DALLAS COUNTY
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Dallas County
Hazard Mitigation Plan

2023

Plan developed for Dallas County Emergency Management

by JEO Consulting Group

Hazard Mitigation Planning Team

Name	Title	Jurisdiction
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Josh Heward	Emergency Management Specialist	Dallas County Emergency Management Agency
Bob Ockerman	Council Member	City of Adel
Chad Leonard	Sheriff	Dallas County
Clint Robinson	Fire Chief	Waukee Fire Department
Craig Leu	Fire and EMS Chief	West Des Moines Fire Department
Jim Clark	Fire Chief	Johnston-Grimes Fire Department
Karl Harris	Assistant Fire Chief	Woodward/Bouton Fire Department
Matt Cavanaugh	City Commission/Fire Chief	City of Woodward/ Woodward Fire Department
Robin Wolfe	Clerk	City of Dawson
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**Served in a consultant or advisory role.*

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List of Acronyms

ACS – American Community Survey
BRIC – Building Resilient Infrastructure and Communities
CDC – Centers for Disease Control and Prevention
CEP – Comprehensive Emergency Plan
CF – Cubic Feet
CFR – Code of Federal Regulations
COVID-19 – Coronavirus Disease 2019
CRS – Community Rating System
CWPP – Community Wildfire Protection Plans
CyanoHABs – Cyanobacterial Harmful Algae Blooms
DMA 2000 – Disaster Mitigation Act of 2000
EAB – Emerald Ash Borer
EAP – Emergency Action Plan
EMA – Emergency Management Agency
EPA – Environmental Protection Agency
ESL – English as Second Language
FBI – Federal Bureau of Investigation
FEMA – Federal Emergency Management Agency
FIRM – Flood Insurance Rate Map
FMA – Flood Mitigation Assistance Program
FR – FEMA's Final Rule
GIS – Geographic Information Systems
HMA – Hazard Mitigation Assistance
HMGP – Hazard Mitigation Grant Program
HMP – Hazard Mitigation Plan
HPSA – Health Professional Shortage Areas
HPRCC – High Plains Regional Climate Center
HRSA – Health Resources and Services Administration
HSEMD – Iowa Department of Homeland Security and Emergency Management
IDALS – Iowa Department of Agriculture & Land Stewardship
IDNR – Iowa Department of Natural Resources
JEO – JEO Consulting Group, Inc.
LGA – Liquid Gallons
MUA – Medically Underserved Areas
MUP – Medically Underserved Populations
NCEI – National Centers for Environmental Information
NDMC – National Drought Mitigation Center
NFIP – National Flood Insurance Program
NOAA – National Oceanic and Atmospheric Administration
NPI – Nonpharmaceutical Interventions
NRC – National Response Center
NWS – National Weather Service
PDSI – Palmer Drought Severity Index
PHMSA – U.S. Pipeline and Hazardous Material Safety Administration
Risk MAP – Risk Mapping, Assessment, and Planning
RMA – Risk Management Agency
SBA – Small Business Administration
SPIA – Sperry-Piltz Ice Accumulation Index
START – National Consortium for the Study of Terrorism and Responses to Terrorism
TORRO – Tornado and Storm Research Organization
USACE – United States Army Corps of Engineers
USDA – United States Department of Agriculture
USGS – United States Geological Survey
WHO – World Health Organization
WUI – Wildland Urban Interface

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Executive Summary

Introduction

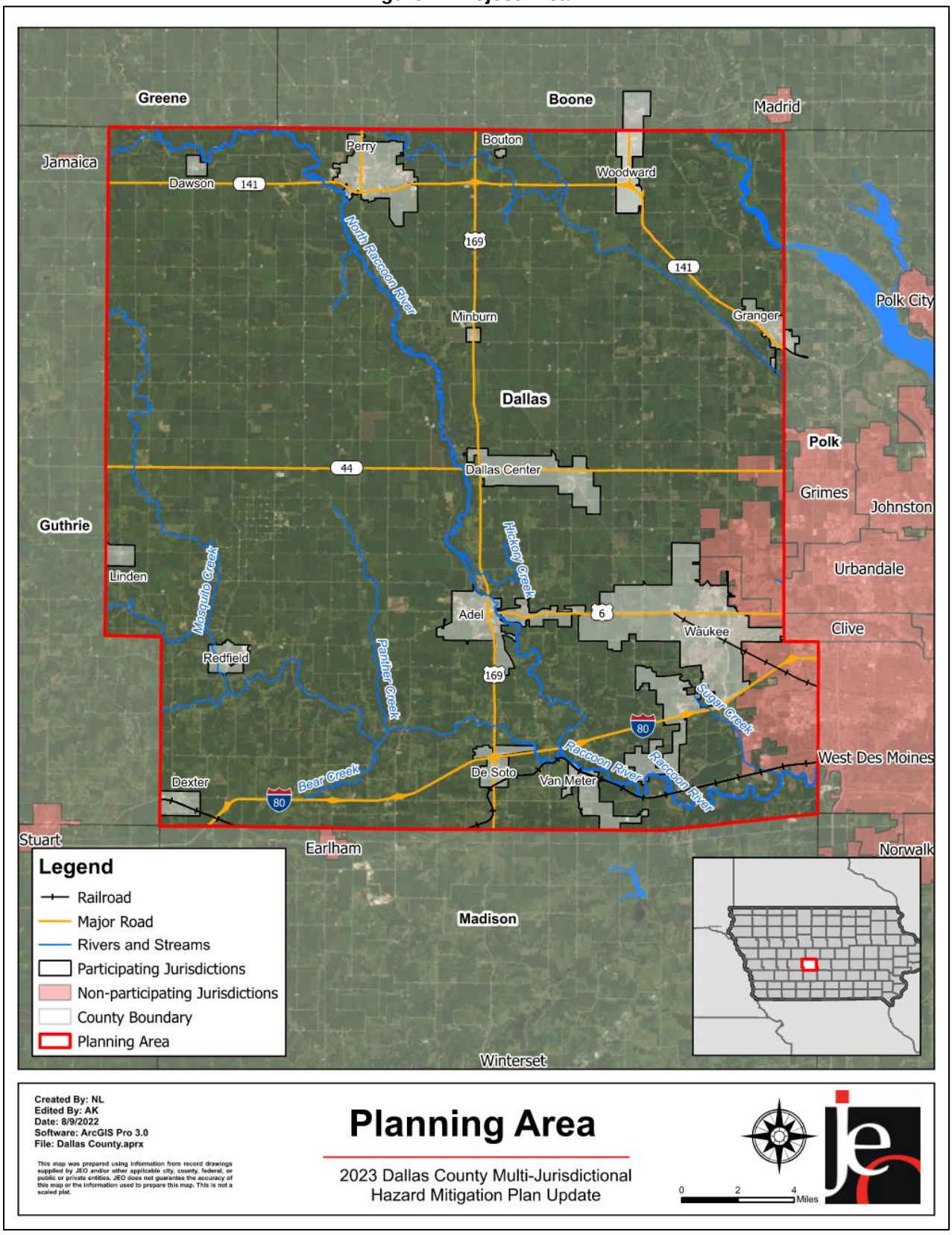
This plan is an update to the Dallas County Hazard Mitigation Plan (HMP) approved in 2018. The plan update was developed in compliance with the requirements of the Disaster Mitigation Act of 2000 (DMA 2000).

Hazard mitigation planning is a process in which hazards are identified and profiled; people and facilities at-risk are identified and assessed for threats and potential vulnerabilities; and strategies and mitigation measures are identified. Hazard mitigation planning increases the ability of communities to effectively function in the face of natural and human-caused disasters. The goal of the process is to reduce risk and vulnerability, in order to lessen impacts to life, the economy, and infrastructure. Plan participants are listed in the following table and illustrated in the following planning area map.

Table 1: Participating Jurisdictions

Participating Jurisdictions	
Dallas County	City of Waukee
City of Adel	City of Woodward
City of Bouton	Adel-DeSoto-Minburn School District
City of Dallas Center	Dallas Center-Grimes School District
City of Dawson	Perry Community School District
City of De Soto	Perry Water Works
City of Dexter	Van Meter School District
City of Granger	Waukee School District
City of Linden	West Central Valley School District
City of Minburn	Woodward-Granger School District
City of Perry	Woodward Township Fire District
City of Redfield	Xenia Rural Water District
City of Van Meter	

Figure 1: Project Area



Goals

The potential for disaster losses and the probability of occurrence of natural and human-caused hazards present a significant concern for the jurisdictions participating in this plan. The driving motivation behind this hazard mitigation plan is to reduce vulnerability and the likelihood of impacts to the health, safety, and welfare of all citizens in the planning area. To this end, the Hazard Mitigation Planning Team reviewed and approved goals which helped guide the process of identifying both broad-based and community-specific mitigation strategies and projects that will, if implemented, reduce their vulnerability and help build stronger, more resilient communities.

Goals from the 2018 HMP were reviewed, and the Hazard Mitigation Planning Team agreed that they are still relevant and applicable for this plan update. Jurisdictions that participated in this plan update agreed that the goals identified in 2018 would be carried forward and utilized for the 2023 plan, with just a couple slight modifications. The term “natural hazards” was changed to “all hazards” to provide further clarification, and the order was changed to list the fourth goal first, to reflect the priority of protecting people. The goals for this plan update are as follows:

Goal 1: Prevent or reduce the impact of all hazards for the residents, businesses, and jurisdictions of Dallas County.

Goal 2: Protect critical facilities and infrastructure from all hazards.

Goal 3: Create a disaster resistant community by improving public understanding of all hazards and risk by providing public awareness, preparedness, and mitigation information through various channels of communication.

Goal 4: Improve capabilities to mitigate all hazards by incorporating mitigation strategies in plans, policies, and programs.

Goal 5: Strengthen communication among governmental agencies and between governmental agencies and the public.

Summary of Changes

The hazard mitigation planning process undergoes several changes during each plan update to best accommodate the planning area and specific conditions. Changes from the 2018 Hazard Mitigation Plan and planning process in this update included combined risk assessment for hazards with similar risks, impacts and mitigation strategies. These include Extreme Temperature (now includes extreme cold) and Flooding (includes flash flooding and riverine flooding). Other changes include the addition of Hazardous Materials Release and Human Infectious Diseases, as well as the inclusion of Plan Maintenance sections for individual community profiles.

This update also works to unify the various planning mechanisms in place throughout the participating communities (i.e., comprehensive plans, local emergency operation plans, zoning ordinances, building codes, etc.) to ensure that the goals and objectives identified in those planning mechanisms are consistent with the strategies and projects included in this plan. Other changes were made based on comments from the 2018 Review Tool:

Table 2: 2018 Plan Comments and Revisions

Comment from 2018 Review Tool	Location of Revision	Summary of Change
Hazard scoring methodology (pg. 3.10): There is some inherent conflict between the chosen scales of Magnitude/Severity and Duration as the Magnitude/Severity scale includes a measure of how long the hazard will impact the jurisdiction ("less than 24 hrs, more than a week, at least 2 weeks and more than 30 days"), which do not correspond to the Duration timeframes ("less than 6 hrs, less than 1 day, less than 1 week, more than 1 week").	Section 3, Section 6	Hazard scoring has been replaced with a hazard prioritization system. This scale consists of Low, Medium, and High priority.
The definitions of "Critical, Essential, High Potential Loss and Transportation/Lifeline Facilities" are similar, making it difficult to identify the differences between each. The definitions could benefit from examples of each or table 3.10 (pg. 3.19) could sort the 17 listed facility types into which are Critical, Essential, High Potential Loss and Transportation Lifeline.	Section 3, Section 6	Community Lifelines are now split into Transportation Facilities, Hazardous Materials Facilities, Health/Medical Facilities, and Critical Facilities. Critical Facilities can include the other types of facilities if the community deems them vital for disaster response.
In 2015 and 2017, the County was part of the Middle Des Moines and North Raccoon Watershed RiskMAP projects, which included development of a number of Flood Risk Products such as a Flood Risk Database and Flood Risk Report; the planning team is highly encouraged to make use of this information in future updates and to integrate the goals of RiskMAP with mitigation planning.	Section 4: Flooding	RiskMAP products/projects are now included.

Additional changes and a summary of the planning process are described in *Section Two: Planning Process*.

Plan Implementation

Various communities across the planning area have implemented hazard mitigation and strategic projects following the 2018 Hazard Mitigation Plan. A few examples of completed projects include warning sirens, backup generators, storm water drainage improvements, safe room, new water storage facility, and others In order to build upon these prior successes and to continue implementation of mitigation and strategic projects, despite limited resources, communities will need to continue relying upon multi-agency coordination as a means of leveraging resources. Communities across the region have been able to work with a range of entities to complete projects; potential partners for future project implementation include but are not limited to: Iowa Department of Homeland Security and Emergency Management (HSEMD), Iowa Department of Transportation (IDOT), Iowa Department of Natural Resources (IDNR), United States Department of Agriculture (USDA), and United States Army Corps of Engineers (USACE).

Hazard Profiles

The hazard mitigation plan includes a description of the hazards considered, including a risk and vulnerability assessment. Data considered during the risk assessment process included: historic occurrences and recurrence intervals; historic losses (physical and monetary); impacts to the built environment (including privately-owned structures as well as critical facilities); and the local risk assessment. The following tables provide an overview of the risk assessment for each hazard and the losses associated with each hazard. See *Section Four: Risk Assessment* for further discussion of counts, probabilities, and likely extent.

Table 3: Regional Risk Assessment

Hazard	Previous Occurrences	Approximate Annual Probability*	Likely Extent
Animal and Plant Disease	Animal Disease: 1	N/A	Unknown
	Plant Disease: 3	Plant Disease 3/22 = 14%	Crop damage or loss
Dam and Levee Failure	0	Less than 1%	Varies by structure
Drought	441/1,527 months	29%	D1-D4
Earthquake	0	Less than 1%	Less than 5.0 on the Richter Scale
Expansive Soils	Unknown	Unknown	Varies by event
Extreme Temperature	Cold: Avg 6 days/year	78/83 = 94%	Max Temp ≤10°F
	Heat: Avg 1 day/year	29/83 = 39%	Max Temp ≥100°F
Flooding	172	21/26 =81%	Some inundation of structures. Some evacuations of people may be necessary.
Grass/Wildfire	10	3/3 = 100%	Avg 22 acres Some homes and structures threatened or at risk
Hazardous Materials Release	Fixed Site Spill: 50	21/32 = 32%	Avg Liquid Spill: 217 gallons Avg Gas Spill: 300 lbs.
	Transportation Spill: 6	22/51 = 43%	Avg Liquid Spill: 182 gallons
Human Infectious Diseases	26,057 Covid cases	N/A	N/A
Infrastructure Failure	Unknown	Unknown	Varies by event
Landslide	Unknown	Unknown	Varies by event
Severe Thunderstorms	650	26/26= 100%	>1” rainfall Avg 66 mph winds
Severe Winter Storms	79	25/26 = 96%	2-16” snow 10-60 mph winds
Sinkhole	Unknown	Unknown	Varies by location/event
Terrorism and Civil Unrest	0	Less than 1%	Varies by event

Hazard	Previous Occurrences	Approximate Annual Probability*	Likely Extent
Tornado and Windstorm	Tornadoes: 31	17/26 = 65%	Mode: EF0 Range: EF0-EF1
	Windstorms: 31	18/26 = 69%	Avg: 55 mph Range 40-70 mph
Transportation Incident	Auto: 11,512	11/11 = 100%	Damages incurred to vehicles involved and traffic delays; substantial damages to aircrafts involved with some aircrafts destroyed
	Aviation: 9	8/60 = 13%	
	Rail: 31	19/47 = 40%	

** Annual Probability = Total Years with an Event Occurrence / Total Years of Record*

The following table provides loss estimates for hazards with sufficient data. Description of major events are included in *Section Seven: Community Profiles.*

Table 4: Hazard Loss Estimates for the Planning Area

Hazard Type		Count	Property	Crop[1]
Animal and Plant Disease	Animal Disease[16]	1	48 birds	N/A
	Plant Disease[1]	3	N/A	$5,056
Dam and Levee Failure[2,10]		0	-	N/A
Drought[3,6]		441/1,527 months	$12,650,000	$47,719,440
Earthquake[4]		0	-	-
Expansive Soils		Unknown	N/A	N/A
Extreme Temperature[5]	Cold (Max Temp ≤10°F)	Avg 6 days per year	N/A	$4,580
	Heat (Max Temp ≥100°F)	Avg 1 day per year	N/A	$558,530
Flooding[6]	Flash Flood	52	$2,020,000	$1,023,979
	Flood	120	$8,938,070	
Grass/Wildfire[7]		10	222 Acres	-
Hazardous Materials Release *9 Injuries, 3 deaths*	Fixed Site[8]	50	$0	N/A
	Transportation[9]	6	$182,140	N/A
Human Infectious Diseases[15] *154 deaths (Covid)*		26,057 Covid cases	N/A	N/A
Infrastructure Failure		Unknown	N/A	N/A
Landslide		Unknown	N/A	N/A
Severe Thunderstorms[6]	Hail	217	$813,000	$18,026,126
	Heavy Rain	134	$20,000	
	Lightning	11	$1,147,000	
	Thunderstorm Wind	288	$8,540,000	
Severe Winter Storms[6] *4 injuries*	Blizzard	14	$900,000	$374,815
	Heavy Snow	24	$4,290,450	
	Ice Storm	12	$848,330	

Hazard Type		Count	Property	Crop[1]
	Winter Storm	28	$574,900	
	Winter Weather	1	$0	
Sinkhole		Unknown	N/A	N/A
Terrorism and Civil Unrest[11]		0	-	N/A
Tornado and Windstorm[6]	Tornadoes: Mode: EF0 Range: EF0-EF3	31	$3,604,000	$0
	Windstorms: Average: 55 mph Range: 40-70 mph	31	$958,110	$15,560,764
Transportation Incident	Auto[12] *1,522 injuries, 53 deaths*	11,472	$76,326,109	N/A
	Aviation[13] *5 injuries, 2 deaths*	9	N/A	N/A
	Rail[14] *17 injuries, 3 deaths*	31	$300,148	N/A
Total		**12,545**	**$122,112,257**	**$83,273,290**

N/A: Data not available
1 USDA RMA, 2000 - 2021
2 IDNR Communication, 2022
3 NOAA, 1895 - March 2022
4 USGS, 1900 - April 2022
5 NOAA Regional Climate Center, 1939 - 2021
6 NCEI, 1996 - 2021
7 IDNR, 2019 - 2021
8 NRC, 1990 - 2021
9 PHMSA 1971 - April 2022
10 USACE NLD, 1900 - April 2022
11 University of Maryland, 1970 - 2018
12 IDOT, 2012 - April 2022
13 NTSB, 1962 - April 2022
14 FRA, 1975 - 2021
15 IDPH, as of 11/22/2022
16 IDALS, 11/22/2022

Events like extreme temperatures, grass/wildland fires, severe thunderstorms, severe winter storms, and transportation incidents will occur annually. Other hazards like dam and levee failure, earthquakes, and terrorism/civil unrest will occur less often. The scope of events and how they will manifest themselves locally is not known regarding hazard occurrences. Historically, drought, severe thunderstorms, severe winter storms, tornadoes/windstorms, and transportation incidents have resulted in the most significant damages within the planning area. Current trends show an increase in event magnitude and a higher number of occurrences for several hazards, as will be explained in *Section Four: Risk Assessment*.

Mitigation Strategies

There are a wide variety of strategies that can be used to reduce the impacts of hazards for the built environment and planning area residents. *Section Five: Mitigation Strategy* shows the mitigation and strategic actions chosen by the participating jurisdictions to assist in preventing future losses.

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Section One: Introduction

Hazard Mitigation Planning

Severe weather and hazardous events are occurring more frequently in our daily lives. Pursuing mitigation strategies reduces these risks and is socially and economically responsible to prevent long-term risks from natural and human-caused hazard events.

FEMA definition of Hazard Mitigation

"Any sustained action taken to reduce or eliminate the long-term risk to human life and property from [natural] hazards."

Natural hazards, such as severe winter storms, high winds and tornadoes, severe thunderstorms, flooding, extreme heat, drought, agriculture diseases, and wildfires are part of the world around us. Human-caused hazards are a product of the society and can occur with significant impacts to communities. Human-caused hazards can include dam failure, hazardous materials release, transportation incidents, and terrorism. These hazard events can occur as a part of normal operation or as a result of human error. All jurisdictions participating in this planning process are vulnerable to a wide range of natural and human-caused hazards that threaten the safety of residents and have the potential to damage or destroy both public and private property, cause environmental degradation, and disrupt the local economy and overall quality of life.

Dallas County has prepared this multi-jurisdictional hazard mitigation plan in an effort to reduce impacts from natural and human-caused hazards and to better protect the people and property of the region from the effects of these hazards. This plan demonstrates a regional commitment to reducing risks from hazards and serves as a tool to help decision makers establish mitigation activities and resources. Further, this plan was developed to ensure the county and participating jurisdictions are eligible for federal Hazard Mitigation Assistance (HMA) programs and to accomplish the following objectives:

- Minimize the disruption to each jurisdiction following a disaster.
- Establish actions to reduce or eliminate future damages in order to efficiently recover from disasters.
- Investigate, review, and implement activities or actions to ensure disaster related hazards are addressed by the most efficient and appropriate solution.
- Educate citizens about potential hazards.
- Facilitate development and implementation of hazard mitigation management activities to ensure a sustainable community.

Disaster Mitigation Act of 2000

The U.S. Congress passed the Disaster Mitigation Act 2000 to amend the Robert T. Stafford Disaster Relief and Emergency Assistance Act[1]. Section 322 of the DMA 2000 requires that state and local governments develop, adopt, and routinely update a hazard mitigation plan to remain eligible for pre- and post-disaster mitigation funding.[2] These funds currently include the Hazard Mitigation Grant Program (HMGP)[3], Building Resilient Infrastructure and Communities (BRIC)[4], and the Flood Mitigation Assistance Program (FMA)[5]. The Federal Emergency Management Agency (FEMA) administers these programs under the Department of Homeland Security.[6]

This plan was developed in accordance with current state and federal rules and regulations governing local hazard mitigation plans. The plan shall be monitored and updated on a routine basis to maintain compliance with the legislation – Section 322, Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as enacted by Section 104 of the DMA 2000 (P.L. 106-390)[7] and by FEMA's Final Rule (FR)[8] published in the Federal Register on November 30, 2007, at 44 Code of Federal Regulations (CFR) Part 201.

Hazard Mitigation Assistance

On June 1, 2009, FEMA initiated the Hazard Mitigation Assistance (HMA) program integration, which aligned certain policies and timelines of the various mitigation programs. These HMA programs present a critical opportunity to minimize the risk to individuals and property from hazards while simultaneously reducing the reliance on federal disaster funds.

Each HMA program is funded by separate legislative actions, and as such, each program differs slightly in scope and intent.

Mitigation is the cornerstone of emergency management. Mitigation focuses on breaking the cycle of disaster damage, reconstruction, and repeated damage. Mitigation lessens the impact disasters have on people's lives and property through damage prevention, appropriate development standards, and affordable flood insurance. Through measures such as avoiding building in damage-prone areas, stringent building codes, and floodplain management regulations, the impact on lives and communities is lessened.
- FEMA Mitigation Directorate

- **HMGP:** To qualify for post-disaster mitigation funds, local jurisdictions must have adopted a mitigation plan that is approved by FEMA. HMGP provides funds to states, territories, Indian tribal governments, local governments, and eligible private non-profits following a presidential disaster declaration. The DMA 2000 authorizes up to seven percent of HMGP

[1] Federal Emergency Management Agency, Public Law 106-390. 2000. "Disaster Mitigation Act of 2000." https://www.fema.gov/sites/default/files/2020-11/fema_disaster-mitigation-act-of-2000_10-30-2000.pdf.
[2] Federal Emergency Management Agency. 2021. "Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended, and Related Authorities." Federal Emergency Management Agency 592: 22. Sec. 322. Mitigation Planning (42 U.S.C. 5165). https://www.fema.gov/sites/default/files/documents/fema_stafford_act_2021_vol1.pdf.
[3] Federal Emergency Management Agency. "Hazard Mitigation Grant Program." Last modified August 6, 2021. https://www.fema.gov/grants/mitigation/hazard-mitigation.
[4] Federal Emergency Management Agency. "Building Resilient Infrastructure and Communities." Last modified December 1, 2021. https://fema.gov/bric.
[5] Federal Emergency Management Agency. "Flood Mitigation Assistance Grant Program." Last modified August 6, 2021. https://www.fema.gov/flood-mitigation-assistance-grant-program.
[6] Federal Emergency Management Agency. "Hazard Mitigation Assistance." Last modified September 30, 2021. https://www.fema.gov/grants/mitigation.
[7] Federal Emergency Management Agency: Federal Register. 2002. "Section 104 of Disaster Mitigation Act 2000: 44 CFR Parts 201 and 206: Hazard Mitigation Planning and Hazard Mitigation Grant Programs; Interim Final Rule." https://www.fema.gov/pdf/help/fr02-4321.pdf.
[8] Federal Emergency Management Agency: Federal Register. 2002. "44 CFR Parts 201 and 206: Hazard Mitigation Planning and Hazard Mitigation Grant Programs; Interim Final Rule." https://www.fema.gov/pdf/help/fr02-4321.pdf.

funds available to a state after a disaster to be used for the development of state, tribal, and local mitigation plans.

- **FMA:** To qualify to receive FMA funds to reduce or eliminate risk of repetitive flood damage to buildings and structures, local jurisdictions must have an adopted and approved mitigation plan. Furthermore, local jurisdictions must be participating communities in the National Flood Insurance Program (NFIP). The goal of FMA is to reduce or eliminate claims under the NFIP.

- **BRIC:** To qualify for funds, local jurisdictions must adopt a mitigation plan that is approved by FEMA. BRIC assists states, territories, Indian tribal governments, and local governments in implementing a sustained pre-disaster hazard mitigation program.

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Section Two: Planning Process

Introduction

The process utilized to develop a hazard mitigation plan is often as important as the final planning document. For this planning process, Dallas County adapted the four-step hazard mitigation planning process outlined by FEMA to fit the needs of the participating jurisdictions. The following pages will outline how the Hazard Mitigation Planning Team was established; the function of the Hazard Mitigation Planning Team; critical project meetings and community representatives; outreach efforts to the general public; key stakeholders and neighboring jurisdictions; general information relative to the risk assessment process; general information relative to local/regional capabilities; plan review and adoption; and ongoing plan maintenance.

Requirement §201.6(b): Planning process. An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:

Requirement §201.6(b)(1): An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;

Requirement §201.6(b)(2): An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and

Requirement §201.6(b)(3): Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

Requirement §201.6(c)(1): The plan shall document the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

Multi-Jurisdictional Approach

According to FEMA, “A multi-jurisdictional hazard mitigation plan is a plan jointly prepared by more than one jurisdiction.” The term ‘jurisdiction’ means ‘local government.’ Title 44 Part 201, Mitigation Planning in the CFR, defines a ‘local government’ as “any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments, regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization, any rural community, unincorporated town or village, or other public entity.” For the purposes of this plan, a ‘taxing authority’ was utilized as the qualifier for jurisdictional participation. FEMA recommends the multi-jurisdictional approach under the DMA 2000 for the following reasons.

- It provides a comprehensive approach to the mitigation of hazards that affect multiple jurisdictions.
- It allows economies of scale by leveraging individual capabilities and sharing cost and resources.
- It avoids duplication of efforts.
- It imposes an external discipline on the process.

Both FEMA and HSEMD recommend this multi-jurisdictional approach through the cooperation of counties and regional emergency management. Dallas County utilized the multi-jurisdiction planning process recommended by FEMA (Local Mitigation Plan Review Guide[9], Local Mitigation Planning Handbook[10], and Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards[11]) to develop this plan.

Hazard Mitigation Planning Process

The hazard mitigation planning process as outlined by FEMA has four general steps which are detailed below. The mitigation planning process is rarely a linear process. It's common that ideas developed during the initial risk assessment may need revision later in the process, or that additional information may be identified while developing the mitigation plan or during plan implementation that results in new goals or additional risk assessments.

Organization of Resources

- Focus on the resources needed for a successful mitigation planning process. Essential steps include: Organizing interested community members; and Identifying technical expertise needed.

Assessment of Risk

- Identify the characteristics and potential consequences of the hazard. Identify how much of the jurisdiction can be affected by specific hazards and the potential impacts on local assets.

Mitigation Plan Development

- Determine priorities and identify possible solutions to avoid or minimize the undesired effects. The result is the hazard mitigation plan and strategy for implementation.

Plan Implementation and Progress Monitoring

- Bring the plan to life by implementing specific mitigation and strategic projects and changing day-to-day operations. It is critical that the plan remains relevant to succeed. Thus, it is important to conduct periodic evaluations and revisions, as needed.

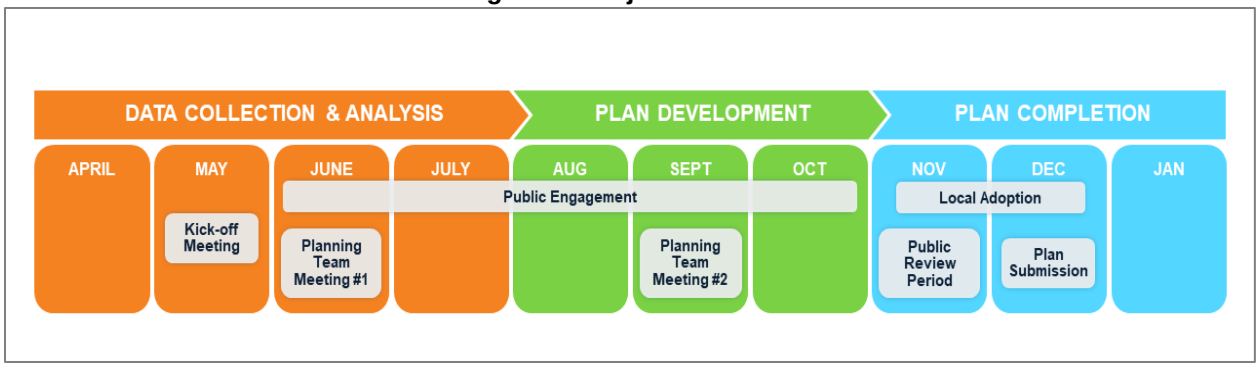
Organization of Resources

Plan Update Process

While the Dallas County Emergency Management Agency (EMA) applied for HMGP funding for their multi-jurisdictional hazard mitigation plan in fiscal year 2020, the final grant approval and allocation of funds were not available in time for plan kickoff. As a result, the EMA funded this planning effort entirely through its general EMA budget. JEO Consulting Group, Inc. (JEO) was contracted in March 2022 to guide and facilitate the planning process and write and assemble the multi-jurisdictional hazard mitigation plan. For the planning area, AJ Seely with Dallas County EMA led the development of the plan and served as the primary point of contact throughout the project. A clear timeline of this plan update process is provided in Figure 2.

[9] Federal Emergency Management Agency. 2011. "Local Mitigation Plan Review Guide." https://www.fema.gov/sites/default/files/2020-06/fema-local-mitigation-plan-review-guide_09_30_2011.pdf.
[10] Federal Emergency Management Agency. 2013. "Local Mitigation Planning Handbook." https://www.fema.gov/sites/default/files/2020-06/fema-local-mitigation-planning-handbook_03-2013.pdf.
[11] Federal Emergency Management Agency. 2013. "Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards." https://www.fema.gov/sites/default/files/2020-06/fema-mitigation-ideas_02-13-2013.pdf.

Figure 2: Project Timeline



Planning Team

At the beginning of the planning process, Dallas County Emergency Management and JEO staff identified who would be the regional Hazard Mitigation Planning Team. This planning team was established to guide the planning process, review the existing plan, and serve as a liaison to plan participants throughout the planning area. A list of planning team members can be found in Table 5. Staff from IDNR provided additional technical support.

Table 5: Hazard Mitigation Planning Team

Name	Title	Jurisdiction
AJ Seely	Emergency Management Director	Dallas County EMA
Josh Heward	Emergency Management Specialist	Dallas County EMA
Bob Ockerman	Council Member	City of Adel
Chad Leonard	Sheriff	Dallas County
Clint Robinson	Fire Chief	Waukee Fire Department
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***Claire Patton**	Planning Intern	JEO Consulting Group, Inc.

**Served in a consultant or advisory role.*

A kick-off meeting was held on May 9, 2022, to discuss an overview of the planning process between JEO staff and members of the Hazard Mitigation Planning Team. Preliminary discussion was held over hazards to be included in this plan, changes to be incorporated since the last plan, goals, identification of key stakeholders to include in the planning process, and a general schedule for the plan update. This meeting also assisted in clarifying the role and responsibilities of the Hazard Mitigation Planning Team and strategies for public engagement throughout the planning process.

Table 6 shows kick-off meeting attendees.

Table 6: Kick-off Meeting Attendees

Name	Title	Jurisdiction
Adel, Iowa – Monday, May 9, 2022		
AJ Seely	Emergency Management Director	Dallas County EMA
Josh Heward	Emergency Management Specialist	Dallas County EMA
Bob Ockerman	Council Member	City of Adel
Chad Leonard	Sheriff	Dallas County
Clint Robinson	Fire Chief	Waukee Fire Department
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Jim Clark	Fire Chief	Johnston-Grimes Fire Department
Karl Harris	Assistant Fire Chief	Woodward/Bouton Fire Department
Becky Appleford	Project Manager	JEO Consulting Group, Inc.
Anthony Kohel	Planner	JEO Consulting Group, Inc.
Claire Patton	Planning Intern	JEO Consulting Group, Inc.

Table 7 shows the date, location, and agenda items of for the kick-off meeting.

Table 7: Kick-off Meeting Location and Time

Location and Time	Agenda Items
Adel, Iowa May 9, 2022 1:00 PM	-Consultant and planning team responsibilities -Overview of plan update process and changes from 2018 HMP -Review and adoption of goals -Plan goals -Hazard identification -Project schedule and dates/locations for public meetings

Public Involvement and Outreach

To notify and engage the public in the planning process, a wide range of stakeholder groups were contacted and encouraged to participate. There were 36 stakeholder groups or entities that were identified and sent letters to participate (Table 10). Of the 36 invited, Adel Iowa Chamber of Commerce, Alliant Energy, Dallas County Hospital, Iowa State University Extension, and UnityPoint Health attended meetings. Any comments these stakeholders provided were incorporated into the appropriate community profiles (see *Section Seven*).

The general public was encouraged to take part in the planning process through a public survey. The survey was distributed by participating jurisdictions and was also made available online. Between May and September 2022, 34 survey responses were collected.

Questions about hazards, past events, priorities for mitigation, and what community members would like to see done locally were asked through the survey. In total, 34 survey responses were collected, with all respondents being residents within the county. The first questions ask respondents to indicate whether they are residents and what location they live. Communities represented are provided in Table 8.

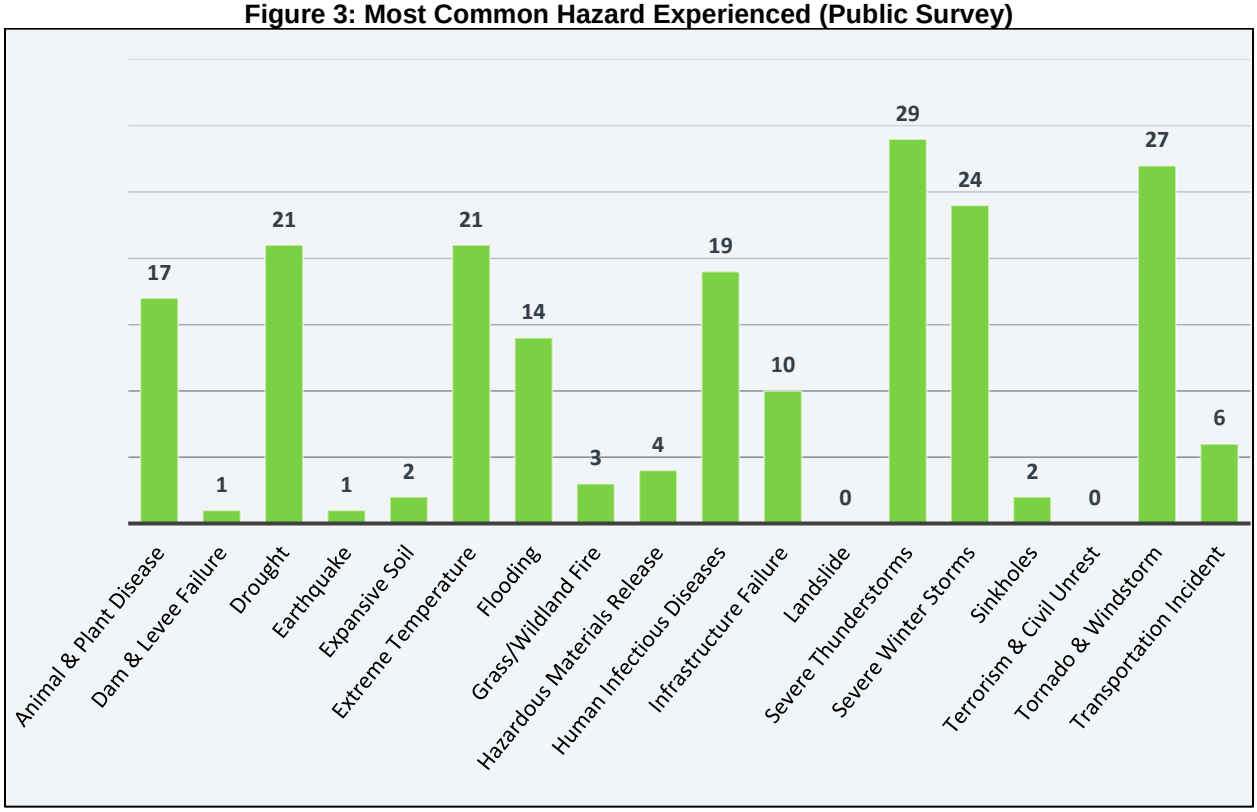
Table 8: Communities Represented in Public Survey

Communities Represented	
City of Adel	City of Clive
City of Dallas Center	City of Dawson
City of Perry	City of Urbandale
City of Van Meter	City of Waukee
City of West Des Moines	City of Woodward
Unincorporated Dallas County/Dallas County Officials	Dallas Center-Grimes School District

Overall respondent results are summarized below. Specific concerns or comments can be found in Community Profiles, as appropriate. Based on responses, the most commonly experienced hazard events for residents are Severe Thunderstorms, Tornado and Windstorms, Severe Winter Storms, and Extreme Temperature, as listed below. This generally aligned with the top ranked hazards of concern (from most concerning to least concerning) by ranked choice voting.

1. Severe Thunderstorms (includes Hail and Lightning)
2. Tornado and Windstorm
3. Severe Winter Storms
4. Extreme Temperature
5. Drought
6. Human Infectious Diseases
7. Animal and Plant Disease
8. Flooding
9. Infrastructure Failure
10. Transportation Incident
11. Hazardous Materials Release
12. Grass/Wildland Fire
13. Expansive Soils
14. Sinkhole
15. Dam and Levee Failure
16. Earthquake
17. Terrorism and Civil Unrest
18. Landslide

Figure 3: Most Common Hazard Experienced (Public Survey)



Respondents also rated hazards according to potential severity of impact to their community or school (from highest impact to lowest impact), as shown below.

1. Tornado and Windstorm
2. Severe Thunderstorms (includes Hail and Lightning)
3. Sever Winter Storms
4. Extreme Temperature
5. Human Infectious Diseases
6. Drought
7. Flooding
8. Infrastructure Failure
9. Hazardous Materials Release
10. Terrorism and Civil Unrest
11. Transportation Incident
12. Grass/Wildland Fire
13. Animal and Plant Disease
14. Sinkhole
15. Earthquake
16. Dam and Levee Failure
17. Expansive Soils
18. Landslide

In response to whether respondents had flood insurance, only one responded “yes”. Respondents were also asked about impacts from the hazards listed above. Some common themes from the responses include property damage, crop loss, tree damage, and power outages from storm-related hazards; increased energy use, heat stroke/hypothermia, and highway buckling from

Extreme Temperature; mass illness, deaths, poor mental health, and burden on the healthcare system from Human Infectious Diseases; and crop/plant loss, increased fire risk, poor mental health, and strain on water systems from Drought.

The majority of respondents indicated the best way to share information about preparing for a disaster is through emergency text alerts (27 votes), Dallas County Emergency Management website/social media posts (14 votes), community website (11 votes), and radio alerts (such as through the NWS, 8 votes). Other unique communication methods listed included newsletters, public meetings, sharing information at social events, email notification, and television.

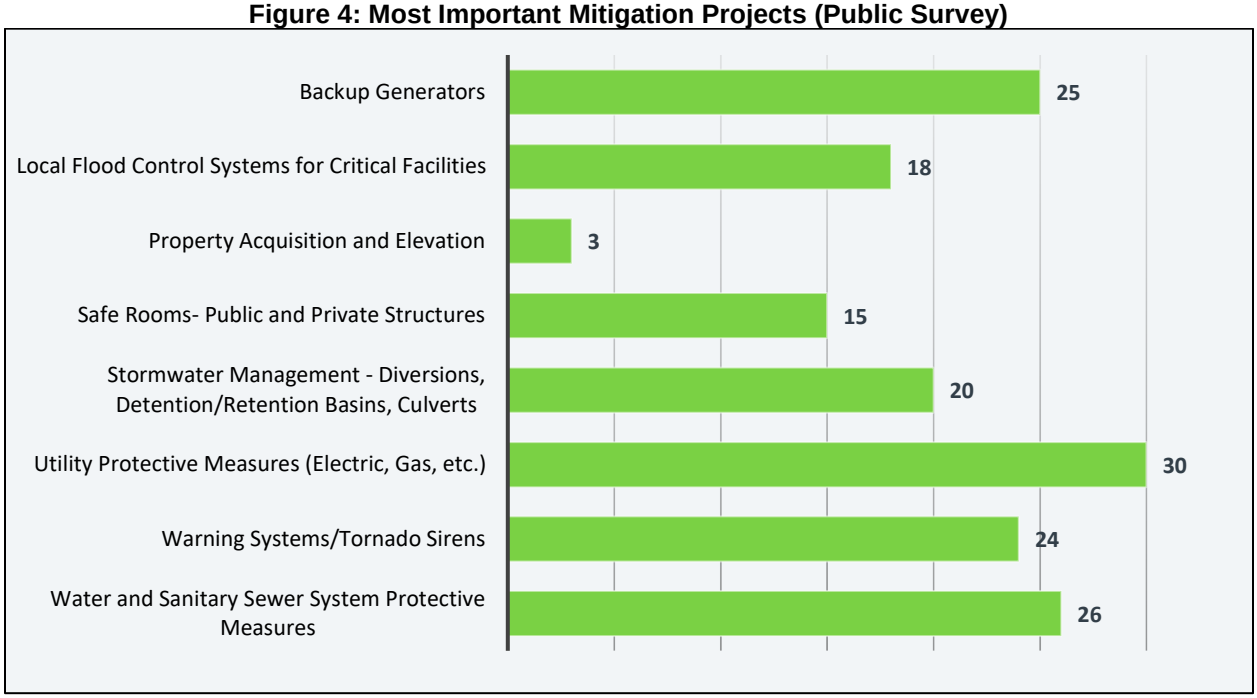
Oftentimes implemented mitigation actions are prioritized based upon need to mitigate risk, cost effectiveness, feasibility, and public support. To help identify overall local support for types of mitigation projects, respondents were asked to rank, from very important to neutral, mitigation action end goals.

Table 9: Priorities for Mitigation End Goals (Public Survey)

Preparing for a disaster can take many forms. Of the following items, please indicate the level of importance to you as one of the following: Very Important, Somewhat Important, or Neutral					
	Protecting people	Protecting private property	Protecting community assets (parks, community buildings)	Protecting critical facilities (hospitals, fire/police stations, utilities)	Preventing development in hazardous areas (example - flood prone areas)
Very Important	33 (97%)	15 (44%)	14 (41%)	31 (91%)	19 (56%)
Somewhat Important	0 (0%)	16 (47%)	13 (38%)	2 (6%)	9 (26%)
Neutral	1 (3%)	3 (9%)	7 (21%)	1 (3%)	6 (18)
	Protecting natural environments	Protecting historical/ cultural landmarks	Increasing cooperation between emergency response agencies and the public	Improving emergency response capabilities (fire/police/ emergency management equipment and training)	
Very Important	19 (56%)	8 (24%)	26 (76%)	29 (85%)	
Somewhat Important	10 (29%)	18 (53%)	4 (12%)	3 (9%)	
Neutral	5 (15%)	8 (24%)	4 (12%)	3 (9%)	

Respondents were also asked which projects would be most important for their community to reduce risk and be more resilient. The most important ones identified included utility protective measures (electric, gas, etc.), water and sanitary sewer system protective measures, backup generators, and warning systems/tornado sirens.

Figure 4: Most Important Mitigation Projects (Public Survey)



Lastly, respondents were asked what they would like to see their respective communities do in the future to protect people and infrastructure from future hazard events. Specific suggestions are included the Community Profiles as applicable; however, common themes and responses are listed below.

- Improving alert sirens and hazard event notification systems for residents (e.g., text alerts and television).
- Improve stormwater drainage.
- Build, designate, and publicize emergency shelters.
- Increase local education efforts, especially for immigrants/refugees.
- Hold emergency exercises with the public.
- Address climate change in county and community planning efforts.
- Strengthen local power supplies and utility infrastructure.
- Remove or trim old and dying trees.

The public was also able to provide comments to the Hazard Mitigation Planning Team through the project website. One comment was provided through the project website. County Supervisor Mark Hanson expressed a desire to use county-owned abandoned quarries for some form of water/flood management. Survey results and comments were shared with the local planning team to inform and guide hazard prioritization and mitigation actions.

Table 10: Notified Stakeholder Groups

Organizations		
Adel Acres Nursing Home	Greater Dallas County Development Alliance	Perry Chamber of Commerce
Adel Iowa Chamber of Commerce	Guthrie REC	Perry City Municipal Airport
Alliant Energy	Husband Airport-39ia	Perry Lutheran Homes

Organizations		
American Red Cross	Independence Villages Senior Living/Village at Legacy Point	Perry Municipal Airport
City of Waukee Utility Billing	Iowa Department of Natural Resources Region 8	Primary Health Care Clinic
Dallas County Conservation Board	Iowa Department of Transportation District 4	Region 12 Council of Governments
Dallas County Farm Service Agency	Iowa Homeland Security and Emergency Management	Robel Airport
Dallas County Health Department	Iowa State University Extension and Outreach, Dallas County	Spurgeon Manor
Dallas County Hospital	Methodist West Hospital	Ultimate Nursing Services
De Soto Airport	Mid-American	UnityPoint Health - Des Moines
Des Moines Area MPO and Central Iowa Regional Transportation Planning Alliance	Northern Natural Gas	Van Fossen Square Independent Living Community
Granger Nursing and Rehabilitation Center	Pearl Valley Rehabilitation and Healthcare Center at Perry	Waukee Gas

Neighboring Jurisdictions

Neighboring jurisdictions were notified and invited to take part in the planning process. The following table indicates which neighboring communities or entities were notified of the planning process. Invitation and informational letters were sent to county clerks, and county and regional emergency managers. Apart from the City of Grimes, jurisdictions outside of the planning area did not take part in the planning process.

Table 11: Notified Neighboring Jurisdictions

Notified Neighboring Jurisdictions	
Adair County	City of West Des Moines
Boone County	Greene County
City of Clive	Guthrie County
City of Grimes	Madison County
City of Johnston	Polk County
City of Urbandale	Warren County

Participant Involvement

Plan participants play a key role in identifying hazards, providing a record of historical disaster occurrences and localized impacts, identifying and prioritizing potential mitigation projects and strategies, and developing plan maintenance procedures. A plan participant is defined as a jurisdiction that fulfills the following requirements: have one representative present at the Round 1 and Round 2 meetings (or attend a follow-up meeting with a JEO planner); assist in data collection by completing worksheets; identify mitigation actions, review plan drafts; and adopt the plan by resolution.

Some jurisdictions sent multiple representatives to meetings. For jurisdictions who had only one representative, they were encouraged to bring meeting materials back to their governing bodies, to collect diverse input on their jurisdiction's meeting documents. Sign-in sheets from all public meetings can be found in *Appendix A.* Jurisdictions that were unable to attend the scheduled public meetings were able to watch a recording of the meetings or request a meeting with JEO

staff to satisfy the meeting attendance requirements. This effort enabled jurisdictions which could not attend a scheduled public meeting to participate in the planning process.

Outreach to eligible jurisdictions included notification prior to all public meetings, phone calls and email reminders of upcoming meetings, and reminders to complete worksheets required for the planning process. Table 12 provides a summary of outreach activities utilized in this process.

Table 12: Outreach Activity Summary

Action	Intent
Project Website	Informed the public and local/planning team members of past, current, and future activities (https://www.jeo.com/dallascounty-hmp).
Press Release	Shared with Regional Planning Team and sent to local media outlets for dispersal.
Survey	Shared with the public to solicit feedback about concerns regarding hazards and to increase awareness of the Hazard Mitigation Plan.
Round 1 Meeting Letters and Emails (30-day notification)	Sent to participants, stakeholders, and neighboring jurisdictions to discuss the agenda/dates/times/ locations of the first round of public meetings.
Round 2 Meeting Letters and Emails (30-day notification)	Sent to participants to discuss the agenda/dates/times/locations of the second round of public meetings.
Notification Phone Calls	Called potential participants to remind them about upcoming meetings.
Follow-up Emails and Phone Calls	Correspondence was provided to remind and assist participating jurisdictions with the collection and submission of required local data.
Project Flyer	Flyers were posted about the Dallas County HMP and how to get involved. Flyers were shared with all Hazard Mitigation Planning team members to distribute.
Word-of-Mouth	Staff discussed the plan with jurisdictions throughout the planning process.

Round 1 Meetings: Hazard Identification

At the Round 1 meetings, jurisdictional representatives (i.e., the local planning teams) reviewed the hazards identified at the kick-off meeting and conducted risk and vulnerability assessments based on these hazards' previous occurrence and the communities' exposure. (For a complete list of hazards reviewed, see *Section Four: Risk Assessment.)*. Table 13 shows the date and location of meetings held for the Round 1 meeting phase of the project.

Table 13: Round 1 Meeting Dates and Locations

Agenda Items	
General overview of the HMP update process, discuss participation requirements, begin the process of risk assessment and impact reporting, update critical facilities, capabilities assessment, and status update on current mitigation and strategic projects	
Location and Time	**Date**
Dallas County Human Services Campus Emergency Management Conference Room Adel, Iowa – 1:30 PM	Tuesday, June 7, 2022

The intent of these meetings was to familiarize local planning team members with the plan update process, expected actions for the coming months, the responsibilities of being a participant, and to collect preliminary information to update the HMP. Data collected at these meetings included: updates to mitigation and strategic actions from the 2018 Dallas County HMP; identify the top

concerns from each jurisdiction; and to begin reviewing and updating community profiles for demographics, capabilities, and critical facilities. Information/data reviewed include but was not limited to local hazard prioritization results; identified critical facilities and their location within the community; future development areas; and expected growth trends (refer to *Appendix B*).

The following tables show the attendees for each jurisdiction who attended a Round 1 meeting or had a one-on-one discussion with JEO staff. Follow-up one-on-one meetings were held for communities who did not have representatives present at public meetings either through watching a recording of the meeting or via conference call with a member of the Hazard Mitigation Planning Team.

Table 14: Round 1 Meeting Attendees

Name	Title	Jurisdiction
Adel, Iowa – Tuesday, June 7, 2022		
AJ Seely	Emergency Management Director	Dallas County EMA
Josh Heward	Emergency Management Specialist	Dallas County EMA
Ann Torbert	Assistant Director County Serv - Regional Director	ISU Extension and Outreach
Bob Ockerman	Council Member	City of Adel
Brian Nelson	Facilities Management Director	Dallas County Hospital
Clint Robinson	Fire Chief	City of Waukee
Cory Iben	HR & Administration Manager	Xenia Rural Water District
Deb Bengtson	President	Adel Iowa Chamber of Commerce
Jack Butler	Public Works Director	City of Perry
Jim Clark	Fire Chief	City of Grimes
Kirk Johnson	COO	Waukee Community School District
Kolleen Dahl	Emergency Preparedness Coordinator	UnityPoint Health - Des Moines
Mark Shearer	Central Iowa District Liaison	Iowa Homeland Security and Emergency Management
Matt Cavanaugh	Fire Chief/City Commission	City of Woodward Woodward Fire Dept.
Matt Hix	Director of Buildings and Grounds	Perry School District
Matt Holmes	Superintendent	Perry City Water Works
Rudy Koester	Public Works Director/City Engineer	City of Waukee
Suzanne Hegarty	Director	Dallas County Health Department
Ty Wheeler	Fire Chief	Granger Fire Department
Becky Appleford	Project Manager	JEO Consulting Group, Inc.
Anthony Kohel	Planner	JEO Consulting Group, Inc.
Claire Patton	Planning Intern	JEO Consulting Group, Inc.

Table 15: Round 1 Recorded Meeting Viewers

Name	Title	Jurisdiction
Jim Uthe	City Clerk	City of Bouton
City Council	-	City of Linden
Joe Stuetelberg	Mayor	City of Minburn

Name	Title	Jurisdiction
Greg Dufoe	Superintendent	Adel-DeSoto-Minburn School District
Scott Grimes	Superintendent	Dallas Center-Grimes School District
Rusty Shockley	Superintendent	West Central Valley School District
Mark Lane	Superintendent	Woodward-Granger School District

Regional Planning Team Meeting

A regional planning team meeting was held on July 26, 2022, to provide an update on the planning process. This entailed a discussion of which jurisdictions had attended the Round 1 Meeting, public involvement status, review of top hazards of concern by jurisdiction, and planning for the Round 2 Meeting. The plan goals were also finalized. Table 16 shows the regional planning team meeting attendees.

Table 16: Regional Planning Team Meeting Attendees

Name	Title	Jurisdiction
Zoom Meeting – July 26, 2022		
AJ Seely	Emergency Management Director	Dallas County EMA
Josh Heward	Emergency Management Specialist	Dallas County EMA
Bob Ockerman	Council Member	City of Adel
Chad Leonard	Sheriff	Dallas County
Craig Leu	Fire and EMS Chief	West Des Moines Fire Department
Jim Clark	Fire Chief	Johnston-Grimes Fire Department
Matt Cavanaugh	City Commission/Fire Chief	City of Woodward/ Woodward Fire Department
Robin Wolfe	Clerk	Dawson
Steve Godwin	Council Member	Woodward
Becky Appleford	Project Manager	JEO Consulting Group, Inc.
Anthony Kohel	Planner	JEO Consulting Group, Inc.
Claire Patton	Planning Intern	JEO Consulting Group, Inc.

Table 17 shows the date, location, and agenda items of for the kick-off meeting.

Table 17: Regional Planning Team Meeting Location and Time

Location and Time	Agenda Items
Zoom Meeting July 26, 2022 1:00 PM	-Hazard Mitigation Plan update status -Public involvement status -Review top hazards of concern by jurisdiction -Review and finalize plan goals -Plan for the Round 2 Meeting

Round 2 Meetings: Mitigation Strategies

Round 2 meetings are designed to identify and prioritize mitigation measures and evaluate potential integration of the HMP alongside other local planning mechanisms. Mitigation and strategic actions and plan integration are essential components in effective hazard mitigation plans. Participating jurisdictions were asked to identify any new mitigation and strategic actions to pursue alongside continued actions from the 2018 HMP and provide copies or descriptions of current jurisdictional plans in which hazard mitigation goals and principals can be integrated. Participating jurisdictions were also asked to review the information collected from the Round 1 meeting related to their community through this planning process for accuracy. Information/data reviewed included but was not limited to local hazard prioritization results, identified critical facilities and their location within the community, future development areas, and expected growth trends (refer to *Appendix B*).

There was also a brief discussion about the planning process, when the plan would be available for public review and comment, annual review of the plan, and the approval and grant opportunities available once the plan was approved. As with Round 1 meetings, any jurisdictions unable to attend were given the opportunity to have a one-on-one phone conference with the consultant or view a recording of the meeting in order to meet plan participation requirements and complete required information. Table 18 shows the date and location of the Round 2 Meeting. Meeting attendees are identified in Table 19 and
Table 20.

Table 18: Round 2 Meeting Dates and Locations

Agenda Items	
Identify new mitigation and strategic actions, review of local data and community profile, discuss review process, discuss available grants and eligibility, and complete plan integration tool.	
Location and Time	**Date**
Dallas County Human Services Campus Emergency Management Conference Room Adel, Iowa – 1:30 PM	Thursday, September 1, 2022

Table 19: Round 2 Meeting Attendees

Name	Title	Jurisdiction
Adel, Iowa – Thursday, September 1, 2022		
AJ Seely	Emergency Management Director	Dallas County EMA
Josh Heward	Emergency Management Specialist	Dallas County EMA
Bob Ockerman	City Council Member	City of Adel
Cindy Riesselman	City Administrator/Finance Director	City of Dallas Center
Clint Robinson	Fire Chief	City of Waukee
Eli Canfield	Public works	City of Dexter
Greg Dufoe	Superintendent	Adel-De Soto-Minburn Schools
Jim Uthe	City Clerk	City of Bouton
John Andorf	Mayor	City of Perry
John Hoy	City Council Member	City of Redfield
Kip Overton	Public Works Director	City of Adel
Kirk Johnson	Chief Operating Officer	Waukee Community School District

Name	Title	Jurisdiction
Matt Cavanaugh	Fire Chief/City Commission	City of Woodward/ Woodward Fire Department
Matt Hix	Director of Buildings and Grounds	Perry School District
Mitch Crozier	Mayor	City of DeSoto
Rusty Shockley	Superintendent	West Central Valley School District
Suzanne Hegarty	Director	Dallas County Health Department
Becky Appleford	Project Manager	JEO Consulting Group, Inc.
Anthony Kohel	Planner	JEO Consulting Group, Inc.
Claire Patton	Planning Intern	JEO Consulting Group, Inc.

Table 20: Round 2 Recorded Meeting Viewers

Name	Title	Jurisdiction
Jim Uthe	City Clerk	City of Bouton
Kristy Trzeciak	City Clerk	City of Granger
City Council	-	City of Linden
Joe Stuetelberg	Mayor	City of Minburn
Scott Grimes	Superintendent	Dallas Center-Grimes School District
Mark Lane	Superintendent	Woodward-Granger School District

Figure 5: Round 2 Meeting

Data Sources and Information

Effective hazard mitigation planning requires the review and inclusion of a wide range of data, documents, plans, and studies. The following table identifies many of the sources utilized during this planning process. Specific references are included as footnotes when used as applicable. The following table is not exhaustive as many studies, plans, and data resources at the local level are not publicly available. Individual examples of plan integration are identified in *Section Seven: Community Profiles*.

Table 21: General Plans, Documents, and Information

Documents	
Disaster Mitigation Act of 2000 DMA https://www.fema.gov/sites/default/files/2020-11/fema_disaster-mitigation-act-of-2000_10-30-2000.pdf	Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (2013) https://www.fema.gov/sites/default/files/2020-06/fema-mitigation-ideas_02-13-2013.pdf
Final Rule (2007) https://www.fema.gov/emergency-managers/risk/hazard-mitigation/regulations-guidance/archive	National Flood Insurance Program Community Status Book (2020) https://www.fema.gov/flood-insurance/work-with-nfip/community-status-book
Hazard Mitigation Assistance Unified Guidance (2015) https://www.fema.gov/sites/default/files/2020-07/fy15_HMA_Guidance.pdf	National Response Framework (2019) https://www.fema.gov/emergency-managers/national-preparedness/frameworks/response
Hazard Mitigation Assistance Guidance and Addendum (2015) https://www.fema.gov/sites/default/files/2020-07/fy15_hma_addendum.pdf	Robert T. Stafford Disaster Relief and Emergency Assistance Act (2021) https://www.fema.gov/disasters/stafford-act
Local Mitigation Plan Review Guide (2011) https://www.fema.gov/sites/default/files/2020-06/fema-local-mitigation-plan-review-guide_09_30_2011.pdf	The Census of Agriculture (2017) https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Census_by_State/Iowa/
Local Mitigation Planning Handbook (2013) https://www.fema.gov/sites/default/files/2020-06/fema-local-mitigation-planning-handbook_03-2013.pdf	What is a Benefit: Guidance on Benefit-Cost Analysis on Hazard Mitigation Projects https://www.fema.gov/grants/guidance-tools/benefit-cost-analysis
Plans and Studies	
Dallas County Hazard Mitigation Plan (2018) https://www.dallascountyiowa.gov/government/public-safety/emergency-management/hazard-mitigation-plan	Iowa Hazard Mitigation Plan (2018) https://homelandsecurity.iowa.gov/wp-content/uploads/2020/09/IowaHMPSection5-508-Compliant.pdf
Flood Insurance Studies https://msc.fema.gov/portal/home	National Climate Assessment (2014) https://nca2014.globalchange.gov/
Fourth National Climate Assessment (2018) https://nca2018.globalchange.gov/	
Data Sources/Technical Resources	
Arbor Day Foundation – Tree City Designation https://www.arborday.org/programs/treecityusa/directory.cfm	National Drought Mitigation Center – Drought Monitor http://droughtmonitor.unl.edu/
Environmental Protection Agency - Chemical Storage Sites https://www.epa.gov/toxics-release-inventory-tri-program	National Environmental Satellite, Data, and Information Service http://www.nesdis.noaa.gov/
Federal Emergency Management Agency http://www.fema.gov	National Fire Protection Association https://www.nfpa.org/

Documents	
FEMA Flood Map Service Center https://msc.fema.gov/portal/advanceSearch	National Flood Insurance Program https://www.fema.gov/flood-insurance
High Plains Regional Climate Center http://climod.unl.edu/	National Flood Insurance Program https://www.iowadnr.gov/environmental-protection/land-quality/flood-plain-management/national-flood-ins-program
Iowa Climatology Bureau https://iowaagriculture.gov/climatology-bureau	National Historic Registry https://www.nps.gov/subjects/nationalregister/index.htm
Iowa Department of Education https://educateiowa.gov/	National Oceanic Atmospheric Administration (NOAA) http://www.noaa.gov/
Iowa Department of Homeland Security and Emergency Management https://homelandsecurity.iowa.gov/	National Weather Service http://www.weather.gov/
Iowa Department of Human Services https://dhs.iowa.gov/	Natural Resources Conservation Service www.ne.nrcs.usda.gov
Iowa Department of Natural Resources https://www.iowadnr.gov/	State Historical Society of Iowa https://iowaculture.gov/history
Iowa Department of Natural Resources – Dam Inventory https://iowadnr.knack.com/dams	Stanford University - National Performance of Dams Program https://npdp.stanford.edu/
Iowa Department of Natural Resources - Environmental Protection https://www.iowadnr.gov/environmental-protection	Storm Prediction Center Statistics http://www.spc.noaa.gov
Iowa Department of Revenue – Property Tax Overview https://tax.iowa.gov/iowa-property-tax-overview	United States Army Corps of Engineers – National Levee Database https://levees.sec.usace.army.mil/#/
Iowa Department of Transportation https://iowadot.gov	United States Census Bureau http://www.census.gov
Iowa Energy Office https://www.iowaeda.com/iowa-energy-office/	United States Census Bureau https://data.census.gov/cedsci/
Iowa Forest Service https://www.iowadnr.gov/conservation/forestry	United States Department of Agriculture http://www.usda.gov
Iowa Forest Service – Fire Protection and Prevention https://www.iowadnr.gov/Conservation/Forestry/Fire-Prevention/Fire-Protection-Prevention	United States Department of Agriculture – Risk Management Agency http://www.rma.usda.gov
Iowa Geospatial Data https://geodata.iowa.gov/	United States Department of Agriculture – Web Soil Survey https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx
Iowa Public Power Service https://www.publicpower.org/public-power-iowa	United States Department of Commerce http://www.commerce.gov/
ISU – College of Agriculture and Life Sciences https://www.cals.iastate.edu/	United States Department of Transportation – Pipeline and Hazardous Materials Safety Administration https://www.phmsa.dot.gov/
ISU – Extension and Outreach https://www.extension.iastate.edu/	United States Geological Survey http://www.usgs.gov/
National Agricultural Statistics Service http://www.nass.usda.gov/	United States National Response Center https://nrc.uscg.mil/
National Centers for Environmental Information	United States Small Business Administration

Documents	
https://www.ncei.noaa.gov/	http://www.sba.gov
National Consortium for the Study of Terrorism and Responses to Terrorism (START) http://www.start.umd.edu/gtd/	Watershed Management Authorities of Iowa https://www.iowadnr.gov/Environmental-Protection/Water-Quality/Watershed-Management-Authorities
National Drought Mitigation Center – Drought Impact Reporter http://droughtreporter.unl.edu/map/	

Public Review

Once the HMP draft was completed, a public review period was opened to allow for participants and community members at large to review the plan, provide comments, and request changes. The public review period was open from November 9, 2022, through December 6, 2022. Participating jurisdictions and relevant stakeholders were emailed or mailed a letter notifying them of this public review period. The draft HMP was also made available on the project website (https://www.jeo.com/dallascounty-hmp) for download. Jurisdictions and the public could provide comments via mail, fax, email, or by using the comment box on the project website.

Table 22: Public Review Revisions

Plan Section	Name, Title, and/or Agency	Comment/Revision
Section 3: County Profile; **Section 4: Severe Thunderstorms, Tornadoes & Windstorms**	Mike Wallace, Executive Director, Dallas County Conservation Board	Additional Mitigation Actions, vulnerability clarification
Section 7: Dallas Center Profile	Cindy Riesselman, City Administrator, City of Dallas Center	Data clarification, boundary map update, Mitigation Action update, addition of future land use map, flood map products update
Section 7: Minburn Profile	Dan Case, Fire Chief, City of Minburn	Data correction, funding update to Mitigation Action
Section 7: Van Meter Profile	Sarah Ames, City Administrator, City of Van Meter	Planning team updates, Critical Facility updates
Section 7: Waukee Profile	Clint Robinson, Fire Chief, Rudy Koester, Public Works Director, City of Waukee	Additional Mitigation Action, typographical and grammatical errors, data clarification.
Section 7: Perry Profile	Josh Wuebker, Public Works Director, City of Perry	Planning Team member corrections
Executive Summary **Section 2: Plan Adoption and Implementation,** **Section 3: County Profile,** **Section 4: Dams,** **Section 4: Human Infectious Diseases,** **Section 6: Unforeseen Opportunities** **Section 7: De Soto Profile, Bouton Profile**	AJ Seely, Emergency Management Director, Dallas County EMA	Data clarification, plan maintenance clarification, typographical and grammatical errors

Plan Adoption and Implementation

Based on FEMA requirements, this multi-jurisdictional hazard mitigation plan must be formally adopted by each participant through approval of a resolution. This approval will create individual ownership of the plan by each participant. Formal adoption provides evidence of a participant's full commitment to implement the plan's goals and action items. A copy of the resolution draft submitted to participating jurisdictions is located in *Appendix A*. Copies of adoption resolutions may be requested from the HSEMD's State Hazard Mitigation Officer.

Requirement §201.6(c)(5): For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.

Hazard mitigation plans are living documents. Once an HMP has been adopted locally, participants are responsible for implementing identified projects, maintaining the plan with relevant information, and fully updating the plan every five years. The plan must be monitored, evaluated, and updated on a five-year or less cycle. Those who participated directly in the planning process would be logical champions during reviews between the five-year cycle update of the plan. It is critical that the plan be reviewed at regular intervals and when a hazard event occurs that significantly affects the area or individual participants. These reviews are the responsibility of each jurisdiction's local planning team and should be documented and reflected in the plan. Participants are encouraged to work alongside the plan sponsor, Dallas County EMA, or the consultant, JEO, to document updates and revise the HMP as needed. See *Section Six: Plan Implementation and Maintenance* for additional information on plan amendments.

Additional implementation of the mitigation plan should include integrating HMP goals and mitigation and strategic actions into county and local comprehensive or capital improvement plans as they are developed or updated. *Section Six* describes the system that jurisdictions participating in the HMP have established to monitor the plan; provides a description of how, when, and by whom the HMP process and mitigation and strategic actions will be evaluated; presents the criteria used to evaluate the plan; and explains how the plan will be maintained and updated.

Section Three: County Profile

Introduction

To identify jurisdictional vulnerabilities, it is vitally important to understand the people and built environment of the county. The following section provides a description of the characteristics of the county to create an overall profile. Many characteristics are covered in each jurisdiction's community profile including demographics, employment, and transportation routes. Redundant information will not be covered in this section. Therefore, this section highlights county specific information and will also serve as the county's profile.

