HARDIN COUNTY 2023

Hazard Mitigation Plan

PLAN DEVELOPED FOR
HARDIN COUNTY BY

JEO CONSULTING GROUP

Hazard Mitigation Planning Team

Name	Title	Jurisdiction
Thomas Craighton	Emergency Management Coordinator	Hardin County EMA
Dave McDaniel	Sheriff	Hardin County
Jessica Sheridan	Zoning Administrator	Hardin County
Renee McClellan	County Supervisor	Hardin County
Michael Nuss	Mayor	City of Ackley
Jeff Fiscus	Mayor	City of Alden
Julie Lycke	Mayor	City of Buckeye
David Dunn	Mayor	City of Eldora
Randy Smuck	Council Member	City of Hubbard
Michael Emerson	Mayor	City of Iowa Falls
Dennis Reece	Mayor	City of New Providence
Jessica Krause	Council Member	City of Radcliffe
Ben Krause	EMS	City of Radcliffe
Timothy Stearns	Mayor	City of Steamboat Rock
Cindy Clemons	Mayor	City of Union
Tom Bays	Representative	City of Union
***Becky Appleford**	Project Manager	JEO Consulting Group, Inc.
***Anthony Kohel**	Planner	JEO Consulting Group, Inc.
***Libbie Smith**	Planner Intern	JEO Consulting Group, Inc.

**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 Hardin 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).

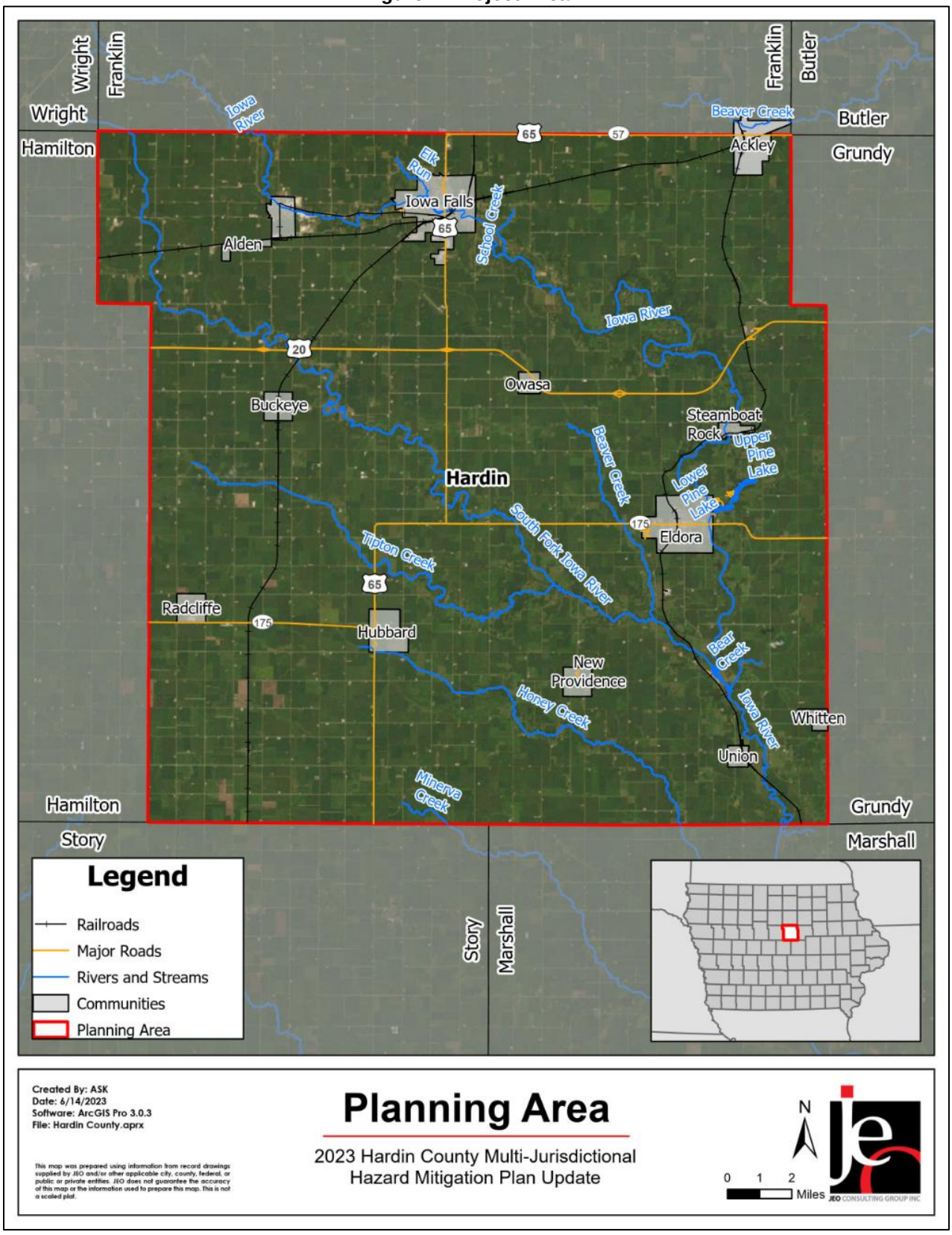
Hazard mitigation planning is a process in which hazards are identified and profiled; people and facilities at-risk are identified and assessed for threats and potential vulnerabilities; and strategies and mitigation measures are identified. Hazard mitigation planning increases the ability of communities 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	
Hardin County	City of Steamboat Rock
City of Ackley	City of Union
City of Alden	City of Whitten
City of Buckeye	AGWSR Community School District
City of Eldora	BCLUW Community School District
City of Hubbard	Ellsworth Community College
City of Iowa Falls	Iowa Falls and Alden Community Schools
City of New Providence	Providence Township Fire District
City of Radcliffe	South Hardin Community Schools

The City of Owasa did not participate in the HMP despite multiple outreach attempts and opportunities.

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 fourth goal was rephrased to include “minimize” at the beginning. The goals for this plan update are as follows:

1. Minimize losses to existing and future structures within hazard areas. Critical facilities and identified assets are high priority structures.

- Implement programs and projects that assist in protecting lives by making homes, businesses, essential facilities, critical infrastructure, and other property more resistant to losses from all hazards.
- Improve hazard assessment information to make recommendations for discouraging new development and encouraging preventive measures for existing development in areas vulnerable to all hazards.
- Protect life and property by implementing current standards, codes and construction procedures.

2. Protect the health and safety of Hardin County residents and visitors.

3. Educate Hardin County citizens about the dangers of hazards and how they can be prepared.

- Increase public awareness of existing threats and the means to reduce these threats by conducting educational and outreach programs to all the various community groups in the County.

4. Minimize significant disruptions to county and local operations from disasters in Hardin County

5. Promote countywide coordination, planning, and training to avoid transferring the risk from one community to a nearby community, where appropriate.

- Continue providing County and City emergency services with training and equipment to address all identified hazards.

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 Temperatures** (now includes extreme cold),
- **Flooding** (includes flash flooding and riverine flooding),
- **Hazardous Materials Release** (includes HAZMAT incident and pipeline transportation incident)
- **Severe Thunderstorms** (now includes hailstorms)
- **Severe Winter Storms** (now includes ice storm)
- **Terrorism and Civil Unrest** (now includes cyber-attack and civil unrest)
- **Transportation Incident** (includes highway transportation incident and railway transportation incident)

Other changes include the addition of Human Infectious Diseases and the removal of Structural Fire due to overlap with Grass/Wildfire as well as existing fire department outreach and education efforts to property owners. Energy Failure was also moved from being assessed as its own hazard to being assessed within each applicable hazard. Plan Maintenance sections are also being included 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. 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, emergency equipment upgrades, backup generators, sanitary sewer improvements, NOAA all-hazard radios, emergency operations center, and others. To build upon these prior successes and 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 community lifelines); 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 2: Regional Risk Assessment

Hazard	Previous Occurrences	Approximate Annual Probability*	Likely Extent
Animal and Plant Disease	Animal Disease: 1	N/A	Unknown
	Plant Disease: 8	Plant Disease 7/23 = 30%	Crop damage or loss
Dam Failure	0	Less than 1%	Varies by structure
Drought	446/1,539 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 8 days/year	83/131 = 63%	Max Temp ≤10°F
	Heat: Avg 1 day/year	83/131 = 63%	Max Temp ≥100°F
Flooding	57	16/27 =59%	Some inundation of structures. Some evacuations of people may be necessary.
Grass/Wildfire	58	12/15 = 80%	Avg 15 acres Some homes and structures threatened or at risk
Hazardous Materials Release	Fixed Site Spill: 29	16/33 = 48%	Avg Liquid Spill: 1,033 gal. Avg Gas Spill: 44 lbs.
	Transportation Spill: 6	6/52 = 12%	Avg Liquid Spill: 33 gallons
Human Infectious Diseases	5,084 Covid cases	N/A	N/A
Infrastructure Failure	Unknown	Unknown	Varies by event
Severe Thunderstorms	298	26/27= 96%	>1” rainfall Avg 66 mph winds
Severe Winter Storms	87	26/27 = 96%	1-16” snow 10-60 mph winds
Sinkhole	Unknown	Unknown	Varies by location/event
Terrorism and Civil Unrest	0	Less than 1%	Varies by event
	Tornadoes: 30	13/27 = 48%	Mode: EF0 Range: EF0-EF1

Hazard	Previous Occurrences	Approximate Annual Probability*	Likely Extent
Tornado and Windstorm	Windstorms: 38	20/27 = 74%	Avg: 54 mph Range 40-60 mph
Transportation Incident	Auto: 2,871	11/11 = 100%	Damages incurred to vehicles involved and traffic delays; substantial damages to aircrafts involved with some aircrafts destroyed
	Aviation: 23	19/62 = 31%	
	Rail: 73	18/48 = 38%	

** 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 3: Hazard Loss Estimates for the Planning Area

Hazard Type		Count	Property	Crop[1]
Animal and Plant Disease	Animal Disease[15]	1	N/A	N/A
	Plant Disease[1]	8	N/A	$43,747
Dam Failure[2]		0	-	-
Drought[3,6]		446/1,539 months	$12,650,000	$36,950,215
Earthquake[4]		0	-	-
Expansive Soils		Unknown	N/A	N/A
Extreme Temperatures[5]	Cold (Max Temp ≤10°F)	Avg 8 days per year	N/A	$18,198
	Heat (Max Temp ≥100°F)	Avg 1 day per year	N/A	$785,106
Flooding[6]	Flash Flood	19	$1,418,000	$491,378
	Flood	38	$1,953,570	
Grass/Wildfire[7]		58	N/A	-
Hazardous Materials Release	Fixed Site[8]	29	$0	N/A
	Transportation[9]	6	$41,677	N/A
Human Infectious Diseases[14] ***71 deaths (Covid)***		5,084 Covid cases	N/A	N/A
Infrastructure Failure		Unknown	N/A	N/A
Severe Thunderstorms[6]	Hail	105	$21,524,000	$54,324,341
	Heavy Rain	47	$125,000	
	Lightning	4	$133,000	
	Thunderstorm Wind	142	$3,850,000	
Severe Winter Storms[6]	Blizzard	25	$520,000	$1,778,072
	Heavy Snow	19	$96,450	
	Ice Storm	12	$303,330	
	Winter Storm	30	$525,900	
	Winter Weather	1	$0	

Hazard Type		Count	Property	Crop[1]
Sinkhole		Unknown	N/A	N/A
Terrorism and Civil Unrest[10]		0	-	-
Tornado and Windstorm[6]	Tornadoes: Mode: EF0 Range: EF0-EF1	30	$882,000	$29,000
	Windstorms: Average: 54 mph Range: 40-60 mph	38	$1,155,110	$15,757,998
Transportation Incident	Auto[11] *417 injuries, 30 deaths*	2,871	$19,701,723	N/A
	Aviation[12] *8 injuries, 2 deaths*	23	N/A	N/A
	Rail[13] *31 injuries, 9 deaths*	73	$272,052	N/A
Total		3,578	$65,151,812	$110,202,949

N/A: Data not available
1 USDA RMA, 2000 - 2022
2 IDNR Communication, 2023
3 NOAA, 1895 - March 2023
4 USGS, 1900 - May 2023
5 NOAA Regional Climate Center, 1939 - 2022
6 NCEI, 1996 - 2022
7 IDNR, 2008 - 2022
8 NRC, 1990 - 2022
9 PHMSA 1971 - April 2023
10 University of Maryland, 1970 - 2018
11 IDOT, 2012 - May 2023
12 NTSB, 1962 - May 2023
13 FRA, 1975 - 2022
14 The New York Times, as of 3/23/2023
15 IDALS, 2022

Events like severe thunderstorms, severe winter storms, and transportation incidents will occur annually. Other hazards like dam 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, flooding, 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 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.

Hardin 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 was authorized 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 adopt 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:** This program provides grant funds to implement projects such as acquisition or elevation of flood-prone homes. Jurisdictions must be participating communities in the National Flood Insurance Program (NFIP) to qualify for this grant. The goal of FMA is to reduce or eliminate claims under the NFIP.

- **BRIC:** This program replaced the Pre-Disaster Mitigation Program beginning in 2020 and provides funds on an annual allocation basis to local jurisdictions for implementing programs and projects to improve resiliency and local capacity before disaster events.

- **PDM:** The PDM grant program makes federal funds available to state, local, tribal, and territorial governments to implement measures designed to reduce the risk to individuals and property from future natural hazards. The Consolidated Appropriations Act of 2023 authorizes funding for 100 projects with total funds of $233,043,782 in 2023.

- **FMAG:** Section 404 of the Stafford Act allows FEMA to provide HMGP grants to any area that received a Fire Management Assistance Grant declaration even if no major Presidential declaration was made. FMAG aids communities in implementing long-term mitigation measures after a wildfire event.

For more information about these grant programs and other funding opportunities to help implement identified mitigation actions see *Appendix D: Hazard Mitigation Project Funding Guidebook*.

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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, Hardin 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:

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

(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

(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

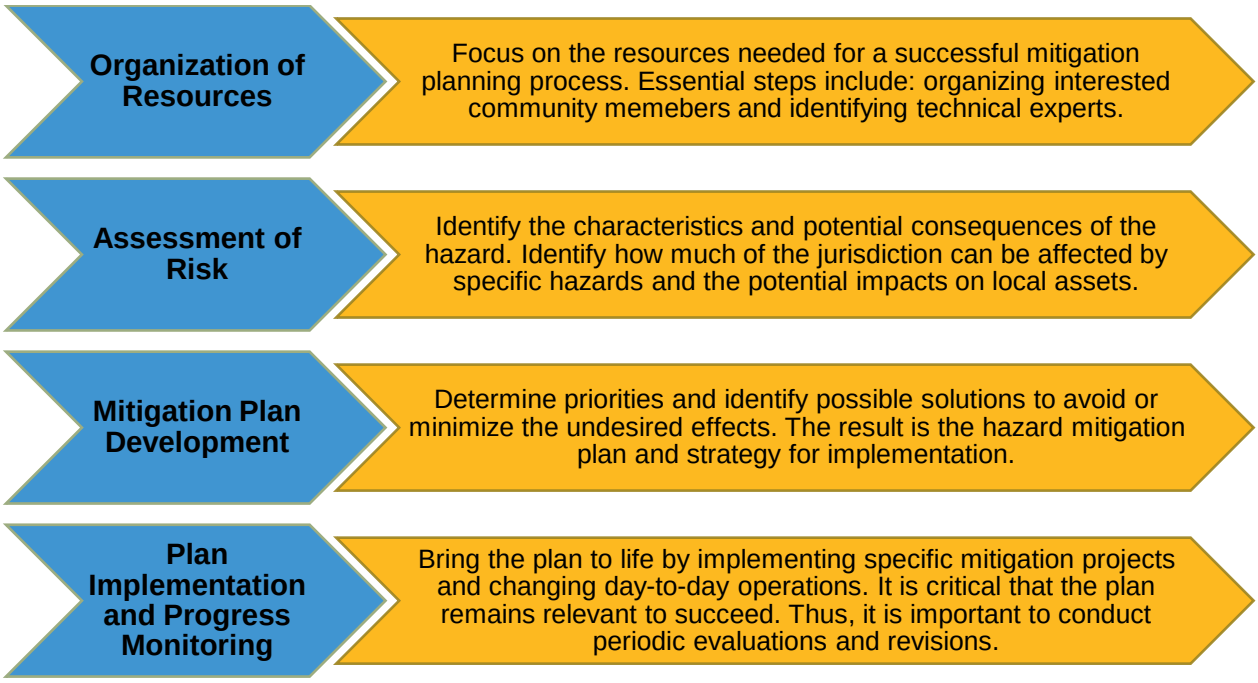
According to FEMA, “A multi-jurisdictional hazard mitigation plan is a plan jointly prepared by more than one jurisdiction.” The term ‘jurisdiction’ means ‘local government.’ Title 44 Part 201, Mitigation Planning in the CFR, defines a ‘local government’ as “any county, municipality, city, town, township, 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. Hardin County utilized the multi-jurisdiction planning process recommended by FEMA (Local Mitigation Planning Policy 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.



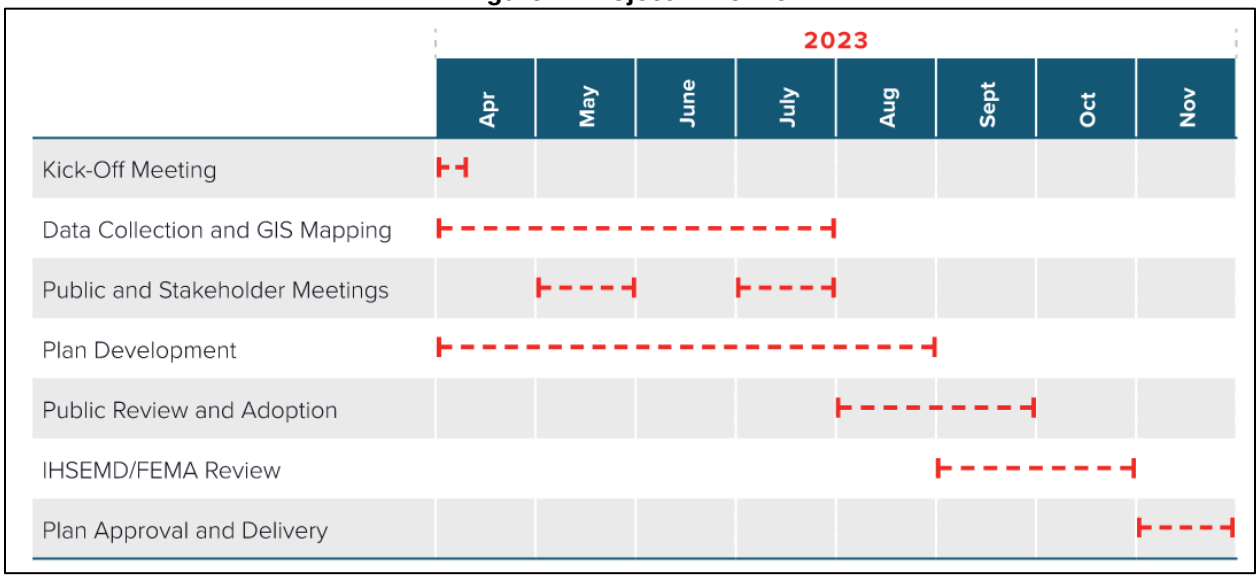
Organization of Resources

Plan Update Process

The Hardin County Emergency Management Agency funded this planning effort entirely through its general EMA budget. JEO Consulting Group, Inc. (JEO) was contracted in March 2023 to guide and facilitate the planning process and write and assemble the multi-jurisdictional hazard mitigation plan. For the planning area, Thomas Craighton with Hardin 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. April 19, 2022. "Local Mitigation Planning Policy Guide." https://www.fema.gov/sites/default/files/documents/fema_local-mitigation-planning-policy-guide_042022.pdf.
10 Federal Emergency Management Agency. May 2023. "Local Mitigation Planning Handbook." https://www.fema.gov/sites/default/files/documents/fema_local-mitigation-planning-handbook_052023.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, Hardin County Emergency Management and JEO staff identified who would comprise 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 4. Staff from IDNR provided additional technical support.

Table 4: Hazard Mitigation Planning Team

Name	Title	Jurisdiction
Thomas Craighton	Emergency Management Coordinator	Hardin County EMA
Dave McDaniel	Sheriff	Hardin County
Jessica Sheridan	Zoning Administrator	Hardin County
Renee McClellan	County Supervisor	Hardin County
Michael Nuss	Mayor	City of Ackley
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**Served in a consultant or advisory role.*

A kick-off meeting was held on April 11, 2023, 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 5 shows kick-off meeting attendees.

Table 5: Kick-off Meeting Attendees

Name	Title	Jurisdiction
Eldora, Iowa – Tuesday, April 11, 2023		
Thomas Craighton	Emergency Management Coordinator	Hardin County EMA
Dave McDaniel	Sheriff	Hardin County
Jessica Sheridan	Zoning Administrator	Hardin County
Dennis Reece	Mayor	New Providence
Becky Appleford	Project Manager	JEO Consulting Group, Inc.
Anthony Kohel	Planner	JEO Consulting Group, Inc.

Table 6 shows the date, location, and agenda items of for the kick-off meeting.

Table 6: Kick-off Meeting Location and Time

Location and Time	Agenda Items
Eldora, Iowa **April 11, 2023** **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

The 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. From May to August 2023, 46 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, 46 survey responses were collected, with all but one respondent 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 7.

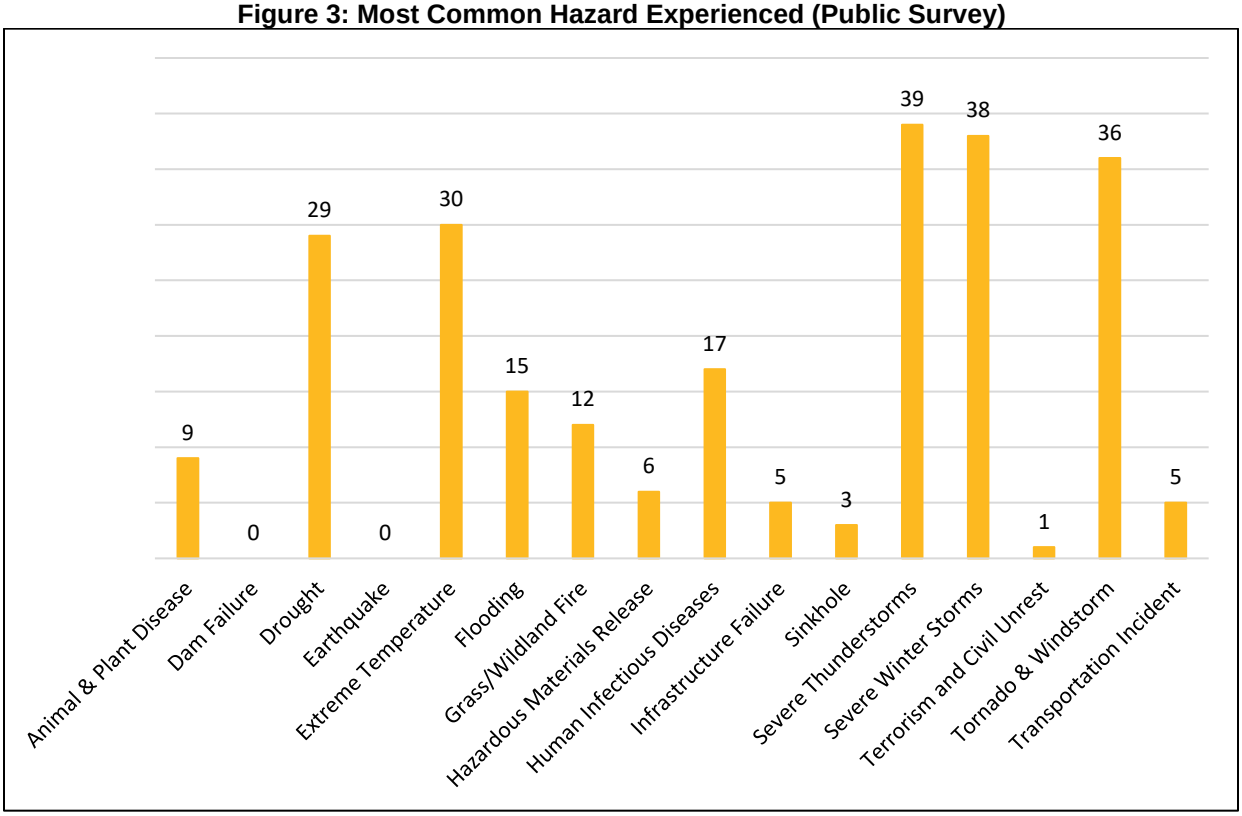
Table 7: Communities Represented in Public Survey

Communities Represented	
City of Ackley	City of Steamboat Rock
City of Alden	City of Union
City of Buckeye	City of Whitten
City of Eldora	Pleasant Township
City of Hubbard	Rural Hardin County
City of Iowa Falls	Unincorporated Hardin County/Hardin County Officials
City of New Providence	Webster City/Hamilton County

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. Sinkhole
14. Dam and Failure
15. Earthquake
16. Terrorism and Civil Unrest

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

In response to whether respondents had flood insurance, eight 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, flooding, and power outages from storm-related hazards; increased energy use, heat stroke/hypothermia, and broken pipes from Extreme Temperature; mass illness, deaths, poor mental health, and economic hardship from Human Infectious Diseases; and crop/plant loss and poor mental health from Drought.

Respondents indicated the best way to share information about preparing for a disaster is through emergency text alerts (24 votes), newsletters (6 votes), website/social media (5 votes), radio alerts (such as through NWS, 5 votes), and Hardin County Emergency management (3 votes). Other unique communication methods listed include local community websites and social events.

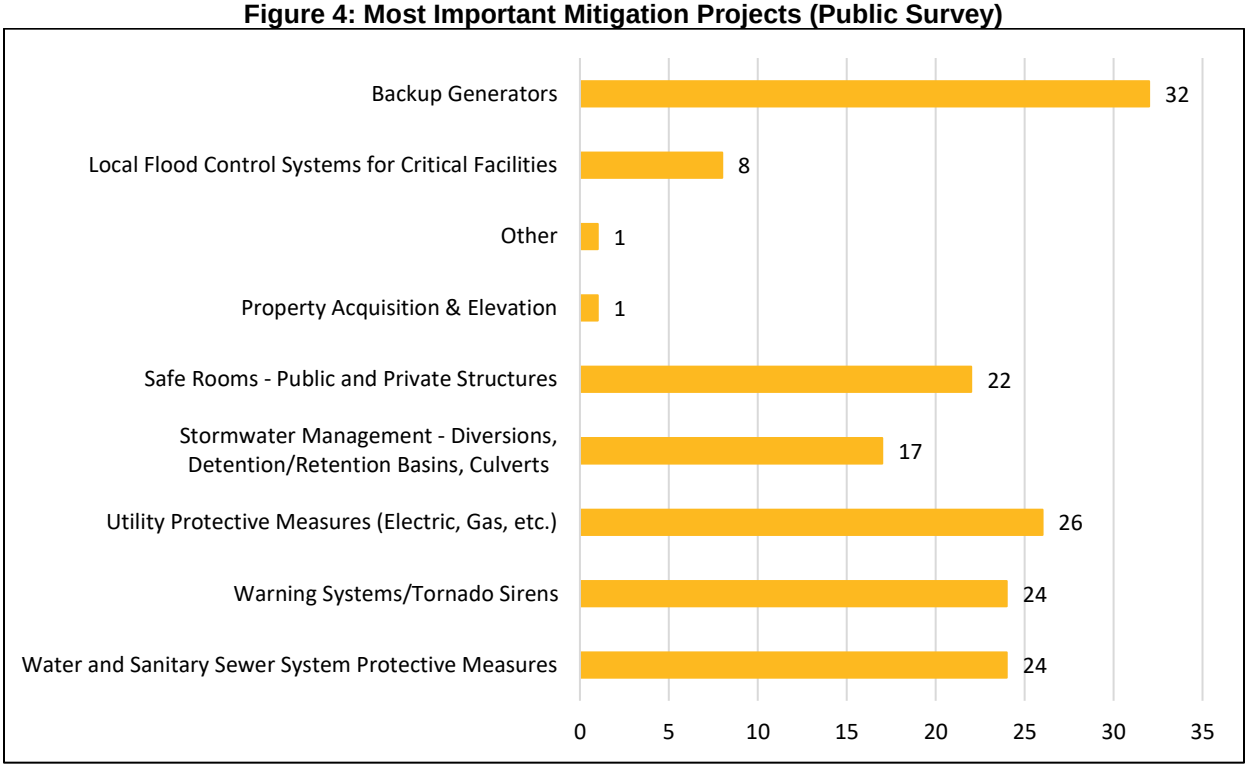
Oftentimes implemented mitigation actions are prioritized based upon need to mitigate risk, cost effectiveness, feasibility, and public support. To help identify overall local support for types of mitigation projects, respondents were asked to rank, from very important to neutral, mitigation action end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

Table 8: 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	43 (93%)	27 (59%)	15 (33%)	39 (85%)	15 (33%)
Somewhat Important	2 (4%)	15 (33%)	26 (57%)	5 (11%)	23 (50%)
Neutral	1 (2%)	4 (9%)	5 (11%)	2 (4%)	8 (17%)
	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	16 (35%)	8 (17%)	35 (76%)	37 (80%)	
Somewhat Important	26 (57%)	31 (67%)	10 (22%)	8 (17%)	
Neutral	4 (9%)	7 (15%)	1 (2%)	1 (2%)	

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 backup generators, utility protective measures (electric, gas, etc.), water and sanitary sewer system protective measures, 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 in the Community Profiles as applicable; however, common themes and responses are listed below.

- Improve alert sirens and hazard event notification systems for residents (e.g., text alerts and television).
- Improve natural stormwater retention methods by restoring the landscape and reducing runoff.
- Build, designate, and publicize emergency shelters.
- Increase local education efforts.
- Hold emergency exercises with the public.
- Add backup generators.
- Strengthen local power supplies and utility infrastructure.

Stakeholders

A wide range of stakeholder groups were also contacted and encouraged to participate. There were 29 stakeholder groups or entities that were identified and sent letters to participate (Table 9). Of the 29 invited, Hansen Family Hospital, Hardin County Extension, Honey Creek Land Improvement, Iowa HSEMD, Northern Natural Gas, RACOM, and Winfield United attended meetings. Any comments these stakeholders provided were incorporated into the appropriate community profiles (see *Section Seven*).

Table 9: Notified Stakeholder Groups

Organizations		
Ackley Development Commission	Iowa Department of Agriculture and Land Stewardship	McFarland Clinic - Iowa Falls
Ackley Medical Center (Department of Hansen Family Hospital)	Iowa Department of Transportation	Middle Cedar Watershed Management Authority
Ellsworth Family Medicine (Department of Hansen Family Hospital)	Iowa DNR	Northern Natural Gas
Hansen Family Hospital	Iowa Falls Area Development	Primary Health Care and Medical Clinic
Hardin County Conservation	Iowa Falls Clinic (Department of Hansen Family Hospital)	RACOM
Hardin County Extension Office	Iowa Falls Municipal Airport	UnityPoint Health
Honey Creek Land Improvement	Iowa Finance Authority	US Geological Survey - Central Midwest Water Science Center
Hubbard Medical Clinic	Iowa Flood Center	USDA Rural Development
HSEMD	Long Term Medical Supply	Winfield United
IIHR Hydroscience and Engineering	McFarland Clinic - Eldora	

Neighboring Jurisdictions

Neighboring jurisdictions were notified and invited to take part in the planning process. The following table indicates which neighboring entities were notified of the planning process. Invitation and informational letters were sent to county emergency managers. Grundy County and Marshall County were the only jurisdictions outside the planning area to take part in the planning process.

Table 10: Notified Neighboring Jurisdictions

Notified Neighboring Jurisdictions	
Butler County	Marshall County
Franklin County	Story County
Grundy County	Wright County
Hamilton 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 11 provides a summary of outreach activities utilized in this process.

Table 11: 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/hardincountyHMP).
Press Release	Shared with Hazard Mitigation 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 Hardin 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.

Notifying and engaging the public was conducted throughout the plan drafting process. All meeting dates, times, and locations were posted online on the project website. A press release about the process was shared on local social media sites and to local news outlets. Project flyers were shared with local planning team representatives and were posted at community hubs including local post offices, city hall buildings, local libraries, and coffee shops. A public survey was shared with the public to solicit feedback about concerns regarding hazards and to increase awareness of the HMP. Overall respondent results are summarized above. Specific concerns or comments can be found in Community Profiles, as appropriate. Letters and/or emails with pertinent information or meeting invitations were shared with all participants, neighboring jurisdictions, and stakeholder groups including vulnerable populations such as care facilities and schools. Participating jurisdictions also discussed and reviewed HMP materials at local council meetings which are open to the public.

Round 1 Meeting: Hazard Identification

At the Round 1 meeting, 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 12 shows the date and meeting location held for the Round 1 meeting phase of the project.

Table 12: Round 1 Meeting Date and Location

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**
Hardin County Emergency Operations Center Eldora, Iowa – 6:00 PM	Tuesday, May 16, 2023

The intent of this meeting 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: identify the top concerns from each jurisdiction; and to begin reviewing and updating community profiles for demographics, capabilities, and critical facilities. 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*).

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 13: Round 1 Meeting Attendees

Name	Title	Jurisdiction
Eldora, Iowa – Tuesday, May 16, 2023		
Thomas Craighton	Emergency Management Coordinator	Hardin County EMA
Dave McDaniel	Sheriff	Hardin County
Renee McClellan	County Supervisor	Hardin County
Deb Crosser	Economic Director	Hardin County
Michael Nuss	Mayor	City of Ackley
Jeff Fiscus	Mayor	City of Alden
Julie Lycke	Mayor	City of Buckeye
Heather Vierkandt	City Clerk	City of Buckeye
Michael Vierkandt	Fire Chief	City of Buckeye
David Dunn	Mayor	City of Eldora
Maile Carter	EMS Director	City of Eldora
Randy Smuck	Council Member	City of Hubbard
Jody Anderson	City Manager	City of Iowa Falls
Rod Hanson	Council Member	City of New Providence
James Nehring	Mayor	City of Owasa

Name	Title	Jurisdiction
Jessica Krause	Council Member	City of Radcliffe
Ben Krause	EMS	City of Radcliffe
April Eller	City Clerk	City of Radcliffe
Timothy Stearns	Mayor	City of Steamboat Rock
Erin Cross	Mayor	City of Whitten
Bobbi Finarty	Director	Hardin County Extension
Erik Smith	Superintendent	AGWSR School District
Adam Seward	Manager	Honey Creek Land Improvement
Barb Klein	Provost	Ellsworth Community College
Chase Babcock	Emergency Management Coordinator	Grundy County EMA
John Kahrs	Operations Manager	Northern Natural Gas
Marie Carlson	Business Development Manager	RACOM
Ernie Hokanson	Operations Manager	Winfield United
Jill Schaefer	Inpatient Director	Hansen Family Hospital
Becky Appleford	Project Manager	JEO Consulting Group, Inc.
Anthony Kohel	Planner	JEO Consulting Group, Inc.

Table 14: Round 1 Recorded Meeting Viewers

Name	Title	Jurisdiction
Cindy Clemons	Mayor	City of Union
Ben Petty	Superintendent	BCLUW School District
Adam Zellmer	Superintendent	South Hardin School District
Tony Neumann	Superintendent	Iowa Falls-Alden Schools
Slade Faris	Fire Chief	Providence Twp Fire District

Round 2 Meeting: Mitigation Strategies

The Round 2 meeting is designed to identify and prioritize mitigation measures, update previous mitigation actions from the 2018 HMP, 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 the Round 1 meeting, 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 15 shows the date and location of the Round 2 Meeting. Meeting attendees are identified in Table 16 and Table 17.

Table 15: Round 2 Meeting Date and Location

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**
Hardin County Emergency Operations Center Eldora, Iowa – 6:30 PM	Tuesday, July 18, 2023

Table 16: Round 2 Meeting Attendees

Name	Title	Jurisdiction
Eldora, Iowa – Tuesday, July 18, 2023		
Thomas Craighton	Emergency Management Coordinator	Hardin County EMA
Dave McDaniel	Sheriff	Hardin County
Renee McClellan	County Supervisor	Hardin County
Michael Nuss	Mayor	City of Ackley
Jeff Fiscus	Mayor	City of Alden
David Dunn	Mayor	City of Eldora
Maile Carter	EMS Director	City of Eldora
Randy Smuck	Council Member	City of Hubbard
Michael Emerson	Mayor	City of Iowa Falls
Josh Nelson	Police Chief	City of Iowa Falls
Rod Hanson	Council Member	City of New Providence
James Nehring	Mayor	City of Owasa
Jessica Krause	Council Member	City of Radcliffe
Ben Krause	EMS	City of Radcliffe
Timothy Stearns	Mayor	City of Steamboat Rock
Cindy Clemons	Mayor	City of Union
Tom Bays	Representative	City of Union
Lacy Hansen	City Clerk	City of Union
Scott Williams	Fire Chief (New)	Providence Twp Fire District
Kimberly Elder	Emergency Management Coordinator	Marshall County
Jack Stinogel	Hazard Mitigation Planner	HSEMD
Collette Linder	Community Planner	FEMA Region 7
Karl Dietrich	Planner	JEO Consulting Group, Inc.
Libbie Smith	Planning Intern	JEO Consulting Group, Inc.

Table 17: Round 2 Recorded Meeting Viewers

Name	Title	Jurisdiction
Julie Lycke	Mayor	City of Buckeye
Heather Vierkandt	City Clerk	City of Buckeye
Kristi Schiebel	City Clerk	City of Whitten
Erik Smith	Superintendent	AGWSR School District
Ben Petty	Superintendent	BCLUW School District
Adam Zellmer	Superintendent	South Hardin School District
Tony Neumann	Superintendent	Iowa Falls-Alden Schools
Barb Klein	Provost	Ellsworth Community College

Figure 5: Round 2 Meeting

Public Review

Once the HMP draft was completed, a public review period was opened to allow participants and community members at large to review the plan, provide comments, and request changes. The public review period was open from September 18, 2023, through October 1, 2023. 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/hardincountyHMP) for download. Jurisdictions and the public could provide comments via mail, email, or by using the comment box on the project website. Communities were encouraged to share or post information about the public review period to local websites and through local news media. A review of the comments and who they were from can be found below.

Table 18: Public Review Revisions

Plan Section	Name, Title, and/or Agency	Comment/Revision
Section 3: County Profile	Thomas Craighton, Emergency Management Coordinator, Hardin County EMA	Housing data correction
Section 7: Hubbard Profile	Marie Neubauer, City Clerk, City of Hubbard	Population data correction
Section 7: Iowa Falls Profile	Kaci Elkin, City Clerk, City of Iowa Falls	Governance data correction

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 implementing 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 cycle or less. 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, Hardin 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.

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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 Hardin County, which is located in central Iowa. The county covers 570 square miles and sits approximately 50 miles north of the City of Des Moines. There are twelve incorporated communities in the county, with the City of Eldora being the county seat. Figure 6 shows the county, incorporated communities, and location within the state. Hardin County resides mostly in the Des Moines Lobe landform region. A portion of the Southern Iowa Drift Plain lies within the county's southeast corner and a portion of the Iowan Surface lies in the northeast corner. 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 Iowa watershed regions cover Hardin County: the South Skunk, Upper Iowa, and Middle Cedar watersheds. Main waterways in the planning area include the Iowa River and the South Fork Iowa River. The county is also home to Pine Lake, located in east central Hardin County.

Climate

The average high temperature in Hardin County for the month of July is 83 degrees and the average low temperature for the month of January is 8 degrees. On average, Hardin County receives about 38 inches of rain and 33 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 19: Hardin County Climate

	Hardin County
July Normal High Temp	83.5 °F
January Normal Low Temp	8.4 °F
Annual Normal Precipitation	37.9 inches
Annual Normal Snowfall	33.2 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 April 2023. https://www.ncei.noaa.gov/access/us-climate-normals/.

Figure 6: Map of Project Area

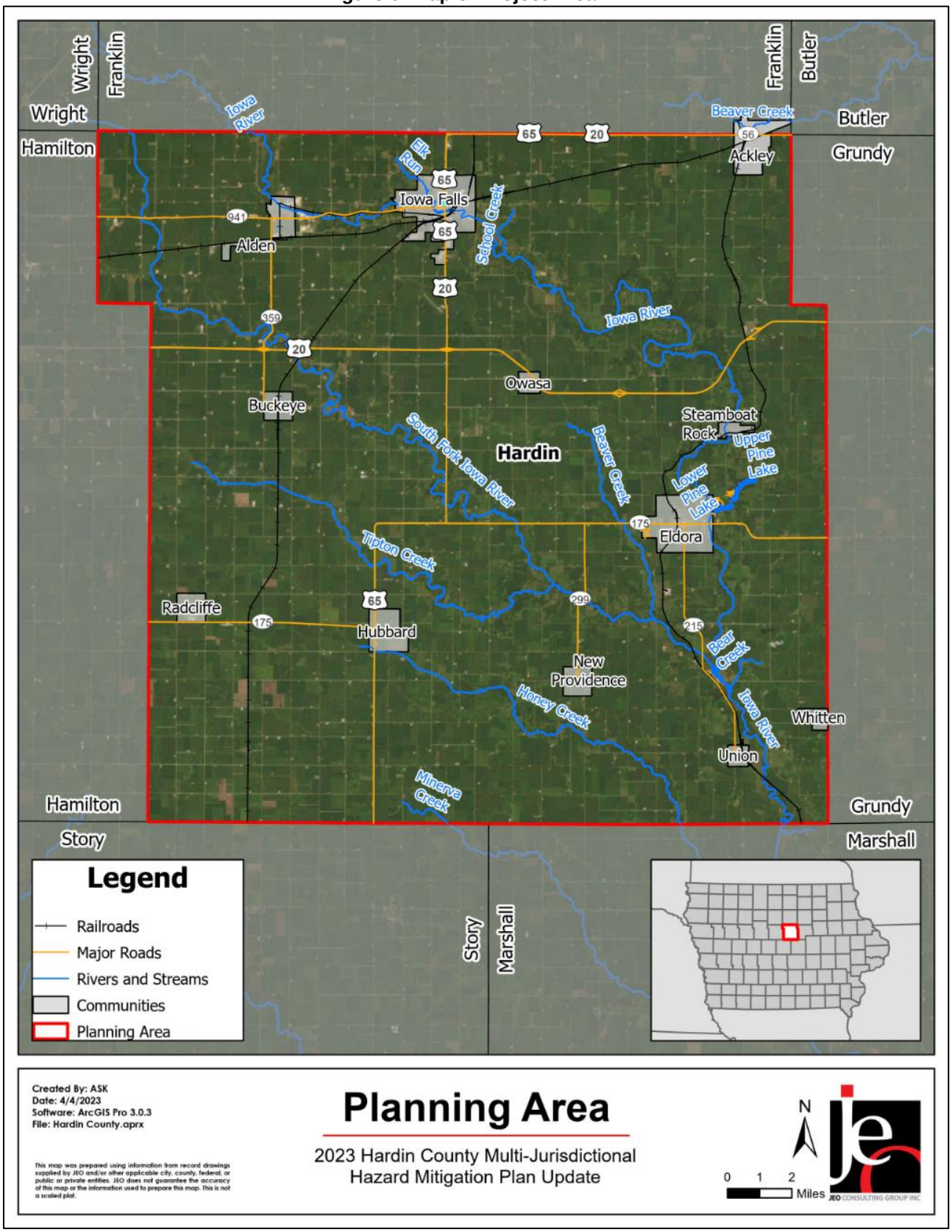
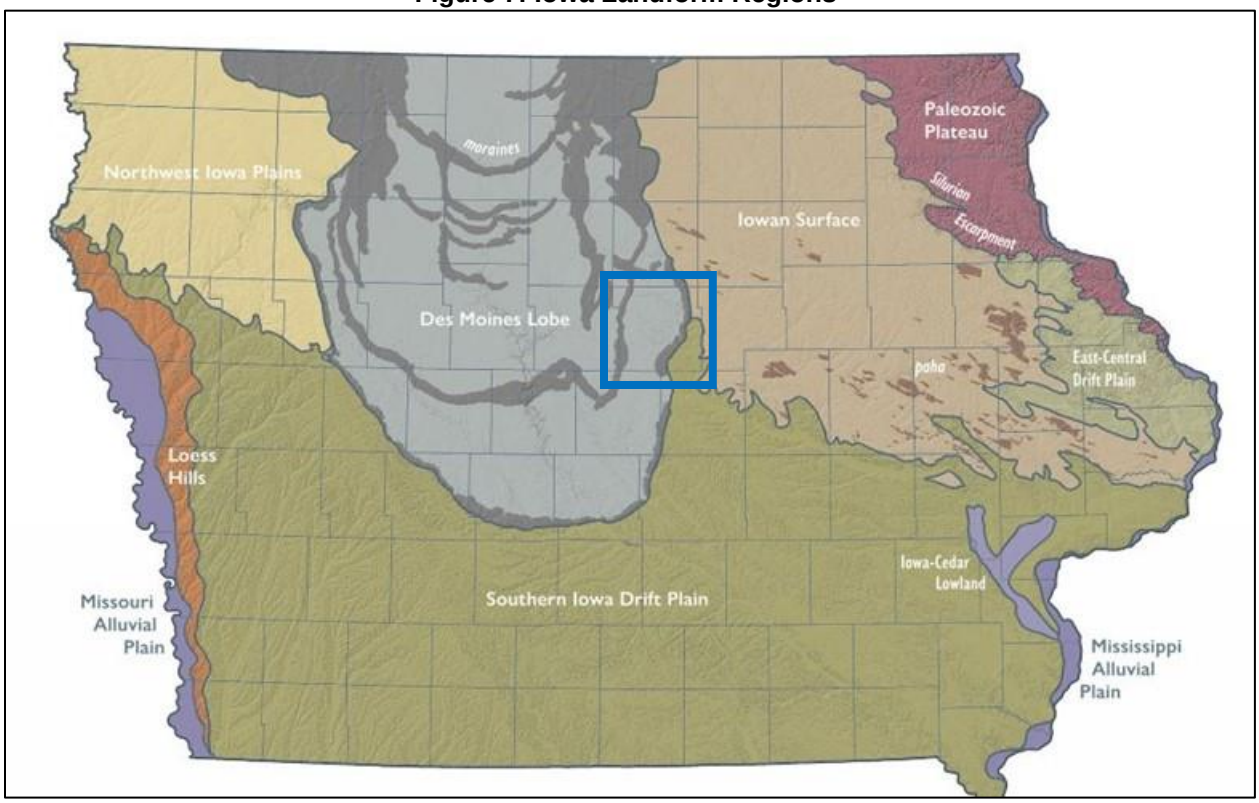


Figure 7: Iowa Landform Regions



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 human-caused disasters. The following figures depict the historical population of the county and the age cohort breakdown in 2021.[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. "2021 Census Bureau American Community Survey: S0101: Age and Sex." https://data.census.gov.

