

Story County, Iowa

Multi-Jurisdictional Hazard Mitigation Plan

2018 Update



Story County, Iowa

Multi-Jurisdictional Hazard Mitigation Plan

2018 Plan Update

Developed by Story County with professional assistance from
Wood Environment & Infrastructure Solutions, Inc.
Homeland Security and Emergency Management

SPECIAL THANKS AND ACKNOWLEDGEMENTS

Story County Hazard Mitigation Planning Committee

Jurisdictional Representatives

Name		Title	Jurisdiction/Organization
Lindsey	Beecher	Superintendent	Gilbert CSD
Andrew	Coree		City of Collins
Jennifer	Davies	City Administrator/Clerk	Slater
Chris	Erickson	Mayor	McCallsburg
Steven	Gast	Public Works	Maxwell
Nicole	Goeser	City Councilperson	Sheldahl
Jason	Grubbs	Deputy Sheriff	Story County
LeAnne	Harter	County Outreach and Special Projects Manager	Story County
Brent	Horn	City Councilperson	Collins
Nathan	Hovick	Public Works Director	Roland
Mark	Jackson	City Administrator	Story City
Bob	Jamison		City of Colo
Mike	Jensen		Iowa State University
Mike	Jensen		City of Story City
Angie	Jewett	Emergency Manager	Iowa State University
John	Kahler	Mayor	Slater
Tasheik	Kerr	Management Analyst	Ames
Kenneth	Kling	Mayor	Kelley
Steven	Kovarik	Mayor	Cambridge
David	Kroese	Facilities Director	Nevada CSD
Jeff	Larson	Fire Chief	Roland
Bill	Lytle	Buildings and Grounds	Colo-Nesco CSD
Matt	Mardesen	City Administrator	Nevada
Ottie	Maxey	Superintendent	Ballard CSD/Collins Maxwell CSD
Lysle	McDonald	Fire Chief	Story City
Keith	Morgan	EM Coordinator	Story County
Tony	Ness	Public Works	Maxwell
Lauris	Olson	Supervisor	Story County
Matt	Patton	Superintendent	Roland-Story CSD
Gerry	Peters	Facilities Director	Ames CSD
Jon	Popp	Mayor	Gilbert
Steve	Ransom	Councilmember	Slater
Charles	Robertson		City of Maxwell
Stephen	Simpson	Director Emergency Management	Iowa State University
Melissa	Spencer	Deputy EM Coordinator	Story County
Gary	Stoll	Police Chief	Huxley
David	Thom	City Councilperson	Cambridge
Andy	Webb	Mayor	Roland

TABLE OF CONTENTS

Special Thanks And Acknowledgements	i
Table Of Contents	ii
Executive Summary.....	iii
Prerequisites.....	v
Model Resolution	vi
1 Introduction and Planning Process	1.1
2 Planning Area Profile and Capabilities	2.1
3 Risk Assessment	3.1
4 Mitigation Strategy	4.1
5 Plan Maintenance Process	5.1
Appendix A: References	
Appendix B: Planning Process	
Appendix C: Completed/Deleted Mitigation Actions	
Appendix D: Adoption Resolutions	
Appendix E: Critical/Essential Facilities (Redacted from Public Version)	



EXECUTIVE SUMMARY

The purpose of hazard mitigation is to reduce or eliminate long-term risk to people and property from hazards. Story County and participating jurisdictions developed this multi-jurisdictional local hazard mitigation plan update to reduce future losses to the County and its communities as a result of hazard events. The plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 and to achieve eligibility for the Federal Emergency Management Agency (FEMA) Hazard Mitigation Assistance Grant Programs.

The Story County Multi-Jurisdictional Hazard Mitigation Plan covers the following jurisdictions that participated in the planning process:

- Unincorporated Story County
- Ames
- Cambridge
- Collins
- Colo
- Gilbert
- Huxley
- Kelley
- Maxwell
- McCallsburg
- Nevada
- Roland
- Sheldahl
- Slater
- Story City
- Ames CSD
- Nevada CSD
- Ballard CSD
- Gilbert CSD
- Roland-Story CSD
- Colo-Nesco CSD
- Collins-Maxwell CSD
- Iowa State University

Story County, the incorporated areas, public school districts, and state university listed above developed a Multi-Jurisdictional Hazard Mitigation Plan that was approved by FEMA on November 5, 2014 (hereafter referred to as the 2014 Story County Hazard Mitigation Plan). Therefore, this current planning effort serves to update the previous plan.

The City of Zeoring was a participant of the previous planning effort and was invited to participate in this plan update but did not meet the participation requirements to be considered an official participating jurisdiction in this plan. However, to provide a comprehensive analysis, the Risk Assessment includes the City of Zeoring. During the plan maintenance and revision process outlined in detail in Chapter 5, all jurisdictions will again be invited to participate in the planning process when the plan is updated during the five-year Iowa Homeland Security and Emergency Management and FEMA revision/approval cycle.

Additional stakeholders were also invited to include private businesses, community groups, private non-profit entities, adjacent communities, state and federal agencies, academia, and local regional agencies that have a stake in mitigation planning in Story County.

The plan update process followed a methodology prescribed by FEMA, which began with the assembly of the Hazard Mitigation Planning Committee (HMPC) comprised of representatives from Story County, participating jurisdictions, and stakeholders. The HMPC updated the risk assessment that identified and profiled hazards that pose a risk to the Story County planning area, assessed the vulnerability to these hazards, and examined the capabilities in place to mitigate them. The planning area is vulnerable to several hazards that are identified, profiled, and analyzed in this plan.

Based upon the risk assessment, the HMPC reviewed the previously developed goals from the 2014 Story County Multi-Jurisdictional Hazard Mitigation Plan for reducing risk from hazards. The goal from that plan were:

- Goal 1: Protect lives and reduce injury.
- Goal 2: Minimize or reduce damage to property, including critical facilities and infrastructure.
- Goal 3: Develop and implement mitigation strategies in plans, policies, and programs that optimize public funds in an efficient and cost-effective way.
- Goal 4: Reduce utility outages during times of severe weather.
- Goal 5: Strengthen communication among agencies and between agencies and the public.

The HMPC recommended combining Goals 2 and 4, editing the language of Goal 2, removing Goal 3, and adding mitigation-specific language to Goal 5. The resulting new, validated goals are listed below:

- Goal 1: Protect lives and reduce injury.
- Goal 2: Minimize or reduce damage to property, especially critical facilities and infrastructure.
- Goal 3: Strengthen communication among agencies and between agencies and the public regarding hazard mitigation.

The recommended mitigation action details to meet the identified goals are in Chapter 4. The HMPC developed an implementation plan for each action, which identifies priority level, background information, responsible agency, timeline, cost estimate, potential funding sources, and more.



PREREQUISITES

44 CFR requirement 201.6(c)(5): The local hazard mitigation plan shall include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan. For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.

Note to Reviewers: When this plan has been reviewed and approved pending adoption by FEMA Region VII the adoption resolutions will be signed by the participating jurisdictions and added to Appendix D. A model resolution is provided.

The following jurisdictions participated in the development of this plan and have adopted the multi-jurisdictional plan. Resolutions of Adoptions are included in Appendix D.

- Unincorporated Story County
- Ames
- Cambridge
- Collins
- Colo
- Gilbert
- Huxley
- Kelley
- Maxwell
- McCallsburg
- Nevada
- Roland
- Sheldahl
- Slater
- Story City
- Ames CSD
- Nevada CSD
- Ballard CSD
- Gilbert CSD
- Roland-Story CSD
- Colo-Nesco CSD
- Collins-Maxwell CSD
- Iowa State University



Resolution # _____

Adopting the Story County Multi-Jurisdictional Local Hazard Mitigation Plan

Whereas, the (Name of Government/District/Organization seeking FEMA approval of hazard mitigation plan) recognizes the threat that natural hazards pose to people and property within our community; and

Whereas, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

Whereas, the U.S Congress passed the Disaster Mitigation Act of 2000 (“Disaster Mitigation Act”) emphasizing the need for pre-disaster mitigation of potential hazards;

Whereas, the Disaster Mitigation Act made available hazard mitigation grants to state and local governments; and

Whereas, an adopted Local Hazard Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre- and post-disaster mitigation grant programs; and

Whereas, the (Name of Government/District/Organization) fully participated in the hazard mitigation planning process to prepare this Multi-Jurisdictional Local Hazard Mitigation Plan; and

Whereas, the Iowa Homeland Security and Emergency Management Department and the Federal Emergency Management Agency Region VII officials have reviewed the “Story County Multi-Jurisdictional Local Hazard Mitigation Plan,” and approved it contingent upon this official adoption of the participating governing body; and

Whereas, the (Name of Government/District/Organization) desires to comply with the requirements of the Disaster Mitigation Act and to augment its emergency planning efforts by formally adopting the Story County Multi-Jurisdictional Local Hazard Mitigation Plan; and

Whereas, adoption by the governing body for the (Name of Government/District/Organization) demonstrates the jurisdictions’ commitment to fulfilling the mitigation goals outlined in this Multi-Jurisdictional Local Hazard Mitigation Plan;

Whereas, adoption of this legitimizes the plan and authorizes responsible agencies to carry out their responsibilities under the plan;

Now, therefore, be it resolved, that the (Name of Government/District/Organization) adopts the “Story County Multi-Jurisdictional Local Hazard Mitigation Plan” as an official plan; and

Be it further resolved, the (Name of Government/District/Organization) will submit this Adoption Resolution to the Iowa Homeland Security and Emergency Management Department and Federal Emergency Management Agency Region VII officials to enable the plan’s final approval.

Date: _____

Certifying Official: _____

1 INTRODUCTION AND PLANNING PROCESS

1 Introduction and Planning Process	1-1
1.1 Purpose	1-1
1.2 Background and Scope	1-1
1.3 Plan Organization	1-3
1.4 Planning Process	1-3
1.4.1 Multi-Jurisdictional Participation	1-3
1.4.2 The Planning Steps	1-5

1.1 Purpose

Story County and its participating cities, public school districts, and Iowa State University prepared this Multi-Jurisdictional Hazard Mitigation Plan update to guide hazard mitigation planning to better protect the people and property of the planning area from the effects of hazard events.

This plan demonstrates the jurisdictions’ commitments to reducing risks from hazards and serves as a tool to help decision makers direct mitigation activities and resources. This plan was also developed to make Story County and the participating jurisdictions eligible for certain federal grant programs, specifically the Federal Emergency Management Agency’s (FEMA) Hazard Mitigation Assistance (HMA) grants including the Hazard Mitigation Grant Program, Pre-Disaster Mitigation Program, and Flood Mitigation Assistance Program.

1.2 Background and Scope

Each year in the United States, disasters take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. These monies only partially reflect the true cost of disasters because additional expenses to insurance companies and nongovernmental organizations are not reimbursed by tax dollars. Many disasters are predictable, and much of the damage caused by these events can be alleviated or even eliminated.

Hazard mitigation is defined by FEMA as “any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event.” The results of a three-year, congressionally mandated independent study to assess future savings from mitigation activities provides evidence that mitigation activities are highly cost-effective. On average, each dollar spent on mitigation saves society \$6 in avoided future losses, in addition to saving lives and preventing injuries (National Institute of Building Science Multi-Hazard Mitigation Council 2017).

Hazard mitigation planning is the process through which hazards that threaten communities are identified, likely impacts of those hazards are determined, mitigation goals are set, and appropriate strategies to lessen impacts are determined, prioritized, and implemented. Story County and the incorporated cities, public school districts, and state university that participated in this plan update developed a Multi-Jurisdictional Hazard Mitigation Plan that was approved by FEMA on May 2, 2014 (hereafter referred to as the *2014 Story County Hazard Mitigation Plan*). Therefore, this current planning effort serves to update the previous plan.

This plan documents the hazard mitigation planning process undertaken by the Story County Hazard Mitigation Planning Committee (HMPC). It identifies relevant hazards and vulnerabilities in the planning

area and sets forth an updated mitigation strategy to decrease vulnerability and increase resiliency and sustainability in Story County.

The Story County Multi-Jurisdictional Hazard Mitigation Plan is a multi-jurisdictional plan that geographically covers the participating jurisdictions within Story County's boundaries (hereinafter referred to as the planning area). The following jurisdictions officially participated in the planning process:

- Story County
- Ames
- Cambridge
- Collins
- Colo
- Gilbert
- Huxley
- Kelley
- Maxwell
- McCallsburg
- Nevada
- Roland
- Sheldahl
- Slater
- Story City
- Ames CSD
- Nevada CSD
- Ballard CSD
- Gilbert CSD
- Roland-Story CSD
- Collins-Maxwell CSD
- Colo-Nesco CSD
- Iowa State University

This plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the Federal Register on February 26, 2002 (44 CFR §201.6) and finalized on October 31, 2007. (Hereafter, these requirements and regulations will be referred to collectively as the Disaster Mitigation Act.) Additionally, this plan is prepared in accordance with the 2013 Local Mitigation Planning Handbook published by FEMA.

While the Disaster Mitigation Act emphasized the need for mitigation plans and more coordinated mitigation planning and implementation efforts, the regulations established the requirements that local hazard mitigation plans must meet in order for a local jurisdiction to be eligible for certain federal disaster assistance and hazard mitigation funding under the Robert T. Stafford Disaster Relief and Emergency Act (Public Law 93-288).

Information in this plan will be used to help guide and coordinate mitigation activities and decisions for local land use policy in the future. Proactive mitigation planning will help reduce the cost of disaster response and recovery to communities and their residents by protecting critical community facilities, reducing liability exposure, and minimizing overall community impacts and disruptions. The Story County planning area has been affected by hazards in the past and the participating jurisdictions are therefore committed to reducing future impacts from hazard events and becoming eligible for mitigation-related federal funding.

1.3 Plan Organization

This Story County Multi-Jurisdictional Hazard Mitigation Plan update is organized as follows:

- Executive Summary
- Chapter 1: Introduction and Planning Process
- Chapter 2: Planning Area Profile and Capabilities
- Chapter 3: Risk Assessment
- Chapter 4: Mitigation Strategy
- Chapter 5: Plan Implementation and Maintenance
- Appendices

This is the same order that was used for the 2014 Story County Hazard Mitigation Plan.

1.4 Planning Process

44 CFR 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.

In February 2017, the State of Iowa Homeland Security and Emergency Management Department contracted with Wood Environment & Infrastructure Solutions, Inc. to facilitate the update of the Story County Multi-Jurisdictional Local Hazard Mitigation Plan. Wood's role was to:

- Assist in establishing the Hazard Mitigation Planning Committee (HMPC) as defined by the Disaster Mitigation Act (DMA),
- Ensure the updated plan meets the DMA requirements as established by federal regulations and following FEMA's planning guidance,
- Facilitate the entire planning process,
- Identify the data requirements that HMPC participants could provide and conduct the research and documentation necessary to augment that data,
- Assist in facilitating the public input process,
- Produce the draft and final plan update documents, and
- Coordinate the Iowa Homeland Security and Emergency Management Department and FEMA plan reviews.

1.4.1 Multi-Jurisdictional Participation

44 CFR Requirement §201.6(a)(3): Multi-jurisdictional plans may be accepted, as appropriate, as long as each jurisdiction has participated in the process and has officially adopted the plan.

Story County Emergency Management Commission invited the unincorporated areas, incorporated cities, public school districts, Iowa State University, and various other stakeholders in mitigation planning (identified in Appendix B) to participate in the Story County Multi-Jurisdictional Hazard Mitigation Plan update process. The jurisdictions that elected to participate in this plan are listed above in section 1.2. The DMA requires that each jurisdiction that participates in the planning process must officially adopt the

multi-jurisdictional hazard mitigation plan. Each jurisdiction that chose to participate in the planning process and development of the plan was required to meet plan participation requirements defined at the first planning meeting, which includes the following:

- Designate a representative to serve on the HMPC;
- Participate in at least one of the three HMPC planning meetings by either direct representation or authorized representation;
- Provide data for and assist in the development of the updated risk assessment that describes how various hazards impact their jurisdiction;
- Provide data to describe current capabilities;
- Develop/update mitigation actions (at least one) specific to each jurisdiction;
- Provide comments on plan drafts as requested;
- Inform the public, local officials, and other interested parties about the planning process and provide opportunities for them to comment on the plan; and
- Formally adopt the mitigation plan.

All of the jurisdictions listed as official participants in this plan met all of these participation requirements. **Table 1.1** shows the representation of each participating jurisdiction at the planning meetings, provision of Data Collection Guides, and update/development of mitigation actions. Sign-in sheets are included in Appendix B: Planning Process Documentation.

Table 1.1: Jurisdictional Participation in Planning Process

Jurisdiction	Kick-off Meeting	Planning Meeting #2	Planning Meeting #3	Data Collection Guide	Status of Previous Actions	Mitigation Action Plans
Story County	x	x	x	x	x	x
Ames	x	x	x	x	x	x
Cambridge	x	x	x	x	x	x
Collins	x	x		x	x	
Colo	x		x	x	x	x
Gilbert	x	x	x	x	x	x
Huxley			x	x	x	x
Kelley	x	x	x	x	x	x
Maxwell	x	x	x	x	x	x
McCallsburg	x	x	x	x	x	x
Nevada	x	x	x	x	x	x
Roland		x	x	x	x	x
Sheldahl	x	x	x	x		x
Slater	x	x	x	x	x	x
Story City	x	x		x	x	x
Ames CSD		x		x	x	x
Nevada CSD		x	x	x	x	x
Ballard CSD		x	x	x	x	x
Gilbert CSD	x	x	x	x	x	x
Roland-Story CSD	x	x	x	x	x	x

Jurisdiction	Kick-off Meeting	Planning Meeting #2	Planning Meeting #3	Data Collection Guide	Status of Previous Actions	Mitigation Action Plans
Collins-Maxwell CSD		x		x	x	x
Colo-Nesco CSD	x	x		x	x	x
Iowa State University	x	x	x	x	x	x

1.4.2 The Planning Steps

Wood and Story County worked together to establish the framework and process for this planning effort using FEMA's *Local Mitigation Planning Handbook* (March 2013). The plan update was completed utilizing the 9-task approach within a broad four-phase process:

- 1) Organize resources,
- 2) Assess risks,
- 3) Develop the mitigation plan, and
- 4) Implement the plan and monitor progress.

Into this process, Wood integrated a detailed 10-step planning process adapted from FEMA's Community Rating System (CRS) and Flood Mitigation Assistance programs. Thus, the process used for this plan meets the requirements of the Disaster Mitigation Act of 2000 as well as the basic requirements for activity 510 under the Community Rating System. **Table 1.2** shows how the process followed fits into FEMA's original four-phase DMA process as well as the revised Nine Task Process outlined in the 2013 *Local Mitigation Planning Handbook* and the 10-step CRS process.