County Geographic Summary

The project area is comprised of Dallas County, which is located in central Iowa. The county covers 592 square miles and sits just west of the City of Des Moines. There are eighteen incorporated communities in the county, with the City of Adel being the county seat. Figure 6 shows the county, incorporated communities, and location within the state. Dallas County resides mostly in the Des Moines Lobe landform region, with a portion of the Southern Iowa Drift Plain within the county's southern edge. The Des Moines Lobe region is noted for its smaller lakes, wetlands, and ridges caused by a glacier 14,000 years ago.[12] [13]

Three watershed regions cover Dallas County: the South Raccoon, North Raccoon, and West Des Moines watersheds. Main waterways in the planning area include the South, Middle, and North Raccoon Rivers, and the Des Moines River.

Climate

The average high temperature in Dallas County for the month of July is 85 degrees and the average low temperature for the month of January is 10 degrees. On average, Dallas County receives over 36 inches of rain and 36.5 inches of snowfall per year. Climate data is helpful in determining if certain events are higher or lower than normal. For example, if the high temperatures in the month of July are running well into the 90s, high heat events may be more likely which could impact vulnerable populations.

Table 23: Dallas County Climate

	Dallas County
July Normal High Temp	85.4 °F
January Normal Low Temp	10.2 °F
Annual Normal Precipitation	36.1 inches
Annual Normal Snowfall	36.5 inches

Source: NCEI U.S. Climate Normals[14],
Precipitation includes all rain and melted snow and ice.

[12] Iowa State University Geographic Information Systems Support & Research Facility. 2022. "Iowa – Landforms Regions and Features." https://www.arcgis.com/apps/mapviewer/index.html?layers=6e1858f40e6545ec9f15538cc8c65180.

[13] Iowa Geological Survey. 2017. "Landform Regions of Iowa." https://www.iihr.uiowa.edu/igs/publications/uploads/2017-04-27_15-04-11_em44.pdf.

[14] National Centers for Environmental Information. "1991-2020 U.S. Climate Normals." Accessed June 2022. https://www.ncei.noaa.gov/access/us-climate-normals/.

Figure 6: Map of Project Area

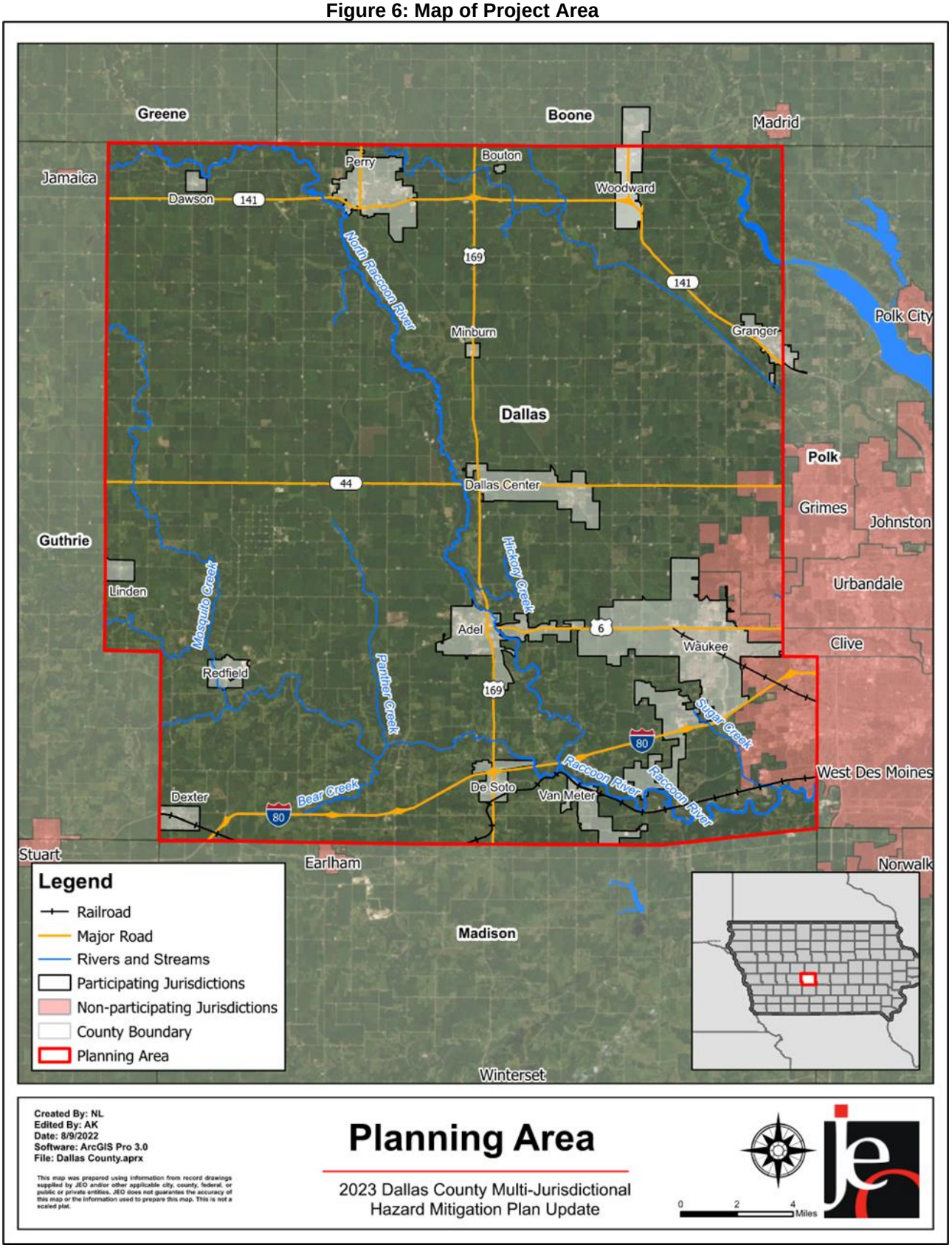
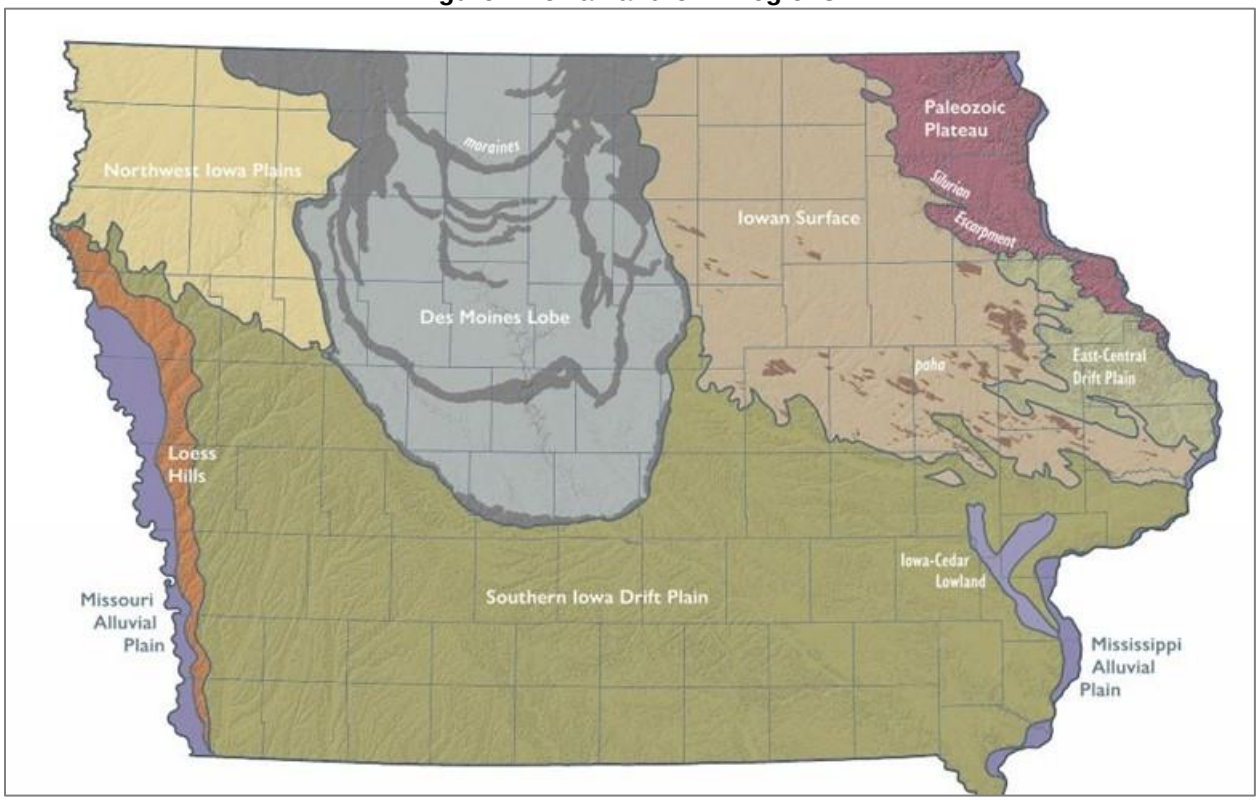


Figure 7: Iowa Landform Regions



Source: Iowa State University, 2017[15]

Demographics

Demographic and asset information can be used to determine levels of vulnerability via population and housing, structural inventories and valuations, critical facilities, and other vulnerable areas analysis. This population includes a range of demographic cohorts and persons at risk to natural and man-made disasters. The following figures depict the historical population of the county and the age cohort breakdown in 2020.[16]

[15] Iowa Geological Survey. 2017. "Landform Regions of Iowa." https://www.iihr.uiowa.edu/igs/publications/uploads/2017-04-27_15-04-11_em44.pdf.

[16] United States Census Bureau. "2020 Census Redistricting Data (Public Law 94-171): P1: Race." [database file]. https://data.census.gov.

Figure 8: County Population 1850-2020

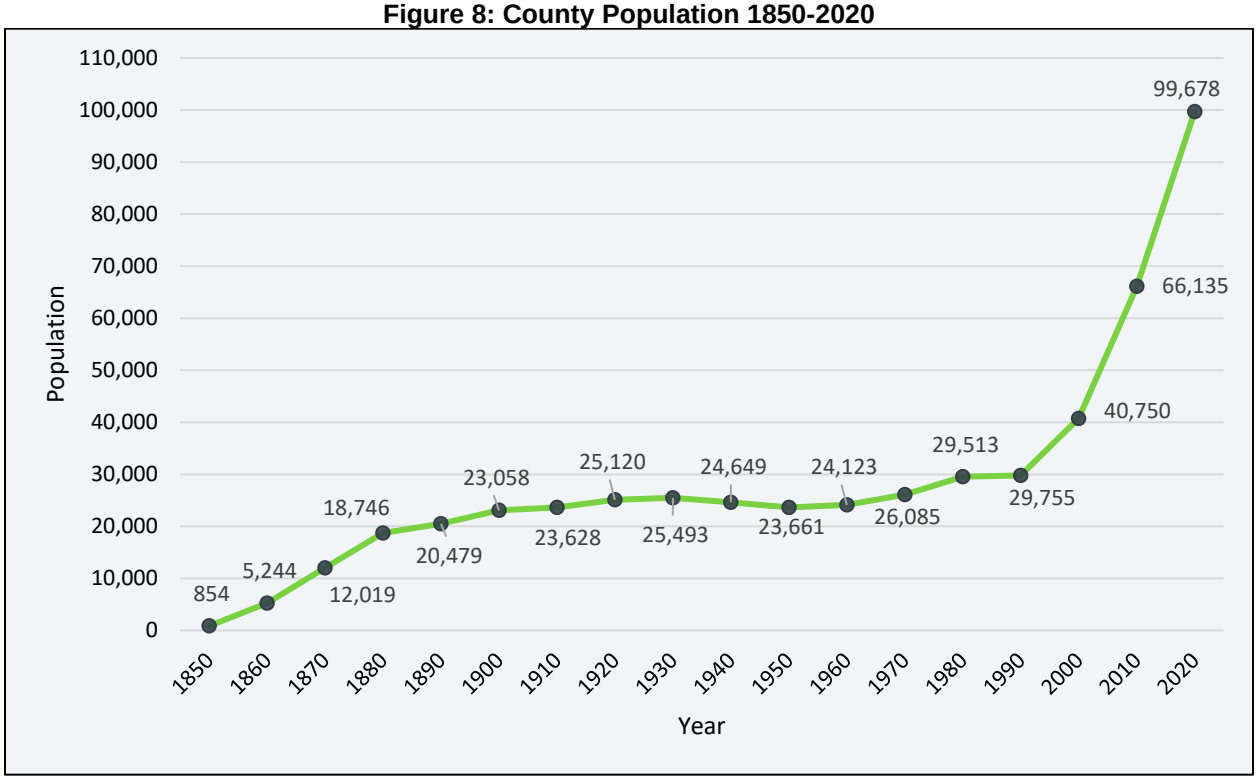
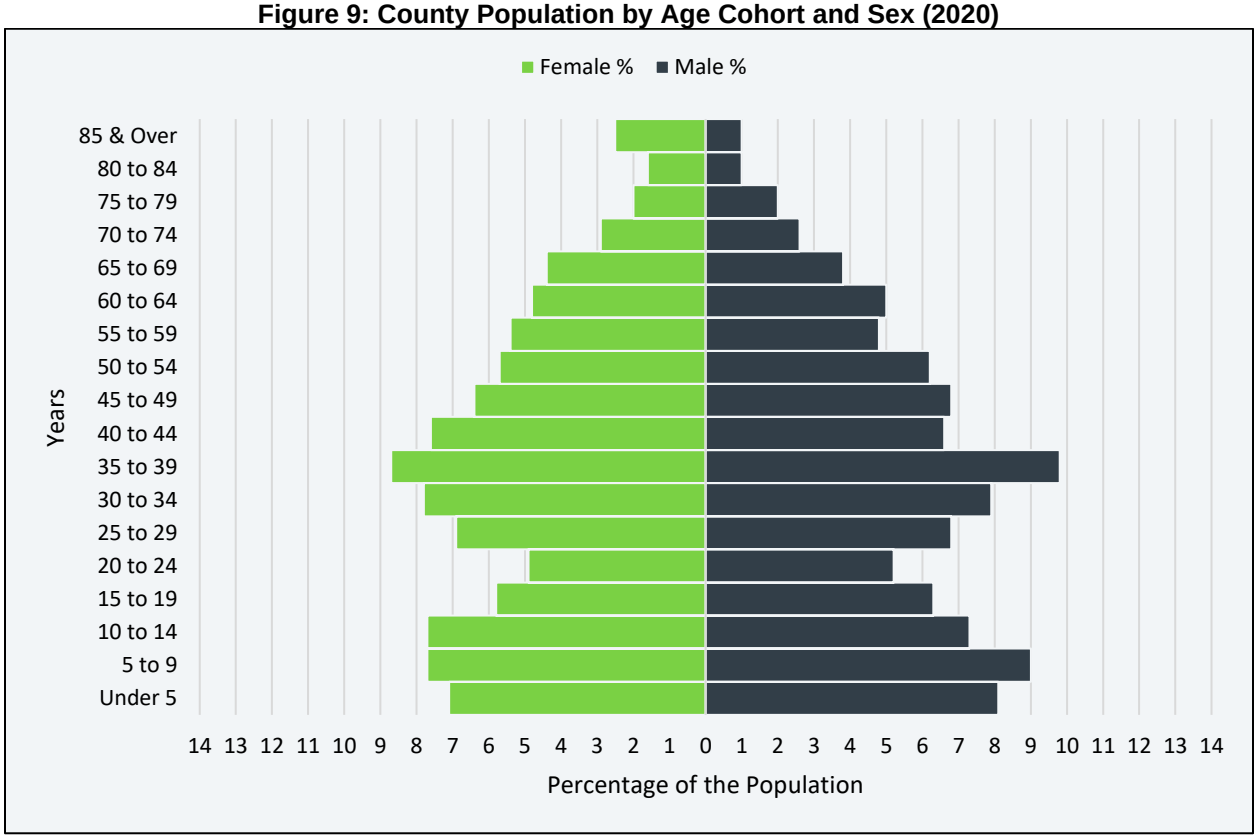


Figure 9: County Population by Age Cohort and Sex (2020)



Source: U.S. Census Bureau

Table 24: Population with the County (2020)

Jurisdiction	2010 Population	2020 Population
City of Adel	3,682	6,153
City of Bouton	129	127
City of Dallas Center	1,623	1,901
City of Dawson	131	116
City of De Soto	1,050	915
City of Dexter	611	640
City of Granger*	1,244	1,654
City of Linden	199	200
City of Minburn	365	325
City of Perry	7,702	7,836
City of Redfield	835	731
City of Van Meter	1,016	1,484
City of Waukee	13,790	23,940
City of Woodward*	1,024	1,346
Total**	66,135	99,678

Source: U.S. Census Bureau
**Part of the Cities of Granger and Woodward are located outside of Dallas County*
***Total includes population from portions of the Cities of Clive, Grimes, Urbandale, and West Des Moines*

The population for the county has increased since the 2010 census (66,135 persons to 99,678 persons). That trend is likely to continue with a higher percentage of individuals under 40 years old. The median age for the county is 35.4 which is younger than the State of Iowa at 38.3. The county accounts for approximately 3.1% of the total population for the state in 2020. Since 2010, the majority of cities in the county have seen an uptick in population. Increasing populations are associated with increased hazard mitigation and emergency planning requirements for development. Increasing populations can also contribute to increasing tax revenues, allowing communities to pursue additional mitigation projects.

At-risk Populations

In general, at-risk populations may have difficulty with medical issues, poverty, extremes in age, and communication issues due to language barriers. Several outliers may be considered when discussing potentially at-risk populations, including:

- Not all people who are considered “at-risk” are vulnerable;
- Outward appearance does not necessarily mark a person as at-risk;
- A hazard event will, in many cases, impact at-risk populations in different ways.

The National Response Framework defines at-risk populations as “…populations whose members may have additional needs before, during, and after an incident in functional areas, including but not limited to: maintaining independence, communication, transportation, supervision, and medical care.”[17]

[17] United States Department of Homeland Security. October 2019. “National Response Framework Third Edition.” https://www.fema.gov/media-library/assets/documents/117791.

Dependent children under 18 years old are one of the most vulnerable populations to disasters.[18] The majority of people in this age group do not have access to independent financial resources and transportation. They lack practical knowledge necessary to respond appropriately during a disaster. Despite this vulnerability, children are generally overlooked in disaster planning because the presence of a caretaker is assumed. With approximately 30% of the planning area's population younger than 20, children are a key vulnerable group to address in the planning process.

Schools house a high number of children within the county during the daytime hours of weekdays, as well as during special events on evenings and weekends. The following table identifies the various school districts located within the county, and Figure 10 displays a map of the school district boundaries.

Table 25: School Inventory

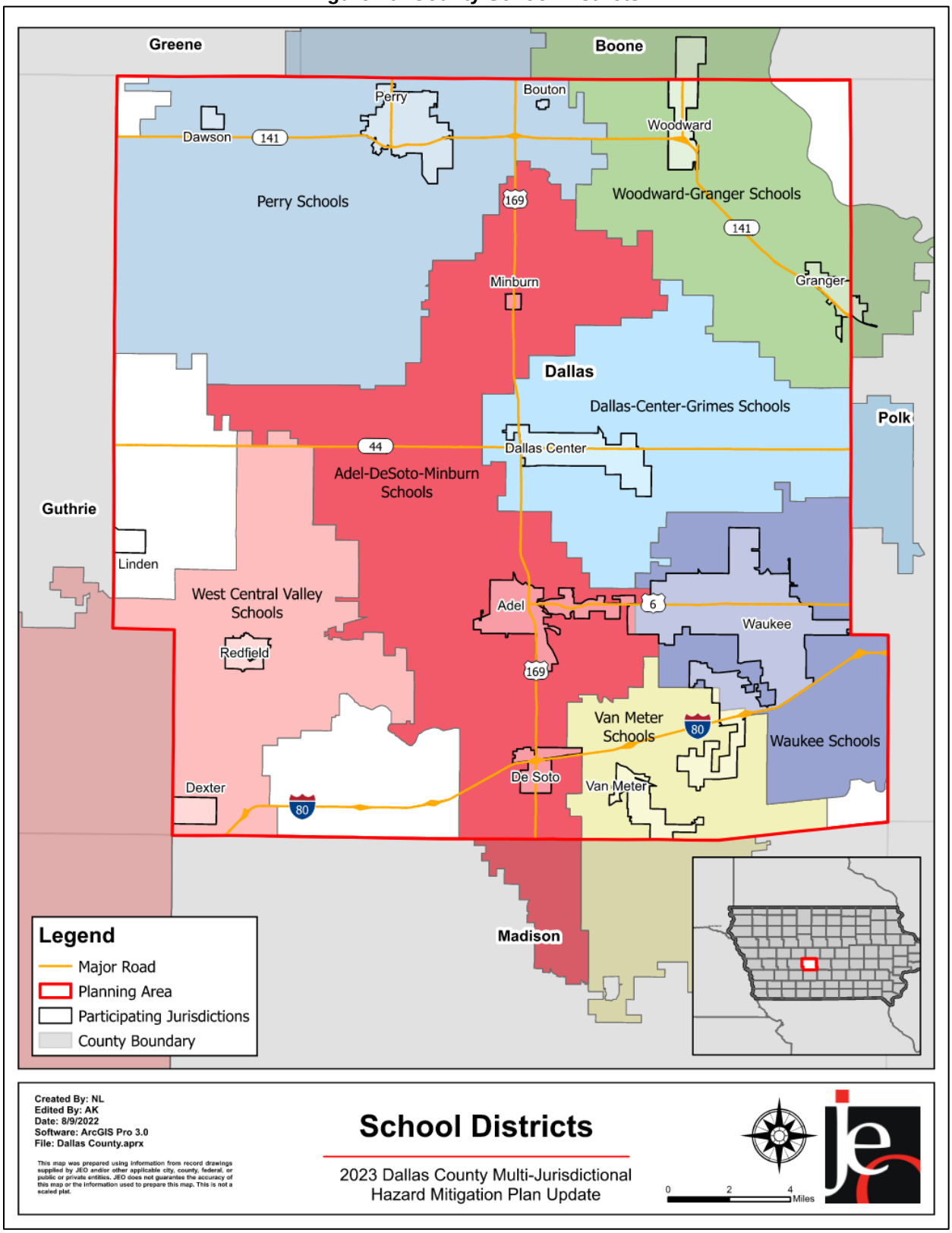
School District	Total Enrollment (2021-2022)	Total Teachers
Adel DeSoto Minburn School District	2,108	154
Dallas Center-Grimes School District	3,443	243
Perry School District	1,702	143
Van Meter School District	993	70
Waukee School District	12,205	885
West Central Valley School District	815	71
Woodward-Granger School District	1,085	105
Total	**22,351**	**1,671**

Source: Iowa Department of Education[19]

[18] Flanagan, Gregory, Hallisey, Heitgerd, & Lewis. 2011. "A Social Vulnerability Index for Disaster Management." Journal of Homeland Security and Emergency Management, 8(11): Article 3.

[19] Iowa Department of Education. "Iowa Public School and AEA Teacher and Teacher Leader Information." Accessed May 2022. https://educateiowa.gov/documents/iowa-public-school-and-aea-teacher-counts-and-salaries-district/2022/05/2021-2022-iowa

Figure 10: County School Districts



Like minors, seniors (age 65 and greater) are often more significantly impacted by hazards and temperature extremes. During prolonged heat waves or periods of extreme cold, seniors may lack resources to effectively address hazard conditions and as a result may incur injury or potentially death. Prolonged power outages (either standalone events or as the result of other contributing factors) can have significant impacts on any citizen relying on medical devices. One study conducted by the Center for Injury Research and Policy found that increases in vulnerability related to severe winter storms (with significant snow accumulations) begin at age 55.[20] The study found that on average there are 11,500 injuries and 100 deaths annually related to snow removal. Men over the age of 55 are 4.25 times more likely to experience cardiac events during snow removal. On the other hand, women can have a more difficult time during post-disaster recovery than men, often due to sector-specific employment, lower wages, and family care responsibilities. Nursing homes and assisted living facilities within the planning area were invited to take part as stakeholders in the planning process, as noted in *Section Two: Planning Process*. Table 26 lists the facilities invited.

Table 26: Stakeholder Outreach to Nursing Homes and Assisted Living Facilities

Nursing Homes and Assisted Living Facilities		
Adel Acres Nursing Home	Pearl Valley Rehabilitation and Healthcare Center at Perry	Van Fossen Square Independent Living Community
Granger Nursing and Rehabilitation Center	Perry Lutheran Homes	
Independence Villages Senior Living/Village at Legacy Point	Spurgeon Manor	

Residents below the poverty line may lack resources to prepare for, respond to, or recover from hazard events. Residents with limited economic resources will struggle to prioritize the implementation of mitigation measures over more immediate needs. Further, residents with limited economic resources are more likely to live in older, more vulnerable structures. These structures could be mobile homes, located in the floodplain, located near known hazard sites (e.g., chemical storage areas), or older poorly maintained structures. Residents below the poverty line will be more vulnerable to all hazards within the county.

Residents who speak English as a second language may struggle with a range of issues before, during, and after hazard events. General vulnerabilities revolve around what could be an inability to effectively communicate with others or an inability to comprehend materials aimed at notification and/or education if a hazard event. When presented with a hazardous situation it is important that all community members be able to receive, decipher, and act on relevant information. An inability to understand warnings and notifications may prevent non-native English speakers from reacting in a timely manner. Further, educational materials related to regional hazards are most often developed in the dominant language for the area, for the county that would be English. Residents who struggle with English in the written form may not have sufficient information related to local concerns to effectively mitigate potential impacts. Residents with limited English proficiency would be at an increased vulnerability to all hazards within the county. Table 27 provides statistics for the county regarding individuals who speak English as a second language (ESL) and families reported as in poverty in the last 12 months.

[20] Center for Injury Research and Policy. 2011. "Snow Shoveling Safety." Accessed July 2022. http://www.nationwidechildrens.org/cirp-snow-shoveling.

Table 27: ESL and Poverty At-Risk Populations

Percent that speak English as second language	People below poverty level
11.2%	5.2%

Source: U.S. Census Bureau[21] [22]

Similar to residents below the poverty line, racial minorities tend to have access to fewer financial and systemic resources that would enable them to implement hazard mitigation and strategic projects and to respond and recover from hazard events, including residence in standard housing and possession of financial stability. The county is primarily White, non-Hispanic; however, racial diversity has significantly increased since 2010, which could affect the county's vulnerability to hazards (Table 28).

Table 28: Racial Composition Trends

Race	2010		2020		% Change
	Number	% of Total	Number	% of Total	
White, Not Hispanic	60,971	92.2%	83,359	83.6%	+36.7%
Black	918	1.4%	2,698	2.7%	+194%
American Indian and Alaskan Native	127	0.2%	224	0.2%	+76.4%
Asian	1,662	2.5%	5,009	5.0%	+201.4%
Native Hawaiian and Other Pacific Islander	39	0.1%	38	0.0%	-2.6%
Other Races	1,409	2.1%	2,556	2.6%	+81.4%
Two or More Races	1,009	1.5%	5,794	5.8%	+474%
Total Population	**66,135**	**-**	**99,678**	**-**	**-**

Source: U.S. Census Bureau[23] [24]

Governance

The county's governmental structure impacts its capability to implement mitigation actions. Dallas County is governed by a three-member board of county supervisors. The county also has the following offices and departments.

- County Assessor
- Sheriff
- County Treasurer
- Planning and Development
- Community Services
- Conservation
- EMS
- Environmental Health
- GIS/Mapping
- Information Services/Technology

[21] U.S. Census Bureau. 2021. "Language Spoken at Home: 2020 American Community Survey (ACS) 5-year estimates." https://data.census.gov/cedsci/.
[22] U.S. Census Bureau. 2021. "Selected Economic Characteristics: 2020 ACS 5-year estimate." https://data.census.gov/cedsci/.
[23] United States Census Bureau. "2010 Census Redistricting Data (Public Law 94-171): P1: Race." https://data.census.gov.
[24] United States Census Bureau. "2020 Census Redistricting Data (Public Law 94-171): P1: Race." https://data.census.gov.

- Public Health
- Emergency Management
- Finance and Operations Department
- Secondary Roads Department
- Veterans Affairs

Capability Assessment

The capability assessment consisted of a review of local existing policies, regulations, plans, and programs with hazard mitigation capabilities. The following tables summarize the county's planning and regulatory capability; administrative and technical capability; fiscal capability; educational and outreach capability; and overall capability to implement mitigation projects.

County funds are sufficient to pursue new capital projects as approved by the board of supervisors. County funds have mostly stayed the same over recent years, according to the local planning team.

Table 29: Capability Assessment

Survey Components/Subcomponents		Yes/No
Planning & Regulatory Capability	Comprehensive Plan	Yes
	Capital Improvements Plan	No
	Economic Development Plan	No
	Emergency Operations Plan	Yes
	Floodplain Management Plan	No
	Storm Water Management Plan	No
	Zoning Ordinance	Yes
	Subdivision Regulation/Ordinance	Yes
	Floodplain Ordinance	Yes
	Building Codes	Yes
	National Flood Insurance Program	Yes
	Community Rating System	No
	Other (if any)	
Administrative & Technical Capability	Planning Commission	Yes
	Floodplain Administration	Yes
	GIS Capabilities	Yes
	Chief Building Official	Yes
	Civil Engineering	No
	Local Staff Who Can Assess Community's Vulnerability to Hazards	Yes
	Grant Manager	No
	Mutual Aid Agreement	Yes
	Other (if any)	
Fiscal Capability	Capital Improvement Plan/ 1 & 6 Year Plan	No
	Applied for grants in the past	Yes
	Awarded a grant in the past	Yes

	Authority to Levy Taxes for Specific Purposes such as Mitigation Projects	Yes
	Gas/Electric Service Fees	No
	Storm Water Service Fees	No
	Water/Sewer Service Fees	No
	Development Impact Fees	No
	General Obligation Revenue or Special Tax Bonds	Yes
	Other (if any)	
Education & Outreach Capability	Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc. Ex. CERT Teams, Red Cross, etc.	Yes
	Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Yes
	Natural Disaster or Safety related school programs	No
	StormReady Certification	Yes
	Other (if any)	

Table 30: Overall Capability

Overall Capability	Limited/Moderate/High
Financial resources needed to implement mitigation projects	Moderate
Staff/expertise to implement projects	Limited
Community support to implement projects	High
Time to devote to hazard mitigation	Limited

Plan Integration

Dallas County has several planning documents that discuss or relate to hazard mitigation. Each plan is listed below along with a short description of how it is integrated with the hazard mitigation plan. Planning documents were reviewed and information from these plans were used in the risk assessment and mitigation strategy sections of this plan. The county will seek out and evaluate any opportunities to integrate the results of the current hazard mitigation plan into other planning mechanisms and updates.

Building Codes (2006)

The building code sets standards for constructed buildings and structures. The county follows the 2006 version of the International Building Code, and the 2008 version of the National Electrical Code. The county plans to update these in the next year.

Comprehensive Plan (2000)

The comprehensive plan is designed to guide the future actions and growth within the county. The county's plan does not discuss natural hazards or mitigation strategies, but it does encourage

infill development. The county plans to update the comprehensive plan in the next few years. County Emergency Management would like to include hazard mitigation enhancements in the next plan update if the county supervisors agree.

Capital Improvement Plan (2022)

The capital improvement plan outlines large purchases and projects that the county would like to pursue. Projects identified include various storm water focused projects including upsizing of culverts and drainage structures, upgrading storm sewer systems, and improving transportation routes for drainage. The plan also includes widening roadways (that would improve evacuations), bridge improvements, installing emergency generators in critical facilities, and improving existing police headquarters. A future update of the plan will include a new public works facility.

Local Road Safety Plan (2019)

A local road safety plan (LRSP) was developed for Dallas County in 2019 to provide a basis for systematic safety improvements along local roads under the county's jurisdiction. The LRSP helps local practitioners make informed safety decisions and fosters coordination between various agencies within the county. The plan focuses on the five E's of safety: Engineering, Emergency Response, Education, Enforcement, and Everyone.

Zoning Ordinance (2022), Floodplain Ordinance (2018), Subdivision Regulations (2013)

The county's floodplain ordinance, zoning ordinance, and subdivision regulations outline where and how development should occur in the future. These documents contain floodplain maps, provide a framework and regulations for development within the floodplain (as required by Iowa DNR and FEMA), and include well setback requirements. The county is currently in the process of updating the zoning ordinance section by section as needed. The floodplain will be updated by the end of 2022 and as required by FEMA.

Water System Emergency Response Plan (2022)

Water system emergency response plans ensure the drinking water systems that serve Dallas County are prepared to supply customers with drinking water in the event of an emergency. It includes identifying potential emergencies and how the utility will ensure water delivery in specific scenarios.

Community Wildfire Protection Plan (2014)

Dallas County Emergency Management participated in the Saylorville Flood Plain Community Wildfire Protection Plan (CWPP), which was developed in 2014. The Saylorville floodplain is located along the Des Moines River. The purpose of the CWPP is to help effectively manage wildfires and increase collaboration and communication among organizations who manage fire. The CWPP discusses area-specific historical wildfire occurrences and impacts, identifies areas most at risk from wildfires, discusses protection capabilities, and identifies wildfire mitigation strategies.

Wellhead Protection Plan

The purpose of wellhead protection plans is to protect the public drinking water supply wells from contamination. It includes identifying potential sources of groundwater contamination in the area.

Economy

According to the US Census Bureau, the top industries in Dallas County are Education, Health Care, and Social Assistance (22.1%), Financial, Insurance, and Real Estate (20.7%), and Professional, Scientific, Management, and Administrative Services (11.2%).[25] Dallas County's median household income in 2020 was $88,368. This is higher than Iowa's median household income of $61,836.

Major employers within the county include Wells Fargo, Tyson, Athene, Sammons Group, and Unity Point Hospital. Approximately 29% of residents in Dallas County travel less than 15 minutes to work, while 24% travel more than 30 minutes, suggesting many residents live and work in somewhat close proximity.

Built Environment and Structural Inventory

Data related to the built environment is an important component of a hazard mitigation plan. It is essential that during the planning process communities and participating jurisdictions display an understanding of their built environment and work to identify needs that may exist within the county. The United States Census Bureau provides information related to housing units and potential areas of vulnerability. The selected characteristics examined below include lacking complete plumbing facilities; lacking complete kitchen facilities; no telephone service available; housing units that are mobile homes; and housing units with no vehicles.

Table 31: Selected Housing Characteristics

	Dallas County
Occupied Housing Units	35,383 (93.7%)
Lacking Complete Plumbing Facilities	0.2%
Lacking Complete Kitchen Facilities	0.3%
No Telephone Service Available	1.3%
No Vehicles Available	3.3%
Mobile Homes	2.7%

Source: U.S. Census Bureau[26]

Less than two percent of housing units lack access to landline telephone service. This does not necessarily indicate that there is not a phone in the housing unit, as cellular telephones are increasingly a primary form of telephone service. However, this lack of access to landline telephone service does represent a population at increased risk to disaster impacts. Reverse 911 systems are designed to contact households via landline services and as a result, some homes in hazard prone areas may not receive notification of potential impacts in time to take protective actions. Emergency managers should continue to promote the registration of cell phone numbers with emergency alert systems and utilize systems which automatically ping cellphones by triangulating cell towers.

Almost three percent of housing units in the county are mobile homes. Mobile homes have a higher risk of sustaining damages during high wind events, tornadoes, severe thunderstorms, and severe winter storms. Mobile homes that are either not anchored or are anchored incorrectly can

[25] United States Census Bureau. "2020 Census Bureau American Community Survey: DP03: Selected Economic Characteristics." https://data.census.gov.

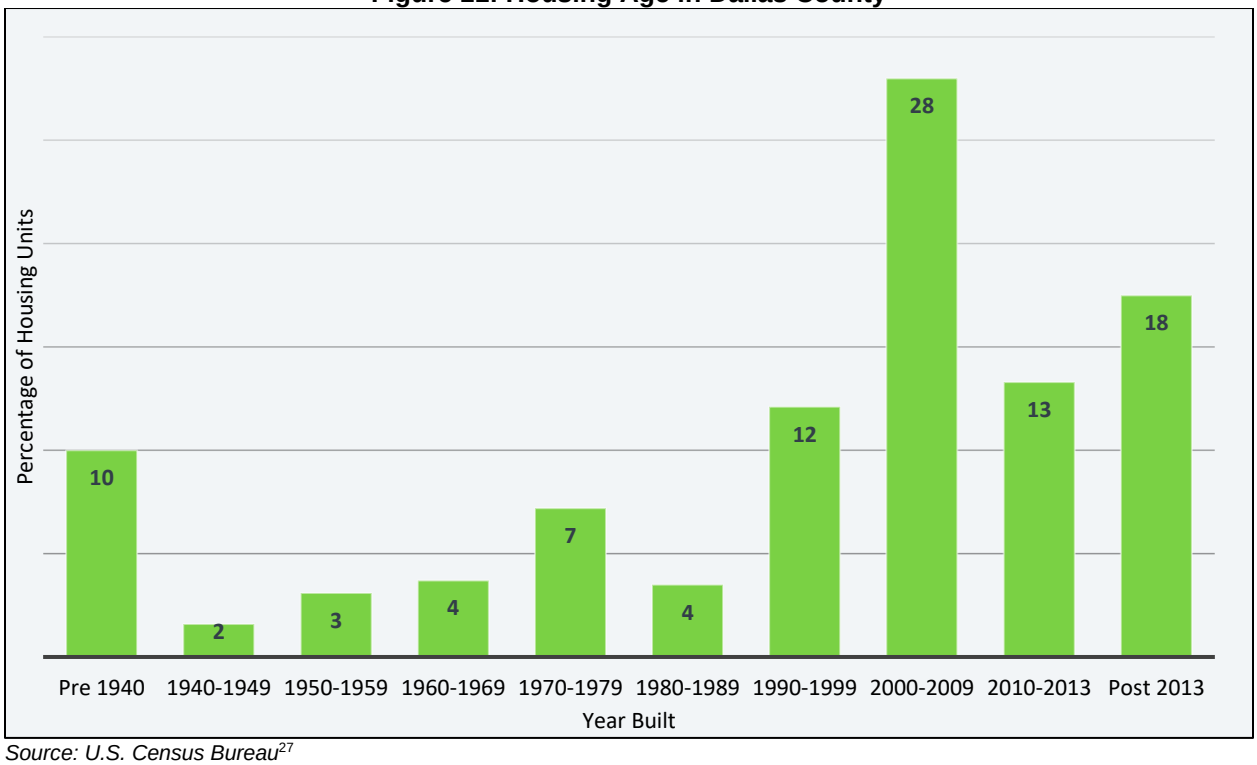
[26] United States Census Bureau. "2020 Census Bureau American Community Survey: DP04: Selected Housing Characteristics." https://data.census.gov.

be overturned by 60 mph winds. A thunderstorm is classified as severe when wind speeds exceed 58 mph, placing improperly anchored mobile homes at risk.

Over six percent of the homes in the county are unoccupied. Unoccupied homes may not be maintained as well as occupied housing, thus adding to their vulnerability. Also, over three percent of households in the county report no available vehicles. Households without vehicles may have difficulty evacuating during a hazardous event and a reduced ability to access resources in time of need.

The vast majority of homes in the county were built 1990 or later (Figure 11). Housing age can serve as an indicator of risk, as structures built prior to state or local building codes being developed may be more vulnerable. According to the Department of Housing and Urban Development (HUD), older homes are at greater risk of poor repair and dilapidation resulting in blighted or substandard properties. Residents living in these homes maybe at higher risk to the impacts of high winds, tornadoes, severe winter storms, and thunderstorms.

Figure 11: Housing Age in Dallas County



Source: U.S. Census Bureau[27]

[27] United States Census Bureau. "2020 Census Bureau American Community Survey: DP04: Selected Housing Characteristics." https://data.census.gov.

Parcel Assessment and Valuation

The planning team acquired GIS parcel data from the County Assessor to analyze the location, number, and value of assessed properties at the parcel level. The data did not contain the number of structures on each parcel. A summary of the results of this analysis is provided in the following tables.

Table 32: Assessed Parcels and Value in the 1% Annual Flood Risk Area

Total Number of Improvements	Total Improvement Value	Number of Improvements in Floodplain	Value of Improvements in Floodplain	% of Improvements in Floodplain
34,462	$11,178,810,910	1,558	$1,158,464,010	5%

Source: County Assessor, 2022

Table 33: Assessed Parcels and Value in the 0.2% Annual Flood Risk Area

Total Number of Improvements	Total Improvement Value	Number of Improvements in Floodplain	Value of Improvements in Floodplain	% of Improvements in Floodplain
34,462	$11,178,810,910	1,309	$748,065,260	4%

Source: County Assessor, 2022

Table 34: County Flood Map Products

Type of Product	Product ID	Effective Date	Details
FIS Report	19049CV000B	12/7/2018	Flood Insurance Study
LOMA	19-07-0830A-190860	4/4/2019	Structure (residence) is outside SFHA
LOMA	20-07-0249A-190860	1/3/2020	Structure (residence) removed from SFHA
LOMA	20-07-0862A-190860	6/19/2020	Structure removed from SFHA

Source: FEMA Flood Map Service Center[28]

Future Development Trends

The future development trends discussed are specific to Dallas County. For a discussion of trends within individual communities, see *Section Seven: Community Profiles*.

The Dallas County Planning & Development administers building code, zoning, subdivision, and floodplain development for the rural, unincorporated areas of Dallas County, Iowa. During the past five years the county has seen a continued trend of annexation by cities as they continued to grow. In rural areas of the county, a trend of new housing continues, as well as a significant increase in commercial and industrial developments.

Requirement §201.6(c)(2)(ii)(C): [The plan should provide] a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

The county has issued 34 Flood Plain Development Permits for projects in rural Dallas County over the past five years, with projects including bank stabilization, wetland restoration, water and sewer improvements, and filling areas to create residential sites. According to the county, all projects meet the requirements of the NFIP.

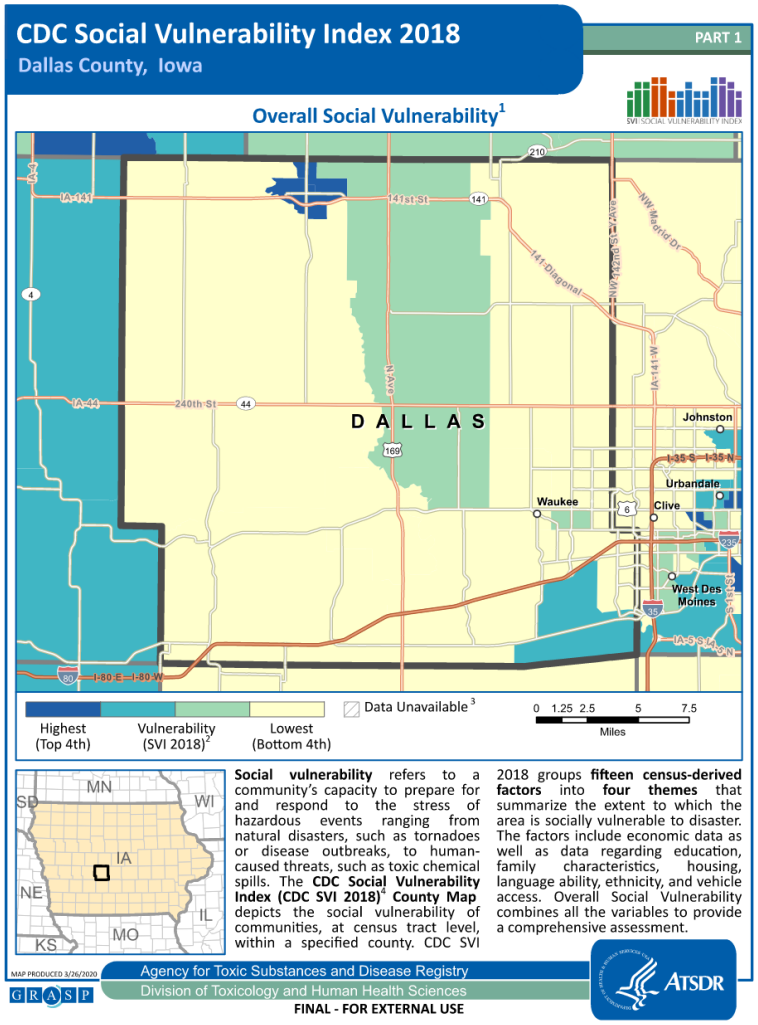
[28] Federal Emergency Management Agency. 2022. "FEMA Flood Map Service Center." Accessed July 2022. https://msc.fema.gov/portal/advanceSearch.

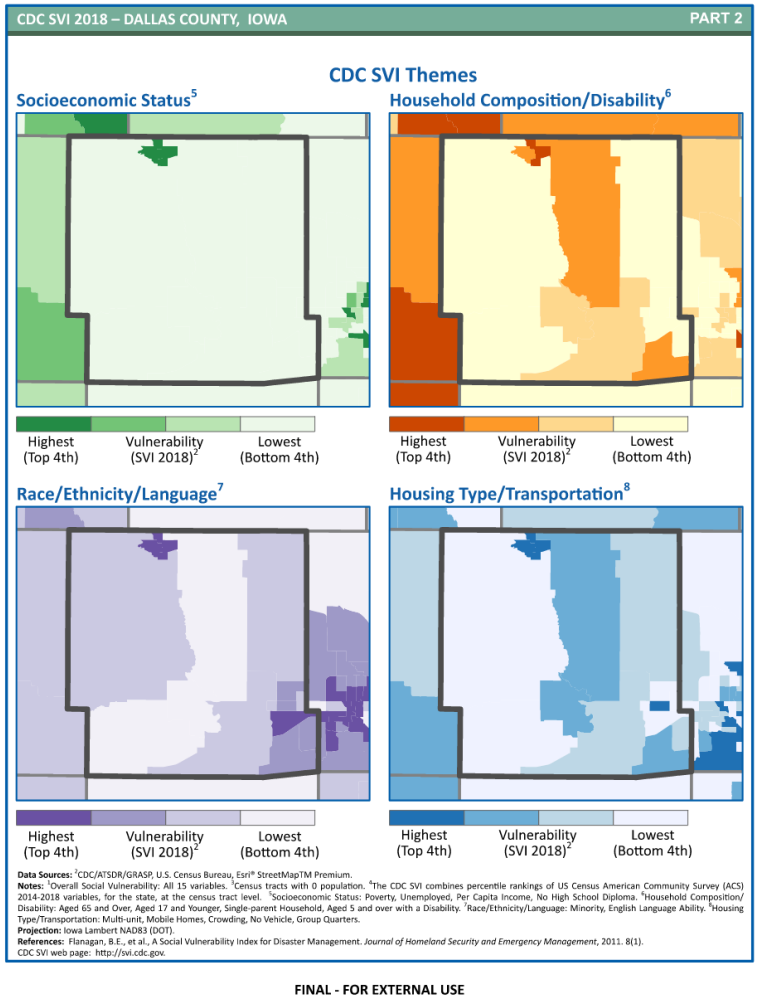
At this time, there are no significant housing or industrial developments planned for the next five years.

Social Vulnerability Index

All communities have some vulnerability to natural and man-made hazard events. Various social conditions such as poverty rates, vehicle access, language, or housing stock contribute to a community's overall social vulnerability. The Centers for Disease Control (CDC) has developed a Social Vulnerability Index to help public health officials and emergency responders identify communities at greater risk before, during, and after major hazardous events. The index evaluates 15 social factors and breaks down vulnerability into four domains: socioeconomic status; household composition and disability; minority status and language; housing and transportation.. Figure 12 illustrates the overall Social Vulnerability Index for Dallas County.

Figure 12: Social Vulnerability Index





Source: CDC Social Vulnerability Index, 2018[29]

[29] Centers for Disease Control Social Vulnerability Index. 2018. "CDC's Social Vulnerability Index (SVI): County Map" https://svi.cdc.gov/prepared-county-maps.html.

Community Lifelines

Community lifelines enable the continuous operation of critical government and business functions and are essential to human health and safety and economic security. When disrupted, decisive intervention is required for stabilization. FEMA has identified seven types of community lifelines: Safety and Security (law enforcement, fire service, search and rescue); Food, Water, Shelter; Health and Medical (medical care, public health, patient movement); Energy; Communications (infrastructure, responder communications, alerts warning, 911, dispatch); Transportation (highway, roadway, mass transit, railway, aviation); and Hazardous Material (facilities, HAZMAT, pollutants, contaminants).

Community lifelines identified in this plan were based off the categories identified by FEMA. Each participant identified their own community lifelines specific to their jurisdiction. These community lifelines are discussed in greater detail in *Section Seven: Community Profiles*. Dallas County lifelines are discussed below.

Transportation

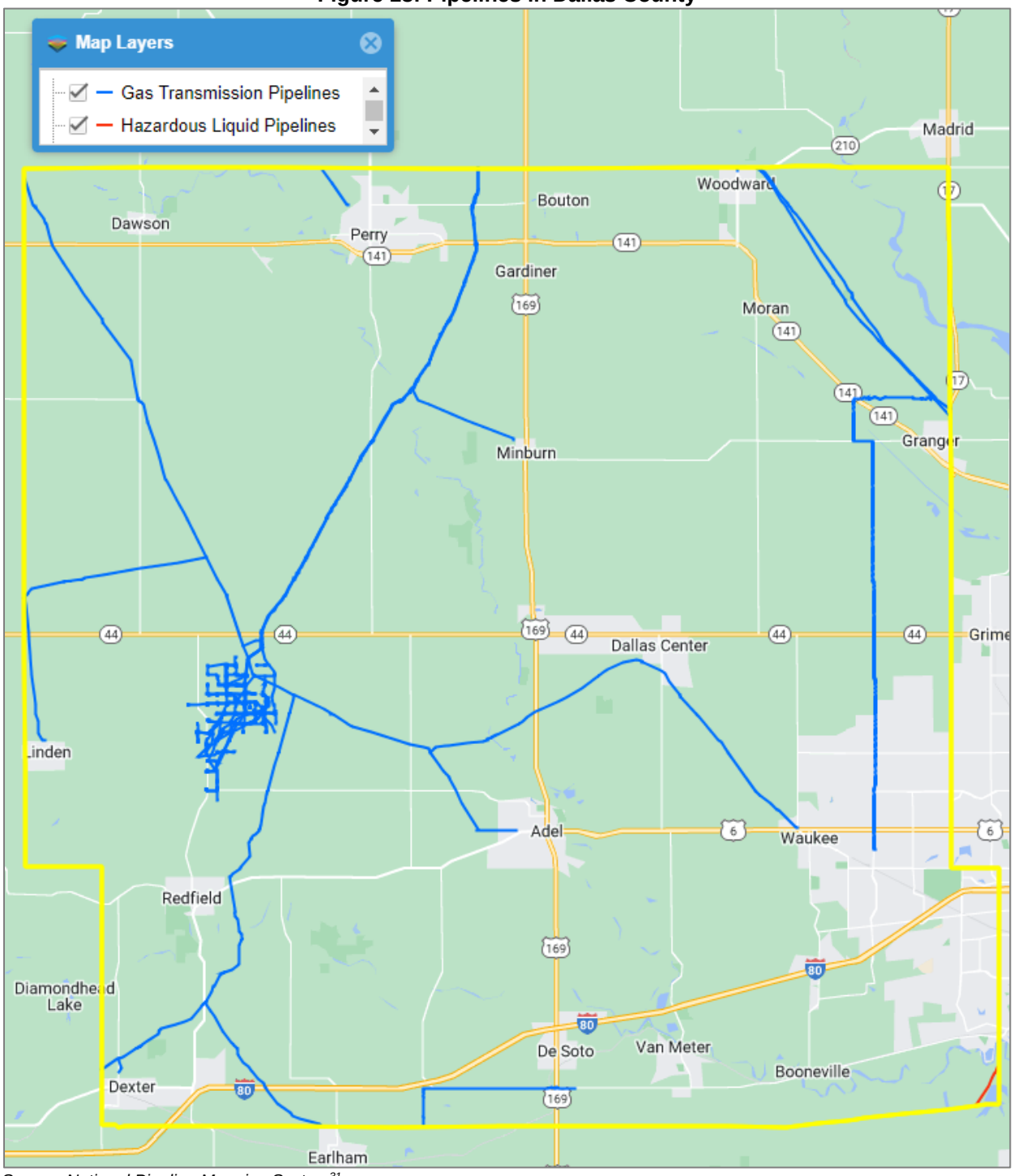
Transportation information is important to hazard mitigation plans because it suggests possible evacuation corridors, as well as areas more at risk of transportation incidents. Dallas County's major transportation corridors include Interstate 80, US Highways 6 and 169, and State Highways 44, 141, and 144. The most traveled route is Interstate 80 in West Des Moines, with an average of 70,600 vehicles daily.[30] Two railroad lines travel through the county. An Iowa Interstate Railroad line runs along the southern edge of the county and a Union Pacific line has a segment that runs into Waukee from the southeast. The county also has the Perry Municipal Airport, located just west of the City of Perry.

[30] Iowa Department of Transportation. 2020. "Iowa Traffic Data". Accessed May 2022. https://iowadot.maps.arcgis.com/apps/MapSeries/index.html?appid=0cce99afb78e4d3b9b24f8263717f910.

Hazardous Materials

There are several gas transmission pipelines and one hazardous liquid pipeline running through the county, as seen in the figure below.

Figure 13: Pipelines in Dallas County



Source: National Pipeline Mapping System[31]

[31] National Pipeline Mapping System. 2022. "Public Viewer." Accessed April 2022. https://pvnpms.phmsa.dot.gov/PublicViewer/.

According to the database/reporting system the State of Iowa uses for Tier II data – E-Plan Emergency Response Information System – there are 69 chemical storage sites within Dallas County which house hazardous materials.

Figure 14: Chemical Storage Sites

Facility Name	Address
Adel Maintenance No 2	516 Greene Highway Adel, IA 50003
Adel Office & Maintenance Facility No 1	415 River Street Adel, IA 50003
CenturyLink - Adel CO	908 Prairie Avenue Adel, IA 50003
CIRM-- Adel Plant	301 S 6th Street Adel, IA 50003
Dallas County Central Maintenance Facility	23380 250th Street Adel, IA 50003
Ferrellgas	23601 Pasco Lane Adel, IA 50003
Inland Coatings	26259 Highway 6 Adel, IA 50003
Landus Cooperative - Panther	23926 H Avenue Adel, IA 50003
Manatts Inc--Adel	103 N 19th Street Adel, IA 50003
MidAmerican Energy-Dallas County Service Center	29817 R Avenue Adel, IA 50003
Northern Natural Gas - Redfield Production & Drilling Facility	2554 G Avenue Adel, IA 50003
United Brick & Tile	1831 W Main Street Adel, IA 50003
Booneville West Sand Pit	30129 360th Street Booneville, IA 50263
Heartland Co-op, Booneville	106 Main Street Booneville, IA 50038
Heartland Co-op, Booneville Agronomy	29927 360th Street Booneville, IA 50038
New Cooperative, Inc. - Bouton	13773 N Avenue Bouton, IA 50039
Wells Fargo - University Building	13733 University Avenue Clive, IA 50325
West Side Storage #13384 Des Moines Water Works	2860 X Avenue Clive, IA 50311
Corteva Dallas Center	205 Fair View Drive Dallas Center, IA 50063
Heartland Co-op, Dallas Center	1107 Sycamore Street Dallas Center, IA 50063
ITC Jamaica	12028 141st Street Dawson, IA 50066
Landus Cooperative - Dawson	212 S First Street Dawson, IA 50066

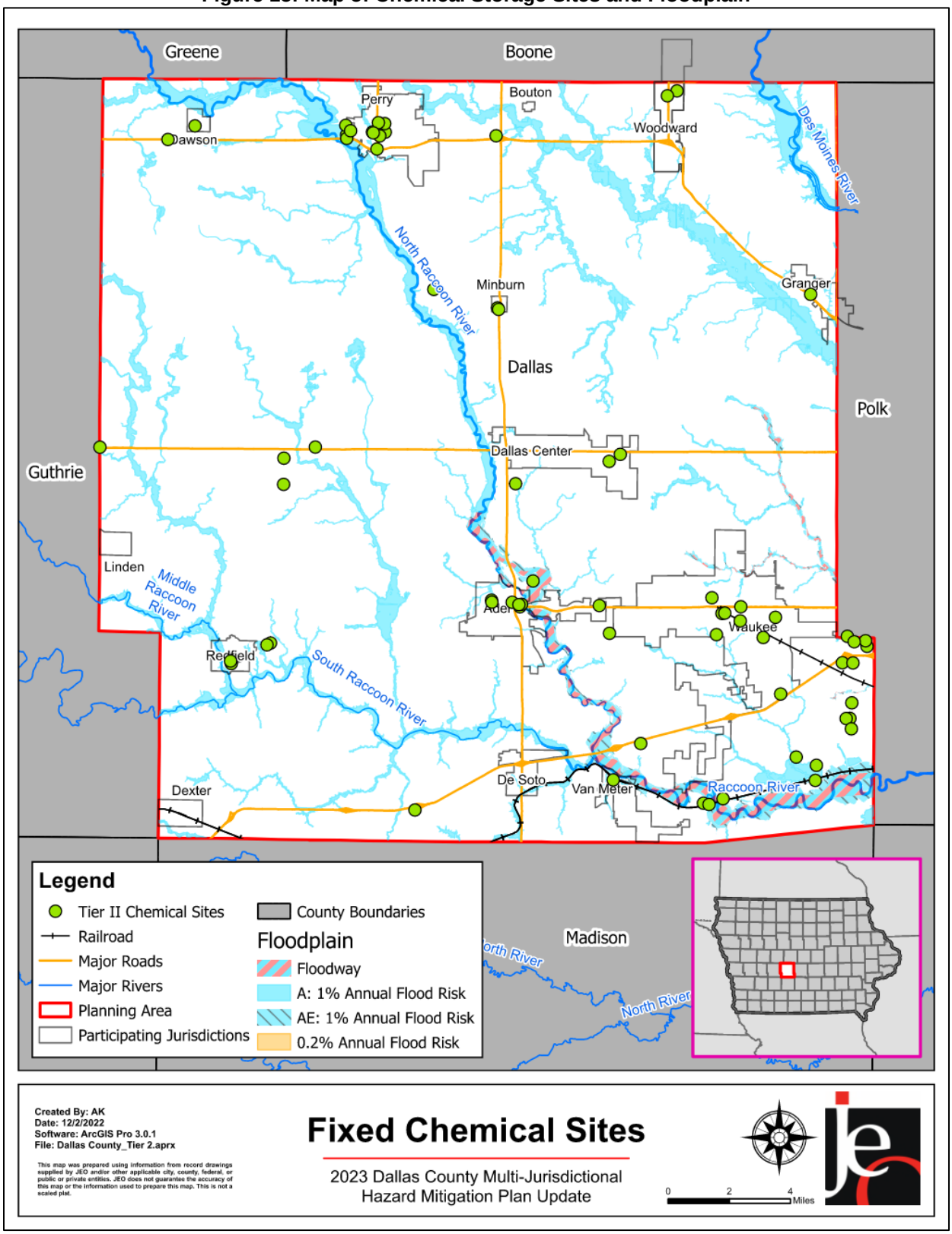
Facility Name	Address
Ferrellgas	20509 360th Court Earlham, IA 50072
Granger Maintenance Building	2111 West Kennedy Blvd Granger, IA 50109
Heartland Co-op, Minburn Acres	2263 187 Road Minburn, IA 50167
Heartland Co-op, Minburn Main Location	500 Walnut Street Minburn, IA 50167
Minburn Telephone Company	416 Chestnut Street Minburn, IA 50167
Agriland FS, Inc. - Dallas CO	23986 A Avenue Panora, IA 50216
CenturyLink - Perry CO	1424 Willis Avenue Perry, IA 50220
CIRM-- Perry Plant	915 Railroad Street Perry, IA 50220
ITC Midwest Perry	1400 I Court Perry, IA 50220
Minburn Telephone Company - CLEC	923 Willis Avenue Perry, IA 50220
Perry Maintenance Building	205 South First Street Perry, IA 50220
Perry Municipal Water Works	1101 W Third Street Perry, IA 50220
Perry Willis	910 I Court Perry, IA 50220
Progressive Foundry Inc	1518 1st Avenue Perry, IA 50220
Quick Oil Co	104 Willis Avenue Perry, IA 50220
Tyson Fresh Meats, Inc	13500 I Court Drive Perry, IA 50220
Wiese Industries	1501 5th Street Perry, IA 50220
Heartland Co-op, Redfield East Agronomy	30352 G Avenue Redfield, IA 50233
Heartland Co-op, Redfield Main Location	513 1 Street Redfield, IA 50233
Heartland Co-op, Redfield West	15571 Hwy 6 Redfield, IA 50233
Northern Natural Gas - Redfield Compressor Station	24282 G Avenue Redfield, IA 50233
Redfield Maintenance Building	1200 Omaha Street Redfield, IA 50233
CenturyLink - Van Meter CDO	406 Wilson Avenue Van Meter, IA 50261
Van Meter & I-80	2804 337th Court Van Meter, IA 52346
3079 CSC, Waukee	605 University Avenue

Facility Name	Address
	Waukee, IA 50263
CenturyLink - Waukee CO	645 Walnut Street Waukee, IA 50263
Fleet Farm	1300 SE Kettlestone Blvd Waukee, IA 50263
Heartland Co-op, Waukee	529 Ashworth Drive Waukee, IA 50263
Heartland Co-op, Waukee Bulk Plant	104 Ashworth Drive Waukee, IA 50263
MidAmerican Energy-Raccoon Trail Substation	2593 West Hickman Road Waukee, IA 50263
OneNeck IT Solutions	390 NE Alices Road Waukee, IA 50263
QG Printing II LLC	400 Deming Avenue Waukee, IA 50263
Waukee Public Works	805 University Avenue Waukee, IA 50263
Costco Wholesale (0788)	7205 Mills Civic Parkway West Des Moines, IA 50266
Des Moines Data Center (DM1/2/3/4)	8855 Grand Avenue West Des Moines, IA 50266
Hallett Materials Booneville Plant	8850 Raccoon River Drive West Des Moines, IA 50266
Lowes Of Jordan Creek, IA (#2648)	450 S Jordan Creek Parkway West Des Moines, IA 50266
Methodist West Hospital	1660 60th Street West Des Moines, IA 50266
MidAmerican Energy - Johnson Creek Substation	11080 Booneville Road West Des Moines, IA 50266
Ramada	1250 C Jordan Creek Parkway West Des Moines, IA 50266
Verizon Wireless Meadowview (IAW4447537)	101 Jordan Creek Parkway West Des Moines, IA 50266
Verizon Wireless Walnut Creek: Cell Site (IAW125787)	6000 University Avenue West Des Moines, IA 50266
Wells Fargo - CSCL Cards Services	7000 Vista Drive West Des Moines, IA 50266
Wells Fargo Home Mortgage HQ	7001 Westown Parkway West Des Moines, IA 50266
Wells Fargo West Des Moines Campus - Union Station	815 E Wells Fargo Trail West Des Moines, IA 50266
Landus Cooperative - Woodward	110 Railway Street Woodward, IA 50276
Minburn Telecommunications, Inc.	108 W 2nd Street Woodward, IA 50276

Source: E-Plan[32], Dallas County EMA - Personal Correspondence

[32] E-Plan – Emergency Response Information System. 2022. "Facility Search." Accessed November 2022. https://erplan.net/eplan/actions/facilitySearch.htm.

Figure 15: Map of Chemical Storage Sites and Floodplain



*Floodplain maps were created based on the available FIRM data at the time. Updated effective FIRM data was scheduled to be available on December 15, 2022. Please refer to FEMA's Flood Map Service Center for the current FIRM information.

Health and Medical Facilities

The following medical and health facilities are located within the county.

Table 35: Care Facility Inventory

Name	Type of Facility	Address	Number of Beds
Adel Acres	Free Standing NF/SNF	1919 Greene Street Adel	50
Arbor Springs of West Des Moines LLC	Free Standing SNF	7951 EP True Pkwy West Des Moines	56
Pearl Valley (Aspire of Perry)	Free Standing NF/SNF	2625 Iowa Street Perry	46
Cedar Ridge Village	Assisted Living Programs	8950 Coachlight Drive West Des Moines	68 (units)
Cedar Ridge Village	Free Standing NF/SNF	8950 Coachlight Drive West Des Moines	40
Dallas Center Medical Associates	Rural Health Clinics	507 14th Street Dallas Center	-
Dallas County Hospital	Critical Access Hospitals	610 Tenth Street Perry	25
DCH Family Medicine Perry	Rural Health Clinics	616 10th Street Perry	-
Edgewater A Wesley Active Life Community LLC	Free Standing NF/SNF	9225 Cascade Avenue West Des Moines	40
Edgewater ALP/D - Beacon Springs	Assisted Living Programs for People with Dementia	9250 Edgeline Drive West Des Moines	32 (units)
Edgewater Assisted Living - Brookside	Assisted Living Programs	9225 Cascade Avenue West Des Moines	62 (units)
Exemplar Care	Full Service Medical Clinic, 24-Hour Urgent Care	7300 Westown Pkwy, Stee 330, West Des Moines	-
Granger Nursing and Rehabilitation Center	Free Standing NF/SNF	2001 Kennedy Street Granger	67
Independence Village of Waukee	Free Standing NF/SNF	1645 SE Holiday Crest Circle, Waukee	48
Independence Village of Waukee AL	Assisted Living Programs	1654 SE Holiday Crest Circle, Waukee	80 (units)
Independence Village of Waukee MC	Assisted Living Programs for People with Dementia	1505 SE Laurel Street Waukee	32 (units)
Iowa Clinic West Des Moines	Medical Facility	5950 University Ave, West Des Moines	-
Iowa Clinic Waukee-Alice's Road	Medical Clinic – Family Medicine, Pediatrics, Physical Therapy	842 NE Alice's Road, Waukee	-
Iowa Clinic Waukee – Dartmoor Drive	Medical Clinic - Family Medicine	120 NE Dartmoor Drive, Waukee	-

Name	Type of Facility	Address	Number of Beds
Jordan Creek Family Medicine	Medical Clinic	230 S. 68th St, Ste 1203, West Des Moines	-
MercyOne Clinic Adel	Non-Profit Medical Center	1120 Greene St, Adel	-
MercyOne Clinic Waukee	Non-Profit Medical Center	25 West Hickman Rd, Waukee	-
Methodist West Hospital	Hospital	1660 60th Street West Des Moines	95
Morningstar at Jordan Creek	Assisted Living Programs	525 S. 60th Street West Des Moines	93 (units)
Morningstar at Jordan Creek MC	Assisted Living Programs for People with Dementia	525 S. 60th Street West Des Moines	58 (units)
Perry Dialysis	End Stage Renal Disease	610 10th Street Perry	-
Perry Lutheran Home	Free Standing NF/SNF	2323 E Willis Avenue Perry	70
Perry Lutheran Home Eden Acres Campus	Free Standing NF	3000 East Willis Avenue Perry	57
Perry Lutheran Homes Eden Acres Campus	Assisted Living Programs	1300 28th Street Perry	16 (units)
Perry Lutheran Homes Spring Valley Campus	Assisted Living Programs	501 12th Street Perry	77 (units)
Redfield Medical Clinic	Rural Health Clinics	1013 First Street Redfield	-
Spurgeon Assisted Living	Assisted Living Programs for People with Dementia	1006 Linden Street Dallas Center	64 (units)
Spurgeon Manor	Free Standing NF/SNF	1204 Linden Street Dallas Center	55
Spurgeon Manor	Residential Care Facilities	1204 Linden Street Dallas Center	30
Universal Pediatrics	Home Health Agencies	6750 Westown Pkwy, Ste 110, West Des Moines	-
Unity Point Clinic - Express at Waukee	Walk-In Urgent Care Clinic	950 E Hickman Rd. Waukee	-
Unity Point Clinic - Express at Jordan Creek	Walk-In Urgent Care Clinic	180 Jordan Creek Pkwy, Ste 120, West Des Moines	-
Unity Point at Kettlestone	Family Medicine Clinic	1152 Southeast Ashworth Rd, Waukee,	-
Unity Point at Lakeview	Walk-In Clinic	6000 University Ave, Ste 101, West Des Moines	-
Unity Point at Waukee	Medical Clinic	30 Hickman Rd, Waukee, IA 50263	-
Unity Point at WDM	Medical Clinic	6010 Mills Civic Pkwy, Suite 200, West Des Moines	-

Name	Type of Facility	Address	Number of Beds
Waggoner Pediatrics	Pediatric Medical Clinic	2555 Berkshire Pkwy, Ste A, Clive	-
Waukee Area Free Clinic	Free Clinic	Westview Church, 1155 SE Boone Dr., Waukee	-

Source: Iowa Department of Inspections and Appeals[33], Dallas County EMA - Personal Correspondence

Critical Facilities

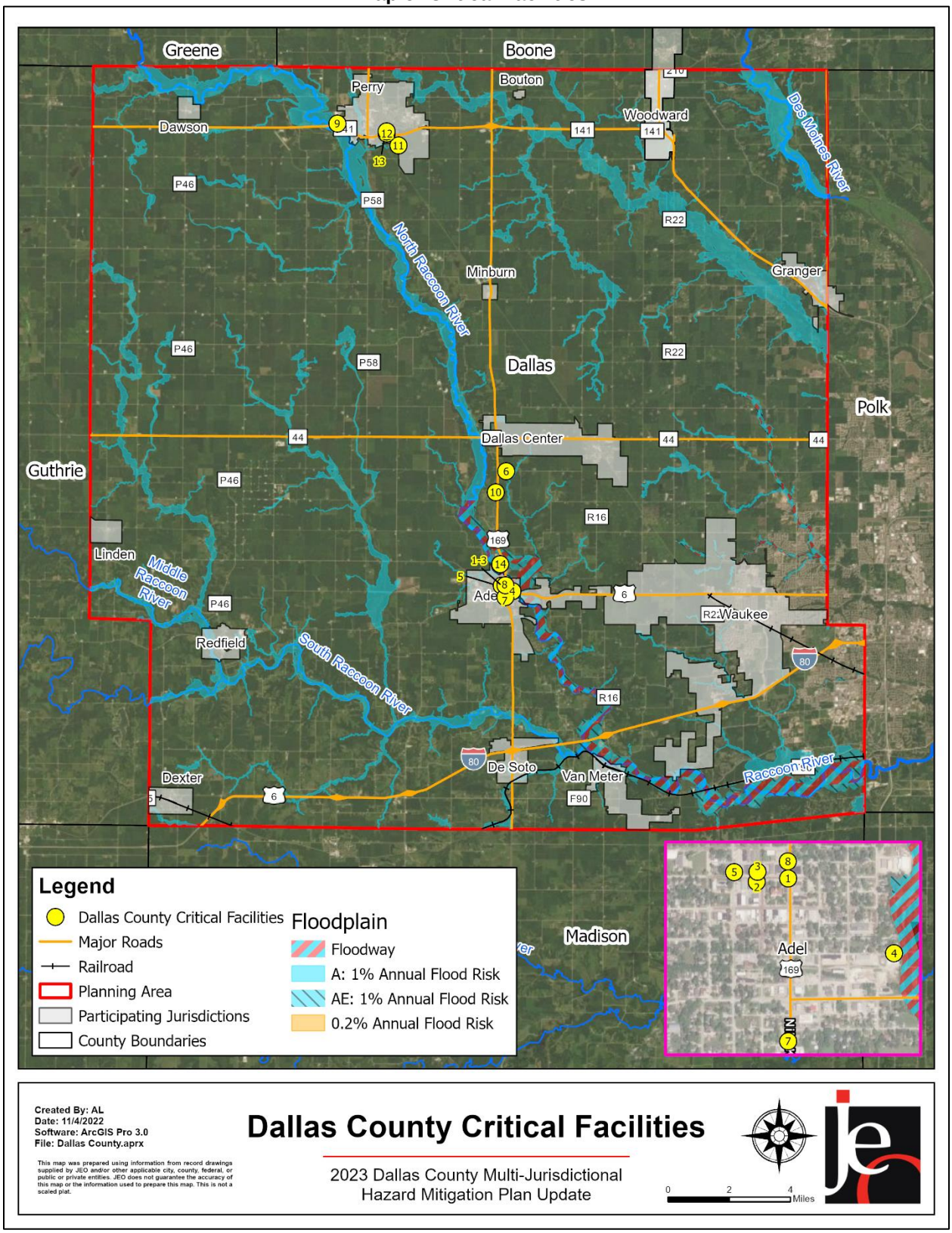
Dallas County identified critical facilities that are vital for disaster response, providing shelter to the public, and essential for returning the county's functions to normal operation during and after a disaster per the FEMA Community Lifelines guidance. Critical facilities were identified during the original planning process and updated as part of this plan update. The following table lists those critical facilities identified by the county.

