Hazard Mitigation Planning Team

Name	Title	Represented Jurisdiction
Aaron Beemer	Deputy Fire Chief	Mason City
Aaron Burnett	City Administrator	Mason City
Aimee Frohling	City Clerk	Meservey
Amy Berding	City Council	Plymouth
Ashley Flatebo	MS Principal	West Fork Community School District
Bennett Smith	City Council Member	Clear Lake
Brian Pauly	Superintendent of Rec & Golf	Mason City
Cecil Kuhlers	Mayor	Plymouth
Cody Brunstein	Police Chief	Rockwell
Daren Huisenga	High School Principal	West Fork Community School District
David Sims	Airport Manager	Mason City Airport
Donna Powers	City Administrator	Ventura
Doug Gee	Superintendent	Clear Lake Schools
Doug Meyer	Fire Chief	Clear Lake
Eric Bullinger	Fire Chief	Mason City
Eric Whipple	Emergency Management Coordinator	Cerro Gordo
Jeff Brinkley	Police Chief	Mason City
Jennifer Larson	City Clerk	Clear Lake
Jeremy Korenberg	Public Works	Clear Lake
Josh Dannen	Fire Chief	Rockwell
Kara Vogelson	Public Health	Cerro Gordo
Kevin Pals	Sheriff	Cerro Gordo
Kimber Kleven	Administrator	Good Shepard Long Term Care
Lance Thompson	HS Principal	West Fork Community School District
Larry Wentz	Mayor	Rockwell
Lori Meacham-Ginapp	Supervisor	Mason City & Cerro Gordo
Lorna Weier	City Clerk	Rockwell
Lynn Nagel	Mayor	Dougherty
Mark Rahm	Engineer	Mason City
Mary Arndt	Assistant County Engineer	Cerro Gordo
Mary Nagel	City Clerk	Dougherty
Matt Reed	Fire Chief	Dougherty
Megan Hobscheidt	City Clerk	Thornton
Mike Colby	Police Chief	Clear Lake
Mike Gobeli	City Councilperson	Meservey
Mike Jensen	Mayor	Thornton
Mike Kruger	Superintendent	West Fork Schools

Name	Title	Represented Jurisdiction
Mike Ritter	Public Works, Floodplain Administrator	Clear Lake
Pat Hamilton	Superintendent of Schools	Mason City Schools
Randy Meyer	Council and Fire Department	Rockwell
Richard Miller	Mayor	Meservey
Ryan Kruger	Elementary Principal	West Fork Community School District
Scott Flory	City Administrator	Clear Lake
Tim Dodd	Mayor	Rock Falls
Tony Laudner	Maintenance Director	Clear Lake Community Schools
Tricia Sandahl	Planning & Zoning MGR	Mason City
Wade Eastman	City Council/Maintenance	Plymouth
Zach Laudner	City Superintendent	Rockwell
Becky Appleford*	Project Manager	JEO Consulting Group
Brooke Seachord*	Project Coordinator	JEO Consulting Group

*Served in a consultant role

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Community Profiles

Cerro Gordo County
City of Clear Lake
City of Dougherty
City of Mason City
City of Meservey
City of Plymouth
City of RockFalls
City of Rockwell
City of Thornton
City of Ventura
Clear Lake School District
Mason City School District
West Fork School District

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List of Acronyms

ACS – American Community Survey
BRIC – Building Resilient Infrastructure and Communities
CDC – Centers for Disease Control and Prevention
CFR – Code of Federal Regulations
COVID-19 – Coronavirus Disease 2019
CRP – Conservation Reserve Program
CRS – Community Rating System
CyanoHABs – Cyanobacterial Harmful Algae Blooms
DMA 2000 – Disaster Mitigation Act of 2000
EAB – Emerald Ash Borer
EAP – Emergency Action Plan
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 – Final Rule
GIS – Geographic Information Systems
HMA – Hazard Mitigation Assistance
HMGP – Hazard Mitigation Grant Program
HMP – Hazard Mitigation Plan
HPRCC – High Plains Regional Climate Center
HSEMD – Iowa Department of Homeland Security and Emergency Management
HUD – Department of Housing and Urban Development
IDALS – Iowa Department of Agriculture & Land Stewardship
IDNR – Iowa Department of Natural Resources
IDOT – Iowa Department of Transportation
IDPH – Iowa Department of Public Health
JEO – JEO Consulting Group, Inc.
LGA – Liquid Gallons
NCEI – National Centers for Environmental Information
NDMC – National Drought Mitigation Center
NFIP – National Flood Insurance Program
NLD – National Levee Database
NOAA – National Oceanic and Atmospheric Administration
NPI – Nonpharmaceutical Interventions
NRCS – Natural Resources Conservation Service
NRC – National Response Center
NTSB – National Transportation Safety Board
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
SHMO – State Hazard Mitigation Officer
SHMT – State Hazard Mitigation Team
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
WMA – Watershed Management Areas
WUI – Wildland Urban Interface

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Executive Summary

Introduction

This plan is an update to the Cerro Gordo 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) and under the new guidance of the Federal Emergency Management Agency's (FEMA) March 2023 Hazard Mitigation Assistance Program and Policy Guide.

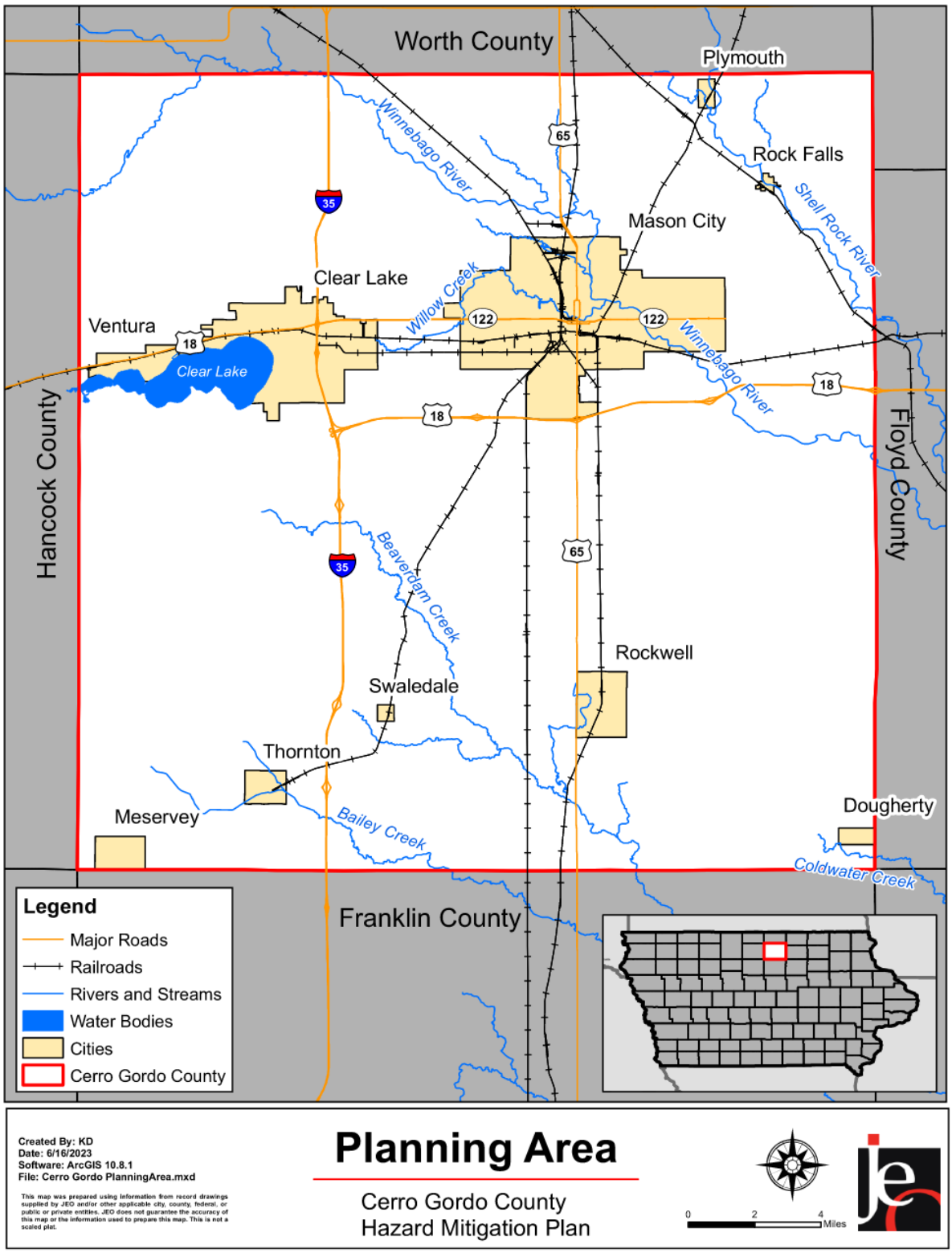
Hazard mitigation planning is a process in which hazards are identified and profiled; people and facilities at-risk are identified and assessed for threats and potential vulnerabilities; and strategies and mitigation measures are identified. Hazard mitigation planning increases the ability of communities to effectively function in the face of natural and human-caused disasters. The goal of the process is to reduce risk and vulnerability to lessen impacts to life, the economy, and infrastructure. All identified communities and special districts in the county were invited and encouraged to participate in the plan update. Jurisdictions who fully participated in the planning process are listed in the following table and illustrated in the following planning area map.

Table 1: Participating Jurisdictions

Participating Jurisdictions	
Cerro Gordo County	City of Rockwell
City of Clear Lake	City of Thornton
City of Dougherty	City of Ventura
City of Mason City	Clear Lake Community Schools
City of Meservey	Mason City Community Schools
City of Plymouth	West Fork Community Schools
City of Rock Falls	

Jurisdictions that opted to not participate or did not complete all requirements to participate include the City of Swaledale. Reasons these jurisdictions did not participate in this planning process included a lack of local capability and/or disinterest in the process. For a full discussion of the planning process and those encouraged to participate in the planning process, see *Section Two: Planning Process.*

Figure 1: Planning Area Map



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 members of 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. The goals for this plan update are as follows:

- **Goal 1**: Minimize vulnerability of the people and their property in Cerro Gordo County to the impacts of hazards.
- **Goal 2**: Protect critical facilities, infrastructure and other community assets from the impact of hazards.
- **Goal 3**: Improve education and awareness regarding hazards and risk in Cerro Gordo County.
- **Goal 4**: Strengthen communication among agencies and between agencies and the public.

Summary of Changes

The 2023 Cerro Gordo Hazard Mitigation Plan underwent significant changes from the previous plan to reflect shifting priorities, new requirements, or improvements to the overall HMP. A list of key changes is provided below; however, the entirety of this plan has been reformatted for easier readability and to meet new federal regulations which went into effect since the previous plan. The plan review tool from the previously FEMA approved HMP was also reviewed and changes were incorporated as needed.

Changes from the 2018 Hazard Mitigation Plan and planning process in this update included:

- Inclusion of community specific profiles with specific hazards of concern, mitigation actions, local capabilities, community lifelines, plan integration, and plan maintenance sections.
- Greater efforts to reach and include stakeholder groups as part of planning process.
- Utilization and analysis of various new data resources, plans, studies, and databases for a more specific hazard risk assessment applicable to the planning area.
- Expansion of risk assessment for new hazards and new subsections including future development and climate change.

Changes to the development of the mitigation strategy included the addition of new mitigation and strategic actions, updated status or removal of past actions, revisions to the mitigation and strategic action selection process, and updated descriptions of actions for consistency across the planning area. A key change included identifying at least one mitigation action to address each hazard of top concern to meet new regulatory guidance by FEMA and a more in-depth process for prioritizing identified actions.

This update also works to unify the various planning mechanisms in place throughout the participating communities (i.e., comprehensive 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.

Table 2: 2018 Plan Comments and Revisions

Comment from 2018 Review Tool Opportunities of Improvement	Location of Revision	Summary of Change
Future updates could be improved by including a discussion on how, if any, public feedback received was incorporated into the plan	Section Two: Planning Process	Methods of stakeholder and public outreach is described in Section Two.
The definition of Extent (Magnitude) used for hazard profiles (pg. 49) is inconsistent with current planning guidance and must be revised in future updates. The Plan identifies Extent as "the size or degree of impacts." The Local Mitigation Handbook defines Extent as "the strength or magnitude of the hazard (described in terms of a scientific scale and/or other hazard factors, such as duration and speed of onset). Extent defines the characteristics of the hazard regardless of the people and property it affects, while impact refers to the effect of a hazard on the people and property in the community." The extent of a hazard is not dependent on impacts.	Section Four	Definition of extent updated to "the strength or magnitude relative to a specific hazard." Extent included for each hazard profile in Section Four.
Though not reviewed for requirements, in future plan updates, the planning committee should consider removing Power Outage as a standalone hazard and incorporate the information as a cascading impact from	Section Four: Infrastructure Failure	The local planning team included Power Outage within the Infrastructure Failure hazard profile for the 2023 HMP. Future

Comment from 2018 Review Tool Opportunities of Improvement	Location of Revision	Summary of Change
identified hazards. This would allow for a greater analysis of vulnerability to specific hazards (in identified hazard areas) and help define more concrete mitigation measures.		updates may choose to move this profile to within hazard profiles as a cascading impact.
Clearly labeling or identifying the planning area on maps and figures would improve reference.	Whole HMP	All maps and figures have been updated for the 2023 HMP
Pg. 117 states there has only been one Presidential Disaster declaration for the county since 2008 that included flooding. Table 3.2 (pg. 32) states that DR-4289 (2016) included severe storms and flooding.	Section Four: Presidential Disaster Declarations	Table 32: Presidential Disaster Declarations updated to include all disasters between 1963-2023. Nine disasters in Cerro Gordo County included flooding impacts.
In future updates, the planning committee is highly encouraged to use problem statements that clearly describe each community's greatest vulnerabilities. With the exception of Flood, all hazard vulnerabilities are only generically described and don't differentiate the unique vulnerabilities of each individual jurisdiction. The plan must provide an overall summary of each jurisdiction's vulnerability to identified hazards. The overall summary of vulnerability identifies structures, systems, populations or other community assets as defined by the community that are susceptible to damage and loss from hazard events.	Section Seven: Jurisdictional Profiles	Jurisdictional profiles include specific hazards of top concern and specific mitigation actions to address each.
The "Low" Flood Risk Ranking score seems incongruous with the Flood Hazard Description, "Flooding has been a significant problem for many of the communities in Cerro Gordo County" (pg. 99). Additionally, 12 of the identified 23 mitigation actions relate to flood, which suggests flood should have a higher planning significance.	Section Four: Flooding & Section Seven: Jurisdictional Profiles	The Flooding hazard risk profile has been updated to relate more accurate flood risk across the county. Individual jurisdictional profiles include descriptions of local flood risk as appropriate.
FEMA's latest *Local Mitigation Planning Handbook* (March 2013) consolidated the 5 mitigation action categories in previous guidance (listed on page 136 in the Plan) into 4 categories: 1) local plans and regulations, 2) structure and infrastructure projects, 3) natural systems protection, and 4) education and awareness programs. Using the current categories would discourage including preparedness or operational readiness actions in the mitigation plan, and result in more substantive, actionable strategies.	Section Five: Mitigation Strategy & Section Seven: Jurisdictional Profiles	All mitigation actions have been reviewed for either a mitigation or capacity building type action. Per new guidance in April 2023, all identified hazards of top concern must have at least one mitigation action to address them.
Mitigation actions that aren't being considered by any community should be deleted to avoid confusion.	Section Five: Mitigation Strategy & Section Seven: Jurisdictional Profiles	All mitigation actions have been reviewed and removed if not identified by a community.
Mitigation actions are "*specific actions, projects, activities or process taken to reduce or eliminate long-term risk".* Future plans should avoid generic actions developed from a laundry list of possible actions and	Section Five: Mitigation Strategy & Section Seven:	All mitigation actions have been reviewed by community representatives and more specific

Comment from 2018 Review Tool Opportunities of Improvement	Location of Revision	Summary of Change
instead focus on specific projects unique to each community that address specific vulnerabilities (as identified in the Risk Assessment through problem statements). The "future mitigation actions under consideration" on pages 152 – 154 are more representative of this concept (although several are preparedness related, not mitigation) and should be incorporated into each jurisdiction's mitigation strategy.	Jurisdictional Profiles	actions have been identified where available.
A multi-jurisdictional plan must describe each participating jurisdiction's individual process for integrating hazard mitigation actions applicable to their community into other planning mechanisms. In the next update, Section 5.2 must be updated to describe each individual jurisdiction's process for integrating mitigation into other planning mechanisms.	Section Three: County Profile & Section Seven: Jurisdictional Profiles	Individual jurisdictional profiles include a "Plans and Studies" section to address local planning mechanisms and the way they interact with this HMP.
The plan does a good job of describing changes to development since the last plan. Future plans could be improved by describing how these changes contributed to increases or reductions to community vulnerability.	Section Four: Risk Assessment & Section Seven: Jurisdictional Profiles	Hazard risk profiles in section four include a future development discussion; Future development is discussed as applicable in each jurisdictional profile.

Hazard Profiles

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

Table 3: Regional Risk Assessment

Hazard	Previous Occurrences	Approximate Annual Probability*	Likely Extent
Agricultural Plant and Animal Disease	Animal Disease: Unavailable	Unknown	Unknown
	Plant Disease: 16	Plant Disease 11/22 = 50%	Major crop damage or loss
Dam Failure	0	~1%	Agricultural lands or areas downstream
Drought	423/1,542 months	27.4%	Mild Drought (D1)
Extreme Heat	Heat: Avg 1 day/year	100%	Max Temp ≥100°F
Extreme Cold	Cold: Avg 10 days/year	100%	Max Temp ≤ 10°F

Hazard	Previous Occurrences	Approximate Annual Probability*	Likely Extent
Flooding/Flash Flooding	81	22/28 = 79%	Some inundation of structures and road closures. Some evacuations of people may be necessary.
Levee Failure	1	~1%	Inundation of floodplains or levee protected areas
Grass and Wildland Fire	139	12/15 = 80%	Avg 16.5 acres
Hazardous Materials Release	Fixed Site Spill: 55	27/33 = 82%	Avg Liquid Spill: 1,745 gallons Avg Gas Spill: 817 lbs.
	Transportation Spill: 152	31/33 = 94%	Avg Spill: 8 lbs of product
Infrastructure Failure	Unknown	Likely to occur annually	Varies by event
Pandemic Human Diseases	2 major outbreaks	>1%	Varies by event, >1 fatality
Severe Thunderstorms	378	28/28= 100%	>1" rainfall Avg 55 mph winds Avg. hail 1.1"
Severe Winter Storms	99	28/28= 100%	1-6" snow 35-45 mph winds
Terrorism and Civil Disorder	0	Less than 1%	Varies by event
Tornado and High Winds	Tornadoes: 22	11/28 = 39%	Mode: EF0 Range: EF0-EF2
	High Winds: 50	22/28 = 79%	Avg: 52 mph Range 35-72 mph

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

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

Table 4: Hazard Loss Estimates for the Planning Area

HAZARD TYPE		Cerro Gordo County		
		COUNT	**PROPERTY**	**CROP[1]**
Agricultural Disease	Animal Disease	N/A	N/A	N/A
	Plant Disease[1]	16	N/A	$229,699
Drought[3]		423 out of 1,542 months	$12,650,000	$50,255,767
Extreme Temperatures[4]	Extreme Cold	Average: 10 days/year	$0	$151,709

HAZARD TYPE		Cerro Gordo County		
	Heat (≥100°F)	Average: 1 day/year	$135,000	$805,878
Flooding[5]	Flash Flood	32	$3,980,000	$217,389
	Flood	49	$3,261,570	
	Dam Failure[2]	0	N/A	N/A
	Levee Failure[10]	1	N/A	N/A
Grass/Wildfires[7]		139	2,299 acres	NA
Hazardous Materials Release	Chemical Spills (Fixed Site)[8]	55	$0	N/A
	Chemical Spills (Transportation)[9]	152	$145,591	N/A
Infrastructure Failure		Unknown	N/A	$7,606
Pandemic Human Disease[6]		2 Outbreaks Unknown Fatalities	N/A	N/A
Severe Thunderstorms[5]	Thunderstorm Wind *Average: 55 mph* *Range: 48-78 mph*	148	$2,058,500	N/A
	Heavy Rain	73	$0	$56,914,099
	Hail *Average (in)*: 1.09 *Range (in):* 0.75-2.75	147	$805,700	$5,364,413
	Lightning	10	$182,000	$571,077
Severe Winter Storms[5]	Blizzard	32	$580,000	$1,469,290
	Heavy Snow	20	$239,545	
	Ice Storm	10	$666,280	
	Winter Storm	36	$470,900	
	Winter Weather	1	$0	
Terrorism[11]		0	$0	N/A
Tornadoes & Windstorms[5]	Windstorms (High Wind) Average: 52 mph Range: 35-72 mph	50	$1,790,110	$1,435,539
	Tornadoes Average: EF0/F0 Range: EF0/F0-EF2/F2	22	$473,000	$0
Totals		**943**	**$27,438,196**	**$117,422,466**

N/A: Data not available
1 - USDA RMA, 2000 -2022
2 - IDNR Communication, 2023
3 - NOAA, 1895-2023
4 - NOAA Regional Climate Center, 1893-2023
5 - NCEI, 1996 - 2023
6 - IDPH
7 - IDNR, 2008-2023
8 - NRC, 1990 - 2023
9 - PHMSA 1971 - April 2023
10 - USACE NLD, local correspondence
11 - University of Maryland, 1970 – 2018

Events like extreme temperatures, grass/wildland fires, severe thunderstorms, and severe winter storms will occur annually. Other hazards like pandemic human disease or terrorism/civil unrest will occur less often. The scope of events and how they will manifest themselves locally is not known regarding hazard occurrences. 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. The following table shows the most common mitigation actions that can be implemented to prevent future losses.

Table 5: Key Mitigation Strategies

Hazard	Mitigation Strategies
Agricultural Plant and Animal Disease	-Public Awareness and Education
Drought	-Public Awareness and Education
Extreme Temperatures	-Construct Shelter/Safe Rooms -Facility Updates
Flooding	-Install Community Sewer System -Construct Floodwall -Drainage Improvements -Public Awareness and Education
Grass and Wildland Fire	-Improve Emergency Response Equipment
Hazardous Materials Release	-Hazardous Material Training
Infrastructure Failure	-Construct Water Treatment Plant -Replace Bridges
Pandemic Human Disease	-Additional Sites for Public Health
Severe Thunderstorms	-Upgrade Outdoor Warning Sirens -Storm Sewer Improvements
Severe Winter Storms	-Emergency Communications - Snow Removal Equipment
Terrorism	--Security System Improvements -Active Shooter Training -Cyber Security Improvements
Tornadoes and High Winds	-Construct Shelter/Safe Rooms -Back-up Generators -Tree Removal

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Section One
Introduction

Hazard Mitigation Planning

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

FEMA definition of Hazard Mitigation

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

Natural hazards, such as severe winter storms, high winds and tornadoes, severe thunderstorms, flooding, extreme heat, drought, agriculture diseases, and wildfires are part of the world around us. Human-caused hazards are a product of the society and can occur with significant impacts to communities. Human-caused hazards can include hazardous materials release 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.

Cerro Gordo County has prepared this multi-jurisdictional hazard mitigation plan 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 is an update to the 2018 FEMA approved Cerro Gordo County Hazard Mitigation Plan (HMP). The plan update was developed in compliance with the requirements of the Disaster Mitigation Act of 2000 (DMA 2000). This plan demonstrates a broad 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 to efficiently recover from disasters.
- Investigate, review, and implement activities or actions to ensure disaster related hazards are addressed by the most efficient and appropriate solution.
- Educate citizens about potential hazards.
- Facilitate development and implementation of hazard mitigation management activities to ensure a sustainable community.

Disaster Mitigation Act of 2000

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

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

Hazard Mitigation Assistance

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

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

FEMA MITIGATION DIRECTORATE

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.

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

[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.

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

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

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

Plan Financing

Regarding the plan financing, Cerro Gordo County Emergency Management direct hired JEO Consulting Group based upon qualifications. Funding for the project came from the county budget.

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

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

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

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

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

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

Multi-Jurisdictional Approach

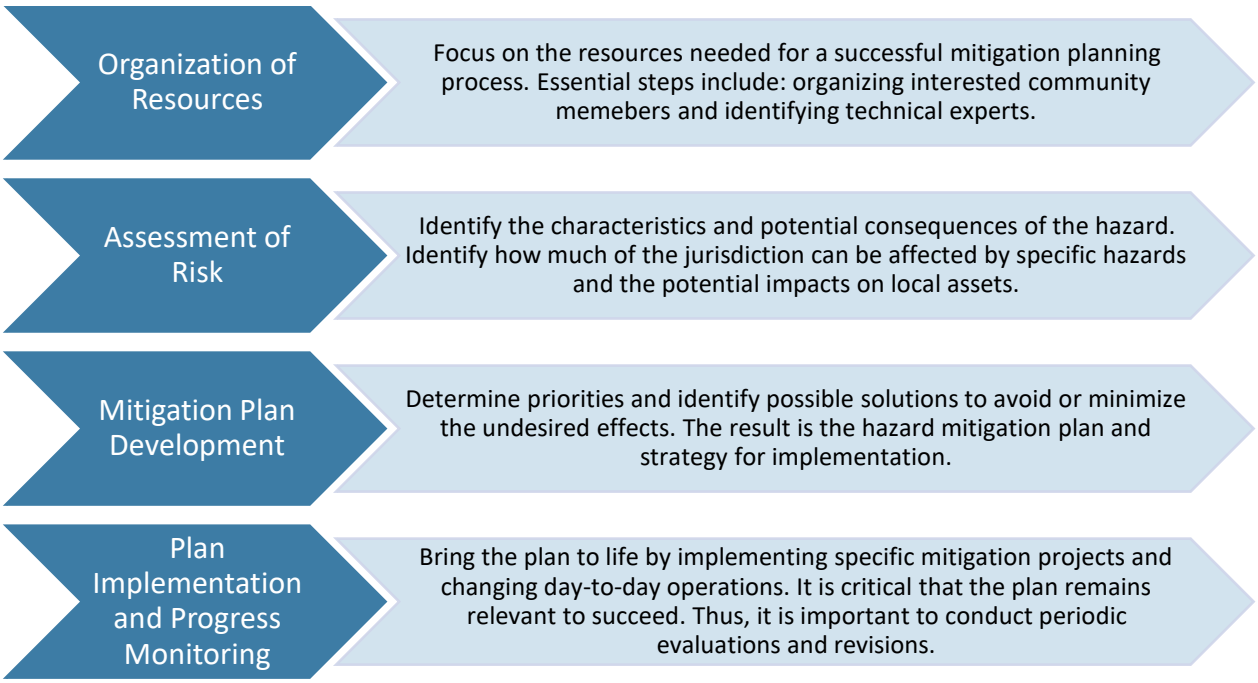
According to FEMA, "A multi-jurisdictional hazard mitigation plan is a plan jointly prepared by more than one jurisdiction." The term 'jurisdiction' means 'local government.' Title 44 Part 201, Mitigation Planning in the CFR, defines a 'local government' as "any county, municipality, city, town, township,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

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

Both FEMA and the Iowa Department of Homeland Security and Emergency Management (HSEMD) recommend this multi-jurisdictional approach through the cooperation of counties, communities, local

stakeholders, and local emergency management. Cerro Gordo County utilized the multi-jurisdictional planning process recommended by FEMA (Local Mitigation Plan Review Guide[9], Local Mitigation Planning Handbook[10], and Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards[11]) to develop this plan.

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

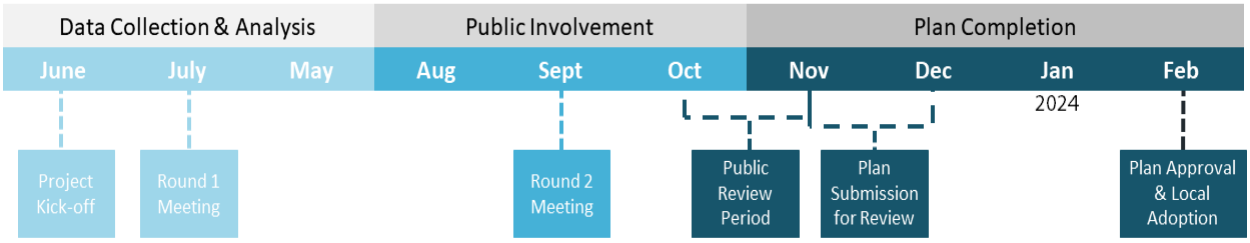
Cerro Gordo County contracted JEO Consulting Group, Inc. (JEO) in June 2023 to guide and facilitate the planning process and write and assemble the multi-jurisdictional hazard mitigation plan. For the planning area, Eric Whipple (Emergency Management Director) with Cerro Gordo County led the development of the plan and served as the primary point of contact throughout the project. A clear timeline of this plan update process is provided in Figure 2.

[9] Federal Emergency Management Agency. 2011. "Local Mitigation Plan Review Guide." https://www.fema.gov/sites/default/files/2020-06/fema-local-mitigation-plan-review-guide_09_30_2011.pdf.

[10] Federal Emergency Management Agency. 2013. "Local Mitigation Planning Handbook." https://www.fema.gov/sites/default/files/2020-06/fema-local-mitigation-planning-handbook_03-2013.pdf.

[11] Federal Emergency Management Agency. 2013. "Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards." https://www.fema.gov/sites/default/files/2020-06/fema-mitigation-ideas_02-13-2013.pdf.

Figure 2: Project Timeline



Hazard Mitigation Planning Team

At the beginning of the planning process, Cerro Gordo County Emergency Management and JEO staff identified who would serve as part of the county and local Hazard Mitigation Planning Teams. Members of the Hazard Mitigation Planning Team included all representatives who attended meetings, provided comment or feedback on plan development, reviewed the existing plan, and/or served as liaisons to community members regarding the plan development.

Those invited to be a part of the Hazard Mitigation Planning Team included representatives from each community including mayors, council members, utility managers, or planning city staff, county representatives including emergency management, commissioners, sheriff's office, engineer, or other department heads, and key stakeholders including local airports, health care facilities, surrounding counties, economic development, and chamber of commerce. A full list of representatives who attended meetings or provided input and the ways they were involved can be found in Table 6.

Table 6: Hazard Mitigation Planning Team

Name	Title	Represented Jurisdiction
Aaron Beemer	Deputy Fire Chief	Mason City
Aaron Burnett	City Administrator	Mason City
Aimee Frohling	City Clerk	Meservey
Amy Berding	City Council	Plymouth
Ashley Flatebo	MS Principal	West Fork Community School District
Bennett Smith	City Council Member	Clear Lake
Brian Pauly	Superintendent of Rec & Golf	Mason City
Cecil Kuhlers	Mayor	Plymouth
Cody Brunstein	Police Chief	Rockwell
Daren Huisenga	High School Principal	West Fork Community School District
David Sims	Airport Manager	Mason City Airport
Donna Powers	City Administrator	Ventura
Doug Gee	Superintendent	Clear Lake Schools
Doug Meyer	Fire Chief	Clear Lake
Eric Bullinger	Fire Chief	Mason City
Eric Whipple	Emergency Management Coordinator	Cerro Gordo
Jeff Brinkley	Police Chief	Mason City
Jennifer Larson	City Clerk	Clear Lake

Name	Title	Represented Jurisdiction
Jeremy Korenberg	Public Works	Clear Lake
Josh Dannen	Fire Chief	Rockwell
Kara Vogelson	Public Health	Cerro Gordo
Kevin Pals	Sheriff	Cerro Gordo
Kimber Kleven	Administrator	Good Shepard Long Term Care
Lance Thompson	HS Principal	West Fork Community School District
Larry Wentz	Mayor	Rockwell
Lori Meacham-Ginapp	Supervisor	Mason City & Cerro Gordo
Lorna Weier	City Clerk	Rockwell
Lynn Nagel	Mayor	Dougherty
Mark Rahm	Engineer	Mason City
Mary Arndt	Assistant County Engineer	Cerro Gordo
Mary Nagel	City Clerk	Dougherty
Matt Reed	Fire Chief	Dougherty
Megan Hobscheidt	City Clerk	Thornton
Mike Colby	Police Chief	Clear Lake
Mike Gobeli	City Councilperson	Meservey
Mike Jensen	Mayor	Thornton
Mike Kruger	Superintendent	West Fork Schools
Mike Ritter	Public Works, Floodplain Administrator	Clear Lake
Pat Hamilton	Superintendent of Schools	Mason City Schools
Randy Meyer	Council and Fire Department	Rockwell
Richard Miller	Mayor	Meservey
Ryan Kruger	Elementary Principal	West Fork Community School District
Scott Flory	City Administrator	Clear Lake
Tim Dodd	Mayor	Rock Falls
Tony Laudner	Maintenance Director	Clear Lake Community Schools
Tricia Sandahl	Planning & Zoning MGR	Mason City
Wade Eastman	City Council/Maintenance	Plymouth
Zach Laudner	City Superintendent	Rockwell

**Served in a consultant or advisory role.*

A kick-off meeting was held on June 21, 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 and objectives, 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.

Representatives including city administrators, mayors, and county board of supervisors were invited to attend the Kick-off Meeting. Table 7 shows the date, location, agenda item, and meeting attendees for the kick-off meeting.

Table 7: Kick-off Meeting

Location and Time	Agenda Items	
Mason City, Iowa June 21, 2023 6:00PM	-Consultant and planning team responsibilities -Overview of plan update process and changes from 2018 HMP -Review and adoption of goals and objectives -Plan goals/objectives -Hazard identification -Project schedule and dates/locations for public meetings	
Name	**Title**	**Jurisdiction**
Mason City, Iowa – June 21, 2023		
Eric Whipple	Emergency Manager	Cerro Gordo County
Kevin Pals	Sheriff	Cerro Gordo County
Lori Meacham-Ginapp	Board Supervisor	Cerro Gordo County
Mike Colby	Interim Police Chief	City of Clear Lake
Tim Dodd	Mayor	City of Rock Falls
Bennett Smith	City Council	City of Clear Lake
Becky Appleford*	Project Manager	JEO Consulting Group

Public Involvement and Outreach

To notify and engage the public in the planning process, a wide range of stakeholder groups were contacted and encouraged to participate. There were 15 stakeholder groups or entities that were identified and sent letters to participate. Of the invited, Good Shepard Long Term Care, Mason City Municipal Airport, and Iowa DNR attended meetings or provided input. Any comments these stakeholders provided were incorporated into the appropriate sections throughout the HMP upfront and community profiles as appropriate (see *Section Seven*).

Table 8: Notified Stakeholder Groups

ORGANIZATIONS		
Good Shepard Long Term Care	Clear Lake Area Chamber of Commerce	MercyOne North Iowa Medical Center
North Iowa Corridor Economic Development Corp.	Central Springs Schools	Mason City Municipal Airport
Iowa Specialty Hospitals & Clinic - Clear Lake	Garner-Hayfield-Ventura Community Schools	Mason City Chamber of Commerce
Clear Lake Sanitary District	Iowa DOT	Iowa DNR
University of Iowa Flood Center	Alliant Energy	Mid-American Energy

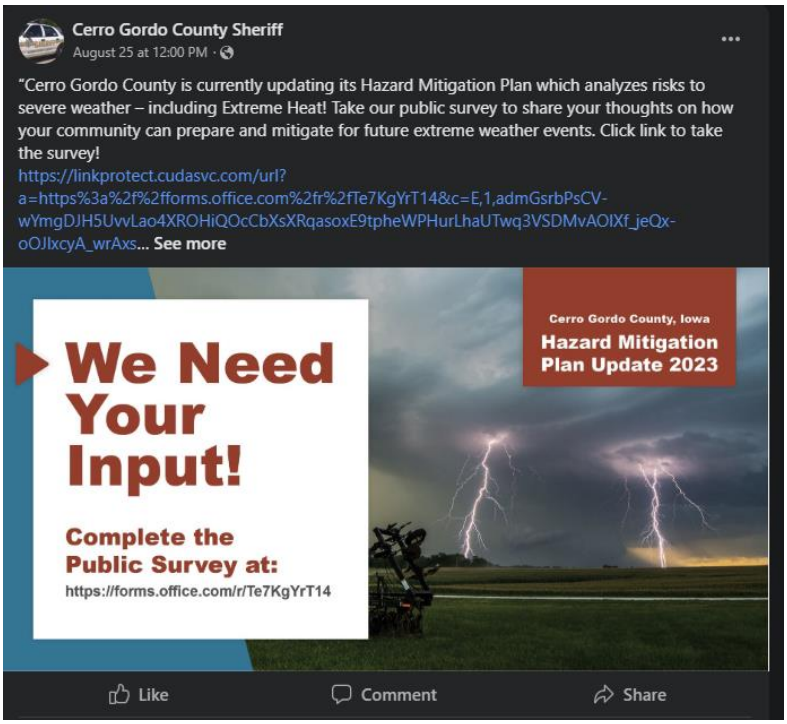
Neighboring Jurisdictions

Neighboring jurisdictions were notified and invited to participate in the planning process. The following table indicates which neighboring communities or entities were notified of the planning process. Invitation and informational letters were sent to county and regional emergency managers for distribution. No jurisdictions outside of the planning area participated in the planning process.

Table 9: Notified Neighboring Jurisdictions

NOTIFIED NEIGHBORING JURISDICTIONS	
Butler County	Floyd County
Franklin County	Hancock County
Mitchell County	Winnebago County
Worth County	Wright County

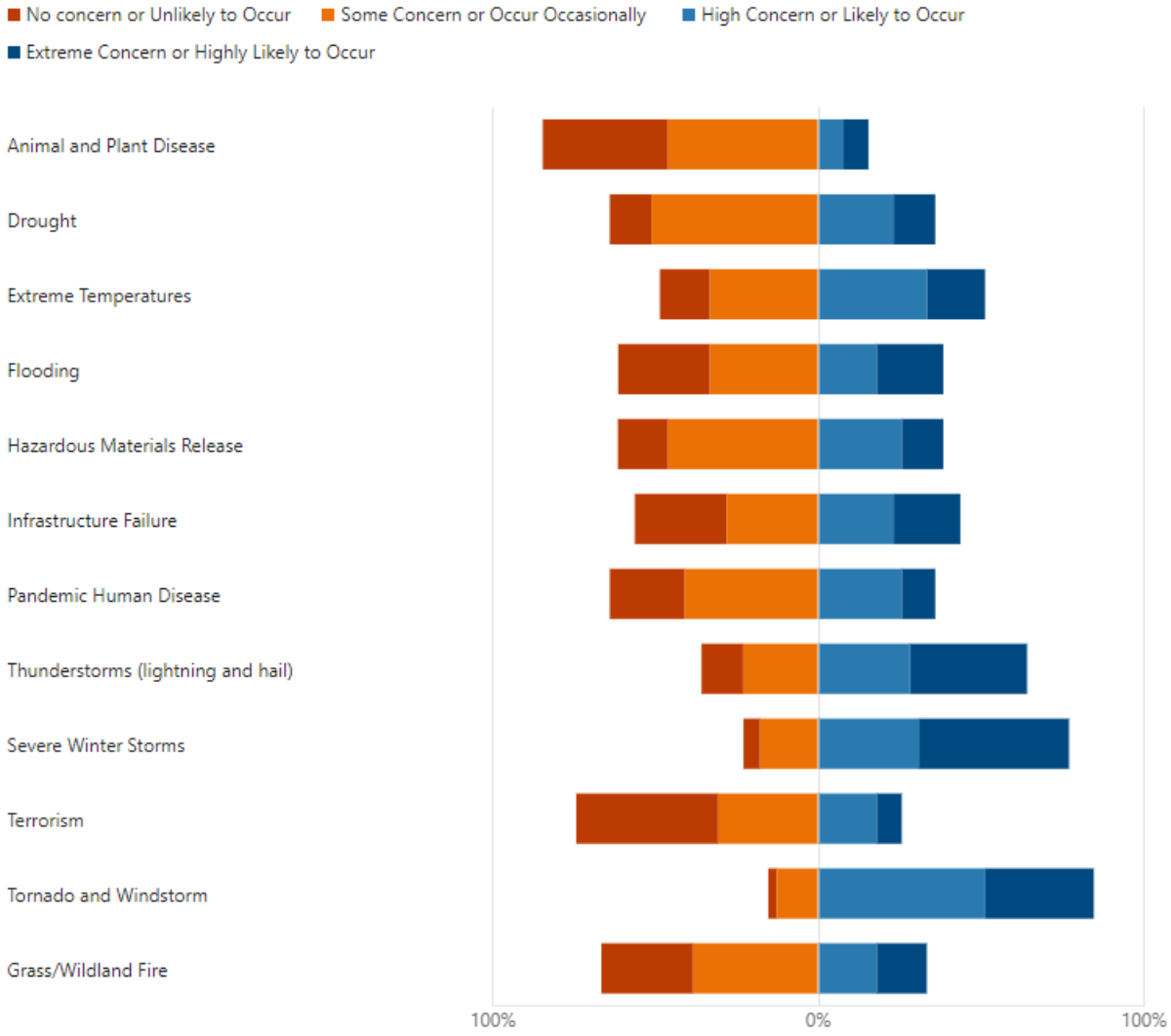
Project Survey



A project survey was developed and shared with the public through social media posts by the county and participating jurisdictions. The purpose of the survey was to collect specific concerns to types of hazards and projects the public have a vested interest in. The survey was available from the beginning of the planning process (prior to Round 1 meetings) and was reposted throughout the planning process. The survey closed after Public Review Period. In total there were 39 total responses to the survey from members of the public, with the majority of responses (16/39) coming from City of Mason City. Also of interest, the majority of respondents noted they had lived or worked in Cerro Gordo County for other 20 years (21/39 responses). This indicates a long standing or institutional knowledge aspect to their responses.

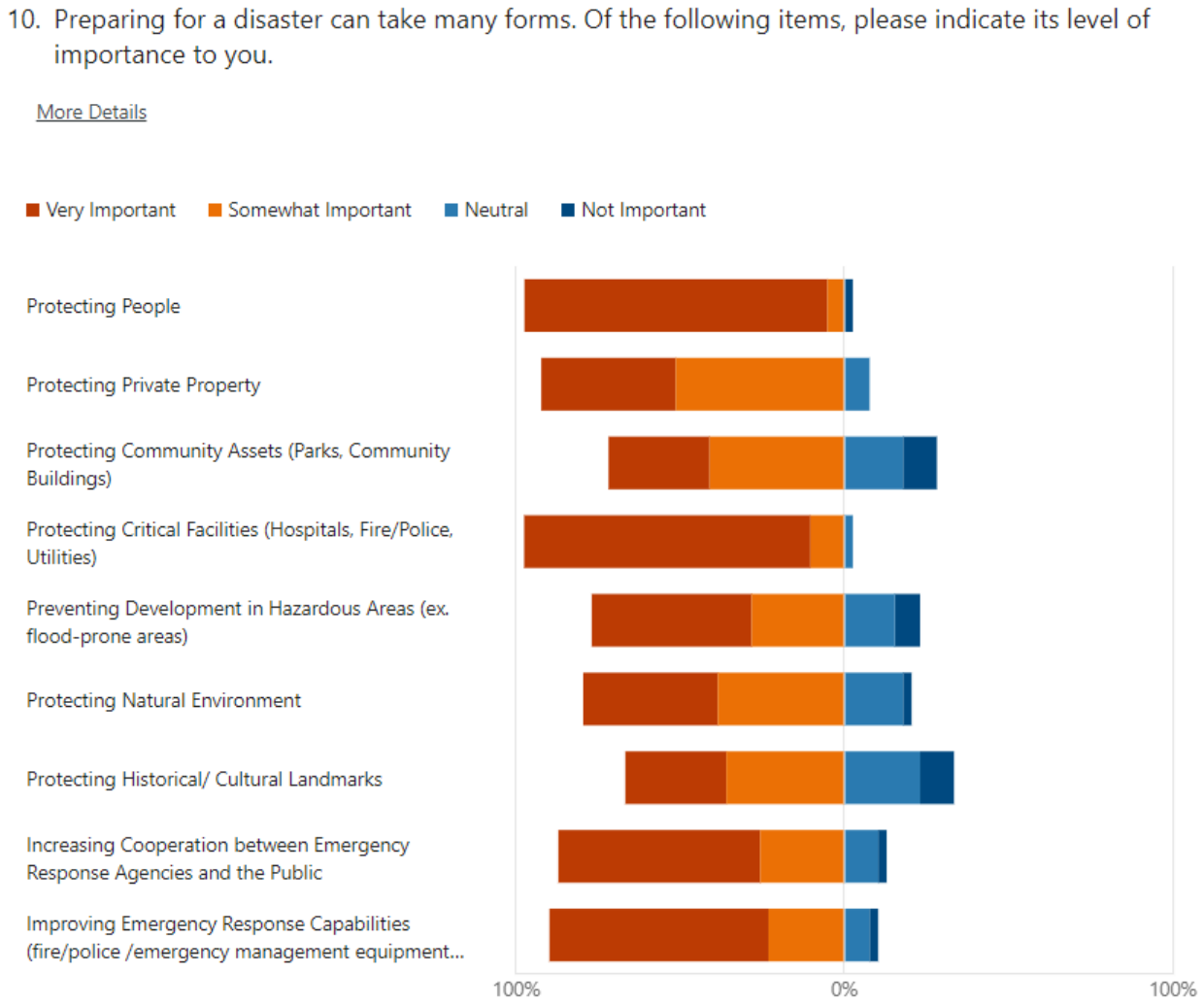
Questions about hazards, past events, priorities for mitigation, and what community members would like to see done locally were asked through the survey. Overall participant results are summarized below. The most commonly experienced hazard events for residents included Severe Thunderstorms, Severe Winter Storms, and Extreme Temperatures. This also aligned with the ranked level of concern for hazard events impacting the community members residence or workplace. The top hazards of concern included: Tornado and Windstorm, Severe Winter Storms, Severe Thunderstorms, and extreme temperatures. Of interest, Flooding hazard was noted to have been experienced by 13 of the 39 respondents yet only two of the respondents noted they carry flood insurance.

Figure 3: Hazard Types of Ranked Level of Concern



The majority of respondents indicated the best way to share information about preparing for a disaster is through emergency text alerts (21 votes), follow by social media posts (8 votes), and Cerro Gordo County Emergency Management website/social media outreach. 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 not important mitigation action end goals. Respondents identified Protecting People (92.3% noted Very Important) and Protecting Critical Facilities (87.2% noted Very Important) as the top priorities for preparing for a disaster, while Protecting Historical/Cultural Landmarks and Protecting Community Assets received the most responses for “Not Important.”

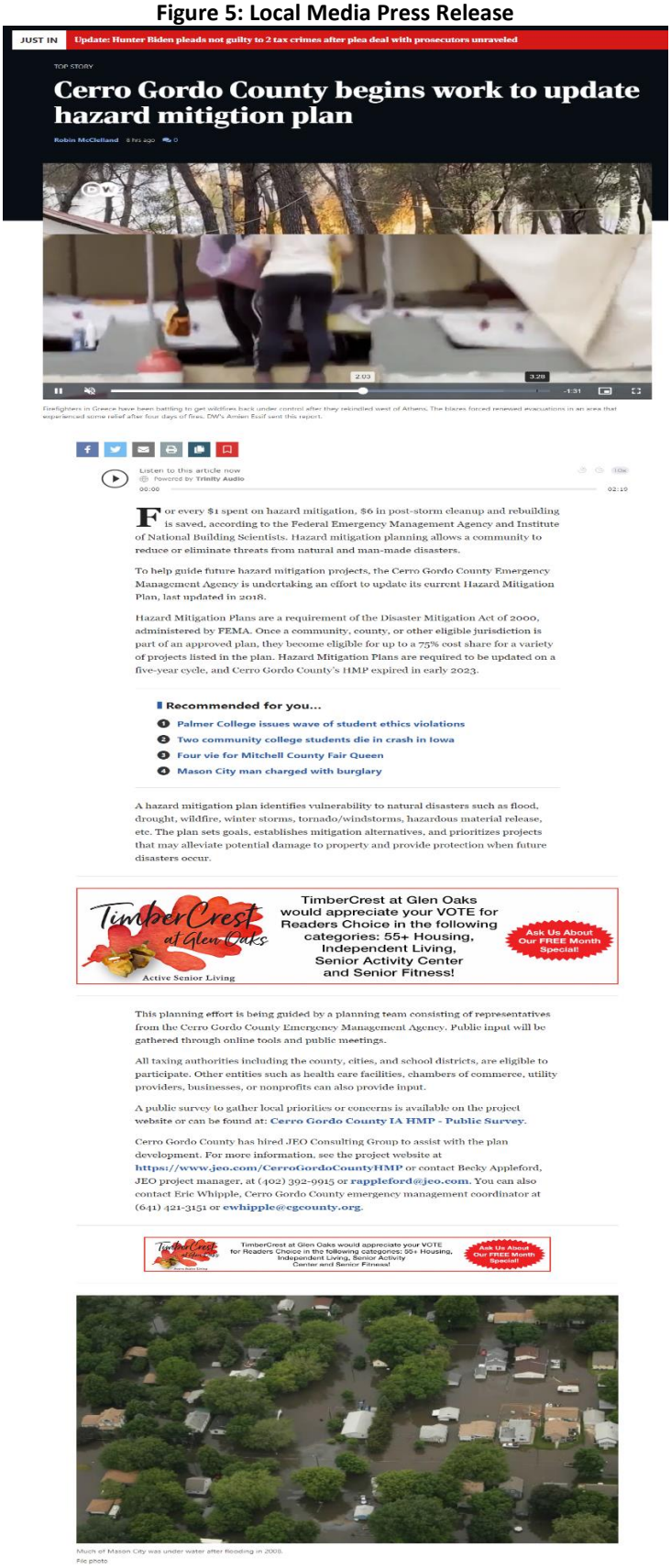
Figure 4: Preparedness Importance by Sector



Respondents were also asked for household mitigation actions which had been done or not. The most commonly done actions included signing up for Alert Iowa Emergency Text Alerts (28/39), reviewing local websites and new stations for emergency information (19/39), or developing a household emergency response plan (8/39). Five of the 39 respondents noted they had taken no activities to prepare for emergency or disasters. 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. Common themes and responses are listed below.