Table 1.2: Mitigation Planning Process Used to Develop the Story County Multi-Jurisdictional Local Hazard Mitigation Plan

Phase	Community Rating System (CRS) Planning Steps (Activity 510)	Local Mitigation Planning Handbook Tasks (44 CFR Part 201)
Phase I	Step 1. Organize	Task 1: Determine the Planning Area and Resources Task 2: Build the Planning Team 44 CFR 201.6(c)(1)
	Step 2. Involve the public	Task 3: Create an Outreach Strategy 44 CFR 201.6(b)(1)
	Step 3. Coordinate	Task 4: Review Community Capabilities 44 CFR 201.6(b)(2) & (3)
Phase II	Step 4. Assess the hazard	Task 5: Conduct a Risk Assessment 44 CFR 201.6(c)(2)(i) 44 CFR 201.6(c)(2)(ii) & (iii)
	Step 5. Assess the problem	
Phase III	Step 6. Set goals	Task 6: Develop a Mitigation Strategy 44 CFR 201.6(c)(3)(i); 44 CFR 201.6(c)(3)(ii); and 44 CFR 201.6(c)(3)(iii)
	Step 7. Review possible activities	
	Step 8. Draft an action plan	
Phase IV	Step 9. Adopt the plan	Task 8: Review and Adopt the Plan
	Step 10. Implement, evaluate, revise	Task 7: Keep the Plan Current
		Task 9: Create a Safe and Resilient Community 44 CFR 201.6(c)(4)

Phase I Organize Resources

Step 1: Organize the Planning Team (Handbook Tasks 1 & 2)

The planning process resulting in the preparation of this plan document officially began with an initial coordination Conference Call/Webinar on December 20, 2017. Participants of the meeting included the Story County Emergency Management Coordinator; Iowa Homeland Security and Emergency Management Department Hazard Mitigation Office Hazard Mitigation Planner and GIS Coordinator; and the Wood Mitigation Planners and GIS Technician. The purpose of this meeting was to determine the jurisdictions and other stakeholders that would be invited to participate on the HMPC (Step 1), set tentative planning meeting dates, identify GIS needs and resources, discuss the hazards to be included in the plan update and options for the flood risk assessment methodology, and develop an initial public participation strategy. Detailed meeting minutes are included in Appendix B.

After the initial coordination meeting, a formal Kick-off planning conference call/webinar was held on February 21, 2018 followed by two additional planning meetings held on April 25, 2018 and June 27, 2018. A complete list of all representatives of the agencies and organizations that participated on the Story County HMPC is provided in Appendix B.

The HMPC communicated during the planning process with a combination of webinars, face-to-face meetings, phone interviews, and email correspondence. The meeting schedule and topics are listed in **Table 1.3**. The meeting minutes for each of the meetings are included in Appendix B.

Table 1.3: Schedule of HMPC Meetings

Meeting	Topic	Date
Informational Meeting	General overview of planning process/requirements and schedule.	December 20, 2017
Kick-off Meeting	Introduction to DMA, the planning process, hazard identification and public input strategy. Distribution of data collection guide to jurisdictions. Preliminary hazard data. Discussion critical facility inventory.	February 21, 2018
Planning Meeting #2	Review of draft Risk Assessment, update plan goals, instructions to update status of previous mitigation actions	April 25, 2018
Planning Meeting #3	Development of new mitigation actions, mitigation action planning and prioritization. Determine process to monitor, evaluate, and update plan.	June 27, 2018

During the kick-off meeting Wood presented information on the scope and purpose of the plan, participation requirements of HMPC members, and the proposed project work plan and schedule. Plans for public involvement (Step 2) and coordination with other agencies and departments (Step 3) were discussed. Wood also introduced hazard identification requirements and data needs. The HMPC discussed potential hazards as well as past events and impacts and refined the identified hazards to be relevant to Story County. The hazard ranking methodology utilized by Iowa Homeland Security and Emergency Management Department in the State Hazard Mitigation Plan was introduced and preliminary information was presented for each hazard identified.

Participants were given the Wood Data Collection Guide to facilitate the collection of information needed to support the plan, such as data on historic hazard events, values at risk, and current capabilities. Each participating jurisdiction completed and returned the worksheets in the Data Collection Guide to Wood. Wood integrated this information into the plan, supporting the development of Chapters 2 and 3.

Step 2: Plan for Public Involvement (Handbook Task 3)

44 CFR Requirement 201.6(b): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of

natural disasters, the planning process shall include: (1) an opportunity for the public to comment on the plan during the drafting stage and prior to plan approval.

At the kick-off meeting, the HMPC discussed options for soliciting public input on the mitigation plan. To provide an opportunity for the public to comment during the drafting stage, the committee determined that the most effective method would be dissemination of a survey. The survey was announced in a press release and posted to the Story County website and the Story County Emergency Management Facebook page on March 6, 2018. Newspaper clippings, posters, and website and social media postings announcing the survey are included in Appendix B.

The public survey was developed specific to the Story County Mitigation Plan and provided a brief plan summary as well as a questionnaire to capture public and stakeholder input. The survey was made available online and in community post offices throughout the County. A copy of the survey is provided in Appendix B.

In addition to notification through media outlets described above, committee members distributed the survey link to members of the public and key stakeholders in their own jurisdiction. In all, 98 surveys were completed.

The survey asked the public and stakeholders to indicate their opinion on the likelihood for each hazard to impact their jurisdiction. They were asked to rate the probability of each hazard profiled in this plan as 1-unlikely, 2-occasional, 3-likely, and 4-highly likely. The summary results of this question are provided in **Figure 1.1**.

Figure 1.1: Survey Results—Probability of Hazards in Jurisdiction

	UNLIKELY (LESS THAN 10% PROBABILITY IN ANY GIVEN YEAR)	OCCASIONAL (BETWEEN 10% AND 20% PROBABILITY IN ANY GIVEN YEAR)	LIKELY (BETWEEN 20% AND 33% PROBABILITY IN ANY GIVEN YEAR)	HIGHLY LIKELY (GREATER THAN 33% PROBABILITY IN ANY GIVEN YEAR)	TOTAL	WEIGHTED AVERAGE
Animal/Plant/Crop Disease	19.79% 19	42.71% 41	22.92% 22	14.58% 14	96	2.32
Dam/Levee Failure	75.53% 71	17.02% 16	4.26% 4	3.19% 3	94	1.35
Drought	7.22% 7	39.18% 38	34.02% 33	19.59% 19	97	2.66
Earthquake	87.23% 82	8.51% 8	1.06% 1	3.19% 3	94	1.20
Expansive Soils (soils that expand and contract when wet or dry)	38.30% 36	35.11% 33	17.02% 16	9.57% 9	94	1.98
Extreme Heat	10.42% 10	25.00% 24	28.13% 27	36.46% 35	96	2.91
Flash Flood	19.39% 19	26.53% 26	27.55% 27	26.53% 26	98	2.61
Grass or Wildland fire	41.24% 40	36.08% 35	12.37% 12	10.31% 10	97	1.92
Hazardous Materials Incident	37.11% 36	35.05% 34	18.56% 18	9.28% 9	97	2.00
Human Disease	21.05% 20	44.21% 42	16.84% 16	17.89% 17	95	2.32
Infrastructure Failure	31.96% 31	41.24% 40	17.53% 17	9.28% 9	97	2.04
Landslide	83.33% 80	11.46% 11	2.08% 2	3.13% 3	96	1.25
Radiological Incident	77.08% 74	18.75% 18	1.04% 1	3.13% 3	96	1.30
River Flooding	20.41% 20	29.59% 29	21.43% 21	28.57% 28	98	2.58
Severe Winter Storm	8.33% 8	10.42% 10	28.13% 27	53.13% 51	96	3.26
Sinkholes	69.07% 67	18.56% 18	10.31% 10	2.06% 2	97	1.45
Terrorism	64.58% 62	20.83% 20	8.33% 8	6.25% 6	96	1.56
Thunderstorm/Lightning/Hail	4.17% 4	10.42% 10	18.75% 18	66.67% 64	96	3.48
Tornado/Windstorm	2.06% 2	14.43% 14	28.87% 28	54.64% 53	97	3.36
Transportation Incident	20.62% 20	24.74% 24	24.74% 24	29.90% 29	97	2.64

Source: SurveyMonkey Results

The survey also asked the public and stakeholders to indicate their opinion on the potential magnitude of each hazard on their jurisdiction. They were asked to rate the probability of each hazard profiled in this plan as 1-negligible, 2-limited, 3-critical, and 4-catastrophic. The summary results of this question are provided in **Figure 1.2**.

Figure 1.2: Survey Results—Magnitude of Hazards in Jurisdiction

	NEGLIGIBLE (LESS THAN 10% PROPERTY SEVERELY DAMAGED)	LIMITED (10% TO 25% PROPERTY SEVERELY DAMAGED)	CRITICAL (25% TO 50% PROPERTY SEVERELY DAMAGED)	CATASTROPHIC (MORE THAN 50% OF PROPERTY SEVERELY DAMAGED)	TOTAL	WEIGHTED AVERAGE
Animal/Plant/Crop Disease	34.38% 33	40.63% 39	19.79% 19	5.21% 5	96	1.96
Dam/Levee Failure	75.79% 72	17.89% 17	3.16% 3	3.16% 3	95	1.34
Drought	18.09% 17	38.30% 36	31.91% 30	11.70% 11	94	2.37
Earthquake	78.49% 73	10.75% 10	7.53% 7	3.23% 3	93	1.35
Expansive Soils	56.38% 53	29.79% 28	8.51% 8	5.32% 5	94	1.63
Extreme Heat	21.05% 20	36.84% 35	30.53% 29	11.58% 11	95	2.33
Flash Flood	22.11% 21	41.05% 39	27.37% 26	9.47% 9	95	2.24
Grass or Wildland Fire	48.45% 47	31.96% 31	15.46% 15	4.12% 4	97	1.75
Hazardous Materials Incident	46.39% 45	34.02% 33	10.31% 10	9.28% 9	97	1.82
Human Disease	29.17% 28	38.54% 37	18.75% 18	13.54% 13	96	2.17
Infrastructure Failure	34.74% 33	35.79% 34	17.89% 17	11.58% 11	95	2.06
Landslide	88.54% 85	6.25% 6	2.08% 2	3.13% 3	96	1.20
Radiological Incident	62.11% 59	18.95% 18	10.53% 10	8.42% 8	95	1.65
River Flooding	23.96% 23	33.33% 32	29.17% 28	13.54% 13	96	2.32
Severe Winter Storm	13.54% 13	36.46% 35	32.29% 31	17.71% 17	96	2.54
Sinkholes	73.96% 71	17.71% 17	6.25% 6	2.08% 2	96	1.36
Terrorism	53.61% 52	17.53% 17	17.53% 17	11.34% 11	97	1.87
Thunderstorm/Lightning/Hail	11.46% 11	30.21% 29	39.58% 38	18.75% 18	96	2.66
Tornado/Windstorm	7.29% 7	20.83% 20	38.54% 37	33.33% 32	96	2.98
Transportation Incident	37.50% 36	40.63% 39	9.38% 9	12.50% 12	96	1.97

Source: SurveyMonkey Results

In the survey, the public was also asked to review 11 types of mitigation actions considered by the Iowa Homeland Security and Emergency Management Department for FEMA funding. The Story County HMPC also considered these types of projects in the Story County Multi-Jurisdictional Hazard Mitigation Plan. The survey asked the public to place a check next to the mitigation project types that they felt could benefit their community. **Figure 1.3** provides the compiled results of this question.

Figure 1.3: Survey Results—Types of Projects

ANSWER CHOICES	RESPONSES	
▼ Flood-prone Property Acquisition & Structure Demolition/Relocation	45.56%	41
▼ Flood-prone Structure Elevation	34.44%	31
▼ Floodproofing of Historical and/or Non-residential Structures	32.22%	29
▼ Minor Localized Flood Reduction Projects (stormwater management or other localized flood control projects)	62.22%	56
▼ Structural Retrofitting of Existing Buildings to Add a Tornado Safe Room	43.33%	39
▼ Retrofitting of Existing Buildings and Facilities to Prevent Wind Damage	43.33%	39
▼ New Tornado Safe Room Construction	47.78%	43
▼ Electrical Utilities Infrastructure Retrofit (i.e. strengthening lines/connections to withstand ice/wind damages, burying power lines)	61.11%	55
▼ Soil Erosion Stabilization	35.56%	32
▼ Wildfire Mitigation	11.11%	10
Total Respondents: 90		

Source: SurveyMonkey Results

The public was also asked to comment on any other issues that the Story County HMPC should consider in developing a strategy to reduce future losses caused by natural hazard events. Some of the additional issues the public indicated in need of attention are provided below:

- Fix the flooding issues. Homes flood [be]cause the lack of water mitigation/planning with our current water/sewer system. Please fix it, it's our fault not nature's; or pay for damaging folk's homes. Thanks.
- Agricultural tile drainage in the area has made flooding flashier and more severe. It costs cities millions to save famers thousands.
- Telling apartment & mobile home residents where to go in case of flash floods & tornadoes. How to know what to look for, etc.
- Bridges; inspect for deterioration, replace BEFORE failure/impact
- Updating storm sewers/actually installing them in existing communities
- More bicycle dedicated lanes downtown
- Stressing importance of self reliance
- Potholes
- Safety bolstering in regard to public water quality
- Repair bridges in Story County
- I think they should bury the telephone and power lines in Story County for ice storms and tornados
- Homeless
- Rain, give golf size ice, quarter balls damage on your car, causing a lot of damage, a lot of money on your car
- Bridge failures, tornados, effects of climate change
- The county needs to plan in collaboration/cooperation with the university. Also, issues of diversity and inclusion need to be part of the planning process, as Ames is an international, intercultural city

- Needs to be comprehensive. Needs to include all potential risk factors and ways to fortify critical infrastructure from various risk factors
- Damage from train accidents should be mitigated by removed them from street level; preferably putting them underground all the way through Ames. This would eliminate spills of potentially hazardous material as well as train/vehicle accidents
- Hazard mitigation education and resources
- Require tornado shelters for mobile home parks.
- Better storm drain-off
- Erosion in creek beds
- Flooding/drains, due to new construction in Gilbert
- People are not prepared for any big emergency
- With rail traffic in the center of the city, increasing numbers of research institutions, and semi traffic on I-35 there is a high threat of a hazardous materials incident affecting Ames. Do we have the resources to deal with a mass casualty event and does the general public know what to do in case of such an event.
- There are many apartment buildings going up quickly. There should be tornado shelters or a storm-safe room available for individuals who live in these large apartment complexes.
- Have the County available to ensure processes and funding is available when hazardous events happen.

The public was also given an opportunity to provide input on the final draft of the complete plan. A link to the entire plan draft was made available on the Story County website. In addition, 2 hard copies were made available at the Ames Public Library and the Story County Emergency Management Office.

Story County announced the availability of the entire final draft plan and the two-week final public comment period on the County website and via the following media outlets: xxx. Copies of the announcements are provided in Appendix B. The final public comment period was from December 1 to December 14, 2018.

The HMPC invited other targeted stakeholders to comment on the draft plan via an e-mail letter, which is described in greater detail in Step 3: Coordinate with Other Departments and Agencies. No comments were received.

Step 3: Coordinate with Other Departments and Agencies and Incorporate Existing Information (Handbook Task 3)

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

There are numerous organizations whose goals and interests interface with hazard mitigation in Story County. Coordination with these organizations and other community planning efforts is vital to the success of this plan. Many stakeholder agencies were contacted throughout the planning process to

obtain data in preparation of the Risk Assessment. This included contact with specific representatives of stakeholder agencies, as well as accessing stakeholder data that has been made available to the public via the internet. These sources have been identified where data is presented. In addition, Story County invited neighboring counties, other local, state, and federal departments and agencies, as well as institutions of higher learning to review and comment on the final draft of the Story County Multi-Jurisdictional Hazard Mitigation Plan prior to final submittal to FEMA. The stakeholders that were invited to comment on the final plan draft are included in Table 1.4.

Table 1.4: Stakeholder Involvement

Stakeholder	Type	Provided Data for Risk Assessment	Invited to Comment on Final Draft
Iowa State University, Iowa Flood Center	Academia	x	x
Hamilton County	Adjacent County		x
Hardin County	Adjacent County		x
Marshall County	Adjacent County		x
Jasper County	Adjacent County		x
Polk County	Adjacent County		x
Boone County	Adjacent County		x
Environmental Protection Agency	Federal Agency	x	x
Federal Emergency Management Agency	Federal Agency	x	x
National Weather Service	Federal Agency	x	x
U.S. Army Corps of Engineers	Federal Agency	x	x
U.S. Geological Survey	Federal Agency	x	x
Iowa Department of Agriculture and Land Stewardship	State Agency	x	x
Iowa Department of Natural Resources	State Agency	x	x
Iowa Homeland Security and Emergency Management	State Agency	x	x

Integration of Other Data, Reports, Studies, and Plans

In addition, input was solicited from many other agencies and organizations that provided information. As part of the coordination with other agencies, the HMPC collected and reviewed existing technical data, reports, and plans. These included:

- Iowa Hazard Mitigation Plan (September 2013);
- Story County Hazard Mitigation Plan (2014);
- National Flood Insurance Program Policy and Loss Statistics;
- Flood Insurance Administration, Repetitive/Severe Repetitive Loss Property Data;
- Flood Insurance Rate Maps for all of Story County;
- Iowa Department of Natural Resources, Dam Safety Program Inventory of Dams for Story County;
- National Inventory of Dams;
- National Levee Database;
- Wildland/Urban Interface and Intermix areas from the SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin;
- Various local plans such as Comprehensive Plans, Economic Development Plans, Capital Improvement Plans, etc. For a complete list of local plans that were reviewed and incorporated, see Chapter 2;

- US Department of Agriculture's (USDA) Risk Management Agency Crop Insurance Statistics

This information was used in the development of the hazard identification, vulnerability assessment, and capability assessment and in the formation of goals, objectives, and mitigation actions. These sources, as well as additional sources of information, are documented throughout the plan and in Appendix A, References.

Phase 2 Assess Risk (Handbook Task 5)

Step 4: Assess the Hazard: Identify and Profile Hazards

Wood assisted the HMPC in a process to identify/update the hazards that have impacted or could impact communities in Story County. At the kick-off meeting, the HMPC examined the history of disaster declarations in Story County, the list of hazards considered in the 2013 Iowa State Hazard Mitigation Plan, and the hazards identified in the previous Story County Hazard Mitigation Plan. The committee then worked through this list of all potential hazards that could affect the planning area. They discussed past hazard events, types of damage, and where additional information might be found. Additional information on the hazard identification process and which hazards were identified for each jurisdiction is provided in Chapter 3.