Figure 8: County Population 1860-2021

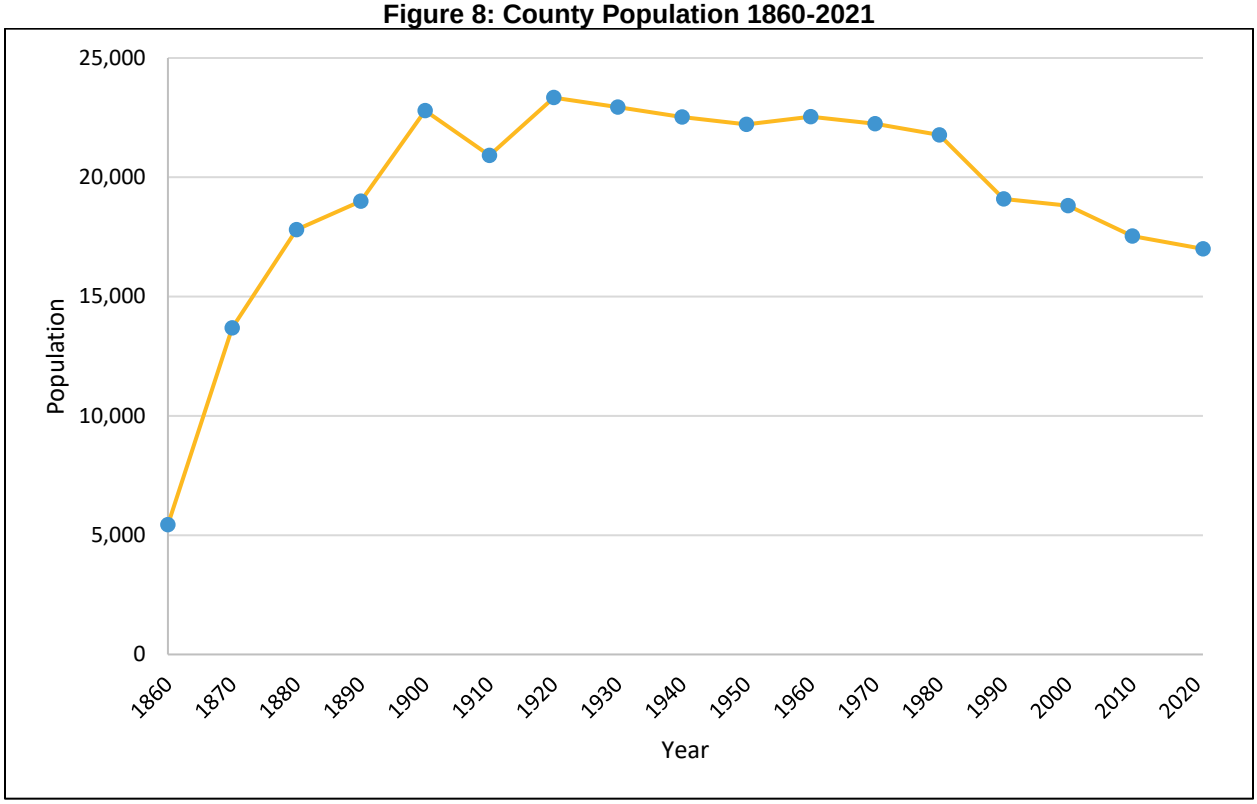
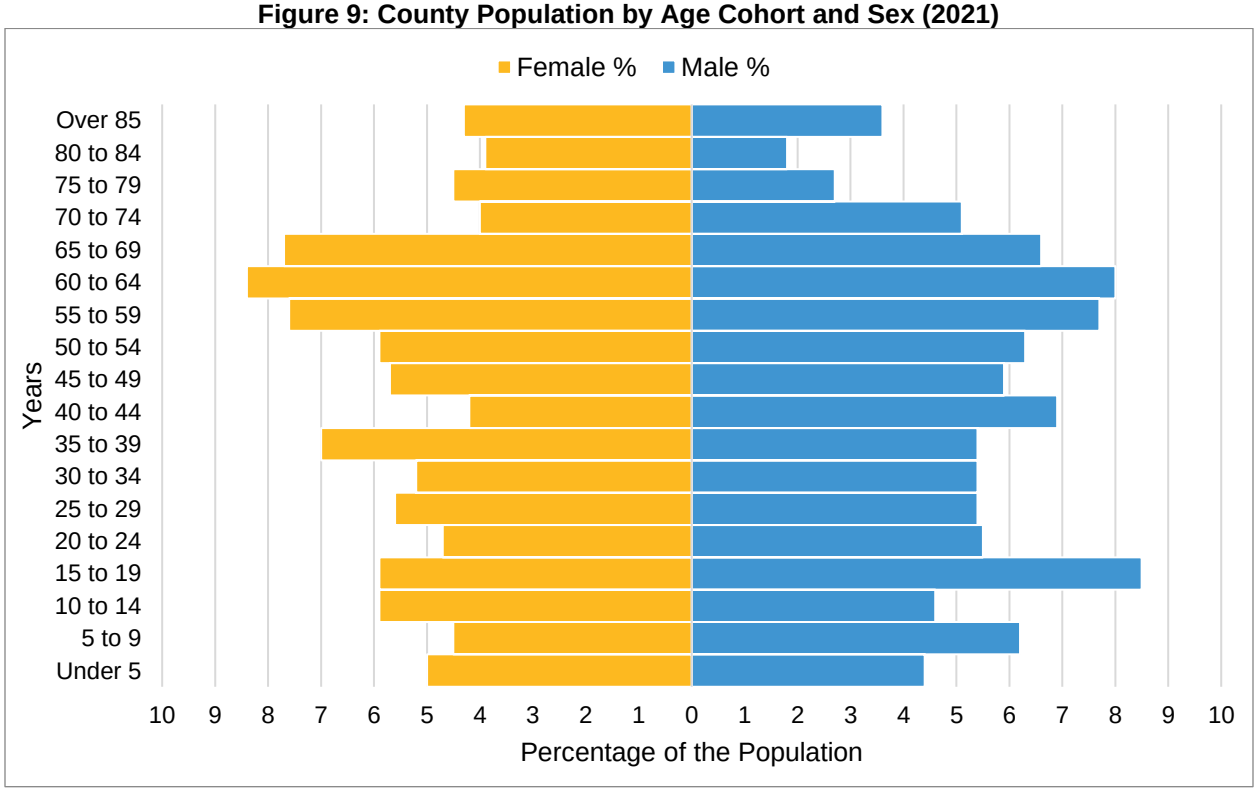


Figure 9: County Population by Age Cohort and Sex (2021)



Source: U.S. Census Bureau

Table 20: Population within the County (2021)

Jurisdiction	2010 Population	2021 Population (Estimate)
City of Ackley*	1,589	1,706
City of Alden	787	882
City of Buckeye	108	112
City of Eldora	2,732	2,673
City of Hubbard	845	745
City of Iowa Falls	5,238	5,154
City of New Providence	228	247
City of Owasa	43	17
City of Radcliffe	545	584
City of Steamboat Rock	310	251
City of Union	397	411
City of Whitten	149	128
Total	**17,534**	**16,997**

Source: U.S. Census Bureau
**Part of the City of Ackley is located outside of Hardin County*

The population for the county has decreased since the 2010 census (17,534 persons to 16,997 persons). That trend may continue as a higher percentage of individuals are over 40 years old. The median age for the county is 44.7 which is older than the State of Iowa at 38.3. The county accounts for approximately 0.5% of the total population for the state in 2021. Since 2010, half of the 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. On the other hand, a declining population can lead to more unoccupied and unmaintained housing that is then at risk to high winds and other hazards. Unoccupied housing may also be an economic indicator that future development is unlikely to occur. Furthermore, with fewer residents, tax revenue decreases, which could make implementing mitigation projects more fiscally challenging.

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 at risk;
- Outward appearance does not necessarily mark a person as at-risk; and
- 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 the 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 21: School Inventory

School District	Total Enrollment (2022-2023)	Total Teachers
AGWSR Community School District	650	57
Alden Community School District	159	13
BCLUW Community School District	506	46
Eldora-New Providence Community School District	540	48
Hubbard-Radcliffe Community School District	377	28
Iowa Falls Community School District	1,278	100

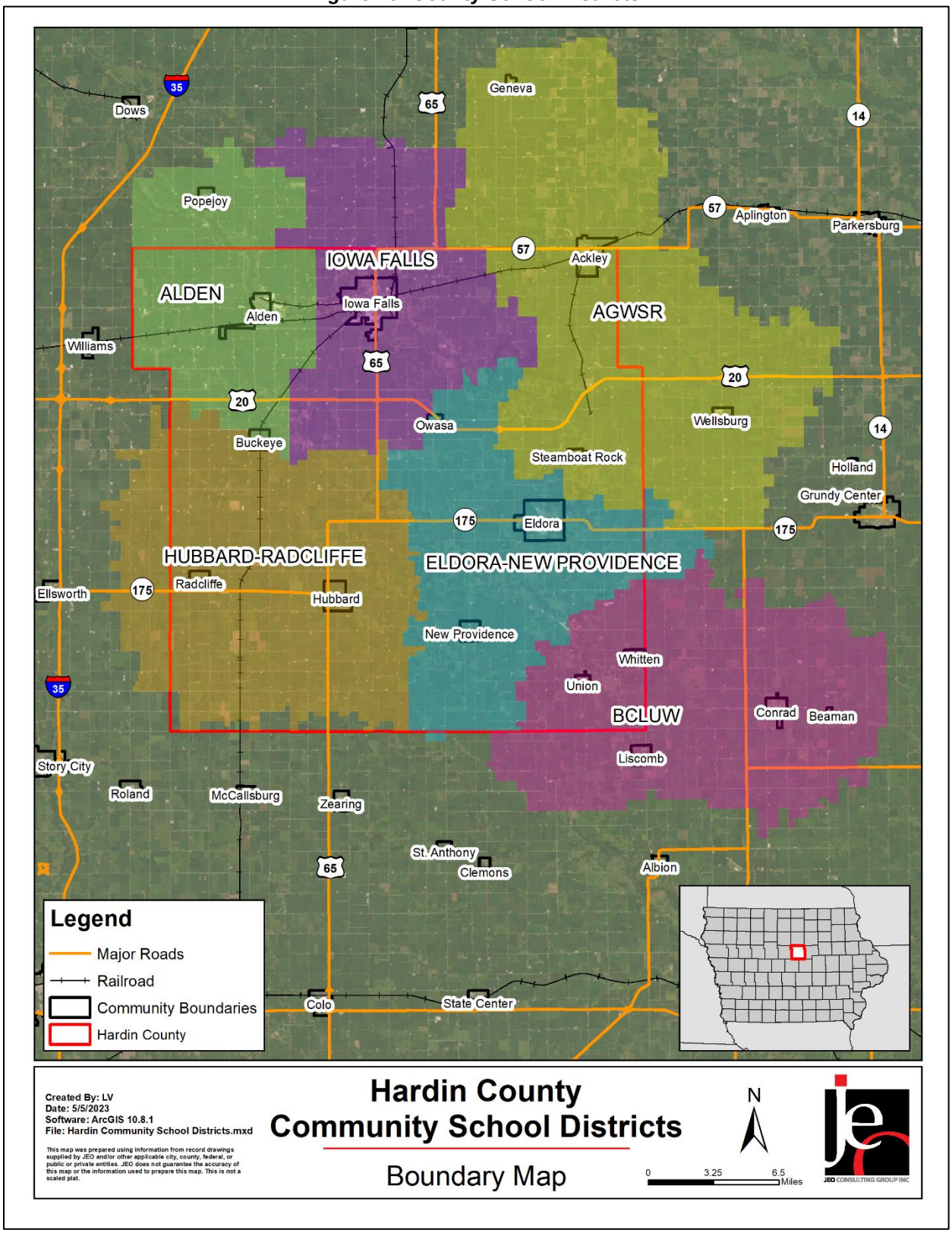
Source: Iowa Department of Education[19] [20]

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 District PreK-12 Enrollments by District, Grade, Race and Gender." Accessed May 2023. https://educateiowa.gov/data-reporting/education-statistics-pk-12.

20 Iowa Department of Education. "2022-2023 Iowa Public School and AEA Teacher and Teacher Leader Information." Accessed May 2023. https://educateiowa.gov/documents/2022-2023-iowa-public-school-and-aea-teacher-and-teacher-leader-information.

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.[21] 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.

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 22 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.

Table 22: ESL and Poverty At-Risk Populations

Percent that speak English as second language	People below poverty level
4.6%	**9%**

Source: U.S. Census Bureau[22] [23]

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

21 Center for Injury Research and Policy. January 2011. "Snow Shoveling Safety." Accessed July 2017. http://www.nationwidechildrens.org/cirp-snow-shoveling.

22 United States Census Bureau. "2021 American Community Survey: S1601: Language Spoken at Home." https://data.census.gov/cedsci/.

23 United States Census Bureau. "2021 American Community Survey: DP03: Selected Economic Characteristics." https://data.census.gov/.

diversity has increased since 2010, which could affect the county's vulnerability to hazards (Table 23).

Table 23: Racial Composition Trends

Race	2010		2021		% Change
	Number	% of Total	Number	% of Total	
White, Not Hispanic	16,799	95.8%	15,879	93.4%	-5.4%
Black	217	1.2%	193	1.1%	-11.1%
American Indian and Alaskan Native	42	0.2%	276	1.6%	+557%
Asian	79	0.5%	139	0.8%	+76%
Native Hawaiian and Other Pacific Islander	1	0.0%	7	0%	+600%
Other Races	205	1.2%	134	0.8%	-34.6%
Two or More Races	191	1.1%	369	2.2%	+93.2%
Total Population	**17,534**	-	**16,997**	-	-

Source: U.S. Census Bureau[24] [25]

Governance

The county's governmental structure impacts its capability to implement mitigation actions. Hardin 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
- County Auditor
- County Recorder
- County Engineer
- County Attorney
- County Conservation
- Public Health – Greenbelt Homecare
- Emergency Management and Homeland Security
- County Information Technology
- Properties Management Department
- County Drainage
- Veterans' Affairs Office
- Environmental Health and Zoning Department
- Economic Development

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

24 United States Census Bureau. "2010 Census Redistricting Data (Public Law 94-171): P1: Race." https://data.census.gov.

25 United States Census Bureau. "2021 Census Bureau American Community Survey: DP05: ACS Demographic and Housing Estimates." https://data.census.gov/.

planning and regulatory capability; administrative and technical capability; fiscal capability; educational and outreach capability; and overall capability to implement mitigation projects.

Table 24: Capability Assessment

Survey Components/Subcomponents		Yes/No
Planning & Regulatory Capability	Comprehensive Plan	Yes
	Capital Improvements Plan	Yes
	Economic Development Plan	Yes
	Emergency Operations Plan	Yes
	Floodplain Management Plan	No
	Storm Water Management Plan	Drainage Districts
	Zoning Ordinance	Yes
	Subdivision Regulation/Ordinance	Yes
	Floodplain Ordinance	Yes
	Building Codes	No
	Community Wildfire Protection Plan	No
	National Flood Insurance Program	Yes
	Community Rating System	No
	Other (if any)	
Administrative & Technical Capability	Planning Commission	Yes
	Floodplain Administration	Yes
	GIS Capabilities	Contracted
	Chief Building Official	Zoning Only
	Civil Engineering	Yes
	Local Staff Who Can Assess Community's Vulnerability to Hazards	Yes
	Grant Manager	Yes
	Mutual Aid Agreement	Yes
	Other (if any)	
Fiscal Capability	Capital Improvement Plan/ 1- & 6- Year Plan	Yes
	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 Permit Fees	Yes
	General Obligation Revenue or Special Tax Bonds	Yes
	Hospital GO Bond	Yes
Education & Outreach Capability	Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	No

Survey Components/Subcomponents		Yes/No
	Ex. CERT Teams, Red Cross, etc.	
	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	Yes
	StormReady Certification	No
	Active Threat Response	Yes

Table 25: Overall Capability

Overall Capability	Limited/Moderate/High
Financial resources to implement mitigation projects	Limited
Staff/expertise to implement projects	Limited
Community support to implement projects	Limited
Time to devote to hazard mitigation	Limited
Ability to expand and improve identified capabilities to achieve mitigation	Moderate

National Flood Insurance Program (NIFP)

Hardin County is a member of the NFIP, having joined on 8/3/2012. The county's Planning and Zoning Coordinator oversees the commitments and requirements of the NFIP, including enforcement of the local floodplain management regulations. The initial FIRM for the county was delineated on 6/19/2012 and the current effective map date is 6/19/2012, which was adopted on 6/20/2012 and incorporated into the county floodplain management regulations. As of September 30, 2022, the county has five NFIP policies in-force totaling $788,400 in coverage. The county does not currently have any repetitive loss or severe repetitive loss structures.

The county requires building permits for all buildings. During the approval process, it is determined whether the project is located in a floodplain. If so, the applicant is directed to apply for a floodplain development permit with the Iowa DNR. If it were discovered that development was happening in the floodplain without approval, the developer would be ordered to stop development until the appropriate permits were obtained. If no permits are allowed/approved, the land would be required to be returned to its original state. The planning team indicated that the county would continue to pursue good standing and involvement with the NFIP in the future.

After a flood event, the county implements substantial improvement and substantial damage provisions as outlined in FEMA's Substantial Improvement/Substantial Damage Desk Reference, which can be found here: https://www.fema.gov/sites/default/files/documents/fema_nfip_substantial-improvement-substantial-damage-desk-reference.pdf.

If the county has minimal capacity and substantial determinations are needed, state resources may be sought, or a contractor could be hired to assist.

Plan Integration

Hardin County has multiple 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 or how it contains hazard mitigation principles. When the county updates these planning mechanisms, the local planning team will review the hazard mitigation plan for opportunities to incorporate the goals and objectives, risk and vulnerability data, and mitigation actions into the plan update.

Grants and Funding

Hardin County's funds are sufficient to pursue new capital projects. A substantial portion of county funds is dedicated to moving an event center out of the floodplain and building a new facility. The amount of county funds has decreased in recent years due to state mandates on property taxes. The county budget currently includes a hazard mitigation project: flood mitigation through roads and bridges projects on an annual basis. In the last five years, the county applied for and was awarded grants for bike trails, conservation, a REAP grant, and Board of Health grants.

Capital Improvement Plans (2022)

The capital improvement plan outlines large purchases and projects that the county would like to pursue. Projects identified in the plan include storm water projects, upsizing of culverts and drainage structures, improving transportation routes for drainage, bridge improvements, installing emergency generators at critical facilities, constructing a new public works facility, improving an existing public works facility, and constructing a new community center. The capital improvement plan is updated regularly.

Comprehensive Plan (2012)

The comprehensive plan is designed to guide the future actions and growth of the county. The plan contains goals and objectives aimed at Safe Growth, limits density in areas adjacent to known hazardous areas, encourages infill development, and encourages preservation of open space in hazard-prone areas. The plan also integrates hazard mitigation by describing the flood hazard and identifying the critical facilities, vulnerable populations, and mitigation actions from the HMP. Currently there is no plan or timeline for the next update of the county's comprehensive plan.

Floodplain Regulations (2012), Zoning Ordinance (2012), and Subdivision Regulations (2012)

The county's floodplain regulations, zoning ordinance, and subdivision regulations outline where and how development should occur in the future. These documents discourage development in the floodplain, limit population density in the floodplain, prohibit filling of wetlands, discourage development near chemical storage sites, and restrict subdivision of land within or adjacent to the floodplain. There is no timeline to update any of these documents.

Economics and Employment

The following table indicates that median household income and per capita income for the county is lower than the State of Iowa. Median home value and rent are also both lower than the rest of the state. Areas with relatively low economic indicators may influence a county's level of resilience during hazardous events.

Table 26: Housing and Income

	Hardin County	State of Iowa
Median Household Income	$58,845	$65,429
Per Capita Income	$29,347	$34,817
Median Home Value	$97,200	$160,700
Median Rent	$706	$845

Source: U.S. Census Bureau[26,27]

Approximately 50% of residents in Hardin County travel less than 15 minutes to work, while 22% travel more than 30 minutes, suggesting many residents live and work in close proximity. Major employers in the county include:

- Cargill
- Seaboard
- Pine Lake Processors
- POET
- Winfield
- Green Products
- IAS
- AgVantage FS
- J&T Transportation
- Hansen Family Hospital
- Fortera
- CTI
- Ellsworth College
- Summit Farms
- Iowa Select
- Martin-Marietta
- Walmart
- Gehrke
- Iowa State Training School
- Juvenile Detention Center
- Hardin County
- Heart of Iowa

According to 2021 Business Patterns Census Data, Hardin County had 513 business establishments. The following table presents the number of businesses, number of paid employees, and the annual payroll in thousands of dollars.

26 United States Census Bureau. "2021 Census Bureau American Community Survey: DP03: Selected Economic Characteristics." https://data.census.gov/.

27 United States Census Bureau. "2021 Census Bureau American Community Survey: DP04: Selected Housing Characteristics." https://data.census.gov/.

Table 27: Business in Hardin County

	Total Businesses	Number of Paid Employees	Annual Payroll (in thousands)
Total For All Sectors	513	4,784	$209,556

Source: U.S Census Bureau [28]

Agriculture is a main staple of Iowa's economy. Hardin County's 837 farms cover 336,611 acres of land, which is about 92% of the county's total area. Crop and livestock production are the visible parts of the agricultural economy, but many related businesses contribute to agriculture by producing, processing, and marketing farm products. These businesses generate income, employment, and economic activity throughout the region.

Table 28: Agricultural Inventory

	Agricultural Inventory
Number of Farms with Harvested Cropland	837
Acres of Harvested Cropland	336,611

Source: USDA Census of Agriculture, 2017 [29]

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; housing units with no vehicles, and broadband access.

Table 29: Selected Housing Characteristics

	Hardin County
Occupied Housing Units	7,033 (87.1%)
Lacking Complete Plumbing Facilities	0.4%
Lacking Complete Kitchen Facilities	2.2%
No Telephone Service Available	1.4%
No Vehicles Available	5.5%
Mobile Homes	2.4%
Broadband Access	77%

Source: U.S. Census Bureau[30]

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

28 United States Census Bureau. "2021 County Business Patterns." https://data.census.gov/.
29 United States Department of Agriculture. "2017 Census of Agriculture." https://www.nass.usda.gov/Publications/AgCensus/2017/.
30 United States Census Bureau. "2021 Census Bureau American Community Survey: DP04: Selected Housing Characteristics." https://data.census.gov.

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.

Internet or broadband access—through Wi-Fi or cellphone coverage—is a critical means of sharing and receiving information regarding hazardous events, including storm warnings, evacuation orders, or weather updates. Rural communities often lack adequate internet or broadband access. However, internet access is as vital a utility as electricity, as seen through the COVID-19 pandemic when many people worked or attended school from home. 77% of households in the county have a broadband internet subscription. Hardin County has a smaller share of households with broadband (77%) compared to the state (84.9%).[31]

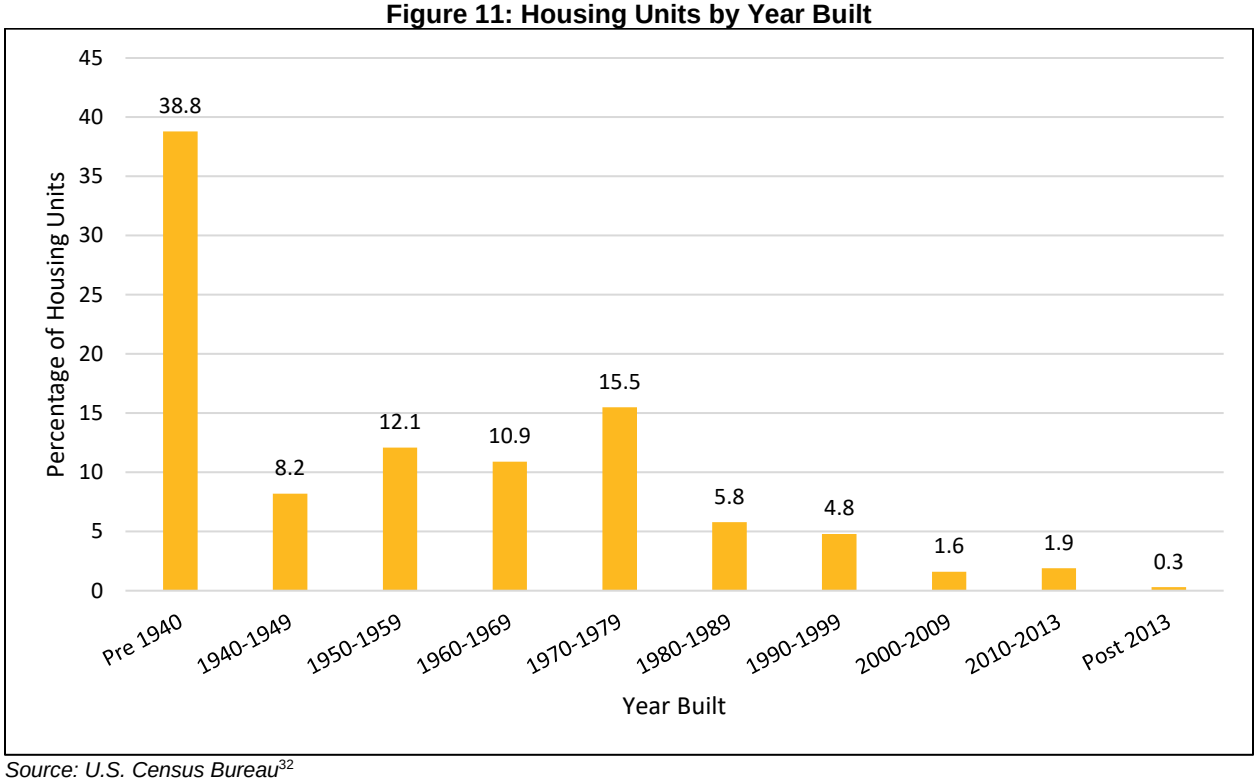
About two percent of housing units in the county are mobile homes. Mobile homes have a higher risk of sustaining damages during high wind events, tornadoes, severe thunderstorms, and severe winter storms. Mobile homes that are either not anchored or are anchored incorrectly can be overturned by 60 mph winds. A thunderstorm is classified as severe when wind speeds exceed 58 mph, placing improperly anchored mobile homes at risk.

Almost thirteen 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, about five 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 prior to 1970 (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.

31 United States Census Bureau. “2021 Census Bureau American Community Survey: DP02: Selected Social Characteristics in the United States.” https://data.census.gov/.

Figure 11: Housing Units by Year Built



Source: U.S. Census Bureau[32]

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 Table 30. Several structures in unincorporated Hardin County have been removed from the floodplain via LOMA. A summary of LOMAs can be found in Table 31.

Table 30: Assessed Parcels and Value in the 1% Annual Flood Risk Area

Number of Parcels	Number of Improvements	Total Improvement Value	Number of Improvements in Floodplain	Value of Improvements in Floodplain
21,593	9,089	$1,047,885,580	$1,047	$144,213,010

Source: County Assessor, 2023

Table 31: County Flood Map Products

Type of Product	Product ID	Effective Date	Details
LOMA	13-07-0824A-190874	02/28/2013	Structures (Quonset Hut and Finisher) removed from SFHA
LOMA	13-07-1242A-190874	04/18/2013	Structure (residence) outside of SFHA
LOMR	12-07-3261P-190874	06/20/2013	Decrease in Zone A and increase in Zone X

32 United States Census Bureau. "2021 Census Bureau American Community Survey: DP04: Selected Housing Characteristics." https://data.census.gov.

Type of Product	Product ID	Effective Date	Details
			(unshaded) along the Iowa River
LOMA	14-07-1839A-190874	07/01/2014	Portion of property removed from SFHA
LOMA	15-07-0593A-190874	02/05/2015	Structure (shed) removed from SFHA
LOMA	15-07-0977A-190874	04/02/2015	Structure removed from SFHA
LOMA	15-07-0999A-190874	04/03/2015	Structure (residence) removed from SFHA
LOMA	15-07-1842A-190874	08/06/2015	Portion of property removed from SFHA
LOMA	16-07-2046A-190874	09/26/2016	Structure removed from SFHA
LOMA	17-07-2259A-190874	09/13/2017	Portion of property removed from SFHA

Source: FEMA Flood Map Service Center[33]

Future Development Trends

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

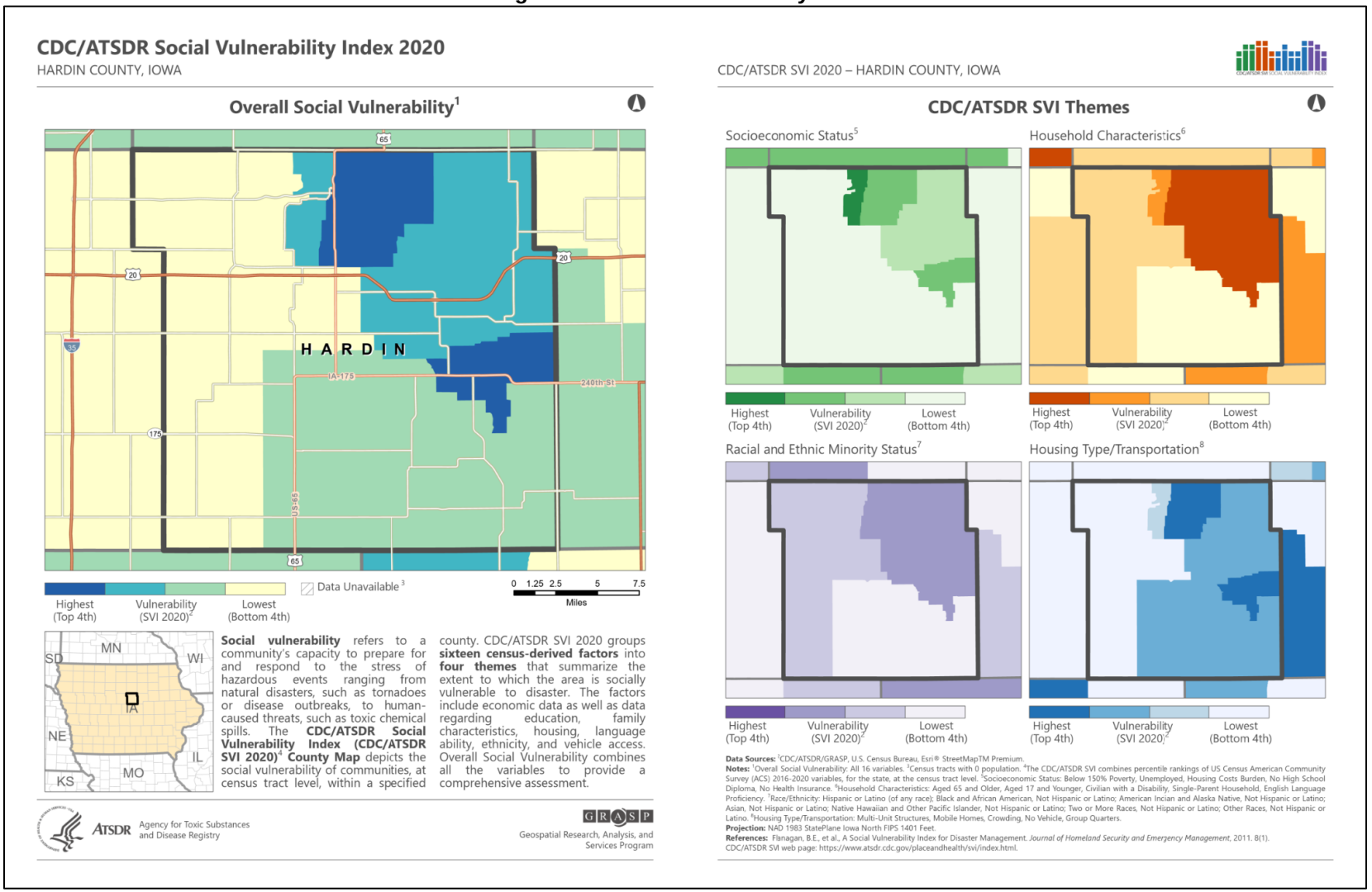
The county planning team indicated that a few developments or changes have occurred in recent years. J&T Transportation built new and expanded facilities in Hubbard. Rivers Edge Trail was established and continues to expand, and roads and bridges are built up each year with ditch clean-out. No new structures were built in hazardous areas within unincorporated Hardin County. There are new developments anticipated for the next five years; however, some are in negotiation and planning. The MiningStore.com is building a facility and the Tiling Company is expanding in Iowa Falls. An agriculture business also has plans for a development. CO2 pipelines are planned in two areas within the county as well.

Social Vulnerability Index

All communities have some vulnerability to natural and human-caused 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 Hardin County.

33 Federal Emergency Management Agency. 2023. "FEMA Flood Map Service Center." Accessed June 2023. https://msc.fema.gov/portal/home.

Figure 12: Social Vulnerability Index



Source: CDC Social Vulnerability Index, 2020[34]

34 Centers for Disease Control Social Vulnerability Index. 2020. "CDC's Social Vulnerability Index (SVI): County Map" https://svi.cdc.gov/prepared-county-maps.html.

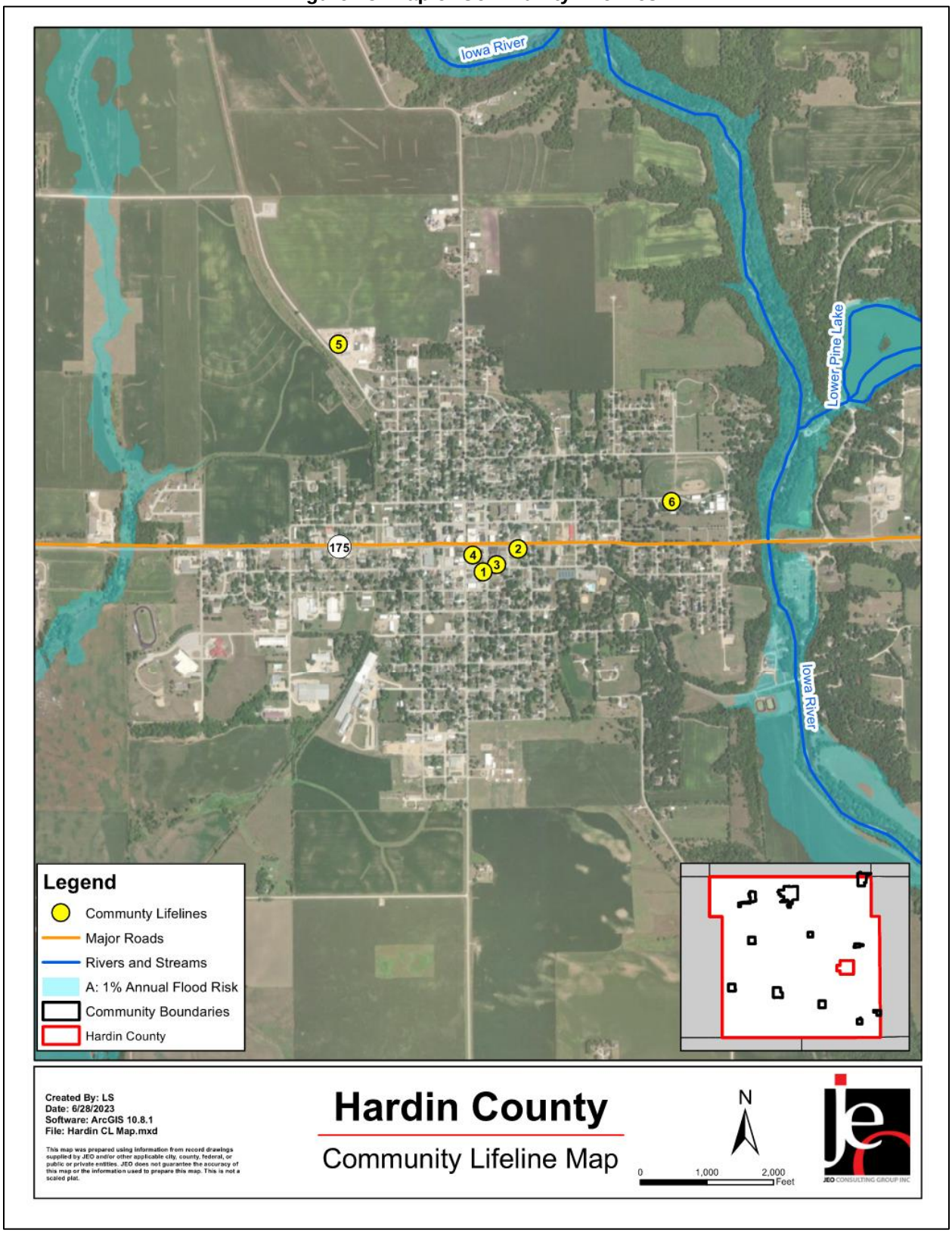
Community Lifelines

Each participating jurisdiction identified community lifelines that are vital for disaster response and essential for returning the jurisdiction's functions to normal during and after a disaster per the FEMA Community Lifelines guidance. The FEMA-recognized lifelines include: Safety and Security; Food, Water, and Shelter; Health and Medical; Energy; Communication; Transportation; and Hazardous Material facilities.

Table 32: Community Lifelines

CL#	Name	Lifeline Type	Generator (G) Shelter (S)	Floodplain (Y/N)
1	Hardin County Office Building	Safety and Security	G	N
2	Hardin County Emergency Management	Safety and Security	G, S	N
3	Hardin County Sheriff	Safety and Security	G	N
4	Hardin County Courthouse	Safety and Security	G	N
5	Hardin County Shop	Safety and Security	-	N
6	Youth Building and Community Building - Fairgrounds	Food, Water, and Shelter	S	N

Figure 13: Map of Community Lifelines



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. Hardin County's major transportation corridors include US Highways 20 and 65, and State Highways US Highways 6 and 169, and State Highway 175. The most traveled route Highway 20, with an average of 9,800 vehicles daily.[35] A few railroad lines travel through the county. A Union Pacific line runs north-south through the county, with an additional segment near Iowa Falls. A Canadian National line runs east-west through the northern part of the county and an Iowa River Railroad spur runs in the northeast corner of the county, extending south from Ackley.[36] Three public-use airports also operate in the county: Ackley Municipal, Iowa Falls Municipal and Eldora Airport (privately-owned, but open to the public).[37] The planning team noted that a significant transportation incident occurred in the county involving the rollover of a livestock trailer. The rollover occurred on Highway 20 and 200 hogs were involved.

35 Iowa Department of Transportation. 2021. "Iowa Traffic Data". Accessed May 2023. https://iowadot.maps.arcgis.com/apps/MapSeries/index.html?appid=0cce99afb78e4d3b9b24f8263717f910.

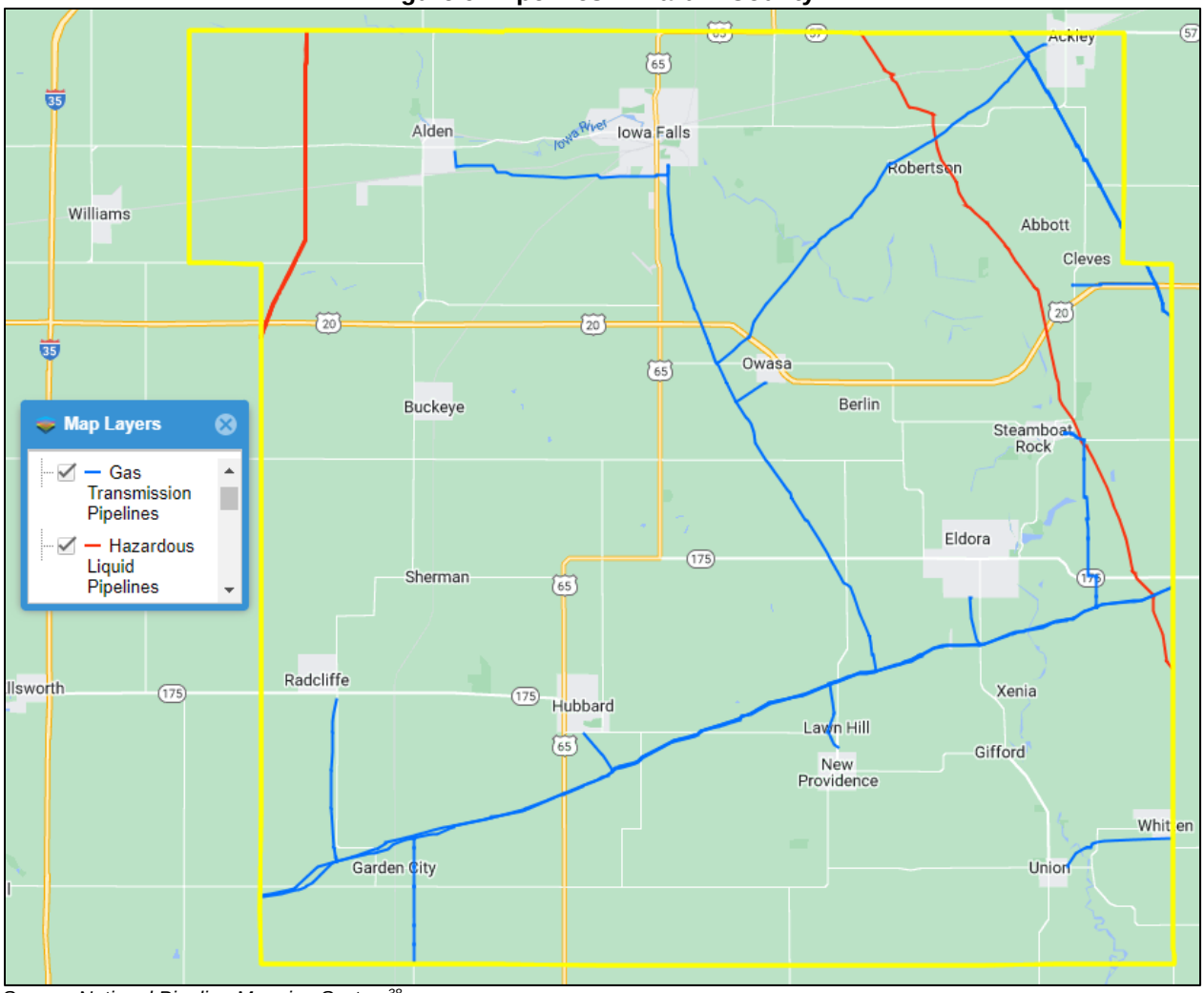
36 Iowa Department of Transportation. 2021. "Iowa Railroads." Accessed May 2023. https://iowadot.gov/iowarail/railroads/maps/basemap.pdf.

37 Iowa Department of Transportation. 2021. "Public Use Airports in Iowa". Accessed May 2023. https://iowadot.gov/aviation/airport-information.

Hazardous Materials

The Hazardous Materials Lifeline includes chemical storage facilities, pipelines, and transported chemical tanks. There are several gas transmission and hazardous liquid pipelines that travel through the county and can be seen on the figure below.

Figure 9: Pipelines in Hardin County



Source: National Pipeline Mapping System[38]

[38] National Pipeline Mapping System. 2023. "Public Viewer." Accessed April 2023. https://pvnpms.phmsa.dot.gov/PublicViewer/.

According to the Tier II System reports submitted to the Iowa Department of Natural Resources, there are 41 chemical storage sites within Hardin County which house hazardous materials (listed in Table 33. The planning team noted a few significant hazardous materials incidents that occurred in the county, including a fire at the AgVantage warehouse in Eldora, an underground storage leak at AgVantage Fuel in Eldora, and a leak at a Northern Natural Gas substation southeast of Hubbard.