- Increase local education efforts – share what resources are available to local residents, update online resources, aid residents in preparing for hazard events.
- Improve notification alert time, i.e. provide earlier notice to residents.
- Improve sirens – either install new tornado sirens or improve existing sirens
- Improving alert sirens and hazard event notification systems for residents (i.e. text alerts).
- Reduce impacts from flooding (prevent development in floodplains, additional flood control structures, stormwater management system upgrades, etc.)
- Build additional safe rooms or shelter locations, specifically near the lake or in park areas
- Conduct a food drive for emergency food storage

Figure 5: Local Media Press Release



JUST IN Update: Hunter Biden pleads not guilty to 2 tax crimes after plea deal with prosecutors unraveled

TOP STORY

Cerro Gordo County begins work to update hazard mitigtion plan

Robin McClelland 8 hrs ago 0

Firefighters in Greece have been battling to get wildfires back under control after they rekindled west of Athens. The blazes forced renewed evacuations in an area that experienced some relief after four days of fires. DW's Amlan Essif sent this report.

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For every $1 spent on hazard mitigation, $6 in post-storm cleanup and rebuilding is saved, according to the Federal Emergency Management Agency and Institute of National Building Scientists. Hazard mitigation planning allows a community to reduce or eliminate threats from natural and man-made disasters.

To help guide future hazard mitigation projects, the Cerro Gordo County Emergency Management Agency is undertaking an effort to update its current Hazard Mitigation Plan, last updated in 2018.

Hazard Mitigation Plans are a requirement of the Disaster Mitigation Act of 2000, administered by FEMA. Once a community, county, or other eligible jurisdiction is part of an approved plan, they become eligible for up to a 75% cost share for a variety of projects listed in the plan. Hazard Mitigation Plans are required to be updated on a five-year cycle, and Cerro Gordo County's HMP expired in early 2023.

Recommended for you...

1. Palmer College issues wave of student ethics violations
2. Two community college students die in crash in Iowa
3. Four vie for Mitchell County Fair Queen
4. Mason City man charged with burglary

A hazard mitigation plan identifies vulnerability to natural disasters such as flood, drought, wildfire, winter storms, tornado/windstorms, hazardous material release, etc. The plan sets goals, establishes mitigation alternatives, and prioritizes projects that may alleviate potential damage to property and provide protection when future disasters occur.

This planning effort is being guided by a planning team consisting of representatives from the Cerro Gordo County Emergency Management Agency. Public input will be gathered through online tools and public meetings.

All taxing authorities including the county, cities, and school districts, are eligible to participate. Other entities such as health care facilities, chambers of commerce, utility providers, businesses, or nonprofits can also provide input.

A public survey to gather local priorities or concerns is available on the project website or can be found at: **Cerro Gordo County IA HMP - Public Survey**.

Cerro Gordo County has hired JEO Consulting Group to assist with the plan development. For more information, see the project website at **https://www.jeo.com/CerroGordoCountyHMP** or contact Becky Appleford, JEO project manager, at (402) 392-9915 or **rappleford@jeo.com**. You can also contact Eric Whipple, Cerro Gordo County emergency management coordinator at (641) 421-3151 or **ewhipple@cgcounty.org**.

TimberCrest at Glen Oaks would appreciate your VOTE for Readers Choice in the following categories: 55+ Housing, Independent Living, Senior Activity Center and Senior Fitness!
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Much of Mason City was under water after flooding in 2008.
File photo

Participant Involvement

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.

To be a participant in the development of this HMP update, jurisdictions were required to:

- Attend Round 1 and Round 2 meetings, watch a meeting recording, or have a one-on-one meeting with JEO staff,
- Provide relevant information throughout the plan update process, and
- Pass an Adoption Resolution for the approved HMP.

Jurisdictions had to have at least one representative present at meetings. 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.

Representatives from the Cerro Gordo County Emergency Management Department served as the local contact and spearheaded local outreach to eligible jurisdictions, including 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 10 provides a summary of outreach activities utilized in this process.

Table 10: 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/CerroGordoCountyHMP).
Press Release	Shared with Hazard Mitigation Planning Team and sent to local media outlets for dispersal.
Round 1 Meeting Letters and Emails	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	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 or to return relevant materials.
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 Cerro Gordo County HMP and how to get involved. Flyers were shared with all Hazard Mitigation Planning Team members to distribute.
Project Survey	Public Survey developed and shared through online websites to gather local priorities.
Press Release	Project press release developed and shared through local media, Globe Gazette and Clear Lake Mirror, to introduce project and share project website
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 stations. Project flyers were shared with local planning team representatives at meetings. 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. Comments or revisions regarding the plan were collected and shared with Cerro Gordo County Emergency Management and/or JEO staff for inclusion in the HMP. No major comments (i.e. comments other than minor grammatical corrections) were reported.

Round 1 Meetings: Local Plan Review and Hazard Identification

At the Round 1 meetings, jurisdictional representatives (i.e., the local planning teams) are familiarized with the HMP update process, review information from the previous HMP, update the general overview of the community's capabilities, and identify hazards of top concern. Table 11 shows the date and location of meetings held for the Round 1 meeting phase of the project.

Table 11: Round 1 Meeting Date and Location

Agenda Items	
General overview of the HMP planning process; discussion of participation requirements; review jurisdiction profile draft; begin risk assessment and impact reporting discussion; update capability assessment; review and identification of critical facilities; identify hazards of top concern.	
Location	**Date and Time**
Muse Norris Conference Room on the Northern Iowa Area Community College (NIACC) campus - 500 College Dr. Mason City, IA 50401	Wednesday, July 26, 2023 @ 6:00pm

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. The Round 1 meeting is also used as an opportunity to identify hazards of top concern, local capabilities, and community demographics.

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. Participants unable to attend meetings in person were able to watch a recording of the in-person meeting or have a one-on-one meeting with JEO representatives.

Table 12: Round 1 Meeting Attendees

Name	Title	Jurisdiction
Aaron Beemer	Deputy Fire Chief	Mason City
Bennett Smith	City Council Member	Clear Lake
Brian Pauly	Superintendent of Rec & Golf	Mason City
Cecil Kuhlers	Mayor	Plymouth
David Sims	Airport Manager	Mason City Airport
Donna Powers	City Administrator	Ventura
Doug Gee	Superintendent	Clear Lake Schools
Doug Meyers	Fire Chief	Clear Lake

Name	Title	Jurisdiction
Eric Bullinger	Fire Chief	Mason City
Eric Whipple	Emergency Manager	Cerro Gordo
Jeff Brinkley	Police Chief	Mason City
Kara Vogelson	Public Health	Cerro Gordo
Kevin Pals	Sheriff	Cerro Gordo
Kimber Kleven	Administrator	Good Shepard Long Term Care
Lori Meacham-Ginapp	Board Supervisor	Cerro Gordo County
Lynn Nagel	Mayor	Dougherty
Mark Rahm	Engineer	Mason City
Mary Nagel	City Clerk	Dougherty
Matt Reed	Fire Chief	Dougherty
Mike Gobeli	City Councilperson	Meservey
Mike Jensen	Mayor	Thornton
Mike Kruger	Superintendent	West Fork Schools
Pat Hamilton	Superintendent	Mason City Schools
Richard Miller	Mayor	Meservey
Tim Dodd	Mayor	Rock Falls
Tricia Sandahl	Planning & Zoning Manager	Mason City
Karl Dietrich	Hazard Mitigation Planner	JEO Consulting Group
Libbie Smith	Hazard Mitigation Intern	JEO Consulting Group

Round 2 Meeting: Hazard Identification and Mitigation Strategy Development

The identification and prioritization of mitigation measures is an essential component in developing effective hazard mitigation plans. The primary goal for this meeting was to review the hazards identified as a top concern at the Round 1 meeting and then evaluated ways to address those concerns. Other key pieces of information discussed at Round 2 included NFIP status and program participation, and integration of other planning mechanisms for the local jurisdiction.

The Round 2 meeting is designed to allow participating jurisdictions an opportunity to update mitigation actions from the previous Cerro Gordo County HMP (as applicable); and identify and describe new mitigation strategies to address prioritized hazards or identified gaps in planning, response, or resiliency from the Round 1 meeting (refer to *Appendix B*).

Participating jurisdictions were also asked to review the information collected from Round 1 meetings related to their community through this planning process to ensure all information included was up-to-date and accurate. Information/data reviewed include but was not limited to identified critical facilities and their location within the community; future development areas; and overall growth trends.

A brief status update on project schedule, public review period, final local adoption, and the approval and grant opportunities available once the plan is approved by HSEMD and FEMA was also provided to all participants. Table 13 shows the date and location of the Round 2 Meeting. Meeting attendees are identified in the following tables.

Table 13: Round 2 Meeting Date and Location

Agenda Items	
Identify new mitigation and strategic actions for each hazard, review of local data and community profile, discuss review process, discuss available grants and eligibility, and complete plan integration tool.	
Location and Time	**Date and Time**
Muse Norris Conference Room on the Northern Iowa Area Community College (NIACC) campus - 500 College Dr. Mason City, IA 50401	Wednesday, September 6, 2023 @ 6:00pm

Table 14: Round 2 Meeting Attendees

Name	Title	Jurisdiction
Aaron Beemer	Deputy Fire Chief	Mason City
Aaron Burnett	City Administrator	Mason City
Bennett Smith	City Council Member	Clear Lake
Brian Pauly	Superintendent of Rec & Golf	Mason City
Cecil Kuhlers	Mayor	Plymouth
Donna Powers	City Administrator	Ventura
Eric Whipple	Emergency Manager	Cerro Gordo
Kevin Pals	Sheriff	Cerro Gordo
Lynn Nagel	Mayor	Dougherty
Mark Rahm	Engineer	Mason City
Mary Arndt	Assistant County Engineer	Cerro Gordo
Mary Nagel	City Clerk	Dougherty
Mike Colby	Interim Police Chief	Clear Lake
Mike Gobeli	City Councilperson	Meservey
Pat Hamilton	Superintendent	Mason City Schools
Richard Miller	Mayor	Meservey
Tim Dodd	Mayor	Rock Falls
Tricia Sandahl	Planning & Zoning Manager	Mason City
Becky Appleford	Project Manager	JEO Consulting Group
Libbie Smith	Hazard Mitigation Intern	JEO Consulting Group

Data Sources and Information

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

Table 15: General Plans, Documents, and Information

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

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

ISU – Extension and Outreach https://www.extension.iastate.edu/	United States Geological Survey http://www.usgs.gov/
National Agricultural Statistics Service http://www.nass.usda.gov/	United States National Response Center https://nrc.uscg.mil/
National Centers for Environmental Information https://www.ncei.noaa.gov/	United States Small Business Administration http://www.sba.gov
National Consortium for the Study of Terrorism and Responses to Terrorism (START) http://www.start.umd.edu/gtd/	Watershed Management Authorities of Iowa https://www.iowadnr.gov/Environmental-Protection/Water-Quality/Watershed-Management-Authorities
National Drought Mitigation Center – Drought Impact Reporter http://droughtreporter.unl.edu/map/	

Public Review

Once the HMP draft was completed, a public review period was opened to allow for participants and community members at large to review the plan, provide comments, and request changes. The public review period was open from Monday, October 23 through Sunday, November 5, 2023. Participating jurisdictions and relevant stakeholders were emailed and 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/CerroGordoCountyHMP) for download. Jurisdictions and the public could provide comments via mail, fax, 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. All changes and comments from participating jurisdictional representatives (i.e., local planning teams) and stakeholders were incorporated into the plan. No comments from the public were received during such meetings to be incorporated into the HMP.

Table 16: Public Review Revisions

Plan Section	Name, Title, and/or Agency	Comment/Revision
City of Rockwell Profile	Adam Wedmore	Spelling Correction
City of Mason City Profile	Aaron Burnett, Tricia Sandahl, Brent Hinson	Spelling Corrections, clarifications to development trends, mitigation actions, and capabilities table
Cerro Gordo County Profile	Eric Whipple	Updates to generator status, updates to *Upgrade Outdoor Warning Sirens* mitigation action

Plan Adoption and Implementation

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

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

resolutions may be requested from the HSEMD's State Hazard Mitigation Officer.

Hazard mitigation plans are living documents. Once an HMP has been adopted locally, participants are responsible for implementing identified projects, maintaining the plan with relevant information, and fully updating the plan every five years. The plan must be monitored, evaluated, and updated on a five-year or less cycle. Those who participated directly in the planning process would be logical champions during the annual reviews and five-year cycle update of the plan. It is critical the plan be reviewed and updated annually or when a hazard event occurs that significantly affects the area or individual participants. These annual reviews are the responsibility of each jurisdiction's representatives and community governments and should be documented and reflected in the plan via amendments. However, participants are encouraged to work alongside the plan sponsor, Cerro Gordo County, or the consultant, JEO, to document updates and revise the HMP as needed.

Additional implementation of the mitigation plan should include integrating HMP goals, objectives, and mitigation and strategic actions into 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 Overview

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 Gordo County. As many characteristics are covered in each jurisdiction's community profile including demographics, employment, and transportation routes, redundant information is not included in this section. Therefore, this section highlights county specific information and will also serve as the county's profile. Jurisdictional specific information can be found in applicable profiles in *Section Seven*.

County Geographic Summary

The project area is comprised of Cerro Gordo County, which is located in the south-central portion of Iowa and covers an area of 575 square miles. Cerro Gordo County resides in both the Des Moines Lobe and the Iowan Surface landform regions as shown in Figure 6. The Des Moines Lobe region is noted for its broadly curved bands of ridges and knobby hills while the Iowan Surface region formed as the hilly landscapes leveled out as seasonal freezing and thawing loosened and moved sediments downslope.[12] [13] There are ten incorporated communities in the county, with the City of Mason City being the county seat. Figure 7 shows the county, incorporated communities, and location within the state.

Climate

Cerro Gordo's climate is classified as humid continental, which is marked by variable weather patterns and a large seasonal temperature variance. The average high temperature in Cerro Gordo County for the month of July is 81.9 degrees and the average low temperature for the month of January is 7.0 degrees. The following table compares these climate indicators with those of the entire planning area and the State of Iowa. 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 17: Cerro Gordo County Climate

	Cerro Gordo County	State of Iowa
January Normal Low Temp	7.0°F	14.7°F
July Normal High Temp	81.9°F	83.8°F
Annual Normal Precipitation	36.27"	32.66"

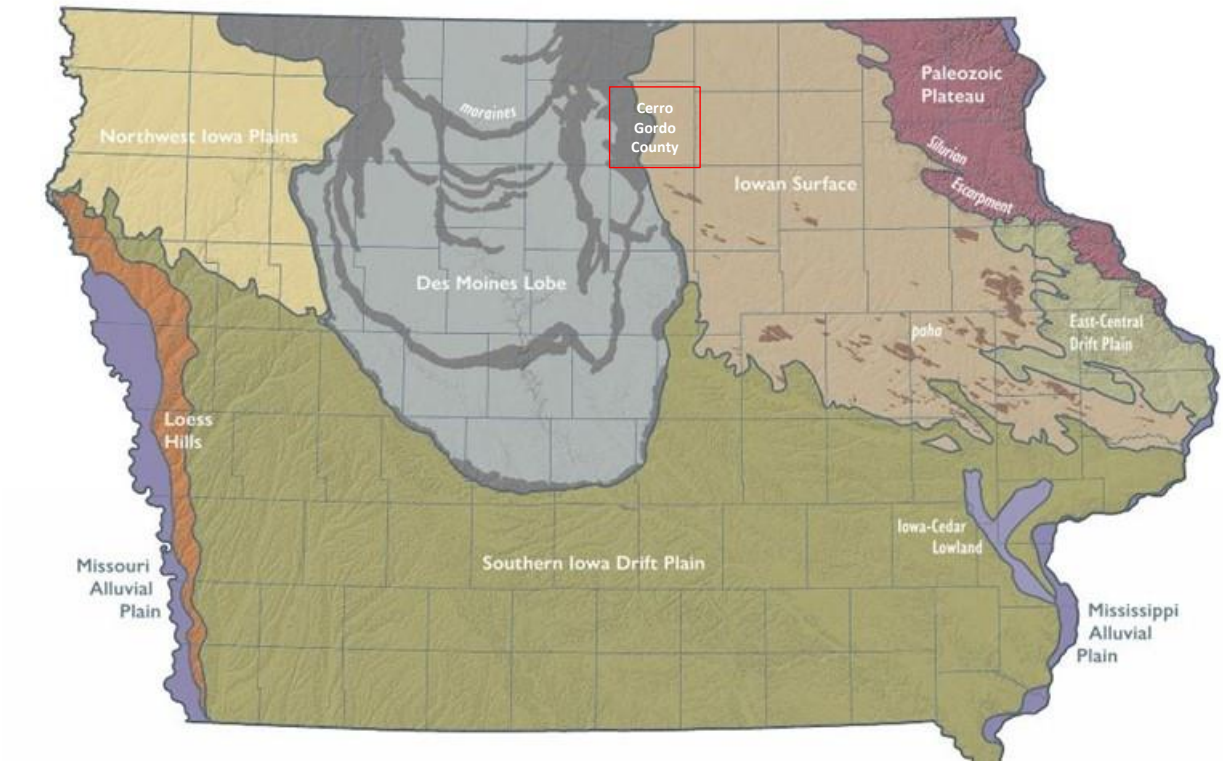
Source: NCEI U.S. Climate Normals[14],
Precipitation includes all rain and melted snow and ice.

[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 December 2022. https://www.ncei.noaa.gov/access/us-climate-normals/ .

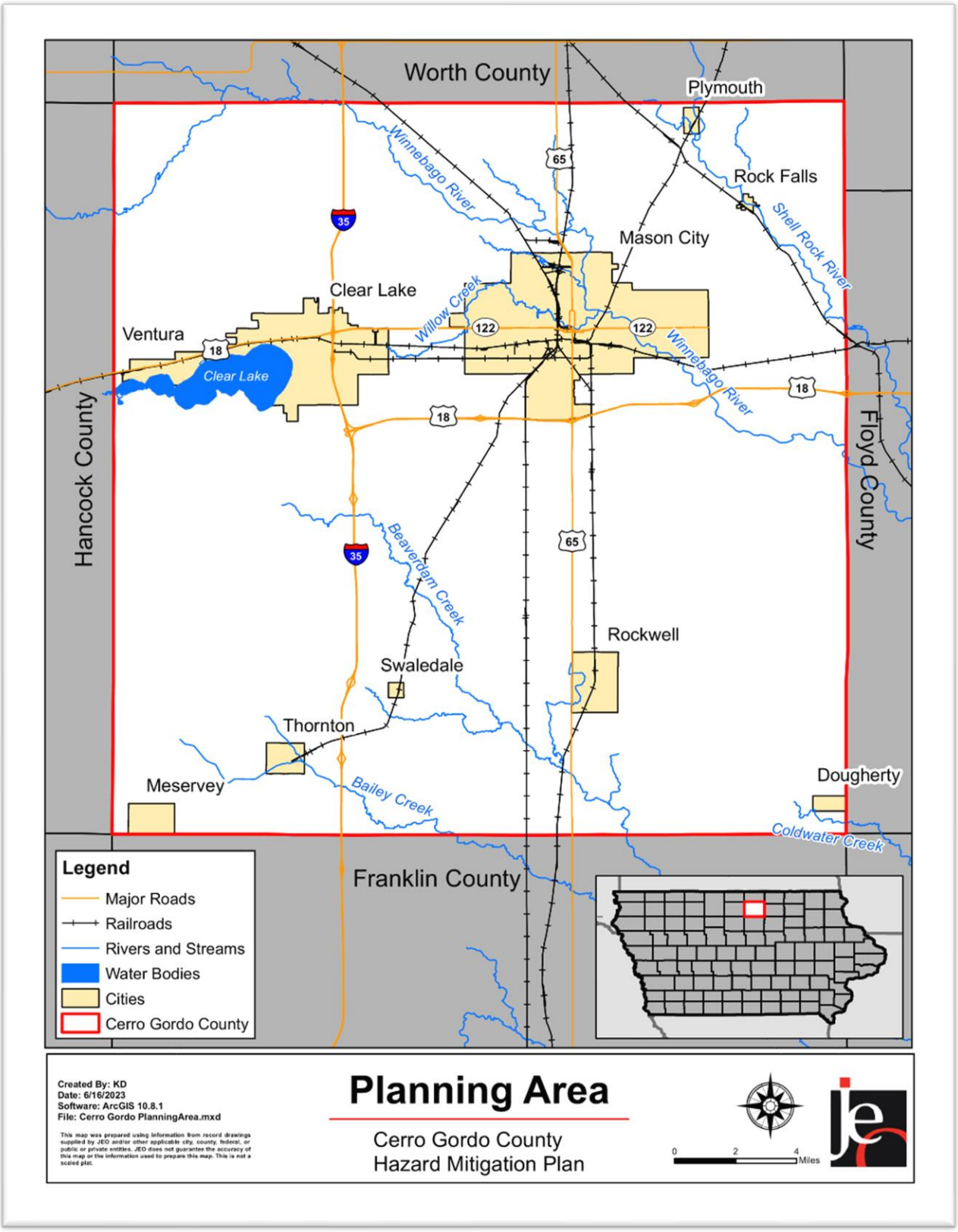
Figure 6: Iowa Landform Regions



Source: Iowa State University, 2017[15]

[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.

Figure 7: Planning Area Map



Demographics and At-Risk Populations

Demographic and asset information can be used to determine levels of vulnerability via population and housing, structural inventories and valuations, critical facilities, and other vulnerable areas analysis. This population includes a range of demographic cohorts and persons at risk to natural and man-made disasters. 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;
- 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."[16]

The young and elderly population may be at greater risk from certain hazards than other age groups. Figure 8 shows Cerro Gordo County's population percentage broken down by sex and five-year age groups.[17] Cerro Gordo County's population is equally spread out between different age groups. This indicates that the population is likely to remain stable in the future. The median age for the county is 44.2 which is older than the State of Iowa at 38.3. Since 2010, the majority of cities in the county have declined in population.

Dependent children under 18 years old are one of the most vulnerable populations to disasters.[18] The majority of people in this age group do not have access to independent financial resources and transportation. They lack practical knowledge necessary to respond appropriately during a disaster. Despite this vulnerability, children are generally overlooked in disaster planning because the presence of a caretaker is assumed. With approximately 23.4% of the planning area's population younger than 20, children are a key vulnerable group to address in the planning process.

Like minors, seniors (age 65 and greater) are often more significantly impacted by storm events 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.[19] 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 over four times as likely to experience cardiac events during snow removal. On the other hand, women can have a more

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

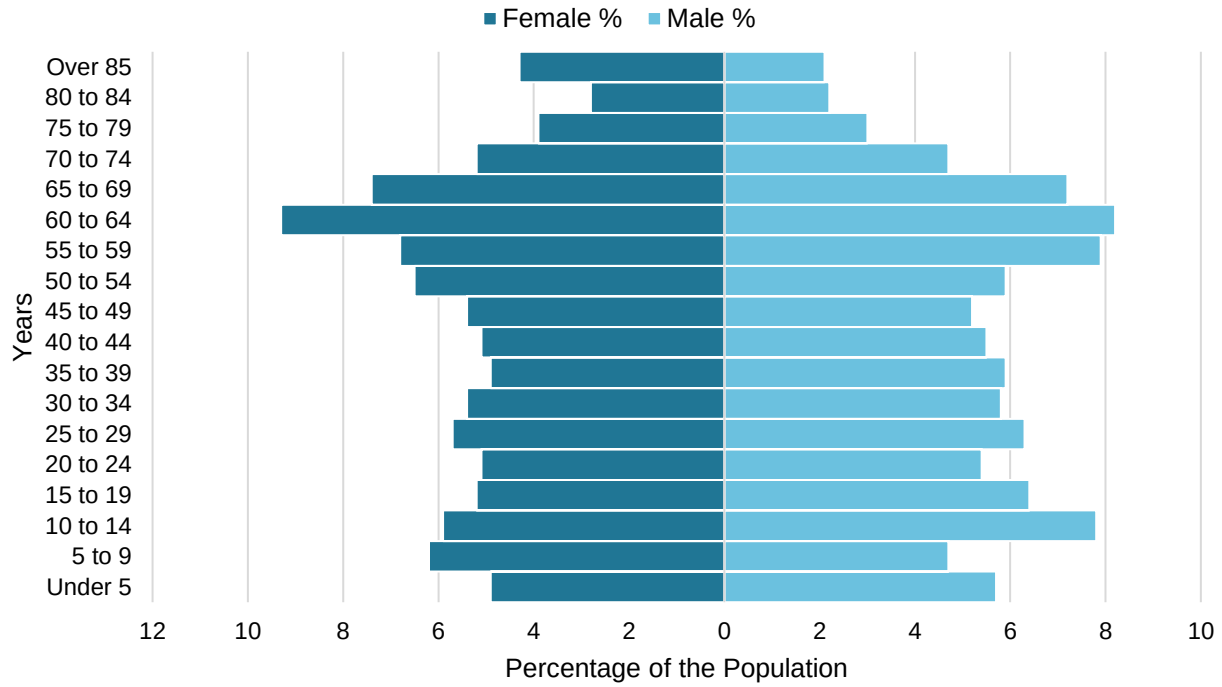
[17] United States Census Bureau. "2021 Census Bureau American Community Survey: S0101: Age and Sex." https://data.census.gov/.

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

difficult time during post-disaster recovery than men, often due to sector-specific employment, lower wages, and family care responsibilities.

Figure 8: County Population by Age Cohort and Sex (2020)



Source: U.S. Census Bureau

Table 18: Population Change within the County (2020)

Jurisdiction	2010 Population	2020 Population	Trend
Clear Lake	7,777	7,687	Declining
Dougherty	58	62	Growing
Mason City	28,079	27,338	Declining
Meservey	256	222	Declining
Plymouth	382	375	Declining
Rock Falls	155	150	Declining
Rockwell	1,039	1,071	Growing
Swaledale	165	144	Declining
Thornton	422	400	Declining
Ventura	717	711	Declining
Unincorporated Cerro Gordo County	5,101	4,967	Declining
Total	**44,151**	**43,127**	

Source: U.S. Census Bureau

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 public-school districts located within the county, and Figure 9 displays a map of the school district boundaries. Note there are additional private school districts throughout the county which also house students at risk.

Table 19: School Inventory

School District	Total Enrollment (2021-2022)	Total Teachers
Clear Lake Community Schools	1,495	109
Mason City Community Schools	3,598	301
West Fork Community Schools	776	58

Source: Iowa Department of Education[20]

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 20 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 20: At-Risk Population Factors

Percent that speak English as second language	People below poverty level
3.2%	9.6%

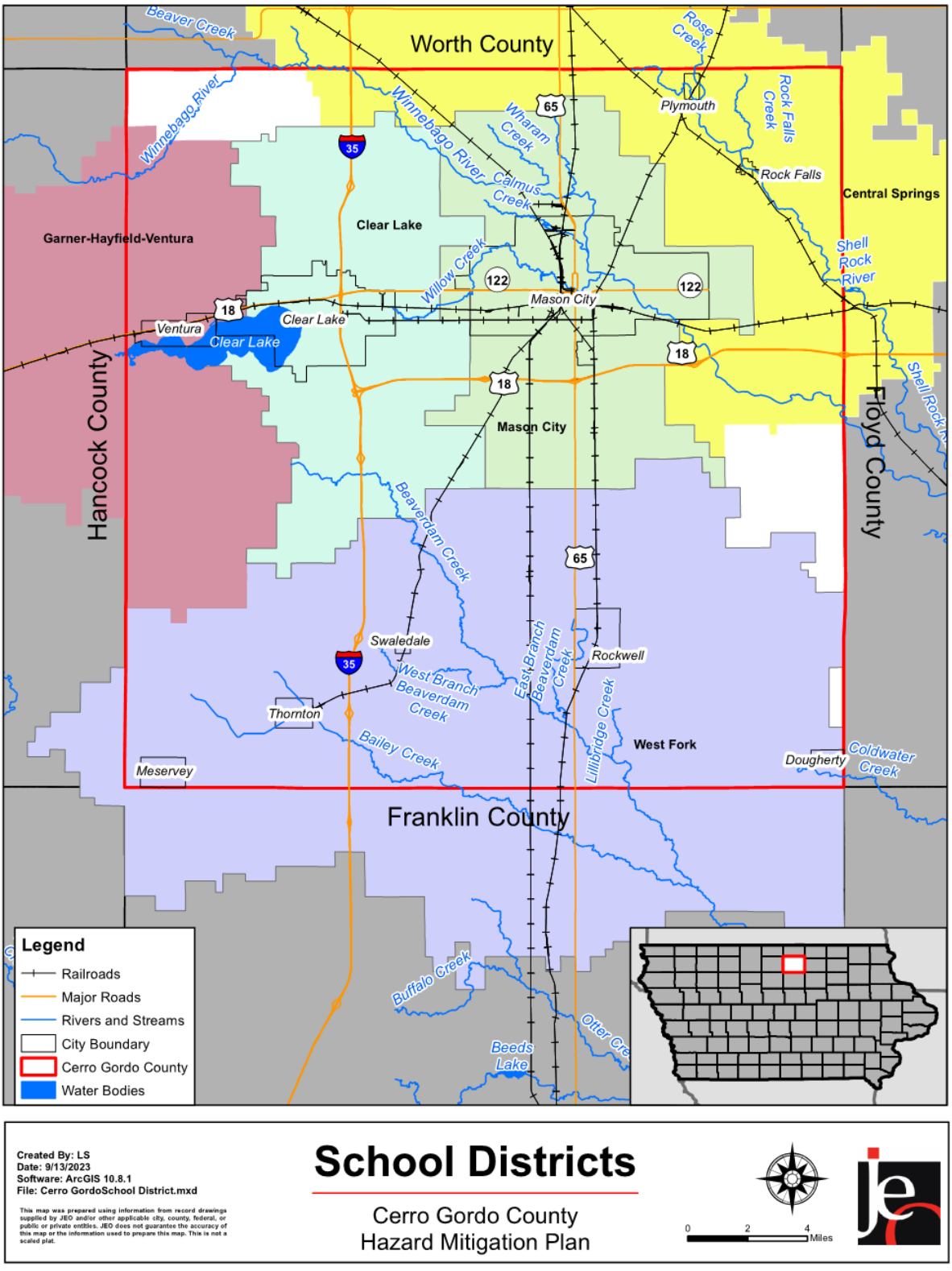
Source: U.S. Census Bureau[21] [22]

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

21 U.S. Census Bureau. 2021. "Language Spoken at Home: 2021 American Community Survey (ACS) 5-year estimates." https://data.census.gov/cedsci/.

22 U.S. Census Bureau. 2021. "Selected Economic Characteristics: 2021 ACS 5-year estimate." https://data.census.gov/cedsci/.

Figure 9: County School Districts



Similar to residents below the poverty line, racial minorities tend to have access to fewer financial and systemic resources that would enable them to implement hazard mitigation and strategic projects and to respond and recover from hazard events, including residence in standard housing and possession of financial stability. The county is primarily White, non-Hispanic; however, racial diversity has significantly increased since 2010, which could affect the county's vulnerability to hazards (Table 21).

Table 21: Racial Composition Trends

Race	2010	2020	Trend
	% of Total	% of Total	
White, Not Hispanic	95.0%	92.3%	Decreasing
Black	1.3%	2.0%	Increasing
American Indian and Alaskan Native	0.2%	0.3%	Increasing
Asian	0.9%	1.2%	Increasing
Native Hawaiian and Other Pacific Islander	0.0%	0.2%	Increasing
Other Races	0.9%	0.6%	Decreasing
Two or More Races	1.6%	3.4%	Increasing

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

Economy

According to 2020 Business Patterns Census Data, Cerro Gordo County had a total of 1,397 business establishments. The following table presents the number of establishments, number of paid employees, and the annual payroll in thousands of dollars per sector.

	Total Businesses	Number of Paid Employees	Annual Payroll (In Thousands)
Total for All Sectors	1,397	20,175	$880,069
Accommodation and food services	119	2,017	$30,616
Administrative and support and waste management and remediation services	81	796	$22,707
Arts, entertainment, and recreation	7	20	$1,319
Construction	32	200	$2,245
Educational services	112	933	$59,179
Finance and insurance	11	164	$4,179
Health care and social assistance	134	976	$53,639
Information	141	4,331	$225,764
Management of companies and enterprises	23	399	$24,520
Manufacturing	55	3,091	$172,681
Mining, quarrying, and oil and gas extraction	4	7	$312
Other services (except public administration)	157	812	$22,178

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

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

	Total Businesses	Number of Paid Employees	Annual Payroll (In Thousands)
Professional, scientific, and technical services	99	659	$47,322
Real estate and rental and leasing	63	179	$5,984
Retail trade	211	3,514	$88,825
Transportation and warehousing	55	744	$38,782
Wholesale trade	89	1,240	$70,959

Source: U.S Census Bureau[25]

Agriculture is important to the economic fabric of the State of Iowa as well. Cerro Gordo's 760 farms cover 319,791 acres of land, about 87% 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, transporting, and marketing farm products. These businesses generate income, employment, and economic activity throughout the region.

Table 22: Agricultural Inventory

	Agricultural Inventory
Number of Total Operations	760
Farm Operations – Acres Operated	319,791
Number of Farms with Harvested Cropland	701
Acres of Harvested Cropland	289,444

Source: USDA Census of Agriculture, 2017[26]

Housing

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

Table 23: Selected Housing Characteristics

	Cerro Gordo County
Lacking Complete Plumbing Facilities	0.2%
Lacking Complete Kitchen Facilities	1.1%
No Telephone Service Available	0.8%
No Vehicles Available	5.2%
Mobile Homes	3.3%

Source: U.S. Census Bureau[27]

[25] United States Census Bureau. "County Business Patterns and 2020 Nonemployer Statistics." https://data.census.gov/.

[26] United States Department of Agriculture. "2017 Census of Agriculture." https://www.nass.usda.gov/Publications/AgCensus/2017/.

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

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

Social Vulnerability Index

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 10 illustrates the overall Social Vulnerability Index for Cerro Gordo County.

State and Federally Owned Properties

The following table lists major 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 24: State and Federally Owned Facilities and Lands

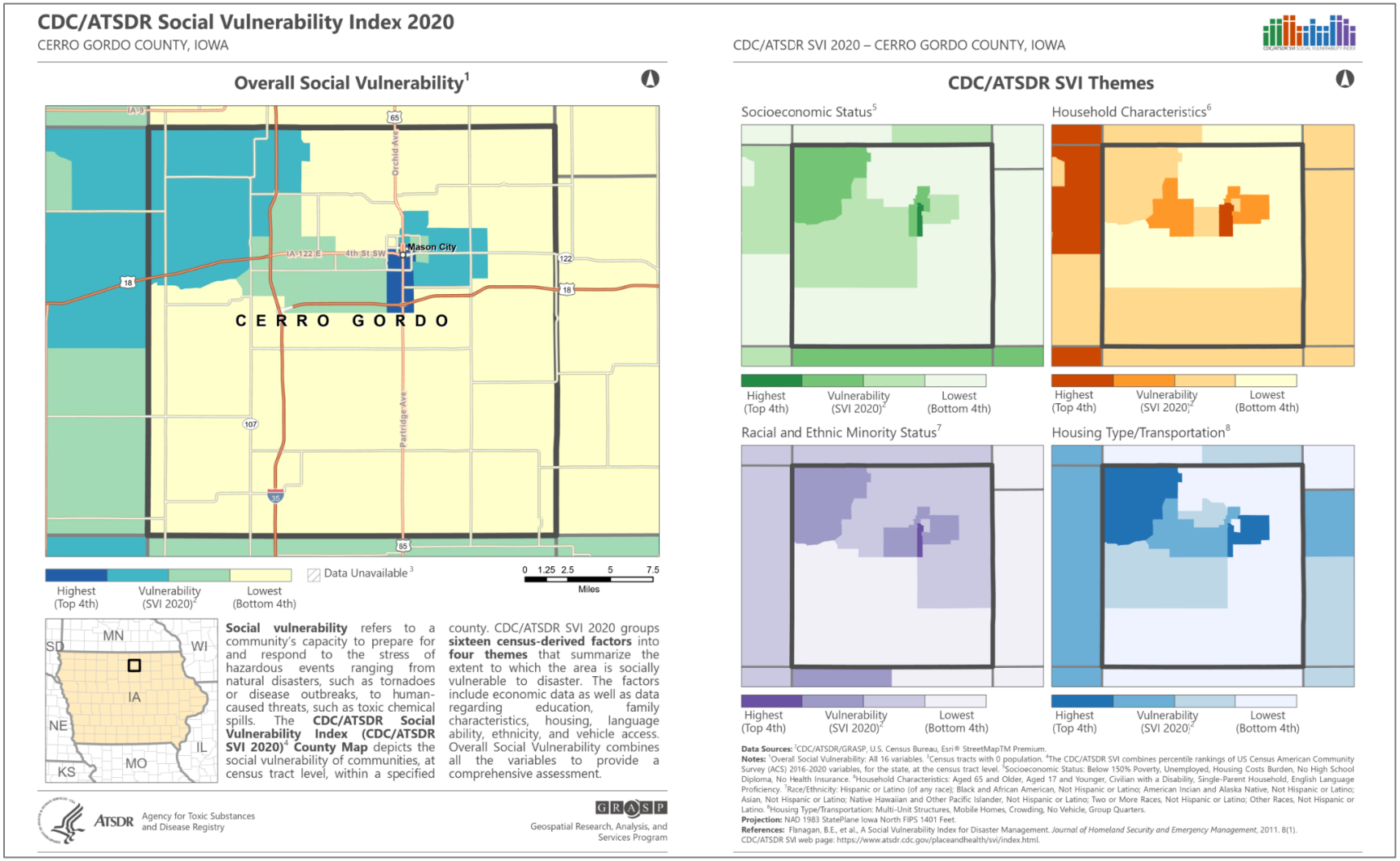
SITE NAME	GENERAL LOCATION
Bailey Creek Wild	Thornton
Beaverdam	Thornton
Clear Lake Pond	Clear Lake
Lekwa Marsh	Clear lake
McIntosh	Ventura
Sandpiper Hills	Ventura
Teal Basins	Clear Lake
Union Hills	Thornton
Ventura Marsh	Ventura
Wild Goose Marsh	Ventura

Source: Iowa Department of Natural Resources,[28] U.S National Park Service[29]

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

29 U.S. Department of the Interior National Park Service. 2022. "National Register of Historic Places." [shapefile]. https://irma.nps.gov/DataStore/Reference/Profile/2210280.

Figure 10: Social Vulnerability Index



Source: CDC Social Vulnerability Index, 2023[30]

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

Historical Sites

According to the National Register of Historic Places for Iowa by the National Park Service, there are 47 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 25: Historical Sites

Site Name	Date Listed	Nearest Community
Andrus, A. J., Duplex	1/29/1980	Mason City
Cannon, Amaziah and Cornelia (Wait), House	8/25/2004	Mason City
City National Bank Building	9/14/1972	Mason City
East Park Band Shell	10/14/2009	Mason City
East Park Historic District	10/15/2014	Mason City
Egloff, William C. & Margaret, House	5/1/2017	Mason City
Elks-Rogers Hotel	6/21/1982	Clear Lake
Elmwood-St. Joseph Municipal Cemetery Historic District	6/7/2018	Mason City
Etzel, John L., House	1/27/1983	Clear Lake
First Church of Christ Scientist	10/30/1997	Mason City
First National Bank of Mason City	5/2/1997	Mason City
Forest Park Historic District	1/20/2015	Mason City
Franke, C. F., House	1/29/1980	Mason City
Gibson, E. R., House	1/29/1980	Mason City
Hotel Lester-Lester Cafe	12/20/2002	Mason City
Jewell Apartments	1/29/1980	Mason City
Keerl-Decker House	12/20/2002	Mason City
Kirk, The	4/12/1982	Mason City
Lippert House	1/29/1980	Mason City
Mason City Downtown Historic District	9/8/2005	Mason City
Mason City Public Library	5/25/1989	Mason City
Mason City YMCA	5/2/2002	Mason City
MBA (Modern Brotherhood of America) Building	9/12/2002	Mason City
Norris, F. M., House	1/29/1980	Mason City
Park Inn Hotel	9/14/1972	Mason City
Parker's Opera House	11/20/1998	Mason City
Parker's Woods Park Historic District	10/15/2014	Mason City
Rock Crest-Rock Glen Historic District	12/28/1979	Mason City
Rock Crest-Rock Glen Historic District (Boundary Decrease)	4/26/2016	Mason City
Rock Falls Bridge	6/25/1998	Rock Falls
Rogers-Knutson House	9/9/1982	Clear Lake
Romey, George, House	1/29/1980	Mason City
Rule, Duncan, House	10/16/1979	Mason City
Rye, Chris, House	1/29/1980	Mason City
Seney, Charles, House	1/29/1980	Mason City
Shipley, C. P., House	1/29/1980	Mason City
St. John Baptist Church	1/24/2002	Mason City

Site Name	Date Listed	Nearest Community
State Street Bridge	6/25/1998	Mason City
Stewart Avenue Bridge	6/25/1998	Mason City
Stockman, Dr. G. C., House	9/17/1992	Mason City
Surf Ballroom	9/6/2011	Clear Lake
Wagner-Mozart Music Hall	11/16/1978	Mason City
Winnebago River Bridge	6/25/1998	Mason City
Wolf, Mier, House	1/29/1980	Mason City
Yelland, Curtis, House	1/29/1980	Mason City
Youngblood, Tessa, House	1/29/1980	Mason City

Source: National Park Service[31]

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

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Section Four
Risk Assessment

Introduction

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

Table 26: Term Definitions

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

Methodology

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

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

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

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

This risk assessment methodology includes an overview of assets at risk and provides historic average annual dollar losses for all hazards for which historic event data are available (FEMA *Requirement §201.6(c)(2)(ii)(B)).* Average annual losses from historical occurrences can be calculated for those hazards which there is a robust historic record and for which monetary damages are recorded. 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. 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 National Centers for Environmental Information (NCEI) data are available for 1996 to 2023. 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:

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

It should be noted that NCEI data is not all inclusive and the database provides very limited information on crop losses. To provide a better picture of the crop losses associated with the hazards, crop loss information provided by the Risk Management Agency (RMA) of the USDA between 2000 and 2023 was also utilized. 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:

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

FEMA Standard Economic Values

As part of FEMA's Benefit-Cost Analysis Toolkit, standard economic values were developed to help 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 27 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 27: FEMA Standard Economic Values

Service Lost	Economic Value
Traffic Delays on Roads and Bridges	$35.60/Vehicle/Hour
Loss of Electric Services	$182/Person/Day
Loss of Wastewater Services	$60/Person/Day
Loss of Potable Water Services	$116/Person/Day
Loss of Communications/IT Services	$130/Person/Day

Source: FEMA, 2022[32]

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 28 shows the six different severity levels, their economic value, and common injuries associated with each level.

Table 28: FEMA Life Safety Economic Values

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).	$35,000

32 FEMA. 2022. "Benefit-Cost Analysis Sustainment and Enhancement". https://www.fema.gov/sites/default/files/documents/fema_standard-economic-values-methodology-report_092022.pdf.

Injury Severity Level	Selected Common Injuries	Economic Value
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.	$545,000
Serious	Major nerve laceration; multiple rib fracture (but without flail chest); abdominal organ contusion; hand, foot, or arm crush/amputation.	$1,218,000
Severe	Spleen rupture; leg crush; chest-wall perforation; cerebral concussion with other neurological signs (unconscious less than 24 hours).	$6,879,000
Un-Survivable	Spinal cord injury (with cord transection); extensive second- or third-degree burns; cerebral concussion with severe neurological signs (unconscious more than 24 hours).	$11,600,000

Source: FEMA, 2022

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 given 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. Cerro Gordo 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. A summary of hazards evaluated at the kick-off and those identified for assessment in this HMP are included in the following table.

Table 29: Hazards Addressed in the Plan

2018 State Hazards	2018 Cerro Gordo County Hazards	2023 Cerro Gordo County Hazards
Dam/Levee Failure	Blizzard	Animal and Plant Disease
Drought	Cyber Attack	Drought
Earthquake	Drought	Extreme Temperatures
Expansive Soils	Flooding	Flooding *Includes Dam and Levee Failure*
Extreme Heat	Hailstorm	Grass or Wildland Fire
Flooding (Flash and Riverine)	HAZMAT Facility	Hazardous Materials Release *Includes HAZMAT Facility and HAZMAT Transportation*
Grass Fire or Wildland Fire	HAZMAT Transportation	Infrastructure Failure *Includes Power Outage & Structural Fire*
Landslide	Ice Storm	Pandemic Human Disease

2018 State Hazards	2018 Cerro Gordo County Hazards	2023 Cerro Gordo County Hazards
Severe Winter Storms	Major Fire/Structural	Thunderstorms: Lightning & Hail
Sinkholes	Pandemic	Severe Winter Storms *Includes Blizzard and Ice Storm*
Thunderstorms: Lightning & Hail	Power Outage	Terrorism *Includes Cyber Attack*
Tornado/Windstorm	Severe Summer Storm (Non-Tornadic)	Tornado and Windstorm
Other Hazards of Concern: • Animal/Crop/Plant Disease • Hazardous Materials • Pandemic Human Disease • Infrastructure Failure • Radiological • Terrorism • Transportation Incidents	Terrorism	
	Tornado	

Hazard Profile Changes

All hazards from the State HMP were considered for Hazard Mitigation Plan. Changes to hazard profiles are listed below.

- Changes
  - Combine HAZMAT Facility and HAZMAT Transportation to Hazardous Materials Release
  - Rename Pandemic to Pandemic Human Disease
  - Rename Power Outage to Infrastructure Failure
    - Include Structural Fire to Infrastructure Failure
  - Include Hailstorm under Thunderstorms
  - Include Blizzard and Ice Storms under Severe Winter Storms
  - Combine Cyber Attack and Terrorism
  - Rename Tornado to Tornado and Windstorm

- New Additions:
  - Animal and Plant Disease
  - Extreme Temperatures

Hazard Assessment Summary Tables

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

Table 30: Regional Risk Assessment

Hazard	Previous Occurrences	Approximate Annual Probability*	Likely Extent
Agricultural Plant and Animal Disease	Animal Disease: Unavailable	Unknown	Unknown
	Plant Disease: 16	Plant Disease 11/22 = 50%	Major crop damage or loss
Dam Failure	0	~1%	Agricultural lands or areas downstream
Drought	423/1,542 months	27.4%	Mild Drought (D1)
Extreme Heat	Heat: Avg 1 day/year	100%	Max Temp ≥100°F
Extreme Cold	Cold: Avg 10 days/year	100%	Max Temp ≤ 10°F
Flooding/Flash Flooding	81	22/28 = 79%	Some inundation of structures and road closures. Some evacuations of people may be necessary.
Levee Failure	1	~1%	Inundation of floodplains or levee protected areas
Grass and Wildland Fire	139	12/15 = 80%	Avg 16.5 acres
Hazardous Materials Release	Fixed Site Spill: 55	27/33 = 82%	Avg Liquid Spill: 1,745 gallons Avg Gas Spill: 817 lbs.
	Transportation Spill: 152	31/33 = 94%	Avg Spill: 8 lbs of product
Infrastructure Failure	Unknown	Likely to occur annually	Varies by event
Pandemic Human Diseases	2 major outbreaks	>1%	Varies by event, >1 fatality
Severe Thunderstorms	378	28/28= 100%	>1” rainfall Avg 55 mph winds Avg. hail 1.1”
Severe Winter Storms	99	28/28= 100%	1-6” snow 35-45 mph winds
Terrorism and Civil Disorder	0	Less than 1%	Varies by event
Tornado and High Winds	Tornadoes: 22	11/28 = 39%	Mode: EF0 Range: EF0-EF2
	High Winds: 50	22/28 = 79%	Avg: 52 mph Range 35-72 mph

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

Table 31: Hazard Loss Estimates for the Planning Area

HAZARD TYPE		Cerro Gordo County		
		COUNT	**PROPERTY**	**CROP[1]**
Agricultural Disease	Animal Disease	N/A	N/A	N/A
	Plant Disease[1]	16	N/A	$229,699
Drought[3]		423 out of 1,542 months	$12,650,000	$50,255,767
Extreme Temperatures[4]	Extreme Cold	Average: 10 days/year	$0	$151,709
	Heat (≥100°F)	Average: 1 day/year	$135,000	$805,878
Flooding[5]	Flash Flood	32	$3,980,000	$217,389
	Flood	49	$3,261,570	
	Dam Failure[2]	0	N/A	N/A
	Levee Failure[10]	1	N/A	N/A
Grass/Wildfires[7]		139	2,299 acres	NA
Hazardous Materials Release	Chemical Spills (Fixed Site)[8]	55	$0	N/A
	Chemical Spills (Transportation)[9]	152	$145,591	N/A
Infrastructure Failure		Unknown	N/A	$7,606
Pandemic Human Disease[6]		2 Outbreaks Unknown Fatalities	N/A	N/A
Severe Thunderstorms[5]	Thunderstorm Wind *Average: 55 mph* *Range: 48-78 mph*	148	$2,058,500	N/A
	Heavy Rain	73	$0	$56,914,099
	Hail *Average (in)*: 1.09 *Range (in):* 0.75-2.75	147	$805,700	$5,364,413
	Lightning	10	$182,000	$571,077
Severe Winter Storms[5]	Blizzard	32	$580,000	$1,469,290
	Heavy Snow	20	$239,545	
	Ice Storm	10	$666,280	
	Winter Storm	36	$470,900	
	Winter Weather	1	$0	
Terrorism[11]		0	$0	N/A
Tornadoes & Windstorms[5]	Windstorms (High Wind) Average: 52 mph Range: 35-72 mph	50	$1,790,110	$1,435,539

HAZARD TYPE		Cerro Gordo County		
	Tornadoes Average: EF0/F0 Range: EF0/F0-EF2/F2	22	$473,000	$0
Totals		**943**	**$27,438,196**	**$117,422,466**

N/A: Data not available
1 - USDA RMA, 2000 -2022
2 - IDNR Communication, 2023
3 - NOAA, 1895-2023
4 - NOAA Regional Climate Center, 1893-2023
5 - NCEI, 1996 - 2023
6 - IDPH
7 - IDNR, 2008-2023
8 - NRC, 1990 - 2023
9 - PHMSA 1971 - April 2023
10 - USACE NLD, local correspondence
11 - University of Maryland, 1970 – 2018

Historical Disaster Declarations

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

Presidential Disaster Declarations

The presidential disaster declarations involving the county from 1963 to July 2023 are summarized in the following table. Declarations prior to 1962 are not designated by county and are not included.