During the kick-off meeting, the HMPC discussed past events and impacts on a county-wide basis to contribute to the risk assessment update. After the kick-off meeting, each jurisdiction completed a Data Collection Guide, including information on previous hazard events in their community. Utilizing the information from the Data Collection Guides as well as existing plans, studies, reports, and technical information as well as information available through internet research and GIS analysis, a profile was developed for each hazard identified. More information on the methodology and resources used to identify and profile the hazards can be found in Chapter 3.

Step 5: Assess the Problem: Identify Assets and Estimate Losses

Assets for each jurisdiction were identified through a combination of several resources. Story County provided datasets with corporate boundaries and other available data. Department of Natural Resources GIS Repository (NRGIS) supplied school district boundaries, and other available GIS layers. Story County building data was extracted from Hazus. Population data was obtained from the U.S. Census Bureau. Critical facilities were supplemented with data available from the NRGIS as well as data available from the Homeland Security Infrastructure Program (HSIP) Freedom 2015 dataset. Methodologies and results of the critical facility analysis are provided in Chapter 3 and Appendix E.

Additional assets such as historic, cultural, and economic assets as well as specific vulnerable populations and structures were obtained from a variety of sources as described in Chapter 3.

The HMPC also analyzed development since the last plan update and future development trends from data provided by each jurisdiction on the Data Collection Guide as well as minutes of the annual review meetings. Data was also obtained from the U.S. Census Bureau and from jurisdictions through other planning mechanisms such as Comprehensive Plans and Future Development Plans.

After profiling the hazards that could affect Story County and identifying assets, the HMPC collected information to describe the likely impacts of future hazard events on the participating jurisdictions. For each hazard, there is a discussion regarding future development as well as climate change impacts regarding how vulnerability to that specific hazard might be impacted in the future.

Existing mitigation capabilities were also considered in developing loss estimates. This assessment consisted of identifying the existing mitigation capabilities of participating jurisdictions. This involved collecting information about existing government programs, policies, regulations, ordinances, and plans

that mitigate or could be used to mitigate risk from hazards. Participating jurisdictions collected information on their regulatory, personnel, fiscal, and technical capabilities, as well as previous and ongoing mitigation initiatives. This information is included in Chapter 2, Planning Area Profile and Capabilities.

Specific capabilities such as participation in the National Flood Insurance Program as well as designation as Fire Wise Communities or Storm Ready Communities and placement of storm sirens are incorporated in the vulnerability analysis discussions, where applicable.

Taking into consideration the vulnerability and capability assessments, and where sufficient information was available, a variety of methods was used to estimate losses for each profiled hazard. For riverine flooding, Hazus was used to determine assets/areas at risk and determine loss estimates. For other geographic hazards such as fixed chemical facilities and grass/wildland fire, assets/areas at risk were determined through GIS analysis. For other hazards such as weather-related hazards, loss estimates were developed based on statistical analysis of historic events. For some human-caused hazards, loss estimates were scenario-based. The methodologies for each loss estimate are described in detail in Chapter 3. Within each hazard section, the text provides details on how the hazard varies by jurisdiction, where applicable. In addition, at the conclusion of each hazard section, a summary table indicates the specific probability, magnitude, warning time, and duration rating of the hazard for each jurisdiction, to show how the hazard varies. Where applicable, introductory text preceding the table highlights noted variables.

Results of the preliminary risk assessment were presented at Meeting #2 and the Draft Risk Assessment (Chapter 3) was provided to the HMPC for review and comment. Several comments, corrections, and suggestions were provided to Wood and incorporated into the risk assessment as appropriate.

Phase 3 Develop the Mitigation Plan (Handbook Task 6)

Step 6: Set Goals

Wood facilitated a discussion session with the HMPC during Meeting #2 to review and update goals. Common categories of mitigation goals were presented as well as the 2013 State Hazard Mitigation Plan goals.

This planning effort is an update to an existing hazard mitigation plan. As a result, the goals from the *2014 Story County Multi-Jurisdictional Hazard Mitigation Plan* were reviewed.

The goal from that plan were:

- Goal 1: Protect lives and reduce injury.
- Goal 2: Minimize or reduce damage to property, including critical facilities and infrastructure.
- Goal 3: Develop and implement mitigation strategies in plans, policies, and programs that optimize public funds in an efficient and cost-effective way.
- Goal 4: Reduce utility outages during times of severe weather.
- Goal 5: Strengthen communication among agencies and between agencies and the public.
- The HMPC recommended combining Goals 2 and 4, editing the language of Goal 2, removing Goal 3, and adding mitigation-specific language to Goal 5. The resulting new, validated goals are listed below:
- Goal 1: Protect lives and reduce injury.
- Goal 2: Minimize or reduce damage to property, especially critical facilities and infrastructure.

- Goal 3: Strengthen communication among agencies and between agencies and the public regarding hazard mitigation.

The recommended mitigation action details to meet the identified goals are in Chapter 4. The HMPC developed an implementation plan for each action, which identifies priority level, background information, responsible agency, timeline, cost estimate, potential funding sources, and more.

Step 7: Review Possible Activities

At meeting #2, a handout of previous actions was provided to all jurisdictions with instructions to provide updates for each action. Jurisdictions were encouraged to maintain a focused approach and continue forward only those actions that are aimed at implementing long-term solutions to prevent losses from hazards. The focus of Meeting #3 was to update the mitigation strategy by discussing relevant new actions considered necessary as a result of the updated risk assessment. The HMPC reviewed the following: plan goals, previous actions from the 2013 plan, key issues from the risk assessment, Iowa Homeland Security and Emergency Management's HMA funding priorities, public opinion survey results on types of actions desired, and FEMA's Mitigation Action Ideas publication.

The group discussed the types of mitigation actions/projects that could be done by the jurisdictions in Story County. Consideration was given to the analysis results provided in the risk assessment and the anticipated success for each project type. Projects relating to emergency response were discussed, but participants were encouraged to focus on long-term mitigation solutions since response-related mitigation actions occur on a routine basis as requirements of other plans. Complex projects that would necessitate use of large numbers of county resources were also discussed. This opportunity to discuss a broad range of mitigation alternatives allowed the jurisdictions to understand the overall priorities of the committee and to allow for discussion of the types of project most beneficial to each jurisdiction. As part of this discussion, consideration was given to the potential cost of each project in relation to the anticipated future cost savings.

The jurisdictions were also provided instructions for completing the Mitigation Action Plan for each continuing and newly developed action. The details from the Action Plan for each Continuing and New action are provided in Chapter 4. The completed and deleted actions are provided in Appendix C. Chapter 4 provides additional details regarding the process undertaken to refine the mitigation strategy to make Story County and its jurisdictions more disaster resistant.

Step 8: Draft an Action Plan

A complete draft of the plan was made available online and in hard copy for review and comment by the public, other agencies and interested stakeholders. This review period was from December 1 to December 14, 2018. Methods for inviting interested parties and the public to review and comment on the plan were discussed in Steps 2 and 3, and materials are provided in Appendix B. Comments were integrated into a final draft for submittal to the Iowa Homeland Security and Emergency Management Division and FEMA.

Phase 4 Implement the Plan and Monitor Progress

Step 9: Adopt the Plan (Handbook Task 8)

To secure buy-in and officially implement the plan, the governing bodies of each participating jurisdiction will adopt the plan following FEMA's "approval pending adoption" of the plan. Scanned copies of resolutions of adoption are included in Appendix D of this plan.

Step 10: Implement, Evaluate, and Revise the Plan (Handbook Tasks 7 & 9)

The HMPC developed and agreed upon an overall strategy for plan implementation and for monitoring and maintaining the plan over time during Meeting #3. This strategy is described in Chapter 5, Plan Maintenance Process.

2 PLANNING AREA PROFILE AND CAPABILITIES

2 Planning Area profile and Capabilities	2-1
2.1 Story County Planning Area Profile	2-1
2.1.1 Geography and Topography.....	2-3
2.1.2 Major Rivers and Watersheds.....	2-3
2.1.3 History.....	2-4
2.1.4 Climate.....	2-6
2.1.5 Population/Demographics.....	2-7
2.1.6 Occupations/Employers.....	2-9
2.1.7 Agriculture.....	2-11
2.1.8 FEMA Hazard Mitigation Assistance Grants in Planning Area.....	2-11
2.2 City/County Capabilities.....	2-12
2.2.1 Public School District and State University Profiles and Mitigation Capabilities.....	2-28

This chapter provides a general profile of Story County and participating jurisdictions, including details on existing capabilities, plans, and programs that enhance their ability to implement mitigation strategies.

2.1 Story County Planning Area Profile

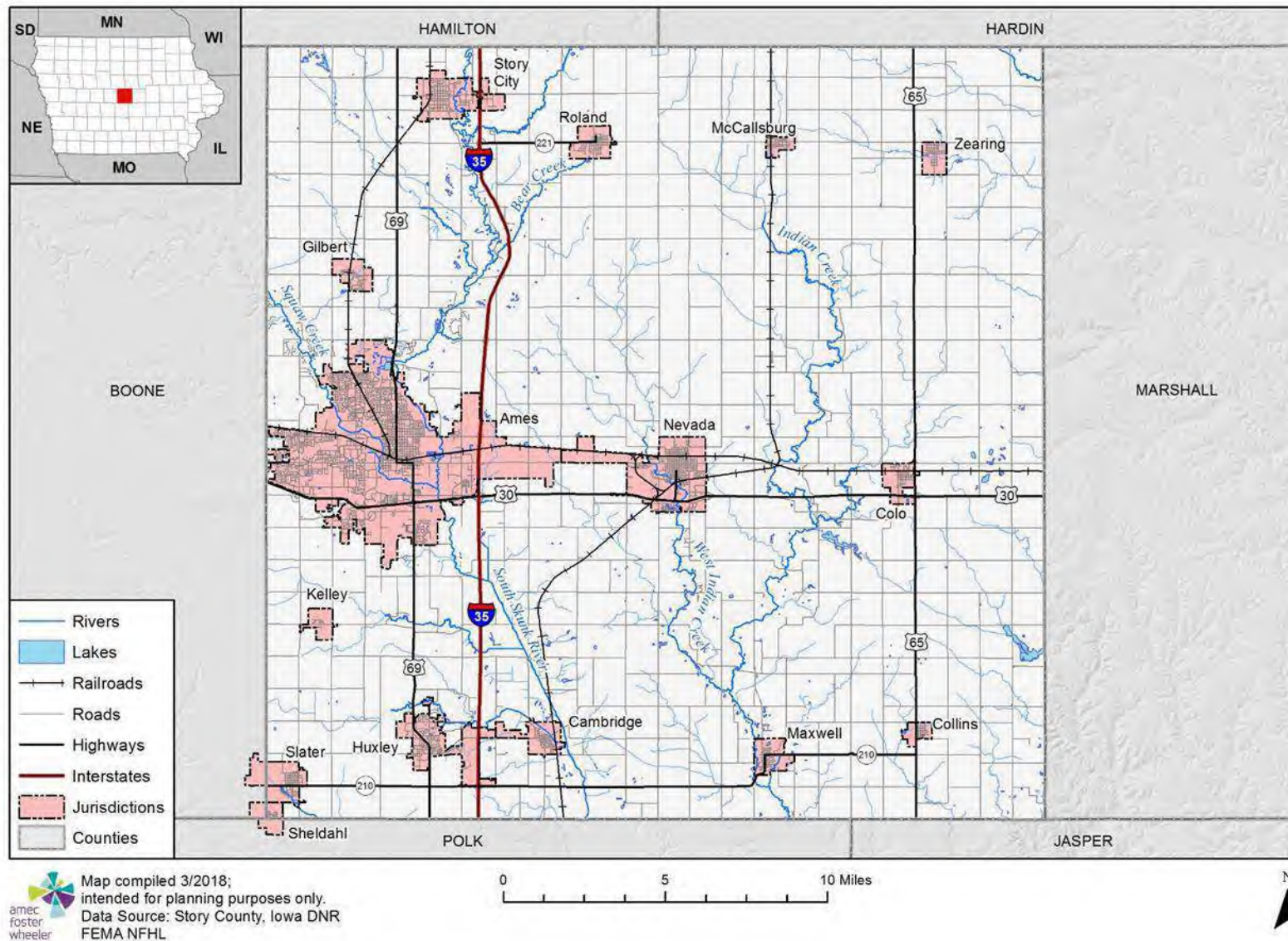
Figure 2.1 provides a map of the Story County planning area. The planning area boundaries include the unincorporated areas of Story County as well as the following incorporated cities:

- Story County
- Ames
- Cambridge
- Collins
- Colo
- Gilbert
- Huxley
- Kelley
- Maxwell
- McCallsburg
- Nevada
- Roland
- Sheldahl
- Slater
- Story City

Story County's Public School Districts and Iowa State University participated in development of this plan and are also included in the planning area. These schools and their capabilities are discussed in additional detail in Section 2.2.

Note that the City of Zearing is not a participant in this plan but was still included in the planning area in order to provide complete risk and vulnerability information for all of the land within Story County.

Figure 2.1: Story County Planning Area



2.1.1 Geography and Topography

Story County is located in central Iowa just north of state capital of Des Moines. The County has a total area of 574 square miles. There are several highways that traverse the county, including the following:

- Interstate Highway 35, which travels north and south in the western portion of the county through Story City, Ames, and Huxley;
- U.S. Highway 69, which travels north and south through the western portion of the county through Ames and Huxley;
- U.S. Highway 65, which travels north and south through the eastern portion of the county through the Zearing, Colo, and Collins;
- U.S. Highway 30, which travels east and west through the center of the county through Ames, Nevada, and Colo;
- Iowa Highway 210, which travels east and west through the southern portion of the county and passes through Slater, Huxley, and Maxwell.

The rest of the roads in the county are county highways and local roads.

Adjacent counties:

- Hamilton County (northwest)
- Hardin County (northeast)
- Marshall County (east)
- Jasper County (southeast)
- Polk County (south)
- Boone County (west)

The land that today is known as Story County was originally prairie, with the exception of some groves along the larger streams in the area. The surface is characterized by nearly level to gently and strongly sloping terrain, the latter of which is most dominant along the South Skunk River and its tributaries. Due to the relatively flat nature of the topography, up to one-half of the county has been drained by artificial systems through the use of tile and open ditches.

All of Story County lies in the Clarion-Nicollet-Webster soil association area which contains some of the best agricultural soils in the State. The general geology consists of the unconsolidated deposits as thick as 200 feet containing silt, clay, sands and gravels. The uppermost bedrock units in the northwest third of the county are dolomites and limestone. In the remainder of the county, the bedrock unit is mostly shale with thin layers of sandstone.

2.1.2 Major Rivers and Watersheds

The primary waterway features in Story County are the South Skunk River, the West Indian Creek, Bear Creek, Indian Creek, Squaw Creek, and Rock Creek. As depicted in Figure 2.2, Story County crosses six HUC-8 watersheds as follows:

- | | |
|--------------------------|--------------------------|
| • South Skunk (07080105) | • Upper Iowa (07080207) |
| • North Skunk (07080106) | • Middle Iowa (07080208) |

- Middle Des Moines (07100004)
- Lake Red Rock (07100008)

Figure 2.2: Story County, Iowa Watersheds (Story County is red square)



Source: Environmental Protection Agency, <https://cfpub.epa.gov/surf/locate/index.cfm>

2.1.3 History

Story County's boundaries were established in 1846. In 1853, it was named after Joseph Story, a pre-eminent United States Supreme Court justice. Three commissioners appointed by the Iowa legislature selected Nevada as the location of county seat on June 27, 1853. The first settlers in Story County came mainly from Indiana, New York, and Pennsylvania. Many Norwegians, Germans, and Danes came directly from overseas and inhabited the area later. The first large population influx occurred during the 1850s. By 1860, the population had increased to 4,501.

The County has 36 listing on the National Register of Historic Places. All listings are detailed in Table 2.1 below.

Table 2.1: Story County Listings in National Register of Historic Places

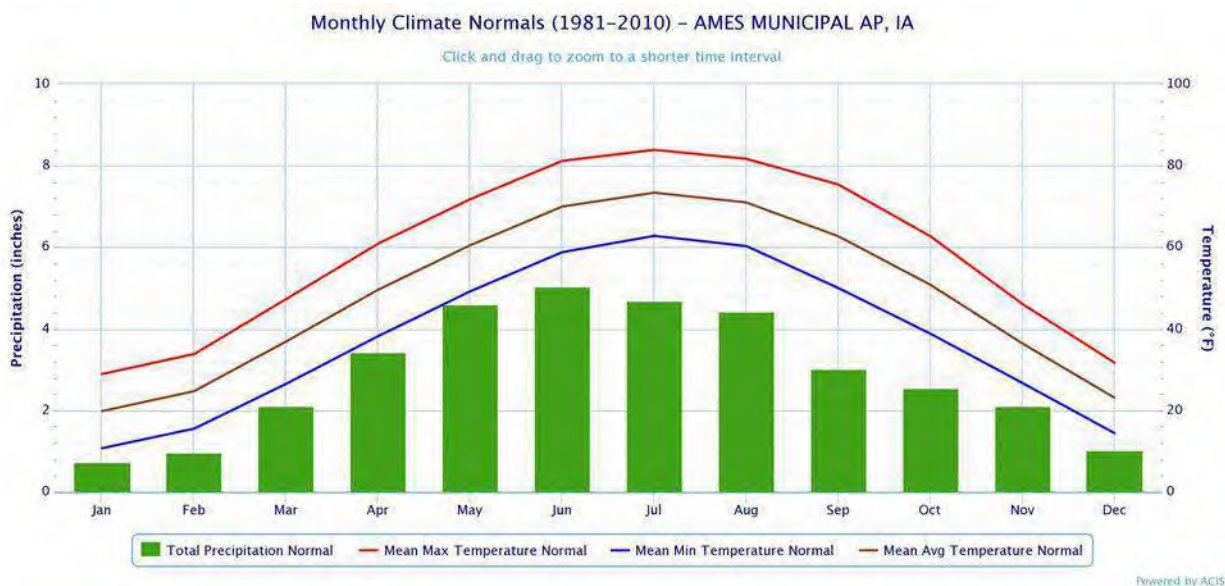
Listing	Date Listed	Location
Agriculture Hall	27-Jun-85	Ames
Alumni Hall	16-Nov-78	Ames
Ames High School	24-Oct-02	Ames
Ames Main Street Historic District	10-May-18	Ames
Bandshell Park Historic District	7-Oct-99	Ames
Briggs Terrace	20-Jul-98	Nevada
Prof. J.L. Budd, Sarah M., and Etta Budd House	8-Aug-01	Ames
Calamus Creek Bridge	15-May-98	Maxwell
Christian Petersen Courtyard Sculptures, and Dairy Industry Building	7-Apr-87	Ames
Colonials Club House	8-Feb-12	Ames
Delta Upsilon Chapter House	10-Nov-10	Ames
East Indian Creek Bridge	15-May-98	Nevada
Edwards-Swayze House	14-Nov-78	Nevada
Engineering Hall	10-Jan-83	Ames
Grand Auditorium and Hotel Block	25-Jan-80	Story City
Henry T. and Emilie (Wiese) Henryson House	20-Apr-05	Story City
Herschel-Spillman Two-Row Portable Menagerie Carousel	6-Jun-86	Story City
Iowa Beta Chapter of Sigma Phi Epsilon	5-Feb-14	Ames
Keigley Branch Bridge	15-May-98	Gilbert
Knapp-Wilson House	15-Oct-66	Ames
Lincoln Township Mausoleum	27-Sep-07	Lincoln Township
Gilmour B. and Edith Craig MacDonald House	6-May-92	Ames
Marston Water Tower	27-May-82	Ames
Masonic Temple	12-Sep-16	Ames
Morrill Hall	28-Jun-96	Ames
Mulcahy Barn	28-Jan-04	Colo
Municipal Building	2-May-97	Ames
Nevada Downtown Historic District	9-May-03	Nevada
Octagon Round Barn, Indian Creek Township	30-Jun-86	Indian Creek Township
Old Town Historic District	2-Jan-04	Ames
Pleasant Grove Community Church and Cemetery	28-May-10	Ames
Roosevelt School	2-Mar-10	Ames
Sheldahl First Norwegian Evangelical Lutheran Church	11-May-84	Sheldahl
Sigma Sigma-Delta Chi Fraternity House	10-Jul-08	Ames
Skunk River Bridge	15-May-98	Ames
William Kennison Wood House	5-Jun-95	Iowa Center

2.1.4 Climate

The climate in Story County is described as hot-summer humid continental with cold winters and hot and humid summers. The average winter temperature is 23.2 degrees Fahrenheit, with an average snowfall of 29.9 inches. The average summer temperature is 71.7 degrees Fahrenheit, with an average annual rainfall of 34.67 inches.