Table 33: Chemical Storage Lifelines

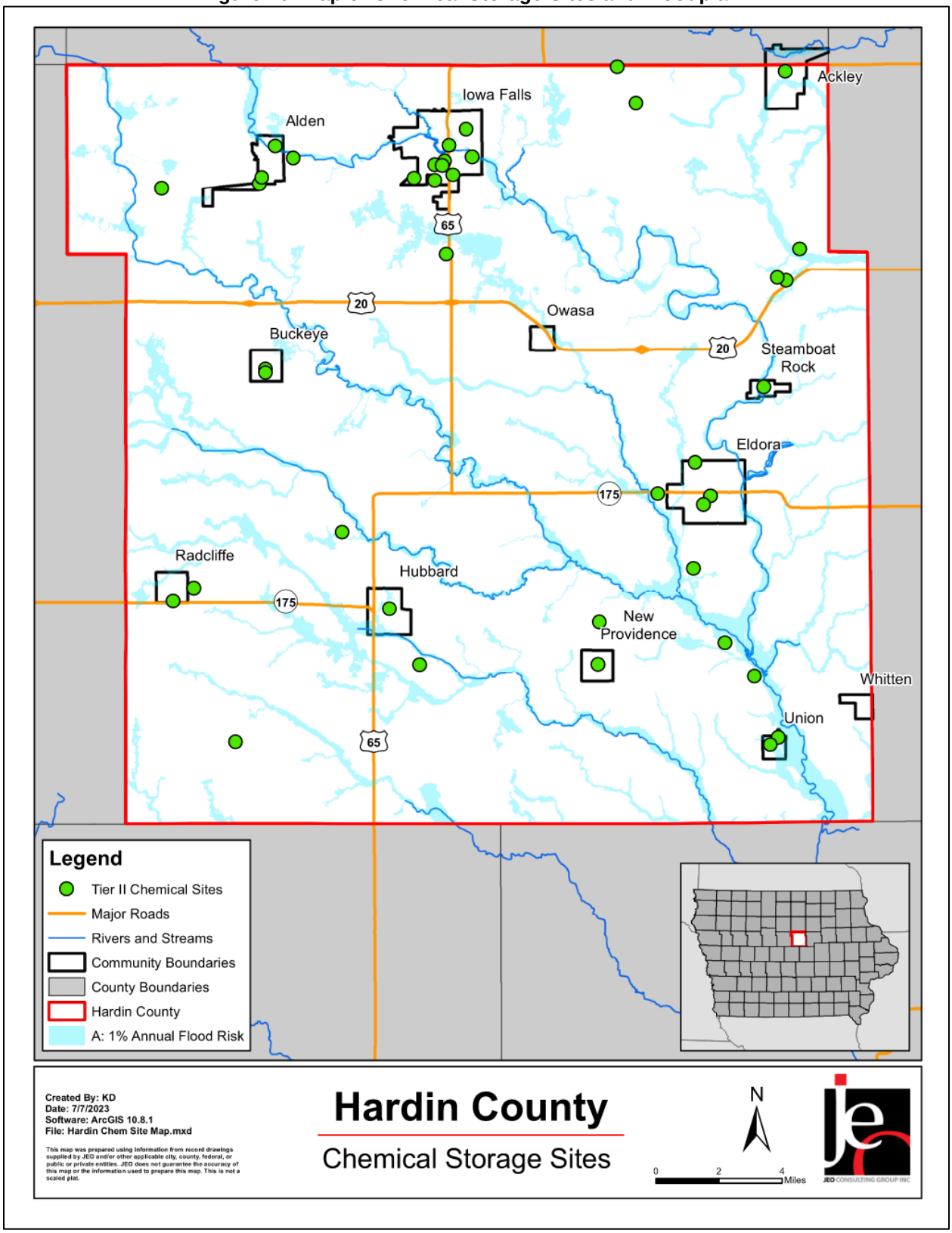
Facility Name	Address
AT&T - IA4660	24762 I Ave, Hubbard, IA
CenturyLink - Iowa Falls CO	403 Estes Street, Iowa Falls, IA
CenturyLink - Ackley CDO	305 Mitchel Street, Ackley, IA
Iowa Limestone Company Resources	800 River Drive, Alden, IA
Naturally Recycled Proteins of Iowa LLC	33460 170th Street, Steamboat Rock, IA
Animal Health International	1500 Riverside Drive, Iowa Falls, IA
Winfield United - Eldora	30473 260th Street, Eldora, IA
Steamboat Rock CO - Heart of Iowa Communications Cooperative	507 Market Street, Steamboat Rock, IA
Union CO - Heart of Iowa Communications Cooperative	506 Main Street, Union, IA
New Providence CO - Heart of Iowa Communications Cooperative	305 1/2 N Main Avenue, New Providence, IA
Eldora CO - Heart of Iowa Communications Cooperative	1426 14th Street, Eldora, IA
Farmers Cooperative Elevator - Radcliffe	109 Isabella Street, Radcliffe, IA
New Century FS Buckeye	402 Market Street, Buckeye, IA
Winfield United - Iowa Falls	1120 Commercial St, Iowa Falls, IA
Innovative Ag Services - Hubbard Bulk Fuels	115 E Oak St, Hubbard, IA
Innovative Ag Services - Lawn Hill	27654 County Hwy S. 55, New Providence, IA
MCI- ALDEIA (VZB- IAALDEIA)	12979 140th St, Alden, IA
Innovative Ag Services - Cleves	33181 159th Street, Ackley, IA
Innovative Ag Services - Garden City	31578 Highway S27, Garden City, IA
Innovative Ag Services - Alden	13600 Hwy S-27, Alden, IA
Innovative Ag Services - Union	302 East Street, Union, IA
Northern Natural Gas - Hubbard Compressor Station	21497 290 Street, Hubbard, IA
Mathy Construction Co. Plant 92	17487 Country Road D20,

Facility Name	Address
	Alden, IA
Concrete Inc--Iowa Falls	1033 Westview Drive, Iowa Falls, IA
Concrete Inc--Gifford	28295 4th Avenue, Gifford, IA
Concrete Inc.--Ackley	104 14th Street, Ackley, IA
ITC Midwest Otter Creek	105 17th Street, Eldora, IA
ITC Midwest Iowa Falls Industrial	703 Industrial Park Road, Iowa Falls, IA
AgVantage FS, A Division of Growmark, Inc. - Union	29323 State Hwy 215, Gifford, IA
AgVantage FS, A Division of Growmark, Inc. - Ackley West	27354 State Hwy 57, Ackley, IA
AgVantage FS, A Division of Growmark, Inc. - Alden	13730 Hwy S27, Alden, IA
Landus Cooperative - Buckeye	201 Ellsworth Avenue, Buckeye, IA
Landus Cooperative - Macy	11277 Hwy S55, Ackley, IA
AgVantage FS, A Division of Growmark, Inc. - Eldora West Plant	29234 Hwy 175, Eldora, IA
Iowa Falls - Midwest Custom Ag Aviation	16041 Highway 65, Iowa Falls, IA
Forterra Concrete Products Inc - Iowa Falls	540 E Country Club Road, Iowa Falls, IA
Remington Seeds	1625 18th Avenue, Eldora, IA
Cargill Inc	602 Industrial Road, Iowa Falls, IA
Pine Lake Corn Processors	33371 170th Street, Steamboat Rock, IA
Iowa DOT Iowa Falls Maintenance Garage	1035 Industrial Park, Iowa Falls, IA
POET Biorefining - Iowa Falls, LLC	21050 140th Street, Iowa Falls, IA

Source: E-Plan[39]

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

Figure 10: Map of Chemical Storage Sites and Floodplain



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 34: State and Federally Owned Facilities and Lands

Site Name	Nearest Community
Pine Lake State Park	Eldora

Source: Iowa Department of Natural Resources,[40] [41] U.S National Park Service[42]

Historic Sites

According to the planning team and the National Register of Historic Places for Iowa by the National Park Service, there are 34 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 35: Historic Sites

Site Name	Date Listed	Nearest Community	In Floodplain?
Alden Bridge	5/15/1998	Alden	Yes
Alden Public Library	3/17/1981	Alden	No
Carnegie-Ellsworth Public Library	5/23/1983	Iowa Falls	No
Civilian Conservation Corps-Prisoner of War Recreation Hall	1/27/2012	Eldora	No
Edgewood School of Domestic Arts	4/19/1979	Iowa Falls	No
Eldora Downtown Historic District	5/12/2009	Eldora	No
Eldora Public Library	5/23/1983	Eldora	No
Ellsworth-Jones Building	10/1/1993	Iowa Falls	No
Estes Park Band Shell	10/1/1993	Iowa Falls	No
First Congregational Church	12/4/1996	Eldora	No
First National Bank	10/1/1993	Iowa Falls	No
Folkert Mound Group	3/17/2009	Steamboat Rock	Address Restricted
Hardin County Courthouse	7/2/1981	Eldora	No
Hardin County Home Historic District	5/24/2010	Eldora	No
Honey Creek Friends' Meetinghouse	2/8/1980	New Providence	No
Illinois Central Combination Depot-Ackley	9/6/1990	Ackley	No
Iowa Falls Bridge	5/15/1998	Iowa Falls	Yes
Iowa Falls Union Depot	9/6/1990	Iowa Falls	No
Kurtz, Glenn and Nell, Lustron Home and Garage	12/2/2014	Iowa Falls	No
McClanahan Block	10/1/1993	Iowa Falls	No
Metropolitan Opera House	2/20/1975	Iowa Falls	No

40 Iowa Department of Natural Resources. 2023. "Wildlife Management Areas." https://www.iowadnr.gov/hunting/places-to-hunt-shoot/wildlife-management-areas#13254117-t---w

41 Iowa Department of Natural Resources. 2023. "State Parks." https://www.iowadnr.gov/Places-to-Go/State-Parks.

42 National Park Service. 2023. "Find a Park: Iowa." https://www.nps.gov/state/ia/index.htm.

Site Name	Date Listed	Nearest Community	In Floodplain?
Mills Tower Historic District	9/6/1990	Iowa Falls	No
New Providence Building Association Stores	3/15/2016	New Providence	No
New Providence School Gymnasium	10/22/1996	New Providence	No
Princess-Sweet Shop	10/1/1993	Iowa Falls	No
River Street Bridge	5/15/1998	Iowa Falls	Yes
Sentinel Block	10/1/1993	Iowa Falls	No
St. Matthew's by the Bridge Episcopal Church	10/1/1993	Iowa Falls	No
Steamboat Rock Consolidated Schools Building	3/31/2004	Steamboat Rock	No
Union Cemetery Gardener's Cottage	1/24/2002	Iowa Falls	No
US Post Office-Iowa Falls	1/5/1994	Iowa Falls	No
W. R. C. Hall	10/1/1993	Iowa Falls	No
Washington Avenue Bridge	5/15/1998	Iowa Falls	Yes
Washington Avenue Commercial Historic District	10/31/2012	Iowa Falls	No

Source: National Park Service[43], County Planning Team

Historical Occurrences

The following table provides a statistical summary for hazards that have occurred in the county. The property damages from the NCEI Storm Events Database (1996 through 2022) should be considered only as broad estimates. Crop damages reports come from the USDA Risk Management Agency for Hardin County between 2000 and 2022.

Table 36: County Hazard Loss History

Hazard Type		Count	Property	Crop[1]
Animal and Plant Disease	Animal Disease[15]	1	N/A	N/A
	Plant Disease[1]	8	N/A	$43,747
Dam Failure[2]		0	-	N/A
Drought[3,6]		446/1,539 months	$12,650,000	$36,950,215
Earthquake[4]		0	-	-
Expansive Soils		Unknown	N/A	N/A
Extreme Temperature[5]	Cold (Max Temp ≤10°F)	Avg 8 days per year	N/A	$18,198
	Heat (Max Temp ≥100°F)	Avg 1 day per year	N/A	$785,106
Flooding[6]	Flash Flood	19	$1,418,000	$491,378
	Flood	38	$1,953,570	
Grass/Wildfire[7]		TBD	Unknown	-

43 National Park Service. 2023. "National Register of Historic Places: Data Downloads." [datafile]. https://www.nps.gov/subjects/nationalregister/data-downloads.htm.

Hazard Type		Count	Property	Crop[1]
Hazardous Materials Release	Fixed Site[8]	29	$0	N/A
	Transportation[9]	6	$41,677	N/A
Human Infectious Diseases[14] *71 deaths (Covid)*		5,084 Covid cases	N/A	N/A
Infrastructure Failure		Unknown	N/A	N/A
Severe Thunderstorms[6]	Hail	105	$21,524,000	$54,324,341
	Heavy Rain	47	$125,000	
	Lightning	4	$133,000	
	Thunderstorm Wind	142	$3,850,000	
Severe Winter Storms[6]	Blizzard	25	$520,000	$1,778,072
	Heavy Snow	19	$96,450	
	Ice Storm	12	$303,330	
	Winter Storm	30	$525,900	
	Winter Weather	1	$0	
Sinkhole		Unknown	N/A	N/A
Terrorism and Civil Unrest[10]		0	-	N/A
Tornado and Windstorm[6]	Tornadoes: Mode: EF0 Range: EF0-EF1	30	$882,000	$29,000
	Windstorms: Average: 54 mph Range: 40-60 mph	38	$1,155,110	$15,757,998
Transportation Incident	Auto[11] *417 injuries, 30 deaths*	2,871	$19,701,723	N/A
	Aviation[12] *7 injuries, 2 deaths*	23	N/A	N/A
	Rail[13] *31 injuries, 9 deaths*	73	$272,052	N/A
Total		**3,520**	**$65,151,812**	**$110,202,949**

N/A: Data not available
1 USDA RMA, 2000 - 2022
2 IDNR Communication, 2023
3 NOAA, 1895 - March 2023
4 USGS, 1900 - May 2023
5 NOAA Regional Climate Center, 1939 - 2022
6 NCEI, 1996 - 2022
7 IDNR, TBD
8 NRC, 1990 - 2022
9 PHMSA 1971 - April 2023
10 University of Maryland, 1970 - 2018
11 IDOT, 2012 - May 2023
12 NTSB, 1962 - May 2023
13 FRA, 1975 - 2022
14 The New York Times, as of 3/23/2023
15 IDALS, 2022

Mitigation Strategy

Completed Mitigation and Strategic Actions

Mitigation Action	Identify Backup Communication Equipment to be Purchased for a Communications Failure
Description	Identify back up communication equipment to be purchased for widespread breakdown or disruption of normal communication system capabilities including loss of or long-term interruption of local government radio facilities and major telephone outages due to mechanical failure, traffic accidents, power failure, line severance, and weather.
Hazard(s)	Animal & Plant Disease, Dam Failure, Drought, Earthquake, Expansive Soils, Extreme Temperature, Flooding, Grass/Wildfire, Hazardous Materials Release, Human Infectious Diseases, Infrastructure Failure, Severe Thunderstorms, Severe Winter Storms, Sinkhole, Terrorism & Civil Unrest, Tornado & Windstorm, Transportation Incident
Status	Equipment has been identified and purchased.

Mitigation Action	Animal and Human Disease Epidemic Planning and Training
Description	Hold session to train emergency personnel to identify animal/crop/plant disease and human epidemic disease outbreaks and proper response. Create county plan to deal with outbreaks.
Hazard(s)	Human Infectious Disease, Animal and Plant Disease
Status	Planning and training has been completed.

Mitigation Action	Establish Emergency Operations Center
Description	Establish emergency operations center for the county.
Hazard(s)	Animal & Plant Disease, Dam Failure, Drought, Earthquake, Expansive Soils, Extreme Temperature, Flooding, Grass/Wildfire, Hazardous Materials Release, Human Infectious Diseases, Infrastructure Failure, Severe Thunderstorms, Severe Winter Storms, Sinkhole, Terrorism & Civil Unrest, Tornado & Windstorm, Transportation Incident
Status	Complete

Mitigation Action	Purchase Generator System for Courthouse
Description	Purchase generator system to be used in courthouse during an extended power outage.
Hazard(s)	Dam Failure, Earthquake, Extreme Temperature, Flooding, Grass/Wildfire, Hazardous Materials Release, Human Infectious Diseases, Infrastructure Failure, Severe Thunderstorms, Severe Winter Storms, Terrorism & Civil Unrest, Tornado & Windstorm, Transportation Incident
Status	Backup generator has been purchased and installed.

Mitigation Action	NOAA All-Hazard Radios for County Use
Description	Secure funding to provide NOAA All-Hazard Radios to all county buildings.
Hazard(s)	Animal & Plant Disease, Dam Failure, Drought, Earthquake, Expansive Soils, Extreme Temperature, Flooding, Grass/Wildfire, Hazardous Materials Release, Human Infectious Diseases, Infrastructure Failure, Severe Thunderstorms, Severe Winter Storms, Sinkhole, Terrorism & Civil Unrest, Tornado & Windstorm, Transportation Incident
Status	NOAA radios have been provided to county buildings.

Mitigation Action	Create a Drainage District
Description	Complete storm drainage district for the county.
Hazard(s)	Flooding, Infrastructure Failure
Status	Complete. There are over 200 drainage districts in Hardin County.

New Mitigation and Strategic Actions

Mitigation Action	Pipeline Inspection Ordinance
Description	Adopt an ordinance that pipelines must be inspected every five years for required cover.
Hazard(s)	Hazardous Materials Release, Infrastructure Failure
Estimated Cost	Staff Time
Local Funding Source	Hardin County General Budget
Timeline	2-5 years
Priority	Medium
Lead Agency/Department	Hardin County Supervisors, County Attorney, Planning and Zoning
Status	Not started

Continued Mitigation and Strategic Actions

Mitigation Action	Erosion Control Along Highways, Conservation, and Bridges
Description	Identify infrastructure that is susceptible to erosion that could damage infrastructure
Hazard(s)	Infrastructure Failure, Flooding
Estimated Cost	TBD
Local Funding Source	Hardin County General Budget, Local Community
Timeline	2-5 years
Priority	Medium
Lead Agency/Department	Hardin County, Local Community
Status	In progress

Mitigation Action	Provide Livestock Containment in the Event of MVAs
Description	Investigate current methods of containing livestock following an MVA. Purchase gates 3 trailer (port. corrals)
Hazard(s)	Infrastructure Failure
Estimated Cost	$13,000
Local Funding Source	Hardin County Emergency Management Strategic Planning
Timeline	2-5 years
Priority	Low
Lead Agency/Department	Hardin County Emergency Management
Status	Not started

Mitigation Action	Create and Implement a PIO Program for County Wide Events
Description	Identify 2-3 people to train and educate them. Provide Law Enforcement those people's info so they can be funneled PIO requests.
Hazard(s)	Animal & Plant Disease, Dam Failure, Drought, Earthquake, Expansive Soils, Extreme Temperature, Flooding, Grass/Wildfire, Hazardous Materials Release, Human Infectious Diseases, Infrastructure Failure, Severe Thunderstorms, Severe Winter Storms, Sinkhole, Terrorism & Civil Unrest, Tornado & Windstorm, Transportation Incident
Estimated Cost	Staff Time
Local Funding Source	Hardin County General Budget, EMA
Timeline	1-2 years
Priority	Medium
Lead Agency/Department	Hardin County Emergency Management
Status	In progress

Mitigation Action	Special Needs Population Sheltering Plan
Description	Develop a special needs population sheltering plan. Find locations, locate transportation methods, and arrange volunteer staffing.
Hazard(s)	Animal & Plant Disease, Dam Failure, Drought, Earthquake, Expansive Soils, Extreme Temperature, Flooding, Grass/Wildfire, Hazardous Materials Release, Human Infectious Diseases, Infrastructure Failure, Severe Thunderstorms, Severe Winter Storms, Sinkhole, Terrorism & Civil Unrest, Tornado & Windstorm, Transportation Incident
Estimated Cost	Staff Time
Local Funding Source	Hardin County EMA
Timeline	1-2 years
Priority	Low
Lead Agency/Department	Hardin County Emergency Management, Public Health
Status	In progress, with updates made as needs and circumstances change.

Mitigation Action	Business Continuity Planning for Business Training
Description	Business continuity planning for business training.
Hazard(s)	Animal & Plant Disease, Dam Failure, Drought, Earthquake, Expansive Soils, Extreme Temperature, Flooding, Grass/Wildfire, Hazardous Materials Release, Human Infectious Diseases, Infrastructure Failure, Severe Thunderstorms, Severe Winter Storms, Sinkhole, Terrorism & Civil Unrest, Tornado & Windstorm, Transportation Incident
Estimated Cost	$1,000
Local Funding Source	Hardin County Emergency Management
Timeline	2-5 years
Priority	Medium
Lead Agency/Department	Hardin County Emergency Management
Status	Training and workshops are offered on a regular basis. Updates are made as needed.

Mitigation Action	Create a Water Use Ordinance
Description	Create a water use ordinance and hold an information session on conservation
Hazard(s)	Drought, Human Infectious Disease, Infrastructure Failure, Grass and Wildland Fire
Estimated Cost	Staff Time
Local Funding Source	Hardin County General Budget
Timeline	2-5 years
Priority	High
Lead Agency/Department	Hardin County Zoning
Status	Discussions are ongoing under drought and Iowa Drought Plan.

Mitigation Action	Laminated Glass for Use During Hailstorms
Description	Secure funding to put up laminated glass to protect county buildings during hailstorms.
Hazard(s)	Severe Thunderstorms
Estimated Cost	$2 million
Local Funding Source	Hardin County General Budget
Timeline	2-5 years
Priority	Low
Lead Agency/Department	Hardin County Emergency Management
Status	Not started

Mitigation Action	Ground Water Protection
Description	Plan to ensure that ground water sources are protected in collaboration with Iowa DNR
Hazard(s)	Sinkhole, Infrastructure Failure, Human Infectious Disease
Estimated Cost	Staff Time
Local Funding Source	Hardin County General Budget
Timeline	2-5 years
Priority	High
Lead Agency/Department	Hardin County Emergency Management, Hardin County Conservation, Zoning
Status	Not started

Mitigation Action	Public Warnings of Dam Failures
Description	Communicate to residents using different media to warn of an imminent dam failure.
Hazard(s)	Dam Failure
Estimated Cost	Staff Time
Local Funding Source	Hardin County Emergency Management
Timeline	2-5 years
Priority	High
Lead Agency/Department	Hardin County Emergency Management
Status	In progress. The county uses Alert Iowa and IPAWS to notify residents.

Mitigation Action	Uniform Building Codes
Description	Modify building codes by adding requirements that may help to reduce the adverse effects hazards may have on new buildings.
Hazard(s)	Dam Failure, Earthquake, Expansive Soils, Extreme Temperature, Flooding, Grass/Wildfire, Infrastructure Failure, Severe Thunderstorms, Severe Winter Storms, Sinkhole, Terrorism & Civil Unrest, Tornado & Windstorm
Estimated Cost	Staff Time
Local Funding Source	Hardin County General Budget
Timeline	2-5 years
Priority	Medium
Lead Agency/Department	Hardin County Planning and Zoning
Status	Not started

Mitigation Action	Grass Fire Training and Equipment
Description	Create a program or incentives for firefighters to be trained for grass fires and purchase or maintain the needed equipment
Hazard(s)	Grass and Wildland Fires
Estimated Cost	TBD
Local Funding Source	Assistance to Firefighters Grant
Timeline	2-5 years
Priority	High
Lead Agency/Department	Hardin County Emergency Management
Status	Training is offered as funding allows. Updates are made as needed.

Mitigation Action	Identify Pipelines and Inform/Educate Landowners
Description	Locate pipelines in Hardin County and hold information session for landowners to educate on dangers and actions to prevent possible incidents.
Hazard(s)	Hazardous Materials Release, Infrastructure Failure
Estimated Cost	TBD
Local Funding Source	Pipeline Association
Timeline	Annually
Priority	High
Lead Agency/Department	Hardin County Emergency Management
Status	In progress

Mitigation Action	Public Awareness and Education
Description	Through activities such as outreach projects, distribution of maps, and environmental education increase public awareness of natural and manmade hazards to both public and private property owners, renters, businesses, and local officials about hazards and ways to protect people and property from these hazards.
Hazard(s)	Animal & Plant Disease, Dam Failure, Drought, Earthquake, Expansive Soils, Extreme Temperature, Flooding, Grass/Wildfire, Hazardous Materials Release, Human Infectious Diseases, Infrastructure Failure, Severe Thunderstorms, Severe Winter Storms, Sinkhole, Terrorism & Civil Unrest, Tornado & Windstorm, Transportation Incident
Estimated Cost	$2,000+
Local Funding Source	Hardin County Emergency Management
Timeline	Annually
Priority	High
Lead Agency/Department	Hardin County Emergency Management
Status	In progress

Mitigation Action	Identify Alternate Advance Warning Systems for Storms/Severe Weather
Description	Identify alternate systems such as radios or backup sirens.
Hazard(s)	Extreme Temperature, Flooding, Severe Thunderstorms, Severe Winter Storms, Tornado & Windstorm
Estimated Cost	TBD; $50,000 per siren
Local Funding Source	Hardin County Emergency Management, HMA
Timeline	2-5 years
Priority	Medium
Lead Agency/Department	Hardin County Emergency Management
Status	Each community currently has a siren and all but one community can be initiated by Hardin County Communications.

Mitigation Action	Elevate Roads
Description	Elevate all County roads or those that are identified as problematic or critical during and immediately following flood events
Hazard(s)	Flooding, Infrastructure Failure
Estimated Cost	$500,000 to $1,000,000
Local Funding Source	Hardin County Secondary Roads
Timeline	2-5 years
Priority	High
Lead Agency/Department	Hardin County Engineer
Status	In progress

Mitigation Action	Communications Network Interoperability
Description	Continue work on radio interoperability
Hazard(s)	Animal & Plant Disease, Dam Failure, Drought, Earthquake, Expansive Soils, Extreme Temperature, Flooding, Grass/Wildfire, Hazardous Materials Release, Human Infectious Diseases, Infrastructure Failure, Severe Thunderstorms, Severe Winter Storms, Sinkhole, Terrorism & Civil Unrest, Tornado & Windstorm, Transportation Incident
Estimated Cost	$5,000,000
Local Funding Source	Hardin County Essential Bonding
Timeline	2-5 years
Priority	High
Lead Agency/Department	Hardin County Emergency Management
Status	Currently working with consulting firm in evaluation and specifications.

Mitigation Action	Construct Safe Rooms in Critical Facilities
Description	Construct safe rooms in critical facilities and in outdoor parks with campsites.
Hazard(s)	Severe Thunderstorms, Severe Winter Storms, Tornado and Windstorm
Estimated Cost	$250,000
Local Funding Source	Hardin County General Budget, CDBG
Timeline	2-5 years
Priority	High
Lead Agency/Department	Hardin County Conservation
Status	In progress

Mitigation Action	Create and Store Sandbags
Description	Create and store sandbags for use during flood situations
Hazard(s)	Flooding, Infrastructure Failure
Estimated Cost	$20,000
Local Funding Source	Hardin County Emergency Management
Timeline	2-5 years
Priority	High
Lead Agency/Department	Hardin County Emergency Management
Status	In progress

Removed Mitigation and Strategic Actions

Mitigation Action	Mitigate Stormwater and Sewage Backups Following High Volume, Low Time Rain Falls
Description	Televise locations with a history of basement flooding not attributed to riverine or stream flooding.
Hazard(s)	Flooding, Infrastructure Failure
Reason for Removal	This project is not currently a priority for the county.

Mitigation Action	Tourism and Natural Resource Preservation of Trails
Description	Tourism and Natural Resource Preservation of Trails.
Hazard(s)	All hazards
Reason for Removal	This project is not currently a priority for the county.

Mitigation Action	Evacuation Planning
Description	Create a master evacuation plan for use in a severe hazard event.
Hazard(s)	All hazards
Reason for Removal	This project is not currently a priority for the county.

Mitigation Action	Protect and Clean Up County Parks
Description	Create a plan to determine protection measures and clean up procedures for county parks.
Hazard(s)	All hazards
Reason for Removal	This project is not currently a priority for the county.

Mitigation Action	Create Hazardous Materials Removal Plan
Description	Develop a plan to remove hazardous materials efficiently from a hazard event site.
Hazard(s)	Hazardous Materials Release
Reason for Removal	This project is not currently a priority for the county.

Mitigation Action	Provide Specialized Training for Fire Department and Maintain Needed Equipment
Description	Create a program or incentives for firefighters to be trained for rare and specialized situations and purchase or maintain the needed equipment.
Hazard(s)	Grass and Wildland Fires, Infrastructure Failure
Reason for Removal	This project is not currently a priority for the county.

Mitigation Action	Repair Roads and Bridges
Description	Repair roads and bridges in need throughout the county.
Hazard(s)	Infrastructure Failure
Reason for Removal	This project is not currently a priority for the county.

Mitigation Action	Update Zoning Codes
Description	Update zoning in critical areas of the county i.e., discouraging development in floodplain or flood-prone areas, ensure proper development near critical facilities, etc.
Hazard(s)	All hazards
Reason for Removal	This project is not currently a priority for the county.

Mitigation Action	Public Information Session on Agricultural Practices
Description	Hold information session to inform local farmers about agriculture practices to reduce risk of flash floods in the county.
Hazard(s)	Flooding, Infrastructure Failure
Reason for Removal	This project is not currently 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 county planning team is responsible for reviewing and updating this profile as changes occur or after a major event. The planning team will include the Hardin County Board of Supervisors, Hardin County Emergency Management, and the Hardin County Sheriff. The plan will be reviewed and updated annually. The public will be involved in the review and revision process through public postings and commission meetings.

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 human-caused 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 37: 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 five primary steps:

1. Identify hazards.
2. Describe hazards.
3. Identify community assets.
4. Analyze impacts.
5. Summarize vulnerability.

When identifying and 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 to relevant hazards. Analysis of regional risk will examine historic impacts and losses and what is possible should the hazard occur in the future. Impact 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 include a summary statement encapsulating the risk and vulnerability 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 historical average annual dollar losses for all hazards for which historical 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 historical record and for which monetary damages 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 2022. 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:

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

It should be noted that NCEI data is not all-inclusive, and the database provides 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 used. The collected data are from 2000 to 2022. 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:

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

FEMA Standard Economic Values

As part of FEMA's Benefit-Cost Analysis Toolkit, standard economic values were developed to better estimate the avoided loss of services when implementing a hazard mitigation project. These standard economic values can also be used to help estimate potential future economic impacts from a hazard event. Table 38 shows the economic value for traffic delays on roads and bridges, loss of electric services, loss of wastewater services, loss of potable water services, and loss of communications/IT services. The assumed damages do not consider physical damage to utility equipment and infrastructure but do consider the impact on economic activity and impact on residential customers.

Table 38: FEMA Standard Economic Values

Service Lost	Economic Value
Traffic Delays on Roads and Bridges	$37.49/Vehicle/Hour
Loss of Electric Services	$199/Person/Day
Loss of Wastewater Services	$66/Person/Day
Loss of Potable Water Services	$138/Person/Day
Loss of Communications/IT Services	$141/Person/Day

Source: FEMA, 2023[44]

Also included in FEMA's Benefit-Cost Analysis Toolkit are life safety economic values. Life safety is the value of lives saved and injuries prevented resulting from mitigation measures. Table 39 shows the six different severity levels, their economic value, and common injuries associated with each level.

44 FEMA. 2023. "Benefit-Cost Analysis Sustainment and Enhancement". https://www.fema.gov/sites/default/files/documents/fema_standard-economic-values-methodology-report_2023.pdf.

Table 39: FEMA Life Safety Economic Values (2022 Dollars)

Injury Severity Level	Selected Common Injuries	Economic Value
Minor	Superficial abrasion or laceration of skin; digit sprain; first degree burn; head trauma with headache or dizziness (no other neurological signs).	$38,000
Moderate	Major abrasion or laceration of skin; cerebral concussion (unconscious less than 15 minutes); finger or toe crush/amputation; closed pelvic fracture with or without dislocation.	$588,000
Serious	Major nerve laceration; multiple rib fracture (but without flail chest); abdominal organ contusion; hand, foot, or arm crush/amputation.	$1,313,000
Severe	Spleen rupture; leg crush; chest-wall perforation; cerebral concussion with other neurological signs (unconscious less than 24 hours).	$3,325,000
Critical	Spinal cord injury (with cord transection); extensive second- or third- degree burns; cerebral concussion with severe neurological signs (unconscious more than 24 hours).	$7,413,000
Un-Survivable	Injuries, which although not fatal within the first 30 days after an accident, ultimately result in death.	$12,500,000

Source: FEMA, 2023[45]

FEMA's standard economic values and life safety economic values will not be used to determine average annual damages and average damage per event estimates for each hazard profile. Past hazard events do not list the total number of people or vehicles impacted, and thus it is impossible to retroactively calculate the total economic impact using these values. While injuries and fatalities may be reported it is not known the severity of those injured during the event. The values are provided in this plan so that participants can better estimate potential losses and determine the benefits of potential future mitigation actions.

Hazard Identification

The identification of relevant hazards for the county began with a review of the 2018 State of Iowa Hazard Mitigation Plan. Hardin 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.

45 FEMA. 2023. "Benefit-Cost Analysis Sustainment and Enhancement". https://www.fema.gov/sites/default/files/documents/fema_standard-economic-values-methodology-report_2023.pdf.

Table 40: Hazards Addressed in the Plan

Hazards Addressed in the Plan		
Animal and Plant Disease	Flooding	Severe Winter Storms
Dam Failure	Grass and Wildland Fire	Sinkhole
Drought	Hazardous Materials Release	Terrorism and Civil Unrest
Earthquake	Human Infectious Diseases	Tornado and Windstorm
Expansive Soils	Infrastructure Failure	Transportation Incident
Extreme Temperatures	Severe Thunderstorms (include Hail and Lightning)	

Hazard Changes

Apart from landslide and levee failure, 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 Temperatures:** 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. The 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: 8	Plant Disease 7/23 = 30%	Crop damage or loss
Dam Failure	0	Less than 1%	Varies by structure
Drought	446/1,539 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 8 days/year	83/131 = 63%	Max Temp ≤10°F
	Heat: Avg 1 day/year	83/131 = 63%	Max Temp ≥100°F
Flooding	57	16/27 =59%	Some inundation of structures. Some

Hazard	Previous Occurrences	Approximate Annual Probability*	Likely Extent
			evacuations of people may be necessary.
Grass/Wildfire	58	12/15 = 80%	Avg 15 acres Some homes and structures threatened or at risk
Hazardous Materials Release	Fixed Site Spill: 29	16/33 = 48%	Avg Liquid Spill: 1,033 gal. Avg Gas Spill: 44 lbs.
	Transportation Spill: 6	6/52 = 12%	Avg Liquid Spill: 33 gallons
Human Infectious Diseases	5,084 Covid cases	N/A	N/A
Infrastructure Failure	Unknown	Unknown	Varies by event
Severe Thunderstorms	298	26/27= 96%	>1" rainfall Avg 66 mph winds
Severe Winter Storms	87	26/27 = 96%	1-16" 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: 30	13/27 = 48%	Mode: EF0 Range: EF0-EF1
	Windstorms: 38	20/27 = 74%	Avg: 54 mph Range 40-60 mph
Transportation Incident	Auto: 2,871	11/11 = 100%	Damages incurred to vehicles involved and traffic delays; substantial damages to aircrafts involved with some aircrafts destroyed
	Aviation: 23	19/62 = 31%	
	Rail: 73	18/48 = 38%	

** 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[15]	1	N/A	N/A
	Plant Disease[1]	8	N/A	$43,747
Dam Failure[2]		0	-	-
Drought[3,6]		446/1,539 months	$12,650,000	$36,950,215
Earthquake[4]		0	-	-
Expansive Soils		Unknown	N/A	N/A
Extreme Temperatures[5]	Cold (Max Temp ≤10°F)	Avg 8 days per year	N/A	$18,198
	Heat (Max Temp ≥100°F)	Avg 1 day per year	N/A	$785,106

Hazard Type		Count	Property	Crop[1]
Flooding[6]	Flash Flood	19	$1,418,000	$491,378
	Flood	38	$1,953,570	
Grass/Wildfire[7]		58	N/A	-
Hazardous Materials Release	Fixed Site[8]	29	$0	N/A
	Transportation[9]	6	$41,677	N/A
Human Infectious Diseases[14] ***71 deaths (Covid)***		5,084 Covid cases	N/A	N/A
Infrastructure Failure		Unknown	N/A	N/A
Severe Thunderstorms[6]	Hail	105	$21,524,000	$54,324,341
	Heavy Rain	47	$125,000	
	Lightning	4	$133,000	
	Thunderstorm Wind	142	$3,850,000	
Severe Winter Storms[6]	Blizzard	25	$520,000	$1,778,072
	Heavy Snow	19	$96,450	
	Ice Storm	12	$303,330	
	Winter Storm	30	$525,900	
	Winter Weather	1	$0	
Sinkhole		Unknown	N/A	N/A
Terrorism and Civil Unrest[10]		0	-	-
Tornado and Windstorm[6]	Tornadoes: Mode: EF0 Range: EF0-EF1	30	$882,000	$29,000
	Windstorms: Average: 54 mph Range: 40-60 mph	38	$1,155,110	$15,757,998
Transportation Incident	Auto[11] *417 injuries, 30 deaths*	2,871	$19,701,723	N/A
	Aviation[12] *8 injuries, 2 deaths*	23	N/A	N/A
	Rail[13] *31 injuries, 9 deaths*	73	$272,052	N/A
Total		3,578	$65,151,812	$110,202,949

N/A: Data not available
1 USDA RMA, 2000 - 2022
2 IDNR Communication, 2023
3 NOAA, 1895 - March 2023
4 USGS, 1900 - May 2023
5 NOAA Regional Climate Center, 1939 - 2022
6 NCEI, 1996 - 2022
7 IDNR, 2008 - 2022
8 NRC, 1990 - 2022
9 PHMSA 1971 - April 2023
10 University of Maryland, 1970 - 2018
11 IDOT, 2012 - May 2023
12 NTSB, 1962 - May 2023
13 FRA, 1975 - 2022
14 The New York Times, as of 3/23/2023
15 IDALS, 2022

FEMA National Risk Index

FEMA's National Risk Index is an online tool that analyzes natural hazard and community risk factors to develop a risk measurement for each county in the United States. Eighteen natural hazards are given a score from very high to very low. The table below gives the National Risk Index ratings for each county in the planning area. Risk Index scores are calculated using an equation that combines scores for expected annual loss, social vulnerability, and community resilience. All values fall between 0 (lowest possible value) and 100 (highest possible value). The national average is 50.02 and the Iowa average is 48.31.

Table 43: National Risk Index

Hazard	Risk Index Rating
Avalanche	Not Applicable
Coastal Flooding	Not Applicable
Cold Wave	Relatively Moderate (68.5)
Drought	Relatively Moderate (93.1)
Earthquake	Very Low (21.1)
Hail	Relatively Moderate (95.8)
Heat Wave	Very Low (25.3)
Hurricane	Very Low (5.9)
Ice Storm	Relatively Low (41.1)
Landslide	Relatively Low (32.3)
Lightning	Very Low (22.8)
Riverine Flooding	Relatively Low (57.4)
Strong Wind	Relatively High (89.1)
Tornado	Relatively Moderate (70.6)
Tsunami	Not Applicable
Volcanic Activity	Not Applicable
Wildfire	Very Low (18.5)
Winter Weather	Relatively High (85.9)
Overall Score	**Relatively Low (60.93)**

Source: FEMA[46]

Historical Disaster Declarations

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

Small Business Administration and Secretarial 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 USDA Secretary of Agriculture is also authorized to make disaster declarations to make emergency loans available through the Farms Service Agency. The following table summarizes the SBA Disasters and Secretarial Disasters involving the planning area since 2018.

46 FEMA. "The National Risk Index". Accessed August 2023. https://hazards.fema.gov/nri/map.

Table 44: SBA Declarations and Secretarial Disaster Declarations

Declaration Date	Disaster Declaration Number	Title	Listed as Primary County	Listed as Contiguous County
07/30/2018	IA-00078	Severe Storms		X
9/3/2020	IA-00097	Derecho	X	
9/8/2020	IA-00096	Drought		X
10/20/2020	IA-00100	Derecho		X
8/10/2021	IA-00105	Drought	X	

Source: Small Business Administration, 2018 - July 2023[47]

Presidential Disaster Declarations

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

Table 45: Presidential Disaster Declarations

Disaster Declaration Number	Declaration Date	Title
193	04/22/65	Flooding
269	08/14/69	Heavy Rains & Flooding
868	05/26/90	Severe Storms & Flooding
928	12/26/91	Ice Storm
996	07/09/93	Severe Storms & Flooding
1133	08/21/96	Severe Storms, and Flooding
1230	07/02/98	Severe Storms, Tornadoes and Flooding
1518	05/25/04	Severe Storms, Tornadoes, and Flooding
3239	09/10/05	Hurricane Katrina Evacuation
1688	03/14/07	Severe Winter Storms
1763	05/27/08	Severe Storms, Tornadoes, and Flooding
1880	03/02/10	Severe Winter Storm
4126	07/02/13	Severe Storms, Tornadoes, and Flooding
4187	08/05/14	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

47 Small Business Administration. 2023. “Current Declared Disasters”. https://disasterloanassistance.sba.gov/ela/s/search-declarations.

Disaster Declaration Number	Declaration Date	Title
4557	08/17/20	Severe Storms

Source: Federal Emergency Management Agency, 1962 – October 2022[48]

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. Changes in the regional climate is 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.[49]

- **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 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.

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

- **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:[50]

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

[50] 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

(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.

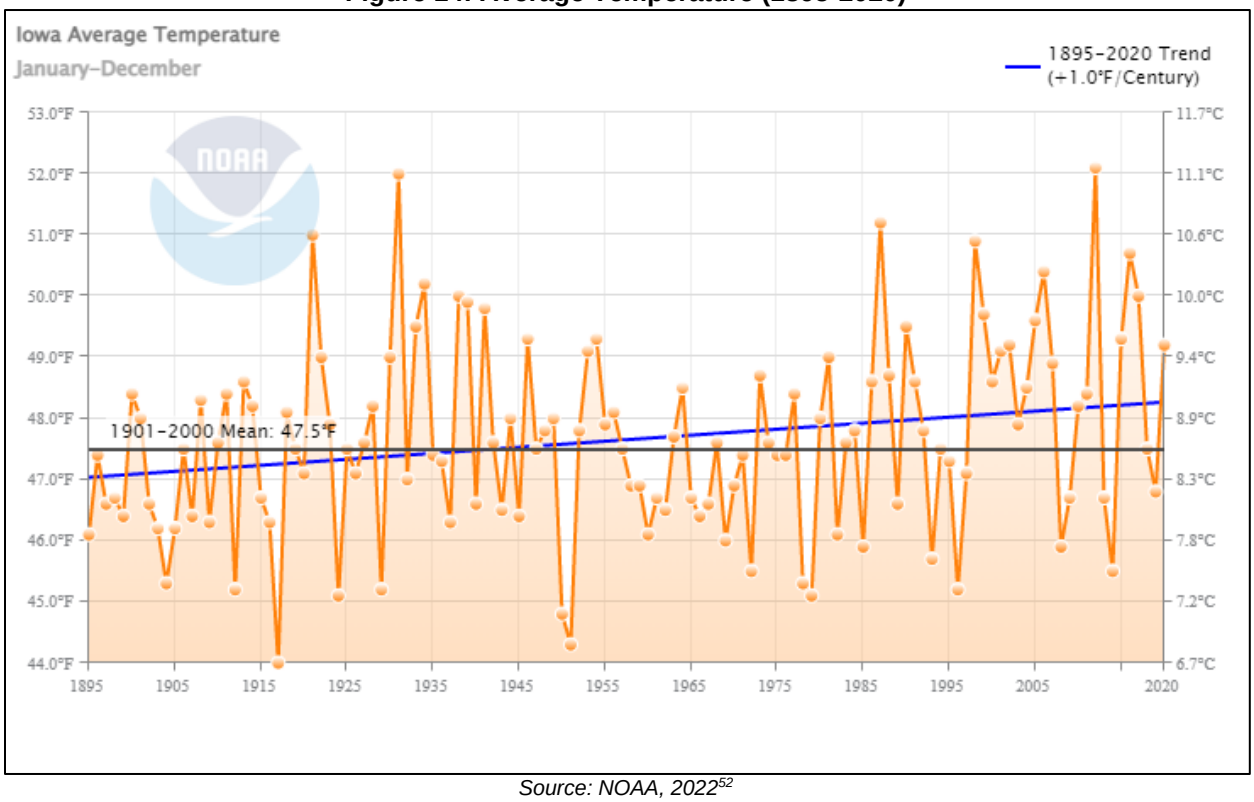
Public Health Effects

- 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 14). 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 (Figure 15).[51]

Figure 14: Average Temperature (1895-2020)

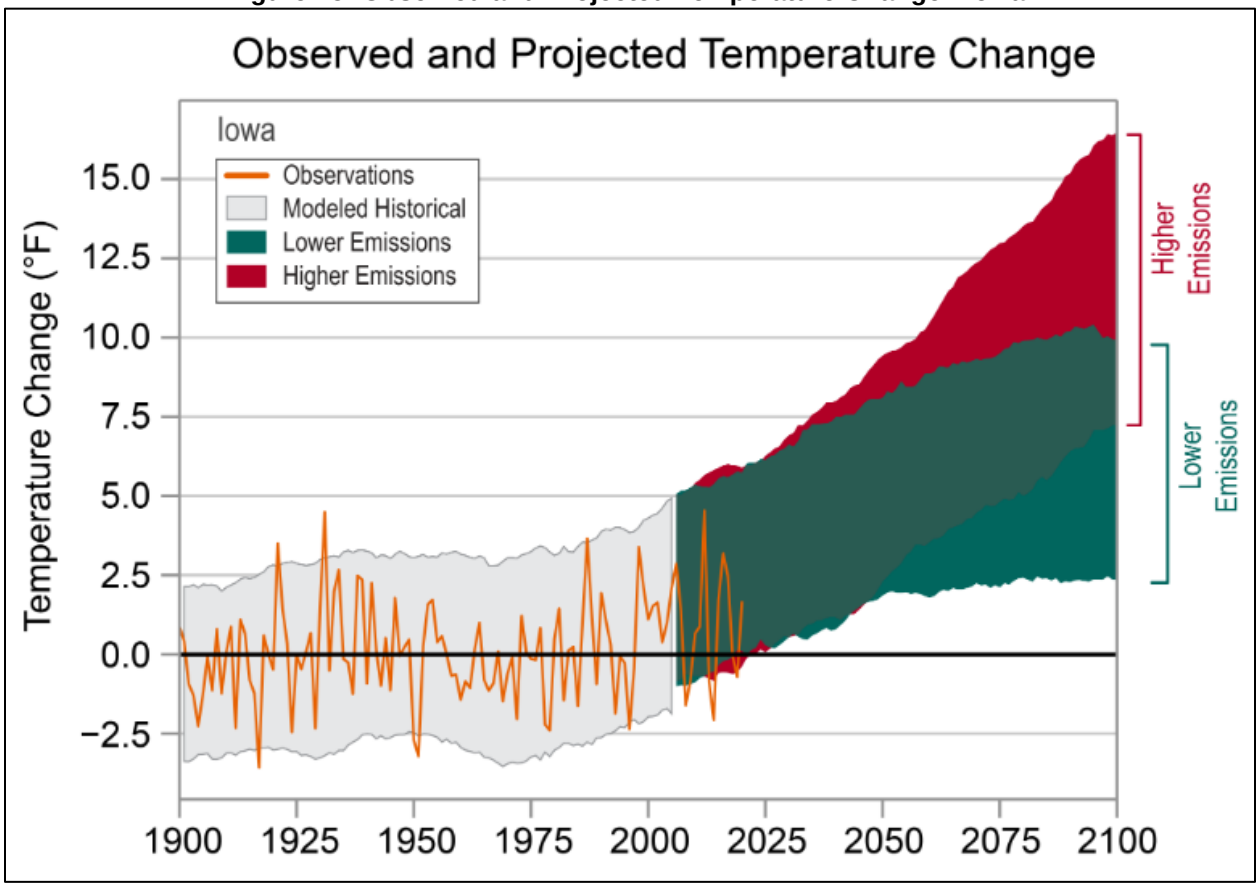


Source: NOAA, 2022[52]

[51] 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.