Table 32: Presidential Disaster Declarations

Disaster Declaration Number	Declaration Date	Title
4483	3/23/2020	Iowa Covid-19 Pandemic
4386	8/20/2018	Iowa Severe Storms, Tornadoes, Straight-Line Winds, and Flooding
4289	10/31/2016	Iowa Severe Storms and Flooding
1763	5/27/2008	Severe Storms, Tornadoes, and Flooding in Iowa
1518	5/25/2004	Iowa Severe Storms, Tornadoes, and Flooding
1282	7/22/1999	Iowa Severe Storms and Flooding
1230	7/2/1998	Iowa Severe Weather, Tornadoes, and Flooding
996	7/9/1993	Iowa Flooding, Severe Storm
928	12/26/1991	Iowa Ice Storm
879	9/6/1990	Iowa Flooding, Severe Storm
590	7/1/1979	Iowa High Winds, Tornadoes
269	8/14/1969	Iowa Heavy Rains, Flooding

Source: Federal Emergency Management Agency, 1963 – 2023[33]

[33] Federal Emergency Management Agency. 2022. "Disaster Declarations". Accessed December 2022. https://www.fema.gov/disasters.

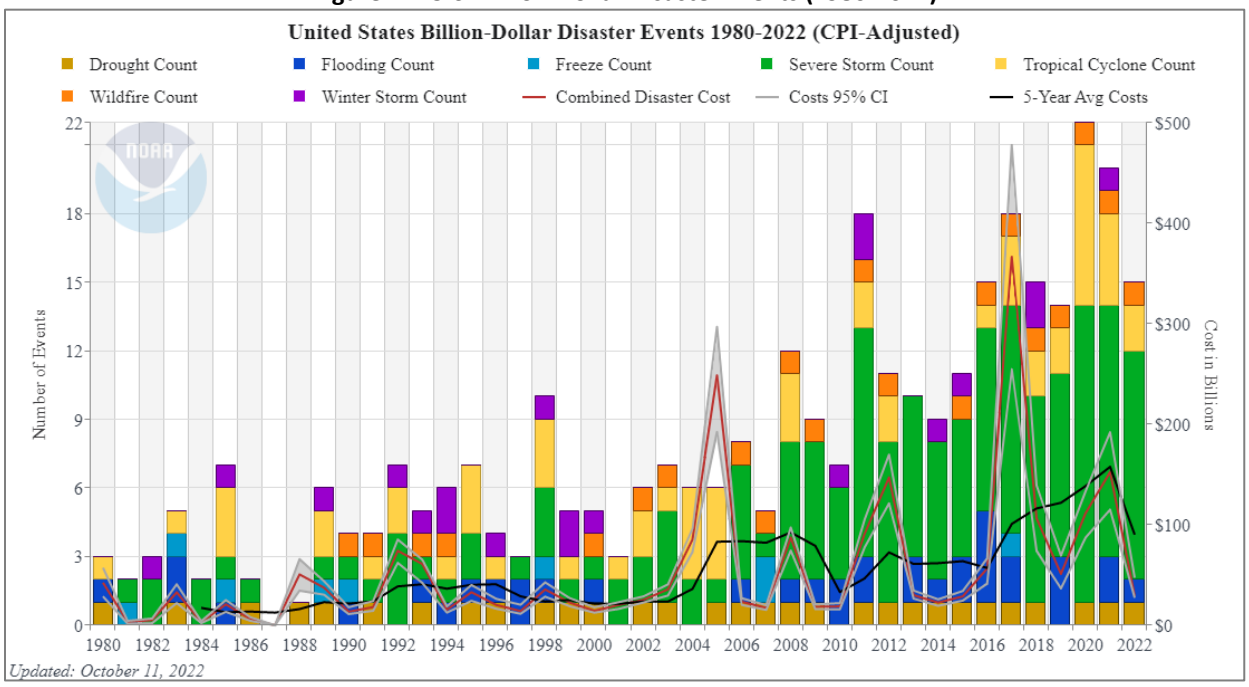
Climate Adaptation

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 weather events. Changes in the regional climate is a top concern impacting communities, residents, local economies, and infrastructure throughout the planning area. 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.

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

Figure 11: U.S. Billion-Dollar Disaster Events (1980-2022)



Source: NOAA, 2022[34]

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.[35]

[34] NOAA National Centers for Environmental Information. 2022. "U.S. Billion-Dollar Weather and Climate Disasters". https://www.ncdc.noaa.gov/billions/

[35] U.S. Global Change Research Program. 2018. "Fourth National Climate Assessment". https://nca2018.globalchange.gov/.

- **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.

- **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. 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 will help to build adaptive capacity and increase resilience.

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.[36]

Iowa's Changing Climate

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:[37]

Increased Precipitation

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

Higher Temperatures

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

Agricultural Challenges

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

Habitat Changes

- Plants are leafing out and flowering sooner.
- Birds are arriving earlier in the spring.
- Some 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

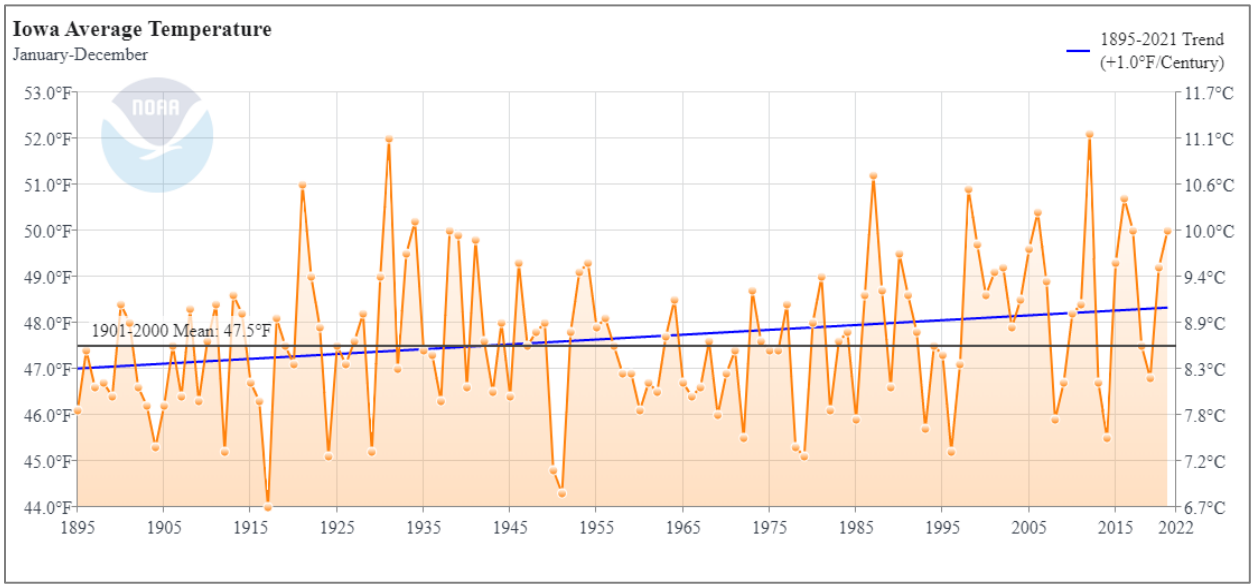
Since 1895 Iowa's overall average temperature has increased by 1° (Figure 12). Climate modeling suggests warmer temperature conditions will continue in the coming decades and rise steadily into mid-century.

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

[37] 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

Warming has increased the most in winter and spring months with winter minimum temperatures rising 2-4°F. Summer has not warmed substantially with a below average number of very hot days. 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. Historically unprecedented warming is projected to continue during this century.[38]

Figure 12: Average Temperature (1895-2022)



Source: NOAA, 2022[39]

Changes in Precipitation

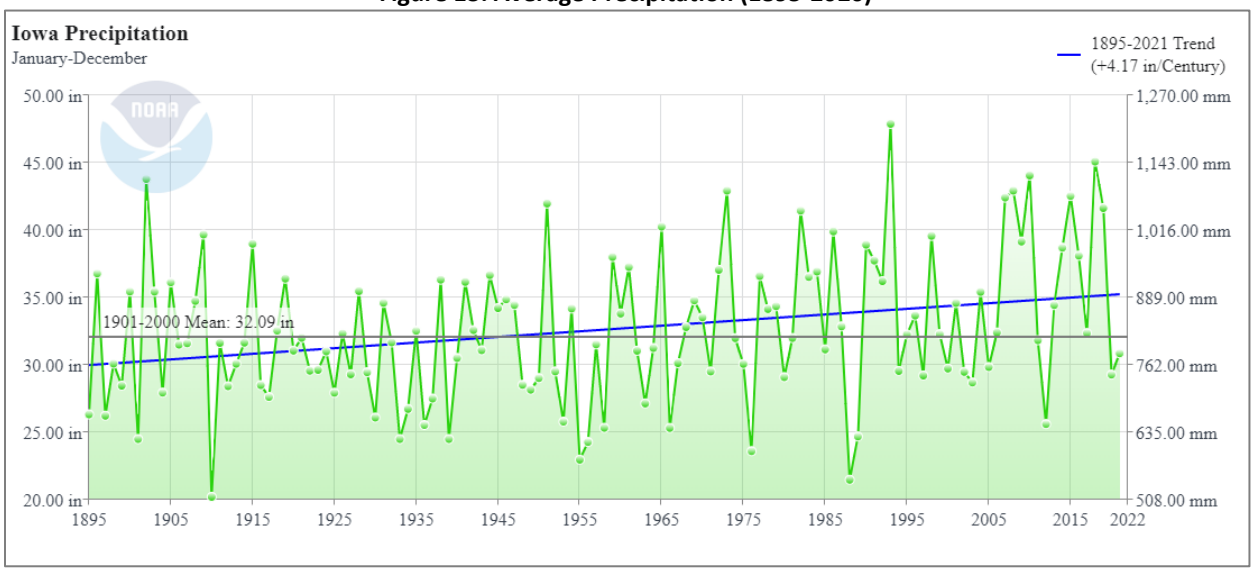
Changing extremes in precipitation are anticipated in the coming decades, with more significant rain and snowfall events and more intense drought periods. Climatological patterns of precipitation for Iowa consist of an east-west gradient, with drier conditions to the west and wetter to the east, The 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 13). This trend is expected to continue as the impacts of climate change continue to be felt.[40]

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

[39] NOAA. 2022. "Climate at a Glance: Statewide Time Series.". Accessed December 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

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

Figure 13: Average Precipitation (1895-2020)



Source: NOAA, 2022[41]

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. A priority in this HMP update was to evaluate specific climate change impacts per hazard to the planning area. All mitigation strategies should be implemented with the consideration of future climate impacts. Participating jurisdictions should consider past and future climate changes and impacts when incorporating mitigation actions into local planning processes.

[41] NOAA. 2022. "Climate at a Glance: Statewide Time Series.". Accessed December 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.

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 33: Top Hazards of Concern

Jurisdiction	*Ag Plant and Animal Disease*	*Drought*	*Extreme Temperatures*	*Flooding*	*Grass/Wildland Fire*	*Hazardous Materials Release*	*Infrastructure Failure*	*Pandemic Human Disease*	*Severe Thunderstorms*	*Severe Winter Storms*	*Terrorism*	*Tornado and High Winds*
Cerro Gordo County	X			X				X		X		X
Clear Lake										X		X
Dougherty										X		X
Mason City				X		X				X		X
Meservey			X						X	X		X
Plymouth				X		X	X		X			
Rock Falls				X						X		
Rockwell									X	X		X
Thornton									X	X		X
Ventura												X
Clear Lake Schools											X	X
Mason City Schools											X	
West Fork Schools									X	X		X

Agricultural Plant and Animal Disease

Agriculture disease is any biological disease or infection that can reduce the quality or quantity of either livestock or vegetative crops. These incidents are naturally occurring infection of livestock with insects, vermin, or diseases that render the livestock unfit for consumption or use. This section looks at both animal disease and plant disease, as both make up a significant portion of Cerro Gordo County's economy. Because of the substantial agricultural industry and related facilities and locations, the potential for infestation of crops or livestock poses a significant risk to the local economy. 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 over $110 million.[42]

Iowa cropland is vulnerable to disease and some level of agricultural infestation is normal, but the introduction of a high-consequence disease could significantly limit or eliminate the ability of producers to move, harvest, and export products. The concern is when the level of an infestation escalates suddenly, or a new infestation appears, overwhelming normal control efforts. The levels and types of agricultural infestation appear to vary by many factors, including cycles of heavy rains and drought. An outbreak of a major infection, disease, or pest infestation may have widespread economic and societal implications for the planning area. Response to an outbreak is a lengthy process and many producers may be put out of business if the economic impacts are large enough. Impact of disease outbreaks to the agricultural market is exhibited by a 2003 incident in Kansas when a rumor of a foot-and-mouth disease outbreak caused the livestock market to plummet. Additionally, the 2009 swine flu outbreak caused market loss in Iowa's pork market. When infestation hits a crop field, the pest may become endemic causing the infestation to occur each subsequent growing season.

Animal Diseases and Infections

The State of Iowa has a substantial agricultural industry, the potential for infestation of livestock poses a significant risk to the Iowa economy. Table 34 shows the population of livestock within Cerro Gordo County. This count does not include wild populations that are also at risk from animal diseases.

Table 34: Livestock Inventory

Location	Market Value of 2017 Livestock Sales	Cattle and Calves	Hogs and Pigs	Sheep and Lambs	Poultry Egg Layers
Iowa	$4,760,338.00	3,950,920	22,730,540	167,208	56,554,774
Cerro Gordo	$57,659.00	9,589	124,086	$934.00	718

Source: U.S. Census of Agriculture, 2017

Crop Pests/Plant Diseases

A plant disease outbreak or a pest infestation could negatively impact crop production and agriculturally dependent businesses. An extreme outbreak or infestation could potentially result in billions of dollars in production losses. The cascading net negative economic effects could result in wide-spread business failures and reduction of tax revenues. Many factors influence disease development in plants, including

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

hybrid/variety genetics, plant growth stage at the time of infection, weather (e.g., temperature, rain, wind, hail, etc.), single versus mixed infections, and genetics of the pathogen populations.

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 35: Land and Crop Values in Cerro Gordo County

Location	# of Farms	Land in Farms (acres)	Market Value of 2017 Crop Sales	Corn		Soybeans	
				Acres Planted	Value (2017)	Acres Planted	Value (2017)
Iowa	86,104	30,563,878	$13,832,573,000	12,969,645,000	$8,463,142,000	9,949,724	$5,058,007
Cerro Gordo	760	319,791	$168,979,000	163,843	$104,114,000	121,099	$59,543,000

Source: U.S. Census of Agriculture, 2017

Location

Given the strong agricultural presence in the county, animal and plant disease have the potential to occur across the county. If a major outbreak were to occur, the economy in the entire region would be affected, including urban areas. According to the 2017 U.S. Census of Agriculture, there are 760 farms in the county that cover over 300,000 acres of land, accounting for roughly 87 percent of the county's land area.

The primary land uses where animal and plant disease will be observed include agricultural lands, range or pasture lands, and forests. It is possible that animal or plant disease will occur in domestic animals or crops in urban areas but in a much smaller and easier to contain fashion. Rodeos and fairs also pose a risk of disease transmission for livestock.

Historical Occurrences

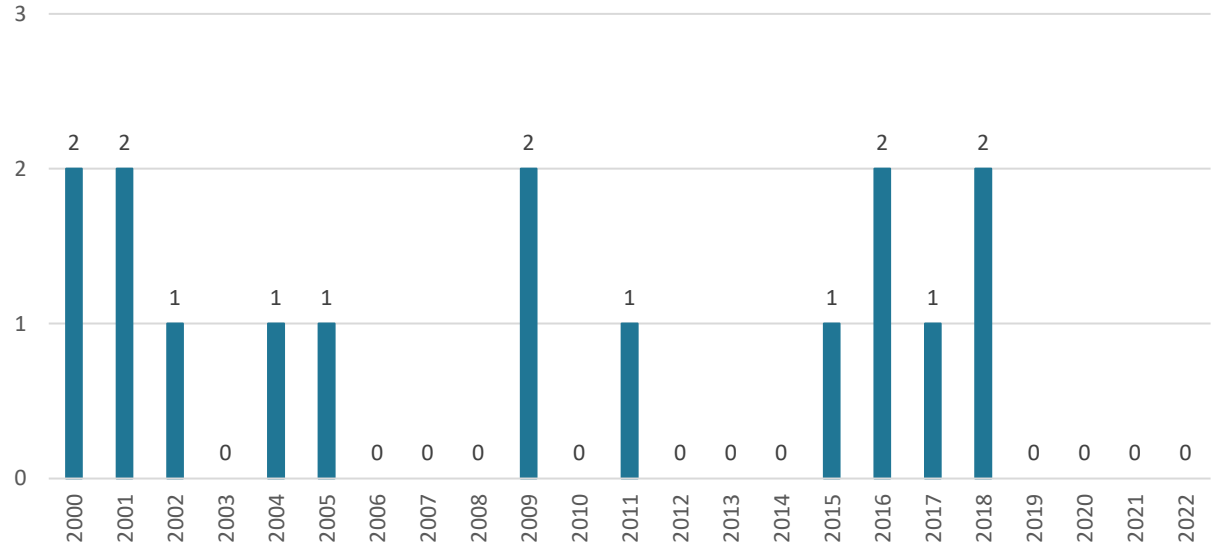
Animal Disease

According to the 2018 Iowa State Plan, in 2015 Iowa experienced impacts to avian populations when 18 counties and 77 sites across the state were affected by highly pathogenic avian influenza. While Cerro Gordo County was not directly impacted, more than 33 million birds had to be euthanized and disposed of and over 8,400 jobs were lost during the outbreaks. A report by the Iowa Farm Bureau Federation noted an impact of $427 million in lost wages in addition to the jobs lost, as well as about $145 million in lost taxes. The report estimated the total economic loss at $1.2 billion. 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. The RMA reported 16 instances of plant disease in Cerro Gordo County between 2000 and 2022. These outbreaks caused $229,699 in crop losses with $189,902 attributed to plant disease and $39,797 attributed specifically to mycotoxin aflatoxin hitting corn and soybean crops.

Table 36: Crop Disease Events by Year



Source: USDA RMA (2000-2023)

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 (2000-2023) there were 16 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 37: Agricultural Plant Disease Losses

Hazard Type	Number of Events	Events per Year	Total Crop Loss	Average Annual Crop Loss
Plant Disease	16	0.7	$229,699	$9,571

Source: RMA, 2000-2023

Emerald Ash Borer

The spread and presence of the Emerald Ash Borer (EAB) has become a rising concern for many Iowan communities in recent years as the beetle spreads through transport of infected ash trees, lumber, and firewood. 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.[43] All species of North American ash trees are vulnerable to infestation.

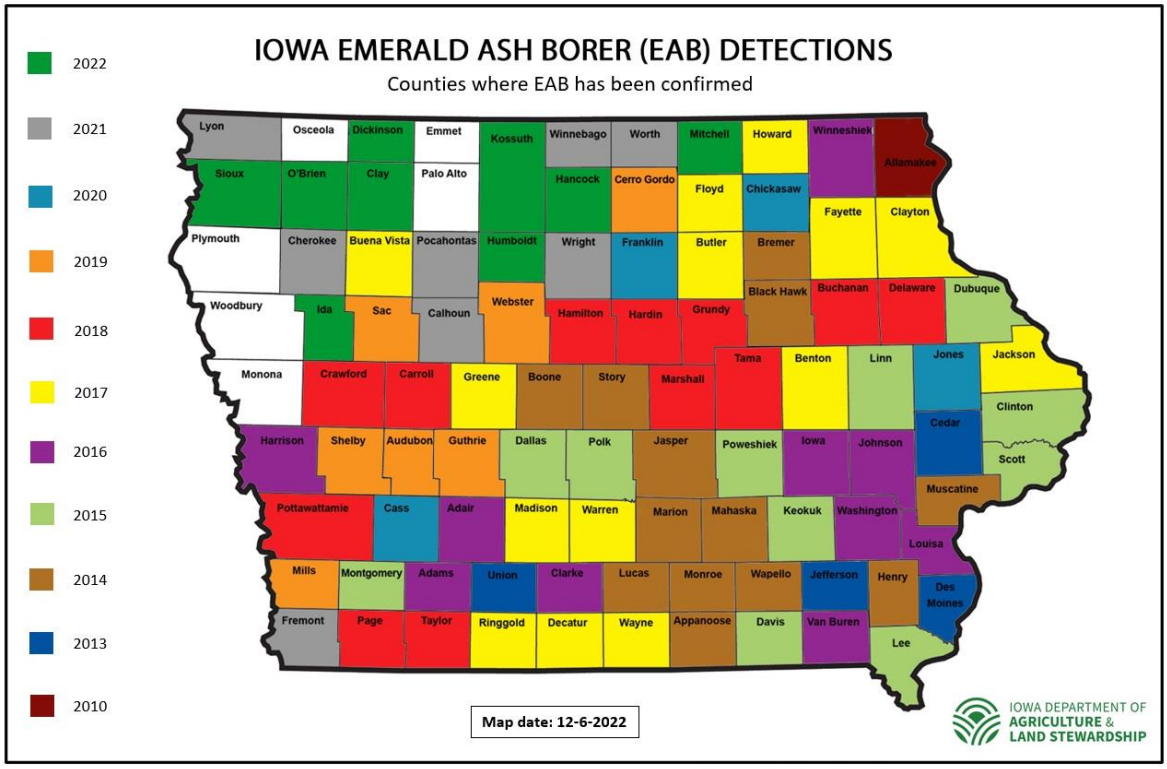
In Cerro Gordo County, EAB was confirmed in Cerro Gordo County in 2020 – specifically Mason City in 2020 and Clear Lake again in 2022.[44] Figure 14 shows the locations of Iowa's confirmed EAB cases as of December 2022. Many communities across the state are prioritizing the removal of ash trees to help curb potential infestations and tree mortality.

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

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

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. 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.[45] 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.

Figure 14: EAB Infestation Status in Iowa



Source: Iowa Department of Agriculture & Land Stewardship, 2022[46]

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.

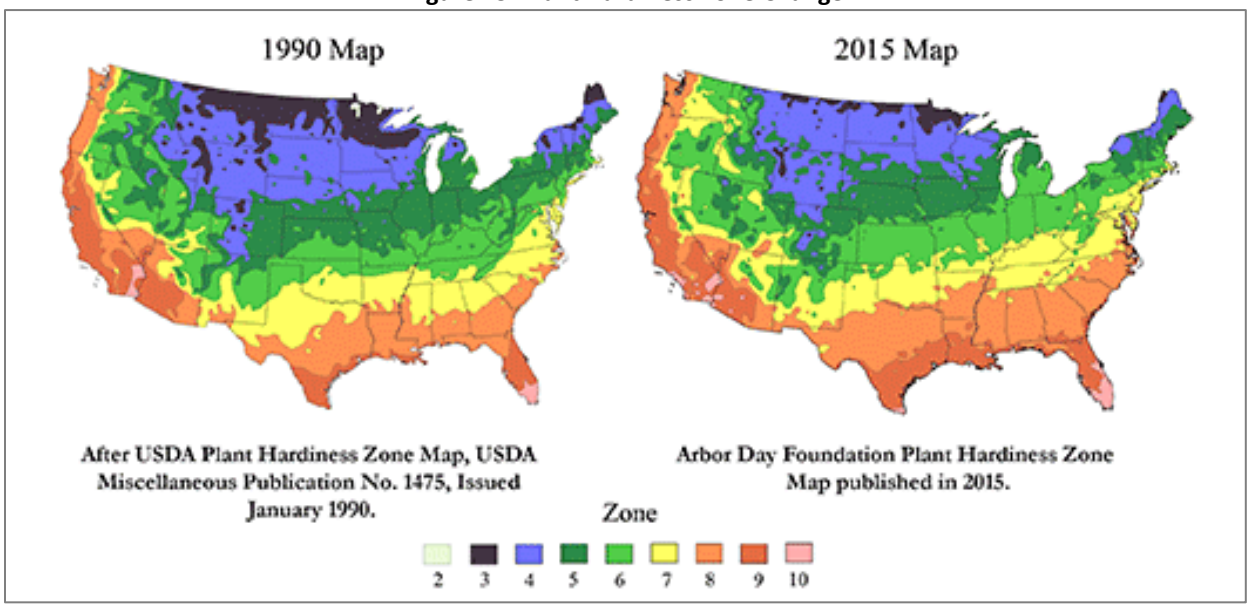
[45] Iowa Department of Natural Resources. 2016. "Emerald Ash Borer." https://www.iowadnr.gov/Portals/idnr/uploads/forestry/Forest%20Health/emerald%20ash%20borer%202016.pdf?ver=2016-12-21-151336-840.

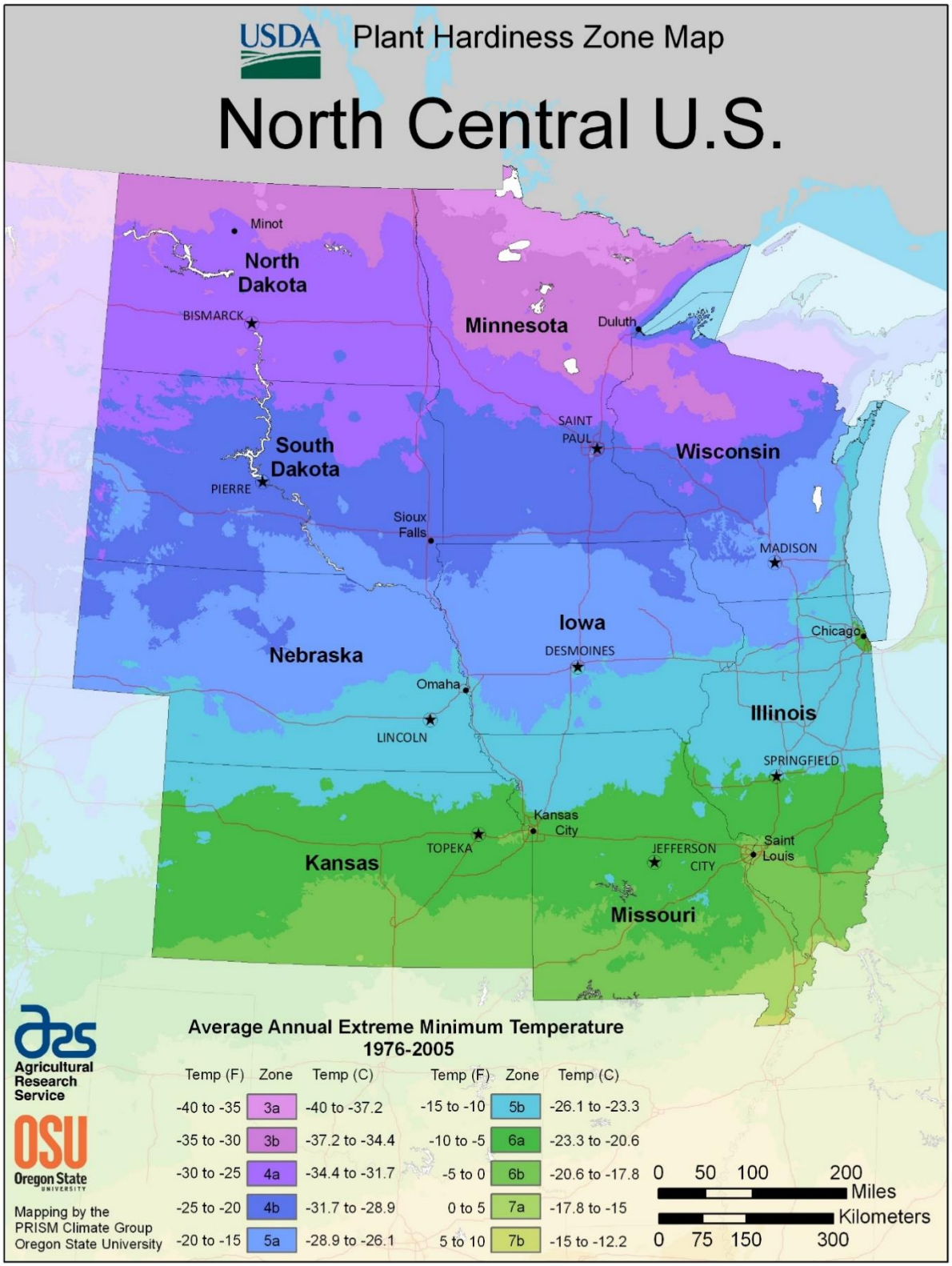
[46] Iowa Department of Agriculture & Land Stewardship. 2022. "Iowa Emerald Ash Borer (EAB) Infestation Status." http://www.iowatreepests.com/eab_home.html.

Climate Change

Iowa is vulnerable to changes in growing season duration and growing season conditions as a heavily agriculturally dependent state. 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 these changes have shifted the annual growing season and expected agricultural production conditions. These added stressors on agriculture could have devastating economic effects if new agricultural and livestock management practices are not adopted.

Figure 15: Plant Hardiness Zone Change





Source: Arbor Day Foundation, 2018[47]

[47] Arbor Day Foundation. 2018. "Hardiness Zones." https://www.arborday.org/media/map_change.cfm.

The distribution and severity of animal and plant disease outbreaks will likely increase alongside climate change impacts. Shifting climatic conditions will stress existing agricultural populations and plant species, creating vulnerability for new diseases to take hold. The trend toward higher average temperatures and increased periods of drought[48] increases the stress levels on animal populations, increasing the risk of disease taking hold. Changes in temperature and precipitation can also 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. These diseases may initially spread faster as the local population is not aware of the proper steps to reduce their risk. Additionally, uncommon diseases may return at higher amounts as changes in the environment cause the release of previously contained diseases or promotes the mutation of diseases.

As noted by the Fourth National Climate Assessment: "*rural communities, where economies are more tightly interconnected with agriculture than with other sectors, are particularly vulnerable to the agricultural volatility related to climate… Crop and livestock production in certain regions will be adversely impacted both by direct effects of climate change (such as increasing trends in daytime and nighttime temperatures; changes in rainfall patterns; and more frequent climate extremes, flooding, and drought) and consequent secondary effects (such as increased weed, pest, and disease pressures; reduced crop and forage production and quality; and damage to infrastructure). While climate change impacts on future agricultural production in specific regions of the United States remain uncertain, the ability of producers to adapt to climate change through planting decisions, farming practices, and use of technology can reduce its negative impact on production*."[49]

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

Changes to crop growth cycles due to warming winters and alterations in the timing and magnitude of rainfall events have already been observed. As these trends continue, they will require new agriculture and livestock management practices.

Economic Impacts

The agricultural sector would see the largest economic impacts from an animal or plant disease outbreak. Infrastructure and transportation will largely be unaffected with only minor localized impacts possible. Cerro Gordo County had total a market value of sold agricultural products of over $3 million and market value of crop products sold over $168 million in 2017. A large disease outbreak could potentially result in millions of dollars in losses. The agricultural impacts would likely have trickle down effects to local

[48] University of Nebraska-Lincoln. 2014. "Understanding and Assessing Climate Change: Implications for Nebraska". http://snr.unl.edu/download/research/projects/climateimpacts/2014ClimateChange.pdf.

[49] Fourth National Climate Assessment. 2018. "Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II". https://nca2018.globalchange.gov/.

[50] USGS. "Nutrients and Eutrophication". Accessed December 2022. https://www.usgs.gov/mission-areas/water-resources/science/nutrients-and-eutrophication?qt-science_center_objects=0#qt-science_center_objects.

businesses and economies that rely on the agricultural sector. While this hazard could occur across the county, smaller rural communities would likely see the largest impacts.

Future Development

The likelihood of agricultural disease outbreaks is likely to remain consistent or increase as future development occurs; particularly if agricultural production remains a driving economic sector in the county. Increases in acreage planted with crops would increase the exposure to drought-related agricultural losses. Increases in population would add additional strain on water supply systems to meet growing demand for potable water.

Probability

Given the historic record of occurrence for agricultural plant disease events (11 out of 22 years with a reported event), for the purposes of this plan, the annual probability of agricultural plant disease occurrence is 50%.

Community Top Hazard Status

The following jurisdictions identified Agricultural Plant and Animal Disease as a top hazard of concern:

- Cerro Gordo County

Regional Vulnerabilities

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

Table 38: 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

Drought

Drought is defined as a period of prolonged abnormally low precipitation producing severe dry conditions. Although many erroneously consider it a rare and random event, drought is a normal, recurrent feature of climate. Drought can be spotty or widespread and 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, though they can and do occur during cooler months. Drought combined with extreme heat can cause significant social stress, economic losses, and environmental degradation. The length of a drought can vary from a few weeks to a period of years with a prolonged drought having serious impacts on a community's water supply and economy. 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. If agricultural production is damaged or destroyed by a loss of crops or livestock, food shortages may occur.

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

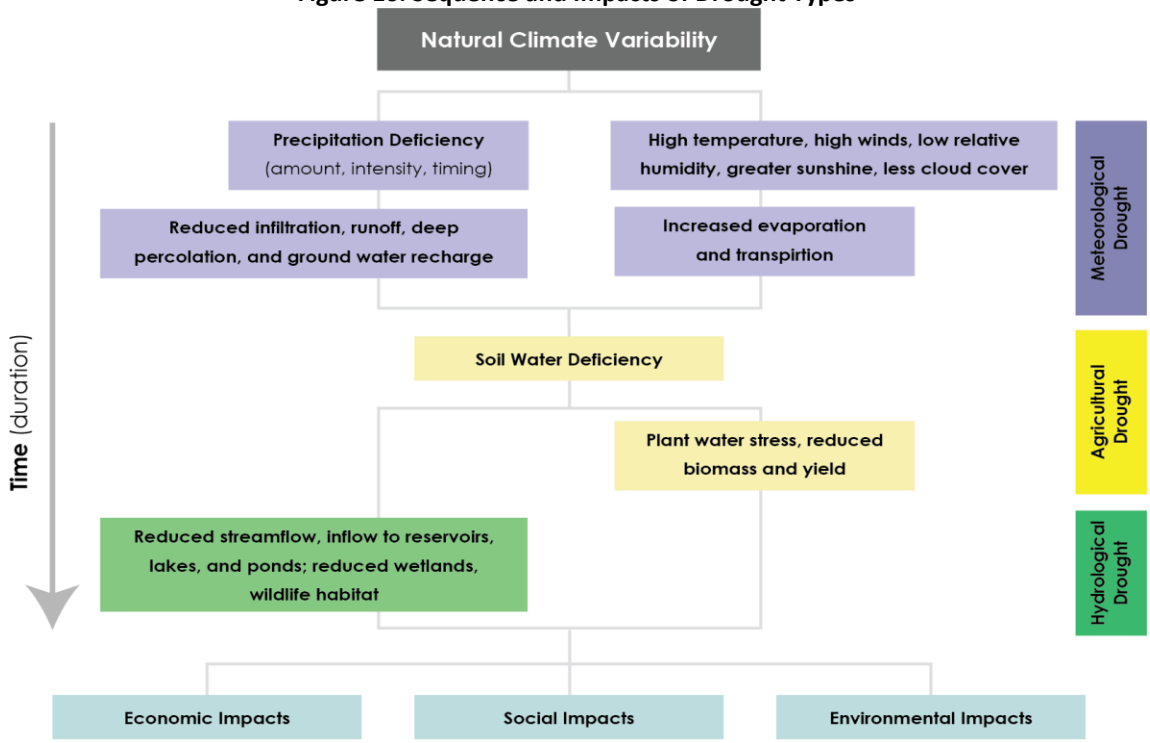
Drought is a slow-onset, creeping phenomenon that can affect a wide range of people, livestock, and industries. While many impacts of these hazards are non-structural, there is the potential that during prolonged drought events structural impacts can occur. Drought normally affects more people than other 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:

- ***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 a deficiency in moisture 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.[51]

[51] National Drought Mitigation Center. 2017. "Drought Basics." https://drought.unl.edu/.

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

Figure 16: Sequence and Impacts of Drought Types



Source: National Drought Mitigation Center, University of Nebraska-Lincoln, 2017[52]

The four different definitions all have significance in Iowa. A meteorological drought is the easiest to determine based on rainfall data and is an easier drought to monitor from rain gauges and reports. A hydrological drought means that stream and river levels are low, which also has an impact for surface water and ground water irrigators. In addition, in-stream discharges that fall below a pre-required level also place the state in regulatory difficulty with U.S. Fish and Wildlife and with neighboring states over cross-border flowage rights. An agricultural drought represents difficulty for Iowa's agricultural-based economy and is also relatively easy to monitor based on crop viabilities for different regions.

Location

All of Cerro Gordo County is at risk of drought. The area has an average of 32.3 inches of rainfall per year. Successive years or extended periods of time with below average amounts of rain or snow result in drought. According to the Palmer Drought Severity Index (PDSI), in the period of record (1/1895-12/2022) Cerro Gordo County has experienced 179 months of mild droughts, 107 months of moderate droughts, 54 months of severe drought, and 83 months of extreme droughts.

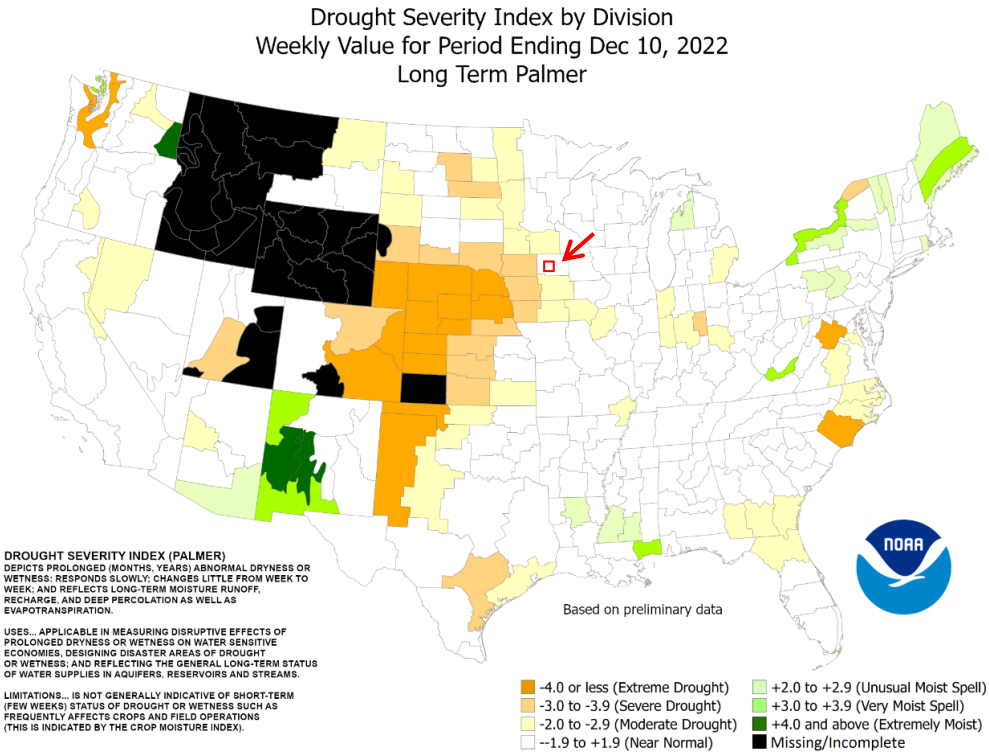
Historical Occurrences

The PDSI is utilized by climatologists to standardize global long-term drought analysis. It uses temperature and precipitation data to calculate water supply and demand, incorporates soil moisture, and is considered most effective for unirrigated cropland. It primarily reflects long-term drought and has been used extensively to initiate drought relief. The PDSI for the period ending on December 2022, is provided

[52] National Drought Mitigation Center. 2017. "Types of Drought." https://drought.unl.edu/Education/DroughtIn-depth/TypesofDrought.aspx.

below. The index indicates moderate drought levels in the planning area (shown approximately by the red box).

Figure 17: Palmer Drought Severity Index



The data for Cerro Gordo County was collected for Climate Division 8, which includes the county. This station's period of record started in 1895.

Table 39 shows the details of the Palmer classifications and Figure 18 shows drought data from this time period. The planning area has experienced several extreme droughts since 1902 and moderate, severe, and extreme droughts are likely in the future.

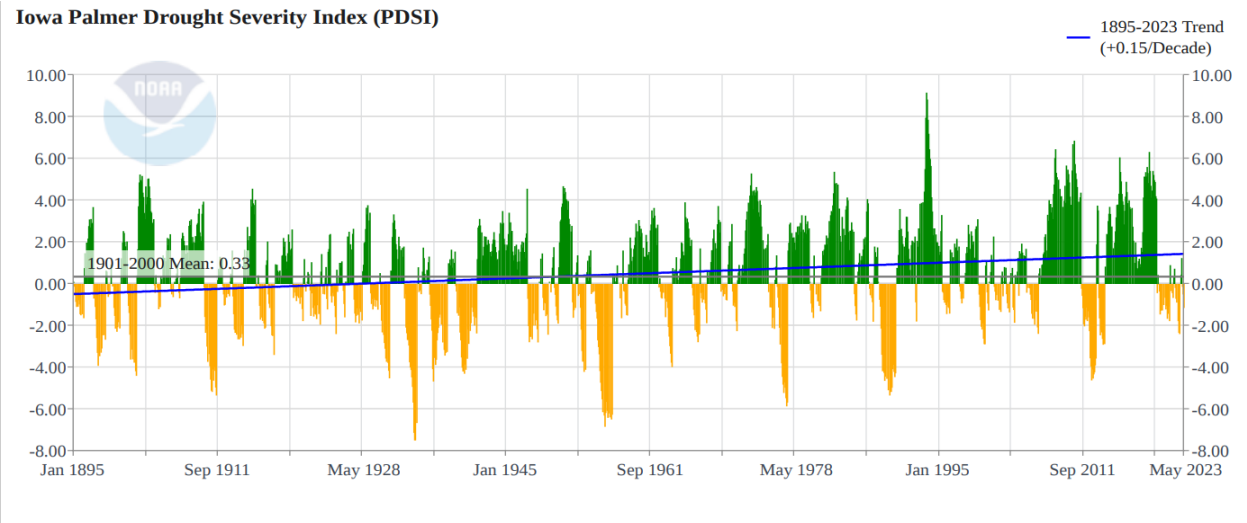
Table 39: Palmer Drought Severity Index Classification

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[53]

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

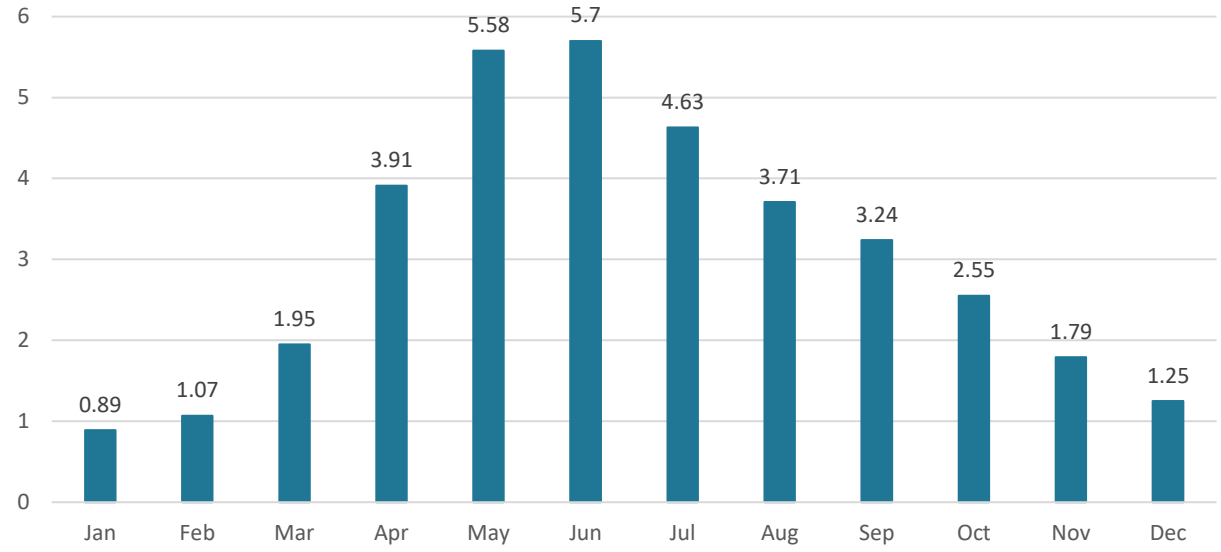
Figure 18: Palmer Drought Severity Index



Source: NCEI, 1895-2023[54]

Figure 19 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.

Figure 19: Average Monthly Precipitation for the Planning Area



Source: NCEI, 1991-2020[55]

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. A

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

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

summary of loss estimates and a detailed summary of insured crop losses as a result of drought is shown in the tables below. 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 40: 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	$451,786	$50,255,767	$2,158,033

Source: 1 Indicates data is from NCEI (1996-2023); 2 Indicates data is from USDA RMA (2000-2022)

Table 41: Annual Losses for Insured Crops Due to Drought in Cerro Gordo County

Year	Total Crop Loss	Year	Total Crop Loss
2000	$76,482	2012	$0
2001	$11,066	2013	$0
2002	$13,070	2014	$0
2003	$0	2015	$9,952
2004	$3,188	2016	$2,642
2005	$26,864	2017	$33,138
2006	$0	2018	$39,796
2007	$0	2019	$0
2008	$0	2020	$0
2009	$8,959	2021	$0
2010	$0	2022	$0
2011	$4,541		

Source: USDA RMA, 2000-2022

Extent

Although drought is not predictable, long-range outlooks may indicate an increased chance of drought, which can serve as a warning. A drought period can last for months, years, or even decades. It is rarely a direct cause of death, though the associated heat, dust, and stress can all contribute to increased mortality. Table 44 indicates it is reasonable to expect extreme drought to occur 5.4% of the time for the planning area (83 extreme drought months in 1,542 months). Severe drought occurred in 54 months of the 1,542 months of record (3.5% of months). Moderate drought occurred in 107 months of the 1,542 months of record (6.9% of months), and mild drought occurred in 179 of the 1,542 months of record (11.6% of months). Non-drought conditions occurred in 1,119 months, or 72.6% 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 32.3 inches according to the NCEI.[56]

Climate Change

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

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

events like extreme heat and drought, which will cause significant economic, social, and environmental impacts on Iowans. [57] 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. Increasing temperatures and drought may reduce the potential for aquifers to recharge, which has long-term implications for the viability of agriculture in Iowa. The increase in droughts will also lead to an increased risk of wildfire events as vegetation becomes drier. The table below shows the likelihood of a year-plus drought and year-plus extreme drought in the county with different warming scenarios.

Table 42: Likelihood of Drought with Different Warming Scenarios

	Warming Scenarios			
Likelihood of:	**0.5° C**	**1° C**	**2° C**	**3° C**
Year-Plus Drought	11-33%	11-33%	11-33%	11-33%
Year-Plus Extreme Drought	0-10%	0-10%	0-10%	0-10%

Source: Probable Futures[58]

NOAA has created the Climate Mapping for Resilience and Adaptation tool that looks at how different emission scenarios affect climatological hazards. The table below shows that the annual number of dry days is projected to increase as time goes on in both the lower emissions and higher emissions scenario.

Table 43: Annual Number of Dry Days – Cerro Gordo County

Emission Scenario	Historical (1976-2005)	Early Century (2015-2044)	Mid Century (2035-2064)	Late Century (2070-2099)
Lower Emissions (RCP 4.5)	203.7 Days	208.5 Days	209.8 Days	210.2 Days
Higher Emissions (RCP 8.5)	211.1 Days	209.8 Days	210.6 Days	213.0 Days

Source: NOAA[59]

Economic Impacts

The agricultural sector would see the largest economic impacts from a drought event. Cerro Gordo County had a market value of sold agricultural projects totaling $169 million in 2017. A prolonged drought event during the growing season could potentially result in millions of dollars in losses. The agricultural impacts would likely have trickle down effects to local businesses and economies that rely on the agricultural sector. While this hazard could occur across the county, smaller rural communities would likely see the largest impacts. Infrastructure and transportation will largely be unaffected by drought. Some roadways and water lines may see damage from shrinking soils, but impacts will likely be minor and localized. If drought is significant enough, community water systems may be impacted. Communities may need to implement voluntary or mandatory water restrictions to help reduce water usage and protect the water supply. FEMA standard values for potable water can be found in *Section 4: Risk Assessment* under *Average Annual Damages and Frequency*.