The coldest winter month is January with an average low of 10.7 degrees Fahrenheit and the hottest summer month is July with an average high of 83.9 degrees Fahrenheit. Seasons fluctuate from being very wet to very dry, and temperatures can fluctuate greatly in spring and autumn months. Story County's rainy season occurs from April through September, with a peak precipitation normal of 5.03 inches in June. Figure 2.3 and Table 2.2 provide monthly climate normals for Ames, Iowa from 1981 to 2010.

Figure 2.3: Monthly Climate Normals (1981-2010), Ames, IA



Source: High Plains Regional Climate Center, <http://climod.unl.edu/>

Table 2.2: Monthly Climate Normals (1981-2010), Ames, IA

Month	Total Precipitation Normal (inches)	Mean Max Temperature Normal (°F)	Mean Min Temperature Normal (°F)	Mean Avg Temperature Normal (°F)
January	0.74	28.9	10.7	19.8
February	0.96	33.8	15.5	24.7
March	2.10	47.3	26.5	36.9
April	3.44	60.9	38.2	49.6
May	4.59	71.8	49.2	60.5
June	5.03	81.2	58.8	70.0
July	4.70	83.9	62.8	73.4
August	4.42	81.7	60.3	71.0
September	3.01	75.4	50.0	62.7
October	2.56	62.7	38.8	50.8
November	2.10	46.1	26.7	36.4
December	1.02	31.7	14.4	23.1
Annual	34.67	58.8	37.7	48.2

Source: High Plains Regional Climate Center, <http://climod.unl.edu/>

2.1.5 Population/Demographics

According to the U.S. Census Bureau, the Story County population has experienced growth, increasing overall by 5.9 percent from 2010 to 2016. Over this period, the cities of Ames, Gilbert, and Slater experienced the most significant growth, each increasing their respective populations by 9 percent over this period. The cities of Cambridge, Colo, Huxley, and Roland experienced minor growth over this same period, while the other incorporated cities and the unincorporated County experienced population declines during this time. The City of Sheldahl appears to have experienced significant population decline, however the margin of error for the 2016 population estimate was greater than the overall change and therefore this conclusion is uncertain. Table 2.3 provides the populations for each city and the unincorporated county for the 2010 decennial census and the 2016 American Community Survey (ACS) 5-Year Population Estimates with the number and percent change from 2010 to 2016.

Table 2.3: Story County Population 2010-2016 by City

Jurisdiction	2010 Census Population	2016 Population Estimate	# Change 2010-2016	% Change 2010-2016
Ames	58,965	64,073	5,108	9%
Cambridge	827	853	26	3%
Collins	495	458	-37	-7%
Colo	876	886	10	1%
Gilbert	1,082	1,183	101	9%
Huxley	3,317	3,474	157	5%
Kelley	309	306	-3	-1%
Maxwell	333	325	-8	-2%
McCallsburg	920	839	-81	-9%
Nevada	6,798	6,796	-2	0%
Roland	1,284	1,312	28	2%
Sheldahl	319	249	-60	-22%
Slater	1,489	1,617	128	9%
Story City	3,431	3,423	-8	0%
Zearing	554	563	9	2%
Unincorporated Story County	8,543	8,477	-66	-1%
Total	89,542	94,834	5,292	5.9%

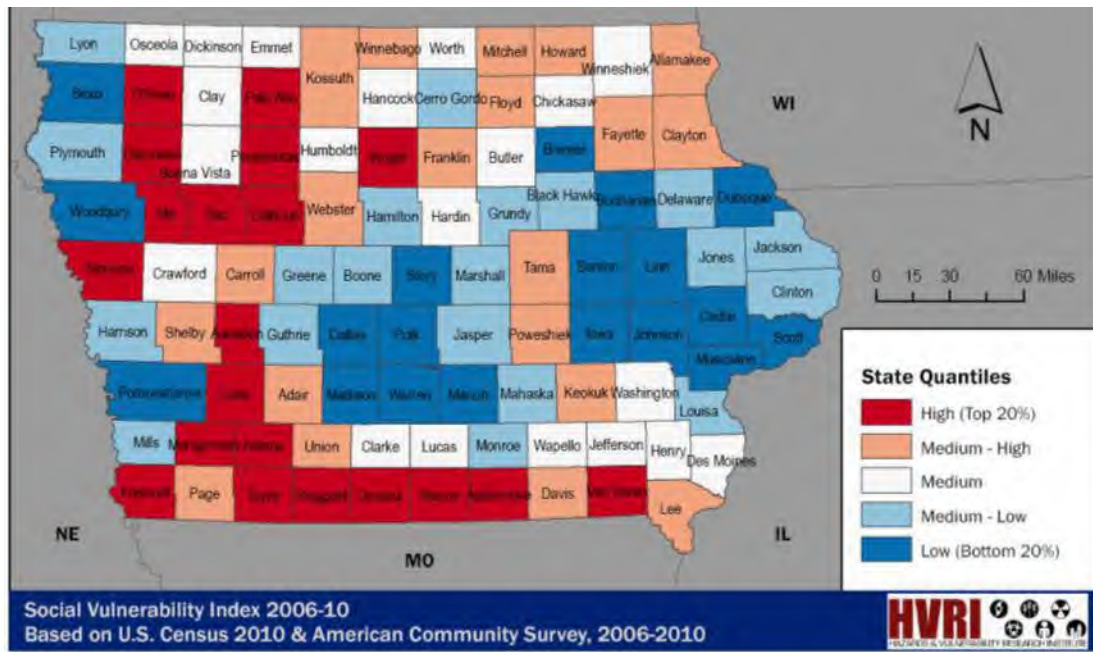
Source: U.S. Census Bureau: 2010 Decennial Census, ACS 2011-2016 5-Year Estimates. Unincorporated Story County Population was estimated by subtracting populations of incorporated cities from the total Story County populations.

According to the ACS 2016 5-Year Estimates, 4.9 percent of the population is under age 5 and 10.8 percent of the population is over age 65 in Story County. In total, there were 38,168 households with an average household size of 2.34 people.

The Hazards and Vulnerability Research Institute at the University of South Carolina developed the Social Vulnerability Index (SoVI ®) to evaluate and rank the ability to respond to, cope with, recover from, and adapt to disasters. The index synthesizes 30 socioeconomic variables, which the research literature suggests contributes to reduction in a community's ability to prepare for, respond to, and recover from hazards. SoVI ® data sources include primarily those from the United States Census Bureau.

Figure 2.4 shows that Story County has a low Social Vulnerability Index. The low index indicates that Story County is generally more able to cope and recover from disasters than counties with a higher index.

Figure 2.4: County Comparison Within the State for Social Vulnerability Index, 2006-2010



Source: Hazards and Vulnerability Research Institute, http://webra.cas.sc.edu/hvri/products/sovi2010_img/PDF/Iowa_0610.pdf
http://webra.cas.sc.edu/hvri/products/sovi2010_data.aspx

Table 2.4 and Table 2.5 provide additional demographic and economic indicators for Story County. The Story County values are for the entire county, including the incorporated cities.

Table 2.4: Unemployment, Income, and Poverty Demographics, Story County, Iowa

Jurisdiction	Population 16 Years and Over	Population 16 Years and Over in the Labor Force	Unemployment Rate (%)	Median Household Income (\$)	Percent Below Poverty Level
Story County	80,325	54,197	5.2	51,201	22.3
Ames	56,942	37,254	6.0	41,278	30.1
Cambridge	564	427	4.7	53,214	14.6
Collins	306	217	1.4	57,917	8.5
Colo	681	484	5.0	60,982	8.0
Gilbert	841	699	3.1	87,917	7.6
Huxley	2,537	2,007	7.5	65,471	10.9
Kelley	252	200	2.5	73,750	5.2
Maxwell	638	476	1.9	70,139	2.3
McCallsburg	227	164	0.6	44,500	18.9
Nevada	5,223	3,727	4.9	56,672	11.7
Roland	916	673	0.7	71,979	3.4
Sheldahl	207	150	4.7	60,481	9.2
Slater	1,127	839	1.0	69,457	5.3
Story City	2,809	1,688	3.1	53,893	13.8
Zearing	466	328	5.2	57,083	11.9

Source: U.S. Census, 2016 American Community Survey, 5-year Estimates

Table 2.5: Educational Attainment, Story County, Iowa

Geography	Population 25 years and over	Percent less than 9th grade*	Percent high school graduate or higher*	Percent bachelor's degree or higher*
Story County	48,629	1.1	96.3	50.3
Ames	28,189	0.8	97.4	63.4
Cambridge	525	2.5	93.3	26.1
Collins	263	3.8	92.4	11.8
Colo	570	1.1	93.3	17.2
Gilbert	688	0.3	98.8	43.9
Huxley	2,147	1.7	95.5	37.0
Kelley	221	0.5	95.0	23.1
Maxwell	550	0.5	96.4	20.4
McCallsburg	207	1.4	89.9	13.5
Nevada	4,602	2.3	93.8	22.9
Roland	799	0.0	98.0	38.3
Sheldahl	178	2.2	93.8	19.1
Slater	941	0.3	98.4	39.1
Story City	2,352	1.0	91.5	29.3
Zearing	376	2.9	89.6	19.4

Source: U.S. Census, 2016 American Community Survey, 5-year Estimates *percentage of population 25 years and over

2.1.6 Occupations/Employers

Table 2.6 provides occupation statistics for the incorporated cities and the county as a whole for the civilian employed population 16 years and over.

Table 2.6: Occupation Statistics, Story County, Iowa

Geography	Civilian employed population 16 years and over	Management, business, science, and arts occupations (%)	Service occupations (%)	Sales and office occupations (%)	Natural resources, construction, and maintenance occupations (%)	Production, transportation, and material moving occupations (%)
Story County	51,343	45.9	17.4	20.5	6.6	9.7
Ames	34,978	47.7	19.4	21.0	4.4	7.4
Cambridge	405	34.6	14.8	19.8	14.8	16.0
Collins	214	24.3	16.8	27.6	15.0	16.4
Colo	460	25.0	23.5	23.3	12.2	16.1
Gilbert	677	38.4	16.1	20.5	9.3	15.7
Huxley	1,857	46.6	13.4	19.2	13.7	7.1
Kelley	195	34.9	9.7	25.6	11.8	17.9
Maxwell	467	33.4	15.2	27.4	11.8	12.2
McCallsburg	163	16.6	16.6	20.2	19.6	27.0
Nevada	3,544	36.0	14.4	20.6	10.9	18.1
Roland	688	39.8	11.7	20.7	10.0	17.8
Sheldahl	143	21.0	9.1	35.7	18.9	15.4
Slater	831	43.2	14.1	20.7	10.5	11.6
Story City	1,635	49.8	15.4	12.5	8.8	13.6
Zearing	311	36.7	9.6	19.0	19.0	15.8

Source: U.S. Census, 2016 American Community Survey, 5-year Estimates

Table 2.7 lists the major employers in Story County according to County and jurisdiction representatives as reported in Data Collection Guides unless otherwise noted. Those jurisdictions not listed did not report any major employers.

Table 2.7: Major Employers, Story County, Iowa

Employer	Estimated # of Employees	Jurisdiction
Iowa State University*	>10,000	Ames
Iowa Department of Transportation*	2,000-5,000	Ames
Mary Greeley Medical Center*	1,000-2,000	Ames
McFarland Clinic PC*	1,000-2,000	Ames
Danfoss*	1,000-2,000	Ames
Ames Community School*	500-1,000	Ames
City of Ames*	500-1,000	Ames
National Centers for Animal Health*	500-1,000	Ames
3M*	250-500	Ames
Ag Leader Technology*	250-500	Ames
Ames Laboratory*	250-500	Ames
Hach Companies*	250-500	Ames
Hy-Vee Food Store, Lincoln Center*	250-500	Ames
Hy-Vee Food Store, West*	250-500	Ames
Workiva*	250-500	Ames
Ballard Community School	30	Cambridge
ICS	25	Cambridge
Precision Underground	25	Cambridge
Local Elevator	5	Collins
Heartland Co-Op	20	Colo
Colo-NESCO Community Schools	n/a	Colo
Gilbert School District	200	Gilbert
Key Coop	10	Gilbert
Open Flame Restaurant	10	Gilbert
Mullenbach Construction	20	Gilbert
The 2000 Day Learning Center	20	Gilbert
Kreg Tools	200	Huxley
Ballard Schools	100	Huxley
Ditch Witch	20	Huxley
Caruth Concrete	n/a	Kelley
Kemin	n/a	Kelley
Collins-Maxwell School	70	Maxwell
Story County	260	Nevada
Story County Medical Center	200	Nevada
Burke Corporation	350	Nevada
Almaco	150	Nevada
Nevada Community Schools	220	Nevada
City of Nevada	90	Nevada
General Financial Supply	115	Nevada
Mid-American Manufacturing	75	Nevada
Paragon International	56	Nevada
Ryerson's John Deere	36	Nevada
Iowa Plains	150	Slater
Ballard West Elementary School	50	Slater

Employer	Estimated # of Employees	Jurisdiction
Absolute Concrete / Greentech of Iowa	250	Slater
Syngenta	150	Slater
American Packaging Corp	320	Story City
Bethany Life	285	Story City
Eby Manufacturing	95	Story City
Indoshell Precision Technologies	65	Story City
Lumber Specialties	50	Story City
KMJ Performance	30	Story City
Record Printing	25	Story City
Winfield	20	Story City
Generation Repair & Service	n/a	Story City

Source: Reported by planning representatives in Data Collection Guides

*Listed by Ames Economic Development Commission

2.1.7 Agriculture

Because of the fertility of its soils and the climate conditions, agricultural crops and livestock are important contributors to the economy of Story County.

According to the 2012 Census of Agriculture there were 966 farms in the County covering 306,000 acres of land (83.3 percent of the 574 sq. miles of land area (367,360 acres) in the County). Crop and livestock production are visible parts of the agricultural economy, but many related businesses contribute by producing, processing, and marketing farm and food products. These businesses generate income, employment and economic activity throughout the region. Farms on average were 317 acres. Story County agriculture and agriculture-related industries provide 7,496 jobs, representing 13.2 percent of the County's workforce. Story County agriculture and economy contributions are summarized in additional detail in Section 3.2.2 of Chapter 3.

2.1.8 FEMA Hazard Mitigation Assistance Grants in Planning Area

Story County and its jurisdictions have received almost \$4 million in Hazard Mitigation Assistance Grants. The following table shows these projects.

Table 2.8: Hazard Mitigation Assistance Grants Awarded in Story County

Community	Project Type	Amount
Ames	Well 16 and 17 Electronic Controls Elevation	\$23,975
Nevada	School Safe Room	\$1,603,243
Huxley	Community Safe Room	\$798,645
Gilbert	School Safe Room	\$686,894
Collins	Backup Generators	\$26,490
Story City	Fire Station/EMS Backup Generator	\$33,158
Colo	Generator	\$53,000
Story County	Hazard Mitigation Plan	\$92,118
Ames	Squaw Creek Water Main Protection	\$124,500
Gilbert	Water Plant Generator	\$40,446
Maxwell	Property Acquisition and Demolition	\$51,658
Iowa State	Vet Med Safe Room	\$440,134
Total		\$3,974,261

2.2 City/County Capabilities

Unincorporated Story County is governed by a three-member Board of Supervisors. Each incorporated city is governed by a six-member Mayor/City Council. Story County has an Emergency Management Commission and an Emergency Management Agency that coordinates emergency management capabilities for the entire county. Story County participates in the Emergency Notification System (CCENS), part of the Alert Iowa system contracted with WENS Inspiron. All jurisdictions within the County have the ability to utilize this service. Table 2.9 and Table 2.10 that follow provide additional capability information for the unincorporated county and incorporated cities.