Table 36: Critical Facilities

CF #	Name	Mass Care (Y/N)	Generator (Y/N)	Floodplain (Y/N)
1	Dallas County Courthouse	N	Y	N
2	County Office Building – Assessor, Planning & Development	N	N	N
3	County Office Building – Attorney, Central Services	N	Y	N
4	County Office Building – Engineer, Secondary Roads Office	N	N	N
5	County Office Building – Auditor/Jail	N	N	N
6	Central Maintenance Facility	N	N	N
7	Dallas County EMS – Adel Station	N	N	N
8	County Office Building – Sheriff	N	Y	N
9	ITC Midwest Electric Substation	N	Unknown	Y (1%)
10	County Emergency Operations Center / Human Services Campus	Y	Y	N
11	Dallas County Conservation	N	N	N
12	Dallas County EMS – Perry Station	N	N	N
13	Dallas County Hospital	Y	Y	N
14	Dallas County Extension Office	N	N	N

[33] Iowa Department of Inspections and Appeals. "Direct Care Worker Registry & Health Facility Database." Accessed April 2022. https://dia-hfd.iowa.gov/.

Map of Critical Facilities



*Floodplain maps were created based on the available FIRM data at the time. Updated effective FIRM data was scheduled to be available on December 15, 2022. Please refer to FEMA's Map Service for the current FIRM information.

Critical Infrastructure

Although they may not be listed in the table above, critical infrastructure can also include power and energy infrastructure, alert sirens, water infrastructure, and wastewater infrastructure.

State and Federally Owned Properties

The following table provides an inventory of state and federally owned properties within the county. Note that this list does not include federally or state-owned highway systems or specific buildings within each community.

Table 37: State and Federally Owned Facilities and Lands

Site Name	Nearest Community
Beaver Lake Wildlife Management Area (WMA)	Dexter
Courtney McCammond WMA	Dexter
Middle Raccoon River WMA	Linden
Perry WMA	Perry
Pleasant Valley WMA	Adel
Saylorville WMA	Granger, Woodward
Snyder Access WMA	Minburn
Two Rivers Access WMA	Van Meter
Silvers-Smith Woods State Preserve	Adel

Source: Iowa Department of Natural Resources,[34] U.S National Park Service[35]

Historical Sites

According to the National Register of Historic Places for Iowa by the National Park Service, there are 17 historic sites located in the county. Structures identified as cultural or historic resources represent assets that are unique to the county and are, in many situations, irreplaceable and have local significance.

Table 38: Historical Sites

Site Name	Date Listed	Nearest Community	In Floodplain?
Adel Bridge	4/18/2002	Adel	Y (Floodway)
Adel Public Square Historic District	12/18/2009	Adel	Y (0.2%)
Beaver Creek Bridge	6/25/1998	Perry	Y (1%)
Bruce's Snowball Market #1 Addition	9/8/2000	Perry	N
Dallas County Courthouse	11/26/1973	Adel	N
Dallas County Courthouse (Boundary Increase)	10/25/1979	Adel	N
Dayton Stagecoach Inn and Tavern Historic District	11/17/2021	Bouton	N
Dexter Community House	3/3/1975	Dexter	N
Downtown Perry Historic District	9/8/2000	Perry	N

34 Iowa Department of Natural Resources. 2022. "Wildlife Management Areas." https://www.iowadnr.gov/hunting/places-to-hunt-shoot/wildlife-management-areas#13254117-t---w

35 U.S. Department of the Interior National Park Service. 2017. "National Register of Historic Places." [shapefile]. https://irma.nps.gov/DataStore/Reference/Profile/2210280.

Site Name	Date Listed	Nearest Community	In Floodplain?
Feller, Robert William Andrew, Farmstead	12/17/1999	Van Meter	N
Jones Business College	11/30/2000	Perry	N
McColl, Anthony M., House	2/5/1987	Woodward	N
Minburn Railroad Depot	12/7/2015	Minburn	N
Perry Carnegie Library Building	10/3/1996	Perry	N
Prairie Center Methodist Episcopal Church and Pleasant Hill Cemetery	10/12/2004	Yale	N
Saint Patrick's Catholic Church and Rectory	3/22/2011	Perry	N
Wilson, John, House	3/30/1979	DeSoto	Y (1%)

Source: National Park Service[36]

36 U.S. National Park Service. April 2022. "National Register of Historic Places NPGallery Database." https://npgallery.nps.gov/nrhp.

Mitigation Strategy

Throughout this planning process, the county was asked to review mitigation projects from the 2018 HMP and identify new potential mitigation and strategic actions to further reduce the effects of hazards. Below are the updated and new mitigation and strategic actions for Dallas County.

Completed Mitigation and Strategic Actions

Mitigation Action	County Road System-200th St-B Ave.
Description	Place additional drainage structures and raise road profile.
Hazard(s)	Flooding, Transportation Incidents
Estimated Cost	$22,000
Funding	County Budget
Timeline	1 year
Priority	Medium
Lead Agency	Dallas County Roads Department
Status	Completed

Mitigation Action	County Road System-205th St-Pioneer Ave.
Description	Place additional drainage structures and raise road profile.
Hazard(s)	Flooding, Transportation Incidents
Estimated Cost	$18,000
Funding	County Budget
Timeline	1 year
Priority	Medium
Lead Agency	Dallas County Roads Department
Status	Completed

Mitigation Action	County Road System-210th St-V. Ave.
Description	Place additional drainage structures and raise road profile.
Hazard(s)	Flooding, Transportation Incidents
Estimated Cost	$15,000
Funding	County Budget
Timeline	1 year
Priority	Medium
Lead Agency	Dallas County Roads Department
Status	Completed

Mitigation Action	County Road System 250th St-T. Ave.
Description	Place additional drainage structures and raise road profile.
Hazard(s)	Flooding, Transportation Incidents
Estimated Cost	$18,000
Funding	County Budget
Timeline	1 year
Priority	Medium
Lead Agency	Dallas County Roads Department
Status	Completed

New Mitigation and Strategic Actions

Mitigation Action	Abandoned Quarry Flood Management
Description	Explore use of abandoned quarries (county-owned) as flood/water management area.
Hazard(s)	Flooding, Drought
Estimated Cost	Unknown
Funding	County Budget
Timeline	5+ years
Priority	Low
Lead Agency	Dallas County Board of Supervisors
Status	Not started

Mitigation Action	Alert/Warning Sirens
Description	Replace aging or obsolete outdoor warning sirens within the county. Add outdoor warning sirens in populated areas.
Hazard(s)	Tornadoes and Windstorms
Estimated Cost	$400,000
Funding	County Budget
Timeline	2-5 years
Priority	High
Lead Agency	Dallas County EMA
Status	Pending funding

Mitigation Action	Alert/Warning Sirens at Park Areas
Description	Install outdoor warning siren/system for designated park areas within the county.
Hazard(s)	Tornadoes and Windstorms
Estimated Cost	$15,000
Funding	County Budget
Timeline	3 years
Priority	Medium
Lead Agency	Dallas County Conservation Board
Status	Not started

Mitigation Action	Backup Generator
Description	Purchase a new backup generator for the Central Maintenance Facility.
Hazard(s)	All Hazards
Estimated Cost	$250,000
Funding	County Budget
Timeline	1 year
Priority	High
Lead Agency	Dallas County Board of Supervisors
Status	Not started

Mitigation Action	Reinforced Structures
Description	Upgrade existing structures or construct new ones in designated parks to provide shelter to the public during severe storms.
Hazard(s)	Severe Thunderstorms, Severe Winter Storms, Tornadoes and Windstorms
Estimated Cost	$300,000
Funding	County Budget
Timeline	5 years
Priority	High
Lead Agency	Dallas County Conservation Board
Status	Awaiting funding

Mitigation Action	Tree Management/Hazardous Tree Removal
Description	Improve tree management practices. Identify and remove hazardous limbs and/or trees.
Hazard(s)	Severe Thunderstorms, Severe Winter Storms, Tornadoes and Windstorms
Estimated Cost	$10,000
Funding	County Budget
Timeline	5 years
Priority	Medium
Lead Agency	Dallas County Conservation Board
Status	Performed on an annual basis

Continued Mitigation and Strategic Actions

Mitigation Action	County Road System-Other
Description	Improve drainage structures and raise road profile.
Hazard(s)	Flooding, Transportation Incidents
Estimated Cost	$250,000
Funding	County Budget
Timeline	1 year
Priority	Medium
Lead Agency	Dallas County Roads Department
Status	Not started

Mitigation Action	Replace Aging Generator System at County EOC North Campus
Description	Remove and replace 25+ year old generator with new generator that powers all EOC/North Campus
Hazard(s)	Severe Thunderstorms, Severe Winter Storms, Tornadoes and Windstorms
Estimated Cost	$100,000 - $500,000
Funding	Local Tax Revenue
Timeline	2-3 years
Priority	Medium
Lead Agency	Dallas County Board of Supervisors
Status	The county is currently seeking grant funds for the replacement.

Mitigation Action	Saferooms in New Dallas County Buildings
Description	Place safe rooms in new construction County public buildings.
Hazard(s)	Flooding, Severe Thunderstorms, Severe Winter Storms, Tornadoes and Windstorms
Estimated Cost	Unknown
Funding	County Budget, Local Tax Revenue
Timeline	3-5 years
Priority	High
Lead Agency	Dallas County Board of Supervisors
Status	This is ongoing as new buildings are planned and built.

Removed Mitigation and Strategic Actions

Mitigation Action	Move IT systems from present location to North Campus /County EOC
Description	Move systems to County EOC/North Campus. Building is 25 to 30ft. higher than present location
Hazard(s)	Flooding
Reason for Removal	This project is no longer a priority for the county.

Plan Maintenance

Hazard Mitigation Plans should be living documents and updated regularly to reflect changes in hazard events, priorities, and mitigation actions. These updates are encouraged to occur after every major disaster event, alongside community planning documents (e.g., annual budgets and Capital Improvement Plans), during the fall before the HMA grant cycle begins, and/or prior to other funding opportunity cycles begin, including CDBG, Water Sustainability Fund, Revolving State Fund, or other identified funding mechanisms.

The local planning team is responsible for reviewing and updating this community profile as changes can occur before or after a major event. The local planning team will include the Dallas County Emergency Management Agency and the plan will be reviewed bi-annually or as needed. Revisions will be conducted internally and proposed during open session of a Board of Supervisors meeting for adoption.

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Section Four:
Risk Assessment

Introduction

The ultimate purpose of this hazard mitigation plan is to minimize the loss of life and property across the county due to natural or man-made hazards. This section contains a county and local risk assessment including descriptions of potential hazards, vulnerabilities and exposures, probability of future occurrences, and potential impacts and losses. By conducting a county and local risk assessment, participating jurisdictions can develop specific strategies to address areas of concern identified through this process. The following table defines terms that will be used throughout this section of the plan.

Table 39: Term Definitions

Term	Definition
Hazard	A potential source of injury, death, or damages
Asset	People, structures, facilities, and systems that have value to the community
Risk	The potential for damages, loss, or other impacts created by the interaction of hazards and assets
Vulnerability	Susceptibility to injury, death, or damages to a specific hazard
Impact	The consequence or effect of a hazard on the community or assets
Historical Occurrence	The number of hazard events reported during a defined period of time
Extent	The strength or magnitude relative to a specific hazard
Probability	Likelihood of a hazard occurring in the future

Methodology

The risk assessment methodology utilized for this plan follows the same methodology as outlined in the FEMA Local Mitigation Planning Handbook. This process consists of four primary steps:

1. Describe the hazard
2. Identify vulnerable community assets
3. Analyze risk
4. Summarize vulnerability

When describing the hazard, this plan will examine the following items: previous occurrences of the hazard within the county; locations where the hazard has occurred in the past or is likely to occur in the future; extent of past events and likely extent for future occurrences; and probability of future occurrences. While the identification of vulnerable assets will be conducted across the entire county, *Section Seven* will discuss community-specific assets at risk for relevant hazards. Analysis for regional risk will examine historic impacts and losses and what is possible should the hazard occur in the future. Risk analysis will include both qualitative (i.e., description of historic or potential impacts) and quantitative data (i.e., assigning values and measurements for potential loss of assets). Finally, each hazard identified in the plan will provide a summary statement encapsulating the information provided during each of the previous steps of the risk assessment process.

For each of the hazards profiled, the best available and most appropriate data available have been considered. Further discussion relative to each hazard is discussed in the hazard profile portion of this section.

Requirement §201.6(c)(2): Risk assessment. The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

Requirement §201.6(c)(2)(i): The risk assessment shall include a description of the type, location, and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

Requirement §201.6(c)(2)(ii): The risk assessment shall include a description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. The plan must also address National Flood Insurance Program insured structures that have been repetitively damaged by floods.

Requirement §201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area.

Requirement §201.6(c)(2)(iii): For multi-jurisdictional plans, the risk assessment must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

Average Annual Damages and Frequency

FEMA *Requirement §201.6(c)(2)(ii) (B)* suggests that when the appropriate data is available, hazard mitigation plans should also provide an estimate of potential dollar losses for structures in vulnerable areas. This risk assessment methodology includes an overview of assets at risk and provides historic average annual dollar losses for all hazards for which historic event data are available. Additional loss estimates are provided separately for those hazards for which sufficient data is available. These estimates can be found within the relevant hazard profiles.

Average annual losses from historical occurrences can be calculated for those hazards which there is a robust historic record and for which monetary damaged are recorded. There are three main pieces of data used throughout this formula.

- **Total Damages in Dollars:** This is the total dollar amount of all property damages and crop damages as recorded in federal, state, and local data sources. The limitation to these data sources is that dollar figures usually are estimates and often do not include all damages from every event, but only officially recorded damages from reported events.

- **Total Years of Record:** This is the span of years there are data available for recorded events. During this planning process, vetted and cleaned NCEI data are available for 1996 to 2021. Although some data are available back to 1950, this plan update only utilizes the more current and more accurate data available. Other periods of record for data sets are supplied where appropriate.

- **Number of Hazard Events:** This shows how often an event occurs. The frequency of a hazard event will affect how a community responds. A thunderstorm may not cause much damage each time, but multiple storms can have an incremental effect on housing and utilities. In contrast, a rare tornado can have a widespread effect on a community.

An example of the event damage estimate is found below:

$$\textbf{Annual Damages } (\$) = \frac{Total\ Damages\ in\ Dollars\ (\$)}{Total\ Years\ \text{of}\ Record\ (\#)}$$

Each hazard will be addressed in this plan, while those which have caused significant damages or occurred in significant numbers are discussed in detail. It should be noted that NCEI data are not all inclusive and the database provides very limited information on crop losses. To provide a better picture of the crop losses associated with the hazards within the county, crop loss information provided by the Risk Management Agency (RMA) of the USDA was also utilized for this update of the plan. The collected data were from 2000 to 2021. Data for all the hazards are not always available, so only those with an available dataset are included in the loss estimation.

Annual probability can be calculated based on the total years of record and the total number of years in which an event occurred. An example of the annual probability estimate is found below:

$$\textbf{Annual Probability } (\%) = \frac{Total\ Years\ with\ an\ Event\ Occuring\ (\#)}{Total\ Years\ of\ Record\ (\#)}\ x\ 100$$

Hazard Identification

The identification of relevant hazards for the county began with a review of the 2018 State of Iowa Hazard Mitigation Plan. Dallas County representatives and key contacts reviewed, discussed, and determined the list of hazards to be profiled in this HMP update at the Kick-off Meeting. The hazards for which a risk assessment was completed are included in the following table.

Table 40: Hazards Addressed in the Plan

Hazards Addressed in the Plan		
Animal and Plant Disease	Flooding	Severe Thunderstorms
Dam and Levee Failure	Grass/Wildland Fire	Severe Winter Storms
Drought	Hazardous Materials Release	Sinkhole
Earthquake	Human Infectious Diseases	Terrorism and Civil Unrest
Expansive Soils	Infrastructure Failure	Tornado and Windstorm
Extreme Temperature	Landslide	Transportation Incident

Hazard Changes

All hazards from the State HMP were included in this Hazard Mitigation Plan. However, some were combined due to their similarity of risks, impacts and mitigation strategies. These combined hazards are listed below.

- **Extreme Temperature:** This hazard includes both Extreme Heat and Extreme Cold. Extreme Cold is included here, rather than with Severe Winter Storms.
- **Flooding:** This hazard includes both Flash and Riverine Flooding.
- **Hazardous Materials Release:** This includes both Hazardous Materials and Radiological.

Hazard Assessment Summary Tables

The following table provides an overview of the data contained in the hazard profiles. Hazards listed in this table and throughout the section are in alphabetical order. This table is intended to be a quick reference for people using the plan and does not contain source information. Source information and full discussion of individual hazards are included later in this section. Annual probability is based off the number of years that had at least one event.

Table 41: Regional Risk Assessment

Hazard	Previous Occurrences	Approximate Annual Probability*	Likely Extent
Animal and Plant Disease	Animal Disease: 1	N/A	Unknown
	Plant Disease: 3	Plant Disease 3/22 = 14%	Crop damage or loss
Dam and Levee Failure	0	Less than 1%	Varies by structure
Drought	441/1,527 months	29%	D1-D4
Earthquake	0	Less than 1%	Less than 5.0 on the Richter Scale
Expansive Soils	Unknown	Unknown	Varies by event
Extreme Temperature	Cold: Avg 6 days/year	78/83 = 94%	Max Temp ≤10°F
	Heat: Avg 1 day/year	29/83 = 39%	Max Temp ≥100°F
Flooding	172	21/26 =81%	Some inundation of structures. Some evacuations of people may be necessary.
Grass/Wildfire	10	3/3 = 100%	Avg 22 acres Some homes and structures threatened or at risk
Hazardous Materials Release	Fixed Site Spill: 50	21/32 = 32%	Avg Liquid Spill: 217 gallons Avg Gas Spill: 300 lbs.
	Transportation Spill: 6	22/51 = 43%	Avg Liquid Spill: 182 gallons
Human Infectious Diseases	26,057 Covid cases	N/A	N/A

Hazard	Previous Occurrences	Approximate Annual Probability*	Likely Extent
Infrastructure Failure	Unknown	Unknown	Varies by event
Landslide	Unknown	Unknown	Varies by event
Severe Thunderstorms	650	26/26= 100%	>1" rainfall Avg 66 mph winds
Severe Winter Storms	79	25/26 = 96%	2-16" snow 10-60 mph winds
Sinkhole	Unknown	Unknown	Varies by location/event
Terrorism and Civil Unrest	0	Less than 1%	Varies by event
Tornado and Windstorm	Tornadoes: 31	17/26 = 65%	Mode: EF0 Range: EF0-EF1
	Windstorms: 31	18/26 = 69%	Avg: 55 mph Range 40-70 mph
Transportation Incident	Auto: 11,512	11/11 = 100%	Damages incurred to vehicles involved and traffic delays; substantial damages to aircrafts involved with some aircrafts destroyed
	Aviation: 9	8/60 = 13%	
	Rail: 31	19/47 = 40%	

** Annual Probability = Total Years with an Event Occurrence / Total Years of Record*

The following table provides loss estimates for hazards with sufficient data. Detailed descriptions of major events are included in *Section Seven: Community Profiles.*

Table 42: Hazard Loss Estimates for the Planning Area

Hazard Type		Count	Property	Crop[1]
Animal and Plant Disease	Animal Disease[16]	1	48 birds	N/A
	Plant Disease[1]	3	N/A	$5,056
Dam and Levee Failure[2,10]		0	-	N/A
Drought[3,6]		441/1,527 months	$12,650,000	$47,719,440
Earthquake[4]		0	-	-
Expansive Soils		Unknown	N/A	N/A
Extreme Temperature[5]	Cold (Max Temp ≤10°F)	Avg 6 days per year	N/A	$4,580
	Heat (Max Temp ≥100°F)	Avg 1 day per year	N/A	$558,530
Flooding[6]	Flash Flood	52	$2,020,000	$1,023,979
	Flood	120	$8,938,070	
Grass/Wildfire[7]		10	222 Acres	-
Hazardous Materials Release *9 Injuries, 3 deaths*	Fixed Site[8]	50	$0	N/A
	Transportation[9]	6	$182,140	N/A
Human Infectious Diseases[15] *154 deaths (Covid)*		26,057 Covid cases	N/A	N/A
Infrastructure Failure		Unknown	N/A	N/A

Hazard Type		Count	Property	Crop[1]
Landslide		Unknown	N/A	N/A
Severe Thunderstorms[6]	Hail	217	$813,000	$18,026,126
	Heavy Rain	134	$20,000	
	Lightning	11	$1,147,000	
	Thunderstorm Wind	288	$8,540,000	
Severe Winter Storms[6] *4 injuries*	Blizzard	14	$900,000	$374,815
	Heavy Snow	24	$4,290,450	
	Ice Storm	12	$848,330	
	Winter Storm	28	$574,900	
	Winter Weather	1	$0	
Sinkhole		Unknown	N/A	N/A
Terrorism and Civil Unrest[11]		0	-	N/A
Tornado and Windstorm[6]	Tornadoes: Mode: EF0 Range: EF0-EF3	31	$3,604,000	$0
	Windstorms: Average: 55 mph Range: 40-70 mph	31	$958,110	$15,560,764
Transportation Incident	Auto[12] *1,522 injuries, 53 deaths*	11,472	$76,326,109	N/A
	Aviation[13] *5 injuries, 2 deaths*	9	N/A	N/A
	Rail[14] *17 injuries, 3 deaths*	31	$300,148	N/A
Total		**12,545**	**$122,112,257**	**$83,273,290**

N/A: Data not available
1 USDA RMA, 2000 - 2021
2 IDNR Communication, 2022
3 NOAA, 1895 - March 2022
4 USGS, 1900 - April 2022
5 NOAA Regional Climate Center, 1939 - 2021
6 NCEI, 1996 - 2021
7 IDNR, 2019 - 2021
8 NRC, 1990 - 2021
9 PHMSA 1971 - April 2022
10 USACE NLD, 1900 - April 2022
11 University of Maryland, 1970 - 2018
12 IDOT, 2012 - April 2022
13 NTSB, 1962 - April 2022
14 FRA, 1975 - 2021
15 IDPH, as of 11/22/2022
16 IDALS, 11/22/2022

Historical Disaster Declarations

The following tables show past disaster declarations that have been granted within the county.

Small Business Administration Disasters

The U.S. Small Business Administration (SBA) was created in 1953 as an independent agency of the federal government to aid, counsel, assist, and protect the interests of small business concerns, to preserve free competitive enterprise, and maintain and strengthen the overall economy of our nation. A program of the SBA includes disaster assistance for those affected by major natural disasters. The following table summarizes the SBA Disasters involving the planning area since 2017.

Table 43: SBA Declarations

Declaration Date	Disaster Declaration Number	Title	Listed as Primary County	Listed as Contiguous County
06/06/2018	IA-00077	Severe Storms, Tornadoes, and Flooding		X
06/06/2018	IA-00083	Severe Winter Storms	X	
03/12/2019	IA-00087	Severe Storms, Flooding, and Tornadoes	X	
08/10/2020	IA-00092	Drought		X
08/10/2020	IA-00093	Drought	X	

Source: Small Business Administration, 2017-2022[37]

Presidential Disaster Declarations

The presidential disaster declarations involving the county from 1962 to April 2022 are summarized in the following table. Declarations prior to 1962 are not designated by county and are not included.

Table 44: Presidential Disaster Declarations

Disaster Declaration Number	Declaration Date	Title
193	04/22/65	Flooding
259	04/25/69	Flooding
590	07/01/79	High Winds & Tornadoes
868	05/26/90	Severe Storms & Flooding
928	12/26/91	Ice Storm
996	07/09/93	Severe Storms & Flooding
1230	07/02/98	Severe Storms, Tornadoes And Flooding
1518	05/25/04	Severe Storms, Tornadoes, And Flooding

37 Small Business Administration. 2022. “Current Declared Disasters”. https://disasterloanassistance.sba.gov/ela/s/search-declarations.

Disaster Declaration Number	Declaration Date	Title
3239	09/10/05	Hurricane Katrina Evacuation
1705	05/25/07	Severe Storms, Flooding, And Tornadoes
1763	05/27/08	Severe Storms, Tornadoes, And Flooding
1880	03/02/10	Severe Winter Storm
1930	07/29/10	Severe Storms, Flooding, And Tornadoes
4234	07/31/15	Severe Storms, Tornadoes, Straight-Line Winds, And Flooding
4386	08/20/18	Severe Storms, Tornadoes, Straight-Line Winds, And Flooding
4421	03/23/19	Severe Storms And Flooding
3480	03/13/20	Covid-19
4483	03/23/20	Covid-19 Pandemic
4557	08/17/20	Severe Storms

Source: Federal Emergency Management Agency, 1953 – April 2022[38]

Climate Adaptation

Long-term climate trends have shifted throughout the 21st century and have created significant changes in precipitation and temperature which have altered the severity and subsequent impacts from severe weather events. The Regional and Local Planning Teams identified changes in the regional climate as a top concern impacting communities, residents, local economies, and infrastructure throughout the planning area. Discussions on temperature, precipitation, and climate impacts are included below.

The planning area is located in the Midwest region of the United States, which includes Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin. The area is well known for agricultural production. The Midwest has many federal, state, and private forests that provide considerable economic and ecological benefits. The Fourth National Climate Assessment has provided an overview of potential impacts within the planning area.[39]

- **Agriculture:** The Midwest is a major producer of a wide range of food and animal feed for national consumption and international trade. Increases in warm-season absolute humidity and precipitation have eroded soils, created favorable conditions for pests and pathogens, and degraded the quality of stored grain. Projected changes in precipitation, coupled with rising extreme temperatures before mid-century, will reduce Midwest agricultural productivity to levels of the 1980s without major technological advances.

- **Forestry:** Midwest forests provide numerous economic and ecological benefits, yet threats from a changing climate are interacting with existing stressors such as invasive species and pests to increase tree mortality and reduce forest productivity. Without adaptive actions, these interactions will result in the loss of economically and culturally important tree species such as paper birch and black ash and are expected to lead to the conversion of some forests to other forest types or even to non-forested ecosystems by the end of the century. Land managers are beginning to manage risk in forests by

[38] Federal Emergency Management Agency. 2022. “Disaster Declarations”. Accessed May 2022. https://www.fema.gov/disasters.
[39] U.S. Global Change Research Program. 2018. “Fourth National Climate Assessment”. https://nca2018.globalchange.gov/.

increasing diversity and selecting for tree species adapted to a range of projected conditions.

- **Biodiversity and Ecosystems:** The ecosystems of the Midwest support a diverse array of native species and provide people with essential services such as water purification, flood control, resource provision, crop pollination, and recreational opportunities. Species and ecosystems, including the important freshwater resources of the Great Lakes, are typically most at risk when climate stressors, like temperature increases, interact with land-use change, habitat loss, pollution, nutrient inputs, and nonnative invasive species. Restoration of natural systems increases in the use of green infrastructure, and targeted conservation efforts, especially of wetland systems, can help protect people and nature from climate change impacts.

- **Human Health:** Climate change is expected to worsen existing health conditions and introduce new health threats by increasing the frequency and intensity of poor air quality days, extreme high temperature events, and heavy rainfalls; extending pollen seasons; and modifying the distribution of disease-carrying pests and insects. By mid-century, the region is projected to experience substantial, yet avoidable, loss of life, worsened health conditions, and economic impacts estimated in the billions of dollars as a result of these changes. Improved basic health services and increased public health measures—including surveillance and monitoring—can prevent or reduce these impacts.

- **Transportation and Infrastructure:** Storm water management systems, transportation networks, and other critical infrastructure are already experiencing impacts from changing precipitation patterns and elevated flood risks. Green infrastructure is reducing some of the negative impacts by using plants and open space to absorb storm water. The annual cost of adapting urban storm water systems to more frequent and severe storms is projected to exceed $500 million for the Midwest by the end of the century.

- **Community Vulnerability and Adaptation:** At-risk communities in the Midwest are becoming more vulnerable to climate change impacts such as flooding, drought, and increases in urban heat islands. Tribal nations are especially vulnerable because of their reliance on threatened natural resources for their cultural, subsistence, and economic needs. Integrating climate adaptation into planning processes offers an opportunity to better manage climate risks now. Developing knowledge for decision-making in cooperation with vulnerable communities and tribal nations will help to build adaptive capacity and increase resilience.

Iowa's Changing Climate

The United States as a whole is experiencing significant changes in temperature, precipitation, and severe weather events resulting from climate change. According to the Iowa Climate Change Impacts Committee's Report to the Governor and Iowa General Assembly, the following changes can be expected for Iowa's future climate:[40]

[40] Iowa Climate Change Impacts Committee. 2010. "Climate Change Impacts on Iowa". https://www.iowadnr.gov/portals/idnr/uploads/air/environment/climatechange/complete_report.pdf?amp;tabid=1077

Increased Precipitation

- Increased frequency of precipitation extremes that lead to flooding.
- Increase of 8 percent more precipitation from 1873 to 2008.
- A larger increase in precipitation in eastern Iowa than in western Iowa.

Higher Temperatures

- Long-term winter temperatures have increased six times more than summer temperatures.
- Nighttime temperatures have increased more than daytime temperatures since 1970.
- Iowa's humidity has risen substantially, especially in summer, which now has 13 percent more atmospheric moisture than 35 years ago as indicated by a three to five degree (Fahrenheit) rise in dew-point temperature. This fuels convective thunderstorms that provide more summer precipitation.

Agricultural Challenges

- Climate extremes, not averages, have the greater impact on crop and livestock productivity.
- Increased soil erosion and water runoff.
- Increased challenges associated with manure applications.
- Favorable conditions for survival and spread of many unwanted pests and pathogens.

Habitat Changes

- Plants are leafing out and flowering sooner.
- Birds are arriving earlier in the spring.
- Particular animals are now being sighted farther north than in the past.

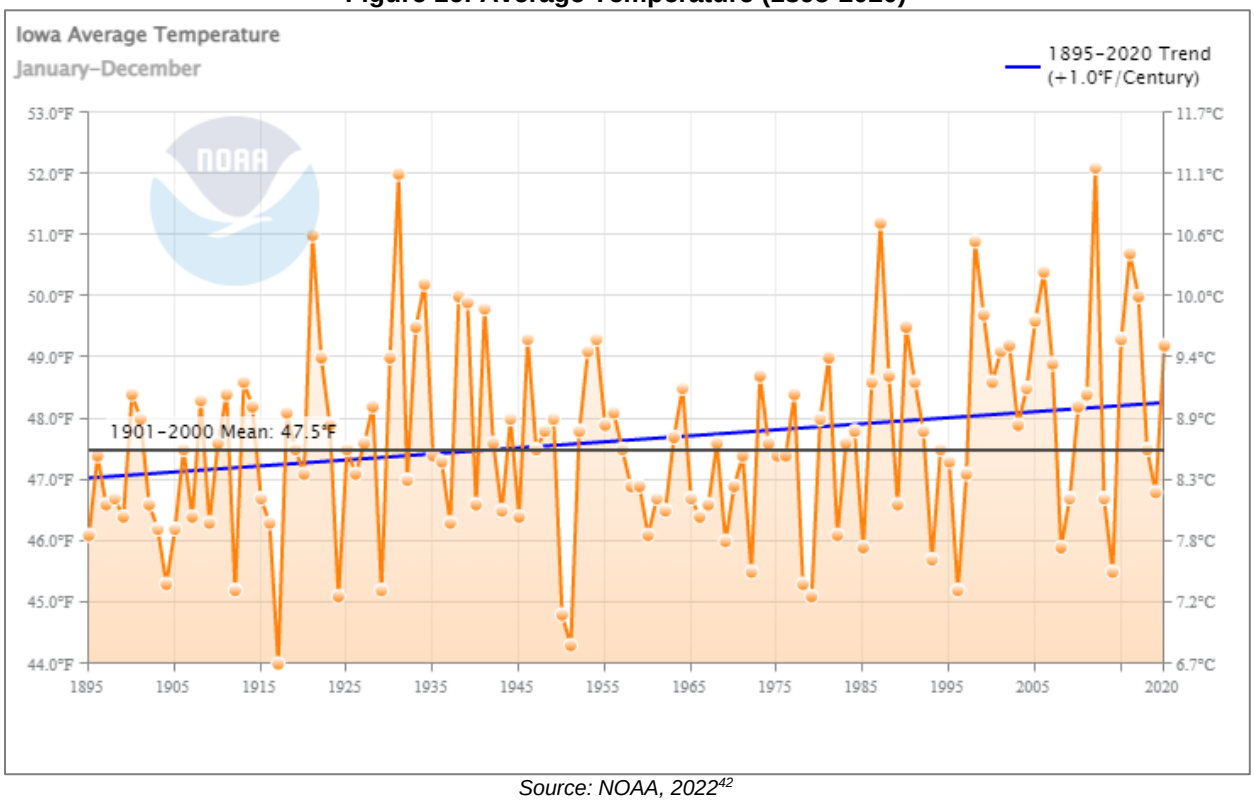
Public Health Effects

- Increases in heart and lung programs from increasing air pollutants of ozone and fine particles enhanced by higher temperatures.
- Increases in infectious diseases transmitted by insects that require a warmer, wetter climate.
- An increased prevalence of asthma and allergies.

Changes in Temperature

Since 1895 Iowa's overall average temperature has increased by 1°F (Figure 16). Climate modeling suggests warmer temperature conditions will continue in the coming decades and rise steadily into mid-century. Warming has increased the most in winter and spring months with winter minimum temperatures rising 2-4°F. In addition, there is greater warming for nighttime lows than for daytime highs. Since 2000, temperatures in Iowa have been higher than any other historical period, apart from the 1930s dustbowl era. Warming across the state has been mostly in the winter and fall, while summer has not warmed substantially with a below average number of very hot days. Historically unprecedented warming is projected to continue during this century.[41]

Figure 16: Average Temperature (1895-2020)



Source: NOAA, 2022[42]

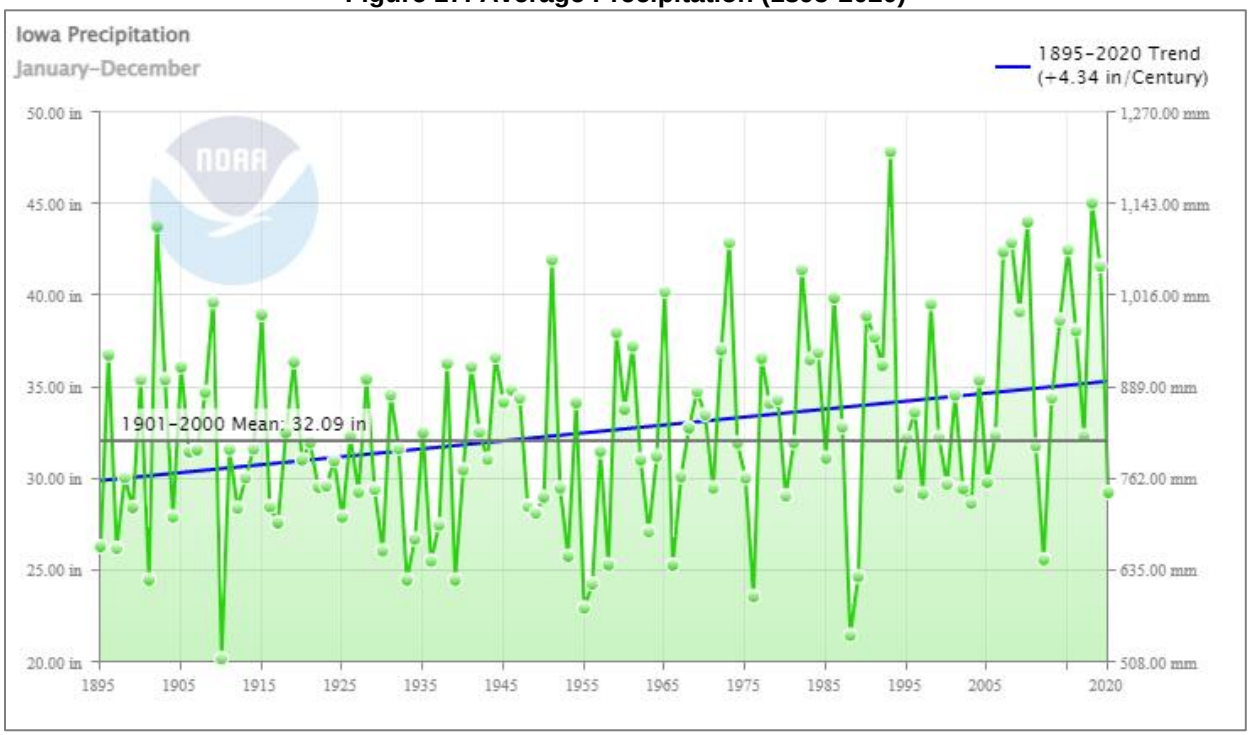
[41] NOAA. "State Climate Summaries 2022 - Iowa". Accessed June 2022. https://statesummaries.ncics.org/chapter/ia/#:~:text=Precipitation%20varies%20widely%20across%20Iowa,central%20part%20of%20the%20state.

[42] NOAA. 2020. "Climate at a Glance: Statewide Time Series.". Accessed June 2022. https://www.ncdc.noaa.gov/cag/statewide/time-series/13/tavg/12/12/1895-2020?base_prd=true&begbaseyear=1901&endbaseyear=2000&trend=true&trend_base=100&begtrendyear=1895&endtrendyear=2020

Changes in Precipitation

Changing extremes in precipitation are anticipated in the coming decades, with more significant rain and snowfall events and more intense drought periods. Climatological patterns of precipitation for Iowa consist of an east-west gradient, with drier conditions to the west and wetter to the east The southeastern portion of the state receives around 38 inches annually compared to only 26 inches in the northwest. Much of Iowa's precipitation falls in summer, with an average of 14 inches in the central part of the state. Spring precipitation has been above average since 1990. Since 1895, yearly annual precipitation for Iowa has increased (Figure 17). This trend is expected to continue as the impacts of climate change continue to be felt.[43]

Figure 17: Average Precipitation (1895-2020)



Source: NOAA, 2022[44]

[43] NOAA. "State Climate Summaries 2022 - Iowa". Accessed June 2022. https://statesummaries.ncics.org/chapter/ia/#:~:text=Precipitation%20varies%20widely%20across%20Iowa,central%20part%20of%20the%20state.

[44] NOAA. 2020. "Climate at a Glance: Statewide Time Series.". Accessed June 2022. https://www.ncdc.noaa.gov/cag/statewide/time-series/13/pcp/12/12/1895-2020?base_prd=true&begbaseyear=1901&endbaseyear=2000&trend=true&trend_base=100&begtrendyear=1895&endtrendyear=2020.

Impacts from Climate Change

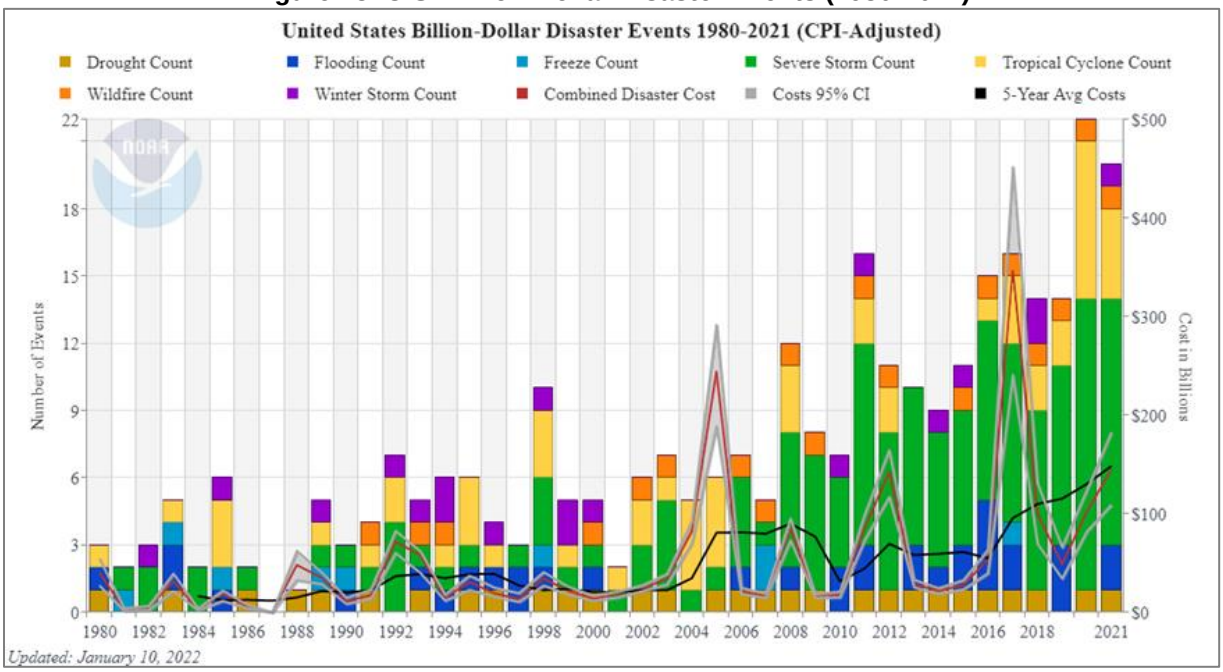
Observed changes in the intensity and frequency of extreme events are a significant concern now and in the future because of the social, environmental, and economic costs associated with their impacts. Challenges that are expected to affect communities, environments, and residents as a result of climate change include:

- Developing and maintaining sustainable agricultural systems.
- Resolving increasing competition among land, water, and energy resources.
- Conserving vibrant and diverse ecological systems.
- Enhancing the resilience of the region's people to the impacts of climatic extremes.

Certain groups of people may face greater difficulty when dealing with the impacts of a changing climate. Older adults, immigrant communities, and those living in poverty are particularly susceptible. Additionally, specific industries and professions tied to weather and climate, like outdoor tourism, commerce, and agriculture, are especially vulnerable.[45]

As seen in the figure below, the United States is experiencing an increase in the number of billion-dollar natural disasters due to increases in development and climate change.

Figure 18: U.S. Billion-Dollar Disaster Events (1980-2021)



Source: NOAA, 2021[46]

Agriculture

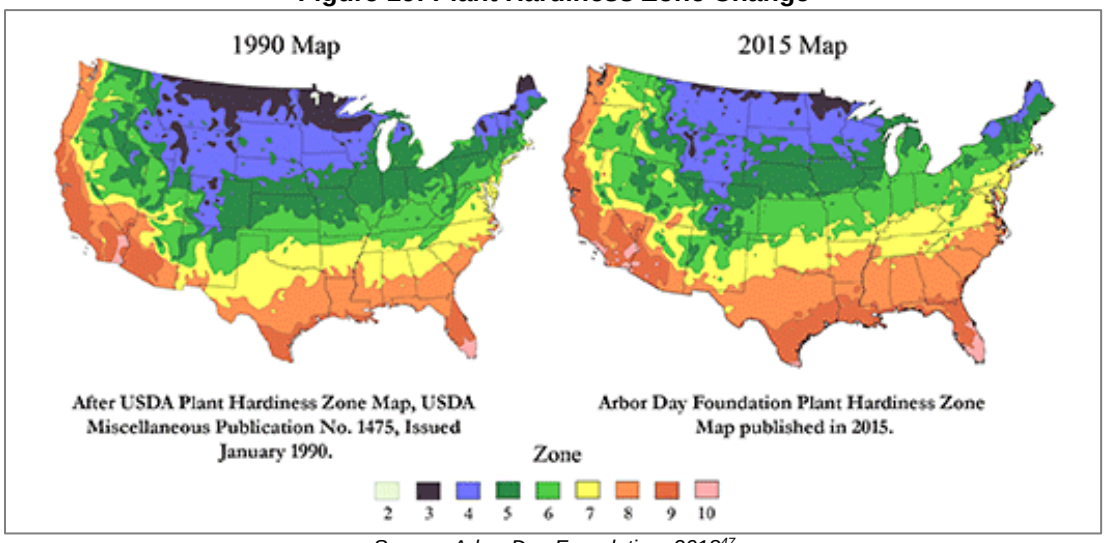
Agriculture is one of the most important sectors in Iowa's economy and is especially vulnerable to extreme weather conditions. The agricultural sector will experience an increase in droughts, an increase in grass and wildfire events, changes in the growth cycle as winters warm, an influx of new and damaging agricultural diseases or pests, and changes in the timing and magnitude of

[45] U.S. Environmental Protection Agency. "Climate Impacts on Society." Accessed June 2022. https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-society_.html.

[46] NOAA National Centers for Environmental Information. 2021. "U.S. Billion-Dollar Weather and Climate Disasters". https://www.ncdc.noaa.gov/billions/

rainfall. As described in the Plant Hardiness Zone map available for the United States (Figure 19), these changes have shifted the annual growing season and expected agricultural production conditions. Iowa is vulnerable to changes in growing season duration and growing season conditions as a heavily agriculturally dependent state. These added stressors on agriculture could have devastating economic effects if new agricultural and livestock management practices are not adopted.

Figure 19: Plant Hardiness Zone Change



Source: Arbor Day Foundation, 2018[47]

Air Quality

Rising temperatures will also impact air quality. Harmful air pollutants and allergens increase as temperatures increase. More extended periods of warmth contribute to longer pollen seasons that allow plant spores to travel farther and increase exposure to allergens. More prolonged exposure to allergens can increase the risk and severity of asthma attacks and worsen existing allergies in individuals.[48] An increase in air pollutants can occur from the increased number of grass/wildfires. The public can be exposed to harmful particulate matter from smoke and ash that can cause various health issues. Depending on the length of exposure, age, and individual susceptibility, effects from wildfire smoke can range from eye and respiratory irritation to severe disorders like bronchitis, asthma, and aggravation of pre-existing respiratory and cardiovascular diseases.[49]

Water Quality

Increasing temperatures, shifting precipitation patterns, and extreme weather events impact water quality throughout the state. With the increasing intensity and frequency of extreme precipitation events, impacts to water systems ultimately threaten human health. Events can lead to flooding and stormwater runoff that can carry pollutants across landscapes and threaten human health by contaminating water wells, groundwater, and other bodies of water. Common pollutants include pesticides, bacteria, nutrients, sediment, animal waste, oil, and hazardous waste.

[47] Arbor Day Foundation. 2018. "Hardiness Zones." https://www.arborday.org/media/map_change.cfm.
[48] Asthma and Allergy Foundation of America. 2010. "Extreme Allergies and Climate Change." Accessed 2022. https://www.aafa.org/extreme-allergies-and-climate-change/.
[49] AirNow. 2019. "Wildfire Smoke: A Guide for Healthcare Professionals." Accessed 2022. https://www.airnow.gov/wildfire-smoke-guide-publications/

As average temperatures increase, water temperatures also rise and put water bodies at risk for eutrophication and excess algal growth that reduce water quality. In agricultural landscapes this can be exacerbated from major storm events that cause sediment and nutrients such as phosphorous and nitrogen to runoff into nearby water sources. The runoff can contribute to the buildup of nutrients in the water, increasing plant and algae growth that can deplete oxygen and kill aquatic life. Nutrient enrichment can lead to toxic cyanobacterial harmful algae blooms (cyanoHABs), which can be harmful to animal and human health. CyanoHABs can cause economic damage such as decreasing property values, reducing recreational revenue, and increasing the costs for treating drinking water.[50]

Zoonotic Disease

Changes in temperature and precipitation can alter the geographic range of disease-carrying insects and pests. Mosquitoes that transmit viruses such as Zika, West Nile and dengue may become more prevalent in Iowa because of the increased temperatures and precipitation. These diseases may initially spread faster as the local population is not aware of the proper steps to reduce their risk.

Energy

As the number of 100°F days increases, along with warming nights, the stress placed on the energy grid will likely increase and possibly lead to more power outages. Severe weather events also stress emergency production, infrastructure transmission, and transportation. Roads, pipelines, and rail lines are all at risk of damages from flooding, extreme heat, erosion, or added stress from increased residential demands.[51] Critical facilities and vulnerable populations that are not prepared to handle periods of power outages, particularly during heat waves, will be at risk.

Drought and Extreme Heat

In Iowa, future droughts are projected to increase in intensity even with an increase in precipitation. An increase in average temperatures will contribute to the raise in the frequency and intensity of hazardous events like extreme heat and drought, which will cause significant economic, social, and environmental impacts on Iowans. Although drought is a natural part of the climate system, increasing temperatures will increase evaporation rates, decrease soil moisture, and lead to more intense droughts in the future, having negative impacts on farming and community water systems. Extreme heat events have adverse effects on both human and livestock health. Heatwaves may also impact plant health, with negative effects on crops during essential growth stages. Increasing temperatures and drought may reduce the potential for aquifers to recharge, which has long-term implications for the viability of agriculture in Iowa.

Grass/Wildfire

Rising temperatures will likely increase the frequency and intensity of grass/wildfires. Warmer temperatures cause snow to melt sooner and create drier soils and forests, which act as kindling to ignite fires. Dry and dead trees will increase fuel loads causing fires to spread much quicker. Additionally, warmer nighttime temperatures contribute to the continued spread of wildfires over multiple days.[52]

[50] USGS. “Nutrients and Eutrophication”. Accessed February 2021. https://www.usgs.gov/mission-areas/water-resources/science/nutrients-and-eutrophication?qt-science_center_objects=0#qt-science_center_objects.

[51] USGCRP, 2018: Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II: Report-in-Brief [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, 186 pp.

[52] NASA Global Climate Change. September 2019. “Satellite Data Record Shows Climate Change's Impact on Fires.” Accessed 2021. https://climate.nasa.gov/news/2912/satellite-data-record-shows-climate-changes-impact-on-fires/.

Severe Storms and Flooding

Iowa experiences frequent snowstorms and ice storms during winter, which can produce heavy snowfall and high wind gusts that lead to whiteout conditions. Thunderstorms capable of producing floods, hail, and tornadoes are common in the warmer months. As temperatures continue to rise, more water vapor evaporates into the atmosphere, creating increased humidity, which can increase the frequency and intensity of these storms. An increase in severe storms and heavy rain events will lead to more flooding and larger magnitude flood events. These severe storm and flooding events can cause increased damages to structures and put more people at risk of injury or death. A powerful derecho that occurred on August 10, 2020, was one of the most destructive thunderstorms to ever affect the state. The storm produced widespread winds greater than 100 mph and caused significant damage to millions of acres of corn and soybean crops across central Iowa. Homes, businesses, and vehicles were also severely damaged, with major impacts occurring mostly in Cedar Rapids.

Future Adaptation and Mitigation

The county will have to adapt to a changing climate and its impacts or experience an increase in economic losses, property damages, agricultural damages, and loss of life. Past events have typically informed HMPs to be more resilient to future events. This HMP includes strategies for the county to address these changes and increase resilience. However, future updates of this HMP should consider including adaptation as a core strategy to be better informed by future projections on the frequency, intensity, and distribution of hazards. Jurisdictions in the county should consider past and future climate changes and impacts when incorporating mitigation actions into local planning processes.

Hazard Profiles

Information from participating jurisdictions was collected and reviewed alongside hazard occurrence, magnitude, and event narratives as provided by local, state, and federal databases. Based on this information, profiled hazards were determined to either have a historical record of occurrence or the potential for occurrence in the future. The following profiles will broadly examine the identified hazards across the region. Hazards of local concern or events which have deviated from the norm are discussed in greater detail in each respective community profile (see *Section Seven* of this plan). The following table identifies the prioritization of hazards by participating jurisdictions (i.e., hazards of top concern). Local jurisdictional planning teams selected these hazards from the regional hazard list as the prioritized hazards for the community based on historical hazard occurrences, potential impacts, and the jurisdictions' capabilities. However, it is important to note that while a jurisdiction may not have selected a specific hazard to be profiled, hazard events can impact any community at any time and their selection is not a full indication of risk.

Table 45: Top Hazards of Concern

Jurisdiction	Animal and Plant Disease	Dam and Levee Failure	Drought	Earthquake	Expansive Soils	Extreme Temperature	Flooding	Grass/Wildland Fire	Hazardous Materials Release	Human Infectious Diseases	Infrastructure Failure	Landslide	Severe Thunderstorms	Severe Winter Storms	Sinkhole	Terrorism and Civil Unrest	Tornado and Windstorm	Transportation Incident
Adel							X				X		X	X			X	
Bouton							X						X	X			X	
Dallas Center	X								X		X						X	
Dawson													X	X			X	
De Soto													X	X			X	
Dexter	X										X			X			X	X
Granger											X		X				X	X
Linden	X												X	X			X	
Minburn									X		X			X			X	
Perry									X		X		X	X			X	
Redfield							X						X	X			X	
Van Meter							X		X		X		X	X			X	X
Waukee													X	X			X	X
Woodward													X				X	

Jurisdiction	Animal and Plant Disease	Dam and Levee Failure	Drought	Earthquake	Expansive Soils	Extreme Temperature	Flooding	Grass/Wildland Fire	Hazardous Materials Release	Human Infectious Diseases	Infrastructure Failure	Landslide	Severe Thunderstorms	Severe Winter Storms	Sinkhole	Terrorism and Civil Unrest	Tornado and Windstorm	Transportation Incident
Adel-DeSoto-Minburn Schools													X	X			X	
Dallas Center-Grimes Schools													X	X			X	
Perry Schools						X							X	X			X	
Perry Water Works						X					X			X			X	
Van Meter Schools												X	X				X	
Waukee Schools																X	X	X
West Central Valley Schools														X			X	X
Woodward-Granger Schools													X	X			X	X
Xenia Rural Water District										X	X			X				
Woodward Township Fire District								X					X				X	X

Animal and Plant Disease

Agriculture disease is any biological disease or infection that can reduce the quality or quantity of either livestock or vegetative crops. This section looks at both animal disease and plant disease, as both make up a significant portion of Iowa's and the planning area's economy.

The State of Iowa's economy is heavily invested in both livestock and crop sales. According to the Iowa Department of Agriculture & Land Stewardship (IDALS) in 2017, the market value of agricultural products sold was estimated at nearly $28 billion; this total is split between crops (estimated $13.8 billion) and livestock (estimated $15.1 billion). For the planning area, the market value of sold agricultural products totaled $93.9 million.[53]

Table 46 shows the population of livestock within the county. This count does not include wild populations that are also at risk from animal diseases.

Table 46: Livestock Inventory

County	Market Value of 2017 Livestock Sales	Cattle and Calves	Hogs and Pigs	Sheep and Lambs	Poultry Egg Layers
Dallas	$28,681,000	22,221	102,435	773	248,947

Source: U.S. Census of Agriculture, 2017

The following tables provide the value and acres of land in farms for the county. Corn is the most prevalent crop type in the region, followed by soybeans.

Table 47: Land and Value of Farms in the County

County	Number of Farms	Land in Farms (acres)	Market Value of 2017 Crop Sales
Dallas	924	293,435	$143,768,000

Source: U.S. Census of Agriculture, 2017

Table 48: Crop Values

County	Corn		Soybeans		Wheat	
	Acres Planted	Value (2017)	Acres Planted	Value (2017)	Acres Planted	Value (2017)
Dallas	135,452	$87,400,000	100,679	$49,712,000	-	-

Source: U.S. Census of Agriculture, 2017

Location

Given the strong agricultural presence in the county, animal and plant disease have the potential to occur across the county. If a major outbreak were to occur, the economy in the entire region would be affected, including urban areas.

[53] US Department of Agriculture, National Agricultural Statistics Server. 2022. "2017 Census of Agriculture – County Data." Accessed May 2022. https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_2_County_Level/Iowa/.

The primary land uses where animal and plant disease will be observed include agricultural lands, range or pasture lands, and forests. It is possible that animal or plant disease will occur in domestic animals or crops in urban areas.

Historical Occurrences

Animal Disease

Dallas County experienced a confirmed case of highly pathogenic avian influenza (HPAI) in October 2022. According to IDALS, the virus was found in a non-commercial backyard flock and was the first confirmed case in Dallas County. The Iowa Secretary of Agriculture stated that enhanced biosecurity is the best way to protect animal health. The recent HPAI detections in birds do not present a public health concern, the CDC indicated.[54]

In 2015 Iowa experienced impacts to avian populations when 18 counties and 77 sites across the state were affected by HPAI. The 2018 Iowa State Hazard Mitigation Plan noted that more than 33 million birds had to be euthanized and disposed of with the cost of replacement estimated at $83.6 million. The replacement cost does not include economic impacts from unemployment and costs to euthanize and dispose of carcasses.

Plant Disease

The RMA provides data on plant disease events and plant losses in the county. There are three instances of plant diseases reported from 2000-2021 by the RMA. These outbreaks occurred in 2008, 2016, and 2019, and caused $5,056 in crop losses.

Emerald Ash Borer

The spread and presence of the Emerald Ash Borer (EAB) have become a rising concern for many Iowan communities in recent years. The beetle spreads through transport of infected ash trees, lumber, and firewood. All species of North American ash trees are vulnerable to infestation. Confirmed cases of EAB have been found in three Canadian provinces and 45 US states, primarily in the eastern, southern, and midwestern regions. The two most recent infestation confirmations came from Georgia and Vermont in 2020. EAB was first confirmed in Iowa on May 14th, 2010. Figure 20 shows the locations of Iowa's confirmed EAB cases as of May 2022. Additional confirmed cases have likely occurred and many communities across the state are prioritizing the removal of ash trees to help curb potential infestations and tree mortality.

While adult beetles cause little damage, larvae damage trees by feeding on the inner bark of mature and growing trees, causing tunnels. Effects of EAB infestation include extensive damage to trees by birds, canopy dieback, bark splitting, and water sprout growth at the tree base, and eventual tree mortality. EAB has impacted millions of trees across North America, killing young trees one to two years after infestation and mature trees three to four years after infestation.[55] In Dallas County, EAB was confirmed in the City of Waukee in 2015 and rural De Soto in 2019.[56] Iowa has an estimated 3.1 million urban ash trees. Estimated costs to Iowa communities for ash tree removal is $1.6 billion and $468 million to replant.[57] Dead or dying trees affected by EAB are also more likely to cause damage during high winds, severe thunderstorms, or severe winter

[54] Iowa Department of Agriculture and Land Stewardship. October 2022. "Iowa Department of Agriculture and Land Stewardship and USDA APHIS Confirm Case of Highly Pathogenic Avian Influenza in Non-Commercial Backyard Flock in Dallas County, Iowa." https://iowaagriculture.gov/news/hpai-confirmed-backyard-flock-dallas-co.

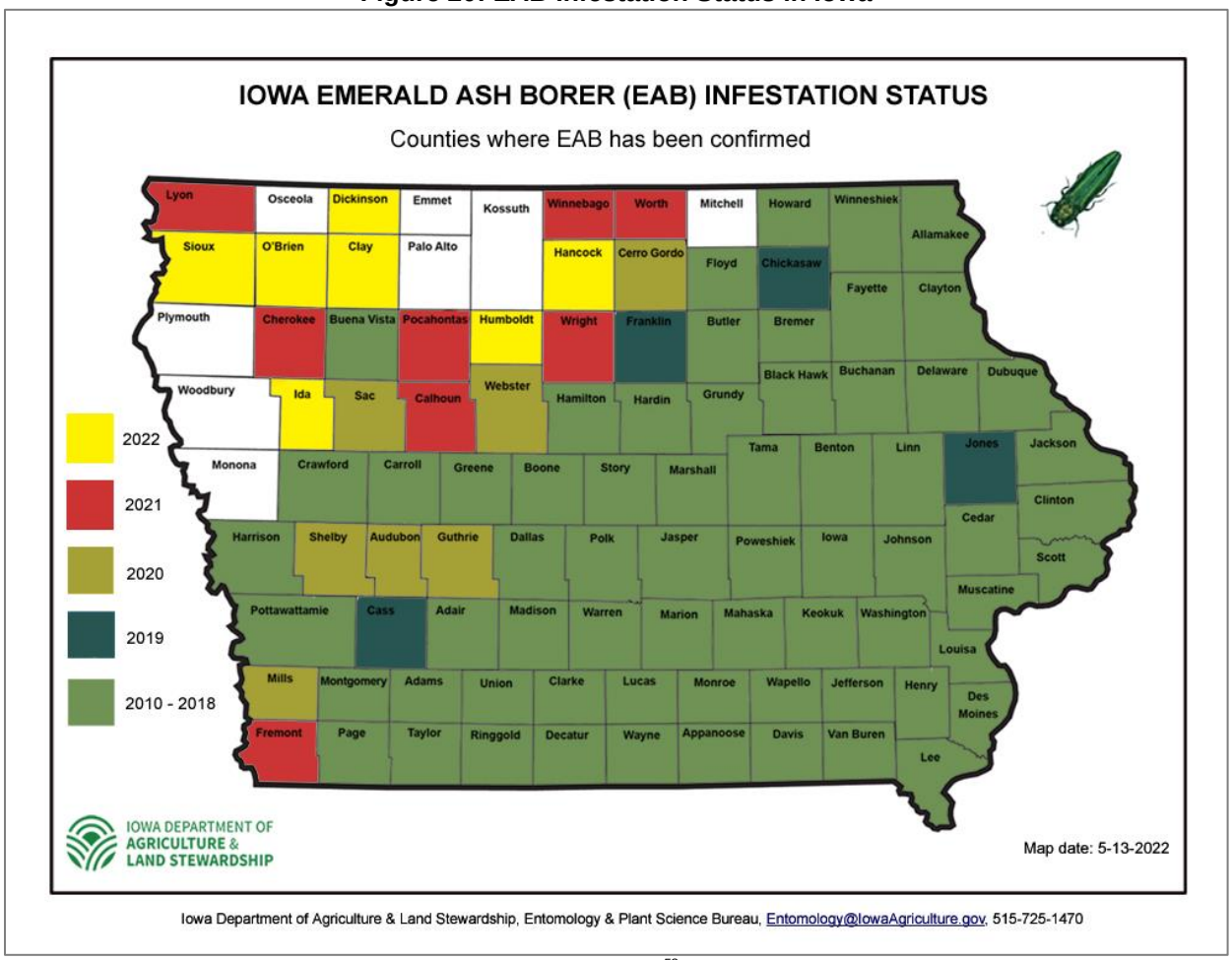
[55] Arbor Day Foundation. 2015. "Emerald Ash Borer." https://www.arborday.org/trees/health/pests/emerald-ash-borer.cfm.

[56] Iowa Department of Agriculture & Land Stewardship. 2022. "Iowa EAB Locations (Confirmed)." http://iowatreepests.com/documents/Iowa_EAB_Locations_2_17_2022.pdf.

[57] Iowa Department of Natural Resources. 2016. "Emerald Ash Borer." https://www.iowadnr.gov/Portals/idnr/uploads/forestry/Forest%20Health/emerald%20ash%20borer%202016.pdf?ver=2016-12-21-151336-840.

storms from weakened or hazardous limbs and can contribute a significant fuel load to grass/wildfire events.

Figure 20: EAB Infestation Status in Iowa



Source: Iowa Department of Agriculture & Land Stewardship, 2022[58]

Average Annual Losses

Average annual losses for agricultural animal disease cannot be calculated as there is no source in the state for documented historical events. According to the USDA RMA (2000-2021) there were three plant disease events in the planning area. While the RMA does not track losses for livestock, annual crop losses from plant disease can be estimated.

Table 49: Agricultural Plant Disease Losses

Hazard Type	Number of Events	Events per Year	Total Crop Loss	Average Annual Crop Loss
Plant Disease	3	.14	$5,056	$230

Source: RMA, 2000-2021

[58] Iowa Department of Agriculture & Land Stewardship. 2022. "Iowa Emerald Ash Borer (EAB) Infestation Status." http://www.iowatreepests.com/eab_home.html.

Extent
There is no standard for measuring the magnitude of agricultural disease. The State of Iowa does not report livestock disease numbers, so the extent is not known. The county is heavily dependent on the agricultural economy. Any severe plant or animal disease outbreak which may impact this sector would negatively impact the entire county's economy.

Probability
Given the lack of historical livestock disease numbers, the annual probability of animal disease occurrence is unknown. With the historic record for agricultural plant disease events (three out of 22 years with a reported event), for the purposes of this plan, the annual probability of agricultural plant disease occurrence is 14%.

