Madison County Multi-Hazard Mitigation Plan

2022

"Under the Federal Disaster Mitigation Act of 2000 (DMA 2000 or "the Act"), Madison County (County) is required to have a Federal Emergency Management Agency ("FEMA") - approved Local Hazard Mitigation Plan ("the Plan") in order to be eligible for certain pre- and post-disaster mitigation funds. Adoption of this Plan by the County and approval by FEMA will serve the dual objectives of providing direction and guidance on implementing hazard mitigation in the County, and qualify the County to obtain federal assistance for hazard mitigation. Solely to help achieve these objectives, the Plan attempts to systematically identify and address hazards that can affect the County. Nothing in this Plan is intended to be an admission, either expressed or implied, by or on behalf of the County, of any County obligation, responsibility, duty, fault or liability for any particular hazard or hazardous condition, and no such County obligation, responsibility, duty, fault or liability should be inferred or implied from the Plan, except where expressly stated."

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1. Introduction and Background

1) Participating Jurisdictions

The Madison County Multi-Hazard Mitigation plan includes four participating jurisdictions: Madison County, the City of Madisonville, the City of Midway, the North Zulch Municipal Utilities District (MUD).

This plan is an update of the County's current plan that expired in March 2019. That plan, the Madison County Hazard Mitigation Plan, also included the cities of Madisonville, Midway, Normangee, North Zulch MUD, and the Brazos Valley Council of Governments.

2) Hazards to be Addressed

The current plan addresses the following natural hazards: hurricanes/ tropical storms, floods, tornados, winter storms, windstorms, hailstorms, drought, lightning, extreme heat and cold, and wildfire.

The mitigation planning regulation of the Disaster Mitigation Act[1] requires that mitigation plans be reviewed and updated every five years to maintain eligibility for mitigation grant funding. As part of this plan, Madison County will develop a schedule to ensure that its hazard mitigation plan is regularly updated.

The Plan update will address the following natural hazards identified in the State of Texas' 2018 Hazard Mitigation Plan as threats throughout the state. Each participating jurisdiction will address the following natural hazards below in Table 1.

[1] 44 CFR §201.6(d)(3)

Table 1: List of Hazards Addressed

Hazard	Jurisdiction			
	Madison County	City of Madisonville	City of Midway	North Zulch MUD
Riverine Flooding	x	x	x	x
Hurricanes, Tropical Storms and Depressions	x	x	x	x
Wildfire	x	x	x	x
Tornados	x	x	x	x
Drought	x	x	x	x
Extreme Cold	x	x	x	x
Extreme Heat	x	x	x	x
Hailstorm Winter	x	x	x	x
Winter Weather	x	x	x	x
Severe Winds	x	x	x	x
Lightning	x	x	x	x
Additional Optional Hazards				
Coastal Erosion				
Inland Erosion				
Land Subsidence/Sinkhole				
Earthquakes				
Expansive Soils				
Dam / Levee Failure				

Omission Statements

Madison County and the participating jurisdictions will not be addressing the following hazards: Earthquakes, Expansive Soils, Land Subsidence, and Coastal/Inland Erosion. The history of impacts for all the omitted hazards have been negligible (or non-existent), therefore the County and participating jurisdictions expects that future impacts will be negligible as well, nor do the County and participating jurisdictions anticipate submitting an application for grant funding to address any of them.

2. Planning Process

The Madison County Multi-Hazard Mitigation Plan is a multi-jurisdiction plan. Representatives to the local planning team were selected by each jurisdiction. Planning team members represented the following offices and departments:

Table 2: Local Planning Team Representatives

Title	Jurisdiction
Emergency Management Coordinator	Madison County
Emergency Management Coordinator Assistant	Madison County
County Judge	Madison County
City Manager Assistant	Madisonville
City Secretary	Midway
Director	North Zulch MUD

Once the planning team was established, members developed a schedule with specific goals and proposed meeting dates over the planning period.

Hazard mitigation planning team (HMPT) members contributed to the following activities throughout the planning process:

1. Providing technical assistance and necessary data to the HMPT.
2. Scheduling, coordinating, and facilitating community meetings.
3. Providing necessary materials for public planning meetings.
4. Collecting and analyzing data.
5. Developing mitigation goals and implementation strategies.
6. Preparing the first draft of the plan and providing technical writing assistance for review, editing, and formatting.

Each member of the HMPT participated in the following activities associated with development of the plan:

1. Identifying, contacting, coordinating, and implementing input from stakeholders.
2. Attending, conferencing in, or providing meeting support and information for regular HMPT meetings.
3. Identifying hazards and estimating potential losses from future hazard events.
4. Developing and prioritizing mitigation actions to address identified risks.
5. Coordinating public meetings to develop the plan.
6. Identifying community resources available to support planning effort.
7. Submitting proposed plan to all appropriate departments for review and comment and working with the city to incorporate the resulting comments into the proposed plan.

Table 3: Plan Schedule

Timeline											
Planning Tasks	**2021**					**2022**					**Completed**
	Aug	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	
Organize Resources and Identify Planning Team											
Create Outreach Strategy											
Review Community Capabilities											
Conduct Risk Assessment											
Identify Mitigation Goals and Actions											
Develop Action Plan for Implementation											
Identify Plan Maintenance Procedures											
Review Plan Draft											
Submit Plan to State and FEMA											
Adopt Plan											TBD
Meetings											
Planning Team		9/15/2021	10/06/2021	11/17/2021							
Public Outreach – Online Surveys											
Stakeholder Outreach											

1) Existing Plans, Reports, Ordinances, and Technical Information Sources

Each planning team member worked to collect and provide the input and information necessary to develop the hazard mitigation strategy. Research was coordinated and conducted by local planning team members. The local planning team reviewed the following documents during the planning process:

Table 4: Planning Team Data Sources

Data Source	Data Incorporation	Purpose
National Centers for Environmental Information (NCEI)	Hazard occurrences	Previous event occurrences, damage dollars, and mapping for all hazards
National Oceanic and Atmospheric Administration (NOAA)	Historic Weather Data	Previous event occurrences, damage dollars, and mapping for all hazards
National Severe Storms Laboratory (NSSL)	Historic Weather Data	Previous event occurrences, damage dollars, and mapping for all severe storms
National Weather Service (NWS), Shreveport, LA Office	Historic Weather Data	Previous event occurrences, damage dollars, and mapping for all hazards
Madison County 2018 CHAMPS Report	Natural hazard data	Review previously compiled natural hazard histories.
Madison County Appraisal District Data	Property values and parcel counts	Population counts, parcel data, and land use data
Madison County Hazard Mitigation Plan, 2013-2018	Previous planning approach, hazards addressed, and mitigation actions	Previous planning team representatives, plan maintenance, hazard histories, and mitigation actions
State of Texas Hazard Mitigation Plan 2018 Update	Hazard Descriptions	Official descriptions of hazards and their potential impacts
Estimated Base Flood Elevation – Federal Emergency Management (FEMA)	Flood Zones maps	GIS mapping of flood zones and potential flooding risk areas
Madison County Flood Damage Prevention Order	Flood damage prevention requirements	Identifying building requirements and restrictions for structures in the floodplain
City of Madisonville Flood Damage Prevention Ordinance	Flood damage prevention requirements	Identifying building requirements and restrictions for structures in the floodplain
City of Madisonville Drought Contingency Plan	Local drought controls	Identify opportunities to increase drought controls and opportunities for water conservation to reduce drought's impact
City of Midway Drought Contingency Plan	Local drought controls	Identify opportunities to increase drought controls and opportunities for water conservation to reduce drought's impact
North Zulch MUD Drought Contingency Plan	Local drought controls	Identify opportunities to increase drought controls and opportunities for water conservation to reduce drought's impact

Additional information sources included: USDA Census of Agriculture, United States Geological Survey, Vaisala, and specific details about previous natural hazard events from planning team participants. Sources are noted throughout the document. Report titles and links to the most recently accessed websites hosting the related information are also noted, where appropriate.

Area stakeholders contacted to participate in the planning process included the following offices and departments within the participating jurisdictions and neighboring jurisdictions. In many cases of non-participation, the title listed is reflective of the office the planning team tried to contact.

Table 5: Local Stakeholders Contacted

Stakeholder	Title	Participated
Brazos County	Emergency Management Coordinator	Y
Grimes County	Emergency Management Coordinator	N
Houston County	Emergency Management Coordinator	Y
Leon County	Emergency Management Coordinator	Y
Robertson County	Emergency Management Coordinator	Y
Walker County	Emergency Management Coordinator	N
High Prairie Water Supply	Owner/Operator	Y

Area stakeholders were contacted by phone and email. In an effort to increase participation, each stakeholder was contacted at least twice. Area stakeholders who chose to participate provided important supplemental input and information that helped shape mitigation strategies for each hazard, in particular by making the planning team aware of hazard areas that had not been previously identified.

2) Project Meetings

The planning team met on three separate occasions. Additional communication was regularly carried out via email and over the phone.

The first planning team meeting was held on September 15th, 2021. During this meeting, the planning team decided which hazards needed to be addressed in the mitigation plan and which were not relevant. To make these decisions, a hazard handout was produced to show previous occurrences of each hazard, associated deaths and injuries, and total dollar damages. The team agreed to use the collected hazard data, as the foundation for its hazard risk assessment and ongoing research into hazard extent, impact, and vulnerability. At the end of the meeting, planning team members were tasked with compiling relevant data, including city ordinances; identifying critical facilities; and providing a status update on previous mitigation actions.

The second planning team meeting was held virtually on October 6th, 2021. To stay on schedule, the planning team needed to meet the following objectives: Finalize the hazards list, collect relevant ordinances and plans, review and refine the critical facilities list, and identify area stakeholders. The meeting closed by beginning the process to identify new mitigation actions appropriate to the natural hazards identified in the first planning team meeting.

The final planning team meeting was held on November 17th, 20121 to review possible mitigation actions and potential eligible projects for each participant. The planning team discussed and identified new mitigation actions, discussed changes to the plan drafts, and agreed to work on completing all deliverables for the plan. Additional work was done over email in preparation for submitting the plan for official review in April 2021.

3) Public Input

Members of the public were invited to participate in two public comment periods to provide input and feedback during the planning process. Due to the COVID-19 pandemic, the public comment periods were held virtually. The first public comment period took place in October 2021. A Google Form survey was posted to the County website for a period of two weeks for members of the public to fill out. A newspaper ad was placed to announce to the public for the opportunity to provide input via online survey. The County and participating jurisdictions actively announced the online survey on their own websites and social medias. The planning team appreciated receiving responses to the survey which helped inform them when identifying and prioritizing new mitigation actions for this plan update. The survey received 63 anonymous responses.

The survey asked nine questions:

1. Where do you live?
2. Do you own or rent?
3. Madison County is looking at addressing the following hazards. Which hazards do you believe impact the County and/or participating cities the most? Please select all that apply (multiple choice answer).
4. Which of the above hazards have affected you directly within the past five years? Please select all that apply (multiple choice answer).
5. How have you been affected by the hazards selected above? (Open-ended question)
6. Have you taken any actions to reduce your risk to these hazards? If so, what actions have you taken? (Open-ended question)
7. What is the best means of communication for you? Please select all that apply (multiple choice answer).
8. Which of the following mitigation project types do you believe local government agencies should focus on to reduce disruptions of services and to strengthen the community? Please check all that apply (multiple choice answer).
9. Do you have any other thoughts or concerns relating to the Hazard Mitigation Plan? (Open-ended question).

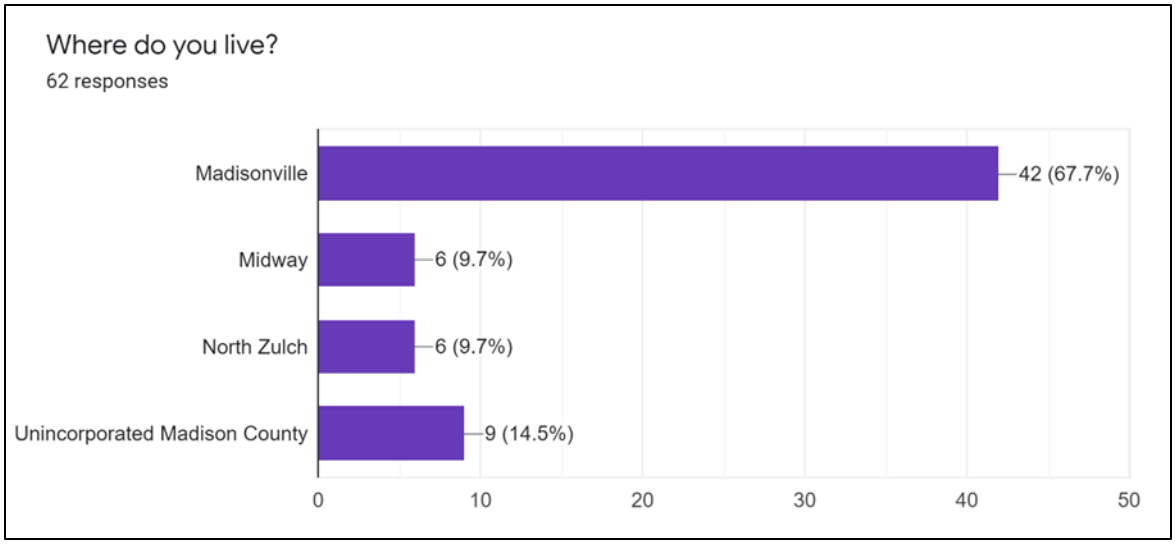


Figure 1: Survey Responses for Question 1

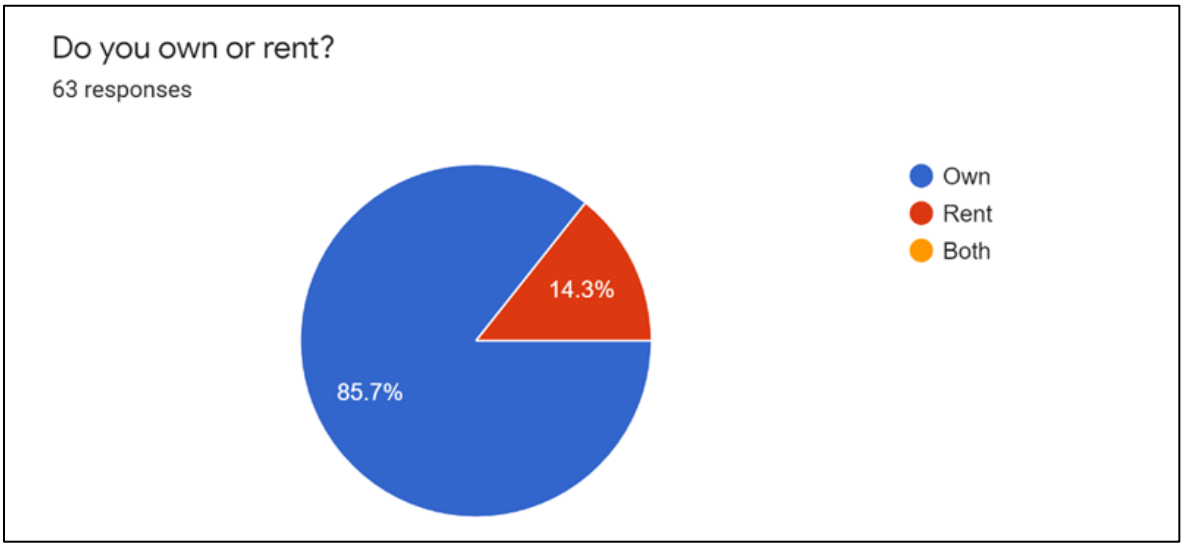


Figure 2: Survey Responses for Question 2

As Figure 1 above shows, majority of the respondents live in the City of Madisonville. About 85.2% of respondents own their home as shown in Figure 2.

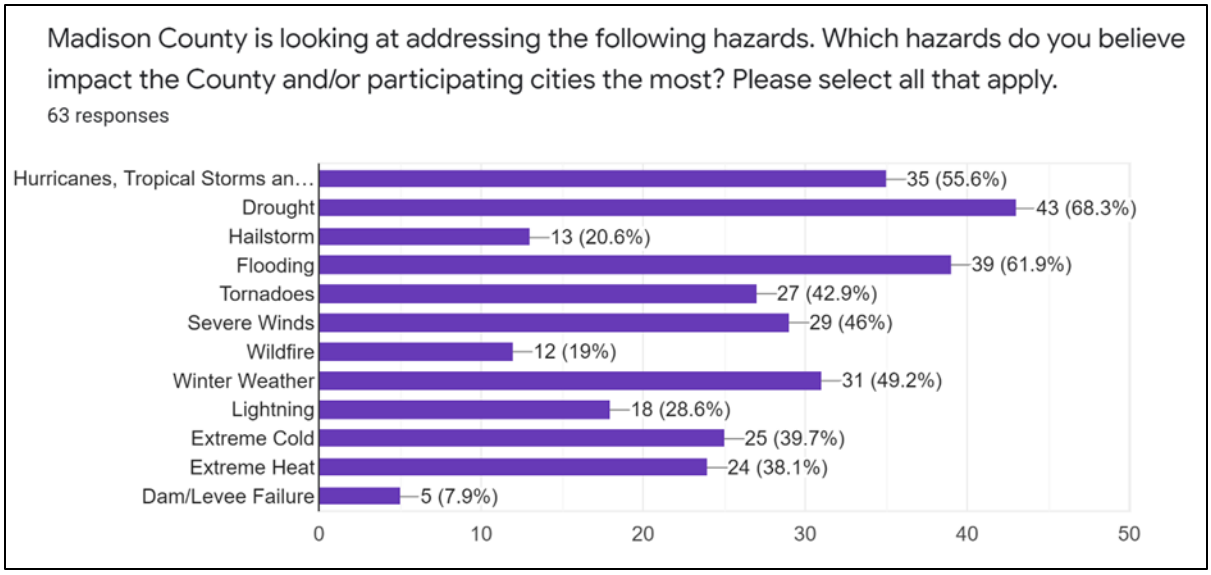


Figure 3: Survey Response for Question 3

The chart in Figure 3 above shows the breakdown of responses for survey question three. The answer choices were Hurricanes/Tropical Storms/Depressions, Drought, Hailstorm, Flooding, Tornados, Severe Winds, Wildfire, Winter Weather, Lightning, Extreme Cold, Extreme Heat, and Dam/Levee Failure. Hurricanes, Tropical Storms, and Depressions; Drought; Flooding; and Winter Weather ranked the highest out of all the hazards addressed in the plan, with each choice getting more than or about 50% of the votes.

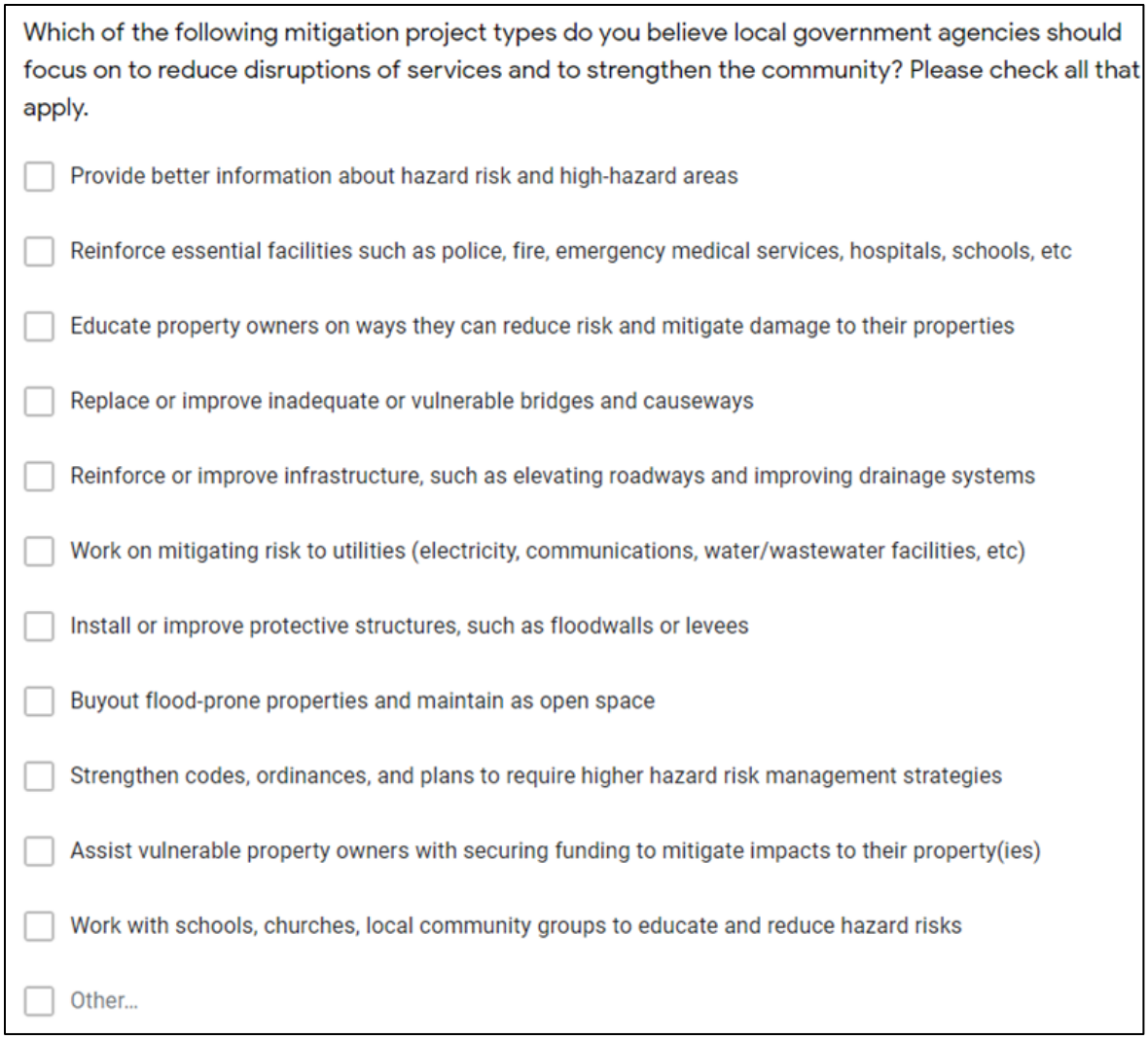


Figure 4: Survey Choices for Question 8

Figure 4 shows the choices for Question 8: Which of the following mitigation project types do you believe local government agencies should focus on to reduce disruptions of services and to strengthen the community? Please check all that apply. Respondents could choose from 11 answers such as “Provide better information about hazard risk and high-hazard areas,” “Reinforce or improve infrastructure, such as elevating roadways and improving drainage systems,” “Install or improve protective structures, such as floodwalls or levees,” or input their own answer.

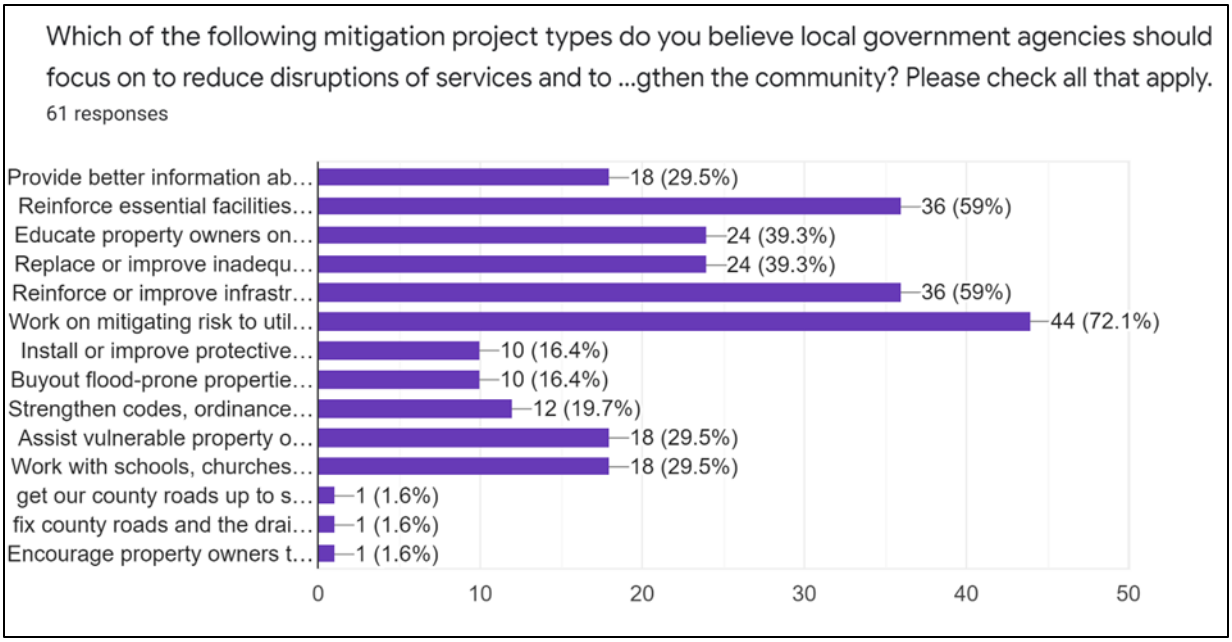


Figure 5: Response Breakdown for Question 8

Figure 5 shows the breakdown of responses to Question 8. The most popular answer was "Work on mitigating risk to utilities (electricity, communications, water/wastewater facilities, etc.)," with 72.1% of respondents voting for it.

The second public comment period took place in March 2021. A copy of the in-progress plan draft was posted to the County website for two weeks for the public to review and comment or provide suggestions. This public comment period was advertised in the newspaper and shared on social media.

4) Plan Maintenance

The hazard mitigation plan is not a static document. As conditions change and mitigation actions are implemented, the plan will need to be updated to reflect new and changing conditions in each jurisdiction.

The planning team has identified specific departments to oversee action implementation in each jurisdiction. The planning team has also identified potential funding sources and an implementation timeframe for each mitigation action. The expected timeframes will be an important component in determining whether or not actions are implemented efficiently. The departments or persons identified for each jurisdiction include but are not limited to:

Table 6: Maintenance Responsibility

Title	Jurisdiction	Agency or Department
Emergency Management Coordinator	Madison County	Emergency Management Coordinator
Emergency Management Coordinator Assistant	Madison County	Emergency Management Coordinator Assistant
County Judge	Madison County	County Judge
City Manager Assistant	Madisonville	City Manager Assistant
City Secretary	Midway	City Secretary
Director	North Zulch MUD	Director

Within one year of adoption of this plan, each department or agency will review and, as appropriate, integrate implementation of their respective mitigation actions with their existing internal plans and policies relating to capital improvements, land use, design and construction, and emergency management.

On a biannual basis, representatives from each jurisdiction serving as the planning team will evaluate progress on implementing the plan's mitigation actions. The planning team will review departmental / agency findings, public input, and future development plans to evaluate the effectiveness and appropriateness of the plan.

In light of changing funding sources, hazard vulnerability, and local mitigation priorities, the planning team will identify changes to plan goals and priorities for their respective jurisdictions, and they will report their findings to the rest of the planning team. It will be the planning team's responsibility to identify relevant reasons for delay or obstacles to completing the plan's mitigation actions, along with recommended strategies to overcome any deficiencies.

Any significant change to the plan, including but not limited to changing mitigation actions, abandoning mitigation actions, or pursuing new mitigation actions, will require the County and participating jurisdictions to provide opportunities for the public to make its views and concerns known. Madison County and the participating jurisdictions will provide notice to the public through announcements in the local paper, fliers posted at city hall, and on the city's website and social media accounts.

5) Plan Monitoring

The Madison County Emergency Management Coordinator (EMC) will be responsible for the overall continued coordination and monitoring of the mitigation plan in its entirety, including but not limited to the planning process, risk assessment, strategy, and the actions assigned for

each hazard. The agency or department identified above in Table 6 shall serve as the responsible party for each respective jurisdiction. The plan monitoring worksheet outlined below will serve as the basis for revision of the plan.

At a minimum, the mitigation plan will be reviewed by the EMC and planning team representatives from each jurisdiction quarterly, during budget workshops, and as other plans are being developed or revised including: comprehensive plans, capital improvement project plans, and emergency plans.

To execute the monitoring requirement, the EMC will produce a plan monitoring worksheet to be completed by each jurisdiction's representative. The worksheet will identify and track the following for each mitigation action: the expected implementation schedule, setbacks or delays, changes to the local risk assessment, changes in jurisdictional capabilities, and current and future opportunities for integration with other local plans.

Regularly monitoring the plan implementation process in each participating jurisdiction will ensure that every component of the plan gets reviewed for potential amendments.

After adoption of this plan, it will be posted to each participating jurisdiction's website or Facebook page, and a printed copy will be available for review in the Office of Emergency Management. The goal is to create the opportunity for constant and continued feedback from local officials, stakeholders, and the general public.

6) Plan Evaluation

Proper evaluation will measure the progress and effectiveness of the mitigation actions identified in the plan. On a bi-annual basis the Emergency Management Coordinator along with the planning team representatives from each jurisdiction will use the following criteria, along with additional metrics as necessary, to assess the effectiveness of the plan in its entirety, including but not limited to the planning process, risk assessment, strategy, and the actions:

- Do the specified goals and objectives still address current and expected conditions?
- Has the nature, magnitude, and/or risk of any hazard changed?
- Have there been changes in land development that the plan needs to address?
- Are available resources suitable for implementing the plan?
- Is funding budgeted or available to successfully implement prioritized mitigation actions?
- Are there opportunities in the local budgeting process or local, state, and national grant funding cycles to increase funding to implement mitigation actions?

Other steps will include site visits to completed mitigation projects in each jurisdiction to measure and ensure their success. In the event that a mitigation project fails to meet its goal,

the planning team will evaluate the causes of the shortcoming. The planning team will use their assessment to amend the project and related projects in other jurisdictions, allocate additional resources to achieve the desired outcome for the project and related projects in other jurisdictions, or replace the project and similar projects in other jurisdictions with better projects.

The EMC and planning team members will also work to implement any additional revisions required to ensure that the plan and their respective jurisdiction is in full compliance with federal regulations and state statutes.

7) Plan Update

The plan is designed to address a five-year period. In accordance with 44CFR Section 201.6, it will be updated every five years to maintain compliance with State and Federal regulations. However, at least every two years from the date of approval, and quarterly on the fifth and final year of the plan, the EMC and planning team representatives from each participating jurisdiction will thoroughly review any significant changes in their respective jurisdictions that might impact the plan update.

During the update process, planning team representatives will do the following for their respective jurisdictions: collect data on recent occurrences of each natural hazard identified in the plan, record how each natural hazard impacted their jurisdiction during the preceding years, determine whether or not implemented mitigation actions produced the desired outcomes in their jurisdiction, and determine whether or not to modify their jurisdiction's list of hazards to be addressed in the update.

Additional considerations to address on a jurisdictional level include but are not limited to: changes in local development, changes in exposure to natural hazards, the development of new mitigation capabilities or techniques, and revisions to state or federal legislation.

The update process will provide continued opportunity for the public and elected officials to determine which actions succeeded, failed, or are no longer relevant. It is also an opportunity for each jurisdiction to identify recent losses due to natural hazards and to consider whether or not any of those losses could have been avoided.

3. Determining Risk

1) Risk Assessment

Throughout the plan, each hazard addressed will be considered in light of its history, likelihood of future events, extent, jurisdictional vulnerability, location and impact.