Table 2.9: Mitigation Capabilities (Story County through City of Huxley)

	Story County	Ames	Cambridge	Collins	Colo	Gilbert	Huxley
Planning Capabilities							
Comprehensive Plan	6/6/2016; Cornerstone to Capstone (C2C Plan)	11/22/2011; land use policy plan is comp. plan for the City	Yes; 2007	No	05/1973; needs updated	Yes; 02/12/2018	2013
Builder's Plan	No	No	No	No		No	N/A
Capital Improvement Plan	03/20/2018; annually reviewed in December and adopted following fiscal year budget adoption	FY 2018/19 - 2022/23	No		05/1995; needs updated	No	In process
Local Emergency Operations Plan	N/A	2017; EOC/Disaster Response Plan	Yes; 2012	No		No	2012
County Emergency Operations Plan	Yes, 2011; 5% adopted annually	Yes	Yes	Yes	Yes	Yes	2012
Local Recovery Plan	N/A	No	Yes; 2009	No		No	
County Recovery Plan	Yes, 2011; part of County EOP, ESF14	Yes	Yes; 2009	Yes	Yes	Yes	Yes
City Mitigation Plan	N/A	N/A; Multi-Jurisdictional HMP	Yes; 2009	No		No	
County Mitigation Plan	Yes, 2014	N/A	Yes; 2009	No		N/A	

	Story County	Ames	Cambridge	Collins	Colo	Gilbert	Huxley
Economic Development Plan	6/6/2016; chapter of C2C plan; economic development process and policies (TIF program) adopted October 2012 and annually reviewed by BoS	N/A; Ames EDC organizes and promotes sound economic growth in Ames	No	No		No	
Transportation Plan	6/6/2016; chapter of C2C plan; secondary roads 5-year road program adopted annually by the BoS	5/23/2017; long range transportation plan - Ames Mobility 2040	No	No		No	
Land-use Plan	6/6/2016; part of C2C Plan	11/22/2011	Yes; 1978, updated 2014	No		Yes; 02/12/2018, including in Comprehensive Plan pg. 27	
Flood Mitigation Assistance (FMA) Plan		No; City worked with consultants to develop strategy to mitigate challenges of area flooding - final report presented in January 2014 with goal to develop recommendations to reduce impact of future flooding	No	No		No	
Watershed Plan		12/2014; Squaw Creek Watershed Management Plan 2014	No	No		Yes; Dec 2014, Squaw Creek Watershed	
Firewise or other fire mitigation plan		No	No	No		N/A; Gilbert/Franklin Fire & EMS	
Critical Facilities Plan (Mitigation/Response/Recovery)		No	No	No		No	
Policies/Ordinances							

	Story County	Ames	Cambridge	Collins	Colo	Gilbert	Huxley
Zoning Ordinance	Yes; part of land development regulations	Yes; Ch. 29 of municipal code	Yes	Yes	Yes	Yes; recodified in 2013, due to recodify in 2018	Yes
Building Code	No	2015 IBC	State	Yes		2015 IBC	2015
Floodplain Ordinance	Yes	Yes; Ch. 9 of municipal code revised 2016	Yes; 2002	No		2013	
Subdivision Ordinance	Yes; part of land development regulations	Yes; Ch. 23 of municipal code	Yes	Yes	Yes	Yes; recodified in 2013, due to recodify in 2018	Yes; all part of our city code
Tree Trimming Ordinance	No	Yes; Ch. 27 of municipal code	Yes	No	Yes	No	Yes
Nuisance Ordinance	Yes; components in the cost of ordinances include: Ch40 Yard Waste, Ch45 Animal Control and Welfare, Ch55 Public Health Nuisances	Yes; Ch.17.30 of municipal code	Yes	No	Yes	Yes	Yes
Storm Water Ordinance	Yes; part of land development regulations referencing SUDAS manual; planning and development department currently has a draft stormwater ordinance out for public review and comment	Yes; post construction stormwater management ordinance, Ch.28 Div. VIII of municipal code	No	No		Yes	Yes
Drainage Ordinance	Yes, drainage districts	Yes; included in Ch.28 Division VIII of municipal code	No	No		No	
Site Plan Review Requirements	Yes; part of land development regulations	Yes	Yes	No	No	Yes; required by Ch. 6 of city ordinance	Yes

	Story County	Ames	Cambridge	Collins	Colo	Gilbert	Huxley
Historic Preservation Ordinance	No	Yes; Ch. 31 of municipal code	No	No	No	No	No
Landscape Ordinance	Yes; part of land development regulations	Yes; Ch. 29.403 of municipal code	No	No	No	No	Yes
Iowa Wetlands and Riparian Areas Conservation Plan	No	Yes; part of Post Construction Storm Water Ordinance (preserve and restore) April 2014	No	No	No	No	No
Debris Management Plan	Planning and Development Department is currently working on potentially siting a construction/demolition landfill	N/A; have document on FEMA debris management policies and guidelines and program implementation guidelines from Iowa DNR Environmental Services Division	No	No		No	
Programs							
Zoning/Land Use Restrictions	Yes; implementation by the planning and development department	Yes	Yes	Yes	Yes	Yes; Ch. 5 of city ordinance, p.27 of comprehensive plan	Yes
Codes Building Site/Design	Yes; implementation by the Planning and Building Development Department	Yes	No	Yes	Yes	Yes; Ch. 5 & 6 of city ordinance	
National Flood Insurance Program	Yes	Yes	Yes	No	No	No	Yes
NFIP Community Rating System (CRS) Participating Community	Yes - Class 7	Yes	No	No	No	Yes; Story County	

	Story County	Ames	Cambridge	Collins	Colo	Gilbert	Huxley
Hazard Awareness Program	Yes; EMA office for severe weather awareness week; public health vaccine clinics	Yes; Story County Local Emergency Planning Committee	No	No	No	Yes; Story County	
National Weather Service (NWS) Storm Ready		No	No	No	Yes	No	
Firewise Community Certification	No	No	No	No	No	N/A; Gilber/Franklin Fire Agency	
Building Code Effectiveness Grading (BCEGs)	No	Yes; Class 4 as of 2014		No	No	No	
ISO Fire Rating	varies across fire districts - 14 districts in county	3	05/5X	6	4	N/A; Gilber/Franklin Fire Agency	5
Economic Development Program	Yes; contract with Ames Economic Development Commission	Yes; Business Development Coordinator; EDC	No	No	Yes	No	Yes
Land Use Program	Yes; implementation by the Planning and Development Department	Yes; Land Use Policy Plan	No	No	No	No	

	Story County	Ames	Cambridge	Collins	Colo	Gilbert	Huxley
Public Education/Awareness	Yes, implementation of BoS Communication Plan by the County Outreach and Special Projects Manager. EMA continual information dissemination throughout the year for public disaster preparedness, response, and recovery	Yes; fire prevention and safety education; storm water permit program	No	No	No	No	
Property Acquisition	No	No	No	No	No	No	
Planning/Zoning Boards	Yes; implementation by the Planning and Development Department - planning and zoning commissions; board of adjustment	Yes; Planning & Zoning Commission; Zoning Board of Adjustment	Yes	Yes	Yes	Yes; both active	Yes
Stream Maintenance Program	No	Yes; Storm Water Erosion Control Program provides for stabilization of areas that have eroded in streams, channels, swales, gullies, or drainage ways that are part of storm water system	No	No	No	No	
Tree Trimming Program	No, performed as necessary	Yes	No	No	No	No	
Engineering Studies for Streams (Local/County/Regional)	Yes; Story County floodplain mapping revisions currently underway	Yes; 2007/2011 Stream Assessment; Flood Mitigation Study HDR Feb 2014	No	No	No	Yes; Squaw Creek Watershed	

	Story County	Ames	Cambridge	Collins	Colo	Gilbert	Huxley
Mutual Aid Agreements	Yes; fire, EMS, and law enforcement; resource recovery plant	Yes; Fire = Story County Fire Agencies, Des Moines Fire (HazMat Response 28E agreement), Iowa Mutual Aid Compact (IMAC), Department of Energy Ames Lab (in process), USDA National Center for Animal Health (MOU); Wastewater = IOWARN; Law Enforcement = Iowa State University, Story, County Sheriff's Office, USDA National Centers for Animal Health (MOU)	Yes	Yes; Story County 28E Agreement	Yes	Yes; Police - Story County Sheriff, Fire/EMS - Gilbert/Franklin Fire Agency, Animal Control - Story County	Yes
Studies/Reports/Maps							
Hazard Analysis/Risk Assessment (City)	N/A	Yes; Multi-Jurisdictional HMP	No	No	No	No	
Hazard Analysis/Risk Assessment (County)	Yes	N/A	N/A	No	Yes	N/A	
Evacuation Route Map	Yes; part of County EOP ESF 1	Yes; Ames has booklet that shows maps; GIS has online maps	No	No		No	Yes
Critical Facilities Inventory	Yes	No	No	No	No	No	Yes
Vulnerable Population Inventory	Yes; County EOP ESF 10 marks vulnerable population near Tier II facilities	Yes; E-911 program (voluntary) - police department maintains addresses and contact info of some vulnerable populations as individuals self-report	No	No	No	No	
Land Use Map	Part of the C2C plan	Yes; in Land Use Policy Plan	Yes	No	No	Yes; comp. plan p. 27	On City's website with Comp. plan

	Story County	Ames	Cambridge	Collins	Colo	Gilbert	Huxley
Staff/Department							
Building Code Official	No	Yes	Yes	No	No	Yes; City Clerk	Yes
Building Inspector	Yes, zoning enforcement only	Yes; Building, Fire, Housing, Plumbing, Electrical, Plan Examiner	No	No	No	Yes; Safe Building	Yes
Mapping Specialist (GIS)	Yes, Assessor's Office	Yes, 3 full-time staff	No	No	No	No	
Engineer	Yes	Yes; Public works (11), Water & Pollution Control (2), Electric Services (5)	Yes; as needed	No	No	Yes; Fox Engineering	Yes
Development Planner	Yes	Yes; Planning Director	No	No	No	No	
Public Works Official	N/A	Yes; Public Works Director	Yes	Yes	Yes	Yes	Yes
Emergency Management Coordinator	Yes	County	No	Yes; Story County	No	No	
NFIP Floodplain Administrator	Yes; also serves as the CRS Coordinator	Yes; 4 planners and Planning Director	Yes	No	No	Yes; City Clerk	
Bomb and/or Arson Squad	No	Yes; Fire Investigation Team (cooperative between ISU Police, Ames Police, Ames Fire)	No	No; County	No	N/A	No
Emergency Response Team	Yes, Sheriff's Office	Yes; ISU Police, Ames Police, Ames Fire, Mary Greeley Medical Center Mobile Intensive Care Services	Yes	Yes; local fire dept.	No	N/A	No
Hazardous Materials Expert	No	Yes; Fire Department and 28E agreement with Des Moines Fire for HazMat response	No	No	No	N/A	No
Local Emergency Planning Committee	yes	Yes; Story County LEPC - Ames Fire Dept. is a member, meets quarterly	No	No	Yes	No	No
County Emergency Management Commission	Yes	Yes	Yes	Yes	Yes	Yes	Yes

	Story County	Ames	Cambridge	Collins	Colo	Gilbert	Huxley
Sanitation Department	Yes, Environmental Health Department	Yes; Water & Pollution Control Dept., City Council acts as Board of Health per municipal code Ch.11	No	No	No	No	Yes; private companies
Transportation Department	Yes; County Engineer	Yes; Traffic Division	No	No	No	Yes	Yes; school
Economic Development Department	Yes; via contract with Ames Economic Development Commission; part of County Outreach and Special Projects Manager programming as well	Yes; Ames EDC	Yes	No	Yes	No	
Housing Department	No, Story County Housing Trust Fund formed in 2017 - BoS have provided funding	Yes; Housing Division	No	No	No	No	
Historic Preservation	No	Yes; Historic Preservation Commission	No	No	Yes	Yes; Gilbert Historical Society	Yes; Huxley Historical Society
Non-Governmental Organizations (NGOs)							
American Red Cross	Yes	No	No	Yes; Des Moines / Ames	No	No	No, Ames
Salvation Army	Yes	Yes; 703 E. Lincoln Way	No	Yes; Des Moines	No	No	No, Ames
Veterans Groups	Yes	Yes; American Legion Post 37	Yes	No	No	No	No
Local Environmental Organization	Yes; Skunk River Navy, Prairie Rivers of Iowa, Isaac Walton League, Audubon Society	Yes; Skunk River Navy, Squaw Creek Watershed Coalition, Skunk River Paddlers, Sierra Club-Central Iowa Group (Ames), Several ISU organizations	No	No	No	No	No

	Story County	Ames	Cambridge	Collins	Colo	Gilbert	Huxley
Utility Companies	Yes	Yes	No	No	No	No	
Homeowner Associations	N/A	Yes	No	No	No	No	
Neighborhood Associations	Yes, member of various within Story County	Yes	No	No	No	No	
Chamber of Commerce	Yes, all	Yes; Lions, Rotary, Kiwanis, Volunteer Center, RSVP, etc.	Yes	Yes; Legion	No	Yes; Lions	Yes, Kiwanis
Community Organizations (Lions, Kiwanis, etc.)	Yes	Yes; 426 5th St. #101	No	Yes; Des Moines / Ames	No	No	No, Ames
Financial Resources							
Ability to apply for Community Development Block Grants	Yes	Yes	Yes	Yes	Yes	Possibly	Yes
Ability to fund projects through Capital Improvements funding	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Authority to levy taxes for a specific purpose	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fees for water, sewer, gas, or electric services	Yes, County does not provide any of these services, however	Yes	Yes	Yes	Yes	Yes	Yes
Impact fees for new development	No, State code does not allow	Yes	Yes	Yes	Yes	Yes; none currently	
Ability to incur debt through general obligation bonds	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ability to incur debt through special tax bonds	Yes	No	Yes	Yes	Yes	Yes; none currently	
Ability to incur debt through private activities	No	No	No	No	Yes	Yes	
Ability to withhold spending in hazard prone areas	No	No	Yes	No	Yes	No	

Table 2.10: Mitigation Capabilities (City of Kelley through City of Story City)

	Kelley	Maxwell	McCallsburg	Nevada	Roland	Sheldahl	Slater	Story City
Planning Capabilities								
Comprehensive Plan	No	Yes; 1996	Yes; referenced in code Ch. 30, 61, 62	3/2/2011	2/25/2008		2007, reviewed 2017	9/6/2016
Builder's Plan	No	No	No	2015	2/19/1998		N/A	11/21/2011
Capital Improvement Plan	No	Yes; 2013	No	Updated 3/12/2018	Feb-14		2016	6/15/2015
Local Emergency Operations Plan	No	Yes; 2013	Yes; incorporates County Plan in Ch. 30	2015		3/21/2018	No	3/1/2018, updated
County Emergency Operations Plan	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Local Recovery Plan	No	Yes; 2013	No	2015			No	
County Recovery Plan	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City Mitigation Plan	No	Yes; 2013	Yes; Ch. 30	updated 8/2/2017	5/7/2014		No	5/6/2008
County Mitigation Plan	Yes	N/A	N/A	updated 8/2/2017	May-14		N/A	
Economic Development Plan	No	No	referenced in Ch. 61, 62	July, 2009			No	
Transportation Plan	No	No	No	March, 2009			No	9/6/2016
Land-use Plan	Yes	Yes; 1996	No	July, 2004	2/25/2008		2006	9/6/2016
Flood Mitigation Assistance (FMA) Plan	No	Yes; 2015	No	2009			No	
Watershed Plan	No	No	No	2002			2017 in conjunction with Polk County	7/6/2011
Firewise or other fire mitigation plan	No	No		2016			No	
Critical Facilities Plan (Mitigation/Response/Recovery)	No	Yes; 2013	Yes; Ch. 30	4/20/2016			No	

	Kelley	Maxwell	McCallsburg	Nevada	Roland	Sheldahl	Slater	Story City
Policies/Ordinances								
Zoning Ordinance	Yes	Yes	Yes, Ch. 62	Yes, 4/10/2017	Yes, Ch. 165	Yes, 2016	Yes	Yes
Building Code	2006	Yes, 2012	Yes, 2009, Ch. 31	2015	IA 2015 International	Yes, 2016	Property manage 2009	IBC
Floodplain Ordinance	No	Yes, 2012	Yes, Ch. 73	Yes, 10/23/2006	Yes, Ch. 160		2001	12/17/2007
Subdivision Ordinance	Yes	Yes	Yes, Ch. 66, 67, 68, 69	Yes	Yes, Ch. 170		Yes	Yes
Tree Trimming Ordinance	No	Yes	Yes, Ch. 26	Yes	Yes, Ch. 151.04	Yes, 2016	Yes	Yes
Nuisance Ordinance	Yes	Yes	Yes, Ch. 26 (see also 25, 28, 31, 35)	Yes	Yes, Ch. 50	Yes, 2016	Yes	Yes
Storm Water Ordinance	Yes	No	Yes, Ch. 35	Yes	Yes, Ch. 95.04(2), 97.01, 170.43		Yes	Yes
Drainage Ordinance	No	No	Yes, Ch. 35, 36, 41, 73	Yes	Yes, Ch. 97.02, 170.43		Yes	Yes, through site plan review
Site Plan Review Requirements	Yes	Yes	Yes, Ch. 31	Yes	Yes, Ch. 165.9	No	Yes	Yes
Historic Preservation Ordinance	No	No	Yes, referenced in Ch. 73	Yes	Yes, Ch. 170.48	No	Yes	No
Landscape Ordinance	No	No	No; landscape waste referenced in Ch. 38	Yes	No	No	Yes	No
Iowa Wetlands and Riparian Areas Conservation Plan	No	No	No	No	No	No	No	No
Debris Management Plan	No	Yes; 2013	No; referenced in Ch. 30	11/11/2017			No	In emergency operation plan
Programs								
Zoning/Land Use Restrictions	Yes	Yes	Yes, Ch. 31, 62	Yes	Sub Section of Comprehensive Plan		Yes	Yes

	Kelley	Maxwell	McCallsburg	Nevada	Roland	Sheldahl	Slater	Story City
Codes Building Site/Design	Yes	Yes	Yes, Ch. 31	Yes	No		Yes	Yes
National Flood Insurance Program	No	Yes		Yes	Yes		Yes	
NFIP Community Rating System (CRS) Participating Community	N/A	Yes		Community # 190258 E; Regular; sought assistance from city insurer - Midwest Insurance			No	
Hazard Awareness Program	No	Yes	No	Yes	No		No	No
National Weather Service (NWS) Storm Ready	N/A	No		Yes, yearly training at FD	No		No	
Firewise Community Certification		No			No		No	
Building Code Effectiveness Grading (BCEGs)		No		Yes, 4			N/A	No
ISO Fire Rating		6	3	3			PPC 6	
Economic Development Program	No	Yes		Yes			Yes	Yes
Land Use Program	No	No	No	Yes	Sub Section of Comprehensive Plan		No	Yes
Public Education/Awareness	No	No		Yes	No		Yes	Yes
Property Acquisition	No	Yes	No	Yes	No		No	No
Planning/Zoning Boards	Yes	Yes	Yes, Ch. 61	Yes	Yes		Yes	Yes
Stream Maintenance Program	N/A	No	No	Yes	No		No	Yes
Tree Trimming Program	No	Yes	No	Yes	No		Yes	Yes
Engineering Studies for Streams (Local/County/Regional)	N/A	No	No				No	Yes
Mutual Aid Agreements	Yes	Yes	Yes, agreements with Zearing	Yes	Yes, Sheriff, Ambulance, Fire	Yes	Yes	Yes