[57] University of Nebraska-Lincoln. 2014. "Understanding and Assessing Climate Change: Implications for Nebraska". http://snr.unl.edu/download/research/projects/climateimpacts/2014ClimateChange.pdf.

[58] Probable Futures. "Maps of Dryness". Accessed December 2022. https://probablefutures.org/ .

[59] NOAA. August 2022. "Climate Mapping for Resilience and Adaptation". https://livingatlas.arcgis.com/assessment-tool/explore/details .

Future Development

Any future developments are likely to increase water demand, increase travel on local transportation routes, and influence continued growth on economic sectors at risk from the impacts of drought. Growing communities will need to adapt and account for increased potable water demands for residential, commercial, and industrial development. However, as the population across Cerro Gordo County is decreasing, residents and communities may not have the funds to adequate mitigate, update, maintain, or improve localized water resources to rely upon during periods of drought.

Probability

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

Table 44: Period of Record in Droughts

PDSI Value	Magnitude	Occurrences by Month	Monthly Probability
4 or more to -0.99	No Drought	1,119/1,542	72.6%
-1.0 to -1.99	Mild Drought	179/1,542	11.6%
-2.0 to -2.99	Moderate Drought	107/1,542	6.9%
-3.0 to -3.99	Severe Drought	54/1,542	3.5%
-4.0 or less	Extreme Drought	83/1,542	5.4%

Source: NCEI, 1895- 2023[60]

Community Top Hazard Status

The following jurisdictions identified Drought as a top hazard of concern:

- Mason City

Regional Vulnerabilities

The impacts of drought can be categorized as primarily economic, environmental, or social. Many economic impacts occur in agriculture and related sectors, including forestry and fisheries, because of the reliance of these sectors on surface and subsurface water supplies. In addition to obvious losses in yields in both crop and livestock production, drought is associated with increases in insect infestations, plant disease, and wind erosion. The incidence of forest and range fires increases substantially during extended droughts, which in turn places both human and wildlife populations at higher levels of risk. Environmental losses are the result of damages to plant and animal species, wildlife habitat, and air and water quality, forest and range fires, degradation of landscape quality, loss of biodiversity, and soil erosion. Some of the effects are short-term and conditions quickly return to normal following the end of the drought. Other environmental effects linger for some time or may even become permanent.

With Cerro Gordo County's 760 farms covering 319,791 acres of land which equates to 87 percent of the land used for agriculture, the planning area has a high exposure to this hazard. Aside from agricultural impacts, other losses related to drought include costs of fire suppression and damage to roads and structural foundations due to the shrink of dynamic expansive soils during excessively dry conditions. Areas associated with agricultural use are vulnerable to drought conditions which could result in a decrease in crop production or a decrease in available grazing area for livestock.

[60] National Centers for Environmental Information. 1895-November 2022. Accessed December 2022. https://www.ncdc.noaa.gov/cag/divisional/time-series

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 12 drought-related impacts in 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 45: Notable Drought Impacts in Planning Area

Category	Date	Title
Agriculture	7/24/2023	Drought, heat hurt crop conditions in Iowa
Fire; Relief, Response & Restrictions	9/3/2020	Iowa Counties adopt burn bans
Agriculture; Water Supply & Quality	7/6/2016	Corn yield potential down in Iowa
Fire; Relief, Response & Restrictions		Dry conditions led to Iowa burn bans
Fire	11/21/2012	Fire burned in lakebed in north central Iowa
Agriculture; Relief, Response & Restrictions		USDA designates 8 counties in Iowa as Primary Natural Disaster Areas with Assistance to Producers in Surrounding States
Agriculture; Relief, Response & Restrictions	8/29/2012	USDA designates 3 counties in Iowa as Primary Natural Disaster Areas with Assistance to Producers in Minnesota
Agriculture; Plants and Wildlife	7/19/2012	Spider mites "somewhat of a problem for the soybean crop" in north central Iowa
Tourism & Recreation; Water Supply & Quality	7/2/20126	Fewer boats in Clear Lake, Iowa
Agriculture	7/2/2012	Corn crops stressed in Cerro Gordo County, Iowa
Relief, Response & Restrictions	9/6/2006	Relief, Response, and Restrictions impact from Media submitted on 9/7/2006
Relief, Response & Restrictions	10/25/2005	Relief, Response, and Restrictions impact from Government submitted on 10/28/2005

Source: NDMC, 2000-August 2023[61]

The following table provide information related to regional vulnerabilities and FEMA's National Risk Index values for Drought. For jurisdictional specific vulnerabilities, refer to *Section Seven*.

Table 46: 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

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

Sector	Vulnerability
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
National Risk Index Values	Risk Index – Relatively Moderate Expected Annual Loss – Relatively Moderate Social Vulnerability – Very Low Community Resilience – Very High

Source: FEMA National Risk Index, 2023

Extreme Temperatures - Heat and Cold

Extreme temperatures include durations of time at both the low and high ends of the thermometer. What constitutes extreme cold varies from region to region but is generally accepted as being temperatures that are significantly lower than the average low temperature. For the purposes of this plan, extreme cold is being defined as the high temperature being 10°F or below. Conditions for extreme heat are defined by temperatures substantially hotter and/or more humid than average for a location at that time of year. This includes temperatures (including heat index) in excess of 100 degrees Fahrenheit or at least three successive days of 90-plus degrees Fahrenheit.

Extreme cold can be dangerous to the well-being of people and animals as 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 and frostbite. Cold can cause fuel to congeal in storage tanks and supply lines, stopping electric generators, overpower a building's heating system, and cause water and sewer pipes to freeze and rupture. Extreme cold also increases the likelihood of ice jams on flat rivers or streams. When combined with high winds from winter storms, extreme cold becomes extreme wind chill, which is extremely hazardous to health and safety.

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 including heatstroke, sunstroke, cramps, exhaustion, and fatigue may arise when a person is overexposed to heat.

Extreme temperatures can also cause people to overuse furnaces and air conditioners, which can lead to power failures. Power outages for prolonged periods increase the risk of health events such as heat stroke or hypothermia and subsequent fatalities. The planning area is largely rural, which presents an added vulnerability to extreme events; those medically suffering from extreme temperature conditions 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 extreme 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 temperatures hazards include water shortages brought on by drought-like conditions and high demand during heat spells or from interrupted utility services from broken pipes during extreme cold periods. Government authorities report that civil disturbances and riots are more likely to occur during heat waves or water shortages. 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.

Location

The entire planning area is subject to extreme temperatures – both heat and cold and all participating jurisdictions are affected.

Historical Occurrences

According to the High Plains Regional Climate Center (HPRCC) the planning area experiences an annual average of 10 days with a high of 10°F or below and an annual average of one day above 100°F per year. The most days below 10°F occurred in 1936 with 30 days while the most days on record above 100°F occurred in the same year with 14 days. However, this data does not include data for July 2023 which has been reported as the hottest month on record to date.

Average Annual Losses

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

The NCEI storm events database reports extreme heat events as excessive heat events and extreme cold as extreme cold/wind chill. According to the NCEI there have been three excessive heat events and 17 extreme cold events within the county between 1996 and 2023. The RMA reports extreme heat events as heat or hot wind and extreme cold events as cold winter and freeze. During the 23-year period 37 instances of crop insurance claims paid for losses related to extreme temperatures totaled $957,587.

Table 47: Loss Estimate for Extreme Temperatures

Hazard Type	Avg. Days Above 100°F[1]	Total Property Loss[2]	Average Annual Property Loss[2]	Total Crop Loss[3]	Average Annual Crop Loss[3]
Extreme Cold	10 days	$0	$0	$151,709	$6,596
Extreme Heat	1 day	$135,000	$4,821	$805,878	$35,038

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

According to the FEMA Benefit Cost Analysis Reference Guide, if an extreme temperatures 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 $182 per person per day.[62] 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 48: Loss of Electricity - Assumed Damage

Jurisdiction	2020 Population	Population Affected (Assumed)	Electric Loss of Use Assumed Damage Per Day
Cerro Gordo County	43,127	4,313	$784,966

Extent

The National Weather Service (NWS) is responsible for issuing excessive heat or cold temperature outlooks, forecasts, watches, or warnings. The NWS' definitions are provided below.[63]:

[62] Federal Emergency Management Agency. June 2009. "BCA Reference Guide."

[63] National Weather Service. 2022. "Heat Information Page". Accessed December 2022. https://www.weather.gov/dmx/dssheat

- ***Heat Advisories*** are issued when temperatures of at least 100°F or Heat Index values of at least 105°F are expected generally within the next 24 hours.
- ***Wind Chill Advisory*** means that wind chill values are expected to fall to between -20° and -29°F within the next 24 to 36 hours. Please exercise caution and wear appropriate clothing if heading outdoors for any prolonged period of time.

- ***Excessive Heat Watches*** are issued when the Heat Index values are expected to reach or exceed 110°F and not fall below 75°F for at least a 48-hour period, beginning in the next 12 to 48 hours.
- ***Wind Chill Watch*** means that wind chill values are expected to fall to -30°F or lower within the next two to three days. Start planning to limit any outdoor activity during this time.

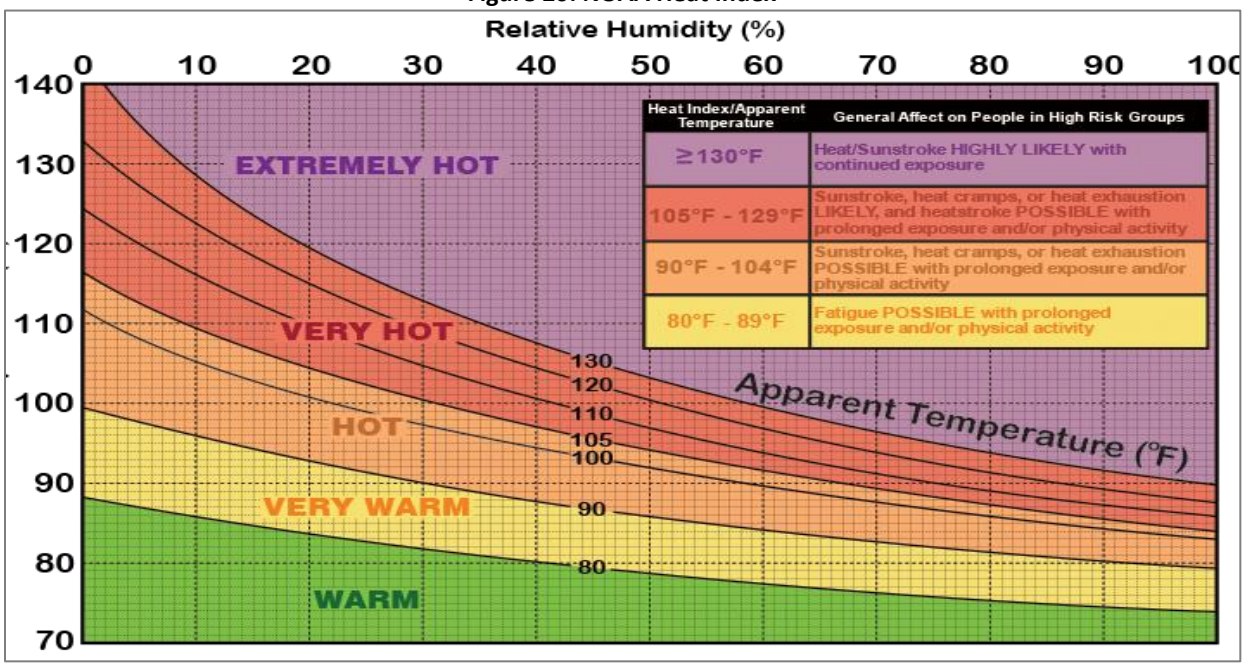
- ***Excessive Heat Warnings*** are issued when Heat Index values are expected to reach or exceed 110°F and not fall below 75°F for at least a 48-hour period, beginning in the next 24 hours.
- ***Wind Chill Warning*** means that wind chill values are expected to fall to -30°F or lower within the next 24 to 48 hours. Please refrain from any unnecessary outdoor activities and wear protective clothing if you must venture outdoors. You can get frostbite in 10-15 min on unprotected skin.

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 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% requires 94°F. The heat index is a number in degrees Fahrenheit that tells how hot it really feels when relative humidity is factored into actual air temperature. 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 20 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.

Figure 20: NOAA Heat Index

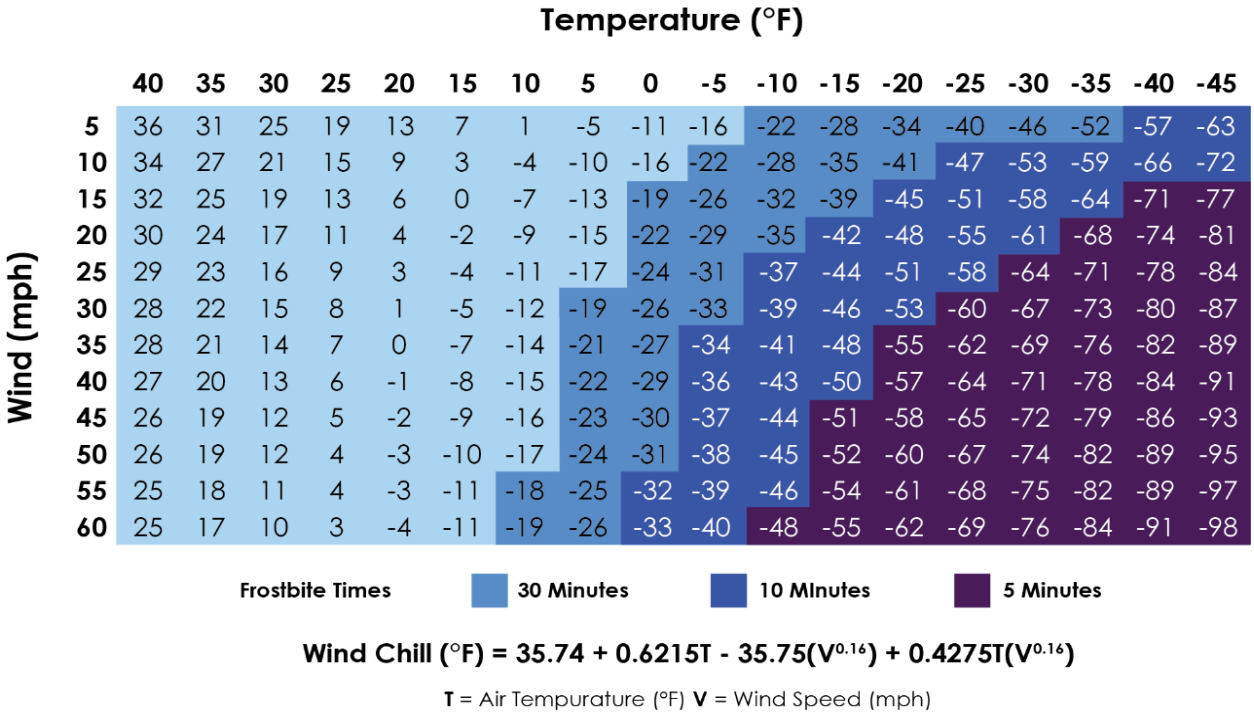


Source: NOAA, 2022[64]

A key factor to consider regarding extreme cold situations is the wind chill. The Wind Chill Index was developed by the NWS to determine the decrease in air temperature felt by the body on exposed skin due to wind. The wind chill is always lower than the air temperature and can quicken the effects of hypothermia or frostbite as it gets lower. Figure 21 shows the Wind Chill Index used by the NWS.

[64] National Oceanic and Atmospheric Administration, National Weather Service. 2022. "Heat Index." https://www.noaa.gov/jetstream/global/heat-index.

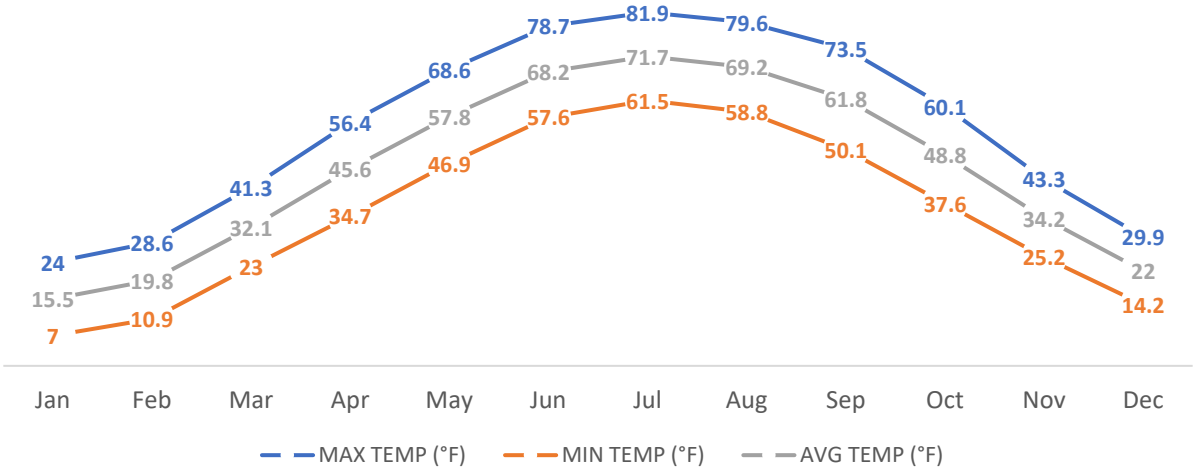
Figure 21: Wind Chill Index Chart



Source: NWS[65]

For the planning area, the coldest months of the year are December, January, and February. The average low temperatures for these months are all below freezing (average low for the three months 10.7°F). The average high temperature for these months is 27.5°F. In the planning area, the months with the highest temperatures are June, July, and August. The average high temperature for these months is approximately 80.1°F while the average low temperature for these months is 59.3°F.

Figure 22: Monthly Climate Normals Temperature (1991-2020)



Source: NCEI, 2022

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

The impacts of extreme temperatures, specifically extreme heat, are exacerbated by other risk factors such as diabetes, obesity, heart disease, or other health equity concerns. Many vulnerable communities and populations at-risk face greater exposure to heat or cold, have fewer resources to respond or escape conditions, and are more likely to suffer severe consequences if left unassisted. Populations at highest risk are those without shelter or who are stranded, or who live in a home that is poorly insulated or without adequate HVAC systems. Other impacts of extreme temperatures include asphyxiation (unconsciousness or death from a lack of oxygen) from toxic fumes from emergency heaters; household fires, which can be caused by fireplaces and emergency heaters; and frozen/burst pipes. Elderly populations are considered particularly vulnerable to the impacts of extreme temperatures events.

Climate Change

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*[66] which included predictions for extreme heat events in the future dependent on future climate actions. The table below summarizes findings for the county.

Table 49: Extreme Heat Predictions for Days over 100°F

Historically 1971-2000	Midcentury Prediction 2036-2065	Late Century Prediction 2070-2099
3 days per year	23 days per year	47 days per year

Source: Union of Concerned Scientists[67]

Impacts from climate change will significantly affect the prevalence and extent of extreme temperature conditions. As the number of days both above 100°F and below 10°F increases, the stress placed on the energy grid will likely increase and possibly lead to more power outages. The Fourth National Climate Assessment noted numerous impacts including increasing health risks from extreme heat conditions or increased severe wildfire events with hot dry conditions.[68] Jurisdictions across the planning area may also experience more than one climate related impact simultaneously such as drought and extreme heat or severe winter storms with extreme cold.

Economic Impacts

Extreme temperature impacts are most likely going to affect people who are outside or lack adequate heating or cooling access. It can also stress electrical systems, water systems, and even roadways during prolonged extreme events. Roadways will likely see localized impacts which will only cause minor delays unless damages occur to highways.

During extreme heat events more water is used for lawn watering and irrigation of crops, which could impact water systems. When tied with drought, communities may need to implement voluntary or mandatory water restrictions to help reduce water usage and protect the water supply. Larger communities like Mason City may see large spikes in energy consumption due to the increased running of air conditioners. This could cause stress to the electrical system and short-term blackouts.

[66] 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.

[67] Union of Concerned Scientists. 2022. "Extreme Heat and Climate Change: Interactive Tool". https://www.ucsusa.org/global-warming/global-warming-impacts/extreme-heat-interactive-tool?location=Cerro Gordo-county--ia

[68] U.S. Global Change Research Program. 2018. "Fourth National Climate Assessment". https://nca2018.globalchange.gov/.

Future Development
The construction of infrastructure to support any future development should take extreme temperatures into account. Facilities such as nursing homes, hospitals, clinics, and day cares should be designed with access to back-up power generation. Public cooling centers should be established across the county for residents.

Probability
Extreme temperatures are a regular part of the climate for the planning area. Extreme heat event of over 100°F occur at least once annually and extreme cold events occur on average 10 times a year. Thus the probability that extreme temperatures (either heat or cold) will occur in any given year in the planning area is 100 percent.

Community Top Hazard Status
The following jurisdiction identified Extreme Temperatures as a top hazard of concern:

- Meservey

Regional Vulnerabilities
Those at greatest risk for temperature-related illness include infants and children up to four years of age, people 65 years of age and older, people who are overweight, and people who are ill or on certain medications. Area elder care facilities, senior housing facilities, and childcare facilities are vulnerable to extreme temperatures. However, even young and healthy individuals are susceptible if they participate in strenuous physical activities during hot weather. In agricultural areas, the exposure of farm workers, as well as livestock, to extreme temperatures is a major concern.

Most notably, power failure during an extreme heat or cold event could shut down these facilities' HVAC systems if back-up power capabilities were not available. Additionally, infrastructure damage such as road damage can occur as a result of extreme heat. When asphalt is exposed to prolonged extreme heat, it can cause buckling of asphalt-paved roads, driveways, and parking lots.

The nonprofit First Street Foundation has developed a Risk Factor tool to help understand risks from a changing climate at the county or community level. Risk Factor provides an overview for heat risk at the county level. The following table outlines key risk factors from heat risk.

Table 50: Cerro Gordo County Heat Risk

Cerro Gordo County	
Overall Heat Factor Risk	Minor Heat Factor
Total Properties at Risk	32,747
Likelihood of 3+ day heat wave (>101F)	47% likelihood this year (2023); 78% likelihood in 30 years
Health Caution Days	33 days this year (2023); 49 days in 30 years
Dangerous Days	7 days this year (2023); 16 days in 30 years
Hot Days	7 days this year (2023); 16 days in 30 years
Number of cooling days (requiring AC)	139 days this year (2023); 148 days in 30 years

Source: Risk Factor, 2023[69]

[69] First Street Foundation. "Risk Factor: Heat Factor." Accessed November 2022. https://riskfactor.com/.

Note: Health caution days = days where "feels like" temperature exceeds 90F; Dangerous days = days where "feels like" temperature exceeds 100F; Hot days = days where "feels like" temperature exceeds 101F.

The following tables provide information related to regional vulnerabilities and FEMA's National Risk Index values for Extreme Heat/Heat Wave. For jurisdictional specific vulnerabilities, refer to *Section Seven.*

Table 51: Regional Extreme Heat Vulnerabilities

Sector	Vulnerability
People	-Human Health impacts including: Heat exhaustion, Heat stroke, Hypothermia, Heart Disease, Asthma -Elderly citizens are at higher risk to injury or death -Citizens without adequate heat or air conditioning at higher risk of injury or death -Workers required to be outside for extended periods of time
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 temperature conditions are likely, adding stress on livestock, crops, people, and infrastructure
National Risk Index Values	**Cold Wave** Risk Index – Relatively Low Expected Annual Loss – Relatively Low Social Vulnerability – Very Low Community Resilience – Very High **Heat Wave** Risk Index – Relatively Low Expected Annual Loss – Relatively Low Social Vulnerability – Very Low Community Resilience – Very High

Source: FEMA National Risk Index, 2023

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 slow 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 resulting in temporary partial or complete inundation of normally dry land. Floodwaters can be extremely dangerous; the force of 6 inches of swiftly moving water can knock people off their feet and 2 feet of water can float a car. Floods can be slow or fast-rising but generally develop over a period of days. 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, including from Levee or Dam Failure

Flash floods, typically rapidly developing with little to no warning time, result from intense precipitation over a brief period, usually due to slow moving thunderstorms or sudden releases due to a failure of an upstream impoundment created behind a dam or levee. Additionally, flash floods may be combined with rapid snowmelt, ice jam release, frozen ground, saturated soil, or impermeable surfaces. Flash floods are distinguished from regular floods by a timescale of fewer than six hours. They are an extremely dangerous form of flooding which can reach full peak in only a few minutes and allows little or no time for protective measures to be taken. Waters move at very fast speeds and can move boulders, tear out trees, scour channels, destroy buildings, and obliterate bridges. Flash floods cause the most flood-related deaths, both human and animal, because of this shorter timescale. Flooding from excessive rainfall events in Iowa usually occurs between late spring and early fall.

Stormwater Flooding

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

Ice Jam Flooding

Ice jams occur when ice breaks up in moving waterways, and then stacks on itself where channels narrow, or human-made obstructions constrict the channel. This creates an ice dam, often causing flooding within

minutes of the dam formation. Ice formation in streams occurs during periods of cold weather when finely divided colloidal particles called "frazil ice" form. These particles combine to form what is commonly known as “sheet ice.” This type of ice covers the entire river. The thickness of this ice sheet depends upon the degree and duration of cold weather in the area. This ice sheet can freeze to the bottom of the channel in places. During spring thaw or winter freezing, rivers frequently become clogged with this winter accumulation of ice. Because of relatively low stream banks and channels blocked with ice, rivers overtop existing banks and flow overland. This type of flooding tends to more frequently occur on wide, shallow rivers, although other rivers can be impacted.

Location

The county resides in the Shell Rock River Watershed, Winnebago, and West Fork Cedar watersheds. The main waterways in the county include the Winnebago River, Shell Rock River, Willow Creek, and Beaverdam Creek. Clear Lake is also located directly south of the cities of Ventura and Clear Lake. These rivers and their tributaries are potential locations for flooding to occur.

Table 52 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 23 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.*

Table 52: FEMA FIRM Panel Status

Jurisdiction	Participating in NFIP? (Y/N)	Current Effective Panel Numbers	Effective Date
Cerro Gordo County	Yes	19033CIND0C; 19033C0113E; 19033C0114E; 19033C0118E; 19033C0119E; 19033C0138E; 19033C0139E; 19033C0142E; 19033C0144E; 19033C0161E; 19033C0162E; 19033C0163E; 19033C0164E; 19033C0166E; 19033C0167E; 19033C0168E; 19033C0169E; 19033C0175E; 19033C0201E; 19033C0202E; 19033C0206E; 9033C0207E; 19033C0226E 19033C0025D; 19033C0050D; 19033C0069D; 19033C0075D; 19033C0088D; 19033C0100D; 19033C0115D; 19033C0120D; 19033C0125D; 19033C0136D; 19033C0137D; 19033C0141D; 19033C0143D; 19033C0150D; 19033C0157D; 19033C0176D; 19033C0177D; 19033C0178D; 19033C0179D; 19033C0188D; 19033C0190D; 19033C0200D; 19033C0225D; 19033C0227D; 19033C0250D; 19033C0251D; 19033C0252D; 19033C0275D; 19033C0300D; 19033C0305D; 19033C0310D; 19033C0315D; 19033C0320D; 19033C0330D; 19033C0335D; 19033C0350D; 19033C0355D; 19033C0360D; 19033C0375D; 19033C0395D; 19033C0400D 19033C_NTU_LETTER	12/15/2022 6/5/2020 3/27/2020

Jurisdiction	Participating in NFIP? (Y/N)	Current Effective Panel Numbers	Effective Date
Clear Lake	Yes	19033CIND0C; 19033C0114E; 19033C0118E; 19033C0119E; 19033C0138E; 19033C0139E; 19033C0207E; 19033C0226E 19033C0136D; 19033C0227D 19033C_NTU_LETTER	12/15/2022 6/5/2020 3/27/2020
Dougherty	No	19033CIND0C 19033C0395D 19033C_NTU_LETTER	12/15/2022 06/05/2020 03/27/2020
Mason City	Yes	19033CIND0C; 19033C0142E; 19033C0144E; 19033C0161E; 19033C0162E; 19033C0163E; 19033C0164E; 19033C0166E; 19033C0167E; 19033C0168E; 19033C0169E 19033C0188D; 19033C0251D; 19033C0252D 19033C_NTU_LETTER	12/15/2022 06/05/2020 03/27/2020
Meservey	No	19033CIND0C 19033C0315D 19033C_NTU_LETTER	12/15/2022 06/05/2020 03/27/2020
Plymouth	Yes	19033CIND0C 19033C0069D; 19033C0088D; 19033C0157D; 19033C0176D 19033C_NTU_LETTER	12/15/2022 06/05/2020 03/27/2020
Rock Falls	Yes	19033CIND0C 19033C0179D 19033C_NTU_LETTER	12/15/2022 06/05/2020 03/27/2020
Rockwell	Yes	19033CIND0C 19033C0355D; 19033C0360D 19033C_NTU_LETTER	12/15/2022 06/05/2020 03/27/2020
Swaledale	Yes	19033CIND0C 19033C0330D; 19033C0335D 19033C_NTU_LETTER	12/15/2022 06/05/2020 03/27/2020
Thornton	Yes	19033CIND0C 19033C0310D; 19033C0320D; 19033C0330D; 19033C0350D	12/15/2022 6/5/2020

Jurisdiction	Participating in NFIP? (Y/N)	Current Effective Panel Numbers	Effective Date
		19033C_NTU_LETTER	3/27/2020
Ventura	Yes	19033CIND0C; 9033C0113E; 19033C0114E; 19033C0201E; 19033C0202E 19033C_NTU_LETTER	12/15/2022 3/27/2020

Source: FEMA, 2023[70] [71]

Dam and levee failure events can cause major flooding where these structures are located. A dam is defined as a barrier constructed across a watercourse for the purpose of storage, control, or diversion of water; while a levee is defined as a barrier alongside a watercourse for the purpose to contain, control, or divert the flow of water to provide some level of protection from flooding. There are no federal levees in the planning area but there are a few non-federal levees across the county including one in Mason City which failed during a flood event in 2008. This structure protects the water treatment facility along the Winnebago River. None of these structures are included in the national levee database.

There are ten dams in Cerro Gordo County according to the National Inventory of Dams (USACE). Nine dams are Low hazard, and one is a Significant hazard dam. The significant hazard dam, Old Quarry Lake Dam is located just outside Mason City to the north.

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. According to the FEMA Flood Map Service Center, there are currently no Risk MAP products available for the three watersheds within Cerro Gordo County.

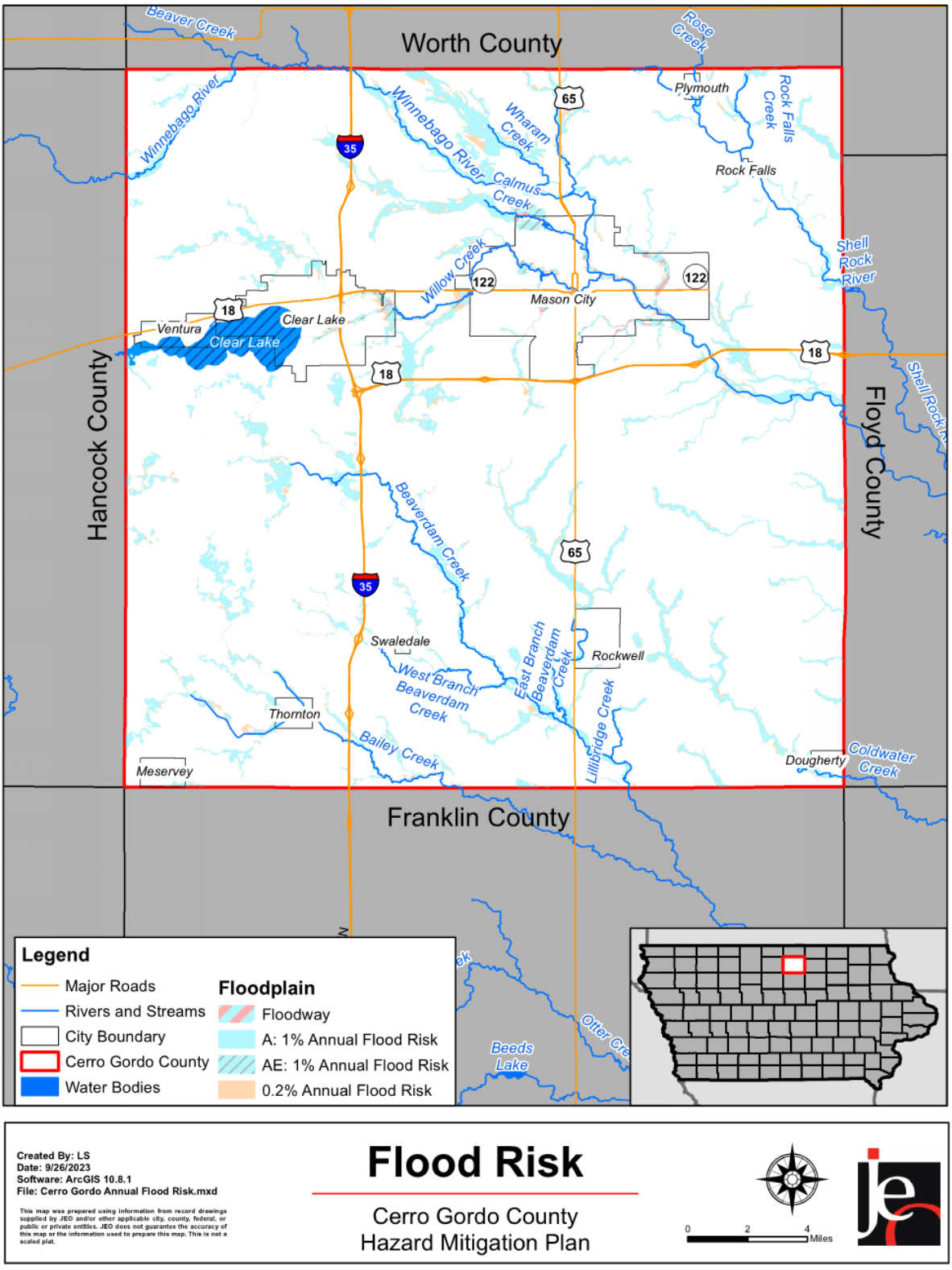
According to the Iowa Department of Natural Resources, other flood plain mapping projects in Cerro Gordo County are currently underway. The state is in the process of collecting lidar data undergoing 2D base level engineering and data development activities across the state.[72] Currently the state has completed Phase One for all of Cerro Gordo County. 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/.

[70] Federal Emergency Management Agency. 2022. "FEMA Flood Map Service Center." Accessed December 2022. http://msc.fema.gov/portal/advanceSearch.

[71] Federal Emergency Management Agency. 2022. "Community Status Book Report." Accessed December 2022. https://www.fema.gov/national-flood-insurance-program-community-status-book

[72] Iowa Department of Natural Resources. 2022. "Flood Plain Mapping." https://www.iowadnr.gov/Environmental-Protection/Land-Quality/Flood-Plain-Management/Flood-Plain-Mapping.

Figure 23: 1% and 0.2% Annual Flood Risk Hazard Areas



Historical Occurrences

The NCEI reports events as they occur in each community. A single flooding event can affect multiple communities and the county at the same time; however, 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, 32 flash flooding events resulted in $3,980,000 in property damage, while 49 riverine flooding events resulted in $3,261,570 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 $217,389. One levee failure event was reported during the 2008 flood event; however damage estimates were not specific to that event.

Descriptions of the most damaging flood events from the NCEI are below:

- **Flash Flood 8/23/2014 - $500,000 in damages:** A thunderstorm complex formed over eastern Nebraska during the evening of the 22nd. The complex grew upscale into an MCC as it moved into Iowa. Thunderstorms produced very heavy rainfall over southern Iowa. A large area of two-to-four-inch rainfall occurred over southern Iowa. There were spotty reports near 5 inches. The rain fell in areas that had received significant rainfall during the previous two days. A line of strong storms moved through the Mason City area and dropped 1.5 inches of rain in about a half hour. The heavy rain caused flash flooding in town and the roof of a Walmart store collapsed from the weight of the water. Once the flash flooding ended, generally flooding continued through the afternoon and evening.

- **Flood/Levee Failure 6/8/2008 – $1,000,000 in damages:** During the initial phase of the severe event, high winds and hail were reported along the line of thunderstorms that formed from northern into west central Iowa. There were four reports of tornadoes in Worth, Winnebago and Cerro Gordo Counties during the afternoon hours of the 7th. This was with the initial round of storms. The most significant weather feature with this event was the heavy rainfall. The antecedent soil conditions in Iowa were extremely wet, such that flash flooding was caused by rainfall of an inch or more in an hour, even in rural areas. Heavy rainfall of 3 to 6 inches occurred in a broad swath extending from west central into north central, and parts of central and northeast Iowa. This resulted in widespread flash flooding. Eventually, the rain led to major to record flooding along many of the rivers in the state. At one point or another, about 40 of the DMX 51 counties in the CWA were under flash flood warning. The situation was very serious over the north central and northeast counties. A levee was breached in the Mason City area as the Winnebago River rose to 3 feet over the record stage. The city was inundated by water. The water treatment plant was under water and non-operational, all power was lost to the power grid in the city. The river cut a new channel and changed course into the downtown area. Flooding along the Shell Rock River resulted in water supply loss in the town of Rockford. There was one death that resulted from the flooding. A 33 year old man died as he drove into flood waters in Interstate 35 at mile post 141 in Hamilton County. A second death occurred in Wright County as a 50 year old male farmer near Galt was sucked into a culvert by flood waters as he checked the field tiles in his farm field.

- **Flash Flood 7/19/1999 – $1,000,000 in damages:** A nearly stationary frontal boundary was draped across Iowa during the afternoon of the 18th into the night. Heavy rains also fell over northeast Cerro Gordo County, overtopping many roads with 1 to 2 feet of water. A 54 car train was derailed

in the area just southwest of Grafton and at least 3 major highways were closed, Iowa Highway 9, U.S. Highway 18, and U.S. Highway 65. Flooding hit a campground southeast of Manly near the town of Rock Falls. One hundred and fifty people were evacuated in the town of Rock Falls itself. The water flooded the campground and debris was recovered three miles downstream of the campground. One of the larger [evacuations] was along the Winnebago River in the Mason City area where 400 homes along the river were ordered evacuated. Highway and bridge damage in Cerro Gordo County topped $750,000. Governor Vilsack declared 8 counties in Iowa disaster areas. In the Des Moines CWA, these included Bremer, Butler, Cerro Gordo and Worth. Crop damage was also quite extensive in these counties with many fields under water.

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 $258,628 in property damages and $9,452 in crop losses per year for the planning area.

Table 53: 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	49	1.75	$3,261,570	$116,485	$217,389	$9,452
Flash Flood	32	1.14	$3,980,000	$142,143		

Source: 1 Indicates data is from NCEI (1996 to 2023); 2 Indicates data is from USDA RMA (2000 to 2022)

Extent

The NWS has three categories to define the severity of a flood once a river reaches flood stage as indicated in Table 54.

Table 54: Flooding Stages

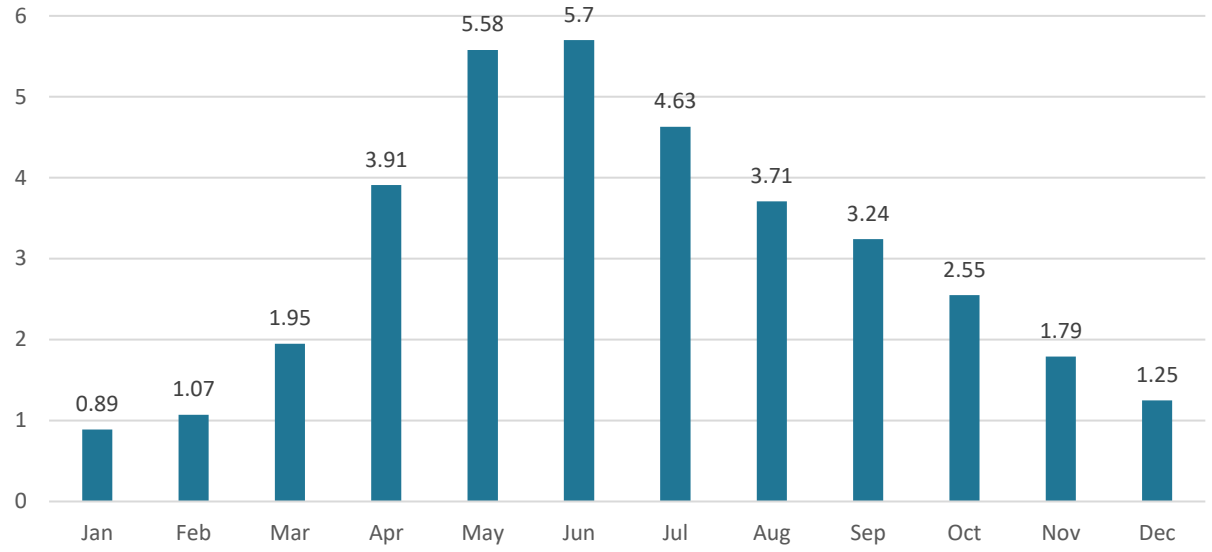
Flood Stage	Description of Flood Impacts
Minor Flooding	Minimal or no property damage, but possibly some public threat or inconvenience
Moderate Flooding	Some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary
Major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

Source: NOAA, 2017[73]

Figure 24 shows the normal average monthly precipitation for the planning area, which is helpful in determining whether any given month is above, below, or near normal in precipitation. As indicated in Figure 25, the most common months for flooding within the planning area are May and June.

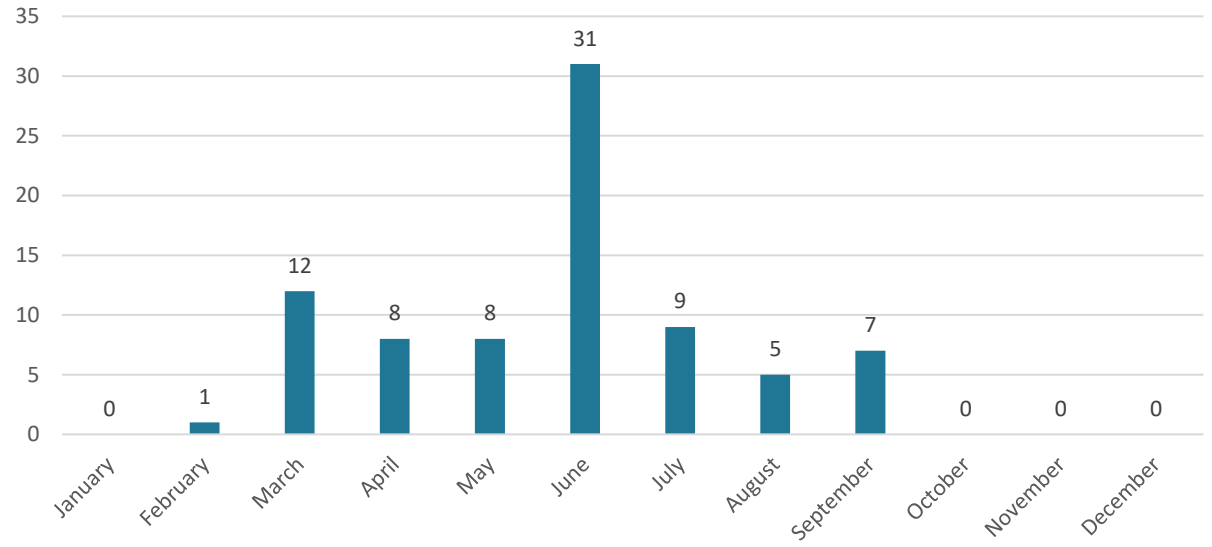
[73] National Weather Service. 2017. "Flood Safety." https://www.weather.gov/safety/flood.

Figure 24: Average Monthly Precipitation for Planning Area



Source: NCEI, 1991-2020[74]

Figure 25: Monthly Events for Floods/Flash Floods



Source: NCEI, 1996-2023

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

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

program has been keeping people away from flooding rather than keeping the flooding away from people—through historically expensive flood control projects.

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.[75] Currently no jurisdictions in the planning area participate in the CRS program. The following tables summarize NFIP participation and active policies within the planning area as of August 2023.

Table 55: NFIP Participants

Jurisdiction	In NFIP?	Eligible- Regular Program	Date Current Map	Sanction	Suspension	Rescinded
Cerro Gordo County	Yes	6/7/1977	12/15/2022	N	N	N
Clear Lake	Yes	5/24/1974	12/15/2022	N	N	N
Dougherty	No	-	-	-	-	-
Mason City	Yes	3/1/1974	12/15/2022	N	N	N
Meservey	No	-	-	-	-	-
Plymouth	Yes	11/8/1974	6/05/20(M)	N	N	N
Rock Falls	Yes	1/14/1977	6/05/20(M)	N	N	N
Rockwell	Yes	3/26/1976	6/05/20(M)	N	N	N
Swaledale	Yes	8/13/1976	6/05/20(M)	N	N	N
Thornton	Yes	12/20/1974	6/05/20(M)	N	N	N
Ventura	Yes	11/5/1976	12/15/2022	N	N	N

Source: Federal Emergency Management Agency, National Flood Insurance Program, 2023[76]
**(M) indicates no elevation determined – All Zone A, C, and X*

Table 56: NFIP Policies in Force and Total Payments

Jurisdiction	Policies In-force	Total Coverage	Total Losses	Total Payments
Cerro Gordo County	7	$3,100,000	6	$27,952
Clear Lake	8	$2,343,600	8	$59,589
Dougherty	0	-	-	-
Mason City	56	$15,068,300	196	$3,274,480
Meservey	0	-	-	-
Plymouth	0	-	1	$9,912
Rock Falls	3	$910,000	0	$0
Rockwell	0	-	0	-

[75] Federal Emergency Management Agency. 2017. "National Flood Insurance Program Community Rating System: Coordinator's Manual FIA-15/2017." Accessed January 2023. https://www.fema.gov/sites/default/files/documents/fema_community-rating-system_coordinators-manual_2017.pdf.

[76] Federal Emergency Management Agency. 2022. "Community Status Book Report." Accessed January 2023. https://www.fema.gov/cis/IA.html

Jurisdiction	Policies In-force	Total Coverage	Total Losses	Total Payments
Swaledale	0	-	0	-
Thornton	1	$350,000	2	$2,661
Ventura	1	$210,000	0	$0

Source: HUDEX, August 2023

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 August 2023, there are seven repetitive loss properties across Cerro Gordo County but no severe repetitive loss. Six properties are located in Mason City and one property is in Clear Lake. All structures are single family homes and account for 19 losses. Currently no mitigation work is planned per property owner desires.

There are no additional repetitive loss or severe repetitive loss properties located in the county. It is important that the county and community works with the property owner to identify a solution to mitigate the repetitive flood damages into the future and is included as a project in the county's profile. Definitions of a structure identified as a NFIP Repetitive Loss (RL) and Severe Repetitive Loss (SRL) are given below.

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

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

(1) That have incurred flood-related damage for which four or more separate claims payments have been made, with the amount of each claim (including building and contents payments) exceeding $5,000, and with the cumulative amount of such claim payments exceeding $20,000; or
(2) For which at least two separate claims payments (building payments only) have been made under such coverage, with cumulative amount of such claims exceeding the market value of the building.
(3) In both instances, at least two of the claims must be within 10 years of each other, and claims made within 10 days of each other will be counted as one claim.

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

(1) Has incurred flood-related damage on two occasions, in which the cost of the repair, on the average, equaled or exceeded 25 percent of the market value of the structure at the time of each such food event; and
(2) At the time of the second incidence of flood-related damage, the contract for flood insurance contains increased cost of compliance coverage.

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

(1) Is covered under a contract for flood insurance made available under the NFIP.
(2) Has incurred flood related damage –
    (a) For which four or more separate claims payments (includes building and contents) have been made under flood insurance coverage with the amount of each such claim exceeding $5,000, and with the cumulative amount of such claim payments exceeding $20,000; or
    (b) For which at least two separate claims payments (includes only building) have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the insured structure.

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

Economic Impacts

Flooding can cause large economic impacts to buildings, crop land, and infrastructure. A flood event can also range in size from impacting a single community or waterway to impacting the entire county or watershed. Assessor and floodplain data was used to determine the value of property improvements located in both the 1% annual flood risk area and 0.2% annual flood risk area. It was found that the value of improvements in the 1% floodplain was $510,015,315 and $559,783,862 in the 0.2% floodplain.

During a large flood event it is possible that any roadway or bridge located in the floodplain may face road closures and delays. These closures and delays would continue until floodwaters have receded and any damages have been repaired. Long term closures and delays will have a trickle-down effect on local businesses due to shipping delays, reduced customer access, and other impacts. Highways 18 and 65 through and around Mason City have stream crossings and are partially located in the floodplain. In addition, Balsam Ave south of Ventura crosses a section between Clear Lake Reservoir and Ventura Marsh Wildlife Management Area.

Future Development

Any future development in floodplains should be discouraged or heavily regulated to protect future assets. Land-use regulations should be used to limit development in floodplains and other flood prone areas as well as a way to protect natural flood mitigation features. Buyout programs can be used to eliminate properties located in floodplains, especially properties that have experienced repetitive losses. Communities may also consider incorporating “Green Infrastructure” to address flooding concerns, and examples of this would include using permeable surfaces for parking areas, using rainwater retention swales, developing rain gardens, developing green roofs, and establishing greenways. Cerro Gordo County is emphasizing the importance of green or open space around Clear Lake and major waterways through zoning.