Likelihood of Future Events is measured based on a hazard's expected frequency of occurrence in light of its previous frequency. Each hazard's likelihood of future events will be considered using the following standardized parameters:

- **Highly likely** – event probable in the next year
- **Likely** – event probable in the next three years
- **Occasional** – event possible in the next five years
- **Unlikely** – event possible in the next 10 years

Given this plan's five-year duration, hazards likely to occur during that period will be given priority when selecting and prioritizing mitigation actions.

Furthermore, vulnerability risk of each hazard has risen as population increased in conjunction with new development and growth in the County since the 2013 Madison County Hazard Mitigation Plan.

2) Distribution of Property by Parcel Count and Potential Damage Values

Table 7: Estimated Values by Location[2]

Category	Madison County[3]	City of Madisonville	City of Midway
Total Housing Units	5,290	1,974	156
Housing Unit Density (per square mile)	11 units/sq. mi	457 units/sq. mi	97 units/sq. mi
Median Housing Value[4]	$113,100	$83,600	$100,700
Estimated Value of Housing Units[5]	$598.2 million	$165 million	$15.7 million

3) Distribution of Vulnerable Populations

The planning team identified a set of indicators it could use to identify each jurisdiction's vulnerable population. The indicators include demographic data like age and income, as well as

[2] Source: U.S. Census 2016-2019 American Community Survey 5-Year Estimates.

[3] Table B25001 2016-2019 ACS Housing unit information for Madison County includes totals for cities and unincorporated areas.

[4] Table B25077 2016-2019 ACS

[5] Total value of housing units derived from median value multiplied by number of units

geographic data including the location of low income or subsidized housing units, concentrations of manufactured and mobile homes, and concentrations of homes in substandard condition.

Age, Disability, and Income

The populations of each jurisdiction were broken down into four categories: young residents, elderly residents, disabled residents, and low-income residents. Residents falling into these categories were deemed most likely to suffer disproportionate losses due to natural hazards because of their potentially limited means to prepare for and recover from a hazard event.

Table 8: Age, Disability, and Poverty Level Percentages by Jurisdiction[6]

Demographic Category	Madison County	City of Madisonville	City of Midway	Texas	U.S.
Population Under Age 5[7]	6.2%	9.2%	13.5%	7.1%	6.1%
Population Over Age 65	15.3%	15.4%	6.3%	12.3%	15.6%
Disability Status[8]	15.6%	15.2%	8.9%	11.5%	12.6%
Individuals Below Poverty Level[9]	12%	12.5%	8.9%	14.7%	13.4%

Distribution of Vulnerable Populations

The following vulnerable populations map is based on a social vulnerability index created specifically for the planning area. The index considers six relevant Census Block Group-level factors: poverty rate, population of residents 65 years old and older, population of residents younger than 18, the population of residents without a high school diploma or GED, the population of residents with a low English proficiency, and the number of homes constructed before 1980.

To create the index, each factor is re-scaled by assigning the largest population in each category a score of 1. The remaining population counts for each category are then given a score based the ratio of the relevant population to the largest population. Once each factor has a re-scaled score, the scores for each factor are totaled to create an overall index number for each Census

[6] Source: U.S. Census 2016-2019 American Community Survey 5-Year Estimates
[7] Table S0101, Age and Sex, 2016-2019 ACS 5-Year Estimates
[8] Table S1810, Disability Characteristics. The U.S. Census defines a person as having a work disability if one or more of the following conditions are met:
1. Persons with a health problem or disability which prevents them from working or which limits the kind or amount of work they can do
2. Persons who have retired or left a job for health reasons
3. Persons currently not in the labor force because of a disability.
4. Persons who did not work at all in the previous year because of illness or disability
5. Under 65 years old and covered by Medicare in previous year.
6. Under 65 years old and received Supplemental Security Income (SSI) in previous year.
7. Received VA disability income in previous year.
[9] Table DP03, Selected Economic Characteristics, 2016-2019 5-Year Estimates

Block Group. The vulnerable populations map is representative of each Census Block Group's overall vulnerability, based on the six factors outlined above, relative to the other Census Block Groups in the planning area.

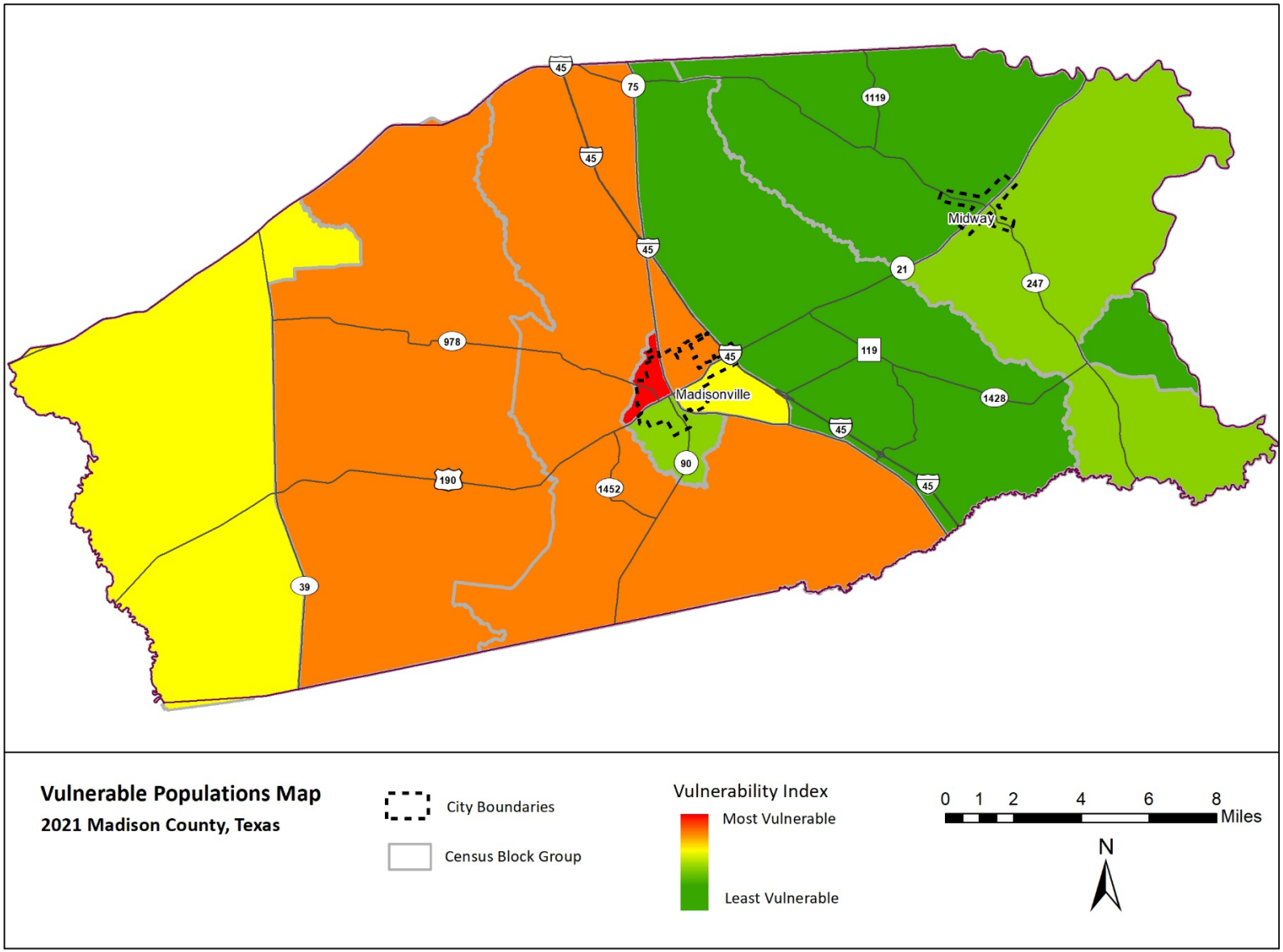


Figure 6: Madison County Social Vulnerability Index

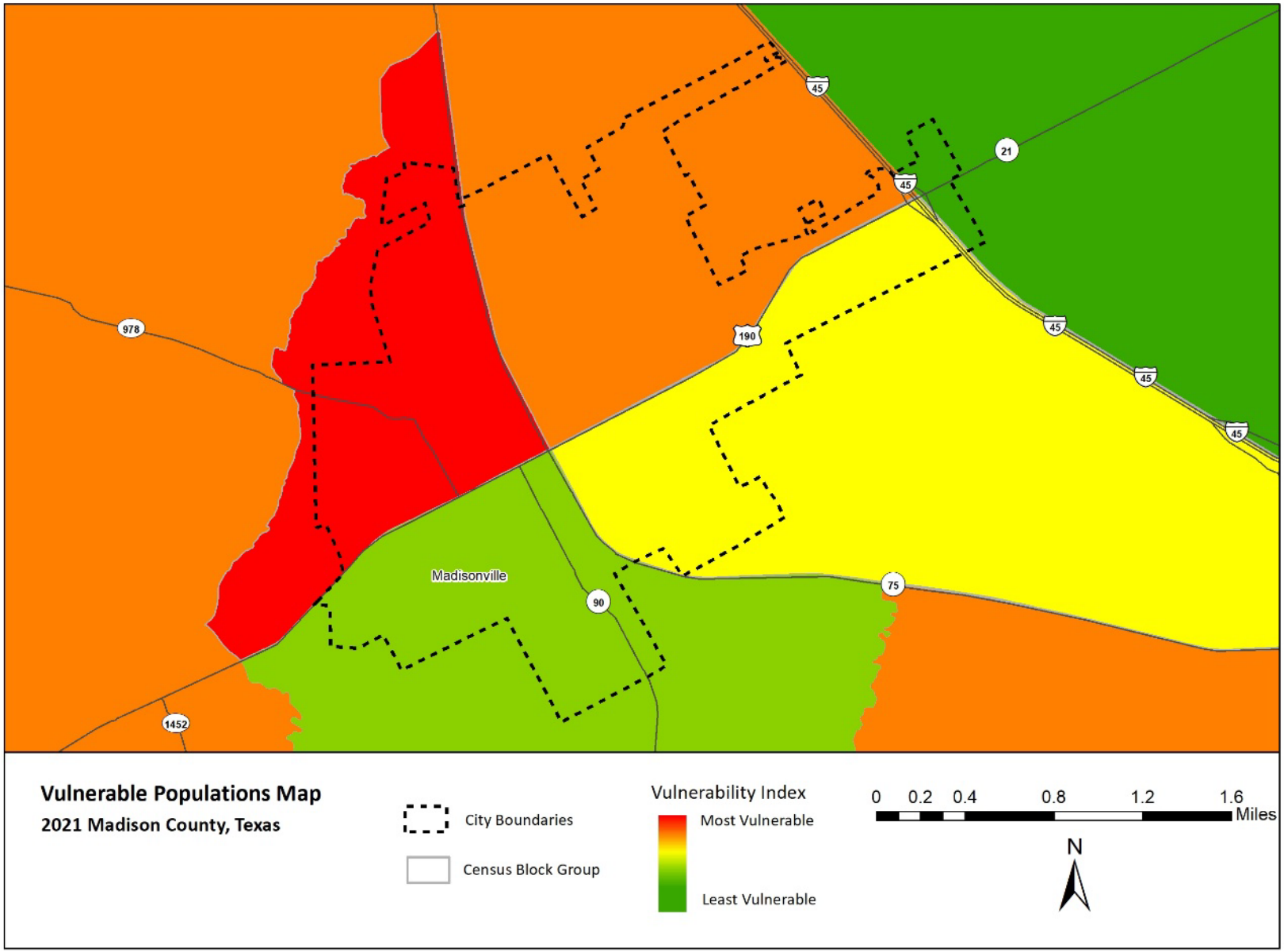


Figure 7: City of Madisonville Social Vulnerability Index

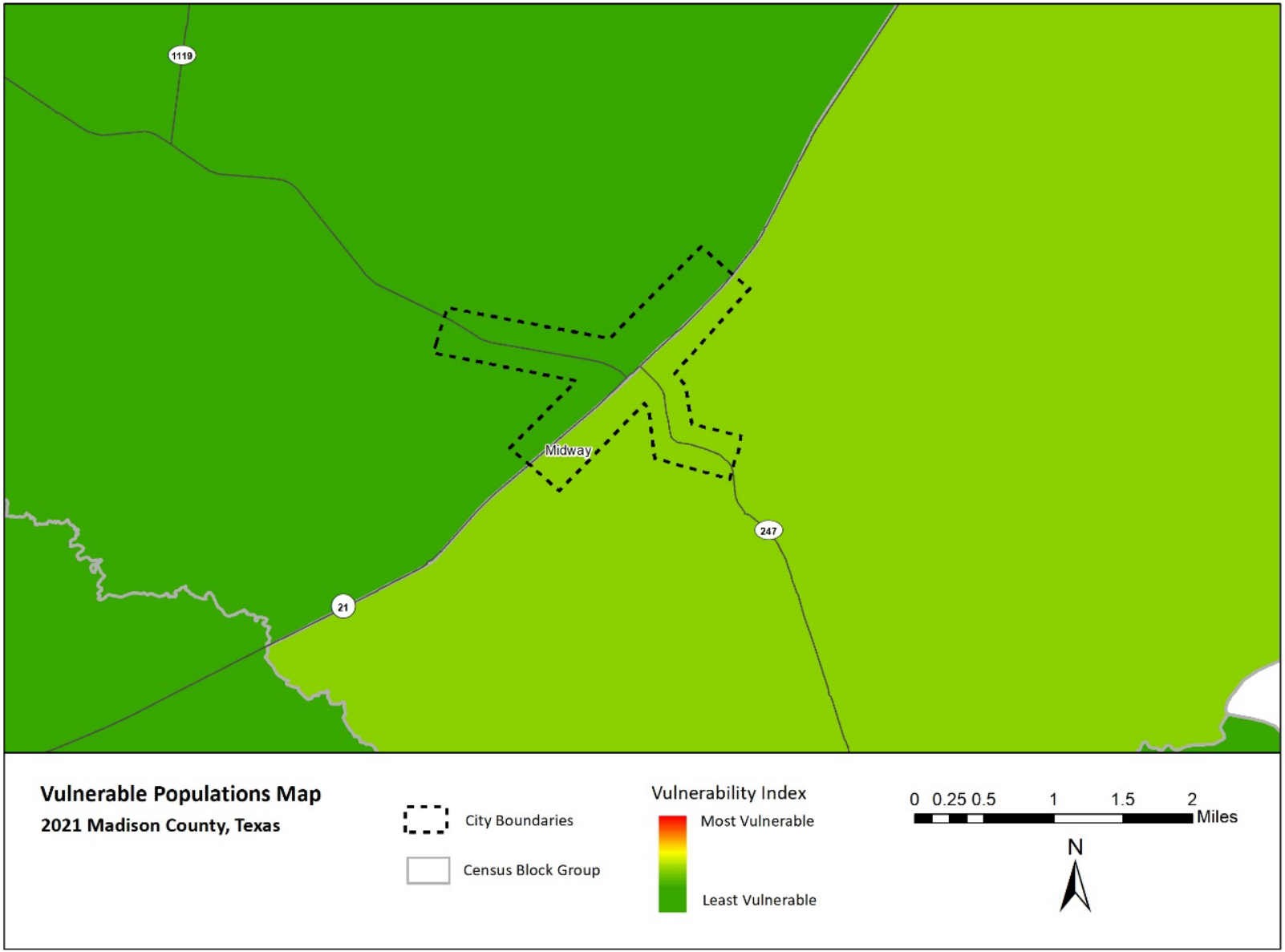


Figure 8: City of Midway Social Vulnerability Index

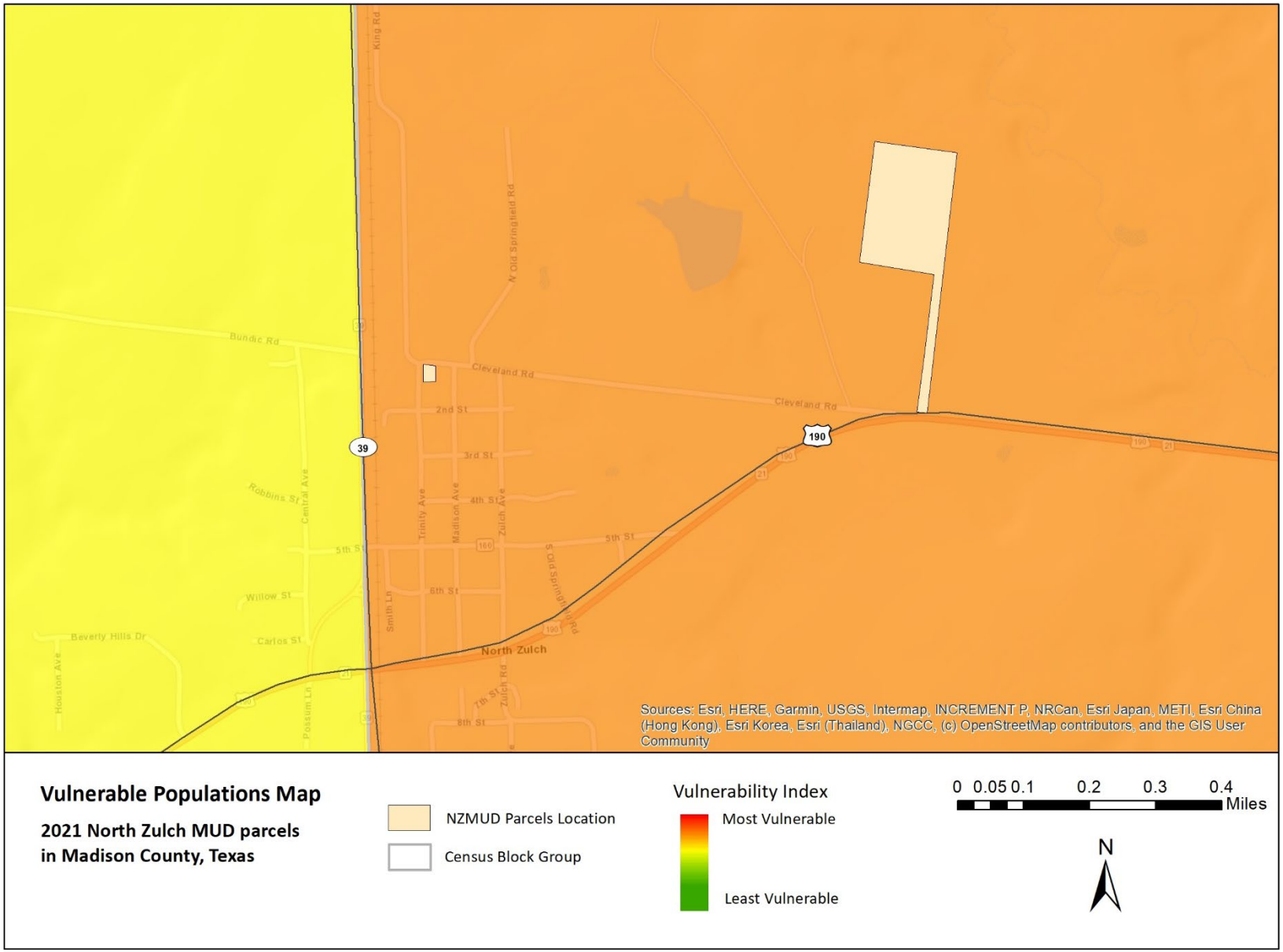


Figure 9: North Zulch MUD Social Vulnerability Index

Low Income and Subsidized Housing

Low-income residents in Madison County are primarily served through rental assistance programs and low-income housing. The Housing Authority of the City of Madisonville and the Brazos Valley Council of Governments are the primary operators of low-income housing in the County[10]. There are four affordable apartment communities offering 140 units in Madison County, the majority of which are in the City of Madisonville; furthermore, there are 68 low-income apartments that do not offer rental assistance but are still considered affordable for low-income families[11].

Residents of low-income housing and/or subsidized housing facilities are expected to suffer disproportionate losses due to natural hazards because of their potentially limited means to prepare for and recover from a hazard event.

Housing Type and Condition

The participating jurisdictions have used housing type and housing conditions to identify additional vulnerable areas and concentrations of vulnerable residents.

I. Manufactured / Mobile Homes

In particular, the jurisdictions have identified areas with large numbers of mobile/manufactured housing as being disproportionately vulnerable to certain hazards including but not limited to hurricanes and tropical storms, floods, tornados, droughts, and severe winds.

Mobile and manufactured homes can be found throughout Madison County, including several RV parks. These parks' populations fluctuate on a seasonal basis. Due to the express portability of RVs, the majority of these structures are expected to evacuate ahead of hazard events with significant warning times. However, RVs may not have enough time to evacuate ahead of less predictable hazard events like tornados.

Locations with clusters of three or more mobile / manufactured homes, including named mobile home parks, are shown in Figure 10 below.

[10] Affordable Housing Online, 2021. https://affordablehousingonline.com/housing-search/Texas/Madison-County
[11] Affordable Housing Online, 2021.

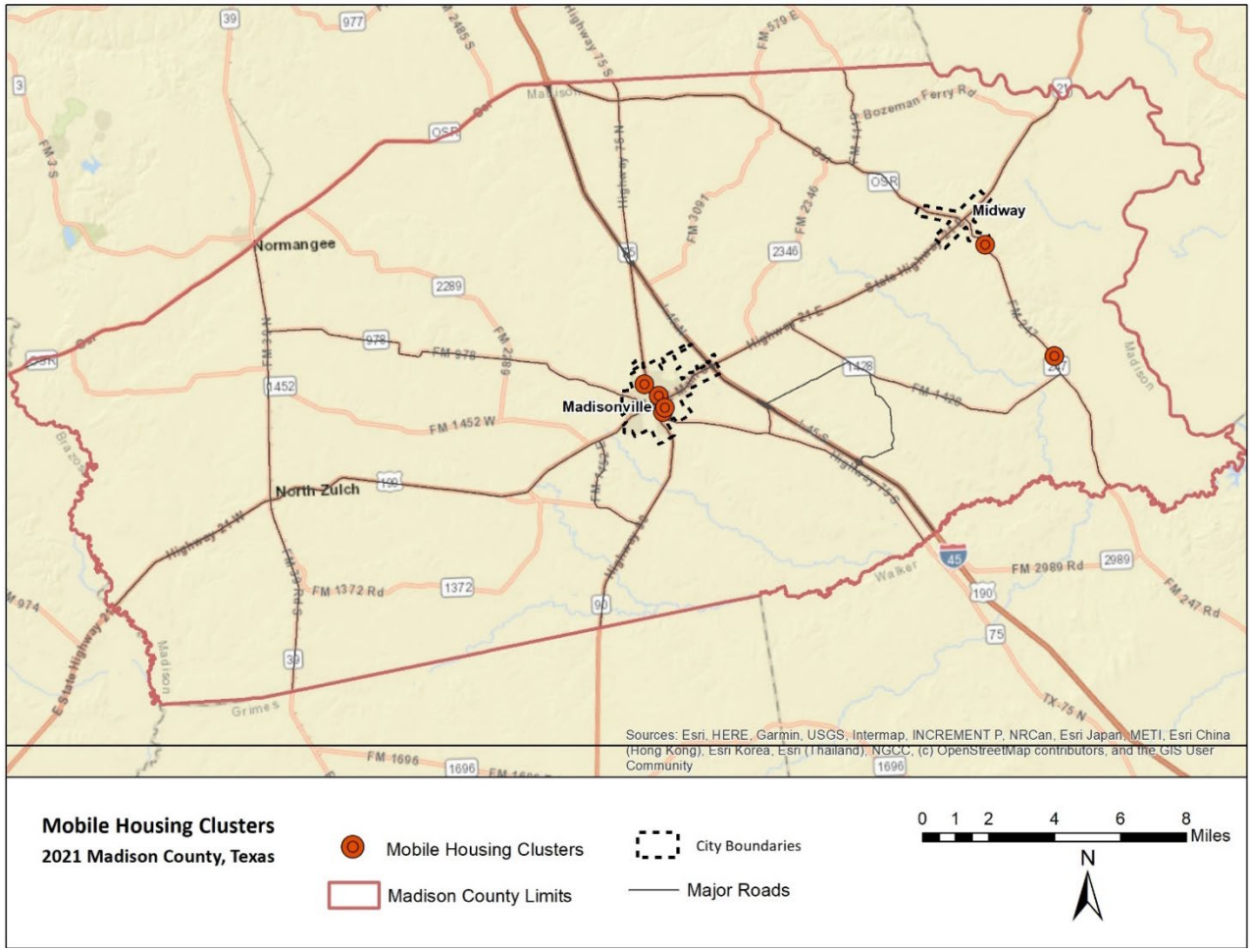


Figure 10: Mobile and Manufacturing Clusters in Madison County and the Participating Jurisdictions

II. Homes in Substandard Condition

The jurisdictions have determined that homes in sub-standard condition, regardless of structure type, may indicate that residents are low-income or otherwise means-limited and thus more vulnerable to certain hazards.

To be considered standard condition, a home must show few or no minor visible exterior defects such as:

- cracked, peeling, or missing paint
- cracked, sagging, rotting, or missing siding, steps, porch planks, or other wooden surfaces
- cracked or broken windowpanes
- cracked masonry, brick, or mortar surfaces
- missing or damaged roof shingles
- small rust spots on mobile homes

The home must generally meet building codes, and there can't be any detriment to health and safety present.

Structures in sub-standard condition may provide less protection to residents during certain hazard events like tropical storms, tornados, or hurricanes. Furthermore, because they're already in a state of disrepair, additional damages due to hazard events may compound existing ones and potentially make these homes uninhabitable.

4. Floods

According to the Texas State Hazard Mitigation Plan, Floods are defined as:

> [T]he accumulation of water within a water body and the overflow of excess water into adjacent floodplain lands.
>
> In hydrologic analysis, runoff is that portion of rainfall which, in combination with other factors, contributes to the stream flow of any surface drainage way. When runoff exceeds the carrying capacity of the stream or drainage, flooding occurs. Runoff is a product of two major groups of factors, climate and physiographic. Climatic factors may include precipitation, evaporation, transpiration and interception. Physiographic factors would include the characteristics of the watershed such as size, shape and slope of the basin's drainage area, the general land use within the basin. Average annual runoff decreases unevenly moving east to west across Texas, the localized variations based on these factors listed above.
>
> When surface water runoff enters into streams, rivers, or dry creek beds, riverine flooding conditions occur whenever the water carrying capacity of the water channel is compromised by excess runoff.
>
> If the local basin drainage area is relatively flat, shallow, slow-moving floodwater can last for days. In drainage areas with substantial slope, or the channel is narrow and confined, rapidly moving and extreme high-water conditions, called a flash flood, can occur.

1) Flood History

The planning team relied on data from the National Centers for Environmental Information (NCEI) to develop a flood history for the County and each participating jurisdiction.

According to Madison County's 2013 HMAP plan, the County and jurisdictions addressing the hazard recorded 21 flood events between October 1994 and April 2009. The 2013 plan recorded about $2.33 million in property damages and $188,125 in crop damages during that time, adjusted to $2021. Flood events during 1994 and 1998 reported 3 deaths, however no injuries were reported. The 2013 plan found that the frequency flood occurrences is highly likely; furthermore, minor flooding was found to occur on low level streets within the City of Madisonville as well as along the Trinity River, east of the County.

The following tables identify the most comprehensive list available of flood events and associated damages in Madison County and the participating jurisdictions. No participating jurisdiction has recorded a damaging flood more recently than 2019.

Table 9: Madison County Flood History

Location	Date Range	Number of Flood Events	Flood Types	Local Fatalities	Local Injuries	Local Property Damage $2021	Local Crop Damage $2021
Countywide	5/25/2015	1	Flash Flood	0	0	$0	$0

Table 10: City of Madisonville Flood History

Location	Date Range	Number of Flood Events	Flood Types	Local Fatalities	Local Injuries	Local Property Damage $2021	Local Crop Damage $2021
Madisonville	10/13/2018	1	Flash Flood	0	0	$0	$0

Table 11: City of Midway Flood History

Location	Date Range	Number of Flood Events	Flood Types	Local Fatalities	Local Injuries	Local Property Damage $2021	Local Crop Damage $2021
Midway	5/26/2016 - 10/13/2018	3	Flash Flood	0	0	$113,747.93	$0

Table 12: North Zulch, Texas area Flood History

Location	Date Range	Number of Flood Events	Flood Types	Local Fatalities	Local Injuries	Local Property Damage $2021	Local Crop Damage $2021
North Zulch	5/22/2013 - 4/24/2019	2	Flash Flood, Flood	0	0	$0	$0

Flood data is generally recorded at the county or city level, so there is no specific information regarding flood events in North Zulch MUD. However, North Zulch MUD's flood history is known to be similar to Madison County and surrounding areas given that it is located within the County and North Zulch, Texas area boundaries.

A) National Flood Insurance Program

The National Flood Insurance Program (NFIP) is administered by FEMA to provide flood insurance coverage to the nation. Madison County and the City of Madisonville are listed as participating NFIP communities in the FEMA Community Status Book Report. The City of Midway is not listed in the NFIP program nor has flood damage prevention ordinances; generally, properties within the City are not often at high risk of flood damages. North Zulch MUD is considered ineligible to participate in the NFIP since they are a utilities district.

Madison County does not have countywide FEMA special flood hazard area mapping. Of the jurisdictions addressing the hazard, only the City of Madisonville has a FEMA Flood Insurance Rate Map (FIRM) map. The map is dated March 5, 1990 and had a Letter of Map Change (LOMC) on March 30, 2019. The map is considered out of date, incomplete, and unreliable. The City of Midway nor the North Zulch, Texas area do not have special flood hazard area mapping.

The County has adopted and enforced flood damage prevention ordinances in their respective jurisdiction. Madison County's Flood Damage Prevention Ordinance designates the Emergency Management Coordinator as the Floodplain Administrator responsible for implementing its floodplain management regulations and ensuring regulations meet or exceed the minimum NFIP requirements. The City of Madisonville's Flood Damage Prevention Ordinance designates the City Manager as the Floodplain Administrator responsible for enforcing its floodplain management regulations and ensuring regulations meet or exceed the minimum NFIP requirements.

Floodplain management ordinances and any future updates will guide each jurisdiction as it continues to comply with NFIP requirements through permitting, inspection, and recordkeeping, especially for new and substantially redeveloped construction. Each jurisdiction will continue to encourage residents to purchase flood insurance to reduce their flood risk. The City of Midway will work to become NFIP participants as soon as is feasible.

The flood mitigation actions outlined in Chapter 15 below were developed with flood mitigation and NFIP compliance in mind. Public engagement will be an ongoing effort in each participating jurisdiction to reduce future losses due to flooding and will continue even after recommended corrective actions have been implemented.

A Repetitive Loss (RL) property is any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling ten-year period, since 1978. According to the best information available, there were three repetitive loss properties in Madison County and there were two repetitive loss properties in the City of Madisonville. In Madison County, the properties, which are residential, account for about $164,787 in repetitive loss payments. In the City of Madisonville, the properties consist of both residential and non-residential, account for about $148,572 in repetitive loss payments.

A severe repetitive loss property is: a single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP and has incurred flood-related damage for which 4 or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding $5,000 and with cumulative amount of such claims payments exceeding $20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property. According to the best information available, there is one severe repetitive loss

property in Madison County. The property is residential and accounted for about $108,970 in severe loss payments.

2) Likelihood of Future Events

In the case of the FEMA 100-year floodplain there is a 1% annual chance, while in the 500-year floodplain there is a 0.02% annual chance. Thus, the likelihood of a 100-year flood event is occasional and the likelihood of a 500-year flood event is unlikely. However, based on the frequency of previous flood events, every jurisdiction can expect to experience some type of flooding that may or may not meet the definition of a 100-year or 500-year event on a more regular basis.