[52] 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

Figure 15: Observed and Projected Temperature Change - Iowa



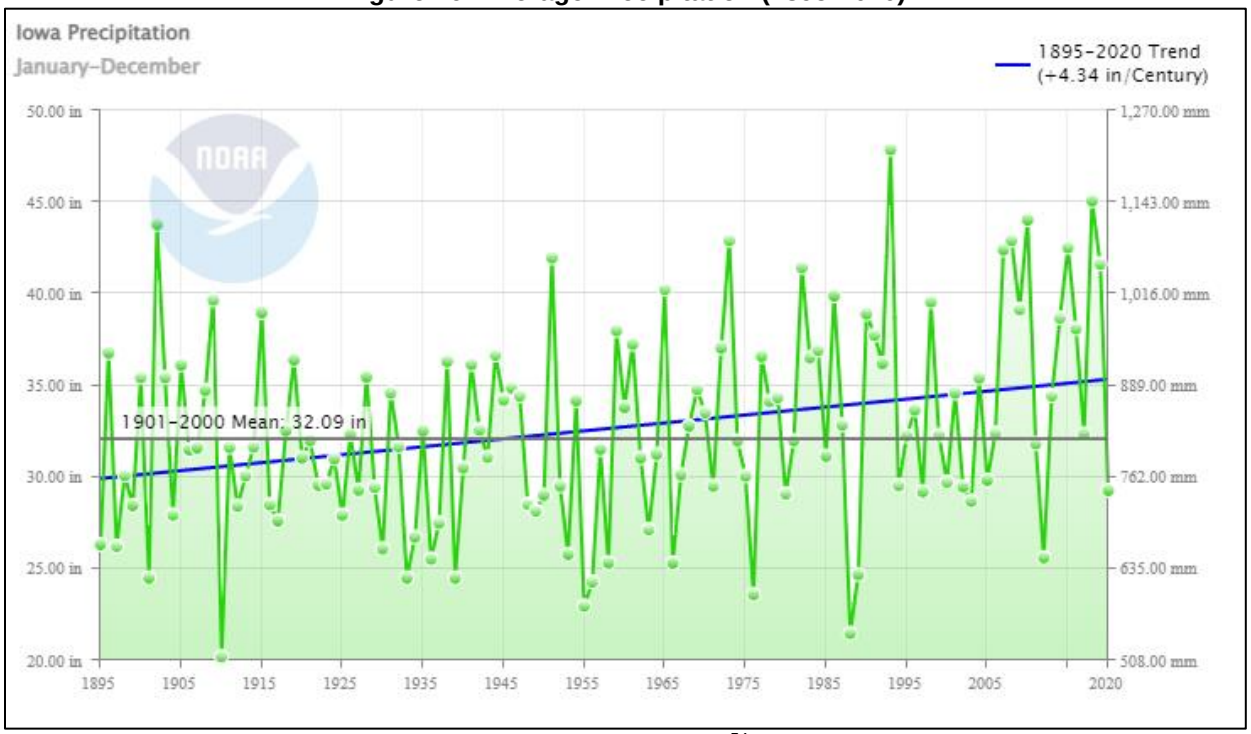
Source: NCEI

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 16).This trend is expected to continue as the impacts of climate change continue to be felt.[53]

[53] 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.

Figure 16: Average Precipitation (1895-2020)



Source: NOAA, 2022[54]

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.

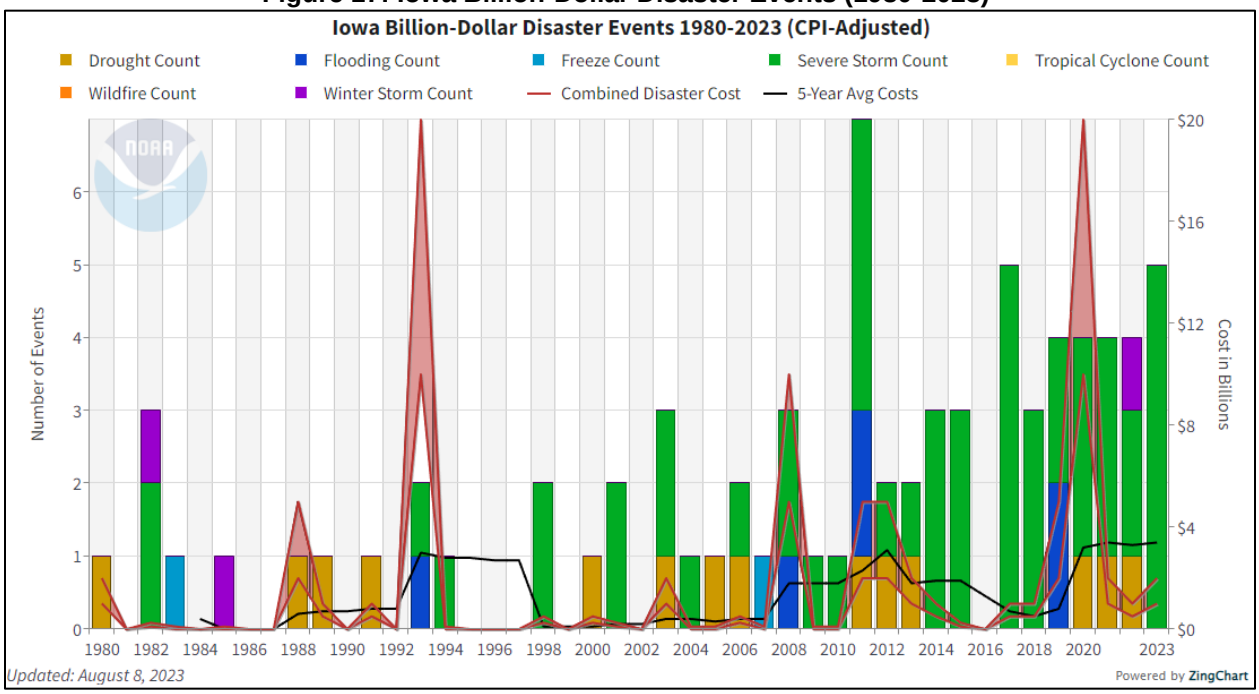
Certain groups of people may face greater difficulty when dealing with the impacts of a changing climate. Older adults, immigrant communities, and those living in poverty are particularly susceptible. Additionally, specific industries and professions tied to weather and climate, like outdoor tourism, commerce, and agriculture, are especially vulnerable.[55]

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

[54] 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.

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

Figure 17: Iowa Billion-Dollar Disaster Events (1980-2023)



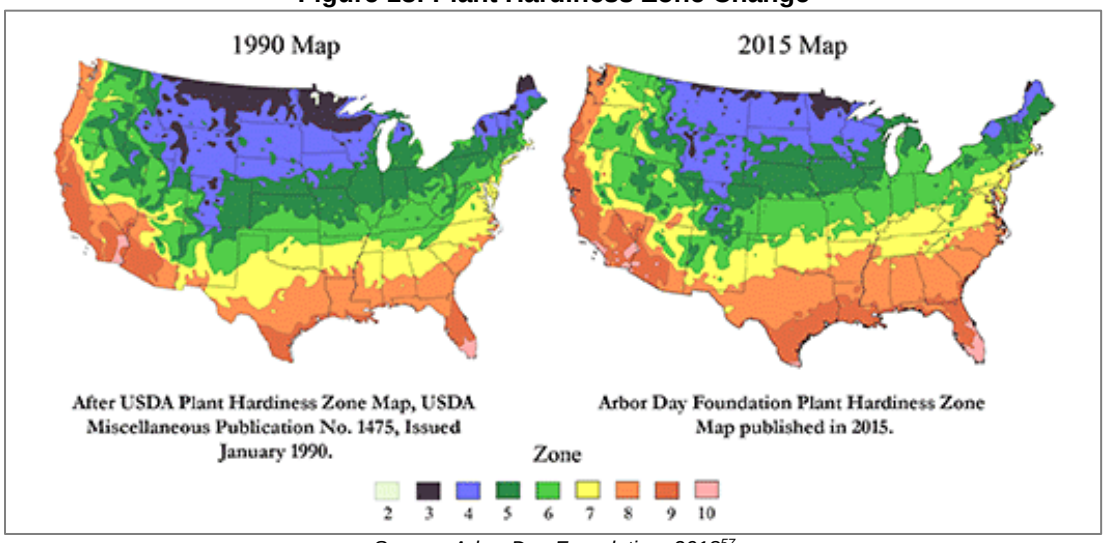
Source: NOAA, 2023[56]

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 rainfall. As described in the Plant Hardiness Zone map available for the United States (Figure 18), 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.

[56] NOAA National Centers for Environmental Information. August 2023. "Iowa Billion-Dollar Weather and Climate Disasters". https://www.ncdc.noaa.gov/billions/

Figure 18: Plant Hardiness Zone Change



Source: Arbor Day Foundation, 2018[57]

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.[58] 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.[59]

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.

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

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

economic damage such as decreasing property values, reducing recreational revenue, and increasing the costs for treating drinking water.[60]

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.[61] 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 rise 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.[62]

[60] 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.

[61] 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.

[62] 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 considerable 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 46: Top Hazards of Concern

Jurisdiction	Animal and Plant Disease	Dam Failure	Drought	Earthquake	Expansive Soils	Extreme Temperatures	Flooding	Grass/Wildland Fire	Hazardous Materials Release	Human Infectious Diseases	Infrastructure Failure	Severe Thunderstorms	Severe Winter Storms	Sinkhole	Terrorism and Civil Unrest	Tornado and Windstorm	Transportation Incident
Ackley	X						X		X		X		X			X	
Alden							X		X		X					X	X
Buckeye								X				X	X				
Eldora									X	X		X	X			X	
Hubbard							X					X				X	
Iowa Falls		X							X			X				X	
New Providence												X	X			X	
Radcliffe									X			X	X			X	X
Steamboat Rock							X		X			X					
Union						X	X					X				X	
Whitten									X				X			X	

Jurisdiction	Animal and Plant Disease	Dam Failure	Drought	Earthquake	Expansive Soils	Extreme Temperatures	Flooding	Grass/Wildland Fire	Hazardous Materials Release	Human Infectious Diseases	Infrastructure Failure	Severe Thunderstorms	Severe Winter Storms	Sinkhole	Terrorism and Civil Unrest	Tornado and Windstorm	Transportation Incident
AGWSR Schools													X			X	X
BCLUW Schools										X		X	X			X	
Iowa Falls-Alden Schools						X					X	X	X			X	
South Hardin Schools												X	X			X	
Ellsworth Community College									X	X						X	
Providence 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 $484.6 million.[63]

Table 47 shows the population of livestock within the county. This count does not include wild populations that are also at risk from animal diseases.

Table 47: Livestock Inventory

County	Market Value of 2017 Livestock Sales	Cattle and Calves	Hogs and Pigs	Sheep and Lambs	Poultry Egg Layers
Hardin	$295,435,000	37,055	628,945	371	-

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 48: Land and Value of Farms in the County

County	Number of Farms	Land in Farms (acres)	Market Value of 2017 Crop Sales
Hardin	837	336,611	$189,174,000

Source: U.S. Census of Agriculture, 2017

Table 49: Crop Values

County	Corn		Soybeans		Wheat	
	Acres Planted	Value (2017)	Acres Planted	Value (2017)	Acres Planted	Value (2017)
Hardin	194,587	$134,835,000	98,010	$52,931,000	-	-

Source: U.S. Census of Agriculture, 2017

Location

Given the strong agricultural presence in the county, animal and plant diseases 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.

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 diseases will occur in domestic animals or crops in urban areas.

[63] US Department of Agriculture, National Agricultural Statistics Server. 2023. "2017 Census of Agriculture – County Data." Accessed May 2023. https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_2_County_Level/Iowa/.

Historical Occurrences

Animal Disease

Hardin County experienced a confirmed case of highly pathogenic avian influenza (HPAI) in April 2022. According to IDALS, the virus was found in a commercial turkey meat bird and 46,000 birds were affected. 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.[64]

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 eight instances of plant diseases reported from 2000-2022 by the RMA. These outbreaks occurred in 2000, 2001, 2002, 2004, 2010, 2014, and 2016, and caused $43,747 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 five Canadian provinces and 36 US states, primarily in the eastern, southern, and midwestern regions. EAB was first confirmed in Iowa on May 14th, 2010. Figure 19 shows the locations of Iowa's confirmed EAB cases as of June 2023. EAB was detected in Hardin County in 2018. 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.[65] In Hardin County, EAB was confirmed in the City of Eldora in 2018.[66] 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.[67] Dead or dying trees affected by EAB are also more likely to cause damage during high winds, severe thunderstorms, or severe winter storms from weakened or hazardous limbs and can contribute a significant fuel load to grass/wildfire events.

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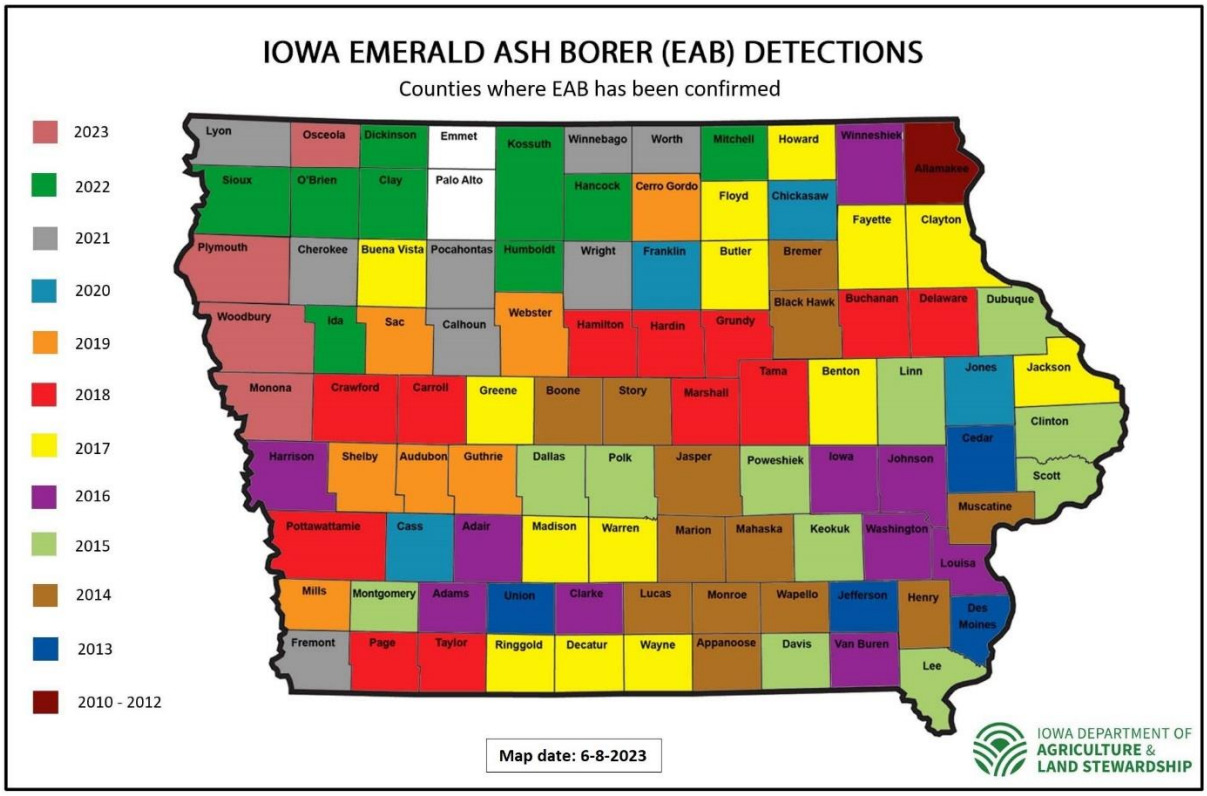
[64] Iowa Department of Agriculture and Land Stewardship. April 2022. "Iowa Department of Agriculture and Land Stewardship and USDA APHIS Confirm Additional Case of Highly Pathogenic Avian Influenza in Hardin County, Iowa." https://iowaagriculture.gov/news/hpai-confirmed-hardin-county.

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

[66] Iowa Department of Agriculture & Land Stewardship. 2023. "EAB Confirmed Locations in Iowa." http://www.iowatreepests.com/documents/EAB_Locations_List.pdf .

[67] 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.

Figure 19: EAB Infestation Status in Iowa



Source: Iowa Department of Agriculture & Land Stewardship, 2023[68]

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 (2000-2022) there were eight 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 50: Agricultural Plant Disease Losses

Hazard Type	Number of Events	Events per Year	Total Crop Loss	Average Annual Crop Loss
Plant Disease	8	.35	$43,747	$1,902

Source: RMA, 2000-2022

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.

[68] Iowa Department of Agriculture & Land Stewardship. 2023. "Iowa Emerald Ash Borer (EAB) Infestation Status." http://www.iowatreepests.com/eab_home.html.

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 (eight out of 23 years with a reported event), for the purposes of this plan, the annual probability of agricultural plant disease occurrence is 30%.

Community Top Hazard Status

The City of Ackley is the only jurisdiction that identified Animal and Plant Disease 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 51: 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 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 52: 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.

Location

According to USACE’s National Inventory of Dams, there are a total of 20 dams located within the planning area, with classifications ranging from low to significant hazard potential. Figure 20 maps the location of these dams in the county.

Figure 20: Dam Locations

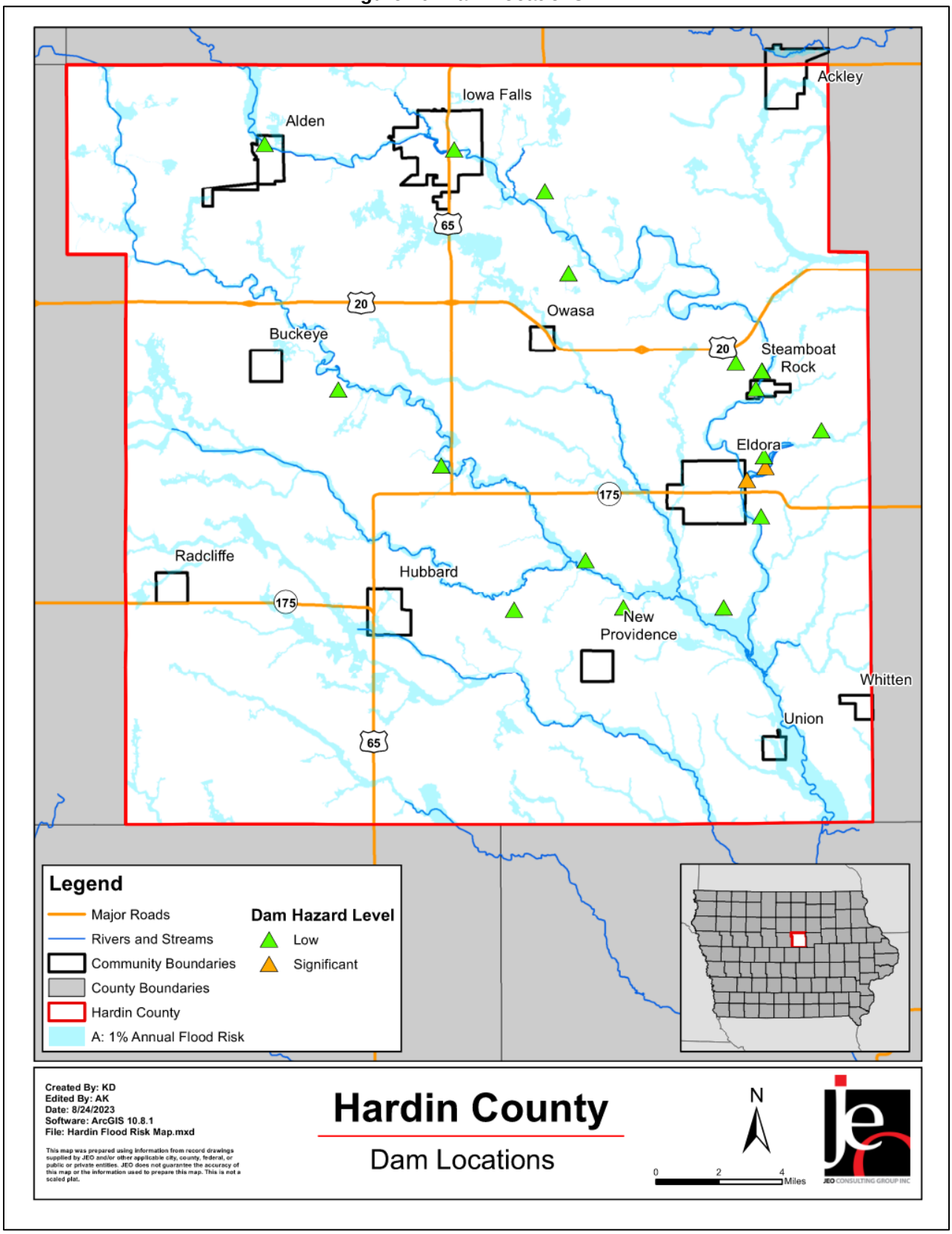


Table 53: Dams in the County

Low Hazard	Significant Hazard	High Hazard
18	2	0

Source: USACE, 2023[69]
*IDNR classifies three dams as significant hazard.

The USACE inventory lists 20 dams in the county.[70] Eighteen dams are classified as low hazard potential and two are classified as significant hazard potential. No dams were classified as high hazard dams. 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. If a dam within the county is reclassified as a high hazard potential dam, then an EAP would be required and developed.

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

Historical Occurrences
According to both IDNR and the Association of State Dam Safety Dam Incident Database, there are no reported dam failures within the planning area.[71]

Average Annual Losses
There are no recorded instances of dam 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.

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

Community Top Hazard Status
The City of Iowa Falls is the only jurisdiction that identified Dam Failure as a top hazard of concern.

Regional Vulnerabilities

[69] United States Army Corps of Engineers. May 2023. “National Inventory of Dams.” https://nid.sec.usace.army.mil/#/dams/search/sy=@countyState:Hardin,%20Iowa&viewType=map&resultsType=dams&advanced=false&hideList=false&eventSystem=false.
[70] Iowa Department of Natural Resources. August 2023. “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.
[71] Association of State Dam Safety Officials. “Dam Incident Database Search”. Accessed August 2023. https://damsafety.org/incidents

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

Table 54: Regional Dam 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
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
Built Environment	-Damage to facilities, recreation areas, and roads
Infrastructure	-Transportation routes could be closed for extended period of time
Critical Facilities	-Any critical facilities in inundation 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

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.

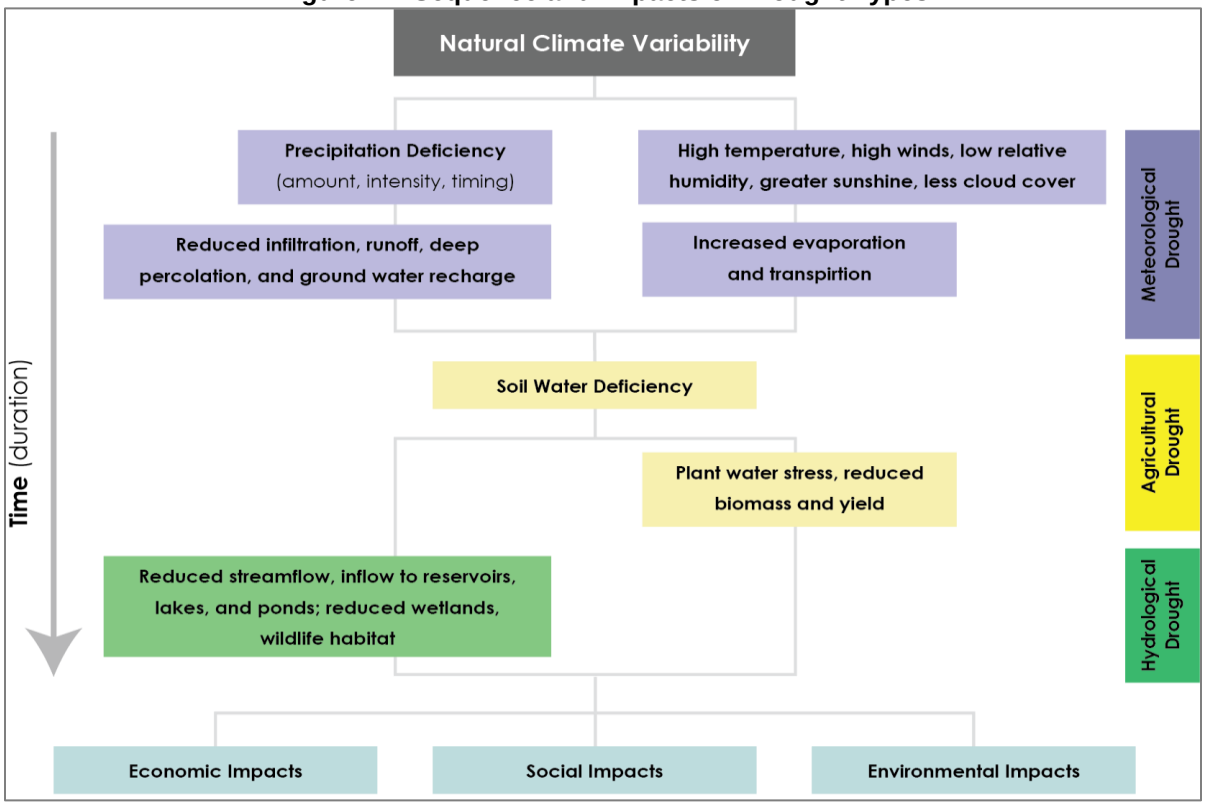
- **Hydrologic Drought** occurs when water available in aquifers, lakes, and reservoirs falls below the statistical average. This situation can arise even when the area of interest receives average precipitation. This is due to the reserves diminishing from increased water usage, usually from agricultural 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.[72]

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

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

Figure 21: Sequence and Impacts of Drought Types



Source: National Drought Mitigation Center, University of Nebraska-Lincoln, 2017[73]

Location

The entire county is susceptible to drought impacts.

Historical Occurrences

Table 55 indicates it is reasonable to expect extreme drought to occur 4.1% of the time for the planning area (63 extreme drought months in 1,539 months). Severe drought occurred in 83 months of the 1,539 months of record (5.4% of months). Moderate drought occurred in 128 months of the 1,539 months of record (8.3% of months), and mild drought occurred in 172 of the 1,539 months of record (11.2% of months). Non-drought conditions occurred in 1,093 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 37.9 inches according to the NCEI.[74]

[73] National Drought Mitigation Center. 2017. “Types of Drought.” https://drought.unl.edu/.

[74] NOAA National Centers for Environmental Information. April 2023. "Data Tools: 1991-2020 Normals." [datafile]. https://www.ncdc.noaa.gov/cdo-web/datatools/normals.

Table 55: Historic Droughts

Drought Magnitude	Months in Drought	Percent Chance
-1 Magnitude (Mild)	172/1,539	11.2%
-2 Magnitude (Moderate)	128/1,539	8.3%
-3 Magnitude (Severe)	83/1,539	5.4%
-4 Magnitude or Greater (Extreme)	63/1,539	4.1%

Source: NCEI, 1895 - March 2023[75]

Extent

Climatologists utilize the Palmer Drought Severity Index (PDSI) to standardize global long-term drought analysis. The data was collected from Climate Division 5, which includes the planning area, with the period of record beginning in 1895. Table 56 shows the details of the Palmer classifications. Figure 22 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 56: Palmer Drought Severity Index Classification

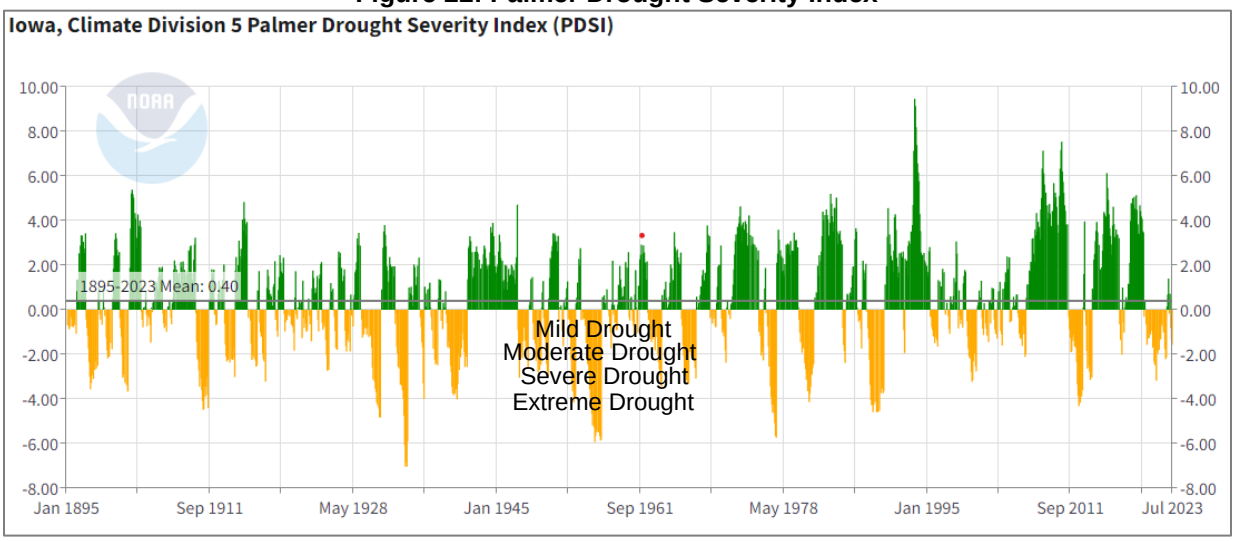
Numerical Value	Description	Numerical Value	Description
4.0 or more	Extremely wet	-0.5 to -0.99	Incipient dry spell
3.0 to 3.99	Very wet	-1.0 to -1.99	Mild drought
2.0 to 2.99	Moderately wet	-2.0 to -2.99	Moderate drought
1.0 to 1.99	Slightly wet	-3.0 to -3.99	Severe drought
0.5 to 0.99	Incipient wet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

Source: Climate Prediction Center[76]

[75] National Centers for Environmental Information. 1895 - March 2023. "Climate at a Glance: Divisional Time Series". Accessed April 2023. https://www.ncdc.noaa.gov/cag/divisional/time-series.

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

Figure 22: Palmer Drought Severity Index

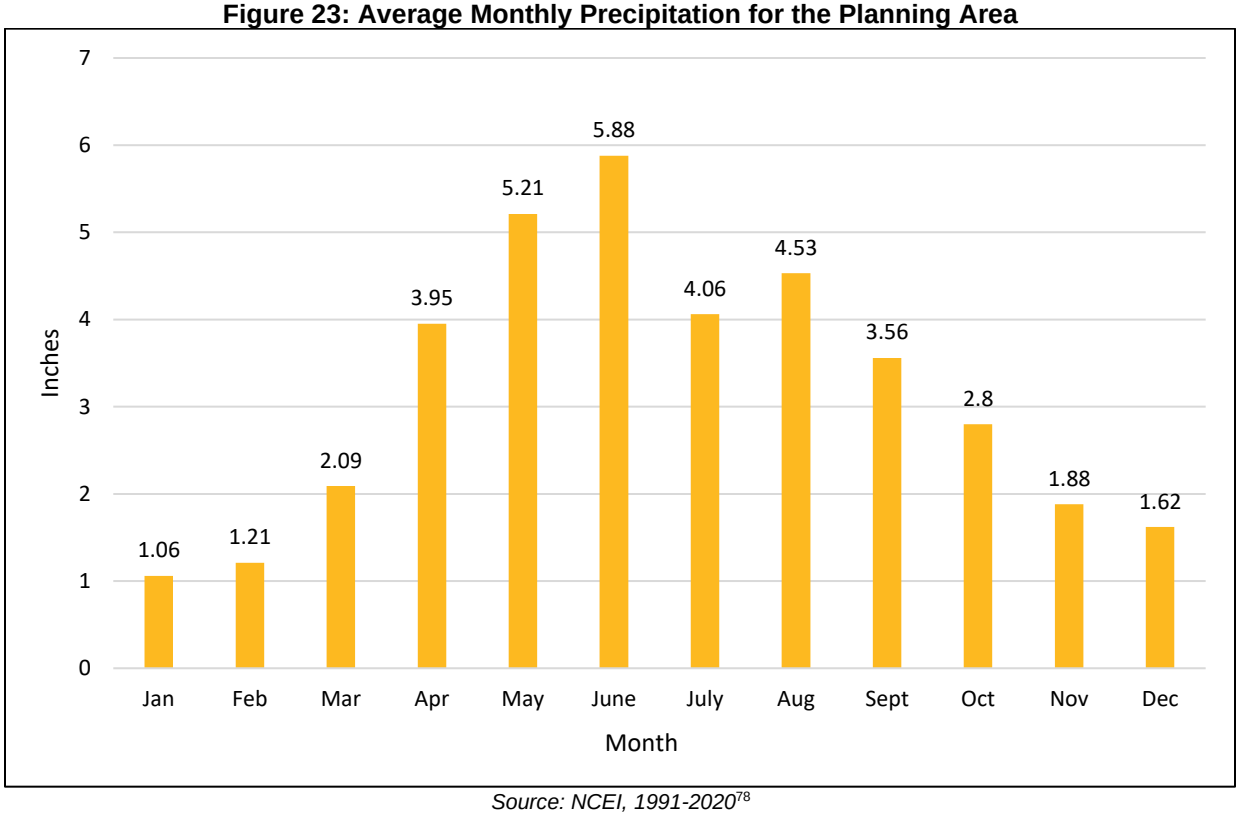


Source: NCEI, 1895 - July 2023[77]

Figure 23 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 influences growing conditions for farmers.

[77] National Centers for Environmental Information. 1895 – July 2023. "Climate at a Glance: Divisional Time Series". Accessed August 2023. https://www.ncdc.noaa.gov/cag/divisional/time-series.

Figure 23: Average Monthly Precipitation for the Planning Area



Source: NCEI, 1991-2020[78]

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 57: 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	$468,519	$36,950,215	$1,606,531

Source: 1 Indicates data is from NCEI (1996-2022); 2 Indicates data is from USDA RMA (2000-2022)

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.

[78] NOAA National Centers for Environmental Information. April 2023. "Data Tools: 1991-2020 Normals." [datafile]. https://www.ncdc.noaa.gov/cdo-web/datatools/normals.

Table 58: Period of Record in Drought

PDSI Value	Magnitude	Drought Occurrences by Month	Monthly Probability
4 or more to -0.99	No Drought	1,093/1,539	71.0%
-1.0 to -1.99	Mild Drought	172/1,539	11.2%
-2.0 to -2.99	Moderate Drought	128/1,539	8.3%
-3.0 to -3.99	Severe Drought	83/1,539	5.4%
-4.0 or less	Extreme Drought	63/1,539	4.1%

Source: NCEI, 1895 - March 2023[79]

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 eight 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 59: Notable Drought Impacts in Planning Area

Category	Date	Title
Agriculture	7/25/2023	Drought, heat hurt crop conditions in Iowa
Fire, Relief, Response & Restrictions	10/25/2022	Burn bans in 28 Iowa counties
Society & Public Health, Tourism & Recreation, Water Supply & Quality	10/5/2021	Drought contributed to higher number of swim advisories in Iowa lakes
Fire, Relief, Response & Restrictions	10/23/2020	Iowa counties adopt burn bans
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, Relief, Response & Restrictions	5/17/2013	Drought-related USDA disaster declarations in 2013
Agriculture	7/5/2012	Corn leaves rolling in Hardin County, Iowa

Source: NDMC, 2000 - July 2023[80]

[79] National Centers for Environmental Information. 1895-March 2023. Accessed April 2023. https://www.ncdc.noaa.gov/cag/divisional/time-series.

[80] National Drought Mitigation Center. 2023. "U.S. Drought Impact Reporter." Accessed August 2023. http://droughtreporter.unl.edu/map/.

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

Table 60: 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

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 61: 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[81]

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

Table 62: 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

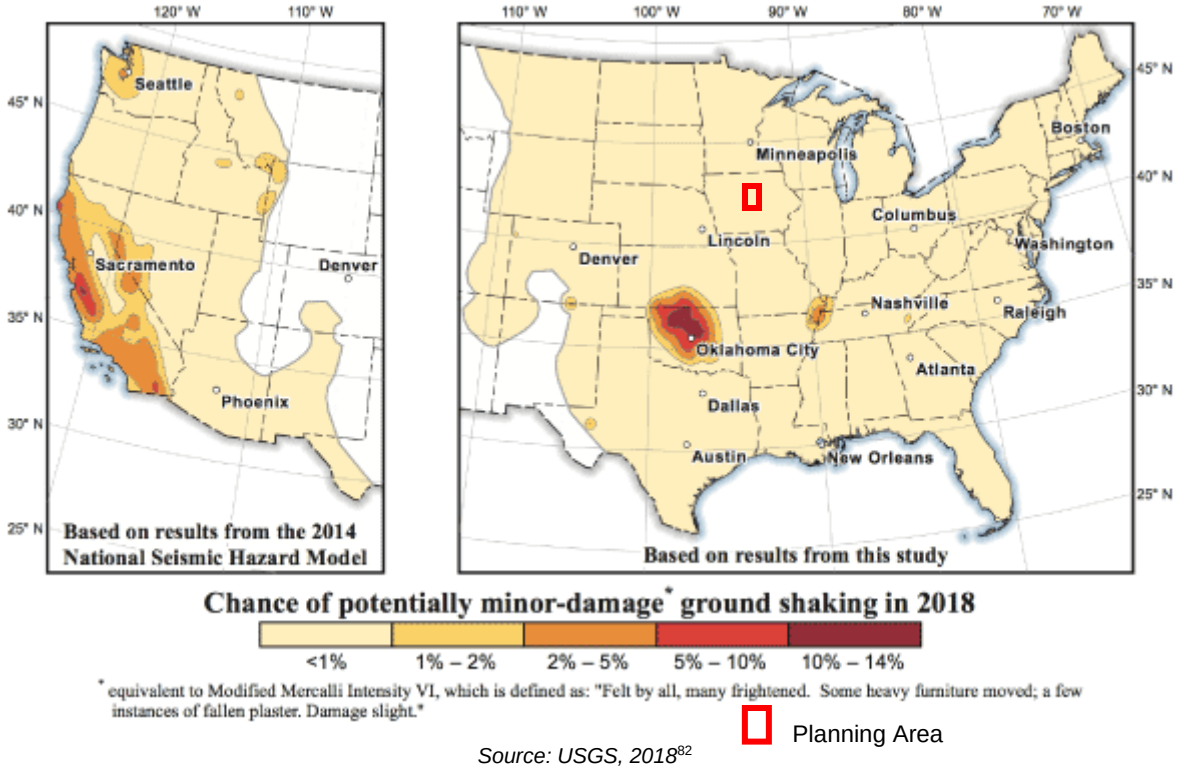
Location
According to the Iowa Department of Natural Resources, there are no major fault lines in Iowa.

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. 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 24 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 24: 2018 Probability of Damage from Earthquakes



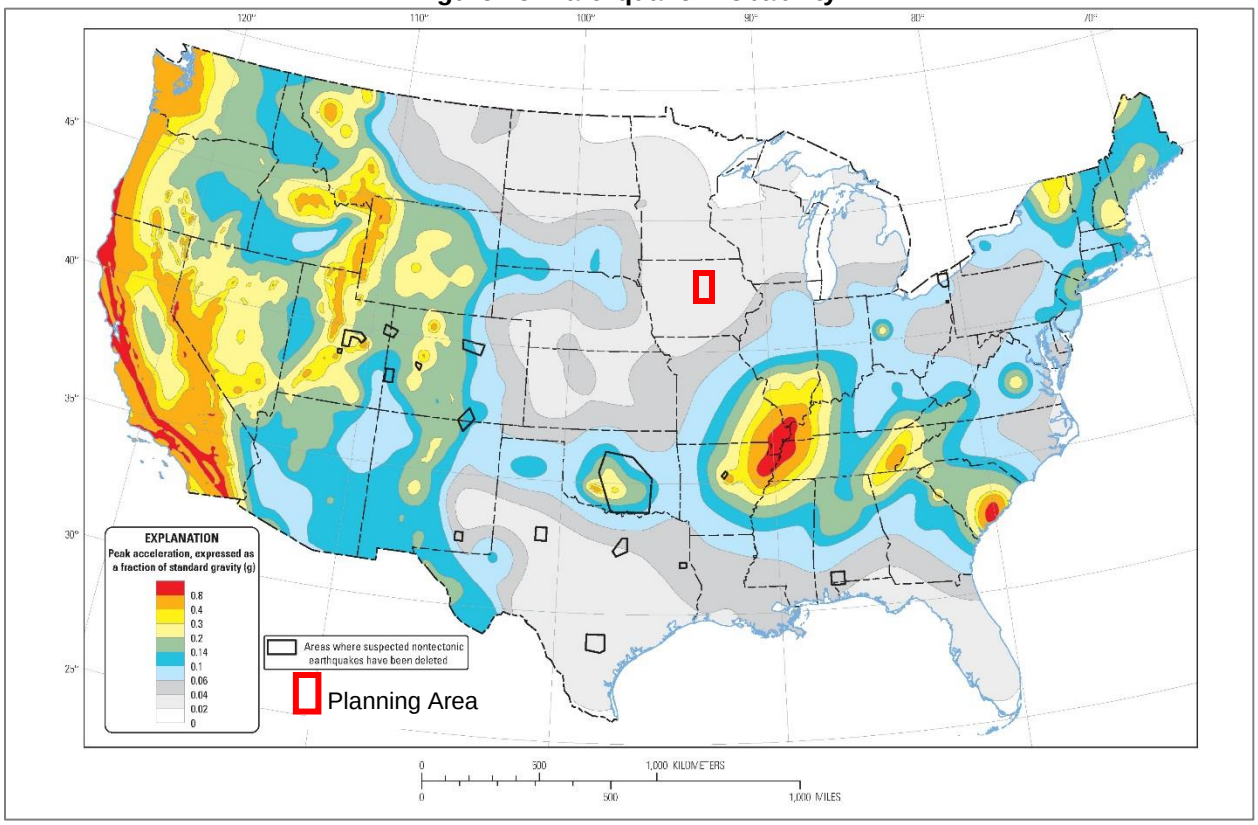
Source: USGS, 2018[82]

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.

