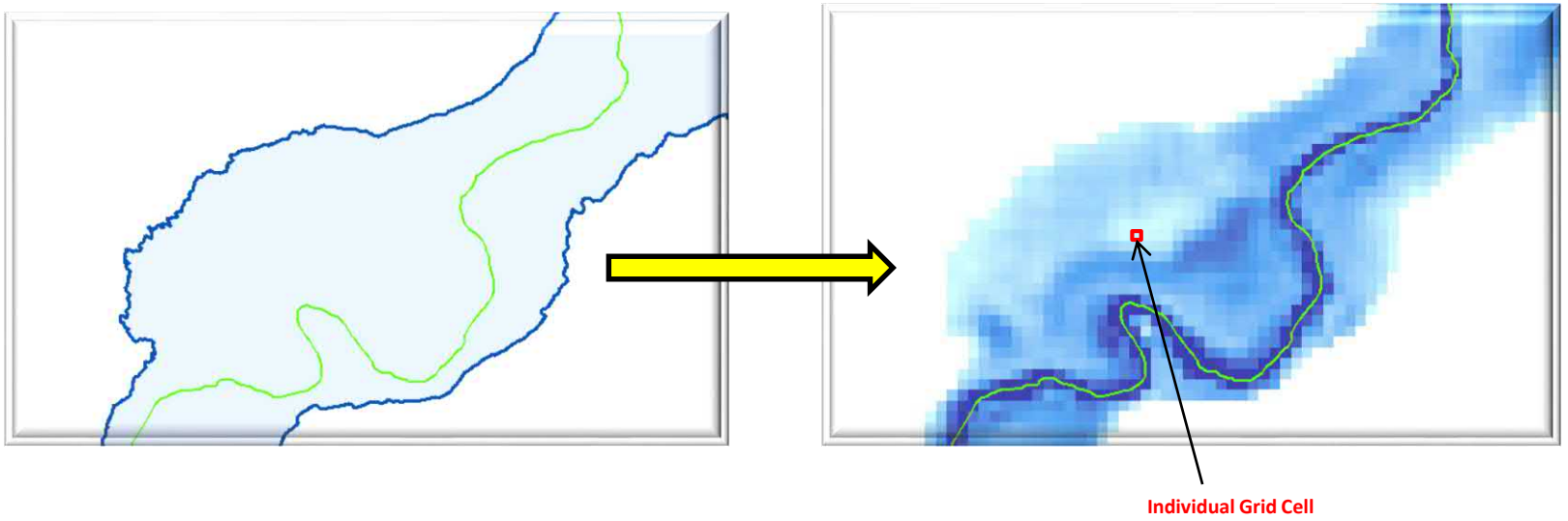
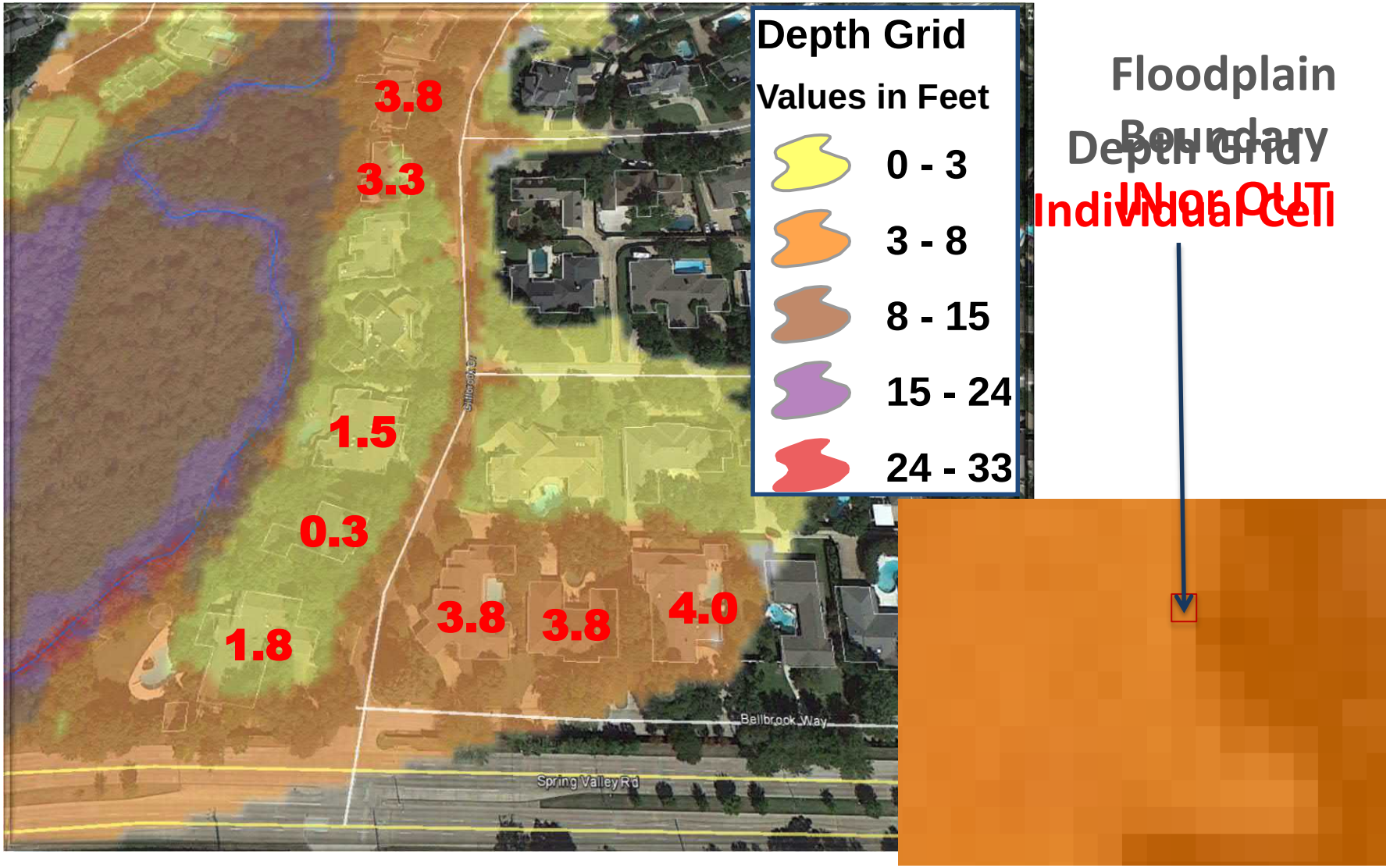
Depth Grids



Each Grid Cell has a Unique Value

BLE Products

Depth Grids



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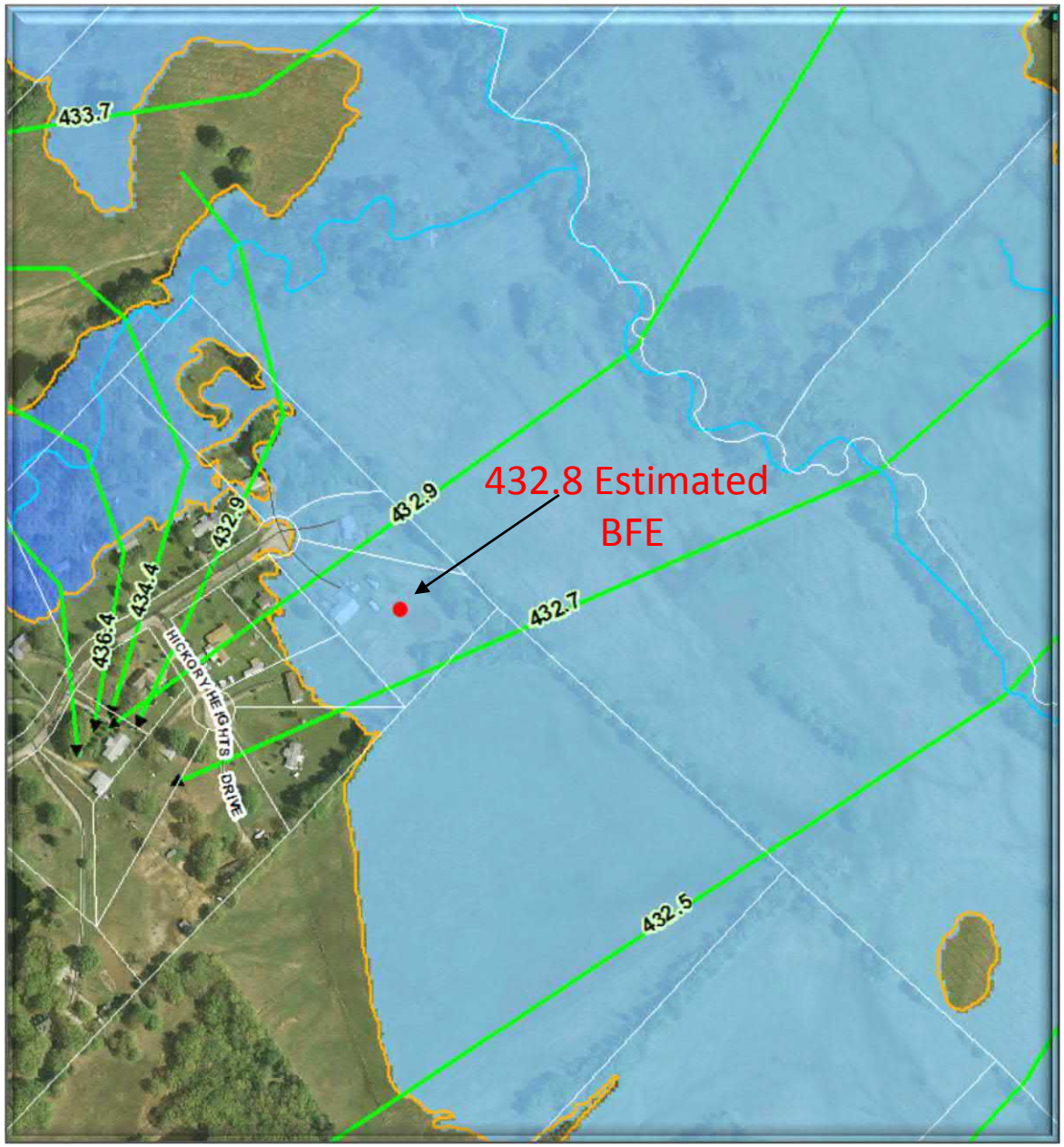
Depth Grids