	Kelley	Maxwell	McCallsburg	Nevada	Roland	Sheldahl	Slater	Story City
Studies/Reports/Maps								
Hazard Analysis/Risk Assessment (City)	No	Yes	Yes	Yes	No	3/21/2018	Yes	
Hazard Analysis/Risk Assessment (County)	Yes	N/A	N/A	Yes	No		No	
Flood Insurance Maps								
FEMA Flood Insurance Study (Detailed)								
Evacuation Route Map	No	Yes	No	No	No		No	
Critical Facilities Inventory	No	No	Yes, Ch. 30	Yes	No		Yes	
Vulnerable Population Inventory	No	No	No	No	No		No	
Land Use Map	Yes	Yes	Yes	Yes	Yes		Yes	Yes
Staff/Department								
Building Code Official	Yes	Yes; Safe Building Compliance, Slater	No	Yes	No		Yes	Yes
Building Inspector	Yes	Yes; Safe Building Compliance, Slater	No	Yes	Yes, Veenstra & Kimm		Yes	Yes
Mapping Specialist (GIS)	No	No	No	Yes, with Story County	No		No	No
Engineer	No	Yes; Snyder & Assoc., Ankeny	No	Yes	Yes, Veenstra & Kimm		Yes; not on staff	Yes
Development Planner	No	No	No	Yes	No		No	No
Public Works Official	No	Yes; Public Works Supervisor		Yes	No		Yes	Yes
Emergency Management Coordinator	No	Yes; Fire Chief		Yes, with Story County	No		Yes; County	
NFIP Floodplain Administrator	N/A	Yes	Yes	Yes	Yes		Yes	Yes, City Administrator

	Kelley	Maxwell	McCallsburg	Nevada	Roland	Sheldahl	Slater	Story City
Bomb and/or Arson Squad	State	No	No	Yes, State Fire Marshall's Office	No		No	
Emergency Response Team	No	Yes; EMS Chief		Yes, Story County Sheriff's Office	Yes, Roland EMS		No	Yes, Fire Dept.
Hazardous Materials Expert	No	No	No	Yes, FD Chief	No		No	Yes, Fire Dept.
Local Emergency Planning Committee	No	Yes; Mayor, Fire Chief, EMS Chief		Yes	No		No	Yes
County Emergency Management Commission	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sanitation Department	No	Yes	No	Yes, outsourced	No		No	No
Transportation Department	No	No	No	Yes	No		No	Yes, Street Dept.
Economic Development Department	No	No	No	Yes, with NEDC	No		Yes	Yes, City Administrator
Housing Department	No	No	No	No	No		No	Yes, City Administrator
Historic Preservation	No	No	No	Yes	No		No	Yes, Historical Society
Non-Governmental Organizations (NGOs)								
American Red Cross	No	No	No	Yes	No	No	Yes	No
Salvation Army	No	No	No	Yes	No	No	No	No
Veterans Groups	No	Yes; Legion & VFW Posts	Yes; American Legion	Yes	Yes, Roland Legion	Slater - American Legion	Yes, Post 260	Yes
Local Environmental Organization	No	No	No	Yes	No	No	No	No
Utility Companies	No	No	No	Yes	No	No	No	Yes
Homeowner Associations	No	No	No	Yes	No	No	No	No
Neighborhood Associations	No	No	No	Yes	No	No	No	Yes

	Kelley	Maxwell	McCallsburg	Nevada	Roland	Sheldahl	Slater	Story City
Chamber of Commerce	No	Yes; Maxwell Area Renewal Committee	Yes	Yes	Kiwanis, RADC		Yes, Slater Community Club	Yes
Community Organizations (Lions, Kiwanis, etc.)	No	No	No	Yes	No	No	Yes	No
Financial Resources								
Ability to apply for Community Development Block Grants	Yes	Yes	Yes	Yes	No	Yes	No	Yes
Ability to fund projects through Capital Improvements funding	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Authority to levy taxes for a specific purpose	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fees for water, sewer, gas, or electric services	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Impact fees for new development	Yes	No	Yes	Yes	Yes		Yes	No
Ability to incur debt through general obligation bonds	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ability to incur debt through special tax bonds	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ability to incur debt through private activities	Yes	No	Yes	Yes		No	Yes, TIF	No
Ability to withhold spending in hazard prone areas	No	No	Some discretion with flood management	Yes			No	No

2.2.1 Public School District and State University Profiles and Mitigation Capabilities

This section includes general profile information for the Story County Public School Districts and Iowa State University. Figure 2.5 provides the boundaries of the school districts in Story County and Table 2.11 that follows provides location and enrollment information.

Figure 2.5: Story County Public School Districts

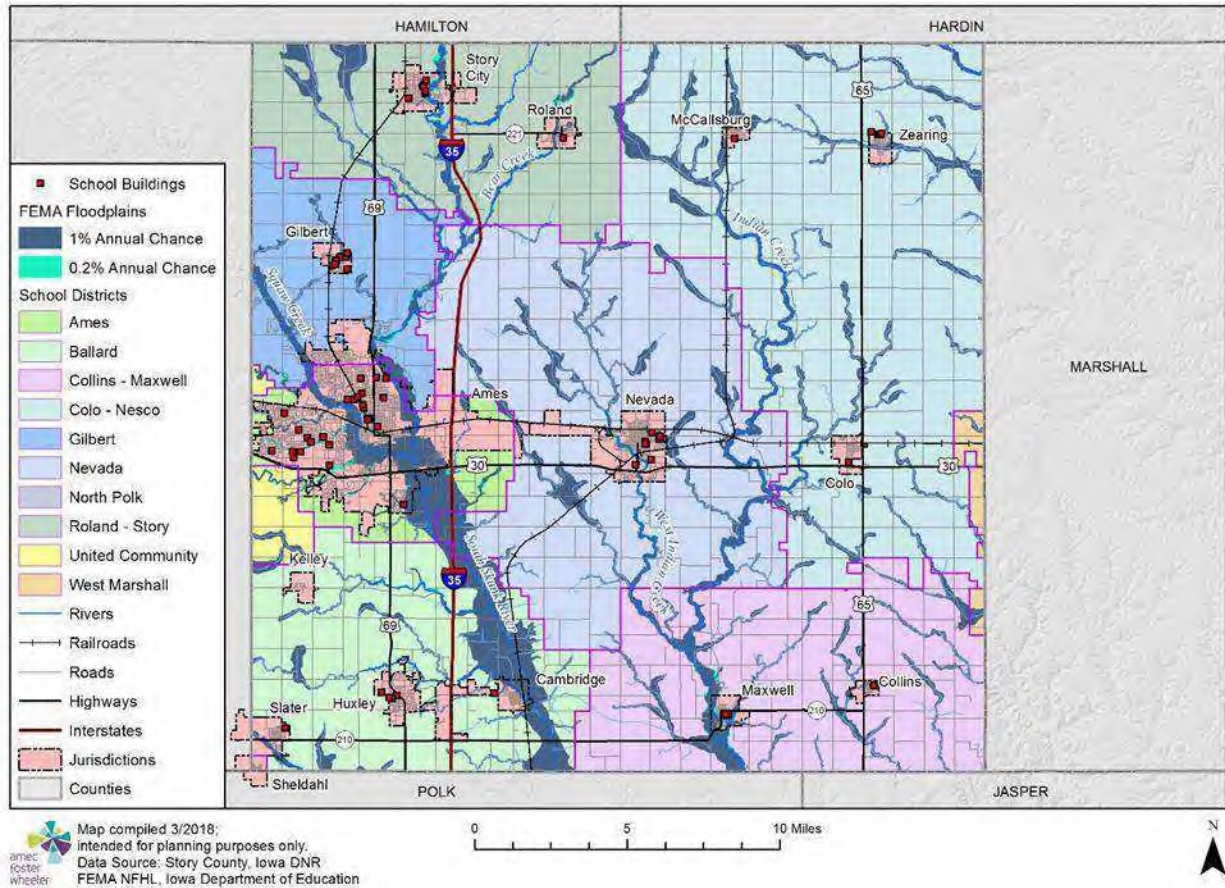


Table 2.11: Story County School Buildings and Enrollment Data, 2015-2016

District Name/Building Name	Total Enrollment
Ames	4,520
Ames High School	1,270
Ames Middle School	990
District level enroll	20
Edwards Elementary School	383
Fellows Elementary School	507
Formative Years Preschool	17
ISU Lab School	18
Meeker Elementary School	468
Mitchell Elementary School	269
Northwood Pre-School	282
Sawyer Elementary School	288
University Community Child Care	8

District Name/Building Name	Total Enrollment
Ballard	1,808
Ballard High School	524
Ballard Middle School	392
East Elementary	359
Lily Pad Preschool	51
Miss Wendy's Preschool	20
Ms. Hollie's Preschool	20
West Elementary	423
Whistlestop Academy	19
Collins-Maxwell	439
Collins-Maxwell Elementary School	203
Collins-Maxwell Middle/High School	236
Colo-NESCO	429
Colo-NESCO Jr./Sr. High School	209
Colo-Nesco Elementary Learning Center	154
Colo-NESCO Intermediate School	66
Gilbert	1,492
Gilbert Elementary School	388
Gilbert High School	435
Gilbert Intermediate School	325
Gilbert Middle School	344
Nevada	1,648
Central Elementary School	726
District level enroll	5
Nevada High School	462
Nevada Middle School	455
Roland-Story	1,123
Roland-Story Elementary School	476
Roland-Story High School	332
Roland-Story Middle School	315
Grand Total	11,459

Source: Iowa Department of Education, Bureau of Planning, Research and Evaluation
http://educateiowa.gov/index.php?option=com_content&view=article&id=346&Itemid=4439

Potential capabilities to implement mitigation programs and projects can vary among school districts. To determine mitigation capabilities, Story County's public school districts and Iowa State University completed Data Collection Guides to report planning, personnel, fiscal, and other capabilities related to implementation of mitigation programs and projects. Table 2.12 provides a summary of the District's reported capabilities.

Table 2.12: Summary of Mitigation Capabilities, Story County Public School Districts and Iowa State University

	Ames	Ballard	Collins-Maxwell	Colo-NESCO	Gilbert	Nevada	Roland-Story	Iowa State University
Planning Elements								
Master Plan	Yes, 02/2018, perpetual	No	Yes	Yes	Yes	N/A	Yes, 2014	Yes, 2000
Capital Improvement Plan	Yes, 12/2017, perpetual	Yes, 2015	Yes, 2018, currently being revised	Yes	Yes, 11/2017	Yes, 2018	No	Yes
School Emergency Plan	Yes, 03/2016, update in progress	Yes, currently being revised	Yes, currently being revised	Yes	Yes, 08/2015	Yes, updated	Yes, 09/2017	Yes, 2017 – Comprehensive Emergency Operation Plan, Shelter in place protocols, campus evacuation protocols
Weapons Policy	Yes, 03/2015	Yes, 2017	Yes, 2017	Yes	Yes, 03/2017	Yes, 01/2017	Yes, 07/2008; board policy 502.6	Yes, 2008
Personnel Resources								
Full-time building official (i.e. principal)	Yes, Principal	Yes, Superintendent	Yes, Superintendent	Yes, Buildings & Grounds	Yes	Yes, Principal and Buildings & Grounds	Yes, Principal	Yes, Senior Vice President for University Services
Emergency Manager	No	No	No	Yes, Principal	No	No	Yes, Principal	Yes, Environmental Health & Safety

	Ames	Ballard	Collins-Maxwell	Colo-NESCO	Gilbert	Nevada	Roland-Story	Iowa State University
Grant Writer	No	No	No	No	No	No	No	Yes, Office of Sponsored Programs Administration
Public Information Officer	Yes, Media Relations Director	No	No	Yes, Principal	No	Yes, Superintendent	Yes, Superintendent	Yes, University Relations
Financial Resources								
Capital Improvements project funding	Yes	Yes	Yes	Yes	Yes	Yes	Yes, PPEL & SAVE	Yes
Local funds	No	No	No	Yes	Yes	Yes	No	No
General obligation bonds		Yes	Yes	Yes	No	Yes	Yes	No
Special tax bonds		No	No	Yes	Yes	Yes	Yes	Yes
Private activities/donations		Yes	Yes	Yes	No	Yes	Yes	Yes
State and federal funds		Yes	Yes	Yes	No	Yes	Yes	Yes
Other								
Public Address/Emergency Alert System	Yes, public address through fire alarm system speakers	Yes, available through every phone	Yes, available through every phone	Yes, PA system	Fire alarm system and security system	Yes, intercom system and radio system for all building offices and bus system; fire and tornado alarms	Yes, intercom system	Some buildings have indoor PA system; Campus has outdoor warning system; ISU Alert notification system
NOAA Weather Radios	Yes	Yes	Yes	Yes	Yes, but they do not work well	Yes	No	Yes

	Ames	Ballard	Collins-Maxwell	Colo-NESCO	Gilbert	Nevada	Roland-Story	Iowa State University
Mitigation Programs to reduce losses / Public Education Programs	New construction with fire sprinklers, fire alarms, door access control, current life safety compliance and building code compliance	Development of training plan for emergency preparedness	Development of training plan for emergency preparedness	Fire & tornado drills	FEMA saferoom at high school	Fire, tornado, and ALICE drills	Installed security cameras and door access controls	Dry-floodproofed three campus buildings: Lied Recreation Athletic Facility, Hilton Coliseum, and Scheman Building
Tornado Shelter/Saferoom	Yes	No, Middle School in Huxley has access to City's saferoom	No	Yes	Yes, meets FEMA standards	Yes, meets FEMA standards	No	Yes, two meet FEMA standards; other buildings have designated shelter areas
Campus Police	No, School Resource Officer provided through City of Ames Police Department	No	No	No	No, contract with Story County Sheriff's Dept. for security needs	No, rely on Nevada Police Department	No, rely on the Story City Police and Story County Sheriff's Dept.	Yes, 30 police officers and dispatchers provide 24/7 service

3 RISK ASSESSMENT

3 Risk Assessment.....	3-1
3.1 Hazard Identification	3-2
3.1.1 Review of Existing Mitigation Plans	3-3
3.1.2 Review Disaster Declaration History	3-4
3.1.3 Research Additional Sources	3-5
3.1.4 Hazards Identified	3-6
3.1.5 Multi-Jurisdictional Risk Assessment.....	3-7
3.1.6 Hazard Scoring Methodology	3-8
3.1.7 Climate Change.....	3-10
3.2 Assets at Risk	3-11
3.2.1 Total Exposure of Population and Structures.....	3-11
3.2.2 Critical and Essential Facilities and Infrastructure	3-17
3.3 Development Since 2014 Plan Update.....	3-21
3.4 Future Land Use and Development.....	3-26
3.5 Hazard Profiles and Vulnerability	3-30
3.5.1 Animal/Plant/Crop Disease	3-32
3.5.2 Dam/Levee Failure	3-44
3.5.3 Drought	3-53
3.5.4 Earthquake	3-62
3.5.5 Expansive Soils.....	3-70
3.5.6 Extreme Heat.....	3-72
3.5.7 Flash Flood	3-80
3.5.8 Grass/Wildland Fire.....	3-88
3.5.9 Hazardous Materials.....	3-93
3.5.10 Human Disease.....	3-105
3.5.11 Infrastructure Failure	3-116
3.5.12 Landslide	3-127
3.5.13 River Flood	3-131
3.5.14 Severe Winter Storm	3-165
3.5.15 Sinkholes	3-172
3.5.16 Terrorism.....	3-181
3.5.17 Thunderstorm with Lightning and Hail.....	3-187
3.5.18 Tornado/Windstorm.....	3-194
3.5.19 Transportation Incident.....	3-207
3.6 Hazard Analysis Summary	3-214

44 CFR Requirement §201.6(c)(2): [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.

The risk assessment process identifies and profiles relevant hazards and assesses the exposure of lives, property and infrastructure within Story County, Iowa to these hazards. The goal of the risk assessment is to estimate the potential loss in the planning area, including loss of life, personal injury, property damage and economic loss, from a hazard event. The risk assessment process allows communities in the planning area to better understand their potential risk to the identified hazards and provides a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events.

The risk assessment for Story County and participating jurisdictions followed the methodology described in the 2013 FEMA Local Mitigation Planning Handbook, which includes a four-step process:

Step 1—Describe Hazards

Step 2—Identify Community Assets

Step 3—Analyze Risks

Step 4—Summarize Vulnerability

This chapter is divided into six main parts:

- **Section 3.1 Hazard Identification** identifies the hazards that threaten the planning area and the methodology utilized to score or rank the hazards;
- **Section 3.2 Assets at Risk** provides the planning area's total exposure to natural hazards, considering critical facilities and other community assets at risk;
- **Section 3.3 Development Since 2014 Plan Update** discusses what changes in development have occurred since the previous Hazard Mitigation Plan;
- **Section 3.4 Future Land Use and Development** discusses areas of planned future development;
- **Section 3.5 Hazard Profiles and Vulnerability** for each hazard; this section is divided into two parts: 1) Hazard Profile discusses the threat to the planning area, the geographic location/extent at risk, previous occurrences of hazard events and probability of future occurrence; and 2) Vulnerability Assessment further discusses specific assets at risk as well as loss estimates. Specifically, where data is available, this section defines and quantifies populations, buildings, critical facilities and other community assets at risk to natural hazards with estimates of potential losses to those assets, where possible;
- **Section 3.6 Hazard Analysis Summary** provides a tabular summary of the hazard ranking for each jurisdiction in the planning area.

3.1 Hazard Identification

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type...of all natural hazards that can affect the jurisdiction.

The hazards identified for this plan update are listed below in alphabetical order:

- Animal/Plant/Crop Disease
- Dam/Levee Failure

- Drought
- Earthquake
- Expansive Soils
- Extreme Heat
- Flash Flood
- Grass/Wildland Fire
- Hazardous Materials
- Human Disease
- Infrastructure Failure
- Landslide
- River Flood
- Severe Winter Storm
- Sinkholes
- Terrorism
- Thunderstorm/Lightning/Hail
- Tornado/Windstorm
- Transportation Incident

The Hazard Mitigation Planning Committee discussed Radiological Incident and whether it should be included in the plan; the committee concurred that since Story County lies outside the Emergency Planning Zone (EPZ) for any of the nuclear power plants that impact Iowa, no further analysis was needed.

Sections 3.1.1 through 3.1.3 describe how these hazards were identified for this plan update.

3.1.1 Review of Existing Mitigation Plans

To identify hazards to include in the Risk Assessment update, a comparison was performed between the hazard identification in the 2013 Iowa State Hazard Mitigation Plan and the 2014 Story County Multi-Jurisdictional Hazard Mitigation Plan. Table 3.1 provides the details of the comparison.