[82] 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 25: 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 63: 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[83]

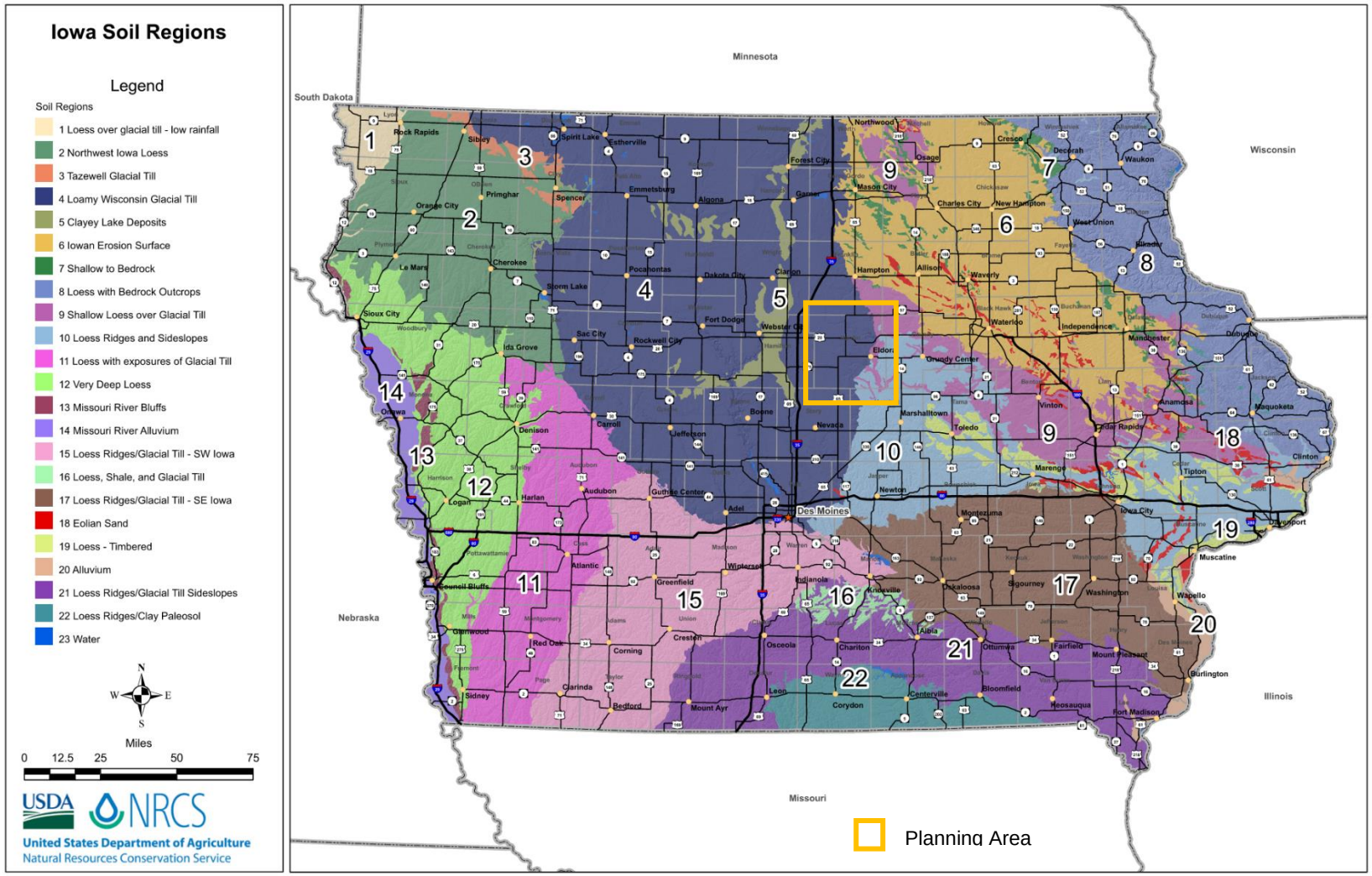
For Iowa, the vulnerability to this hazard most frequently is associated with soils shrinking during periods of drought.

Location

The following figure shows a map of the soil types in Iowa. Hardin County mainly has Loamy Wisconsin Glacial Till, with the southeast corner and eastern edge made up of Shallow Loess over Glacial Till and Loess Ridges and Sideslopes. Glacial Till is a high-clay content soil that is prone to expansion. Loess is a compressive soil comprised mainly of silt.

83 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 26: Iowa Soil Regions



Source: NRCS[84]

[84] Iowa Natural Resources Conservation Service. Accessed August 2023. "Iowa Soil Regions Map." https://www.nrcs.usda.gov/sites/default/files/2022-09/IowaSoilRegionsMap.pdf.

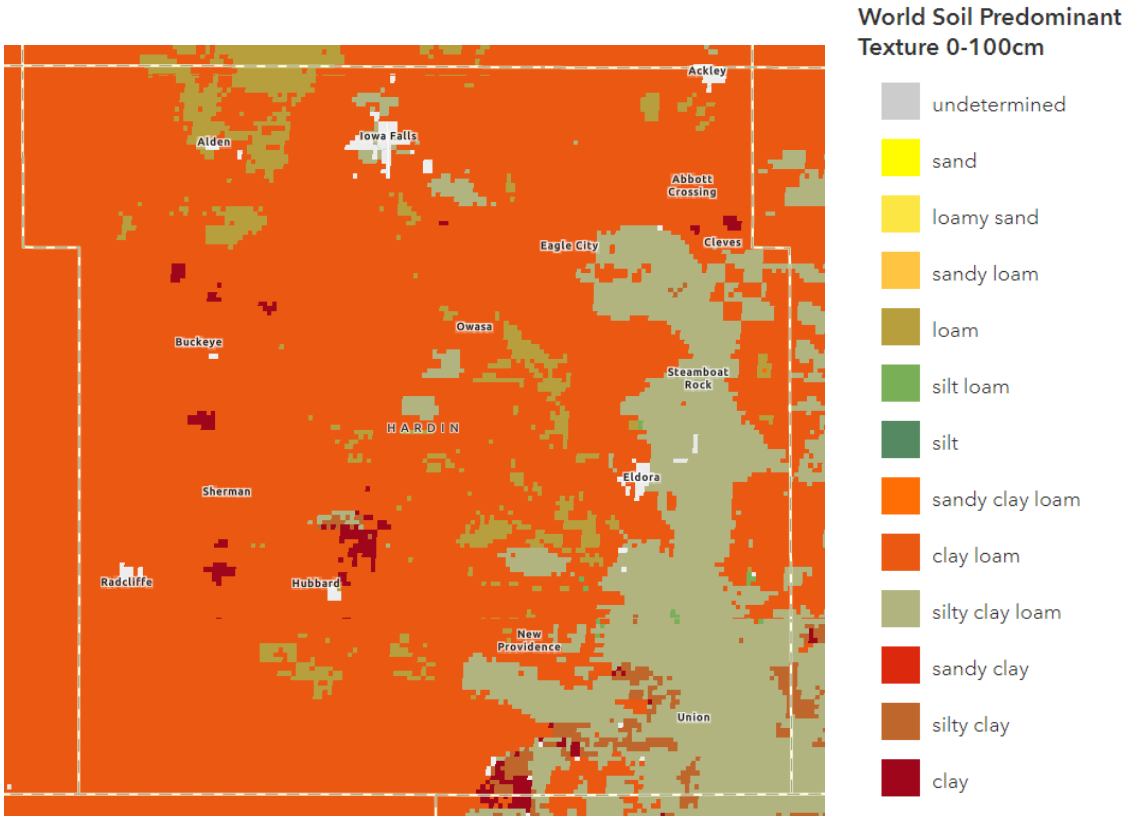
Historical Occurrences

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 Hardin County are shown in Figure 27. 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 world's crop rooting depths. Hardin County primarily consists of sandy clay loam, silty clay loam, loam, and clay soil textures.

Figure 27: Predominant Soil Texture 0-100 cm



Source: Esri Environment, 2023[85]

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.

[85]Esri Environment. August 2023. "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 64: 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 Temperatures (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 body's 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.

The NWS also posts watches and warnings during anticipated dangerous cold wind chill values.

- **Wind chill advisories** are issued when seasonably cold wind chill values, but not extremely cold values are expected or occurring.
- **Wind chill watches** are released when dangerously cold wind chill values are possible.
- **Wind chill warnings** are issued when dangerously cold wind chill values are expected or occurring.

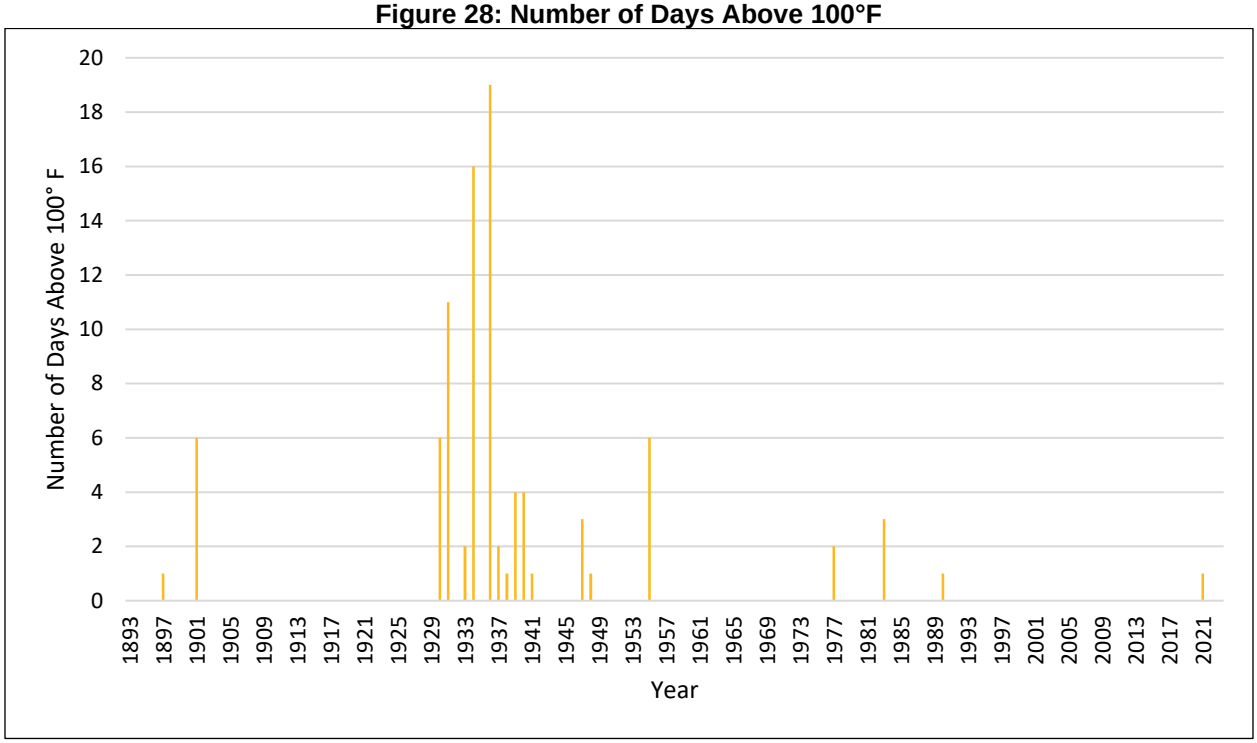
Location

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

Historical Occurrences

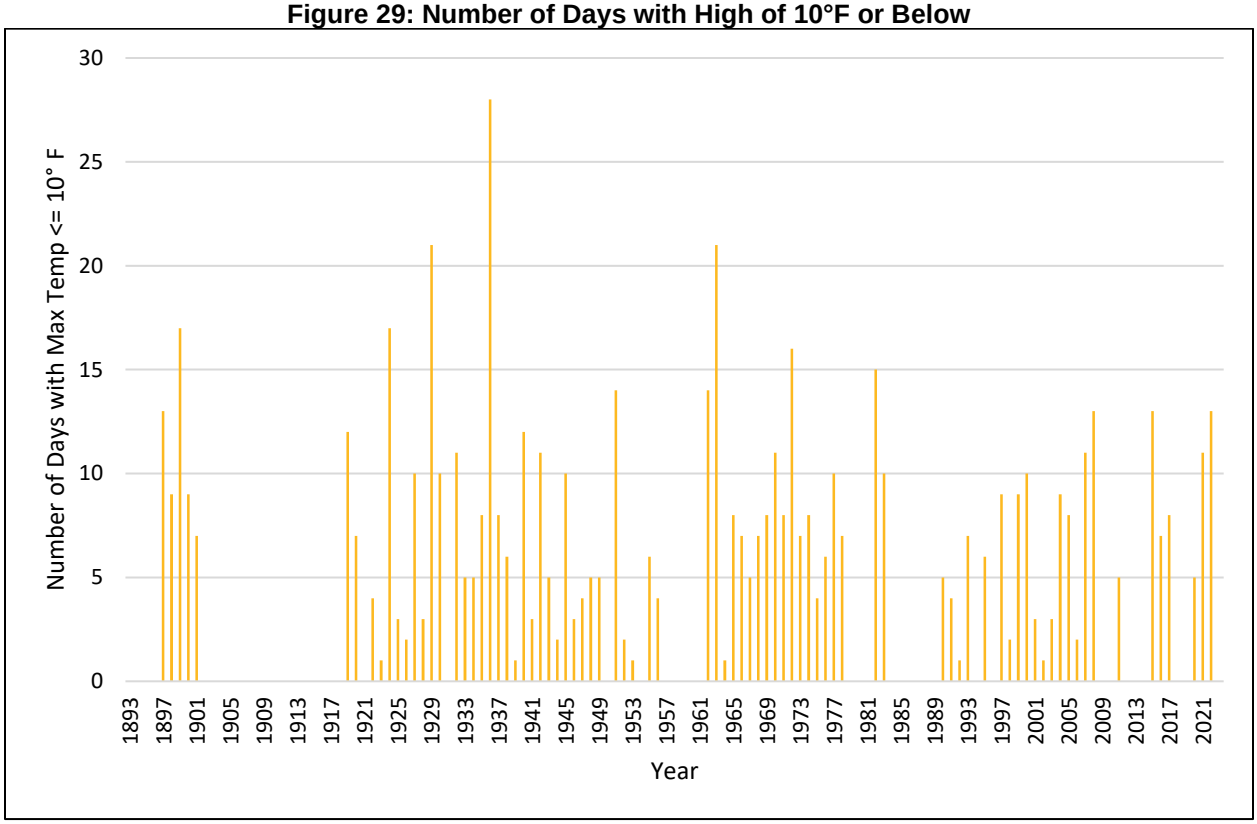
According to the High Plains Regional Climate Center (HPRCC), on average, the county experiences one day above 100°F per year. The county experienced the most days on record above 100°F in 1936 with 19 days (Figure 28). Conversely, the planning area experiences an annual average of eight days with a high of 10°F or below and saw the most days below 10°F in 1936 with 28 days (Figure 29).

Figure 28: Number of Days Above 100°F



Source: HPRCC, 1893 – April 2023

Figure 29: Number of Days with High of 10°F or Below



Source: HPRCC, 1893 – April 2023

Extent (Extreme Heat)

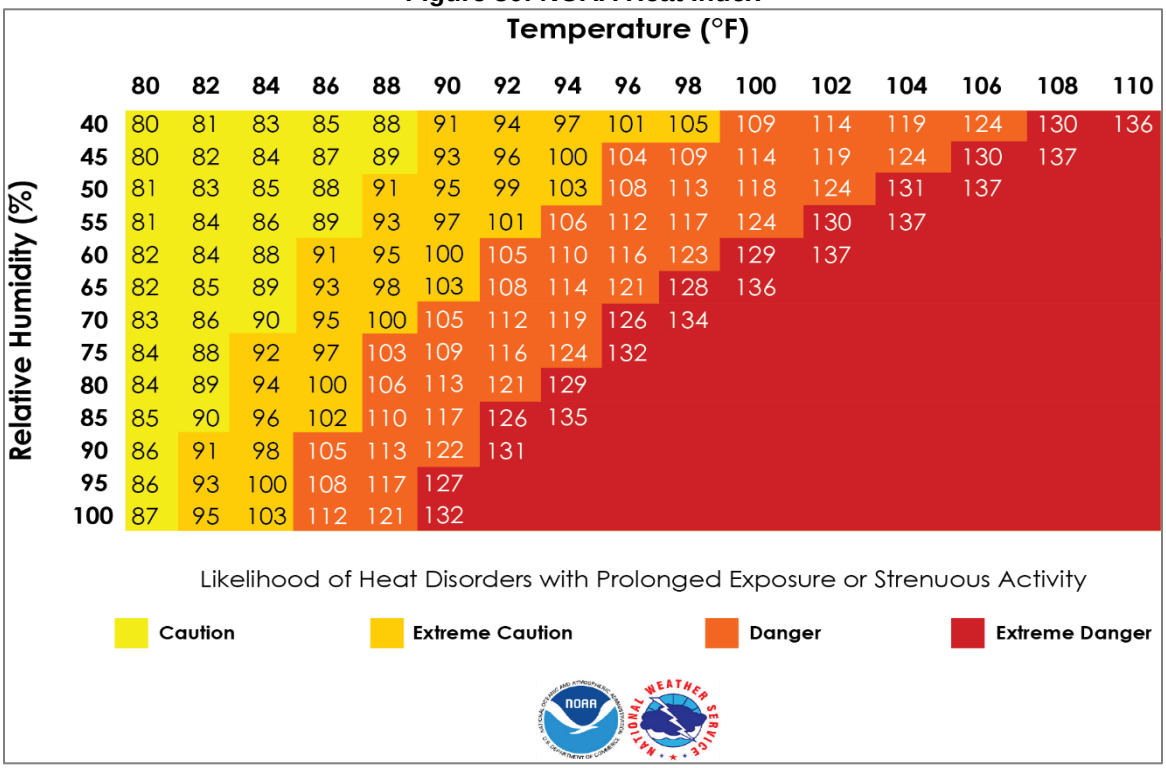
A key factor to consider regarding extreme heat situations is the humidity level relative to the temperature. As is indicated in the following figure from the National Oceanic and Atmospheric Administration (NOAA), as the relative humidity increases, the temperature needed to cause a dangerous situation 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 30 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 defined as temperatures of 100°F or greater. In the planning area, the months with the highest temperatures are June, July, and August (Figure 31) The average high for these three months is 81.8 °F.[86]

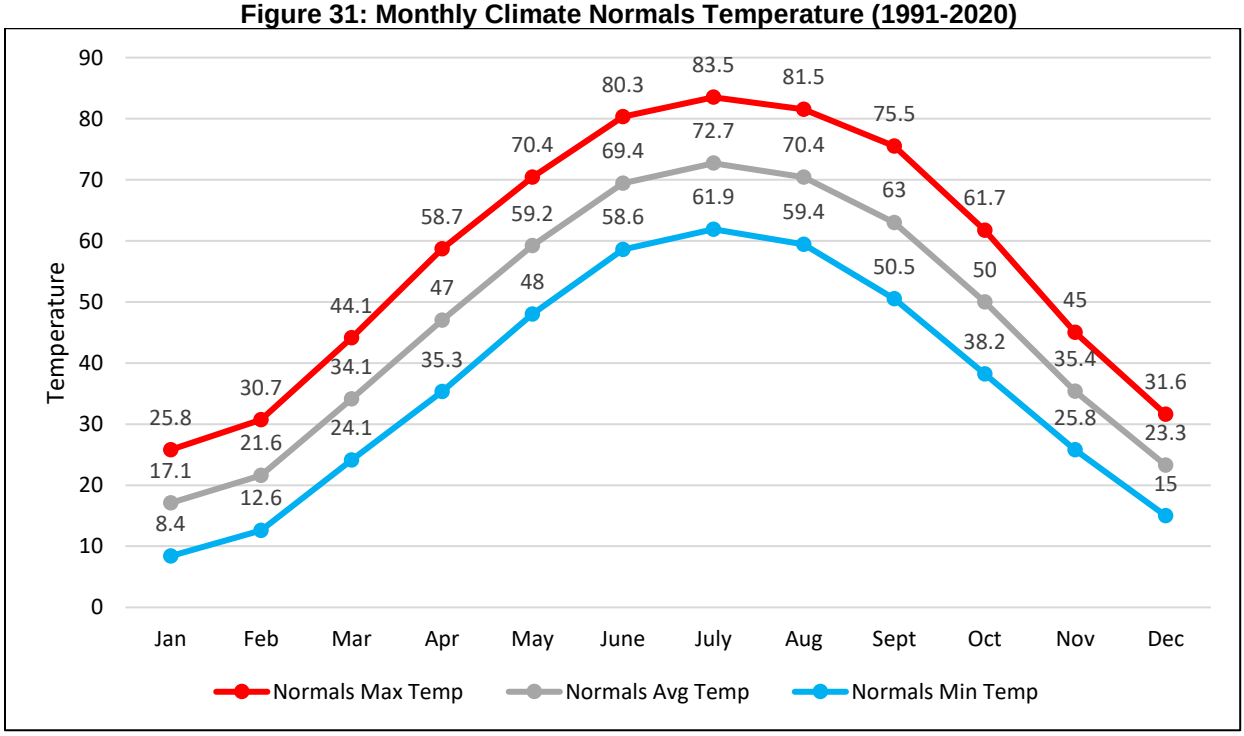
[86] NOAA National Centers for Environmental Information. April 2023. "Data Tools: 1991-2020 Normals." [datafile]. https://www.ncdc.noaa.gov/cdo-web/datatools/normals.

Figure 30: NOAA Heat Index



Source: NOAA, 2017[87]

Figure 31: Monthly Climate Normals Temperature (1991-2020)



Source: NCEI, 2023

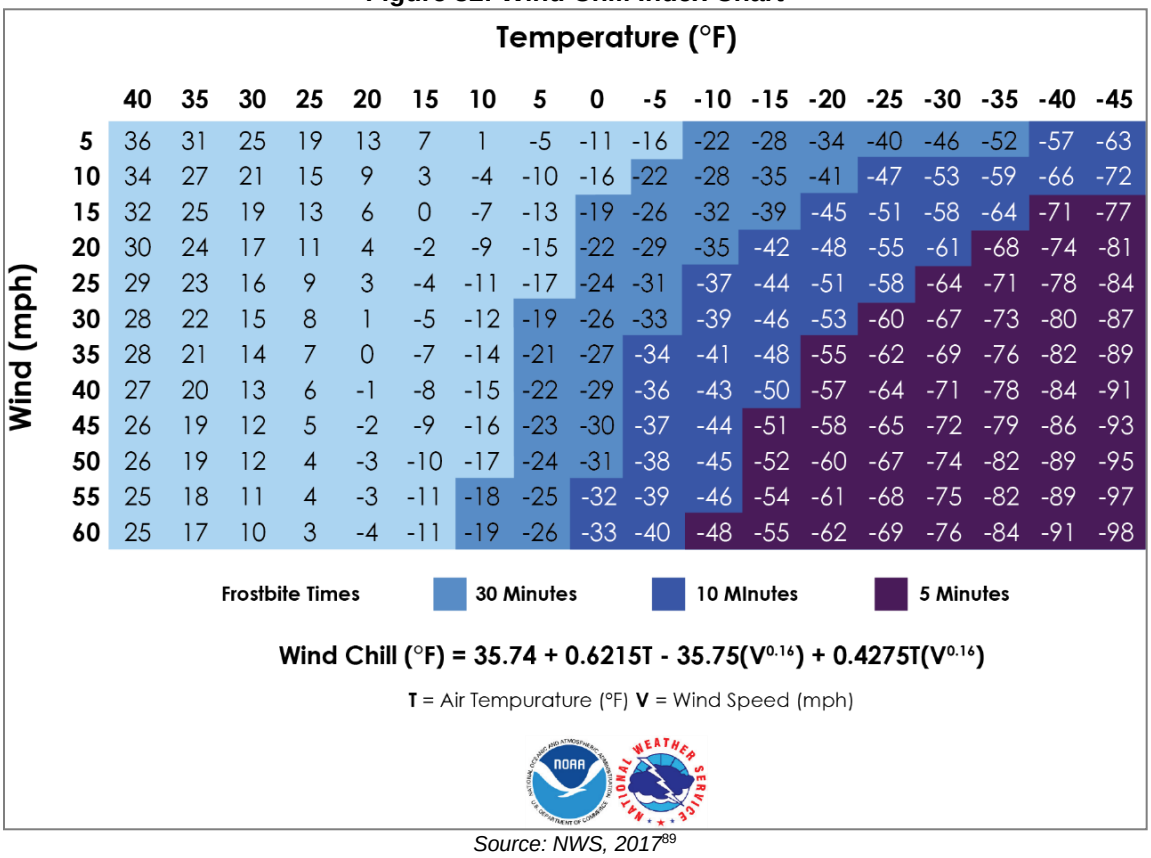
[87] National Oceanic and Atmospheric Administration, National Weather Service. 2017. "Heat Index." http://www.nws.noaa.gov/om/heat/heat_index.shtml.

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 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 31). The average low for these three months is 12°F.[88]

The NWS developed the Wind Chill Index 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 32 shows the Wind Chill Index used by the NWS.

Figure 32: Wind Chill Index Chart



Source: NWS, 2017[89]

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

[88] NOAA National Centers for Environmental Information. April 2023. "Data Tools: 1991-2020 Normals." [datafile]. https://www.ncdc.noaa.gov/cdo-web/datatools/normals.

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

critical facilities. High demand and intense use of HVAC systems or water pumps can overload the electrical systems and damage infrastructure.

Table 65: 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 day	$135,000	$5,000	$785,106	$34,135

Source: 1 HPRCC (1893 – March 2023); 2 Indicates data is from NCEI (1996 to 2022); 3 Indicates data is from USDA RMA (2000 to 2022)

Table 66: 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	8 days	$0	$0	$18,198	$791

Source: 1 HPRCC (1893 – March 2023); 2 Indicates data is from NCEI (1996 to 2022); 3 Indicates data is from USDA RMA (2000 to 2022)

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.[90] 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 67: Loss of Electricity - Assumed Damage

Jurisdiction	2020 Population	Population Affected (Assumed)	Electric Loss of Use Assumed Damage Per Day
Hardin County	16,878	1,688	$293,712

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 83 out of 131 years. The probability that extreme heat will occur in any given year in the planning area is 63 percent. Extreme cold events having at least one day with a high at or below 10°F occurred in 83 out of 131 years. The probability that extreme cold will occur in any given year in the planning area is 63 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*[91] 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.

[90] 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.

[91] 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.

Table 68: Extreme Heat Predictions for Days over 100°F

Jurisdiction	Midcentury Prediction 2036-2065 (days per year)	Late Century Prediction 2070-2099 (days per year)
Hardin County	28	53

Source: Union of Concerned Scientists, 1971-2000[92]

Community Top Hazard Status

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

Jurisdictions	
City of Union	Iowa Falls-Alden Schools

Regional Vulnerabilities

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

Table 69: 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

[92] Union of Concerned Scientists. 2023. "Extreme Heat and Climate Change: Interactive Tool". https://www.ucsusa.org/resources/killer-heat-interactive-tool?location=hardin-county--ia.

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 are 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 occur more frequently on wide, shallow rivers, although other rivers can be impacted.

Location

The county resides in the South Skunk, Upper Iowa, and Middle Cedar watersheds. Main waterways in the planning area include the Iowa River and the South Fork Iowa River. The county is also home to Pine Lake, located in east central Hardin County. These rivers, their tributaries, and lakes are potential locations for flooding to occur.

Table 70 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 33 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 70: FEMA FIRM Panel Status

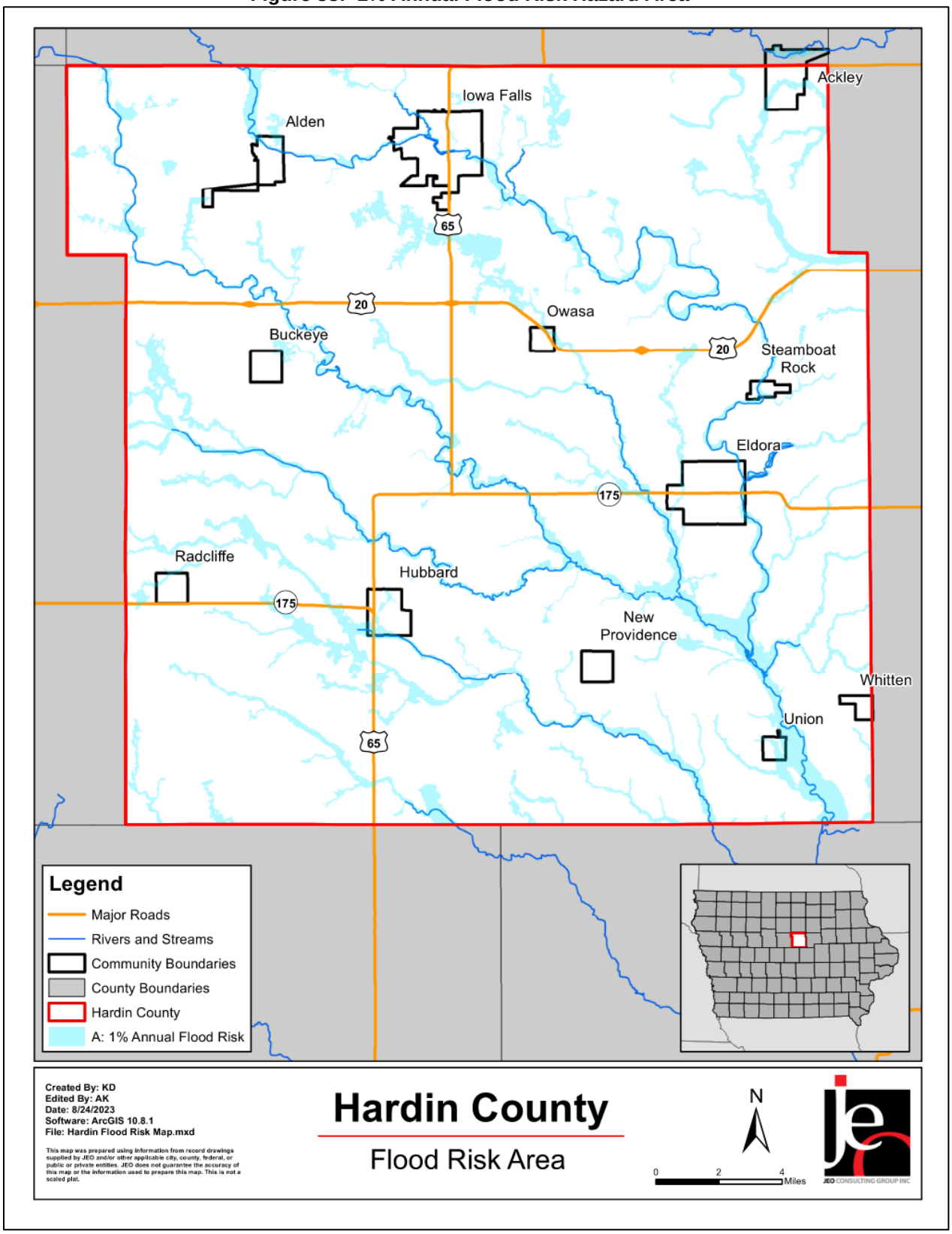
Jurisdiction	Participating in NFIP? (Y/N)	Panel Number	Effective Date
Hardin County	Y	19083CIND0A, 19083C0385C, 19083C0380C, 19083C0375C, 19083C0350C, 19083C0325C, 19083C0300C, 19083C0280C, 19083C0275C, 19083C0260C, 19083C0245C, 19083C0240C, 19083C0235C, 19083C0230C, 19083C0225C, 19083C0200C, 19083C0195C, 19083C0190C, 19083C0175C, 19083C0150C, 19083C0135C, 19083C0125C, 19083C0110C, 19083C0095C, 19083C0090C, 19083C0075C, 19083C0065C, 19083C0045C, 19083C0040C, 19083C0025C, 19083C0020C	6/19/2012
Ackley	Y	19083CIND0A, 19083C0095C, 19083C0090C, 19083C0085C, 19083C0080C	6/19/2012
Alden	Y	19083CIND0A, 19083C0020C, 19083C0040C, 19083C0110C	6/19/2012
Buckeye	N	19083CIND0A, 19083C0125C, 19083C0150C	6/19/2012
Eldora	Y	19083CIND0A, 19083C0190C, 19083C0260C, 19083C0280C	6/19/2012
Hubbard	Y	19083CIND0A, 19083C0230C, 19083C0235C, 19083C0240C, 19083C0245C	6/19/2012
Iowa Falls	Y	19083CIND0A, 19083C0045C, 19083C0065C, 19083C0135C	6/19/2012
New Providence	N	19083CIND0A, 19083C0275C	6/19/2012
Owasa	N	19083CIND0A, 19083C0175C	6/19/2012
Radcliffe	N	19083CIND0A, 19083C0225C	6/19/2012
Steamboat Rock	Y	19083CIND0A, 190141, 19083C0190C, 19083C0195C	1/3/1975, 6/19/2012
Union	Y	19083CIND0A, 19083C0380C, 19083C0385C	6/19/2012
Whitten	N	19083CIND0A, 19083C0300C	6/19/2012

Source: FEMA, 2023[93] [94]

[93] Federal Emergency Management Agency. 2023. "FEMA Flood Map Service Center." Accessed August 2023. http://msc.fema.gov/portal/advanceSearch.

[94] Federal Emergency Management Agency. 2023. "Community Status Book Report." Accessed May 2023. https://www.fema.gov/flood-insurance/work-with-nfip/community-status-book.

Figure 33: 1% Annual Flood Risk Hazard Area



Risk Map Products

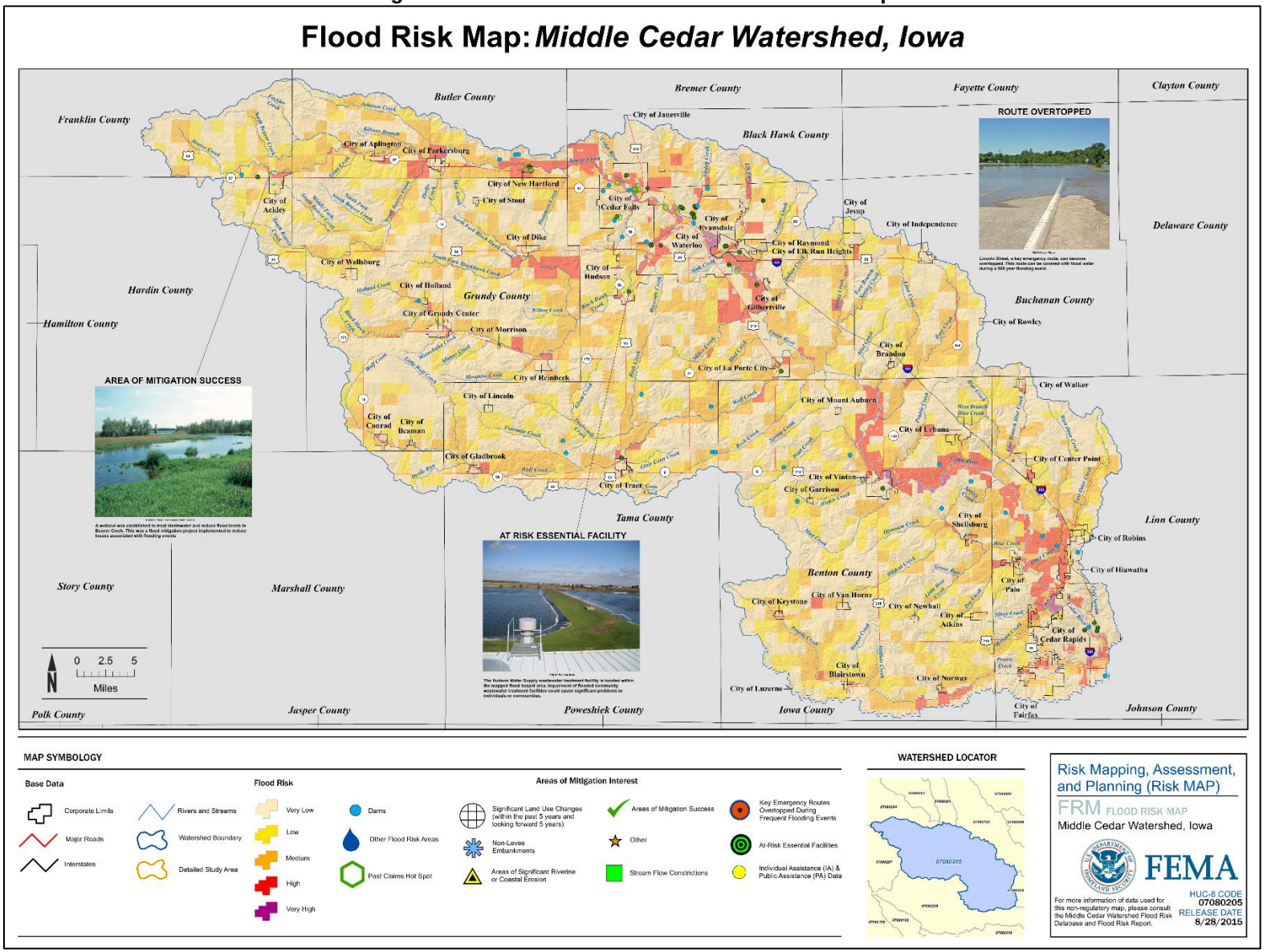
Risk Mapping, Assessment, and Planning (Risk MAP) is a FEMA program that provides communities with flood information and additional flood risk data (e.g., flood depth grids, percent chance grids, areas of mitigation interest, etc.) that can be used to enhance their mitigation plans and take action to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

One Risk Map product was completed for a watershed in the planning area. In 2015, a Risk Map project for the Middle Cedar Watershed was completed. According to the Middle Cedar Watershed Flood Risk Report, the watershed has a drainage area of 2,417 square miles and its main water body is the Cedar River.[95] The Flood Risk Map can be seen in Figure 34.[96] The watershed includes portions of Hardin County and nine other counties. The only community within the Hardin County portion of the watershed is Ackley. Total estimates for potential losses from flood event scenarios exceed $30.3 million in annualized losses.

[95] FEMA. 2015. Flood Risk Report: Middle Cedar Watershed, Iowa." https://map1.msc.fema.gov/data/FRP/FRR_07080205_20150831.pdf?LOC=ebe7ceb8b63bfe915ee6bc4089f7b5db.

[96] FEMA. 2015. "Flood Risk Map: Middle Cedar Watershed, Iowa." https://map1.msc.fema.gov/data/FRP/FRM_07080205_20150831.pdf?LOC=06ce4861a344a3f08e9e33da36c34be6.

Figure 34: Middle Cedar Watershed Flood Risk Map



According to the Iowa Department of Natural Resources, Hardin County also recently underwent other flood risk reduction projects, including LiDAR data collection and 2D base level engineering activities.[97]

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 71.

Table 71: Flooding Stages

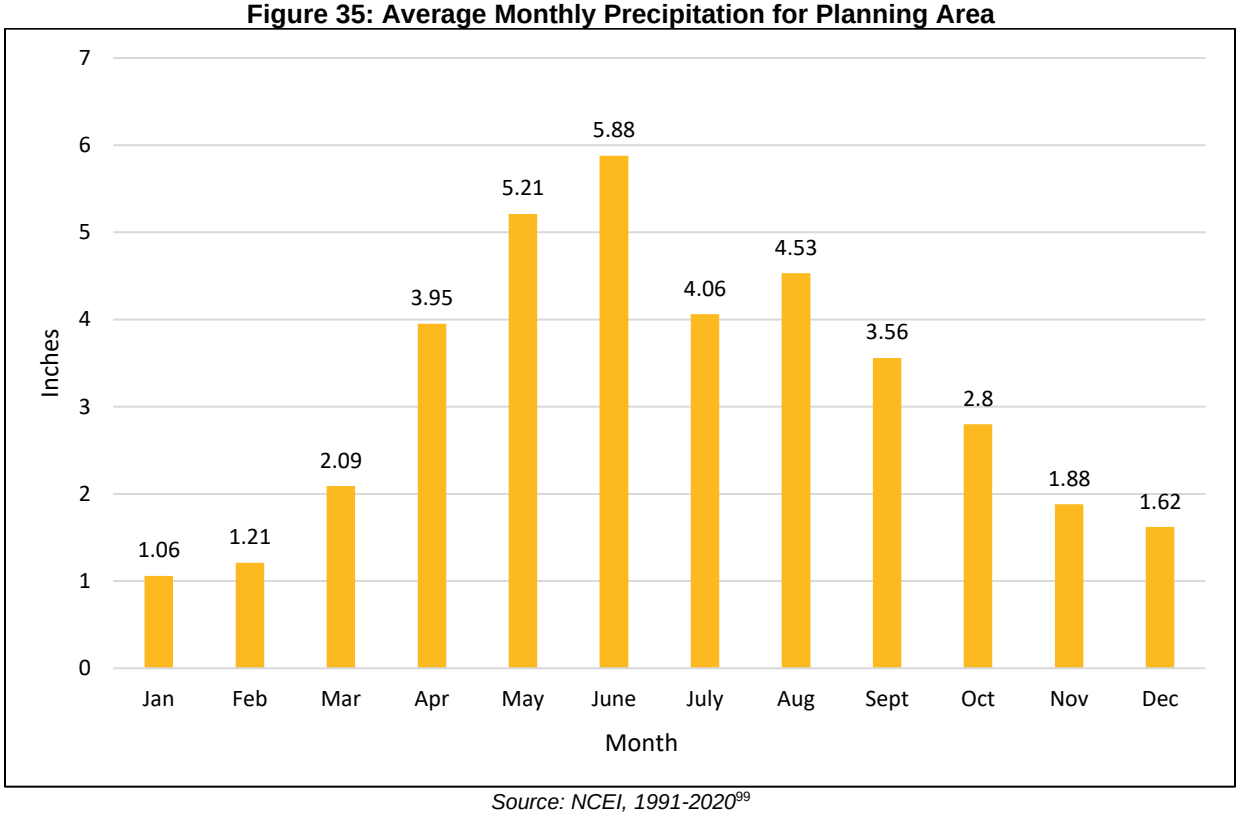
Flood Stage	Description of Flood Impacts
Minor Flooding	Minimal or no property damage, but possibly some public threat or inconvenience
Moderate Flooding	Some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary
Major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

Source: NOAA, 2017[98]

Figure 35 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 36, the most common months for flooding within the planning area are May and June.

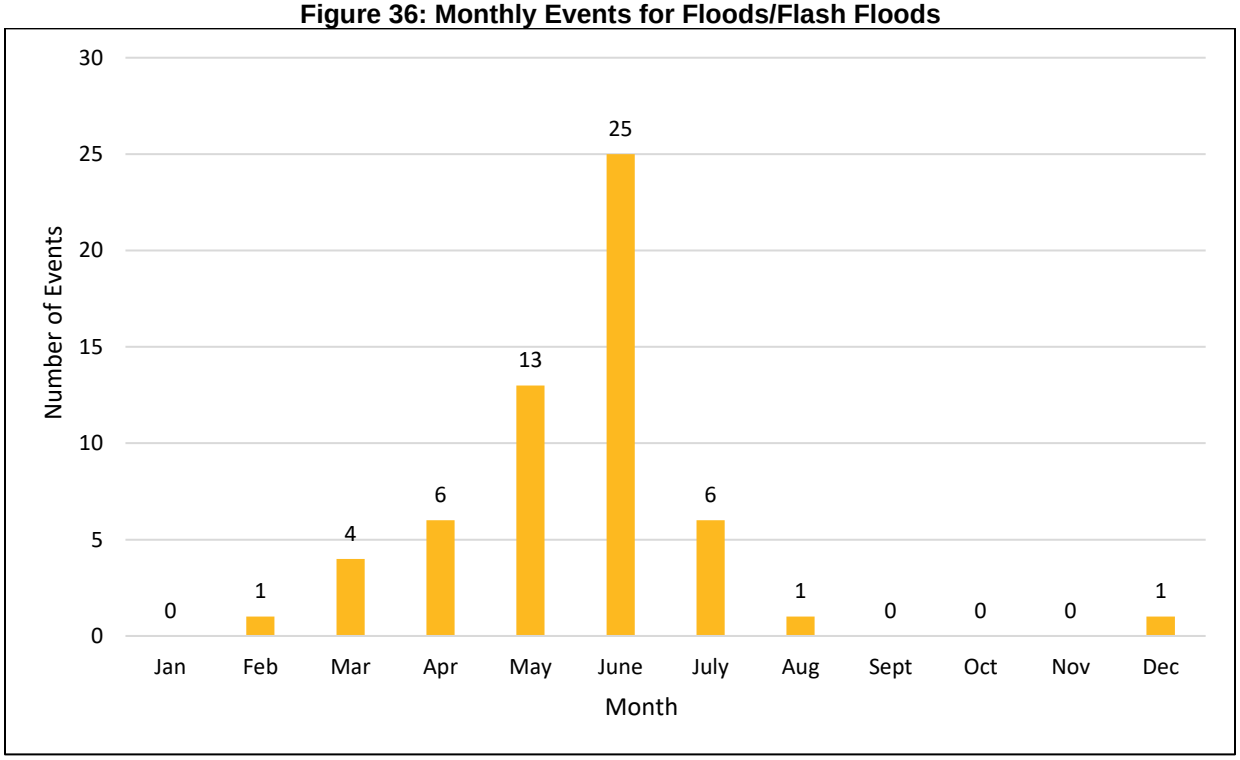
[97] Iowa Department of Natural Resources. 2023. "Flood Plain Mapping." https://www.iowadnr.gov/Environmental-Protection/Land-Quality/Flood-Plain-Management/Flood-Plain-Mapping.
[98] National Weather Service. 2017. "Flood Safety." https://www.weather.gov/safety/flood.

Figure 35: Average Monthly Precipitation for Planning Area



Source: NCEI, 1991-2020[99]

Figure 36: Monthly Events for Floods/Flash Floods



Source: NCEI, 1996-2022

[99] NOAA National Centers for Environmental Information. April 2023. "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 72: NFIP Participants

Jurisdiction	Participate in NFIP	Eligible-Regular Program	Date Current Map	Sanction	Suspension	Rescinded
Hardin County	Y	8/3/2012	6/19/2012(M)	-	-	-
Ackley	Y	8/1/2012	6/19/2012(M)	-	-	-
Alden	Y	9/1/1996	6/19/2012(M)	-	-	-
Buckeye	N	-	6/19/2012	6/19/2013	-	-
Eldora	Y	5/1/1987	6/19/2012(M)	-	-	-
Hubbard	Y	8/7/2012	6/19/2012(M)	-	-	-
Iowa Falls	Y	8/1/1987	6/19/2012(M)	-	-	-
New Providence	N	-	-	-	-	-
Owasa	N	-	6/19/2012	6/19/2013	-	-
Radcliffe	N	-	6/19/2012	6/25/1977	-	-
Steamboat Rock	Y	8/24/12	6/19/2012(M)	-	-	-
Union	Y	6/1/1987	6/19/2012(M)	-	-	-
Whitten	N	-	-	-	-	-

Source: Federal Emergency Management Agency, National Flood Insurance Program, 2023[100]
**(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.