- Estimated BFEs on-the-go

Key to Features

- BLE Model Stream
- BLE Cross Section
- BLE Mapping: 100-Year

BLE WSE: 100-Year

Depth in Feet

High : 446.5

Low : 431.4

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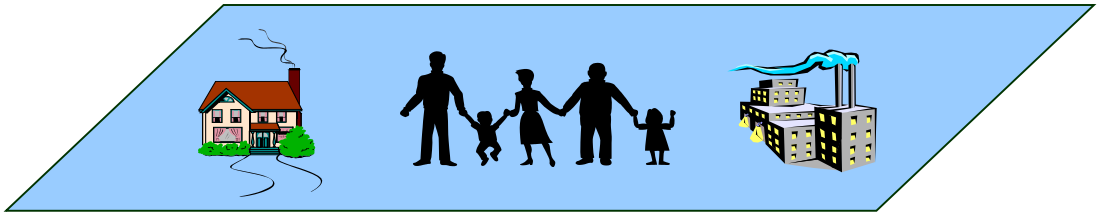
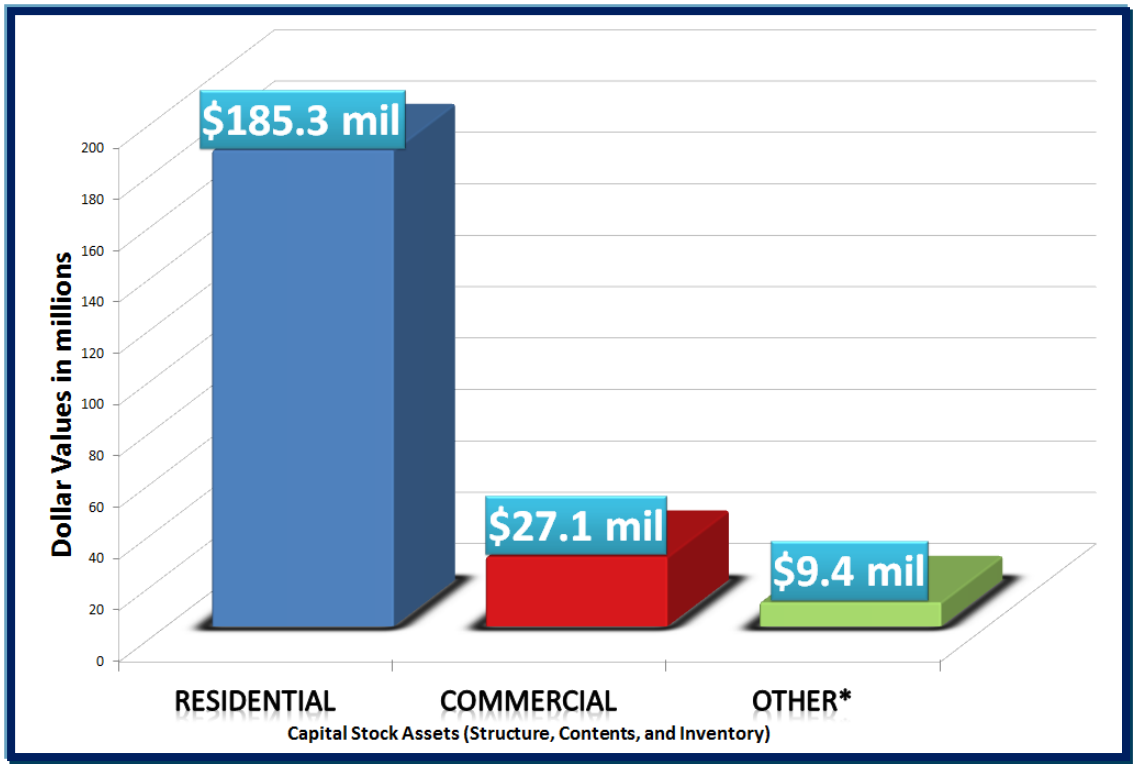
Flood Risk Assessment



- Inventory of built environment
- Demographics



*** Other - include Industrial, Agricultural, Education, Religious, and Government structures.**

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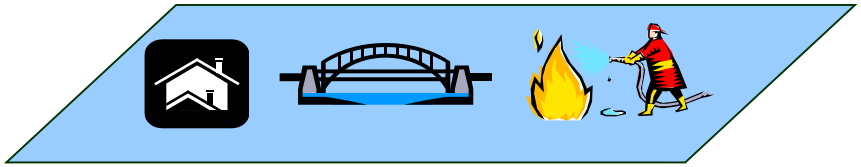
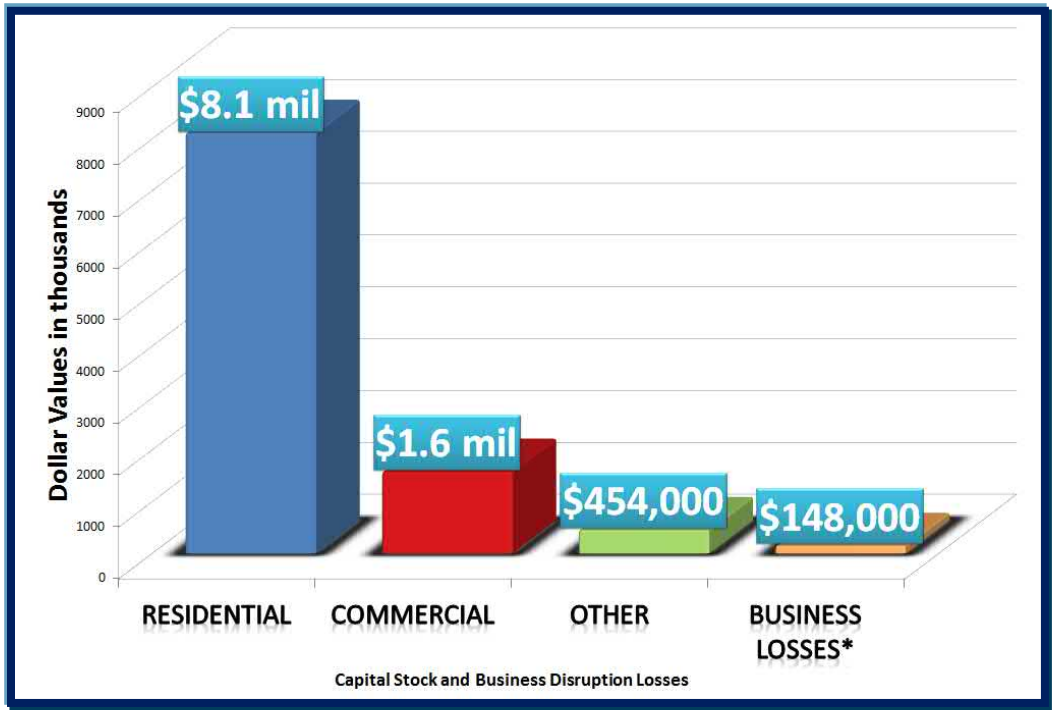
Flood Risk Assessment



- Estimate Damages

- Estimate Losses/Needs



*** Business Losses - are the sum of Inventory Loss, Relocation Cost, Income Loss, Rental Income Loss, Wage Loss and Direct Output Loss.**

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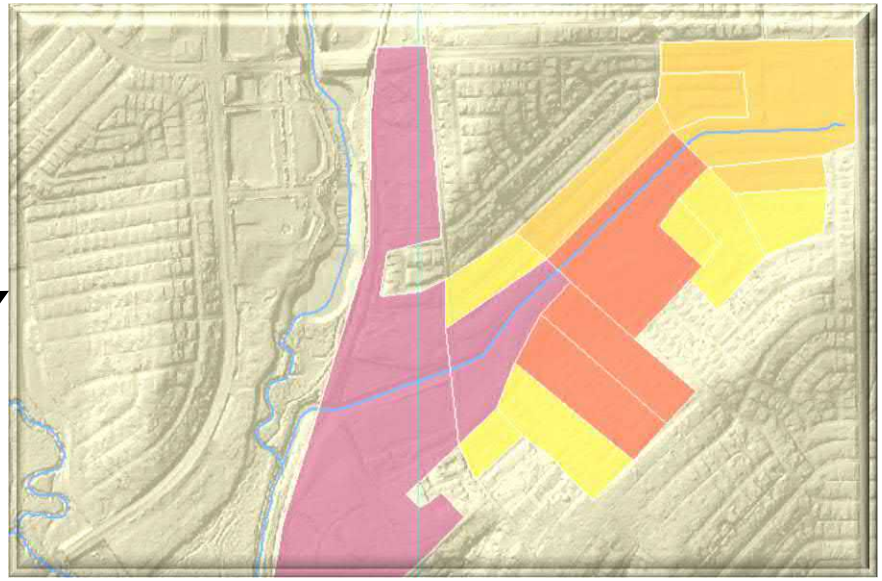
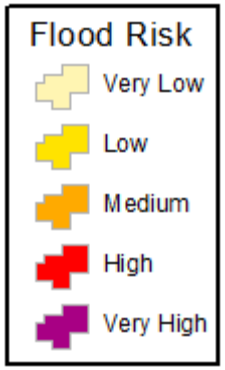
Flood Risk Assessment