According to the Iowa DNR, building in floodplains can increase flood problems through the following:

- Development anywhere in the watershed can increase the amount of stormwater runoff that goes to the rivers and streams, increasing flood heights.
- Fill and buildings in the floodplain can obstruct flood flows.
- Floodplain development reduces the amount of room available to store floodwaters, increasing flood heights.
- Floodplain development can destroy habitat and other natural floodplain functions.

According to Iowa's floodplain regulations, the minimum level of flood protection for a building depends on the damage potential of the building and contents. Minimum standards for floodplain management require that all new construction and substantial improvements of residential structures shall have the lowest floor (including basements) elevated to or above one foot above the base flood elevation.

Climate Change

In the warmer months, convective storms are common and include flash flood-producing rainstorms. 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 heavy rain events will lead to more flooding and larger magnitude flood events. NOAA has created the Climate Mapping for Resilience and Adaptation tool that looks at how different emission scenarios affect climatological hazards. Table 57 shows that the annual total precipitation is expected to increase in both low emissions and high emission scenarios. During the next century, spring rainfall and average precipitation are likely to increase, and severe rainstorms are likely to intensify. Each of these factors will tend to further increase the risk of flooding in Iowa.[77] Table 58 shows the annual number of days that exceed the 99th percentile precipitation increases as time goes on in both the lower emissions and higher emissions scenario.

Table 57: Average Annual Total Precipitation

County	Emission Scenario	Historical (1976-2005)	Early Century (2015-2044)	Mid Century (2035-2064)	Late Century (2070-2099)
Cerro Gordo County	Lower Emissions (RCP 4.5)	32.5	33.6	33.8	33.9
	Higher Emissions (RCP 8.5)	32.5	33.5	33.8	34.8

Source: NOAA[78]

Table 58: Annual Days that exceed 99th Precipitation

County	Emission Scenario	Historical (1976-2005)	Early Century (2015-2044)	Mid Century (2035-2064)	Late Century (2070-2099)
Cerro Gordo County	Lower Emissions (RCP 4.5)	5 Days	6 Days	6 Days	6 Days
	Higher Emissions (RCP 8.5)	5 Days	6 Days	6 Days	7 Days

Source: NOAA

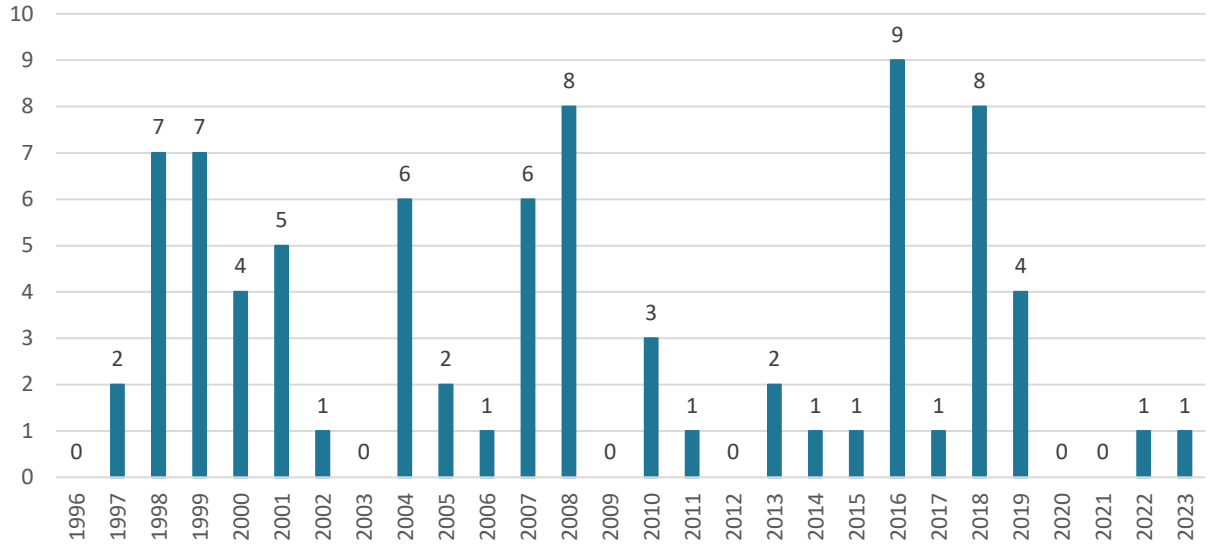
Probability

The NCEI reports 49 flooding and 32 flash flooding events for a total of 81 events from 1996 to 2023. Some years had multiple flooding events. Figure 26 shows the events broken down by year which displays flood events occurred in 22 out of 28 years. Based on the historic record and reported incidents by participating communities, there is a 79% percent probability that flooding will occur annually in any given year for the county.

[77] EPA. 2016. "What Climate Change Means for Iowa". https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-ia.pdf

[78] NOAA. August 2022. "Climate Mapping for Resilience and Adaptation". https://livingatlas.arcgis.com/assessment-tool/explore/details .

Figure 26: Yearly Events for Floods/Flash Floods



Source: NCEI, 1996-2023

Community Top Hazard Status

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

- Cerro Gordo County
- Mason City
- Plymouth
- Rock Falls

Regional Vulnerabilities

In Iowa, Watershed Management Authorities (WMA) are a tool to help cities, counties, Soil and Water Conservation Districts, and stakeholders to work towards watershed planning and management. The Shell Rock River WMA is the only watershed management authority in Cerro Gordo County and covers the western edge and southeastern corner. 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.

An updated national study examining social vulnerability as it relates to flood events found that low-income and minority populations are disproportionately vulnerable to flood events.[79] 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 and renters are more likely to live in areas vulnerable to the threat of flooding yet lack the resources necessary to purchase flood insurance. And finally 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, children, 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

[79] Tate, E., Rahman, M.A., Emrich, C.T. *et al.* Flood exposure and social vulnerability in the United States. *Nat Hazards* (2021). https://doi.org/10.1007/s11069-020-04470-2

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.

Any future development in floodplains should be discouraged to protect future assets. Land-use regulations should be used to limit development in floodplains and other flood prone areas as well as protecting natural flood mitigation features. Buyout programs can be used to eliminate properties located in floodplains, especially properties that have experienced repetitive losses. Communities may also consider incorporating "Green Infrastructure" to address flooding concerns, and examples of this would include using permeable surfaces for parking areas, using rainwater retention swales, developing rain gardens, developing green roofs, and establishing greenways.

Iowa's minimum standards for floodplain management require that all new construction and substantial improvements of residential structures shall have the lowest floor (including basements) elevated to or above one foot above the base flood elevation. These standards also require that new structures for human habitation are not permitted in the floodway. These requirements will help reduce flood impacts and damages by requiring a one foot "freeboard" to allow for known flood hazards and also result in lower premiums for those participating in the NFIP.

To analyze parcels and populations located in the floodplain, GIS parcel data were acquired from the Cerro Gordo 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 59: Parcel Improvements and Value in the 1% Annual Flood Risk Area

Jurisdiction	Number of Improvements	Total Improvement Value ($)	Improvements in 1% Floodplain		
			Number	Percentage	Value
Cerro Gordo County	20,175	$3,654,633,873	1,693	8%	$510,015,315
Clear Lake	3696	$1,046,294,240	302	8%	$167,707,630
Dougherty	72	$3,777,640	0	0%	$0
Mason City	11559	$1,849,444,004	524	5%	$152,306,175
Meservey	157	$5,056,000	1	1%	$3,160
Plymouth	183	$19,663,130	27	15%	$3,262,520
Rock Falls	89	$14,233,070	13	15%	$1,878,600
Rockwell	473	$60,221,786	8	2%	$1,410,140
Swaledale	108	$5,640,360	2	2%	$37,100
Thornton	242	$20,312,310	12	5%	$2,525,610
Ventura	406	$88,858,173	30	7%	$7,153,370

Source: Cerro Gordo County Assessor, 2023

Table 60: Parcel Improvements and Value in the 0.2% Annual Flood Risk Area

Jurisdiction	Number of Improvements	Total Improvement Value ($)	Improvements in 0.2% Floodplain		
			Number	Percentage	Value
Cerro Gordo County	20,175	$3,654,633,873	1,996	10%	$559,783,862
Clear Lake	3696	$1,046,294,240	309	8%	$169,370,600
Dougherty	72	$3,777,640	0	0%	$0
Mason City	11559	$1,849,444,004	782	7%	$195,949,192
Meservey	157	$5,056,000	1	1%	$3,160
Plymouth	183	$19,663,130	31	17%	$3,470,670
Rock Falls	89	$14,233,070	13	15%	$1,878,600
Rockwell	473	$60,221,786	9	2%	$1,411,810
Swaledale	108	$5,640,360	2	2%	$37,100
Thornton	242	$20,312,310	16	7%	$3,053,190
Ventura	406	$88,858,173	31	8%	$7,250,030

Source: Cerro Gordo County Assessor, 2023

Plymouth has the largest percentage of parcel improvements located in the floodplain at 15 percent, which indicates that the city, particularly along waterways, has the greatest flood vulnerability to people and infrastructure. Significant flood events would impact the economy throughout the entire planning area as structures and roadways are damaged.

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

Table 61: 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
National Risk Index Values (Riverine Flooding)	Risk Index – Relatively Low Expected Annual Loss – Relatively Moderate Social Vulnerability – Very Low Community Resilience – Very High

Source: FEMA National Risk Index, 2023

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. As new development encroaches into the WUI, the number of structures and people at risk from wildfires increases.

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. To control the fuel levels, ranchers, farmers, and other land managers will intentionally set fire to vegetation and restore soil nutrients. Causes of wildfires can range from lightning strikes to small burns that get out of control such as campfires or burn piles. 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. These fire danger predictions are updated regularly and should be reviewed frequently by community leaders and fire department officials.

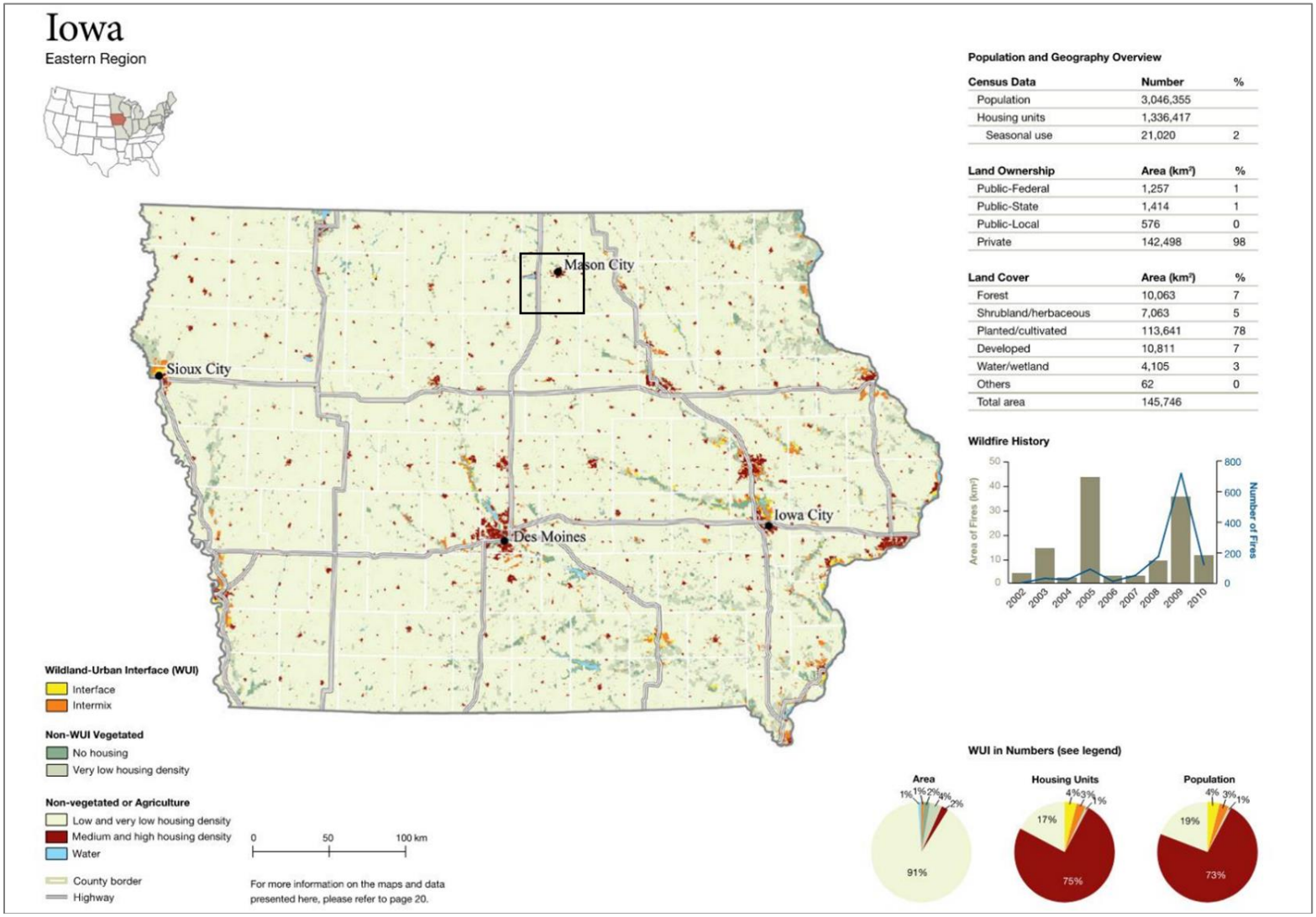
In recent decades, as the population of the United States has decentralized and residents have moved farther away from the center of cities, the WUI has developed significantly, both in terms of population and building stock. The WUI is defined as the zone of transition between developed areas and undeveloped 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 most wildfire mitigation efforts. Iowa's WUI is growing as metro areas expand into natural forest, prairies, and agricultural areas that are in permanent vegetative cover through the Conservation Reserve Program (CRP), of which the state has over 1.5 million acres. Additionally, Iowa has roughly 230,000 acres in federal ownership and conservation easements.

Location

Grass and wildland fires can occur across the entire county. The following figure produced by the USDA Forest Service displays the State of Iowa's WUI conditions as of 2010. It's worth noting that the report identified states in the Midwest including Nebraska and Iowa as states with the smallest WUI area. The

approximate location of the planning area is indicated by the black outline. According to this WUI map (Figure 27), intermix areas (orange) are primarily found in central Cerro Gordo County, near Mason City. The rest of the planning area is primarily non-WUI vegetated designated areas, with no or low-density housing with a mix of vegetated, non-vegetated, and agricultural land. Figure 28 shows the WUI map for Cerro Gordo County.

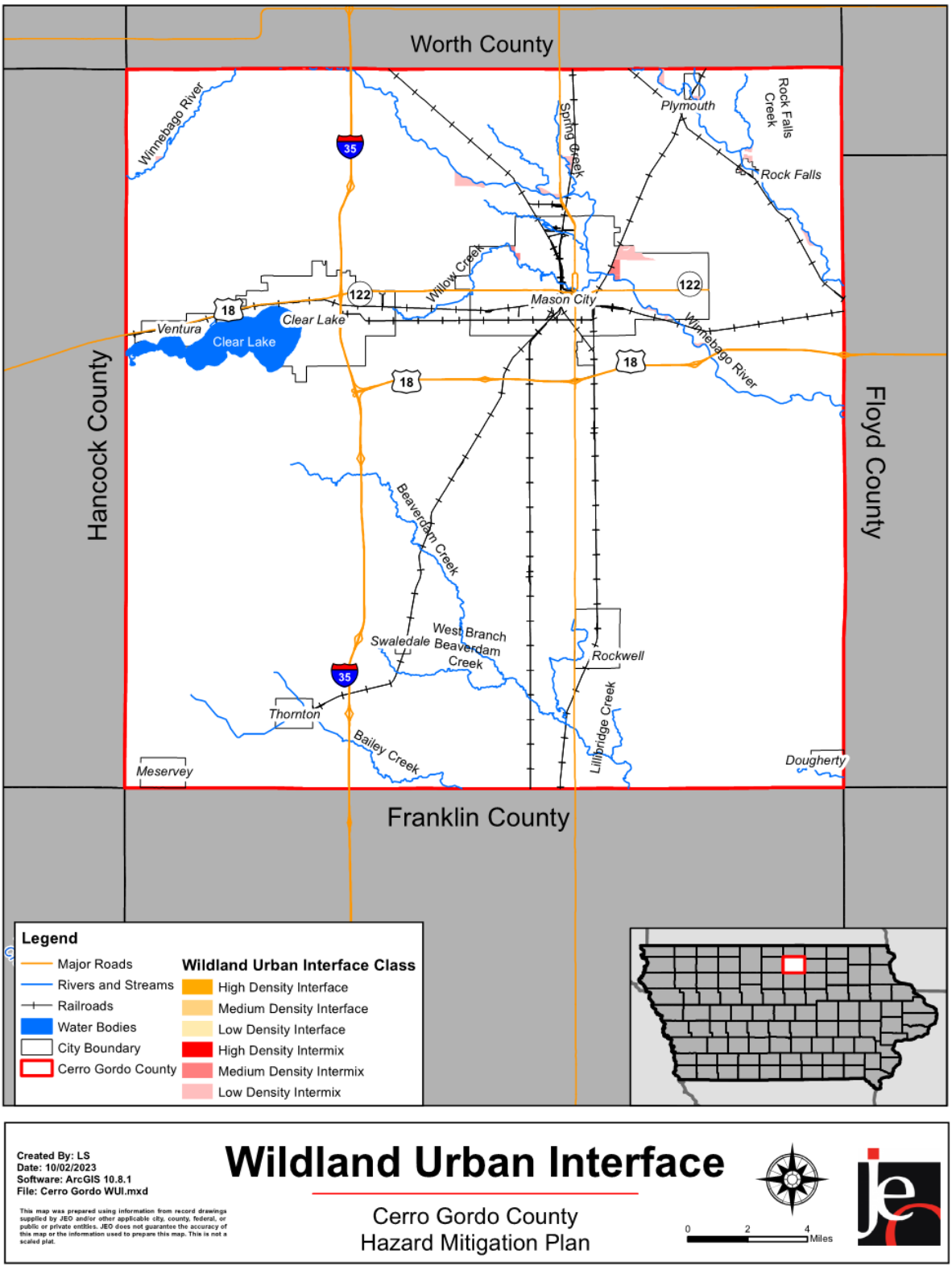
Figure 27: Wildland Urban Interface Map - Iowa



Source: USDA, 2015[80]

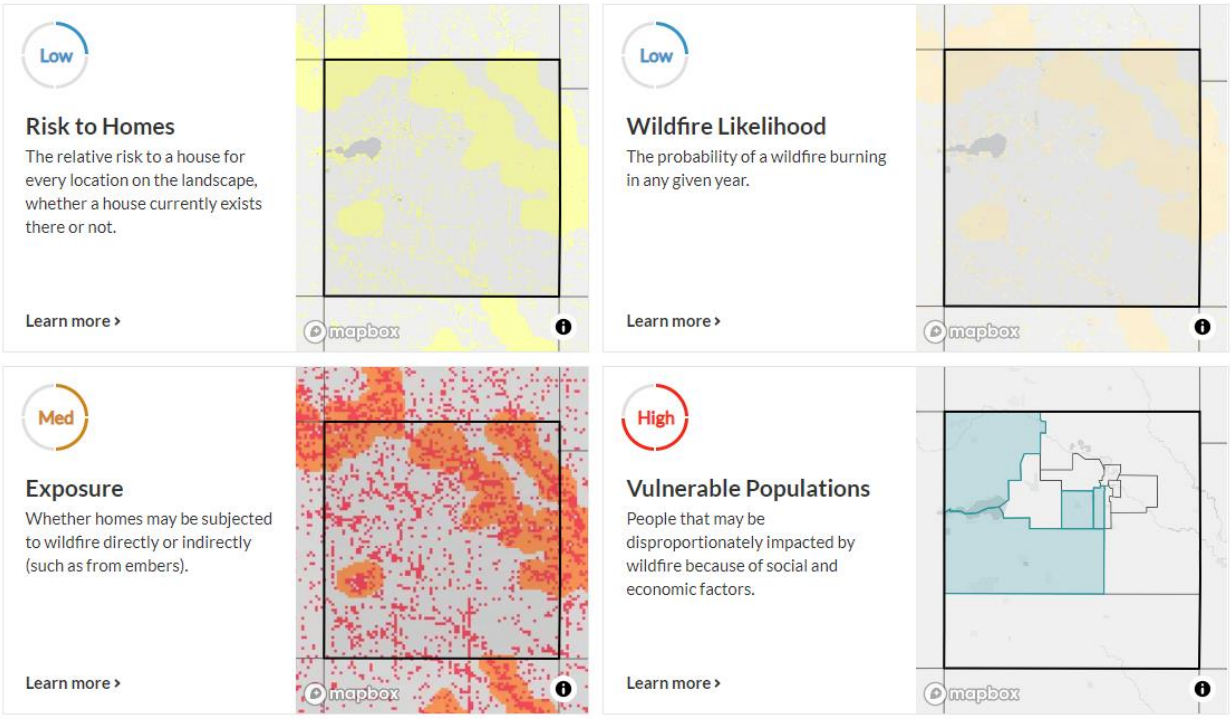
[80] USDA, USFS, & University of Wisconsin. 2015. "The 2010 Wildland-Urban Interface of the Conterminous United States." https://www.fs.fed.us/nrs/pubs/rmap/rmap_nrs8.pdf.

Figure 28: Wildland Urban Interface Map - Cerro Gordo 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 29 displays wildfire risk factors for Cerro Gordo County.

Figure 29: Wildfire Risk Factors



Source: Wildfire Risk to Communities[81]

Table 62: Wildfire Vulnerabilities

County	Risk to Homes (compared to Iowa Counties)	Exposure Type	Wildfire Likelihood (compared to Iowa Counties)
Cerro Gordo	Populated areas in Cerro Gordo County have, on average, greater risk than 6% of counties in Iowa.	Populated areas in Cerro Gordo County are predominantly not exposed and are not likely to be subjected to wildfire directly or indirectly.	Populated areas in Cerro Gordo County have, on average, greater wildfire likelihood than 6% of counties in Iowa.

Source: Wildfire Risk to Communities, 2023[82]

[81] United States Department of Agriculture, United States Forest Service. 2022. "Wildfire Risk to Communities." Accessed January 2023. https://wildfirerisk.org/.

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

Table 63: Wildfire Vulnerable Populations

About vulnerable populations

Social and economic factors can make it more difficult for some people to prepare for, respond to, and recover from wildfire. Vulnerable populations may lack access to resources, experience cultural and institutional barriers, have limited mobility, or have medical conditions exacerbated by stress or smoke.

For example, people over age 65 and people who are disabled are more susceptible to air pollution and particulates associated with wildfire smoke. Language barriers can make it difficult to follow directions during an evacuation or to access support after a disaster. Race and ethnicity are strongly correlated with disparities in health and access to aid and resources. Wildfires disproportionately impact people with low incomes because of factors such as inadequate housing and a diminished ability to evacuate or relocate.

Vulnerable populations
All areas in Cerro Gordo County

Indicator	Number	Percent
Families in poverty	632 ±182	5.5% ±1.6%
People with disabilities	5,841 ±540	13.9% ±1.4%
People over 65 years	9,175 ±598	21.5% ±1.6%
People under 5 years	2,294 ±322	5.4% ±0.8%
People of color	4,304 ±1,940	10.1% ±4.6%
Black	906 ±326	2.1% ±0.8%
Native American	154 ±83	0.4% ±0.2%
Hispanic	2,143 ±532	5% ±1.3%
Difficulty with English	184 ±200	0.5% ±0.5%
Households with no car	1,224 ±245	6.3% ±1.3%
Mobile homes	604 ±204	3.1% ±1.4%

Download detailed report

Data are from the U.S. Census Bureau, American Community Survey. See methods for more information.

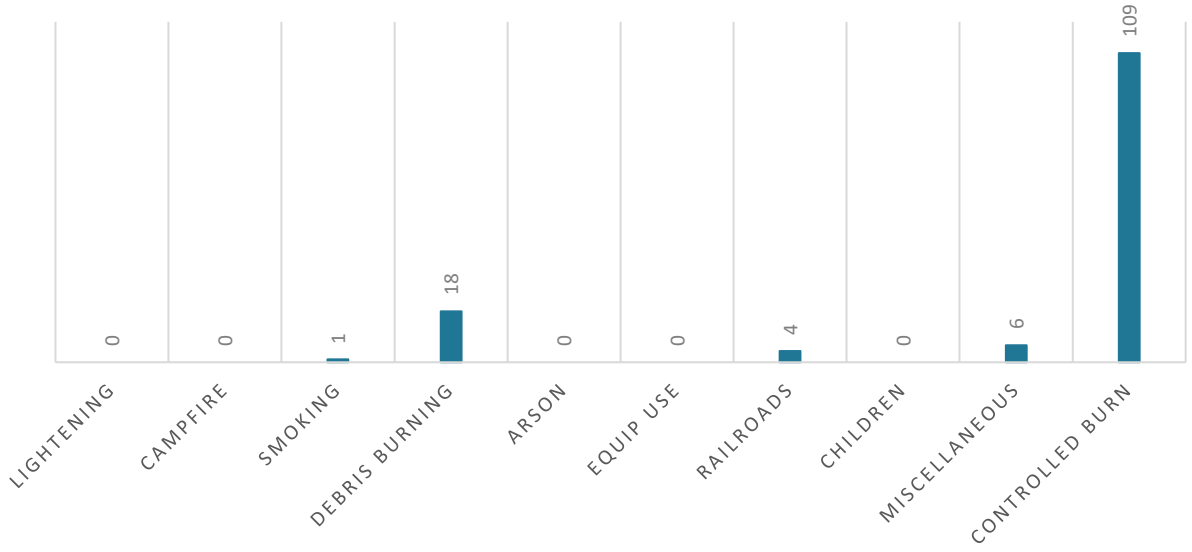
Source: Wildfire Risk to Communities, 2023

Historical Occurrences

It is important to note that there is no comprehensive wildfire event database. Fire events, magnitude, and local responses were reported voluntarily by local fire departments and local reporting standards can vary between departments. Actual fire events and their impacts are likely underreported in the available data. According to IDNR wildland fire supervisor, fire report data in Cerro Gordo County reports from 2009 to 2023. Local fire districts reported a total of 139 wildfires during that time that burned a total of 2,299 acres. The most fires occurred in 2009 with 68 fire events and the largest fire reported by the United States Fish and Wildlife Service and Iowa DNR and burned 502 acres in 2021.

The majority of wildfires in the planning area are caused by controlled burning (78%), with debris burning as the second leading (12.9%) (Figure 30). Wildfires in the planning area have ranged from one to 502 acres, with an average event burning 16.5 acres.

Figure 30: Wildfires by Cause in the Planning Area



Source: IDNR Wildland Fire Supervisor (personal correspondence), 2008-2023

Average Annual Damages

No damages were reported by NCEI or from IDNR, so it is not possible to calculate the average annual damages for wildfire. Additionally, no crop damage was reported to the USDA RMA as being caused by wildfires.

Table 64: Wildfire Loss Estimation

Hazard Type	Number of Events[1]	Events Per Year	Total Property Loss[1]	Average Property Loss per Event[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Wildfires	139	8.7	2,299 acres	16.5 acres	$0	$0

Source: 1 Indicates data is from IDNR (2008-2023); 2 Indicates data is from USDA RMA (2000-2022)

Extent

For Cerro Gordo County, the following fire departments reported wildfire events: Cerro Gordo CCB, Clear Lake Fire Department, Clear Lake State Park, IDNR Clear Lake WMU, Clear Lake Fire Department, DNR State Park, Joice Fire Department, Manly Fire Department, McIntosh Woods State Park, Nora Springs Fire Department, Plymouth Fire Department, and Ventura Fire Department. Fire districts respond to both wildfires and structural fires in cities.

Wildfire is a threat throughout the planning area. Nora Springs Fire Department has reported the greatest number of fires and the greatest number of acres burned.

Table 65: Reported Wildfires by Fire Department

Fire Department	Reported Wildfires	Acres Burned
Cerro Gordo CCB	80	334
Clear Lake Fire Dept.	1	3
Clear Lake State Park	2	5.6
DNR State Parks	5	834.05

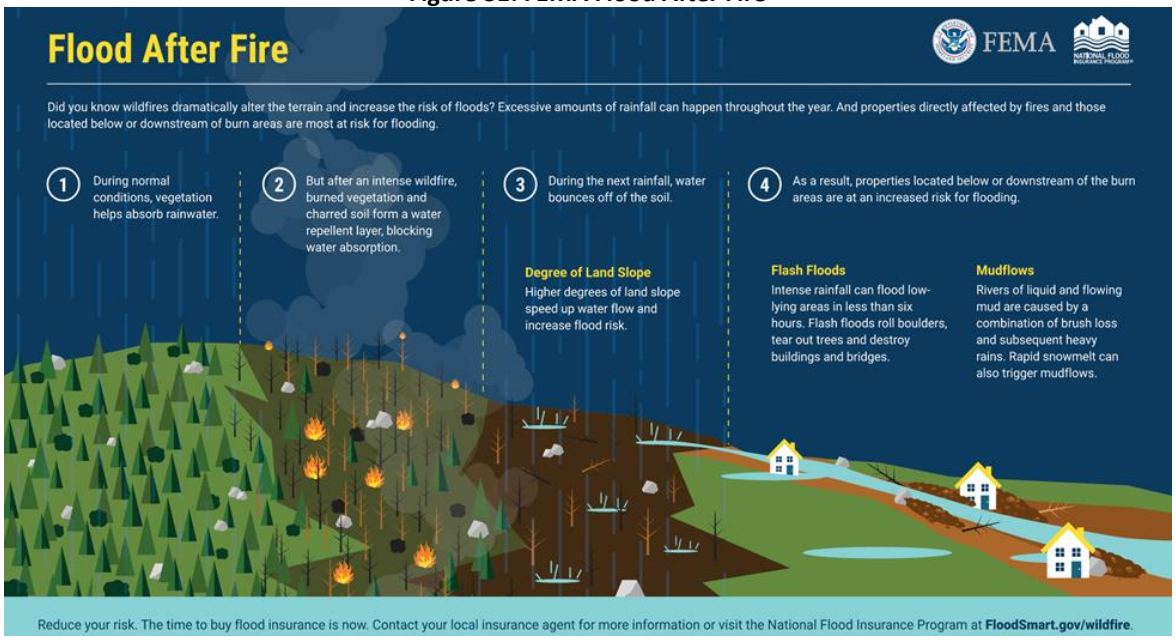
Fire Department	Reported Wildfires	Acres Burned
Joice FD	2	13
Manly Fire Dept	1	7
McIntosh Woods State Park	3	5
Nora Springs	31	697.25
Plymouth Fire Department	0	0.2
Ventura Fire Department	12	399.7
Total	**139**	**2,298.8**

Source: IDNR Fire Supervisor (personal correspondence), 2008-2023

As seen in Table 65 above, wildfires have burned 2,298.8 acres of land. In total, there were 139 reported wildfires in the planning area. The largest wildfire burning 502 acres in 2021.

Wildfire also contributes to an increased risk from other hazard events, compounding damages and straining resources. FEMA has provided additional information in recent years detailing the relationship between wildfire and flooding (Figure 31). 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 31: FEMA Flood After Fire



Source: FEMA, 2020[83]

Climate Change

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 can ignite fires quicker and cause them to spread rapidly. Damages caused by wildfires extend past the loss of building stock, recreation areas, timber, forage, wildlife habitat, and scenic views. Secondary effects of wildfires, including erosion, landslides, introduction of invasive species, and changes in water quality, all increase

[83] 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.

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. Additionally, warmer nighttime temperatures contribute to the continued spread of wildfires over multiple days.[84] With increased drought conditions, grass/wildfires will also likely increase due to dry vegetation and less access to water. Changes in climate can lead to the spread of invasive species, increasing potential fuel loads in wildland areas. The table below shows the change in wildfire danger days in the county with different warming scenarios.

Table 66: Change in Wildfire Danger Days

	Warming Scenarios			
	1° C	1.5° C	2° C	3° C
Change in Wildfire Danger Days	-6-6 Days/Year	-6-6 Days/Year	7-13 Days/Year	14-29 Days/Year

Source: Probable Futures[85]

Economic Impacts

Economic impacts from grass and wildland fire would be to crop land, buildings, and power lines. Road closures may occur due to poor visibility or if in the direct line of the fire. However, closures will be heavily dependent on the size, wind direction, and spread of the fire. Power outages from burned poles and downed lines is very likely but would typically only impact small areas. While grass and wildland fires can occur anywhere in the county, the northeastern corner and areas around the Union Hills Waterfowl Protection Area have the highest wildfire risk and therefore are more likely to see economic impacts. FEMA standard values for traffic delays and electric power can be found in *Section 4: Risk Assessment* under *Average Annual Damages and Frequency*.

Future Development

Future development in the WUI would increase the number of structures and populations vulnerable to wildfires. Of most concern would be development on the edges of communities or other areas that encroach on wildland or natural areas. 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. Additionally, it is advisable to enact a defensible space ordinance which limits availability of fuel in close proximity to residences. Problems can arise if new development increases without coordinated fuels reduction and the creation of defensible space around homes.

Probability

The probability of wildfire occurrence is based on the historic record provided by the IDNR and reported potential by participating jurisdictions. With a grass/wildfire occurring in 12 of the 15-year period of record, there is an 80 percent annual probability of grass/wildfires occurring in the county in any given year.

Community Top Hazard Status

No jurisdictions identified Grass and Wildland Fire as a top hazard of concern.

[84] NASA Global Climate Change. September 2019. "Satellite Data Record Shows Climate Change's Impact on Fires." Accessed 2022. https://climate.nasa.gov/news/2912/satellite-data-record-shows-climate-changes-impact-on-fires/.

[85] Probable Futures. "Maps of Dryness". Accessed December 2022. https://probablefutures.org/ .

Regional Vulnerabilities

The potential for and magnitude of wildland fires will be exacerbated by periods of drought throughout the year and extreme heat conditions during summer months. Drought has a high probability of occurring in the planning area and during a severe drought, dry conditions, and/or windy conditions, large wildfires can more easily spread.

Wildfire poses a threat to a range of demographic groups. Wildfire, wildfire within the WUI, and urban fire could result in major evacuations of residents in impacted and threatened areas. Groups and individuals lacking reliable transportation could be trapped in dangerous locations. Lack of transportation is common among the elderly, low-income individuals, and racial minorities. 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. 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.[86] 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 Mason City or Clear Lake 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 and FEMA's National Risk Index values for Wildfire. For jurisdictional specific vulnerabilities, refer to *Section Seven*.

Table 67: 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

[86] AirNow. 2019. "Wildfire Smoke: A Guide for Healthcare Professionals." Accessed 2022. https://www.airnow.gov/wildfire-smoke-guide-publications/

SECTOR	VULNERABILITY
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
National Risk Index Values	Risk Index – Very Low Expected Annual Loss – Relatively Low Social Vulnerability – Very Low Community Resilience – Very High
Other	-May lead to poor water quality -Post fire, flash flooding events may be exacerbated.

Source: FEMA National Risk Index, 2022

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…" When radiological materials are moved across Iowa highways, state officials are notified, and appropriate escorts are provided. 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. The table below demonstrates the nine classes of hazardous material according to the 2020 Emergency Response Guidebook.

Table 68: 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	-

**The words "poison" or "poisonous" are synonymous with the word "toxic".*
Source: Emergency Response Guidebook, 2020[87]

Location

Iowa has approximately 4,365 facilities across the state that house hazardous materials according to the Tier II reports submitted to the Iowa Department of Natural Resources. Within Cerro Gordo County, there are 97 Tier II facilities. These locations are shown in the following figure and a list of hazardous material storage sites can be found in *Section Seven: Community Profiles* for each jurisdiction. Additionally, Cerro Gordo County is home to a variety of hazardous materials, based on the industries which occur within it. Chemicals are frequently transported through Cerro Gordo County for both agricultural and industrial uses. These chemicals are transported over highways, pipelines, and rail lines.

[87] 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.

Hazardous material releases during transportation primarily occur on major transportation routes as identified in Figure 33. 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. Key transportation corridors in the planning area include an interstate, state highways, and railroads.

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 Cerro Gordo County can be seen below (Figure 34).[88] According to the U.S. Energy Information Administration (EIA) there is the one natural gas pipeline that runs north-south through the county.[89] There is one nuclear power plant within Iowa's borders, the Duane Arnold Energy Center, but it is in Linn County and is over 100 miles away from Cerro Gordo County (Figure 35). 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.[90]

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

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

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

Figure 32: Fixed Chemical Sites in the County

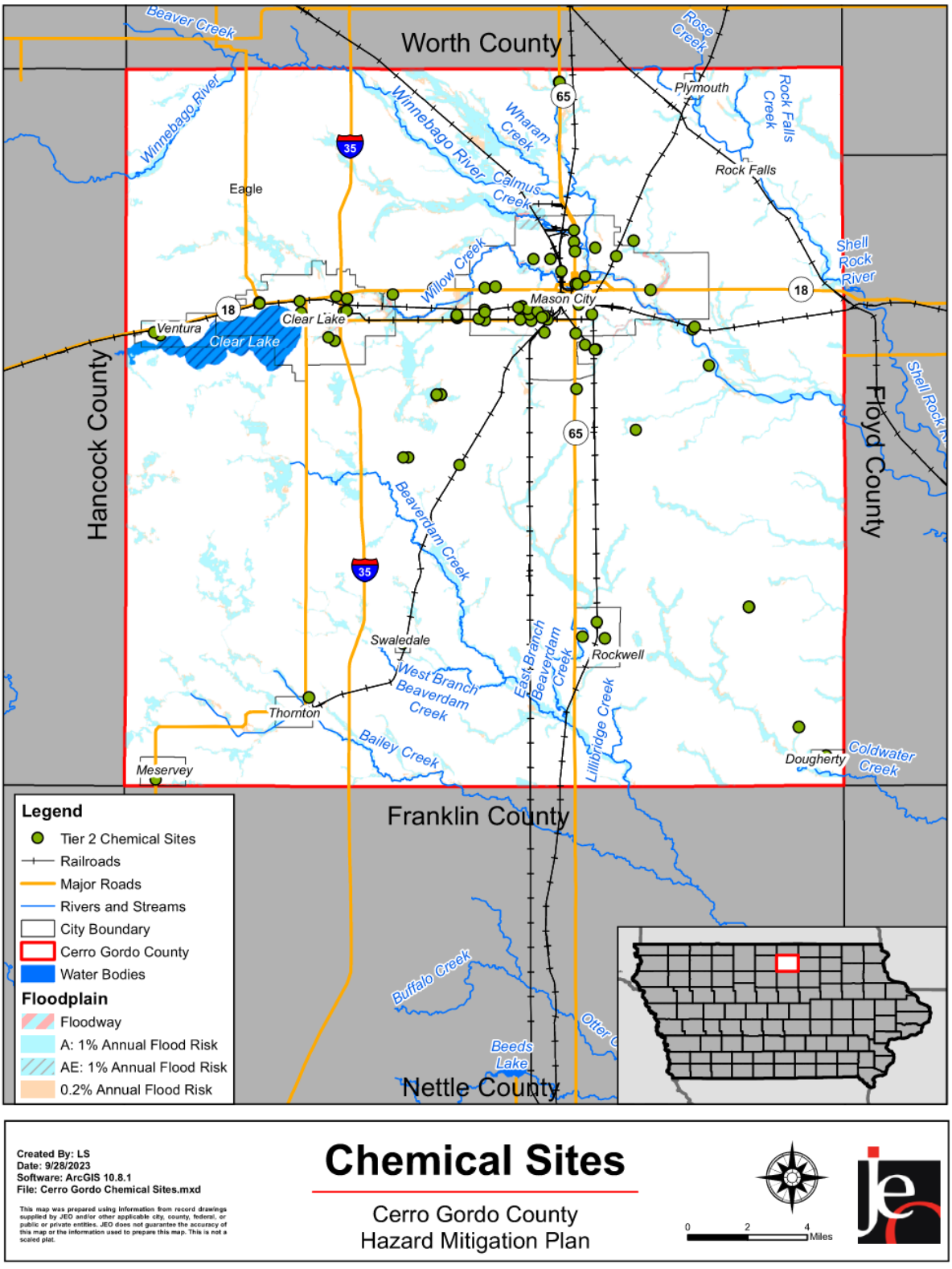


Figure 33: Major Transportation Routes with Half Mile Buffer

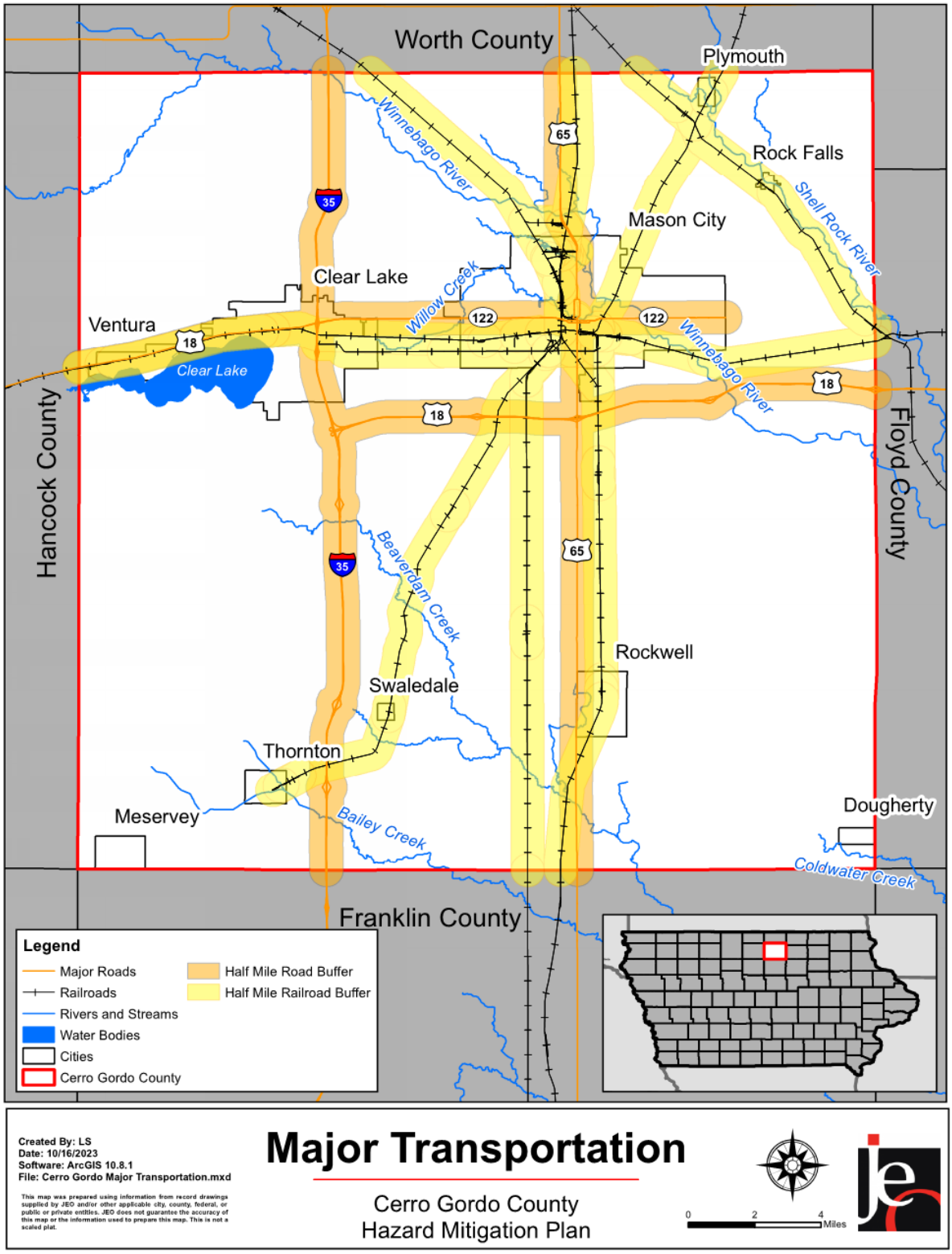
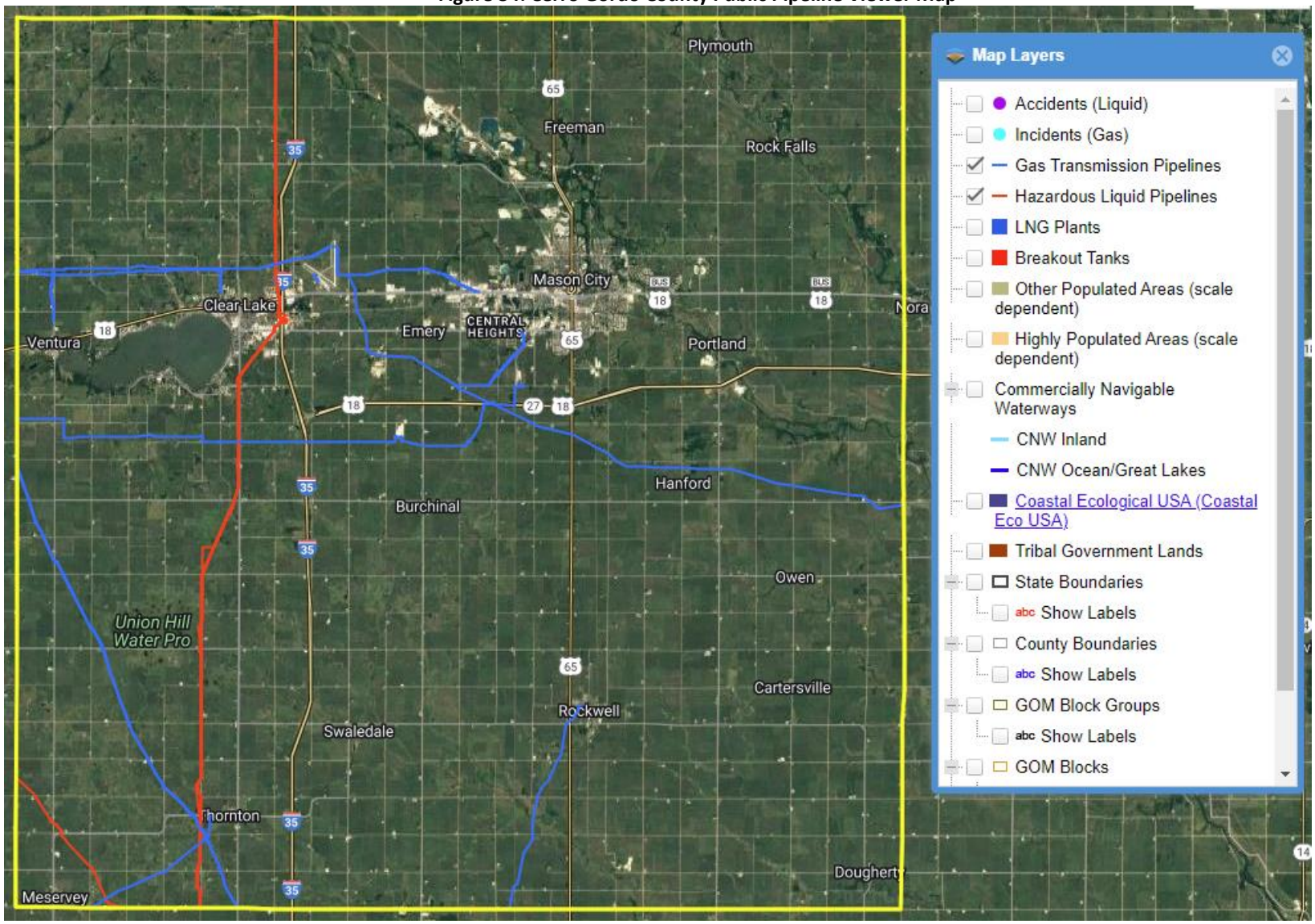
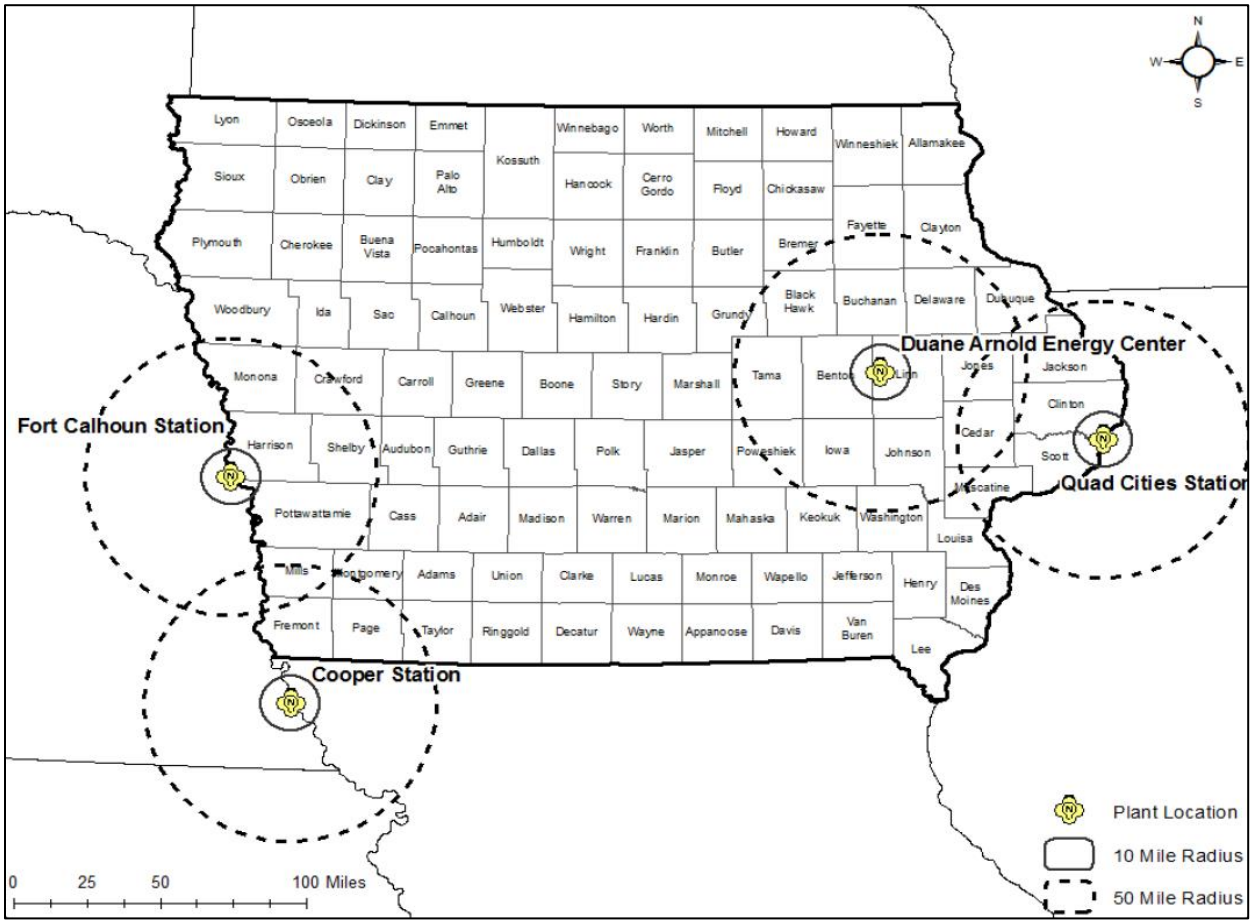


Figure 34: Cerro Gordo County Public Pipeline Viewer Map



In 1984, 641 Iowa Administrative Code, Chapter 136C was amended to give the Governor authority to enter into an agreement with the U.S. Nuclear Regulatory Commission (NRC) to regulate the use of all radioactive materials in Iowa. There is one radiological fixed site in Iowa, the Duane Arnold Energy Center Plant in Linn County. The Fort Calhoun Station and Cooper Station are located in Nebraska and the Quad Cities Station located on the eastern border of Iowa within Illinois. Cerro Gordo County is located closest to the Duane Arnold Energy Center but is outside of the 50-mile radius from any station.