[100] Federal Emergency Management Agency. 2023. "Community Status Book Report." Accessed April 2023. https://www.fema.gov/cis/IA.html

Table 73: NFIP Policies in Force and Total Payments

Jurisdiction	Policies In-force	Total Coverage	Total Premiums	Total Losses	Total Payments
Hardin County	5	$788,400	$6,853	1	-
Ackley	9	$502,500	$6,455	3	$17,416
Alden	3	$239,000	$3,401	1	-
Iowa Falls	4	$846,300	$5,409	1	$70,126
Steamboat Rock	2	$543,000	$1,881	1	-
Union	6	$503,100	$9,116	5	$1,614

Source: HUDEX, September 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.[101] 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 2023, there are no repetitive loss properties or severe repetitive loss properties located in the county. Definitions of a structure identified as an 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.

(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:

[101] 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.

(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, 19 flash flooding events resulted in $1,418,000 in property damage, while 38 riverine flooding events resulted in $1,953,570 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 $491,378. Descriptions of the most damaging flood events from the NCEI are below:

- **June 24, 2013 – Flash Flood – Ackley:** *An unstable airmass was in place over Iowa with CAPE over 2000 J/kg already by early in the morning. Downdraft CAPE was quite high, in the 1000 to 1300 J/kg range, with 400 to 600 J/kg in the -10 to -30 C layer of the atmosphere. The shear was quite weak, in the 25 to 35 kt range. Deep moisture was in place with precipitable water values of 1.8 inches. The LCL was quite low as well, in the 500-to-750-meter range. There was little hail as the freezing level was quite high at 14,400 feet. Strong thunderstorms developed in a north to south line across eastern Nebraska and western Iowa. During the morning the line took on a bow echo appearance as bow beta elements began to push rapidly east. A swath of 60 to 70 MPH winds took place from east of the Omaha-Council Bluffs area in southwest Iowa all the way east into central Iowa in the Marshalltown and Oskaloosa areas. The high winds overturned semi-tractor trailer trucks in Guthrie and Greene Counties. Shingles were also blown from a house in Guthrie Count west of Guthrie Center. In Audubon County, high winds lifted two farm buildings off their post foundations and carried them one quarter of a mile away. A funnel cloud was observed west of Eldora in Hardin County. Very heavy rainfall occurred over parts of northeast Iowa. Franklin, Butler, and Grundy Counties were hard hit. Numerous roads and highways were under water and closed as 4 to over 7 inches of rain fell in under six hours. The heaviest rainfall total was in the*

Aplington Area in Butler County. A total of 7.5 inches fell there. Severe flooding took place in the New Hartford area. Near record high river stages prompted the evacuation of the town. In Parkersburg, 1500 to 2000 feet of railroad tracks were washed out. There was some hail with the storms. Most of them had small hail, though no significant hail was reported. Parts of S56 were flooded. Several roads near Ackley were flooded.

- **June 16, 1996 – Flash Flood – Hubbard:** *Intense thunderstorms developed in a very unstable atmosphere. Precipitable water values were over 2 inches, with K indices in the lower to middle 40s. Surface temperatures warmed into the lower 80s with dew point readings in the lower to middle 70s. The rain was tropical in nature as a warm core low at 500 mb was approaching from the west. Thunderstorms produced copious amounts of rainfall. Rainfall of 4 to 7 inches was common across northeast Boone, southern Hamilton, northern Story, and southwest Hardin Counties. Doppler radar precipitation estimates were as high as 8.5 inches in the area. Officially, the heaviest observed rainfall was 7.83 inches just southwest of Jewell. Nearly 7 inches /6.9/ of that fell in a 2 1/2 hour time period. Unofficial reports of 8 to 9 inches were received as well. Most of the rain fell in a three-hour period between 1800 and 2100 CST. Flash flooding was widespread with numerous reports of bridges washed out and roads under water. Many highways were closed, and Interstate 35 was closed for a period of time as well. Squaw Creek in Ames crested near the all-time high. Crop damage was extensive as well with many fields washed out. Some of the damage included by county included: 8 homes and 3 businesses heavily damaged north of Ames in Story county. Fifteen to 20 businesses with damage in the 10s of thousands of dollars in Ames, another 15 to 20 with minor damage. Damage to roads was estimated at $200,000. In Boone County, road damage was placed around $200,000. The Governor of Iowa granted a disaster declaration for Boone, Story, Hardin, and Hamilton Counties.*

- **May 16, 1999 – Flood – Hardin County:** *May of 1999 saw several significant flooding episodes across the Des Moines CWA. For the most part, central Iowa was spared the extremely heavy rainfall that caused major, and at several locations record, flooding along rivers in the northeast and east parts of the state. The most serious flooding was caused by heavy rains during the overnight hours of May 16. The heaviest rains fell in the counties just to the northeast of the Des Moines CWA. Up to 8 inches of rain fell over parts of Fayette County with anywhere from 2 to 6 inches falling over parts of Butler, Bremer, and Black Hawk Counties. Most of the rain fell in the Cedar River basin, which includes the West Fork Cedar River, Shell Rock River, Beaver Creek, and Black Hawk Creek. Among the largest 24-hour rain gage reports within the basin were the 5.18 inches at Kesley in the upper West Fork Cedar basin and 4.75 inches at Shell Rock in the Shell Rock basin. An isohyetal analysis of the storm produced by Harry Hillaker, the State Climatologist of Iowa, showed the heavy rainfall pattern extended across north central and northeast Iowa, with much less, but still significant, rain over central and northwest Iowa. Flooding was widespread across portions of Black Hawk, Butler, and Bremer Counties, with many smaller streams and creeks spilling out of their banks. A Flash Flood Warning was issued for Butler County late on the 16th and for Black Hawk County during the morning hours of the 17th. The runoff into the tributaries of the Cedar River from all of this rainfall led to the cresting of rivers from midday on the 17th to early on the 18th. Among the most notable crests were: 16.07 feet (flood stage is 12 feet) at Finchford on the West Fork Cedar River, which was the 5th highest on record and the highest since 1993. On the Beaver Creek at New Hartford the crest of 12.89 feet (flood stage is 8 feet) late on the 17th was the 7th highest on record, and again the highest since 1993. Much of the town of New Hartford was under water and many roads closed during a site visit by the Hydrologist on the 18th. Fortunately for the residents of Cedar Falls and Waterloo, rainfall in the upper portions of the mainstem Cedar River above Charles City was less than one half inch, helping to reduce the flow on the river through these locations. The contributions from the major tributaries above were still enough to bring about a crest of 19.20 feet (flood stage is 12 feet) at Waterloo, the 9th highest on record and also the highest since 1993. With levee protection to 26 feet, the city of Waterloo was not seriously impacted by this flood. Upstream in the Cedar Falls area, there were substantial impacts, with flooding and evacuations in several residential areas. In addition to property and public damages caused by the flooding, there was considerable damage to agricultural lands. Many areas had to replant crops and over the northeast part of the state soil*

erosion was very serious with some farmers reporting as much as a foot loss of topsoil. It is very difficult to calculate the cost of that as its effect will go on for hundreds of years.

- **May 29, 2013 – Flash Flood – Eldora:** *A warm front moved slowly north into Iowa during the overnight hours of the 28th into the 29th. The airmass became unstable as surface temperatures warmed into the low 80s, with dewpoints around 70 along and south of the front. CAPE rose to around 3000 J/kg with a downdraft CAPE of 900 J/kg, and CAPE in the -10 to -30 C layer of the atmosphere of 600 to 800 J/kg. The lifted index fell to -9 C. Considerable moisture was available with the precipitable water values around 1.7 inches. The atmosphere was moderately sheared with 35 to 40 kts of shear available. Thunderstorms developed rapidly around mid-day and produced very heavy rainfall, as well as high winds and hail. Most of the hail was somewhat limited in spite of the relatively low freezing level of 12,600 feet. The LC was relatively low at 1000 meters, however there were no reports of tornadoes. Wind and heavy rainfall were the dominant weather type. Hail was limited to penny size up to 1.5 inches in diameter. Several of the storms produced 60 to 70 MPH winds, downing numerous trees and power lines. The most extensive damage was in Butler County. Winds estimated around 80 MPH caused considerable damage to a containment build and significant structural damage to 18 houses in the town of Greene. Damage in town was around $500,000. A band of 2 to 4 inches of rainfall was observed from southwest through central into northeast Iowa. This caused flash flooding as the rain fell on already saturated soil. There were numerous roads under water from the flood waters. In the Waterloo area, the water was deep enough to submerge cars and cause many motorists to stall out and become stranded by the flood waters. In the Hudson areas of Black Hawk County, flooding in town occurred as the levy partially failed on the river. Officials in Tama County reported that a bridge was washed out, at a cost of $75,000, and at least $150,000 in damage to secondary roads. In Grundy County, initial estimates of damage to county secondary roads were at least $170,000. As of the 29th of May, Governor Terry Branstad declared 15 Iowa counties disaster areas due to the storms and flooding. They included Buena Vista, Cherokee, Butler, Floyd, Grundy, Johnson, Iowa, Jasper, Marshall, Mitchell, Plymouth, Poweshiek, Sioux, Tama, Wapello, and Wright.*

- **March 17, 2019 – Flash Flood – Iowa Falls:** *Reports from the 13h through the 19th in this entry. || A relatively deep and widespread snowpack existed across the region during early to mid-March. Many areas in central and northern Iowa had around a foot to two feet of snow on the ground, along with many areas in upstream river basins in Minnesota and the Dakotas having similar or deeper snowpacks on the ground. Additionally, with the below normal temperatures throughout the majority of the 2019 year to date, soils were frozen to depths of a foot or more throughout the aforementioned areas. All of that primed the area for potential moderate to major flooding issues should a rapid snowmelt and/or rainfall event occur, which unfortunately came to fruition. ||The primary driver was two-fold with warm air advection on the backside of a departing high pressure on the 12th, and a sizable low-pressure system that moved through the region on the 13th and 14th. The event began with widespread temperatures and dew points in the upper 30s to low 40s on the 12th with the initial warm air advection, which continued through the overnight hours into the 13th. As the low-pressure system developed off the Colorado Rockies, warm air advection continued to push temperatures and dew points up into the upper 40s and low 50s on the 13th and 14th, aiding the rapid snow melt. On top of the rapid snowmelt, which often went from 12 or more inches on the ground to zero in a matter of about two days, light to moderate rainfall occurred ahead of and on the backside of the low-pressure system on the 13th and 14th. All combined to cause widespread overland flooding, river flooding, and ice jam issues.*

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 $124,873 in property damages and $21,364 in crop losses per year for the planning area.

Table 74: Flood Loss Estimate

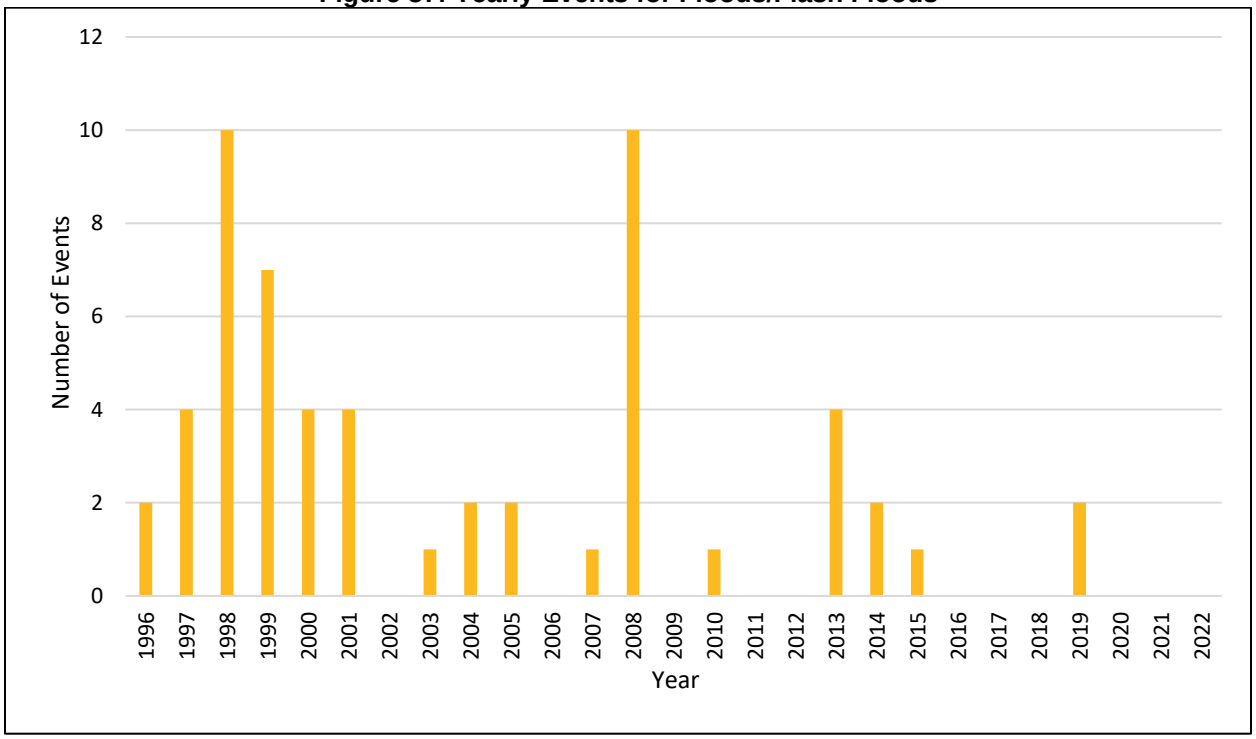
Hazard Type	Number of Events[1]	Average Events Per Year	Total Property Loss[1]	Average Annual Property Loss [1]	Total Crop Loss[2]	Average Annual Crop Loss [2]
Flooding	57	2.1	$3,371,570	$124,873	$491,378	$21,364

Source: 1 Indicates data is from NCEI (1996 to 2022); 2 Indicates data is from USDA RMA (2000 to 2022)

Probability

The NCEI reports 38 flooding and 19 flash flooding events for a total of 57 events from 1996 to 2022. Some years had multiple flooding events. Figure 37 shows the events broken down by year. 16 out of 27 years. Based on the historic record and reported incidents by participating communities, there is a 59% percent probability that flooding will occur annually in the county.

Figure 37: Yearly Events for Floods/Flash Floods



Source: NCEI, 1996-2022

Community Top Hazard Status

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

Jurisdictions	
City of Ackley	City of Steamboat Rock
City of Alden	City of Union
City of Hubbard	

Regional Vulnerabilities

Low-income and minority populations are disproportionately vulnerable to flood events.[102] 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 Hardin 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 75: Assessed Parcels and Value in the 1% Annual Flood Risk Area

Number of Parcels	Number of Improvements	Total Improvement Value	Number of Improvements in Floodplain	Value of Improvements in Floodplain
21,593	9,089	$1,047,885,580	$1,047	$144,213,010

Source: Hardin County Assessor, 2023

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 two watershed management authorities that cover two small portions of Hardin County: Middle Cedar WMA and Headwaters of the South Skunk WMA. WMAs are directed by a board of directors and may perform activities to reduce flood risk.
More information on Watershed Management Authorities can be found at the following link: https://www.iowadnr.gov/Environmental-Protection/Water-Quality/Watershed-Management-Authorities.

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

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

Table 76: 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 and Wildland Fire

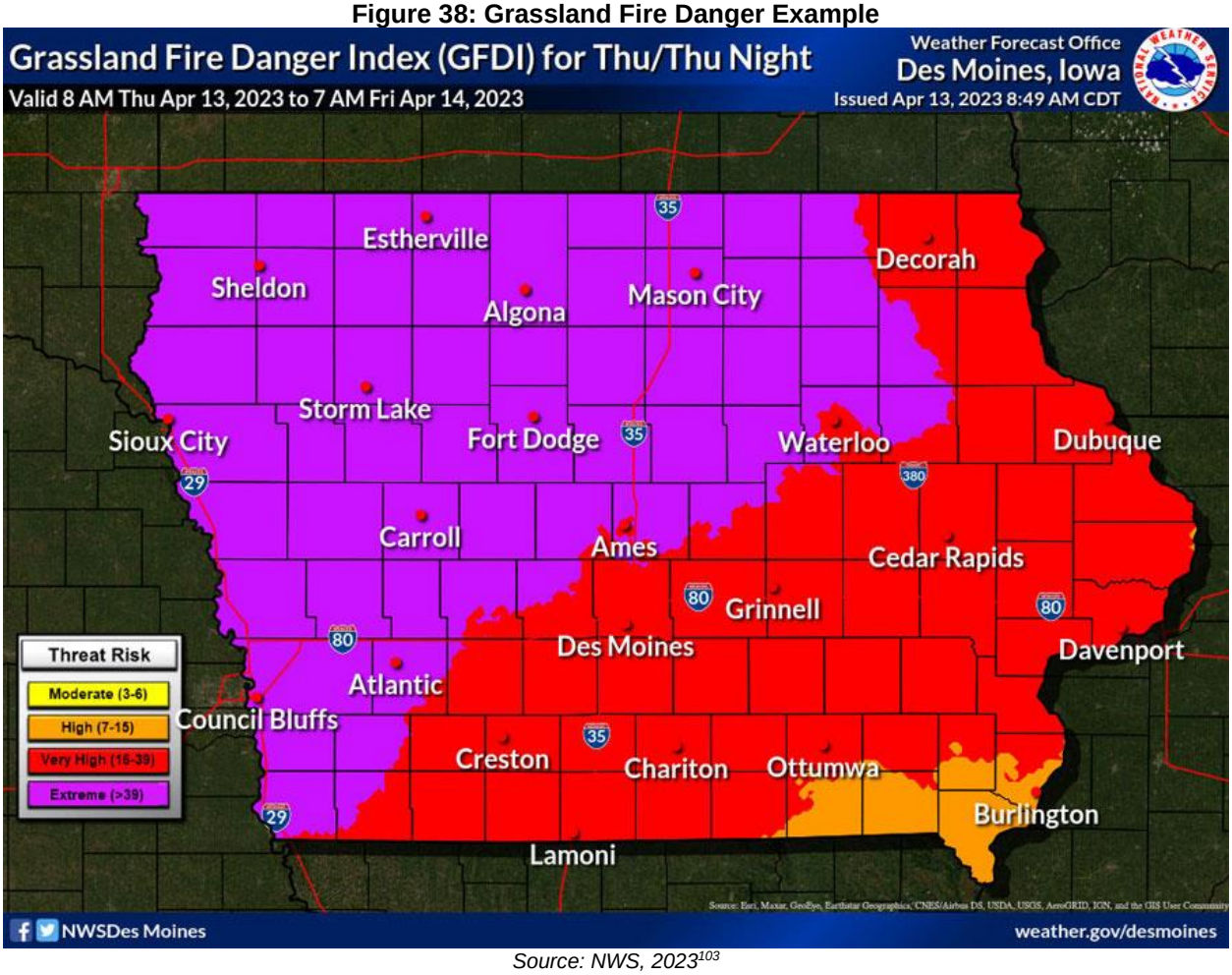
Wildfires, also known as grass fires, brush fires, forest fires, or wildland fires, are uncontrolled fires that occur in the countryside or wildland. Wildland areas may include but are not limited to grasslands, forests, woodlands, agricultural fields, pastures, and other vegetated areas. Wildfires differ 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 38). These fire danger predictions are updated regularly and should be reviewed frequently by community leaders and fire department officials.

Figure 38: Grassland Fire Danger Example



Source: NWS, 2023[103]

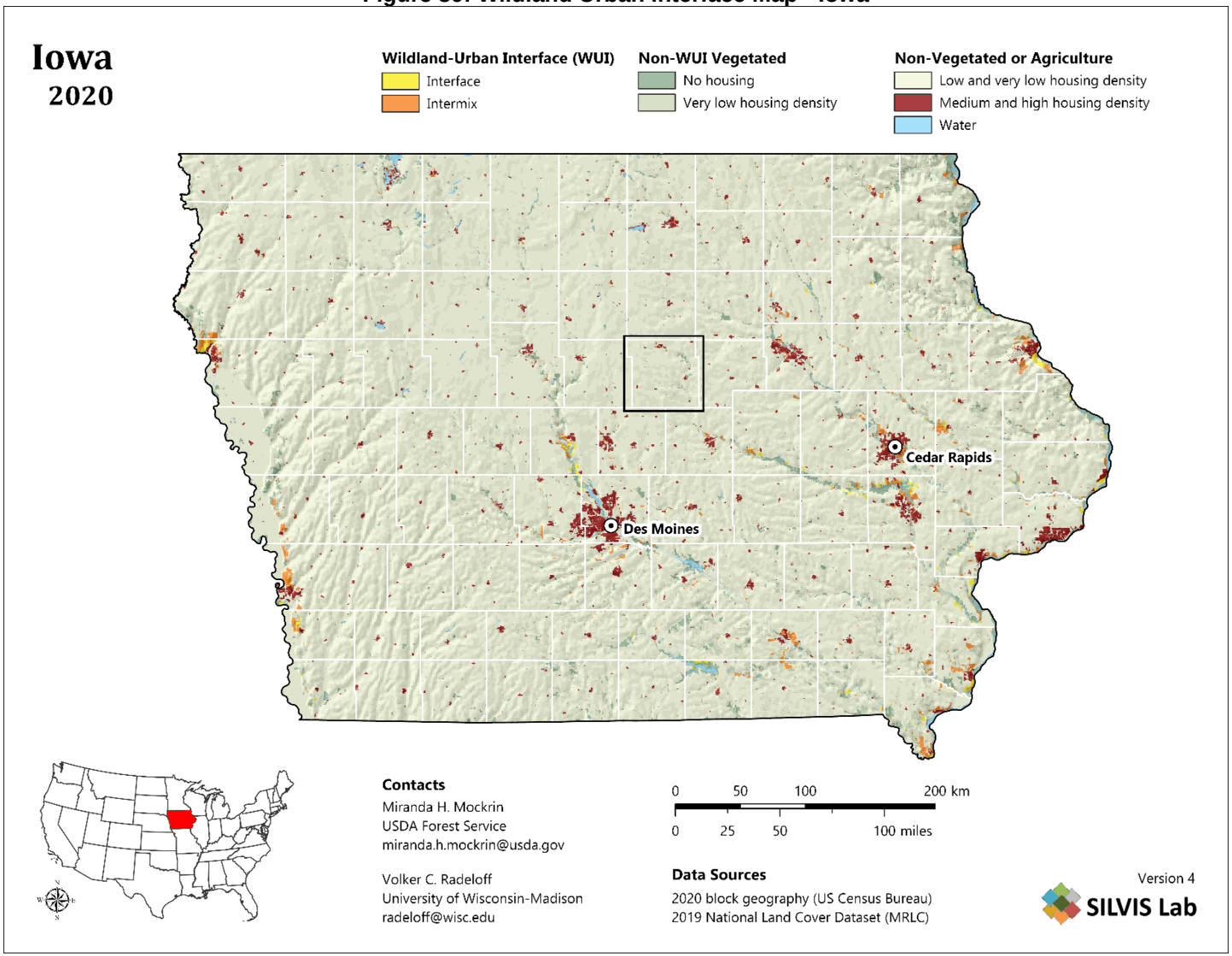
In recent decades, as the population of the United States has decentralized and residents have moved farther away from the center of cities, the WUI has developed significantly, both in terms of population and building stock. The WUI is defined as the zone of transition between developed areas and undeveloped 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 and 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 2020. The approximate location of the planning area is indicated by the black outline. According to this WUI map (Figure 39), intermix areas (orange) are primarily found around Iowa Falls, Steamboat Rock, Ackley, Eldora, and Gifford. 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. An interactive version of this map is available online at the following location: https://silvis.forest.wisc.edu/data/wui-change/. Figure 40 shows a WUI map for Hardin County.

[103] National Weather Service. 2023. "Iowa Grassland Fire Danger Index." https://www.weather.gov/dmx/fire.

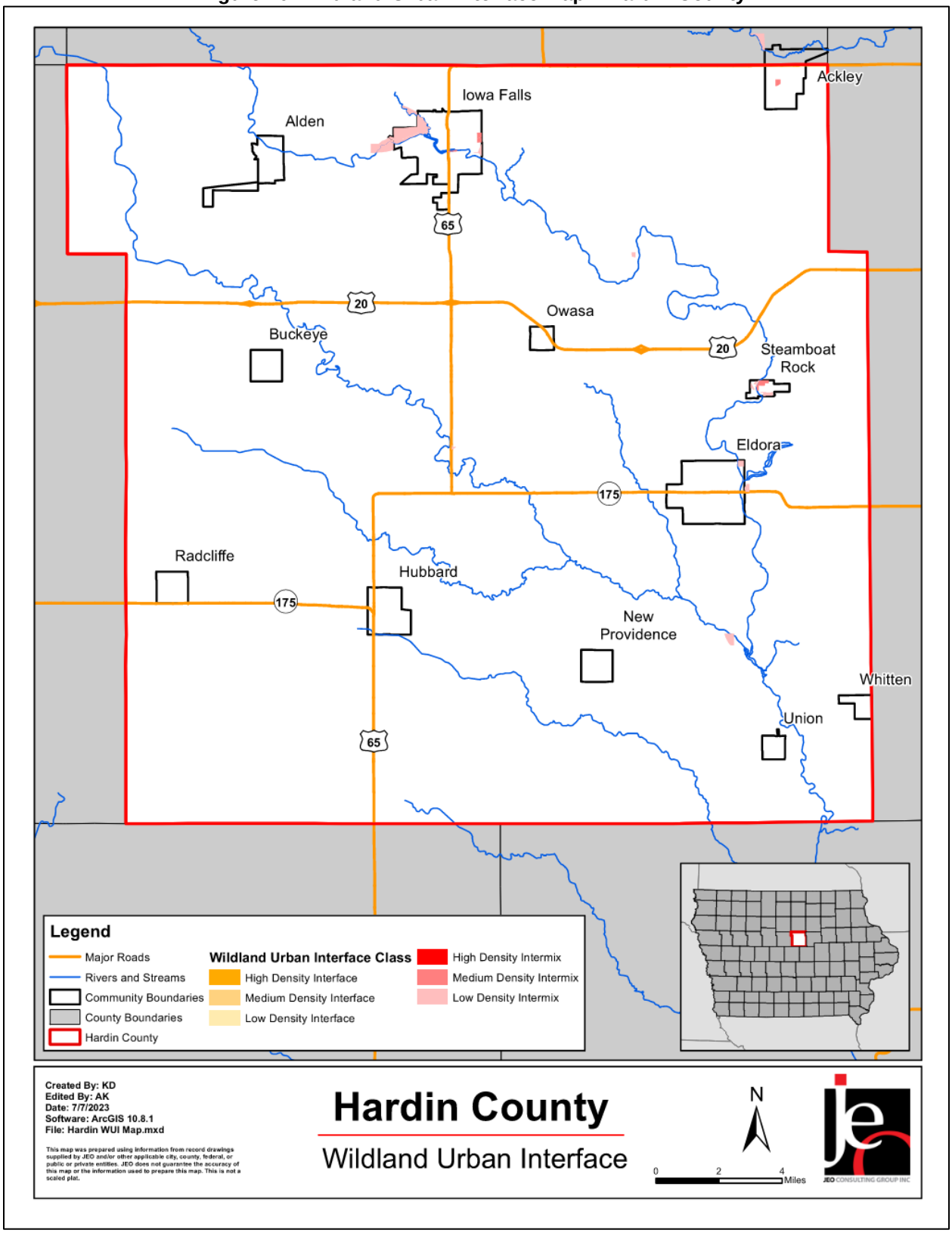
Figure 39: Wildland Urban Interface Map - Iowa



Source: University of Wisconsin-Madison, 2023[104]

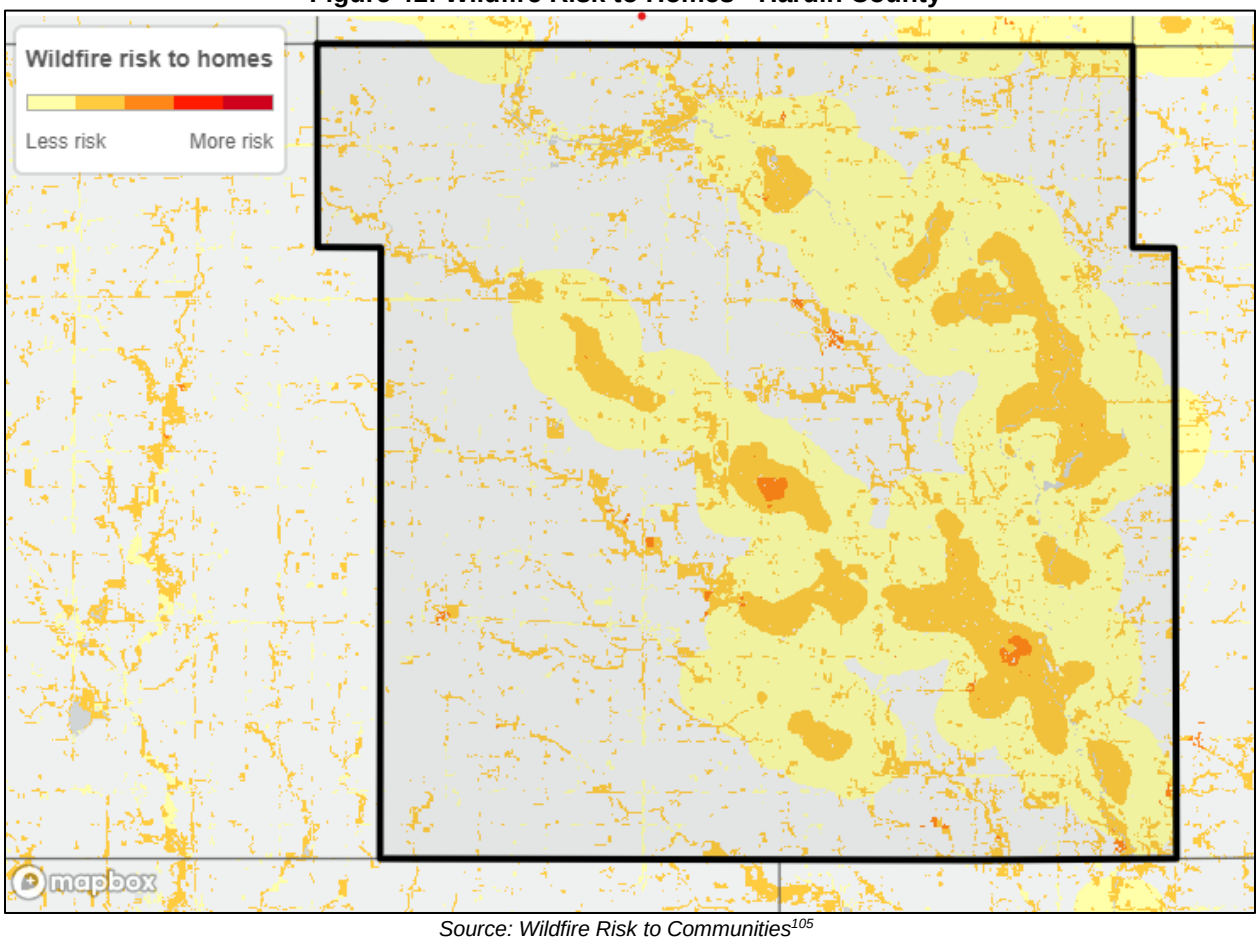
[104] USDA Forest Service, University of Wisconsin-Madison: SILVIS Lab. 2023. "Wildland-Urban Interface (WUI) Change 1990-2020." https://silvis.forest.wisc.edu/data/wui-change/.

Figure 40: Wildland Urban Interface Map – Hardin 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 41 displays wildfire risk to homes in Hardin County, as of August 2023.

Figure 41: Wildfire Risk to Homes - Hardin County



Source: Wildfire Risk to Communities[105]

Table 77: Wildfire Vulnerabilities

County	Risk to Homes (compared to Iowa Counties)	Exposure Type*	Wildfire Likelihood (compared to Iowa Counties)
Hardin	15%	Not Exposed (28%) Directly Exposed (28%) Indirectly Exposed (44%)	16%

Source: Wildfire Risk to Communities, 2023[106]
* Exposure is defined as the intersection of wildfire likelihood and intensity with communities.

[105] United States Department of Agriculture, United States Forest Service. 2023. "Wildfire Risk to Communities." Accessed August 2023. https://wildfirerisk.org/.
[106] United States Department of Agriculture, United States Forest Service. 2023. "Wildfire Risk to Communities." https://wildfirerisk.org/.

Table 78: Wildfire Vulnerable Populations

County	Families in Poverty	People with Disabilities	People over 65	Difficulty with English	Households with no Vehicle	Mobile Homes
Hardin	3.5%	12.6%	21.8%	0.9%	6.2%	2.3%

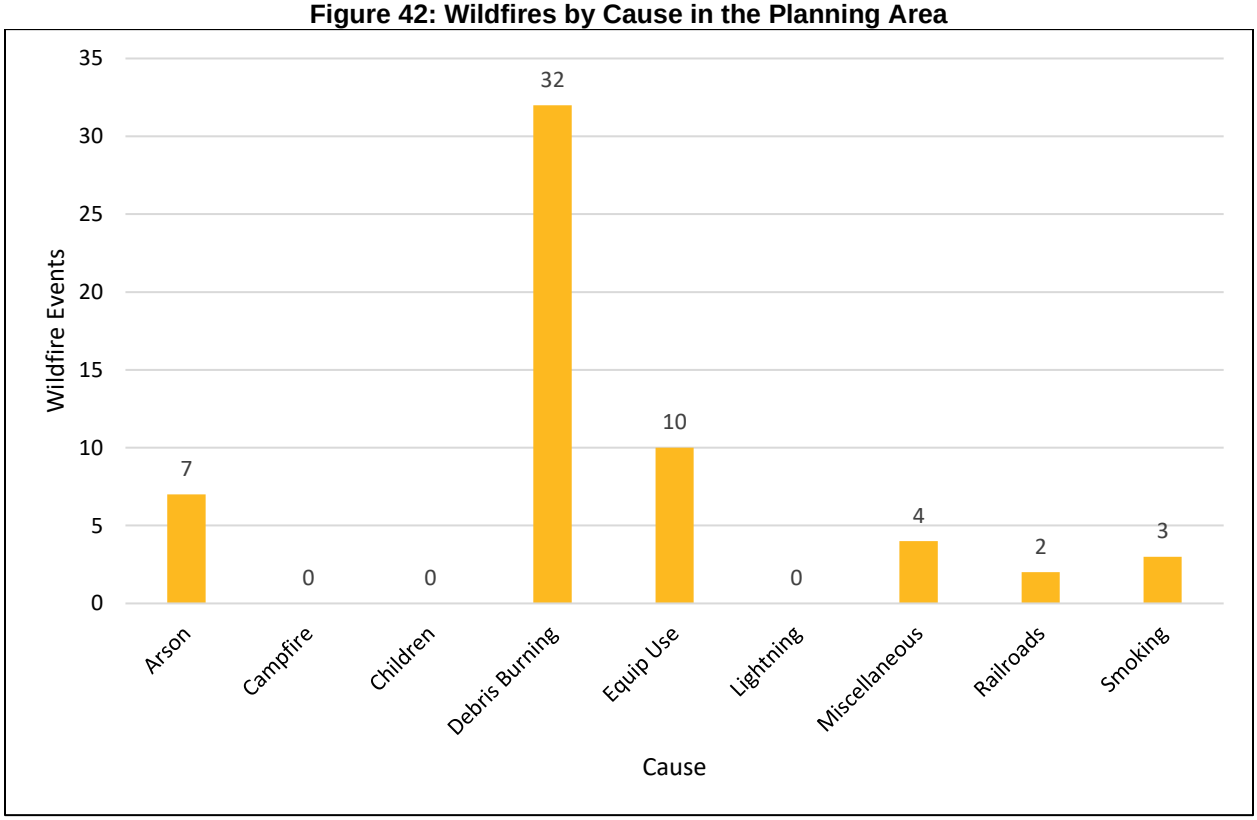
Source: Wildfire Risk to Communities, 2023[107]

Historical Occurrences

According to the Iowa Department of Natural Resources fire supervisor, fire report data in Hardin County is available from 2008 to 2022. Local fire districts reported a total of 58 wildfires during that time. The most fires occurred in 2018, with 18. The total reported events burned 858 acres.

The majority of wildfires in the planning area are caused by debris burning (69%), with equipment use as the second leading cause (18%) (Figure 42). Wildfires in the planning area have ranged from 2 to 345 acres, with an average event burning 15 acres.

Figure 42: Wildfires by Cause in the Planning Area



Source: IDNR Fire Supervisor (personal correspondence), 2008-2022

Average Annual Damages

No damages were reported by NCEI; however, the U.S. Risk Management Agency (RMA) reported $24,894 from 2000 to 2022. The average annual crop loss during that time is $1,082.

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,

[107] United States Department of Agriculture, United States Forest Service. 2023. "Wildfire Risk to Communities." https://wildfirerisk.org/.

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.

Table 79: 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	58	3.9	N/A	N/A	$24,894	$1,082

Source: 1 Indicates data is from NCEI (1996-2022); 2 Indicates data is from USDA RMA (2000-2022)

Extent

For Hardin County, the following fire departments reported wildfire events: Eldora Fire Department, Iowa Falls Fire Department, and Steamboat Rock Fire Department. Fire departments respond to both wildfires and structural fires in cities.

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

Table 80: Reported Wildfires by Fire Department

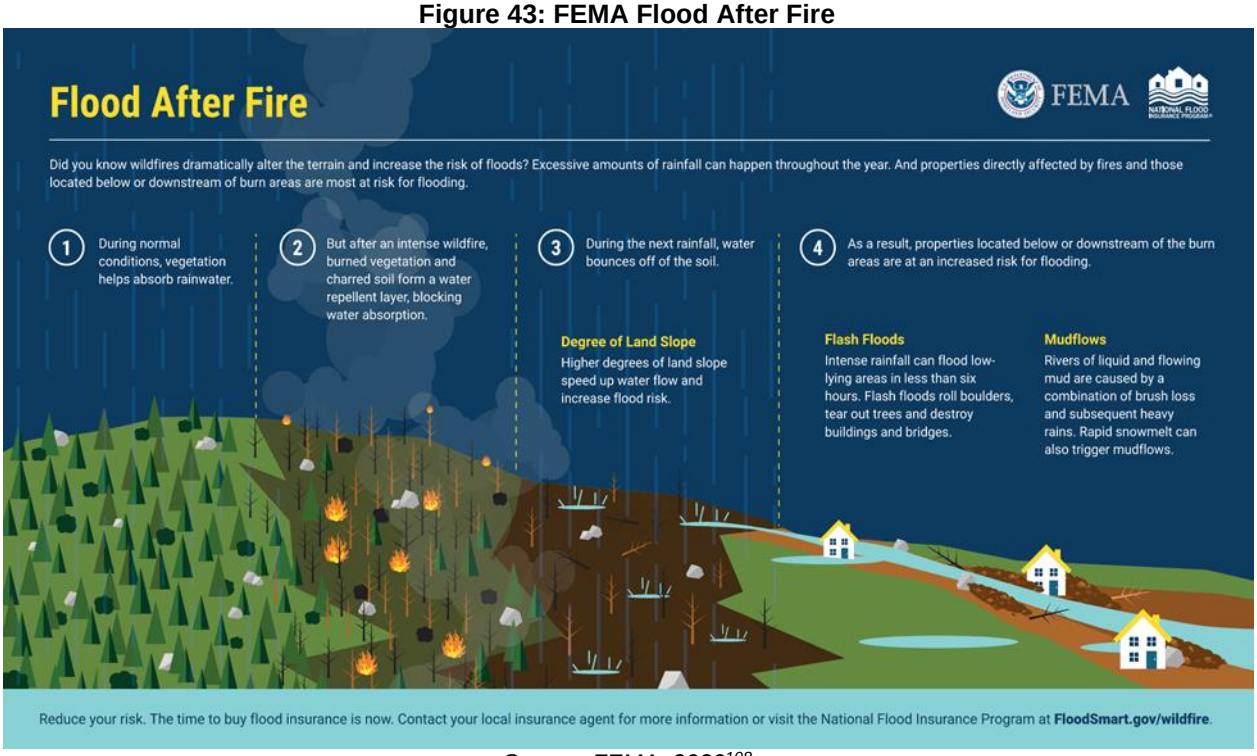
Fire Department	Reported Wildfires	Acres Burned
Eldora Fire Department	50	808
Iowa Falls Fire Department	4	47
Steamboat Rock Fire Department	4	3.5
Total	**58**	**858**

Source: IDNR Fire Supervisor (personal correspondence), 2008-2022

As seen in Table 80 above, wildfires have burned 858 acres of land. In total, there were 58 reported wildfires in the planning area. Of these, two fires burned 90 acres or more, with the largest wildfire burning 100 acres in April 2019.

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 43). 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 43: FEMA Flood After Fire



Source: FEMA, 2020[108]

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

The following table lists jurisdictions which identified Grass and Wildland Fire as a top hazard of concern.

Jurisdictions	
City of Buckeye	Providence Township Fire District

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 28). 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.

[108] 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.

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 Iowa Falls 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 81: 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

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

Table 82: 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[109]

[109] 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, 41 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 45). 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 and State Routes.

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 Hardin County can be seen below (Figure 46).[110] According to the U.S. Energy Information Administration (EIA) there is one crude oil pipeline, one petroleum product pipeline, and multiple natural gas pipelines that run through the county. [111]

[110] Pipeline and Hazardous Materials Safety Administration. 2023. “National Pipeline Mapping System.” https://www.npms.phmsa.dot.gov/ .