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BLE Products

Flood Risk Assessment

Building-Related Losses

X (Y%) of buildings at least moderately damaged (11-50%)

Total Economic Losses

$X million total

Y% residential

Displaced Populations

X households displaced

Y individuals requiring short-term shelter

Critical Facility Losses

At least moderate damage to:

- X Fire Station
- Y Police Station
- Z Schools

Debris Generation

X tons of debris

Y truckloads of debris

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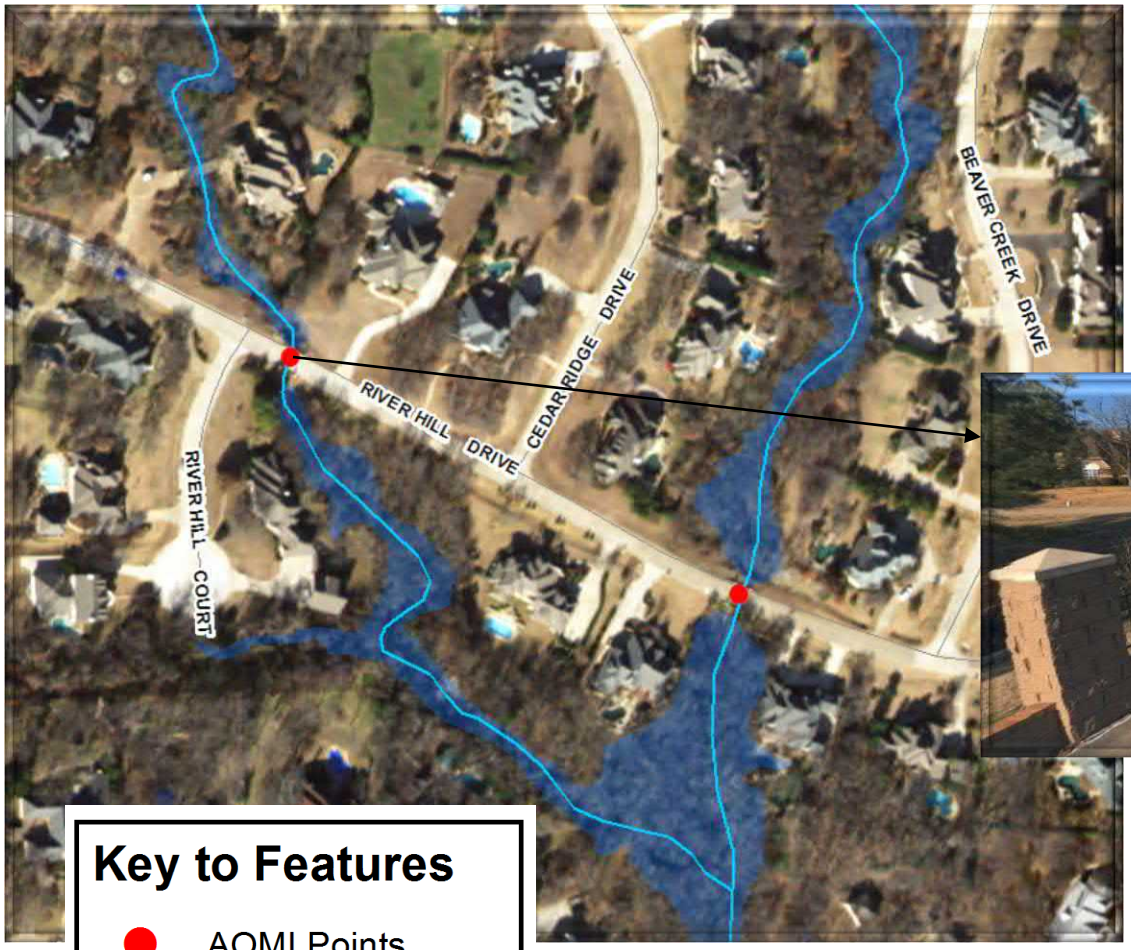
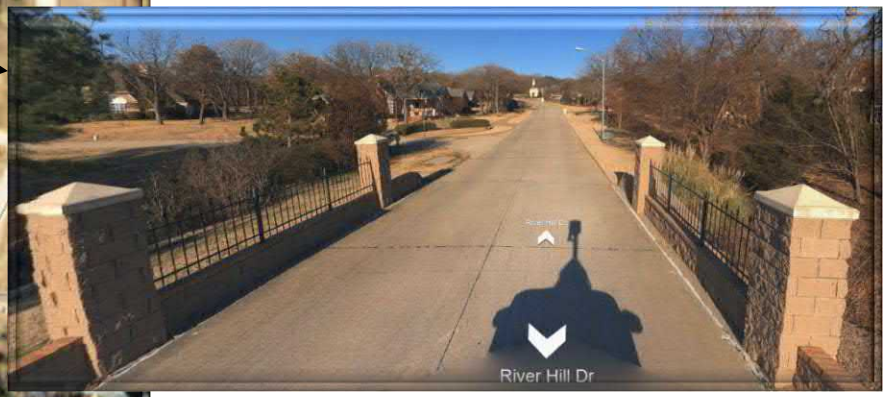
Areas of Mitigation Interest (AoMI)



- Structure inventory for future Discovery/Mitigation Efforts



Key to Features

- AOMI Points
- Model Stream
- Mapping: 100-Year

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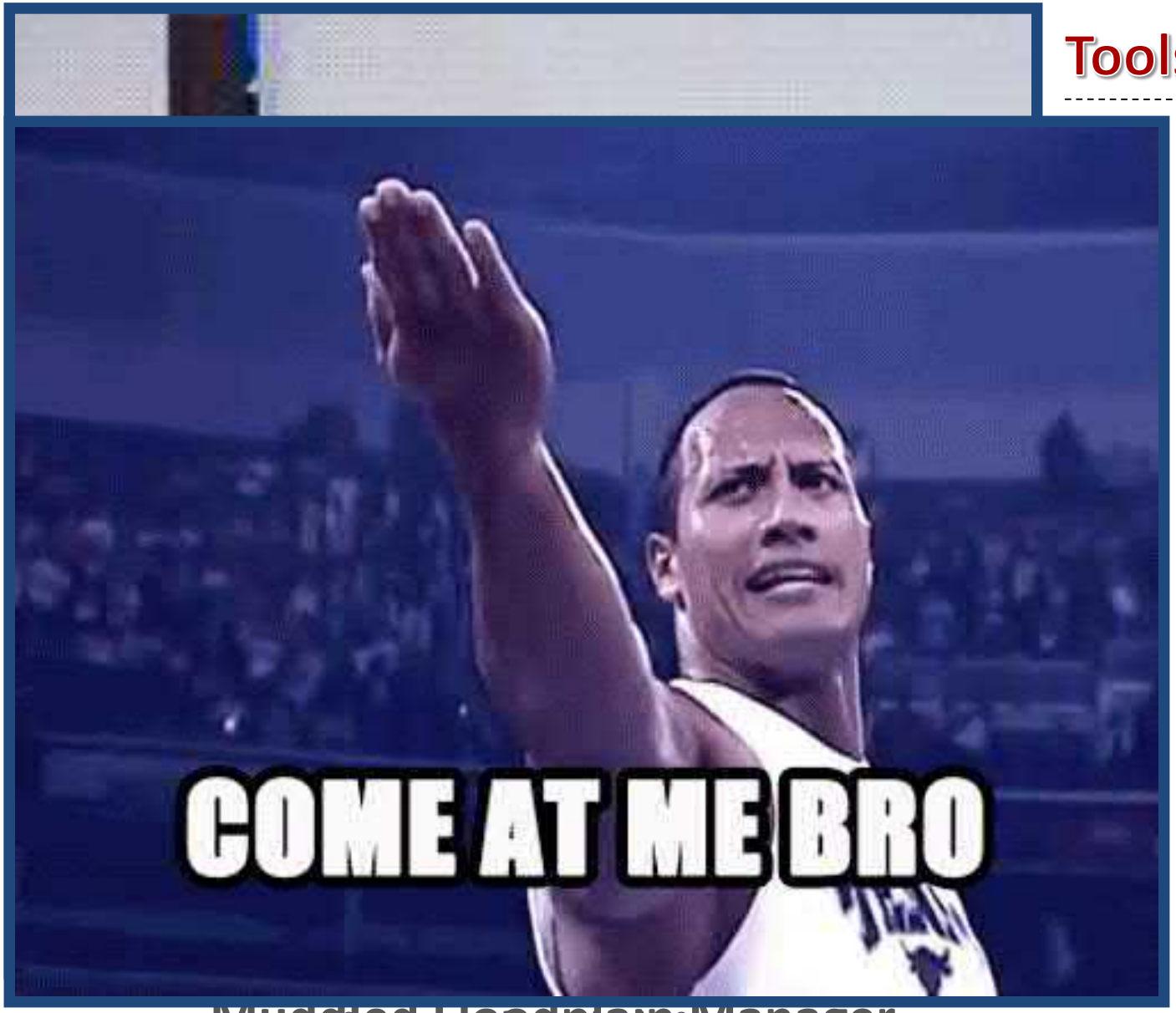
Tools for Outreach