The local planning team determined it is probable that Madison County and the participating jurisdictions will experience a flood event in the next year, meaning an event is highly likely.

3) Extent

Flood magnitude is generally measured by depth of flood waters in feet or inches. Throughout Madison County and the participating jurisdictions, the worst flood events have been associated with flooding due to combinations of heavy rainfall, flash flooding, and riverine flooding. The worst flooding events in Madison County and the participating involved about 10" to 12" of heavy rainfall[12]. Hurricane Harvey brought up to 25 inches of rainfall[13] to Madison County and surrounding areas, leading to widespread flooding. Furthermore, the worst flooding events in Madison County and the participating jurisdictions have inflicted as high as $113,747.93[14] in property damages. No crop damages have been reported as a result of flooding in NCEI data for Madison County. No injuries or deaths have been reported due to floods in Madison County.

Future worst-case flood events in Madison County and the participating jurisdictions may meet previous worst-case 12" flood depths.

4) Location and Impact

Currently, Madison County and the jurisdictions addressing the hazard for not have FEMA Special Hazard Flood Area mapping. However, the maps below were developed to demonstrate potential risk areas by utilizing the Base Level Engineering (BLE) and Estimated Base Flood Elevation analysis developed by FEMA[15].

Roughly 24% (72,632.39 acres out of 302,055.49) of Madison County is in the FEMA 100-year floodplain. In contrast, only about 1.5% (4,454.89 acres out of 302,055.49) of Madison County is

[12] Incident date: 5/26/2016 and 10/13/2018, NOAA Data
[13] https://theeagle.com/news/local/meteorologists-hurricane-harvey-on-track-to-bring-rain-wind-to-brazos-valley/article_ca51170c-38d5-5816-84bc-0ca29e4d70f7.html
[14] Incident date 5/26/2016, NOAA Data, Adjusted for inflation to $2021
[15] https://webapps.usgs.gov/infrm/estbfe/

in the FEMA 500-year floodplain. Nearly every type of land use found in Madison County can be found in both the FEMA 100-year and FEMA 500-year floodplains.

A) Location

I. Madison County

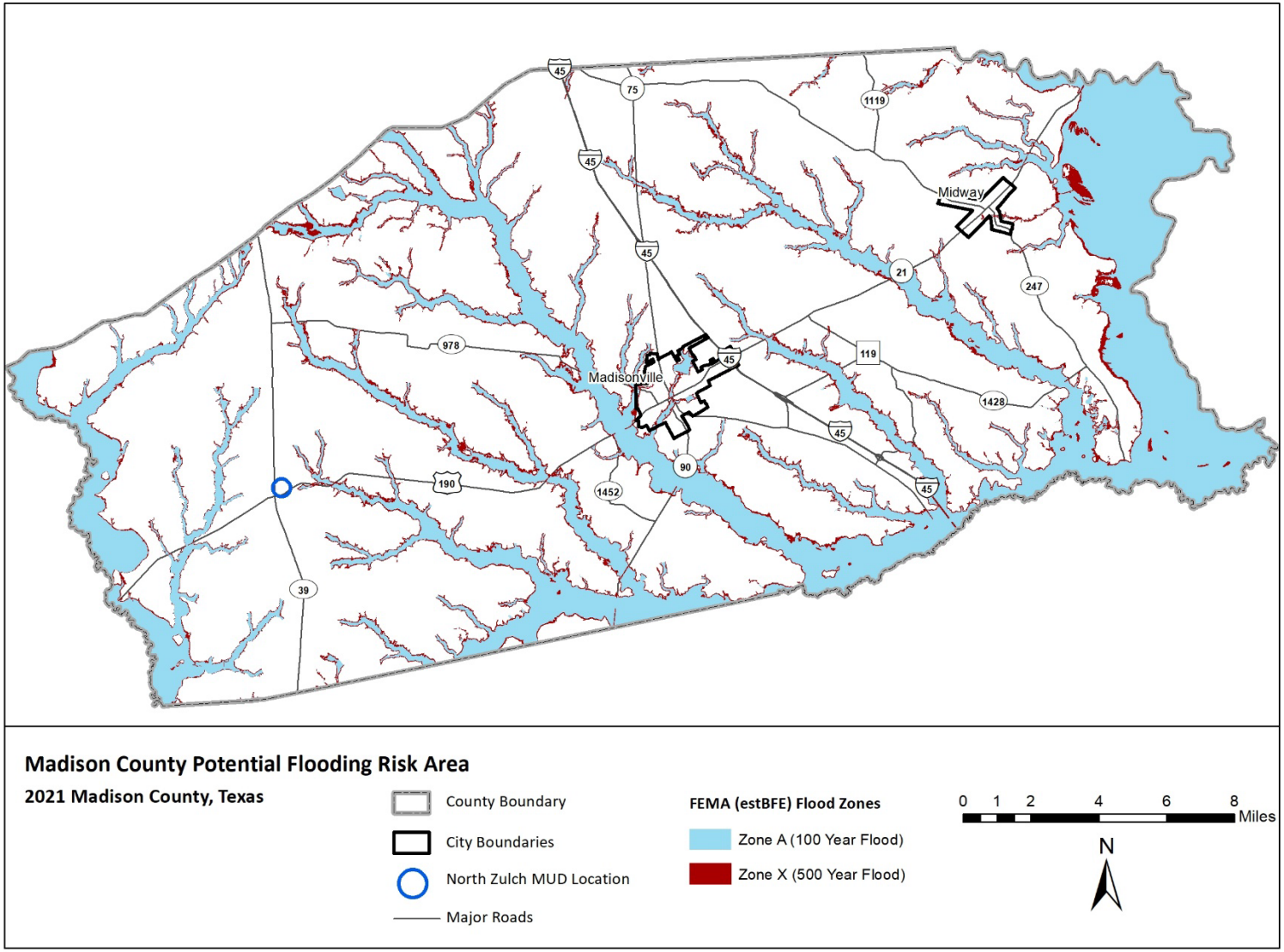


Figure 11: Madison County FEMA (estBFE) Potential Flooding Risk

II. City of Madisonville

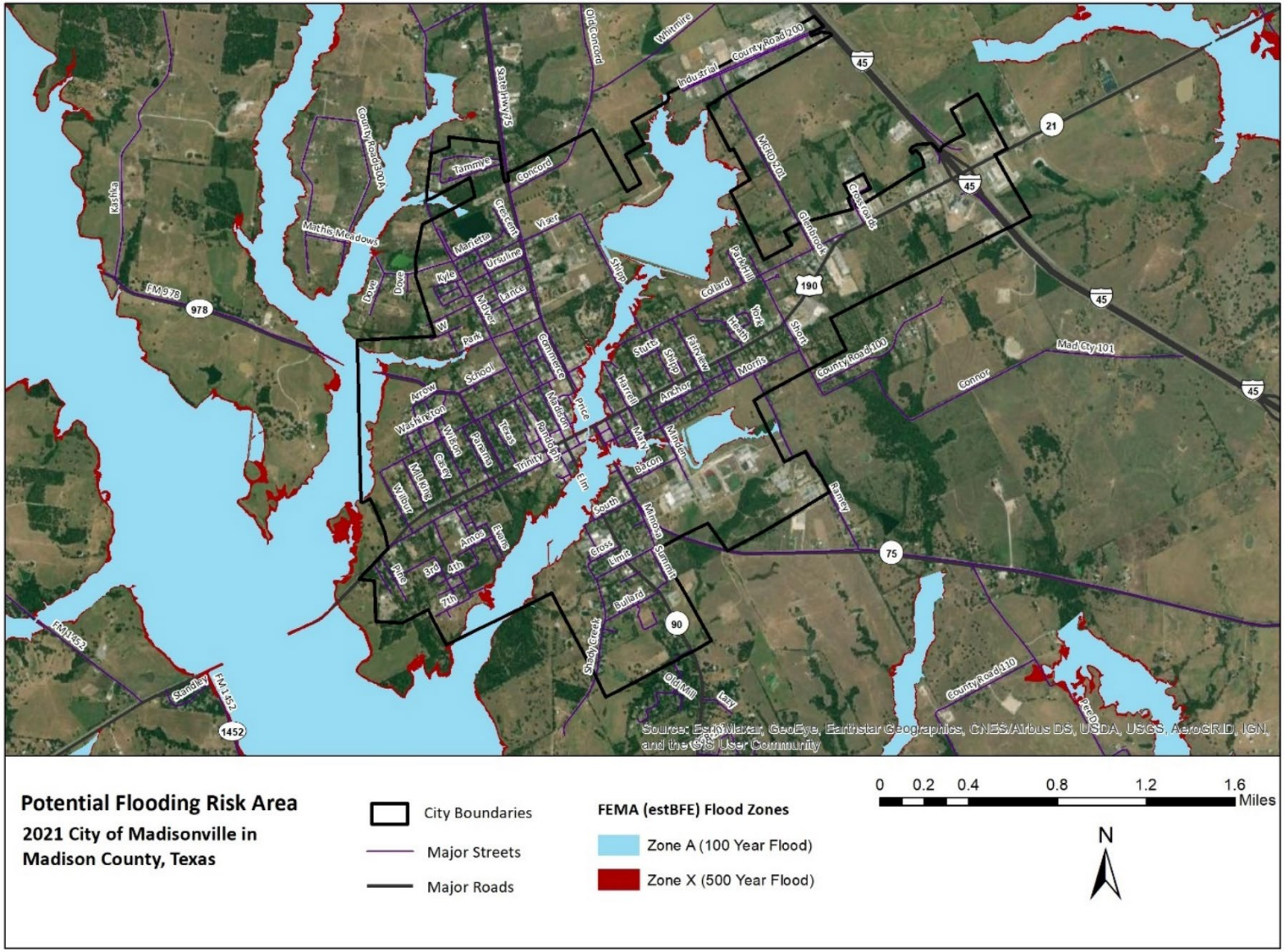


Figure 12: City of Madisonville Potential Flood Risk Area

III. City of Midway

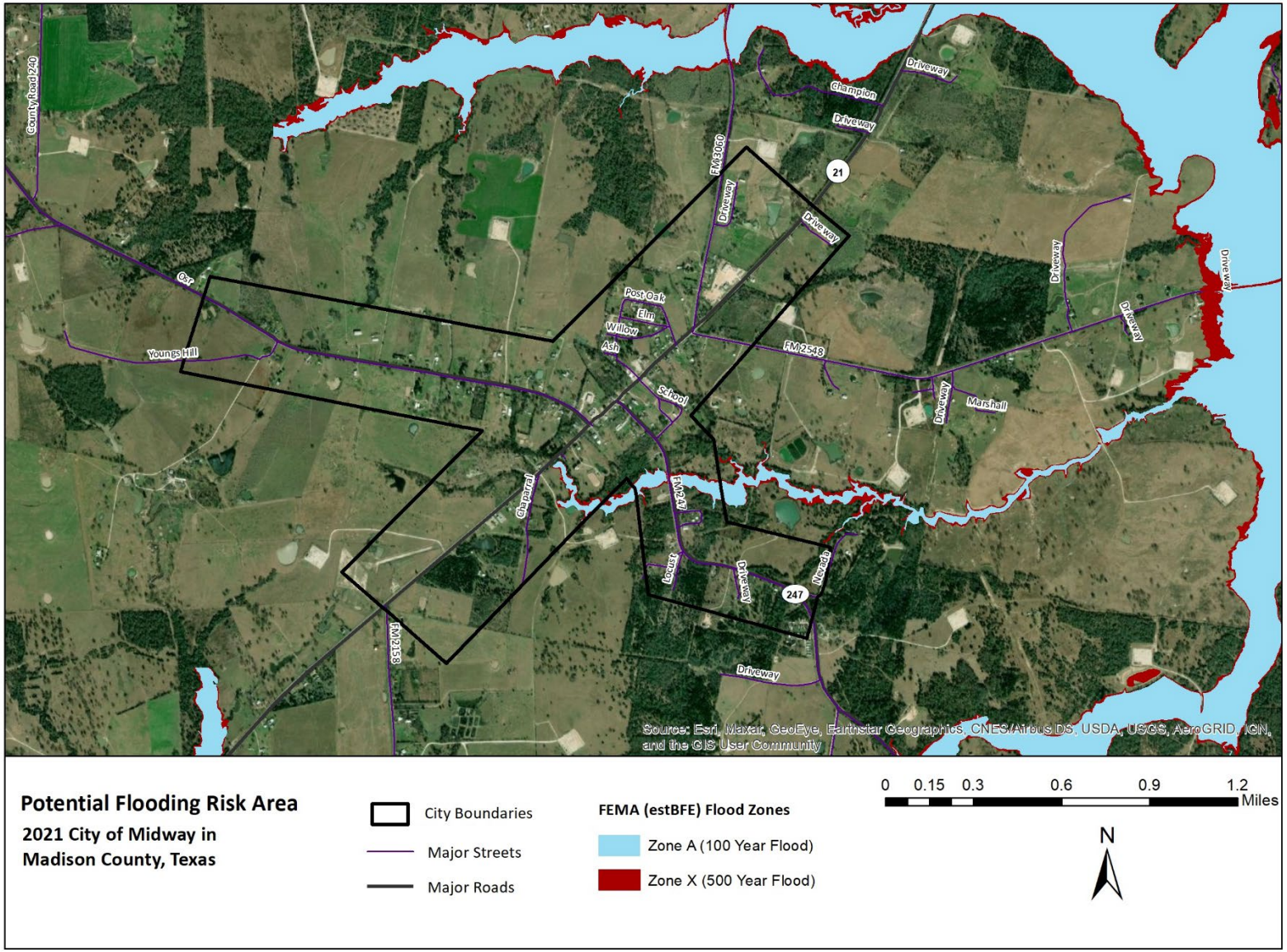


Figure 13: City of Midway Potential Flood Risk Area

IV. North Zulch MUD

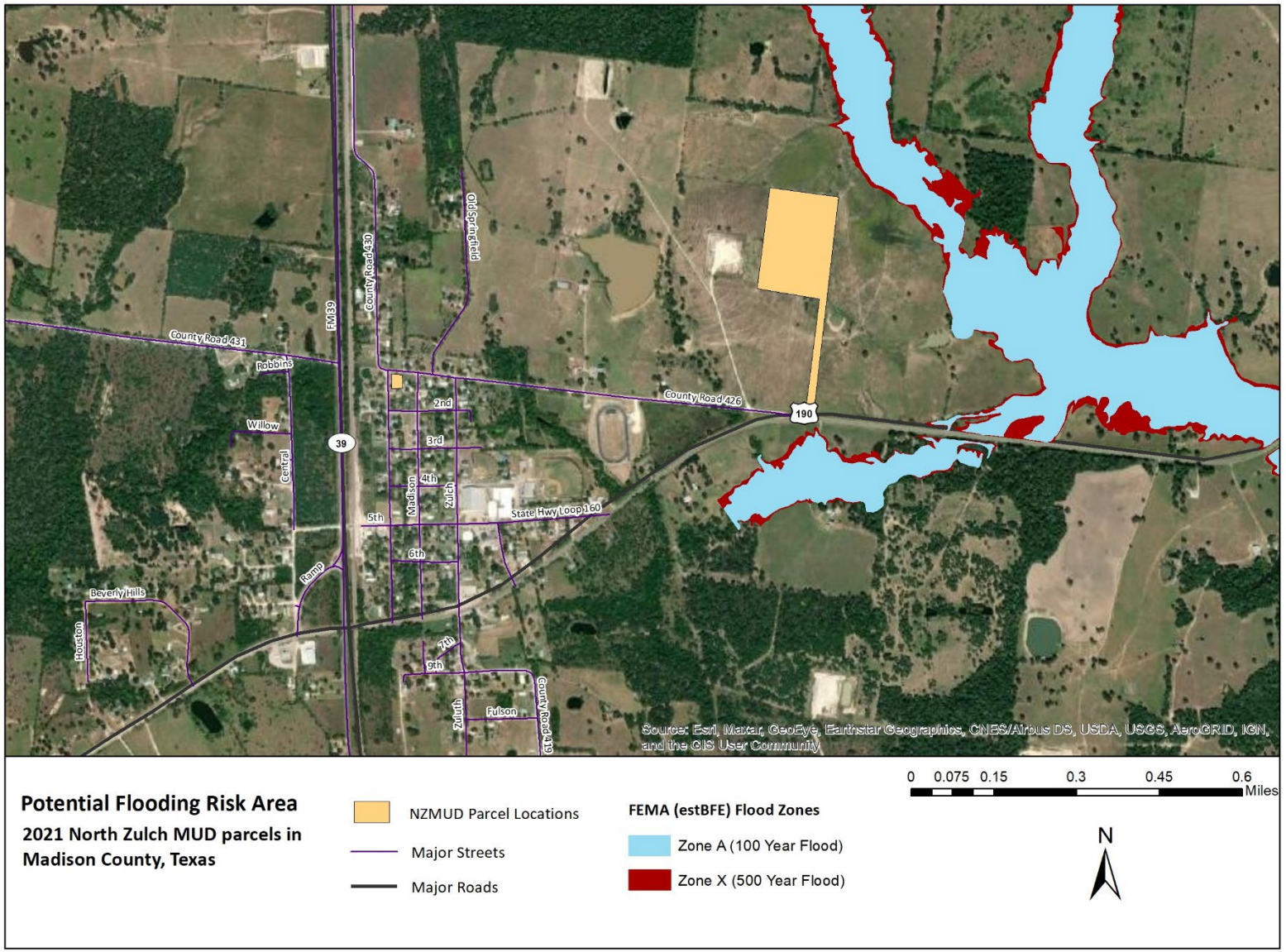


Figure 14: North Zulch Municipal Utility District Potential Flood Risk Area

B) Impact

Flood impact in Madison County and the participating jurisdictions will vary depending on the location, size of the affected area, and number of structures affected. Although the likelihood of a FEMA 100-year flood event remains occasional, 1% in any given year, the floodplain crosses all of Madison County's major thoroughfares, potentially limiting travel across, within, and around the County.

Residents in the participating jurisdictions may temporarily lose power due to downed power lines. Motorists and residents may be left stranded and needing rescue. Affected structures may be flooded, damaged by foodborne contaminants, damaged by debris flow, or even completely washed away. Crops may be damaged or destroyed. Estimated damage totals to vulnerable parcels affected during a 100-year flood event may meet the totals outlined in Tables 14 through 18.

Despite the unlikely probability of a so-called 500-year flood, 0.02% in any given year, the danger is not negligible. Moreover, the relatively limited information on the 500-year flood zone should not be interpreted to mean that a 500-year flood will only occur in the areas depicted within the 500-year flood zones. Similar to 100-year flood events, parts of the County may temporarily lose power due to downed power lines; motorists and residents may be left stranded and needing rescue; affected structures may be flooded, damaged by flood borne contaminants, damaged by debris flow, or even completely washed away; crops may be damaged or destroyed. Estimated damage totals to vulnerable parcels affected during a 500-year flood event may meet the totals outlined in Tables 14 through 18.

In addition to flooding's direct effects, the participating jurisdictions may be subject to indirect effects. These may include but aren't limited to loss of power, limited travel due to flooded and/or washed-out roads, and limited access to nearby emergency care centers.

5) Vulnerability

A) Population

As described in Section 3 of Chapter 3 above, Madison County and the participating jurisdictions are home to many vulnerable residents. Increased vulnerability may be due to many factors including but not limited to age, physical ability, financial means, housing type, and housing condition. Many of these vulnerabilities often overlap.

The participating jurisdictions recognize that vulnerable populations may need additional help preparing for and recovering from a flood.

Residents of mobile / manufactured housing are of particular concern. These structures are never considered safe during a flood, and depending on tie-down methods, may threaten surrounding structures.

Residents of sub-standard structures are also of particular concern. Structures in sub-standard condition ahead of a flood, whether due to structural damages, missing windows or doors, holes in exterior walls or the roof, may be less safe during a flood than structures in standard condition. Existing structural weaknesses may mean increased damages, injuries, or loss of life.

B) Critical Facilities

The planning team identified 51 critical facilities spread across the County and participating jurisdictions. Four are located within a known FEMA Flood Zone.

Table 13: Madison County Critical Facilities Vulnerable to Flooding

Proposed Madison County Critical Facilities
City of Madisonville Lift Station #5
City of Madisonville Lift Station #6
City of Madisonville Lift Station #12
City of Madisonville – Wastewater Treatment Plant

C) Vulnerable Parcels[16]

The planning team developed a parcel inventory to identify estimated damage values during a flood event. Parcels vulnerable to flooding have been identified by their complete or partial location within the FEMA 100-year floodplain and the FEMA 500-year floodplain. Actual damages will vary based on the location and extent of flooding.

Table 14: Vulnerable Parcels by Flood Zone in Madison County

Jurisdiction	Total Parcels	Estimated Potential Damage Value
FEMA 100-Year Flood Zone A		
Madison County	**2,322**	**$922,159,660**
FEMA 500-Year Flood Zone		
Madison County	**2,027**	**$860,948,000**

[16] County Parcel Count Includes All Parcels in Madison County

Table 15: Vulnerable Parcels by Flood Zone in the City of Madisonville

Jurisdiction	Total Parcels	Estimated Potential Damage Value
FEMA 100-Year Flood Zone A		
City of Madisonville	**179**	**$63,242,570**
FEMA 500-Year Flood Zone		
City of Madisonville	**149**	**$58,938,620**

Table 16: Vulnerable Parcels by Flood Zone in the City of Midway

Jurisdiction	Total Parcels	Estimated Potential Damage Value
FEMA 100-Year Flood Zone A		
City of Midway	**3**	**$607,130**
FEMA 500-Year Flood Zone		
City of Midway	**3**	**$607,130**

Table 17: Vulnerable Parcels by Flood Zone in the North Zulch Municipal Utility District

Jurisdiction	Total Parcels	Estimated Potential Damage Value
FEMA 100-Year Flood Zone A		
North Zulch MUD	**0**	**N/A**
FEMA 500-Year Flood Zone		
North Zulch MUD	**0**	**N/A**

5. Hurricanes / Tropical Storms

Once a tropical depression has intensified to the point where its maximum sustained winds are between 35-64 knots (39 – 73 mph), it becomes a tropical storm. At these wind speeds the storm becomes more organized and begins to become more circular in shape – resembling a hurricane. The rotation of a tropical storm is more recognizable than for a tropical depression. Tropical storms can cause many problems without becoming a hurricane. However, most of the problems a tropical storm causes stem from heavy rainfall and high winds.

According to National Oceanic and Atmospheric Administration (NOAA), a hurricane is an intense tropical weather system of strong thunderstorms with a well-defined surface circulation and maximum sustained winds of 74 mph or higher. Hurricanes are categorized according to the strength of their winds using the Saffir-Simpson Hurricane Scale. A Category 1 storm has the lowest wind speeds, while a Category 5 hurricane has the highest. These are relative terms, because lower category storms can sometimes inflict greater damage than higher category storms, depending on where they strike and the particular hazards they bring. In fact, tropical storms can also produce significant damage and loss of life, mainly due to flooding.

The ingredients for a hurricane include a pre-existing weather disturbance, warm tropical oceans, moisture, and relatively light winds aloft. If the right conditions persist long enough, they can combine to produce the violent winds, incredible waves, torrential rains, and floods associated with this phenomenon.

1) Hurricanes / Tropical Storms History

The planning team relied on data from the National Centers for Environmental Information (NCEI) to develop a flood history for the County and each participating jurisdiction.

According to Madison County's 2013 plan, the County and surrounding jurisdictions were hit by Hurricane Ike which caused about $7 million in property damage in 2008. This event caused parts of the rural areas in the County to lost power for up to ten days. Historically, Madison County and participating jurisdictions have reported unlikely frequency of hurricane occurrences.

NCEI data shows that the participating jurisdictions experienced one hurricane events since the 2013 plan, Hurricane Harvey in 2017. During Hurricane Harvey, Madison County received heavy rains and major flooding which impacted homes, roads, and businesses; this event caused about $89 million in property damages.

Table 18: Madison County Hurricane History

Location	Date Range	Number of Hurricane & Tropical Storm Events	Hurricane & Tropical Storm Category Range	Maximum Wind Speed Range	Local Fatalities	Local Injuries	Local Property Damage $2021	Local Crop Damage $2021
Countywide	8/25/2017 – 8/29/2017	1	TS - Cat 4	20 – 50 MPH	0	0	$89,100,195.82	$0

No crop damages, injuries, or deaths due to hurricanes, tropical storms, or tropical depressions have been reported since the previous plan.

2) Likelihood of Future Events

Hurricanes occur in seasonal patterns between June 1 and November 30. Based on historical frequency of hurricanes and tropical storms in Madison County and the participating jurisdictions outlined above, the likelihood of a hurricane or tropical storm affecting any or all of the participating jurisdictions is unlikely, meaning an event is possible in the next ten years.

3) Extent

Storms with winds less than 39 miles an hour are called Tropical depressions. Tropical storms have wind speeds between 39 – 74 miles an hour. Storms maintaining winds of 74 or more miles an hour are called hurricanes. The Saffir-Simpson Scale categorizes hurricane intensity linearly based upon maximum sustained winds, barometric pressure, and storm surge potential. Wind, pressure, and surge are combined to estimate potential damage. Categories 3, 4 and 5 are classified as “major” hurricanes. Major hurricanes comprise only 20 percent of total tropical cyclone landfalls, but they account for over 70 percent of the damage in the United States. Damage from hurricanes can result from spawned tornados, coastal flooding from storm surge, and inland flooding from heavy rainfall.

Table 19: Saffir-Simpson Scale

Category	Maximum Sustained Wind Speed (MPH)	Minimum Surface Pressure (Millibars)	Storm Surge (Feet)
1	74-95	Greater than 980	3-5
2	96-110	979-965	6-8
3	111-130	964-945	9-12
4	131-155	944-920	13-18
5	155+	Less than 920	19+

Table 21 below profiles the potential wind speeds in miles per hour (mph) that Madison County might expect during a hurricane event for various return periods. In the case of a 10-year, 20-year, and 50-year event, the wind speeds are projected to fall below the minimum sustained

winds necessary to be classified as a Category 1 hurricane. Instead, these wind speeds fall between the lower end and middle of the tropical storm wind range, 39 – 73 mph.

Table 20: Average Hurricane Wind Speed by Jurisdiction[17]

Jurisdiction	Wind Speed (MPH) Per Return Period						
	10-year	20-year	50-year	100-year	200-year	500-year	1,000-year
Madison County	39	55	72	84	95	107	116

Madison County and the participating jurisdictions are located far enough from the coast that storm surge is unlikely to have a local impact.

The worst hurricanes and tropical storms in Madison County and the participating jurisdictions have measured as high as Category 1 on the Saffir-Simpson scale, dropped up to 25" in rainfall[18] and cause property damages of about $80 million.

Future hurricanes and tropical storms may meet previous worst-case Hurricanes and Tropical Storms in terms of strength, rainfall, flooding, damage dollars, injuries, and deaths.

4) Location and Impact

A) Location

Location is often referred to in terms of Tier I and II counties, designated by the Texas Department of Insurance (TDI) for windstorm insurance purposes, to represent differing levels of loss exposure to coastal counties and adjacent counties. Tier I are those counties adjacent to the Gulf of Mexico and Tier II are those counties adjacent to Tier I counties.

Madison County is not a Tier I or Tier II County. However, the County and all participating jurisdictions are located within 200 miles of the Gulf coast. Although tropical storm and hurricane effects begin to diminish as they move inland, the winds alone from Hurricane Harvey reached as far as 140 miles from the eye of the storm. The County and all participating jurisdictions are considered especially susceptible to indirect impacts from hurricanes and tropical storms including high winds and flooding.

Tropical storms and hurricanes vary tremendously in terms of size, location, intensity and duration. According to the Madison County 2018 CHAMPS Report, Madison County's proximity

[17] Section 8: Hurricane, p. 61 – *Madison County Hazard Mitigation Plan 2013-2018*

[18] https://theeagle.com/news/local/meteorologists-hurricane-harvey-on-track-to-bring-rain-wind-to-brazos-valley/article_ca51170c-38d5-5816-84bc-0ca29e4d70f7.html

to the coast places it among the middle 20% of all Texas counties in terms of recorded hurricane and tropical storm impacts including damage dollars, injuries, and deaths.

B) Impact

The planning team determined that Madison County is uniformly exposed to tropical storms and hurricanes.

Impacts from a hurricane or tropical Storm in Madison County and the participating jurisdictions may include but are not limited to loss of power due to downed lines caused by flying debris or fallen trees, flooding, flooding due to damaged or destroyed roofs, damaged or broken windows, damage due to flying debris, wind damage, escaped livestock and pets, injured or killed livestock and pets, crop damage or destruction. In the worst storms, people may be injured or killed.

5) Vulnerability

A) Population

As described in Section 3 of Chapter 3 above, Madison County and the participating jurisdictions are home to many vulnerable residents. Increased vulnerability may be due to many factors including but not limited to age, physical ability, financial means, housing type, and housing condition. Many of these vulnerabilities often overlap.

The participating jurisdictions recognize that vulnerable populations may need additional help preparing for and recovering from a hurricane or tropical storm.

Residents of mobile / manufactured housing are of particular concern. These structures are never considered safe during a hurricane, and depending on tie-down methods, may also be unsafe during strong tropical storms. The participating jurisdictions also recognize that subdivisions or neighborhoods with only a single entrance may be cut off due to Hurricane/Tropical Storm impacts and therefore unable to obtain supplies or receive emergency services.

Residents of sub-standard structures are also of particular concern. Structures in sub-standard condition ahead of a tropical storm or hurricane, whether due to structural damages, missing windows or doors, holes in exterior walls or the roof, may be less safe during a hurricane or tropical storm than structures in standard condition. Existing structural weaknesses may mean increased damages, injuries, or loss of life.

B) Critical Infrastructure

There are no major TxDOT-designated major hurricane evacuation routes in Madison County, however Interstate 45 is considered a TxDOT-designated potential contraflow.

Interstate 45, State High 21, and U.S. Highway 90 run through the City of Madisonville. State Highway 21 goes through the City of Midway. U.S. Highway 90 runs through the North Zulch, Texas area.

Flooding along any of these routes during a hurricane evacuation could strand motorists trying to escape the storm. These drivers may need to be rescued and could be injured or killed.

C) Critical Facilities

The planning team identified 51 critical facilities spread across the County and participating jurisdictions. Because of Madison County's proximity to the Gulf coast, the planning team determined that all critical facilities, no matter their jurisdictional location, are equally vulnerable to a hurricane or tropical storm.