Community Top Hazard Status
The following table lists jurisdictions which identified Animal and Plant Disease as a top hazard of concern:

Jurisdictions	
Dallas Center	Linden
Dexter	

Regional Vulnerabilities
The following table provides information related to regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 50: Regional Agricultural Disease Vulnerabilities

Sector	Vulnerability
People	-Those in direct contact with infected livestock -Potential food shortage during prolonged events -Residents in poverty if food prices increase
Economic	-Regional economy is reliant on the agricultural industry -Large scale or prolonged events may impact tax revenues and local capabilities -Land value may largely drive population changes within the county
Built Environment	None
Infrastructure	-Transportation routes can be closed during quarantine
Critical Facilities	None
Climate	-Exacerbate outbreaks, impacts, and/or recovery period -Changes in seasonal normals can promote spread of invasive species and agricultural disease

Dam and Levee Failure

A dam is defined as a barrier constructed across a water course for the purpose of storage, control, or diversion of water. Dams are typically constructed of earth, rock, concrete, or mine failings. Dam failure is the uncontrolled release of impounded water resulting in downstream flooding, affecting both life and property. Structural failure can occur during extreme conditions, which include, but are not limited to:

- Reservoir inflows in excess of design flows
- Flood pools higher than previously attained
- Unexpected drop in pool level
- Pool near maximum level and rising
- Excessive rainfall or snowmelt
- Large discharge through spillway
- Erosion, landslide, seepage, settlement, and cracks in the dam or area
- Earthquakes
- Vandalism
- Terrorism

The effective height of a dam is defined as the difference in elevation in feet between the natural bed of the stream or watercourse measured at the downstream toe (or from the lowest elevation of the outside limit of the barrier if it is not across stream) to the auxiliary spillway crest. The effective storage is defined as the total storage volume in acre-feet in the reservoir below the elevation of the crest of the auxiliary spillway. If the dam does not have an auxiliary spillway, the effective height and effective storage should be measured at the top of dam elevation.

The thresholds for state-regulated dams are outlined in Iowa Administrative Code 567-73.3. They are listed below.

- A dam with a height of at least 25 feet and a storage of 15 acre-feet or more at the top of the dam elevation.
- A dam with a storage of 50 acre-feet or more at the top of the dam elevation and a height of at least 6 feet.
- A dam that is assigned a hazard potential of high hazard.

Exceptions include:

- Road embankments or driveways with culverts are exempt unless such structure serves, either primarily or secondarily, a purpose commonly associated with dams, such as the temporary storage of water for flood control.

The State of Iowa assigns existing and proposed dams a hazard potential classification based on future land and impoundment use. Changes in downstream land use, development, impoundment, or critical hydraulic structures to a dam require a reevaluation of the hazard potential. The Iowa Department of Natural Resources periodically performs inspections of dams

posing a significant risk to downstream life and property. The three hazard potential classifications are low hazard, significant hazard, and high hazard and are defined below.

Table 51: Dam Hazard Classification

Hazard Type	Definition
Low	A dam shall be classified as “low hazard” if failure of the dam would result in no probable loss of human life, low economic losses, and low public damages.
Significant	A dam shall be classified as “significant hazard” if failure of the dam would result in no probable loss of human life but may damage residential structures or industrial, commercial, or public buildings; may negatively impact important public utilities or moderately traveled roads or railroads; or may result in significant economic losses or significant public damages.
High	A dam shall be classified as “high hazard” if located in an area where failure would result in probable loss of human life.

According to FEMA:

> The United States has thousands of miles of levee systems. These manmade structures are most commonly earthen embankments designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water to provide some level of protection from flooding. Some levee systems date back as far as 150 years. Some levee systems were built for agricultural purposes. Those levee systems designed to protect urban areas have typically been built to higher standards. Levee systems are designed to provide a specific level of flood protection. No levee system provides full protection from all flooding events to the people and structures located behind it. Thus, some level of flood risk exists in these levee-impacted areas.

Levee failure can occur several ways. A breach of a levee is when part of the levee breaks away, leaving a large opening for floodwaters to flow through. A levee breach can be gradual by surface or subsurface erosion, or it can be sudden. A sudden breach of a levee often occurs when there are soil pores in the levee that allow water to flow through causing an upward pressure greater than the downward pressure from the weight of the soil of the levee. This under seepage can then resurface on the backside of the levee and can quickly erode a hole to cause a breach. Sometimes the levee actually sinks into a liquefied subsurface below.

Another way a levee failure can occur is when the water overtops the crest of the levee. This happens when the flood waters simply exceed the lowest crest elevation of the levee. An overtopping can lead to significant erosion of the backside of the levee and can result in a breach and thus a levee failure.

Location

According to USACE’s National Inventory of Dams, there are a total of 66 dams located within the planning area, with classifications ranging from low to high hazard. Figure 21 maps the location of these dams in the county.

Figure 21: Dam Locations

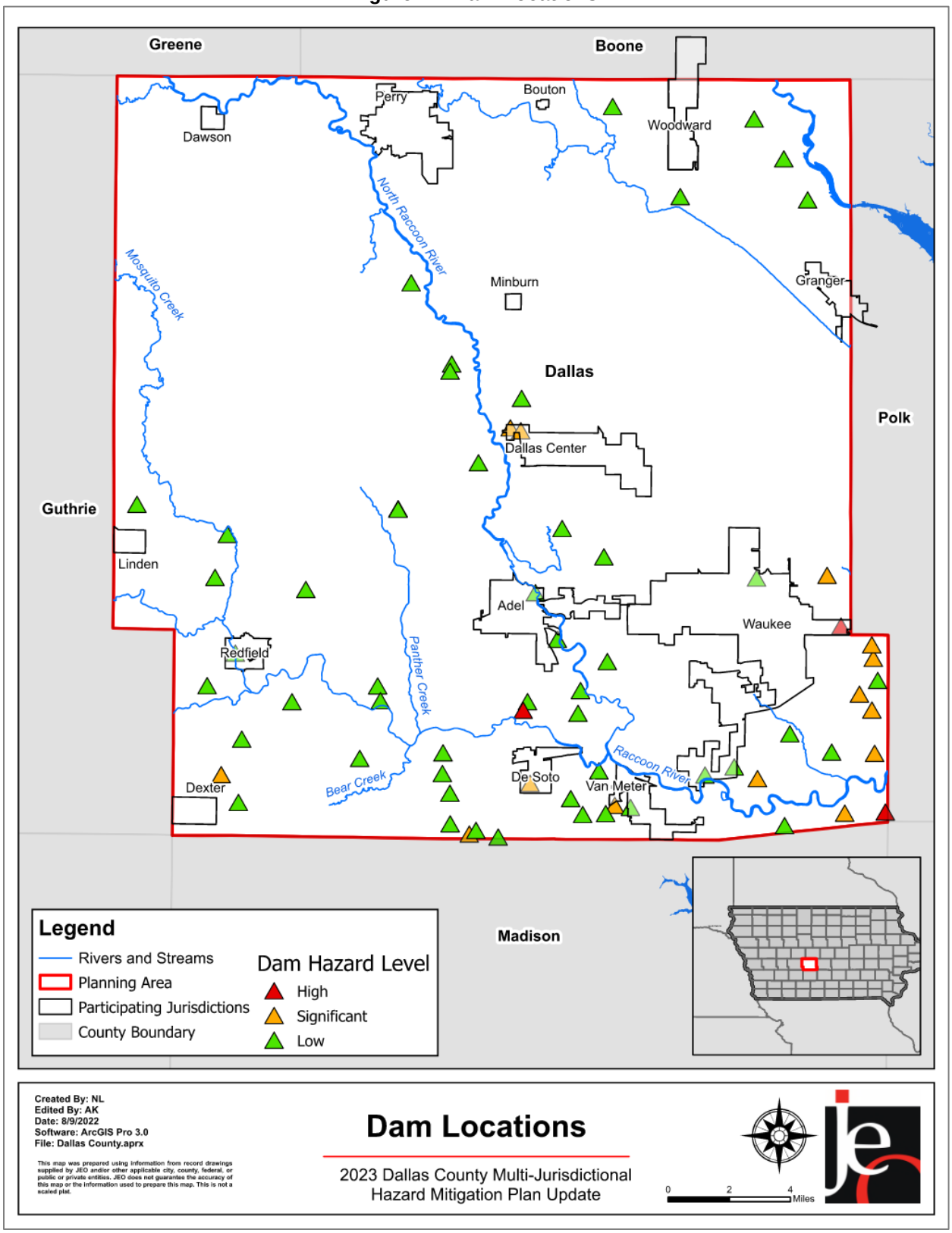


Table 52: Dams in the County

Low Hazard	Significant Hazard	High Hazard
50	14	3*

Source: USACE, 2022[59]
*The Iowa Homeland Security Hazard Mitigation Viewer classifies six dams as high hazard.

While the USACE inventory lists 66 dams in the county, the Iowa Department of Natural Resources inventory indicates there are 69 dams.[60] However, both inventories have the same three dams classified with high hazard potential. Dams classified with high hazard potential require the creation of an Emergency Action Plan (EAP). The EAP defines responsibilities and provides procedures designed to identify unusual and unlikely conditions which may endanger the structural integrity of the dam within sufficient time to take mitigating actions and to notify the appropriate emergency management officials of possible, impending, or actual failure of the dam. The EAP may also be used to provide notification when flood releases will create major flooding. An emergency situation can occur at any time; however, emergencies are more likely to happen when extreme conditions are present. High hazard dams are listed in the table below.

Table 53: High Hazard Dams in the Planning Area

Dam Name	NID ID	Dam Height (Feet)	Dam Length (Feet)	Condition	Inspection Date
Heritage Woods Dam	IA03548	35	300	Satisfactory	5/21/2020
Maffitt Reservoir Dam	IA01338	79	1,800	Satisfactory	6/12/2019
Southfork Dam	IA02411	38	560	Satisfactory	3/12/2021
Jordan Creek Mall – Northwest Dam*	IA03530	17	920	Satisfactory	6/22/2018
Jordan Creek Mall – South Dam*	IA03529	17	1,100	Satisfactory	6/22/2018
JSC Farms Dam*	IA02906	49	740	Satisfactory	8/19/2022

Source: USACE, 2022[61]*, IDNR, 2022*[62]*, HSEMD, 2022*[63]
*HSEMD classifies these dams as high hazard, while USACE and IDNR classify them as significant hazard dams.

According to the USACE, there are no high hazard dams upstream from the planning area that would impact the county.

The USACE's National Levee Database shows one levee within the planning area, which is located in Van Meter. The Van Meter Levee spans approximately 1.8 miles in length and protects 124 residents and 49 structures. The levee has not been inspected and thus has no risk rating. The levee is locally constructed, operated, and maintained. An illustration of the levee can be seen in Figure 22.

[59] United States Army Corps of Engineers. November 2022. "National Inventory of Dams." https://nid.usace.army.mil/#/dams/search/sy=@countyState:Dallas,%20Iowa&viewType=map&resultsType=dams&advanced=false&hideList=false&eventSystem=false.

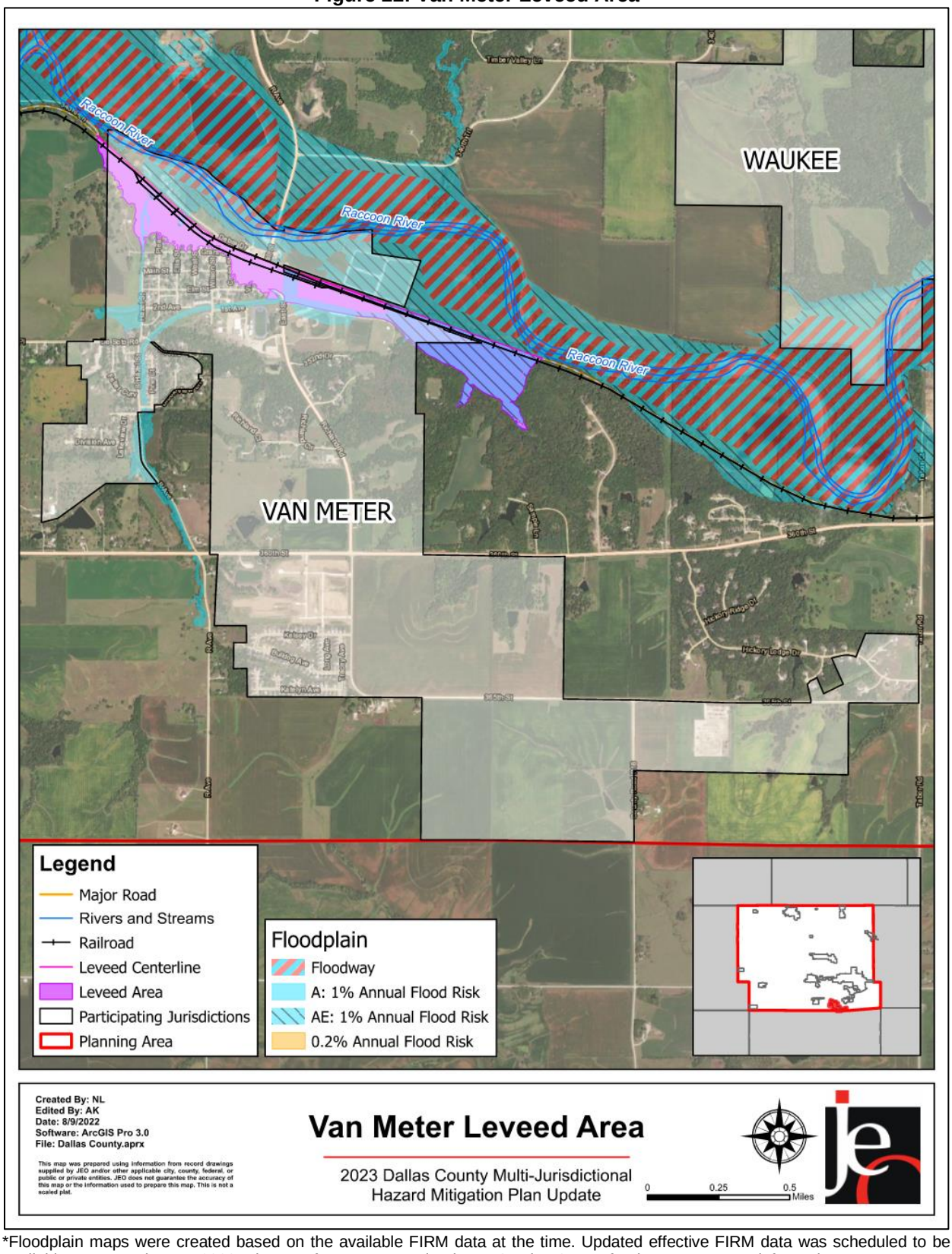
[60] Iowa Department of Natural Resources. November 2022. "Iowa DNR Dam Inventory." https://iowadnr.knack.com/dams#public/?view_136_filters=%5B%7B%22value%22%3A%22Existing%22%2C%22operator%22%3A%22is%22%2C%22field%22%3A%22field_431%22%7D%5D.

[61] United States Army Corps of Engineers. November 2022. "National Inventory of Dams." https://nid.usace.army.mil/#/dams/search/sy=@countyState:Dallas,%20Iowa&viewType=map&resultsType=dams&advanced=false&hideList=false&eventSystem=false.

[62] Iowa Department of Natural Resources. November 2022. "Iowa DNR Dam Inventory." https://iowadnr.knack.com/dams#public/?view_136_filters=%5B%7B%22value%22%3A%22Existing%22%2C%22operator%22%3A%22is%22%2C%22field%22%3A%22field_431%22%7D%5D.

[63] Iowa Department of Homeland Security and Emergency Management. November 2022. "Iowa Homeland Security Hazard Mitigation Viewer: Dams & Levee Failure." https://iowahsemd.maps.arcgis.com/apps/MapSeries/index.html?appid=581c59432cb24779af37161c492309fa.

Figure 22: Van Meter Leveed Area



*Floodplain maps were created based on the available FIRM data at the time. Updated effective FIRM data was scheduled to be available on December 15, 2022. Please refer to FEMA's Flood Map Service Center for the current FIRM information.

Beyond the USACE's National Levee Database, there is no known comprehensive list of levees that exists in the planning area, especially for private agricultural levees. Due to limited information on non-federal levees, it is not currently possible to document all levee locations, the areas for which they provide flood risk reduction, or the potential levee failure impacts.

However, the City of Adel indicated that the city has a berm structure in the northern portion of town to mitigate flooding along the North Racoon River watershed. The city has expressed interest in adding to the berm structure, which was originally built in the early 2000s.

Table 54: Levees in Planning Area

Levee Name	Sponsor	Location	Length (Miles)	Risk Level	Population in Leveed Area	Structures in Leveed Area	Property Value in Leveed Area
Van Meter Levee	Undefined	Van Meter	1.8	Not rated	124	49	$24.7 M

Source: USACE Levee Database[64]

Historical Occurrences

According to the Association of State Dam Safety Dam Incident Database, there are no reported dam failures within the planning area.[65] No recorded instances of levee failure were reported either.

Average Annual Losses

There are no recorded instances of dam or levee failure in the planning area; therefore, the average annual losses are $0.

Extent

Areas directly downstream of dams (e.g., agricultural land, out buildings, county roads, and communities) are at greatest risk in the case of dam failure. The extent of dam failure is indicated by its hazard classification and location. Note that hazard classification does not indicate the likelihood of a dam failure event to occur, but rather the extent of potential damages that may occur in case of a failure.

There is one levee in the planning area, located in the City of Van Meter. If the levee were to fail, approximately 49 structures would be inundated.

USACE, who is responsible for federal levee oversight and inspection of levees, has three ratings for levee inspections. Non-federal levees, such as the Van Meter Levee, are not inspected and thus do not have ratings.

[64] United States Army Corps of Engineers. April 2022. "National Levee Database." https://levees.sec.usace.army.mil/#/.
[65] Association of State Dam Safety Officials. "Dam Incident Database Search". Accessed April 2022. https://damsafety.org/incidents

Table 55: USACE Levee Rating Categories

Ratings	Description
Acceptable	All inspection items are rated as Acceptable
Minimally Acceptable	One or more inspection items are rated as Minimally Acceptable, or one or more items are rated as Unacceptable and an engineering determination concludes that the Unacceptable inspection items would not prevent the segment/system from performing as intended during the next flood event
Unacceptable	One or more items are rated as Unacceptable and would prevent the segment/system from performing as intended, or a serious deficiency noted in past inspections has not been corrected within the established timeframe, not to exceed two years

Source: USACE

Probability

For the purpose of this plan, the probability of dam or levee failure will be stated at less than one percent annually as no dams or levees have failed in the planning area.

Community Top Hazard Status

No jurisdictions identified Dam and Levee Failure as a top hazard of concern.

Regional Vulnerabilities

The following table provides information related to regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 56: Regional Dam and Levee Failure Vulnerabilities

Sector	Vulnerability
People	-Those living downstream of high hazard dams -Those at recreational sites situated near high hazard dams -Evacuation needs likely with high hazard dam failure events -Hospitals, nursing homes, and the elderly at greater risk due to low mobility -Minimal risk from unmapped private levees and berms
Economic	-Loss of downstream agricultural land -Businesses or recreation sites located in inundation areas would be impacted and closed for an extended period of time -Employees of closed businesses may be out of work for an extended period of time -Minimal impact to agricultural lands from levee failure
Built Environment	-Damage to facilities, recreation areas, and roads -All buildings within leveed areas are at risk to damages
Infrastructure	-Transportation routes could be closed for extended period of time -Minimal impact to infrastructure due to levee failure. Likely to be localized
Critical Facilities	-Any critical facilities in inundation or leveed areas are vulnerable to damages
Climate	-Increased annual precipitation contributes to sustained stress on systems -Changes in water availability and supply can constrain energy production and reservoir stores -Changes in seasonal precipitation and temperature normals can increase strain on any unmapped private levees and berms

Drought

Drought is generally defined as a natural hazard that results from a substantial period of below normal precipitation. Although many erroneously consider it a rare and random event, drought is a normal, recurrent feature of climate. It occurs in virtually all climatic zones, but its characteristics vary significantly from one region to another. A drought often coexists with periods of extreme heat, which together can cause significant social stress, economic losses, and environmental degradation. The planning area is largely rural, which presents an added vulnerability to drought events; drought conditions can significantly and negatively impact the agricultural economic base.

Drought is a slow-onset, creeping phenomenon that can affect a wide range of people, livestock, and industries. While many impacts of these hazards are non-structural, there is the potential that during prolonged drought events structural impacts can occur. Drought normally affects more people than other natural hazards, and its impacts are spread over a larger geographical area. As a result, the detection and early warning signs of drought conditions and assessment of impacts are more difficult to identify than that of quick-onset natural hazards (e.g., flood) that results in more visible impacts. According to the National Drought Mitigation Center (NDMC), droughts are classified into four major types:

> **Drought** is a normal, recurrent feature of climate, although many erroneously consider it a rare and random event. It occurs in virtually all climatic zones, but its characteristics vary significantly from one region to another.
> ~National Drought Mitigation Center

- **Meteorological Drought** is defined based on the degree of dryness and the duration of the dry period. Meteorological drought is often the first type of drought to be identified and should be defined regionally as precipitation rates and frequencies (norms) vary.

- **Agricultural Drought** occurs when there is deficient moisture that hinders planting germination, leading to low plant population per hectare and a reduction of final yield. Agricultural drought is closely linked with meteorological and hydrological drought, as agricultural water supplies are contingent upon the two sectors.

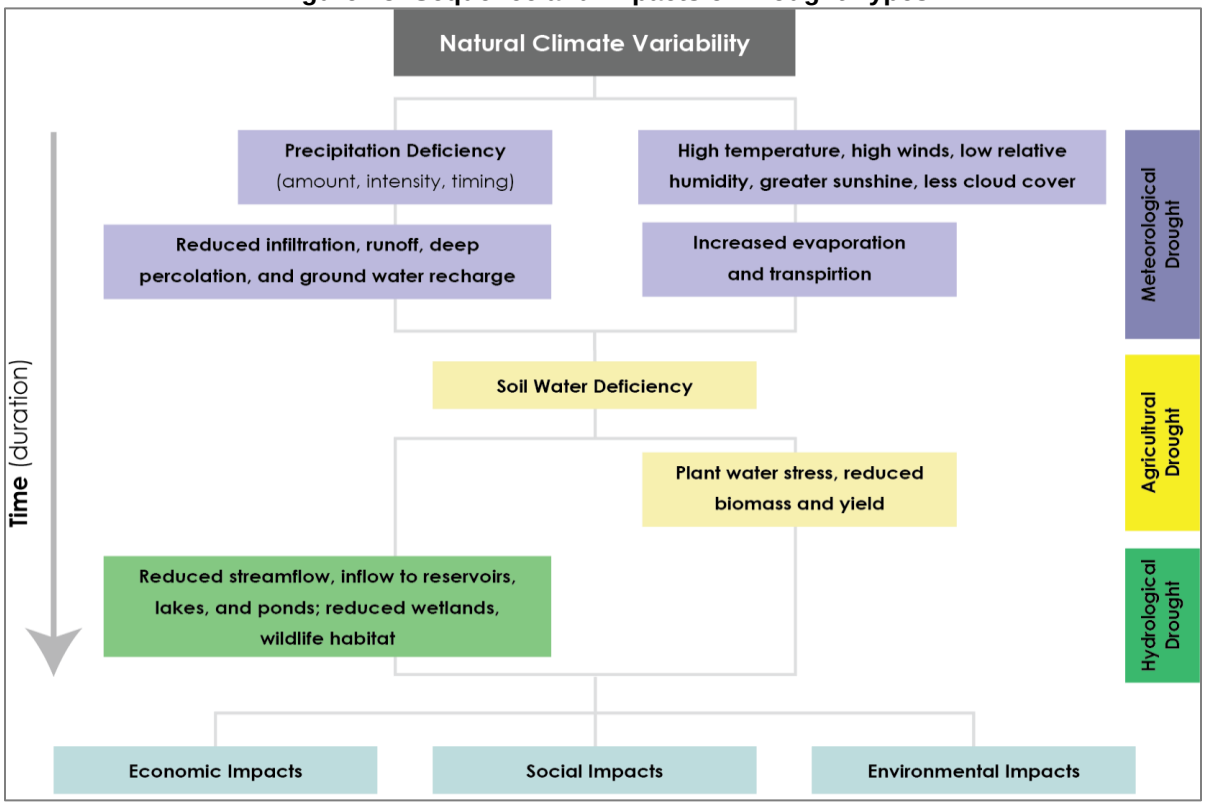
- **Hydrologic Drought** occurs when water available in aquifers, lakes, and reservoirs falls below the statistical average. This situation can arise even when the area of interest receives average precipitation. This is due to the reserves diminishing from increased water usage, usually from agricultural use or high levels of evapotranspiration, resulting from prolonged high temperatures. Hydrological drought often is identified later than meteorological and agricultural drought. Impacts from hydrological drought may manifest themselves in decreased hydropower production and loss of water-based recreation.

- **Socioeconomic Drought** occurs when the demand for an economic good exceeds supply due to a weather-related shortfall in water supply. The supply of many economic goods includes, but are not limited to, water, forage, food grains, fish, and hydroelectric power.[66]

The following figure indicates different types of droughts, their temporal sequence, and the various types of effects they can have on a community.

[66] National Drought Mitigation Center. 2017. “Drought Basics.” https://drought.unl.edu/.

Figure 23: Sequence and Impacts of Drought Types



Source: National Drought Mitigation Center, University of Nebraska-Lincoln, 2017[67]

Location

The entire county is susceptible to drought impacts.

Historical Occurrences

Table 57 indicates it is reasonable to expect extreme drought to occur 4.1% of the time for the planning area (63 extreme drought months in 1,527 months). Severe drought occurred in 83 months of the 1,527 months of record (5.4% of months). Moderate drought occurred in 126 months of the 1,527 months of record (8.3% of months), and mild drought occurred in 169 of the 1,527 months of record (11.1% of months). Non-drought conditions occurred in 1,086 months, or 71% percent of months. These statistics show that the drought conditions of the planning area are highly variable. The average annual planning area precipitation is approximately 36.1 inches according to the NCEI.[68]

[67] National Drought Mitigation Center. 2017. "Types of Drought." https://drought.unl.edu/.
[68] NOAA National Centers for Environmental Information. May 2022. "Data Tools: 1991-2020 Normals." [datafile]. https://www.ncdc.noaa.gov/cdo-web/datatools/normals.

Table 57: Historic Droughts

Drought Magnitude	Months in Drought	Percent Chance
-1 Magnitude (Mild)	169/1,527	11.1%
-2 Magnitude (Moderate)	126/1,527	8.3%
-3 Magnitude (Severe)	83/1,527	5.4%
-4 Magnitude or Greater (Extreme)	63/1,527	4.1%

Source: NCEI, 1895-2022[69]

Extent

The Palmer Drought Severity Index (PDSI) is utilized by climatologists to standardize global long-term drought analysis. The data for the planning area was collected for Climate Division 5, which includes the planning area. This particular station's period of record started in 1895. Table 58 shows the details of the Palmer classifications. Figure 23 shows drought data from this time period. The negative Y axis represents the extent of a drought, for which '-2' indicates a moderate drought, '-3' a severe drought, and '-4' an extreme drought. The planning area has experienced several extreme droughts since 1901 and moderate, severe, and extreme droughts are likely in the future.

Table 58: Palmer Drought Severity Index Classification

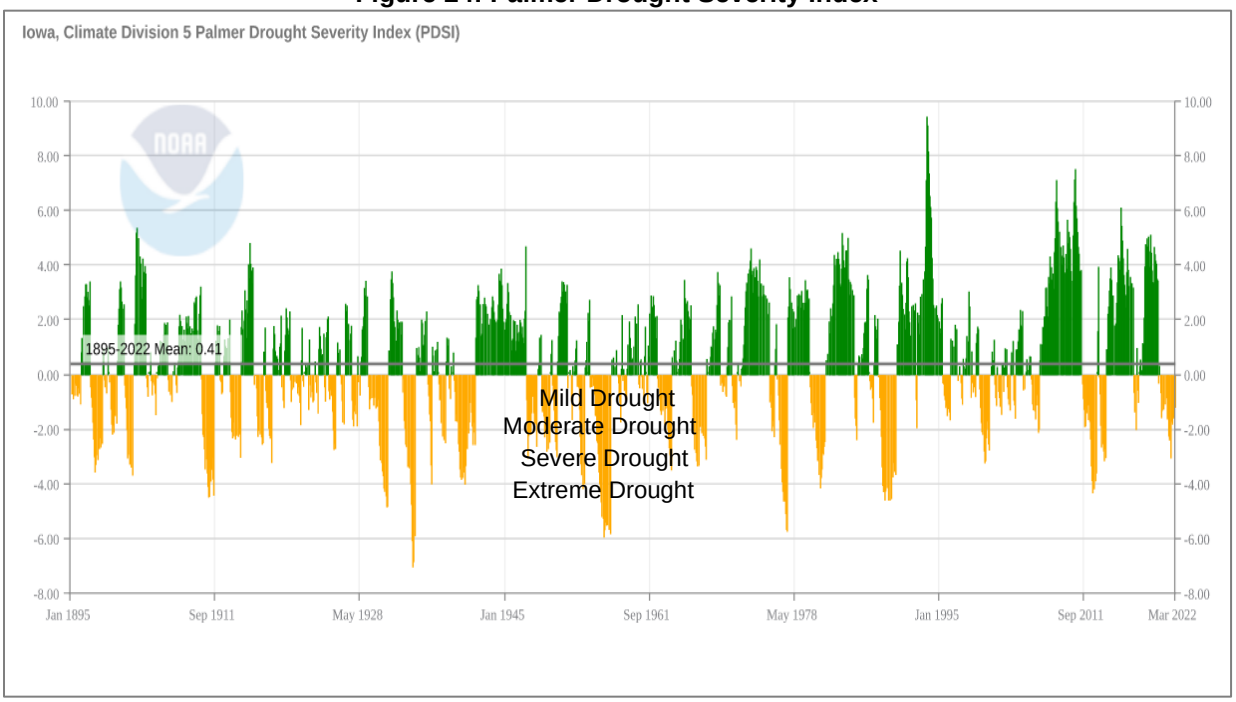
Numerical Value	Description	Numerical Value	Description
4.0 or more	Extremely wet	-0.5 to -0.99	Incipient dry spell
3.0 to 3.99	Very wet	-1.0 to -1.99	Mild drought
2.0 to 2.99	Moderately wet	-2.0 to -2.99	Moderate drought
1.0 to 1.99	Slightly wet	-3.0 to -3.99	Severe drought
0.5 to 0.99	Incipient wet spell	-4.0 or less	Extreme drought
0.49 to -0.49	Near Normal	--	--

Source: Climate Prediction Center[70]

[69] National Centers for Environmental Information. 1895-2022. "Climate at a Glance: Divisional Time Series". Accessed April 2022. https://www.ncdc.noaa.gov/cag/divisional/time-series.

[70] National Weather Service. 2017. "Climate Prediction Center." https://www.cpc.ncep.noaa.gov/.

Figure 24: Palmer Drought Severity Index

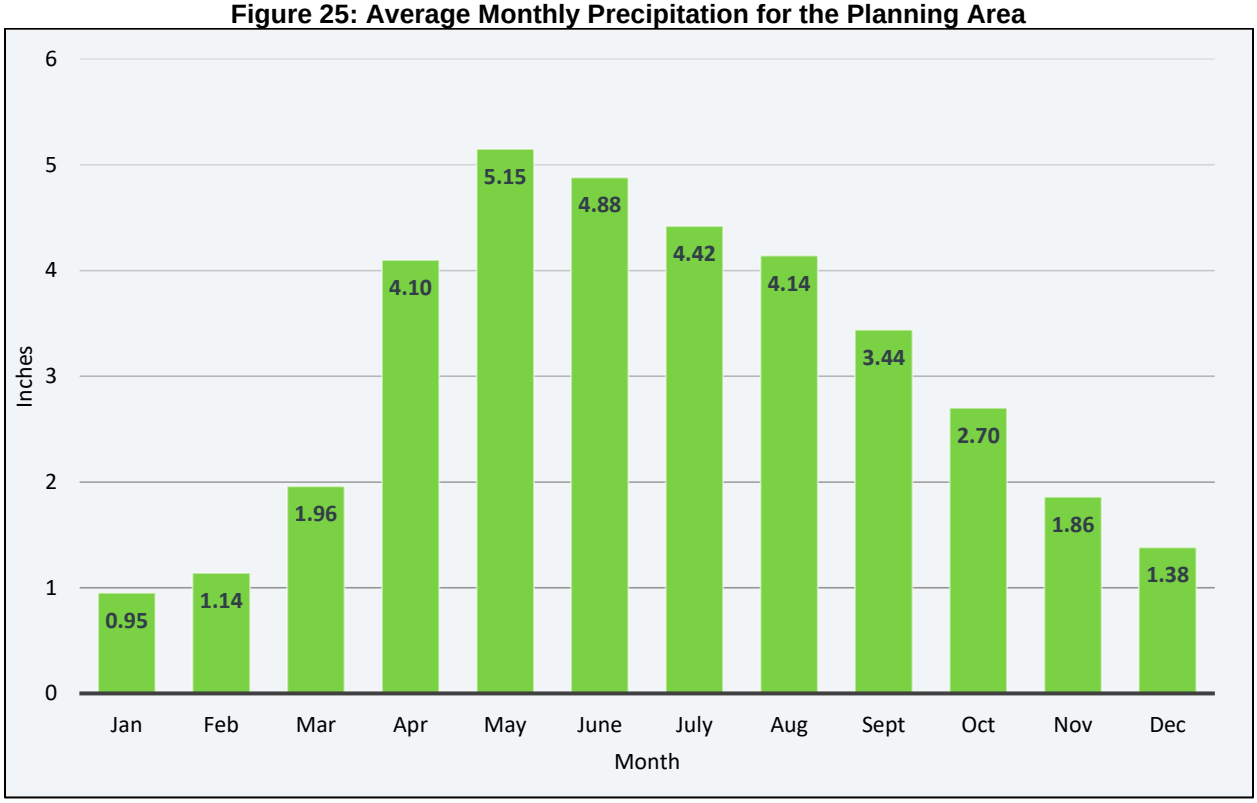


Source: NCEI, 1895-March 2022[71]

Figure 24 shows the normal average monthly precipitation for the planning area, which is helpful in determining whether any given month is above, below, or near normal in precipitation. Prolonged deviation from the norm showcases drought conditions and influence growing conditions for farmers.

[71] National Centers for Environmental Information. 1895-2022. "Climate at a Glance: Divisional Time Series". Accessed April 2022. https://www.ncdc.noaa.gov/cag/divisional/time-series.

Figure 25: Average Monthly Precipitation for the Planning Area



Source: NCEI, 1991-2020[72]

Average Annual Losses

The annual property estimate was determined based upon NCEI Storm Events Database since 1996. The annual crop loss was determined based upon the RMA Cause of Loss Historical Database since 2000. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. The direct and indirect effects of drought are difficult to quantify. Potential losses such as power outages could affect businesses, homes, and critical facilities. High demand and intense use of air conditioning or water pumps can overload the electrical systems and damage infrastructure.

Table 59: Loss Estimate for Drought

Hazard Type	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Drought	$12,650,000	$486,538	$47,719,440	$2,169,065

Source: 1 Indicates data is from NCEI (1996-2021); 2 Indicates data is from USDA RMA (2000-2021)

Probability

Drought conditions are likely to occur regularly in the planning area. The following table summarizes the magnitude of drought and monthly probability of occurrence.

[72] NOAA National Centers for Environmental Information. May 2022. "Data Tools: 1991-2020 Normals." [datafile]. https://www.ncdc.noaa.gov/cdo-web/datatools/normals.

Table 60: Period of Record in Drought

PDSI Value	Magnitude	Drought Occurrences by Month	Monthly Probability
4 or more to -0.99	No Drought	1,086/1,512	71.0%
-1.0 to -1.99	Mild Drought	169/1,527	11.1%
-2.0 to -2.99	Moderate Drought	126/1,527	8.3%
-3.0 to -3.99	Severe Drought	83/1,527	5.4%
-4.0 or less	Extreme Drought	63/1,527	4.1%

Source: NCEI, 1895-April 2022[73]

Community Top Hazard Status

No jurisdictions identified Drought as a top hazard of concern.

Regional Vulnerabilities

The Drought Impact Reporter is a database of drought impacts throughout the United States, with data going back to 2000. The Drought Impact Reporter has recorded a total of 13 drought-related impacts throughout the county. Notable drought impacts are summarized in the following table. This is not a comprehensive list of droughts that may have impacted the planning area.

Table 61: Notable Drought Impacts in Planning Area

Category	Date	Title
Fire, Relief, Response & Restrictions	10/23/2020	Iowa counties adopt burn bans
Agriculture, Plants & Wildlife, Water Supply & Quality	8/6/2020	Reduction in corn yields, dry stock ponds in west central Iowa
Agriculture	7/22/2020	Corn, soybeans stressed in west central Iowa
Plants & Wildlife, Water Supply & Quality	9/26/2017	Leaves turning color early in Dallas County, Iowa
Agriculture, Water Supply & Quality	7/8/2016	Corn yield potential down in Iowa
Agriculture, Relief, Response & Restrictions	9/11/2013	Muscatine County and 35 other Iowa counties received authorization from the Farm Service Agency for emergency haying and grazing
Agriculture, Society & Public Health, Water Supply & Quality	5/13/2013	Drought-stressed crops left unused fertilizer in Iowa fields, impacting water quality
Agriculture, Relief, Response & Restrictions	5/17/2013	Drought-related USDA disaster declarations in 2013
Agriculture, Relief, Response & Restrictions	9/21/2012	USDA Designates 6 Counties in Iowa as Primary Natural Disaster Areas with Assistance to Producers in Surrounding States

[73] National Centers for Environmental Information. 1895-March 2022. Accessed April 2022. https://www.ncdc.noaa.gov/cag/divisional/time-series

Agriculture	9/10/2012	Wide range of corn yield in Iowa
Plants & Wildlife, Water Supply & Quality	8/6/2012	Roughly 40,000 shovelnose sturgeon died in the Des Moines River in Iowa
Agriculture	11/14/2012	Elk Mound Seed Co in Wisconsin arranged to purchase about 20 percent more corn seed this year
Relief, Response & Restrictions	9/7/2006	Relief, Response & Restrictions impact from Media submitted on 9/7/2006

Source: NDMC, 2000-June. 2022[74]

The following table provides information related to regional vulnerabilities. For jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 62: Regional Drought Vulnerabilities

Sector	Vulnerability
People	-Insufficient water supply -Loss of jobs in agricultural sector -Residents in poverty if food prices increase
Economic	-Closure of water intensive businesses (carwashes, pools, etc.) -Short-term interruption of business -Loss of tourism dollars -Decrease in cattle prices -Decrease of land prices→ jeopardizes educational funds
Built Environment	-Cracking foundations (residential and commercial structures) -Damages to landscapes
Infrastructure	-Damages to waterlines below ground -Damages to roadways (prolonged extreme events)
Critical Facilities	-Loss of power and impact on infrastructure
Climate	-Increased risk of wildfire events, damaging buildings and agricultural land

[74] National Drought Mitigation Center. 2022. "U.S. Drought Impact Reporter." Accessed April 2022.. http://droughtreporter.unl.edu/map/.

Earthquake

An earthquake is the result of a sudden release of energy in the Earth's tectonic plates that creates seismic waves. The seismic activity of an area refers to the frequency, type, and size of earthquakes experienced over a period of time. Although rather uncommon, earthquakes do occur in Iowa and are usually small, generally not felt, and cause little to no damage. Earthquakes are measured by magnitude and intensity. Magnitude is measured by the Richter Scale, a base-10 logarithmic scale, which uses seismographs around the world to measure the amount of energy released by an earthquake. Intensity is measured by the Modified Mercalli Intensity Scale, which determines the intensity of an earthquake by comparing actual damage against damage patterns of earthquakes with known intensities. The following tables summarize the Richter Scale and Modified Mercalli Scale.

Table 63: Richter Scale

Richter Magnitudes	Earthquake Effects
Less Than 3.5	Generally not felt but recorded.
3.5 – 5.4	Often felt, but rarely causes damage.
Under 6.0	At most, slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions.
6.1 – 6.9	Can be destructive in areas up to about 100 kilometers across where people live.
7.0 – 7.9	Major earthquake. Can cause serious damage over larger areas.
8 Or Greater	Great earthquake. Can cause serious damage in areas several hundred kilometers across.

Source: FEMA, 2016[75]

[75] Federal Emergency Management Agency. 2016. "Earthquake." https://www.fema.gov/earthquake.

Table 64: Modified Mercalli Intensity Scale

Scale	Intensity	Description of Effects	Corresponding Richter Scale Magnitude
I	Instrumental	Detected only on seismographs	
II	Feeble	Some people feel it	< 4.2
III	Slight	Felt by people resting, like a truck rumbling by	
IV	Moderate	Felt by people walking	
V	Slightly Strong	Sleepers awake; church bells ring	< 4.8
VI	Strong	Trees sway, suspended objects swing, objects fall off shelves	< 5.4
VII	Very Strong	Mild Alarm; walls crack; plaster falls	< 6.1
VIII	Destructive	Moving cars uncontrollable; masonry fractures, poorly constructed buildings damaged	
IX	Ruinous	Some houses collapse; ground cracks; pipes break open	< 6.9
X	Disastrous	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread	< 7.3
XI	Very Disastrous	Most buildings and bridges collapse; roads, railways, pipes and cables destroyed; general triggering of other hazards	< 8.1
XII	Catastrophic	Total destruction, trees fall, ground rises and falls in waves	> 8.1

Source: FEMA, 2016

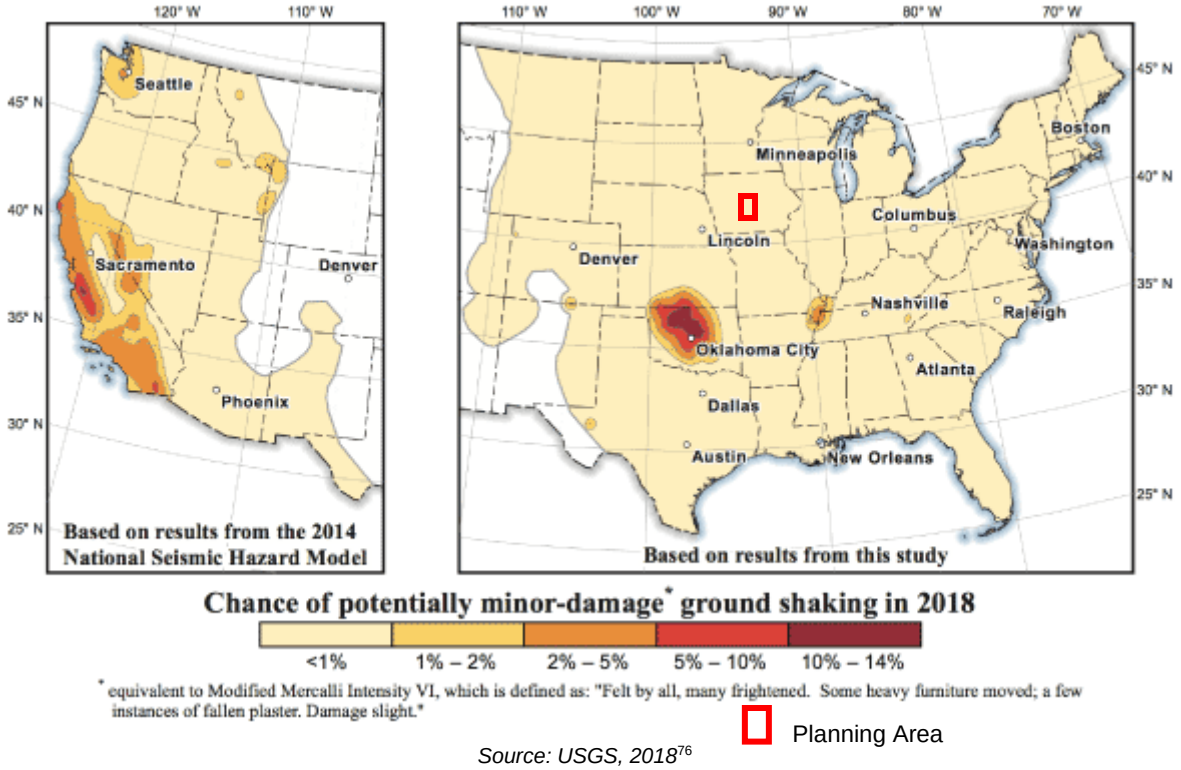
Location
According to the Iowa Department of Natural Resources, there are no major fault lines in Iowa.

Historical Occurrences
According to the United States Geological Survey (USGS), there have been zero earthquakes that have occurred in the planning area since 1900.

Extent
If an earthquake were to occur in the planning area, it would likely measure between 5.0 or less on the Richter Scale. Very little to no damage is anticipated from events of these magnitudes.

Average Annual Losses
Due to zero historical earthquakes and low earthquake risk for the area, it is not feasible to utilize the ‘event damage estimate formula’ to estimate potential losses for the planning area. Figure 26 shows the probability of damage from earthquakes, according to the USGS. The figure shows that the planning area has a less than one percent chance of damages from earthquakes.

Figure 26: 2018 Probability of Damage from Earthquakes



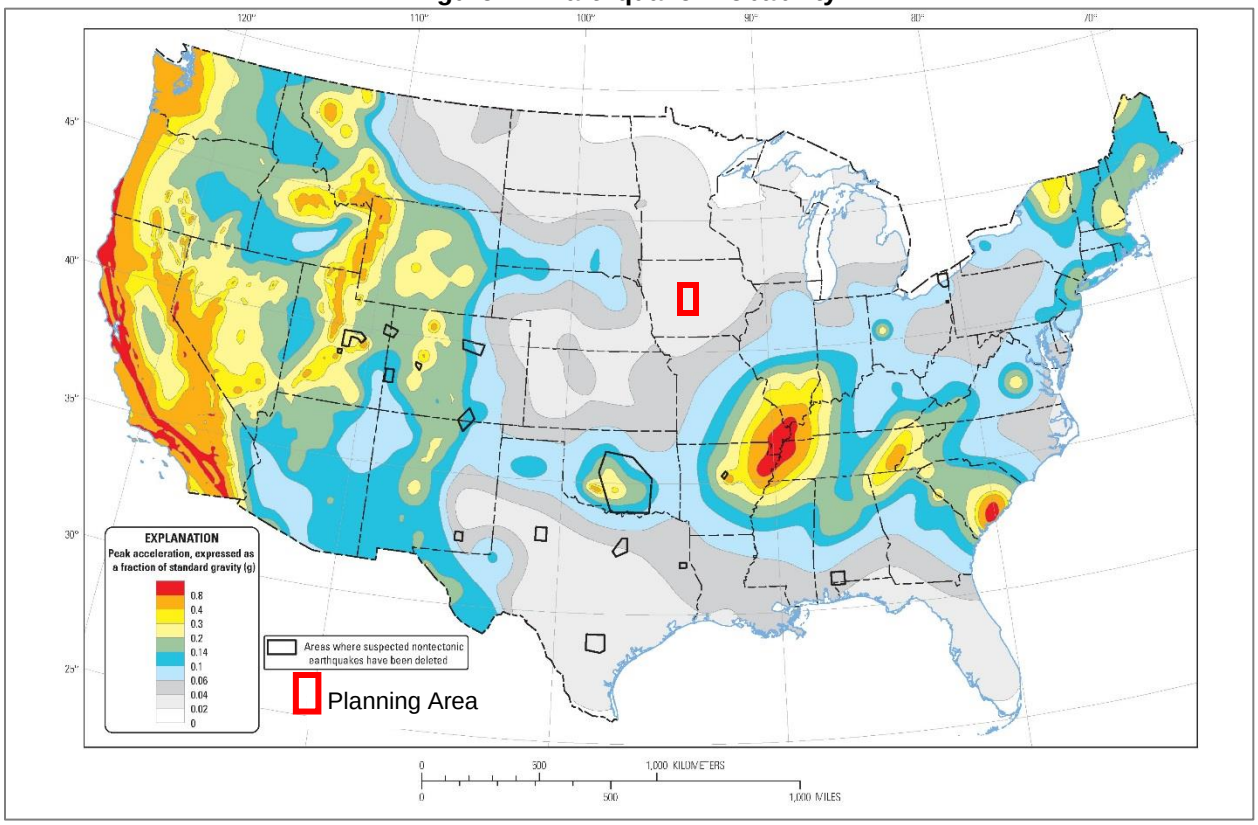
Source: USGS, 2018[76]

Probability

The following figure visualizes the probability of a 5.0 or greater earthquake occurring in the planning area within 50 years. Based on zero occurrences of earthquakes over a 122-year period, the probability of an earthquake in the county in any given year is less than one percent.

[76] United States Geological Survey. 2018. "Short-term Induced Seismicity Models: 2018 One-Year Model." https://www.usgs.gov/natural-hazards/earthquake-hazards/science/short-term-induced-seismicity-models?qt-science_center_objects=0#qt-science_center_objects.

Figure 27: Earthquake Probability



Source: USGS 2009 PSHA Model
**Map shows the two-percent probability of exceedance in 50 years of peak ground acceleration.*

Community Top Hazard Status

No jurisdictions identified Earthquake as a top hazard of concern.

Regional Vulnerabilities

The following table provides information related to regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 65: Regional Earthquakes Vulnerabilities

Sector	Vulnerability
People	-Risk of injury or death from falling objects and structures
Economic	-Short term interruption of business
Built Environment	-Damage to buildings, homes, or other structures from foundation cracking, falling objects, shattered windows, etc.
Infrastructure	-Damage to subterranean infrastructure (i.e. waterlines, gas lines, etc.) -Damage to roadways
Critical Facilities	-Same as all other structures
Climate	-None

Expansive Soils

A relatively widespread geologic hazard for Iowa is the presence of expansive soils or clay soils, which behave differently than other soils due to their tendency to swell and shrink due to changes in moisture content. Fluctuations in the groundwater table, changes in humidity, and prolonged drought followed by precipitation events can accelerate the swelling and shrinking of expansive soils.

Other factors influencing the behavior of expansive soils are plumbing leaks, site drainage, and irrigation practices that cause differences in moisture volume in the soil. Expansive soils can cause the following problems in structures:

- Structural damage to lightweight structures such as sidewalks and driveways
- Lifting of buildings, damage to basements, and building settlement
- Heaving of roads and highway structures
- Cracks in walls and ceilings
- Damage to pipelines and other public utilities[77]

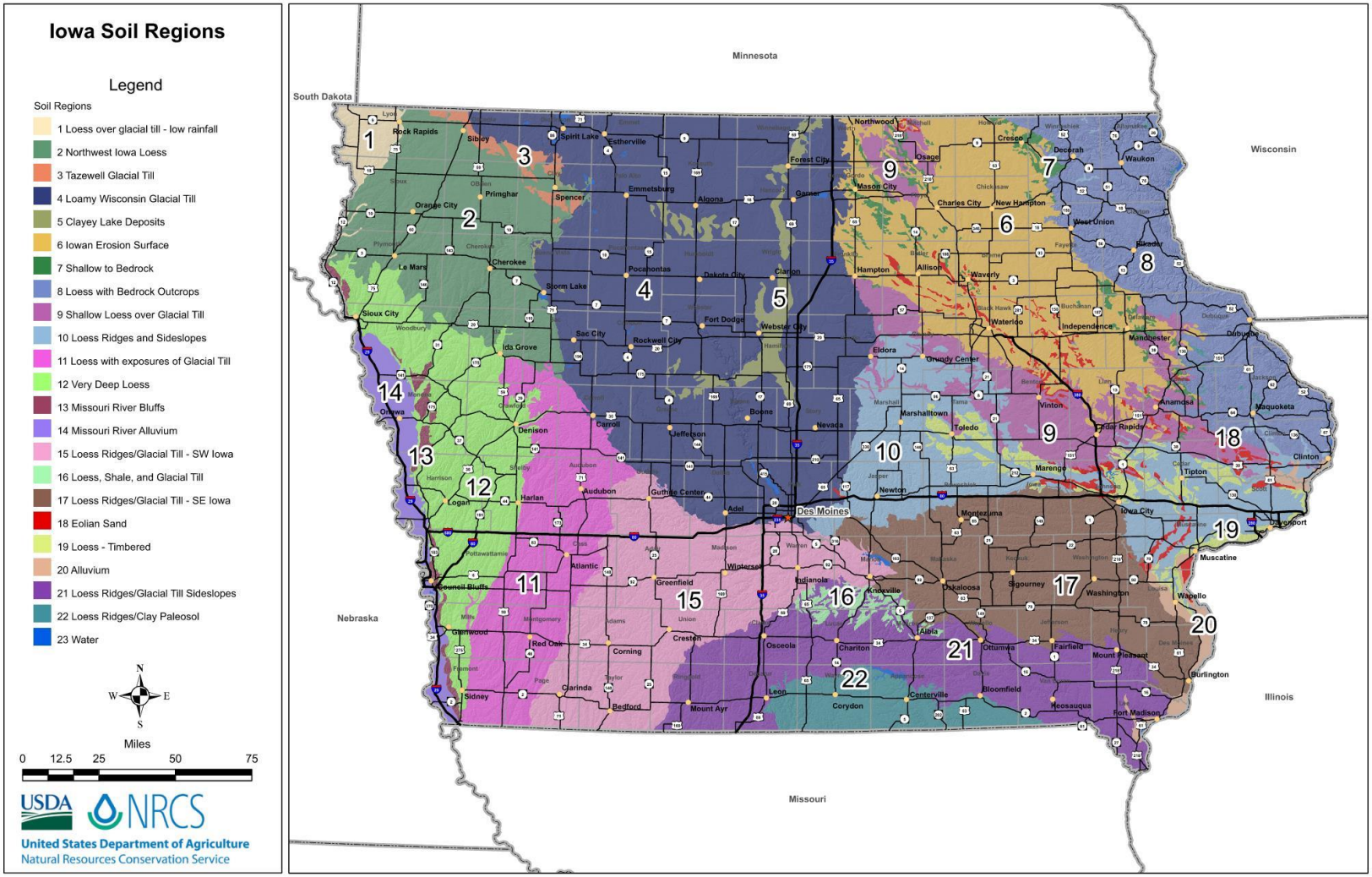
For Iowa, the vulnerability to this hazard most frequently is associated with soils shrinking during periods of drought.

Location

The following figure shows a map of the soil types in Iowa. Dallas County is mainly located in Loamy Wisconsin Glacial Till and Loess Ridges/Glacial Till soil regions. Glacial Till is a high-clay content soil that is prone to expansion. Loess is a compressive soil comprised mainly of silt.

77 Colorado Geological Survey. Accessed March 2022. “Expansive Soil and Rock”. https://coloradogeologicalsurvey.org/hazards/expansive-soil-rock/#:~:text=Expansive%20soils%20are%20one%20of,the%20range%20of%20%242%20billion.

Figure 28: Iowa Soil Regions



Source: NRCS[78]

[78] Iowa Natural Resources Conservation Service. Accessed April 2022. "Iowa Soil Regions Map." https://www.nrcs.usda.gov/wps/portal/nrcs/ia/soils/

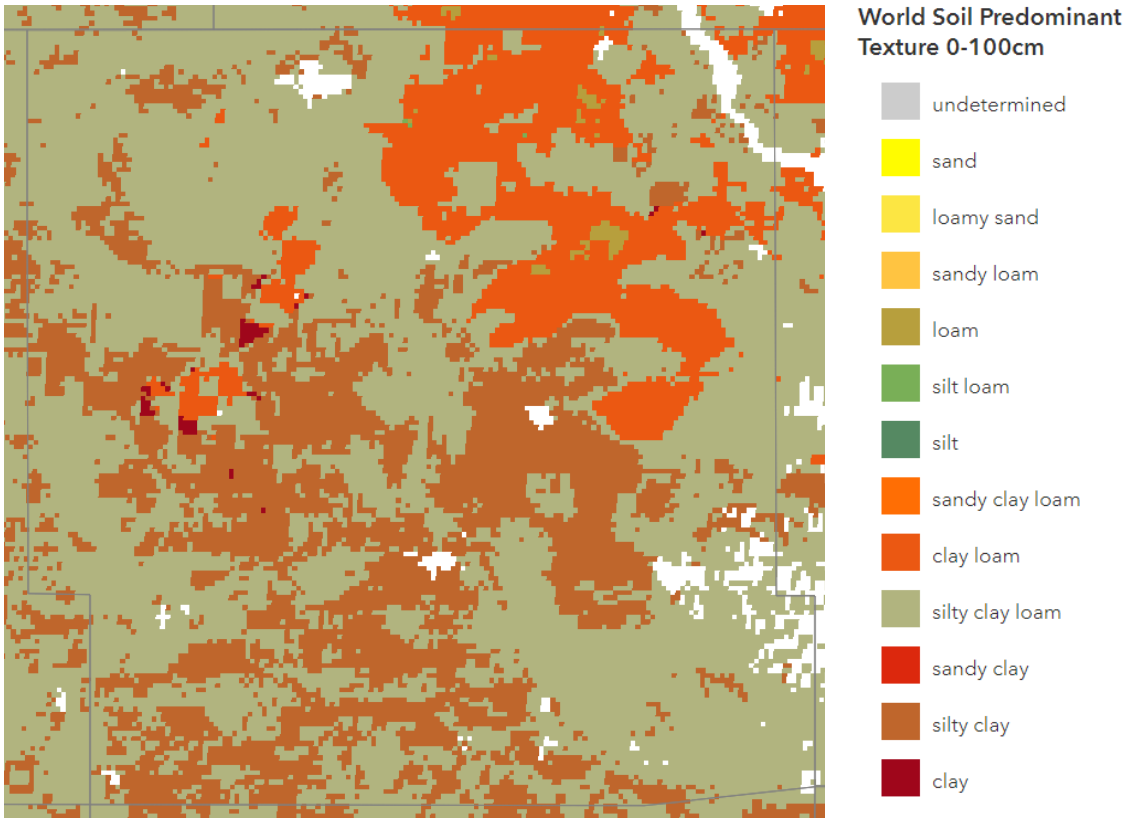
Historical Occurrences

There is no official data pertaining to damages from expansive soils; however, the frequency of damage from expansive soils can be associated with the cycles of drought and heavy rainfall which reflect changes in moisture content.

Extent

The types of soil texture in Dallas County are shown in Figure 29. Soil texture is identified by predominant USDA texture class derived from predicted percent sand, silt, and clay. The figure displays a 100cm depth, which matches many of the worlds crop rooting depths. Dallas County primarily consists of silty clay loam, silty clay, and sandy clay loam soil textures.

Figure 29: Predominant Soil Texture 0-100 cm



Source: Esri Environment, 2022[79]

Average Annual Losses

There is no data available to determine damage estimates for this hazard. In most cases, individual property owners, local governments, and businesses pay for repairs for damages caused by this hazard.

[79]Esri Environment. June 2022. "SoilGrids: World Soil Predominant texture 0-100cm". https://www.arcgis.com/home/item.html?id=3988bece11ac44b4a2fc0ecb88c8e081

Probability
Due to a lack of data surrounding expansive soil occurrences in the planning area, the probability for this hazard occurring annually cannot be calculated.

Community Top Hazard Status
No jurisdictions identified Expansive Soils as a top hazard of concern.

Regional Vulnerabilities
The following table provides information related to regional vulnerabilities. For jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 66: Regional Expansive Soils Vulnerabilities

Sector	Vulnerability
People	-Risk of injury from falling structures.
Economic	-Damages to buildings and property can cause significant losses to business owners and divert tax revenue from social and economic improvement programs
Built Environment	-Basements and subterranean infrastructure can incur damage
Infrastructure	-Roadways, sidewalks, driveways, and bridges can be damaged
Critical Facilities	-Same as all other structures
Climate	-None

Extreme Temperature (Heat/Cold)

Extreme Heat

Extreme heat is often associated with periods of drought but can also be characterized by long periods of high temperatures in combination with high humidity. During these conditions, the human body has difficulty cooling through the normal method of the evaporation of perspiration. Health risks arise when a person is overexposed to heat. Extreme heat can also cause people to overuse air conditioners, which can lead to power failures. Power outages for prolonged periods increase the risk of heat stroke and subsequent fatalities due to loss of cooling and proper ventilation. The planning area is largely rural, which presents an added vulnerability to extreme heat events; those suffering from an extreme heat event may be farther away from medical resources as compared to those living in an urban setting.

Along with humans, animals also can be affected by high temperatures and humidity. Cattle and other farm animals respond to heat by reducing feed intake, increasing their respiration rate, and increasing their body temperature. These responses assist the animal in cooling itself, but this is usually not sufficient. When animals overheat, they will begin to shut down body processes not vital to survival, such as milk production, reproduction, or muscle building.

Other secondary concerns connected to extreme heat hazards include water shortages brought on by drought-like conditions and high demand. Government authorities report that civil disturbances and riots are more likely to occur during heat waves. In cities, pollution becomes a problem because the heat traps pollutants in densely populated urban areas. Adding pollution to the stresses associated with the heat magnifies the health threat to the urban population.

The National Weather Service (NWS) is responsible for issuing excessive heat outlooks, excessive heat watches, and excessive heat warnings.

- **Excessive heat outlooks** are issued when the potential exists for an excessive heat event in the next three to seven days. Excessive heat outlooks can be utilized by public utility staffs, emergency managers, and public health officials to plan for extreme heat events.

- **Excessive heat watches** are issued when conditions are favorable for an excessive heat event in the next 24 to 72 hours.

- **Excessive heat warnings** are issued when an excessive heat event is expected in the next 36 hours. Excessive heat warnings are issued when an extreme heat event is occurring, is imminent, or has a very high probability of occurring.

Extreme Cold

Prolonged exposure to cold causes the human body to lose heat faster than it can be produced and use up the bodies stored energy. As a result, abnormally low body temperature can lead to hypothermia. Frostbite is another symptom of prolonged cold exposure that causes a loss of feeling and color in affected areas of the body. Frostbite most often affects the nose, ears, cheeks, chin, fingers, or toes and can permanently damage body tissues.

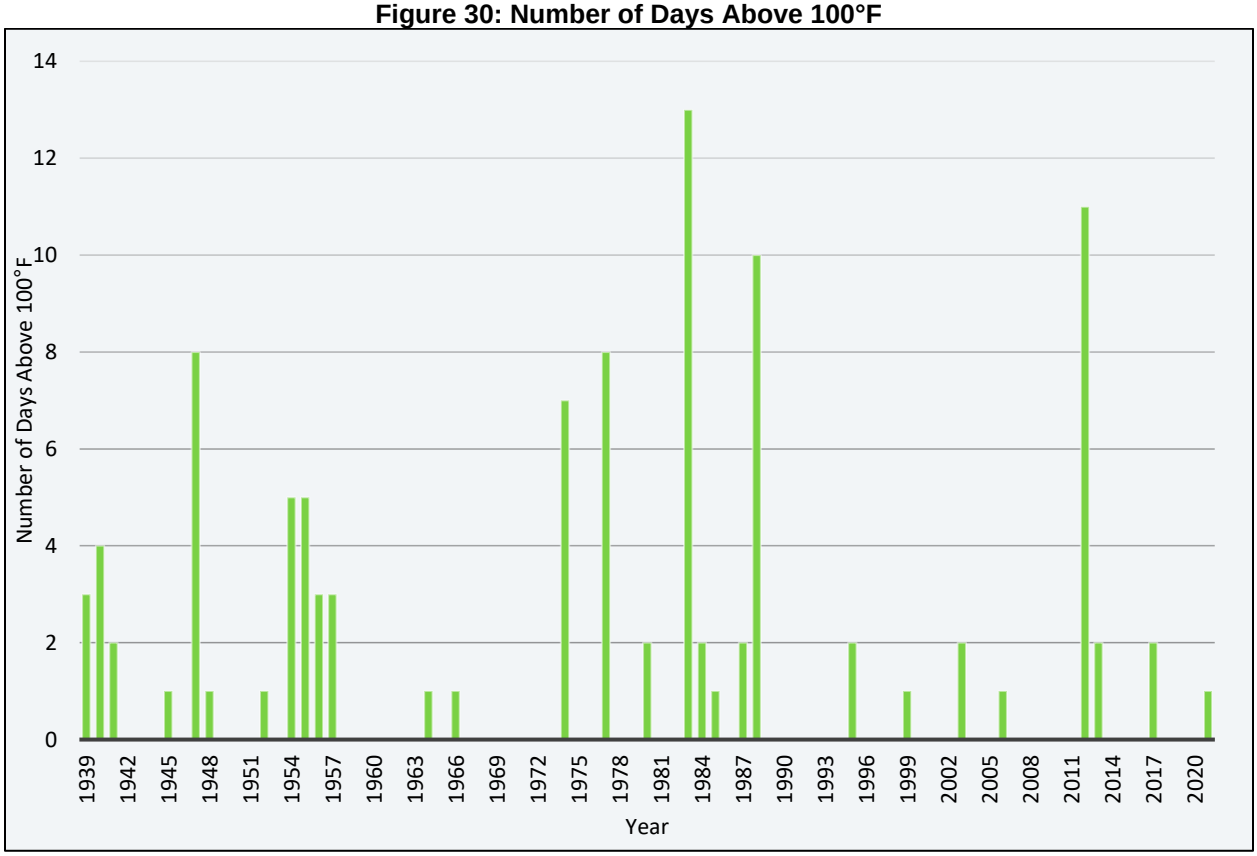
Location

The entire county is susceptible to extreme heat and cold impacts.

Historical Occurrences

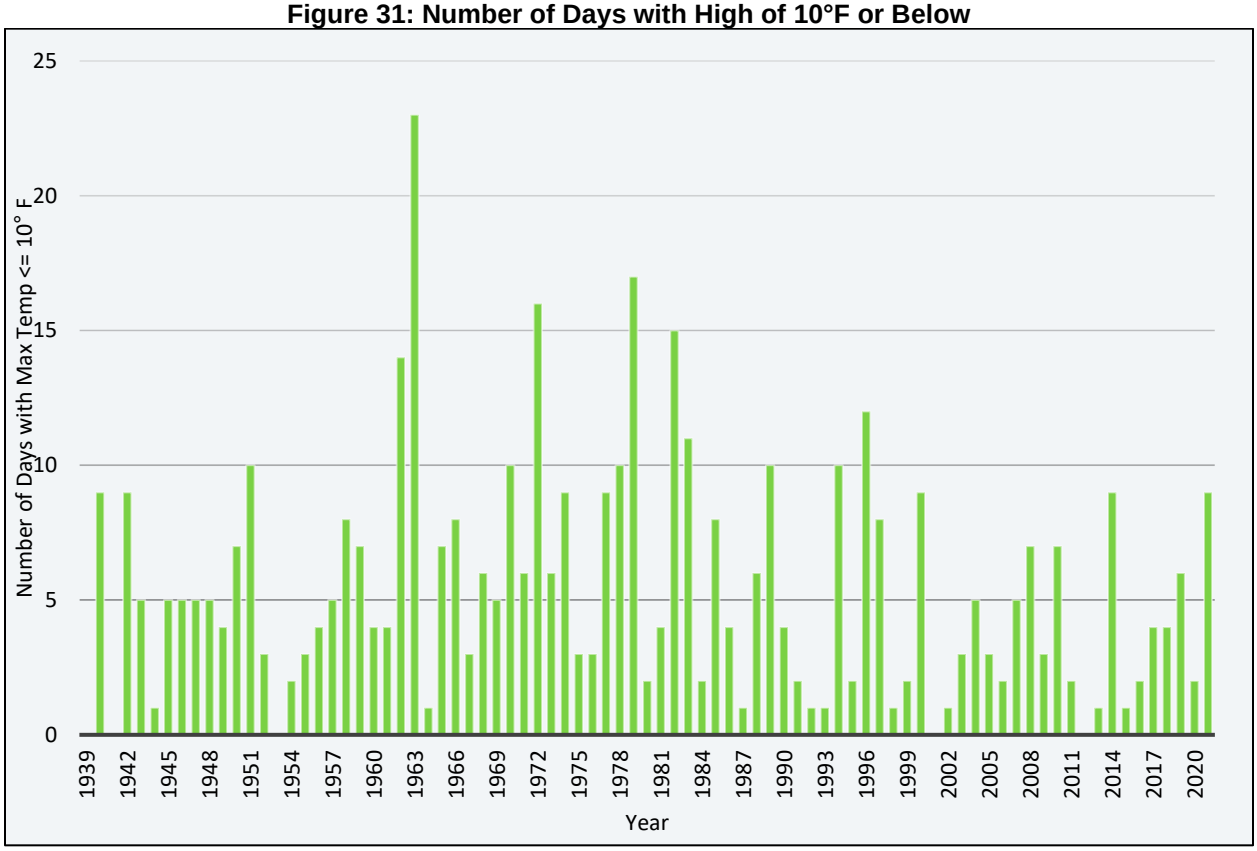
According to the High Plains Regional Climate Center (HPRCC), on average, the county experiences one day above 100°F per year. The county experienced the most days on record above 100°F in 1983 with 13 days (Figure 30). Conversely, the planning area experiences an annual average of one day with a high of 10°F or below and saw the most days below 10°F in 1963 with 23 days (Figure 31).