Muddled Floodplain Manager

Confident Floodplain Manager

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Example Post-Discovery Projects

2013

2013 Village Creek Study – Arlington, Kennedale, and Tarrant County

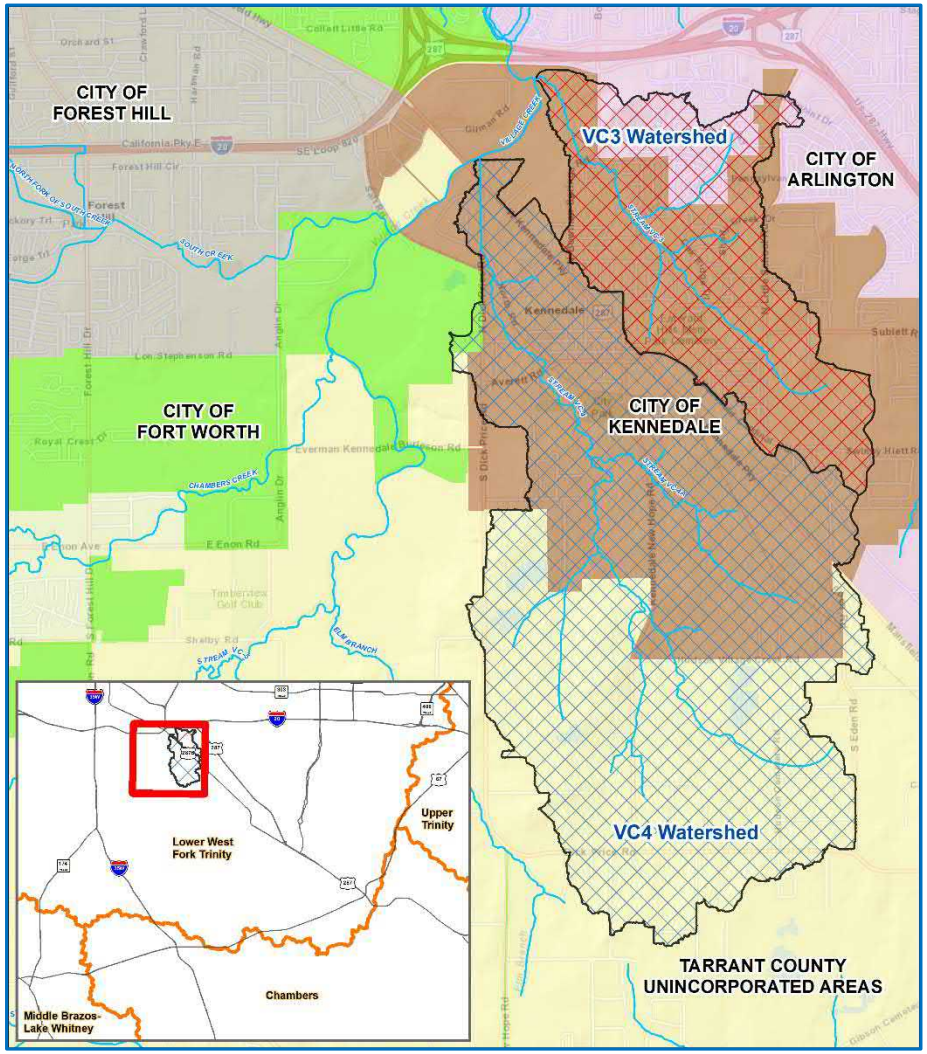
- New Hydrology, Hydraulics, and Mapping for 13 streams
- Flood Risk Products including Flood Risk Assessment

Major Highways
Streams
HUC - 8 Boundaries

NCTCOG FY13 Study Watersheds

VC3
VC4

75% Federal Grant
25% Local Cost match



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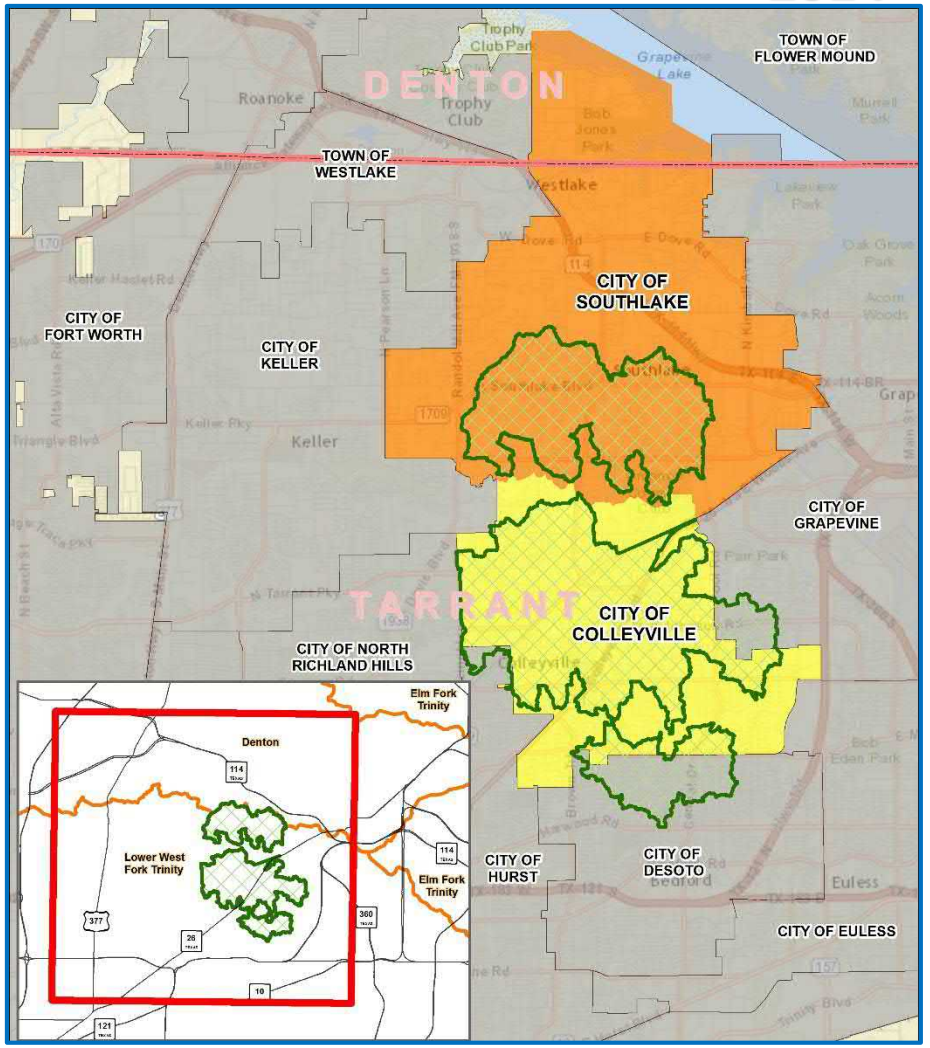
Example Post-Discovery Projects

2014

2014 Bear Creek Study – Southlake and Colleyville

- New Hydrology, Hydraulics, and Mapping for 19 streams (Colleyville) and 8 streams (Southlake)
- Flood Risk Products including Flood Risk Assessment

75% Federal Grant
25% Local Cost match



Major Highways
HUC - 8 Boundaries
Study Watershed Boundary
County Boundary
Other Cities