Table 21: Critical Facilities Vulnerable to Tropical Storms and Hurricanes and Potential Impacts

Jurisdiction	Critical Facilities	Potential Hurricane / Tropical Storm Impacts									
		Loss of Power	Flying Debris	Uprooted Trees	Flooding	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Madison County	Tower site for BVWACS (public safety radio)	x	x	x	x				x	x	x
	Courthouse & Emergency Operations Center	x	x	x	x	x	x	x	x	x	x
	Courthouse Annex	x	x	x	x	x	x	x	x	x	x
	Sheriff's Office	x	x	x	x	x	x	x	x	x	x
	Madisonville Consolidated Independent School District Campuses	x	x	x	x		x	x	x	x	x
	Madison/St. Joseph Hospital	x	x	x	x			x	x	x	x
	Madison County Jail	x	x	x	x	x		x	x	x	x
Madisonville	Buc-ee's	x	x	x	x	x	x	x	x	x	x
	First Baptist Church (Sheltering)	x	x	x	x	x	x	x	x	x	x
	Truman Kimbro Center	x	x	x	x	x	x	x	x	x	x
	Quick Visit Urgent Care	x	x	x	x	x	x	x	x	x	x
	Madisonville Police Dept.	x	x	x	x	x	x	x	x	x	x
	KMVL Radio Station	x	x	x	x	x	x	x	x	x	x
	Madisonville Municipal Airport	x	x	x	x	x	x		x	x	x
	Hensarling Airport	x	x	x	x	x	x		x	x	x
	City Hall of Madisonville	x	x		x	x	x	x	x	x	x
	City Of Madisonville Well #3	x	x	x	x	x			x	x	x
	City Of Madisonville Well #5	x	x	x	x	x			x	x	x
	City Of Madisonville Lift Station #2	x	x	x					x	x	x
	City Of Madisonville Lift Station #3	x	x		x	x			x	x	x
	City Of Madisonville Lift Station #4	x	x	x					x	x	x
	City Of Madisonville Lift Station #5	x	x	x	x	x			x	x	x
	City Of Madisonville Lift Station #7	x	x	x					x	x	x
	City Of Madisonville Lift Station #8	x	x	x					x	x	x

	City Of Madisonville Lift Station #9	x	x	x					x	x	x
	City Of Madisonville Lift Station #10	x	x	x					x	x	x
	City Of Madisonville Lift Station #11	x	x	x					x	x	x
	City Of Madisonville Lift Station #12	x	x	x	x	x			x	x	x
	City Of Madisonville Wastewater Treatment Plant	x	x	x	x	x	x	x	x	x	x
	City Of Madisonville Fire Station	x	x	x	x	x	x	x	x	x	x
Midway	City Hall/Fire Station	x	x	x	x	x	x	x	x	x	x
	Well Yard	x	x	x	x	x	x	x	x	x	x
	Lift Station A	x	x	x					x	x	x
	Lift Station B	x	x	x					x	x	x
	Lift Station C	x	x	x					x	x	x
	Lift Station D	x	x	x	x	x			x	x	x
	TX Dept Criminal Justice - Ferguson Unit	x	x				x	x	x	x	x
North Zulch MUD	Water Plant and Well #3	x	x	x	x	x	x		x	x	x
	Wastewater Treatment Plant	x	x	x	x	x			x	x	x
	Lift Station #1	x	x	x	x	x			x	x	x
	Lift Station #2	x	x	x					x	x	x
	Grinder Station #1	x	x	x	x	x			x	x	x
	Grinder Station #2	x	x	x	x	x			x	x	x
	Grinder Station #3	x	x	x	x	x			x	x	x
	North Zulch Consolidated Independent School District Campus	x	x	x	x	x	x	x	x	x	x
	North Zulch Volunteer Fire Department / Senior Center	x	x	x	x	x	x	x	x	x	x

D) Vulnerable Parcels

Central Appraisal District data was used to estimate potential damage values for each participating jurisdiction. Given the broad nature of vulnerability, damage values were calculated on the jurisdictional level.

Table 22: Estimated Potential Damage Values by Jurisdiction

Jurisdiction	Parcel Count	Estimated Potential Damage Value
Madison County	**9,669**	**$2,061,617,225**
City of Madisonville	2,083	$207,605,330
City of Midway	189	$12,141,000
North Zulch Municipal Utility District	2	$131,610

6. Wildfire

Wildfire is defined as a sweeping and destructive conflagration and can be further categorized as wildland, interface, or intermix fires.

Wildland fires are fueled almost exclusively by natural vegetation wildland/urban interface (WUI) fires include both vegetation and the built environment. The wildfire disaster cycle begins when homes are built adjacent to wildland areas. When what would have been rural wildfires occur, they advance through all available fuels, which can include homes and structures.

1) Wildfire History

The Texas A&M Forest Service Wildfire Risk Assessment Portal provides wildfire data on fires that occurred as recently as 2015. Additional data came from local planning team members.

In the 2013 plan, the County and participating jurisdictions looked at Texas A&M Forest Service Wildfire Risk Assessment Portal data to determine wildfire risk across Madison County.

None of the participating jurisdictions have data available on fires past 2015.

The following tables show the wildfire history of each participant as recorded by the Texas A&M Forest Service. None of these events includes any information about damages, injuries, or fatalities.

Table 23: Madison County Wildfire History

Location	Date Range	Number of Wildfire Events	Range of Acres Burned	Total Acres Burned
Countywide	4/13/2010 – 7/31/2015	42	.01 - 99	418.91

Table 24: City of Madisonville Wildfire History

Location	Date Range	Number of Wildfire Events	Range of Acres Burned	Total Acres Burned
Madisonville	1/22/2011 – 9/18/2013	146	.5 - 3000	4868

Table 25: City of Midway Wildfire History

Location	Date Range	Number of Wildfire Events	Range of Acres Burned	Total Acres Burned
Midway	1/6/2011 – 9/18/2011	31	.1 - 9	71.9

Table 26: North Zulch, TX Wildfire History

Location	Date Range	Number of Wildfire Events	Range of Acres Burned	Total Acres Burned
North Zulch	1/3/2006 – 2/27/2006	5	1 - 5	13

While the North Zulch MUD does not have specific information about wildfire history, the histories are assumed to be the same as Madison County, the North Zulch community area, and the participating cities.

Wildfire history isn't broken down beyond the city level. However, given the participating jurisdictions' locations within the planning area, and specifically the number of their facilities located in the wildfire hazard area, participating jurisdictions determined they're vulnerable to hazard despite lacking a specific history of previous wildfire events.

2) Likelihood of Future Events

Although the County and participating jurisdictions haven't recorded a wildfire since 2015, given the prior frequency of wildfire events, a wildfire event in any of the jurisdictions addressing the hazard is highly likely, meaning an event is probable within the next year.

3) Extent

The Texas A&M Forest Service's Characteristic Fire Intensity Scale (FIS) specifically identifies areas where significant fuel hazards and associated dangerous fire behavior potential exist. The FIS is a fire behavior output, which is influenced by three environmental factors - fuels, weather, and topography. According to Texas A&M Forest Service data, Madison County and the participating jurisdictions are rated between Class 1 and Class 4.

Table 27: Characteristic Fire Intensity Scale[19]

Class 1 Very Low	Very small, discontinuous flames, usually less than one foot in length; very low rate of spread; no spotting. Fires are typically easy to suppress by firefighters with basic training and non-specialized equipment.
Class 2 Low	Small flames, usually less than two feet long; small amount of very short-range spotting possible. Fires are easy to suppress by trained firefighters with protective equipment and specialized tools.
Class 3 Moderate	Flames up to 8 feet in length; short-range spotting is possible. Trained firefighters will find these fires difficult to suppress without support from aircraft or engines, but dozer and plows are generally effective. Increasing potential for harm or damage to life and property.
Class 4 High	Large flames, up to 30 feet in length; short-range spotting common; medium range spotting possible. Direct attack by trained firefighters, engines, and dozers is generally ineffective, indirect attack may be effective. Significant potential for harm or damage to life and property.
Class 5 Very High	Very large flames up to 150 feet in length; profuse short-range spotting, frequent long-range spotting; strong fire-induced winds. Indirect attack marginally effective at the head of the fire. Great potential for harm or damage to life and property.

The National Wildfire Coordinating Group (NWCG) provides an additional way to measure extent by accounting for fire size. Based on Texas A&M Forest Service data, the average fire in Madison County and the participating jurisdictions is a Class C event.

Table 28: National Wildfire Coordinating Group Size Class of Fire[20]

Class A	¼ acre or less
Class B	More than ¼ acre, but less than 10 acres
Class C	10 acres or more, but less than 100 acres
Class D	100 acres or more, but less than 300 acres
Class E	300 acres or more, but less than 1,000 acres
Class F	1,000 acres or more, but less than 5,000 acres
Class G	5,000 acres or more

[19] https://www.texaswildfirerisk.com
[20] http://www.nwcg.gov/term/glossary/size-class-of-fire

Previous wildfires in Madison County and the participating jurisdictions have ranged between Class 1 and Class 4 on the Characteristic Fire Intensity Scale, with flames up to 30’ or more in length, and between Class A and Class C on the National Wildfire Coordinating Group Size Class of Fire scale (NWCGSCF). Most fires have been small and were contained quickly. However, the worst reported fire in Madison County burned 99 acres.

Future fire events in Madison County and the participating jurisdictions may meet previous worst-case Class C (NWCGSCF) and Class 4 (FIS) wildfires in terms of intensity, acreage burned, and inflicted damage.

4) Location and Impact

A) Location

Due to wildfire’s ability to inflict damages to both structures and landscapes, wildfire location has been assessed by parcel, rather than by structure. Parcels have been determined to be either partially or completely vulnerable to wildfire based on TxWRAP’s Wildland Urban Interface boundaries.

Because wildfires are dynamically unpredictable, the following maps and tables may not be representative of every location and parcel at risk of wildfire.

I. Madison County Location

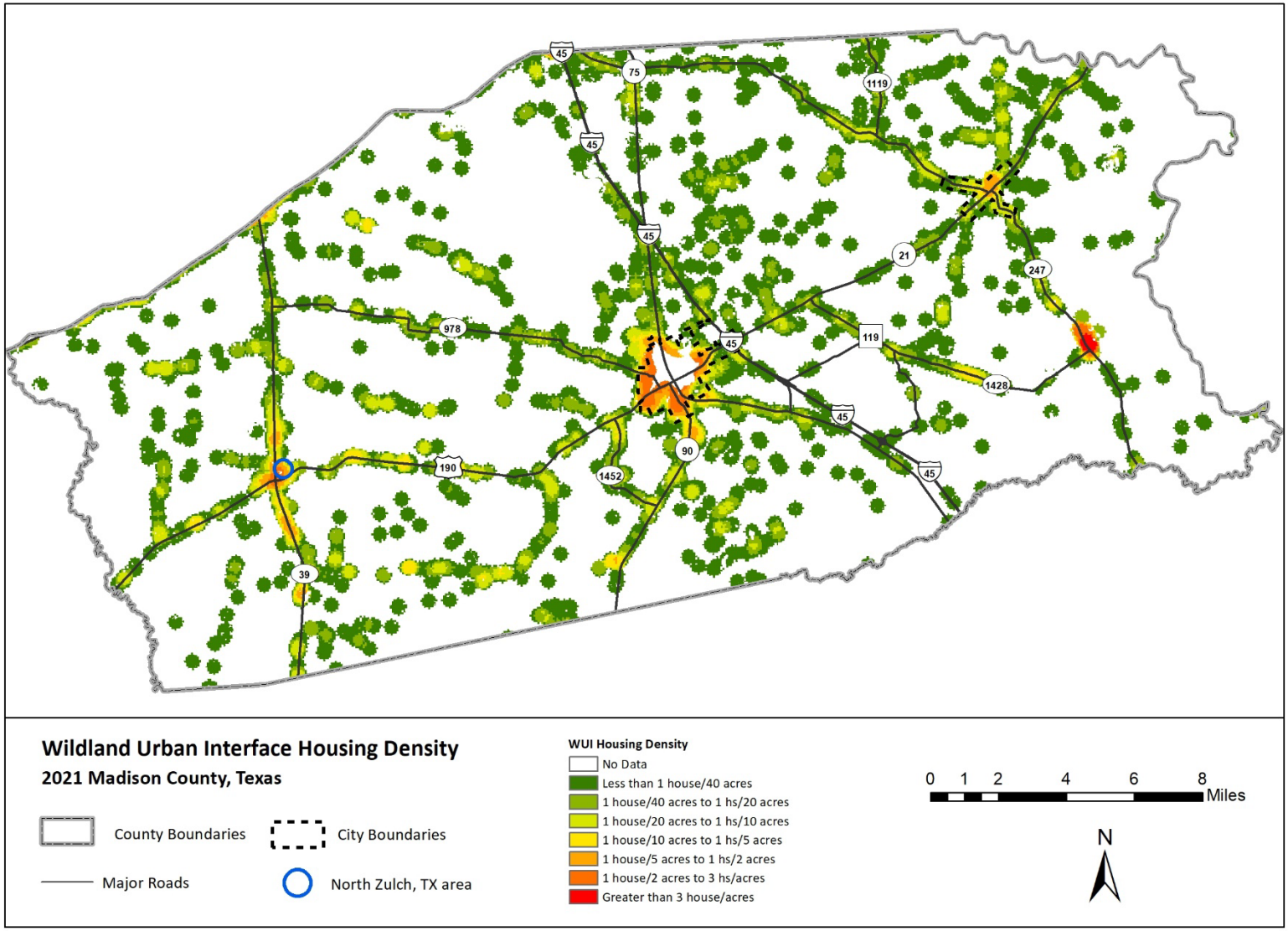


Figure 15: Madison County Wildland Urban Interface

II. City of Madisonville Location

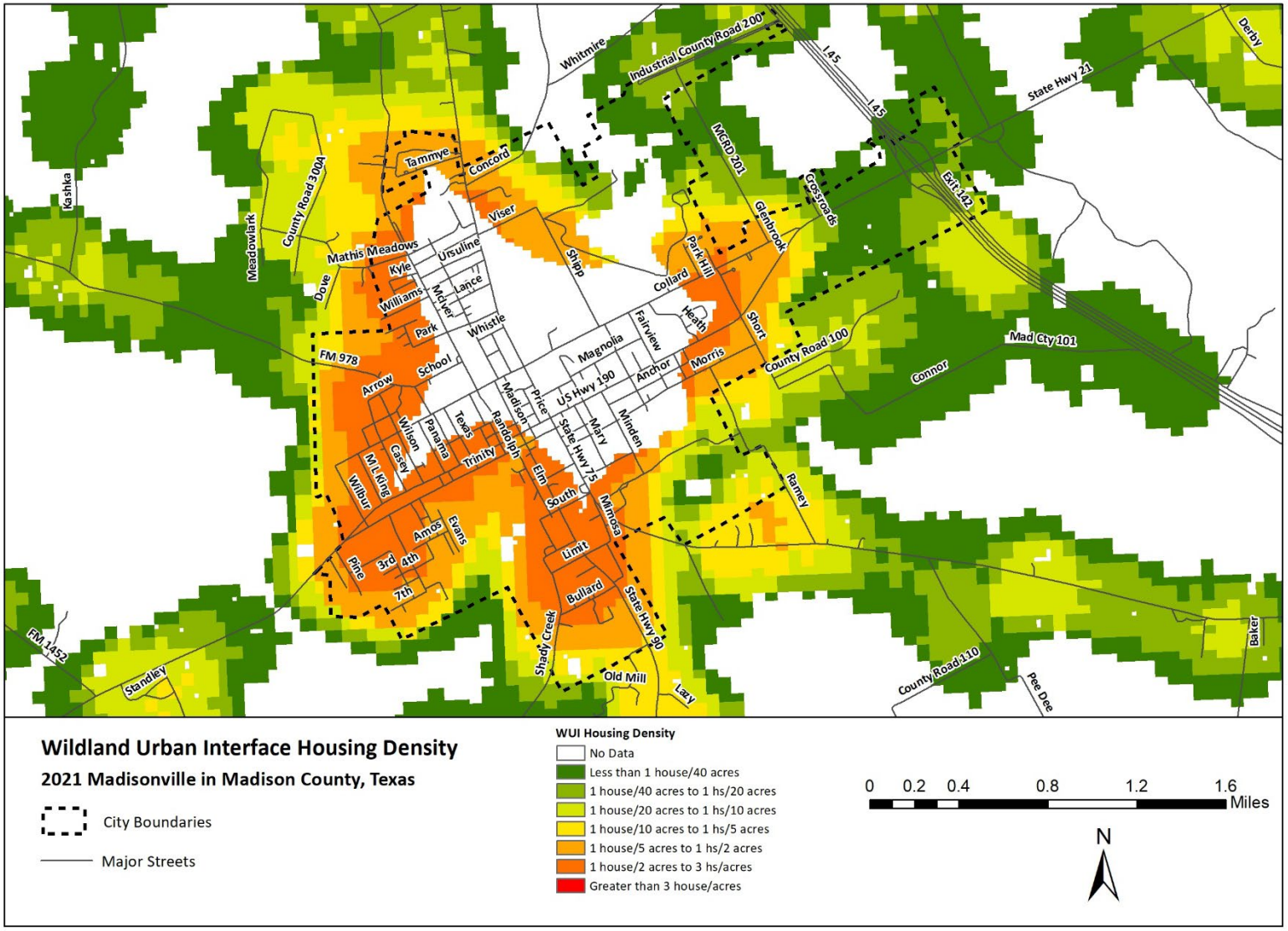


Figure 16: City of Madisonville Wildland Urban Interface

III. City of Midway Location

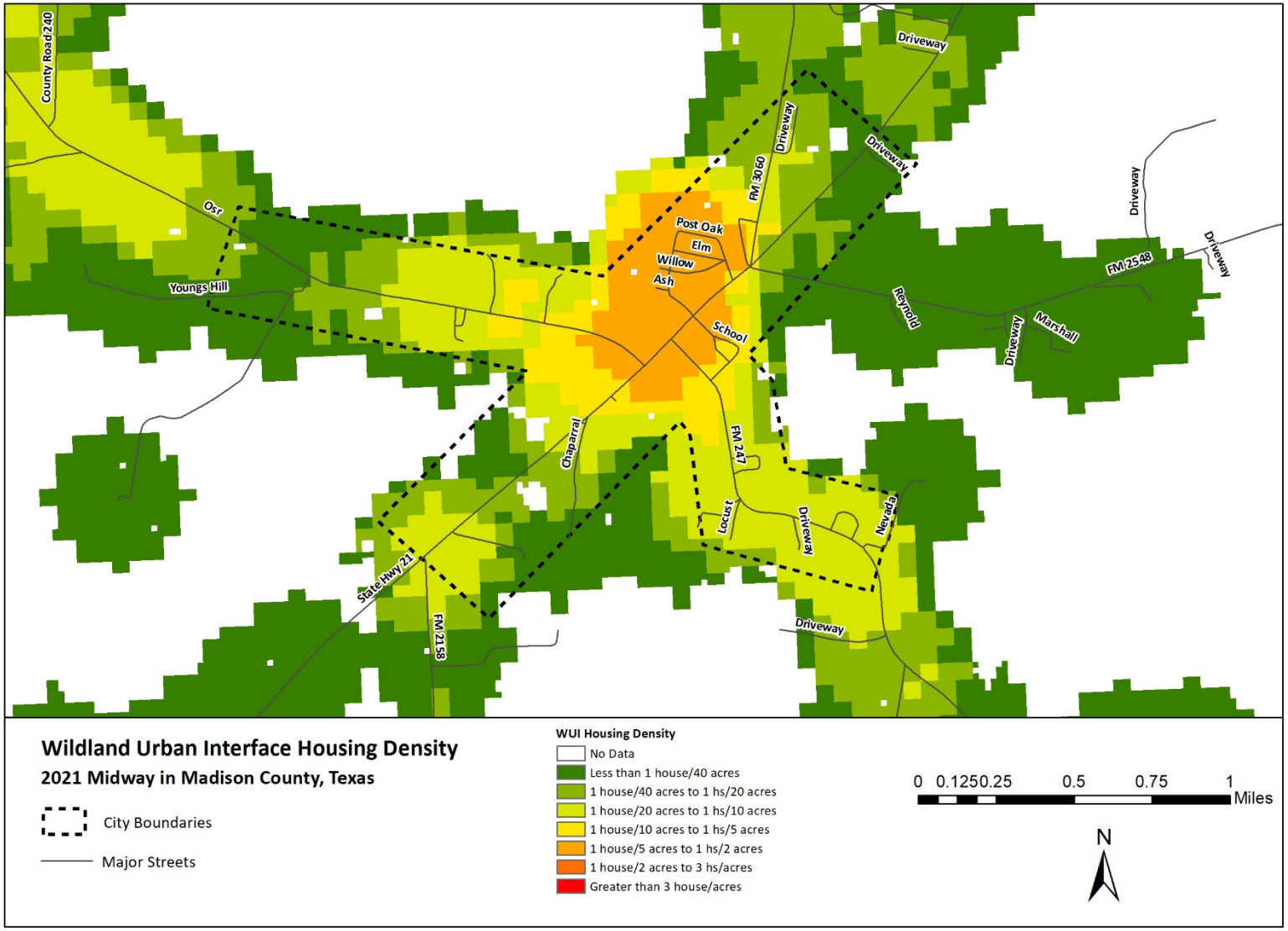


Figure 17: City of Midway Wildland Urban Interface

IIV. North Zulch MUD

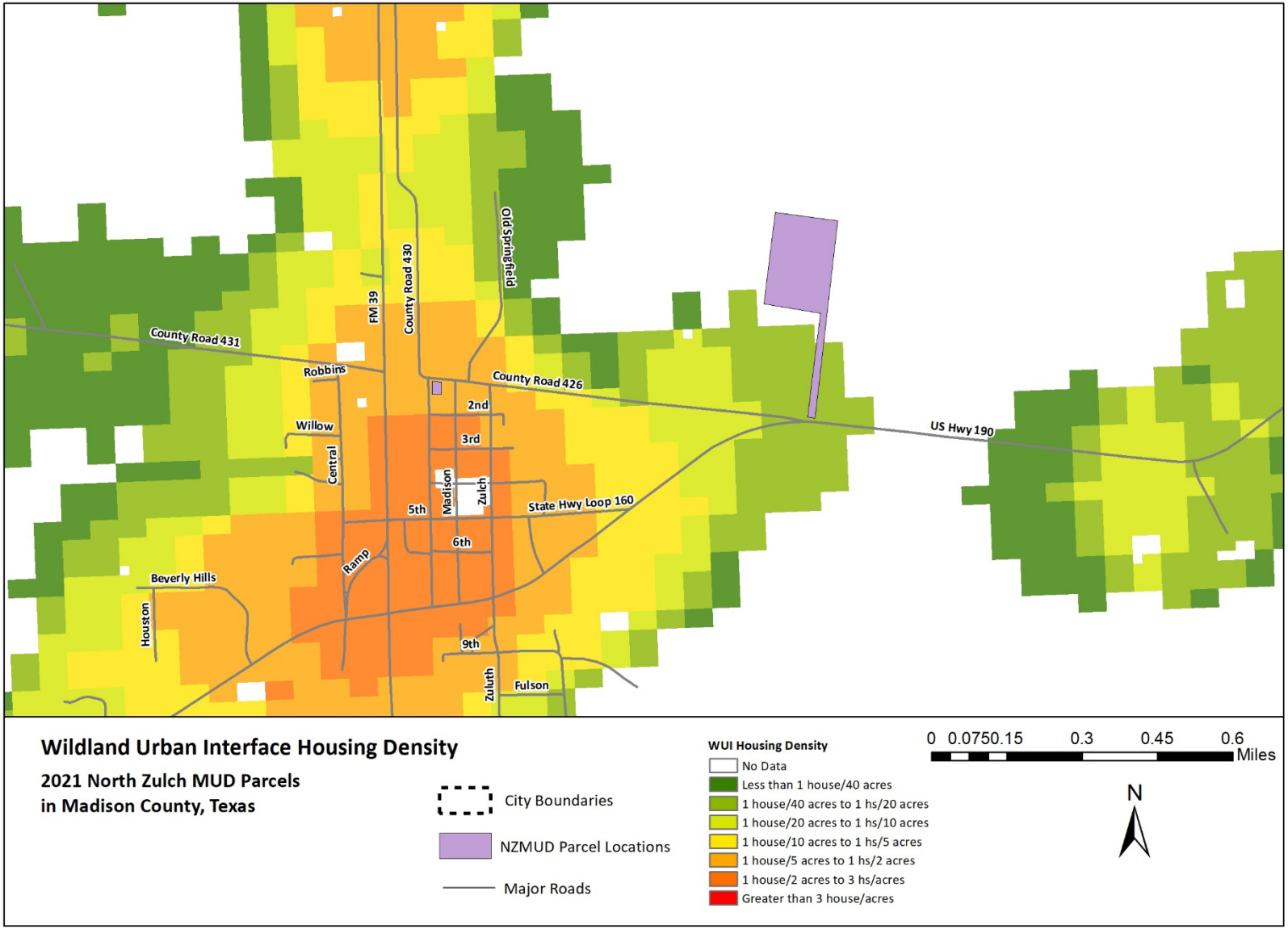


Figure 18: North Zulch MUD Wildland Urban Interface

B) Impact

Impacts from a wildfire in Madison County and the participating jurisdictions may include but are not limited to: crop damage or destruction, damaged or destroyed agricultural, residential, commercial, and industrial buildings, escaped, lost, injured or killed livestock and pets. In the worst cases, residents may be injured or killed.

5) Vulnerability

A) Population

As described in Section 3 of Chapter 3 above, Madison County and the participating jurisdictions are home to many vulnerable residents. Increased vulnerability may be due to many factors including but not limited to age, physical ability, financial means, housing type, and housing condition. Many of these vulnerabilities often overlap.

The jurisdictions recognize that vulnerable populations may need additional help preparing for and recovering from a wildfire.

Residents of mobile homes, specifically those built before HUD's Manufactured Housing and Standards requirements were introduced in 1976, are of particular concern[21]. These structures are more prone to fire and have a higher incidence of occupant death than modern manufactured homes.

Residents of sub-standard structures are also of particular concern. Structures in sub-standard condition ahead of a wildfire, whether due to structural damages, missing windows or doors, holes in exterior walls or the roof, may be less safe during a wildfire than structures in standard condition. Exterior damages may make the homes more prone to fire by more readily exposing flammable materials to flame. Missing windows and other exterior gaps may leave residents and structures prone to smoke inhalation and smoke damage.

All of these issues may increase damages and lead to injuries or loss of life.

[21] https://www.usfa.fema.gov/downloads/pdf/statistics/rural.pdf

B) Critical Facilities

There are 51 critical facilities located throughout the County and participating jurisdictions. 45 of the 51 critical facilities are located in the wildland urban interface (WUI), as defined by the Texas A&M Forest Service. Because of their location in the WUI, the density of development, and proximity to wildland areas, these facilities are believed to be particularly susceptible to future wildfire threats.

Table 29: Critical Facilities Vulnerable to Wildfire and Potential Impacts

Jurisdiction	Critical Facilities	Potential Wildfire Impacts				
		Destruction	Partial Destruction	Heat Damage	Smoke Damage	Water Damage
Madison County	Tower site for BVWACS (public safety radio)	x	x	x	x	x
	Courthouse & Emergency Operations Center	x	x	x	x	x
	Courthouse Annex	x	x	x	x	x
	Sheriff's Office	x	x	x	x	x
	Madisonville Consolidated Independent School District Campuses	x	x	x	x	x
	Madison/St. Joseph Hospital	x	x	x	x	x
	Madison County Jail	x	x	x	x	x
Madisonville	Buc-ee's	x	x	x	x	x
	First Baptist Church (Sheltering)	x	x	x	x	x
	Truman Kimbro Center	x	x	x	x	x
	Quick Visit Urgent Care	x	x	x	x	x
	Madisonville Police Dept.	x	x	x	x	x
	KMVL Radio Station	x	x	x	x	x
	Madisonville Municipal Airport	x	x	x	x	x
	Hensarling Airport	x	x	x	x	x
	City Hall Of Madisonville	x	x	x	x	x
	City Of Madisonville Well #3	x	x	x	x	x
	City Of Madisonville Well #5	x	x	x	x	x
	City Of Madisonville Lift Station #2	x	x	x	x	x
	City Of Madisonville Lift Station #3	x	x	x	x	x
	City Of Madisonville Lift Station #4	x	x	x	x	x

	City Of Madisonville Lift Station #5	x	x	x	x	x
	City Of Madisonville Lift Station #7	x	x	x	x	x
	City Of Madisonville Lift Station #8	x	x	x	x	x
	City Of Madisonville Lift Station #9	x	x	x	x	x
	City Of Madisonville Lift Station #10	x	x	x	x	x
	City Of Madisonville Lift Station #11	x	x	x	x	x
	City Of Madisonville Lift Station #12	x	x	x	x	x
	City Of Madisonville Wastewater Treatment Plant	x	x	x	x	x
	City Of Madisonville Fire Station	x	x	x	x	x
Midway	City Hall/Fire Station	x	x	x	x	x
	Well Yard	x	x	x	x	x
	Lift Station A	x	x	x	x	x
	Lift Station B	x	x	x	x	x
	Lift Station C	x	x	x	x	x
	Lift Station D	x	x	x	x	x
	TX Dept Criminal Justice - Ferguson Unit	x	x	x	x	x
North Zulch MUD	Water Plant and Well #3	x	x	x	x	x
	Wastewater Treatment Plant	x	x	x	x	x
	Lift Station #1	x	x	x	x	x
	Lift Station #2	x	x	x	x	x
	Grinder Station #1	x	x	x	x	x
	Grinder Station #2	x	x	x	x	x
	Grinder Station #3	x	x	x	x	x
	North Zulch Consolidated Independent School District Campus	x	x	x	x	x
	North Zulch Volunteer Fire Department / Senior Center	x	x	x	x	x

C) Vulnerable Parcels

Table 30: Madison County Parcels Vulnerable to Wildfire

Jurisdiction	Total	Estimated Potential Damage Value
Countywide	**2,319**	**$169,984,660**

Table 31: City of Madisonville Parcels Vulnerable to Wildfire

Jurisdiction	Total	Estimated Potential Damage Value
City of Madisonville	**948**	**$78,115,310**

Table 32: City of Midway Parcels Vulnerable to Wildfire

Jurisdiction	Total	Estimated Potential Damage Value
City of Midway	**129**	**$6,683,150**

Table 33: North Zuch MUD Parcels Vulnerable to Wildfire

Jurisdiction	Total	Estimated Potential Damage Value
North Zulch MUD	**2**	**$131,610**

7. Tornado

A tornado is defined as a rapidly rotating vortex or funnel of air extending ground-ward from a cumulonimbus cloud. Most of the time, vortices remain suspended in the atmosphere and are visible as a funnel cloud. However, when the lower tip of a vortex touches the ground, the tornado becomes a force of destruction. Tornado strength is currently measured using the Enhanced Fujita (EF) Scale. Like the previously used Fujita scale, the EF Scale uses damage to estimate tornado wind speeds and assign a number between 0 and 5. A rating of EF0 represents minor to no damage whereas a rating of EF5 represents destruction of buildings.

1) Tornado History

In the 2013 HMAP, Madison County and the participating jurisdictions reported 13 tornados between October 1954 and April 2009. The 2013 plan recorded $3.63 million in property damages and $50 thousand in crop damages during that time. Tornado events between 1987 and 2006 reported 7 injuries and 3 fatalities. Historically, the County reported likely frequency of tornados throughout the jurisdictions in relation to seasonal patterns favorable for tornado occurrences.

The following tables identify the most comprehensive list available of severe wind events and associated damages in Madison County and the participating jurisdictions No participating jurisdiction has recorded a severe wind event more recently than 2017.

Table 34: Madison County Tornado History

Location	Date Range	Number of Tornados	F / EF Magnitude Range	Fatalities	Injuries	Property Damage $2021	Crop Damage $2021
Countywide	4/28/2012	1	EF0	0	0	$11,890.69	$5,945.34

Table 35: North Zulch, TX County Tornado History

Location	Date Range	Number of Tornados	F / EF Magnitude Range	Fatalities	Injuries	Property Damage $2021	Crop Damage $2021
North Zulch	1/15/2017	1	EF0	0	0	$0	$0

According to the best information available, there have been no tornado events in the Cities of Madisonville and Midway since the 2013 plan. While the North Zulch Municipal Utility District does not have recorded history of tornados, its hazard risk is assumed to be similar to the North Zulch, Texas area as well as Madison County.