[111] U.S. Energy Information Administration. 2023. “Maps – Crude Oil Pipelines, Natural Gas Interstate and Intrastate Pipelines, Petroleum Products Pipelines.” https://www.eia.gov/maps/layer_info-m.php

Figure 44: Fixed Chemical Sites in the County

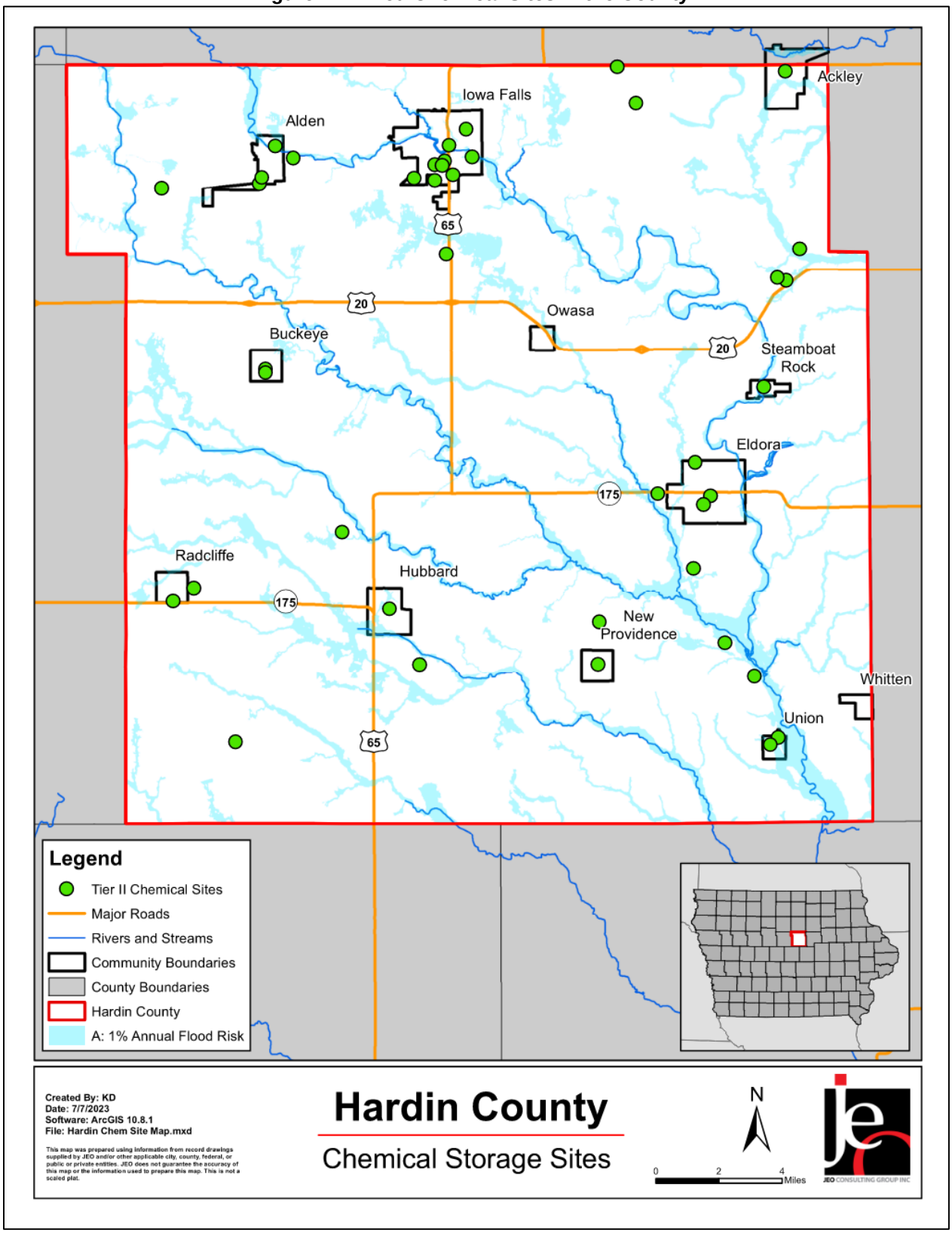


Figure 45: Major Transportation Routes with Half Mile Buffer

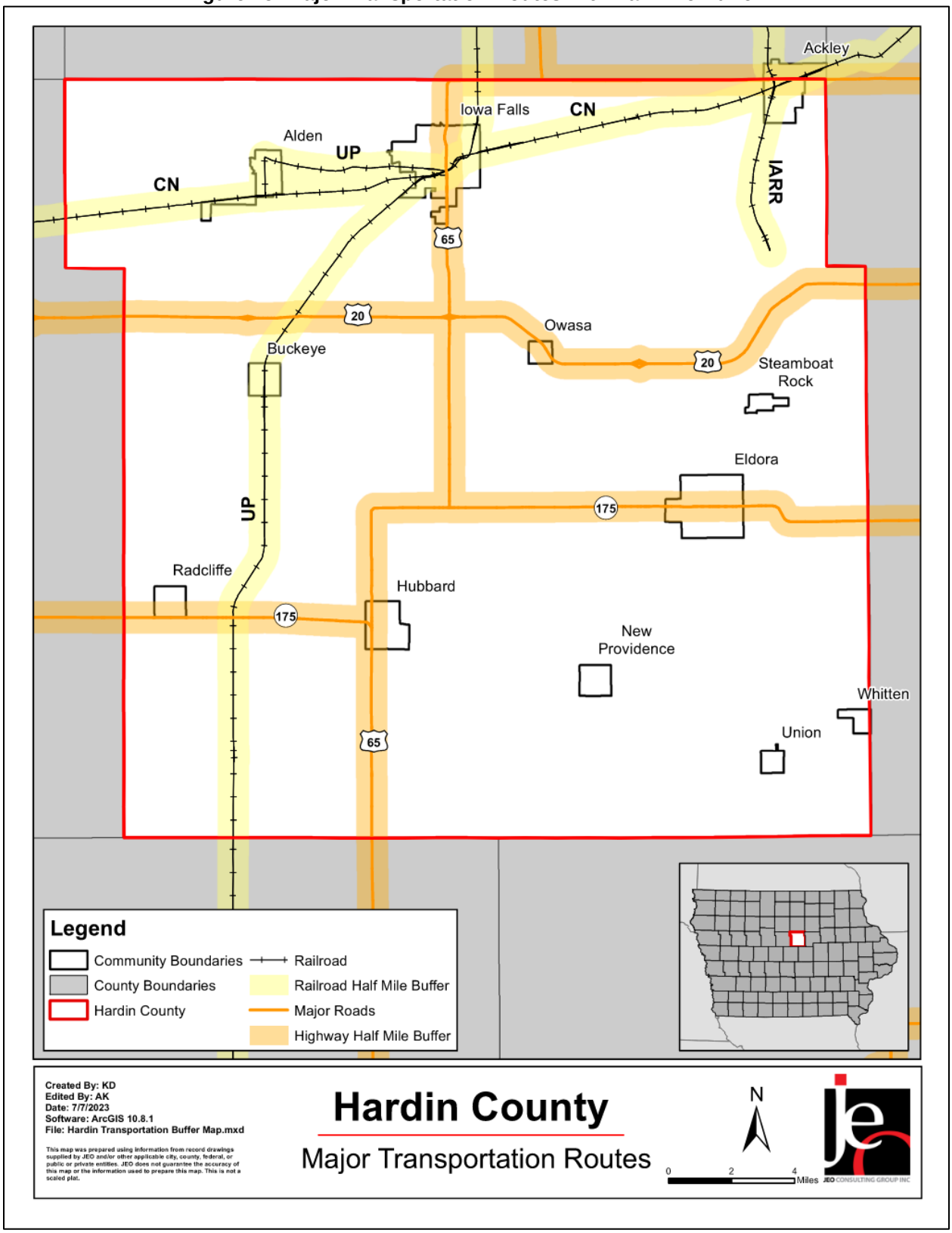
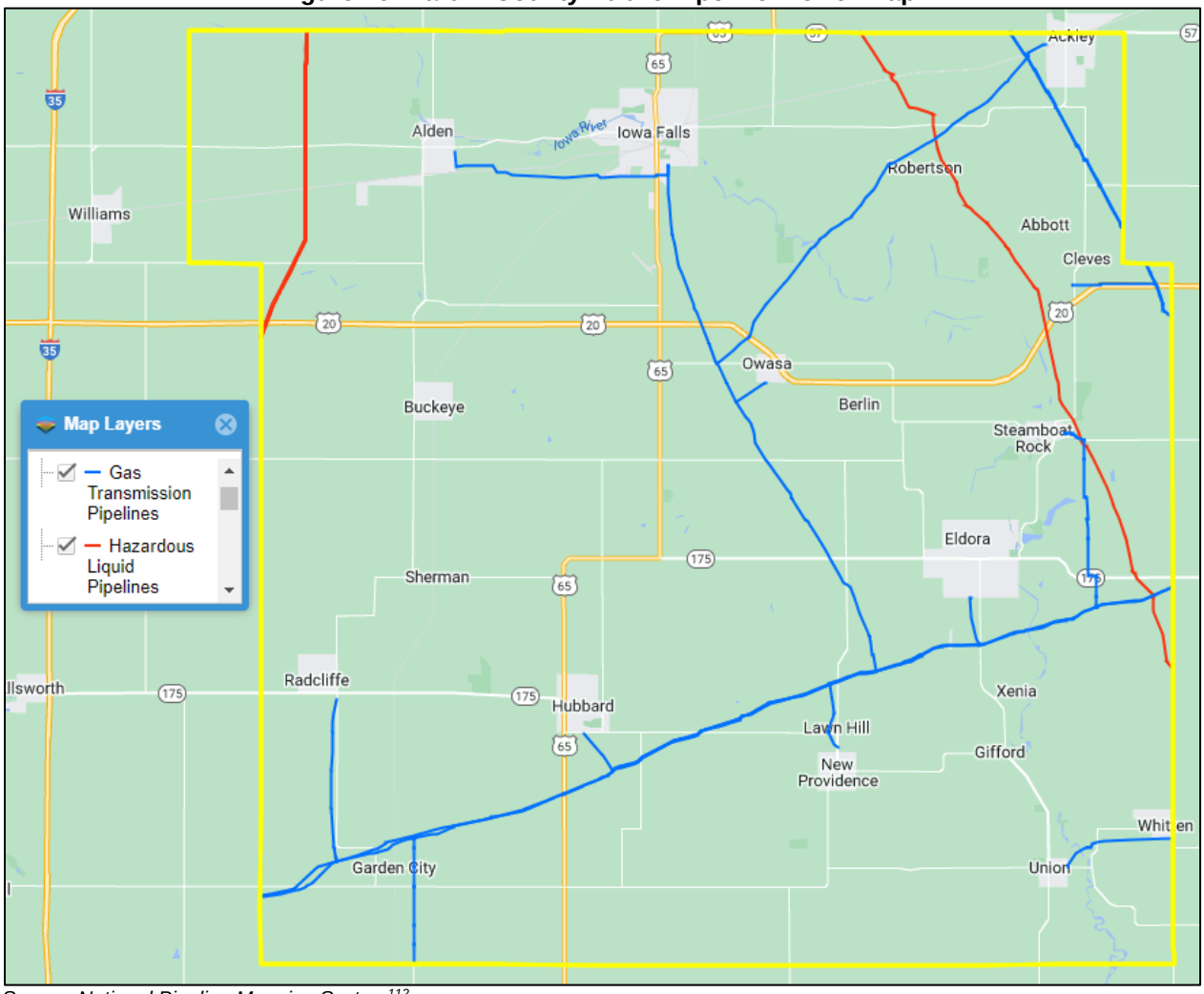


Figure 46: Hardin County Public Pipeline Viewer Map



Source: National Pipeline Mapping System[112]

[112] National Pipeline Mapping System. 2023. "Public Viewer." Accessed April 2023. https://pvnpms.phmsa.dot.gov/PublicViewer/.

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.[113]

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 29 fixed site releases have occurred in the planning area, and the total amount spilled ranged from one gallon to 4,000 gallons. Of the 29 chemical spills, one spill led to an evacuation of six employees when an unknown amount of acrolein was released into the air and a fire broke out. No spills resulted in injury or death.

In total, six releases have occurred during transportation in the planning area. Transportation spills ranged from less than one liquid gallon of material released to 100 liquid gallons released, with an average quantity spilled of 33 liquid gallons. None of the six chemical spills led to an evacuation, injury, or death. Based on historical 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 29 fixed site chemical spills from 1990 to 2022 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 (>1,000 gallons).

Table 83: Large Fixed Site Chemical Spills

Date	Location of Release	Quantity Spilled	Material Involved	Number of Injuries	Property Damage
1990	Iowa Falls	3,500 gal. (oil) 4,000 gal. (gasoline)	Oil, Gasoline	0	$0
2017	Iowa Falls	1,600 gal.	Diesel Oil	0	$0

Source: National Response Center, 1990- 2022

Transportation Spills

According to PHMSA, six hazardous materials releases occurred during transportation in the planning area between 1971 and April 2023. During these events, there were no evacuations, fatalities, or injuries. Damages totaled $41,677. The following table provides a list of the larger historical transportation chemical spills (>50 gallons).

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

Table 84: Large Chemical Transportation Spills

Date of Event	Location of Release	Failure Description	Material Involved	Transportation Mode	Injuries or Fatalities	Total Damage
2/4/2021	Owasa	Vehicle Accident	100 LGA Sulfuric Acid	Highway	None	$12,615

Source: PHMSA, 1971 - April 2023

Average Annual Damages

There have been 29 fixed site spills in the planning area reported from the NRC and six transportation spills as reported by PHMSA. Neither the NRC nor PHMSA track crop losses from chemical spills. These events reported $41,677 property damages. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life.

Table 85: Hazardous Materials Release Loss Estimate

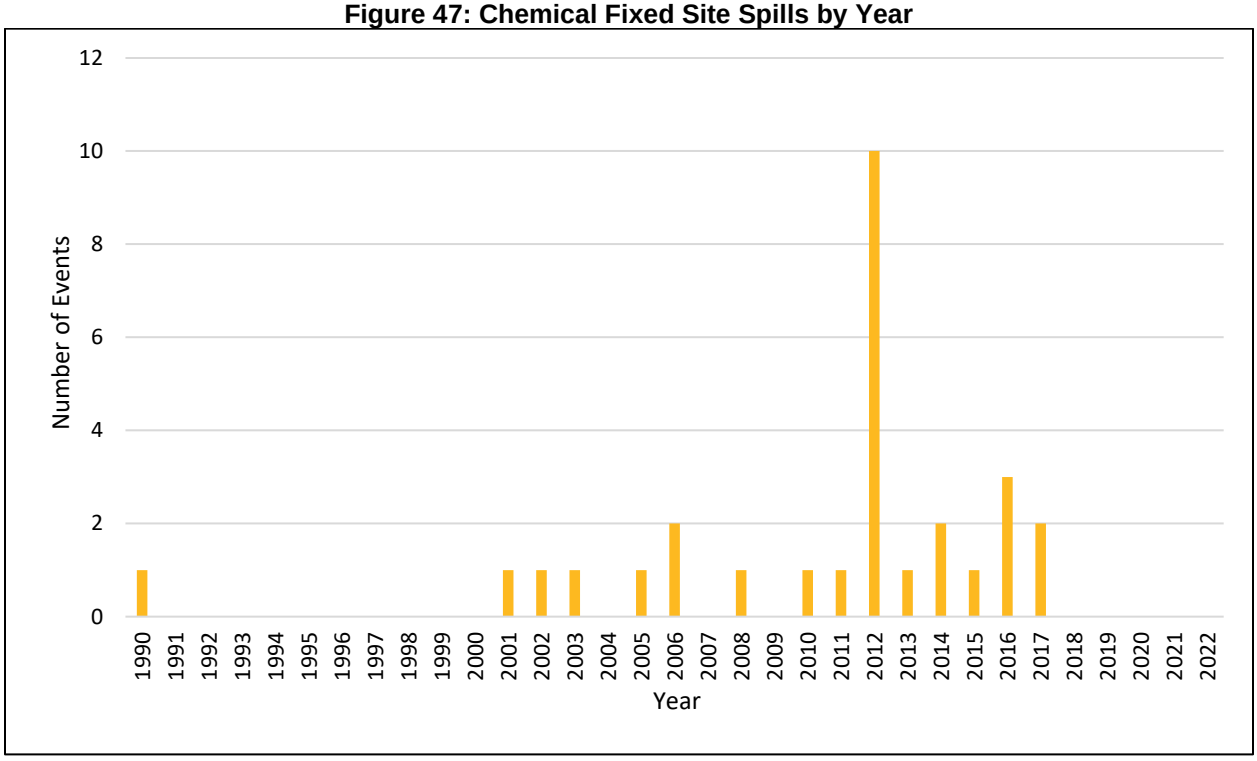
Hazard Type	Number of Events	Events Per Year	Injuries	Total Evacuated	Total Damages	Average Annual Loss
Hazardous Materials Release (Fixed Site)	29	0.88	0	6	$0	$0
Hazardous Materials Release (Transportation)	6	0.12	0	0	$41,677	$801

Source: National Response Center, 1990 - 2022; PHMSA, 1971 - April 2023

Probability

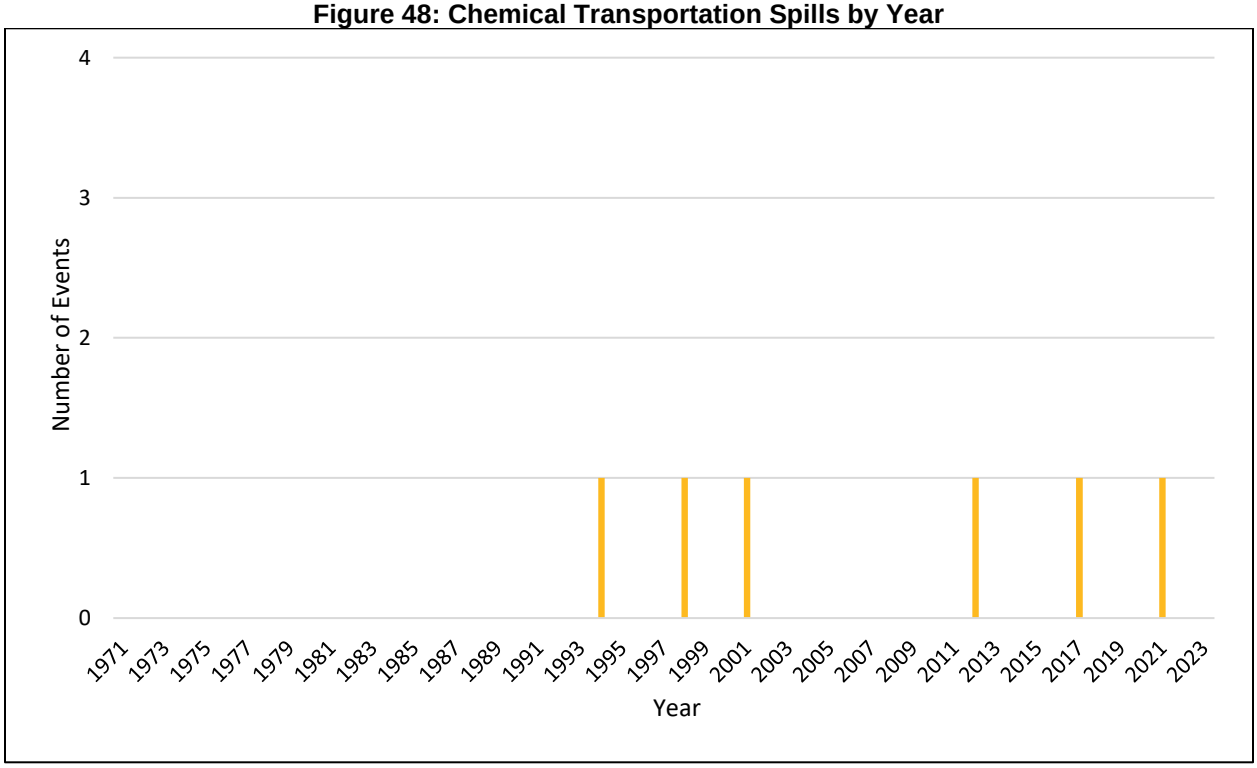
Given the historic record of occurrence for fixed chemical spill events (at least one chemical spill reported in 15 of 33 years), for the purposes of this plan, the annual probability of a fixed chemical spill is 45 percent. Given the historic record of occurrence for chemical transportation spill events (6 out of 53 years with a reported event), for the purposes of this plan, the annual probability of chemical transportation occurrence is 11%.

Figure 47: Chemical Fixed Site Spills by Year



Source: National Response Center, 1990-2022

Figure 48: Chemical Transportation Spills by Year



Source: PHMSA, 1971 - April 2023

Community Top Hazard Status

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

Jurisdictions	
City of Ackley	City of Radcliffe
City of Alden	City of Steamboat Rock
City of Eldora	City of Whitten
City of Iowa Falls	Ellsworth Community College

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 86: 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."[114]

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.[115]

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.

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

[115] 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.

- 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.

- 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 Hardin County Public Health Department serves all of Hardin 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.[116] 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

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

against potential exposures. The H1N1 continues to appear annually and persons in the planning area are at risk of infection in the future.

- 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 April 1, 2023.

Table 87: COVID-19 Cases in Hardin County

Population	Total Number of Tests	Confirmed Cases	Fatalities
16,878	5,902	5,091	71

Source: Iowa Department of Public Health[117]

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 is one hospital 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 Hardin County and for the state are listed in the table below.

Table 88: Diabetes Prevalence in the Planning Area

Geography	Diagnosed Diabetes Rate (Total Adults Age 20+)
Hardin County	8.6%
State of Iowa	5%

Source: Centers of Disease Control and Prevention, 2023[118]
**State data is from 2021.*

[117] Iowa Department of Public Health. April 1, 2023. "Covid-19 Reporting". https://idph.iowa.gov/Emerging-Health-Issues/Novel-Coronavirus/COVID-19-Reporting

[118] Centers for Disease Control and Prevention. 2023. "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.[119] 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

The following table lists jurisdictions which identified Human Infectious Diseases as a top hazard of concern:

Jurisdictions	
City of Eldora	Ellsworth Community College
BCLUW School District	

[119] 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.

Regional Vulnerabilities

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

Table 89: 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

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) 2023 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.[120]

Some jurisdictions have mentioned concerns of infrastructure failure, including Ackley, Alden, Iowa Falls-Alden Schools. Concerns include inadequate water/sewer systems, hazardous buildings, HVAC outages to schools, and threats to water storage.

Location

Infrastructure failure is not correlated to a specific geographic area.

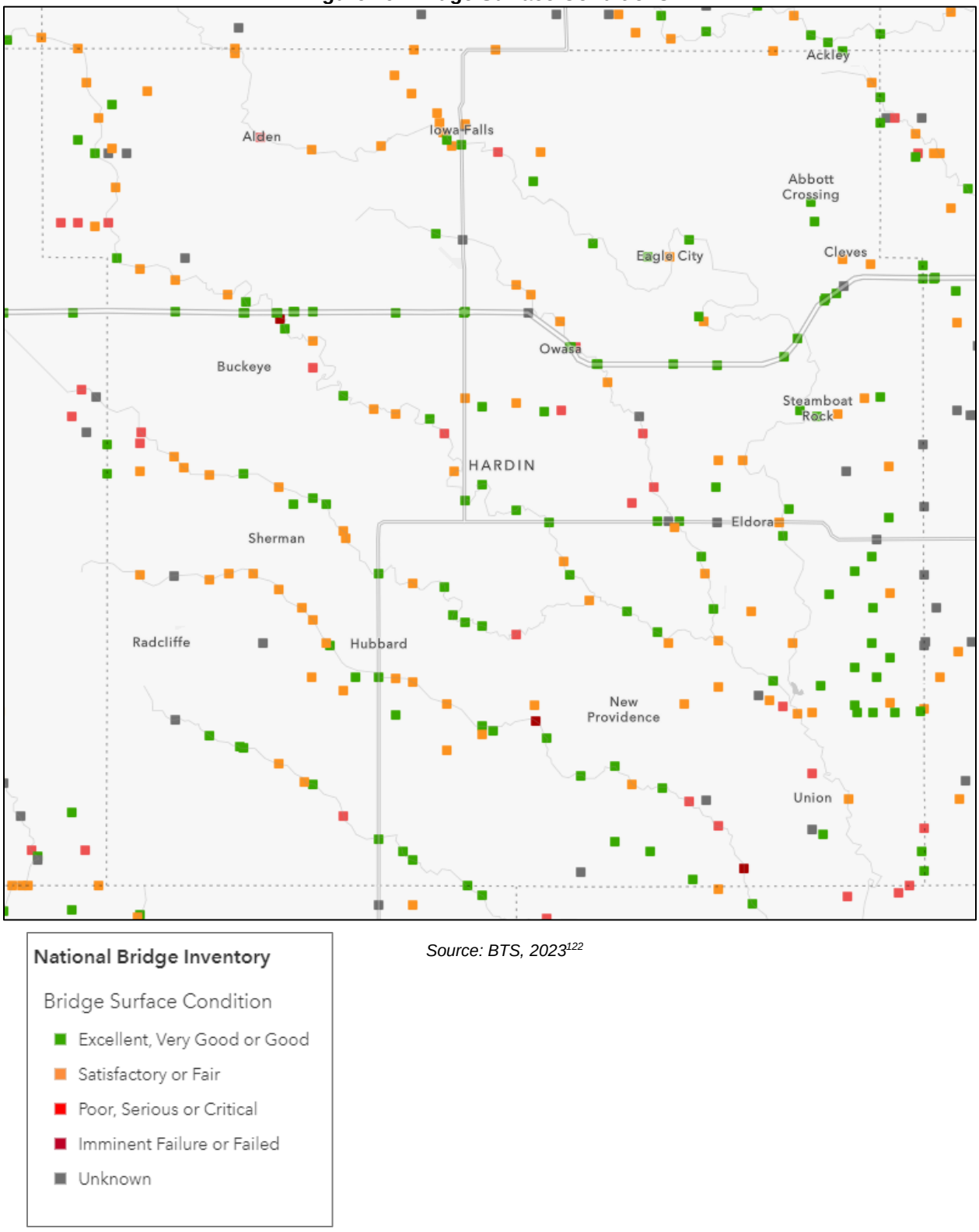
Extent

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, Hardin County has 251 bridges with 18% of those bridges in poor condition and 82% in medium to fair condition.[121] Figure 49 displays the bridge surface conditions for Hardin County.

[120] American Society of Civil Engineers. 2023. "2023 Iowa Infrastructure Report Card." https://infrastructurereportcard.org/state-item/iowa/

[121] Bureau of Transportation Statistics. 2023. "County Transportation Profiles." https://data.bts.gov/Research-and-Statistics/County-Transportation-Profiles/qdmf-cxm3/data

Figure 49: Bridge Surface Conditions



Source: BTS, 2023[122]

[122] Bureau of Transportation Statistics. August 2023. "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	
City of Ackley	Iowa Falls-Alden Schools
City of Alden	

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

Table 90: 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

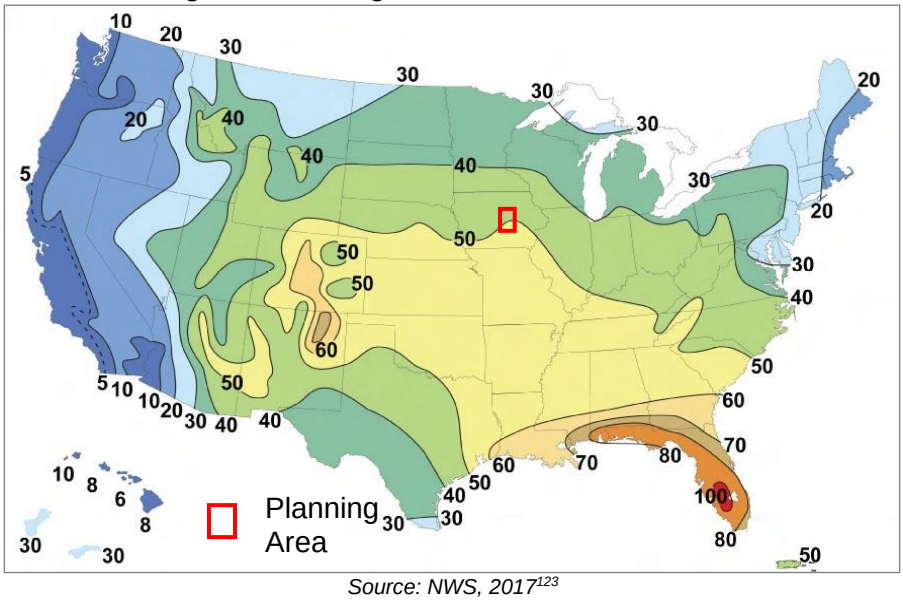
Severe Thunderstorms
(Includes Hail and Lightning)

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 50 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 50: Average Number of Thunderstorms



Source: NWS, 2017[123]

[123] 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 91 outlines the TORRO Hail Scale.

Table 91: 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

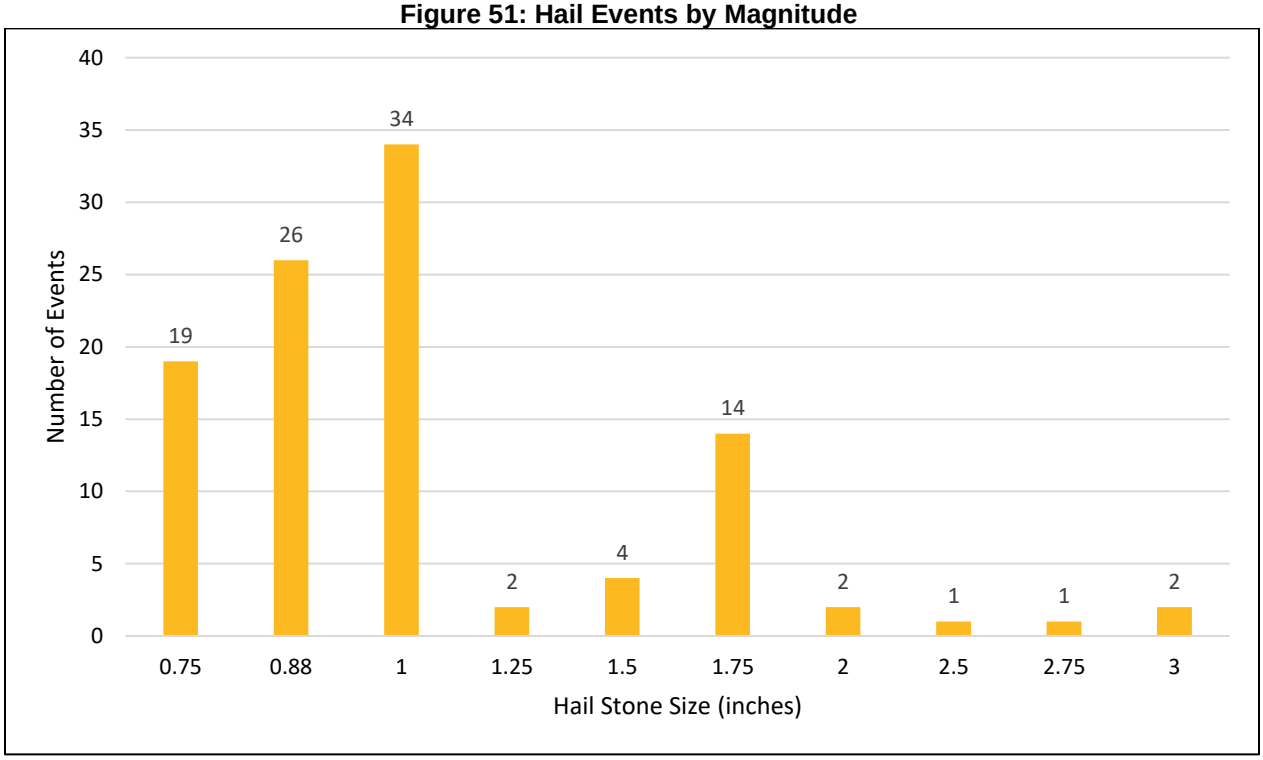
Source: TORRO, 2019[124]

Of the 105 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

[124] 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 two H8 hail events (3.0 – 3.5 inches) during the period of record. Figure 51 shows hail events based on the size of the hail.

Figure 51: Hail Events by Magnitude

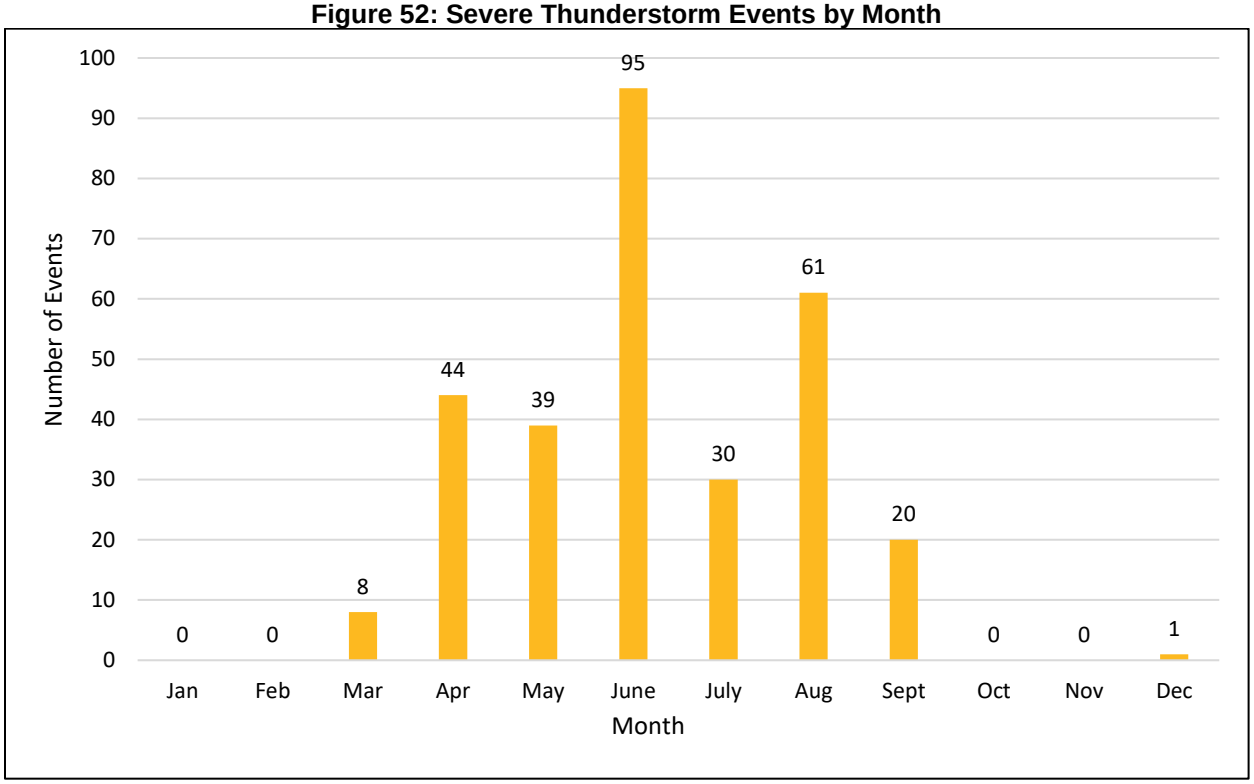


Source: NCEI, 1996-2022

Historical Occurrences

Severe thunderstorms in the planning area usually occur in the afternoon and evening from March through September (Figure 52).

Figure 52: Severe Thunderstorm Events by Month



Source: NCEI, 1996-2022

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 105 hail, 47 heavy rain, 4 lightning, and 142 thunderstorm wind events in the planning area from 1996 to 2022. In total these events were responsible for $25,632,000 in property damages. The USDA RMA data shows that severe thunderstorms caused $54,324,341 in crop damages. There were 22 injuries reported in association with these storms.

Multiple public survey respondents mentioned that an August 2009 severe thunderstorm produced damaging impacts. In Eldora, impacts included serious hail damage to roofs, siding, windows, and automobiles. Several trees were stripped of vegetation or knocked down by the wind. Additionally, people and animals that were caught outside were bruised and many animals died. Trees continue to be lost due to damage from the storm.

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 $949,333 per year in property damages and $2,361,928 in crop damages.

Table 92: 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	105	3.9	$21,524,000	$1,158	$54,324,341	$2,361,928
Heavy Rain	47	1.7	$125,000	$4,630		
Lightning	4	0.1	$133,000	$4,926		
Thunderstorm Wind	142	5.3	$3,850,000	$142,593		
Total	**298**	**11**	**$25,632,000**	**$949,333**	**$54,324,341**	**$2,361,928**

Source: 1 Indicates data is from NCEI (1996 to 2022); 2 Indicates data is from USDA RMA (2000 to 2022)

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 27 years, resulting in a 96 percent chance for severe thunderstorms to occur annually.

Community Top Hazard Status

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

Jurisdictions	
City of Buckeye	City of Steamboat Rock
City of Eldora	City of Union
City of Hubbard	BCLUW School District
City of Iowa Falls	Iowa Falls-Alden School
City of New Providence	Providence Township Fire District
City of Radcliffe	

Regional Vulnerabilities

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

Table 93: 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
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

Sector	Vulnerability
	-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”.[125] 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 NWS developed the Sperry-Piltz Ice Accumulation Index (SPIA) 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 53 shows the SPIA index.

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

Figure 53: 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	

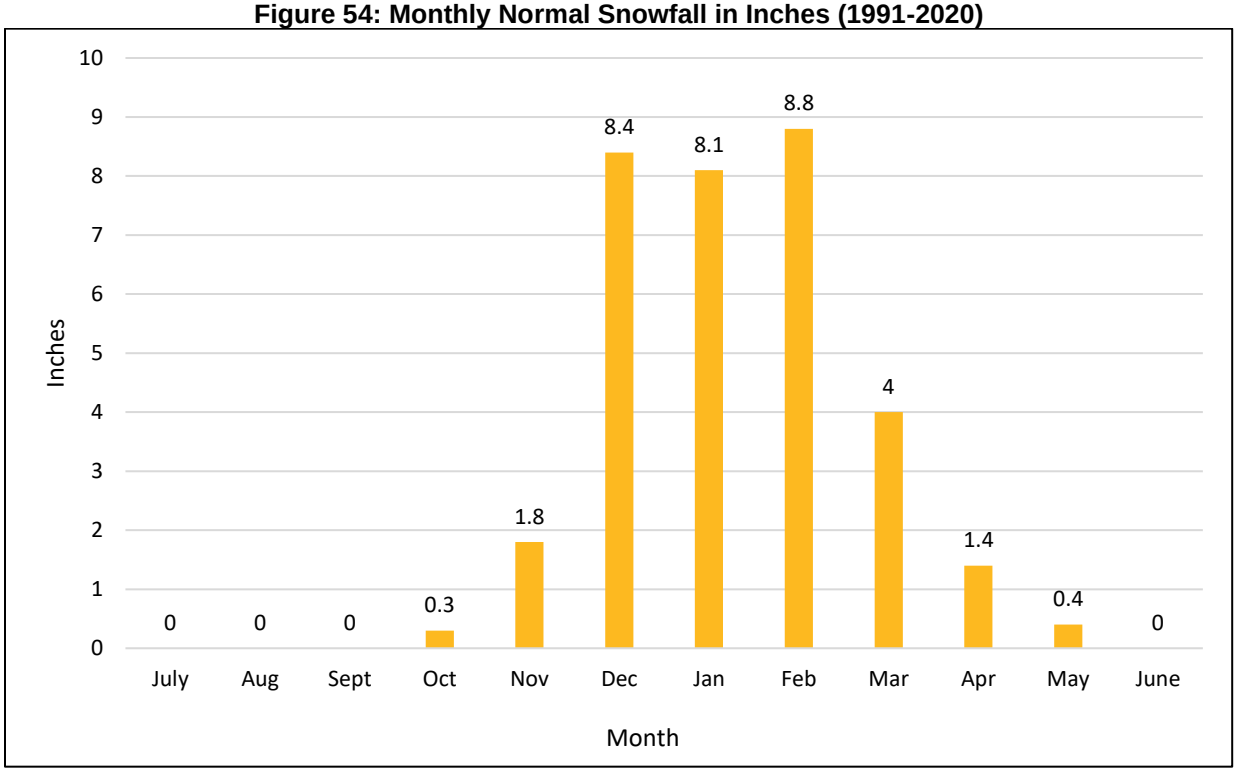
(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

Source: SPIA-Index, 2017[126]

Average monthly snowfall for the planning area is shown in (Figure 54), 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.

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

Figure 54: Monthly Normal Snowfall in Inches (1991-2020)



Source: High Plains Regional Climate Center, 2023

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 87 severe winter storm events for the planning area from 1996 to 2022. January had the most recorded events for the planning area. These recorded events caused a total of $1,445,680 in reported property damages and $1,778,072 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 $53,543 per year in property damage and $77,307 per year in crop damages for the planning area.

Table 94: 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	25	0.9	$520,000	$19,259	$1,778,072	$77,307
Heavy Snow	19	0.7	$96,450	$3,572		

Ice Storm	12	0.4	$303,330	$11,234		
Winter Storm	30	1.1	$525,900	$19,478		
Winter Weather	1	0.04	$0	$0		
Total	**87**	**3.2**	**$1,445,680**	**$53,543**	**$1,778,072**	**$77,307**

Source: 1 Indicates data is from NCEI (1996-2022); 2 Indicates data is from USDA RMA (2000-2022)

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 26 of 27 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	
City of Ackley	City of Whitten
City of Buckeye	AGWSR School District
City of Eldora	BCLUW School District
City of New Providence	Iowa Falls-Alden Schools
City of Radcliffe	Providence 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 95: 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

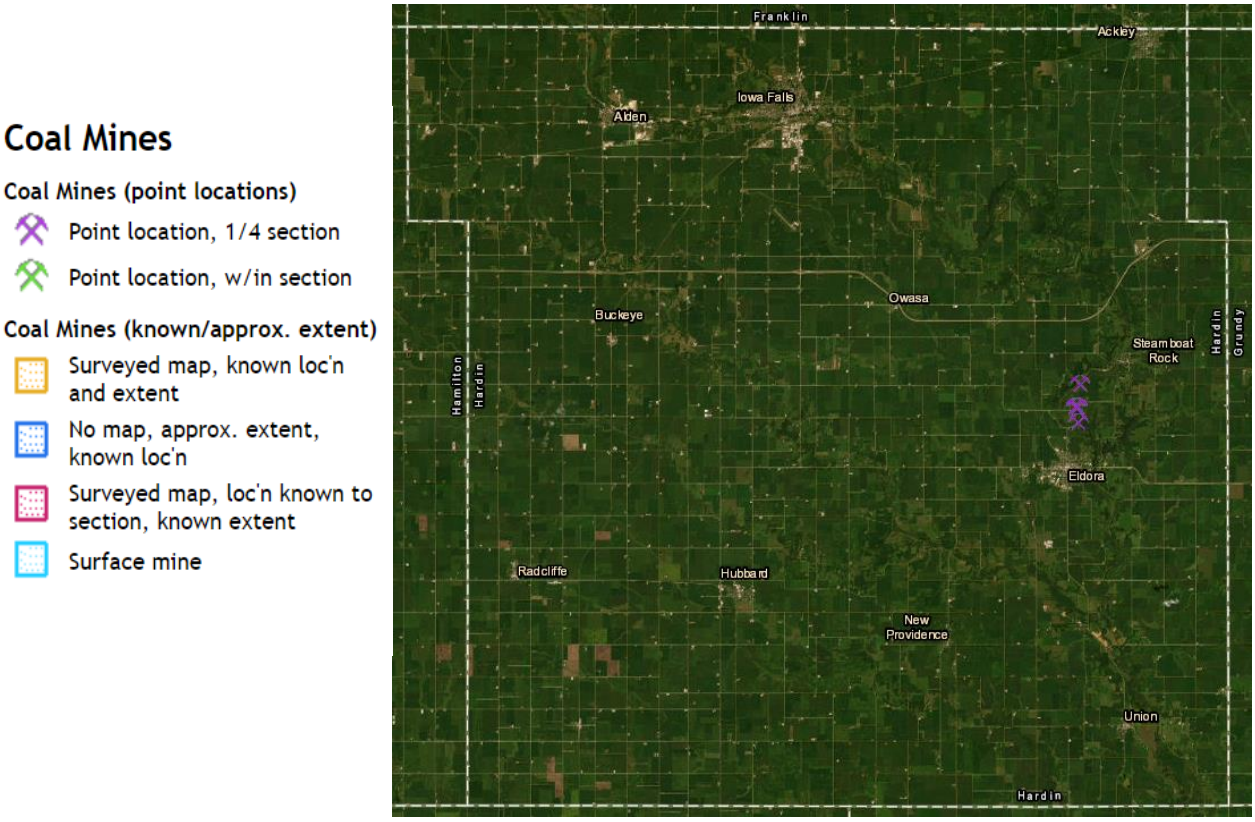
A sinkhole is defined as the loss of surface elevation due to the removal of subsurface support. Sinkholes can range from broad, regional lowering of the land surface to localized collapse. The primary causes of most subsidence are human activities such as: underground mining of coal, groundwater or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

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 Hardin County partly stems from the existence of old mines.

Location

The following map (Figure 57) shows historic coal mining areas reported by IDNR. These documented coal mines may be prone to a sinkhole event.

Figure 55: Historic Coal Mining Areas



Source: IDNR, 2023[127]

Extent

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

[127] IDNR. Accessed August 2023. "Iowa Coal Mines." https://programs.iowadnr.gov/maps/coalmines/

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 96: 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.[128,129]

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".[130] 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

[128] Civil Disorders, 18 U.S. Code § 231-233 (1992)
[129] Terrorism, 28 U.S. Code § 0.85.
[130] 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 areas, 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.[131]

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

No jurisdictions 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 97: 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

[131] 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:

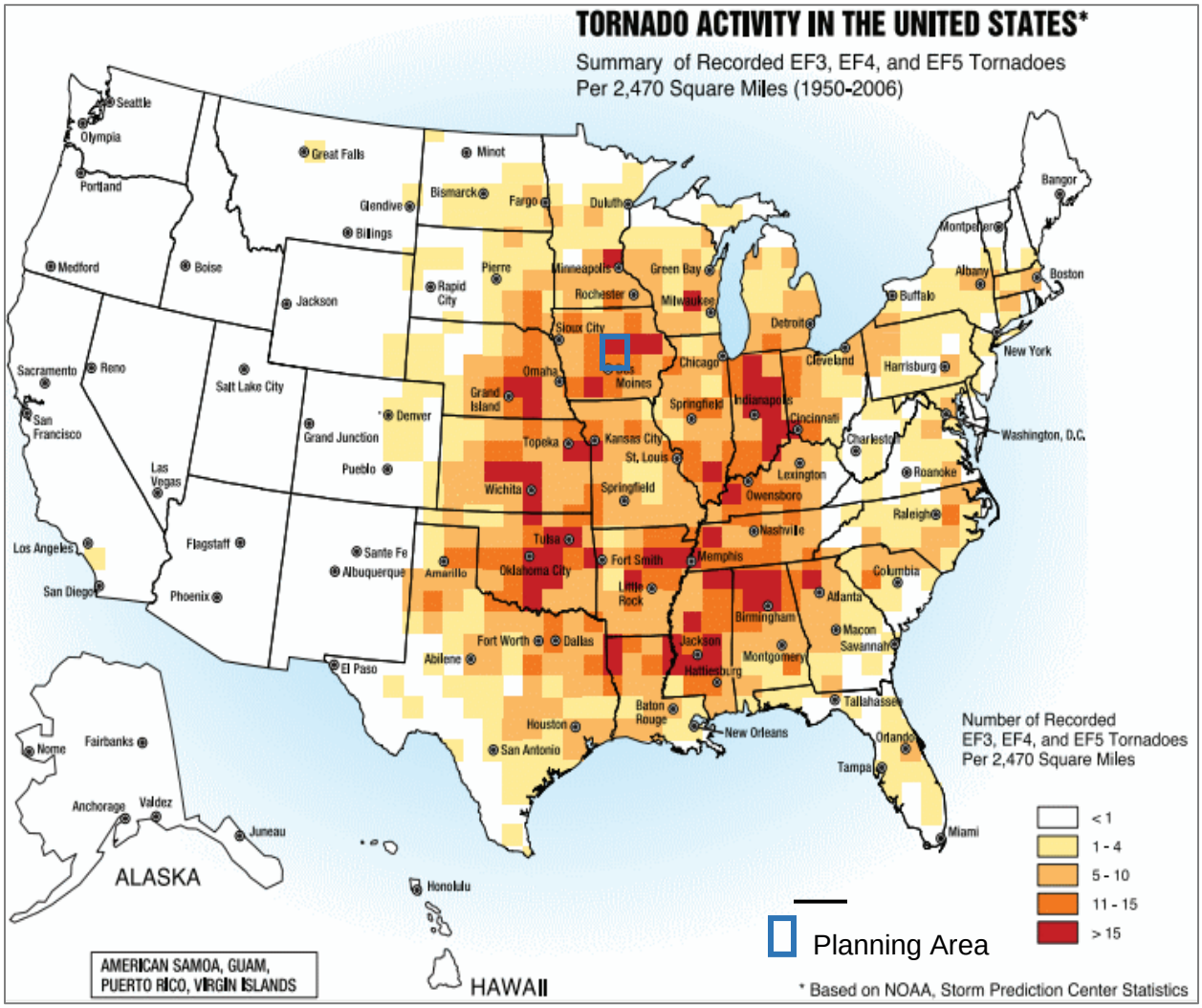
- There must be a microscale rotating area of wind, ranging in size from a few feet to a few miles wide;
- The rotating wind, or vortex, must be attached to a convective cloud base and must be in contact with the ground; and,
- The spinning vortex of air must have caused enough damage to be classified 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 of over 100 miles and reach over 11 miles above ground. Tornadoes usually stay on the ground for 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.[132] Figure 56 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.