FY14 Participating Cities

Colleyville
Southlake

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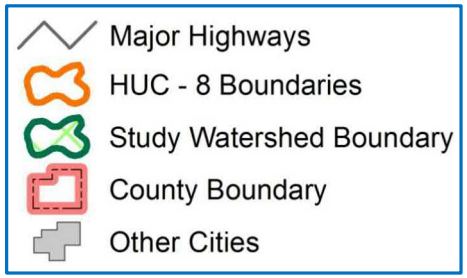
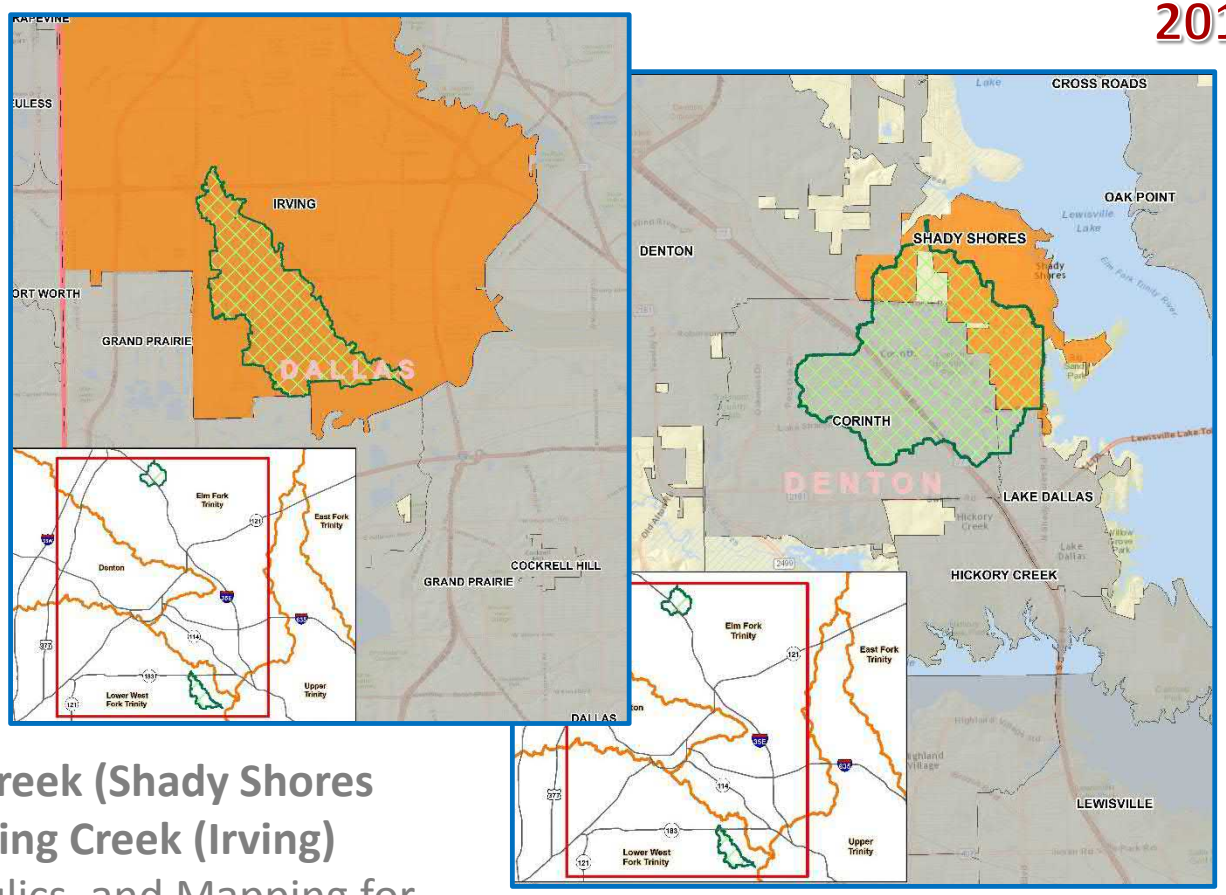
Example Post-Discovery Projects

2015





2015 Study – Lynchburg Creek (Shady Shores and Corinth) and West Irving Creek (Irving)

- New Hydrology, Hydraulics, and Mapping for a total of 10 streams
- Flood Risk Products including Flood Risk Assessment

75% Federal Grant
25% Local Cost match

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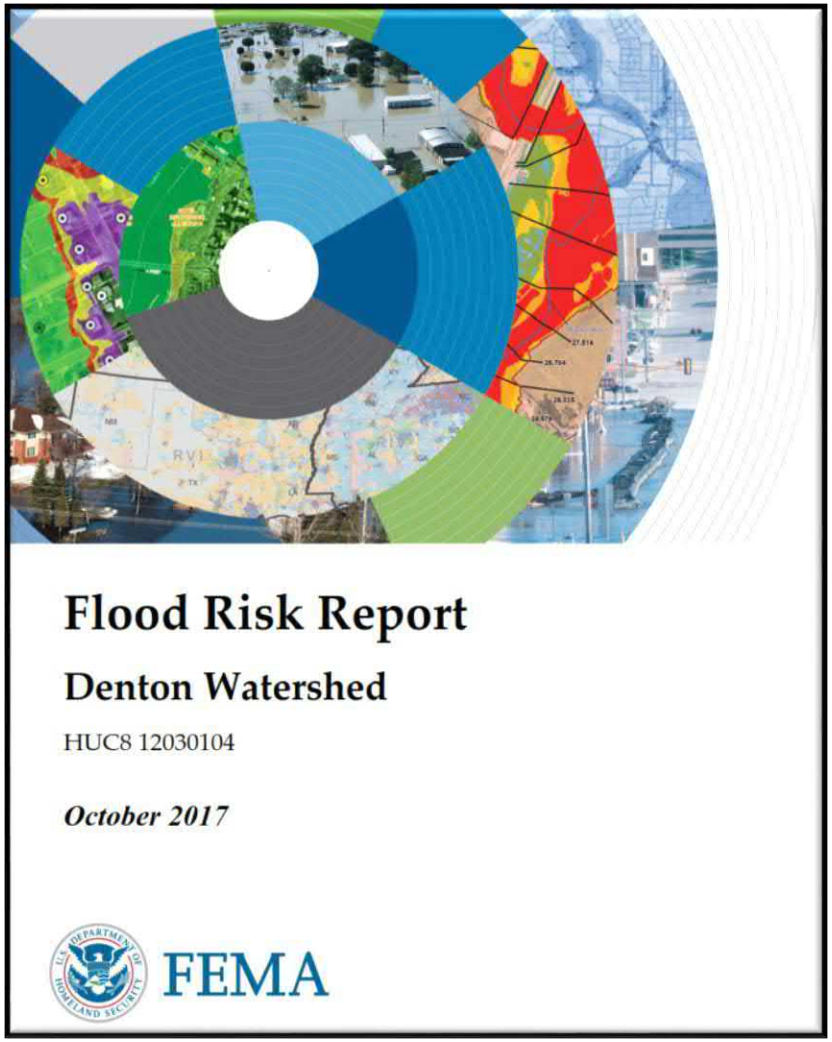
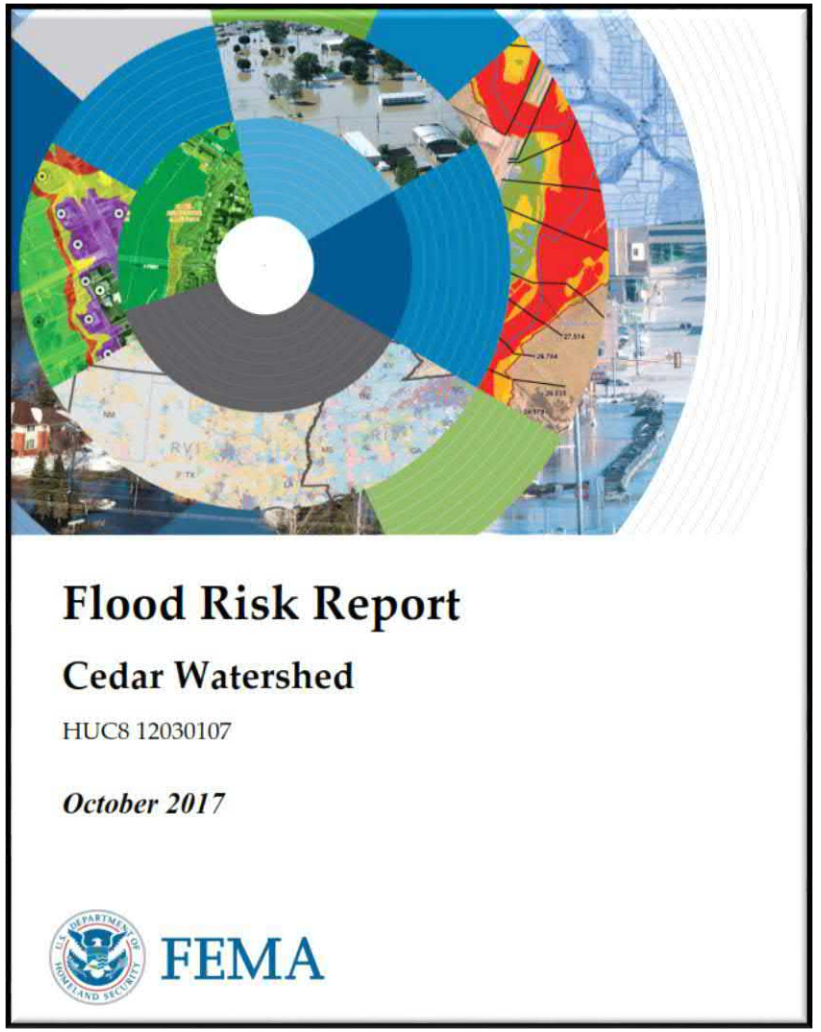
2017 NCTCOG Discovery