Table 3.1: Hazard Comparison Chart

	2013 State Plan	2014 Story County Plan
NATURAL HAZARDS	Animal/Crop/Plant Disease	Animal/Crop/Plant Disease
	Dam/Levee Failure	Dam Failure
		Levee Failure
	Drought	Drought
	Earthquake	Earthquake
	Expansive Soils	Expansive Soils
	Extreme Heat	Extreme Heat
	Flash Flood	Flash Flood
	River Flood	River Flooding
	Grass or Wildland Fire	Grass or Wildland Fire
	Landslide	Landslide

	2013 State Plan	2014 Story County Plan
	Severe Winter Storm	Severe Winter Storms
	Sinkholes	Sinkholes
	Thunderstorm/Lightning/Hail	Hailstorm
		Thunderstorm & Lightning
	Tornado/Windstorm	Tornado
TECHNOLOGICAL HAZARDS		Windstorm
	Hazardous Materials	Hazardous Materials
	Human Disease	Human Disease
	Infrastructure Failure	Infrastructure Failure
	Radiological	
HUMAN-CAUSED HAZARDS	Transportation Incident	Transportation Incident
	Terrorism	Terrorism

3.1.2 Review Disaster Declaration History

Information utilized to identify hazards relevant for inclusion in the Story County plan update was obtained by examining events that triggered federal disaster declarations. Federal and/or state declarations may be granted when the severity and magnitude of an event surpasses the ability of the local government to respond and recover. Disaster assistance is supplemental and sequential. When the local government's capacity has been surpassed, a state disaster declaration may be issued, allowing for the provision of state assistance. If the disaster is so severe that both the local and state governments' capacities are exceeded, a federal emergency or disaster declaration may be issued allowing for the provision of federal assistance.

FEMA also issues emergency declarations, which are more limited in scope and do not include the long-term federal recovery programs of major disaster declarations. Determinations for declaration type are based on scale and type of damages and institutions or industrial sectors affected.

Table 3.2 lists federal disaster declarations that included Story County for the period from 1965 to 2016.

Table 3.2: Disaster Declarations that included Story County, Iowa, 1969-2017

Disaster Number	Declaration Date	Title	Incident Begin Date	Incident End Date
259	4/25/1969	Flooding	4/25/1969	4/25/1969
443	6/24/1974	Severe Storms & Flooding	6/24/1974	6/24/1974
868	5/26/1990	Severe Storms & Flooding	5/18/1990	7/6/1990
911	7/12/1991	Severe Storms & Flooding	6/1/1991	6/15/1991
996	7/9/1993	Severe Storms & Flooding	4/13/1993	10/1/1993
1133	8/21/1996	Severe Storms, And Flooding	6/15/1996	6/30/1996
1230	7/2/1998	Severe Storms, Tornadoes and Flooding	6/13/1998	7/15/1998
1282	7/22/1999	Severe Storms and Flooding	7/2/1999	8/10/1999
1518	5/25/2004	Severe Storms, Tornadoes, and Flooding	5/19/2004	6/24/2004
1688	3/14/2007	Severe Winter Storms	2/23/2007	3/2/2007
1763	5/27/2008	Severe Storms, Tornadoes, and Flooding	5/25/2008	8/13/2008
1880	3/2/2010	Severe Winter Storm	1/19/2010	1/26/2010
1930	7/29/2010	Severe Storms, Flooding, and Tornadoes	6/1/2010	8/31/2010
4016	8/24/2011	Severe Storms, Straight-Line Winds, and Flooding	7/9/2011	7/14/2011
4126	7/2/2013	Severe Storms, Tornadoes, and Flooding	5/19/2013	6/14/2013

Source: Federal Emergency Management Agency, www.fema.gov/

The U.S. Department of Agriculture's Secretary of Agriculture is authorized to designate counties as disaster areas to make emergency loans (EM) to producers suffering losses in those counties, and in counties that are contiguous to a designated county. In addition to EM eligibility, other emergency assistance programs, such as Farm Service Agency (FSA) disaster assistance programs, have historically used disaster designations as an eligibility requirement trigger.

Table 3.3 provides the USDA Secretarial disaster declarations that included Story County from 2012 to 2016. Details on USDA declarations prior to 2012 are not available.

Table 3.3: USDA Secretarial Disaster Declarations Including Story Co. (2012-2017)

County	Crop Year	Desig. No.	Drought	Wind, High Winds	Fire, Wildfire	Heat, Excessive heat High temp. (incl. low humidity)	Frost, Freeze	Insects	Begin Date	Description of disaster
Story	2012	S3310	1	1	1	1		1	7/24/2012	Drought-FAST TRACK
Story	2013	S3614	1	1	1	1		1	8/27/2013	Drought-FAST TRACK
Story	2013	S3618	1						7/15/2013	Drought

Source: U.S. Department of Agriculture; <https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/disaster-designation-information/index>

3.1.3 Research Additional Sources

Additional data on locations and past impacts of hazards in the planning area was collected from the following sources:

- Story County Flood Insurance Rate Map, FEMA
- Story County Emergency Management
- Story County Flood Insurance Study, FEMA
- Story County Multi-Jurisdictional Hazard Mitigation Plan, 2014
- Data Collection Guides completed by jurisdictions
- Environmental Protection Agency
- Federal Emergency Management Agency (FEMA)
- Flood Insurance Administration
- Hazards US (HAZUS)
- Iowa Department of Agriculture and Land Stewardship, Division of Soil Conservation
- Iowa Department of Education, Bureau of Information and Analysis Services
- Iowa Department of Natural Resources
- Iowa Department of Public Safety
- Iowa Department of Transportation, Office of Traffic and Safety

- Iowa State Hazard Mitigation Plan (September 2013)
- Iowa State University
- Iowa Utilities Board
- National Drought Mitigation Center Drought Reporter
- National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information
- SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin
- U.S. Army Corps of Engineers, National Levee Database
- U.S. Department of Agriculture's (USDA) Risk Management Agency Crop Insurance Statistics
- U.S. Department of Transportation
- United States Geological Survey
- Various articles and publications available on the internet (sources are indicated where data is cited)

3.1.4 Hazards Identified

Through the hazard identification review process, it was determined that all hazards profiled in the 2014 plan and all additional hazards profiled in the 2013 State plan would be included in the plan update. The hazards identified for this plan update are listed below in alphabetical order

- Animal/Plant/Crop Disease
- Dam/Levee Failure
- Drought
- Earthquake
- Expansive Soils
- Extreme Heat
- Flash Flood
- Grass/Wildland Fire
- Hazardous Materials
- Human Disease
- Infrastructure Failure
- Landslide
- River Flooding
- Severe Winter Storm
- Sinkholes
- Terrorism
- Thunderstorm/Lightning/Hail
- Tornado/Windstorm

- Transportation Incident

To maintain consistency and to facilitate the roll-up or summarization of hazards in the next State Plan Update, it was agreed that the hazard grouping/hazard naming for this update will be consistent with the 2013 State Plan.

3.1.5 Multi-Jurisdictional Risk Assessment

For this multi-jurisdictional plan, the risks are assessed for each jurisdiction where they deviate from the risks facing the entire planning area. The planning area is fairly uniform in terms of climate and topography as well as building construction characteristics. Accordingly, the geographic areas of occurrence for weather-related hazards do not vary greatly across the planning area for most hazards. The more urbanized areas within the planning area have more assets that are vulnerable to the weather-related hazards, and varied development trends impact the future vulnerability. Similarly, more rural areas have more assets (crops/livestock) that are vulnerable to drought. These differences are discussed in greater detail in the vulnerability sections of each hazard.

Although 20 hazards with the potential to significantly affect the planning area were identified and selected for additional analysis, not all hazards impact every jurisdiction. Table 3.4 provides a summary of the jurisdictions impacted by each hazard. An "x" indicates the jurisdiction is impacted by the hazard. A "-" indicates the hazard is not applicable to that jurisdiction.

Table 3.4: Hazards Identified for Each Jurisdiction

Jurisdiction	Animal/Crop/Plant Disease	Dam/Levee Failure	Drought	Earthquake	Expansive Soils	Extreme Heat	Flash Flood	Grass or Wildland Fire	Hazardous Materials	Human Disease	Infrastructure Failure	Landslide	River Flood	Severe Winter Storm	Sinkholes	Terrorism	Thunderstorm/Lightning/Hail	Tornado/Windstorm	Transportation Incident
Unincorp. Story County	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Ames	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Cambridge	x	-	x	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x	x
Collins	x	-	x	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x	x
Colo	x	-	x	x	x	x	x	x	x	x	x	x	-	x	-	x	x	x	x
Gilbert	x	-	x	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x	x
Huxley	x	-	x	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x	x
Kelley	x	-	x	x	x	x	x	x	x	x	x	x	-	x	-	x	x	x	x
Maxwell	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x	x
McCallsburg	x	-	x	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x	x
Nevada	x	-	x	x	x	x	x	x	x	x	x	x	x	-	-	x	x	x	x
Roland	x	-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Sheldahl	x	-	x	x	x	x	x	x	x	x	x	x	-	x	-	x	x	x	x
Slater	x	-	x	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x	x
Story City	x	-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Zearing	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-	x	x	x	x
Ames CSD	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x	x
Ballard CSD	x	-	x	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x	x
Collins-Maxwell CSD	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x	x
Colo-Nesco CSD	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x	x
Gilbert CSD	x	-	x	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x	x
Nevada CSD	x	-	x	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x	x
Roland-Story CSD	x	-	x	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x	x
Iowa State University	x	-	x	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x	x

3.1.6 Hazard Scoring Methodology

To maintain a reporting format consistent with the *2013 Iowa State Hazard Mitigation Plan*, the Story County Hazard Mitigation Planning Committee (HMPC) used the same methodology to score and prioritize the hazards. This prioritization was based on a hazard scoring system that considers four elements of risk: probability, magnitude/severity, warning time, and duration. Table 3.5 provides definitions for each of the four elements along with associated rating levels.

Table 3.5: Hazard Score Element Definitions and Rating Scales

Element/Score	Definitions
Probability: Reflects the likelihood of the hazard occurring again in the future, considering both the hazard's historical occurrence and the projected likelihood of the hazard occurring in any given year.	
1—Unlikely	Less than 10% probability in any given year (up to 1 in 10 chance of occurring), history of events is less than 10% likely or the event is unlikely but there is a possibility of its occurrence.
2—Occasional	Between 10% and 20% probability in any given year (up to 1 in 5 chance of occurring), history of events is greater than 10% but less than 20% or the event could possibly occur.
3—Likely	Between 20% and 33% probability in any given year (up to 1 in 3 chance of occurring), history of events is greater than 20% but less than 33% or the event is likely to occur.
4—Highly Likely	More than 33% probability in any given year (event has up to a 1 in 1 chance of occurring), history of events is greater than 33% likely or the event is highly likely to occur.
Magnitude / Severity: Assessment of severity in terms of injuries and fatalities, personal property, and infrastructure and the degree and extent with which the hazard affects the jurisdiction.	
1—Negligible	Less than 10% of property severely damaged, shutdown of facilities and services for less than 24 hours, and/or injuries /illnesses treatable with first aid.
2—Limited	10% to 25% of property severely damaged, shutdown of facilities and services for more than a week, and/or injuries/illnesses that do not result in permanent disability.
3—Critical	More than 25% to 50% of property severely damaged, shutdown of facilities and services for at least 2 weeks, and/or injuries/illnesses that result in permanent disability.
4—Catastrophic	More than 50% of property severely damaged, shutdown of facilities and services for more than 30 days, and/or multiple deaths.
Warning Time: Rating of the potential amount of warning time that is available before the hazard occurs. This should be taken as an average warning time.	
1	More than 24 hours warning time
2	More than 12 to 24 hours warning time
3	6 to 12 hours warning time
4	Minimal or no warning time (less than 6 hours warning)
Duration: A measure of the duration of time that the hazard will affect the jurisdiction.	
1	Less than 6 hours
2	More than 6 hours but Less than 1 day
3	More than 1 day but Less than 1 week
4	More than one week

Using the rating scales described in the table above, the formula used to determine each hazard's score, including weighting factors, is provided below:

$$(\text{Probability} \times .45) + (\text{Magnitude/Severity} \times .30) + (\text{Warning Time} \times .15) + (\text{Duration} \times .10) = \text{SCORE}$$

Based on the hazard's overall weighted score, the hazards are categorized as follows: High (3.0-4.0), Moderate (2.0-2.9), and Low (1.0-1.9).

These terms relate to the level of planning analysis to be given to the particular hazard in the risk assessment process and are not meant to suggest that a hazard would have only limited impact. In order to focus on the most critical hazards, those assigned a level of high or moderate were given more extensive attention in the remainder of the risk assessment (e.g., quantitative analysis or loss estimation), while those with a low planning significance were addressed in more general or qualitative ways.

The HMPC determined overview hazard ranking scores for the planning area as a whole. The results of this overview are provided below in Table 3.6. Additionally, the hazard ranking overview is provided at

the beginning of each hazard profile and vulnerability section. A detailed hazard summary by jurisdiction for participating jurisdictions is provided at the conclusion of each hazard profile and vulnerability section to provide a summary of how the hazard varies by jurisdiction.

Table 3.6: Story County Planning Area Hazard Ranking Results

Hazard	Probability	Magnitude	Warning Time	Duration	CPRI	Planning Significance
Tornado/Windstorm	4	4	4	1	3.70	High
River Flooding	4	4	2	4	3.70	High
Flash Flood	4	3	3	1	3.25	High
Severe Winter Storm	4	2	3	3	3.15	High
Hazardous Materials	4	2	4	1	3.10	High
Extreme Heat	3	2	1	4	2.95	Moderate
Thunderstorm/Lightning/Hail	4	2	2	2	2.90	Moderate
Human Disease	2	4	2	4	2.80	Moderate
Grass or Wildland Fire	3	2	4	2	2.75	Moderate
Transportation Incident	3	2	4	1	2.65	Moderate
Terrorism	1	4	4	4	2.65	Moderate
Infrastructure Failure	2	2	4	4	2.50	Moderate
Drought	3	2	1	4	2.50	Moderate
Dam/Levee Failure	1	2	4	4	2.05	Moderate
Animal/Plant/Crop Disease	1	3	1	4	1.90	Low
Sinkholes	1	1	4	4	1.75	Low
Earthquake	1	1	4	1	1.45	Low
Expansive Soils	2	1	1	1	1.45	Low
Landslide	1	1	2	1	1.15	Low

3.1.7 Climate Change

In accordance with FEMA Administrator Policy 2011-OPPA-01, where possible, this plan update has considered the potential impacts of climate change on the hazards profiled. In 2010, the Iowa Climate Change Advisory Council reported to the Governor and the Iowa General Assembly on Climate Change Impacts in Iowa. The Report summarized the following climate changes Iowa is already experiencing:

More 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 3 - 5-degree F rise in dew-point temperature. This fuels convective thunderstorms that provide more summer precipitation.

Agricultural Challenges

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

Habitat Changes

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

Public Health Effects

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

3.2 Assets at Risk

This section assesses the population, structures, critical facilities and infrastructure, and other important assets in the planning area that may be at risk to hazards.

3.2.1 Total Exposure of Population and Structures

Unincorporated County and Incorporated Cities

Table 3.7 shows the total population and building/improvement counts and values for the county and each city. Building exposure information was derived from inventory data associated with FEMA's loss estimation software HAZUS-MH contained in Census Blocks. Content values were also included and were estimated as a percentage of building value based on their property type, using FEMA/HAZUS estimated content replacement values. Those content values are 50% for residential, 100% for agriculture, commercial, education, government, and religion, and 150% for industrial. It should be noted that all values are in thousands of dollars and a value of \$0 does not necessarily mean \$0 but less than \$1,000.

The methodology employed to extract the summary of building/improvement counts and values from the HAZUS inventory is provided below:

- General Building Stock and Building Count layers were extracted from HAZUS by Property Types (Agriculture, Commercial, Education, Government, Industrial, Religion, Residential).
- Census Blocks were spatially attributed based on jurisdiction boundaries.
- Census Blocks were summarized by Building Counts and Improved Values by Jurisdiction and Property Types.

Population data is based on the U.S. Census Bureau's annual population estimates. The contents exposure values were calculated based on usage type. The contents multipliers were derived from HAZUS and are defined below in Table 3.7. Land values have been purposely excluded from the tables because land remains following disasters, and subsequent market devaluations are frequently short term and difficult to quantify. Additionally, state and federal disaster assistance programs generally do not address loss of land or its associated value (other than crop insurance).