Figure 30: Number of Days Above 100°F



Source: HPRCC, 1939-2021

Figure 31: Number of Days with High of 10°F or Below



Source: HPRCC, 1939-2021

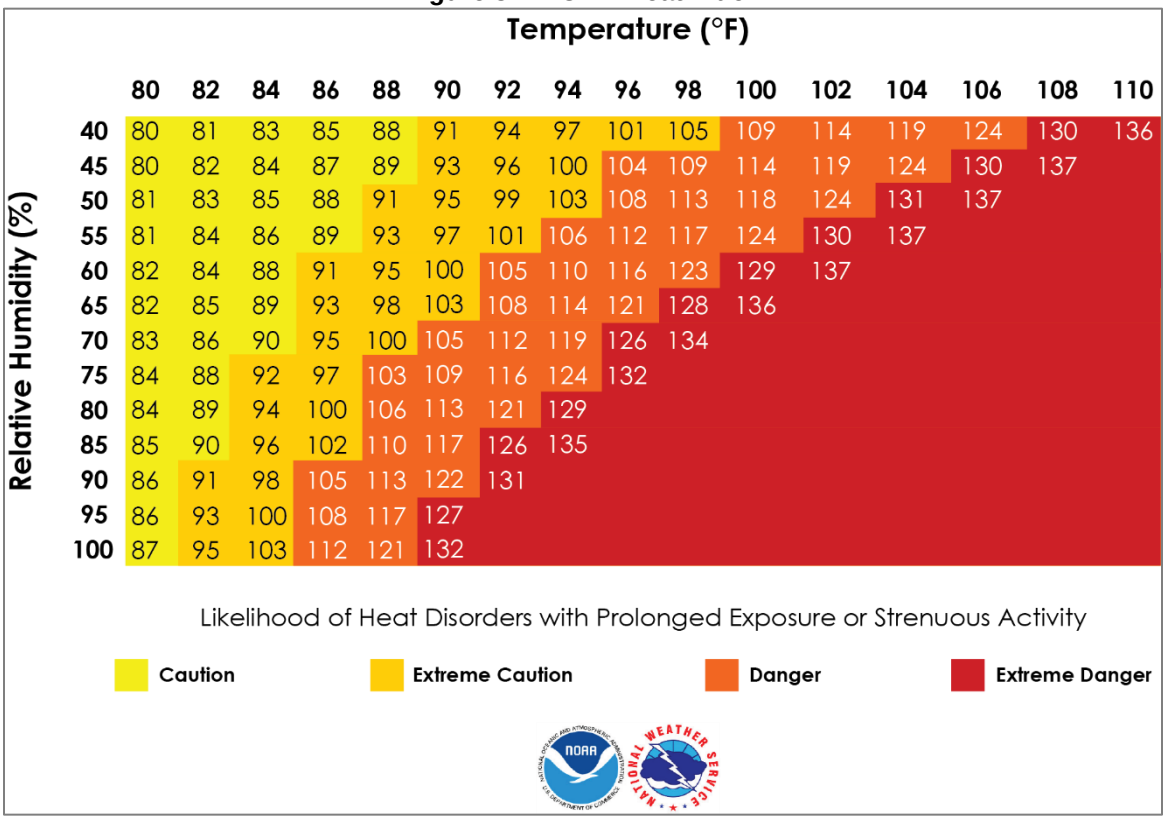
Extent (Extreme Heat)

A key factor to consider regarding extreme heat situations is the humidity level relative to the temperature. As is indicated in the following figure from the National Oceanic and Atmospheric Administration, as the relative humidity increases, the temperature needed to cause a dangerous situation decreases. For example, for 100% relative humidity, dangerous levels of heat begin at 86°F whereas a relative humidity of 50%, require 94°F. The combination of relative humidity and temperature result in a heat index as demonstrated below:

$$100\%\ Relative\ Humidity + 86°\mathrm{F} = 112°\mathrm{F}\ Heat\ Index$$

Figure 32 is designed for shady and light wind conditions. Exposure to full sunshine or strong winds can increase hazardous conditions and raise heat index values by up to 15°F. For the purposes of this plan, extreme heat is being defined as temperatures of 100°F or greater. In the planning area, the months with the highest temperatures are June, July, and August.

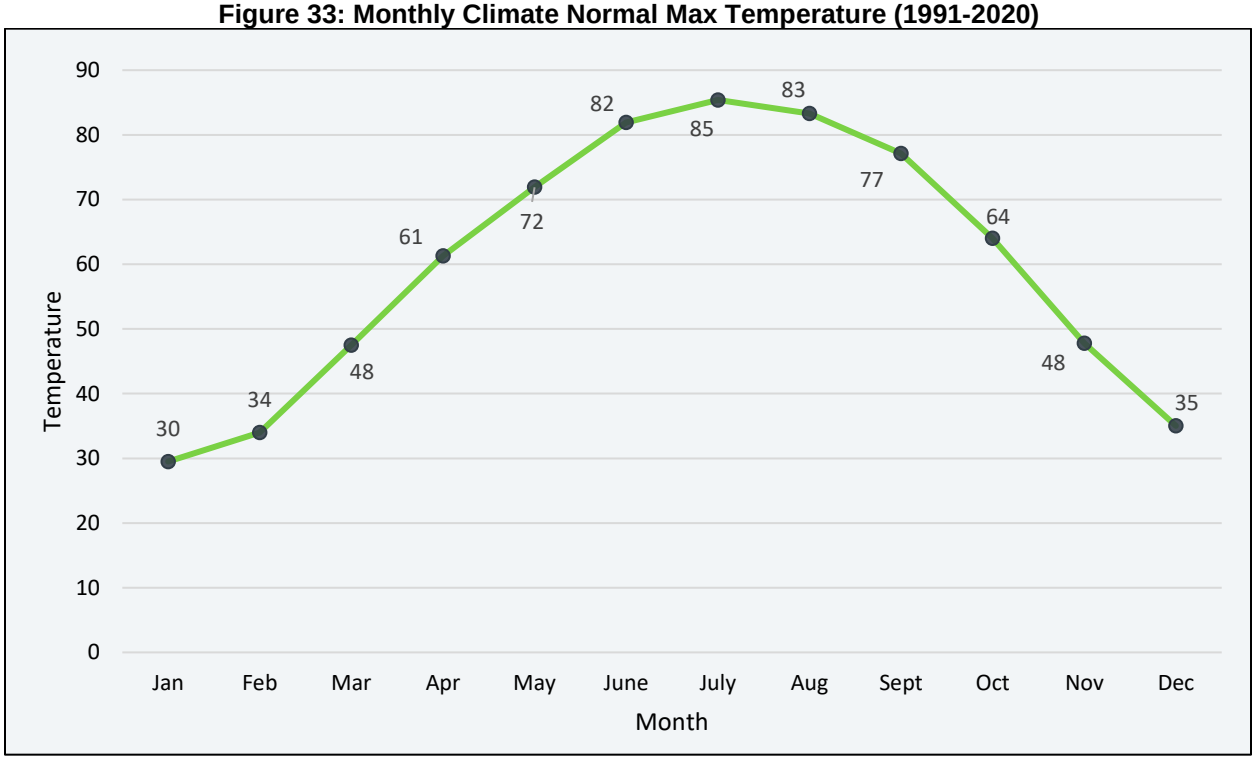
Figure 32: NOAA Heat Index



Source: NOAA, 2017[80]

[80] National Oceanic and Atmospheric Administration, National Weather Service. 2017. "Heat Index." http://www.nws.noaa.gov/om/heat/heat_index.shtml.

Figure 33: Monthly Climate Normal Max Temperature (1991-2020)



Source: NCEI, 2022

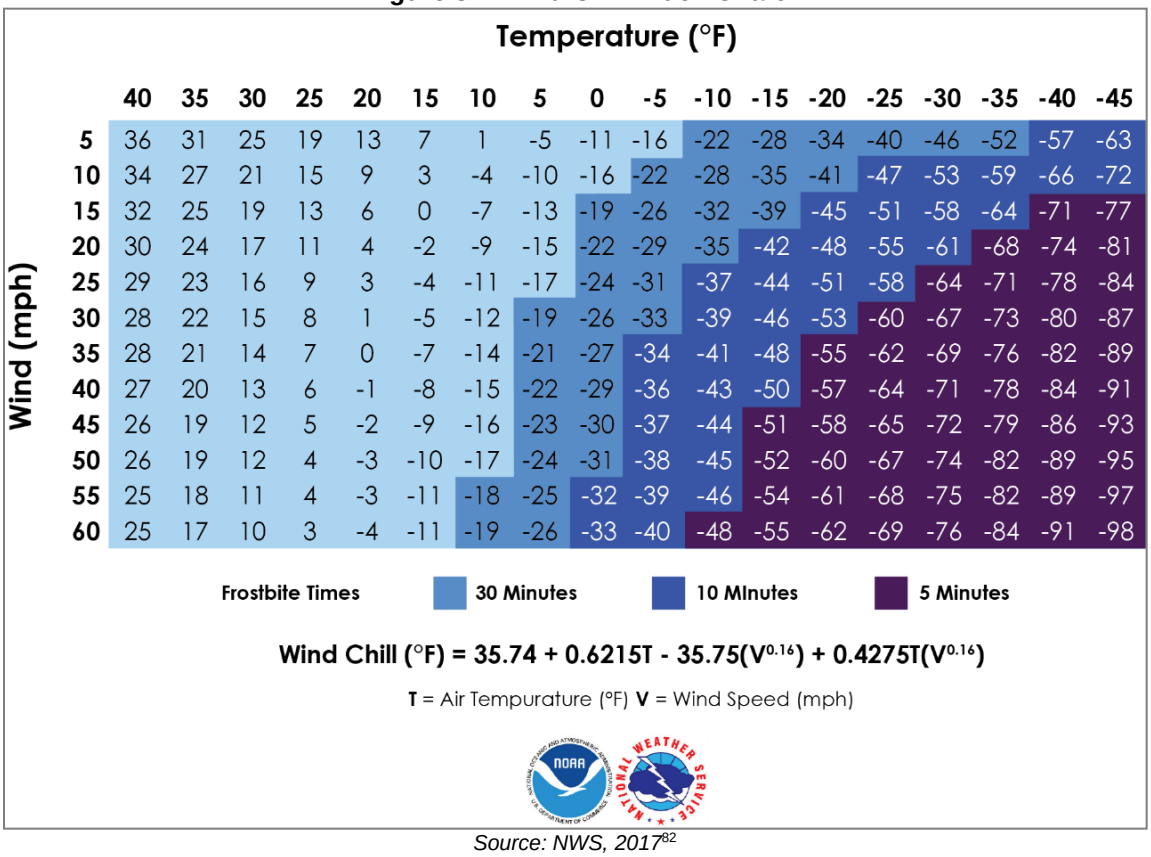
Extent (Extreme Cold)

Along with snow and ice storm events, extreme cold is dangerous to the well-being of people and animals. What constitutes extreme cold varies from region to region but is generally accepted as temperatures that are significantly lower than the region's average low temperature. For the purposes of this plan, extreme cold is being defined as the high temperature being 10°F or below. For the planning area, the coldest months of the year are December, January, and February (Figure 35). The average low temperature for these months is below freezing (average low for the three months is 13.6°F).[81]

The Wind Chill Index was developed by the NWS to determine the decrease in air temperature felt by the body on exposed skin due to wind. The wind chill is always lower than the air temperature and can quicken the effects of hypothermia or frost bite as it gets lower. Figure 34 shows the Wind Chill Index used by the NWS.

[81] NOAA National Centers for Environmental Information. May 2022. "Data Tools: 1991-2020 Normals." [datafile]. https://www.ncdc.noaa.gov/cdo-web/datatools/normals.

Figure 34: Wind Chill Index Chart

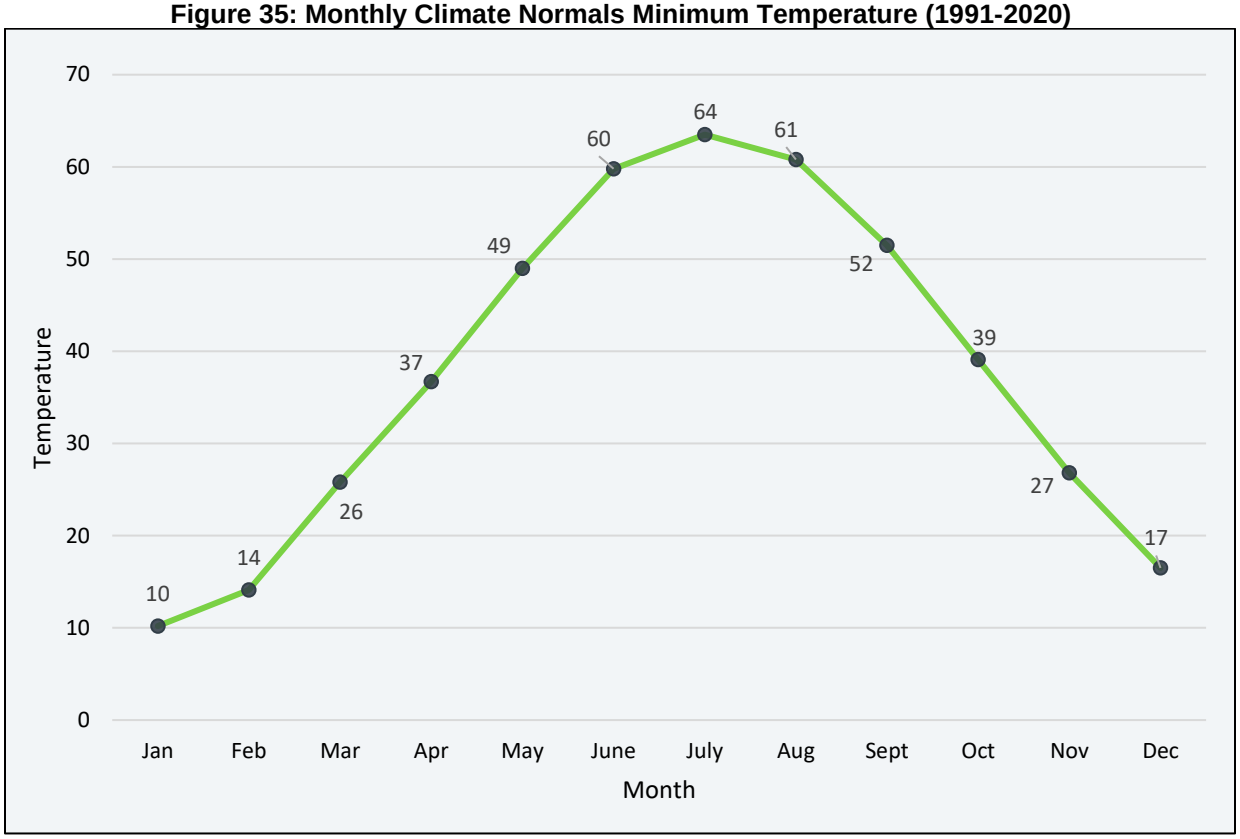


Wind (mph)	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-82	-89	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Source: NWS, 2017[82]

[82] National Weather Service. 2001. "Wind Chill Chart." http://www.nws.noaa.gov/om/cold/wind_chill.shtml .

Figure 35: Monthly Climate Normals Minimum Temperature (1991-2020)



Source: NCEI, 2022

Average Annual Losses

The annual property estimate was determined based upon NCEI Storm Events Database since 1996. The annual crop loss was determined based upon the RMA Cause of Loss Historical Database since 2000. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. The direct and indirect effects of extreme temperatures are difficult to quantify. Potential losses such as power outages could affect businesses, homes, and critical facilities. High demand and intense use of HVAC systems or water pumps can overload the electrical systems and damage infrastructure.

Table 67: Loss Estimate for Extreme Heat

Hazard Type	Avg. Number of Days Above 100°F[1]	Total Property Loss[2]	Average Annual Property Loss[2]	Total Crop Loss[3]	Average Annual Crop Loss[3]
Extreme Heat	1 days	$135,000	$5,192	$558,530	$25,388

Source: 1 HPRCC (1939-2021); 2 Indicates data is from NCEI (1996 to 2021); 3 Indicates data is from USDA RMA (2000 to 2021)

Table 68: Loss Estimate for Extreme Cold

Hazard Type	Avg. Number of Days with Max Temp <=10°F[1]	Total Property Loss[2]	Average Annual Property Loss[2]	Total Crop Loss[3]	Average Annual Crop Loss[3]
Extreme Cold	6 days	$0	$0	$4,580	$208

Source: 1 HPRCC (1939-2021); 2 Indicates data is from NCEI (1996 to 2021); 3 Indicates data is from USDA RMA (2000 to 2021)

Estimated Loss of Electricity

According to the FEMA Benefit Cost Analysis Reference Guide, if an extreme heat event occurred within the planning area, the following table assumes the event could potentially cause a loss of electricity for 10% of the population at a cost of $174 per person per day.[83] In rural areas, the percent of the population affected, and duration may increase during extreme events. The assumed damages do not take into account physical damages to utility equipment and infrastructure.

Table 69: Loss of Electricity - Assumed Damage

Jurisdiction	2020 Population	Population Affected (Assumed)	Electric Loss of Use Assumed Damage Per Day
Dallas County	99,678	9,968	$1,734,432

Probability

Extreme temperatures are a regular part of the climate for the planning area. Extreme heat events having at least one day of 100°F occurred in 29 out of 83 years. The probability that extreme heat will occur in any given year in the planning area is 35 percent. Extreme cold events having at least one day with a high at or below 10°F occurred in 78 out of 83 years. The probability that extreme cold will occur in any given year in the planning area is 94 percent.

The Union for Concerned Scientists released a report in July 2019 titled *Killer Heat in the United States: Climate Choices and the Future of Dangerously Hot Days*[84] which included predictions for extreme heat events in the future dependent on future climate actions. The table below summarizes those findings for the planning area.

Table 70: Extreme Heat Predictions for Days over 100°F

Jurisdiction	Midcentury Prediction 2036-2065 (days per year)	Late Century Prediction 2070-2099 (days per year)
Dallas County	33	58

Source: Union of Concerned Scientists, 1971-2000[85]

[83] Federal Emergency Management Agency. July 2020. "FEMA Benefit-Cost Analysis (BCA) Toolkit 6.0 Release Notes." https://www.fema.gov/sites/default/files/2020-08/fema_bca_toolkit_release-notes-july-2020.pdf.

[84] Union of Concerned Scientists. 2019. "Killer Heat in the United States: Climate Choices and the Future of Dangerously Hot Days." https://www.ucsusa.org/sites/default/files/attach/2019/07/killer-heat-analysis-full-report.pdf.

[85] Union of Concerned Scientists. 2021. "Extreme Heat and Climate Change: Interactive Tool". https://www.ucsusa.org/global-warming/global-warming-impacts/extreme-heat-interactive-tool?location=dallas-county--ia

Community Top Hazard Status

The following table lists jurisdictions which identified Extreme Temperatures as a top hazard of concern:

Jurisdictions	
Perry Community School District	Perry Water Works

Regional Vulnerabilities

The following table provides information related to regional vulnerabilities. For jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 71: Regional Extreme Heat Vulnerabilities

Sector	Vulnerability
People	-Heat exhaustion -Heat stroke -Hypothermia -Heart Disease -Asthma Vulnerable populations include: -People working outdoors -People without air conditioning or heat -Young children outdoors or without air conditioning or heat -Elderly outdoors or without air conditioning or heat
Economic	-Short-term interruption of business -Loss of power -Agricultural losses
Built Environment	-Damage to HVAC systems if overworked
Infrastructure	-Damages to roadways (prolonged extreme events) -Stressing electrical systems (brownouts during peak usage) -Stressing water systems
Critical Facilities	-Loss of power
Climate	-Increased risk of wildfire events -Increases in extreme heat conditions are likely, adding stress on livestock, crops, people, and infrastructure -Increases in extreme cold conditions are likely, adding stress on electrical systems, people, and infrastructure

Flooding

Flooding can occur on a local level, sometimes affecting only a few streets, but can also extend throughout an entire district, affecting whole drainage basins and impacting people and property in multiple states. Heavy accumulations of ice or snow can also cause flooding during the melting stage. These events are complicated by the freeze/thaw cycles characterized by moisture thawing during the day and freezing at night. There are four main types of flooding: riverine flooding, flash flooding, stormwater flooding, and ice jam flooding.

Riverine Flooding

Riverine flooding, typically slower developing with a moderate to long warning time, is defined as the overflow of rivers, streams, drains, and lakes due to excessive rainfall, rapid snowmelt or ice melt. The areas adjacent to rivers and stream banks that carry excess floodwater called floodplains. A floodplain or flood risk area is defined as the lowland and relatively flat area adjoining a river or stream. The terms “base flood” and “100-year flood” refer to the area in the floodplain that is subject to a one percent or greater chance of flooding in any given year. Floodplains are part of a larger entity called a basin or watershed, which is defined as all the land draining to a river and its tributaries.

Flash Flooding

Flash floods, typically rapidly developing with little to no warning time, result from convective precipitation usually due to intense thunderstorms or sudden releases due to a failure of an upstream impoundment created behind a dam, landslide, or levee. Flash floods are distinguished from regular floods by a timescale of fewer than six hours. Flash floods cause the most flood-related deaths because of this shorter timescale. Flooding from excessive rainfall events in Iowa usually occurs between late spring and early fall.

Stormwater Flooding

In some cases, flooding may not be directly attributable to a river, stream, or lake overflowing its banks. Rather, it may simply be the combination of excessive rainfall or snowmelt, saturated ground, and inadequate drainage capacity. With no place to go, the water will find the lowest elevations – areas that are often not in a floodplain. This type of flooding, often referred to as stormwater flooding, is becoming increasingly prevalent as development exceeds the capacity of drainage infrastructure, therefore limiting its ability to convey stormwater. Flooding also occurs due to combined storm and sanitary sewers being overwhelmed by the high flows that often accompany storm events. Typical impacts range from dangerously flooded roads to water backing up into homes or basements, which damages mechanical systems and can create serious public health and safety concerns.

Ice Jam Flooding

Ice jams occur when ice breaks up in moving waterways, and then stacks on itself where channels narrow, or human-made obstructions constrict the channel. This creates an ice dam, often causing flooding within minutes of the dam formation. Ice formation in streams occurs during periods of cold weather when finely divided colloidal particles called "frazil ice" form. These particles combine to form what is commonly known as “sheet ice.” This type of ice covers the entire river. The thickness of this ice sheet depends upon the degree and duration of cold weather in the area. This ice sheet can freeze to the bottom of the channel in places. During spring thaw or winter freezing, rivers frequently become clogged with this winter accumulation of ice. Because of relatively low stream banks and channels blocked with ice, rivers overtop existing banks and

flow overland. This type of flooding tends to more frequently occur on wide, shallow rivers, although other rivers can be impacted.

Location

The county resides in the South Raccoon, North Raccoon, and West Des Moines watersheds. Main waterways in the area include the South, Middle, and North Raccoon Rivers, and the Des Moines River. These rivers and their tributaries are potential locations for flooding to occur.

Table 72 shows current statuses of FIRM panels. For additional details on localized flood risk such as flood zone types, please refer to the official FIRM available from FEMA's Flood Map Service Center.

Figure 36 shows the modeled floodplain for the county. For jurisdictional-specific maps as well as an inventory of structures in the floodplain, please refer to *Section Seven: Community Profiles.*

Table 72: FEMA FIRM Panel Status

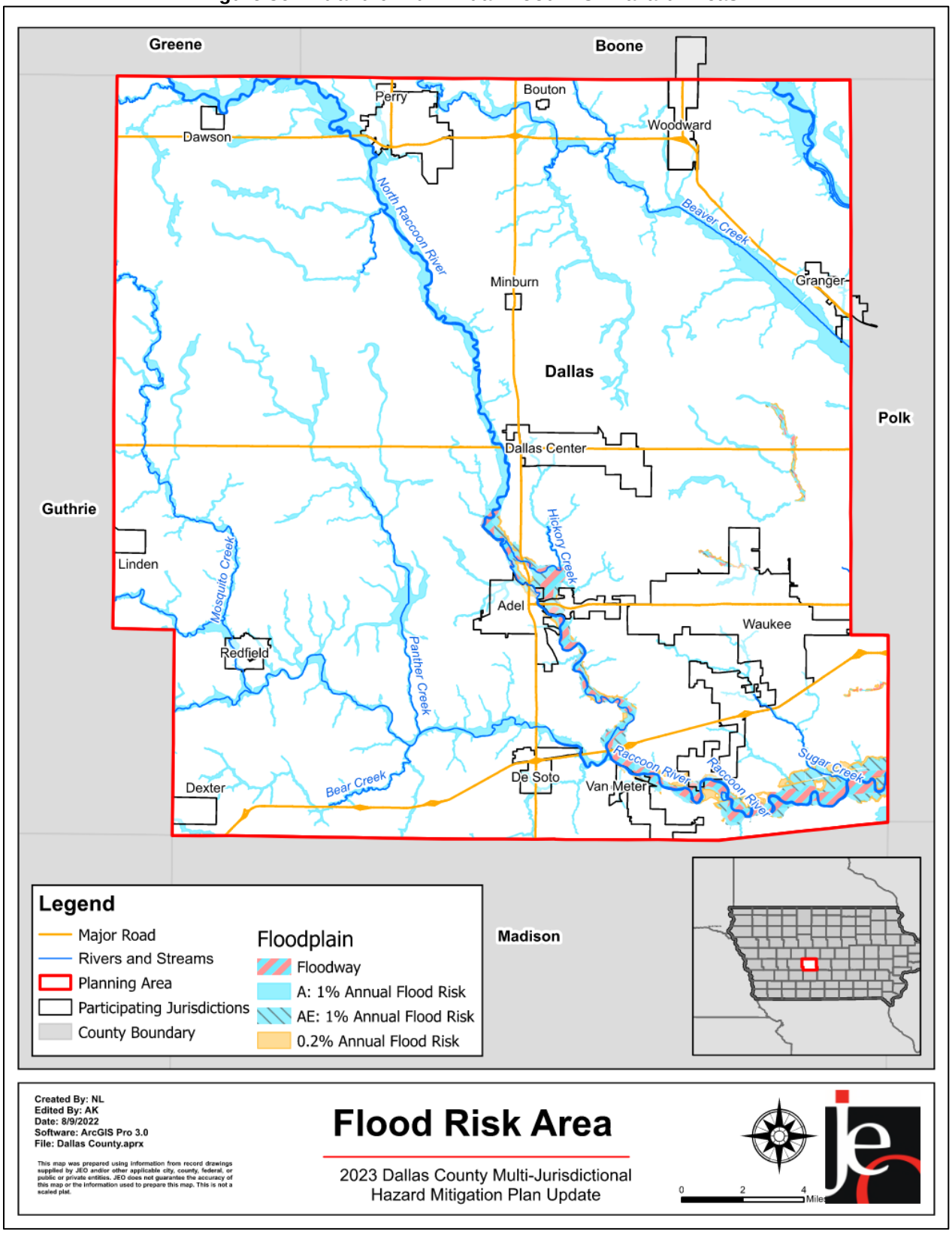
Jurisdiction	Participating in NFIP? (Y/N)	Panel Number	Effective Date
Dallas County	Y	19049CIND0C, 19049C0025F, 19049C0050F, 19049C0075F, 19049C0100F, 19049C0125F, 19049C0150F, 19049C0175F, 19049C0180F, 19049C0185F, 19049C0190F, 19049C0191G, 19049C0192G, 19049C0193G, 19049C0194G, 19049C0205F, 19049C0210F, 19049C0211G, 19049C0212G*, 19049C0213G, 19049C0214G, 19049C0220F, 19049C0230F, 19049C0240F, 19049C0275F, 19049C0300F, 19049C0305F, 19049C0306G, 19049C0307G, 19049C0308G, 19049C0309G, 19049C0315F, 19049C0320F, 19049C0326G, 19049C0327G*, 19049C0328G, 19049C0329G, 19049C0335F, 19049C0336G, 19049C0337G, 19049C0338G, 19049C0339G, 19049C0341G, 19049C0342G, 19049C0343G, 19049C0344G, 19049C0355F, 19049C0361G, 19049C0362G, 19049C0363G, 19049C0364G, 19049C0366G, 19049C0368G	12/7/2018, 12/15/2022
Adel	Y	19049CIND0C, 19049C0193G, 19049C0194G, 19049C0306G, 19049C0307G, 19049C0309G, 19049C0326G, 19049C0327G*, 19049C0328G	12/15/2022
Bouton	N	19049CIND0C, 19049C0075F	12/7/2018, 12/15/2022
Dallas Center	Y	19049CIND0C, 19049C0185F, 19049C0192G, 19049C0205F, 19049C0211G, 19049C0212G*	12/7/2018, 12/15/2022
Dawson	Y	19049CIND0C, 19049C0050F	12/7/2018, 12/15/2022
De Soto	Y	19049CIND0C, 19049C0320F, 19049C0336G	12/7/2018, 12/15/2022
Dexter	N	19049CIND0C, 19049C0300F	12/7/2018, 12/15/2022
Granger	Y	19049CIND0C, 19049C0125F, 19049C0230F, 19049C0235F*	12/7/2018, 12/15/2022
Linden	N	19049CIND0C, 19049C0150F	12/7/2018, 12/15/2022
Minburn	N	19049CIND0C, 19049C0075F	12/7/2018, 12/15/2022
Perry	Y	19049CIND0C, 19049C0050F, 19049C0075F	12/7/2018, 12/15/2022
Redfield	Y	19049CIND0C, 19049C0300F	12/7/2018, 12/15/2022
Van Meter	Y	19049CIND0C, 19049C0337G, 19049C0339G, 19049C0343G	12/15/2022
Waukee	Y	19049CIND0C, 19049C0214G, 19049C0220F, 19049C0240F, 19049C0327G*, 19049C0335F, 19049C0341G, 19049C0342G, 19049C0343G, 19049C0355F	12/7/2018, 12/15/2022

Woodward	N	19049CIND0C, 19015C0325D, 19015C0450D, 19049C0100F	12/7/2018, 10/21/2021, 12/15/2022

Source: FEMA, 2022[86] [87]
*Panel not printed

[86] Federal Emergency Management Agency. 2022. "FEMA Flood Map Service Center." Accessed December 2022. http://msc.fema.gov/portal/advanceSearch.
[87] Federal Emergency Management Agency. 2022. "Community Status Book Report." Accessed December 2022. https://www.fema.gov/flood-insurance/work-with-nfip/community-status-book.

Figure 36: 1% and 0.2% Annual Flood Risk Hazard Areas



*Floodplain maps were created based on the available FIRM data at the time. Updated effective FIRM data was scheduled to be available on December 15, 2022. Please refer to FEMA's Flood Map Service Center for the current FIRM information.

Risk Map Products

Risk Mapping, Assessment, and Planning (Risk MAP) is a FEMA program that provides communities with flood information and additional flood risk data (e.g., flood depth grids, percent chance grids, areas of mitigation interest, etc.) that can be used to enhance their mitigation plans and take action to better protect their citizens.

There have been two Risk Map products completed for watersheds in the planning area. In 2015, a Risk Map project for the North Raccoon Watershed was completed, and in 2017, a project was completed for the Middle Des Moines Watershed. According to the North Raccoon Watershed Flood Risk Report, the watershed has a drainage area of 3,625 square miles and is made up of the North Raccoon River, Middle Raccoon River, and South Raccoon River.[88] The Flood Risk Map can be seen in Figure 37.[89] The watershed includes portions of Dallas County and 14 other counties. Communities within the Dallas County portion of the watershed include Adel, Clive, Dallas Center, Dawson, Grimes, Minburn, Perry, Urbandale, Van Meter, Waukee, and West Des Moines. Total estimates for potential losses from flood event scenarios exceed $24 million in annualized losses.

The Middle Des Moines Watershed has a drainage area of 1,881 square miles, with the Des Moines River being the main waterbody.[90] The Flood Risk Map can be seen in Figure 38.[91] The watershed includes all or portions of 14 counties and 41 communities. Communities within the Dallas County portion of the watershed include Bouton, Dallas Center, Granger, Grimes, Minburn, Perry, Urbandale, and Woodward. Total estimates for potential losses from flood event scenarios reach almost $34 million in annualized losses.

[88] FEMA. 2015. Flood Risk Report: North Raccoon Watershed, Iowa." https://map1.msc.fema.gov/data/FRP/FRR_07100006_20150331.pdf?LOC=c252de054463d7acbe62a0fd9415c760.
[89] FEMA. 2015. "Flood Risk Map: North Raccoon Watershed, Iowa." https://map1.msc.fema.gov/data/FRP/FRM_07100006_20150331.pdf?LOC=2705e51e7c3059e9b3c8e7f4f4a7a3d3.
[90] FEMA. 2017. Flood Risk Report: Middle Des Moines Watershed, Iowa." https://map1.msc.fema.gov/data/FRP/FRR_07100004_20170615.pdf?LOC=25990c6ac01b92de111a77fcb352889f.
[91] FEMA. 2017. "Flood Risk Map: Middle Des Moines Watershed, Iowa." https://map1.msc.fema.gov/data/FRP/FRM_07100004_20170615.pdf?LOC=8c126c63fe857697e2a2d9c235a98502.

Figure 37: North Raccoon Watershed Flood Risk Map

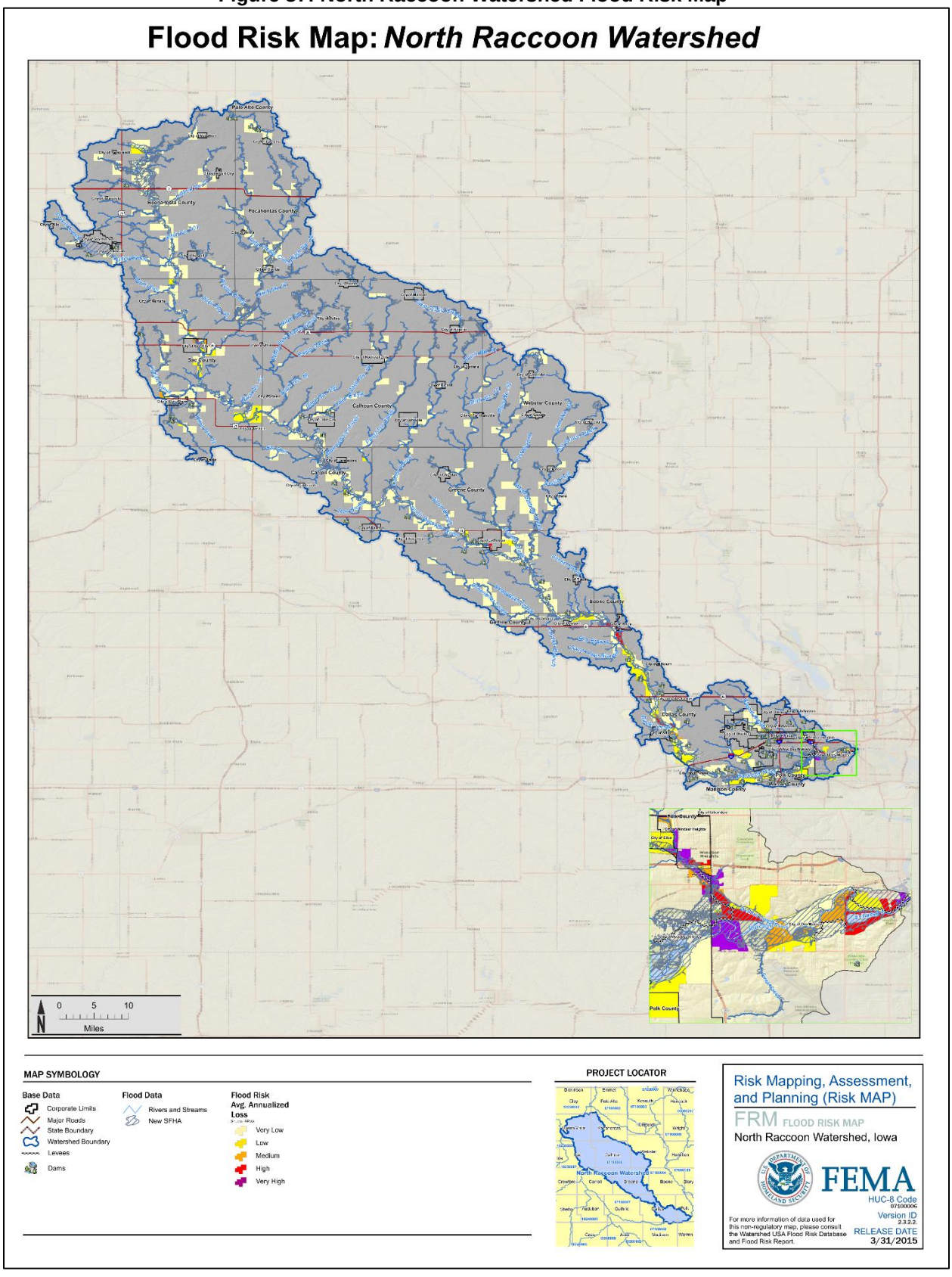
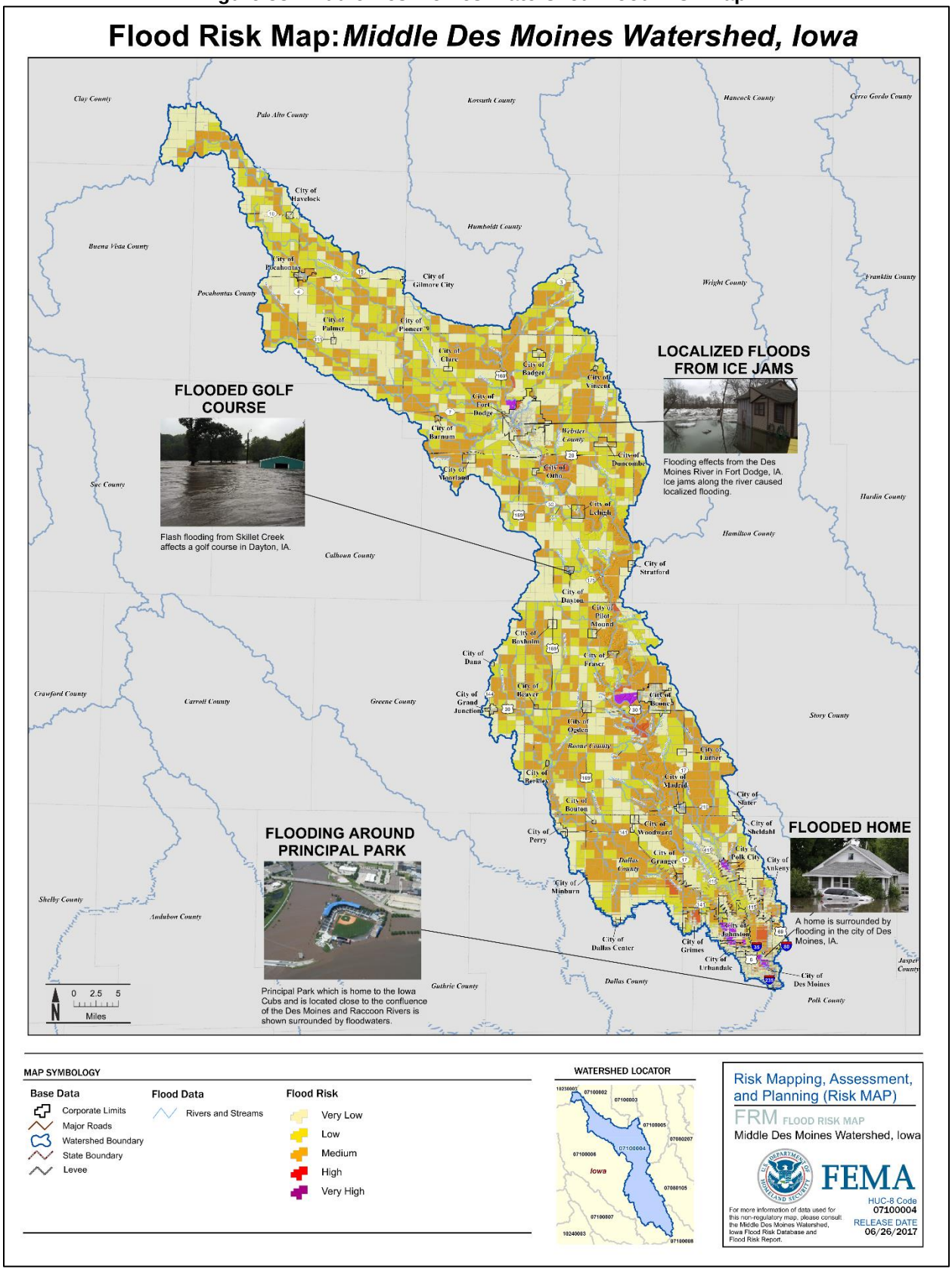


Figure 38: Middle Des Moines Watershed Flood Risk Map



According to the Iowa Department of Natural Resources, other flood plain mapping projects in Dallas County are currently underway. As of 2022, lidar data has been collected and the county is undergoing 2D base level engineering and data development activities.[92]

The Iowa Flood Center hosts flood risk maps on an interactive web map that contains tools for analyzing scour-prone areas, flood risk gradients, and flood depths.
The interactive flood risk maps can be viewed at:
https://ifis.iowafloodcenter.org/ifis/newmaps/risk/map/.

Extent

The NWS has three categories to define the severity of a flood once a river reaches flood stage as indicated in Table 73.

Table 73: Flooding Stages

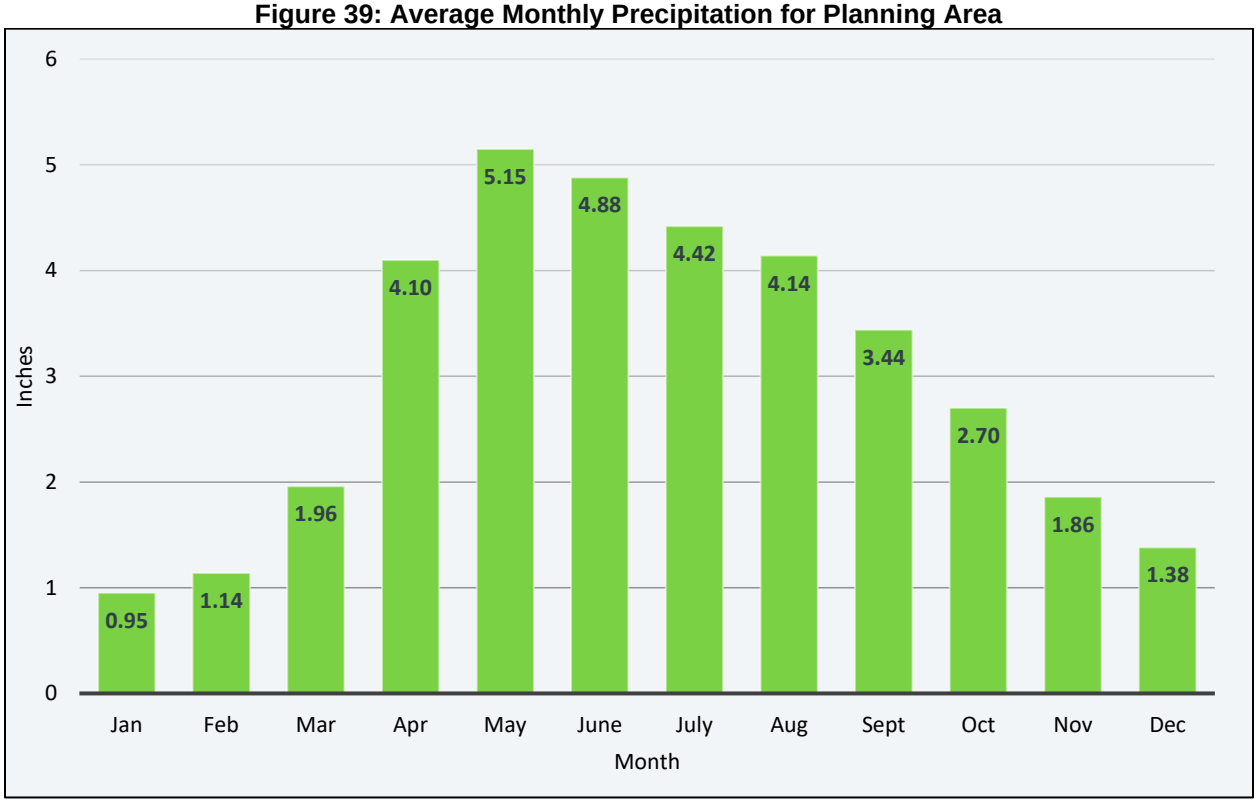
Flood Stage	Description of Flood Impacts
Minor Flooding	Minimal or no property damage, but possibly some public threat or inconvenience
Moderate Flooding	Some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary
Major Flooding	Extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations

Source: NOAA, 2017[93]

[92] Iowa Department of Natural Resources. 2022. "Flood Plain Mapping." https://www.iowadnr.gov/Environmental-Protection/Land-Quality/Flood-Plain-Management/Flood-Plain-Mapping.
[93] National Weather Service. 2017. "Flood Safety." https://www.weather.gov/safety/flood.

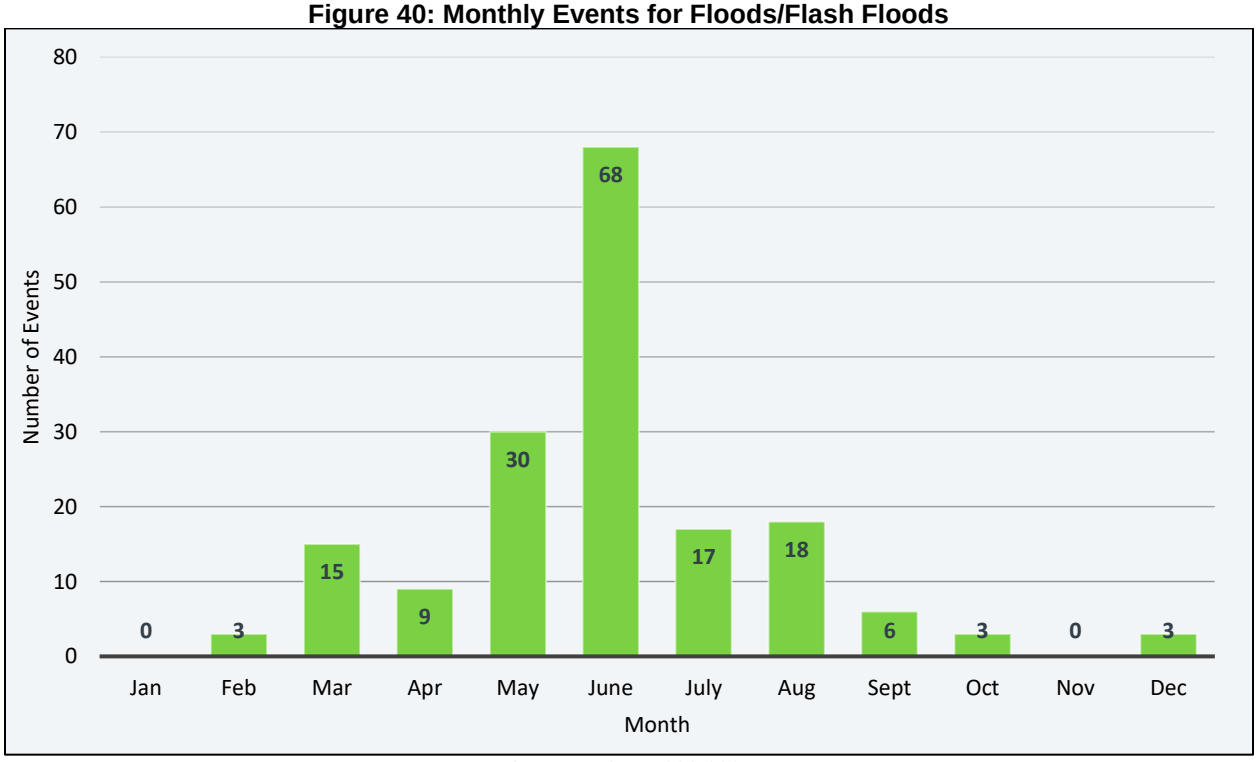
Figure 39 shows the normal average monthly precipitation for the planning area, which is helpful in determining whether any given month is above, below, or near normal in precipitation. As indicated in Figure 40, the most common months for flooding within the planning area are May and June.

Figure 39: Average Monthly Precipitation for Planning Area



Source: NCEI, 1991-2020[94]

Figure 40: Monthly Events for Floods/Flash Floods



Source: NCEI, 1996-2021

[94] NOAA National Centers for Environmental Information. May 2022. "Data Tools: 1991-2020 Normals." [datafile]. https://www.ncdc.noaa.gov/cdo-web/datatools/normals.

National Flood Insurance Program (NFIP)

The NFIP was established in 1968 to reduce flood losses and disaster relief costs by guiding future development away from flood hazard areas where feasible; by requiring flood resistant design and construction practices; and by transferring the costs of flood losses to the residents of floodplains through flood insurance premiums.

In return for availability of federally backed flood insurance, jurisdictions participating in the NFIP must agree to adopt and enforce floodplain management standards to regulate development in special flood hazard areas as defined by FEMA's flood maps. One of the strengths of the program has been keeping people away from flooding rather than keeping the flooding away from people—through historically expensive flood control projects. The following tables summarize NFIP participation and active policies within the planning area.

Table 74: NFIP Participants

Jurisdiction	Participate in NFIP	Eligible-Regular Program	Date Current Map	Sanction	Suspension	Rescinded
Dallas County	Y	5/1/1994	12/7/2018	-	-	-
Adel	Y	8/4/1987	12/7/2018	-	-	-
Bouton	N	1/19/2000	12/7/2018	-	-	-
Dallas Center	Y	02/22/10	12/07/18(M)	-	-	-
Dawson	Y	08/12/11	12/07/18(M)	-	-	-
De Soto	Y	09/27/85	12/07/18(M)	-	-	-
Dexter	N	1/19/2000	12/7/2018	-	-	-
Granger	Y	06/01/87	12/7/2018	-	-	-
Linden	N	1/19/2000	12/7/2018	-	-	-
Minburn	N	1/19/2000	12/7/2018	-	-	-
Perry	Y	09/04/85	12/07/18(M)	-	-	-
Redfield	Y	09/18/85	12/07/18(M)	-	-	-
Van Meter	Y	1/19/2000	01/26/09	-	-	-
Waukee	Y	1/19/2000	05/03/01	-	-	-
Woodward	N	9/1/1996	10/21/2021	-	-	-

Source: Federal Emergency Management Agency, National Flood Insurance Program, 2022[95]
**(M) indicates no elevation determined – All Zone A, C, and X; (L) indicates original FIRM by Letter – All Zone A, C, and X; (E) indicates entry in Emergency Program*

The NFIP Emergency Program allows a community to voluntarily participate in the NFIP if no flood hazard information is available for their area; the community has a Flood Hazard Boundary Map but no FIRM; or the community has been identified as flood-prone for less than a year.

[95] Federal Emergency Management Agency. 2022. "Community Status Book Report." Accessed June 2022. https://www.fema.gov/cis/IA.html

Table 75: NFIP Policies in Force and Total Payments

Jurisdiction	Policies In-force	Total Coverage	Total Premiums	Total Losses	Total Payments
Dallas County	18	$4,924,300	$11,126	8	$115,546
Adel	6	$857,800	$2,352	14	$73,578
Dallas Center	4	$1,050,000	$1,767	2	$55,406
Granger	2	$560,000	$957	1	$1,000
Perry	5	$741,700	$5,419	7	$4,200
Redfield	1	$280,000	$485	3	$565
Van Meter	6	$941,000	$4,180	0	$0
Waukee	16	$4,342,000	$7,207	2	$1,595

Source: HUDEX, April 2022

This plan highly recommends and strongly encourages plan participants to enroll, participate, and remain in good standing with the NFIP. Compliance with the NFIP should remain a top priority for each participant. Jurisdictions are encouraged to initiate activities above the minimum participation requirements, which are described in the Community Rating System (CRS) Coordinator's Manual.[96] Currently no jurisdictions in the planning area participate in the CRS program.

NFIP Repetitive Loss Structures

IDNR was contacted to determine if any existing buildings, infrastructure, or critical facilities are classified as NFIP Repetitive Loss Structures. As of July 2022, there are two repetitive loss properties in unincorporated Dallas County. Both structures are non-residential. There are no additional repetitive loss or severe repetitive loss properties located in the county. It is important that the county works with the property owner to identify a solution to mitigate the repetitive flood damages into the future and is included as a project in the county's profile. Definitions of a structure identified as a NFIP Repetitive Loss (RL) and Severe Repetitive Loss (SRL) are given below.

NFIP RL: Repetitive Loss Structure refers to a structure covered by a contract for flood insurance under the NFIP that has incurred flood-related damage on two occasions during a 10-year period, each resulting in at least a $1,000 claim payment.

NFIP SRL: Severe Repetitive Loss Properties are defined as single or multifamily residential properties that are covered under an NFIP flood insurance policy and:

(1) That have incurred flood-related damage for which four or more separate claims payments have been made, with the amount of each claim (including building and contents payments) exceeding $5,000, and with the cumulative amount of such claim payments exceeding $20,000; or

(2) For which at least two separate claims payments (building payments only) have been made under such coverage, with cumulative amount of such claims exceeding the market value of the building.

[96] Federal Emergency Management Agency. 2017. "National Flood Insurance Program Community Rating System: Coordinator's Manual FIA-15/2017." Accessed June 2022. https://www.fema.gov/sites/default/files/documents/fema_community-rating-system_coordinators-manual_2017.pdf.

(3) In both instances, at least two of the claims must be within 10 years of each other, and claims made within 10 days of each other will be counted as one claim.

HMA RL: A repetitive loss property is a structure covered by a contract for flood insurance made available under the NFIP that:

(1) Has incurred flood-related damage on two occasions, in which the cost of the repair, on the average, equaled or exceeded 25 percent of the market value of the structure at the time of each such food event; and

(2) At the time of the second incidence of flood-related damage, the contract for flood insurance contains increased cost of compliance coverage.

HMA SRL: A severe repetitive loss property is a structure that:

(1) Is covered under a contract for flood insurance made available under the NFIP.

(2) Has incurred flood related damage –

(a) For which four or more separate claims payments (includes building and contents) have been made under flood insurance coverage with the amount of each such claim exceeding $5,000, and with the cumulative amount of such claim payments exceeding $20,000; or

(b) For which at least two separate claims payments (includes only building) have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the insured structure.

Purpose of the HMA definitions: The HMA definitions were allowed by the Biggert-Waters Flood Insurance Reform Act of 2012 to provide an increased federal cost share under the FMA grant when a property meets the HMA definition.

Historical Occurrences

The NCEI reports events as they occur in each community. A single flooding event can affect multiple communities and counties at a time; the NCEI reports these large scale, multi-county events as separate events. The result is a single flood event covering a large portion of the planning area could be reported by the NCEI as several events. According to the NCEI, 52 flash flooding events resulted in $2,020,000 in property damage, while 120 riverine flooding events resulted in $8,938,070 in property damage. USDA RMA data does not distinguish the difference between riverine flooding damages and flash flooding damages. The total crop loss according to the RMA is $1,023,979. Descriptions of the most damaging flood events from the NCEI are below:

- **June 18, 1998 – Flood – Dallas County:** Following a brief break from the rain on the 16th, rainfall resumed on the 17th and 18th. Heavy rain fell over just about the entire state on both days, with the heaviest amounts of 1 to 3 inches on the first night in the Nishnabotna River basin, the Upper Des Moines and Iowa basins, and the lower parts of the South Skunk basin. These rains fell on already saturated soils and resulted on considerable runoff. On the 18th, the Des Moines metropolitan area was blitzed with a massive flooding event. Local rains in the city ranged from 1 to 4 inches, much of it falling in one to two hours. Much of this water was quickly added to the flows on the already high

Raccoon River. The Raccoon crested again on the afternoon of the 18th with the 11th highest crest of record and the 2nd highest since 1993. Four Mile Creek in Des Moines crested at the 3rd highest crest on record, and numerous evacuations were conducted as a result. Cleanup and repair of the damages from this event alone were estimated at $12 million. Numerous rivers south of Des Moines flooded as well. The rivers effected from this event were the Iowa, Squaw Creek, Cedar Creek south of Des Moines, Skunk, Raccoon, Walnut Creek in Des Moines, Beaver Creek in Des Moines, Four Mile Creek in Des Moines, the North, Middle, and South. The situation had become very serious across much of Iowa by this point. In early July, 10 counties were declared major disaster areas by President Clinton and a few days later another 16 counties were added to this list by Vice President Gore. Much of the damage was due to flooding, although severe weather played a major role as well. Damage was very widespread across the state. Many people had water in their basements. Some said they had water even though they did not have water during the flood of '93, suggesting the water table in many areas was as high or higher than during the great flood of '93. Many crop fields were drowned out by high water. The true extent of the damage will not be known until the harvest in the fall.

- **June 20, 1996 – Flood – Dallas County:** Another round of heavy thunderstorms occurred on the 20th and affected much of the west third of Iowa including the Raccoon River basin. This produced minor to moderate flooding on the North Raccoon River which continued to the end of the month. Virtually the entire basin received heavy rains, which were generally in the 1-to-3-inch range. The flooding was primarily lowland flooding even though the river rose over 6 feet over flood stage at Jefferson.

- **April 25, 2007 – Flood – Redfield:** A strong low pressure developed over eastern Colorado and moved southeast into northern Oklahoma by the 24th. Deep moisture was pulled north ahead of the low with surface dew points in the low 70s reaching northern Oklahoma. Strong isentropic lift took place over the Des Moines CWA and resulted in a large and sustained area of rain and embedded thunderstorms. Rainfall of two to over five inches of rainfall occurred over a large part of the CWA, with isolated amounts in the six-to-seven-inch range over a 2-day period. This event brought about the flash flooding event of the evening of the 24th. The situation transitioned into a general areal flood event on the 25th, with several counties reporting serious flooding from the 25th into early on the 28th. Many roads were either under water or washed out by the flood waters and countless basements were flooded.

- **June 8, 2008 – Flood – Panther:** Low pressure developed over Kansas with a strong southerly flow of very moist air streaming into Iowa ahead of it. Surface temperatures warmed into the 80s with dew point readings in the low to mid 70s. A semi-stationary front extended northeast from the low, across northern Iowa during the afternoon into the evening hours. The atmosphere became very unstable with MUCAPE in the 4500 to 5000 J/kg range by midafternoon and lifted indices around -7 C. The shear was quite high, between 40 and 70 kts. Downdraft CAPW was between 1000 and 1300 J/kg with cape in the -10 to -30 C. layer of the atmosphere around 400 J/kg. The LCL was in the 750-to-1000-meter range, with the lowest over north central Iowa. With the exception of one hail report of 3-inch diameter hail report in north central Iowa, hail size was somewhat limited by the freezing level of 15500 to 16500 feet. A very strong transport of moisture took place on a 50 to 75 kt 850 mb jet. Precipitable water values soared to 1.6 to 1.9 inches by evening. During the initial phase of the severe event, high winds and hail were reported along the line of thunderstorms that formed from northern into west central Iowa. There were four reports of tornadoes in Worth, Winnebago and Cerro Gordo Counties during the

afternoon hours of the 7th. This was with the initial round of storms. One of the tornadoes in Winnebago County destroyed a hog confinement building containing 3500 hogs. Several of them were killed and the remaining hogs needed to be taken to slaughter. The event transitioned into a flooding event overnight, then tornadoes began again during the afternoon of the 8th. A tornado touched down in Taylor County. Windows were blown out of houses there and several trees were twisted and blown down around the house. A pole shed was completely destroyed south of Ferguson in Marshall County. A stronger tornado was on the ground north to northeast of Ottumwa. A home lost a roof, with a wall of one room partially collapsed by the tornado. Several trees were also downed around the home. The event transitioned into a major Flood/Flash Flood event during the evening and early morning hours with many locations reporting 1 to 2 inches of rainfall, and spotty amounts of around 5 inches in just a few hours' time. The line moved very little for a period of several hours. During the predawn hours, the line became broad and weakened to generally below severe limits. A new round of thunderstorms from Nebraska, which was the southwest part of the extensive line, moved into west central and southwest Iowa. The storm generally remained below severe levels for the most part, but they did produce very heavy rains. Another line of thunderstorms formed/re-intensified along the frontal boundary by the early afternoon hours. Initially, the storms produced strong winds and some small hail. As they moved southeast, several reports of high winds to near 70 MPH and a few reports of tornadoes were received. The most significant weather feature with this event was the heavy rainfall. The antecedent soil conditions in Iowa were extremely wet, such that flash flooding was caused by rainfall of an inch or more in an hour, even in rural areas. Heavy rainfall of 3 to 6 inches occurred in a broad swath extending from west central into north central, and parts of central and northeast Iowa. This resulted in widespread flash flooding. Eventually, the rain led to major to record flooding along many of the rivers in the state. At one point or another, about 40 of the DMX 51 counties in the CWA were under flash flood warning. The situation was very serious over the north central and northeast counties. A levy was breached in the Mason City area as the Winnebago River rose to 3 feet over the record stage. The city was inundated by water. The water treatment plant was under water and nonoperational, all power was lost to the power grid in the city. The river cut a new channel and changed course into the downtown area. In the New Hartford area, a dam broke on Beaver Creek, resulting in the water level rising 2 feet above the all-time record level. High water along the mainstem Cedar River also caused communities to lose water. Nashua lost water as the water plant became flooded. Flooding along the Shell Rock River resulted in water supply loss in the town of Rockford. There was one death that resulted from the flooding. A 33-year-old man died as he drove into flood waters in Interstate 35 at mile post 141 in Hamilton County. A second death occurred in Wright County as a 50-year-old male farmer near Galt was sucked into a culvert by flood waters as he checked the field tiles in his farm field.

Average Annual Damages

The average damage per event estimate was determined based upon NCEI Storm Events Database since 1996 and the number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. Flooding causes an average of $421,464 in property damages and $39,384 in crop losses per year for the planning area.

Table 76: Flood Loss Estimate

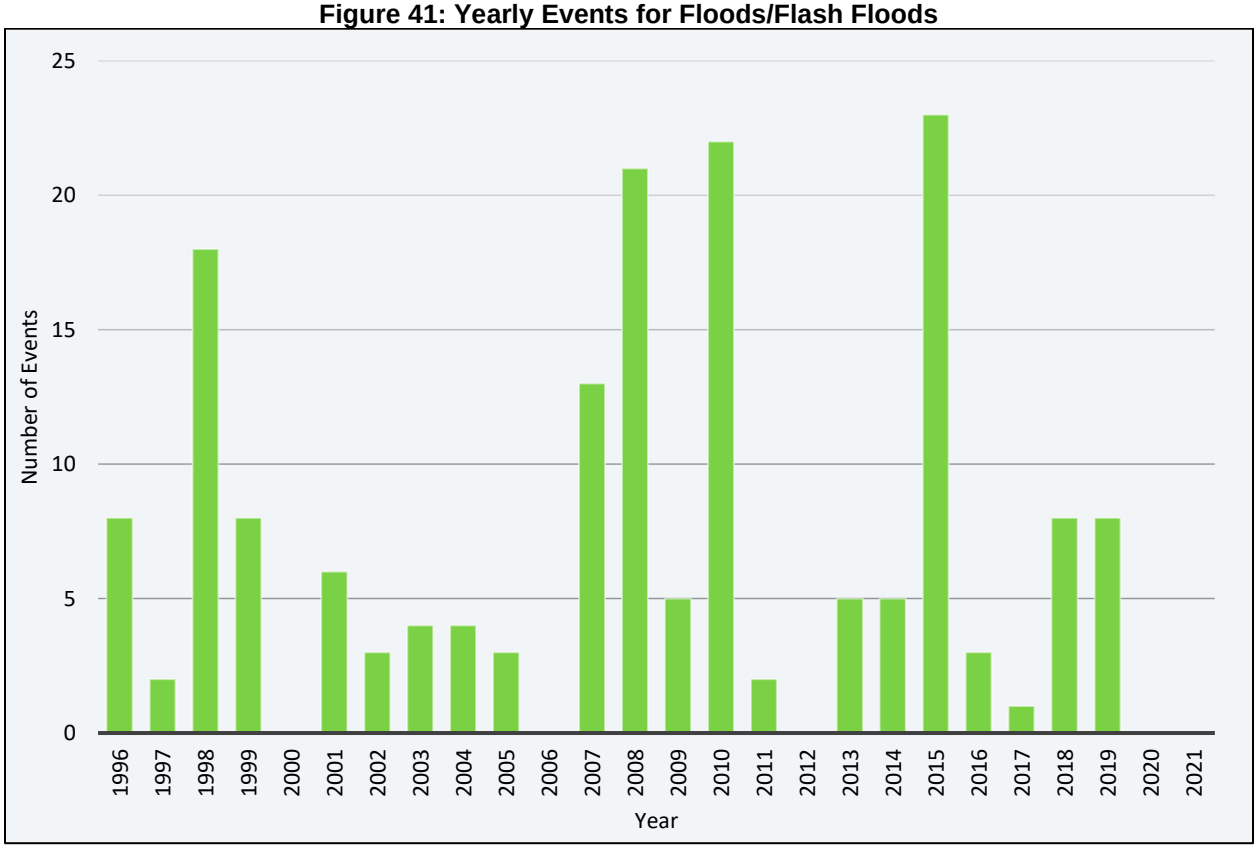
Hazard Type	Number of Events[1]	Average Events Per Year	Total Property Loss[1]	Average Annual Property Loss [1]	Total Crop Loss[2]	Average Annual Crop Loss [2]
Flooding	172	7	$10,958,070	$421,464	$1,023,979	$39,384

Source: 1 Indicates data is from NCEI (1996 to 2021); 2 Indicates data is from USDA RMA (2000 to 2021)

Probability

The NCEI reports 120 flooding and 52 flash flooding events for a total of 172 events from 1996 to 2021. Some years had multiple flooding events. Figure 41 shows the events broken down by year. 21 out of 26 years. Based on the historic record and reported incidents by participating communities, there is an 81% percent probability that flooding will occur annually in the county.

Figure 41: Yearly Events for Floods/Flash Floods



Source: NCEI, 1996-2021

Community Top Hazard Status

The following table lists jurisdictions which identified Flooding as a top hazard of concern:

Jurisdictions	
Adel	Redfield
Bouton	Van Meter

Regional Vulnerabilities

Low-income and minority populations are disproportionately vulnerable to flood events.[97] These groups may lack needed resources to mitigate potential flood events as well as resources that are necessary for evacuation and response. In addition, low-income residents are more likely to live in areas vulnerable to the threat of flooding but lack the resources necessary to purchase flood insurance. The study found that flash floods are more often responsible for injuries and fatalities than prolonged flood events.

Other groups that may be more vulnerable to floods, specifically flash floods, include the elderly, those outdoors during rain events, and those in low-lying areas. Elderly residents may suffer from a decrease or complete lack of mobility and as a result, be caught in flood-prone areas. Residents in campgrounds or public parks may be more vulnerable to flooding events. Many of these areas exist in natural floodplains and can experience rapid rise in water levels resulting in injury or death.

To analyze parcels and populations located in the floodplain, GIS parcel data were acquired from the Dallas County Assessor. This data was analyzed for the location, number, and value of property improvements at the parcel level. Property improvements include any built structures such as roads, buildings, and paved lots. The data did not contain the number of structures on each parcel. A summary of the results of this analysis for the planning area is provided in the following table. Specific jurisdictional parcel improvements in the floodplain can be found in the corresponding community profiles in *Section Seven*.

Table 77: Parcel Improvements and Value in the 1% Annual Flood Risk Area

Number of Improvements	Total Improvement Value	Number of Improvements in Floodplain	Value of Improvements in Floodplain	Percentage of Improvements in Floodplain
34,462	$11,178,810,910	1,558	$1,158,464,010	5%

Source: Dallas County Assessor, 2022

Table 78: Parcel Improvements and Value in the 0.2% Annual Flood Risk Area

Number of Improvements	Total Improvement Value	Number of Improvements in Floodplain	Value of Improvements in Floodplain	Percentage of Improvements in Floodplain
34,462	$11,178,810,910	1,309	$748,065,260	4%

Source: Dallas County Assessor, 2022

In Iowa, Watershed Management Authorities (WMA) are a tool to help cities, counties, Soil and Water Conservation Districts (SWCDs), and stakeholders to work towards watershed planning and management. There are six watershed management authorities that cover portions of Dallas County: Beaver Creek WMA, Walnut Creek WMA, North Raccoon River Watershed Management Coalition, and Middle-South Raccoon WMA. WMAs are directed by a board of directors and may perform activities to reduce flood risk.