Flood Risk Report





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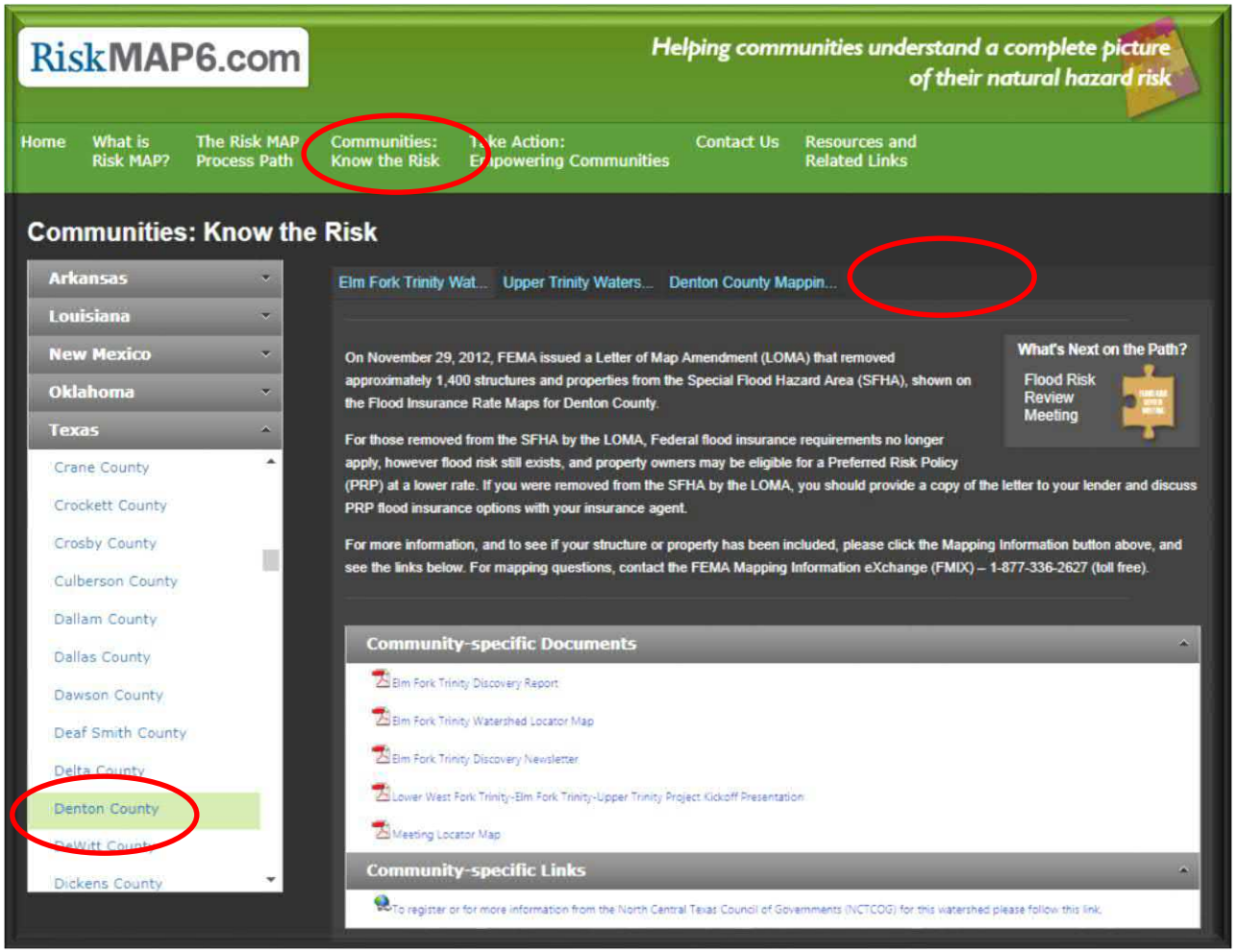
Next Steps

https://www.riskmap6.com



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Next Steps

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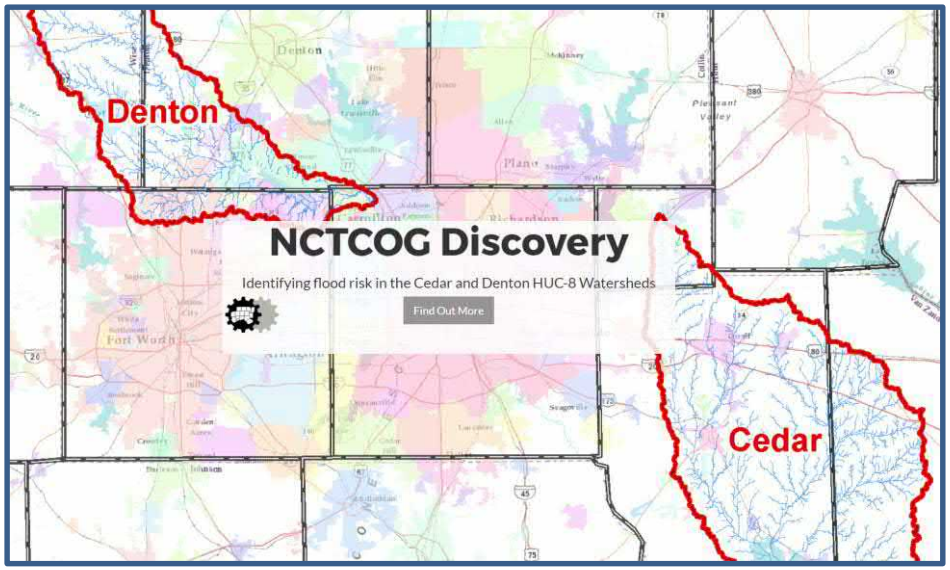
Login: EMAIL ADDRESS

Password: NCTCOG_2017!



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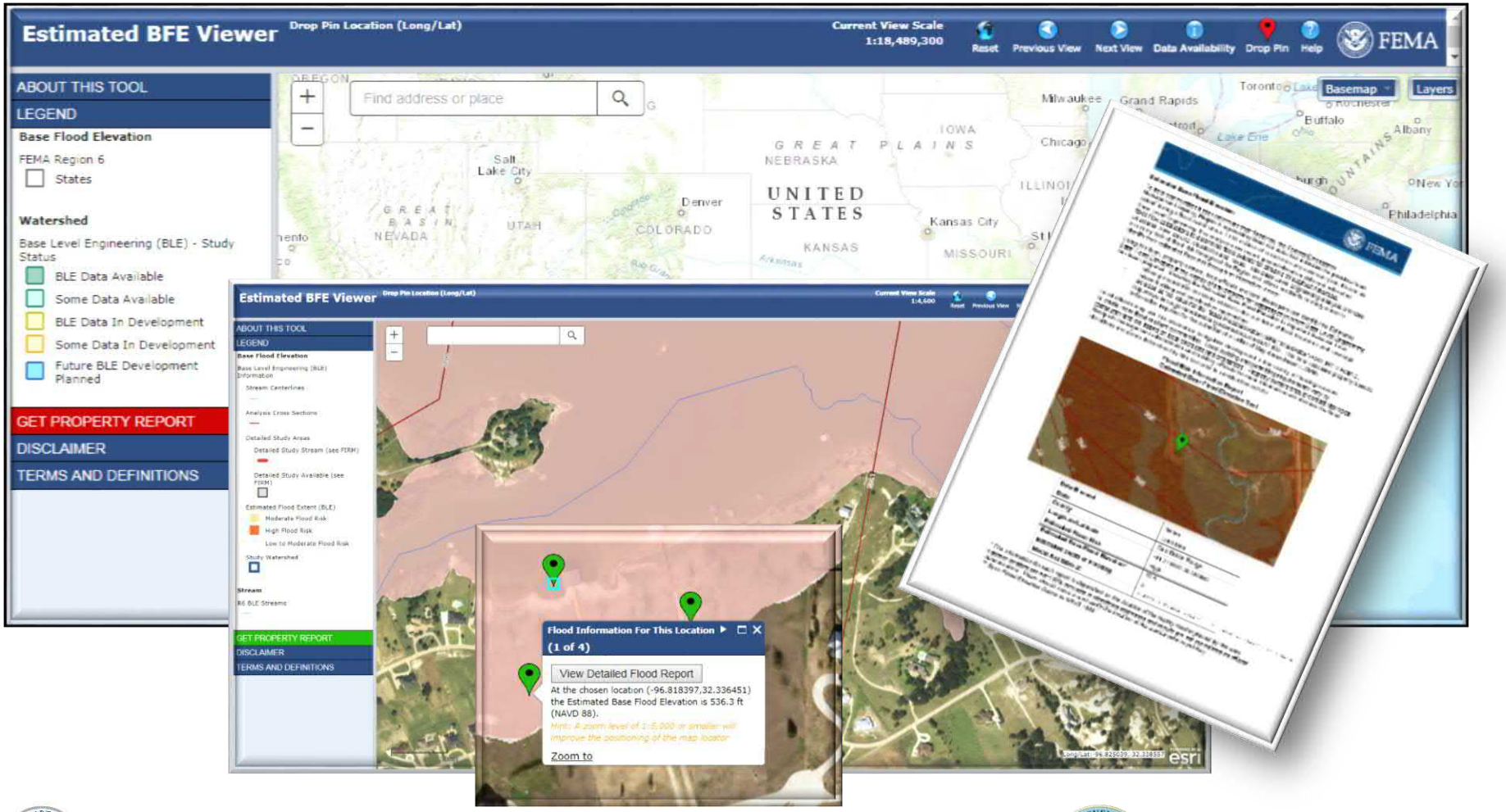
Next Steps