2) Likelihood of Future Events

The likelihood of future tornados will be determined in consideration of all tornados in Madison County. Tornado events in Madison County are considered an occasional hazard given the frequency of previous tornados in the County and participating jurisdictions, meaning one is possible in the next five years.

3) Extent

Before 2007, the Fujita Scale was used for rating tornado strength. The Fujita Scale is based on damage intensity instead of wind speed, with estimated wind speed ranges based on the extent of observed damage.

Table 36: Fujita Scale

Fujita Scale			
Enhanced Fujita Category	Wind Speed (MPH)	Character	Potential Damage
Zero (F0)	40-72	Weak	Light Damage. Some damage to chimneys; branches broken off trees, shallow-rooted trees uprooted, sign boards damaged.
One (F1)	73-112	Weak	Moderate damage. Roof surfaces peeled off; mobile homes pushed foundations or overturned; moving autos pushed off road.
Two (F2)	113-157	Strong	Considerable damage. Roofs torn from frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light objects become projectiles.
Three (F3)	158-206	Strong	Severe damage. Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
Four (F4)	207-260	Violent	Devastating damage. Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.
Five (F5)	260-318	Violent	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m (109 yds.); high-rise buildings have significant structural deformation; incredible phenomena will occur.

Adopted after 2007, the Enhanced Fujita Scale, or EF Scale, is the scale for rating the strength of tornados via the damage they cause. Six categories from zero to five represent increasing degrees of damage. The scale considers how most structures are designed and is thought to be an accurate representation of the surface wind speeds in the most violent tornados.

Table 37: Enhanced Fujita Scale[22]

Enhanced Fujita (EF) Scale		
Enhanced Fujita Category	Wind Speed (MPH)	Potential Damage
EF0	65-85	Light damage. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
EF1	86-110	Moderate damage. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	Considerable damage. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	136-165	Severe damage. Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	166-200	Devastating damage. Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.
EF5	200+	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m (109 yds.); high-rise buildings have significant structural deformation; incredible phenomena will occur.

The most recent tornados in Madison County and the participating jurisdictions have been classified as EF0s on the Enhanced Fujita Scale. Madison County sits within Zone III (200 mph winds) of the ICC's wind speed map. Based on that information, the worst tornados in Madison County and the participating jurisdictions may be as bad as EF4.

4) Location and Impact

A) Location

Tornados are not constrained by any distinct geographic boundary. Tornados can occur across all participating jurisdictions and may freely cross from one jurisdiction into another.

B) Impact

Impacts from a tornado may include but are not limited to damaged or destroyed personal property including vehicles, damaged or destroyed agricultural, residential, commercial, and industrial buildings. Crops may be damaged or destroyed. Pets and livestock may be injured or

[22] Texas State Hazard Mitigation Plan, 2013 Update.

killed by tornados or flying debris. Pets and livestock may escape due to damaged or destroyed structures and fences.

In the worst cases, tornados may cause injuries and/or be deadly.

5) Vulnerability

Tornadoes have the potential to impact the entire planning area. All existing and future buildings, critical facilities, critical infrastructure, improved property, and the population of the participating jurisdictions are considered vulnerable to this hazard.

A) Population

As described in Section 3 of Chapter 3 above, Madison County and the participating jurisdictions are home to many vulnerable residents. Increased vulnerability may be due to many factors including but not limited to age, physical ability, financial means, housing type, and housing condition. Many of these vulnerabilities often overlap.

The participating jurisdictions recognize that vulnerable populations may need additional help preparing for and recovering from a tornado. Residents of mobile / manufactured homes are of particular concern. These structures are never considered safe during a tornado.

Residents of sub-standard structures are also of particular concern. Structures in sub-standard condition ahead of a tornado, whether due to structural damages, missing windows or doors, holes in exterior walls or the roof, may be less safe during a tornado than structures in standard condition. Existing structural weaknesses, due to housing type or existing damages, may lead to compounded damages, injuries, or loss of life.

B) Critical Facilities and Infrastructure

Certain critical facilities and infrastructure in each jurisdiction may be particularly vulnerable to tornados. These facilities have been identified for reasons including: the number of people who use the facility or infrastructure, the facility's role in providing basic services to begin the cleanup process and get the jurisdictions running again, and the facility's ability to offer goods and materials residents will need to resume normalcy as quickly as possible. The selected critical facilities are built from a variety of materials with varying levels of resistance to tornadic damages. Additionally, their varying ages mean they weren't constructed to uniform building standards. Given tornados' violent nature, these facilities may experience increased levels of vulnerability to the hazards. Damage to any of these facilities may have a disproportionately negative impact on each jurisdiction's recovery from a tornado if that damage affects the facility's ability to reopen and resume normal business right away.

Table 38: Critical Facilities Vulnerable to Tornados and Potential Impacts

Jurisdiction	Critical Facilities	Potential Hurricane / Tropical Storm Impacts								
		Loss of Power	Flying Debris	Uprooted Trees	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Madison County	Tower site for BVWACS (public safety radio)	x	X	x				x	x	x
	Courthouse & Emergency Operations Center	x	X	x	x	x	x	X	x	x
	Courthouse Annex	x	x	x	X	x	x	X	x	x
	Sheriff's Office	x	x	x	X	x	x	X	x	x
	Library	x	x	x	x	x	x	X	x	x
	Madisonville Consolidated Independent School District Campuses	x	x	x		x	x	x	x	x
	Madison/St. Joseph Hospital	x	x	x			x	x	x	x
	Madison County Jail	x	x	X		x	x	x	x	x
Madisonville	Buc-cee's	x		x	x	x	x	x	x	x
	First Baptist Church (Sheltering)	x	x	X	X	x	x	X	x	x
	Truman Kimbro Center	X	x	X	X	x	x	X	x	x
	Quick Visit Urgent Care	X	x	x	x	x	x	x	x	x
	Madisonville Police Dept.	x	x			x	x	x	x	x
	KMVL Radio Station	x	x	x	x	x	x	X	x	x
	Madisonville Municipal Airport	x	x	x		X		x	x	x
	Hensarling Airport	x	x	x		x		x	x	x
	City Hall of Madisonville	x	x		x	x	x	x	x	x
	City Of Madisonville Well #3	x	x	X	x			x	x	x
	City Of Madisonville Well #5	x	x	x	x			x	x	x
	City Of Madisonville Well# 6	x	x	x	x			x	x	x
	City Of Madisonville Lift Station #2	x	x	x				x	x	x
	City Of Madisonville Lift Station #3	x	X		x			x	x	x
	City Of Madisonville Lift Station #4	x	x	x				x	x	x
	City Of Madisonville Lift Station #5	x	x	x	x			x	x	x

	City Of Madisonville Lift Station #6	x	x	x	x			x	x	x
	City Of Madisonville Lift Station #7	x	x	X				x	x	x
	City Of Madisonville Lift Station #8	x	X	X				X	x	x
	City Of Madisonville Lift Station #9	x	X	X				x	x	x
	City Of Madisonville Lift Station #10	x	x					X	x	x
	City Of Madisonville Lift Station #11	x	x	X				x	x	x
	City Of Madisonville Lift Station #12	x	x	x	x			x	x	x
	City Of Madisonville Wastewater Treatment Plant	x	x	x	x	x	x	x	x	x
	City Of Madisonville Fire Station	x	x	x		x	X	x	x	x
Midway	City Hall/Fire Station	x	x	x	x	x	X	X	x	x
	Well Yard	x	x	x	x	X	x	x	x	x
	Lift Station A	x	x	x				x	x	x
	Lift Station B	x	x	x				x	x	x
	Lift Station C	x	x	x				x	x	x
	Lift Station D	x	x	x	x			x	x	x
	Midway Sewer Treatment Plant	x	x	x	x	x	x	x	x	x
	TX Dept Criminal Justice - Ferguson Unit	x	x			x	x	x	x	x
North Zulch MUD	Water Plant and Office and Well #4	x	x	x	x	x	x	X	x	x
	Water Plant and Well #3	X	x	x	x	x		x	x	x
	Wastewater Treatment Plant	x	x	x	X			x	x	x
	Lift Station #1	x	x	x	x			x	x	x
	Lift Station #2	x	x	x				x	x	x
	Grinder Station #1	x	x	x	x			X	x	x
	Grinder Station #2	x	x	x	x			x	x	x
	Grinder Station #3	x	x	x	x			x	x	x
	North Zulch Consolidated Independent School District Campus	x	x	x		x	x	x	x	x
	North Zulch Volunteer Fire Department / Senior Center	x	x	x	x	x	x	x	x	x

C) Vulnerable Parcels

Table 39: Parcels Vulnerable to Tornados

Jurisdiction	Parcel Count	Estimated Potential Damage Value
Madison County	**9,669**	**$2,061,617,225**
City of Madisonville	2,083	$207,605,330
City of Midway	189	$12,141,000
North Zulch Municipal Utility District	2	$131,610

8. Drought

Drought is defined as the consequence of a natural reduction in the amount of precipitation expected over an extended period, usually a season or more in length.

Droughts are one of the most complex natural hazards to identify because it is difficult to determine their precise beginning or end. In addition, droughts can lead to other hazards such as extreme heat and wildfires. Their impact on wildlife and area farming is enormous, often killing crops, grazing land, edible plants and even in severe cases, trees. A secondary hazard to drought is wildfire because dying vegetation serves as a prime ignition source. Therefore, a heat wave combined with a drought is a very dangerous situation.

Table 40: Drought Classifications

Meteorological Drought	The degree of dryness or departure of actual precipitation from an expected average or normal amount based on monthly, seasonal, or annual time scales.
Hydrologic Drought	The effects of precipitation shortfalls on stream flows and reservoir, lake, and groundwater levels.
Agricultural Drought	Soil moisture deficiencies relative to water demands of plant life, usually crops.
Socioeconomic Drought	The effect of demands for water exceeding the supply as a result of a weather-related supply shortfall.

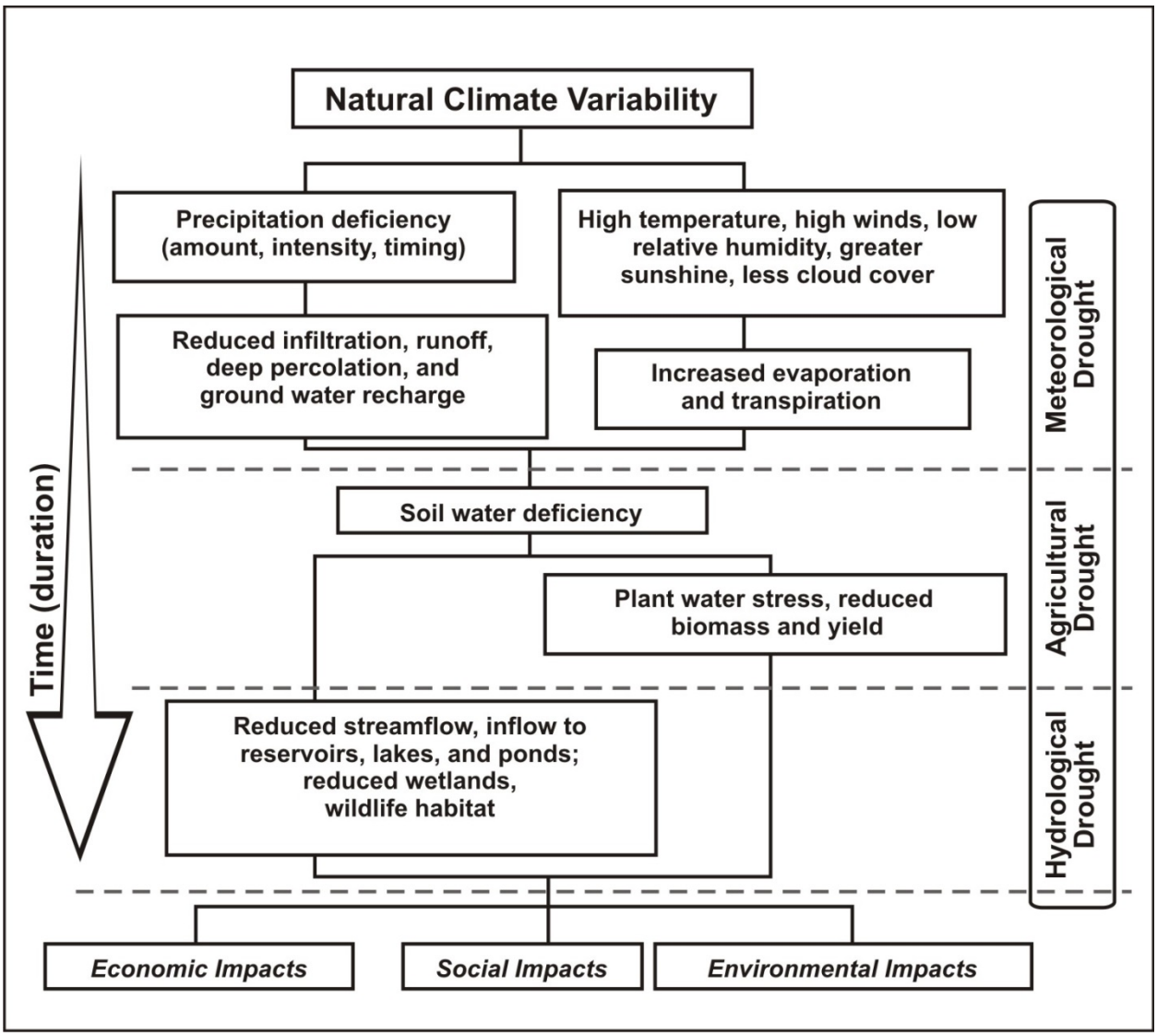
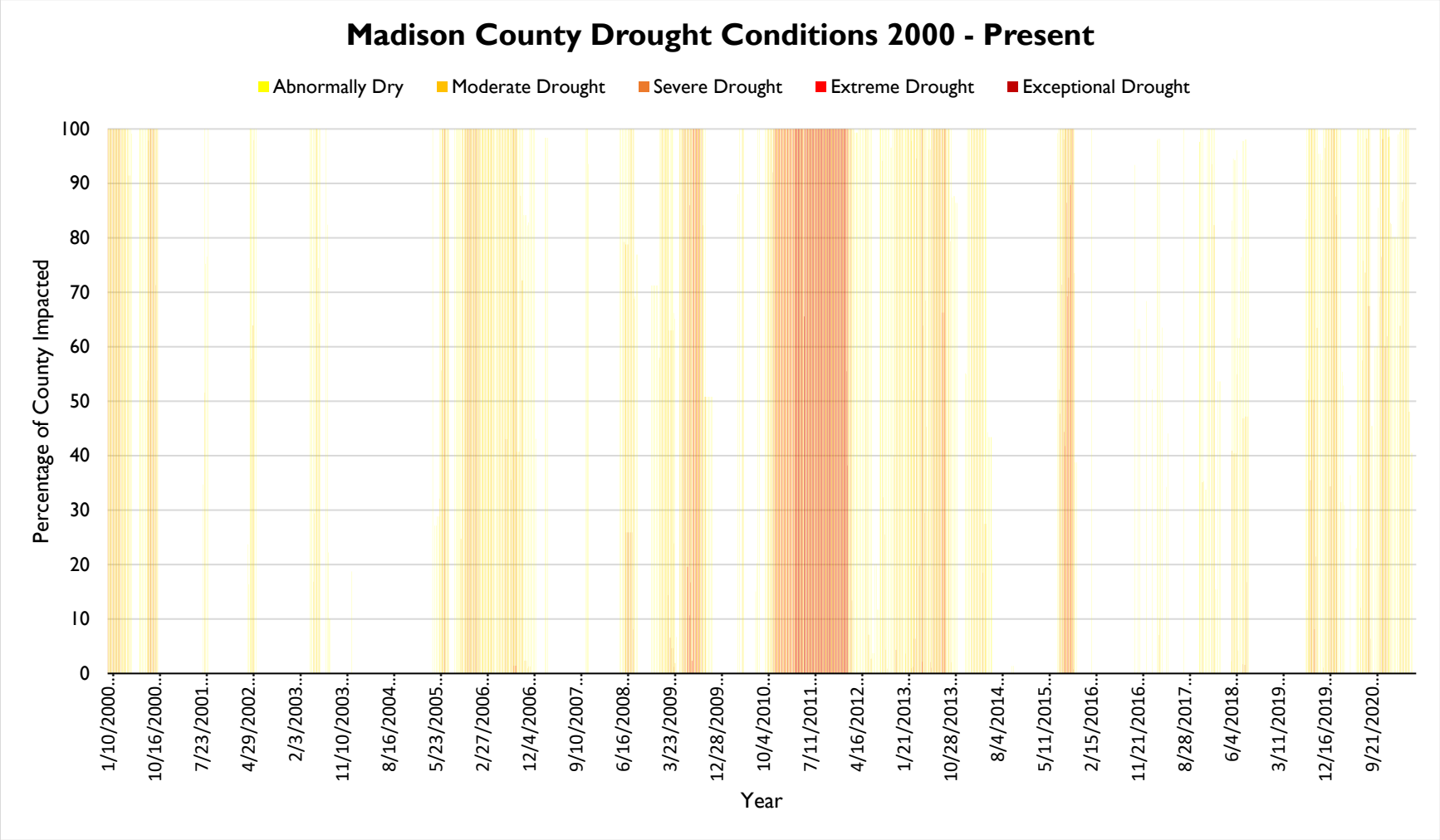


Figure 19: Sequence of Drought Occurrence and Impacts for Commonly Accepted Drought Types[23]

[23] Source: National Drought Mitigation Center, University of Nebraska-Lincoln, http://drought.unl.edu/DroughtBasics/TypesofDrought.aspx

1) Drought History

Figure 20: Madison County Drought History



Source: United States Drought Monitor https://droughtmonitor.unl.edu/Data.aspx

Drought history is recorded at the county level. However, the data is measured by the percentage of the county affected by drought. Although no specific data regarding drought's occurrences in the individual cities is available, it's possible to use the data in Figure 20 to infer when the participating jurisdictions addressing the hazard previously experienced drought conditions due to the fact that the conditions impacted 100% of the county. According to the data, Madison County and the participating jurisdictions have regularly experienced drought conditions since 2000.

In Madison County's 2013 plan, the participating jurisdictions established a regular history of Drought with 11 events from April 1996 to August 2011. The 2013 HMAP recorded a total of $39 million in property damages and $452 million in crop damages during that time for all events, adjusted to $2021. These drought events develop economic concerns such as high food prices, low municipal water quality, and increase likelihood of wildfires within the County. The 2013 Plan found that the frequency of drought occurrences is likely for the entire planning area.

There have been no drought events reported since the previous plan.

2) Likelihood of Future Events

Based on historical drought in Texas and Madison County, it is likely that a future drought will affect Madison County and the participating jurisdictions, meaning an event affecting any or all the participating jurisdictions is probable in the next three years, and a major drought every 20 years.

3) Extent

Since 2000, Madison County has regularly experienced county-wide droughts classified as periods ranging from abnormal dryness to exceptional drought. Between 2010 and 2012, the entire County, including all participating jurisdictions, was in a state of extreme or exceptional drought, the most severe drought categories.

The Palmer Drought Index is used to measure the extent of drought by measuring the duration and intensity of long-term drought-inducing circulation patterns. Long-term drought is cumulative, with the intensity of drought during the current month dependent upon the current weather patterns plus the cumulative patterns of previous months. The hydrological impacts of drought (e.g., reservoir levels, groundwater levels, etc.) take longer to develop.

Table 41: Palmer Drought Index

Drought Index	Drought Conditions Classifications						
	Extreme	Severe	Moderate	Normal	Mostly Moist	Very Moist	Extremely Moist
Z Index	-2.75 and below	-2.00 to -2.74	-1.25 to -1.99	-1.24 to +.99	+1.00 to +2.49	+2.50 to +3.49	n/a
Meteorological	-4.00 and below	-3.00 to -3.99	-2.00 to -2.99	-1.99 to +1.99	+2.00 to +2.00	+3.00 to +3.00	+4.00 and above
Hydrological	-4.00 and below	-3.00 to -3.99	-2.00 to -2.99	-1.99 to +1.99	+2.00 to +2.00	+3.00 to +3.00	+4.00 and above

Table 42: Palmer Drought Category Descriptions[24]

Category	Description	Possible Impacts	Palmer Drought Index
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures; fire risk above average. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered.	-1.0 to -1.9
D1	Moderate Drought	Some damage to crops, pastures; fire risk high; streams, reservoirs, or wells low, some water shortages developing, or imminent, voluntary water use restrictions requested.	-2.0 to -2.9
D2	Severe Drought	Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions imposed.	-3.0 to -3.9
D3	Extreme Drought	Major crop/pasture losses; extreme fire danger; widespread water shortages or restrictions.	-4.0 to -4.9
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; exceptional fire risk; shortages of water in reservoirs, streams, and wells, creating water emergencies.	-5.0 or less

Drought is monitored nationwide by the National Drought Mitigation Center (NDMC). Indicators are used to describe broad scale drought conditions across the U.S. Indicators correspond to the intensity of drought.

Based on the historical occurrences of drought, Madison County and all participating jurisdictions should anticipate experiencing droughts ranging from abnormally dry to exceptional drought or D0 to D4 based on the Palmer Drought Category. Given varying conditions, droughts may start on the low end of the Index but will intensify with duration and ongoing lack of precipitation. Future drought events may reach the intensity of D4 on the Palmer Drought Index.

[24] www.droughtmonitor.unl.edu

4) Location and Impact

A) Location

Drought has no distinct geographic boundary. Drought can occur across all participating jurisdictions.

B) Impact

General impacts may include water shortage, risk to public safety due to wildfire risk increases, respiratory impacts to the public due to affected air quality, and degradation of fish and wildlife habitat. Economic impacts may include increased prices for food, unemployment for farm workers and ranch hands, livestock mortality from limited grazing availability, and reduced tax revenues because of reduced supplies of agriculture products and livestock that are dependent on rainfall.

The City of Madisonville adopted its current Drought Contingency Plan in June 2019. The plan describes five stages of water restrictions ranging from voluntary conservation to a prohibition of activities and water allocation. Each stage is triggered by changes in the level of water demand relative to the safe operating capacity of the City's water supply facilities or the occurrence of a water supply emergency.

The City of Midway adopted its current Drought Contingency Plan in August 2016. The plan describes six stages of water restrictions ranging from voluntary conservation to a prohibition of activities and water allocation. Each stage is triggered by changes in the level of water demand relative to the safe operating capacity of the City's water supply facilities or the occurrence of a water supply emergency.

North Zulch Municipal Utility District adopted its current Drought Contingency Plan in February 2021. The plan describes six stages of water restrictions ranging from voluntary conservation to a prohibition of activities and water allocation. Each stage is triggered by changes in the level of water demand relative to the safe operating capacity of the district's water supply facilities or the occurrence of a water supply emergency.

Madison County does not have a drought contingency plan.

5) Vulnerability

Because drought has the potential to impact every jurisdiction equally, all improved property and the entire population is exposed to this hazard. General impacts may include water shortage, risk to public safety due to wildfire risk increases, respiratory impacts to the public due to affected air quality, and degradation of fish and wildlife habitat.

Economic impacts may include increased prices for food, unemployment for farm workers and ranch hands, livestock mortality from limited grazing availability, and reduced tax revenues because of reduced supplies of agriculture products and livestock that are dependent on rainfall.

Lower income populations who may not have the resources to buy large quantities of bottled water in the event of a shortage may be more vulnerable than other populations.

A) Population

As described in Section 3 of Chapter 3 above, Madison County and the participating jurisdictions are home to many vulnerable residents. Increased vulnerability may be due to many factors including but not limited to age, physical ability, financial means, housing type, and housing condition. Many of these vulnerabilities often overlap.

The jurisdictions recognize that vulnerable populations may need additional help preparing for and recovering from a drought. Lower income populations who may not have the resources to buy large quantities of bottled water in the event of a shortage may be more vulnerable than other populations.

B) Critical Facilities

In addition to triggering various components of participating jurisdictions' Drought Contingency plans, drought conditions may affect local critical facilities. Area fire departments may see increased demand for controlling wildland fire due to dry conditions. Drought is likely to require increased output from the local power companies to keep up with electrical demand. Depending on factors like time of year, temperature, and duration, increased electrical demand may cause brownouts that would impact critical facilities.

Table 43: Critical Facilities Vulnerable to Drought and Potential Impacts

Jurisdiction	Critical Facilities	Potential Drought Impacts	
		Increased Demand for Services	Economic Damages
Madison County	Tower site for BVWACS (public safety radio)	x	
	Courthouse & Emergency Operations Center	x	
	Courthouse Annex	x	
	Sheriff's Office	x	
	Library	x	
	Madisonville Consolidated Independent School District Campuses	x	
	Madison/St. Joseph Hospital	x	
	Madison County Jail	x	
Madisonville	Buc-cee's	x	
	First Baptist Church (Sheltering)	x	
	Truman Kimbro Center	x	
	Quick Visit Urgent Care	x	
	Madisonville Police Dept.	x	
	KMVL Radio Station	x	
	Madisonville Municipal Airport	x	
	Hensarling Airport	x	
	City Hall of Madisonville	x	
	City Of Madisonville Well #3		x
	City Of Madisonville Well #5		x
	City Of Madisonville Well# 6		x
	City Of Madisonville Lift Station #2		x
	City Of Madisonville Lift Station #3		x
	City Of Madisonville Lift Station #4		x
	City Of Madisonville Lift Station #5		x

	City Of Madisonville Lift Station #6		x
	City Of Madisonville Lift Station #7		x
	City Of Madisonville Lift Station #8		x
	City Of Madisonville Lift Station #9		x
	City Of Madisonville Lift Station #10		x
	City Of Madisonville Lift Station #11		x
	City Of Madisonville Lift Station #12		x
	City Of Madisonville Wastewater Treatment Plant		x
	City Of Madisonville Fire Station	x	
Midway	City Hall/Fire Station	x	
	Well Yard		x
	Lift Station A		x
	Lift Station B		x
	Lift Station C		x
	Lift Station D		x
	Sewer Treatment Plant		x
	TX Dept Criminal Justice - Ferguson Unit	x	
North Zulch MUD	Water Plant and Office and Well #4		x
	Water Plant and Well #3		x
	Wastewater Treatment Plant		x
	Lift Station #1		x
	Lift Station #2		x
	Grinder Station #1		x
	Grinder Station #2		x
	Grinder Station #3		x
	North Zulch Consolidated Independent School District Campus	x	
	North Zulch Volunteer Fire Department / Senior Center	x	

C) Vulnerable Parcels

Given drought's geographic reach, all parcels within the participating jurisdictions are equally vulnerable to the hazard. However, given the limited damages inflicted by previous droughts, future damages are expected to be similarly limited.

Table 44: Parcels Vulnerable to Drought

Jurisdiction	Parcel Count	Estimated Potential Damage Value
Madison County	**9,669**	**$2,061,617,225**
City of Madisonville	2,083	$207,605,330
City of Midway	189	$12,141,000
North Zulch Municipal Utility District	2	$131,610

I. Agricultural Production

According to the USDA 2017 Census of Agriculture[25], the total market value of agricultural products sold, including direct sales, in Madison County was $124,061,000. About $1,583,122 in indemnities was paid to farmers in Madison County between 1995 and 2020[26]. That is roughly $63,214 per year. Although the proportion of indemnities paid to cover losses due to drought isn't identifiable, given Madison County's recent drought history, it is likely that at least some of the dollars paid were related to drought-caused damages.

Given agriculture's role in the County, drought-caused losses will have impacts beyond any individual and may lead to contraction in the wider economy. However, because the data is recorded at the county level, there is no specific information regarding agricultural losses to due drought for the individual participating jurisdictions.

[25]ttps://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_2_County_Level/Texas/st48_2_0001_0001.pdf

[26] https://farm.ewg.org/cropinsurance.php?fips=48313&summpage=IN_REGPAGE

9. Extreme Cold

Extreme cold can happen anywhere in the state, although its levels can range extensively. In the panhandle extreme cold means days below zero Fahrenheit while in the Rio Grande Valley it means reaching temperatures below freezing. Extreme cold is an issue any time winter temperatures drop significantly below normal and make staying warm and safe a challenge.

Extreme cold can accompany winter weather, but it can also be independent of those storms. For that reason, the impacts of extreme cold are presented here separately from the impacts of winter weather.

1) Extreme Cold History

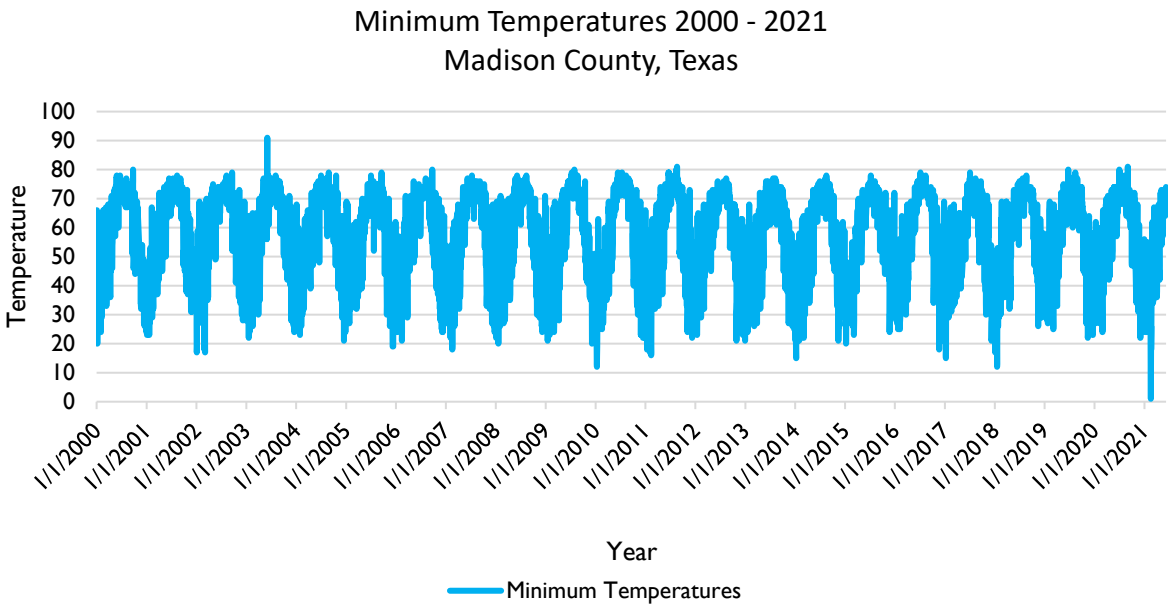


Figure 21: Minimum Recorded Daily Temperature 2000-Present[27]

Madison County and the jurisdictions addressing the hazard have not previously included extreme cold in their mitigation plan as a standalone hazard. Prior to the 2018 update to the State of Texas mitigation plan, extreme cold was considered part of the winter weather hazard.

Between 2000 and 2021, Madison County experienced 798 days with a minimum temperature of 32˚F or colder. At least 17 of those days had a maximum temperature of 32˚F or below. During the same timeframe, the coldest temperature recorded was 1˚F on February 16, 2021.

[27] Source: National Centers for Environmental Information, https://www.ncdc.noaa.gov/cdo-web/datasets

Temperature data is recorded at the county level. However, given the nature of extreme cold and the proximity of all jurisdictions to each other, the jurisdictions addressing the hazard experienced the same extreme cold events.