[97] Cutter, Susan and Finch, Christina. February 2008. “Temporal and Spatial Changes in Social Vulnerability to Natural Hazards”.

More information on Watershed Management Authorities can be found at the following link: https://www.iowadnr.gov/Environmental-Protection/Water-Quality/Watershed-Management-Authorities.

The following table is a summary of regional vulnerabilities. For jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles.*

Table 79: Regional Flooding Vulnerabilities

Sector	Vulnerability
People	-Low income and minority populations may lack the resources needed for evacuation, response, or to mitigate the potential for flooding -Elderly or residents with decreased mobility may have trouble evacuating -Residents in low-lying areas, especially campgrounds, are vulnerable during flash flood events -Residents living in the floodplain may need to evacuate for extended periods
Economic	-Business closures or damages may have significant impacts -Agricultural losses from flooded fields or cattle loss -Closed roads and railways would impact commercial transportation of goods
Built Environment	-Buildings may be damaged
Infrastructure	-Damages to roadways and railways
Critical Facilities	-Wastewater facilities are at risk, particularly those in the floodplain -Critical facilities, especially those in the floodplain, are at risk to damage (critical facilities are noted within individual community profiles)
Climate	-Changes in seasonal and annual precipitation normals will likely increase frequency and magnitude of flood events

Grass/Wildland Fire

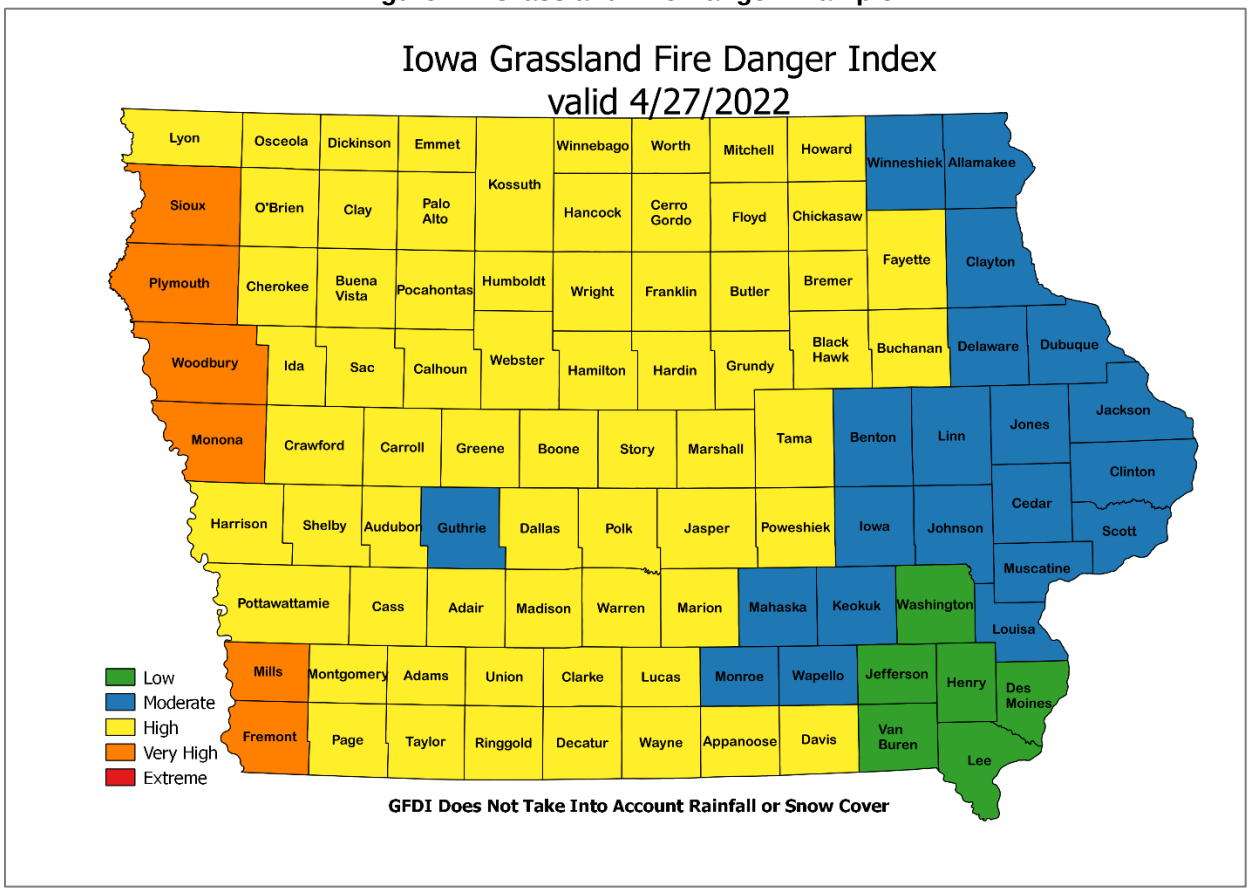
Wildfires, also known as grass fires, brush fires, forest fires, or wildland fires, are uncontrolled fires that occur in the countryside or wildland. Wildland areas may include but are not limited to grasslands, forests, woodlands, agricultural fields, pastures, and other vegetated areas. Wildfires differ from other fires by their potential extensive size, the speed at which they can spread from the original source, their ability to change direction unexpectedly, and to jump gaps (such as roads, rivers, and fire breaks). While some wildfires burn in remote forested and grassland regions, others can cause extensive destruction of homes and other property located in the wildland-urban interface (WUI), the zone of transition between developed areas and undeveloped wilderness.

> Lightning starts approximately 10,000 forest fires each year, yet ninety percent of forest fires are started by humans.
> ~National Park Service

Wildfires are a growing hazard in most regions of the United States, posing a threat to life and property, particularly where native ecosystems meet urban developed areas or where local economies are heavily dependent on open agricultural land. Although fire is a natural and often beneficial process, fire suppression can lead to more severe fires due to the buildup of vegetation, which creates more fuel and increases the intensity and devastation of future fires.

Wildfires are characterized in terms of their geographical characteristics including topography, weather, and fuels; or physical properties such as flame length and propagation. Wildfire behavior is often complex and variably dependent on factors such as fuel type and moisture content, humidity, wind speed, topography, geographic location, and ambient temperature. Fuel is the only one of these factors that humans can control and is the target of most mitigation efforts. The NWS monitors the risk factors including high temperature, high wind speed, fuel moisture (greenness of vegetation), low humidity, and cloud cover in the state on a daily basis (Figure 42). These fire danger predictions are updated regularly and should be reviewed frequently by community leaders and fire department officials.

Figure 42: Grassland Fire Danger Example



Source: NWS, 2022[98]

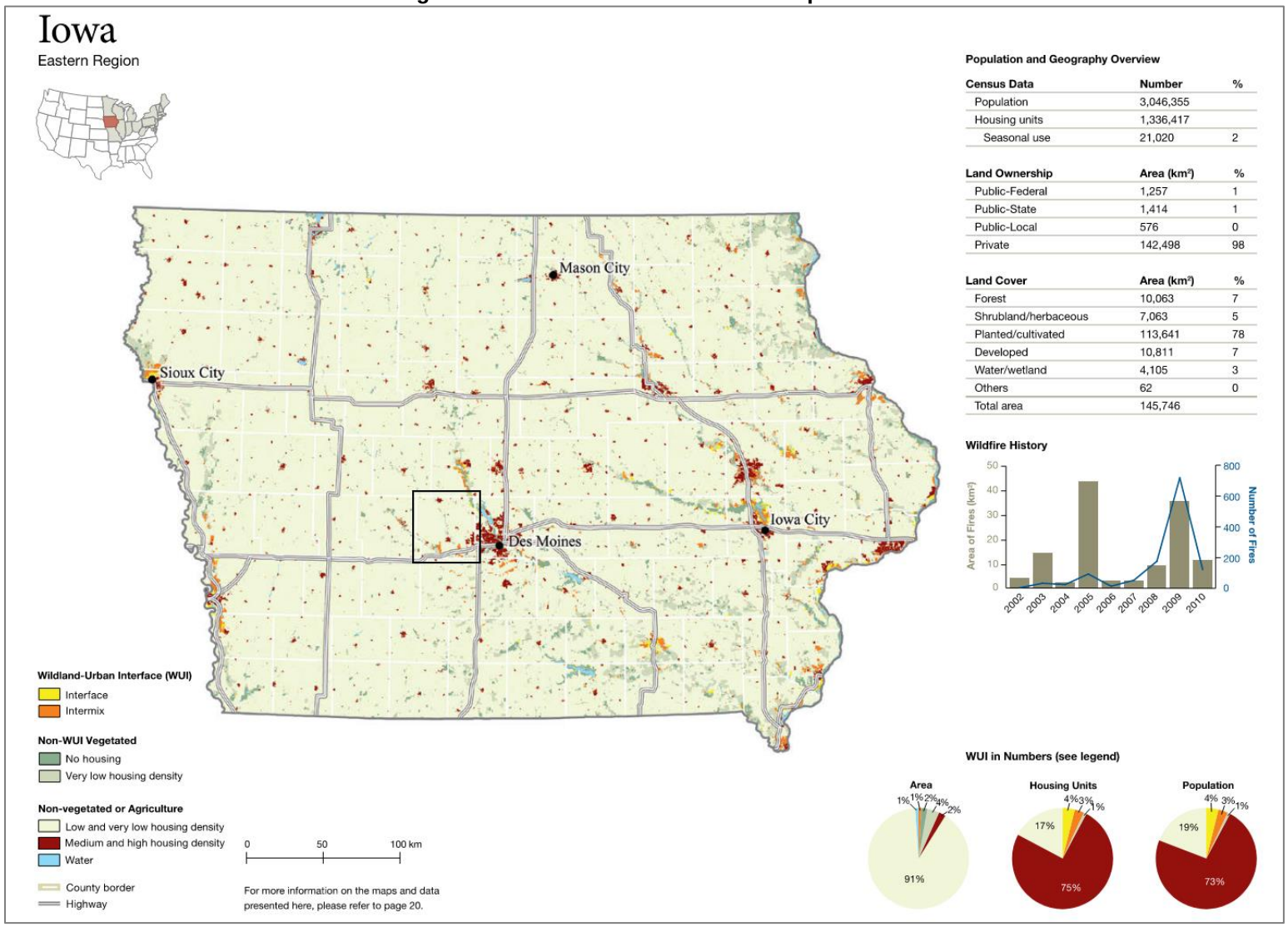
In recent decades, as the population of the United States has decentralized and residents have moved farther away from the center of cities, the WUI has developed significantly, both in terms of population and building stock. The WUI is defined as the zone of transition between developed areas and undeveloped wilderness, where structures and other human development meet wildland. The expansion of the WUI increases the likelihood that wildfires will threaten people and homes, making this area the focus of the majority of wildfire mitigation efforts.

Location

Grass/wildland fires can occur throughout the planning area. The following figure produced by the USDA Forest Service displays the State of Iowa's WUI conditions as of 2010. The approximate location of the planning area is indicated by the black outline. According to this WUI map (Figure 43), intermix areas (orange) are primarily found on the southern portion of Dallas County, near the interstate. An interface area (yellow) is also located in the northeast corner of the county, near the Des Moines River. The rest of the planning area is primarily non-WUI vegetated designated areas, with no or low-density housing with a mix of vegetated, non-vegetated, and agricultural land. Figure 44 shows the WUI map for Dallas County.

[98] National Weather Service. April 2022. "Iowa Grassland Fire Danger Index." https://www.weather.gov/dmx/fire.

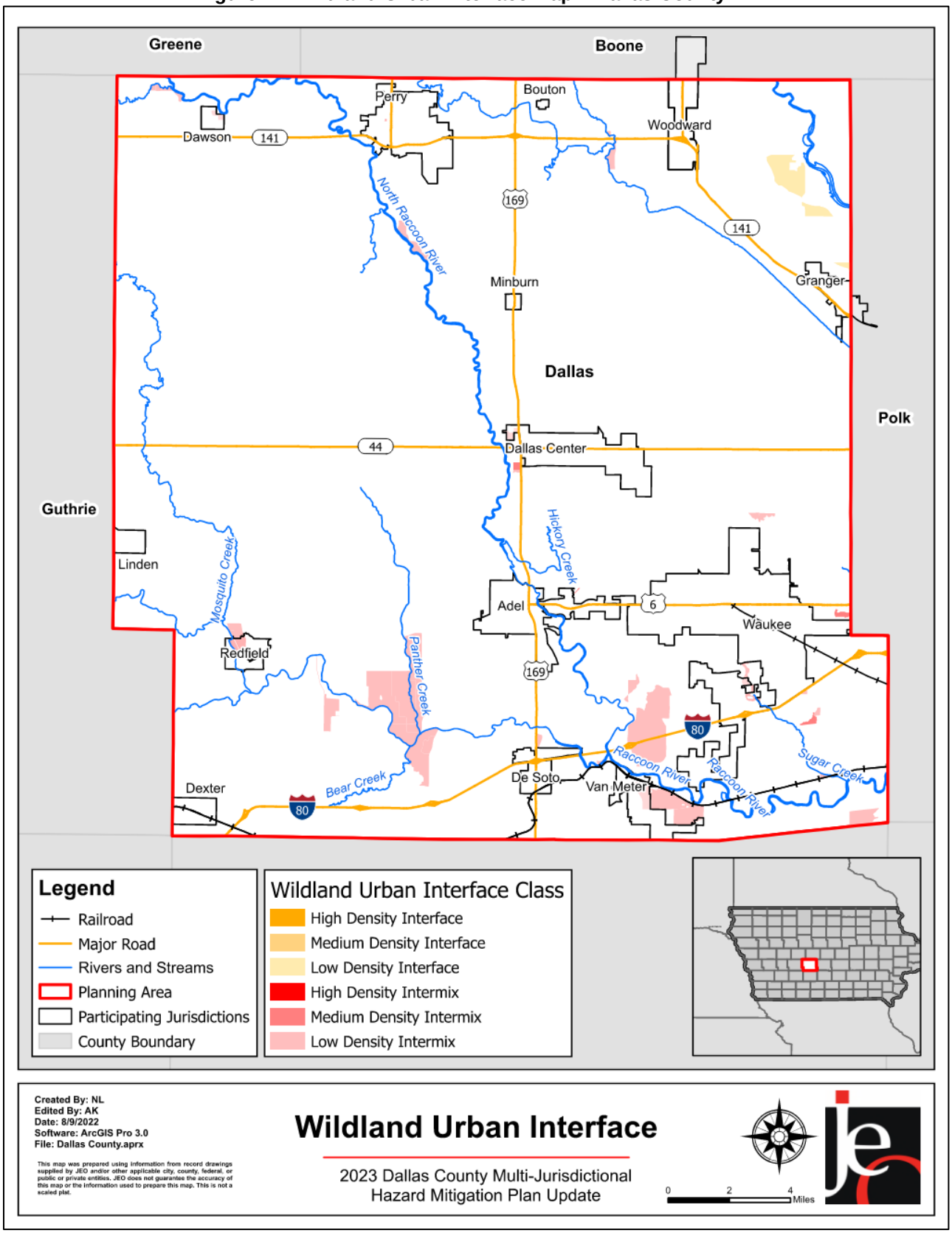
Figure 43: Wildland Urban Interface Map - Iowa



Source: USDA, 2015[99]

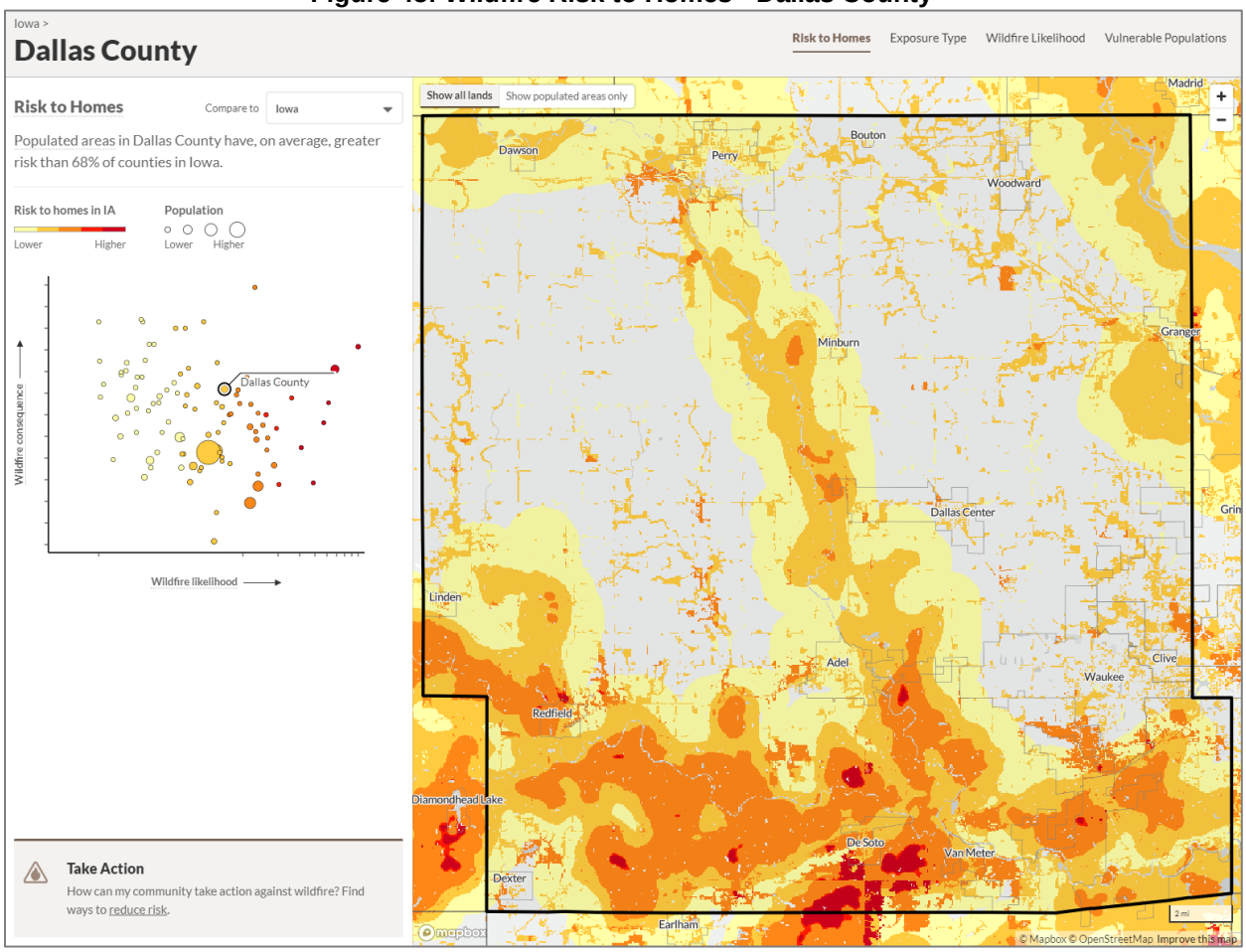
[99] USDA, USFS, & University of Wisconsin. 2015. "The 2010 Wildland-Urban Interface of the Conterminous United States." https://www.fs.fed.us/nrs/pubs/rmap/rmap_nrs8.pdf.

Figure 44: Wildland Urban Interface Map – Dallas County



The United States Department of Agriculture Forest Service created the interactive web resource, *Wildfire Risk to Communities,* to help communities and jurisdictions understand, explore, and reduce wildfire risk. Figure 45 displays wildfire risk to homes in Dallas County, as of April 2022.

Figure 45: Wildfire Risk to Homes - Dallas County



Source: Wildfire Risk to Communities[100]

Table 80: Wildfire Vulnerabilities

County	Risk to Homes (compared to Iowa Counties)	Exposure Type*	Wildfire Likelihood (compared to Iowa Counties)
Dallas	68%	Not Exposed (43%) Directly Exposed (33%) Indirectly Exposed (24%)	68%

Source: Wildfire Risk to Communities, 2022[101]

* Exposure is defined as the spatial coincidence of wildfire likelihood and intensity with communities.

[100] United States Department of Agriculture, United States Forest Service. 2022. "Wildfire Risk to Communities." Accessed April 2022. https://wildfirerisk.org/.

[101] United States Department of Agriculture, United States Forest Service. 2022. "Wildfire Risk to Communities." https://wildfirerisk.org/.

Table 81: Wildfire Vulnerable Populations

County	Families in Poverty	People with Disabilities	People over 65	Difficulty with English	Households with no Vehicle	Mobile Homes
Dallas	3.5%	7.2%	11.5%	1.6%	3.2%	2.6%

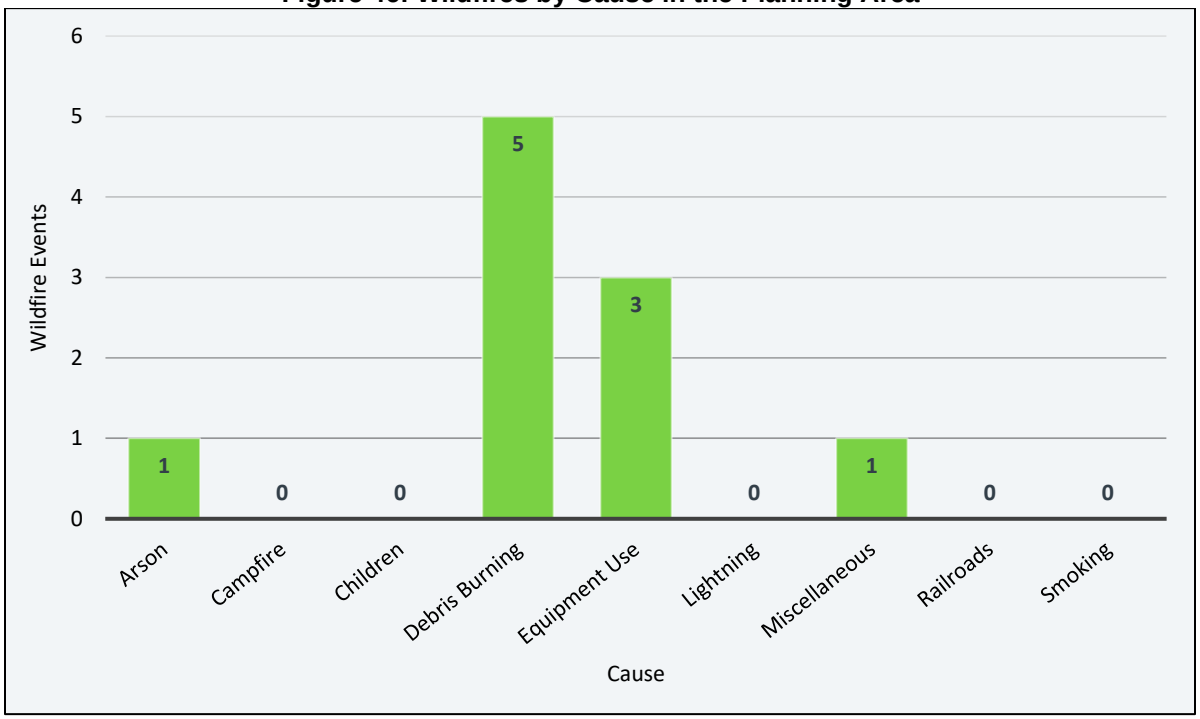
Source: Wildfire Risk to Communities, 2022[102]

Historical Occurrences

According to the Iowa Department of Natural Resources fire supervisor, fire report data in Dallas County is only available from 2019 to 2021. Local fire districts reported a total of ten wildfires during that time. The most fires occurred in 2020, with five. The reported events burned 222 acres.

The majority of wildfires in the planning area are caused by debris burning (50%), with equipment use as the second leading cause (30%) (Figure 44). Wildfires in the planning area have ranged from two to 77 acres, with an average event burning 22.2 acres.

Figure 46: Wildfires by Cause in the Planning Area



Source: IDNR Fire Supervisor (personal correspondence), 2019-2021

Average Annual Damages

No damages were reported by NCEI or from IDNR, so it is not possible to calculate the average annual damages for wildfire.

Damages caused by wildfires extend past the loss of building stock, recreation areas, timber, forage, wildlife habitat, and scenic views. Secondary effects of wildfires, including erosion, landslides, introduction of invasive species, and changes in water quality, all increase due to the exposure of bare ground and loss of vegetative cover following a wildfire, and can often be more disastrous than the fire itself in long-term recovery efforts.

[102] United States Department of Agriculture, United States Forest Service. 2022. "Wildfire Risk to Communities." https://wildfirerisk.org/.

Table 82: Wildfire Loss Estimation

Hazard Type	Number of Events	Events Per Year	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Wildfires	10	3.3	N/A	N/A	$9,653	$439

Source: 1 Indicates data is from NCEI (1996-2021); 2 Indicates data is from USDA RMA (2000-2021)

Extent

For Dallas County, the following fire departments reported wildfire events: Adel Fire Department, Minburn Fire Department, and Yale Fire Department. Fire districts respond to both wildfires and structural fires in cities.

As the reported wildfires by department indicates, wildfire is a threat throughout the planning area. Minburn Fire Department has reported the greatest number of fires, while Adel Fire reported the greatest number of acres burned.

Table 83: Reported Wildfires by Fire Department

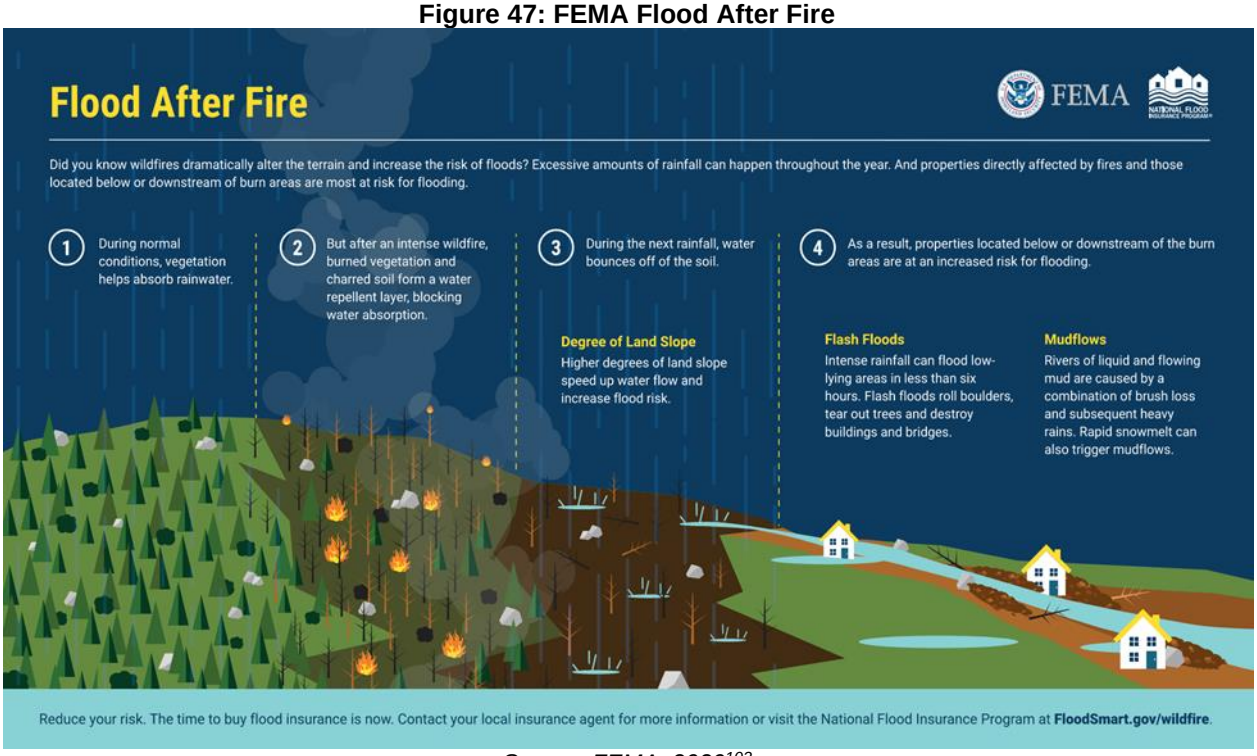
Fire Department	Reported Wildfires	Acres Burned
Adel Fire Department	1	77
Minburn Fire Department	7	70
Yale Fire Department	2	75
Total	**10**	**222**

Source: IDNR Fire Supervisor (personal correspondence), 2019-2021

As seen in Table 83 above, wildfires have burned 222 acres of land. In total, there were 10 reported wildfires in the planning area. Of these, two fires burned 50 acres or more, with the largest wildfire burning 77 acres in 2021.

Wildfire also contributes to an increased risk from other hazard events, compounding damages and straining resources. FEMA has provided additional information in recent years detailing the relationship between wildfire and flooding (Figure 47). Wildfire events remove vegetation and harden soil, reducing infiltration capabilities during heavy rain events. Subsequent severe storms that bring heavy precipitation can then escalate into flash flooding, dealing additional damage to jurisdictions.

Figure 47: FEMA Flood After Fire

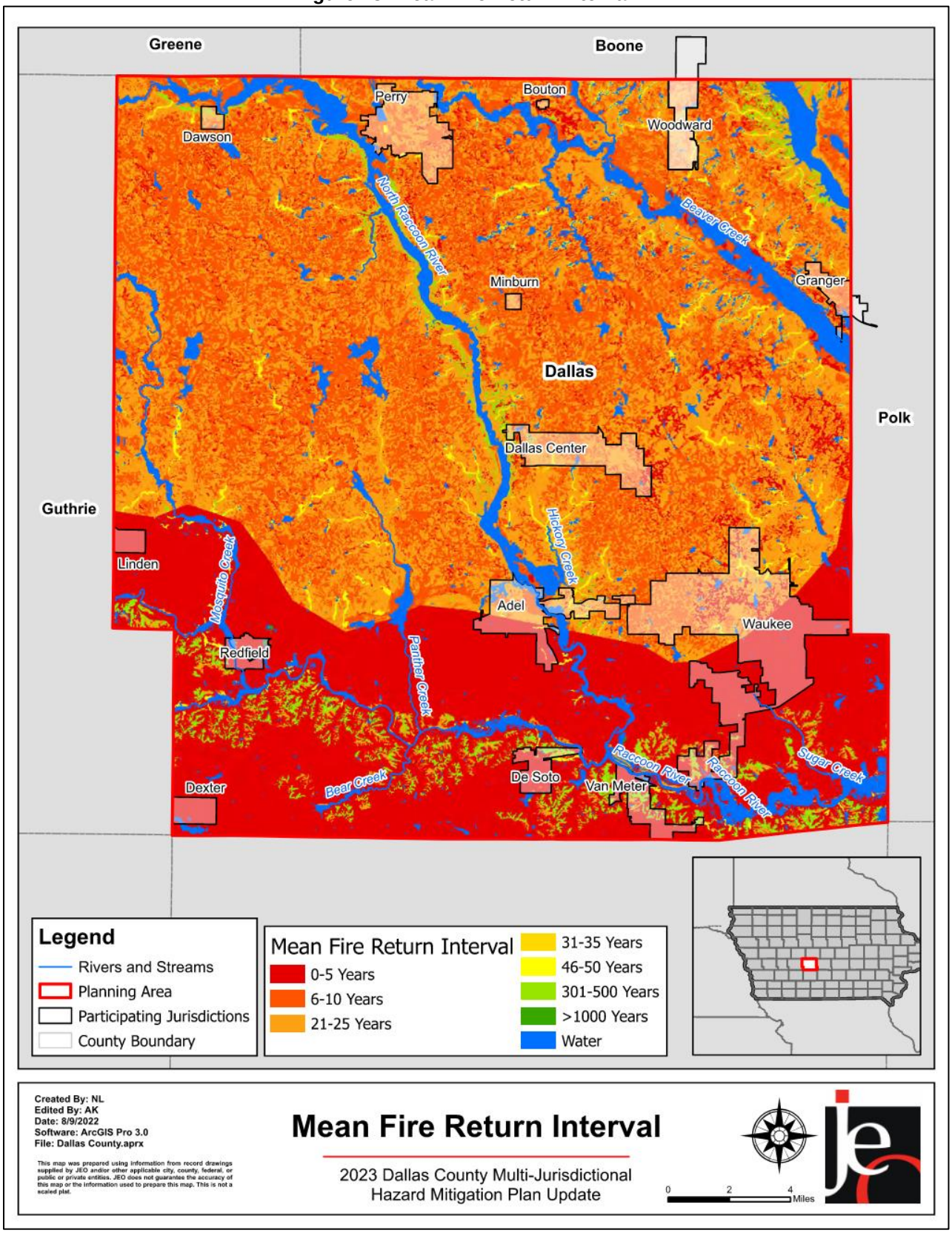


Source: FEMA, 2020[103]

Figure 48 shows the USGS' Mean Fire Return Interval for the planning area. This model considers a variety of factors, including landscape, fire dynamics, fire spread, fire effects, and spatial context. These values show how often fires occur in each area under natural conditions.

[103] FEMA and NFIP. 2020. "Flood After Fire." Accessed September 2020. https://www.fema.gov/media-library-data/1573670012259-3908ab0344ff8fbf5d537ee0c6fb531d/101844-019_FEMA_FAF_Infographic-ENG-web_v8_508.pdf.

Figure 48: Mean Fire Return Interval



Probability

The probability of wildfire occurrence is based on the historic record provided by the Iowa Department of Natural Resources and reported potential by participating jurisdictions. With a grass/wildfire occurring in each year for the period of record, there is a 100 percent annual probability of grass/wildfires occurring in the county each year.

Community Top Hazard Status

Woodward Township Fire District was the only jurisdiction which identified Grass/Wildland Fire as a top hazard of concern.

Regional Vulnerabilities

Periods of drought can occur throughout the year while extreme heat conditions during summer months greatly increase the potential for and magnitude of wildland fires. Drought has a high probability of occurring in the planning area and the planning area sees, on average, one day above 100°F each year (Figure 30). During a severe drought, dry conditions, and/or windy conditions, large wildfires can more easily spread.

Wildfire poses a threat to a range of demographic groups. Wildfire, wildfire within the WUI, and urban fire could result in major evacuations of residents in impacted and threatened areas. Groups and individuals lacking reliable transportation could be trapped in dangerous locations. Lack of transportation is common among the elderly, low-income individuals, and racial minorities, including on tribal reservation lands. Wildfires can cause extensive damage to both urban and rural building stock and properties including critical facilities and infrastructure, as well as agricultural producers which support the local industry and economy. Damaged homes can reduce available housing stock for residents, causing them to leave the area. Additionally, fire events threaten the health and safety of residents and emergency response personnel. Recreation areas, timber and grazing land, wildlife habitat, and scenic views can also be threatened by wildfires.

Development across the planning area may be located within the WUI, particularly in larger municipalities such as the City of Adel with a larger amount of intermix overlap. Local officials can adopt codes and ordinances that can guide growth in ways to mitigate potential losses from wildfires. These may include more stringent building code standards, setback requirements, or zoning regulations. Other notable vulnerabilities exist for fire departments which service both urban and rural areas as some fire districts lack adequate staff to respond to multi-fire complexes or events in separate areas. The utilization and development of mutual aid agreements or memorandum of understandings are an important tool for districts to share resources and/or coverage.

The following table provides information related to regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles.*

Table 84: Regional Wildfire Vulnerabilities

Sector	Vulnerability
People	-Risk of injury or death for residents and firefighting personnel -Displacement of people and loss of homes -Lack of transportation poses risk to low-income individuals, families, and elderly -Transportation routes may be blocked by fire, preventing evacuation efforts
Economic	-Damages to buildings and property can cause significant losses to business owners -Loss of businesses
Built Environment	-Property damages
Infrastructure	-Damage to power lines and utility structures -Potential loss of firefighting equipment and resources
Critical Facilities	-Risk of damages
Climate	-Changes in seasonal temperature and precipitation normals can increase frequency and severity of wildfire events -Changes in climate can help spread invasive species, changing potential fuel loads in wildland areas
Other	-Increased chance of landslides, erosion, and land subsidence -May lead to poor water quality -Post fire, flash flooding events may be exacerbated

Hazardous Materials Release

The following description for hazardous materials is provided by the Federal Emergency Management Agency (FEMA):

> *Chemicals are found everywhere. They purify drinking water, are used in agriculture and industrial production, fuel our vehicles and machines, and simplify household chores. But chemicals also can be hazardous to humans or the environment if used or released improperly. Hazards can occur during production, storage, transportation, use, or disposal. The community is at risk if a chemical is used unsafely or released in harmful amounts.*

Hazardous materials in various forms can cause fatalities, serious injury, long-lasting health effects, and damage to buildings, homes, and other property. Many products containing hazardous chemicals are used and stored in homes routinely. Chemicals posing a health hazard include carcinogens, toxic agents, reproductive toxins, irritants, and many other substances that can harm human organs or vital biological processes.

Chemical manufacturers are one source of hazardous materials, but there are many others, including service stations, hospitals, and hazardous materials waste sites. Varying quantities of hazardous materials are manufactured, used, or stored at an estimated 4.5 million facilities in the United States—from major industrial plants to local dry-cleaning establishments or gardening supply stores.

Hazardous materials come in the form of explosives, flammable and combustible substances, poisons, and radioactive materials. Hazardous material incidents are technological (meaning non-natural hazards created or influenced by humans) events that involve large-scale releases of chemical, biological or radiological materials. Hazardous materials incidents generally involve releases at fixed-site facilities that manufacture, store, process or otherwise handle hazardous materials or along transportation routes such as major highways, railways, navigable waterways and pipelines.

Fixed sites are those that involve chemical manufacturing sites and stationary storage facilities. The Environmental Protection Agency (EPA) requires the submission of the types and locations of hazardous chemicals being stored at any facility within the state over the previous calendar year. This is completed by submitting a Tier II form to the EPA as a requirement of the Emergency Planning and Community Right-to-Know Act of 1986. Likewise, the U.S. Department of Transportation, through the U.S. Pipeline and Hazardous Materials Safety Administration (PHMSA), has broad jurisdiction to regulate the transportation of hazardous materials, including the discretion to decide which materials shall be classified as hazardous. These materials are placed into one of nine hazard classes based on their chemical and physical properties. The hazard schedules may be further subdivided into divisions based on their characteristics. Because the properties and characteristics of materials are crucial in understanding the dynamics of a spill during a transportation incident, it is important for response personnel to understand the hazard classes and their divisions.

The transportation of hazardous materials is defined by PHMSA as "…a substance that has been determined to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce…" According to PHMSA, hazardous materials traffic in the U.S. now exceeds 1,000,000 shipments per day. Nationally, the U.S. has had 108 fatalities associated with the transport of hazardous materials between 2007 through 2016. While such fatalities are a low probability risk, even one event can harm many people.

Table 85 demonstrates the nine classes of hazardous material according to the 2020 Emergency Response Guidebook.

Table 85: Hazardous Material Classes

Class	Type of Material	Divisions
1	Explosives	Division 1.1 – Explosives which have a mass explosion hazard Division 1.2 – Explosives which have a projection hazard but not a mass explosion hazard Division 1.3 – Explosives which have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard Division 1.4 – Explosives which present no significant hazard Division 1.5 – Very insensitive explosives with a mass explosion hazard Division 1.6 – Extremely insensitive articles which do not have a mass explosion hazard
2	Gases	Division 2.1 – Flammable gases Division 2.2 – Non-flammable, non-toxic gases Division 2.3 – Toxic gases
3	Flammable liquids (and Combustible liquids)	
4	Flammable solids; Substances liable to spontaneous combustion; Substances which, on contact with water, emit flammable gases	Division 4.1 – Flammable solids, self-reactive substances and solid desensitized explosives Division 4.2 – Substances liable to spontaneous combustion Division 4.3 – Substances which in contact with water emit flammable gases
5	Oxidizing substances and Organic peroxides	Division 5.1 – Oxidizing substances Division 5.2 – Organic peroxides
6	Toxic Substances and infectious substances	Division 6.1 – Toxic substances Division 6.2 – Infectious substances
7	Radioactive materials	-
8	Corrosive substances	-
9	Miscellaneous hazardous materials/dangerous goods and articles	-

Source: Emergency Response Guidebook, 2020[104]

[104] U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration. 2022. "2020 Emergency Response Guidebook." https://www.phmsa.dot.gov/hazmat/erg/emergency-response-guidebook-erg.

Location

Iowa has approximately 4,602 facilities across the state that house hazardous materials according to the Tier II reports submitted to the Iowa Department of Natural Resources. Of those, 69 locations are located in the planning area. These locations are shown in the following figure. A listing of hazardous material storage sites can be found in *Section Seven: Community Profiles* for each jurisdiction.

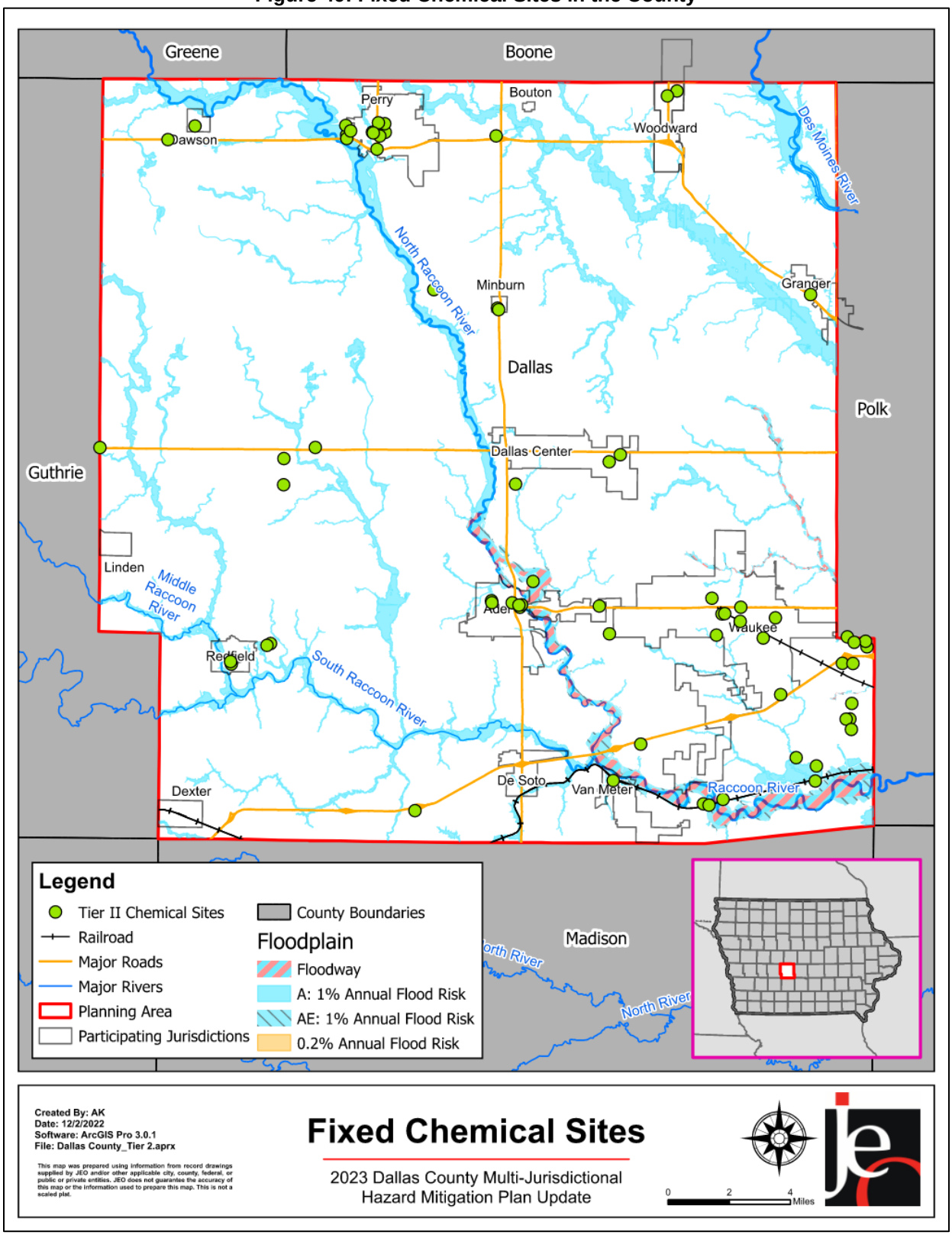
Hazardous material releases during transportation primarily occur on major transportation routes as identified in (Figure 50). Railroads providing service through the planning area have developed plans to respond to chemical releases along rail routes. A large number of spills also typically occur during the loading and unloading of chemicals for highway and pipeline chemical transport. Transportation corridors in the planning area are primarily US Routes, State Routes, and one Interstate Highway.

According to PHMSA, there are several gas transmission and hazardous liquid pipelines located in the planning area. A map of the pipelines and incidents from PHMSA for Dallas County can be seen below (Figure 51).[105] According to the U.S. Energy Information Administration (EIA) there is one crude oil pipeline and three natural gas pipelines that run through the county. [106]

[105] Pipeline and Hazardous Materials Safety Administration. 2022. "National Pipeline Mapping System." https://www.npms.phmsa.dot.gov/ .

[106] U.S. Energy Information Administration. 2022. "Maps – Crude Oil Pipelines, Natural Gas Interstate and Intrastate Pipelines, Petroleum Products Pipelines." https://www.eia.gov/maps/layer_info-m.php

Figure 49: Fixed Chemical Sites in the County



*Floodplain maps were created based on the available FIRM data at the time. Updated effective FIRM data was scheduled to be available on December 15, 2022. Please refer to FEMA's Flood Map Service Center for the current FIRM information.

Figure 50: Major Transportation Routes with Half Mile Buffer

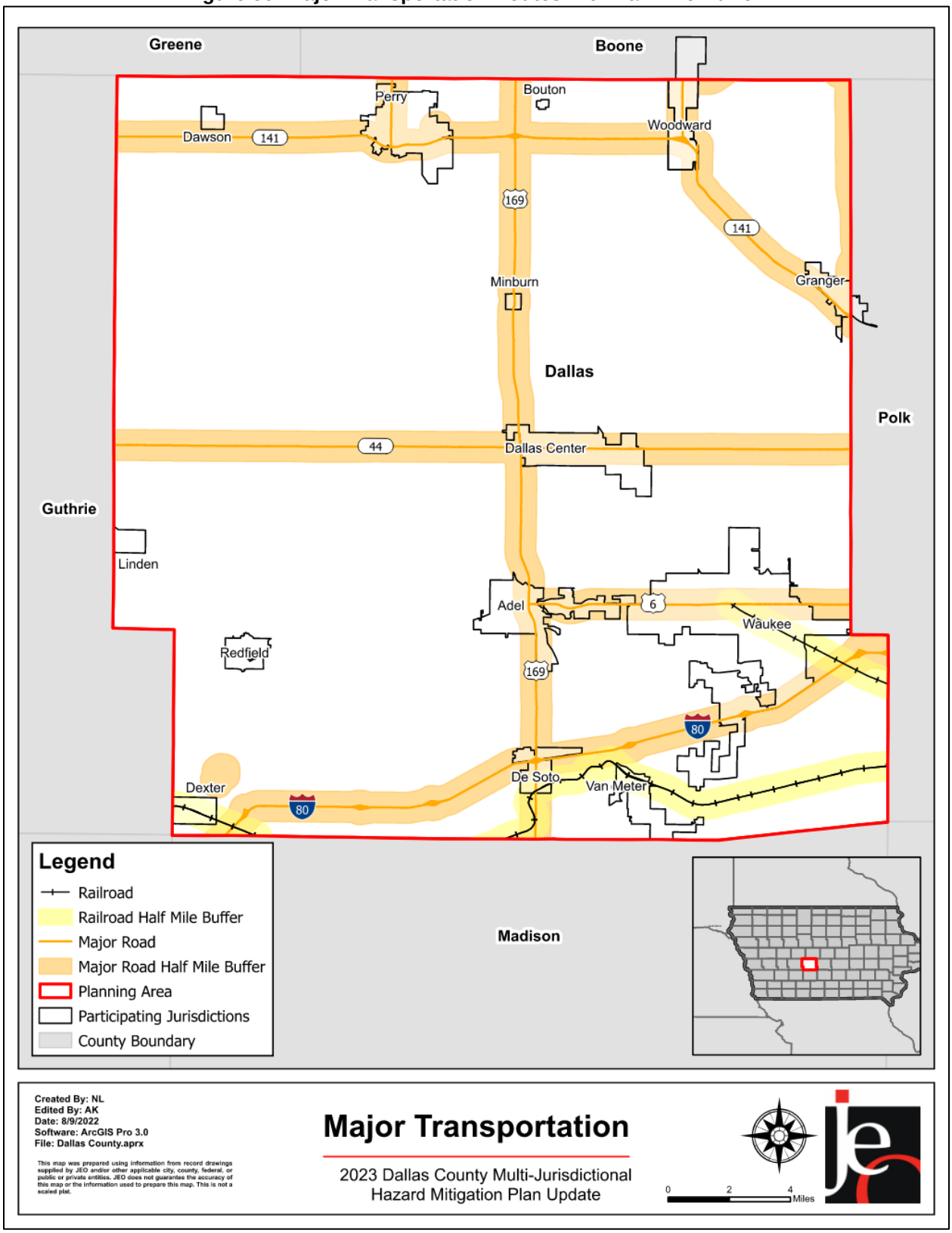
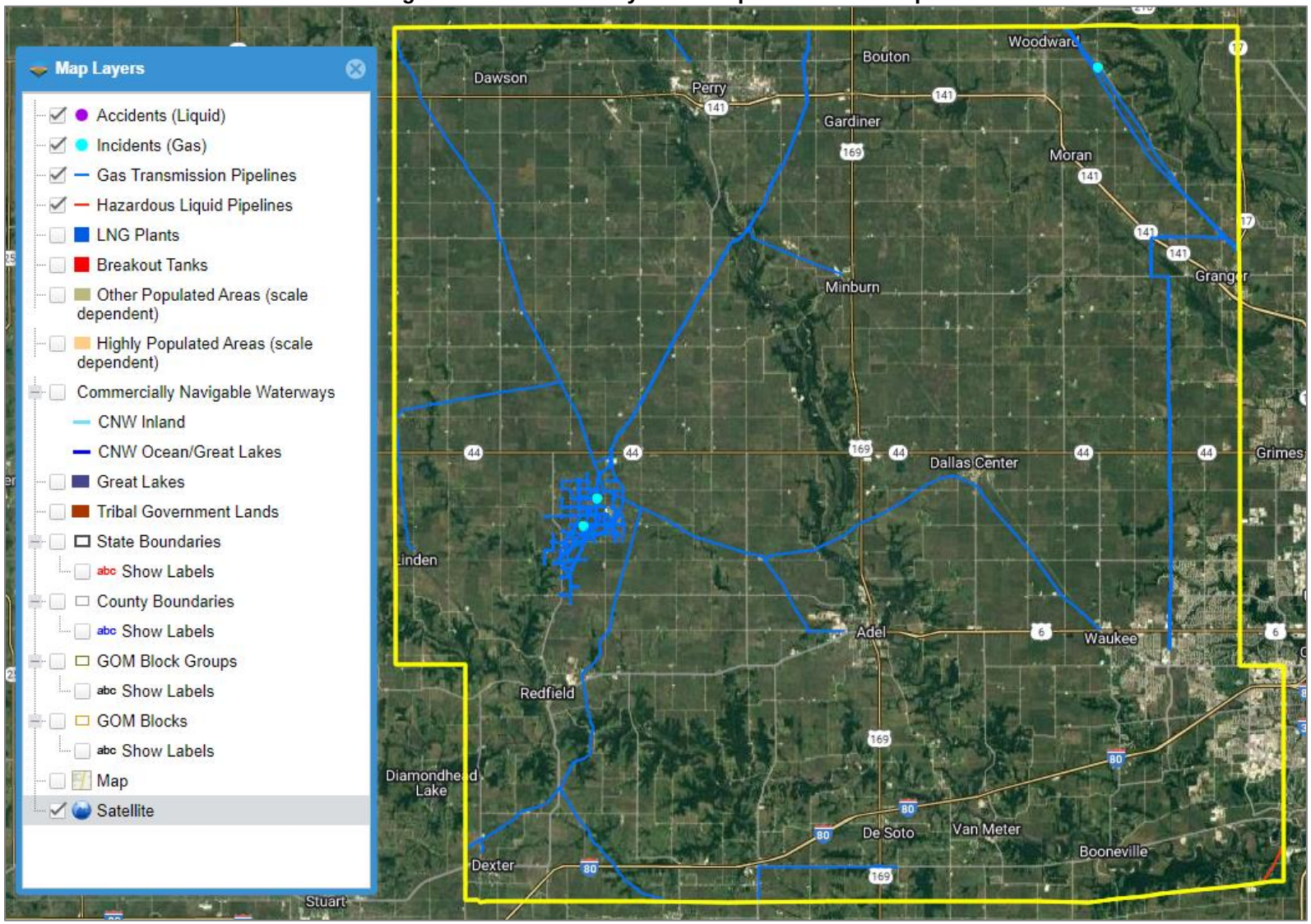


Figure 51: Dallas County Public Pipeline Viewer Map



Iowa has established a Weapons of Mass Destruction (WMD)/HazMat team to provide statewide coverage for identifying, assessment and support of render-safe procedures involving explosive devices and those that may contain chemical, biological, radioactive, nuclear, or explosive (CBRNE) materials. The team is made up of personnel from Council Bluffs, Davenport, and Des Moines and helps enhance the capabilities of existing fire department hazmat teams across the state.[107]

Extent

The extent of chemical spills at fixed sites varies and depends on the type of chemical that is released with a majority of events localized to the facility. The probable extent of chemical spills during transportation is difficult to anticipate and depends on the type and quantity of chemical released. In total 37 fixed site releases have occurred in the planning area, and the total amount spilled ranged from one gallon to 1,000 gallons. Of the 37 chemical spills, four spills led to the evacuations, one of 600 people. Four spills led to injuries and one spill resulted in a fatality.

In total, 75 releases have occurred during transportation in the planning area. Transportation spills ranged from less than one liquid gallon of material released to 4,500 liquid gallons released, with an average quantity spilled of 182 liquid gallons. None of the 75 chemical spills led to an evacuation or fatality; however, one injury did occur. Based on historic records, it is likely that any spill involving hazardous materials will not affect an area larger than a quarter mile from the spill location.

Historical Occurrences

Fixed Site Spills

According to the U.S. Coast Guard's National Response Center database (NRC), there have been 37 fixed site chemical spills from 1990 to 2021 in the planning area. There were no property damages reported for these chemical spills. The following table displays the larger spills that have occurred throughout the planning area (>500 gallons).

Table 86: Large Fixed Site Chemical Spills

Date	Location of Release	Quantity Spilled	Material Involved	Number of Injuries	Property Damage
1990	Perry	1,000 lbs.	Anhydrous Ammonia	0	$0
1995	Near Des Moines	1,000 gal.	Diesel Oil	0	$0

Source: National Response Center, 1990- 2021

Transportation Spills

According to PHMSA, 75 hazardous materials releases occurred during transportation in the planning area between 1971 and 2021. During these events, there were no evacuations or fatalities; however, one injury did occur. Damages totaled $1,048,377. The following table provides a list of the larger historical transportation chemical spills (>500 gallons).

[107] HSEMD. 2020. "Iowa's Emergency Response Teams." https://homelandsecurity.iowa.gov/programs/special-teams/.

Table 87: Large Chemical Transportation Spills

Date of Event	Location of Release	Failure Description	Material Involved	Transportation Mode	Injuries or Fatalities	Total Damage
8/10/2005	Grimes	Vehicle Accident	1,300 LGA Gasoline with Ethyl Alcohol	Highway	None	$108,200
10/25/2006	Perry	Vehicle Accident	3,000 LGA Ethanol Alcohol	Highway	None	$180,000
6/17/2016	West Des Moines	Abrasion	3,998 LGA Diesel Fuel	Highway	None	$363,393
6/17/2016	West Des Moines	Abrasion	4,400 LGA Gasoline with Ethyl Alcohol	Highway	None	$363,393

Source: PHMSA, 1971-2021

Average Annual Damages

There have been 37 fixed site spills in the planning area reported from the NRC and 75 transportation spills as reported by PHMSA. Neither the NRC nor PHMSA track crop losses from chemical spills. These events reported $1,048,377in property damages. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life.

Table 88: Hazardous Materials Release Loss Estimate

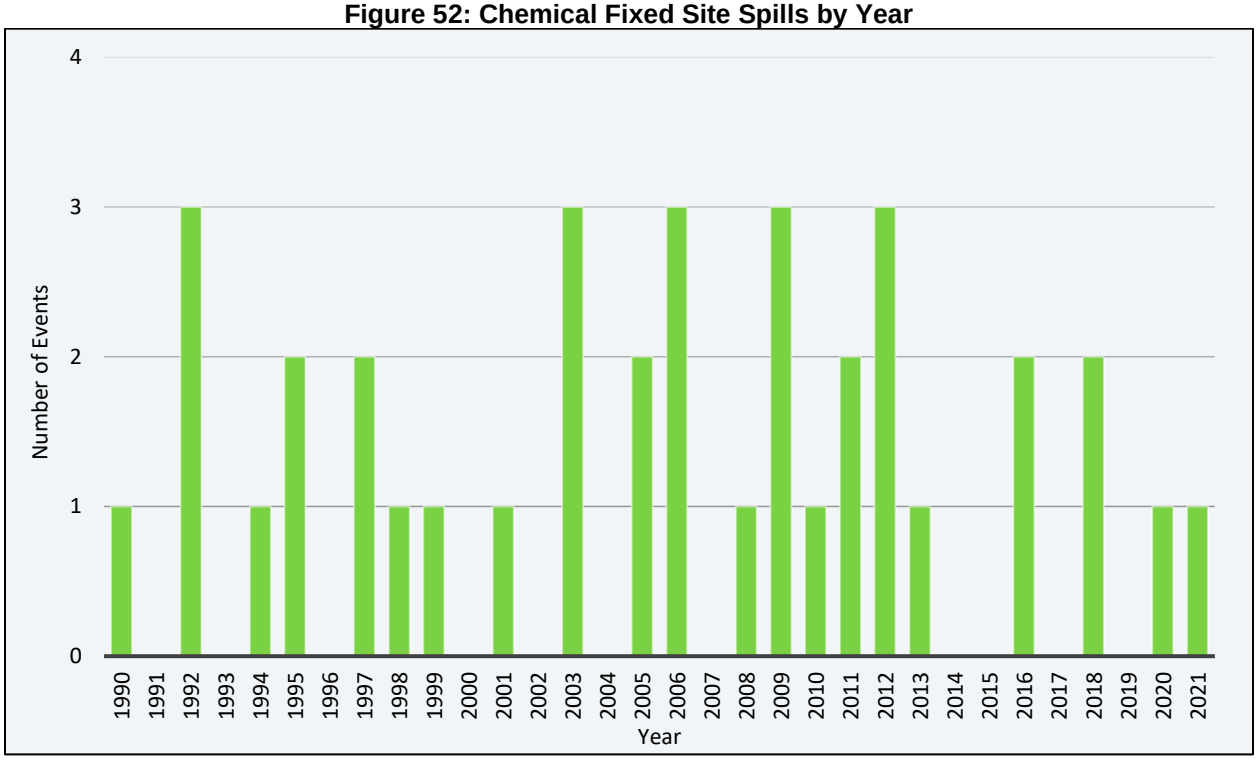
Hazard Type	Number of Events	Events Per Year	Injuries	Total Evacuated	Total Damages	Average Annual Loss
Hazardous Materials Release (Fixed Site)	37	1.2	0	1,130	$0	$0
Hazardous Materials Release (Transportation)	75	1.5	1	0	$1,048,377	$20,556

Source: National Response Center, 1990-2021; PHMSA, 1971-2021

Probability

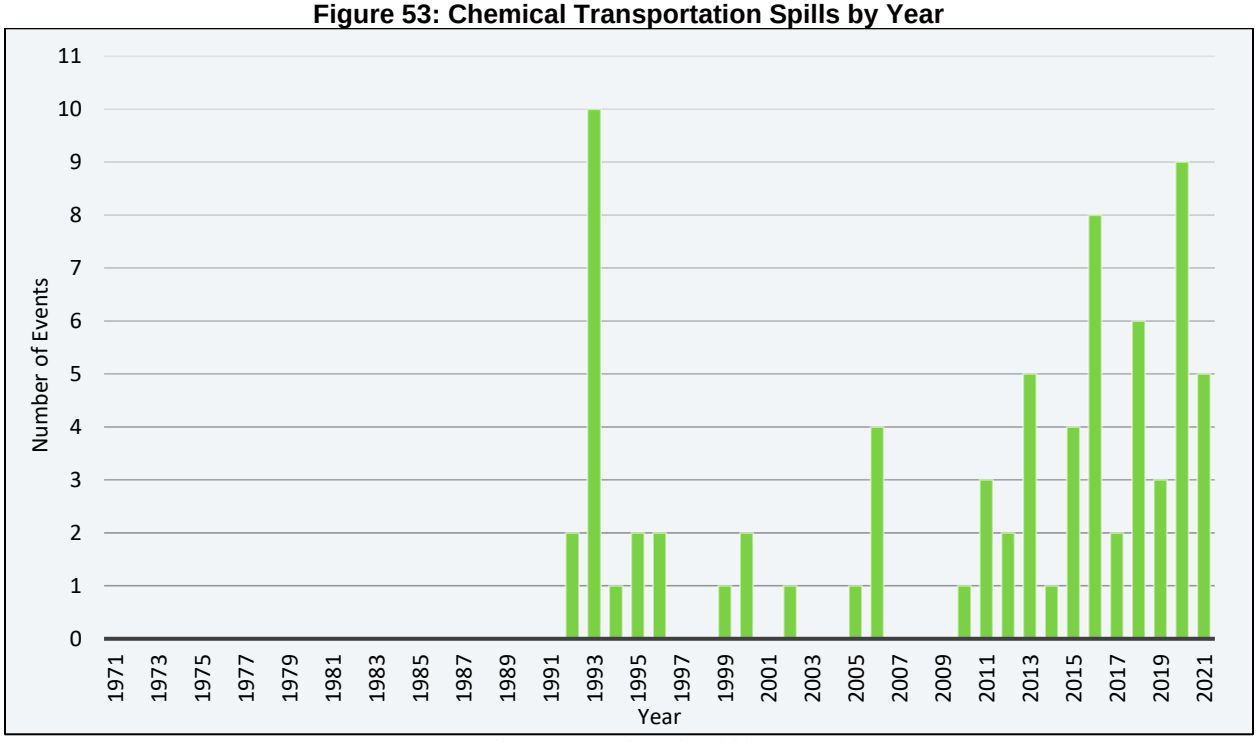
Given the historic record of occurrence for fixed chemical spill events (at least one chemical spill reported in 21 of 32 years), for the purposes of this plan, the annual probability of a fixed chemical spill is 66 percent. Given the historic record of occurrence for chemical transportation spill events (22 out of 51 years with a reported event), for the purposes of this plan, the annual probability of chemical transportation occurrence is 43%.

Figure 52: Chemical Fixed Site Spills by Year



Source: National Response Center, 1990-2021

Figure 53: Chemical Transportation Spills by Year



Source: PHMSA, 1971-2021

Community Top Hazard Status

The following table lists jurisdictions which identified Hazardous Materials Release as a top hazard of concern:

Jurisdictions	
Dallas Center	Perry
Minburn	Van Meter

Regional Vulnerabilities

To reduce the risk to people and property damage, future development should encourage chemical storage and manufacturing facilities to be built away from critical facilities such as hospitals, schools, daycares, nursing homes, and other residential areas. Likewise, development and critical facilities should be built away from major transportation corridors used for chemical transportation. Specific vulnerabilities exist for critical facilities or vulnerable population centers (schools, daycares, hospital, etc.) which are most heavily populated during the daytime as most chemical transportation incidents occur during the weekday daytime hours.

The following table summarizes regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 89: Regional Hazardous Materials Release Vulnerabilities

Sector	Vulnerability
People	-Those in close proximity could have minor to severe health impacts -Possible evacuation -Hospitals, nursing homes, and the elderly at greater risk due to low mobility
Economic	-A chemical plant shutdown in smaller communities would have significant impacts on the local economy -Evacuations and closed transportation routes could impact businesses near spill
Built Environment	-Risk of fire or explosion
Infrastructure	-Transportation routes can be closed during evacuations or cleanup
Critical Facilities	-Risk of fire, explosion, or other damages -Risk of evacuation
Climate	-More extreme weather events and flood events put sites at risk of flooding at greater risk

Human Infectious Diseases

According to the Cleveland Clinic, Infectious Diseases are:

> "illnesses caused by harmful agents (pathogens) that get into your body. The most common causes are viruses, bacteria, fungi and parasites. Infectious diseases usually spread from person to person, through contaminated food or water and through bug bites."[108]

In some situations Human Infectious Diseases can lead to the declaration of a public health emergency. The number of cases that qualifies as a public health emergency depends on several factors including the illness, its symptoms, ease in transmission, incubation period, and available treatments or vaccinations. With the advent of sanitation sewer systems and other improvements in hygiene since the 19th century, the spread of infectious disease has greatly diminished. Additionally, the discovery of antibiotics and the implementation of universal childhood vaccination programs have played a major role in reducing human disease impacts.

Today, human disease incidences are carefully tracked by the Centers for Disease Control and Prevention (CDC) and state organizations for possible epidemics and to implement control systems. Novel illnesses or diseases have the potential to develop annually and significantly impact residents and public health systems.

Some of the best actions or treatments for outbreaks are nonpharmaceutical interventions (NPI). These are readily available behaviors or actions, and response measures people and communities can take to help slow the spread of respiratory viruses such as influenza. Understanding NPIs and increasing the capacity to implement them in a timely way, can improve overall community resilience during an outbreak. Using multiple NPIs simultaneously can reduce influenza transmission in communities even before vaccination is available.[109]

Pandemics are global or national disease outbreaks. These types of illnesses, such as influenza, can easily spread person-to-person, cause severe illness, and are difficult to contain. An especially severe pandemic can lead to high levels of illness, death, social disruption, and economic turmoil. Past pandemic events include:

- 1918 Spanish Flu: the H1N1 influenza virus spread world-wide during 1918 and 1919. It is estimated that at least 50 million people worldwide died during this pandemic with about 675,000 deaths alone in the United States. No vaccine was ever developed, and control efforts included self-isolation, quarantine, increased personal hygiene, disinfectant use, and social distancing.

- 1957 H2N2 Virus: a new influenza A virus emerged in Eastern Asia and eventually crossed into coastal U.S. cities in summer of 1957. In total 1.1 million people worldwide died of the flu with 116,000 of those in the United States.
- 1968 H3N2 Virus: an influenza A virus discovered in the United States in September 1968 which killed over 100,000 citizens. The majority of deaths occurred in people 65 years and older.

[108] Cleveland Clinic. 2022. Accessed November 2022. "Infectious Diseases." https://my.clevelandclinic.org/health/diseases/17724-infectious-diseases.

[109] U.S. Department of Health and Human Services. 2017. "Pandemic Influenza Plan: 2017 Update." https://www.cdc.gov/flu/pandemic-resources/pdf/pan-flu-report-2017v2.pdf.

- 2009 H1N1 Swine Flu: a novel influenza A virus discovered in the United States and spread quickly across the globe. This flu was particularly prevalent in young people while those over 65 had some antibody resistance. The CDC estimated the U.S. had over 60.8 million cases and 12,469 deaths.

- 2019 COVID-19: the novel influenza A virus which originated in Wuhan China and spread globally. As of November 8, 2022, the CDC reported 97.6 million cases and 1.1 million deaths attributed to COVID-19 in the United States. Efforts to control and limit the virus included self-isolation, quarantine, increased cleaning measures, social distancing, and vaccinations. Significant impacts to the national and global economy have been caused by COVID-19.

The Iowa Department of Public Health requires doctors, hospitals, and laboratories to report on many communicable diseases and conditions to monitor disease rates for epidemic events. Additionally, regional or county health departments monitor local disease outbreaks and collect data relevant to public health. The Dallas County Health Department serves all of Dallas County.