https://apps.femadata.com/estbfe



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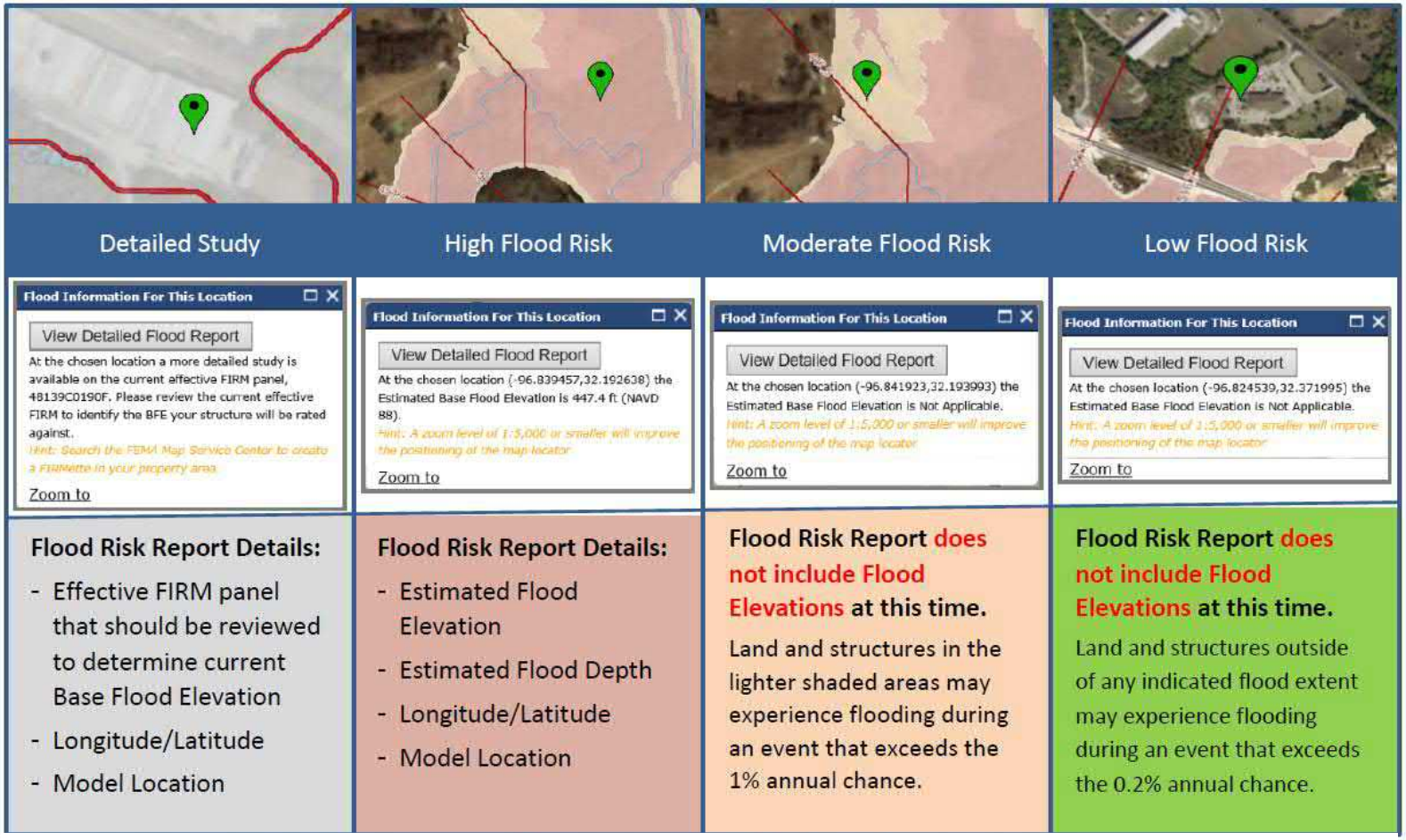
Next Steps

There are four possible outcomes dependent upon where the **Drop Pin** is placed: Detailed Study Available, High Risk, Low to Moderate Risk and Low Risk. More information is available in Table below.



Detailed Study	High Flood Risk	Moderate Flood Risk	Low Flood Risk
Flood Information For This Location View Detailed Flood Report At the chosen location a more detailed study is available on the current effective FIRM panel, 48139C0190F. Please review the current effective FIRM to identify the BFE your structure will be rated against. Hint: Search the FEMA Map Service Center to create a FIRMette in your property area Zoom to	Flood Information For This Location View Detailed Flood Report At the chosen location (-96.839457,32.192638) the Estimated Base Flood Elevation is 447.4 ft (NAVD 88). Hint: A zoom level of 1:5,000 or smaller will improve the positioning of the map locator Zoom to	Flood Information For This Location View Detailed Flood Report At the chosen location (-96.841923,32.193993) the Estimated Base Flood Elevation is Not Applicable. Hint: A zoom level of 1:5,000 or smaller will improve the positioning of the map locator Zoom to	Flood Information For This Location View Detailed Flood Report At the chosen location (-96.824539,32.371995) the Estimated Base Flood Elevation is Not Applicable. Hint: A zoom level of 1:5,000 or smaller will improve the positioning of the map locator Zoom to
Flood Risk Report Details: - Effective FIRM panel that should be reviewed to determine current Base Flood Elevation - Longitude/Latitude - Model Location	**Flood Risk Report Details:** - Estimated Flood Elevation - Estimated Flood Depth - Longitude/Latitude - Model Location	**Flood Risk Report does not include Flood Elevations at this time.** Land and structures in the lighter shaded areas may experience flooding during an event that exceeds the 1% annual chance.	**Flood Risk Report does not include Flood Elevations at this time.** Land and structures outside of any indicated flood extent may experience flooding during an event that exceeds the 0.2% annual chance.

Note: At this time, flood elevations are only available in the High Flood Risk extent area

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Questions

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Contact Information

THANK YOU

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- FEMA:
  - Alan Johnson – Alan.Johnson@fema.dhs.gov
- TWDB / TNRIS:
  - Manuel Razo – Manuel.Razo@twdb.texas.gov
  - Michael Segner – Michael.Segner@twdb.texas.gov

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Appendix IV: Resources

Watershed Follow-up Points of Contact

Subject/Topic of Interest	Name	Contact Information
FEMA Region 6 Risk MAP Lead *Project Outreach*	Alan Johnson Risk Analysis Branch FEMA Region 6	Phone: 940-898-5171 Email: alan.johnson@fema.dhs.gov
FEMA Technical Monitor	Jennifer Knecht Risk Analysis Branch FEMA Region 6	Phone: (940) 898-5553 Email: jennifer.knecht@fema.dhs.gov
• Floodplain Management • Floodplain Ordinance • Community Assistance Visits • Higher Standards	John Bowman	Phone: 840-297-0185 Email: john.bowman@fema.dhs.gov
• Community Rating System • Flood Insurance	Jonathan Smith	Phone: 228-235-6506 Email: jsmith@iso.com
• How to find and read FIRMs • Letters of Map Change and Elevation Certificates • Flood zone disputes • Mandatory insurance purchase guidelines • Map Service Center (MSC) and National Food Hazard Layer	FEMA Map Information eXchange (FMIX)	Phone: 877-FEMA-MAP (336.2627) Email: FEMAMapSpecialist@riskmapcds.com Live Chat: https://www.floodmaps.fema.gov/fhm/fmx_main.html

State Partners

Organization/Title	Name	Partner Location	Contact Information
Texas Water Development Board (TWDB) State NFIP Coordinator	Michael Segner, CFM	P.O. Box 13231 Austin, TX 78711	Phone: 512-463-3509 Email: michael.segner@twdb.texas.gov Web Page: http://www.twdb.texas.gov
Texas Division of Emergency Management (TDEM) State Hazard Mitigation Officer	David Jackson	P.O. Box 4087 Austin, TX 78773	Phone: 512-424-7820 Email: David.Jackson@dps.texas.gov Web Page: http://www.dps.texas.gov/dem/
North Central Texas Council of Governments (NCTCOG) *Environment & Development Director*	Edith Marvin, P.E., CFM	616 Six Flags Drive Arlington, TX 76005	Phone: 817-695-9211 Email: emarvin@nctcog.org Web Page: http://www.nctcog.org/envir/index.asp
North Central Texas Council of Governments (NCTCOG) *Environment & Development Planner*	Kori Mullen	616 Six Flags Drive Arlington, TX 76005	Phone: 817-695-9215 Email: kmullen@nctcog.org Web Page: http://www.nctcog.org/envir/index.asp
North Central Texas Council of Governments (NCTCOG) *Environment & Development Planner*	Mia Brown, CFM	616 Six Flags Drive Arlington, TX 76005	Phone: 817-695-9227 Email: mbbrown@nctcog.org Web Page: http://www.nctcog.org/envir/index.asp

Texas Water Development Board

http://www.twdb.texas.gov/

Louisiana is a high-risk state for emergency events and disasters. The Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP) is the agency responsible for coordinating the state's efforts throughout the emergency management cycle to prepare for, prevent where possible, respond to, recover from, and mitigate against hazards to lessen the effects of man-made or natural disasters that threaten the state. GOHSEP can save lives and reduce property damage by understanding risks and taking action to address those risks, as well as minimizing disaster impacts and increasing the resiliency in our communities, environment, and economy.

North Central Texas Council of Governments

http://nctcog.org/

The North Central Texas Council of Governments (NCTCOG) is a voluntary association of, by and for local governments, established to assist local governments in planning for common needs, cooperating for mutual benefit, and coordinating sound regional development. Serving a 16-county region of North Central Texas, NCTCOG is centered around the two urban centers of Dallas and Fort Worth. NCTCOG has over 230 member governments including 16 counties, numerous cities, school districts, and special districts. NCTCOG has been a Cooperating Technical Partner (CTP) with FEMA since 2004. From providing critical Light Detection and Ranging (LiDAR) data for Map Modernization (Map Mod) activities to offering up-to-date floodplain management training for floodplain managers and community leaders in the region, NCTCOG has served as a key stakeholder for risk reduction in North Texas.

NCTCOG FLOOD INFORMATION AND RESOURCES

NCTCOG is a proactive agency that has a long history of supporting floodplain management activities in the region. NCTCOG led and implemented new strategies over the past decades such as the Corridor Development Certificate for local floodplain permit decision making along the Trinity River Corridor since 1993. NCTCOG has been a Cooperating Technical Partner (CTP) with FEMA since 2004. From providing critical LiDAR data for map modernization activities to offering up-to-date floodplain management training for floodplain managers and community leaders in the region, NCTCOG has served as a key stakeholder for risk reduction in North Texas.

NCTCOG and TWDB worked hard to integrate our efforts with FEMA's Coordinated Needs Management Strategy (CNMS) to ensure that the work aligned with FEMA's Risk MAP goals and procedures.