One Extreme Cold/Wind Chill event was reported since the previous plan on February 15th, 2021, Winter Storm Uri. No injuries, deaths, or crop damages were reported, however there was about $140,000 in property damages reported in conjunction with this Extreme Cold/Winter Chill event.

2) Likelihood of Future Occurrence

Based on historic weather data, extreme cold in Madison County and the participating jurisdictions is likely, meaning an event affecting any or all the participating jurisdictions is probable in the next three years.

3) Extent

The magnitude or intensity of an extreme cold event is measured according to temperature in relation to wind speed. The relationship is referred to as the "Wind Chill," and is depicted in Figure 19.

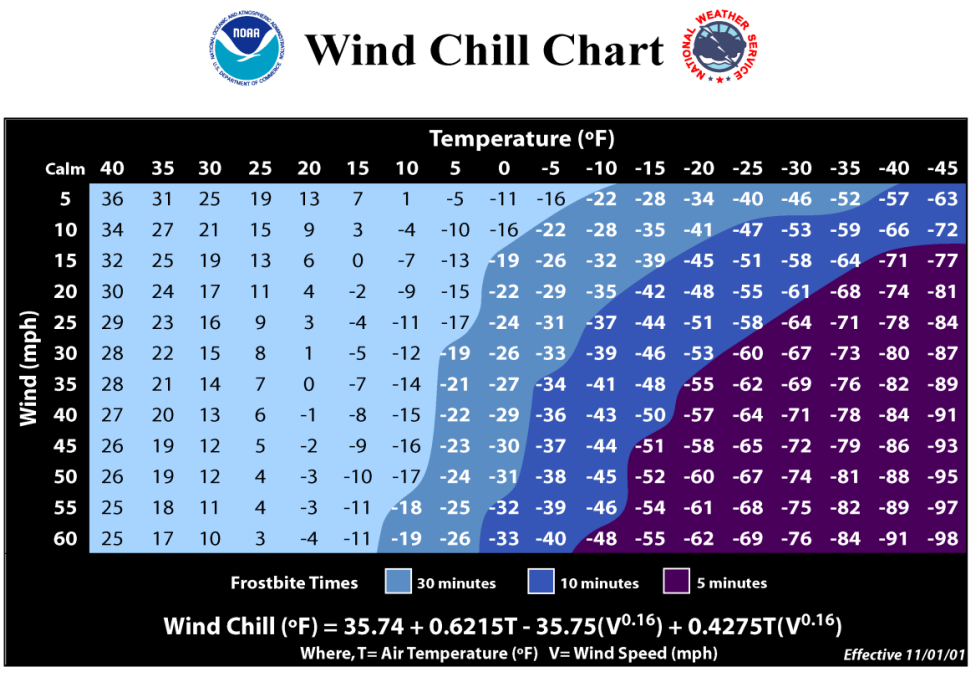


Figure 22: NOAA's NWS Wind Chill Index

As displayed in Figure 22, the wind chill temperature is a measurement of how cold the wind makes the air feel to the human body. Since wind can dramatically accelerate heat loss from the body, a 20° day could feel just as cold as a calm day with 0° temperatures. The Wind Chill Chart factors the wind chill; it is not applicable in calm winds or when the temperature is over 50°.

The coldest temperatures in Madison County and the participating jurisdictions may meet the current record temperature of 1˚F. Future extreme cold events may be as intense, long-lasting, and dangerous as previous ones.

4) Location and Impact

A) Location – All Jurisdictions

Extreme cold has no distinct geographic boundary. Extreme cold can occur across the entire planning area and uniformly affect all participating jurisdictions.

B) Impact – All Jurisdictions

The potential impact of extreme cold is normally minor, resulting in few, if any, injuries. No property or crop damage specifically tied to extreme cold events has been recorded in any of the participating jurisdictions. No deaths related to extreme cold have ever been reported in the participating jurisdictions. However, based on the hazard's potential, in the worst cases, especially if combined with winter weather, the hazard may inflict property or crop damages, and it can even be deadly. Any shutdown of facilities due to extreme cold is expected to be temporary.

5) Vulnerability

A) Population

As described in Section 3 of Chapter 3 above, Madison County and the participating jurisdictions are home to many vulnerable residents. Areas with concentrations of young, elderly, and low-income residents may feel greater impacts from extreme cold due to those populations' limited ability to properly address the hazard. Deficiencies may include but aren't limited to lack of heating in their homes or vehicles, lack of access to heated public spaces during the coldest part of the day or night, and frozen pipes that may jeopardize access to drinking water, and in the worst cases, lead to severe structural damage that can render a home unlivable. The consequences for these populations' exposure to extreme cold may include but are not limited to complications for those suffering from hypertension, hypothyroidism, and diabetes, as well as exhaustion, hypothermia, trench foot, or death.

B) Critical Facilities

While all the jurisdictions are exposed to extreme temperatures, existing buildings, infrastructure, and critical facilities are not considered vulnerable to damages significant enough to interrupt or stop normal operations. Therefore, any estimated property losses associated with the hazard are anticipated to be minimal across the area.

10. Extreme Heat

Extreme heat is defined as summertime temperatures that are substantially hotter and/or more humid than average for a given location at that time of year. Humid conditions, which add to the discomfort of high temperatures, occur when a "dome" of high atmospheric pressure traps hazy, damp air near the ground.

Although heat can damage buildings and facilities, it presents a more significant threat to the safety and welfare of citizens. The major human risks associated with severe summer heat include heat cramps; sunburn; dehydration; fatigue; heat exhaustion; and heat stroke. The most vulnerable population to heat casualties are children and the elderly or infirm, who frequently live on low fixed incomes and cannot afford to run air-conditioning on a regular basis. This population is sometimes isolated, with no immediate family or friends to look out for their wellbeing.

Severe summer heat is an invisible killer. Although a heat wave does not happen with the spectacle of other hazards such as tornados and floods, the National Center for Environmental Health reports that extreme heat caused 7,415 heat-related deaths in the United States from 1999 to 2010[28]. Extreme heat kills more people than hurricanes, floods, tornados, and lightning combined, according to the National Weather Service. In 2001, 300 deaths were caused by excessive heat exposure.

[28] http://www.bt.cdc.gov/disasters/extremeheat/heat_guide.asp

1) Extreme Heat History

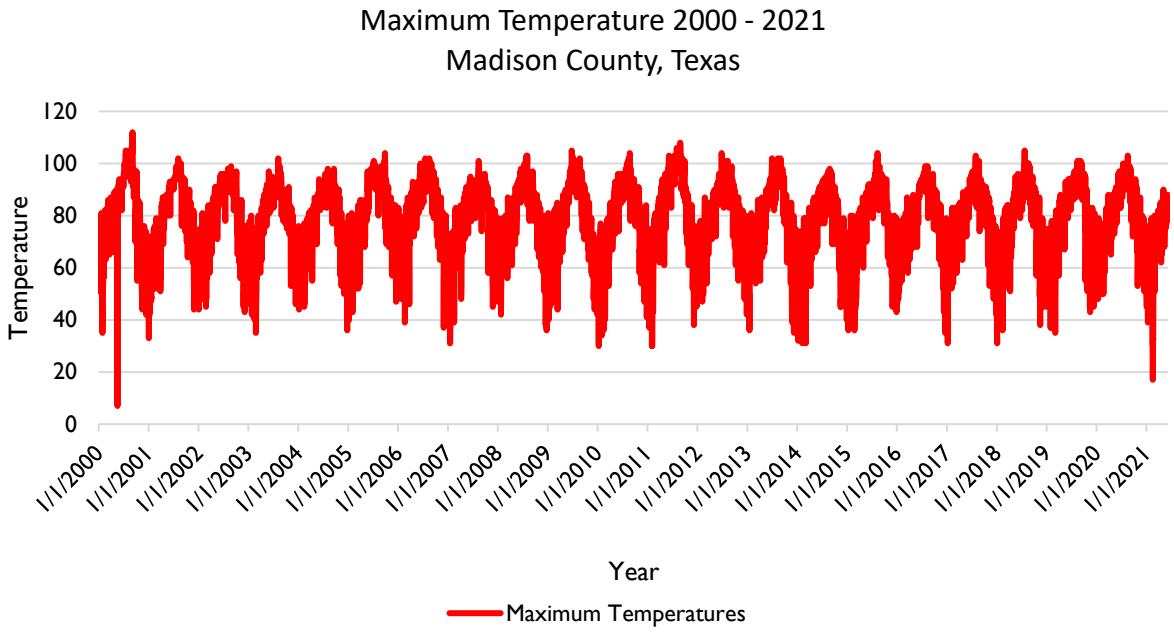


Figure 23: Maximum Recorded Daily Temperature 2000-2021[29]

In the 2013 HMAP, Madison County and the participating jurisdictions reported 8 excessive heat events from July 1995 and August 2011. The 2013 HMAP also reported that it is highly likely Madison County, and its jurisdictions, will experience extreme heat with urban areas possibly being at greater risk than within rural areas.

Between 2000 and 2021, Madison County and the participating jurisdictions experienced 221 days with a maximum temperature of 100˚F or hotter and 410 days where the combination of humidity and moderate-to-high temperatures warranted a heat advisory, if not an extreme heat warning.

Extreme heat data is recorded at the county level. However, given the nature of extreme heat and the proximity of all jurisdictions to each other, every jurisdiction experienced the same extreme heat events.

According to the best information available, there have been no extreme heat events for the County or participating jurisdictions since the 2013 Hazard Mitigation Plan.

[29] Source: National Centers for Environmental Information, https://www.ncdc.noaa.gov/cdo-web/datasets

2) Likelihood of Future Events

Based on historic weather data, extreme heat in Madison County and the participating jurisdictions is highly likely, meaning an event affecting any or all of the participating jurisdictions is probable in the next year.

3) Extent

The magnitude or intensity of an extreme heat event is measured according to temperature in relation to the percentage of humidity. According to the National Oceanic Atmospheric Administration (NOAA), this relationship is referred to as the "Heat Index," and is depicted in Figure 24. This index measures how hot it feels outside when humidity is combined with high temperatures.

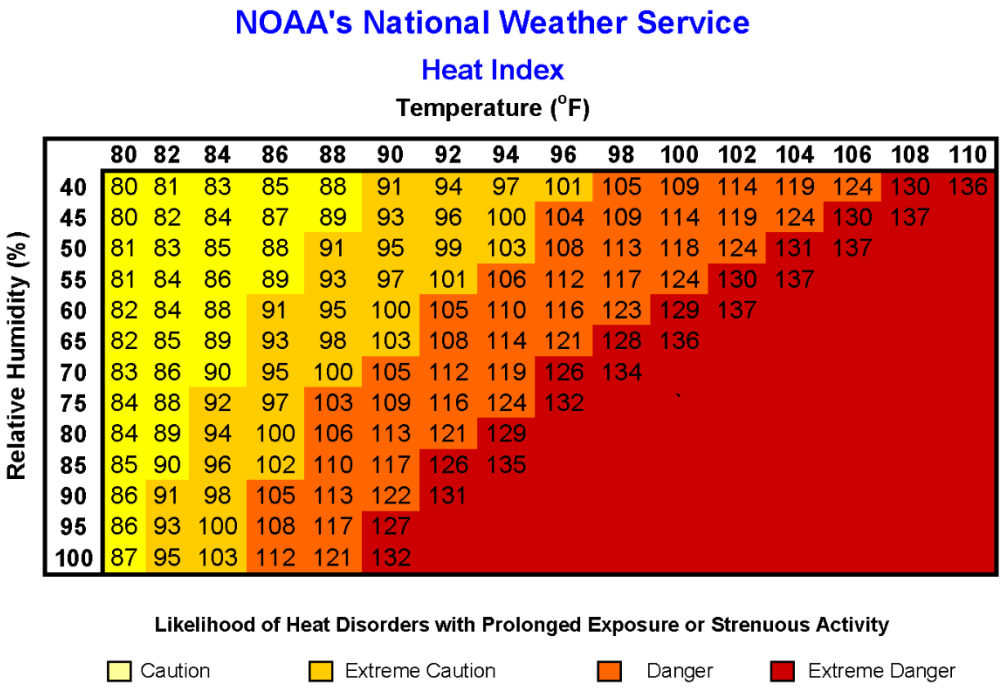


Figure 24: NOAA's NWS Heat Index Chart[30]

The extent scale in Figure 24 displays varying degrees of caution depending on the relative humidity combined with the temperature. For example, when the temperature is below 90˚F, caution should be exercised if the humidity level is at or above 40 percent.

The shaded zones on the chart indicate varying symptoms or disorders that could occur depending on the magnitude or intensity of the event. "Caution" is the first level of intensity where fatigue due to heat exposure is possible. "Extreme Caution" indicates that sunstroke,

[30] http://www.nws.noaa.gov/om/heat/ht-images/heatindexchart.png

muscle cramps or heat exhaustion are possible, whereas a "Danger" level means that these symptoms are likely. "Extreme Danger" indicates that heat stroke is likely.

The National Weather Service (NWS) initiates alerts based on the Heat Index as shown in Table 49.

Table 45: Heat Intensity

Intensity	Description
Heat Advisory	Extreme heat index making it feel hot, typically between 105˚F to 110˚F for 3 hours or more during the day and at or above 75˚F at night.
Excessive Heat Warning	Extreme heat index making it feel very hot, typically above 105˚F for 3 hours or more during the day and at or above 80˚F at night.

Given an estimated daily average relative humidity level of 75%[31], highs as low as 89˚F can produce a heat index temperature of 106˚F. The combination of high humidity and moderate temperatures creates an environment that reaches the Danger Zone on NOAA's Heat Index Chart and may trigger an NWS Heat Advisory.

Between 2010 and 2021, Madison County and the participating jurisdictions experienced 410 days with highs of 89˚F or hotter and overnight lows of 75˚F or hotter. Based on the NWS descriptions in Table 49 above, and the average daily humidity level, these days likely warranted a heat advisory.

The hottest temperature recorded in Madison County in the recent past, 112˚F, was reached on September 9, 2000. Based on the NWS descriptions in Table 49 above, at least 9 of the 410 heat advisory days warranted an excessive heat warning based on daytime highs, the average daily humidity level, and overnight lows not falling below 80˚F.

Future extreme heat events may meet the heat index requirements for issuing an Excessive Heat Warning as described in the Heat Intensity scale in Table 49 above. The hottest temperatures in Madison County and the participating jurisdictions may meet the current record temperature of 112˚F. Future extreme heat events may be as intense, long-lasting, and dangerous as previous ones.

[31] Used Houston Average, closest to County - https://www.currentresults.com/Weather/Texas/humidity-annual.php

4) Location and Impact

A) Location – All Jurisdictions

Extreme heat has no distinct geographic boundary. Extreme heat can occur across the entire planning area and uniformly affect all participating jurisdictions.

B) Impact – All Jurisdictions

The potential impact of excessive summer heat is normally minor, resulting in few, if any, injuries. No property or crop damage specifically tied to extreme heat events has been recorded in any of the participating jurisdictions. No deaths related to extreme heat have ever been reported in the participating jurisdictions. However, based on the hazard's potential, in the worst cases, especially if combined with drought conditions, the hazard may inflict property or crop damages, and it can even be deadly. Any shutdown of facilities due to extreme heat is expected to be temporary.

5) Vulnerability

C) Population

As described in Section 3 of Chapter 3 above, Madison County and the participating jurisdictions are home to many vulnerable residents. Vulnerable populations may feel greater impacts from extreme heat due to these populations' limited ability to properly address the hazard due to deficiencies including but not limited to lack of air conditioning in their homes or vehicles, lack of access to air-conditioned public spaces during the hottest part of the day, insufficient numbers of box or ceiling fans, or lack of access to other means of cooling. The consequences for these populations' exposure to extreme heat can include but are not limited to heat cramps, sunburn, dehydration, fatigue, heat exhaustion, heat stroke, or death.

D) Critical Facilities

While all of the jurisdictions are exposed to extreme temperatures, existing buildings, infrastructure, and critical facilities are not considered vulnerable to damages significant enough to interrupt or stop normal operations. Therefore, any estimated property losses associated with the hazard are anticipated to be minimal across the area.

11. Hailstorm

Early in the developmental stages of a hailstorm, ice crystals form within a low-pressure front due to the rapid rising of warm air into the upper atmosphere and subsequent cooling of the air mass. Frozen droplets gradually accumulate into ice crystals until they fall as precipitation that is round or irregularly shaped masses of ice. The size[32] of hailstones is a direct result of the size and severity of the storm.

High velocity updraft winds are required to keep hail in suspension in thunderclouds. The strength of the updraft is a byproduct of heating on the Earth's surface. Higher temperature gradients above Earth's surface result in increased suspension time and hailstone size.

Texas officials estimate that up to 40 percent of all homeowners' insurance claims in the state result from hail damage.

1) Hailstorm History

In the 2013 HMAP, Madison County and the participating jurisdictions noted that there have been 36 hail events between May 1976 and September 2009. Historically, the County reported high probability of hailstorms, particularly in association with seasonal patterns during the spring and early fall. There were no injuries or fatalities associated with hailstorms for these events. The 2013 HMAP recorded $367,846 in property damages during that time adjusted to $2021, there was no record of crop damages.

The following tables identify the most comprehensive list available of hailstorm events and associated damages in Madison County and the participating jurisdictions. No participating jurisdiction has recorded a hailstorm more recently than what is listed below.

Table 46: Madison County Hailstorm History

Location	Date Range	Number of Hailstorms	Hail Diameter in inches	Fatalities	Injuries	Property Damage $2021	Crop Damage $2021
Countywide	5/21/2013	2	1 – 1.75	0	0	$0	$0

Table 47: City of Madisonville Hailstorm History

Location	Date Range	Number of Hailstorms	Hail Diameter in inches	Fatalities	Injuries	Property Damage $2021	Crop Damage $2021
Madisonville	3/28/2014 - 4/6/2019	5	0.88 – 2.75	0	0	$ 18,153.43	$0

[32] As of January 5, 2010, the national minimum size for severe hail increased from ¾" to 1".

Table 48: City of Midway Hailstorm History

Location	Date Range	Number of Hailstorms	Hail Diameter in inches	Fatalities	Injuries	Property Damage $2021	Crop Damage $2021
Midway	3/17/2018	1	1	0	0	$0	$0

Table 49: North Zulch, TX Hailstorm History

Location	Date Range	Number of Hailstorms	Hail Diameter in inches	Fatalities	Injuries	Property Damage $2021	Crop Damage $2021
North Zulch	3/28/2014 – 4/24/2019	3	1 – 1.75	0	0	$0	$0

Hailstorm data is generally recorded at the county or city level, therefore there is no specific information regarding hailstorm events in North Zulch MUD. However, given it is located with Madison County and the North Zulch, TX area, its hailstorm history is known to be similar to the County and surrounding jurisdictions.

2) Likelihood of Future Events

Based on the history of hailstorms, a hailstorm in Madison County and each of the participating jurisdictions is highly likely, meaning that an event is probable within the next year.

3) Extent

The severity of hail events ranges based on the size of the hail, wind speed, and the number and types of structures in the path of the hailstorm. Storms that produce high winds in addition to hail are most damaging and can result in numerous broken windows and damaged siding.

When hail breaks windows, water damage from accompanying rains can also be significant. A major hailstorm can easily cause damage running into the millions of dollars. Nationwide hail is responsible for over $1 billion in property and crop damages per year. The scale showing intensity categories in Table 45 was developed by combining data from National Climatic Data Center (NCDC) and the Tornado and Storm Research Organization (TORRO).

Table 50: Hailstorm Intensity[33,34]

Size Code	Intensity Category	Size (Diameter in inches)	Descriptive Term	Typical Damage
H0	Hard Hail	Up to 0.33	Pea	No damage
H1	Potentially Damaging	0.33-.060	Mothball	Slight damage to plants and crops
H2	Significant	.060-.080	Penny	Significant damage to fruit, crops, and vegetation
H3	Severe[35]	0.80-1.20	Nickel – Half dollar	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	1.2-1.6	Half dollar – Ping pong ball	Widespread glass damage and vehicle bodywork damage
H5	Destructive	1.6-2.0	Ping pong ball – hen egg	Wholesale destruction of glass, damage to tiled roofs, and significant risk of injuries
H6	Destructive	2.0-2.4	Hen egg – tennis ball	Bodywork of grounded aircraft dented, and brick walls pitted
H7	Destructive	2.4-3.0	Tennis ball – Baseball	Severe roof damage and risk of serious injuries
H8	Destructive	3.0-3.5	Hockey puck	Severe damage to aircraft bodywork
H9	Super Hailstorms	3.5-4.0	Softball	Extensive structural damage could cause fatal injuries
H10	Super Hailstorms	4.0+	Greater than softball-sized	Extensive structural damage could cause fatal injuries

According to NCEI data, the worst hailstorms in Madison County and the participating jurisdictions have produced hail up to 2.75" in diameter, H7 on the Hailstorm Intensity Scale.

Future hailstorms may meet previous worst-case H7 storms in terms of hailstone size, damage dollars inflicted, and the number of residents injured or killed.

4) Location and Impact

A) Location

Hailstorms vary in terms of size, location, intensity, and duration but are considered frequent occurrences in the planning area. Each jurisdiction is uniformly exposed to hail events just as each is uniformly exposed to the thunderstorms that typically produce the hail events.

[33] http://www1.ncdc.noaa.gov/pub/data/cmb/extremes/scec/reports/SCEC-Hail-Guide.pdf
[34] http://www.torro.org.uk/hscale.php
[35] Hail must be 1" or larger to be classified as severe

B) Impact

The severity of a hailstorm's impact is considered limited since they generally result in injuries treatable with first aid, shut down critical facilities and services for 24 hours or less, and less than ten percent of affected properties are destroyed or suffer major damage. All existing and future buildings, facilities, and populations are in the participating jurisdictions are considered exposed to this hazard and could potentially be impacted.

5) Vulnerability

A) Population

As described in Section 3 of Chapter 3 above, Madison County and the participating jurisdictions are home to many vulnerable residents. Increased vulnerability may be due to many factors including but not limited to age, ability, financial means, housing type, and housing condition. Many of these vulnerabilities often overlap.

Since hailstorms arise with little to no warning, the participating jurisdictions recognize that vulnerable populations may primarily need additional help recovering from a hailstorm. Residents of sub-standard structures are of particular concern. Structures in sub-standard condition ahead of a hailstorm, whether due to structural damages, missing windows or doors, holes in exterior walls or the roof, may sustain more damages than structures in standard condition.

Existing weaknesses, especially those related to the condition of a structure's roof, due to housing type or existing damages, may lead to compounded damages, injuries, or loss of life.

B) Critical Facilities

The presence of older structures that have not been hardened against hailstorms, and / or the presence of metal buildings that may be more susceptible to hail. Thus, the following critical facilities were determined to be especially vulnerable to hailstorms due to the presence of structures with flat roofs and its increased vulnerability.

Table 51: Critical Facilities Vulnerable to Hailstorms and Potential Impacts

Jurisdiction	Critical Facilities	Potential Hailstorm Impacts		
		Damaged or Destroyed Roof	Damaged Windows	Water damage due to Physical Damages
Madison County	Tower site for BVWACS (public safety radio)	x	x	x
	Courthouse & Emergency Operations Center	x	x	x
	Courthouse Annex	x	x	x
	Sheriff's Office	x	x	x
	Library	x	x	x

	Madisonville Consolidated Independent School District Campuses	x	x	x
	Madison/St. Joseph Hospital	x	x	x
	Madison County Jail	x	x	x
Madisonville	Buc-cee's	x	x	x
	Truman Kimbro Center	x	x	x
	Quick Visit Urgent Care	x	x	x
	Madisonville Police Dept.	x	x	x
	KMVL Radio Station	x	x	x
	Madisonville Municipal Airport	x	x	x
	Hensarling Airport	x	x	x
	City Hall of Madisonville	x	x	x
	City Of Madisonville Well #5	x		x
	City Of Madisonville Well# 6	x		x
	City Of Madisonville Wastewater Treatment Plant	x	x	x
	City Of Madisonville Fire Station		x	
Midway	City Hall/Fire Station	x		x
	Well Yard	x		x
	Sewer Treatment Plant	x	x	x
	TX Dept Criminal Justice - Ferguson Unit	x		x
North Zulch MUD	Water Plant and Office and Well #4	x	x	x
	Water Plant and Well #3	x		x
	Wastewater Treatment Plant	x	x	x
	North Zulch Consolidated Independent School District Campus	x	x	x
	North Zulch Volunteer Fire Department / Senior Center	x	x	x

C) Vulnerable Commercial Structures

Every structure is vulnerable to damage from hail. However, commercial structures with large and/or flat roofs are especially vulnerable due to the increased exposure that large and/or flat roofs create. According to the Texas State Comptroller's 2020 Property Value Study, Madison County has commercial real property valued at $97,979,400 [36].

[36] https://comptroller.texas.gov/auto-data/PT2/PVS/2020F/1540000001A.php

D) Vulnerable Parcels

Table 52: All Parcels Vulnerable to Hailstorms

Jurisdiction	Parcel Count	Estimated Potential Damage Value
Madison County	**9,669**	**$2,061,617,225**
City of Madisonville	2,083	$207,605,330
City of Midway	189	$12,141,000
North Zulch Municipal Utility District	2	$131,610

12. Winter Weather

Winter weather is defined by extreme cold and heavy concentrations of snowfall or ice. Due to low frequency, severe winter weather storms affect Texas more severely compared to other regions that experience severe winter weather more frequently. The types of severe winter storms which Texans are most familiar with are snowstorms, blizzards, cold waves, and ice storms.

Snowfall with an accumulation of four or more inches in a 12-hour period is considered a heavy snowfall. Snowfall of any amount is rare south of a line from Del Rio to Port Arthur, and it is this rarity of event, coupled with a lack of preparedness for such an event, that creates a severe weather condition.

Blizzards are the most perilous of all winter storms, characterized by low temperatures and strong winds more than 35 mph, bearing large amounts of blowing or drifting snow. Blizzards take a terrible toll on livestock and people caught in the open. In Texas, blizzards are most likely to occur in the Panhandle and South Plains Regions.

The passage of a winter cold front with a drastic drop in temperature heralds the arrival of a cold wave, usually referred to as a "blue north'er."

An ice storm occurs when rain falls out of the warm and moist upper layers of the atmosphere into a cold and dry layer near the ground. The rain freezes on contact with the cold ground and accumulates on exposed surfaces. If a half inch of rain freezes on trees and utility wires, damage can occur, especially if accompanied by high winds, thus half an inch is used as the criteria before an icing event is categorized as an "ice storm."

1) Severe Winter Storm History

In the 2013 HMAP, Madison County and the participating jurisdictions reported 8 winter weather evens between January 1997 and February 2011. These events caused $1.75 million in damages in Madison County and the participating jurisdictions adjusted to $2021. The 2013 plan found that the frequency of occurrences of severe winter storms is unlikely, with an event probable in the next ten years.

NCEI data shows that the participating jurisdictions experienced 3 winter storm events between January 2015 and February 2021. None are reported to have caused any injuries or fatalities nor significant property or crop damages. The most recent winter weather event was Winter Storm Uri in February 2021. During that event, Madison County received between three to six inches of snow and sleet, along with a period of freezing rain with quarter to half inch ice accretion. Many objects, such as tree limbs and power lines, were heavily impacted due to the

weight of accumulated snow and ice causing significant disruptions including power outages and boil bans.

Table 53: Madison County Severe Winter Storm History

Location	Date Range	Number of Severe Winter Storms	Winter Storm Types	Fatalities	Injuries	Property Damage $2021	Crop Damage $2021
Countywide	1/23/2014 – 2/17/2021	3	Ice Storm, Winter Storm	0	0	$0	$0

2) Likelihood of Future Events

Future winter storms in Madison County and the participating jurisdictions are considered occasional due to the significant impacts of the historic winter weather, meaning an event affecting any or all of the participating jurisdictions is probable in the next five years.

3) Extent

Table 56 below displays the magnitude of severe winter storms.

Table 54: Winter Weather Extent Scale[37]

Frost Advisory*	Issued when nighttime minimum temperatures are expected to range from 33°F to 36°F in the growing season.
Freeze Warning*	Issued when nighttime minimum temperatures are expected to reach 32°F or lower in the growing season. They are usually issued to highlight the first few freezes of the fall or unusually late freezes in the spring. *A Freeze Watch is issued when these conditions may be met 12 to 48 hours in the future.*
Snow Advisory	Issued when accumulating snow of 2 to 4 inches is expected. An advisory may still be warranted if lesser accumulations will produce travel difficulties, especially early in the winter season.
Blowing Snow Advisory	Issued when blowing snow is expected to occasionally reduce visibilities to 1/4 mile or less with winds generally 25 to 34 mph. The event should last at least 3 hours.
Snow and Blowing Snow Advisory	Issued when winds of 25 to 34 mph are expected to be accompanied by falling snow and blowing snow, occasionally reducing the visibility to 1/4 mile or less. The event should last at least 3 hours
Freezing Rain / Drizzle Advisory	Issued for freezing rain when ice accumulations are expected to cause travel problems, but not exceed 1/4".

[37] Source: National Weather Service Weather Forecast Office; Norman, Oklahoma. http://www.srh.noaa.gov/oun/?n=spotter-wwa-definitions

Sleet Advisory	Issued for accumulating sleet of 1/4" to 1". Because sleet usually occurs with other precipitation types, a winter weather advisory will almost always be used in such cases.
Winter Weather Advisory	Issued for a winter weather event in which there is more than one hazard present, but all precipitation is expected to remain below warning criteria. For example, it would be issued if 2 inches of snow were expected with a small amount of sleet mixing in at times.
Wind Chill Advisory[38]	Issued when wind chill temperatures are expected to be a significant inconvenience to life with prolonged exposure, and, if caution is not exercised, could lead to hazardous exposure.
Wind Chill Warning[39]	Issued when wind chill temperatures are expected to be hazardous to life within several minutes of exposure.
Ice Storm Warning	Issued when a period of freezing rain is expected to produce ice accumulations of 1/4" or greater, or cause significant disruptions to travel or utilities.
Heavy Sleet Warning	Issued when a period of sleet is expected to produce ice accumulations of 1" or greater, or cause significant disruptions to travel or utilities.
Heavy Snow Warning	Issued when snow is expected to accumulate 4 inches or more in 12 hours, or 6 inches or more in 24 hours.
Winter Storm Warning	Issued for a winter weather event in which there is more than one hazard present, and one of the warning criteria listed above is expected to be met. For example, it would be issued if 5 inches of snow were expected in 12 hours, with some sleet mixing in at times. It is commonly issued for heavy snow with strong winds of 25-34 mph that will cause blowing and drifting of the snow. *A Winter Storm Watch is issued when these conditions may be met 12 to 48 hours in the future.*
Blizzard Warning	Issued for sustained wind or frequent gusts greater than or equal to 35 mph accompanied by falling and/or blowing snow, frequently reducing visibility to less than 1/4 mile for three hours or more. *A Blizzard Watch is issued when these conditions may be met 12 to 48 hours in the future.*

* - Non-precipitation watch / warning / advisory

Based on previous winter storm events, future storms in Madison County and the participating jurisdictions may see snow accumulation of up to 6” and see ice accumulation of up to .5”.

[38] https://www.osha.gov/dts/weather/winter_weather/windchill.html
[39] https://www.osha.gov/dts/weather/winter_weather/windchill.html

4) Location and Impact

A) Location – All Jurisdictions

Severe winter weather has no distinct geographic boundary. Severe winter weather can occur across the entire planning area and uniformly affect all participating jurisdictions.