Location

Human disease outbreaks can occur anywhere in the planning area. Public heath emergencies or pandemic threshold levels are dependent on the outbreak type, transmission vectors, location, and season. Normal infectious disease patterns are changing due to increasing human mobility and climate change. Rural populations are particularly at risk for animal-related diseases while urban areas are at greater risk from community spread type illnesses. All residents throughout the planning area are at risk during public health emergencies. All areas within the planning area experienced impacts from COVID-19 specifically during 2020.

Historical Occurrences

Cases and fatalities associated with Human Infectious Diseases vary between illness types and severity of outbreak. Past major outbreaks in Iowa have specifically included the H1N1 Swine Flu in 2009 and COVID-19 in 2020.

- H1N1 Swine Flu (2009) – outbreaks were first reported in mid-April 2009 and spread rapidly. The new flu strand for which immunity was nonexistent in persons under 60 years old was similar in many ways to typical seasonal influenza. Symptoms of H1N1 included fever greater than 100°F, cough, and sore throat. County specific counts of H1N1 are not available, however a total of 92 confirmed cases were reported for Iowa by June 12, 2009.[110] Outbreaks in Iowa were typically seen sporadically. The U.S. Public Health Emergency for the H1N1 Influenza outbreak expired on June 23, 2010. The CDC developed and encouraged all US residents to receive a yearly flu vaccination to protect against potential exposures. The H1N1 continues to appear annually and persons in the planning area are at risk of infection in the future.

[110] Centers for Disease Control and Prevention. June 2009. “Novel H1N1 Flu Situation Update.” https://www.cdc.gov/h1n1flu/updates/061209.htm.

- COVID-19 (2020) – In January 2020, the CDC confirmed the first case of COVID-19 in the United States, and it quickly spread across the country. By March 2020, the World Health Organization declared COVID-19 a pandemic and travel bans were instituted around the globe. Primary symptoms of the infection included cough, fever or chills, shortness of breath or difficulty breathing, fatigue, muscle and body aches, headache, loss of taste or smell, sore throat, and others. The first confirmed cases of COVID-19 in the State of Iowa were three residents in Johnson County. Governor Kim Reynolds issued a Public Health Disaster Emergency Proclamation on March 17, 2020, which lasted until February 14, 2022.

The table below displays COVID-19 confirmed cases and deaths as of November 22, 2022.

Table 90: COVID-19 Cases in Dallas County

Population	Total Number of Tests	Confirmed Cases	Fatalities
99,678	30,531	26,057	154

Source: Iowa Department of Public Health[111]

Extent

Those most affected by human infectious disease outbreaks are typically the very young, the very old, the immune-compromised, the economically vulnerable, and the unvaccinated. Roughly 28% of the planning area's population is 18 years or younger, and 12% of the planning area is 65 years or older. These factors increase vulnerability to the impacts of outbreaks. Refer to *Section Three: County Profile* for further discussion of age and economic vulnerability in the planning area. It is not possible to determine the extent of individual public health emergency events, as the type and severity of a novel outbreak cannot be predicted. However, depending on the disease type, a significant portion of residents may be at risk to illness or death.

The extent of human infectious diseases is closely tied to the proximity or availability of health centers and services. There are two hospitals in the county and several nursing facilities and health clinics.

Immunodeficiency disorders (such as diabetes), obesity, or other pre-existing health complications reduce the ability of the body to fight infection. Diabetes prevalence in Dallas County and for the state are listed in the table below.

Table 91: Diabetes Prevalence in the Planning Area

Geography	Diagnosed Diabetes Rate (Total Adults Age 20+)
Dallas County	6.4%
State of Iowa	5%

Source: Centers of Disease Control and Prevention, 2019[112]
**State data is from 2018.*

[111] Iowa Department of Public Health. November 22, 2022. "Covid-19 Reporting". https://idph.iowa.gov/Emerging-Health-Issues/Novel-Coronavirus/COVID-19-Reporting

[112] Centers for Disease Control and Prevention. 2017. "Diagnosed diabetes prevalence – Iowa." https://gis.cdc.gov/grasp/diabetes/DiabetesAtlas.html.

Iowa Code, Chapter 139a.8(6) and Iowa Administrative Code, 641-7.7(139) outline the immunization requirement for students attending licensed childcare centers and elementary or secondary schools. Requirements are for the following vaccinations: Pneumococcal, diphtheria, pertussis, tetanus, polio, measles, rubella, Hepatitis B, meningococcal, and varicella (chicken pox). The Vaccines for Children program is a federally funded and state-operated vaccine supply program that provides free vaccines to children under 18 who are of American Indian or Alaska Native descent, enrolled in Medicaid, uninsured, or underinsured. Additionally, the HPV vaccination series is recommended for teenagers and influenza vaccinations are recommended yearly for those over six months old. Individuals without vaccinations are at greater risk of contracting diseases or carrying diseases to others.

Average Annual Losses

The national economic burden of influenza medical costs, medical costs plus lost earnings, and total economic burden was $10.4 billion, $26.8 billion, and $87.1 billion respectively in 2007.[113] However, associated costs with pandemic response are much greater. Current estimated costs for COVID-19 in the United States exceed $16 trillion. Specific costs do not include losses from displacement, functional downtime, economic loss, injury, or loss of life. The direct and indirect effects of significant health impacts are difficult to quantify.

Probability

There is no pattern as to when public health emergencies will occur. Based on historical records, it is likely that small-scale disease outbreaks will occur annually within the county. However, large scale emergency events (such as COVID-19) cannot be predicted.

Community Top Hazard Status

Xenia Rural Water District was the only jurisdiction which identified Human Infectious Diseases as a top hazard of concern.

Regional Vulnerabilities

The following table summarizes regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 92: Regional Human Infectious Disease Vulnerabilities

Sector	Vulnerability
People	-Vulnerable populations include the very young, the very old, the unvaccinated, the economically vulnerable, and those with immunodeficiency disorders.
Economic	-Institutional settings such as prisons, dormitories, long-term care facilities, day cares, and schools are at higher risk to contagious diseases
Built Environment	-Poverty, rurality, underlying health conditions, and drug or alcohol use increase chronic and infectious disease rates
Infrastructure	-Large scale or prolonged events may cause businesses to close, which could lead to significant revenue loss and loss of income for workers
Critical Facilities	-Increased number of unoccupied business structures
Climate	-Transportation routes may be closed if a quarantine is put in place

[113] Molinari, N.M., Ortega-Sanchez, I.R., Messonnier, M., Thompson, W.W., Wortley, P.M., Weintraub, E., & Bridges, C.B. April 2007. "The annual impact of seasonal influenza in the US: measuring disease burden and costs." DOI: 10.1016/j.vaccine.2007.03.046.

Infrastructure Failure

The Iowa Hazard Mitigation Plan notes a variety of different occurrences which may be classified as infrastructure failure; including communication failure, energy failure, structural failure, and structural fire. The plan goes on to note that one potential cause of infrastructure failure is space weather/solar flares. Any sort of disruption in cell, electric, radio or other service may be considered a form of infrastructure failure. Community infrastructure that provides vital supplies such as electrical and water utilities are also vulnerable to both natural and technological hazards.

Vulnerability can largely be measured as a result of aging infrastructure. According to FEMA's *Strategic Foresight Initiative* published in June 2011, "…infrastructure in the United States is becoming more prone to failure as the average age of structures increases." The publication goes on to state that many necessary updates to infrastructure failure may be considered cost prohibitive due to rising construction costs.

According to the American Society of Civil Engineers' (ASCE) 2019 Infrastructure Report Card, Iowa received an overall grade of C. The Infrastructure Report Card is updated every four years with the goal of depicting the condition and performance of infrastructure systems. The Report Card utilizes letter grades similar to those used for school report cards. Using this classification, an "A" would indicate a state is exceeding expectations; an "F" is failing to meet expectations. Thus, a "C" indicates slightly below expected standards. Specifically, for Iowa, bridges, dams, wastewater, inland waterways, received a below expected score (C- to D-). This is largely consistent with reports from local planning teams.[114]

Some jurisdictions have mentioned concerns of infrastructure failure, including Adel, Dallas Center, Dexter, Granger, Minburn, Perry, Van Meter, Perry Water Works, and Xenia Rural Water District. Concerns include threats to water supplies and utilities, inadequate sewer systems, and threats to the electrical grid.

Location

Infrastructure failure is not correlated to a specific geographic area.

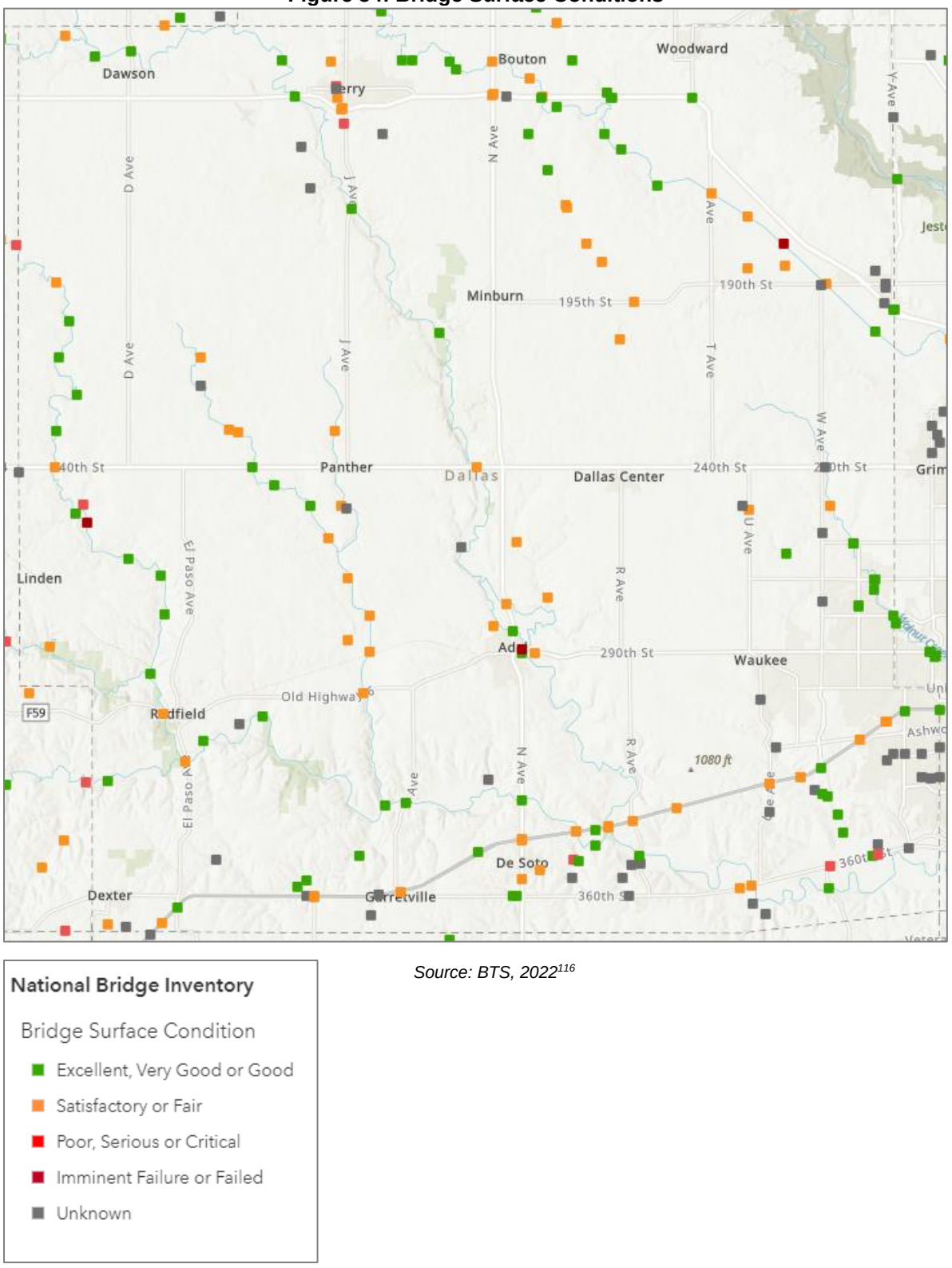
Extent

The extent of infrastructure failure events is hard to quantify given the lack of recorded events. Potential losses will likely be related to aging structures. The BTS National Bridge Inventory displays information describing the location, description, classification, and general condition of bridges located on public roads, such as interstate highways, U.S. highways, state and county roads, and publicly accessible bridges on federal and tribal lands. According to BTS, Dallas County has 186 bridges with 11% of those bridges in poor condition and 89% in medium to fair condition.[115] Figure 54 displays the bridge surface conditions for Dallas County.

[114] American Society of Civil Engineers. 2019. "2019 Iowa Infrastructure Report Card." https://infrastructurereportcard.org/state-item/iowa/

[115] Bureau of Transportation Statistics. July 2022. "County Transportation Profiles." https://data.bts.gov/Research-and-Statistics/County-Transportation-Profiles/qdmf-cxm3/data

Figure 54: Bridge Surface Conditions



Source: BTS, 2022[116]

[116] Bureau of Transportation Statistics. July 2022. "National Bridge Inventory." https://www.arcgis.com/home/item.html?id=a0fa29a39fe444ac97d4337c569b9801

Historical Occurrences
There is no known database for recording infrastructure failure, and thus, previous occurrences may not be calculated.

Average Annual Losses
Due to lack of data, potential losses are not calculated for this hazard.

Probability
With no recorded past events, future occurrences may not be calculated.

Community Top Hazard Status
The following table lists jurisdictions which identified Infrastructure Failure as a top hazard of concern:

Jurisdictions	
Adel	Perry
Dallas Center	Van Meter
Dexter	Xenia Rural Water District
Granger	Perry Water Works
Minburn	

Regional Vulnerabilities
The following table summarizes regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 93: Regional Infrastructure Failure Vulnerabilities

Sector	Vulnerability
People	-Vulnerable populations including the very young and the very old may not have the capability to properly care for their aging private infrastructure
Economic	-Building, bridge, or road closures may cause businesses to close temporarily, which could lead to significant revenue loss and loss of income for workers
Built Environment	-Aging fixtures such as roofs and siding make buildings vulnerable to failure
Infrastructure	-Aging infrastructure is particularly vulnerable
Critical Facilities	-Critical facilities may close if they are not properly maintained
Climate	-Space weather/solar flares can disrupt cell, electric, and radio services which could result in infrastructure failure
Other	-Severe winter storms, severe thunderstorms, and tornadoes can exacerbate this hazard

Landslide

Landslides are the downward and outward movement of slopes with debris. These events include names such as slumps, rockslides, debris slide, lateral spreading, debris avalanche, earth flow, and soil creep. The size of a landslide usually depends on the geology and landslide triggering mechanism. Landslides initiated by rainfall tend to be smaller, while those initiated by earthquakes may be very large. Slides associated with volcanic eruptions can include as much as one cubic mile of material.

Landslides are typically triggered by periods of heavy rainfall or rapid snowmelt. Earthquakes, changes to the hydrology, removal of vegetation, and excavations may also trigger landslides. Certain geologic formations are more susceptible to landslides than others. Human activities, including locating development near steep slopes, can increase susceptibility to landslide events as well. Landslides on steep slopes are more dangerous because movements can be rapid. Some characteristics that determine the type of landslide are slope of the hillside, moisture content, and the nature of the underlying materials.

Slow moving landslides can occur on relatively gentle slopes and can cause significant property damage. However, slow moving landslides are far less likely to result in serious injuries than rapidly moving landslides that can leave little time for evacuation.

Van Meter School District has experienced landslides from a hill near the school. A retaining wall has been built but concerns continue due to the proximity of the hill.

Location

This hazard is correlated with elevation change; thus, this hazard is more likely to occur in the sloped areas of the county. Small landslides have occurred in the Van Meter area at the school building.

Extent

Rapidly moving landslides (debris flows and earth flows) present the greatest risk to human life. Persons living in or traveling through areas more prone to rapidly moving landslides should take caution if the conditions warrant. Slow moving landslides can cause significant property damage but are less likely to result in serious human injuries.

Landslides can be massive, or they may disturb only a few cubic feet of material. Events in Dallas County are likely to cause limited property damage; limited or no deaths and injuries; and little or no impacts to critical facilities and infrastructure. However, single events near populated areas or key infrastructure may have significant impacts.

Historical Occurrences

According to the USGS Landslide Inventory Map, no recorded landslides occurred in Dallas County from 1878 to 2021.[117] However, the Regional Planning Team and local planning team indicated that some small landslides have occurred in the Van Meter area.

[117] United States Geological Survey. 2022. “U.S. Landslide Inventory”. https://usgs.maps.arcgis.com/apps/webappviewer/index.html?id=ae120962f459434b8c904b456c82669d.

Average Annual Losses
With no historical reported landslide events, the average annual losses for property and crops are $0. Any landslides that could occur are likely to have minimal impacts on the built environment.

Probability
For the purpose of this plan, the probability of landslide will be stated at less than one percent annually as there have been zero recorded by the USGS and minimal amounts locally reported in the planning area.

Landslides can be sporadic and somewhat unpredictable. These events are more likely to occur in the rural and hilly parts of the county, typically in areas where they won't get recorded. However, in the case of a post-wildfire condition and in combination of heavy precipitation, it is more likely that landslides, debris flows, and mudslides will occur more frequently.

Large mudflows can occur when a relatively common rainfall event happens over a watershed that has been exposed to wildfire. As the vegetation and soil in a burned area recover and the watershed returns to its pre-burn hydrologic condition, the depth and intensity of rainfall necessary to generate a mudflow will generally increase for a given location.

Jurisdictional Top Hazard Status
Van Meter School District was the only jurisdiction which identified Landslide as a top hazard of concern.

Future Developments
Although landslides are a natural geologic process, the incidence of landslides and their impacts on people can be exacerbated by human activities. Grading for road construction and development can increase slope steepness and decrease the stability of a hillslope by adding weight to the top of the slope, removing support at the base of the slope, and increasing water content. Other human activities affecting landslides include: excavation, drainage and groundwater alterations, and changes in vegetation. Future development could be vulnerable to landslides, as well as the infrastructure required to support this growth, if not accounted for in siting and design.

Regional Vulnerabilities
The following table provides information related to county vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles.*

Table 94: Regional Landslide Vulnerabilities

Sector	Vulnerability
People	-Exposure is more likely to occur driving on roadways and in sloped recreation areas
Economic	-People living in homes located on steep slopes
Built Environment	-First responders in areas that are still geologically unstable
Infrastructure	-Limited loss of accessibility and potential damage to businesses
Critical Facilities	-Damage to roadways and bridges -Damage or breaking of underground utility lines -Power loss from downed lines and towers
Climate	-More extreme weather events, such as severe thunderstorms, severe winter storms, and grass/wildfire events put areas at greater risk to landslides

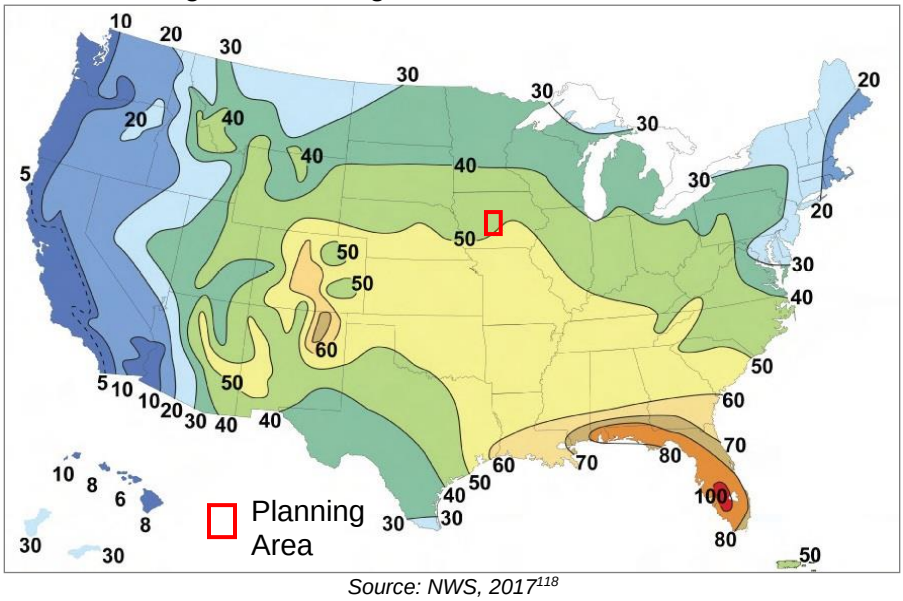
Severe Thunderstorms
(Includes Hail and Lightning)

Severe thunderstorms are common and unpredictable seasonal events throughout Iowa. A thunderstorm is defined as a storm that contains lightning and thunder, which is caused by unstable atmospheric conditions. When the cold upper air sinks and the warm, moist air rises, storm clouds or "thunderheads" develop, resulting in thunderstorms. This can occur singularly, in clusters, or in lines.

Thunderstorms can develop in fewer than 30 minutes and can grow to an elevation of eight miles into the atmosphere. Lightning, by definition, is present in all thunderstorms and can cause harm to humans and animals, fires to buildings and agricultural lands, and electrical outages in municipal electrical systems. Lightning can strike up to 10 miles from the portion of the storm depositing precipitation. There are three primary types of lightning: intra-cloud, inter-cloud, and cloud to ground. While intra and inter-cloud lightning are more common, communities are potentially impacted when lightning comes in contact with the ground. Lightning generally occurs when warm air mixes with colder air masses resulting in atmospheric disturbances necessary for polarizing the atmosphere. Severe thunderstorms usually occur in the evening during the spring and summer months.

Economically, thunderstorms are generally beneficial in that they provide moisture necessary to support Iowa's largest industry, agriculture. The majority of thunderstorms do not cause damage, but when they escalate to severe storms, the potential for damages increases. Damages can include crop losses from wind; property losses due to building and automobile damages from high wind, flash flooding, and death or injury to humans and animals from lightning, drowning, or getting struck by falling or flying debris. Figure 55 displays the average number of days with thunderstorms across the country each year. The planning area experiences an average of 40 to 50 thunderstorms over the course of one year.

Figure 55: Average Number of Thunderstorms



Source: NWS, 2017[118]

[118] National Weather Service. 2017. "Introduction to Thunderstorms." http://www.srh.noaa.gov/jetstream/tstorms/tstorms_intro.html.

Location

The entire county is at risk of severe thunderstorms and associated damages from heavy rain, lightning, hail, and thunderstorm level wind.

Extent

The geographic extent of a severe thunderstorm event may be large enough to impact the entire planning area (such as in the case of a squall line, derecho, or long-lived supercell) or just a few square miles, in the case of a single cell that marginally meets severe criteria.

The NWS defines a thunderstorm as severe if it contains hail that is one inch in diameter or capable of wind gusts of 58 mph or higher. The Tornado and Storm Research Organization (TORRO) scale is used to classify hailstones and provides some detail related to the potential impacts from hail. Table 95 outlines the TORRO Hail Scale.

Table 95: TORRO Hail Scale

TORRO Classification / Intensity	Typical Hail Diameter	Typical Damage Impacts
H0: Hard Hail	5 mm; (Pea size); 0.2 in	No damage
H1: Potentially Damaging	5 -15 mm (Marble) 0.2 – 0.6 in	Slight general damage to plants and crops
H2: Significant	10 -20 mm (Grape) 0.4 – 0.8 in.	Significant damage to fruit, crops, and vegetation
H3: Severe	20 -30 mm (Walnut) 0.8 – 1.2 in	Severe damage to fruit and crops, damage to glass and plastic structures
H4: Severe	30 -40 mm (Squash Ball) 1.2 – 1.6 in	Widespread damage to glass, vehicle bodywork damaged
H5: Destructive	40 – 50 mm (Golf ball) 1.6 – 2.0 in.	Wholesale destruction of glass, damage to tiled roofs; significant risk or injury
H6: Destructive	50 – 60 mm (Chicken Egg) 2.0 – 2.4 in	Grounded aircrafts damaged; brick walls pitted; significant risk of injury
H7: Destructive	60 – 75 mm (Tennis Ball) 2.4 – 3.0 in	Severe roof damage; risk of serious injuries
H8: Destructive	75 – 90 mm (Large Orange) 3.0 – 3.5 in.	Severe damage to structures, vehicles, airplanes; risk of serious injuries
H9: Super Hail	90 – 100 mm (Grapefruit) 3.5 – 4.0 in	Extensive structural damage; risk of severe or even fatal injuries to persons outdoors
H10: Super Hail	>100mm (Melon); >4.0 in	Extensive structural damage; risk of severe or even fatal injuries to persons outdoors

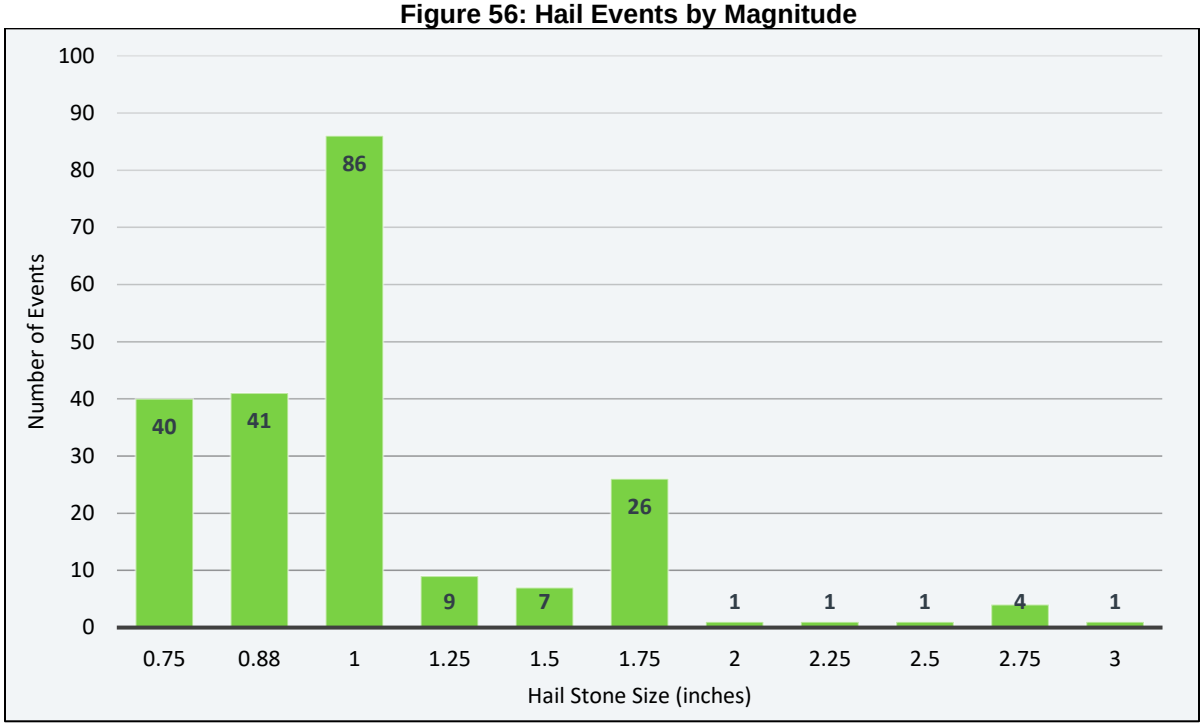
Source: TORRO, 2019[119]

Of the 217 hail events reported for the planning area, the average hailstone size was 1.1 inches. Events of this magnitude correlate to an H3 classification. It is reasonable to expect H3 classified

[119] Tornado and Storm Research Organization. 2019. "Hail Scale." http://www.torro.org.uk/hscale.php.

events to occur several times in a year throughout the county. In addition, it is reasonable, based on the number of occurrences, to expect larger hailstones to occur in the county annually. The county has endured one H8 hail event (3.0 – 3.5 inches) during the period of record. Figure 56 shows hail events based on the size of the hail.

Figure 56: Hail Events by Magnitude

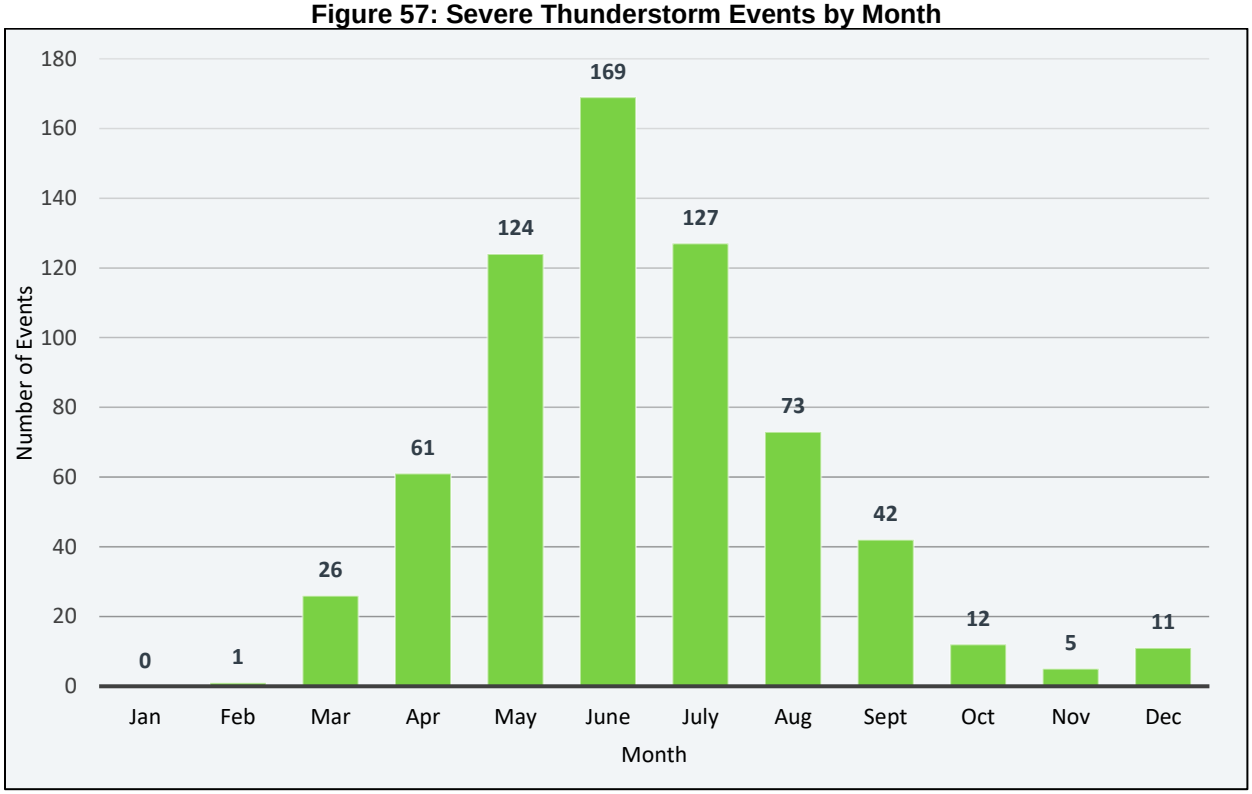


Source: NCEI, 1996-2021

Historical Occurrences

Severe thunderstorms in the planning area usually occur in the afternoon and evening from May through July (Figure 57).

Figure 57: Severe Thunderstorm Events by Month



Source: NCEI, 1996-2021

The NCEI reports events as they occur in each community. A single severe thunderstorm event can affect multiple communities and counties at a time; the NCEI reports these large scale, multi-county events as separate events. The result is a single thunderstorm event covering the entire region could be reported by the NCEI as several events.

The NCEI reports a total of 217 hail, 134 heavy rain, 11 lightning, and 288 thunderstorm wind events in the planning area from 1996 to 2021. In total these events were responsible for $10,520,000 in property damages. The USDA RMA data shows that severe thunderstorms caused $18,026,126 in crop damages. There were four injuries reported in association with these storms. The county conservation board expressed concern about people being vulnerable to severe thunderstorms while outside in public conservation areas. More shelter locations are needed in those areas.

Average Annual Damages

The average damage per event estimate was determined based upon recorded damages from NCEI Storm Events Database since 1996 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. Severe thunderstorms cause an average of $404,615 per year in property damages and $819,369 in crop damages.

Table 96: Severe Thunderstorms Loss Estimate

Hazard Type	Number of Events[1]	Average Events Per Year	Total Property Loss[1]	Average Annual Property Loss	Total Crop Loss[2]	Average Annual Crop Loss
Hail	217	8.3	$813,000	$31,269	$18,026,126	$819,369
Heavy Rain	134	5.2	$20,000	$769		
Lightning	11	0.4	$1,147,000	$44,115		
Thunderstorm Wind	288	11.1	$8,540,000	$328,462		
Total	**651**	**25**	**$10,520,000**	**$404,615**	**$18,026,126**	**$819,369**

Source: 1 Indicates data is from NCEI (1996 to 2021); 2 Indicates data is from USDA RMA (2000 to 2021)

Probability

Based on historical records and reported events, severe thunderstorms events are likely to occur on an annual basis. The NCEI reported a severe thunderstorm 26 out of 26 years, resulting in a 100 percent chance for thunderstorms to occur annually.

Community Top Hazard Status

The following table lists jurisdictions which identified Severe Thunderstorms as a top hazard of concern:

Jurisdictions	
Adel	Waukee
Bouton	Woodward
Dawson	Adel-DeSoto-Minburn School District
De Soto	Dallas Center-Grimes School District
Granger	Perry Community School District
Linden	Van Meter School District
Perry	Woodward-Granger School District
Redfield	Woodward Township Fire District
Van Meter	

Regional Vulnerabilities

The following table provides information related to regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 97: Regional Thunderstorm Vulnerabilities

Sector	Vulnerability
People	-Elderly citizens with decreased mobility may have trouble evacuating or seeking shelter -Mobile home residents are risk of injury and damage to their property if the mobile home is not anchored properly -Injuries can occur from not seeking shelter, standing near windows, and shattered windshields in vehicles
Economic	-Damages to buildings and property can cause significant losses to business owners and employees

Sector	Vulnerability
Built Environment	-Buildings are at risk to hail damage -Downed trees and tree limbs -Roofs, siding, windows, gutters, HVAC systems, etc. can incur damage
Infrastructure	-High winds and lightning can cause power outages and down power lines -Roads may wash out from heavy rains and become blocked from downed tree limbs
Critical Facilities	-Power outages are possible -Critical facilities may sustain damage from hail, lightning, and wind
Climate	-Changes in seasonal precipitation and temperature normals can increase frequency and magnitude of severe storm events

Severe Winter Storms

Severe winter storms are an annual occurrence in Iowa. Winter storms can bring extreme cold, freezing rain, heavy or drifting snow, and blizzards. Blizzards are particularly dangerous due to drifting snow and the potential for rapidly occurring whiteout conditions which greatly inhibit vehicular traffic. Generally, winter storms occur between the months of November and March but may occur as early as October and as late as April. Heavy snow is usually the most defining element of a winter storm. Large snow events can cripple an entire jurisdiction by hindering transportation, knocking down tree limbs and utility lines, and structurally damaging buildings.

Freezing Rain

Along with snow events, winter storms also have the potential to deposit significant amounts of ice. Ice buildup on tree limbs and power lines can cause them to collapse. This is most likely to occur when rain falls that freezes upon contact, especially in the presence of wind. Freezing rain is the name given to rain that falls when surface temperatures are below freezing. Unlike a mixture of rain and snow, ice pellets or hail, freezing rain is made entirely of liquid droplets. Freezing rain can also lead to many problems on the roads, as it makes them slick, causing automobile accidents, and making vehicle travel difficult.

Blizzards

A blizzard can be defined as “blowing and/or falling snow with winds of at least 35 mph, reducing visibilities to a quarter of a mile or less for at least three hours”.[120] Blizzards are particularly dangerous due to drifting snow and the potential for rapidly occurring whiteout conditions, which greatly inhibits vehicular traffic. Heavy snow is usually the most defining element of a winter storm. Large snow events can cripple an entire jurisdiction for several days by hindering transportation, knocking down tree limbs and utility lines, structurally damaging buildings, and injuring or killing crops and livestock.

Location

The entire county is at risk of severe winter storms.

Extent

The Sperry-Piltz Ice Accumulation Index (SPIA) was developed by the NWS to predict the accumulation of ice and resulting damages. The SPIA assesses total precipitation, wind, and temperatures to predict the intensity of ice storms. Figure 58 shows the SPIA index.

[120] National Weather Service. 2022. “Winter Weather Safety.” https://www.weather.gov/dmx/wintersafety.

Figure 58: SPIA Index

ICE DAMAGE INDEX	*AVERAGE ICE AMOUNT (in inches) *Revised: Oct. 2011*	WIND (mph)	DAMAGE AND IMPACT DESCRIPTIONS
0	<0.25	<15	Minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages.
1	0.10 – 0.25	15 – 25	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
	0.25 – 0.50	>15	
2	0.10 – 0.25	25 – 35	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulation.
	0.25 – 0.50	15 – 25	
	0.50 – 0.75	>15	
3	0.10 – 0.25	> – 35	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasting 1 – 5 days.
	0.25 – 0.50	25 – 35	
	0.50 – 0.75	15 – 25	
	0.75 –1.00	>15	
4	0.25 – 0.50	> – 35	Prolonged and widespread utility interruptions with extensive damage to main distribution feeder lines and some high voltage transmission lines/structures. Outages lasting 5 – 10 days.
	0.50 – 0.75	25 – 35	
	0.75 –1.00	15 – 25	
	1.00 –1.50	>15	
5	0.50 – 0.75	> – 35	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeeks in some areas. Shelters needed.
	0.75 –1.00	> – 25	
	1.00 –1.50	> – 15	
	> 1.50	Any	

(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

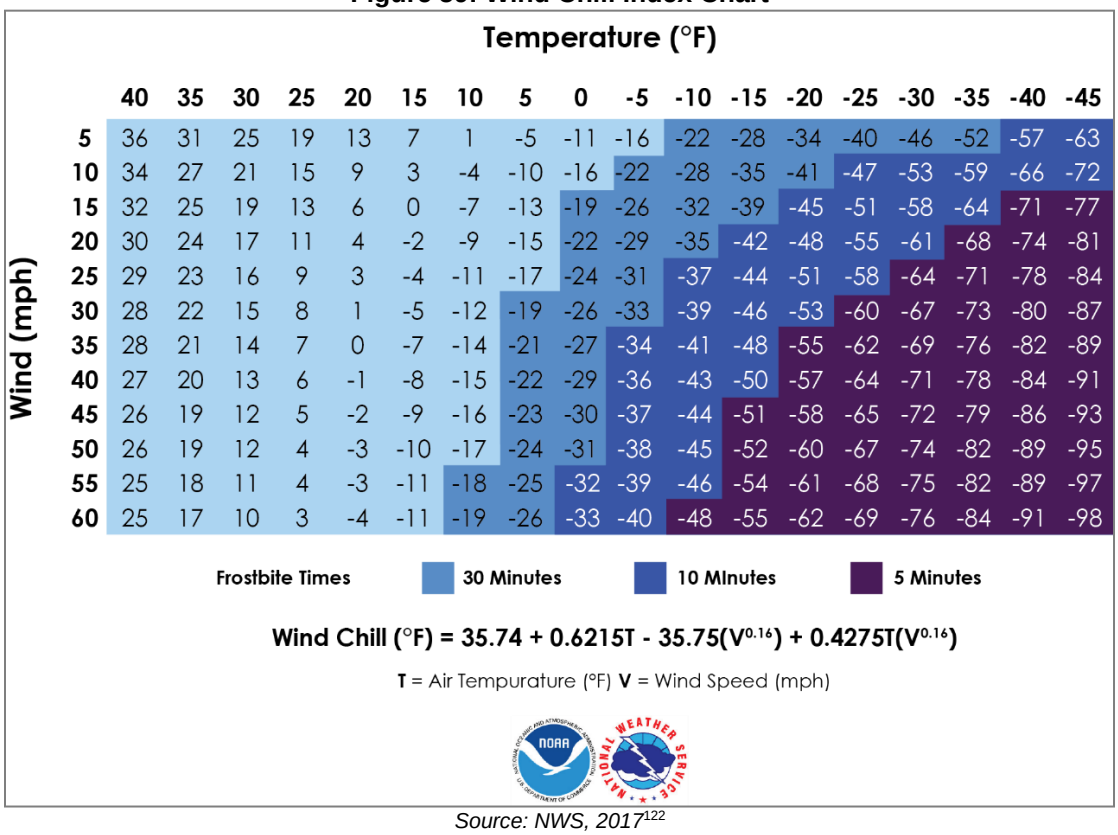
Source: SPIA-Index, 2017[121]

The Wind Chill Index was developed by the NWS to determine the decrease in air temperature felt by the body on exposed skin due to wind. The wind chill is always lower than the air temperature and can quicken the effects of hypothermia or frost bite as it gets lower. Figure 59 shows the Wind Chill Index used by the NWS.

Average monthly snowfall for the planning area is shown in Figure 61, which shows the snowiest months are between December and March. A common snow event (likely to occur annually) will result in accumulation totals between one and six inches. Often these snow events are accompanied by high winds. It is reasonable to expect wind speeds of 25 to 35 mph with gusts reaching 50 mph or higher. Strong winds and low temperatures can combine to produce extreme wind chills of 20°F to 40°F below zero.

[121] SPIA-Index. 2009. "Sperry-Piltz Ice Accumulation Index." Accessed June 2017. http://www.spia-index.com/index.php.

Figure 59: Wind Chill Index Chart

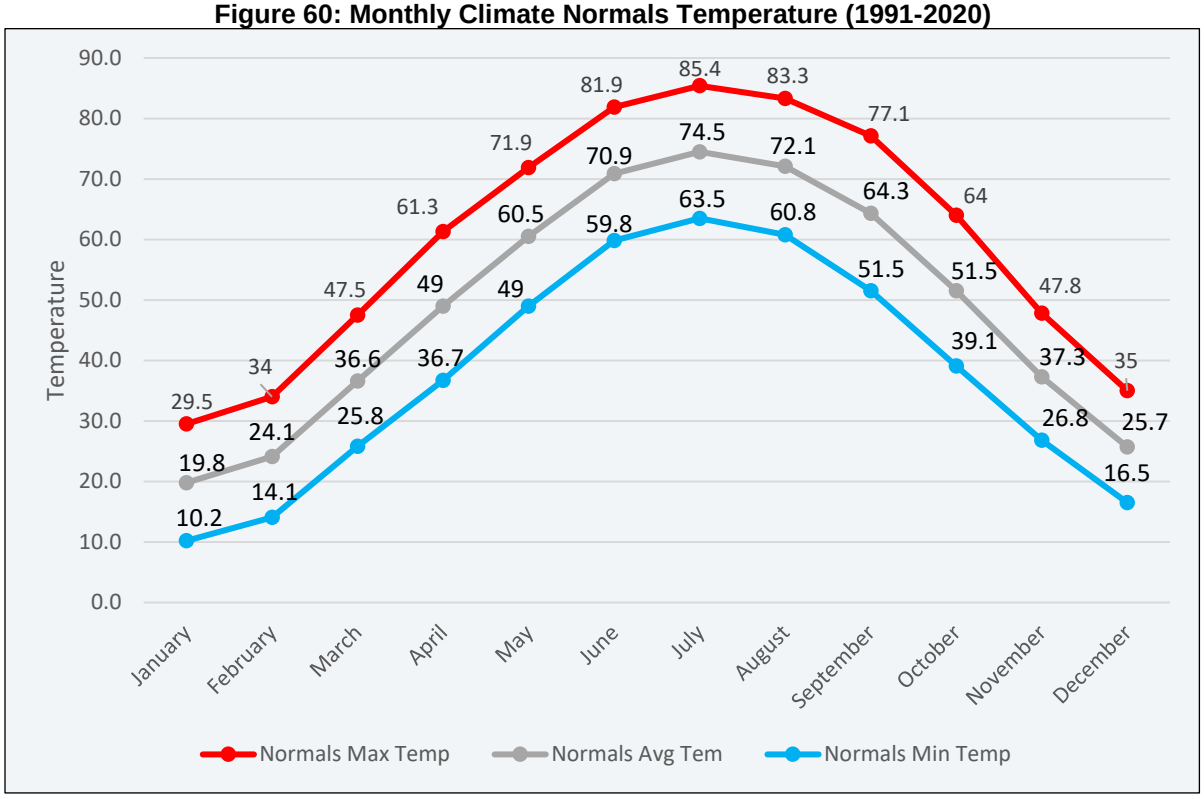


Wind (mph)	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-82	-89	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Source: NWS, 2017[122]

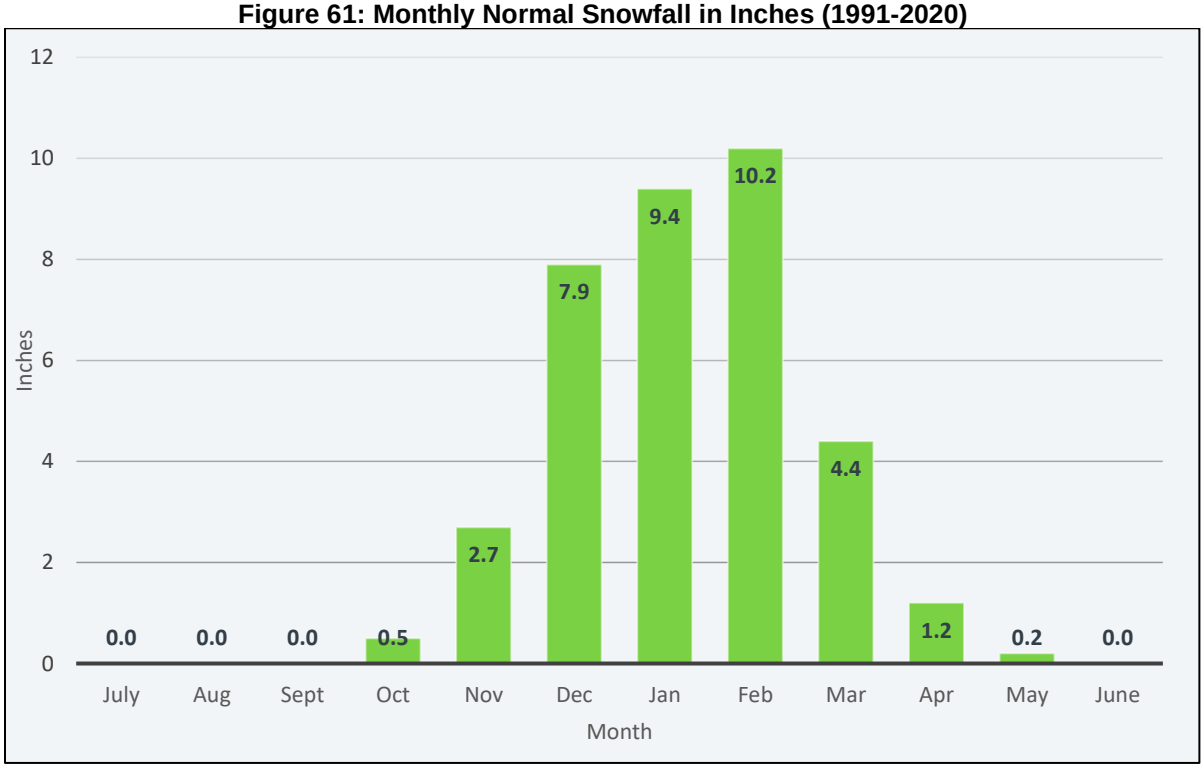
[122] National Weather Service. 2001. "Wind Chill Chart." https://www.weather.gov/safety/cold-wind-chill-chart.

Figure 60: Monthly Climate Normals Temperature (1991-2020)



Source: NCEI, 2022

Figure 61: Monthly Normal Snowfall in Inches (1991-2020)



Source: High Plains Regional Climate Center, 2022

Historical Occurrences

Due to the regional scale of severe winter storms, the NCEI reports events as they occur in each county. According to the NCEI, there were a combined 79 severe winter storm events for the planning area from 1996 to 2021. January had the most recorded events for the planning area. These recorded events caused a total of $6,613,680 in reported property damages and $374,815 in crop damages.

According to the NCEI, there were no injuries or fatalities associated with winter storms in the planning area. Additional information from these events from NCEI and reported by each community are listed in *Section Seven: Community Profiles*.

Average Annual Damages

The average damage per event estimate was determined based upon NCEI Storm Events Database since 1996 and includes aggregated calculations for each of the five types of winter weather as provided in the database. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. Severe winter storms have caused an average of $256,372 per year in property damage and $17,037 per year in crop damages for the planning area.

Table 98: Severe Winter Storm Loss Estimate

Hazard Type	Number of Events[1]	Average Events Per Year[1]	Total Property Loss[1]	Average Annual Property Loss [1]	Total Crop Loss[2]	Average Annual Crop Loss [2]
Blizzard	14	0.5	$900,000	$36,615	$374,815	$17,037
Heavy Snow	24	0.9	$4,290,450	$165,017		
Ice Storm	12	0.5	$848,330	$32,628		
Winter Storm	28	1.1	$574,900	$22,112		
Winter Weather	1	0.04	$0	$0		
Total	**79**	**3.04**	**$6,613,680**	**$256,372**	**$374,815**	**$17,037**

Source: 1 Indicates data is from NCEI (1996-2021); 2 Indicates data is from USDA RMA (2000-2021)

Probability

Based on historical records and reported events, severe winter storm events are likely to occur on an annual basis. The NCEI reported a severe winter storm event in 25 of 26 years, resulting in 96% percent chance annually for severe winter storms.

Community Top Hazard Status

The following table lists jurisdictions which identified Severe Winter Storms as a top hazard of concern:

Jurisdictions	
Adel	Van Meter
Bouton	Waukee
Dawson	Adel-Desoto-Minburn School District
De Soto	Dallas Center-Grimes School District
Dexter	Perry Community School District
Linden	West Central Valley School District
Minburn	Woodward-Granger School District
Perry	Xenia Rural Water District
Redfield	Perry Water Works

Regional Vulnerabilities

The following table provides information related to regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 99: Regional Severe Winter Storm Vulnerabilities

Sector	Vulnerability
People	-Elderly citizens are at higher risk to injury or death, especially during extreme cold and heavy snow accumulations -Citizens without adequate heat and shelter at higher risk of injury or death
Economic	-Closed roads and power outages can cripple a region for days, leading to significant revenue loss and loss of income for workers
Built Environment	-Heavy snow loads can cause roofs to collapse -Significant tree damage possible, downing power lines and blocking roads
Infrastructure	-Heavy snow and ice accumulation can lead to downed power lines and prolonged power outages -Transportation may be difficult or impossible during blizzards, heavy snow, and ice events
Critical Facilities	-Emergency response and recovery operations, communications, water treatment plants, and others are at risk to power outages, impassable roads, and other damages
Climate	-Changes in seasonal precipitation and temperature normals can increase frequency and magnitude of severe winter storm events

Sinkhole

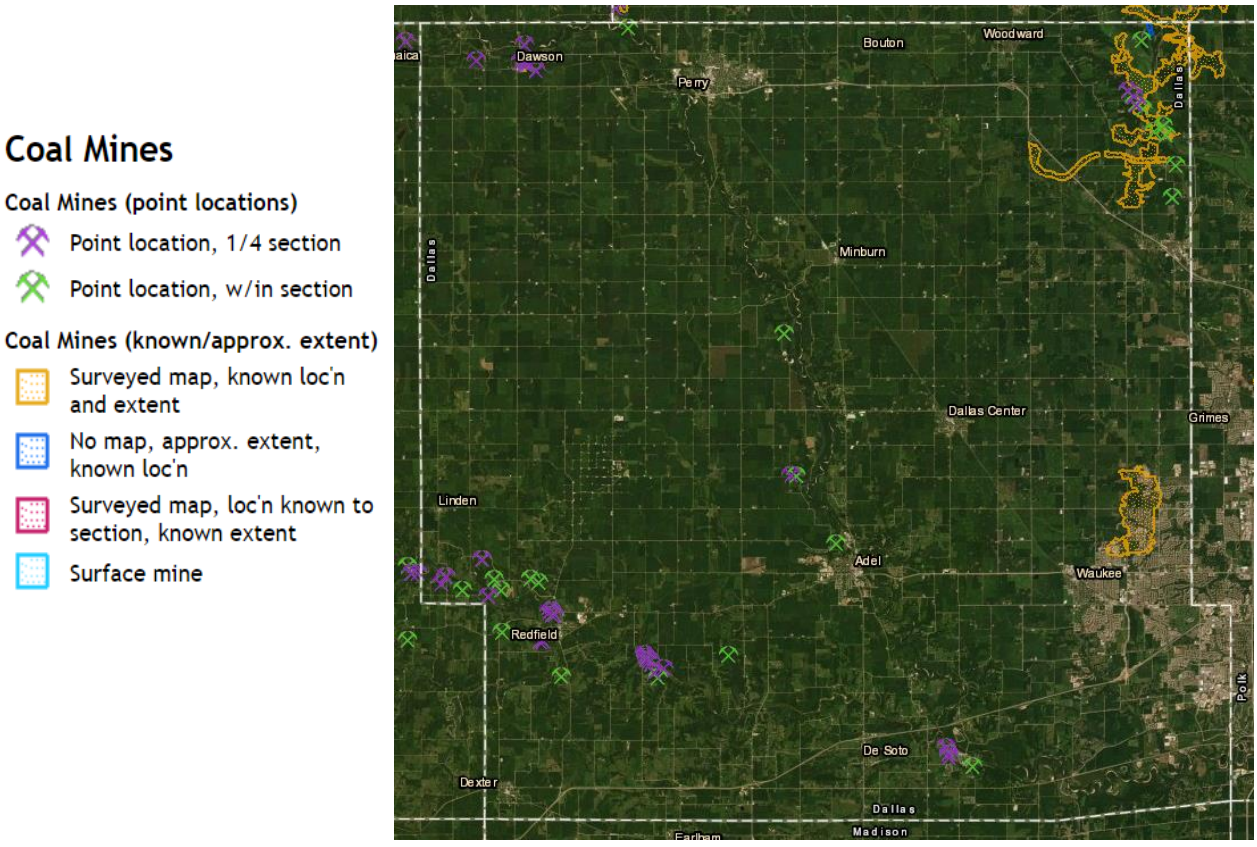
A sinkhole is defined as the loss of surface elevation due to the removal of subsurface support. Sinkholes can range from broad, regional lowering of the land surface to localized collapse. The primary causes of most subsidence are human activities such as: underground mining of coal, groundwater or petroleum withdraw, and drainage of organic soils. Sinkholes can also be due to erosion of limestone of the subsurface.

As a result of Iowa's former mining operations and unique geology, sinkholes are found throughout much of the state, but the majority of the sinkholes are located in the northeast quadrant of the state. The vulnerability of sinkholes in Dallas County primarily stems from the existence of old mines.

Location

The following map (Figure 62) shows historic coal mining areas reported by IDNR. These documented coal mines may be prone to a sinkhole event.

Figure 62: Historic Coal Mining Areas



Source: IDNR, 2022[123]

[123] IDNR. Accessed April 2022. "Iowa Coal Mines." https://programs.iowadnr.gov/maps/coalmines/

Extent
Any sinkhole that might occur would likely be isolated to a small area.

Historical Occurrences
There have been no reported sinkholes within the county.

Average Annual Losses
There is no data available to determine damage estimates for this hazard. In most cases, individual property owners, local governments, and businesses pay for repairs for damages caused by this hazard.

Probability
Future occurrences of sinkholes are possible, but without a well-documented record of events, it is difficult to determine the overall probability of this hazard. However, for the purposes of this plan, the probability of sinkholes will be estimated as ten percent annually.

Community Top Hazard Status
No jurisdictions identified Sinkhole as a top hazard of concern.

Regional Vulnerabilities
The following table summarizes regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 100: Regional Sinkhole Vulnerabilities

Sector	Vulnerability
People	-Citizens living near old mining operations in the northern half of the Country are at risk
Economic	-If a business is impacted, employees may be temporarily out of work
Built Environment	-All building stock has a small risk of damage
Infrastructure	-All underground infrastructure at risk to damages
Critical Facilities	-Roadways may be damaged
Climate	-Fluctuating precipitation extremes (drought or heavy rain events) can cause sinkholes

Terrorism and Civil Unrest

Terrorism and civil disorder are broad terms typically used by law enforcement to describe groups of people protesting major socio-political problems by choosing not to observe a law or regulation or the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof in furtherance of political or social objectives. Though peaceful public demonstrations are allowed under US Federal law, any domestic situations such as a strike or riot involving three or more people could be considered civil disorder if the demonstration has devolved into having a potential for causing injuries, casualties, or property damage.[124,125]

According to the Federal Bureau of Investigation (FBI), there is no single, universally accepted definition of terrorism. Terrorism is defined in the Code of Federal Regulations as "the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof in furtherance of political or social objectives".[126] Terrorist activities are also classified based on motivation behind the event (such as religious fundamentalism, national separatist movements, and social revolutionary movements). Terrorism can also be random with no ties to ideological reasoning.

The FBI further describes terrorism as either domestic or international, depending on the origin, base, and objectives of the terrorist organization. For this plan, the following definitions from the FBI will be used:

- Domestic terrorism is the unlawful use, or threatened use, of force or violence by a group or individual based and operating entirely within the United States or Puerto Rico without foreign direction committed against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof in furtherance of political or social objectives.

- International terrorism involves violent acts or acts dangerous to human life that are a violation of the criminal laws of the United States or any state, or that would be a criminal violation if committed within the jurisdiction of the United States or any state. These acts appear to be intended to intimidate or coerce a civilian population, influence the policy of a government by intimidation or coercion, or affect the conduct of a government by assassination or kidnapping. International terrorist acts occur outside the United States or transcend national boundaries in terms of the means by which they are accomplished, the persons they appear intended to coerce or intimidate, or the locale in which their perpetrators operate or seek asylum.

There are different types of terrorism depending on the target of attack, which are:

- Political Terrorism
- Bio-Terrorism
- Cyber-Terrorism
- Eco-Terrorism
- Nuclear-Terrorism

[124] Civil Disorders, 18 U.S. Code § 231-233 (1992)
[125] Terrorism, 28 U.S. Code § 0.85.
[126] Terrorism, 28 U.S. Code Section 0.85

- Narco-Terrorism
- Agro-Terrorism

Terrorist activities are also classified based on motivation behind the event such as ideology (e.g., religious fundamentalism, national separatist movements, and social revolutionary movements). Terrorism can also be random with no ties to ideological reasoning.

The FBI also provides clear definitions of a terrorist incident and prevention:

- A terrorist *incident* is a violent act or an act dangerous to human life, in violation of the criminal laws of the United States, or of any state, to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives.

- Terrorism *prevention* is a documented instance in which a violent act by a known or suspected terrorist group or individual with the means and a proven propensity for violence is successfully interdicted through investigative activity.

Cyber-terrorism is an incident involving the theft or modification of information on computer systems that can compromise the system or potentially disrupt essential services. A cyber-terrorism incident can impact city agencies, private utilities, or critical infrastructure/key resources like a power grid, public transportation system, and wireless networks. Cyber infrastructure includes electronic information and communications systems, and the information contained in those systems. Computer systems, control systems such as Supervisory Control and Data Acquisition (SCADA) systems, and networks such as the Internet are all part of cyber infrastructure.

Nation-states, criminal organizations, terrorists, and other malicious actors conduct attacks against critical cyber infrastructure on an ongoing basis. The impact of a serious cyber incident or successful cyber-attack would be devastating to state, local, tribal, and territorial governments' assets, systems, and/or networks; the information contained in those networks; and the confidence of those who trust governments to secure those systems.

A cyber incident can affect a system's:

- Confidentiality: protecting a user's private information
- Integrity: ensuring that data is protected and cannot be altered by unauthorized parties
- Availability: keeping services running and giving administration access to key networks and controls.

> "Many of the Nation's essential and emergency services, as well as our critical infrastructure, rely on the uninterrupted use of the Internet and the communications systems, data, monitoring, and control systems that comprise our cyber infrastructure. A cyber-attack could be debilitating to our highly interdependent critical infrastructure and key resources and ultimately to our economy and national security."
>
> - National Strategy for Homeland Security

The Department of Homeland Security and its affiliated agencies are responsible for disseminating any information regarding terrorist activities in the country. The system in place is the National Terrorism Advisory System (NTAS). NTAS replaced the Homeland Security Advisory

System (HSAS) which was the color-coded system put in place after the September 11th attacks by Presidential Directive 5 and 8 in March of 2002. NTAS replaced HSAS in 2011.

NTAS is based on a system of analyzing threat levels and providing either an imminent threat alert or an elevated threat alert.

An ***Imminent Threat Alert*** warns of a credible, specific and impending terrorist threat against the United States.

An ***Elevated Threat Alert*** warns of a credible terrorist threat against the United States.

The Department of Homeland Security, in conjunction with other federal agencies, will decide whether a threat alert of one kind or the other should be issued should credible information be available. Each alert provides a statement summarizing the potential threat and what, if anything should be done to ensure public safety.

U.S. Code on civil disorder considers the following actions to be civil disorder:

(1) Whoever teaches or demonstrates to any other person the use, application, or making of any firearm or explosive or incendiary device, or technique capable of causing injury or death to persons, knowing or having reason to know or intending that the same will be unlawfully employed for use in, or in furtherance of, a civil disorder which may in any way or degree obstruct, delay, or adversely affect commerce or the movement of any article or commodity in commerce or the conduct or performance of any federally protected function; or
(2) Whoever transports or manufactures for transportation in commerce any firearm, or explosive or incendiary device, knowing or having reason to know or intending that the same will be used unlawfully in furtherance of a civil disorder; or
(3) Whoever commits or attempts to commit any act to obstruct, impede, or interfere with any fireman or law enforcement officer lawfully engaged in the lawful performance of his official duties incident to and during the commission of a civil disorder which in any way or degree obstructs, delays, or adversely affects commerce or the movement of any article or commodity in commerce or the conduct or performance of any federally protected function

Primarily, threat assessment, mitigation and response to civil unrest and terrorism are federal and state directives and work primarily with local law enforcement. The Office of Infrastructure Protection within the Federal Department of Homeland Security is a component within the National Programs and Protection Directorate.

Location

Terrorism and Civil Unrest can occur throughout the entire planning area. Urban area, schools, and government buildings are more likely to see terroristic activity. Concerns are primarily related to political unrest, activists' groups, and others that may be targeting businesses police, and federal buildings. In schools, concerns center on political terrorism and are generally perpetrated erratically by loners. In rural areas, concerns are primarily related to agro-terrorism and tampering with water supplies. However, water systems of any size could be vulnerable.

Extent

Incidents of civil disorder and terrorism can vary greatly in scale and magnitude, depending on the location of the attack, number of protesters, and reasoning for unrest.

Historical Occurrences

To identify any incidence of civil disorder or terrorism in the planning area, data was gathered from the Global Terrorism Database, maintained by the University of Maryland and the National

Consortium for the Study of Terrorism and Responses to Terrorism (START). This database contains information for over 140,000 terrorist attacks. According to this database, there were zero civil disorder or terrorist incidents within the planning area from 1970-2017.[127]

Average Annual Damages

According to the START Global Terrorism Database (1970-2017), no civil unrest or terrorist events have occurred in the planning area. As there were no such events within the planning area, there were no average annual damages.

Probability

Given zero incidences over a 48-year period, the annual probability for civil unrest and terrorism in the planning area has a less than one percent chance of occurring during any given year. This does not indicate that an event will never occur within the planning area, only that the likelihood of such an event is incredibly low.

Community Top Hazard Status

Waukee School District was the only jurisdiction that identified Terrorism and Civil Unrest as a top hazard of concern.

Regional Vulnerabilities

The following table provides information related to regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles.*

Table 101: Regional Terrorism Vulnerabilities

Sector	Vulnerability
People	-Police officers and first responders at risk of injury or death -Civilians at risk of injury or death -Students and staff at school facilities at risk of injury or death from school shootings
Economic	-Damaged businesses can cause loss of revenue and loss of income for workers -Agricultural attacks could cause significant economic losses for the region -Risk of violence in an area can reduce income flowing into and out of that area
Built Environment	-Targeted buildings may sustain heavy damage
Infrastructure	-Water supply, power plants, utilities may be damaged
Critical Facilities	-Police stations, government offices, and schools are at a higher risk
Climate	-None

[127] National Consortium for the Study of Terrorism and Responses to Terrorism. 2018. Global Terrorism Database [Data file]. Retrieved from https://www.start.umd.edu/gtd.

Tornado and Windstorm

A tornado is typically associated with a supercell thunderstorm. For a rotation to be classified as a tornado, three characteristics must be met:

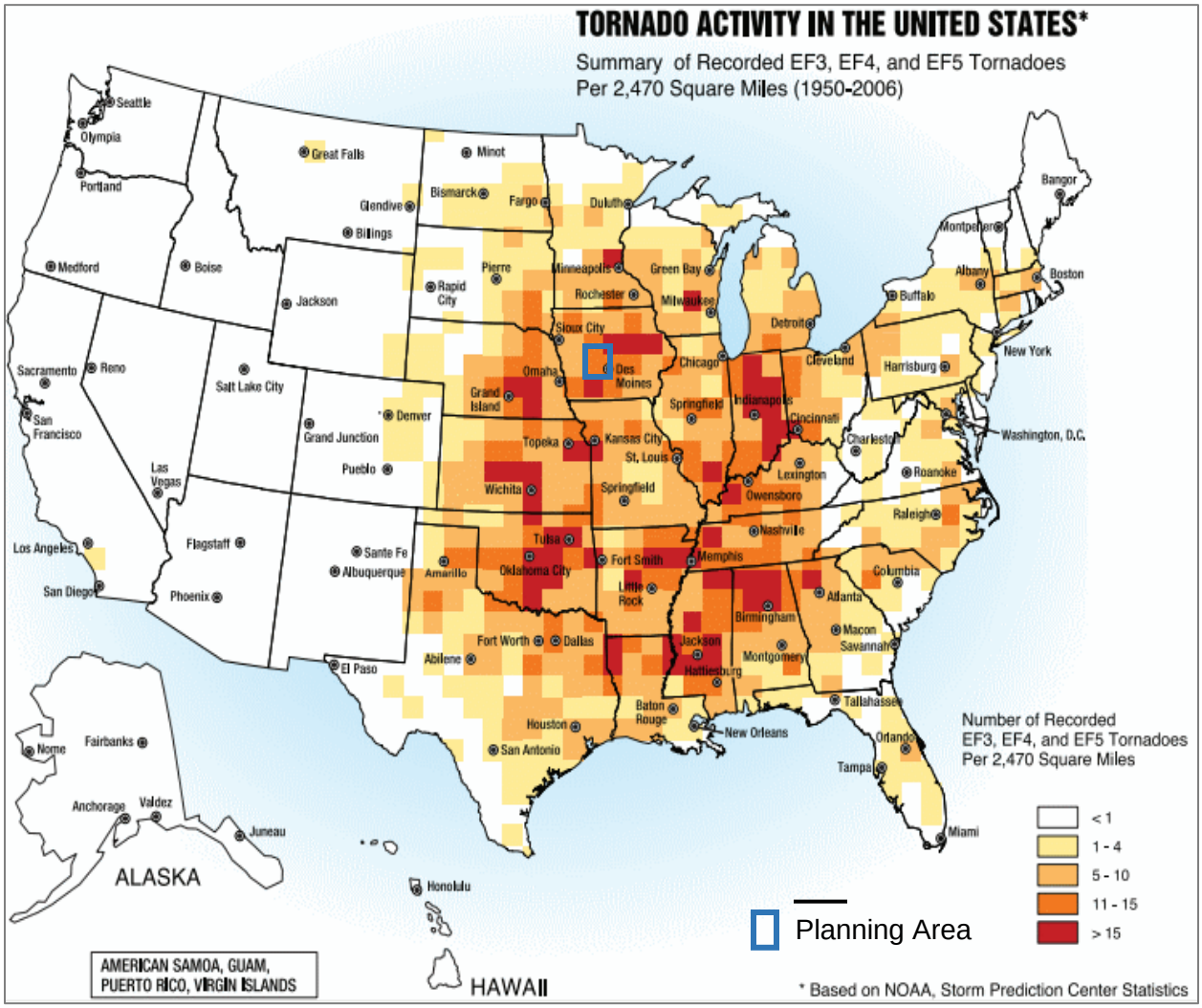
- There must be a microscale rotating area of wind, ranging in size from a few feet to a few miles wide;
- The rotating wind, or vortex, must be attached to a convective cloud base and must be in contact with the ground; and,
- The spinning vortex of air must have caused enough damage to be classified by the Fujita Scale as a tornado.