POINTS OF CONTACT:

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Texas Floodplain Management Association (TFMA)

The Texas Floodplain Management Association (TFMA) is an organization of professionals involved in floodplain management, flood hazard mitigation, the National Flood Insurance Program (NFIP), flood preparedness, warning and disaster recovery. The Association has become a respected voice in floodplain management practice and policy in Texas. The Association includes flood hazard specialists from local, state, and Federal government; the mortgage, insurance and research communities; and the associated fields of flood zone determination, engineering, hydraulic forecasting, emergency response, water resources, geographic information systems, and others.

Organization	Contact Information	Website
Texas Floodplain Management Association	Phone: 512-260-1366	http://www.tfma.org

Certified Floodplain Manager (CFM) Certification

The Association of State Floodplain Managers (ASFPM) established a national program for certifying floodplain managers. This program recognizes continuing education and professional development that enhances the knowledge and performance of local, state, Federal, and private-sector floodplain management professionals.

The role of the nation's floodplain managers is expanding due to increases in disaster losses, the emphasis on mitigation to alleviate the cycle of damage-rebuild-damage, and a recognized need for professionals to adequately address these issues. This certification program will lay the foundation for ensuring that highly qualified individuals are available to meet the challenge of breaking the damage cycle and stopping its negative drain on the nation's human, financial, and natural resources.

CFM® is a registered trademark and available only to individuals certified and in good standing under the ASFPM Certified Floodplain Manager Program.

For more information, you may want to review these available CFM Awareness Videos:

- What is the CFM Program?
- Who can be a CFM?

- What are the Benefits of a CFM?

Study materials for those interested in applying for the CFM certification can be found on the ASFPM Website at: http://www.floods.org/index.asp?menuID=215

Check the calendar on TFMA's website for in-person training sessions near you.

For information on becoming a member and the exam application process in the State of Texas visit http://www.tfma.org/?page=Renewal.

Interactive Preliminary Data Viewer

(maps.riskmap6.com)

To support community review of the study information and promote risk communication efforts, FEMA launched an interactive web tool accessible on-line at http://maps.RiskMAP6.com for the project areas.

For more information on the Interactive Preliminary Data Viewer, refer to the Region 6 Fact sheet: What is your Flood Risk?

Estimated Base Flood Elevation (BFE) Viewer

As a part of the Risk MAP process, FEMA is completing **Base Level Engineering (BLE)** to provide a complete picture of flood hazard throughout a watershed. The BLE analysis uses high resolution ground elevation data, flood flow calculations, and fundamental engineering modeling techniques to define flood extents for streams.

To provide a look at BLE data availability and relative engineering analysis, FEMA developed the through the **Estimated BFE Viewer** for community officials, property owners, and land developers to identify the flood risk (high, moderate, low), expected flood elevation, and estimated flood depth near any property or structure within watersheds where BLE has been prepared.

Visit the Estimated BFE Viewer **(**https://apps.femadata.com/estbfe**)** application to learn the status of BLE in your area of interest or surrounding communities, to view the flood hazard data developed, or to utilize the tool's flood risk reporting features for a location where BLE has been made available.

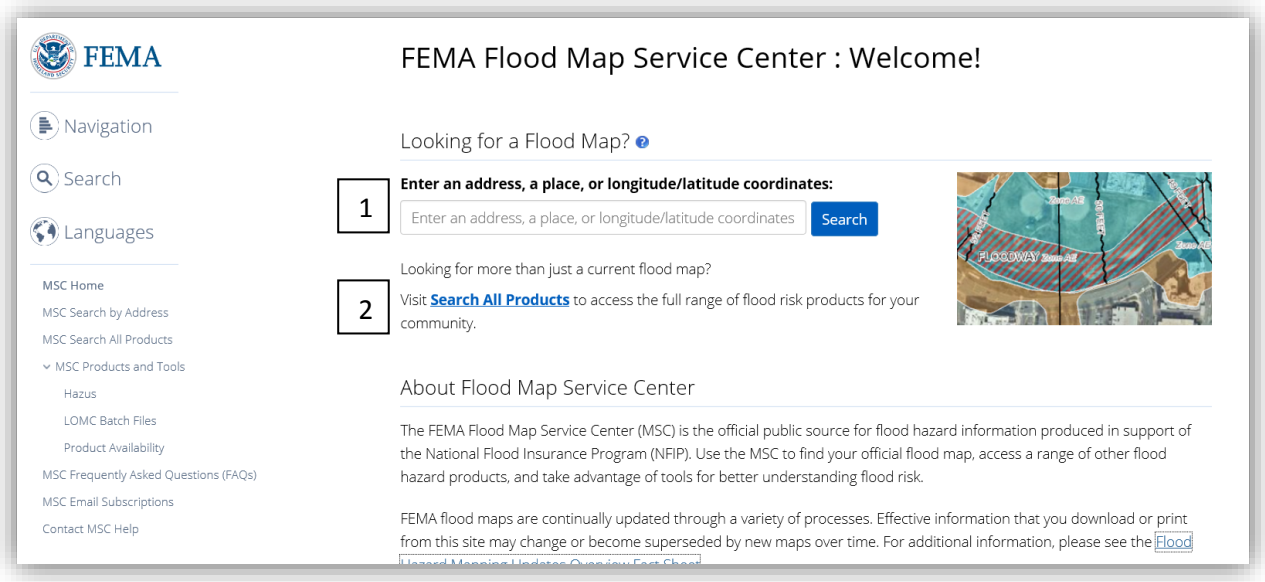
Map Service Center – Available Map Data

The FEMA Flood Map Service Center (MSC) is the official public source for flood hazard information produced in support of the NFIP. Use the MSC to find your official effective flood map, preliminary flood maps, and access a range of other flood hazard products.

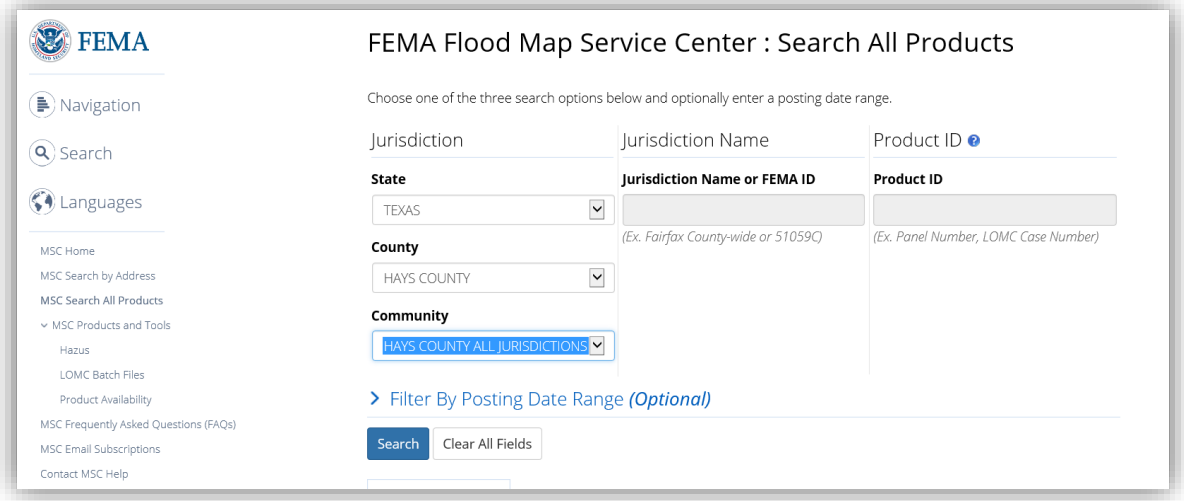
FEMA flood maps are continually updated through a variety of processes. Effective information that you download or print from this site may change or become superseded by new maps over time. For additional information, please see the Flood Hazard Mapping Updates Overview Fact Sheet.

At the MSC, there are two ways to locate flood maps in your vicinity.

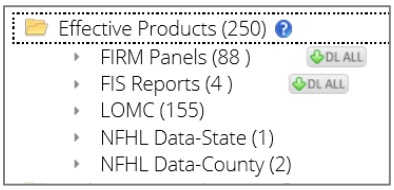
1. Enter an address, place name, or latitude/longitude coordinates and click search. This will provide the current effective FIRM panel where the location is shown.
2. Or Search All Products, which will provide access to the full range of flood risk information available.



By using the more advanced search option, "Search All Products," users may access current, preliminary, pending, and historic flood maps. Additionally, GIS data and flood risk products may be accessed through the site with these few steps.

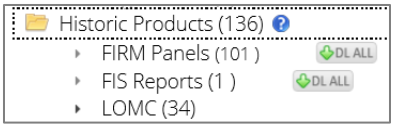


Using the pull down menus, select your state, county, and community of interest. For this example, we selected Hays County - All Jurisdictions. After the search button is selected, the MSC will return all items in the area. There are five types of data available.



Effective Products. The current effective FIS, FIRM, and DFIRM database (if available) is available through the MSC. If users click on the available effective products, they are presented a breakdown of the available products. FIRM panels, FIS reports, LOMRs, statewide National Flood Hazard Layer (NFHL) data, and countywide NFHL data may be available, as indicated in the breakdown on the right of the page.

Historic Products. A range of historic flood hazard maps, FIS texts, and Letters of Map Change are available through the MSC.



Flood Risk Products. The Flood Risk Report, Flood Risk Map, and Flood Risk Database will be made available through the MSC once they have been compiled and completed. These products are made available after the flood study analysis and mapping have been reviewed and community comments incorporated.