Figure 35: Iowa Nuclear Power Impact, 2018

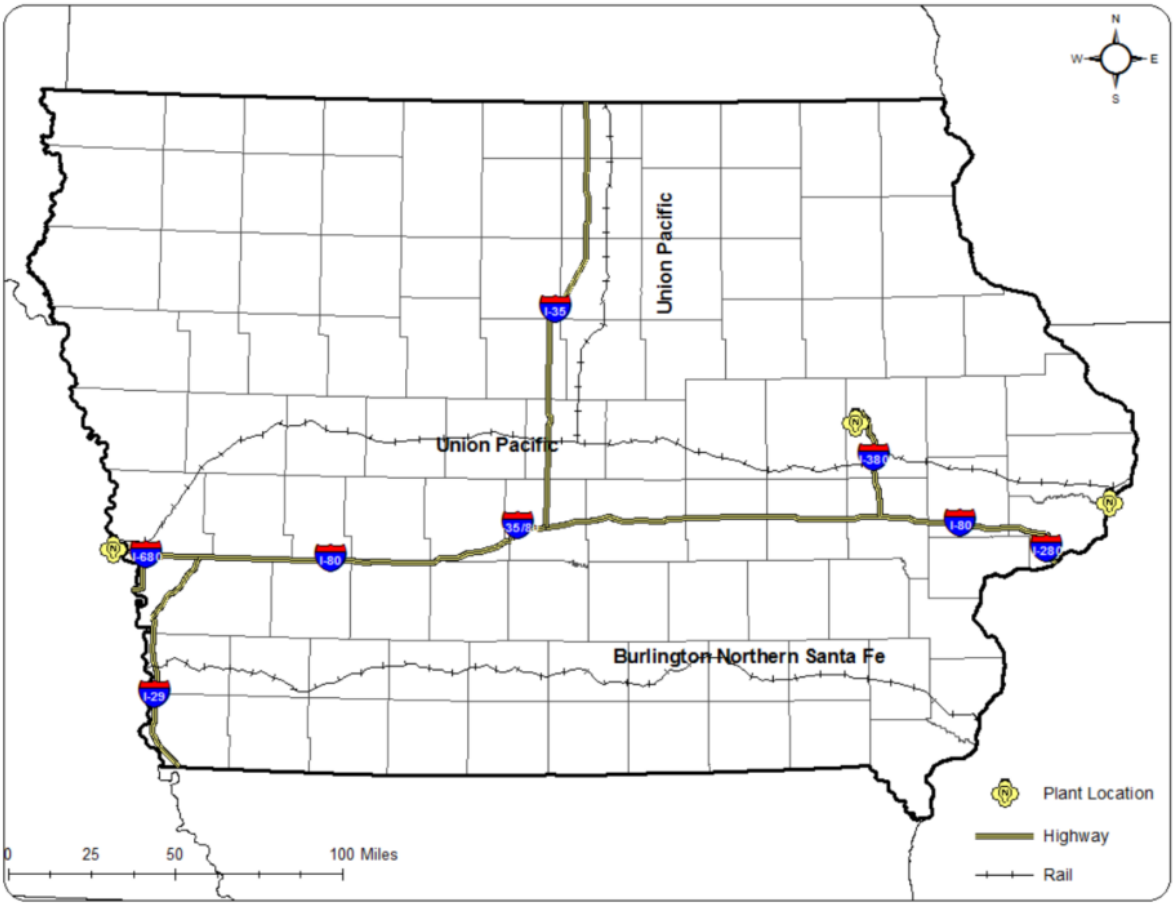


Source: Iowa Hazard Mitigation Plan, 2018

I-35 and rail lines through Cerro Gordo have been identified as a major thoroughfare for nuclear waste (Figure 36). Transport of nuclear waste is a highly regulated process; however, incidents can still occur due to mismanagement, equipment failures, or human error.

Figure 36: Nuclear Waste Transport Routes

Potential Transportation Routes for Nuclear Waste. Source: Nevada Agency for Nuclear Projects



Source: Iowa Hazard Mitigation Plan, 2018

Historical Occurrences

Fixed Site Spills

According to the U.S. Coast Guard's National Response Center database (NRC), there have been 55 fixed site chemical spills from 1990 to 2023 in the planning area. While no events reported property damages there was one event with 40 injuries, one event with one injury and 50 evacuations, and one event with 130 evacuations. The following table displays the larger spills or spills which caused damages that have occurred throughout the planning area (>500 gallons).

Table 69: Large Fixed Site Chemical Spills

Date	Location of Release	Quantity Spilled	Material Involved	Injuries	Evacuations
1993	Mason City	50 lbs	Chlorine	1	50
2012	Mason City	4.3 million cubic feet	Natural Gas	0	130
1997	Clear Lake	Unknown	Naphtha	40	0
1990	Clear Lake	18,000 gallons	Nitrogen Solution	0	0

Date	Location of Release	Quantity Spilled	Material Involved	Injuries	Evacuations
1999	Mason City	15,000 lbs	Freon	0	0
1997	Mason City	2,500 gallons	Oil	0	0
1993	Mason City	2,000 gallons	Hydraulic Oil	0	0
1994	Mason City	600 lbs	Anhydrous Ammonia	0	0
2000	Mason City	518 lbs	Xylene	0	0

Source: National Response Center, 1990- 2023

Transportation Spills

According to PHMSA, 152 hazardous materials releases occurred during transportation in the planning area between 1971 and 2023. During these events, there were no evacuations, injuries, or fatalities; however, the spills cost a total of $145,591 in damages. The following table provides the most costly historical transportation chemical spills.

Table 70: Chemical Transportation Spills

Date of Event	Location of Release	Failure Description	Material Involved	Mode	Total Damage
4/19/2020	Mason City	Loose Closure	AMMONIA ANHYDROUS	Rail	$50,000.00
3/5/2020	Clear Lake	Human Error	DIESEL FUEL	Highway	$22,861.00
5/27/2008	Mason City	Human Error	FERRIC CHLORIDE, SOLUTION	Highway	$10,500.00
1/4/2013	Clear Lake	Puncture	DIESEL FUEL	Highway	$7,660.00
7/23/2006	Mason City	Over-pressurized	PHOSPHORIC ACID SOLUTION	Rail	$5,640.00

Source: PHMSA, 1971-2023

Radiological Incidents

There have been no incidents reported in the planning area or the state. Radiological transport incidents are the most common type of incident due to sheer volume of shipments made; however, there have been no events that have required assistance beyond what is considered regular roadside services. Further, the transportation of radiological materials is heavily regulated and monitored. There are other plans across the state that have thoroughly addressed this threat.

Average Annual Damages

There have been 55 fixed site spills in the planning area reported from the NRC and 152 transportation spills as reported by PHMSA. Neither the NRC nor PHMSA track crop losses from chemical spills. These events reported $145,591 in property damages. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life.

Table 71: 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)	55	1.6	0	0	$0	$0
Hazardous Materials Release (Transportation)	152	2.9	0	0	$145,591	$2,747

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

Extent

The extent of chemical spills at fixed sites varies and depends on the type of chemical that is released. The probable extent of chemical spills during transportation is difficult to anticipate and depends on the type and quantity of chemical released. In total 55 fixed site releases have occurred in the planning area[91], and the total amount spilled ranged from half a gallon to 18,000 gallons and 50 pounds to 15,000 pounds of product. Of the chemical spills, there was one event with 40 injuries, one event with one injury and 50 evacuations, and one event with 130 evacuations.

In total, 152 releases have occurred during transportation in the county. Transportation spills ranged from 0 liquid gallons of material released to 250 liquid gallons released. No events led to evacuations, injuries, or fatalities. Based on historic records, it is likely that any spill involving hazardous materials will not affect an area larger than a quarter mile from the spill location.

Climate Change

Climate trends are not anticipated to have a direct impact on hazardous materials releases. However, as events continue to impact infrastructure used by and for hazardous materials, future spills will likely occur. For example, flooding is likely to increase, which could damage roadways and pipelines causing more spills to occur.

Economic Impacts

Transportation is the most likely sector to see economic impacts from a hazardous materials release. During a chemical spill nearby roads may be partially or fully closed until the spill has been cleaned up and the area is deemed safe. For most releases, delays will be minimal with nearby alternate routes available. However, if a large spill were to occur on one of the state highways, delays and closures could last longer. Since many transportation spills occur during vehicle accidents, delays may take longer as the crashes get cleaned up as well. FEMA standard values for traffic delays can be found in *Section 4: Risk Assessment* under *Average Annual Damages and Frequency*.

Future Development

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 transport. Specific vulnerabilities exist for critical facilities or vulnerable population centers (schools, daycares, hospital, etc.) which are

[91] U.S. Coast Guard National Response Center. 2022. "Chemical Pollution and Railroad Incidents, 1990-2022.". http://nrc.uscg.mil/.

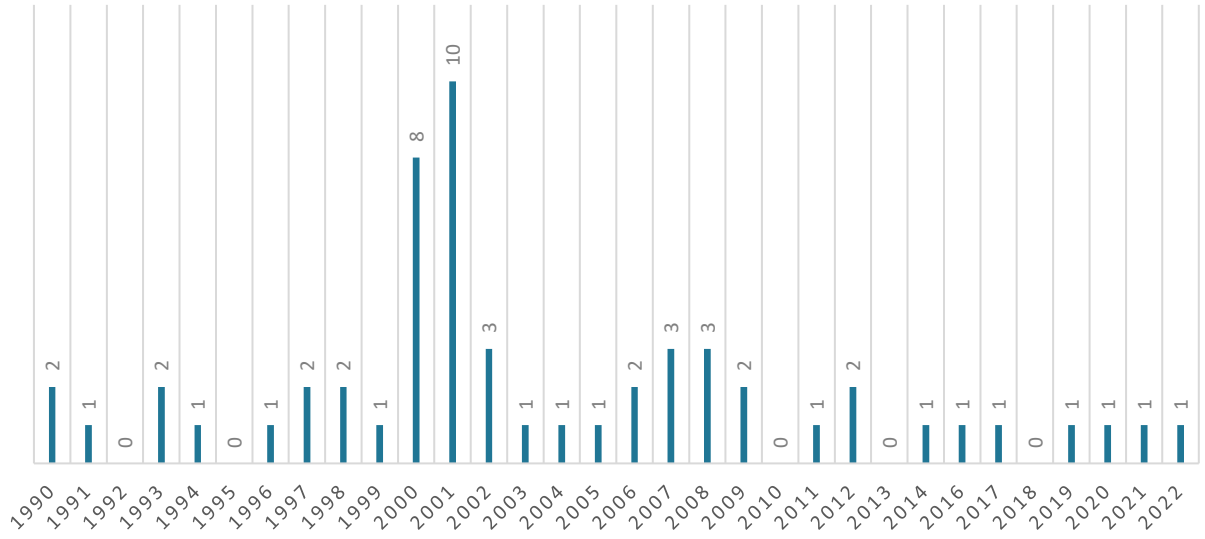
most heavily populated during the daytime as most chemical transportation incidents occur during the weekday daytime hours.

Probability

Given the historic record of occurrence for fixed chemical spill events (at least one chemical spill reported in 27 of 33 years), for the purposes of this plan, the annual probability of a fixed chemical spill is 82 percent. Given the historic record of occurrence for chemical transportation spill events (31 out of 33 years with a reported event), for the purposes of this plan, the annual probability of chemical transportation occurrence is 94%.

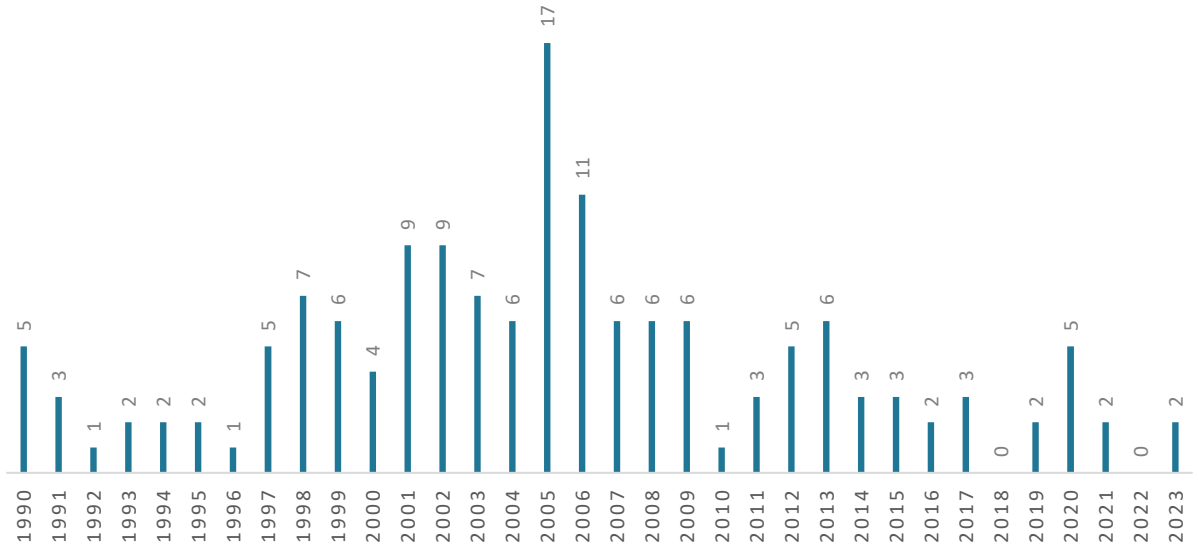
No nuclear plant evacuations or incidents have occurred which have impacted Cerro Gordo County. As the county is outside the localized evacuation extent (i.e. 10-mile radius) and the greater evacuation extent (50-mile radius) it is unlikely such an event would directly impact the planning area. If an event were to occur at the Duane Arnold Energy Center station, the surrounding radius may not be affected depending on the type of accident and the weather conditions.

Figure 37: Chemical Fixed Site Spills by Year



Source: National Response Center, 1990-2023

Figure 38: Chemical Transportation Spills by Year



Source: PHMSA, 1990-2023

Community Top Hazard Status

The following jurisdictions identified Hazardous Materials Releases as a top hazard of concern:

- Mason City
- Plymouth

Regional Vulnerabilities

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

Table 72: 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

Infrastructure Failure

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

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

According to the American Society of Civil Engineers' (ASCE) 2019 Infrastructure Report Card, Iowa received an overall grade of C. The Infrastructure Report Card is updated every four years with the goal of depicting the condition and performance of infrastructure systems. The Report Card utilizes letter grades similar to those used for school report cards. Using this classification, an "A" would indicate a state is exceeding expectations; an "F" is failing to meet expectations. Thus, a "C" indicates slightly below expected standards. Specifically, for Iowa, bridges, dams, wastewater, inland waterways, received a below expected score (C- to D-). This is largely consistent with reports from residents and members of the local planning teams.[92]

America's electric grid is made up of more than 450,000 miles of high voltage transmission lines. Comprised of the West, East, and Texas power grids, these grids supply more than 140 million customers over industries, businesses and residences with electricity. Major power utilities in Cerro Gordo County include Alliant Energy, Prairie Energy, and Franklin Rural Electric Cooperative.

Location

Infrastructure failure is not correlated to a specific geographic area. Rather, the entire county and all areas with built infrastructure are at risk. Locations of potential infrastructure failure may be centered where major transportation corridors exist or electrical power is supplied. Cerro Gordo County's electrical power is provided by Interstate Power and Light Company (IPL), owned by Alliant Energy, Mid America Energy, and four Rural Electric Companies (REC), Prairie Energy, Franklin REC, Butler County REC, and Heartland Power.

Historical Occurrences

There is no known database for recording specific infrastructure failure, and thus, previous occurrences may not be calculated. However, power loss reports are often listed as an impact from other hazard events in the NCEI Storm Events database. While these events are counted under other hazard profiles and are not included here, descriptions of major events are provided below.

- February 17, 2007 – An Ice Storm/Blizzard created a power outage for 8,000 Alliant customers in the Mason City Region including the communities and rural areas of Clear Lake, Mason City, Meservey, Plymouth and Rockwell. Some customers were without service for three days or more.
- March 10, 2007 – An explosion at a substation near the Franklin County border took out power to the communities of Rockwell and Dougherty for 3 hours.

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

- June 2008 – A large portion of Mason City including Mercy Medical Center – North Iowa lost power nearly twenty-four hours due to flooding which destroyed a substation in downtown Mason City.
- June 22, 2015 – The community of Plymouth was without power for half a day as a result of high winds from a fast moving strong thunderstorm
- May 17, 2017 – 717 customers in Cerro Gordo County were without power for several hours as a result of severe storms.
- July 17, 2017 – 3,500 residents in Clear Lake and 200 residents in Mason City were without power for most of the day due to severe storms
-

Average Annual Losses

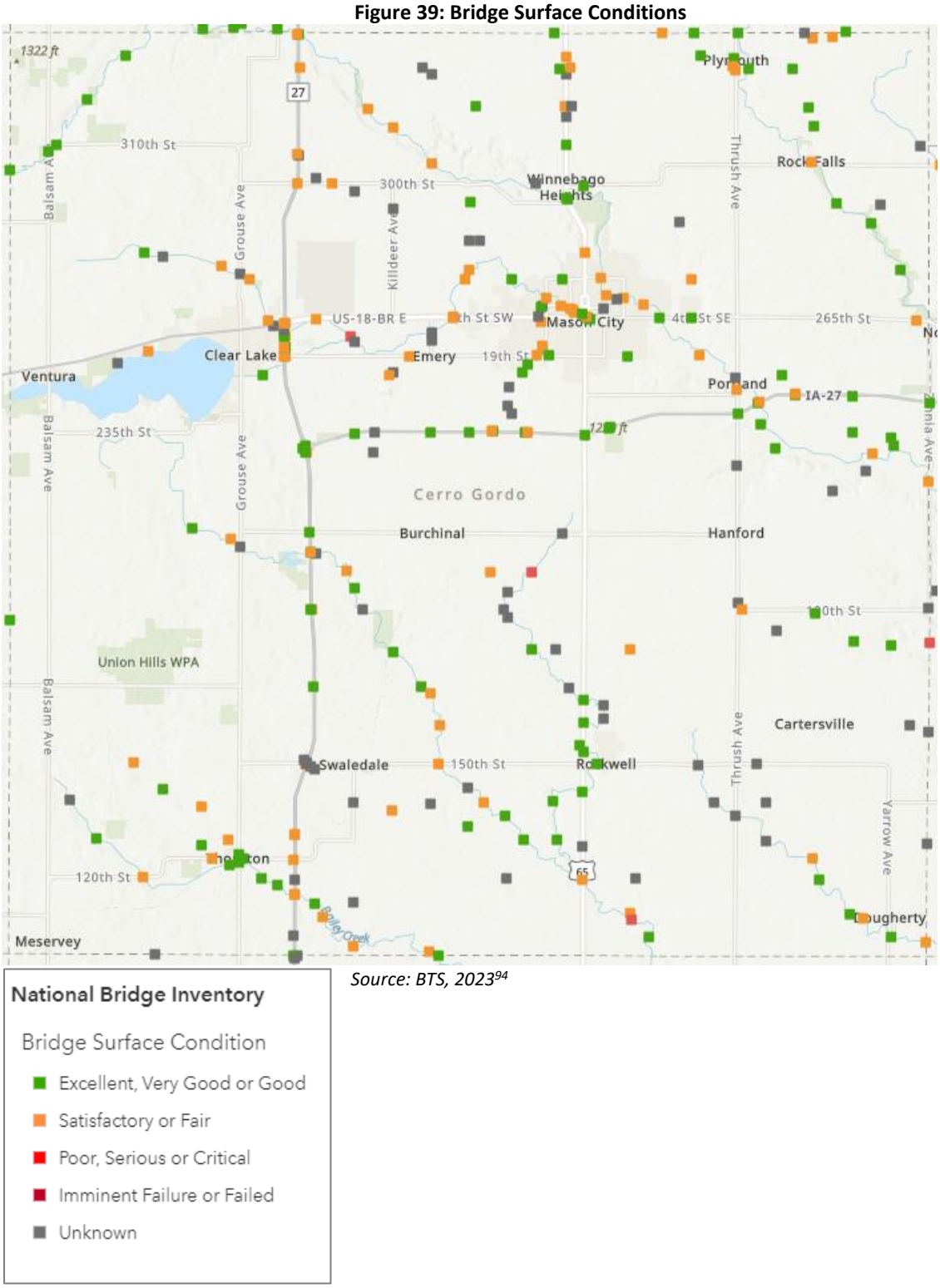
Due to lack of data, potential losses are not calculated for this hazard.

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, Cerro Gordo County has 265 bridges with 11% of those bridges in poor condition and 89% in medium to fair condition.[93] Figure 39 displays the bridge surface conditions for Cerro Gordo County.

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

Figure 39: Bridge Surface Conditions



Source: BTS, 2023[94]

[94] Bureau of Transportation Statistics. Accessed August 2023. "National Bridge Inventory." https://www.arcgis.com/home/item.html?id=a0fa29a39fe444a97d4337c569b9801

Key infrastructure in Cerro Gordo County is provided through local utilities. Power companies with infrastructure in the county include Alliant Energy (provides services in Clear Lake, Meservey, Swaledale, Plymouth, Thornton, Mason City, Rock Falls, and Ventura), Prairie Energy (provides services to un-incorporated cooperative areas), and Franklin Rural Electric Cooperative (provides services to Dougherty). The majority of fuel consumed in Cerro Gordo County is natural gas and there are two power plants in the county – Emery Station (Clear Lake) and Hawkeye Power Partners (Ventura). The majority of power lines throughout the county are above ground and subject to damages during storm events.

Climate Change

According to the Fourth National Climate Assessment severe weather is more likely due to climate change. Severe weather events 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.[95] Critical facilities and vulnerable populations that are not prepared to handle periods of power outages, particularly during heat waves, will be at risk. Increased failures of infrastructure not built to withstand heavy rain, flooding, ice, hail, heavy snowfall, or other severe weather is likely.

Economic Impacts

Infrastructure failure can cause large economic impacts to the county and local communities. Roadway failure is unlikely to cause major delays unless it occurs on one of the state highways the travel through county. This is because the roadway failure will likely be limited to a small area with alternate routes available. Bridge failure could cause longer delays as there may be fewer alternate routes available for people to take. Other infrastructure failure like water lines, sewer lines, power lines, and communication equipment may have larger impacts depending on the population served and redundancies available. FEMA standard values for traffic delays, electric power loss, potable water loss, wastewater loss, and IT/communication loss can be found in *Section 4: Risk Assessment* under *Average Annual Damages and Frequency*.

Future Development

To limit vulnerability from infrastructure failure events, it is recommended that aging infrastructure be replaced or updated as communities grow or improve local infrastructure. Continued development of our community's residential and industrial areas will require new power distribution lines, generating plants, and substations, increasing vulnerability.

Probability

There is no data available that would provide a basis for estimating infrastructure failure in Cerro Gordo County. However, as infrastructure throughout the county is aging and deteriorating, it is reasonable to assume a failure of some form will occur annually. Additionally, the county annually experiences the impacts from ice storms, severe thunderstorms with high winds and blizzards which in turn lead to power outages. Cyberattacks are also a rising threat and power grid systems are a likely target adding to the probability of power outages either localized or regional.

Community Top Hazard Status

The following jurisdictions identified Infrastructure Failure as a top hazard of concern:

[95] 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.

- Plymouth

Regional Vulnerabilities

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

Table 73: 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 - Worsening severe winter storms, severe thunderstorms, and tornadoes can exacerbate this hazard

Pandemic Human Diseases

According to the World Health Organization (WHO), a public health emergency is:

> *"an occurrence or imminent threat of an illness or health condition, caused by bio terrorism, epidemic or pandemic disease, or (a) novel and highly fatal infectious agent or biological toxin, that poses a substantial risk of a significant number of human fatalities or incidents or permanent or long-term disability" (WHO, 2001). The declaration of a state of public health emergency permits the governor to suspend state regulations and change the functions of state agencies.*[96]

The Iowa Hazard Mitigation Plan defined a human disease incident as "a medical, health, or sanitation threat to the general public, including contamination, epidemics, plagues, or infestations".

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 public health emergencies 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 a public health emergency. Using multiple NPIs simultaneously can reduce influenza transmission in communities even before vaccination is available.[97]

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.

[96] World Health Organization. 2008. Accessed April 2020. "Glossary of humanitarian Terms." https://www.who.int/hac/about/definitions/en/.
[97] 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.

- 1957 H2N2 Virus: a new influenza A virus emerged in Eastern Asia and eventually crossed into coastal U.S. cities in summer of 1957. In total 1.1 million people worldwide died of the flu with 116,000 of those in the United States.

- 1968 H3N2 Virus: an influenza A virus discovered in the United States in September 1968 which killed over 100,000 citizens. The majority of deaths occurred in people 65 years and older.

- 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 February 2, 2021, the CDC reported over 78,900,375 cases and 950,112 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.

Public health departments require 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. CG Public Health serves all of Cerro Gordo 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 between 2019 and 2022.

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.[98] Outbreaks in Iowa were typically seen sporadically. The U.S. Public Health Emergency for the H1N1 Influenza outbreak expired on June 23, 2010. The CDC developed and encouraged all US residents to receive a yearly flu vaccination to protect against potential exposures. The H1N1 continues to appear annually and persons in the planning area are at risk of infection in the future.

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

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

The table below displays COVID-19 data reports from the Iowa COVID-19 Tracker between March 8, 2020 and March 29, 2023 for Cerro Gordo County. Note that due to health data privacy concerns and political considerations during the COVID-19 pandemic, reported numbers are likely much lower than what actually occurred.

Table 74: COVID-19 Cases in Cerro Gordo County

Population	Total Number of Tests	Confirmed Cases	Fatalities
43,127	90,032	79,227	1,185

Source: Iowa Department of Public Health, 2023[99]

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.[100] However, associated costs with pandemic response are much greater. Current estimated costs for COVID-19 in the United States exceed $1.4 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.

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 23% of the planning area's population is 18 years or younger, and 21% of the planning area is 65 years or older. These factors increase vulnerability to the impacts of outbreaks. It is not possible to determine the extent of individual public health emergency events, as the type and severity of a novel outbreak cannot be predicted. However, depending on the disease type, a significant portion of residents may be at risk to illness or death.

The extent of human infectious diseases is closely tied to the proximity or availability of health centers and services. There are two hospitals in the county and several nursing facilities and health clinics. Immunodeficiency disorders (such as diabetes), obesity, or other pre-existing health complications reduce

[99] Iowa Department of Public Health. September 26, 2022. "COVID-19 Reporting". https://idph.iowa.gov/Emerging-Health-Issues/Novel-Coronavirus/COVID-19-Reporting

[100] 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.

the ability of the body to fight infection. Diabetes prevalence is slightly higher in Cerro Gordo County (9.4%) than compared to the State of Iowa (9%). [101]

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.

Climate Change

Shifting climatic conditions 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 the midwest. These types of zoonotic disease may initially spread faster as the local population is not aware of the proper steps to reduce their risk. 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.[102]

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.

It is estimated that over the next 30 years, 143 million people are likely to migrate to other areas due to the effects of climate change like increasing sea levels, drought, and other climate disaster events.[103] This global migration could lead to increased public health emergencies as different population groups come more in contact with each other and are exposed to different pathogens.

Economic Impacts

As seen with the COVID-19 pandemic, human disease can have economic impacts on nearly every sector of the economy. A localized community or county outbreak can stress local governments and businesses with employees out sick. However, it is not likely to have large impacts on the cost of shipping, goods, and other raw materials. A large-scale state, national, or global outbreak will see similar stresses with employees out sick but could also see those larger impacts. During the COVID-19 pandemic, costs of raw

[101] Centers for Disease Control and Prevention. 2019. "Diagnosed diabetes prevalence – Iowa." https://gis.cdc.gov/grasp/diabetes/DiabetesAtlas.html.

[102] Asthma and Allergy Foundation of America. 2010. "Extreme Allergies and Climate Change." Accessed 2022. https://www.aafa.org/extreme-allergies-and-climate-change/.

[103] Intergovernmental Panel on Climate Change. 2022. "Climate Change 2022: Impacts, Adaptation and Vulnerability". https://www.ipcc.ch/report/ar6/wg2/.

materials and shipping increased dramatically due to production slowdowns and shutdowns across the globe. This forced many local businesses to increase prices of their products in order to stay viable. Some businesses in the county were forced to close due to increased costs and less customers.

IRUA identified human disease as a hazard of concern. The major concern associated with this hazard is if there is an outbreak, such as Covid, it could impact personnel staffing for the district, thereby affecting its ability to operate the water system effectively. With 61 staff members, any significant outbreak that results in a large number of employees being unable to work could cause a major problem for the district.

Future Development

To limit further vulnerability from future human disease events, it is recommended that those involved in public health initiatives continue to emphasize educational materials. The county intends to pursue further training opportunities for first responders. Areas with dramatic increases in development should prioritize the development of adequate health care facilities, staff, and resources.

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

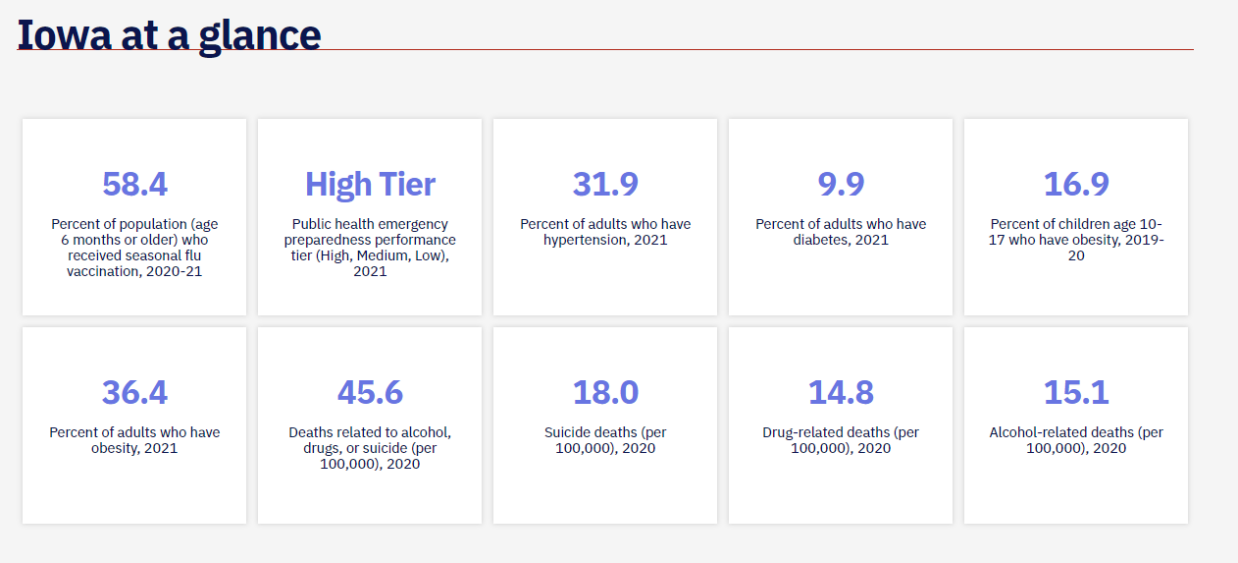
The following jurisdictions identified Pandemic Human Diseases as a top hazard of concern:

- Cerro Gordo County

Regional Vulnerabilities

An independent study conducted in 2019 by Trust for America's Health gave Iowa a score of four out of ten for their efforts to reduce vulnerability to the spread of infectious diseases. The report noted: "Iowa's public health outcomes stack up unevenly against those of the United States, and it has not taken several steps that would strengthen its preparedness for public health emergencies. Deaths owed to drug misuse, alcohol, or suicide trail the country as a whole. Its rates of obesity and related conditions indicate a mixed picture, with the percentage of adults with obesity higher than the U.S. median, even as rates of diabetes and hypertension rank in the middle of the pack. Finally, the state achieved a score of four out of a possible 10 measures of public health preparedness for diseases, disasters, and bioterrorism." The following figure describes Iowa's overall statistics.

Figure 40: Trust for America Public Health Statistics



Source: Trust for America's Health, 2019

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

Table 75: 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	-Transportation routes may be closed if a quarantine is put in place -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	-Spread of insects or pests carrying zoonotic diseases -Increases spread and exposure to allergens and pollutants in air and water

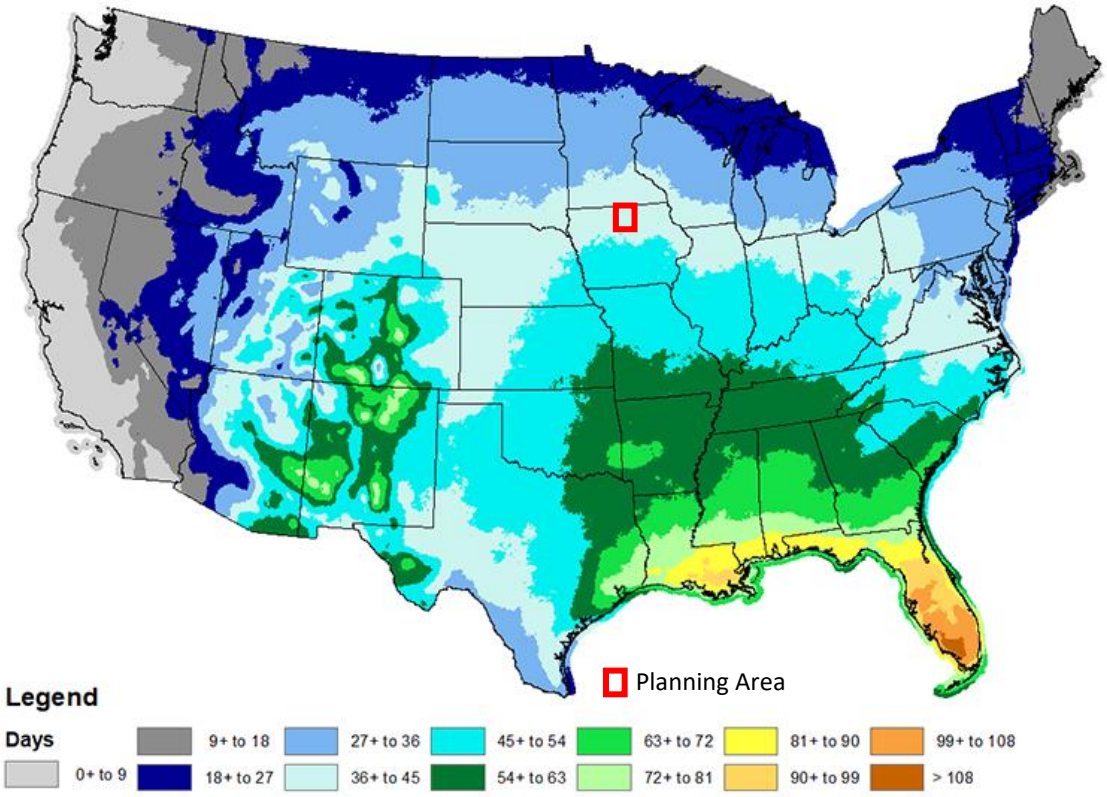
Severe Thunderstorms

(*Includes Hail and Lightning*)

Severe thunderstorms are common and unpredictable seasonal events throughout Iowa. 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 generally occurs when warm air mixes with colder air masses resulting in atmospheric disturbances necessary for polarizing the atmosphere. Lightning can strike up to 10 miles away from the rainfall area. 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 most impacted when lightning meets the ground. Severe thunderstorms most often occur in Iowa in the spring and summer, during the afternoon and evenings, but can occur at any time. Figure 41 displays the average number of days with thunderstorms across the country each year. The planning area experiences an average of 36 to 45 thunderstorms over the course of one year.

Figure 41: Average Number of Thunderstorms (1993-2018)



Source: NWS, 2018[104]

[104] National Weather Service. 2022. "Introduction to Thunderstorms." https://www.weather.gov/jetstream/tstorms_intro#:~:text=It%20is%20estimated%20that%20there.

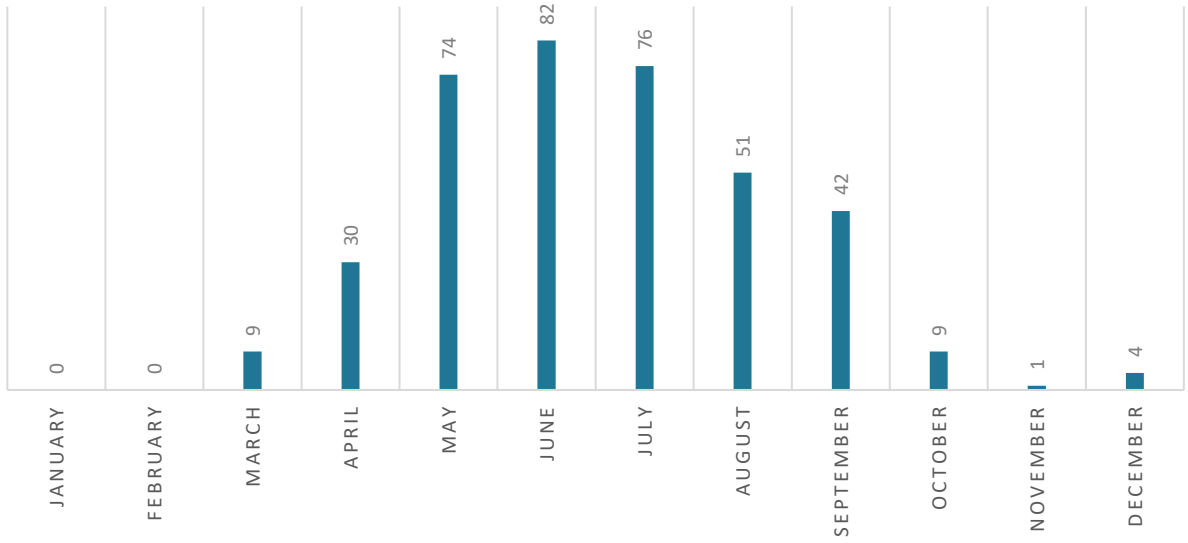
Location

The entire county is at risk of severe thunderstorms and associated damages from heavy rain, lightning, hail, and thunderstorm level wind. Although, these storms occur similarly throughout the planning area, they are more frequently reported in densely settled areas. Additionally, damages are more likely to occur in the densely populated areas.

Historical Occurrences

Severe thunderstorms in the planning area usually occur in the afternoon and evening from June through August (Figure 42).

Figure 42: Severe Thunderstorm Events by Month



Source: NCEI, 1996-2023

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 378 total severe thunderstorm events. Of those there were:

- Hail 147 events
- Heavy Rain 73 events
- Lightning 10 events
- Thunderstorm Wind 148 events 10 injuries

In total these events were responsible for $3,046,200 in property damage. The USDA RMA data does not specify severe thunderstorms as a cause of loss, however heavy rains and hail which may be associated with severe thunderstorms caused $62,849,588 in crop damages. There were 10 injuries reported in association with thunderstorm wind events.

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. In general, hail can cause damages to people, the local economy, the built environment, infrastructure, and critical facilities.

In general, assets in the County are vulnerable to severe thunderstorm events, including people, crops, vehicles, and built structures. Most damage seen occurs due to hail or strong thunderstorm winds. People may experience damages due to standing near windows, not seeking adequate shelter, or shattering windshields. Economic losses may be a result of damages to the place of business itself. Hail may damage roofs, siding, windows, gutters, HVAC systems, which all may compromise the built environment. Hail stones may damage power and utility lines, which can be of critical importance, especially in a disaster scenario. Communications equipment and warning transmitters and receivers can also be knocked out by lightning strikes or hail. Additionally, while less likely, lightning strikes may cause a building fire.

Severe thunderstorms have caused over $108,000 per year in property damages and over $2.7 million per year in crop damages.

Table 76: 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	147	5.3	$805,700	$28,775	$5,364,413	$233,235
Heavy Rain	73	2.6	$0	$0	$56,914,099	$2,474,526
Lightning	10	0.4	$182,000	$6,500	$571,077	$24,829
Thunderstorm Wind	148	5.3	$2,058,500	$73,518	N/A	N/A
Total	**378**	**13.5**	**$3,046,200**	**$108,793**	**$62,849,588**	**$2,732,591**

Source: 1 Indicates data is from NCEI (1996 to 2023); 2 Indicates data is from USDA RMA (2000 to 2022)

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 impacting a single city, 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. The table below outlines the TORRO Hail Scale.

Table 77: TORRO Hail Scale

TORRO Classification/Intensity	Typical Hail Diameter	Typical Damage Impacts
H0: Hard Hail	5 mm; (Pea size); 0.2 in	No damage

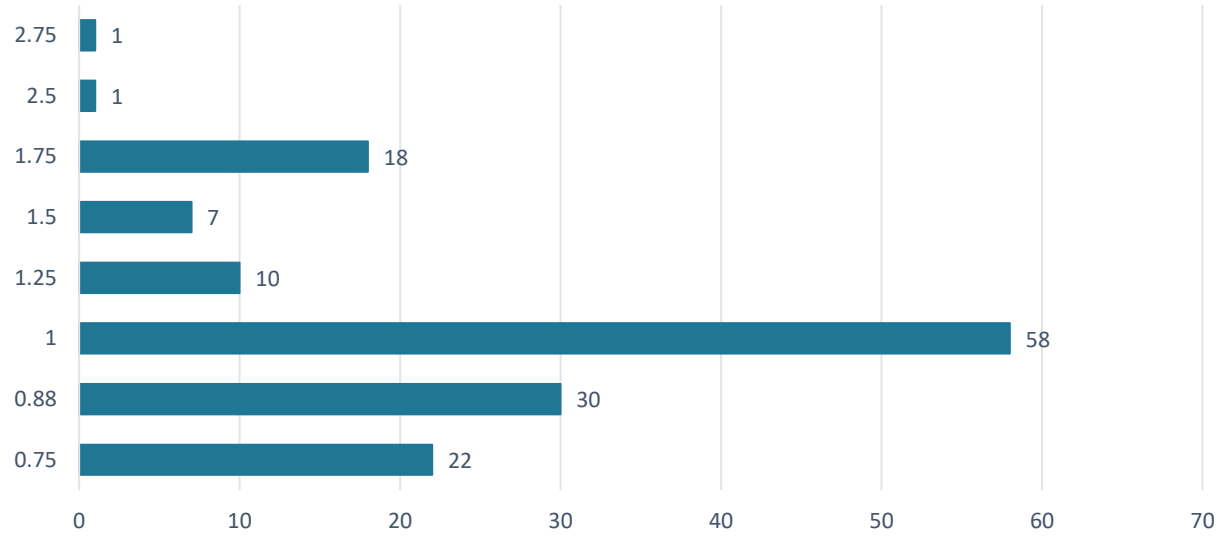
TORRO Classification/Intensity	Typical Hail Diameter	Typical Damage Impacts
H1: Potentially Damaging	5 -15 mm (Marble) 0.2 – 0.6 in	Slight general damage to plants and crops
H2: Significant	10 -20 mm (Grape) 0.4 – 0.8 in.	Significant damage to fruit, crops, and vegetation
H3: Severe	20 -30 mm (Walnut) 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[105]

The NCEI reported a total of 147 hail events 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 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 H7 hail events in 2003 (2.5 inches and 2.75 inches respectively) during the period of record. Figure 43 shows hail events based on the size of the hail.

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

Figure 43: Hail Events by Magnitude



Source: NCEI, 1996-2023

Climate Change

According to the Fourth National Climate Assessment, "modeling studies consistently suggest that the frequency and intensity of severe thunderstorms in the United States could increase as climate changes."[106] There is also some suggestion in the models that the atmosphere will become more favorable to severe thunderstorm development and increased intensity. The Iowa Department of Natural Resources report that Climate Change in Iowa will lead to increased frequency of precipitation extremes that lead to flooding and a larger increase in precipitation in eastern Iowa than in western Iowa[107]. These severe storm and flooding events can cause increased damages to structures and put more people at risk of injury or death.

Economic Impacts

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.

The electrical system is the most likely piece of infrastructure to be impacted during severe thunderstorms. Thunderstorm winds and lightning can cause tree branches to fall on powerlines resulting in power outages. During a large thunderstorm event this can occur in several areas causing power to be lost for a significant portion of a community. Severe thunderstorms pose a hazard to the IRUA with potential damage to the water system from excessive rainfall, lightning strikes, hail damage, or high winds. This hazard could cause power outages or damage assets causing issues with water delivery as well as personnel's ability to access sites and report in to work. Downed trees, branches, and power lines can also block roadways causing delays until they can be removed. Typically, these delays are minimal with several alternate routes available. Severe thunderstorms can also cause major damages to buildings. Hail can also

[106] Fourth National Climate Assessment. 2018. "Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II: Chapter 2". https://nca2018.globalchange.gov/chapter/2/.
[107] Iowa Department of Natural Resources. "Climate Change". https://www.iowadnr.gov/Conservation/Climate-Change.

damage crops depending on the time of year and size of the hail. FEMA standard values for traffic delays and electric power loss can be found in *Section 4: Risk Assessment* under *Average Annual Damages and Frequency*.

Future Development

Future development will increase the risk of damages to buildings and infrastructure from severe thunderstorms. Additionally, an increased reliance on technology could increase vulnerabilities to lightning strikes associated with the use of electronic equipment. It is recommended that hail resistant materials and hail guards be considered for HVAC systems during construction and renovations, building codes be updated to require or recommend the use of hail resistant material, and existing structures incorporate hail resistant products such as concrete roof tiles and siding. Communities can also establish a Tree Board and tree ordinances to ensure urban canopies are safe and healthy, reducing the potential impacts of downed tree limbs during severe thunderstorms.

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 event (hail, lightning, heavy rain, or thunderstorm winds) in every year on record (1996-2023), resulting in a 100 percent chance for thunderstorms to occur annually.

Community Top Hazard Status

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

- Meservey
- Plymouth
- Rockwell
- Thornton
- West Fork Schools

Regional Vulnerabilities

The following tables provide information related to regional vulnerabilities and FEMA's National Risk Index values for Severe Thunderstorms. For jurisdictional specific vulnerabilities, refer to *Section Seven*.

Table 78: 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 -Roads may wash out from heavy rains and become blocked from downed tree limbs
Critical Facilities	-Power outages are possible

SECTOR	VULNERABILITY
	-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
National Risk Index Values	**Hail** Risk Index – Relatively Low Expected Annual Loss – Relatively Low Social Vulnerability – Very Low Community Resilience – Very High **Lightning** Risk Index – Relatively Low Expected Annual Loss – Relatively Low Social Vulnerability – Very Low Community Resilience – Very High

Source: FEMA National Risk Index, 2023

Severe Winter Storms

Severe winter storms are an annual occurrence in Iowa and may last for several days. Winter storms can bring 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 area by hindering transportation, knocking down tree limbs and utility lines, and structurally damaging buildings. Heavy accumulations of ice, often the result of freezing rain, can bring down trees, utility poles, and communications towers and disrupt communications and power for days. Even small accumulations of ice can be extremely dangerous to motorists and pedestrians.

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 rainfall 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.

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".[108] 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.

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 99 severe winter storm events. These recorded events caused a total of $1,956,725 in reported property damages. The RMA does not identify losses as severe winter storms, the RMA uses "cold wet weather", "frost", "cold winter", and "freeze" to identify a severe winter storm. The RMA reports $1,469,290 in crop damages from 2000 to 2022. According to the NCEI, there were no injuries or fatalities associated with winter storms in the planning area.