B) Impact – All Jurisdictions

The potential impact of a severe winter storm is normally minor, resulting in few, if any, injuries. Because of the rarity of winter storm events in Madison County and the participating jurisdictions, drivers, especially those unfamiliar with or unable to drive in icy conditions, may be at the highest risk of crashing their vehicle and sustaining injuries.

Beyond accidents caused by icy conditions, severe winter weather has the potential to cause widespread power outages. Trees and other vegetation that grow along or near power lines and utility lines can become overburdened by ice and snow accumulation. Falling limbs or trees can easily take down power and utility lines. Neglected vegetation is especially at risk of failure due to increased weight loads. Power outages can create a cascading effect depending on residents' ability to heat their homes without electricity, especially for those young, elderly, and low-income residents as identified in Section 3 of Chapter 3 above. Although no deaths related to severe winter storms have been reported in the participating jurisdictions, in the worst cases, the hazard has the potential to be deadly.

Severe winter storms will likely cause only minor property damage and minimal disruption to the quality of life in the participating jurisdictions.

Depending on when the event happens, a severe winter storm may damage or destroy crops.

5) Vulnerability

A) Infrastructure

While all of the participating jurisdictions are exposed to extreme temperatures, existing buildings, infrastructure, and critical facilities are not considered vulnerable to significant damage caused by severe winter storm events. This determination was made based on the expectation that most roofs can support 20 lbs. / square foot of snow[40]. The worst snowstorm in any participating jurisdiction dropped 6". Although it's not impossible[41] for that much snow to cause structural damage, given that the snow weight is well below the threshold where damage is likely, structural damages are not expected. Additionally, 1" of ice is roughly

[40] https://disastersafety.org/freezing-weather/prevent-roof-collapse-homes/

[41] https://www.fema.gov/media-library-data/7d8c55d1c4f815edf3d7e7d1c120383f/FEMA957_Snowload_508.pdf - The weight of a foot a snow can vary widely based on how wet the snow is, between 3 and 21 lbs. per square foot. However, wet snow primarily affects the East Coast, Pacific Northwest, and southwestern Alaska.

equivalent in weight per square foot to 1" of snow. Considering the worst ice storms in the participating jurisdictions cause ice accumulations of ½", it's unlikely, but not impossible, that an ice storm causing structural ice accumulations of less than 4" will cause significant structural damages.

However, significant damages may be incurred indirectly. Examples include, but are not limited to, trees and limbs that fall after being overburdened with snow or ice, building strikes due to vehicles losing traction on snow or ice-covered roads, and power outages that affect building temperature regulation and allow pipes to freeze and burst.

B) Population

As described in Section 3 of Chapter 3 above, Madison County and the participating jurisdictions are home to many vulnerable residents. Areas with concentrations of young, elderly, and low-income residents may feel greater impacts from severe winter weather due to those populations' limited ability to properly address the hazard. Deficiencies may include but aren't limited to lack of heating in their homes or vehicles, lack of access to heated public spaces during the coldest part of the day or night, and frozen pipes that may jeopardize access to drinking water, and in the worst cases, lead to severe structural damage that can render a home unlivable. The consequences for these populations' exposure to severe winter weather can include but are not limited to complications for those suffering from hypertension, hypothyroidism, and diabetes, as well as exhaustion, hypothermia, trench foot, or death.

C) Critical Facilities

Any shutdown of critical facilities due to severe winter weather is expected to be temporary. However, based on the proximity of trees and powerlines on their properties, the following critical facilities may be at a higher risk of losing power due to falling limbs.

Table 55: Critical Facilities Vulnerable to Winter Storms

Jurisdiction	Critical Facilities	Potential Severe Winter Storm Impacts
		Falling Tree Limbs
Madison County	Tower site for BVWACS (public safety radio)	x
	Courthouse & Emergency Operations Center	x
	Courthouse Annex	x
	Library	x
	Madison/St. Joseph Hospital	x
Madisonville	First Baptist Church (Sheltering)	x
	Truman Kimbro Center	x
	Quick Visit Urgent Care	x
	KMVL Radio Station	x

	Hensarling Airport	x
	City Of Madisonville Well #3	x
	City Of Madisonville Well# 6	x
	City Of Madisonville Lift Station #2	x
	City Of Madisonville Lift Station #4	x
	City Of Madisonville Lift Station #5	x
	City Of Madisonville Lift Station #6	x
	City Of Madisonville Lift Station #8	x
	City Of Madisonville Lift Station #9	x
	City Of Madisonville Lift Station #11	x
	City Of Madisonville Lift Station #12	x
	City Of Madisonville Wastewater Treatment Plant	x
	City Of Madisonville Fire Station	x
Midway	City Hall/Fire Station	x
	Well Yard	x
	Lift Station B	x
	Lift Station C	x
	Lift Station D	x
	Sewer Treatment Plant	x
North Zulch MUD	Water Plant and Office and Well #4	x
	Water Plant and Well #3	x
	Wastewater Treatment Plant	x
	Lift Station #1	x
	Lift Station #2	x
	Grinder Station #1	x
	Grinder Station #2	x
	Grinder Station #3	x
	North Zulch Consolidated Independent School District Campus	x
	North Zulch Volunteer Fire Department / Senior Center	x

13. Severe Winds

A windstorm[42] is classified as any wind that is strong enough to cause at least light damage to trees and buildings, which may or may not be accompanied by precipitation. Wind speeds during a windstorm typically exceed 41 knots. Damage can be attributed to gusts or longer periods of sustained winds.

Windstorms may last for just a few minutes when caused by downbursts from thunderstorms, or they may last for hours (and even several days) when they result from large-scale weather systems. A windstorm that travels in a straight line and is caused by the gust front (the boundary between descending cold air and warm air at the surface) of an approaching thunderstorm is called a derecho. Derechos are capable of causing widespread damage and landscape devastation.

1) Windstorm History

In the 2013 HMAP, Madison County and the participating jurisdictions did not identify a specific hazard history for windstorms. Instead, wind was generally included as part of a Thunderstorm hazard history. In the 2013 plan, Madison County and participating jurisdictions recorded 62 thunderstorm winds events from May 1980 and September 2009. There were no injuries or fatalities associated with hailstorms for these events. The 2013 plan recorded $900,052 in property damages during that time adjusted to $2021, there was no record of crop damages. Historically, the County reported high probability of thunderstorms, and therefore increase risk of severe winds.

The following tables identify the most comprehensive list available of severe wind events and associated damages in Madison County and the participating jurisdictions. No participating jurisdiction has recorded a severe wind event more recently than 2019.

Table 56: Madison County Severe Wind History

Incidents	Date Range	Windstorm Events	Windspeed Range (Knots)	Fatalities	Injuries	Property Damage $2021	Crop Damage $2021
Countywide	8/19/2014 - 7/10/2019	3	50 - 52	0	0	$32,888.92	$0

Table 57: City of Madisonville Windstorm History

Incidents	Date Range	Windstorm Events	Windspeed Range (Knots)	Fatalities	Injuries	Property Damage $2021	Crop Damage $2021
Madisonville	1/25/2012 - 12/27/2018	8	50 - 70	0	0	$190,327.51	$0

[42] https://www.britannica.com/science/windstorm

Table 58: City of Midway Severe Wind History

Incidents	Date Range	Windstorm Events	Windspeed Range (Knots)	Fatalities	Injuries	Property Damage $2021	Crop Damage $2021
Midway	12/27/2018	1	60	0	0	$ 5,435.99	$0

Table 59: North Zulch, TX area Wind History

Incidents	Date Range	Windstorm Events	Windspeed Range (Knots)	Fatalities	Injuries	Property Damage $2021	Crop Damage $2021
North Zulch	10/12/2013	1	55	0	0	$0	$0

Severe windstorm data is generally recorded at the county or city level, so there is no specific information regarding severe windstorm events in North Zulch MUD. However, given that it is located within Madison County and the North Zulch area, North Zulch MUD's severe wind history is known to be similar to the County and surrounding areas.

2) Likelihood of Future Events

Madison County and the participating jurisdictions have experienced a damaging severe wind event roughly once every three to five years. Given the frequency of past events in all jurisdictions, a damaging severe wind event in the future is likely, meaning that an event is probable in the next three years.

3) Extent

The generally accepted extent scale for wind events is the Beaufort Wind Scale. The following table lists categories, measurement, classification, and appearance descriptions.

Table 60: Beaufort Wind Scale[43]

Beaufort Wind Scale				
Force	Wind (Knots)	WMO Classification	Appearance of Wind Effects	
			On the Water	On Land
0	Less than 1	Calm	Sea surface smooth and mirror-like	Calm, smoke rises vertically
1	1-3	Light Air	Scaly ripples, no foam crests	Smoke drift indicates wind direction, still wind vanes
2	4-6	Light Breeze	Small wavelets, crests glassy, no breaking	Wind felt on face, leaves rustle, vanes begin to move

[43] Source: www.spc.noaa.gov/faq/tornado/beaufort.html

3	7-10	Gentle Breeze	Large wavelets, crests begin to break, scattered whitecaps	Leaves and small twigs constantly moving, light flags extended
4	11-16	Moderate Breeze	Small waves 1-4 feet becoming longer, numerous whitecaps	Dust, leaves, and loose paper lifted, small tree branches move
5	17-21	Fresh Breeze	Moderate waves 4-8 feet taking longer form, many whitecaps, some spray	Small trees in leaf begin to sway
6	22-27	Strong Breeze	Larger waves 8-13 feet, whitecaps common, more spray	Larger tree branches moving, whistling in wires
7	28-33	Near Gale	Sea heaps up, waves 13-20 feet, white foam streaks off breakers	Whole trees moving, resistance felt walking against wind
8	34-40	Gale	Moderately high (13-20 feet) waves of greater length, edges of crests begin to break into spindrift, foam blown in streaks	Whole trees in motion, resistance felt walking against wind
9	41-47	Strong Gale	High waves (20 feet), sea begins to roll, dense streaks of foam, spray may reduce visibility	Slight structural damage occurs, slate blows off roofs
10	48-55	Storm	Very high waves (20-30 feet) with overhanging crests, sea white with densely blown foam, heavy rolling, lowered visibility	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	56-63	Violent Storm	Exceptionally high (30-45 feet) waves, foam patches cover sea, visibility more reduced	
12	64+	Hurricane	Air filled with foam, waves over 45 feet, sea completely white with driving spray, visibility greatly reduced	

The worst severe wind events in Madison County and the participating jurisdictions have ranged up to a 12 on the Beaufort Wind Scale. The most devastating severe wind events have inflicted up to $160,524 in property damages, adjusted for inflation to $2021. No recent severe wind events in any of the participating jurisdictions have caused any injuries, deaths, or crop damages. Future severe wind events may meet previous worst-case Force 12 events in terms of wind speed.

4) Location and Impact

A) Location

Windstorms are not constrained by any distinct geographic boundary. Windstorms can occur across all participating jurisdictions.

B) Impact

Impacts from a windstorm may include but are not limited to damaged or destroyed personal property including vehicles, damaged or destroyed agricultural, residential, commercial, and industrial buildings. Crops may be damaged or destroyed. Pets and livestock may be injured or killed by flying debris. Pets and livestock may escape due to damaged or destroyed structures and fences.

In the worst cases, windstorms may cause injuries and/or be deadly.

5) Vulnerability

Windstorms have the potential to impact all participating jurisdictions. Therefore, each jurisdiction is equally exposed to the hazard. Improved property, critical facilities, critical infrastructure, and the entire population are considered vulnerable to windstorms.

Based on windstorm data collected for the participating jurisdictions, windstorms primarily damage physical structures. However, there is no uniformity with respect to the type of structures that have been damaged by windstorms in any of the participating jurisdictions. Windstorm damages can be directly caused by the wind itself, flying debris, and falling trees, or indirectly by damages like power outages.

A) Population

As described in Section 3 of Chapter 3 above, Madison County and the participating jurisdictions are home to many vulnerable residents. Increased vulnerability may be due to many factors including but not limited to: age, physical ability, financial means, housing type, and housing condition. Many of these vulnerabilities often overlap.

The participating jurisdictions recognize that vulnerable populations may need additional help preparing for and recovering from a windstorm.

Residents of mobile / manufactured homes are of particular concern. These structures may not be safe during a windstorm.

Residents of sub-standard structures are also of particular concern. Structures in sub-standard condition ahead of a windstorm, whether due to structural damages, missing windows or doors, holes in exterior walls or the roof, may be less safe during a windstorm than structures in standard condition.

Existing structural weaknesses, due to housing type or existing damages, may lead to compounded damages, injuries, or loss of life.

B) Critical Facilities

Certain critical facilities and infrastructure in each jurisdiction may be particularly vulnerable to windstorms similar to hurricane and tornado events. These facilities have been identified for reasons including: the number of people who use the facility or infrastructure, the facility's role in providing basic services to begin the cleanup process and get the jurisdictions running again, and the facility's ability to offer goods and materials residents will need to resume normalcy as quickly as possible. The selected critical facilities are built from a variety of materials with varying levels of resistance to wind damages. Additionally, their varying ages mean they weren't constructed to uniform building standards. Given wind's potentially violent nature, these facilities may experience increased levels of vulnerability to the hazards. Damage to any of these facilities may have a disproportionately negative impact on each jurisdiction's recovery from a windstorm if that damage affects the facility's ability to reopen and resume normal business right away.

Table 61: Critical Facilities Vulnerable to Windstorms and Potential Impacts

Jurisdiction	Critical Facilities	Potential Hurricane / Tropical Storm Impacts								
		Loss of Power	Flying Debris	Uprooted Trees	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Madison County	Tower site for BVWACS (public safety radio)	x	X	x	x	x		x	x	x
	Courthouse & Emergency Operations Center	x	X	x	x	x	x	X	x	x
	Courthouse Annex	x	x	x	X	x	x	X	x	x
	Sheriff's Office	x	x	x	X	x	x	X	x	x
	Library	x	x	x	x	x	x	X	x	x
	Madisonville Consolidated Independent School District Campuses	x	x	x		x	x	x	x	x
	Madison/St. Joseph Hospital	x	x	x			x	x	x	x
	Madison County Jail	x	x	X		x	x	x	x	x
Madisonville	Buc-cee's	x		x	x	x	x	x	x	x
	First Baptist Church (Sheltering)	x	x	X	X	x	x	X	x	x
	Truman Kimbro Center	X	x	X	X	x	x	X	x	x
	Quick Visit Urgent Care	X	x	x	x	x	x	x	x	x
	Madisonville Police Dept.	x	x			x	x	x	x	x
	KMVL Radio Station	x	x	x	x	x	x	X	x	x
	Madisonville Municipal Airport	x	x	x		X		x	x	x
	Hensarling Airport	x	x	x		x		x	x	x
	City Hall of Madisonville	x	x		x	x	x	x	x	x
	City Of Madisonville Well #3	x	x	X	x			x	x	x
	City Of Madisonville Well #5	x	x	x	x			x	x	x
	City Of Madisonville Well# 6	x	x	x	x			x	x	x
	City Of Madisonville Lift Station #2	x	x	x				x	x	x
	City Of Madisonville Lift Station #3	x	X		x			x	x	x
	City Of Madisonville Lift Station #4	x	x	x				x	x	x

	City Of Madisonville Lift Station #5	x	x	x	x			x	x	x
	City Of Madisonville Lift Station #6	x	x	x	x			x	x	x
	City Of Madisonville Lift Station #7	x	x	X				x	x	x
	City Of Madisonville Lift Station #8	x	X	X				X	x	x
	City Of Madisonville Lift Station #9	x	X	X				x	x	x
	City Of Madisonville Lift Station #10	x	x					X	x	x
	City Of Madisonville Lift Station #11	x	x	X				x	x	x
	City Of Madisonville Lift Station #12	x	x	x	x			x	x	x
	City Of Madisonville Wastewater Treatment Plant	x	x	x	x	x	x	x	x	x
	City Of Madisonville Fire Station	x	x	x		x	X	x	x	x
Midway	City Hall/Fire Station	x	x	x	x	x	X	X	x	x
	Well Yard	x	x	x	x	X	x	x	x	x
	Lift Station A	x	x	x				x	x	x
	Lift Station B	x	x	x				x	x	x
	Lift Station C	x	x	x				x	x	x
	Lift Station D	x	x	x	x			x	x	x
	Sewer Treatment Plant	x	x	x	x	x	x	x	x	x
	TX Dept Criminal Justice - Ferguson Unit	x	x			x	x	x	x	x
North Zulch MUD	Water Plant and Office and Well #4	x	x	x	x	x	x	X	x	x
	Water Plant and Well #3	X	x	x	x	x		x	x	x
	Wastewater Treatment Plant	x	x	x	X			x	x	x
	Lift Station #1	x	x	x	x			x	x	x
	Lift Station #2	x	x	x				x	x	x
	Grinder Station #1	x	x	x	x			X	x	x
	Grinder Station #2	x	x	x	x			x	x	x
	Grinder Station #3	x	x	x	x			x	x	x
	North Zulch Consolidated Independent School District Campus	x	x	x		x	x	x	x	x
	North Zulch Volunteer Fire Department/ Senior Center	x	x	x	x	x	x	x	x	x

C) Vulnerable Parcels

Table 62: Parcels Vulnerable to Windstorms

Jurisdiction	Parcel Count	Estimated Potential Damage Value
Madison County	**9,669**	**$2,061,617,225**
City of Madisonville	2,083	$207,605,330
City of Midway	189	$12,141,000
North Zulch Municipal Utility District	2	$131,610

14. Lightning

Lightning is a massive electrostatic discharge between electrically charged regions within clouds, or between a cloud and the Earth's surface.

Lightning damage can result in electrocution of humans and animals; vaporization of materials along the path of the strike; fire caused by the high temperature produced by the strike; and sudden power surges that can damage electrical and electronic equipment. Millions of dollars of direct and indirect damages result from lightning strikes on electric utility substations and distribution lines. While property damage is the major hazard associated with lightning, it should be noted that lightning strikes kill nearly 49 people [44] each year in the United States.

1) Lightning History

According to NCEI data, Madison County and the participating jurisdictions have experienced three lightning events between June 1997 and March 2018. Neither of the events are reported to have caused injuries nor fatalities. There is no data documenting a lightning event more recent than 2018. Madison County and the participating jurisdictions did not include Lightning as a standalone hazard in the 2013 Hazard Mitigation Action Plan; however, the planning team determined that lightning events occur multiple times annually.

Table 63: Madison County Lightning History

Location	Date Range	Number of Lightning Events	Fatalities	Injuries	Property Damage $2021	Crop Damage $2021
Countywide	3/17/2018	1	0	0	$ 2,717.99	$0

Table 64: City of Madisonville Lightning History

Location	Date Range	Number of Lightning Events	Fatalities	Injuries	Property Damage $2021	Crop Damage $2021
Madisonville	6/7/1997	1	0	0	$ 42,523.83	$0

Table 65: City of Midway Lightning History

Location	Date Range	Number of Lightning Events	Fatalities	Injuries	Property Damage $2021	Crop Damage $2021
Midway	3/17/2018	1	0	0	$2,174.40	$0

According to the best information available, there have been no lightning events for the North Zulch, TX area where North Zulch MUD is located.

[44] https://www.weather.gov/safety/lightning-victims

2) Likelihood of Future Events

Lightning is especially associated with thunderstorms. Despite the lack of officially reported instances of lightning-caused damages, a lightning event is highly likely, meaning an event affecting any or all of the participating jurisdictions is probable in the next year. According to information from VAISALA[45], most of Madison County can expect about 13 to 20 lightning flashes per square miles per year.

3) Extent

The extent for lightning can be expressed in terms of the number of strikes within an interval. Given the lack of lightning history data, it is expected that Madison County and all participating jurisdictions may experience lightning events between LAL 1 and LAL 5. Dry thunderstorms, LAL 6, are not expected.

Table 66: Lightning Activity Levels[46]

Lightning Activity Level (LAL)		
Activity levels are valuable guidance tools to aid in the preparation for possible fire initiation from cloud-to-ground lightning.		
LAL	Cloud and Storm Development	Lightning Strikes per 15 Minutes
1	No thunderstorms.	-
2	Cumulus clouds are common but only a few reaches the towering cumulus stage. A single thunderstorm must be confirmed in the observation area. The clouds produce mainly virga, but light rain will occasionally reach the ground. Lightning is very infrequent.	1-8
3	Towering cumulus covers less than two-tenths of the sky. Thunderstorms are few, but two to three must occur within the observation area. Light to moderate rain will reach the ground, and lightning is infrequent.	9-15
4	Towering cumulus covers two to three-tenths of the sky. Thunderstorms are scattered and more than three must occur within the observation area. Moderate rain is common, and lightning is frequent.	16-25
5	Towering cumulus and thunderstorms are numerous. They cover more than three-tenths and occasionally obscure the sky. Rain is moderate to heavy and lightning is frequent and intense.	25+
6	Similar to LAL 3 except thunderstorms are dry.	

[45] https://www.vaisala.com/sites/default/files/documents/WEA-MET-Annual-Lightning-Report-2020-B212260EN-A.pdf

[46] Source: http://www.prh.noaa.gov/hnl/pages/LAL.php

4) Location and Impact

A) Location

Lightning strikes have no distinct geographic boundary. Lightning can occur across each participating jurisdiction.

B) Impact

Impacts from lightning in all jurisdictions may include but are not limited to loss of power due to electrical surges, damaged or destroyed personal property including computers and other electronics, damaged or destroyed agricultural, residential, commercial, and industrial buildings. Crops may be damaged or destroyed. Livestock may be injured or killed by lightning. In the worst cases, lightning may cause injuries or even loss of life.

5) Vulnerability

According to the Lightning Protection Institute, it is a myth[47] that lightning always strikes the tallest objects. Given lightning's indiscriminate nature, it is impossible to identify buildings that are at an increased risk of being struck by lightning. All existing and future buildings, critical facilities, critical infrastructure, improved property, and the population are exposed to this hazard. However, structures without adequate lightning protection and those with large concentrations of electronic equipment like computers, servers, and printers, are most vulnerable, as are locations that may have outside crowds during a lightning event.

A) Critical Facilities

Table 67: Critical Facilities Vulnerable to Lightning and Potential Impacts

Jurisdiction	Critical Facilities	Potential Lightning Impacts			
		Physical Damage	Electrical Damage	Data Damage or Loss	Fire
Madison County	Tower site for BVWACS (public safety radio)	x	x	x	x
	Courthouse & Emergency Operations Center	x	x	x	x
	Courthouse Annex	x	x	x	x
	Sheriff's Office	x	x	x	x
	Library	x	x	x	x
	Madisonville Consolidated Independent School District Campuses	x	x	x	x
	Madison/St. Joseph Hospital	x	x	x	x
	Madison County Jail	x	x	x	x
Madisonville	Buc-cee's	x	x	x	x
	First Baptist Church (Sheltering)	x	x	x	x
	Truman Kimbro Center	x	x	x	x
	Quick Visit Urgent Care	x	x	x	x

[47] http://lightning.org/wp-content/uploads/2015/06/LPI_lightning_infographic_2015.jpg

	Madisonville Police Dept.	x	x	x	x
	KMVL Radio Station	x	x	x	x
	Madisonville Municipal Airport	x	x	x	x
	Hensarling Airport	x	x	x	x
	City Hall of Madisonville	x	x	x	x
	City Of Madisonville Well #3	x	x	x	x
	City Of Madisonville Well #5	x	x	x	x
	City Of Madisonville Well# 6	x	x	x	x
	City Of Madisonville Lift Station #2	x	x	x	x
	City Of Madisonville Lift Station #3	x	x	x	x
	City Of Madisonville Lift Station #4	x	x	x	x
	City Of Madisonville Lift Station #5	x	x	x	x
	City Of Madisonville Lift Station #6	x	x	x	x
	City Of Madisonville Lift Station #7	x	x	x	x
	City Of Madisonville Lift Station #8	x	x	x	x
	City Of Madisonville Lift Station #9	x	x	x	x
	City Of Madisonville Lift Station #10	x	x	x	x
	City Of Madisonville Lift Station #11	x	x	x	x
	City Of Madisonville Lift Station #12	x	x	x	x
	City Of Madisonville Wastewater Treatment Plant	x	x	x	x
	City Of Madisonville Fire Station	x	x	x	x
Midway	City Hall/Fire Station	x	x	x	x
	Well Yard	x	x	x	x
	Lift Station A	x	x	x	x
	Lift Station B	x	x	x	x
	Lift Station C	x	x	x	x
	Lift Station D	x	x	x	x
	Sewer Treatment Plant	x	x	x	x
	TX Dept Criminal Justice - Ferguson Unit	x	x	x	x
North Zulch MUD	Water Plant and Office and Well #4	x	x	x	x
	Water Plant and Well #3	x	x	x	x
	Wastewater Treatment Plant	x	x	x	x
	Lift Station #1	x	x	x	x
	Lift Station #2	x	x	x	x
	Grinder Station #1	x	x	x	x
	Grinder Station #2	x	x	x	x
	Grinder Station #3	x	x	x	x
	North Zulch Consolidated Independent School District Campus	x	x	x	x
	North Zulch Volunteer Fire Department/Senior Center	x	x	x	x

B) Vulnerable Parcels

Table 68: Parcels Vulnerable to Lightning

Jurisdiction	Parcel Count	Estimated Potential Damage Value
Madison County	**9,669**	**$2,061,617,225**
City of Madisonville	2,083	$207,605,330
City of Midway	189	$12,141,000
North Zulch Municipal Utility District	2	$131,610

15. Mitigation Strategy

1) Capability Assessment

Madison County and the participating jurisdictions have shown themselves to be highly capable, especially in terms of implementing hazard mitigation actions. All four jurisdictions participated in the 2013 plan. Each of these jurisdictions completed, or is in the process of completing, many of the actions recommended in the 2013 plan.

In addition to reviewing previous actions and the steps taken to implement them, the planning team reviewed existing regulatory capabilities and opportunities for establishing new capabilities and enhancing existing ones. At this time, all jurisdictions could improve their hazard mitigation capabilities through the following efforts: budgeting for mitigation actions and support, passing policies and procedures to implement mitigation actions, adopting and implementing stricter mitigation regulations, approving the hiring and training of staff for mitigation activities, and approving mitigation updates and additions to existing plans as new needs are recognized. The participating cities could further improve their capabilities by creating and adopting regularly updated comprehensive plans.

Table 69: Capability Assessment by Jurisdiction

Madison County Administrative, Financial, Regulatory, and Technical Abilities
Floodplain Management
Emergency Management
Economic Development
Road and Bridge Management
Tax Collection
Grant Writing
General Budgeting
CIP Funding
CDBG Funding
State and Federal Grant Funding
Environmental Enforcement Officer

City of Madisonville Administrative, Financial, Regulatory, and Technical Abilities
Floodplain management
Emergency Management
Subdivision
Zoning
Building Code Enforcement
Nuisance Abatement
Substandard Structures Abatement
Water Conservation Planning
Drought Contingency Planning
Comprehensive Planning
Economic Development
Grant Writing
General Budgeting
CIP Funding
CDBG Funding
State and Federal Grant Funding

City of Midway Administrative, Financial, Regulatory, and Technical Abilities
Emergency Management
Drought Contingency Planning
Grant Writing
General Budgeting
CIP Funding
State and Federal Grant Funding
Tax Collection
CIP Funding
CDBG Funding

North Zulch MUD Administrative, Financial, Regulatory, and Technical Abilities
Emergency Management
Drought Contingency Planning
Grant Writing
General Budgeting
CIP Funding

2) Goals and Objectives Overview

The hazard analysis has shown that Madison County and the participating jurisdictions are at risk of multiple natural hazards. The following goals and objectives take a broad approach to improving outcomes before, during, and after these anticipated natural hazard events.

The goals in this plan update are similar to the goals listed in the 2013 plan. They have been expanded to include public services, public infrastructure, economic impacts, civic resources, and cultural resources as priorities in addition to reducing loss of life, injury, property damage, and preservation of natural resources. The mitigation actions the County and participating jurisdictions have selected are designed to address specific hazard-related issues in support of achieving the desired goals and objectives.

3) Long-Term Vision

The hazard mitigation plan must strike a balance between identifying long-term goals and objectives and prioritized mitigation actions that may be addressed sooner, depending on funding availability and local priorities. The result is that certain goals and objectives don't have a corresponding mitigation action. Instead, by taking the long view, the local planning team has created a framework that can be developed as the plan is updated over time.

4) Goals

A) Goal 1: To reduce loss of life and injury to persons

Objective 1.1

Improve the delivery and effectiveness of warning messages

Objective 1.2

Preserve public and private emergency response capability (9-1-1, law enforcement, fire services, emergency medical services, hospitals).

Objective 1.3

Utilize available mitigation measures to prevent or reduce life-threatening impacts of natural hazards.

Objective 1.4

Reduce obstacles to timely and safe evacuation of flood hazard areas.

Objective 1.5

Reduce vulnerability of individuals living in mobile homes / manufactured housing.

Objective 1.6

Reduce life or health threatening impacts on individuals with special physical care requirements.

Objective 1.7

Reduce secondary impacts to health and safety from cascading effects.

B) Goal 2: To reduce disruptions to essential public services and infrastructure

Objective 2.1

Minimize disruption to and enhance rapid restoration of utilities.

Objective 2.2

Minimize disruption to and enhance rapid restoration of essential transportation infrastructure.

Objective 2.3

Minimize disruption to governmental, educational, and other institutions providing services to the public.

C) Goal 3: To reduce economic impacts to individuals, businesses, and area institutions

Objective 3.1

Increase home and business owner investment in available mitigation measures for private property.

Objective 3.2

Increase home and business owner participation in appropriate insurance programs.

Objective 3.3

Increase public and private sector development and use of operations continuity strategies.

Objective 3.4

Utilize available mitigation measures to prevent or reduce economic losses from natural hazards.

Objective 3.5
Reduce vulnerability of existing development by encouraging property owners to participate in buy-out or flood-proofing opportunities.

Objective 3.6
Reduce vulnerability of future development by utilizing available planning and structural standards.

D) Goal 4: To reduce losses to civic, cultural, and environmental resources

Objective 4.1
Protect public investment in community-owned facilities and infrastructure through appropriate structural, non-structural, and financial methods.

Objective 4.2
Reduce future losses to the non-profit sector through participation in available mitigation opportunities.

Objective 4.3
Reduce vulnerability of historically or culturally significant structures.

Objective 4.4
Minimize environmental impacts from cascading effects.

5) Mitigation Action Plan

A) Mitigation Action Prioritization

The planning team members have identified at least two mitigation actions per natural hazard. The previous plan had four prioritization criteria: 1) benefits in terms of effect on overall risk and to life and property, including the effects on both new and existing buildings and infrastructure; 2) ease of implementation; 3) political and community support; and 4) cost and funding. The priorities for this plan were expanded based due to community changes in priorities. For this update, action items were identified and prioritized in consideration of the following criteria:

1) Life safety and property protection improvements
2) Cost effectiveness – do the action's future benefits exceed its implementation costs
3) Technical feasibility – is the action reasonable given its technical requirements
4) Political acceptability
5) Administrative capabilities and legal authorities for implementation
6) Funding availability
7) The action's environmental impacts

8) The action's social acceptability
9) The action's ability to reduce risk to more than one hazard
10) The ease of implementation
11) The availability of a local champion
12) The action's relationship to other community objectives

In addition to considering an action's cost effectiveness as described above, the planning team considered TDEM's Cost-Effectiveness, Environmental Soundness and Technical Feasibility requirements as they relate to construction projects. Mitigation actions relating to physical infrastructure will meet the State's standards as outlined below:

A. Any state government construction project, regardless of potential funding source, has to be cost effective, technically feasible and meet all of the appropriate federal, state, and local environmental laws and regulations before it is started.
B. State government projects funded by Federal Mitigation Grant Programs administered by TDEM have to meet specific criteria related to cost effectiveness, environmental soundness and technical feasibility. These are outlined in the applicable FEMA grant program guidance for that particular funding program.