[132] 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 56: Tornado Activity in the United States



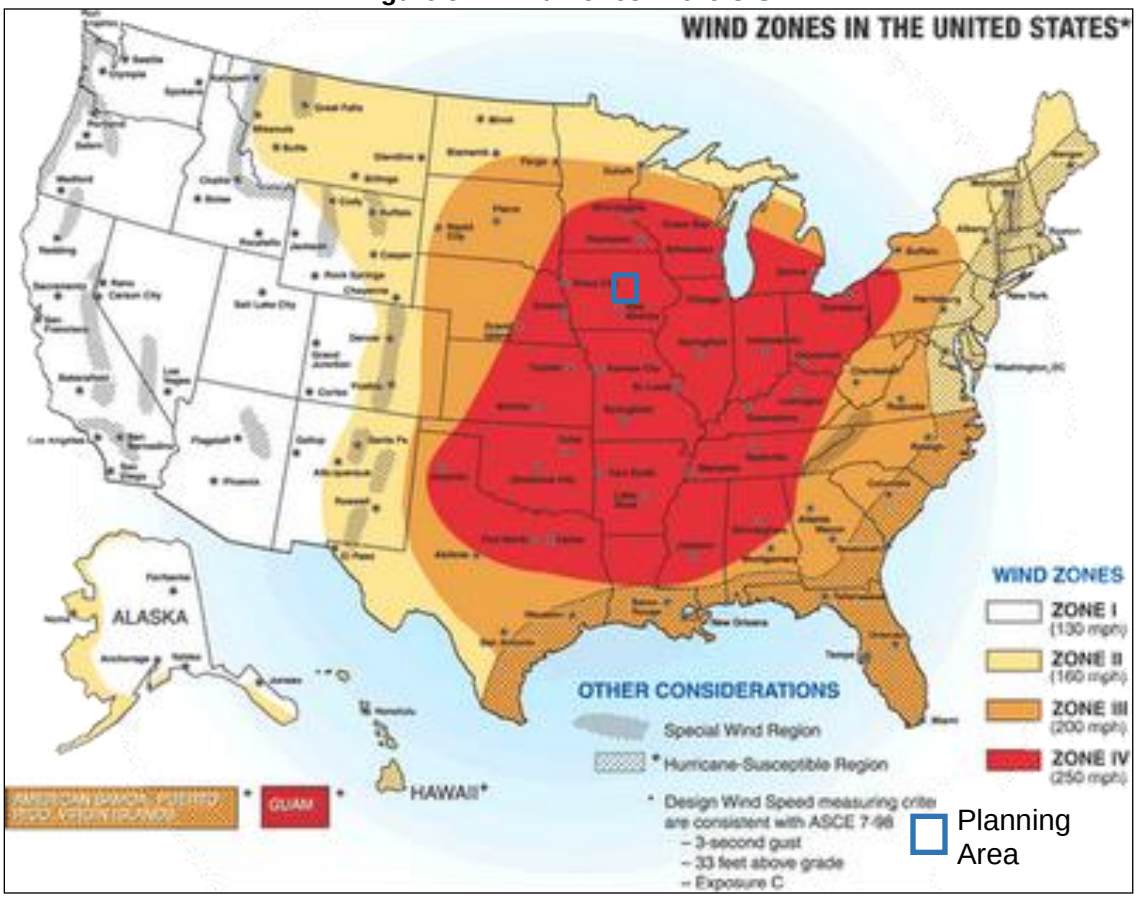
Source: FEMA, 2008[133]

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.[134] The NWS issues High Wind Advisories when there are sustained winds of 25 to 39 mph and/or gusts to 57 mph. Figure 57 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.

[133] Federal Emergency Management Agency. August 2008. "Taking Shelter From the Storm: Building a Safe Room for Your Home or Small Business, 3rd edition."
[134] National Weather Service. 2017. "Glossary." http://w1.weather.gov/glossary/index.php?letter=h.

Figure 57: Wind Zones in the U.S.

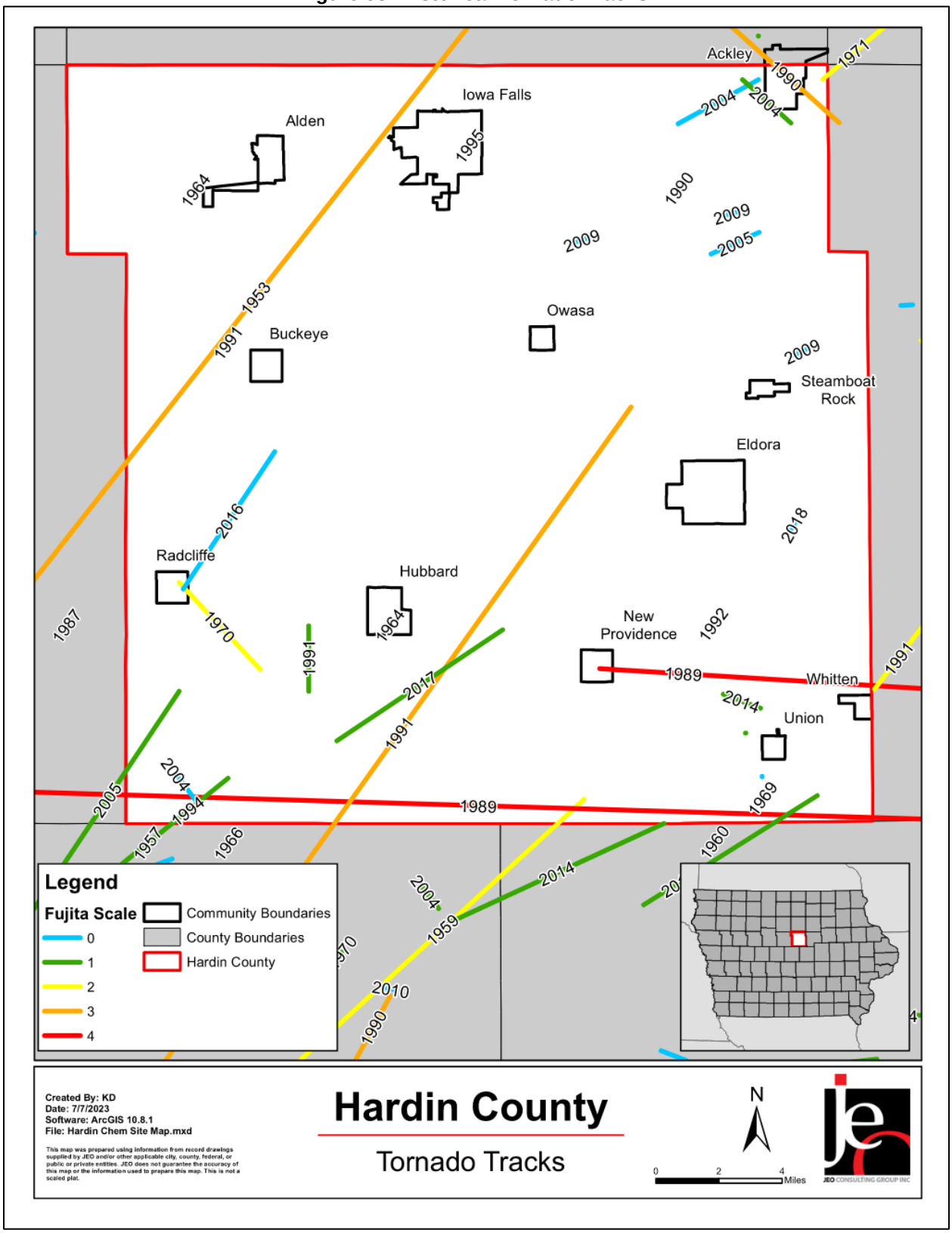


Source: FEMA, 2016

Location

Windstorms commonly occur throughout Hardin County and tornadoes can take place anywhere in the county. The impacts would likely be greater in more densely populated areas, such as the Cities of Iowa Falls, Eldora, and Ackley. Figure 58 shows the historical track locations across the region according to the Midwestern Regional Climate Center (1950-2018). A couple significant tornado events have directly impacted communities located in the planning area between 1996 and 2022. These include a 2001 F1 that impacted Alden, and an EF1 in Buckeye in 2014.

Figure 58: Historical 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 98 outlines the Beaufort scale, provides wind speed ranking, range of wind speeds per ranking, and a brief description of conditions for each ranking.

Table 98: 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[135]

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 54 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.

[135] 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.[136]

Table 99: 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 a 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 100: 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.

[136] 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

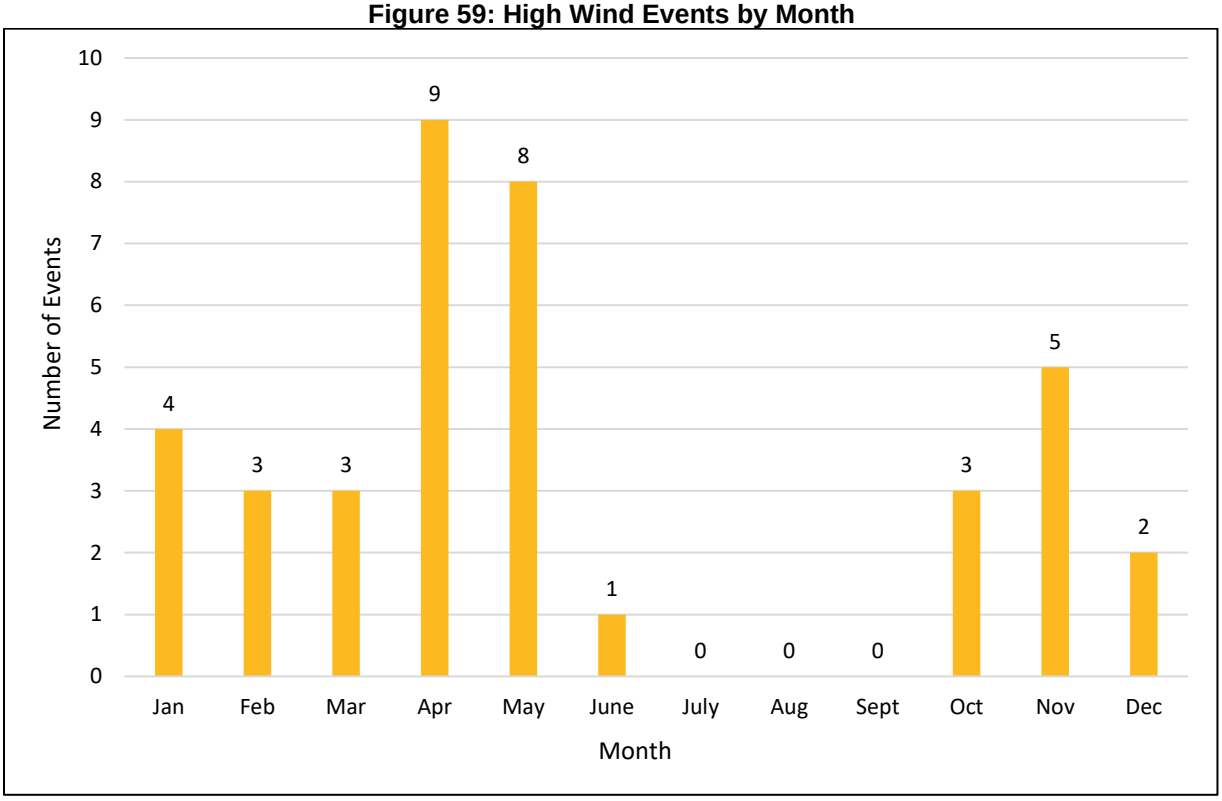
Based on historic record, it is most likely that tornadoes within the planning area will be of EF0 strength. Of the 30 reported tornado events, 21 were EF0 and nine were EF1.

Historical Occurrences

There were 38 windstorm events that occurred between 1996 and 2022 and 30 tornadic events ranging from a magnitude of EF0 to EF1. These events were responsible for $2,037,110 in property damages and $15,786,998 in crop damages. No deaths or injuries were reported.

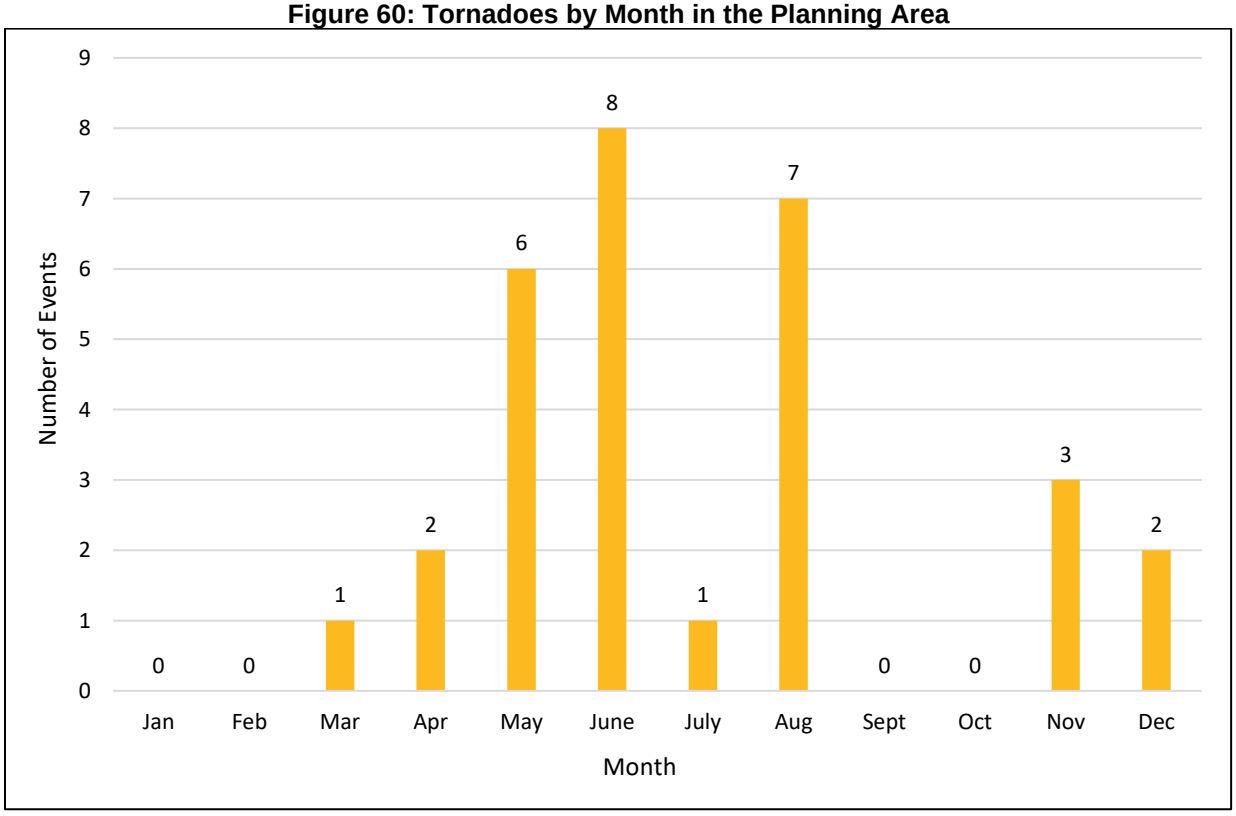
The most damaging tornado occurred in 2001, causing $500,000 in damages. This F1 tornado touched down within the City of Alden. In 2014, an EF1 tornado hit Buckeye and caused $100,000 in property damage. As seen in the following figures, the majority of windstorm events occur in the spring and winter months, while most tornado events occur in the spring and summer.

Figure 59: High Wind Events by Month



Source: NCEI, 1996-2022

Figure 60: Tornadoes by Month in the Planning Area



Source: NCEI, 1996-2022

Event descriptions from NCEI for the most damaging events are provided below.

- **4/20/2001 Tornado –** *Short touchdown within the town of Alden. A complex and active weather pattern was in place over the upper Midwest. A warm front lifted north across the state during the previous day, allowing a strong surge of moisture to flow north from the Gulf of Mexico. Temperatures rose into the 70s to low 80s as surface dew point temperatures rose into the upper 50s and 60s across the state. By the early evening hours, a frontal boundary extended from near Sioux City east-northeast into the northeast corner of the state. Thunderstorms fired along this front and became severe during the evening. These storms produced very heavy rain with numerous reports of hail. For the most part, the hail was around an inch in diameter with the storms. There were a few reports of hail up to the size of golf balls however. Reports of golf ball size hail were received from the Ringsted area of Emmet County, and also from the Fraser area of Boone County. Two things were taking place during the evening. While the thunderstorms were firing along the warm front over northern Iowa, a strong low-pressure system was racing out of Colorado. CAPE values across northeast Kansas into Iowa were in the 2000 to 3000 J/Kg range as a dry line extending south from the low approached the area. Strong thunderstorms developed over northeast Colorado and raced east across Nebraska and Kansas. The thunderstorms took on a bow echo configuration as they headed across the Plains at more than 60 MPH. High winds raked Nebraska and Kansas before moving into Iowa. There were numerous reports of winds of 60 to 80 MPH as the line advanced across the west half of Iowa with numerous reports of trees and power lines downed. As the storms moved through Carroll County, several outbuildings were destroyed in the Templeton area. Machine sheds were totally destroyed in Adair County by the high winds. Further northwest, in Greene County, a barn was flattened north of Scranton. Damage continued as the storms continued east with reports of outbuildings damaged or destroyed toward Hamilton County. One of the most damaging events of the night took place late in the storm cycle. The storms turned into wind producers. High winds hit the Lake Mills area in Winnebago County for example. A barn and several sheds were destroyed by the winds around 80 MPH. As the storms moved into Hardin County, a microburst occurred west of the Iowa Falls area with winds estimated around 85 MPH. A tornado touched down briefly in the community of Alden, causing considerable damage in the town. The tornado touched down in two locations of the town, damaging several buildings four blocks apart. Concrete blocks were picked up and thrown 50 to 75 yards and roofs of the affected buildings were strewn one quarter to three eighths of a mile downstream. One business was damages with estimated damage around $180,000. On a farm at the edge of town damage was estimated at $100,000. Numerous trees were downed on Highways 491 and D15, blocking travel in the area. Shortly after this event occurred, the storms weakened and continued moving northeast.*

- **8/31/2014 Tornado -** *This tornado moved into Hardin county from Hamilton county. This short segment did primarily crop damage but hit a farmstead before dissipating causing the destruction of two grain bins and badly damaging three outbuildings. This tornado was found and rated using high resolution satellite imagery. An unstable airmass was in place across Iowa with afternoon highs reaching well into the 80s, and dewpoint readings in the low to mid 70s. CAPE rose to 2000 to 3000 J/kg. Downdraft CAPE was around 900 to 1000 J/kg, with CAPE in the -10 to -30 C layer of the atmosphere in the 600 to 900 J/kg range. Precipitable water increased to around 1.75 inches. The freezing level was quite high at around 15,000 feet. Fairly strong shear was present with 40 to 50 kts of effective shear by late afternoon. A line of thunderstorms formed ahead of the cold front by late afternoon and moved east across the state through the evening hours. Hail with the storms was generally quite small. One inch diameter hail fell in Crawford County in Dow City. The primary severe events from this system were high winds that occurred as the MCS progressed across the state. Several locations reported gusts of 60 MPH or higher. An 80 MPH gust was reported in Guthrie County at Yale and Bayard. A 71 MPH wind gust occurred in Marion County. Heavy rainfall was also of significance with flash flooding in Crawford County. This was caused by a dam failure which flooded Highway 39. Three inches of rain fell in*

50 minutes in Dallas County. There were numerous reports of around 2 inches of rain falling in Boone and Polk Counties. Water ponding and low-land flooding was common. One person was struck by lightning at the Denison Airport. The person received minor injuries. Funnel clouds were sighted in both Crawford and Boone Counties. Additional heavy rainfall events are included on 01 September 2014 entry.

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 $42,782 per year in property damages and $685,130 per year in crop damages. Tornadoes have caused an average of $32,667 per year in property damages and $1,261 annually in crop damages; however, damages from tornadoes vary greatly depending on the severity or magnitude of each event.

Table 101: 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	30	1.1	$882,000	$32,667	$29,000	$1,261
Windstorm	38	1.4	$1,155,110	$42,782	$15,757,998	$685,130

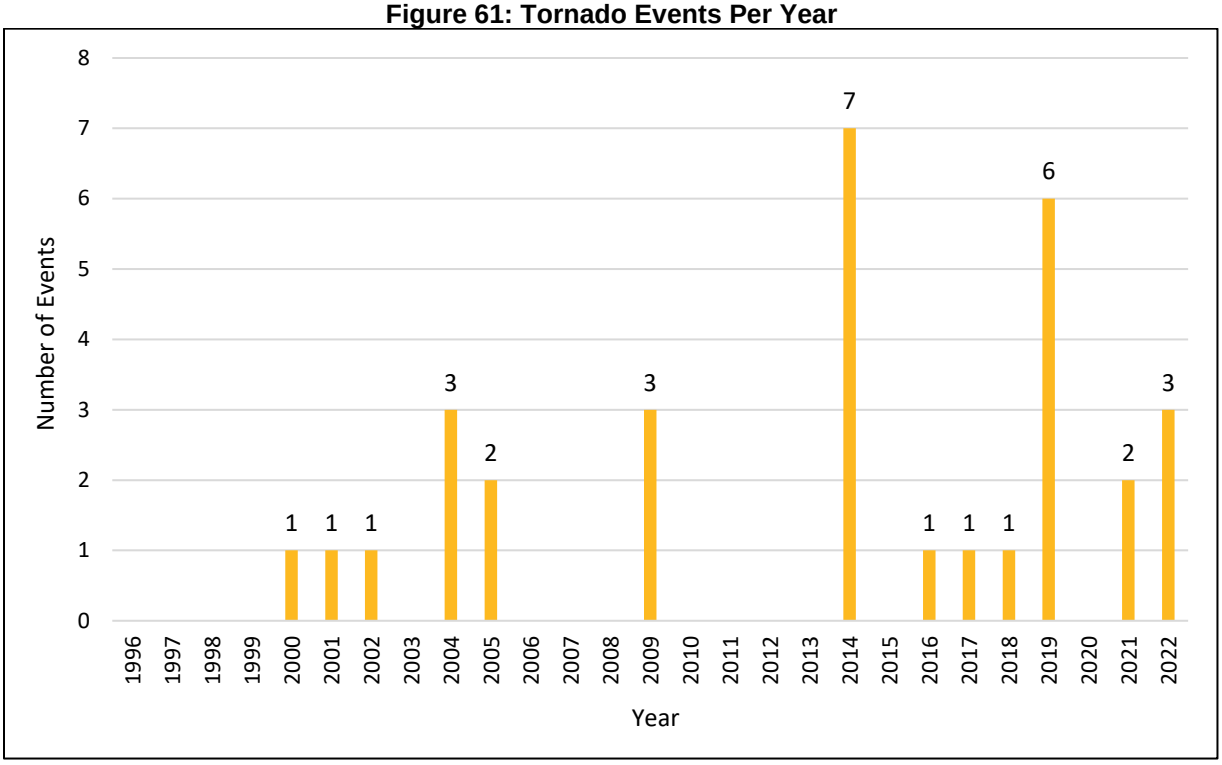
Source: 1 Indicates data is from NCEI (1996 to 2022); 2 Indicates data is from USDA RMA (2000 to 2022)

Probability

Given the historic record of occurrence for windstorms (20 out of 27 years with reported events), for the purposes of this plan, the annual probability of windstorm occurrence is 74 percent. However, windstorms could be more common than presented here but may have simply not been reported in past years.

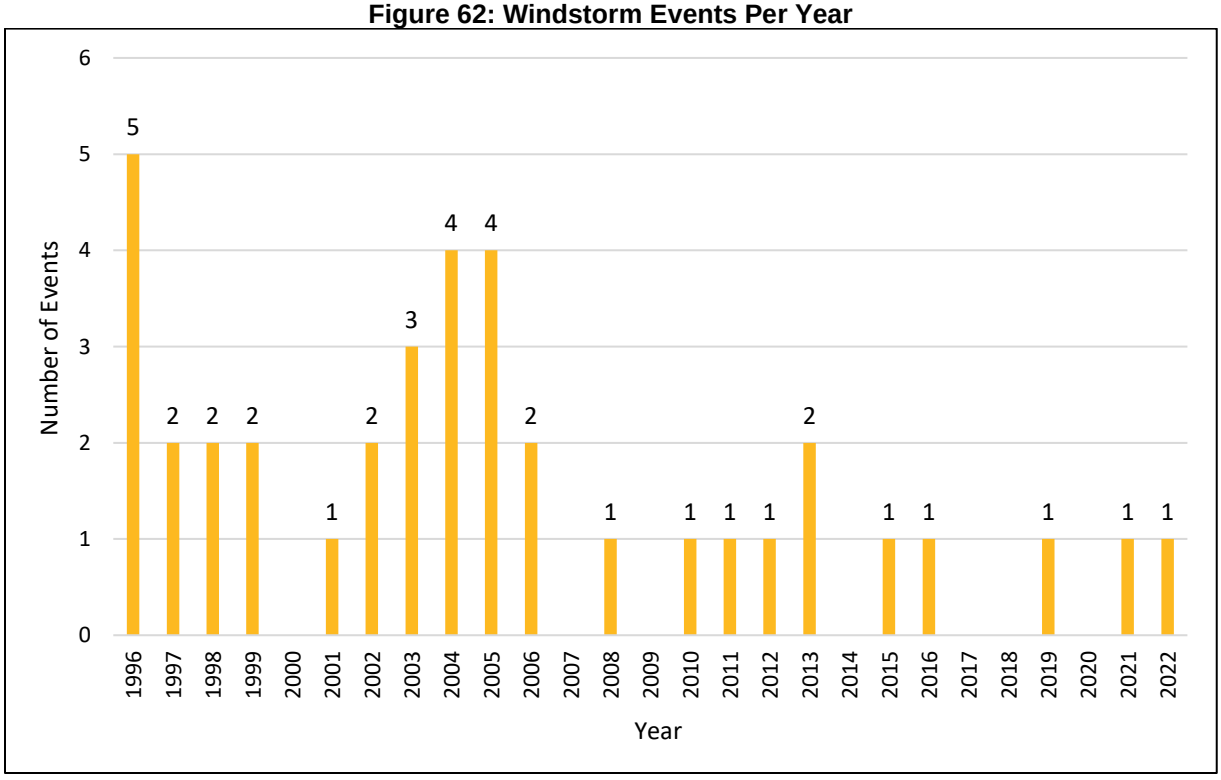
Given the historic record of occurrence for tornado events (13 out of 27 years with reported events), for the purposes of this plan, the annual probability of tornado occurrence is 48 percent. However, it is worth noting that the period of record for data utilized during this analysis is from 1996-2022.

Figure 61: Tornado Events Per Year



Source: NCEI, 1996-2022

Figure 62: 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	
City of Ackley	City of Union
City of Alden	City of Whitten
City of Eldora	AGWSR School District
City of Hubbard	BCLUW School District
City of Iowa Falls	Iowa Falls-Alden Schools
City of New Providence	Ellsworth Community College
City of Radcliffe	Providence 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 102: 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, 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.

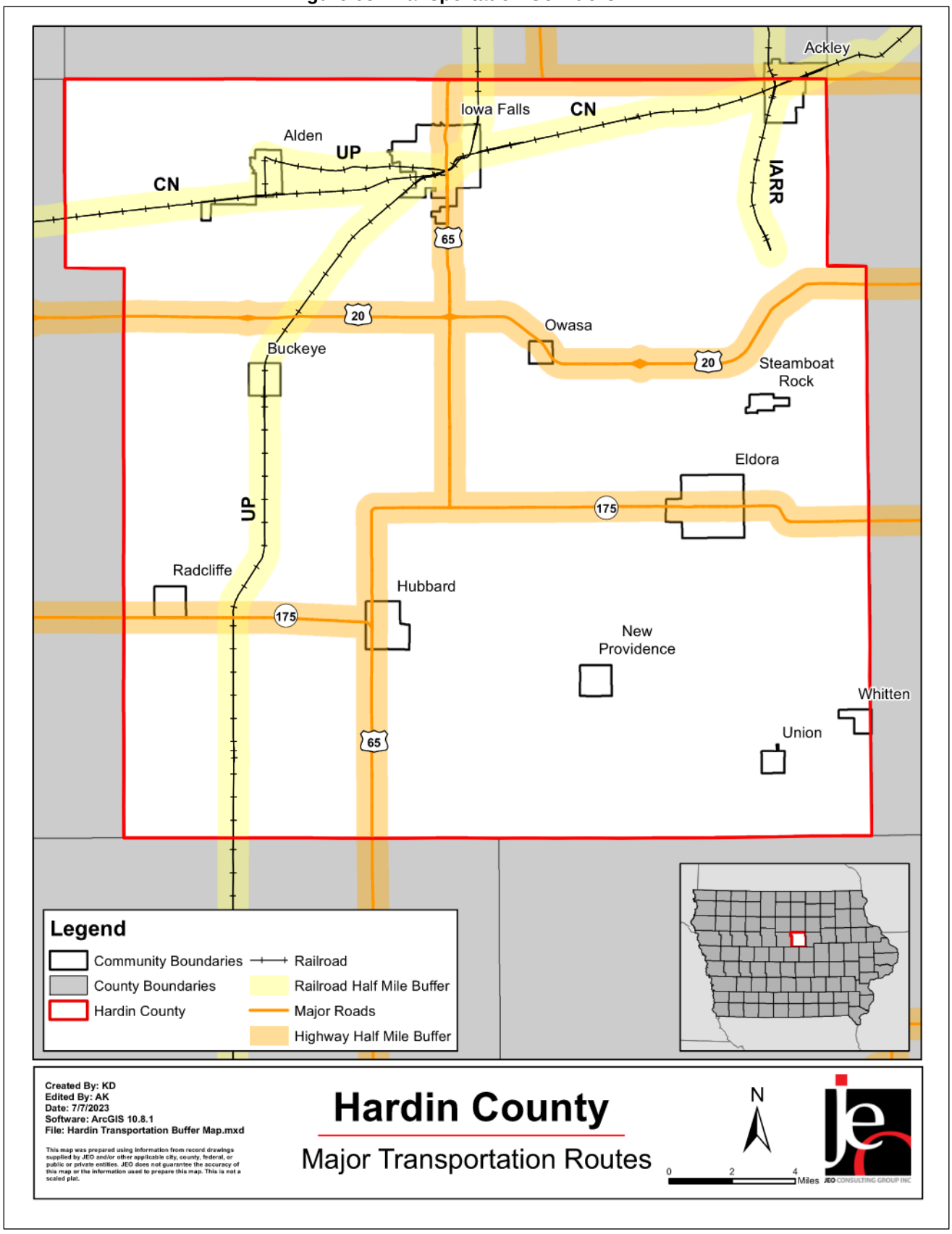
There are three public-use airports in Hardin County: the Iowa Falls Municipal Airport, the Ackley Municipal Airport, and the Eldora Airport. The Ackley Airport and Eldora Airport are privately-owned, but open to the public.

Figure 63 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 63: Transportation Corridors

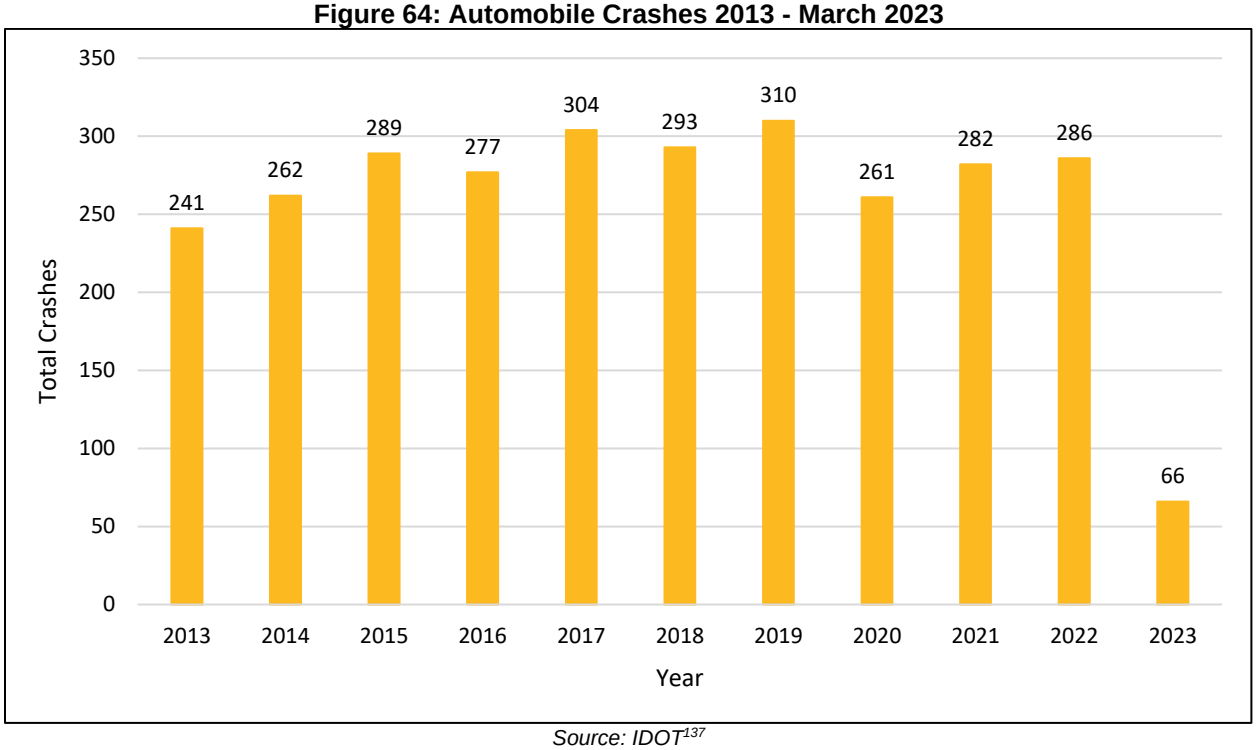


Historical Occurrences

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 2013 to March 2023. These events resulted in a total of 2,871 crashes, 417 injuries, and 30 fatalities.

Figure 64: Automobile Crashes 2013 - March 2023



Source: IDOT[137]

Highway Rail

The Federal Railroad Administration (FRA) keeps data on all highway rail accidents since 1975. Table 103 shows the number of highway rail accidents that have occurred in the county from 1975 to 2022. 31 injuries and nine deaths resulted from these events.

Table 103: Historical Highway Rail Incidents

Number of Incidents	Injuries	Fatalities
73	31	9

Source: Federal Railroad Administration, 1975-2022[138]

[137] Iowa Department of Transportation. 2023. "ICAT-Iowa Crash Analysis Tool." https://icat.iowadot.gov/
[138] Federal Railroad Administration. 2023. "Highway Rail Accidents". https://safetydata.fra.dot.gov/OfficeofSafety/publicsite/on_the_fly_download.aspx.

Aviation

From 1962 through April 2023, there were 23 aviation accidents in the planning area, as reported by the National Transportation Safety Board (NTSB) database. The events resulted in eight injuries and two fatalities.

Table 104: Historical Aviation Incidents with Injuries or Fatalities

Date	Phase of Flight	Injuries	Fatalities	Nearest Community
8/81971	In Flight	2	0	Ackley
6/30/1979	In Flight	1	0	Iowa Falls
8/8/1988	Maneuvering	0	1	Eldora
4/20/1990	Approach	3	0	Eldora
7/31/2009	Approach	2	0	Iowa Falls
7/15/2010	Approach	0	1	Iowa Falls

Source: National Transportation Safety Board, 1962-April 2023[139]

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 $1,796,734 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 105: Transportation Incidents Loss Estimate

Hazard Type	Number of Events	Average Events per Year	Total Property Loss	Average Annual Property Loss
Auto[1]	2,871	261	$19,701,723	$1,791,066
Aviation[2]	23	0.37	N/A	N/A
Highway Rail[3]	73	1.5	$272,052	$5,668
Total	**2,967**	**263**	**$19,973,775**	**$1,796,734**

Source:1 IDOT, 2013-March 2023; 2 NTSB 1962-April 2023; 3 FRA 1975- 2022

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 31% annual probability (19 out of 62 years with reported events) for aviation incidents, and a 38% probability (18 out of 48 years) of highway rail incidents occurring in the planning area each year.

[139] National Transportation Safety Board. 1962-April 2023. “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	
City of Alden	AGWSR School District
City of Radcliffe	

Regional Vulnerabilities

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

Table 106: 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

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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. The term "natural hazards" was changed to "all hazards" to provide further clarification, and the fourth goal was rephrased to include "minimize" at the beginning. The goals were then shared with all planning team members at the Round 1 public meetings.

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.

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.

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.

1. Minimize losses to existing and future structures within hazard areas. Critical facilities and identified assets are high priority structures.

- Implement programs and projects that assist in protecting lives by making homes, businesses, essential facilities, critical infrastructure, and other property more resistant to losses from all hazards.
- Improve hazard assessment information to make recommendations for discouraging new development and encouraging preventive measures for existing development in areas vulnerable to all hazards.
- Protect life and property by implementing current standards, codes and construction procedures.

2. Protect the health and safety of Hardin County residents and visitors.

3. Educate Hardin County citizens about the dangers of hazards and how they can be prepared.

- Increase public awareness of existing threats and the means to reduce these threats by conducting educational and outreach programs to all the various community groups in the County.

4. Minimize significant disruptions to county and local operations from disasters in Hardin County

5. Promote countywide coordination, planning, and training to avoid transferring the risk from one community to a nearby community, where appropriate.

- Continue providing County and City emergency services with training and equipment to address all identified hazards.

Selected Mitigation and Strategic Actions

Local community representatives evaluated and prioritized mitigation and strategic actions at the local level. 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.

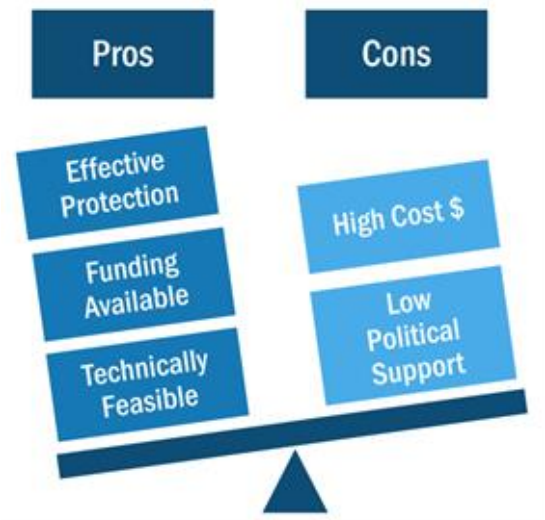
The Hazard Mitigation Planning Team provided each participant a link to the FEMA Mitigation Ideas document as a list of mitigation actions to be used as a starting point. Participants were also encouraged to think of actions that may need FEMA grant assistance and to review their hazard prioritization 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.

The local planning team members prioritized the mitigation actions according to criterion most applicable to their jurisdiction. Note that the listed priority rating does not indicate which actions may be implemented first – as some low priority actions may be easily accomplished while high priority actions may require a more time-consuming implementation process. Not all mitigation actions identified by a community can be a high priority project due to a lack of funds, time, or local capacity. Representatives were tasked with considering the pros and cons of the following amongst the local planning team when determining whether to pursue a mitigation action and its priority level:

- Does the action address a local concern? To what extent does it mitigate local risk? Does the action address multiple hazard concerns or broadly improve resiliency?
- How much might the action cost? Are the costs reasonable compared to probable benefits? Are there local funds to accomplish the project or is outside funding needed?
- Does the lead agency or responsible party have the time, expertise, or capacity to implement the project?
- Does the project or action have local and/or political support?
- Is the project prohibitive in some way? For example: financially prohibitive; lacking legal authority to implement; strong local opposition; etc.

Generally, high priority actions either address a major concern for the jurisdiction, have few to no challenges in implementation, and/or garner large support from the public and administration. Low priority actions either address a minor concern for the jurisdiction, have many challenges in implementation, and/or may not have support from the public or administration at this time. Medium priority actions may only have one or two of the items listed above. A mitigation action's priority may change very quickly as circumstances change. The local planning team members qualitatively established all mitigation action priority levels. Future updates to the plan should consider a quantitative approach to feasibility, benefit, and support when prioritizing actions.



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; availability of existing information; prohibitive costs or funding opportunities and limitations; low benefit-cost ratio; administrative capabilities of communities; 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.

Mitigation and strategic actions identified by participants of the Hardin County HMP are found in the Mitigation and Strategic Actions Project Matrix below. 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. 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.

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 107: Mitigation and Strategic Actions Selected by Each Jurisdiction (1 of 2)

Actions	Goal	Hardin County	City of Ackley	City of Alden	City of Buckeye	City of Eldora	City of Hubbard	City of Iowa Falls	City of New Providence	City of Radcliffe	City of Steamboat Rock	City of Union	City of Whitten
Alert/Warning Sirens	2, 4	X		X			X	X					
Backup and Emergency Generators	1, 2, 4		X	X	X	X	X	X	X	X	X	X	X
Building Code Enforcement/Improvement	1, 2	X											
Continuity Planning/Training	3, 4, 5											X	
Clean Culverts/ Deepen Drainage Ditches	1, 2									X			
Create/Store Sandbags	1, 2		X			X	X	X					X
Communication Equipment	2, 4, 5												X
Community Essentials Shelf	2, 4			X									
Debris Removal	1, 2					X							
Demolish Hazardous Structures	1, 2		X		X	X						X	
Disaster Response Plan	2, 3, 4, 5												X
Emergency Notifications	1, 2, 3, 5	X						X					
Emergency Operations Center	1, 2, 4, 5							X					
Emergency Response Equipment	1, 2, 4					X						X	
Erosion Control	1	X											
Evacuation Plan	2, 3, 4, 5											X	
Fire Hall	1, 2, 4								X				
Fire Training/Equipment	2, 3, 4, 5	X				X		X	X				
Flood Control Structure Improvements	1		X					X					
Fuel Storage	4												X
Groundwater Protection Plan	2, 4, 5	X											
HAZMAT Removal	2, 4										X		
HAZMAT Training/Awareness	2, 3, 5		X	X	X			X					X

Actions	Goal	Hardin County	City of Ackley	City of Alden	City of Buckeye	City of Eldora	City of Hubbard	City of Iowa Falls	City of New Providence	City of Radcliffe	City of Steamboat Rock	City of Union	City of Whitten
Improve Communications Network	2, 4, 5	X						X					
Improve Water System	1, 2, 4									X			
Infrastructure Hardening	1, 2, 4	X									X		X
Lift Station	1, 2		X	X							X		
Livestock Containment	2, 4	X											
Pipeline Inspection Ordinance	1, 2	X											
Public Awareness/Education	2, 3	X	X	X		X	X		X	X	X	X	X
Public Information Officer Program	2, 4, 5	X											
Remove Hazardous Trees	1, 2, 4		X										
Roadway Elevation	1, 2, 4	X											
Short Term Residency Shelters	2, 4	X					X						
Snow Removal Equipment	2, 4									X			X
Storm Shelters / Safe Rooms	1, 2, 4	X	X		X							X	X
Stormwater System and Drainage Improvements	1, 2, 4		X			X	X	X			X		
Wastewater Treatment	1, 2, 4								X		X	X	
Water Storage	1, 2, 4								X				
Water Treatment	2, 4												X
Water Use Ordinance	2, 4	X											
Water Well	2, 4			X									
Weather Radios	2, 4			X				X					X
Windbreaks	1, 2												X

Table 108: Mitigation and Strategic Actions Selected by Each Jurisdiction (2 of 2)

Actions	Goal	AGWSR Community School District	BCLUW Community School District	Ellsworth Community College	Iowa Falls-Alden Schools	Providence Township Fire District	South Hardin Schools
Active Shooter Containment	2, 3, 5				X		X
Backup and Emergency Generators	1, 2, 4	X	X			X	X
Communication Equipment	2, 4, 5	X	X				X
Debris Removal	1, 2	X					
Disaster Response Plan	2, 3, 4, 5		X	X			
Emergency Notifications	1, 2, 3, 5	X	X				
Fire Hall	1, 2, 4					X	
HAZMAT Removal	2, 4	X					
HAZMAT Training/Awareness	2, 3, 5	X					
Improve Communication Network	2, 4, 5						X
Infrastructure Hardening	1, 2, 4				X		X
Public Awareness/Education	2, 3	X	X	X	X	X	X
Snow Removal Equipment	2, 4				X		
Storm Shelters / Safe Rooms	1, 2, 4	X	X	X	X	X	X
Storm Spotters	2, 4		X				
Stormwater System and Drainage Improvements	1, 2, 4						X
Weather Radios	2, 4		X				
Windbreaks	1, 2						X

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Section Six:
Plan Implementation and Maintenance

Monitoring, Evaluating, and Updating the Plan

Each participating jurisdiction in the Hardin 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 Hardin 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 Hardin 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 Hazard Mitigation 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*[140] guidance, as well as FEMA's *2015 Plan Integration*[141] 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.

[140] 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

[141] 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 Hardin 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*.