Average Annual Damages

The average property 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. Crop damage is estimated based on the USDA RMA from 2000 to 2022. Severe winter storms have caused an average of $69,883 per year in property damage and $63,882 per year in crop damages for the planning area.

[108] National Weather Service. 2022. "Winter Weather Safety." https://www.weather.gov/dmx/wintersafety.

Table 79: 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	32	1.1	$580,000	$20,714	$1,469,290	$63,882
Heavy Snow	20	0.7	$239,545	$8,555		
Ice Storm	10	0.4	$666,280	$23,796		
Winter Storm	36	1.3	$470,900	$16,818		
Winter Weather	1	0.0	$0	$0		
Total	99	3.5	$1,956,725	$69,883	$1,469,290	$63,882

Source: 1 Indicates data is from NCEI (1996-2023); 2 Indicates data is from USDA RMA (2000-2022)

Extent

The entire planning area is vulnerable to the effects of severe winter storms. Winter storms tend to make driving more treacherous and can impact the response of emergency vehicles. The probability of utility and infrastructure failure increases during winter storms due to freezing rain accumulation on utility poles and power lines. Secondary effects from loss of power could include burst water pipes in homes without electricity during winter storms. Public safety hazards include risk of electrocution from downed power lines. Buildings with overhanging tree limbs are more vulnerable to damage during winter storms and businesses experience loss of income as a result of closure during power outages or winter storms. In general heavy winter storms increase wear and tear on roadways though the cost of such damages is difficult to determine. Same as with extreme cold conditions, populations at highest risk are those without shelter or who are stranded, or who live in a home that is poorly insulated or without heat. Elderly populations are considered particularly vulnerable to the impacts of winter storm and extreme cold events.

The Sperry-Piltz Ice Accumulation Index (SPIA) was developed by the NWS to predict the accumulation of ice and resulting damages. The SPIA assesses total precipitation, wind, and temperatures to predict the intensity of ice storms. Ice Storm Warnings are issued when accumulation of at least 0.25 inches is expected from a storm, which controlling for high winds, would tend to classify ice storms in Iowa as SPIA Level 2 or higher. The figure below shows the SPIA index.

Figure 44: 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	

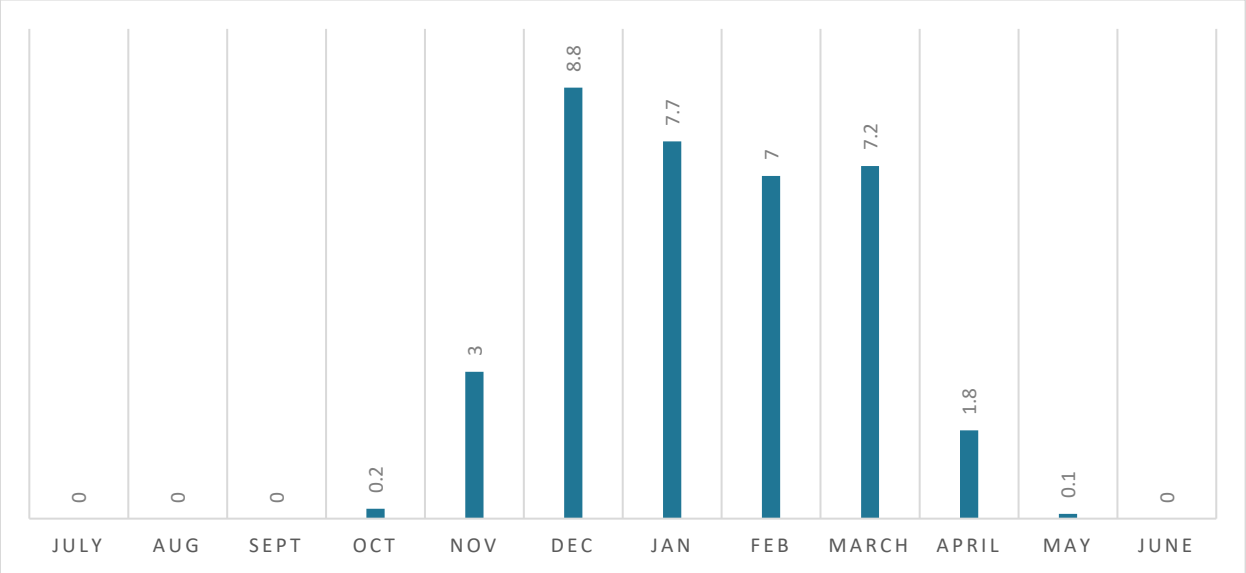
(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

Source: SPIA-Index, 2017[109]

Average monthly snowfall for the planning area is shown in Figure 45, 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 eight 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.

[109] SPIA-Index. 2009. "Sperry-Piltz Ice Accumulation Index." Accessed December 2022. http://www.spia-index.com/index.php.

Figure 45: Monthly Normal Snowfall in Inches



Source: High Plains Regional Climate Center, 2023

Climate Change

Iowa experiences frequent snowstorms and ice storms during winter, which can produce heavy snowfall and high wind gusts that lead to whiteout conditions. 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. For extreme events like severe winter storms "it is difficult to know what will happen to the frequency and intensity" of these events. However, "winter precipitation is projected to increase through the 21st century" in Iowa.[110] Some studies indicate that atmospheric circulation patterns in the Arctic could affect winter storms in midlatitude regions, and there may be a link between arctic warming and the frequency and intensity of severe winter storms in the United States.[111]

Economic Impacts

Large snow events, blizzards, and ice storms can cause large economic impacts to the county. These events can also range in size from impacting a single community to impacting the entire county or a multi-county region. Transportation is the most likely sector impacted by severe winter storms. During a countywide snowstorm it is possible that all or most of roadways in the county will face hazardous driving conditions, significant delays, or even road closures. These delays and closures will have a trickle-down effect on local businesses due to shipping delays, reduced customer access, and other impacts. Severe winter storms can also negatively impact the local economy even when occurring outside the county. I-35 is a major thoroughfare through Cerro Gordo County. Large storms in and around the county can close this vital interstate and other major highways resulting in delays for commuters and shipping. Power loss due to winter storms can also negatively impact local businesses forcing them to close until power is restored.

FEMA standard values for traffic delays and loss of electrical services can be found in *Section 4: Risk Assessment* under *Average Annual Damages and Frequency*.

[110] University of Massachusetts. 2022. "State Climate Reports-Iowa". Accessed December 2022. https://blogs.umass.edu/csrc/state-climate-reports/

[111] Fourth National Climate Assessment. 2018. "Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II: Chapter 2". https://nca2018.globalchange.gov/chapter/2/.

Future Development

All future development will be affected by severe winter storms. Increased development or infrastructure in the county creates a higher probability of damage to occur from winter weather as more property is exposed to risk. The ability to withstand impacts lies in sound land use practices and consistent enforcement of codes and regulations for new construction.

Probability

Based on historical records and reported events, severe winter storm events are likely to occur regularly in the county. The NCEI reported a severe winter storm event in each of the 28-year period of record, resulting in 100 percent chance annually for severe winter storms.

Community Top Hazard Status

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

- Cerro Gordo County
- Clear Lake
- Dougherty
- Mason City
- Meservey
- Rock Falls
- Rockwell
- Thornton
- West Fork Schools

Regional Vulnerabilities

The following tables provide information related to regional vulnerabilities and FEMA's National Risk Index values for Severe Winter Storms. For jurisdictional specific vulnerabilities, refer to *Section Seven.*

Table 80: 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
National Risk Index Values	**Ice Storm** Risk Index – Relatively Low Expected Annual Loss – Relatively Low Social Vulnerability – Very Low

Sector	Vulnerability
	Community Resilience – Very High **Winter Weather** Risk Index – Relatively Low Expected Annual Loss – Relatively Low Social Vulnerability – Very Low Community Resilience – Very High

Source: FEMA National Risk Index, 2022

Terrorism

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".[112] 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.[113,114]

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 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.

There are different types of terrorism depending on the target of attack, which include: Political Terrorism, Bio-Terrorism, Cyber-Terrorism, Eco-Terrorism, Nuclear-Terrorism, Marco-Terrorism, and Agro-Terrorism. 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.

> "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

[112] Terrorism, 28 U.S. Code Section 0.85
[113] Civil Disorders, 18 U.S. Code § 231-233 (1992)
[114] Terrorism, 28 U.S. Code § 0.85.

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.

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. 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 specifically cyber-attacks, can occur throughout the entire planning area. Cities, schools, and government buildings are more likely to see attacks. 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. School shootings are an increasing threat across the country.

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.[115]

[115] 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.

Average Annual Damages

According to the START Global Terrorism Database (1970-2017), no terrorist events have occurred in the planning area. As there were no such events within the planning area, there were no average annual damages.

Extent

Incidents of terrorism or cyber-attacks can vary greatly in scale and magnitude, depending on the location of the attack, number of protesters, and reasoning for unrest.

Climate Change

Climate change will likely have a limited impact on terrorism or cyber-attacks. Climate activism may be a growing motive for civil unrest and lead to terrorist events. Government authorities report that civil disturbances and riots are more likely to occur during heat waves.[116] With an increase in the number of 100°F days,[117] these events may be more likely to occur but are unlikely to reach the level of terrorism.

Economic Impacts

Buildings, water and wastewater system, electrical system, and communications can all be targets of a terroristic event. Typically, these events are meant to cause as much damage or impact as possible. Large events can impact an entire community or county while smaller events can impact a single building. Bridges can also be targets of terrorism, meant to cause damage, and disrupt traffic. Protests and civil disorder often impact roadways. Terrorism is more likely to occur in large population communities like Mason City or Clear Lake because the impacts will be greater. FEMA standard values for traffic delays, electric power loss, IT/communications loss, potable water loss, and wastewater loss can be found in *Section 4: Risk Assessment* under *Average Annual Damages and Frequency*.

Future Development

Increased security measures at vulnerable locations such as schools will reduce the likelihood and impacts of a terroristic act. Measures can include bollards to protect from vehicles, fencing, security cameras, advanced locks, etc. Having strong cyber security can keep bad actors from taking control of municipal systems with the intent to cause harm to humans and damage to buildings.

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

The following jurisdictions identified Terrorism as a top hazard of concern:

- Mason City Schools
- Clear Lake Community Schools

[116] Yeeles, Adam. 2015. Weathering unrest: The ecology of urban social disturbances in Africa and Asia". https://journals.sagepub.com/doi/full/10.1177/0022343314557508.

[117] Union of Concerned Scientists. 2022. "Extreme Heat and Climate Change: Interactive Tool". https://www.ucsusa.org/resources/killer-heat-interactive-tool.

Regional Vulnerabilities

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

Table 81: 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	-Climate activism provides increasing motive for disturbances

Tornado and High Winds

The NWS defines a tornado as a violently rotating column of air extending from a thunderstorm to the ground. 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.

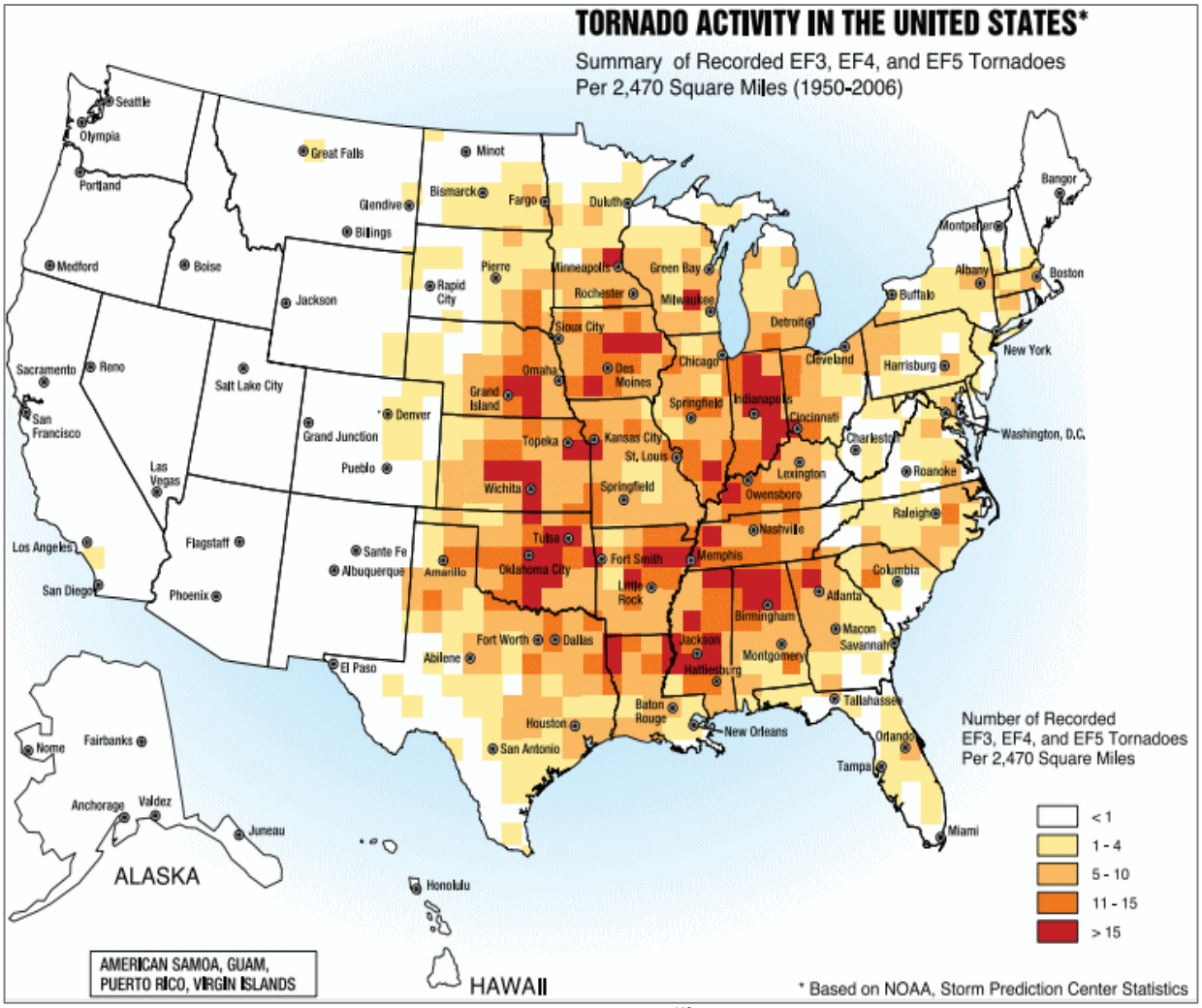
Once tornadoes are formed, they can be extremely violent and destructive. They have been recorded all over the world but are most prevalent in the American Midwest and South, in an area known as "Tornado Alley." Though the description of "tornado alley" varies slightly, Iowa is generally considered to be included in, or on the edge of, the geographic area. Approximately 1,250 tornadoes are reported annually in the contiguous United States. Tornadoes can travel distances over 100 miles and reach over 11 miles above ground. Tornadoes usually stay on the ground 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.

There are certain socio-economic factors which may increase the vulnerability of different populations. Citizens living in mobile homes, citizens who are elderly with decreased mobility or have poor hearing are at higher risk for lasting impacts from a tornado event. High winds can cause damage to structures and power lines which in turn create hazardous conditions for people. Debris flying from high wind events can shatter windows in structures and vehicles and can harm people that are not adequately sheltered. Campers, construction trailers, mobile homes, barns, and sheds and their occupants are particularly vulnerable as high wind events in Cerro Gordo County can be sufficient in magnitude to overturn these lighter structures. Additionally, older homes which have not been maintained may be more susceptible to damage during windstorms.

Iowa is ranked sixth in the nation for tornado frequency with an annual average of 47 tornadoes between 1985 and 2014.[118] Roughly 64% of tornadoes in Iowa occur in the months of May, June, and July. Figure 46 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.

[118] 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 46: Tornado Activity in the United States



Source: FEMA, 2008[119]

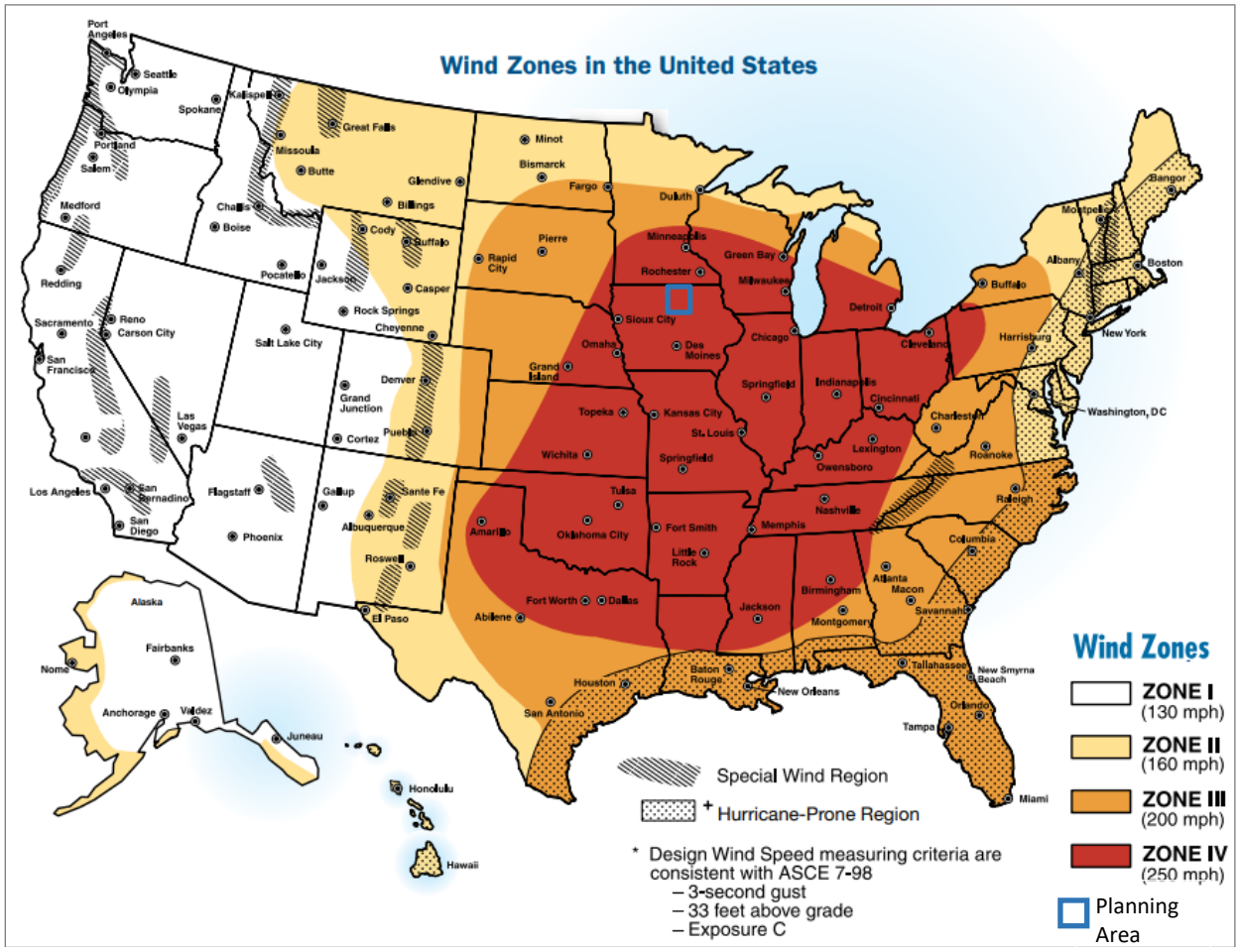
The National Weather Service (NWS) defines high winds as sustained wind speeds of 40 mph or greater lasting for one hour or longer, or winds of 58 mph or greater for any duration.[120] The NWS issues High Wind Advisories when there are sustained winds of 25 to 39 mph and/or gusts to 57 mph. High winds 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.

Figure 47 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.

[119] Federal Emergency Management Agency. August 2008. "Taking Shelter From the Storm: Building a Safe Room for Your Home or Small Business, 3rd edition."

[120] National Weather Service. 2017. "Glossary." http://w1.weather.gov/glossary/index.php?letter=h.

Figure 47: Wind Zones in the U.S.

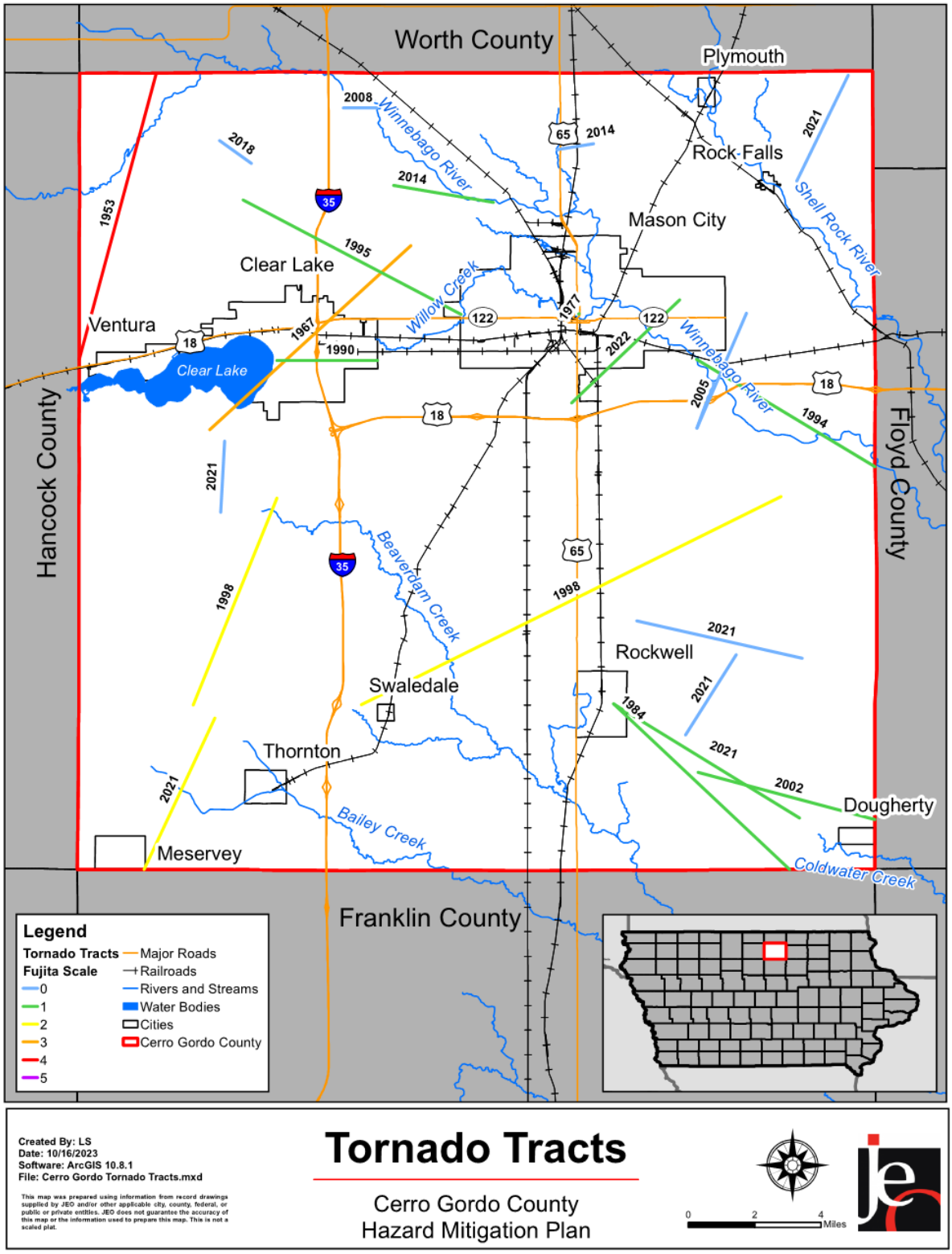


Source: FEMA, 2016

Location

High winds and tornadoes can take place anywhere in the county. Impacts would likely be greater in densely populated areas, such as Mason City or the Clear Lake/Ventura area. **Error! Reference source not found.** shows the historical track locations across the region according to the Midwestern Regional Climate Center. A few tornado events have significantly impacted communities located in the planning area between 1996 and 2023. These include a 1998 EF2 near Swaledale, a 2021 EF2 near Meservey, and a 2022 EF1 in Mason City. Prior to 1996, a 1967 EF3 and 1990 EF1 impacted Clear Lake.

Figure 48: Historic Tornado Tracks



Historical Occurrences

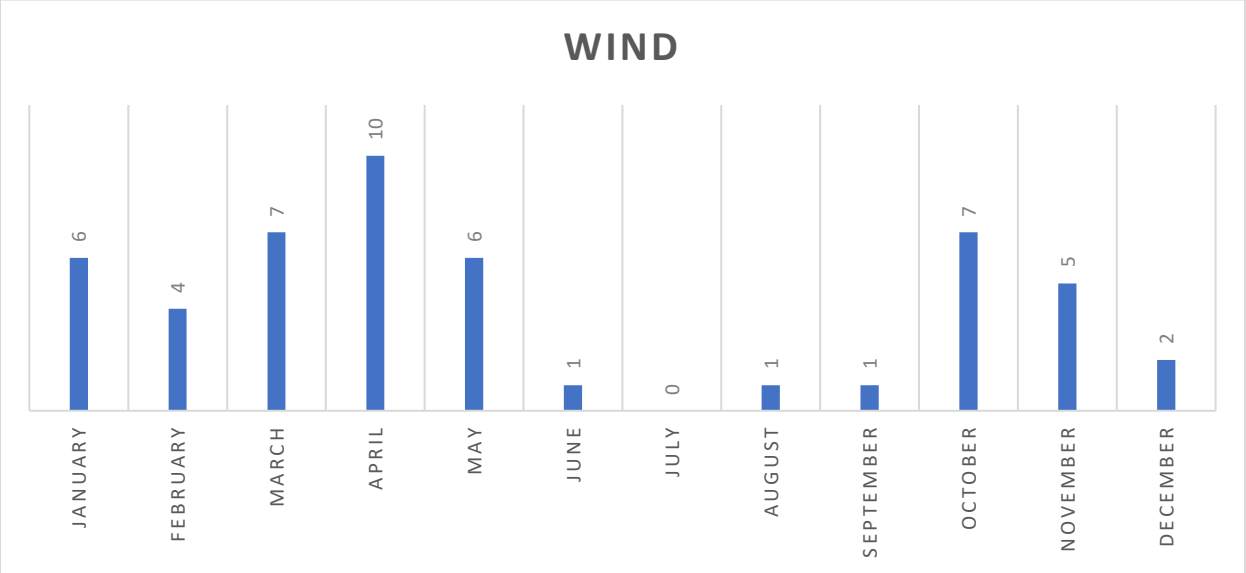
There were 50 high wind events that occurred between 1996 and 2022 and 22 tornadic events ranging from a magnitude of EF0 to EF2. These events were responsible for $2,263,110 in property damages and $1,435,539 in crop damages. The NCEI reported one injury.

The most damaging event was a high wind event in November 1998 which caused $300,000 in damages while one high wind event in 2003 led to one injury. The NCEI provided the following description of the November 1998 event:

> *Iowa experienced the worst November storm system since the great storm of 9 and 10 November 1975. During the 9th, low pressure developed over southeast Colorado. The low moved across Kansas during the afternoon and evening of the 9th and deepened to about 990 mb. Warm and moist air was drawn north ahead of the low resulting in widespread across the state. Thunderstorms erupted during the late evening of the 9th, though no severe weather occurred. … Most of the state experienced a period of 12 to 18 hours of sustained winds of 35 to 50 MPH, with frequent gusts of 65 to 75 MPH. Officially,* ***some of the higher winds include*** *68 MPH at Waterloo,* ***66 MPH at Mason City****, and 67 MPH at Ottumwa. Damage was widespread across the state with countless trees and power lines down. Over the northeast third of the state, spotty reports of gas line breakage were received. Officials indicated the reason for this was that due to the prolonged period of high wind. The wind places stress on the buildings, and thus the pipelines, resulting in spotty failures. In addition to the tree and power line damage, several outbuildings were downed by the high winds. There were also several reports of minor structural damage to buildings around the state, ranging from shingles removed to entire roofs. Numerous reports of business windows being blown out were received from around the state. Semi-tractor trailer rigs were overturned along Iowas highways as the winds buffeted them. Over the northern third of the state, snow was also a problem as the high winds dropped visibility to near zero at times. The snow was not the main problem, however Interstate 35 was closed from Story City north to the Minnesota border due to high winds and blowing snow. There was one death during the wind storm in Hamilton County at Jewell. A man was repairing a roof and was blown off the roof during the storm. He was rushed to the hospital in critical condition, but did not survive. In addition, there were some livestock deaths as well.* ***For example, near Mason City 60 head were lost as they moved into a culvert to get out of the wind and ended up freezing to death once they became wet.***

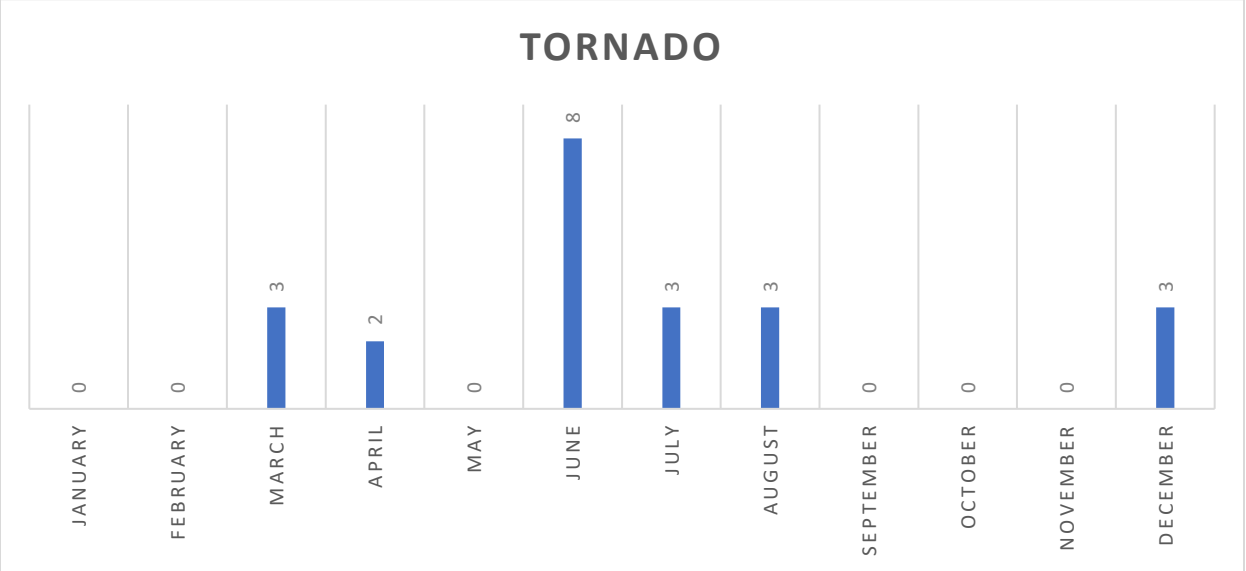
As seen in the following figures, the majority of high winds events occur in the spring and winter months, while most tornado events occur during the summer.

Figure 49: High Wind Events by Month



Source: NCEI, 1996-2023

Figure 50: Tornadoes by Month in the Planning Area



Source: NCEI, 1996-2023

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. Crop damages were determined based on the USDA RMA since 2000. It is important to note that damages from tornadoes vary greatly depending on the severity or magnitude of each event.

Table 82: Tornado and High Wind 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	22	0.8	$473,000	$16,893	$0	$0
High Wind	50	1.8	$1,790,110	$63,933	$1,435,539	$62,415

Source: 1 Indicates data is from NCEI (1996 to 2022); 2 Indicates data is from USDA RMA (2000 to 2021)

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 83 outlines the Beaufort scale, provides wind speed ranking, range of wind speeds per ranking, and a brief description of conditions for each ranking.

Table 83: Beaufort Wind Ranking

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[121]

Using the NCEI reported events, the most common high wind event in the planning area is a level 10 on the Beaufort Wind Ranking scale. The reported high wind events ranged from 35 mph to 72 mph, with an average speed of 52 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. The following table summarize the Enhanced Fujita Scale and description of common damages. According

[121] Storm Prediction Center: National Oceanic and Atmospheric Administration. 1805. "Beaufort Wind Scale." http://www.spc.noaa.gov/faq/tornado/beaufort.html.

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.[122]

Table 84: Enhanced Fujita Scale

Storm Category	3 Second Gust (mph)	Damage Level	Damage Description
EF0	65-85 mph	Gale	Some damages to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages to sign boards.
EF1	86-110 mph	Weak	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages might be destroyed.
EF2	111-135 mph	Strong	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
EF3	136-165 mph	Severe	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
EF4	166-200 mph	Devastating	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown, and large missiles generated.
EF5	200+ mph	Incredible	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel re-enforced concrete structures badly damaged.
EF No rating	--	Inconceivable	Should a tornado with the maximum wind speed in excess of F5 occur, the extent and types of damage may not be conceived. A number of missiles such as iceboxes, water heaters, storage tanks, automobiles, etc. will create serious secondary damage on structures.

Source: NOAA; FEMA

Based on historic record, it is most likely that tornadoes within the planning area will be of EF0 strength. Of the 22 reported tornado events, 15 were EF0, three were EF1, three was EF2, and one was EFU. The extent of damage felt by high wind or tornado events will vary depending on the severity of the event and amount of infrastructure and development within a community or area. Due to the nature of how tornadic events are categorized, significant tornado events will occur in areas with more infrastructure. Communities such as Mason City would have greater extent of impacts if a tornado or high wind event were to occur; however, small communities with limited staff and fiscal capability are more likely to have a prolonged recovery period and the extent of damages would be felt more severely.

Climate Change

For extreme events like tornadoes and high winds "scientists do now know how the frequency and severity of tornadoes will change". The EPA's climate change snapshot indicates that "rising

[122] 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."

concentrations of greenhouse gases tend to increase humidity, and thus, atmospheric instability, which would encourage tornadoes. But wind shear is likely to decrease, which would discourage tornadoes."[123]

Economic Impacts

Tornadoes and high winds can cause large scale damage to buildings, communication infrastructure, and electrical infrastructure. Water and wastewater can also be impacted if treatment plants are damaged. Downed tree branches and power poles can result in power outages that range in size from a couple blocks to entire portions of a community. Downed trees, branches, and power lines can also block roadways causing delays until they can be removed. These delays could last for several days as recovery may be focused on other areas. Cellphone or other communication towers can be damaged during tornado causing a loss in service. FEMA standard values for traffic delays, potable water loss, wastewater loss, IT/communication loss, and electric power loss can be found in *Section 4: Risk Assessment* under *Average Annual Damages and Frequency*.

Future Development

In planning future development, jurisdictions in the planning area should work to ensure that all facilities housing large numbers of people and/or vulnerable populations have access to safe rooms. Additionally, safe rooms can be especially useful in areas with transient populations, such as parks and campgrounds. New development built to modern building codes, and well-maintained older buildings are unlikely to contribute to greater high wind vulnerability. Of course, any structure, regardless of its age or construction, could be damaged by flying debris, fallen trees, or tree limbs.

Probability

Given the historic record of occurrence for high wind (22 out of 28 years with reported events), for the purposes of this plan, the annual probability of high wind occurrence is 79 percent. However, high winds 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 (11 out of 28 years with reported events), for the purposes of this plan, the annual probability of tornado occurrence is 39 percent.

Community Top Hazard Status

The following jurisdictions identified Tornado and High Winds as a top hazard of concern:

- Cerro Gordo County
- Clear Lake
- Dougherty
- Mason City
- Meservey
- Rockwell
- Thornton
- Ventura
- Clear Lake Community Schools
- West Fork Schools

[123] Environmental Protection Agency. 2016. "What Climate Change Means for Iowa". Accessed January 2023. https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-ia.pdf

Regional Vulnerabilities

The following tables provide information related to regional vulnerabilities and FEMA's National Risk Index values for Tornadoes and High Winds. For jurisdictional specific vulnerabilities, refer to *Section Seven*.

Table 85: Regional Tornado and High Winds 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
National Risk Index Values	**Strong Wind** Risk Index – Relatively Low Expected Annual Loss – Relatively Low Social Vulnerability – Very Low Community Resilience – Very High **Tornadoes** Risk Index – Relatively Low Expected Annual Loss – Relatively Low Social Vulnerability – Very Low Community Resilience – Very High

Source: FEMA National Risk Index, 2022

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 and objectives. 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.

Goals from the 2018 HMP were reviewed, and members of 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.

Requirement §201.6(c)(3): The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs, and resources, and its ability to expand on and improve these tools.

Requirement §201.6(c)(3)(i): The hazard mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

Requirement §201.6(c)(3)(ii): The mitigation strategy shall include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure. The jurisdiction's participation in the National Flood Insurance Program and continued compliance with NFIP requirements, as appropriate, must also be addressed.

Requirement: §201.6(c)(3)(iii): The mitigation strategy section shall include an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

Requirement §201.6(c)(3)(iv): For multi-jurisdictional plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.

Goals

Below is the final list of goals as determined for this plan update. These goals provide direction to guide participants in reducing future hazard related losses.

- **Goal 1**: Minimize vulnerability of the people and their property in Cerro Gordo County to the impacts of hazards.
- **Goal 2**: Protect critical facilities, infrastructure and other community assets from the impact of hazards.
- **Goal 3**: Improve education and awareness regarding hazards and risk in Cerro Gordo County.
- **Goal 4**: Strengthen communication among agencies and between agencies and the public.

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.

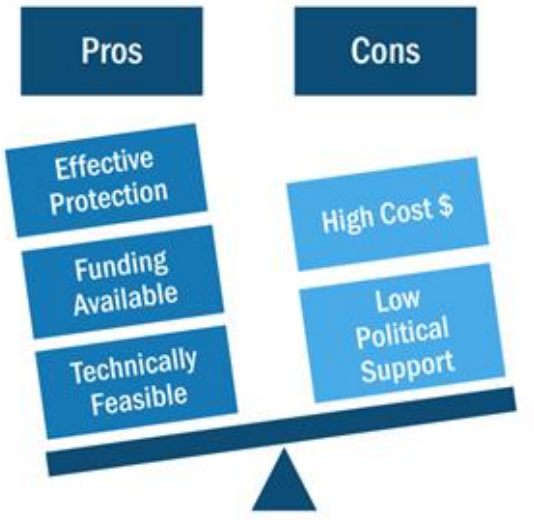
The Hazard Mitigation Planning Team provided each participant a link to the FEMA Handbook as a list of mitigation actions to be used as a starting point. Participants were also encouraged to think of actions that may need FEMA grant assistance and to review their hazard prioritization for potential mitigation actions. These suggestions helped participants determine which actions would best assist their respective jurisdiction in alleviating damages in the event of a disaster. The listed priority rating does not indicate which actions will be implemented first but serves as a guide in determining the order in which each action should be implemented. Participants were informed of the STAPLEE (Social, Technical, Administrative, Political, Legal, Economic, Environmental) feasibility review process and were encouraged to use it when determining project priorities.

These prioritized projects are the core of a hazard mitigation plan. The local planning teams were instructed that each action must directly relate to the goals of the plan and the hazards of top concern for their jurisdiction. Actions must be specific activities that are concise and can be implemented individually. Mitigation and strategic actions were evaluated based on referencing the community's risk assessment and capability assessment. Jurisdictions were encouraged to choose mitigation and strategic actions that were realistic and relevant to the concerns identified.

Mitigation actions were prioritized by the local planning team members 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. All mitigation action priority levels were established qualitatively by the local planning team members. 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 Cerro Gordo County IA 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.

Table 86: Mitigation and Strategic Actions Selected by Each Jurisdiction (1 of 2)

Actions	Goal	Cerro Gordo County	Clear Lake	Dougherty	Mason City	Meservey	Plymouth	Rock Falls
Acquire Flood Prone Properties	1				X			
Active Shooter Training	1		X					
Additional Site for Public Health	1	X						
Armor Road Improvements	2	X						
Back-up Generators	1	X		X			X	X
Construct Floodwall on Lake Outlet	2		X					
Construct Shelter/Safe Rooms	1	X		X		X		
Drainage Improvements	2	X						
Emergency Communications	4					X		
Extend Life of Above Ground Power Grid	2				X			
Facility Updates	2			X				
Flood Storage	1				X			
Hazardous Material Training	4						X	
Improve Emergency Response Equipment	2	X						
Install Community Sewer System	2			X				
IT Security Plan	4	X						
Paved Low Water Crossings	2	X						
Public Awareness and Education	3	X	X	X	X	X	X	X
Security System Improvements	1	X						
Snow Removal Equipment	2	X	X					
Storm Sewer Improvements	2					X		
Stormwater Management System Upgrades	2				X			
Tree Removal	1	X						
Upgrade Outdoor Warning Sirens	1	X	X			X	X	
Watershed Management Plan or Study	3				X			

Table 87: Mitigation and Strategic Actions Selected by Each Jurisdiction (2 of 2)

Action	Goal	Rockwell	Thornton	Ventura	Clear Lake Schools	Mason City Schools	West Fork Schools
Active Shooter Training	3				X		X
Back-up Generators	2	X	X	X			
Construct Shelter/Safe Rooms	1	X	X	X	X		X
Construct Water Treatment Plant	2			X			
Cyber Security Improvements	1					X	
Emergency Plans and Training	3				X	X	X
Facility Updates	2						X
Public Awareness and Education	3	X	X	X			
Replace Bridges	2		X				
Security System Improvements	1				X		

Table 88: Identified Action by Hazard

Action	*Ag Plant and Animal Disease*	*Drought*	*Extreme Temperatures*	*Flooding*	*Grass/Wildland Fire*	*Hazardous Materials Release*	*Infrastructure Failure*	*Pandemic Human Disease*	*Severe Thunderstorms*	*Severe Winter Storms*	*Terrorism*	*Tornado and High Winds*
Acquire Flood Prone Properties				x								
Active Shooter Training											x	
Additional Site for Public Health			x				x	x				
Armor Road Improvements				x					x			
Back-up Generators			x		x	x	x	x	x	x		x
Construct Floodwall on Lake Outlet				x					x			
Construct Shelter/Safe Rooms			x			x	x		x	x	x	x
Construct Water Treatment Facility		x		x	x				x			
Cyber Security Improvements											x	
Drainage Improvements				x					x			
Emergency Communications	x	x	x	x	x	x	x	x	x	x	x	x
Emergency Plans and Training	x	x	x	x	x	x	x	x	x	x	x	x
Extend Life of Above Ground Power Grid							x		x	x	x	x

Action	*Ag Plant and Animal Disease*	*Drought*	*Extreme Temperatures*	*Flooding*	*Grass/Wildland Fire*	*Hazardous Materials Release*	*Infrastructure Failure*	*Pandemic Human Disease*	*Severe Thunderstorms*	*Severe Winter Storms*	*Terrorism*	*Tornado and High Winds*
Facility Updates			x			x	x	x	x	x	x	x
Flood Storage				x					x			
Hazardous Material Training						x						
Improve Emergency Response Equipment						x			x	x	x	x
Install Community Sewer System				x			x		x			
IT Security Plan							x				x	
Paved Low Water Crossings				x					x			
Public Awareness and Education	x	x	x	x	x	x	x	x	x	x	x	x
Replace Bridges				x			x		x	x		x
Security System Improvements							x				x	
Snow Removal Equipment										x		
Storm Sewer Improvements				x			x		x	x		
Stormwater Management System Upgrades				x			x		x			
Tree Removal	x	x			x				x	x		x
Upgrade Outdoor Warning Sirens									x			x

ACTION	*Ag Plant and Animal Disease*	*Drought*	*Extreme Temperatures*	*Flooding*	*Grass/Wildland Fire*	*Hazardous Materials Release*	*Infrastructure Failure*	*Pandemic Human Disease*	*Severe Thunderstorms*	*Severe Winter Storms*	*Terrorism*	*Tornado and High Winds*
Watershed Management Plan or Study		x		x					x			

Section Six
Plan Implementation and Maintenance

Monitoring, Evaluating, and Updating the Plan

Each participating jurisdiction in the Cerro Gordo County HMP is responsible for monitoring (annually at a minimum), 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 mitigation and strategic 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 Action Plan

Plan review and updates will occur annually and will be led by the local planning team members as identified in each jurisdictional profile. It is the individual responsibility of each participants governing body to ensure updates and changes are recorded and provided to IHSEMD regarding individual profiles. Cerro Gordo County Emergency Management is responsible for maintaining a copy of the entire FEMA approved HMP.

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.

Local planning team members should engage with the public, other elected officials, and multiple departments as they review and update the plan. Many communities identified specific ways to include the public in the review process including addressing revisions or updates at local board or council meetings, posting the plan online, or soliciting input through social media outreach.

A complete update will occur 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. The governing body and local planning team members overseeing the evaluation process will review the capabilities assessment and mitigation actions identified in 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:

- If any mitigation or capacity building strategies have been completed, did they have the desired impact on the identified vulnerability? If not, what was the reason it was not 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 current resources appropriate to implement the plan?
- Did the plan partners participate as originally planned?
- Were other plan participants, stakeholders, or partner agencies identified which should be included in future plan updates?
- Are there other strategies identified to engage the public – either locally or county-wide?

Plan Amendments

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 and considered separate from the annual review and other proposed plan amendments. The applicable Hazard Mitigation Planning Team will compile a list of proposed amendments received annually and prepare a report for state officials, 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.

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 – local bars and restaurants, post offices, coffee shops, gas stations, grocery stores, churches, etc.
- City Hall and County Courthouse
- Local Websites
- Social media accounts – Facebook, Twitter
- Local radio stations
- Local newspapers – Globe Gazette and Clear Lake Mirror

- Regionally distributed newsletters – non-profit organizations, Agriculture Societies, charities, etc.

Any amendments to the HMP as determined through public involvement or community actions must be submitted to HSEMD for inclusion in the final HMP.

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. 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 Cerro Gordo County planning area.

Incorporation into Existing Planning Mechanisms

The Hazard Mitigation Planning Team utilized a variety of tools to help communities determine how their existing planning mechanisms were related to the Hazard Mitigation Plan. The local planning teams used FEMA's *Integrating Hazard Mitigation Into the Local Comprehensive Plan*[124] guidance, as well as FEMA's *2015 Plan Integration*[125] guide. These documents offered an easy way for participants to identify both plans and components therein which interface with the HMP. 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.

[124] 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

[125] 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 Cerro Gordo 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 meetings and through key informational documents. Each profile includes the following elements:

- Local Planning Team Members
    - Governance
    - Plan Maintenance
- Location and Geography
- Development Trends
- Demographics
- Employment and Economics
- Housing
- Capability Assessment
    - Social Vulnerability
- Plans and Studies
- Community Lifelines
- Hazard Prioritization and Mitigation Strategy

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.

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Section Eight
Funding Guidebook

Overview

The following *Hazard Mitigation Project Funding Guidebook* is intended to provide initial guidance on hazard mitigation project funding opportunities and where to find more information on grants. The information included is consistent with established processes for hazard mitigation planning. However, it is important to note the following in terms of the context for this guidebook relative to the overall planning process.

Project identification includes identifying all possible options (or alternatives) to address planning objectives; at this stage, all options are viable. At times, the best option may be to work with other stakeholders in the community to design solutions that are in line with community values while reducing risk (e.g., a bike path or ball field that can double as a retention area, or the preservation of an animal habitat that also serves as a natural buffer). These types of solutions can often be funded in very innovative ways, including solutions which increase local industry and revenue (e.g., tapping into the entrepreneurial community). For information on the broad range of mitigation project types and how projects have been implemented in communities across the country, please refer to FEMA's Mitigation Best Practices webpage at https://www.fema.gov/mitigation-best-practices-portfolio.

It should be noted that the grant programs listed in this guidebook are not the only ones that could support hazard mitigation project implementation. Additionally, many of these programs are dependent on yearly funding allocations, resulting in fluctuations in their fund availability. However, at this point, it is more important to be aware of the potential for various avenues of support for a broad array of project types. As needs and potential hazard mitigation project options are identified, more information can begin to be gathered on the range of programs which might be utilized. It will be more efficient to start with project options and then follow up with the identification of potential matches, working with the full range of available programs and agencies as part of a comprehensive project evaluation process.

When the current FEMA hazard mitigation planning program was formulated in the late 1990s as part of the Disaster Mitigation Act of 2000, there was an assumption that federal funding would be provided on a substantial, on-going basis for implementing hazard mitigation projects. However, the level of funding has varied from year to year and future prospects are unclear. Additionally, some communities have not been successful in their pursuit of these grants and have not seen the value of their investment in mitigation planning. While participation in a hazard mitigation plan is required for a jurisdiction to be eligible for FEMA funds, those are not the only funding source available for mitigation actions. Depending on the type of mitigation project being pursued, FEMA funding is not always the best option either, so it is increasingly important to look for other opportunities.

Opportunities for funding and technical assistance exist in various federal, state, and local agencies. Non-governmental funding opportunities are available at the regional or local level with private sector businesses, private foundations, non-profit organizations (NPOs) and other non-governmental organizations (NGOs). In order to fully map out the range of local and state options, it is necessary to undertake a detailed stakeholder analysis – something which has not been done at this time. The following contains an overview of key federal and state programs that may include opportunities for

hazard mitigation project funding, as well as additional information on suggested alternative funding routes.