B) Incorporation and Integration of Existing Capabilities and Hazard Mitigation

As previously outlined, the planning team reviewed a range of codes, ordinances, and planning studies that have been adopted by the participating jurisdictions. The planning team's goal was to understand how these existing capabilities might affect mitigation actions in terms of implementation and enforcement.

Mitigation Action Status – 2013 Plan

In addition to reviewing existing codes, ordinances, and planning studies, the planning team also examined the status of each mitigation action identified in the 2013 plan.

A slight increase in local development is not known to have affected local vulnerability to the natural hazards this plan addresses or to those addressed in the 2013 plan.

Mitigation actions marked as incomplete are no longer considered relevant as written to the participating jurisdictions.

Table 70: Previous Mitigation Actions – All Jurisdictions

Jurisdiction	Hazards Addressed	Mitigation Actions	Status
Madison County	**Tornado, hurricane, severe winter storm, thunderstorm**	Individual Safe-Room Program for existing structures.	*Completed*

Madison County	**Flooding, wildfires, hailstorms, excessive heat, drought**	Create a regional map modernization program and prioritize mapping needs. Enhance GIS system with digital floodplain and topographic data. Need to convert city floodplain data to digital.	*In Progress*
Madison County	**Drought**	Develop drought contingency plans outlining actions to take at varying levels of drought.	*Abandoned: Water providers have developed their own drought contingency plans*
Madison County	**Fire**	Adopt fire hydrant maintenance and map all locations.	*Abandoned: No Longer Deemed Relevant*
Madison County	**Tornado and/or Hurricane Winds**	Harden the existing Emergency Operations Center (EOC) to meet wind resistance standards.	*Completed*
Madison County	**Hurricane, severe winter storms, thunderstorms, flooding, wildfire**	Designate POD locations with generators.	*Completed*
Madison County	**Dam Failure, flood**	Create dam failure inundation maps	*Completed*
Madison County	**Drought**	Public Outreach and Education	*In Progress*
Madison County	**Excessive Heat, drought**	Fan Distribution campaign	*Completed*
Madison County	**Excessive Heat**	Home delivered meals	*Completed*
Madison County	**Hail**	Public Outreach and Education	*In Progress*
Madison County	**Wildfires**	Create and display signage for evacuations and detour routes in emergency hazard situations.	*Completed*
Madison County	**Hurricane, flood, severe winter storms**	Back-up generator for waste-water system	*Abandoned: County does not have a public wastewater system*
Madison County	**Winter storm, Tornado, Hailstorm, Thunderstorm, Excessive Heat**	Community Safe Room	*Abandoned: Unable to secure grant funding and insufficient personnel*

Madison County	**Wildfire, Drought, Excessive Heat**	Burn Bans	*Completed*
Madison County	**Winter Storm**	Burying overhead power lines to the Emergency Operation Center	*Abandoned: Relocated to basement of courthouse instead*
Madison County	**Dam Failure**	Elevate existing homes located downstream of Town Branch Dam in the dam failure inundation zone	*Abandoned: Became a primary task for the City of Madisonville*

Jurisdiction	Hazards Addressed	Mitigation Actions	Status
City of Madisonville	**Flood**	Expand storm water drains to accommodate more flood flows.	*In Progress*
City of Madisonville	**Tornado, Hurricane, Winter Storm, Hail, Thunderstorm, Excessive Heat**	Build a new dual use community safe room.	*Abandoned: No Longer Deemed Relevant*
City of Madisonville	**Tornado, Hurricane, Winter Storm, Hail, Thunderstorm, Excessive Heat**	Public Outreach and Education.	*Deferred to Plan Update*
City of Madisonville	**Drought**	Develop drought contingency plans.	*Deferred to Plan Update*
City of Madisonville	**Wildfires, Drought, Excessive Heat**	Burn Bans	*Deferred to Plan Update*
City of Madisonville	**Drought and Wildfires**	Develop and coordinate public education campaign.	*Deferred to Plan Update*
City of Madisonville	**Flooding**	Per NFIP participation, improve drainage along waterways to protect new and existing structures from the 100-year flood.	*In Progress*
City of Madisonville	**Severe winter storms, hurricane winds**	Tree Limb removal program to protect existing power supplies	*Completed*
City of Madisonville	**Hurricane, flood, severe winter storms**	Back-up generator for waste-water system	*Completed*
City of Madisonville	**Thunderstorms and wildfires**	Installation of Lightning Protection for existing buildings	*Abandoned: No Longer Deemed Relevant*

City of Madisonville	**Thunderstorms**	Early Warning Systems.	*Deferred to Plan Update*
City of Madisonville	**Hail**	Strengthen Building Codes for new buildings	*In Progress*
City of Madisonville	**Dam Failure, flood**	Public Outreach and Education	*Deferred to Plan Update*
City of Madisonville	**Dam Failure**	Acquire existing homes located downstream of Town Branch Dam and Crescent Lake Dam within the city limits of Madisonville	*Abandoned: No Longer Deemed Relevant*

Jurisdiction	Hazards Addressed	Mitigation Actions	Status
City of Midway	**Flood**	Increase the amount of fire hydrants available and map their locations.	*Completed*
City of Midway	**Tornado, Hurricane, Winter Storm, Hail, Thunderstorm, Excessive Heat**	Build a new dual use community safe room.	*Deferred to Plan Update*
City of Midway	**Tornado, Hurricane, Winter Storm, Hail, Thunderstorm, Excessive Heat**	Public Outreach and Education.	*Completed*
City of Midway	**Drought, Wildfires**	Develop and coordinate public education campaign.	*Completed*
City of Midway	**Wildfires, Drought, Excessive Heat**	Burn Bans	*Completed*
City of Midway	**Hurricane, flood, severe winter storms**	Back-up generator for waste-water system	*Completed*
City of Midway	**Hurricane, flood, severe winter storms, drought**	Build a community safe room	*Deferred to Plan Update*
City of Midway	**Flood**	Acquisition of Repetitive Loss (RL) homes from the 100-year flood plain.	*Abandoned: no longer deemed relevant*

City of Midway	**Flood**	Elevation of Repetitive Loss (RL) homes in the 100-year flood plain.	*Abandoned: no longer deemed relevant*

Jurisdiction	Hazards Addressed	Mitigation Actions	Status
North Zulch MUD	**Tornado, Hurricane, Winter Storm, Hail, Thunderstorm, Excessive Heat**	Build a new dual use community safe room.	*Abandoned: no longer deemed relevant*
North Zulch MUD	**Tornado, Hurricane, Winter Storm, Hail, Thunderstorm, Excessive Heat**	Public Outreach and Education.	*Deferred to Plan Update*
North Zulch MUD	**Drought, Wildfires**	Develop and coordinate public education campaign.	*Deferred to Plan Update*
North Zulch MUD	**Wildfires, Drought, Excessive Heat**	Burn Bans	*Completed*
North Zulch MUD	**Fire**	Adopt routine fire hydrant maintenance and map all locations.	*Completed*
North Zulch MUD	**Hurricane, flood, severe winter storms**	Back-up generator for waste-water system	*In Progress*
North Zulch MUD	**Floods**	Acquire existing homes located in the identified special flood hazard area (the 100-year floodplain)	*Abandoned: no longer deemed relevant*

Each jurisdiction has its own established process for integrating new actions, codes, ordinances, plans, and studies into its existing capabilities. The planning team will ensure that each jurisdiction's various departments continue to integrate hazard mitigation actions into their day-to-day processes.

Table 71: Plan Integration

Department	All Departments	Commissioners' Court, Road and Bridge, Mayor's Office, Council, Public Works, Economic Development,	Planning, Zoning, Economic Development, Public Works, Mayor's Office, Floodplain Manager	Office of Emergency Management, Mayor's Office, Mayor and Council, Commissioners' Court	Office of Emergency Management, Mayor's Office, Chief of Fire Department	Office of Emergency Management, Mayor's Office, Administrative Office	Floodplain Manager, Mayor's Office
Activity	Annual Budget	Capital Improvement Projects	Comprehensive Master Plan	Public Involvement	Emergency Operations	Grant Application	Floodplain Management
Time Frame	Quarterly/ Annual workshops	Bi-annually	Every 10 Years	As Needed	Annually	Annual Funding Cycles	Annually
Integration Process	Discuss integration of medium and high priority actions with Commissioners' Court, Council, or Schoolboard (as appropriate) concerning feasibility, potential funding sources, and a preliminary cost benefit review.	Discuss inclusion of mitigation actions with CIPs. Ensure CIPs are consistent with mitigation actions, NFIP compliance, and any new land use development.	Review existing floodplain and land use controls to ensure that long term goals are consistent with actions in the HMAP.	Utilize jurisdictional web sites, social media, and other forms of advertising to make announcements of any periodic review activities concerning potential amendments or updating of the HMAP	Review prevention and protection projects for continued relevance. Ensure appropriate actions and information are included in the Emergency Operation Plan.	Review and update mitigation actions as necessary based on funding opportunities available through FEMA FMA, FEMA PDM, FEMA HMGP, and other grant funding sources.	Update and maintain floodplain information including but not limited to: maps, construction practices, permitting, and NFIP compliance.
Jurisdiction							
Madison County	x	x	x	x	x	x	x
City of Madisonville	x	x	x	x	x	x	x
City of Midway	x	x		x	x	x	
North Zulch MUD	x	x		x		x	

Each new mitigation action below outlines the following requirements: the identified responsible department head or delegate will research all relevant information to confirm the action's feasibility and prioritization, will formulate a plan of action, and will confirm funding sources and identify any fiscal liabilities associated with the mitigation action.

As part of each jurisdiction's commitment to transparency, all relevant information, including but not limited to that described above and in each action's description, will be presented to the public before the action is formally adopted for implementation. After public notification, the integration process will resemble the one outlined in Table 75 below.

Table 72: Integration Process

Jurisdiction	Integration Process
Madison County	After considering integrating mitigation actions with the activities outlined in Table 74 above, mitigation actions will be presented, considered, and formally adopted by the County Commissioners' Court and County Judge. Madison County will also use the Madison County Hazard Mitigation Plan as a technical reference and data source for identified and future mitigation actions, as well as future planning processes.
City of Madisonville	After considering integrating mitigation actions with the activities outlined in Table 74 above, mitigation actions will be presented, considered, and formally adopted by the council and mayor. The City of Madisonville will also use the Madison County Hazard Mitigation Plan as a technical reference and data source for identified and future mitigation actions, as well as future planning processes.
City of Midway	After considering integrating mitigation actions with the activities outlined in Table 74above, mitigation actions will be presented, considered, and formally adopted by the council and mayor. The City of Midway will also use the Madison County Hazard Mitigation Plan as a technical reference and data source for identified and future mitigation actions, as well as future planning processes.
North Zulch MUD	After considering integrating mitigation actions with the activities outlined in Table 74 above, mitigation actions will be presented, considered, and formally adopted by the council and mayor. The North Zulch MUD will also use the Madison County Hazard Mitigation Plan as a technical reference and data source for identified and future mitigation actions, as well as future planning processes.

C) Mitigation Actions by Jurisdiction and by Hazard

Each jurisdiction has selected actions that were identified as high or medium priority and that are in line with TDEM's recommended mitigation actions. However, many of the mitigation actions below are dependent upon outside grant funding for implementation. For all actions likely to require grant funding, potential sources have been identified. However, grant funding is awarded on a competitive basis, so applying for funding doesn't guarantee that funds will be received. Madison County and the participating jurisdictions have a successful history of applying for and receiving grant funding to implement physical infrastructure actions. Budget constraints will remain the determining factor for how and when each action is implemented.

i. Madison County

Multi-Hazard Actions

Mitigation Action	**Educational Outreach**
Objective	This action will create a program to educate the public about specific mitigation actions for all hazards, including but not limited to participation in Wildfire Fuels Reduction, Tornado Saferooms, Structural Hardening, etc.
Hazard	Hurricane/Tropical Storm, Flood, Wildfire, Tornado, Drought, Extreme Heat, Hailstorm, Extreme Cold, Winter Weather, Severe Winds, Lightning
Priority	Medium
Estimated Cost	Less than $10,000 per hazard
Potential Funding Source (s)	Madison County, FEMA PDM, FEMA HMGP, FEMA FMA, TWDB
Responsible Department	Emergency Management
Implementation Schedule	1 - 5 Years
Target	Existing and future population

Mitigation Action	**Install Impact and Wind-resistant Windows and Doors at Public Facilities**
Objective	This action proposes hardening facilities. Hardening will include adding impact and wind-resistant doors and windows at critical and public facilities in the County.
Hazard	Hurricane / Tropical Storm, Tornados, Hailstorm, Severe Winds
Priority	Medium
Estimated Cost	$100,000
Potential Funding Source (s)	Madison County, FEMA PDM, FEMA HMGP
Responsible Department	County Commissioners' Court & Planning Department

Implementation Schedule	5 Years
Target	Existing infrastructure

Mitigation Action	**Set up Cooling and Heating Centers in Existing Facilities**
Objective	The action's goal is to increase extreme heat resilience by limiting vulnerable populations' exposure to extreme heat by creating new or opening up existing facilities as cooling centers or warming centers.
Hazard	Extreme Heat & Extreme Cold
Priority	Medium
Estimated Cost	Less than $10,000
Potential Funding Source (s)	County, FEMA PDM, FEMA HMGP
Responsible Department	County Commissioners' Court
Implementation Schedule	1 - 5 Years
Target	Existing and future population

Mitigation Action	**Install Back Up Power Generators**
Objective	Installing generators at critical facilities will help ensure physical safety for facility occupants and maintain electronic systems functionality during power outages. Portable generators will maintain additional systems functionality including but not limited to lift stations, pumps, and communications infrastructure.
Hazard	Hurricane/Tropical Storm, Flood, Wildfire, Tornado, Extreme Heat, Hailstorm, Extreme Cold, Winter Weather, Severe Winds, Lightning
Priority	Medium
Estimated Cost	More than $100,000 Each for Fixed Generators, Including Associated Engineering Costs. Less than $100,000 Each for Portable Generators
Potential Funding Source (s)	County, FEMA PDM, FEMA HMGP
Responsible Department	County Commissioners' Court
Implementation Schedule	5 Years
Target	Existing infrastructure

Mitigation Action	**Harden Facilities**

Objective	This action proposes hardening facilities. Hardening will include but is not limited to adding impact and wind-resistant doors, windows; reinforcing building foundations, elevating low-lying structures, upgrading and/or adding shatter-resistant films to all glazing, upgrading thermal insulation, building protective walls around exposed gas tanks and cylinders, shielding roof-mounted equipment, and adding bracing and tie-down clips to building roofs.
Hazard	Hailstorms, Winter Weather, Extreme Cold, Riverine Flooding, Tornados
Priority	Medium
Estimated Cost	Greater than $100,000
Potential Funding Source (s)	County, FEMA FMA, FEMA BRIC, FEMA HMGP, CDBG MIT
Responsible Department	County Sheriff's Office
Implementation Schedule	5 Years
Target	Existing infrastructure

Single Hazard Actions

Mitigation Action	**Construct Storm Drainage Infrastructure**
Objective	This action proposes constructing new storm drainage infrastructure to reduce the potential impacts of future flood events.
Hazard	Riverine Flooding
Priority	Medium
Estimated Cost	More than $1,000,000
Potential Funding Source (s)	Madison County, FEMA BRIC, FEMA HMGP, FEMA FMA, TWDB
Responsible Department	Commissioners' Court & Planning Department
Implementation Schedule	Short Term: 0-2 Years
Target	Existing infrastructure

Mitigation Action	**Create Drainage Master Plan**
Objective	This action proposes creating a drainage master plan for the City, in conjunction with other jurisdictions, that will provide the City with a comprehensive planning document that provides basic information and necessary guidance for the county-wide drainage system, including but not limited to an H&H study.
Hazard	Riverine Flooding

Priority	Medium
Estimated Cost	Less than $100,000
Potential Funding Source (s)	City, FEMA BRIC, FEMA FMA, FEMA HMGP, CDBG-MIT
Responsible Department	Commissioners' Court & Planning Department
Implementation Schedule	5 Years
Target	Existing and future infrastructure

Mitigation Action	**Replace Water Fixtures with Low Flow Units**
Objective	This action's goal is to limit water consumption at County-owned and maintained facilities by replacing traditional water fixtures with low flow units.
Hazard	Drought
Priority	Medium
Estimated Cost	$10,000 - $100,000
Potential Funding Source (s)	County, FEMA BRIC, FEMA HMGP
Responsible Department	County Commissioners' Court
Implementation Schedule	Medium Term: 3-5 Years
Target	Existing and Future infrastructure

Mitigation Action	**Replace Current Landscaping with Drought Resistant Plant Varieties**
Objective	This action's goal is to limit water consumption at City-owned and maintained facilities by replacing existing landscaping with more drought resistant types.
Hazard	Drought
Priority	High
Estimated Cost	Less than $10,000
Potential Funding Source (s)	County, FEMA BRIC, FEMA HMGP
Responsible Department	County Commissioners' Court
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing and future infrastructure

Mitigation Action	Install Surge Protection and Grounding Systems to Protect Electronic Assets
Objective	This action will install surge protection at all City facilities to prevent damage to critical electronic devices including but not limited to: computers, servers, audio/visual equipment, laboratory equipment, and appliances.
Hazard	Lightning
Priority	Medium
Estimated Cost	$1,000 - $100,000
Potential Funding Source (s)	County, FEMA PDM, FEMA HMGP
Responsible Department	County Elected Officials
Implementation Schedule	1 - 5 Years
Target	Existing infrastructure

ii. City of Madisonville

Multi-Hazard Actions

Mitigation Action	Educational Outreach
Objective	This action will create a program to educate the public about specific mitigation actions for all hazards, including but not limited to participation in Wildfire Fuels Reduction, Tornado Saferooms, Structural Hardening, etc.
Hazard	Hurricane/Tropical Storm, Flood, Wildfire, Tornado, Drought, Extreme Heat, Hailstorm, Extreme Cold, Winter Weather, Severe Winds, Lightning
Priority	High
Estimated Cost	Less than $10,000 per hazard
Potential Funding Source(s)	City of Madisonville, FEMA PDM, FEMA HMGP, FEMA FMA, TWDB
Responsible Department	Mayor and Council, City Administration
Implementation Schedule	1 - 5 Years
Target	Existing and future population

Mitigation Action	Implement a Tree Trimming Program
Objective	This action will develop and implement a tree trimming program to reduce wildfire fuels and minimize the amount of debris generated during natural hazard events. Projects may include but are not

	limited to trees along power lines within the jurisdiction that are connected to critical facilities and creating firebreaks.
Hazard	Hurricane/Tropical Storm, Wildfire, Tornado, Hailstorm, Winter Weather, Severe Winds
Priority	Medium
Estimated Cost	$10,000 - $500,0000
Potential Funding Source(s)	City of Madisonville, FEMA PDM, FEMA HMGP
Responsible Department	City Administration
Implementation Schedule	1 - 5 Years
Target	Existing and future infrastructure

Mitigation Action	**Purchase Back Up Power Generators**
Objective	Installing generators at critical facilities will help ensure physical safety for facility occupants and maintain electronic systems functionality during power outages. Portable generators will maintain additional systems functionality including but not limited to lift stations, pumps, and communications infrastructure.
Hazard	Hurricane/Tropical Storm, Flood, Wildfire, Tornado, Extreme Heat, Hailstorm, Extreme Cold, Winter Weather, Severe Winds, Lightning
Priority	Medium
Estimated Cost	More than $100,000 Each for Fixed Generators, Including Associated Engineering Costs. Less than $100,000 Each for Portable Generators
Potential Funding Source (s)	City of Madisonville, FEMA PDM, FEMA HMGP
Responsible Department	Mayor and Council, City Administration
Implementation Schedule	5 Years
Target	Existing infrastructure

Single Hazard Actions

Mitigation Action	**Upgrade Existing Drainage Pump Stations**
Objective	This action proposes upgrading existing drainage pump stations to reduce the potential impacts of future flood events.
Hazard	Riverine Flooding
Priority	Medium
Estimated Cost	$10,000 to $100,000

Potential Funding Source (s)	City of Madisonville, FEMA BRIC, FEMA HMGP, FEMA FMA, TWDB
Responsible Department	Mayor and Council, City Administration
Implementation Schedule	Medium Term: 3 – 5 Years
Target	Existing infrastructure

Mitigation Action	**Install Check Valves**
Objective	This action proposes installing check valves to prevent backflow and reduce the potential impacts of future flood events.
Hazard	Flood
Priority	Medium
Estimated Cost	$250,000
Potential Funding Source (s)	City of Madisonville, FEMA FMA, FEMA BRIC, FEMA HMGP
Responsible Department	Mayor and Council, City Administration
Implementation Schedule	Medium Term: 3-5 Years
Target	Existing infrastructure

Mitigation Action	**Create Drainage Master Plan**
Objective	This action proposes creating a drainage master plan for the City, in conjunction with the County, that will provide the City with a comprehensive planning document that provides basic information and necessary guidance for the county-wide drainage system, including but not limited to an H&H study.
Hazard	Flood
Priority	Low
Estimated Cost	Less than $100,000
Potential Funding Source (s)	City of Madisonville, FEMA BRIC, FEMA FMA, FEMA HMGP, CDBG-MIT
Responsible Department	Mayor and Council, City Administration
Implementation Schedule	5 Years
Target	Existing and future infrastructure

Mitigation Action	**Develop and Implement a New Water Conservation Ordinance**

Objective	Jurisdiction will re-evaluate all existing water conservation and reduction measures to identify strengths and weaknesses in order to develop and enforce a new water conservation ordinance.
Hazard	Drought
Priority	Low
Estimated Cost	Less than $10,000
Potential Funding Source (s)	City of Madisonville, FEMA PDM, FEMA HMGP
Responsible Department	Mayor and City Council
Implementation Schedule	Short Term – 1 - 5 Years
Target	Existing and future population and infrastructure

iii. City of Midway

Multi-Hazard Actions

Mitigation Action	**Educational Outreach**
Objective	This action will create a program to educate the public about specific mitigation actions for all hazards, including but not limited to participation in Wildfire Fuels Reduction, Tornado Saferooms, Structural Hardening, etc.
Hazard	Hurricane/Tropical Storm, Flood, Wildfire, Tornado, Drought, Extreme Heat, Hailstorm, Extreme Cold, Winter Weather, Severe Winds, Lightning
Priority	High
Estimated Cost	Less than $10,000 per hazard
Potential Funding Source(s)	City of Midway, FEMA PDM, FEMA HMGP, FEMA FMA, TWDB
Responsible Department	City Administration
Implementation Schedule	1 - 5 Years
Target	Existing and future population

Mitigation Action	**Implement a Tree Trimming Program**
Objective	This action will develop and implement a tree trimming program to reduce wildfire fuels and minimize the amount of debris generated during natural hazard events. Projects may include but are not limited to trees along power lines within the jurisdiction that are connected to critical facilities and creating firebreaks.
Hazard	Hurricane/Tropical Storm, Wildfire, Tornado, Hailstorm, Winter Weather, Severe Winds

Priority	Medium
Estimated Cost	$10,000 - $500,0000
Potential Funding Source(s)	City of Midway, FEMA PDM, FEMA HMGP
Responsible Department	City Administration
Implementation Schedule	1 - 5 Years
Target	Existing and future infrastructure

Mitigation Action	**Install Impact and Wind-resistant Windows and Doors at Public Facilities**
Objective	This action proposes hardening facilities. Hardening will include adding impact and wind-resistant doors and windows at critical and public facilities in the City.
Hazard	Hurricane / Tropical Storm, Tornados, Hailstorm, Severe Winds
Priority	Low
Estimated Cost	$100,000
Potential Funding Source(s)	City of Midway, FEMA PDM, FEMA HMGP
Responsible Department	City Administration, Mayor and City Council
Implementation Schedule	5 Years
Target	Existing infrastructure

Mitigation Action	**Purchase Back Up Power Generators**
Objective	Installing generators at critical facilities will help ensure physical safety for facility occupants and maintain electronic systems functionality during power outages. Portable generators will maintain additional systems functionality including but not limited to lift stations, pumps, and communications infrastructure.
Hazard	Hurricane/Tropical Storm, Flood, Wildfire, Tornado, Extreme Heat, Hailstorm, Extreme Cold, Winter Weather, Severe Winds, Lightning
Priority	Medium
Estimated Cost	More than $100,000 Each for Fixed Generators, Including Associated Engineering Costs. Less than $100,000 Each for Portable Generators
Potential Funding Source (s)	City of Midway, FEMA PDM, FEMA HMGP
Responsible Department	City Administration
Implementation Schedule	5 Years
Target	Existing infrastructure

Single Hazard Actions

Mitigation Action	**Develop and Implement a New Tie-Down Ordinance for Manufactured / Mobile Homes, Temporary Buildings, and Unrestrained Advertisement Signs**
Objective	Re-evaluate all existing tie-down measures to identify strengths and weaknesses in order to develop and enforce a new tie-down ordinance.
Hazard	Severe Winds
Priority	Low
Estimated Cost	Less than $10,000
Potential Funding Source (s)	City of Midway, FEMA PDM, FEMA HMGP
Responsible Department	City Administration
Implementation Schedule	Short Term - 1-5 Years
Target	Existing and future population and infrastructure

Mitigation Action	**Create Drainage Master Plan**
Objective	This action proposes creating a drainage master plan for the City, in conjunction with the County, that will provide the City with a comprehensive planning document that provides basic information and necessary guidance for the county-wide drainage system, including but not limited to an H&H study.
Hazard	Flood
Priority	Low
Estimated Cost	Less than $100,000
Potential Funding Source (s)	County, City of Midway, FEMA BRIC, FEMA FMA, FEMA HMGP, CDBG-MIT
Responsible Department	City Administration
Implementation Schedule	5 Years
Target	Existing and future infrastructure

Mitigation Action	**Develop and Implement a New Drought Contingency Plan**
Objective	Re-evaluate all existing drought control measures to identify strengths and weaknesses in order to develop and enforce a new or updated drought contingency plan.

Hazard	Drought
Priority	Medium
Estimated Cost	Less than $10,000
Potential Funding Source(s)	City of Midway, FEMA PDM, FEMA HMGP
Responsible Department(s)	Mayor and City Council
Implementation Schedule	1-5 Years
Target	Existing and future population and infrastructure

Mitigation Action	**Develop and Implement a New Water Conservation Ordinance**
Objective	Jurisdiction will re-evaluate all existing water conservation and reduction measures to identify strengths and weaknesses in order to develop and enforce a new water conservation ordinance.
Hazard	Drought
Priority	Low
Estimated Cost	Less than $10,000
Potential Funding Source (s)	City of Midway, FEMA PDM, FEMA HMGP
Responsible Department	Mayor and City Council
Implementation Schedule	Short Term – 1 - 5 Years
Target	Existing and future population and infrastructure

Mitigation Action	**Install Surge Protection and Grounding Systems to Protect Electronic Assets**
Objective	This action will install surge protection at all City facilities to prevent damage to critical electronic devices including but not limited to: computers, servers, audio/visual equipment, laboratory equipment, and appliances.
Hazard	Lightning
Priority	Medium
Estimated Cost	$1,000 - $100,000
Potential Funding Source (s)	City of Midway, FEMA PDM, FEMA HMGP
Responsible Department	City Administration
Implementation Schedule	1 - 5 Years
Target	Existing infrastructure

Mitigation Action	Set up Cooling and Heating Centers in Existing Facilities
Objective	The action's goal is to increase extreme heat resilience by limiting vulnerable populations' exposure to extreme heat by creating new, or opening up existing facilities as cooling centers or warming centers.
Hazard	Extreme Heat & Extreme Cold
Priority	Medium
Estimated Cost	Less than $10,000
Potential Funding Source(s)	City of Midway, FEMA PDM, FEMA HMGP
Responsible Department(s)	City Administration
Implementation Schedule	1 - 5 Years
Target	Existing and future population

iv. North Zulch MUD

Multi-Hazard Actions

Mitigation Action	Educational Outreach
Objective	This action will create a program to educate the public about specific mitigation actions for all hazards, including but not limited to participation in Wildfire Fuels Reduction, Tornado Saferooms, Structural Hardening, etc.
Hazard	Hurricane/Tropical Storm, Flood, Wildfire, Tornado, Drought, Extreme Heat, Hailstorm, Extreme Cold, Winter Weather, Severe Winds, Lightning
Priority	Medium
Estimated Cost	Less than $10,000 per hazard
Potential Funding Source (s)	NZMUD, FEMA PDM, FEMA HMGP, FEMA FMA, TWDB
Responsible Department	NZMUD Director
Implementation Schedule	1 - 5 Years
Target	Existing and future population

Mitigation Action	Purchase Back Up Power Generators
Objective	Installing generators at critical facilities will help ensure physical safety for facility occupants and maintain electronic systems functionality during power outages. Portable generators will

	maintain additional systems functionality including but not limited to lift stations, pumps, and communications infrastructure.
Hazard	Hurricane/Tropical Storm, Flood, Wildfire, Tornado, Extreme Heat, Hailstorm, Extreme Cold, Winter Weather, Severe Winds, Lightning
Priority	High
Estimated Cost	More than $100,000 Each for Fixed Generators, Including Associated Engineering Costs. Less than $100,000 Each for Portable Generators
Potential Funding Source (s)	NZMUD, FEMA PDM, FEMA HMGP
Responsible Department	NZMUD Director
Implementation Schedule	5 Years
Target	Existing infrastructure

Mitigation Action	**Develop and Implement a New Drought Contingency Plan**
Objective	Re-evaluate all existing drought control measures to identify strengths and weaknesses in order to develop and enforce a new or updated drought contingency plan.
Hazard	Drought
Priority	Medium
Estimated Cost	Less than $10,000
Potential Funding Source (s)	NZMUD, FEMA PDM, FEMA HMGP
Responsible Department	NZMUD Director
Implementation Schedule	1-5 Years
Target	Existing and future population and infrastructure

Mitigation Action	**Implement a Tree Trimming Program**
Objective	This action will develop and implement a tree trimming program to reduce wildfire fuels and minimize the amount of debris generated during natural hazard events. Projects may include but are not limited to trees along power lines within the jurisdiction that are connected to critical facilities and creating firebreaks.
Hazard	Hurricane/Tropical Storm, Wildfire, Tornado, Hailstorm, Extreme Cold, Winter Weather, Severe Winds
Priority	High
Estimated Cost	$10,000 - $500,0000
Potential Funding Source (s)	NZMUD, FEMA PDM, FEMA HMGP

Responsible Department	NZMUD Director
Implementation Schedule	1 - 5 Years
Target	Existing and future infrastructure

Single Hazard Actions

Mitigation Action	**Install Check Valves**
Objective	This action proposes installing check valves to prevent backflow and reduce the potential impacts of future flood events.
Hazard	Flood
Priority	Medium
Estimated Cost	$250,000
Potential Funding Source (s)	NZMUD, FEMA FMA, FEMA BRIC, FEMA HMGP
Responsible Department	NZMUD Director
Implementation Schedule	Medium Term: 3-5 Years
Target	Existing infrastructure