Once tornadoes are formed, they can be extremely violent and destructive. They have been recorded all over the world but are most prevalent in the American Midwest and South, in an area known as "Tornado Alley." Approximately 1,250 tornadoes are reported annually in the contiguous United States. Tornadoes can travel distances over 100 miles and reach over 11 miles above ground. Tornadoes usually stay on the ground no more than 20 minutes. Nationally, the tornado season typically occurs between April and July. On average, 80% of tornadoes occur between noon and midnight. In Iowa, 64% of all tornadoes occur in the months of May, June, and July.

Iowa is ranked sixth in the nation for tornado frequency with an annual average of 47 tornadoes between 1985 and 2014.[128] Figure 63 shows the tornado activity in the United States as a summary of recorded EF3, EF4, and EF5 tornadoes per 2,470 square miles from 1950 through 2006.

[128] NOAA. "U.S. Annual Averages: Tornadoes by State (1985-2014)". Accessed April 2022. https://www.spc.noaa.gov/wcm/ustormaps/1985-2014-stateavgtornadoes.png

Figure 63: Tornado Activity in the United States



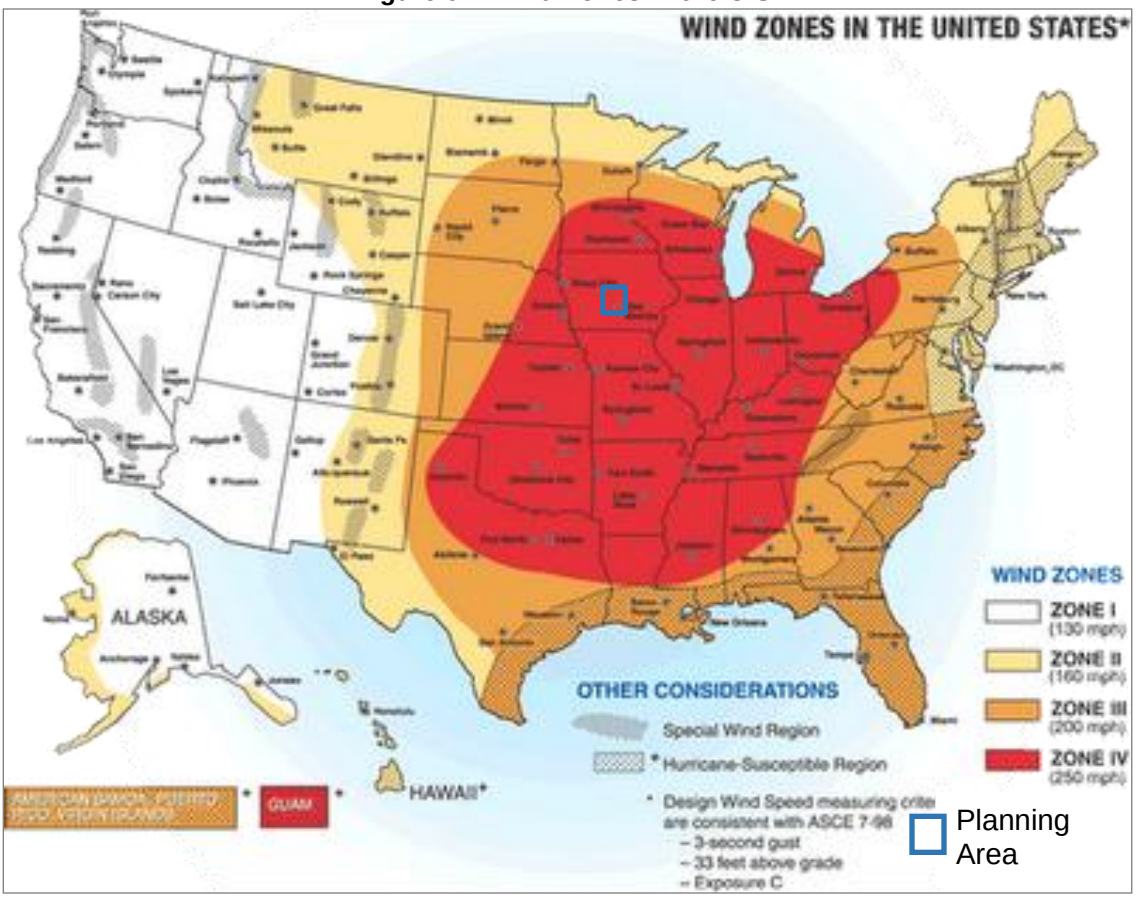
Source: FEMA, 2008[129]

Windstorms typically accompany severe thunderstorms, severe winter storms, tornadoes, and other large low-pressure systems, which can cause significant crop damage, downed power lines, loss of electricity, traffic flow obstructions, and significant property damage including to trees and center-pivot irrigation systems.

The National Weather Service (NWS) defines high winds as sustained wind speeds of 40 mph or greater lasting for one hour or longer, or winds of 58 mph or greater for any duration.[130] The NWS issues High Wind Advisories when there are sustained winds of 25 to 39 mph and/or gusts to 57 mph. Figure 64 shows the wind zones in the United States. The wind zones are based on the maximum wind speeds that can occur from a tornado or hurricane event. The planning area is located in Zone IV which has maximum winds of 250 mph, equivalent to an EF5 tornado.

[129] Federal Emergency Management Agency. August 2008. "Taking Shelter From the Storm: Building a Safe Room for Your Home or Small Business, 3rd edition."
[130] National Weather Service. 2017. "Glossary." http://w1.weather.gov/glossary/index.php?letter=h.

Figure 64: Wind Zones in the U.S.

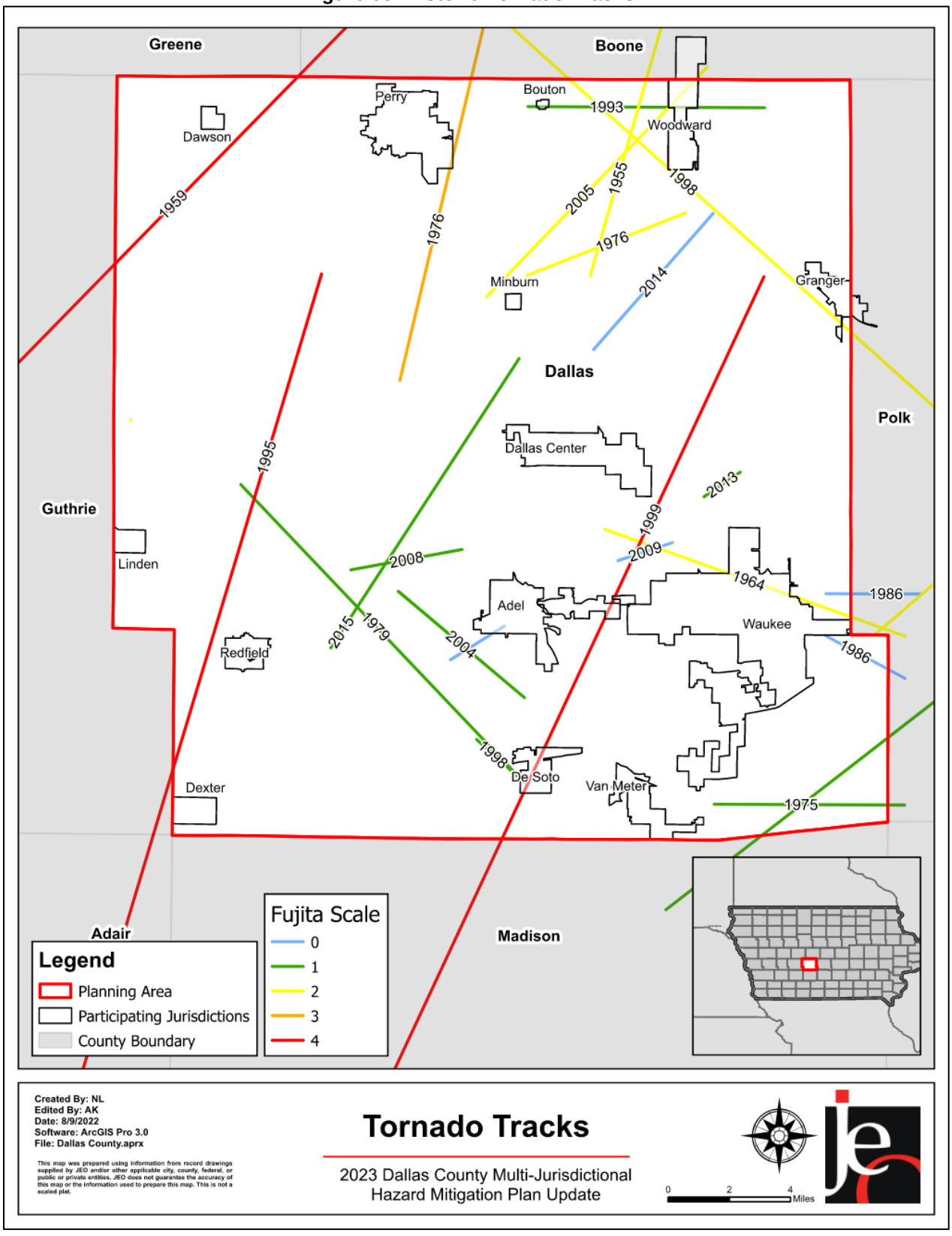


Source: FEMA, 2016

Location

Windstorms commonly occur throughout Dallas County and tornadoes can take place anywhere in the county. The impacts would likely be greater in densely populated areas, such as cities within the Des Moines Metro, Perry, and Adel . Figure 65 shows the historical track locations across the region according to the Midwestern Regional Climate Center. A few significant tornado events have directly impacted communities located in the planning area between 1996 and 2021. These include a 2005 EF2 that impacted Minburn and Woodward, and an EF2 in Granger in 1998.

Figure 65: Historic Tornado Tracks



Extent

The Beaufort Wind Scale can be used to classify wind strength, while the magnitude of tornadoes is measured by the Enhanced Fujita Scale. Table 102 outlines the Beaufort scale, provides wind speed ranking, range of wind speeds per ranking, and a brief description of conditions for each ranking.

Table 102: Beaufort Wind Ranking

Beaufort Wind Force Ranking	Range of Wind	Conditions
0	<1 mph	Smoke rises vertically
1	1 – 3 mph	Direction shown by smoke but not wind vanes
2	4 – 7 mph	Wind felt on face; leaves rustle; wind vanes move
3	8 – 12 mph	Leaves and small twigs in constant motion
4	13 – 18 mph	Raises dust and loose paper; small branches move
5	19 – 24 mph	Small trees in leaf begin to move
6	25 – 31 mph	Large branches in motion; umbrellas used with difficulty
7	32 – 38 mph	Whole trees in motion; inconvenience felt when walking against the wind
8	39 – 46 mph	Breaks twigs off tree; generally, impedes progress
9	47 – 54 mph	Slight structural damage; chimneypots and slates removed
10	55 – 63 mph	Trees uprooted; considerable structural damages; improperly or mobiles homes with no anchors turned over
11	64 – 72 mph	Widespread damages; very rarely experienced

Source: Storm Prediction Center, 2017[131]

Using the NCEI reported events, the most common windstorm event in the planning area is a level 10 on the Beaufort Wind Ranking scale. The reported high wind events ranged from 40 mph to 70 mph, with an average speed of 55 mph.

The Enhanced Fujita Scale replaced the Fujita Scale in 2007. The Enhanced Fujita Scale does not measure tornadoes by their size or width, but rather the amount of damage caused to human-built structures and trees after the event. The official rating category provides a common benchmark that allows comparisons to be made between different tornadoes. The enhanced scale classifies EF0-EF5 damage as determined by engineers and meteorologists across 28 different types of damage indicators, including different types of building and tree damage. To establish a rating, engineers and meteorologists examine the damage, analyze the ground-swirl patterns, review damage imagery, collect media reports, and sometimes utilize photogrammetry and videogrammetry. Based on the most severe damage to any well-built frame house, or any comparable damage as determined by an engineer, an EF-Scale number is assigned to the tornado.

[131] Storm Prediction Center: National Oceanic and Atmospheric Administration. 1805. “Beaufort Wind Scale.” http://www.spc.noaa.gov/faq/tornado/beaufort.html.

The following tables summarize the Enhanced Fujita Scale and damage indicators. According to a recent report from the National Institute of Science and Technology on the Joplin Tornado, tornadoes rated EF3 or lower account for around 96 percent of all tornado damages.[132]

Table 103: Enhanced Fujita Scale

Storm Category	3 Second Gust (mph)	Damage Level	Damage Description
EF0	65-85 mph	Gale	Some damages to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages to sign boards.
EF1	86-110 mph	Weak	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages might be destroyed.
EF2	111-135 mph	Strong	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
EF3	136-165 mph	Severe	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
EF4	166-200 mph	Devastating	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown, and large missiles generated.
EF5	200+ mph	Incredible	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel re-enforced concrete structures badly damaged.
EF No rating	--	Inconceivable	Should a tornado with the maximum wind speed in excess of F5 occur, the extent and types of damage may not be conceived. A number of missiles such as iceboxes, water heaters, storage tanks, automobiles, etc. will create serious secondary damage on structures.

Source: NOAA; FEMA

Table 104: Enhanced Fujita Scale Damage Indicator

Number	Damage Indicator	Number	Damage Indicator
1	Small barns, farm outbuildings	**15**	School - 1-story elementary (interior or exterior halls)
2	One- or two-family residences	**16**	School - Junior or Senior high school
3	Single-wide mobile home (MHSW)	**17**	Low-rise (1-4 story) bldg.
4	Double-wide mobile home	**18**	Mid-rise (5-20 story) bldg.

[132] Kuligowski, E.D., Lombardo, F.T., Phan, L.T., Levitan, M.L., & Jorgensen, D.P. March 2014. "Final Report National Institute of Standards and Technology (NIST) Technical Investigation of the May 22, 2011, Tornado in Joplin, Missouri."

Number	Damage Indicator	Number	Damage Indicator
5	Apartment, condo, townhouse (3 stories or less)	**19**	High-rise (over 20 stories)
6	Motel	**20**	Institutional bldg. (hospital, govt. or university)
7	Masonry apartment or motel	**21**	Metal building system
8	Small retail bldg. (fast food)	**22**	Service station canopy
9	Small professional (doctor office, branch bank)	**23**	Warehouse (tilt-up walls or heavy timber)
10	Strip mall	**24**	Transmission line tower
11	Large shopping mall	**25**	Free-standing tower
12	Large, isolated ("big box") retail bldg.	**26**	Free standing pole (light, flag, luminary)
13	Automobile showroom	**27**	Tree - hardwood
14	Automotive service building	**28**	Tree - softwood

Source: NOAA; FEMA

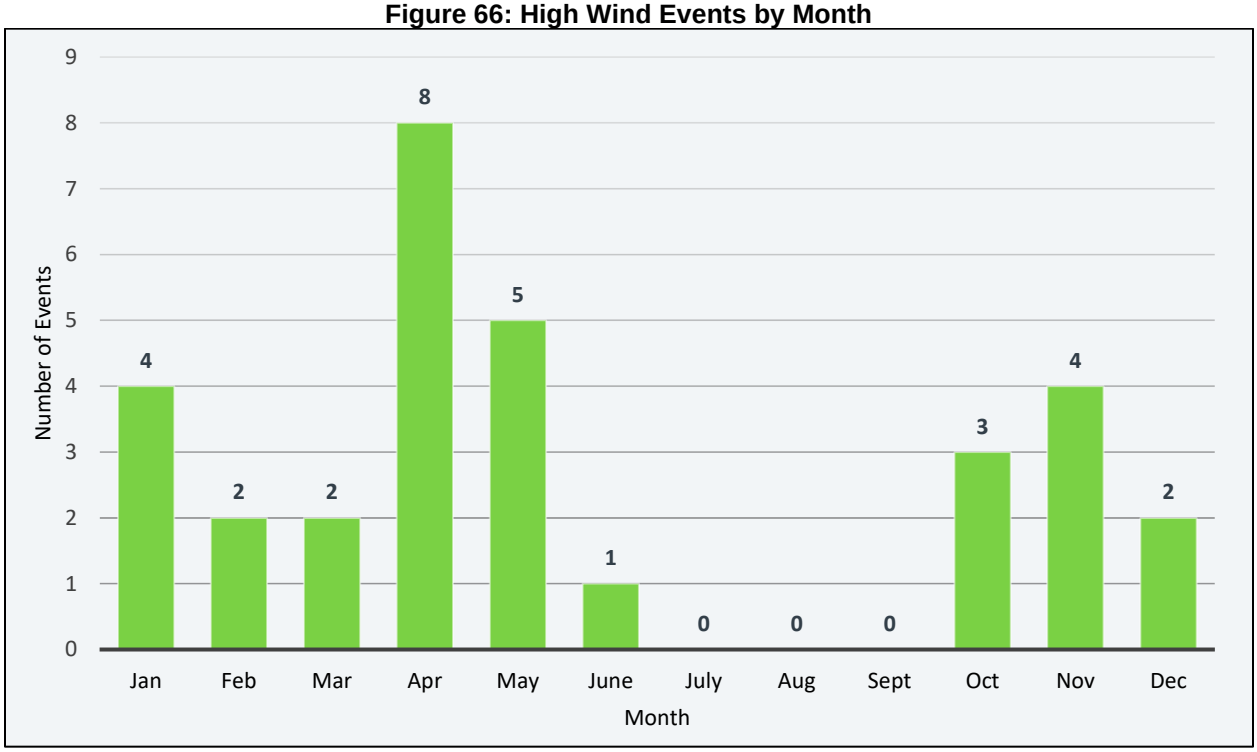
Based on historic record, it is most likely that tornadoes within the planning area will be of EF0 strength. Of the 31 reported tornado events, 23 were EF0, five were EF1, two were EF2, and one was EF3.

Historical Occurrences

There were 31 windstorm events that occurred between 1996 and 2021 and 31 tornadic events ranging from a magnitude of EF0 to EF3. These events were responsible for $4,562,110 in property damages and $15,560,764 in crop damages. No deaths or injuries were reported.

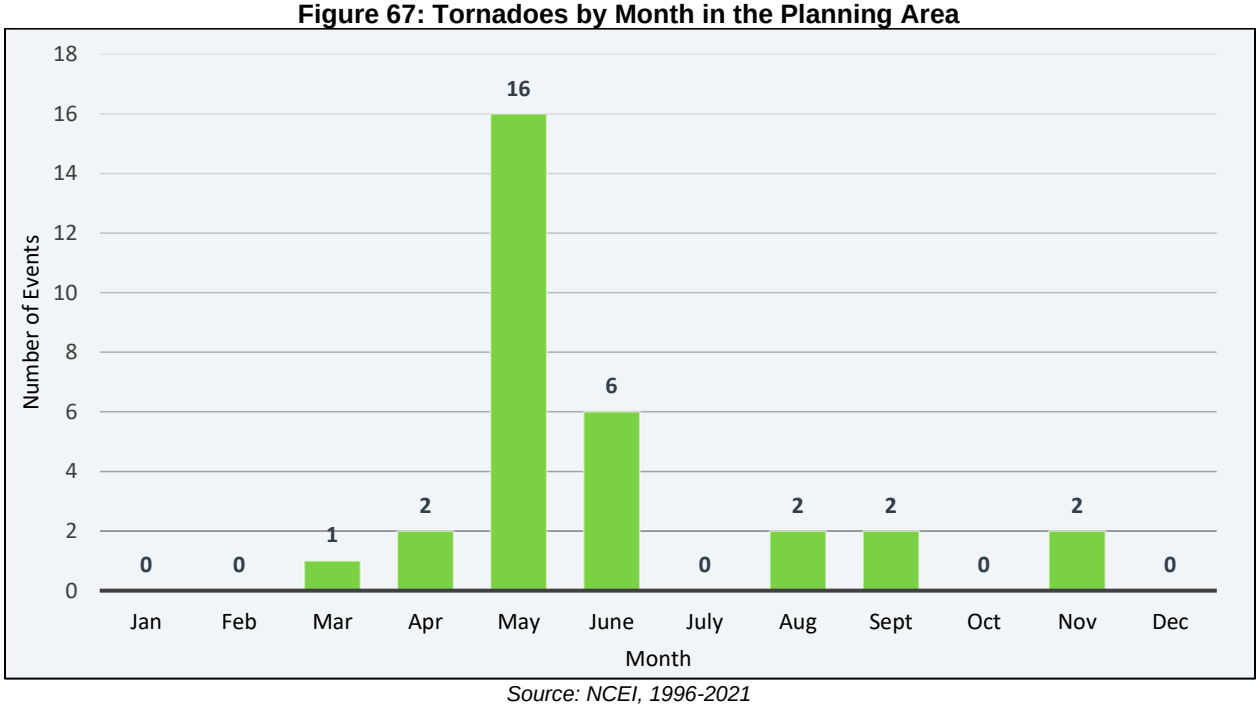
The most damaging tornado occurred in 2005, causing $2,500,000 in damages. This EF2 tornado tracked from just outside Minburn through Woodward. The tornado destroyed at least 12 houses near downtown Woodward and resulted in two serious injuries. A second EF2 tornado hit Granger in 1998 and caused $500,000 in property damage. As seen in the following figures, the majority of windstorm events occur in the spring and winter months, while most tornado events occur in the spring. The county conservation board expressed concern about people being vulnerable to tornadoes and windstorms while outside in public conservation areas. More shelter locations are needed in those areas.

Figure 66: High Wind Events by Month



Source: NCEI, 1996-2021

Figure 67: Tornadoes by Month in the Planning Area



Source: NCEI, 1996-2021

Event descriptions from NCEI for the most damaging events are provided below.

- **6/29/1998 Tornado –** $500,000 in property damages, $20,000 in crop damage. *A complex weather situation was set up over the central U.S. as a mesoscale convective system passed to the south of Iowa during the overnight hours and early morning of the 29th. Initially, the surface warm front was located to the south of this system. That was not actually the case aloft, however. During the predawn hours the surface front surged north and by sunrise was located across northeast Nebraska across northern Iowa. The airmass was very unstable to the south of the front with dew point temperatures will in the 70s F. The initial development of thunderstorms took place during the early part of the day over northeast Nebraska. The storms became severe quickly as they moved and developed eastward into Iowa. By mid-morning, the storms had formed a nearly east to west line. Storm relative inflow into the line was around 40 knots. The storms produced a variety of severe weather across Iowa. They initially moved east across the northern and central counties, but then began sinking southeast. The dominant severe weather with the storms was extremely high winds. Damage was very widespread across the state. Winds in excess of 100 MPH were reported with one unofficial wind speed measured at 126 MPH in the town of Washington at 1405 CST. In one unusual story, high winds hit Mahaska County. Three miles south of New Sharon, a puppy was tied to its doghouse which was picked up by the wind. The doghouse and puppy were lifted over the top of a two-car garage and a corn crib. Both were deposited in the farmyard. When found the doghouse was upside down and the puppy, though scared, was fine. There were several tornadoes during the event. One of the longer track well defined tornadoes was the initial tornado. It was on the ground for about 11 miles as it swept across Crawford County. Several residences, outbuildings, grain bins, and trees were damaged along its path. Reports indicate that between 30 and 50 residences were damaged by this tornado. There were several small tornadoes in central Iowa. They had short tracks and only touched down briefly. One cut a mile long path east of Marshalltown through a corn field and a grove of trees. Another in Dallas County was on the ground through mostly open country for two miles. High winds were a major problem with these storms. Many places reported winds over 80 MPH with incredible tree damage and numerous buildings damaged or destroyed. At least 38 counties were declared disaster areas by the Federal Government due to the severe damage and flooding. A final total will not be available before publication deadlines, however preliminary data have been included. In the Des Moines County Warning Area these included: Wright, Franklin, Butler, Bremer, Hamilton, Hardin, Grundy, Crawford, Carroll, Greene, Boone, Story, Marshall, Audubon, Guthrie, Dallas, Polk, Jasper, Cass, Adair, Madison, Warren, Marion, Adams, and Taylor. One of the hardest hit Counties was Polk County. Damage appeared to be from straight line winds based on a storm survey that was done following the event. The damage occurred over the southwest semicircle of a large meso low in contact with the ground. Due to the rapid translational speed of 50 to 75 MPH, winds were enhanced on the southwest semicircle of the meso low. Smaller scale winds could have been embedded within this circulation as well. There was little evidence of small scale convergent tornadic damage, however aerial surveys did make some suggestion and eyewitness accounts of sightings were quite numerous in the metro Des Moines area. All trees and debris were laid down to the south or southeast. The major damage swath as 3 to 7 miles wide northwest of Camp Dodge, with a widening into a full-blown derecho after that. The event was born a few miles northwest of Perry, between Rippey and Berkley in southwest Boone County. The mile wide damage path expanded to over 3 miles by the time it reached full intensity near highway 169 between Woodward and Perry. The path continued through Granger, Camp Dodge, and Johnston. The path was nearly 7 miles wide near Granger. A second, smaller, meso low passed near Madrid, downing power lines. This meso low matured near Jester Park Golf Course, causing significant structural damage to houses. The two meso lows merged near the NWS Forecast Office in Johnston, with two miles of power poles snapped off between Johnston and Granger. Much of the damage along the most severe track was in the F1 intensity category, with speeds in the 75 to 110 MPH range. A few spots along the path, such as in the Granger and Camp Dodge area, sustained*

sufficient damage to justify F2 winds, 110 to 155 MPH. It appears a tornado or family of tornadoes touched down southeast of Berkley and moved southeast into the Pleasant Hill area just east of Des Moines. The track was intermittent, indicating either one tornado touching down occasionally, or one or more weak tornadoes rotating around the meso circulation. The worst effected metro areas were the Granger area, Johnston, and the northeast side of Des Moines proper. A duplex in Granger was flattened by the winds. There were several reports of roofs being ripped off stores and houses in the metropolitan Des Moines area. Several small private planes were flipped at a small airfield north of Des Moines. There were also several reports of semi-tractor-trailer trucks being blown over on Interstate 35. Heavy construction equipment was overturned on Interstate 35/80 just north of Des Moines. Damage was extensive to the east side of Des Moines proper. To make matters worse, following the passage of the main line of thunderstorms, a second line of severe thunderstorms developed and moved across the same areas already hit. The storms were smaller but did produce brief tornado touch downs and hail up to 2.5 inches in diameter. The second line of storms did eventually combine with the first and moved southeast across the rest of the state. Damage was widespread across the state, and it will be months before final numbers are in. Estimates from Polk County alone are near $100 million in damage including cleanup. Totals were still being tallied at this writing; however, a few include over $11 million in damage from initial claims in Johnston and $726,000 from West Des Moines just to city buildings and systems. West Des Moines was on the far west edge of the major damage, however. In addition to the property damage, at least 125 people were injured during the storm. Most of the injuries were caused by flying debris and many were not serious. Fortunately, there were no fatalities. Heavy damage was reported by MidAmerica Energy. On a statewide report, they indicated 200,000 homes were without electricity, effecting over 500,000 people, at one time during the storm. In the metropolitan Des Moines area, 100,000 homes were without electricity at the height of the storm. That number was reduced to around 25,000 36 hours later. The worst damaged areas were without power for 5 to 6 days. Heavy damage was also reported by local telephone and cable systems. In Polk County, the worst damage extended from the Camp Dodge area into the northeast parts of Des Moines. At least 462 homes in the metro Des Moines area sustained significant damage. Statewide, 80 homes were destroyed, 559 sustained severe damage, with 1416 others receiving moderate damage. In the Camp Dodge area, 80 to 90 percent of the brick buildings were damaged with the roofs removed from many of them. Lightning from the storms struck the WSR-88D in the midst of the storm. The radar was taken out of service for more than 24 hours because of this. In addition to the severe weather, flooding quickly became a problem. Iowa soil was nearly saturated as the weather pattern had been very wet for six weeks previous. Although rainfall was not extreme, one to three inches of rain fell over a several county area. This caused widespread urban flooding across north central into central Iowa, though damage from the flooding was not serious. Crop damage was very difficult to determine and will not likely be clear until the fall harvest. Reports from some of the local extension agents say damage to the corn ranged up to 75% destroyed in areas with the highest wind, such as the swath that went through central Iowa in association with the tornado there. No doubt losses will be in the hundreds of thousands of dollars if not in the millions. Accounts of damage were of course too numerous to document here as the areal extent of the storms was very large. Countless reports of parts of crop fields being flattened were received. Semi-tractor-trailer trucks were overturned by the high winds both in the Des Moines metro area as well as in Newton. Trees were found on houses over a large part of the state. One news reported wrote there is not a power pole standing between Fort Dodge and Oskaloosa". Though not figuratively true this statement does point out the extensive damage that occurred with these storms.

- *"***11/12/2005 Tornado -** $2,500,000 in property damages. *A very intense weather system developed over the central U.S. during the day on the 12th. A strong upper-level system moved through the area with mid and upper-level winds in the 70 to 90 kt range. Low level winds of 35 to 50 kts transported moisture north into the system. High temperatures reached the mid-60s to*

low 70s, with dew point readings approaching 60 by late afternoon. A surface low developed over northern Kansas during the previous night and lifted northeast into eastern South Dakota during the afternoon of the 12th, then into central Minnesota as a 985 mb low by late evening. The atmosphere became quite unstable with CAPE values reaching 1000 J/kg by late afternoon. The Lifted Index values were in the -5 C. range. Being as it was in November, the freezing level was quite low during the event, in the 10,000-to-11,000-foot range. Though the soundings were quite unidirectional, there was plenty of shear with zero to 6 km shear values around 65 kts. Thunderstorms erupted during the afternoon in west central into southwest Iowa. The storms became severe quite quickly. Initially the storms produce quarter to golf ball size hail, with 2 1/2-inch diameter hail falling in Dallas County. Hail up to baseball size fell in Greene County as well. The system transitioned into a tornadic system within an hour with several tornadoes touching down in the central sections of the state. At least 9 communities were hit by tornadoes and 65 homes damaged or destroyed. An 82-year-old woman was killed in Stratford when the tornado demolished her home. In a 2 or 3 block area of downtown Woodward, at least 12 houses were totally destroyed. There was one minor injury in Ames, two serious injuries in the Woodward area, and three injuries in Stratford. Due to the extensive damage to property caused by the tornadoes, Iowa Governor Vilsack declared Boone, Story, Webster, Dallas, and Hamilton Counties disaster areas.

Average Annual Damages

The average damage per event estimate was determined based upon NCEI Storm Events Database since 1996 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. It is estimated that windstorm events can cause an average of $36,850 per year in property damages and $707,307 per year in crop damages. Tornadoes have caused an average of $138,615 per year in property damages; however, damages from tornadoes vary greatly depending on the severity or magnitude of each event.

Table 105: Tornado and Windstorm Loss Estimate

Hazard Type	Number of Events[1]	Average Events Per Year	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Tornado	31	1.2	$3,604,000	$138,615	$0	$0
Windstorm	31	1.2	$958,110	$36,850	$15,560,764	$707,307

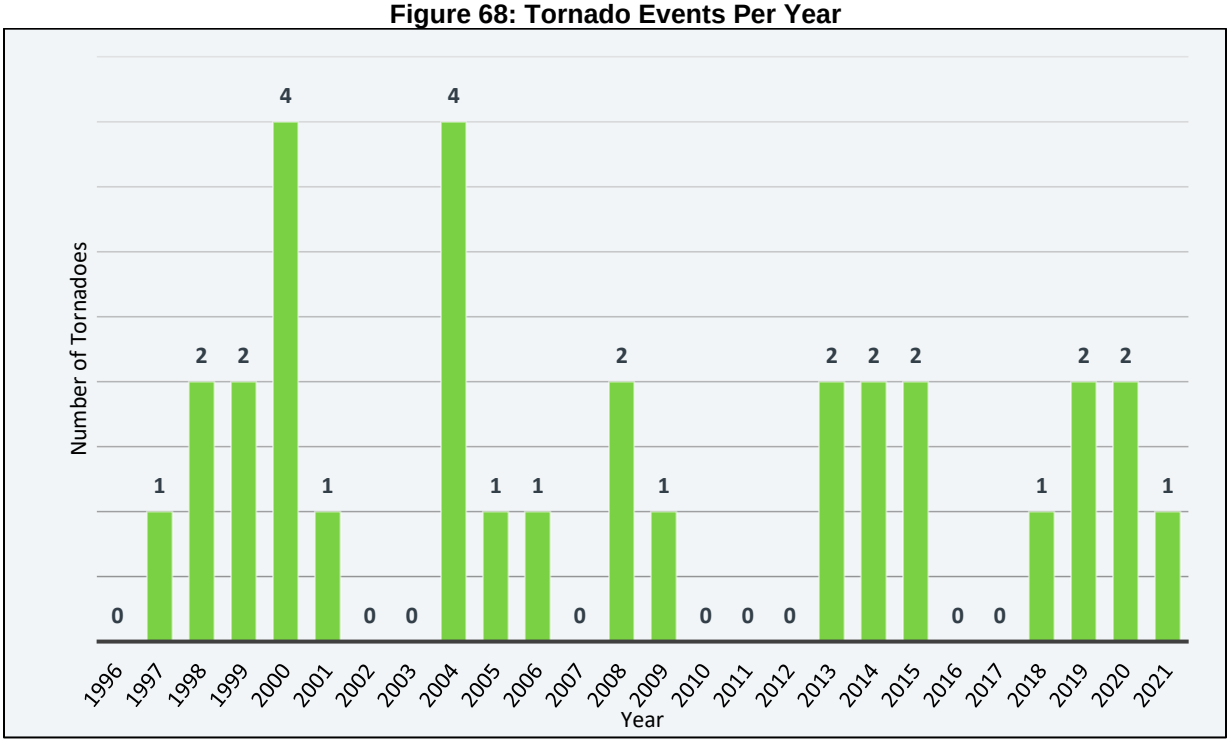
Source: 1 Indicates data is from NCEI (1996 to 2021); 2 Indicates data is from USDA RMA (2000 to 2021)

Probability

Given the historic record of occurrence for windstorms (18 out of 26 years with reported events), for the purposes of this plan, the annual probability of windstorm occurrence is 69 percent. However, windstorms could be more common than presented here but may have simply not been reported in past years.

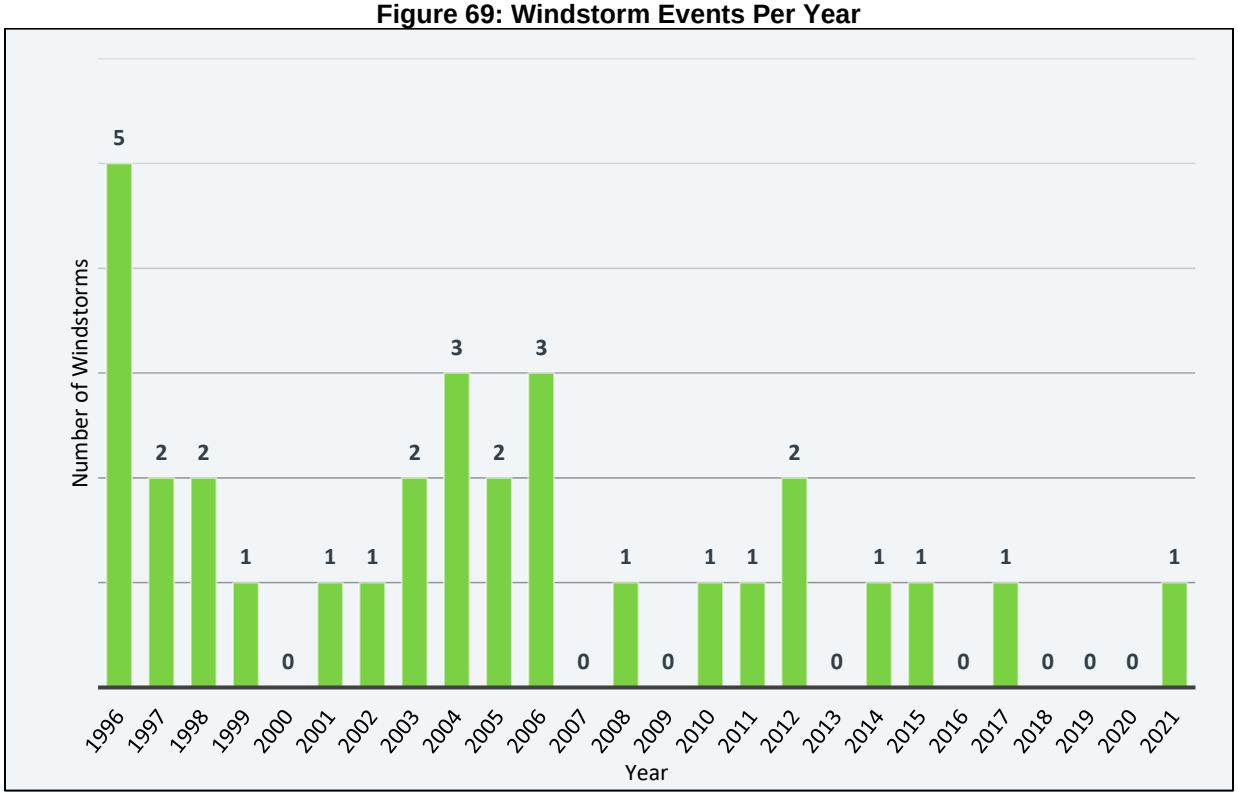
Given the historic record of occurrence for tornado events (17 out of 26 years with reported events), for the purposes of this plan, the annual probability of tornado occurrence is 65 percent. However, it is worth noting that the period of record for data utilized during this analysis is from 1996-2021.

Figure 68: Tornado Events Per Year



Source: NCEI, 1996-2021

Figure 69: Windstorm Events Per Year



Community Top Hazard Status

The following table lists jurisdictions which identified Tornado and Windstorm as a top hazard of concern:

Jurisdictions	
Adel	Waukee
Bouton	Woodward
Dallas Center	Adel-DeSoto-Minburn School District
Dawson	Dallas Center-Grimes School District
De Soto	Perry Community School District
Dexter	Van Meter School District
Granger	Waukee School District
Linden	West Central Valley School District
Minburn	Woodward-Granger School District
Perry	Woodward Township Fire District
Redfield	Perry Water Works
Van Meter	

Regional Vulnerabilities

The following table provides information related to regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 106: Regional Tornado and Windstorm Vulnerabilities

Sector	Vulnerability
People	-Vulnerable populations include those living in mobile homes (especially if they are not anchored properly), nursing homes, and/or schools -People outdoors during events -Citizens without access to shelter below ground or in safe rooms -Elderly with decreased mobility or poor hearing may be higher risk -Lack of multiple ways of receiving weather warnings, especially at night
Economic	-Agricultural losses to both crops and livestock -Damages to businesses and prolonged power outages can cause significant impacts to the local economy, especially with EF3 tornadoes or greater
Built Environment	-All building stock is at risk of significant damages
Infrastructure	-Downed power lines and power outages -All above ground infrastructure at risk to damages -Impassable roads due to debris blocking roadways
Critical Facilities	-All critical facilities are at risk to damages and power outages
Climate	-Changes in seasonal precipitation and temperature normals can increase frequency and magnitude of severe storm events

Transportation Incident

A transportation accident involves an incident between one or more conveyances on land, sea, or air. Transportation accidents can cause property damage, bodily injury, and death. Accidents are influenced by several factors, including the type of driver, road condition, weather conditions, density of traffic, type of roadway, signage, and signaling.

In the planning area, automobile accidents are likely to be the most common type of incident as there are few rail lines and bodies of water. In addition, most of the airports in the county are smaller with a low number of takeoffs and landings.

Location

Transportation incidents can occur anywhere along transportation routes in the planning area but are most likely to occur along major highways due to increased speeds and the higher number of vehicles.

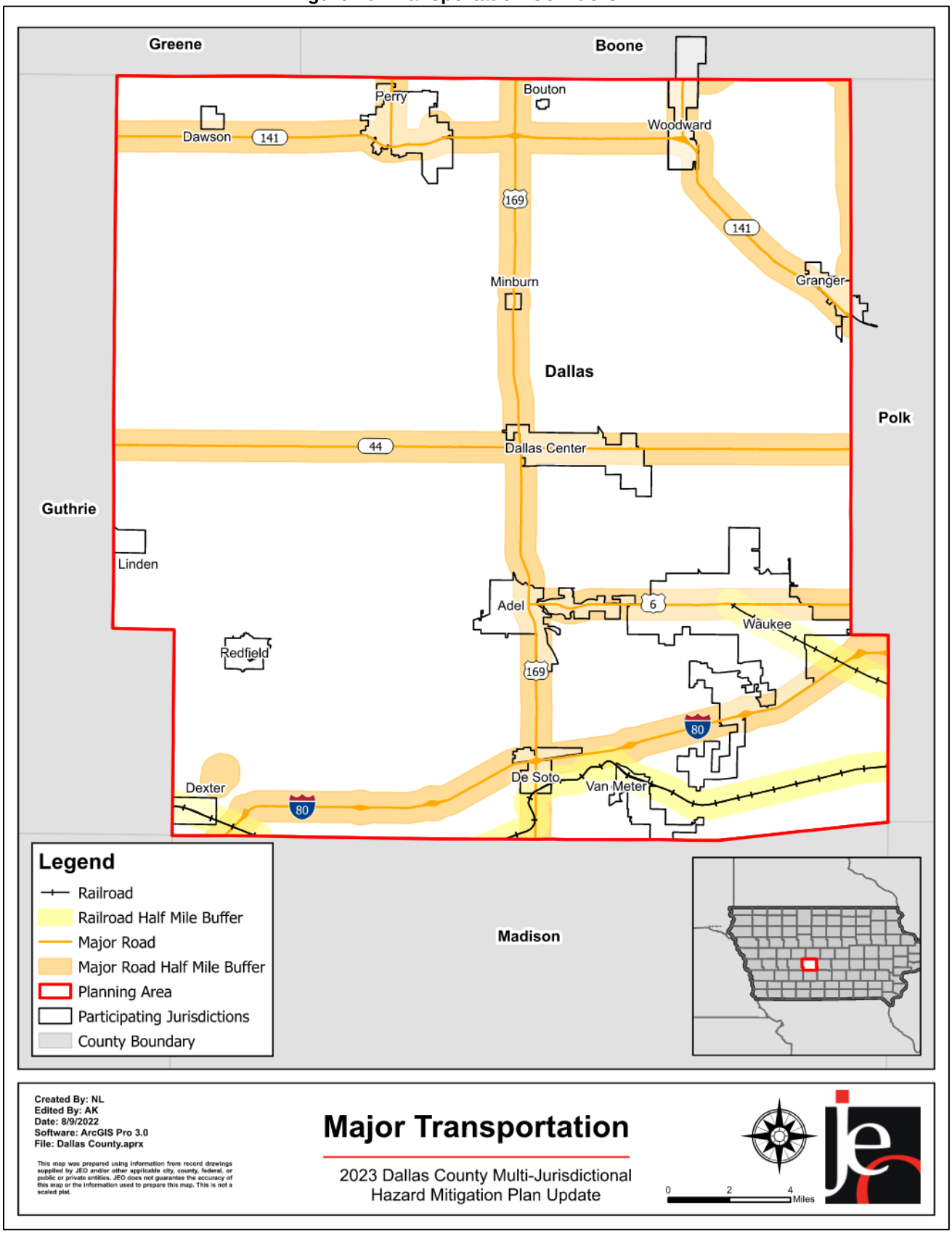
The Perry Municipal Airport is the only public airport in Dallas County, according to the Iowa Department of Transportation. The Des Moines International Airport is only six miles east of southeast Dallas County. Des Moines International Airport, Iowa's largest airport, serves over one million passengers per year plus 120,000+ tons of cargo and some military use.

Figure 70 shows the location of the major transportation routes in the planning area.

Extent

The extent of automobile, rail, and air incidents is usually localized, however catastrophic events can occur and may require assistance from outside jurisdictions. Transportation incidents can also cause hazard materials releases, which can further increase damages and risk of injury.

Figure 70: Transportation Corridors

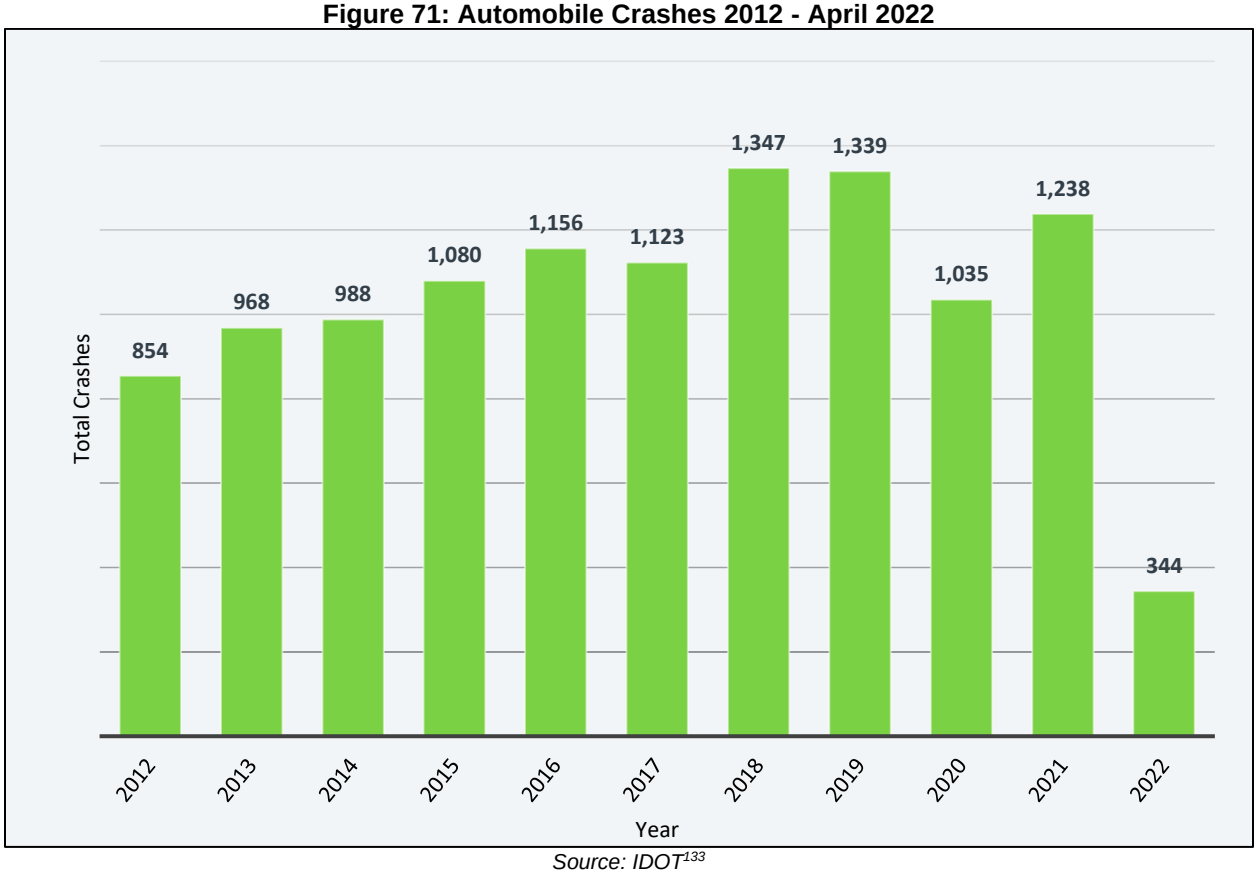


Historical Occurrences

Automobile

The Iowa Department of Transportation (IDOT) maintains records at the county level for certain automobile related accidents. The following figure shows total crashes from 2012 to April 2022. These events resulted in a total of 11,472 crashes, 3,780 injuries, and 53 fatalities.

Figure 71: Automobile Crashes 2012 - April 2022



Source: IDOT[133]

Highway Rail

The Federal Railroad Administration (FRA) keeps data on all highway rail accidents since 1975. Table 107 shows the number of highway rail accidents that have occurred in the county from 1975 to 2021. 17 injuries and three deaths resulted from these events.

Table 107: Historical Highway Rail Incidents

Number of Incidents	Injuries	Fatalities
31	17	3

Source: Federal Railroad Administration, 1975-2021[134]

[133] Iowa Department of Transportation. 2022. "ICAT-Iowa Crash Analysis Tool." https://icat.iowadot.gov/

[134] Federal Railroad Administration. 2022. "Highway Rail Accidents". https://safetydata.fra.dot.gov/OfficeofSafety/publicsite/on_the_fly_download.aspx.

Aviation

From 1962 through April 2022, there were nine aviation accidents in the planning area, as reported by the National Transportation Safety Board (NTSB) database. The events resulted in five injuries and two fatalities.

Table 108: Historical Aviation Incidents

Date	Phase of Flight	Injuries	Fatalities	Nearest Community
5/2/1982	Landing	0	1	Adel
8/24/1996	Landing	0	0	Dexter
12/30/1983	Cruise	2	0	Grimes
8/9/1999	Landing	0	0	Perry
7/10/1989	Maneuvering	1	0	Perry
4/10/1986	Takeoff	0	0	Perry
9/9/1983	Approach	1	0	Perry
5/7/1998	Maneuvering	0	1	Waukee
3/17/2022	Unlisted	1	0	De Soto

Source: National Transportation Safety Board, 1962-April 2022[135]

Average Annual Damages

The average damage per event estimate was determined for each incident type based upon records from IDOT, FRA, NTSB, and number of historical occurrences. Only transportation events from FRA included damage totals. This does not include losses from functional downtime, economic loss, injury, or loss of life. Transportation incidents have caused an average of $6,943,739 per year in property damages to the planning area. RMA data is not available for transportation incidents, but crop damage would be expected to be minimal.

Table 109: Transportation Incidents Loss Estimate

Hazard Type	Number of Events	Average Events per Year	Total Property Loss	Average Annual Property Loss
Auto[1]	11,472	1,043	$76,326,109	$6,938,737
Aviation[2]	9	0.15	N/A	N/A
Highway Rail[3]	31	0.67	$300,148	$5,002
Total	**11,512**	**1,044**	**$76,626,257**	**$6,943,739**

Source:1 IDOT, 2012-April 2022; 2 NTSB 1962-April 2022; 3 FRA 1975- 2021

Probability

The probability of transportation incidents is based on the historic record provided by the IDOT, FRA, and NTSB. Based on the historic record, there is a 100% annual probability of auto incidents, a 13% annual probability (8 out of 60 years with reported events) for aviation incidents, and a 40% probability (19 out of 47 years) of highway rail incidents occurring in the planning area each year.

[135] National Transportation Safety Board. 1962-April 2022. "Aviation Accident Database & Synopses". https://www.ntsb.gov/_layouts/ntsb.aviation/index.aspx.

Community Top Hazard Status

The following table lists jurisdictions which identified Transportation Incident as a top hazard of concern:

Jurisdictions	
Dexter	Waukee School District
Granger	West Central Valley School District
Van Meter	Woodward-Granger School District
Waukee	Woodward Township Fire District

Regional Vulnerabilities

The following table provides information related to regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles.*

Table 110: Regional Transportation Incidents Vulnerabilities

Sector	Vulnerability
People	-Injuries and fatalities to drivers and passengers -Injuries and fatalities to those nearby if hit
Economic	-Prolonged road closures and detours for clean-up
Built Environment	-Potential damage to nearby buildings
Infrastructure	-Damage to roadways, utility poles, and other infrastructure if struck by a vehicle
Critical Facilities	-Roadway closures -Damage to facilities if located near transportation routes
Climate	-None

Section Five: Mitigation Strategy

Introduction

The primary focus of the mitigation strategy is to identify action items to reduce the effects of hazards on existing infrastructure and property based on the established goals. These actions should consider the most cost effective and technically feasible manner to address risk.

The establishment of goals took place during the kick-off meeting with the Hazard Mitigation Planning Team. Meeting participants reviewed the goals from the 2018 HMP and discussed recommended additions and modifications. The intent of each goal is to develop strategies to account for risks associated with hazards and identify ways to reduce or eliminate those risks.

The Hazard Mitigation Planning Team decided to keep the same list of goals from the 2018 HMP, with a couple slight modifications. "Natural hazards" was updated to "All hazards" to provide clarification, and the order was changed to move the fourth goal to be listed first to reflect the priority of protecting people. The goals were then shared with all planning team members at the Round 1 public meetings.

Summary of Changes

The development of the mitigation strategy for this plan update includes the addition of new mitigation and strategic actions, updated status or removal of past actions, and revisions to the mitigation and strategic action selection process or descriptions of actions for consistency across the planning area.

Requirement §201.6(c)(3): The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs, and resources, and its ability to expand on and improve these tools.

Requirement §201.6(c)(3)(i): The hazard mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

Requirement §201.6(c)(3)(ii): The mitigation strategy shall include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure. The jurisdiction's participation in the National Flood Insurance Program and continued compliance with NFIP requirements, as appropriate, must also be addressed.

Requirement: §201.6(c)(3)(iii): The mitigation strategy section shall include an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

Requirement §201.6(c)(3)(iv): For multi-jurisdictional plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.

Goals

Below is the final list of goals as determined for this plan update. These goals provide direction to guide participants in reducing future hazard related losses.

Goal 1: Prevent or reduce the impact of all hazards for the residents, businesses, and jurisdictions of Dallas County.

Goal 2: Protect critical facilities and infrastructure from all hazards.

Goal 3: Create a disaster resistant community by improving public understanding of all hazards and risk by providing public awareness, preparedness, and mitigation information through various channels of communication.

Goal 4: Improve capabilities to mitigate all hazards by incorporating mitigation strategies in plans, policies, and programs.

Goal 5: Strengthen communication among governmental agencies and between governmental agencies and the public.

Selected Mitigation and Strategic Actions

Local planning teams evaluated and prioritized mitigation and strategic actions. These actions included: the mitigation and strategic actions identified per jurisdiction in the previous plan; additional mitigation and strategic actions discussed during the planning process; and recommendations from JEO for additional mitigation and strategic actions based on risk probability and vulnerability at the local level.

The Hazard Mitigation Planning Team provided each participant a link to the FEMA Handbook as a list of mitigation actions to be used as a starting point. Participants were also encouraged to think of actions that may need FEMA grant assistance and to review their hazard prioritization for potential mitigation actions. These suggestions helped participants determine which actions would best assist their respective jurisdiction in alleviating damages in the event of a disaster. The listed priority rating does not indicate which actions will be implemented first but serves as a guide in determining the order in which each action should be implemented. Participants were informed of the STAPLEE (Social, Technical, Administrative, Political, Legal, Economic, Environmental) feasibility review process and were encouraged to use it when determining project priorities.

These prioritized projects are the core of a hazard mitigation plan. The local planning teams were instructed that each action must directly relate to the goals of the plan and the hazards of top concern for their jurisdiction. Actions must be specific activities that are concise and can be implemented individually. Mitigation and strategic actions were evaluated based on referencing the community's risk assessment and capability assessment. Jurisdictions were encouraged to choose mitigation and strategic actions that were realistic and relevant to the concerns identified.

A final list of alternatives was established including the following information: description of action; which hazard(s) the action addresses; responsible party; priority; cost estimate; potential local funding sources; and estimated timeline. This information was established through input from participants and determination by the Hazard Mitigation Planning Team.

It is important to note that not all the mitigation and strategic actions identified by a jurisdiction may ultimately be implemented due to limited capabilities, prohibitive costs, low benefit-cost ratio, or other concerns. These factors may not be identified during this planning process. The cost estimates, priority rating, potential funding, and identified agencies are used to give communities an idea of what actions may be most feasible over the next five years. This information will serve as a guide for the participants to assist in hazard mitigation for the future. Also, some jurisdictions may identify and pursue additional mitigation and strategic actions not identified in this HMP.

Participant Mitigation and Strategic Actions

Mitigation and strategic actions identified by participants of the Dallas County HMP are found in the Mitigation and Strategic Actions Project Matrix below. Additional information about selected actions can be found in respective *Section Seven: Community Profiles.* Each action includes the following information in the respective community profile.

- Action: General title of the action item.
- Description: Brief summary of what the action item(s) will accomplish.
- Hazard(s) Addressed: Which hazard the action aims to address.
- Estimated Cost: General cost estimate for implementing the action for the appropriate jurisdiction.
- Funding: A list of any potential local funding mechanisms to fund the action.
- Timeline: General timeline as established by planning participants.
- Priority: General description of the importance and workability in which an action may be implemented (high/medium/low); priority may vary between each community, mostly dependent on funding capabilities and the size of the local tax base.
- Lead agency: Listing of agencies or departments which may lead or oversee the implementation of the action item.
- Status: A description of what has been done, if anything, to implement the action item.

Implementation of the actions will vary between individual plan participants based upon the availability of existing information; funding opportunities and limitations; and administrative capabilities of communities. Establishing a cost-benefit analysis for any projects listed is beyond the scope of this plan and could potentially be completed prior to submittal of a project grant application or as part of an annual or five-year update. Completed, removed, and ongoing or new mitigation actions for each participating jurisdiction can be found in *Section Seven: Community Profiles.*

Mitigation and Strategic Actions Project Matrix

During public meetings, each participant was asked to review mitigation and strategic projects listed in the 2018 HMP and identify new potential actions, if needed, to reduce the effects of the hazards profiled for their area. Selected projects varied per jurisdiction depending upon the significance of each hazard present. The information listed in the following tables is a compilation of new and ongoing mitigation and strategic actions identified by jurisdiction. Completed and removed actions can be found in respective community profiles.

Table 111: Mitigation and Strategic Actions Selected by Each Jurisdiction (1 of 2)

Actions	Goal	Dallas County	City of Adel	City of Bouton	City of Dallas Center	City of Dawson	City of De Soto	City of Dexter	City of Granger	City of Linden	City of Minburn	City of Perry	City of Redfield	City of Van Meter	City of Waukee	City of Woodward
Alert/Warning Sirens	1, 3	X			X				X		X					
Backup and Emergency Generators	1, 2	X				X		X			X	X			X	X
Bank Stabilization	1, 2		X													
Building Code Enforcement/Improvement	1, 2, 4											X				
Clean Culverts/ Deepen Drainage Ditches	1, 2											X				
Emergency Management Exercise	1, 3															
Emergency Operations	1, 2, 5				X				X							
Flood Control Structure Improvements	1, 2		X													
Floodplain Management	1, 2	X														
Flood Prone Property Acquisition	1		X													
HAZMAT Training/Awareness	1, 3, 5										X					
Improve Water System	1, 2										X					
NIMS Training	1, 5								X			X				
Public Awareness/Education	1, 3				X			X			X	X		X		X
Remove Hazardous Trees	1, 2							X								
Short Term Residency Shelters	1											X				
Storm Shelters / Safe Rooms	1, 2	X	X	X	X		X		X	X		X	X		X	

Actions	Goal	Dallas County	City of Adel	City of Bouton	City of Dallas Center	City of Dawson	City of De Soto	City of Dexter	City of Granger	City of Linden	City of Minburn	City of Perry	City of Redfield	City of Van Meter	City of Waukee	City of Woodward
Stormwater System and Drainage Improvements	1, 2	X	X	X	X				X							X
Tree Management	1, 2				X			X				X				
Water Storage	1, 2								X		X					

Table 112: Mitigation and Strategic Actions Selected by Each Jurisdiction (2 of 2)

Actions	Goal	Adel-DeSoto-Minburn Schools	Dallas Center-Grimes Schools	Perry Community Schools	Perry Water Works	Van Meter Schools	Waukee Schools	West Central Valley Schools	Woodward-Granger Schools	Xenia Rural Water District	Woodward Township Fire District
Backup and Emergency Generators	1, 2			X	X	X				X	X
Bank Stabilization	1, 2									X	
Civil Service Improvements	1, 2										X
Emergency Management Exercise	1, 3, 5	X									
Improve Water System	1, 2				X						
Public Awareness/Education	1, 3	X									
Storm Shelters / Safe Rooms	1, 2	X	X			X	X	X	X		
Water Treatment Plant	1, 2				X						

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Section Six:
Plan Implementation and Maintenance

Monitoring, Evaluating, and Updating the Plan

Each participating jurisdiction in the Dallas County HMP is responsible for monitoring, evaluating, and updating the plan during its five-year lifespan. Hazard mitigation and strategic projects will be prioritized by each participant's governing body with support and suggestions from the public and business owners. Unless otherwise specified by each participant's local planning team, the governing body will be responsible for implementing the recommended projects. The responsible party for the various implementation actions will report on the status of all projects and include which implementation processes worked well, any difficulties encountered, how coordination efforts are proceeding, and which strategies could be revised.

As projects or actions are implemented, a detailed timeline of how that project was completed should be written and attached to the plan in a format selected by the governing body. Information that will be included will address project timelines, agencies involved, area(s) benefited, total cost (if complete), etc. At the discretion of each governing body, local planning team members, and other identified relevant stakeholders should review the original draft of the mitigation plan and recommend applicable changes.

Plan review and updates should occur regularly, with a complete update occurring every five years at a minimum. At the discretion of each governing body, updates may be incorporated more frequently, especially in the event of a major hazard or as additional mitigation needs are identified. Local planning team members should engage with the public, other elected officials, and multiple departments as they review and update the plan. The persons overseeing the evaluation process will review the goals of the previous plan and evaluate them to determine whether they are still pertinent and current. Among other questions, they may want to consider the following:

- Do the goals address current and expected conditions?
- If any of the recommended projects have been completed, did they have the desired impact on the goal for which they were identified? If not, what was the reason it was not

Requirement §201.6(c)(4)(i): The plan maintenance process shall include a section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

Requirement §201.6(c)(4)(ii): The plan shall include a process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.

Requirement §201.6(c)(4)(iii): The plan maintenance process shall include a discussion on how the community will continue public participation in the plan maintenance process.

Requirement §201.6(d)(3): A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within five years to continue to be eligible for mitigation project grant funding.

successful (lack of funds/resources, lack of political/popular support, underestimation of the amount of time needed, etc.)?
- Have either the nature, magnitude, and/or type of risks changed?
- Are there implementation problems?
- Are current resources appropriate to implement the plan?
- Were the outcomes as expected?
- Did the plan partners participate as originally planned?
- Are there other agencies which should be included in the revision process?

Worksheets in *Appendix C* may also be used to assist with plan review and updates.

In addition, the governing body will be responsible for ensuring that the HMP's goals are incorporated into applicable revisions of other planning mechanisms per jurisdiction. These plans may include: Comprehensive Plans, Capital Improvement Plans, Zoning Ordinances, Floodplain Ordinances, Building Codes, and/or Watershed Management Plans. Future updates of this HMP will review and update discussions of plan integration per community as appropriate.

Continued Public Involvement

To ensure continued plan support and input from the public and business owners, public involvement should remain a top priority for each participating jurisdiction. Notices for public meetings involving discussion of an action on mitigation updates should be published and posted in the following locations:

- Public spaces around the jurisdiction
- City/Village Hall
- Websites
- Social media
- Local radio stations
- Local newspapers
- Regionally distributed newsletters

Any amendments to the HMP as determined through public involvement or community actions should be shared with HSEMD.

Integrating Other Capabilities

There are a number of state and federal agencies with capabilities that can be leveraged during HMP updates or mitigation and strategic action implementation. A description of some regional resources is provided below.

Iowa Department of Homeland Security and Emergency Management

HSEMD is the coordinating body for homeland security and emergency management activities across the state of Iowa. HSEMD is responsible for emergency management, which is usually divided into five phases: preparedness, response, recovery, prevention, and mitigation.

The governor appoints the Iowa homeland security advisor and the director of the Iowa Department of Homeland Security and Emergency Management (HSEMD). The HSEMD director serves as the state administrative agent for grants administered by the federal government: such

as HMGP, FMA and BRIC. HSEMD is responsible for developing the state hazard mitigation plan, which serves as a comprehensive set of guidelines for hazard mitigation across the state. The state hazard mitigation officer (SHMO) is responsible for the coordination of plan updates and maintenance. The SHMO also serves as the lead coordinator for the State Hazard Mitigation Team (SHMT), which provides input on the state hazard mitigation planning process.

For more information regarding HSEMD responsibilities as well as their ongoing projects and programs, please go to https://homelandsecurity.iowa.gov/.

Iowa Department of Natural Resources

The IDNR is committed to providing Iowa's citizens and leaders with the data and analyses they need to make appropriate natural resource decisions for the benefit of all Iowan's both now and in the future. This state agency is responsible in the areas of forest and prairie management, fish and wildlife programs, fire prevention, surface water and groundwater, floodplain management, dam safety, natural resource planning, animal feeding operations, permitting, solid waste management, household hazardous materials and many other programs and services. IDNR also coordinates with the US Forest Service, State and private forest agencies, the Big Rivers Forest Fire Management Compact to support natural resource managers and fire departments in fire prevention efforts.

For more information regarding IDNR's responsibilities as well as their ongoing projects, please go to https://www.iowadnr.gov/.

Silver Jackets Program

The Silver Jackets program is also worth mentioning for their extensive role in providing a formal and consistent strategy for an interagency approach to planning and implementing measures to reduce the risks associated with flooding and other natural hazards. It brings together multiple state, federal, and sometimes tribal and local agencies to learn from one another and apply their knowledge to reduce risk. The State Hazard Mitigation Team and the Iowa Flood Risk Management Team, also known as the Silver Jackets, coordinate efforts related to the review and update of the Iowa Hazard Mitigation Plan. The State Hazard Mitigation Team has largely delegated flood mitigation interagency coordination to the Silver Jackets.

At this time the Silver Jackets do not have any projects taking place in the Dallas County planning area.

Unforeseen Opportunities

If new, innovative mitigation strategies arise that could impact the planning area or elements of this plan, which are determined to be of importance, a plan amendment may be proposed. If a new mitigation action is identified in between the five-year updates, it is recommended to share this amendment with Dallas County Emergency Management, as the plan sponsor, and with HSEMD, who will file it with FEMA. Re-adoption of the plan would not be needed until the normal five-year update. Such amendments should include all applicable information for each proposed action, including description of changes, identified funding, responsible agencies, etc. For an amendment template, see Appendix C.

Incorporation into Existing Planning Mechanisms

The Regional Planning Team utilized a variety of plan integration tools to help communities determine how their existing planning mechanisms were related to the Hazard Mitigation Plan. Utilizing FEMA's *Integrating Hazard Mitigation Into the Local Comprehensive Plan*[136] guidance, as well as FEMA's *2015 Plan Integration*[137] guide, each jurisdiction engaged in a plan integration discussion. This discussion was facilitated by a Plan Integration Worksheet, created by the Hazard Mitigation Planning Team. This document offered an easy way for participants to notify the Hazard Mitigation Planning Team of existing planning mechanisms, and if they interface with the HMP.

Each jurisdiction referenced all relevant existing planning mechanisms and provided information on how these did or did not address hazards and vulnerability. Summaries of plan integration are found in each participant's *Community Profile*. For jurisdictions that lack existing planning mechanisms, especially smaller communities, the HMP may be used as a guide for future activity and development in the jurisdiction.

[136] Federal Emergency Management Agency. July 2020. "FEMA Region X Integrating the Local Natural Hazard Mitigation Plan into a Community's Comprehensive Plan." https://www.fema.gov/sites/default/files/2020-07/integrating-hazard-mitigation-local-plan.pdf

[137] Federal Emergency Management Agency. July 2015. "Plan Integration: Linking Local Planning Efforts." https://www.fema.gov/sites/default/files/2020-06/fema-plan-integration_7-1-2015.pdf

Section Seven: Community Profiles

Purpose of Community Profiles

Community Profiles contain information specific to jurisdictions participating in the Dallas County planning effort. Community Profiles were developed with the intention of highlighting each jurisdiction's unique characteristics that affect its risk to hazards. Community Profiles may serve as a reference of identified vulnerabilities and mitigation and strategic actions for a jurisdiction as they implement the mitigation plan. Information from individual jurisdictions was collected at public and one-on-one meetings and used to establish the plan. Community Profiles include the following elements:

- Local Planning Team
- Location and Geography
- Demographics
- Employment and Economics
- Housing
- Governance
- Capability Assessment
- Plan Integration
- Future Development Trends
- Community Lifelines
- Structural Inventory and Valuation
- Historical Occurrences
- Hazard Prioritization
- Mitigation Strategy
- Plan Maintenance

In addition, maps specific to each jurisdiction are included, such as jurisdiction identified critical facilities, flood-prone areas, and a future land use map (when available).

The hazard prioritization information, as provided by individual participants, varies due in large part to the extent of the geographical area, the jurisdiction's designated representatives (who were responsible for completing meeting worksheets), identification of hazards, and occurrence and risk of each hazard type.

The overall risk assessment for the identified hazard types represents the presence and vulnerability to each hazard type throughout the entire planning area. A discussion of certain hazards selected for each Community Profile was prioritized by the local planning team based on the identification of hazards of greatest concern, hazard history, and the jurisdiction's capabilities. The hazards not examined in depth for each community profile can be found in *Section Four: Risk Assessment*.