Federal Funding Resources

Information about federal hazard mitigation project funding opportunities is organized by agency. Under each agency heading, applicable grant programs are listed with a description of the grant and, when available, information on typical funds available, eligibility, examples of past projects funded, and any additional relevant information. Agencies covered in this guidebook include:

- FEMA
- US Forest Service
- US Bureau of Reclamation – WaterSMART
- US Department of Agriculture
- US Department of Agriculture Rural Development Funding
- US Department of Energy
- US Department of Housing and Urban Development
- US Economic Development Administration
- US Environmental Protection Agency
- US Fish and Wildlife Service

Note: This is not a complete list of all federal funding opportunities. These grant programs have been chosen for their applicability to popular mitigation actions. The websites and reference materials used to provide this information are as current as possible; however, it is important to note that funding programs are dynamic and subject to frequent changes. While it is helpful to be familiar with the current information, it is equally as important to engage candidate federal and state agencies in a dialog as soon as possible.

Federal Emergency Management Agency

BUILDING RESILIENT INFRASTRUCTURE AND COMMUNITIES PROGRAM	
Description	This FEMA program aims to focus on research-supported, proactive investment in community resilience. Through BRIC, FEMA invests in a variety of mitigation activities with an added focus on infrastructure projects benefitting disadvantaged communities, nature-based solutions, climate resilience and adaption, and adopting hazard resistant building codes.
Funds Available	For FY 2023, the total amount of funds that are being made available to **100 congressionally directed projects will be $233,043,782**. Applicants may request up to an additional 5% of project costs for management and administration of the program from a separate pool of funds.
Eligibility	Eligible states, territories and federally recognized tribal governments can submit applications on behalf of subapplicants for BRIC funding. Applicants may have their own priorities or requirements when screening their subapplications. Subapplicants cannot submit these directly to FEMA. Subapplicants must submit them to their applicant for review and submission. Subapplicants are local governments, including cities, townships, counties, special district governments, state agencies and federally recognized tribal governments and must submit subapplication to their state, territory, or tribal applicant agency.
Examples	The top five type of projects funded in Fiscal Year 2021 included Flood Control, Utility/Infrastructure Protection, Stabilization and Restoration, Mitigation Reconstruction, and Retrofits.
Additional Information	**All applicants and subapplicants must have a FEMA-approved Hazard Mitigation Plan by the application deadline and at the time of the obligation of funds, unless the subapplicant is applying for a planning subgrant.** A cost share is required for all subapplications funded under BRIC. The non-federal cost share funding may consist of cash; donated or third-party in-kind services and materials; or any combination thereof. Generally, the cost share for this program is 75% federal cost share funding/25% non-federal cost share funding. Additional information can be found at https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities/before-apply#funding

FIRE MANAGEMENT ASSISTANCE GRANT (FMAG) PROGRAM	
Description	FMAG is available to states, local and tribal governments, for the mitigation, management, and control of fires on publicly or privately-owned forests or grasslands, which threaten such destruction as would constitute a major disaster.
Funds Available	The individual fire cost threshold is based on total eligible costs for the declared fire. The individual fire cost threshold for a state is the greater of $100,000 or 5 percent times the statewide per capita indicator, multiplied by the state population (the statewide per capita indicator is adjusted annually for inflation [e.g., the FY21 indicator is $1.55]).
Eligibility	Eligible applicants are entities legally responsible for the firefighting activities that reimbursement is being requested for, this includes states, local governments, and tribal governments.
Examples	Eligible firefighting costs may include expenses for field camps, repair and replacement tools, mobilization and demobilization activities, equipment use, materials and supplies.

FIRE MANAGEMENT ASSISTANCE GRANT (FMAG) PROGRAM	
Additional Information	https://www.fema.gov/assistance/public/fire-management-assistance

FLOOD MITIGATION ASSISTANCE PROGRAM	
Description	FMA is a competitive program that provides funding for projects that reduce or eliminate the risk of repetitive flood damages to buildings insured by the National Flood Insurance Program. Projects must be cost effective, located in a participating NFIP community in good standing, align with the current hazard mitigation plan, and meet all environmental and historical preservation requirements.
Funds Available	Fiscal Year 2022 had $800 million available for distribution which was more than five times the amount available for Fiscal Year 2021.
Eligibility	States, territories, and federally recognized tribes are eligible. Local governments are considered sub-applicants and must apply to the State, territory, or tribe.
Examples	Projects include: project scoping, technical assistance, community flood mitigation projects, individual structure/property-level flood mitigation projects, and management costs.
Additional Information	**All applicants and subapplicants must have a FEMA-approved Hazard Mitigation Plan by the application deadline and at the time of the obligation of funds, unless the subapplicant is applying for a planning subgrant.** Cost share is required for all subapplications funded by the Flood Mitigation Assistance program. Generally, the cost share for this program is 75% federal / 25% non-federal. Contributions of cash, third-party in-kind services, materials, or any combination thereof, may be accepted as part of the non-federal cost share. More information can be found at https://www.fema.gov/grants/mitigation/floods

HAZARD MITIGATION GRANT PROGRAM (HMGP)	
Description	FEMA's Hazard Mitigation Grant Program provides funding to state, local, tribal and territorial governments so they can develop hazard mitigation plans and rebuild in a way that reduces, or mitigates, future disaster losses in their communities. Funding is available when authorized under a Presidential major disaster declaration and in areas of the state requested by the Governor. Federally recognized tribes may also submit a request for a Presidential major disaster declaration within their impacted areas. **All state, local, tribal and territorial governments must develop and adopt hazard mitigation plans to receive funding for their hazard mitigation projects.**
Funds Available	Amount of funding is based on the estimated total or aggregate cost of disaster assistance: Up to 15% of the first $2 billion; Up to 10% for amounts between $2 billion and $10 billion; Up to 7.5% for amounts between $10 billion and $35.333 billion; States with enhanced mitigation plans: Up to 20%, not to exceed $35.333 billion.
Eligibility	Project eligibility under HMGP can be limited by the State as part of the HMGP Administrative Plan developed post-disaster. For example, funding may only be made available for projects that are related to the type of disaster, i.e., HMGP

HAZARD MITIGATION GRANT PROGRAM (HMGP)	
	related to a significant flood disaster declaration may only be designated for flood mitigation projects like acquisitions of repetitively flooded properties.
Examples	Retrofitting existing buildings to make them less susceptible to damage from a variety of natural hazards. Purchasing hazard prone property to remove people and structures from harm's way. Drainage improvement projects to reduce potential for flood damage.
Additional Information	Eligible project types do not have to coincide with the type of disaster declaration, as the state decides funding prioritization accordingly. In this program, private homeowners and businesses cannot apply for a grant. However, a local community or other public entity may apply for funding on their behalf. Generally, the cost share is 75% federal and 25% non-federal funding. The 25% can come from any non-federal source, such as the state or local government, an individual, private contributions, Increased Cost of Compliance (ICC) funds from a flood insurance policy, or Small Business Administration loans. Additional information can be found at: https://www.fema.gov/grants/mitigation/hazard-mitigation/before-you-apply

HMGP-POST FIRE	
Description	This program provides funding to help communities implement hazard mitigation measures focused on reducing the risk of harm from wildfire. Provides hazard mitigation grant funding to state, local, tribal, and territorial governments in areas receiving a Fire Management Assistance Grant (FMAG) declaration. The FMAG is the Disaster Declaration required and funding amounts are determined by FEMA based on an annual national aggregate calculation of the past 10 year's FMAG declarations.
Funds Available	Funds available each year are based on an average of historical Fire Management Assistance Grant declarations from the past 10 years. Total funding available for each FMAG declaration in Fiscal Year 2022 is $786,552 for applicants with a standard hazard mitigation plans and $1,048,736 for those with an enhanced hazard mitigation plan. Multiple event funding will be aggregated into one grant under the first declaration.
Eligibility	States, federally-recognized tribes and territories affected by fires resulting in an Fire Management Assistance Grant (FMAG) declaration on or after October 5, 2018, are eligible to apply.
Examples	Defensible space, reducing hazardous fuels, removing standing burned trees, ignition-resistant construction, installing warning signs, strengthen or harden water systems that were burned and caused contamination, reseeding ground cover, planting grass to prevent noxious weeds, erosion barriers on slopes, modify/remove culverts, drainage dips and emergency spillways.
Additional Information	The application period opens with the state or territory's first FMAG declaration of the fiscal year and closes six months after the end of that fiscal year. Application extensions may be requested. https://www.fema.gov/grants/mitigation/post-fire

PRE-DISASTER MITIGATION (PDM)	
Description	The Pre-Disaster Mitigation grant program makes federal funds available to state, local, tribal, and territorial governments to plan for and implement sustainable cost-effective measures. These mitigation efforts are designed to reduce the risk to individuals and property from future natural hazards, while also reducing reliance on federal funding from future disasters.
Funds Available	On March 1, 2023, FEMA published a Notice of Funding Opportunity (NOFO) for FY23 Pre-Disaster Mitigation grant program. The total amount of funds that are being made available to 100 congressionally directed projects will be $233,043,782. Applicants may request up to an additional 5% of project costs for management and administration of the program from a separate pool of funds.
Eligibility	Only states, territories, or federally recognized tribal governments identified by Congress in the Consolidated Appropriations Act and enumerated in the accompanying Joint Explanatory Statement for Division F are identified in this Notice of Funding Opportunity (NOFO) and are eligible to apply. All applicants and subapplicants must have a FEMA-approved Hazard Mitigation Plan by the application deadline
Examples	Storm Shelters, Wildfire Prevention Project, Bridge Rehabilitation, Drainage Improvements, Water Storage Tanks, Flood Mitigation Planning Projects, Evacuation Center, and more.
Additional Information	https://www.fema.gov/grants/mitigation/pre-disaster

RECOVERY AND RESILIENCE RESOURCE LIBRARY	
Description	FEMA developed library to navigate the numerous programs available to the United States and its territories to help recover from a disaster. Tool helps users to find and research federal disaster recovery resources that would be beneficial to pre-disaster recovery planning or in the wake of a disaster.
Funds Available	Varies
Eligibility	Resources are intended for state, local, territorial, and tribal governments as well as non-profits, businesses, healthcare institutions, schools, individuals, and households.
Examples	Evidence-based or evidence-informed interventions to strengthen rural and urban communities.
Additional Information	https://www.fema.gov/emergency-managers/practitioners/recovery-resilience-resource-library

STATE AND LOCAL CYBERSECURITY GRANT PROGRAM	
Description	Funding to help states, local governments, rural areas, and territories address cybersecurity risks and cybersecurity threats to information systems.
Funds Available	$183.5 million is available under the SLCGP, with varying funding amounts allocated over four years from the Infrastructure Investment and Jobs Act. The recipient contribution can be cash (hard match) or third-party in-kind (soft match).

STATE AND LOCAL CYBERSECURITY GRANT PROGRAM	
Eligibility	All U.S. states and territories are eligible to apply. The designated State Administrative Agency (SAA) for each state and territory is the only entity eligible to apply for SLCGP funding.
Examples	Planning, equipment, exercises, management & administration, organization, and training.
Additional Information	This year, each state and territory will receive a funding allocation as determined by the statutory formula: • Allocations for states and territories include a base funding level as defined for each entity: 1% for each state, the District of Columbia, and Puerto Rico; and 0.25% for American Samoa, the Commonwealth of the Northern Mariana Islands, Guam, and the U.S. Virgin Islands. • State allocations include additional funds based on a combination of state population and rural population totals. • 80% of total state allocations must support local entities, while 25% of the total state allocations must support rural entities; these amounts may overlap.

SAFEGUARDING TOMORROW THROUGH ONGOING RISK MITIGATION REVOLVING LOAN FUND (STORM-RLF)	
Description	FEMA is making $50 million available to fund capitalization grants that enable eligible entities to administer revolving loan funds and provide direct loans to local governments for projects and activities that mitigate the impacts of drought, intense heat, severe storms (including hurricanes, tornados, windstorms, cyclones, and severe winter storms), wildfires, floods, earthquakes, and other natural hazards. FEMA will work closely with participating entities and gather best practices on topics such as entity administrative burden and capacity, achieving resilience and equity goals, and common project and activity types for loans under this program. FEMA's goal is to increase entity participation with higher funding levels in future grant cycles.
Funds Available	FEMA intends to award $472 million of the funds available under the new program to address climate change and create a more equitable and resilient nation.
Eligibility	Eligible entities are States, Federally recognized tribes that received a major disaster declaration, Territories, and the District of Columbia. State entities must enroll in this program for it to be an option to local public entities.
Examples	This is an opportunity to prioritize low-impact development, wildland-urban interface management, conservation areas, reconnection of floodplain and open space projects. Funding can be utilized for building code adoption and enforcement. Allowable uses include: Mitigation Activities, Non-Federal Cost-Share, Local Government Technical Assistance, and Entity Administrative Costs.
Additional Information	Application period will be open starting February 1 - April 28, 2023. https://www.fema.gov/grants/mitigation/storm-rlf

U.S. Bureau of Reclamation

SMALL SCALE WATER EFFICIENCY PROJECTS	
Description	Funding for small-scale on-the-ground water management projects that conserve, better manage, or otherwise increase efficient use of water supplies. Projects supported by an existing water management and conservation plan, System Optimization Review, or other planning effort led by the applicant are prioritized.
Funds Available	Applicants may request up to $100,000 in federal funding, with a non-federal cost-share of 50% or more of total project costs for projects with total project costs no more than $225,000.
Eligibility	Eligible applicants for all WaterSMART Grants funding opportunities include states; tribes; irrigation districts; water districts; state, regional, or local authorities, whose members include one or more organization with water or power delivery authority; other organizations with water or power delivery authority; and nonprofit conservation organizations that are acting in partnership with and with the agreement of an entity previously described. To be eligible, applicants must be located in the Western United States or U.S. Territories. Entities located in Alaska and Hawaii are also eligible to apply.
Examples	Example projects include Canal lining/piping, municipal metering, irrigation flow measurement, SCADA and automation, landscape irrigation measures, high-efficiency indoor appliances and fixtures, commercial cooling systems.
Additional Information	https://www.usbr.gov/watersmart/swep/index.html

WATER MARKETING STRATEGY GRANTS	
Description	Financial assistance for the development of water marketing strategies to facilitate water markets as a tool for helping willing buyers and sellers meet water demands efficiently in times of shortage and prevent water conflicts.
Funds Available	Program funding is allocated through a competitive process. Applicants may request federal funding up to $400,000 for projects to be completed within three years with a non-Federal cost share of 50% or more of the total project cost.
Eligibility	Eligible applicants for all WaterSMART Grants funding opportunities include states; tribes; irrigation districts; water districts; state, regional, or local authorities, whose members include one or more organization with water or power delivery authority; other organizations with water or power delivery authority; and nonprofit conservation organizations that are acting in partnership with and with the agreement of an entity previously described. To be eligible, applicants must be located in the Western United States or U.S. Territories. Entities located in Alaska and Hawaii are also eligible to apply.
Examples	Funding awarded under Water Marketing Strategy Grants can be used for outreach and partnership building, planning activities (e.g., hydrologic, economic, legal and other types of analysis), pilot activities, and the development of a “water marketing strategy” document.
Additional Information	https://www.usbr.gov/watersmart/watermarketing/index.html

WATER AND ENERGY EFFICIENCY GRANTS	
Description	Focuses on projects that result in quantifiable and sustained water savings, including canal lining and piping projects, municipal metering projects, and Supervisory Control and Data Acquisition (SCADA) and automation projects.
Funds Available	Applicants may request federal funding: (I) up to $500,000 for projects to be completed within two years, (II) up to $2 million for projects to be completed within three years; and (III) up to $5 million for projects to be completed within three years, with a non-Federal cost share of 50% or more of the total project cost. No more than $5,000,000 in total WaterSMART Water and Energy Efficiency Grants funds will be awarded to any single applicant under this Funding Opportunity per fiscal year (i.e., an applicant may receive up to $5.0M in FY 2023 funds.
Eligibility	Eligible applicants for all WaterSMART Grants funding opportunities include states; tribes; irrigation districts; water districts; state, regional, or local authorities, whose members include one or more organization with water or power delivery authority; other organizations with water or power delivery authority; and nonprofit conservation organizations that are acting in partnership with and with the agreement of an entity previously described. To be eligible, applicants must be located in the Western United States or U.S. Territories. Entities located in Alaska and Hawaii are also eligible to apply.
Examples	Projects conserve and use water more efficiently; increase the production of hydropower; mitigate conflict risk in areas at a high risk of future water conflict; and accomplish other benefits that contribute to water supply reliability in the western United States.
Additional Information	https://www.usbr.gov/watersmart/weeg/faq.html

U.S. Department of Agriculture

CONSERVATION INNOVATION GRANTS (CIG)	
Description	Competitive program that supports the development of new tools, approaches, practices, and technologies to further natural resource conservation on private lands. Through creative problem solving and innovation, CIG partners work to address our nation's water quality, air quality, soil health and wildlife habitat challenges, all while improving agricultural operations. Public and private grantees develop the tools, technologies, and strategies to support next-generation conservation efforts on working lands and develop market-based solutions to resource challenges.
Funds Available	Applications made a CIG funding notice is announced each year. Funds for single- or multi-year projects, not to exceed three years, are awarded through a nationwide competitive grants process. Grantees must match the CIG investment at least one to one.
Eligibility	The natural resource concerns eligible for funding through CIG are identified in the funding announcement and may change annually to focus on new and emerging, high-priority natural resource concerns. National and State CIG – all non-Federal entities and individuals are eligible to apply. All CIG projects must involve EQIP-eligible producers.

CONSERVATION INNOVATION GRANTS (CIG)	
Examples	Projects may be watershed-based, regional, multi-state or nationwide in scope.
Additional Information	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/cig/

EMERGENCY WATERSHED PROTECTION PROGRAM	
Description	The EWP Program offers technical and financial assistance to help local communities relieve imminent threats to life and property caused by floods, fires, windstorms, and other natural disasters that impair a watershed. EWP does not require a disaster declaration by federal or state government officials for program assistance to begin.
Funds Available	NRCS may provide technical assistance as services and/or funds to plan, design, and contract the emergency measures, subject to an agreement between NRCS and the Sponsor. Installation/Construction costs are not to exceed 75% or 90% for limited resource areas. Engineering/Technical Assistance is not to exceed 100%. No funds are available for real property rights.
Eligibility	Project criteria requires the project to provide protection from flooding or soil erosion; reduce threats to life and property; restore the hydraulic capacity to the natural environment; and economically and environmentally defensible. Eligible local sponsors for recovery projects include cities, counties, towns, conservation districts, or any federally-recognized Native American tribe or tribal organization.
Examples	Removal of debris from stream channels, road culverts, and bridges; reshaping and protection of eroded streambanks; correction of damaged or destroyed drainage facilities; establishing vegetative cover on critically eroding lands; repair of levees and structures; repair of certain conservation practices; and purchase of floodplain easements.
Additional Information	https://www.nrcs.usda.gov/programs-initiatives/ewp-emergency-watershed-protection

SMALL BUSINESS INNOVATION RESEARCH	
Description	The Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs at the U.S. Department of Agriculture (USDA) offer competitively awarded grants to qualified small businesses to support high quality research related to important scientific problems and opportunities in agriculture that could lead to significant public benefits. This program as two phases, Phase I is open to any small business concern that meets the SBIR/STTR eligibility requirements and Phase II is open only to previous Phase I awardees.
Funds Available	Funds are offered across 10 topic areas including: Forests and Related Resources, Plant Production and Protection-Biology, Animal Production and Protection, Conservation of Natural Resources, Food Science and Nutrition, Rural and Community Development, Aquaculture, Biofuels and Biobased Products, Small and Mid-size Farms, and Plant Production and Protection-Engineering
Eligibility	The SBIR/STTR programs do not make loans and do not award grants for the purpose of helping a business get established. The program seeks to stimulate technological innovation in the private sector, strengthen the role of small businesses in

SMALL BUSINESS INNOVATION RESEARCH	
	meeting federal research and development needs, increase private sector commercialization of innovations derived from USDA-supported research and development efforts, and foster and encourage participation by women-owned and socially and economically disadvantaged small business firms in technological innovations
Examples	Salary and wages for company employees, associated fringe benefits, materials and supplies, and a number of other direct costs needed to conduct the proposed R&D
Additional Information	https://www.nifa.usda.gov/grants/programs/small-business-innovation-research-technology-transfer-programs-sbirsttr

WATERSHED REHABILITATION PROGRAM	
Description	The Watershed Rehabilitation Program helps project sponsors rehabilitate aging dams that are reaching the end of their design life and/or no longer meet federal or state standards. NRCS provides technical and financial assistance to local project sponsors to rehabilitate aging dams that protect lives and property, and infrastructure.
Funds Available	Across the Nation, watershed REHAB projects provide over $2.2 billion in reduced flooding and erosion damage while improving wildlife habitat, recreation, water quality and supply for an estimated 47 million people. Costs associated with additional or new water supply storage purposes added to the rehabilitation project may be cost-shared with watershed rehabilitation funds. Eligible project costs are covered 65% Federal/35% Local of total eligible project cost, not to exceed 100% of actual construction cost. No more than 100% of the engineering/Technical Assistance will be covered.
Eligibility	Eligible projects are dams that were originally constructed through a NRCS Watershed Program, no longer meet current safety and performance standards, including dams past their evaluated life, and has current operation and maintenance.
Examples	*Information not available*
Additional Information	https://www.nrcs.usda.gov/programs-initiatives/watershed-rehabilitation

WATERSHED AND FLOOD PREVENTION OPERATIONS PROGRAM	
Description	The WFPO program provides technical and financial assistance to help plan and implement authorized watershed projects for the purpose of flood prevention, watershed protection, public recreation, public fish and wildlife, agricultural water management, municipal and industrial water supply, water quality management, and watershed structure rehabilitation. The WFPO Program helps units of federal, state, local and tribal of government (project sponsors) protect and restore watersheds up to 250,000 acres.
Funds Available	The percentage of a project that will be covered by the federal cost-sharing varies by project purpose. Engineering and Technical Assistance is covered 100% for most project, except for Municipal and Industrial Water Supply projects. The

WATERSHED AND FLOOD PREVENTION OPERATIONS PROGRAM	
	percentage of installation/construction costs that are covered are as follows: Flood prevention-100%, Watershed Protection - Variable, Public Fish and Wildlife or Public Recreational Development - No more than 50%, Agricultural Water Management - Up to 75%, Municipal and Industrial Water Supply - no more than 50%, Water Quality Management - To be determined, Rehabilitation - No more than 100%.
Eligibility	Project criteria requires public sponsorship, be a watershed project of 250,000 acres or less, and have agricultural benefits that, including rural communities, must be 20% or more of the total benefits for the project. Eligible project sponsors include States, local governments, and tribal organizations.
Examples	Watershed Plans, flood prevention projects, drainage, irrigation, reservoir structure, dams.
Additional Information	https://www.nrcs.usda.gov/conservation-basics/conservation-by-state/iowa

U.S. Department of Agriculture Rural Development Funding

COMMUNITY FACILITIES LOANS AND GRANTS	
Description	This program provides affordable funding to develop essential community facilities in rural areas, an essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area, and does not include private, commercial, or business undertakings.
Funds Available	*Information not available*
Eligibility	Eligible for areas 20,000 or less in population. Applicants are municipalities, non-profits, special purpose districts, and federally recognized Indian tribes. Eligible borrowers include public bodies, community based non-profit corporations, and federally recognized tribes.
Examples	Funds can be used to purchase, construct, and/or improve essential community facilities, purchase equipment, and pay related project expenses
Additional Information	https://www.rd.usda.gov/programs-services/community-facilities/community-facilities-direct-loan-grant-program/ne

COMMUNITY FACILITY RURAL COMMUNITY DEVELOPMENT INITIATIVE GRANTS	
Description	RCDI grants are awarded to help non-profit housing and community development organizations, low-income rural communities and federally recognized tribes support housing, community facilities, and community and economic development projects in rural areas. Funds may be used to improve housing, community facilities, and community and economic development projects in rural areas.
Funds Available	Grants are awarded with a minimum amount of $50,000 and maximum of $250,000. Funds are limited and are awarded through a competitive process. Matching fund requirement equal to amount of grant but in-kind contributions cannot be used as matching funds. Partnerships with other federal, state, local, private, and nonprofit entities are encouraged.

COMMUNITY FACILITY RURAL COMMUNITY DEVELOPMENT INITIATIVE GRANTS	
Eligibility	Open to public bodies, non-profit organizations, and qualified private organizations. Rural and rural areas other than a city or town with a population of greater than 50,000 people and the urbanized area contiguous and adjacent to such city or town.
Examples	RCDI grants may be used for but are not limited to training sub-grantees and providing technical assistance to sub-grantees on strategic plan developments, accessing alternative funding sources, board training, developing successful child care facilities, creating training tools, and effective fundraising techniques.
Additional Information	https://www.rd.usda.gov/programs-services/community-facilities/rural-community-development-initiative-grants#overview

COMMUNITY FACILITY TECHNICAL ASSISTANCE AND TRAINING GRANT	
Description	Provide associations Technical Assistance and/or training with respect to essential community facilities programs. The Technical Assistance and/or training will help identify and plan for community facility needs that exist in the area. Once those needs have been identified, the Grantee can assist in identifying public and private resources to finance those identified community facility needs.
Funds Available	Maximum grant award of $150,000. Grant funds are limited and are awarded through a competitive process. Matching funds are not required, in-kind contributions cannot be used as matching funds, partnerships with other entities are encouraged.
Eligibility	Open to public bodies, non-profit organizations, and federally recognized tribes. Rural areas including cities, villages, townships, towns, and Federally Recognized Tribal Lands outside the boundaries of a city of 20,000 or more.
Examples	Webster County purchased a new ambulance and equipment with Rural Development funds (and other sources) and South Sioux City was able to build a new fire station with funding from USDA Rural Development (and other sources).
Additional Information	https://www.rd.usda.gov/programs-services/community-facilities/community-facilities-technical-assistance-and-training-grant#overview

EMERGENCY COMMUNITY WATER ASSISTANCE GRANTS (ECWAG)	
Description	This program helps eligible communities prepare for, or recover from, an emergency that threatens the availability of safe, reliable drinking water. A federal disaster declaration is not required, and this grant covers events such as drought or flood, earthquake, tornado or hurricane, disease outbreak, chemical spill, leak, or seepage, or other disasters.
Funds Available	Up to $150,000 for water transmission line projects. Water Source grants up to $1,000,000.
Eligibility	Primarily for residential purposes and are eligible for 10,000 or less population areas. Applicants are municipalities, special purpose districts (RWS), non-profits, and Recognized Indian Tribes. Applications are accepted year-round online through the RD Apply or through local RD office

EMERGENCY COMMUNITY WATER ASSISTANCE GRANTS (ECWAG)	
Examples	Construction of waterline extensions, repair breaks or leaks in existing water distribution lines, and address related maintenance necessary to replenish the water supply. Water Source Grants are to construct a water source, intake, or treatment facility.
Additional Information	https://www.rd.usda.gov/programs-services/water-environmental-programs/emergency-community-water-assistance-grants/ne

U.S. Department of Energy

GRID INNOVATION PROGRAM	
Description	This program provides support for projects that use innovative approaches to transmission, storage, and distribution infrastructure to enhance grid resilience and reliability. Projects selected under this program will include interregional transmission projects, investments that accelerate interconnection of clean energy generation, and utilization of distribution grid assets to provide backup power and reduce transmission requirements. Innovative approaches can range from use of advanced technologies to innovative partnerships to the deployment of projects identified by innovative planning processes.
Funds Available	The Grid Innovation Program will invest up to $5 billion ($1 billion/year for Fiscal Years 2022-2026) in innovation and new approaches to transmission, distribution, storage, and regional resilience. The first funding cycle will include both FY22 and FY23, up to $2 billion. Projects are subject to a 50% cost share minimum.
Eligibility	Eligible entities include a state, a combination of 2 or more states, an Indian Tribe, a unit of local government, or a public utility commission.
Examples	Transmission, storage, and distribution infrastructure to enhance grid resilience and reliability.
Additional Information	

GRID RESILIENCE UTILITY AND INDUSTRY GRANTS	
Description	Grants provide funding to support activities that will modernize the electric grid to reduce impacts from extreme weather and natural disasters. This grant program will fund comprehensive transformational transmission and distribution technology solutions that will mitigate weather hazards across a region or within a community that can cause a disruption to the power system. Grants awarded under the program will fund transmission and distribution technology projects that seek to address hazards within a region or a community that can disrupt the power system, such as wildfires, floods or hurricanes.
Funds Available	Funding of $2.5 Billion over five years from FY 22-26 with $500 million available per year. Funding is capped at the amount the eligible entity has spent in the previous three years on hardening efforts. There is a 100% cost match for this program. The program includes a small utility set aside for those entities selling no more than 4 million MWh of electricity per year.

GRID RESILIENCE UTILITY AND INDUSTRY GRANTS	
Eligibility	This funding opportunity is available to electric grid operators, electricity storage operators, electricity generators, transmission owners or operators, distribution providers, and fuel suppliers.
Examples	Infrastructure upgrades to strengthen and modernize the power grid against natural disasters that are exacerbated by the climate crisis.
Additional Information	https://www.energy.gov/gdo/grid-resilience-utility-and-industry-grants

SMART GRID GRANTS	
Description	Smart Grid Grants is designed to increase the flexibility, efficiency, and reliability of the electric power system, with particular focus on: increasing capacity of the transmission system, preventing faults that may lead to wildfires or other system disturbances, integrating renewable energy at the transmission and distribution levels, and facilitating the integration of increasing electrified vehicles, buildings, and other grid-edge devices. Smart grid technologies funded and deployed at scale through this program must demonstrate a pathway to wider market adoption.
Funds Available	The Smart Grid Grant program will invest up to $3 billion ($600 million/year for Fiscal Years 2022-2026) in grid resilience technologies and solutions. The first funding cycle will include both FY22 and FY23, up to $1.2 billion. Recipients must provide a cost-share of at least 50% of the grant.
Eligibility	This program is open to domestic entities including institutions of higher education; for-profit entities; non-profit entities; and state and local governmental entities, and tribal nations.
Examples	Grid enhancing technologies such as dynamic line rating, flow control devices, advanced conductors, and network topology optimization, to improve system efficiency and reliability. Investments in optical ground wire, dark fiber, operational fiber, and wireless broadband communications networks.
Additional Information	https://www.energy.gov/gdo/grid-innovation-program

U.S. Department of Housing and Urban Development

COMMUNITY DEVELOPMENT BLOCK GRANTS	
Description	Provides annual grants on a formula basis to states, cities, and counties to develop viable urban communities by providing decent housing and a suitable living environment, and by expanding economic opportunities, principally for low- and moderate-income persons.
Funds Available	HUD determines the amount of each entitlement grantee's annual funding allocation by a statutory dual formula which uses several objective measures of community needs, including the extent of poverty, population.
Eligibility	Eligible grantees include principal cities of Metropolitan Statistical Areas, Other metropolitan cities with populations of at least 50,000, qualified urban counties with populations of at least 200,000 (excluding the population of entitled cities),

COMMUNITY DEVELOPMENT BLOCK GRANTS	
	States and insular areas. Eligibility for participation as an entitlement community is based on population data provided by Census. Each activity must meet one of the following national objectives for the program: benefit low- and moderate-income persons, prevention or elimination of slums or blight, or address community development needs having a particular urgency because existing conditions pose a serious and immediate threat to the health or welfare of the community for which other funding is not available.
Examples	CDBG funds may be used for activities which include, but are not limited to: Acquisition of real property; Relocation and demolition; Rehabilitation of residential and non-residential structures; Construction of public facilities and improvements, such as water and sewer facilities, streets, neighborhood centers, and the conversion of school buildings for eligible purposes; Public services, within certain limits; Activities relating to energy conservation and renewable energy resources; Provision of assistance to profit-motivated businesses to carry out economic development and job creation/retention activities
Additional Information	HUD does not provide CDBG assistance directly to individuals, businesses, nonprofit or organizations or other non-governmental entities. https://www.hud.gov/program_offices/comm_planning/cdbg

CDBG DISASTER RECOVERY ASSISTANCE	
Description	The Community Development Block Grant (CDBG) Program has Disaster Recovery grants to rebuild the affected areas and provide crucial seed money to start the recovery process. These flexible grants help cities, counties, and States recover from Presidentially declared disasters, especially in low-income areas, subject to availability of supplemental appropriations. Since CDBG Disaster Recovery (CDBG-DR) assistance may fund a broad range of recovery activities, HUD can help communities and neighborhoods that otherwise might not recover due to limited resources.
Funds Available	Varies according to the state plan outlined by the state department of economic development.
Eligibility	CDBG-DR funds are provided to the most impacted and distressed areas for Disaster Relief, Long-Term Recovery, Restoration of Infrastructure, Housing, and Economic Revitalization. HUD will notify eligible States, cities and counties if they are eligible to receive CDBG-DR grants. Those who receive grant money include state agencies, non-profit organizations, economic development agencies, citizens and businesses
Examples	Funding can be provided to cover unmet needs such as local cost share funding from public assistance projects or hazard mitigation grant projects.
Additional Information	https://www.hud.gov/program_offices/comm_planning/cdbg-dr

NEIGHBORHOOD STABILIZATION PROGRAM	
Description	The Neighborhood Stabilization Program (NSP) was established for the purpose of providing emergency assistance to stabilize communities with high rates of abandoned and foreclosed homes, and to assist households whose annual incomes are up to 120 percent of the area median income (AMI). NSP funds were used for activities which included: Establish

NEIGHBORHOOD STABILIZATION PROGRAM	
	financing mechanisms for purchase and redevelopment of foreclosed homes and residential properties; Purchase and rehabilitate homes and residential properties abandoned or foreclosed; Establish land banks for foreclosed homes; Demolish blighted structures; Redevelop demolished or vacant properties.
Funds Available	$4 billion nationwide. Iowa receives $21.6 million in NSP funding
Eligibility	States, certain local governments, and other organizations.
Examples	The NSP provides grants to every state, certain local communities, and other organizations to purchase foreclosed or abandoned homes and to rehabilitate, resell, or redevelop these homes in order to stabilize neighborhoods and stem the decline of house values of neighboring homes.
Additional Information	https://www.hud.gov/program_offices/comm_planning/nsp

U.S. Economic Development Administration

PUBLIC WORKS AND ECONOMIC ADJUSTMENT ASSISTANCE (EAA)	
Description	The EAA provides funding to help plan, build, innovate, and put people into quality jobs in hundreds of communities across the nation. The Economic Adjustment Assistance program is EDA's most flexible program, and grants made under this program will help hundreds of communities across the nation plan, build, innovate, and put people back to work through construction or non-construction projects designed to meet local needs.
Funds Available	Total Program Funding of $500 Million with an award ceiling of $10 Million and a floor of $100,000.
Eligibility	A wide range of technical, planning, workforce development, entrepreneurship, and public works and infrastructure projects are eligible for funding under this program. Eligible applicants for EDA's Economic Adjustment Assistance program include a(n): District Organization of an EDA-designated Economic Development District; Indian Tribe or a consortium of Indian Tribes; State, county, city, or other political subdivision of a State, including a special purpose unit of a State or local government engaged in economic or infrastructure development activities, or a consortium of political subdivisions; Institution of higher education or a consortium of institutions of higher education; Public or private non-profit organization or association acting in cooperation with officials of a political subdivision of a State. Individuals or for-profit entities are not eligible.
Examples	Public infrastructure related to economic development.
Additional Information	As part of the $300 million Coal Communities Commitment, EDA will allocate at least $200 million of the Economic Adjustment Assistance funding to support coal communities.

U.S. Environmental Protection Agency

CLEAN WATERS ACT SECTION 319 GRANTS	
Description	Clean Water Act Section 319(h) funds are provided only to designated state and tribal agencies to implement their approved nonpoint source management programs. State and tribal nonpoint source programs include a variety of components, including technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and regulatory programs.
Funds Available	Each year EPA awards Section 319(h) funds to states in accordance with a state-by-state allocation formula that EPA has developed in consultation with the states. Grant totals over the past 5 years have increased from $155.9 million in 2013 and $178 million in 2022.
Eligibility	*Information not available*
Examples	*Information not available*
Additional Information	https://www.epa.gov/sites/default/files/2015-09/documents/319-guidelines-fy14.pdf

ENVIRONMENTAL JUSTICE COLLABORATIVE PROBLEM-SOLVING	
Description	This cooperative agreement program provides financial assistance to eligible organizations working on or planning to work on projects to address local environmental and/or public health issues in their communities. The program assists recipients in building collaborative partnerships with other stakeholders to develop solutions that will significantly address environmental and/or public health issue(s) at the local level. Selected applicants, or recipients, are required to use the EPA's Environmental Justice Collaborative Problem Solving Model as part of their projects.
Funds Available	The EJCPS Program anticipates awarding approximately $30,000,000 of Inflation Reduction Act funding through 83 cooperative agreements, organized in two tracks of funding. $25,000,000 for CBOs proposing projects for up to $500,000 each. Approximately 50 awards for up $500,000 each are anticipated under this track. $5,000,000 for qualifying small CBOs with 5 or fewer full-time employees proposing projects for up to $150,000 each. For more details about this opportunity, please review closely the "Small Community-based Nonprofit Set Aside". Approximately 33 awards for up to $150,000 each are anticipated under this track. Cooperative agreements will be funded for a three-year performance period.
Eligibility	Eligible entities include incorporated non-profit organizations, US Territories, Tribal government, either federally or state recognized, tribal organizations, and freely associated states.
Examples	In 2003 the Pacific Basin Development Council received this grant to build community resiliency.
Additional Information	https://www.epa.gov/environmentaljustice/environmental-justice-collaborative-problem-solving-cooperative-agreement-5

URBAN WATERS SMALL GRANTS	
Description	The mission of this program is to help local residents and their organizations, particularly those in underserved communities, restore their urban waters in ways that also benefit community and economic revitalization. The program recognizes that healthy and accessible urban waters can help grow local businesses and enhance educational, recreational, social, and employment opportunities in nearby communities. Projects should meet the following four objectives: address local water quality issues related to urban runoff pollution; provide additional community benefits; actively engage underserved communities; and foster partnership.
Funds Available	Urban Waters Small Grants are competed and awarded every two years with individual award amounts of up to $60,000.
Eligibility	Eligible applicants include States, local governments, Indian Tribes, public and private universities and colleges, public or private nonprofit institutions/organizations, intertribal consortia, and interstate agencies.
Examples	An example of a past grant awarded was to the University of Nebraska-Lincoln in 2015-2016 to provide technical assistance and training on stormwater and green infrastructure to small businesses and residents of under-served communities.
Additional Information	https://www.epa.gov/urbanwaterspartners/urban-waters-small-grants

WATER INFRASTRUCTURE FINANCE AND INNOVATION ACT OF 2014 (WIFIA)	
Description	The WIFIA program provides long-term, low-cost supplemental loans for regionally and nationally significant water and wastewater infrastructure projects. Borrowers benefit from a single fixed interest rate that is equal to the US Treasury rate of a similar maturity, an interest rate that is not impacted by the borrower's credit or loan structure, custom long-term repayment schedules with options to defer payment for up to 5 years.
Funds Available	$20 million minimum project size for large communities, $5 million minimum for small communities of 25,000 or less. WIFIA can fund a maximum of 49% of eligible project costs.
Eligibility	Eligible borrowers are 1) local, state, tribal, and federal government entities; 2) Partnerships and joint ventures; 3) Corporations and trusts; 4) Clean Water and Drinking Water State Revolving Fund (SRF) programs.
Examples	Wastewater conveyance and treatment projects. Drinking water treatment and distribution projects. Enhanced energy efficiency projects at drinking water and wastewater facilities.
Additional Information	Total federal assistance may not exceed 80% of a project's eligible costs. https://www.epa.gov/wifia/what-wifia

U.S. Fish and Wildlife Services

NORTH AMERICAN WETLANDS CONSERVATION STANDARD AND SMALL GRANT	
Description	A competitive matching grants program that supports public-private partnerships carrying out projects in the United Stated that further the goals of the North American Wetlands Conservation Act. These projects must involve long-term protection,

NORTH AMERICAN WETLANDS CONSERVATION STANDARD AND SMALL GRANT	
	restoration, and/or enhancement of wetlands and associated uplands habitat for the benefit of all wetlands-associated migratory birds.
Funds Available	US Small Grants may not exceed $100,000 and require a 1-to-1 ratio match for awarded grant amount. The US Standard Grant is for grants larger than $100,000 and requires a 1-to-1 match ratio.
Eligibility	US Small Grants proposals are due in October or else will be considered an early submission for the next Fiscal Year. The US Standard Grant has a two deadline for proposals, one in February and one in July. Proposal submitted after July are considered ineligible unless clearly marked as an early submission for the next Fiscal Year.
Examples	Acquisition of land for the purposes of wetlands conservation, wetland restoration projects, wetland enhancement projects, wetland establishment, or other direct long-term wetland conservation work.
Additional Information	https://www.fws.gov/sites/default/files/documents/north-american-wetlands-conservation-act-us-eligibility-criteria_0.pdf

U.S. Forest Service

FORESTRY LEGACY PROGRAM	
Description	Focuses on private forest land that is faced by threats of conversion to non-forest land by urbanization, residential development. Providing economic incentives to landowners to keep forests as forest encourages sustainable forest management and supports strong markets for forest products. Landowners participate in the FLP by either selling property outright or by retaining ownership and selling only a portion of the property's development rights; both are held by state agencies or another unit of government. Use of a conservation easement allows land to remain in private ownership while ensuring that its environmental values are retained. Program funded by Land and Water Conservation Fund, which invests a small percentage of federal offshore drilling fees towards the conservation of important land, water, and recreation areas for all Americans.
Funds Available	Previous year funds for Fiscal Year 2022 totaled $88,878,955 across 14 projects.
Eligibility	Private Lands
Examples	Funded projects from 2022 include the Montana Great Outdoors Conservation Project, Oregon's Spence Mountain Forest, Wyoming's Munger Mountain Corridor Initiative, and others.
Additional Information	https://www.fs.usda.gov/managing-land/private-land/forest-legacy/program

State of Iowa Funding Resources

In addition to federal grants, there are a number of state agencies and programs with potential applicability to supporting funding and implementation of mitigation projects. Many federal hazard mitigation grant programs are administered at the state level by HSEMD and IDNR, as noted above. These agencies will also likely be important in earlier stages of the hazard mitigation planning process by providing current hazard and risk assessment data.

While this section of the funding guidebook attempts to list as many funding options as possible, it is by no means a complete list of programs in Iowa that could have the potential to support hazard mitigation project implementation. Similar to federal grant programs, many of these programs are dependent on yearly funding allocations, which results in fluctuations in their availability. The websites and reference materials used to provide this information are as current as possible; however, it is important to note that funding programs are dynamic and subject to frequent changes. While it is helpful to be familiar with the current information, it is equally as important to engage candidate federal and state agencies as soon as possible.

WELLMARK FOUNDATION GRANTS	
Description	Grant opportunities that promote and fund sustainable projects to eat healthy and engage in everyday physical activity. Applications for built environment initiatives also accepted. Projects must align with one of the two focus areas: Access to and consumption of healthy foods. Or safe environments to be physically active in.
Funds Available	Varies by program
Eligibility	Must be classified as a Section 501(c)(3) tax-exempt organization under Internal Revenue Code or a governmental entity. Must be an organization within the states of either 3 Iowa or South Dakota or seeking funding support for grant funding restricted for use in Iowa or South Dakota.
Additional Information	Varies by program

IOWA DEPARTMENT OF NATURAL RESOURCES CLEAN WATER STATE REVOLVING FUND	
Description	Iowa's Clean Water State Revolving Fund (CWSRF) is the best choice to finance publicly owned wastewater treatment, sewer rehabilitation, replacement, and construction, and storm water quality improvements.
Funds Available	Since 1989, the CWSRF has provided more than $1.4 billion in financing assistance for water pollution control.
Eligibility	Publicly owned treatment works including: municipalities, counties, sanitary districts, or other governmental entities empowered to provide sewage collection and treatment services.
Examples	Wastewater treatment plants – construction, expansion, upgrades, and rehabilitation Sewer system rehab and replacement Interceptors, collectors, and lift stations Infiltration/inflow correction Combined sewer overflow correction Nonpoint source projects Stormwater projects that have a water quality benefit

IOWA DEPARTMENT OF NATURAL RESOURCES CLEAN WATER STATE REVOLVING FUND	
Additional Information	http://www.iowasrf.com/program/clean_water_loan_program/clean-water-srf-intended-use-plan-information/

DERELICT BUILDING PROGRAM	
Description	The Derelict Building Program is available for Iowa towns of 5,000 or fewer residents to address neglected commercial or public structures that have sat vacant for at least 6 months.
Funds Available	
Eligibility	To be eligible, the building must not reside on the National Historic Register. Only a City government may be an applicant and they must own or be in the process of owning the building. Applicants may partner with non-profits on projects, but building must be owned by applicant. The building must be a former commercial or public building that's been abandoned for at least six months.
Additional Information	https://www.iowadnr.gov/Environmental-Protection/Land-Quality/Waste-Planning-Recycling/Derelict-Building-Program

IOWA SILVER JACKETS	
Description	The Iowa Silver Jackets Program provides 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 in the State of Iowa. Federal and state agencies are working together to enhance intergovernmental partnerships resulting in comprehensive and sustainable solutions to Iowa state flood risk hazards.
Funds Available	Varies
Additional Information	https://www.floodrisk.iowa.gov/

Alternative Funding Resources

In recent years, states and communities across the country have sought and developed innovative funding sources as alternatives to traditional government grant programs. These funding sources fall into three main categories: Local Funding Options, Public-Private Partnerships, and Private Foundations. These funding sources will be important for current and future hazard mitigation planning efforts for several reasons including:

- Decreases in funding for pre-disaster mitigation grant and assistance programs at the federal level and for state agencies - While technical assistance and other related support functions are still actively supported across federal and state agencies, and in some cases are increasing, allocations for "bricks and mortar" pre-disaster hazard mitigation projects will be competing with a broad range of government funding needs. These funds may not completely disappear, but the need will continue to outstrip the supply in the foreseeable future.

- Opportunities to fund projects that might not qualify or align with traditional grant and assistance programs. Funding programs seek solutions that reduce risk for a particular threshold (i.e., 1-percent flood) and meet absolute cost-benefit criteria that the agencies themselves must adhere to. Therefore, these programs, by their basic nature, are not able to support efforts that may help most of the time but don't meet these thresholds, e.g., a homeowner installed flood wall in a

repetitive loss area that prevents annual floods, but not larger magnitude events that come along every few years. There is a related concept that can be referred to as "cumulative risk reduction". For example, a homeowner with limited resources (and no real access to grant funds) might be willing to spend a little time and money each year getting just a little bit safer.

Local Funding Options

Local funding options are just what they sound like, using local funds for local mitigation projects. Local funds are also needed as the non-federal share or "matching funds" for federal grant programs but can also be used independently to fund a range of project types. Local funding options include the following:

Capital Improvement Programs – Ongoing civic improvements can include prioritized hazard mitigation projects or mitigation can be included as one aspect of a larger project. For example, improving the hydraulic capacity of a culvert or bridge to prevent upstream flooding while undertaking periodic replacements for end of service considerations is one example. Replacing windows in a school with shatter resistant glass as part of an overall renovation is another example. Capital improvement programs are generally funded with local tax revenues and municipal bonds.

Permits, Fees, and Developer Contributions- Communities can establish fees, earmark a portion of existing permit and fee structures, and/or establish requirements for developer contributions for new developments in hazard prone areas that can then be used to fund local mitigation projects. The proceeds can be accumulated in what is often referred to as a Mitigation Trust Fund and the uses are typically tied to specific project types and/or relationships with projects already identified in specific plans or documents such as an HMP. These types of funds can also be used to create vouchers or other incentives for individual action.

Force Account / In-Kind Services – Although there is a cost associated with activities of public employees, there are a wide range of activities that can be undertaken by local government staff and officials as well as interested parties on their behalf that would yield significant benefits. Some of the obvious examples are public outreach and education for individual property owners, businesses, and institutions to reduce their risk through correspondingly inexpensive or essential activities. This would include tapping into available educations resources, promoting individual action, etc.

Property Owners – For a project that directly benefits one or more specific properties, the property owner can be asked to contribute. Through the HIRA process, property owners can become better aware of their risks and options. Owners that recognize they have a real flood problem may be willing to pay a portion of the cost. In recent years, property owners have voluntarily agreed to pay the non-federal share (up to 25 percent of the total project cost) for FEMA HMA grants in some states. In some cases, the owners have paid even higher percentages of the cost. In addition, after a flood, owners may have cash from insurance claims or disaster assistance that they will be using to repair their homes and properties. By including the right floodproofing and mitigation project components into the repairs, the resilience of the property to future flooding may be improved. Having property owners contribute to the project can help stretch available local funds and gives the property owner an enhanced stake in the outcome of the project and incentive to make sure the property is properly maintained.

Individual Participation – Although mitigation is ultimately intended to benefit individuals, HMPs often neglect to integrate participation of potential beneficiaries into the process. The participation by individuals, including small business owners, is important for making sure the resulting HMP reflects

community needs and priorities, but it also allows for the planning team to identify measures and options that individuals can take to reduce their own risk at a cost they can afford.

Public-Private Partnerships

Developing a public-private partnership is a phrase used frequently in a wide range of government programs and for good reason, especially in the content of hazard mitigation. Participation of private sector organizations in solving their own hazard risk situations can be a low-cost and effective method. The phrase also encompasses finding opportunities for public and private sector partners to share costs equitably for larger projects that require substantial funds to implement. Private sector businesses and organizations have their own cost-benefit calculations to perform but joint efforts may make the balance sheets work for both sides.

Private Foundations

Cultivating relationships with local, regional, or even national foundations with interests or missions consistent with hazard mitigation, community sustainability, climate change adaptation, and other related topics can yield successful results in terms of funding and other means of support.

There are many local foundations around the State of Iowa, many of which fund programs that can be utilized for components of hazard mitigation projects. Many of these foundations only support non-profit organizations, so the applicability of these funds to projects depends upon the partners involved.