Table 3.7: Population and Building Exposure by Jurisdiction-Unincorporated County and Incorporated Cities

Jurisdiction & Population	Property Type	Building Counts	Improved Value*	Content Value*	Total Value*
Ames 64,073	Agriculture	71	\$38,328	\$38,328	\$76,656
	Commercial	1,015	\$1,959,843	\$1,959,843	\$3,919,686
	Education	279	\$5,567,177	\$5,567,177	\$11,134,354
	Government	44	\$105,599	\$105,599	\$211,198
	Industrial	216	\$561,242	\$841,863	\$1,403,105
	Religion	107	\$227,528	\$227,528	\$455,056
	Residential	13,620	\$7,257,047	\$3,628,524	\$10,885,571
	Total	15,352	\$15,716,764	\$12,368,862	\$28,085,626
Cambridge 853	Agriculture	3	\$966	\$966	\$1,932
	Commercial	12	\$6,736	\$6,736	\$13,472
	Education	3	\$6,930	\$6,930	\$13,860
	Government	0	\$212	\$212	\$424
	Industrial	1	\$308	\$462	\$770
	Religion	4	\$5,414	\$5,414	\$10,828
	Residential	330	\$111,754	\$55,877	\$167,631
	Total	353	\$132,320	\$76,597	\$208,917
Collins 458	Agriculture	1	\$238	\$238	\$476
	Commercial	8	\$7,260	\$7,260	\$14,520
	Education	1	\$3,598	\$3,598	\$7,196
	Government	2	\$638	\$638	\$1,276
	Industrial	0	\$174	\$261	\$435
	Religion	3	\$4,248	\$4,248	\$8,496
	Residential	217	\$71,132	\$35,566	\$106,698
	Total	232	\$87,288	\$51,809	\$139,097
Colo 886	Agriculture	2	\$1,168	\$1,168	\$2,336
	Commercial	25	\$12,662	\$12,662	\$25,324
	Education	3	\$4,554	\$4,554	\$9,108
	Government	0	\$212	\$212	\$424
	Industrial	3	\$1,667	\$2,501	\$4,168
	Religion	6	\$5,248	\$5,248	\$10,496
	Residential	328	\$115,636	\$57,818	\$173,454
	Total	367	\$141,147	\$84,163	\$225,310

Jurisdiction & Population	Property Type	Building Counts	Improved Value*	Content Value*	Total Value*
Gilbert 1,183	Agriculture	3	\$1,460	\$1,460	\$2,920
	Commercial	22	\$20,272	\$20,272	\$40,544
	Education	3	\$11,662	\$11,662	\$23,324
	Government	2	\$1,576	\$1,576	\$3,152
	Industrial	7	\$3,472	\$5,208	\$8,680
	Religion	3	\$4,354	\$4,354	\$8,708
	Residential	358	\$137,978	\$68,989	\$206,967
	Total	398	\$180,774	\$113,521	\$294,295
Huxley 3,474	Agriculture	6	\$4,250	\$4,250	\$8,500
	Commercial	66	\$69,359	\$69,359	\$138,718
	Education	1	\$4,074	\$4,074	\$8,148
	Government	2	\$1,763	\$1,763	\$3,526
	Industrial	24	\$19,759	\$29,639	\$49,398
	Religion	5	\$7,434	\$7,434	\$14,868
	Residential	1,151	\$420,023	\$210,012	\$630,035
	Total	1,255	\$526,662	\$326,530	\$853,192
Kelley 306	Agriculture	1	\$740	\$740	\$1,480
	Commercial	6	\$4,426	\$4,426	\$8,852
	Education	0	\$0	\$0	\$0
	Government	1	\$4,231	\$4,231	\$8,462
	Industrial	4	\$3,715	\$5,573	\$9,288
	Religion	2	\$1,142	\$1,142	\$2,284
	Residential	118	\$42,296	\$21,148	\$63,444
	Total	132	\$56,550	\$37,260	\$93,810
Maxwell 839	Agriculture	4	\$1,692	\$1,692	\$3,384
	Commercial	29	\$20,285	\$20,285	\$40,570
	Education	4	\$6,334	\$6,334	\$12,668
	Government	4	\$7,576	\$7,576	\$15,152
	Industrial	3	\$1,604	\$2,406	\$4,010
	Religion	6	\$4,212	\$4,212	\$8,424
	Residential	355	\$121,717	\$60,859	\$182,576
	Total	405	\$163,420	\$103,364	\$266,784
McCallsburg 325	Agriculture	2	\$770	\$770	\$1,540
	Commercial	7	\$5,788	\$5,788	\$11,576
	Education	2	\$1,210	\$1,210	\$2,420
	Government	3	\$4,176	\$4,176	\$8,352
	Industrial	2	\$950	\$1,425	\$2,375
	Religion	1	\$4,140	\$4,140	\$8,280
	Residential	145	\$60,726	\$30,363	\$91,089

Jurisdiction & Population	Property Type	Building Counts	Improved Value*	Content Value*	Total Value*
	Total	162	\$77,760	\$47,872	\$125,632
Nevada 6,796	Agriculture	19	\$7,810	\$7,810	\$15,620
	Commercial	238	\$309,538	\$309,538	\$619,076
	Education	9	\$21,940	\$21,940	\$43,880
	Government	8	\$9,252	\$9,252	\$18,504
	Industrial	51	\$125,298	\$187,947	\$313,245
	Religion	26	\$29,242	\$29,242	\$58,484
	Residential	2,541	\$933,516	\$466,758	\$1,400,274
	Total	2,892	\$1,436,596	\$1,032,487	\$2,469,083
Roland 1,312	Agriculture	5	\$1,722	\$1,722	\$3,444
	Commercial	23	\$20,230	\$20,230	\$40,460
	Education	1	\$5,956	\$5,956	\$11,912
	Government	2	\$4,551	\$4,551	\$9,102
	Industrial	11	\$15,343	\$23,015	\$38,358
	Religion	5	\$6,822	\$6,822	\$13,644
	Residential	506	\$181,414	\$90,707	\$272,121
	Total	553	\$236,038	\$153,003	\$389,041
Sheldahl 249	Agriculture	0	\$0	\$0	\$0
	Commercial	0	\$0	\$0	\$0
	Education	0	\$0	\$0	\$0
	Government	0	\$0	\$0	\$0
	Industrial	0	\$0	\$0	\$0
	Religion	0	\$0	\$0	\$0
	Residential	58	\$21,060	\$10,530	\$31,590
	Total	58	\$21,060	\$10,530	\$31,590
Slater 1,617	Agriculture	30	\$142,870	\$142,870	\$285,740
	Commercial	44	\$25,310	\$25,310	\$50,620
	Education	3	\$12,014	\$12,014	\$24,028
	Government	1	\$1,040	\$1,040	\$2,080
	Industrial	9	\$3,720	\$5,580	\$9,300
	Religion	6	\$7,630	\$7,630	\$15,260
	Residential	568	\$212,875	\$106,438	\$319,313
	Total	661	\$405,459	\$300,882	\$706,341
Story City 3,423	Agriculture	15	\$6,146	\$6,146	\$12,292
	Commercial	114	\$139,084	\$139,084	\$278,168
	Education	5	\$7,060	\$7,060	\$14,120
	Government	6	\$3,695	\$3,695	\$7,390
	Industrial	37	\$80,466	\$120,699	\$201,165
	Religion	17	\$24,776	\$24,776	\$49,552

Jurisdiction & Population	Property Type	Building Counts	Improved Value*	Content Value*	Total Value*
	Residential	1,190	\$506,008	\$253,004	\$759,012
	Total	1,384	\$767,235	\$554,464	\$1,321,699
Zearing 563	Agriculture	5	\$1,980	\$1,980	\$3,960
	Commercial	16	\$14,314	\$14,314	\$28,628
	Education	3	\$1,522	\$1,522	\$3,044
	Government	1	\$3,693	\$3,693	\$7,386
	Industrial	7	\$3,239	\$4,859	\$8,098
	Religion	4	\$3,000	\$3,000	\$6,000
	Residential	236	\$87,442	\$43,721	\$131,163
	Total	272	\$115,190	\$73,089	\$188,279
Unincorporated 8,477	Agriculture	243	\$105,802	\$105,802	\$211,604
	Commercial	249	\$270,416	\$270,416	\$540,832
	Education	4	\$7,418	\$7,418	\$14,836
	Government	2	\$820	\$820	\$1,640
	Industrial	96	\$130,376	\$195,564	\$325,940
	Religion	26	\$32,924	\$32,924	\$65,848
	Residential	3,212	\$1,332,020	\$666,010	\$1,998,030
	Total	3,832	\$1,879,776	\$1,278,954	\$3,158,730
Pop Total: 94,834	Grand Total	28,308	\$21,944,039	\$16,613,384	\$38,557,423

*All values are in thousands of dollars, a value of \$0 does not necessarily mean \$0 but less than \$1,000.

Sources: Population Estimate, U.S. Census Bureau, American Community Survey 2016 5-Year Estimates; Building/Improvement Count and Values, HAZUS MH 4.0. Contents Exposure derived by applying multiplier to Building Exposure based on HAZUS MH 2.2 standard contents multipliers per usage type as follows: Residential (50%), Agricultural, Commercial, Education, Government, Religion (100%), Industrial (150%).

Table 3.8: Year Structure Built

Jurisdiction	Total Housing Units	Built 2014 or later	Built 2010 to 2013	Built 2000 to 2009	Built 1990 to 1999	Built 1980 to 1989	Built 1970 to 1979	Built 1960 to 1969	Built 1950 to 1959	Built 1940 to 1949	Built 1939 or earlier
Ames	25,604	119	844	4,824	4,885	2,604	3,945	3,163	1,754	916	2,550
Cambridge	324	0	0	32	30	20	82	42	11	2	105
Collins	196	0	0	1	4	8	56	14	23	20	70
Colo	343	0	7	35	32	12	93	15	42	11	96
Gilbert	402	0	2	83	78	33	101	49	11	6	39
Huxley	1,375	20	48	241	173	118	406	76	112	12	169
Kelley	150	0	0	9	11	7	46	9	11	8	49
Maxwell	154	0	0	21	13	10	18	12	16	12	52
McCallsburg	341	2	0	39	8	10	75	19	30	9	149
Nevada	3,020	0	50	228	333	358	474	414	306	297	560
Roland	507	0	3	35	110	17	109	59	13	8	153
Sheldahl	114	0	0	4	12	3	18	16	15	0	46
Slater	591	0	3	103	86	23	95	83	60	13	125
Story City	1,543	16	0	279	280	133	328	167	102	28	210
Zearing	266	0	0	3	35	13	45	34	35	19	82
Unincorporated	3,238	43	32	627	709	119	441	291	136	105	735
County Total	38,168	200	989	6,564	6,799	3,488	6,332	4,463	2,677	1,466	5,190

Source: U.S. Census Bureau 2016 American Community Survey 5-Year Estimates

Public School Districts

The 2017-2018 enrolled number of students at the participating public school districts is provided in Table 3.9, as well as the number of buildings, building values (building exposure) and contents value (contents exposure).

Table 3.9: Enrollment and Building Exposure by Jurisdiction-Public School Districts

Public School District	Enrollment	Building Count	Building Exposure (\$M)	Contents Exposure (\$M)	Total Exposure (\$M)
Ames CSD	4,797	10	\$244.5	\$36.3	\$280.8
Ballard CSD	1,853	5	\$59.4	\$11.6	\$71.0
Collins-Maxwell CSD	424	3	\$20.5	\$2.4	\$22.9
Colo-Nesco CSD	443	3	(not available)	(not available)	(not available)
Gilbert CSD	1,559	4	\$60.9	\$5.8	\$66.8
Nevada CSD	1,590	11	\$57.6	\$5.0	\$62.5
Roland-Story CSD	1,120	9	\$32.7	\$7.2	\$39.9

Source: Enrollment Statistics from 2015-2016 Iowa Public School Pre K-12 Enrollments by District – Iowa Department of Education, Bureau of Information and Analysis Services; Building Count and Exposure from Data Collection Guides from Public School Districts; *includes non-school buildings/assets such as administration building, bus barns, sport complexes.

3.2.2 Critical and Essential Facilities and Infrastructure

As part of the update to the Story County Multi-Jurisdictional Hazard Mitigation Plan, participating jurisdictions assessed the vulnerability of the following types of facilities below:

- **Critical Facilities:** Those facilities that are essential in providing utility or direction either during the response to an emergency or during the recovery operation.
- **Essential Facilities:** Those facilities that if damaged, would have devastating impacts on disaster response and/or recovery.
- **High Potential Loss Facilities:** Those facilities that would have a high loss or impact on the community.
- **Transportation and Lifeline Facilities:** Those facilities and infrastructure that are critical to transportation, communications, and necessary utilities.

Table 3.10 is a summary of the inventory of critical and essential facilities and infrastructure in the planning area. This inventory was compiled from 2017 data provided by the Story County GIS Department for this plan update. The full list of critical facilities is included in Appendix E. This is a non-public appendix and is maintained by Story County Emergency Management.

Table 3.10: Inventory of Critical/Essential Facilities and Infrastructure by Jurisdiction

Facility Type	Ames	Cambridge	Collins	Colo	Gilbert	Huxley	Kelley	Maxwell	McCallsburg	Nevada	Roland	Sheldahl	Slater	Story City	Zearing	Unincorporated	Total
Communications	28	2	1	2	0	4	1	1	2	7	1	0	3	2	2	35	91
Eldercare/Vulnerable Needs Facility	15	1	1	0	0	2	0	1	1	9	3	0	0	4	1	1	39
Emergency Response	6	1	1	1	1	2	1	1	1	4	1	0	1	2	2	0	25
Energy	23	1	0	2	0	2	0	0	2	2	1	0	0	3	1	31	68
Food & Agriculture	3	1	1	3	1	0	0	1	1	4	0	0	1	1	1	5	23
Government Facility	12	1	2	2	2	3	2	1	3	5	3	1	3	5	3	0	48
Medical Care	13	0	0	0	0	1	0	1	0	5	0	0	1	1	1	0	23
Schools & Daycares	89	4	2	3	12	15	0	8	1	36	5	0	3	11	4	5	198
Tier II Facility	29	1	1	1	2	5	0	0	0	7	0	1	3	5	1	21	77
Transportation	8	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	10
Water Facility	39	1	1	1	1	3	2	3	1	5	3	1	5	4	2	12	84
Total	265	13	10	15	20	37	6	17	12	85	17	3	20	38	18	110	686

Source: 2017 data provided by Story County GIS Department.

Other Assets

Assessing the vulnerability of the planning area to disaster also involves inventorying the natural, historic, cultural and economic assets of the area. This is important for the following reasons:

- The plan participants may decide that these types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy.
- If these resources are impacted by a disaster, knowing about them ahead of time allows for more prudent care in the immediate aftermath, when the potential for additional impacts is higher.
- The rules for reconstruction, restoration, rehabilitation and/or replacement are often different for these types of designated resources.
- Natural resources can have beneficial functions that reduce the impacts of natural hazards, such as wetlands and riparian habitat, which help absorb and attenuate floodwaters.
- Losses to economic assets (e.g., major employers or primary economic sectors) could have severe impacts on a community and its ability to recover from disaster.

In the planning area, specific assets include the following:

Threatened and Endangered Species: Table 3.11 includes Federally Threatened, Endangered, Proposed and Candidate Species in Story County, Iowa.

Table 3.11: Threatened and Endangered Species in Story County

Common Name	Scientific Name	Status
Indiana bat	Myotis sodalist	Endangered
Northern long-eared bat	Myotis septentrionalis	Threatened
Prairie bush clover	Lespedeza leptostachya	Threatened
Western prairie fringed orchid	Platanthera praeclara	Threatened

Source: U.S. Fish and Wildlife Service, http://www.fws.gov/midwest/endangered/lists/iowa_cty.html

Natural Resources: The Story County Conservation Board manages the following parks and nature preserve areas in Story County:

- 265th Street Bridge Access: 1 acre
- Anderson Canoe Access: 2 acres
- Askew Bridge/Cambridge Pond: 27 acres
- Bear Creek: 116 acres
- C.J. Shreck Access: 3 acres
- Christiansen Forest Preserve: 49 acres
- Cooper's Prairie Marsh: 40 acres
- Crooked Bend: 66 acres
- Dakins Lake: 103
- Doolittle Prairie: 43 acres
- E-18 Greenbelt Access: 210 acres
- Ed Powell Wildlife Area: 17 acres
- Gladys Leui Preserve: 25 acres
- Heart of Iowa Nature Trail: 394 acres
- Hertz Family Woods and Nature Preserve: 22 acres
- Hickory Grove Park: 445 acres
- I-35 Prairie Area: 23 acres
- Jennett Heritage Area: 171 acres
- Jim Ketelsen Greenwing Marsh: 68 acres
- Larson Marsh: 12 acres
- Lekwa Access: 10 acres
- Leopold Woods: 20 acres
- McFarland Park: 240 acres

- O'Neil Prairie: 5 acres
- Peterson Park: 203 acres
- Peterson Park Access: 1 acre
- Praeri Rail Trail: 135 acres
- Robison Wildlife Acres: 78 acres
- Roland Wildlife Area: 80 acres
- Sheffield Wildlife Area: 3 acres
- Skunk River Flats: 123 acres
- Sleepy Hollow: 13 acres
- Soper's Mill: 16 acres
- Tedesco Environmental Learning Corridor: 37 acres
- Wakefield Woods: 10 acres

Additional details about managed areas listed above can be found at <http://www.storycountyiowa.gov/518/Conservation-Board>

Historic Resources: The National Register of Historic Places is the official list of the Nation's cultural resources worthy of preservation. Authorized under the National Historic Preservation Act of 1966, the National Register is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect our historic and archeological resources. The National Register is administered by the National Park Service under the Secretary of the Interior. Properties listed in the National Register include districts, sites, buildings, structures and objects that are significant in American history, architecture, archeology, engineering and culture. Table 3.12 provides the list of properties on the National Register in Story County.

Table 3.12: Properties/Landmarks on the National Register of Historic Places, Story County

City	Resource	Address	Year Listed
Ames	Budd, Prof, J.L., Sarah M., and Etta Budd, House	804 Kellogg Ave.	2001
Ames	Ames High School	515 Clark Ave.	2002
Ames	Old Town Historic District	Bet. Duff and Clark Ave., and 7th and 9th St.	2004
Ames	Sigma Sigma-Delta Chi Fraternity House	405 Hayward Ave.	2008
Ames	Roosevelt School	921 9th St.	2010
Ames	Pleasant Grove Community Church and Cemetery	56971 170th St	2010
Ames	Delta Upsilon Chapter House	117 Ash Ave	2010
Ames	Colonials Club House	217 Ash Ave.	2012
Ames	Iowa Beta Chapter of Sigma Phi Epsilon	228 Gray Ave.	2014
Ames	Masonic Temple	413, 417, 427, 429 Douglas Ave.	2016
Ames	Knapp-Wilson House	Iowa State University campus	1966
Ames	Alumni Hall	Iowa State University campus	1978
Ames	Marston Water Tower	Iowa State University campus	1982
Ames	Engineering Hall	Union Dr., Iowa State University campus	1983
Ames	Agriculture Hall	Iowa State University	1985
Ames	Christian Petersen Courtyard Sculptures, and Dairy Industry Building	Union Dr. and Wallace Rd., Iowa State University campus	1987
Ames	MacDonald, Gilmour B. and Edith Craig, House	517 Ash St.	1992
Ames	Morrill Hall	Morrill Rd., facing E toward central campus, Iowa St. University	1996
Ames	Municipal Building	420 Kellogg Ave.	1997
Ames	Skunk River Bridge	255th St. over Skunk R.	1998

City	Resource	Address	Year Listed
Ames	Bandshell Park Historic District	Bounded by Duff Ave., E. 5th St., E. 6th St., and Carroll Ave.	1999
Colo	Mulcahy Barn	25623--710th Ave.	2004
Gilbert	Keigley Branch Bridge	550th St. over Keigley Branch	1998
Iowa Center	Octagon Round Barn, Indian Creek Township	Off CR S14	1986
Iowa Center	Wood, William Kennison, House	Co. Rd. off S27	1995
Maxwell	Calamus Creek Bridge	325th St. over Calamus Cr.	1998
Nevada	Nevada Downtown Historic District	Approx. 6th St. from I Ave. to M Ave.	2003
Nevada	Edwards-Swayze House	1110 9th St.	1978
Nevada	East Indian Creek Bridge	260th St. over East Indian Cr.	1998
Nevada	Briggs Terrace	1204 H Ave.	1998
Sheldahl	Sheldahl First Norwegian Evangelical Lutheran Church	3rd and Willow St.	1984
Story City	Henryson, Henry T. and Emilie (Wiese), House	619 Grad Ave.	2005
Story City	Grand Auditorium and Hotel Block	Broad St.	1980
Story City	Herschel--Spillman Two-Row Portable Menagerie Carousel	North Park, Story St., and Grove Ave.	1986
Zearing	Lincoln Township Mausoleum	Cty Rd. E18, N end of Pearl St.	2007

Source: National Park Service, <https://www.nps.gov/nr/research/index.htm>

Agriculture and the Economy: Agriculture plays an important role in the Story County economy (see Table 3.13).

Table 3.13: Agricultural Statistics for Story County

2012 Census of Agriculture	
Total Land in Farms (acres)	306,000
Number of Farms	966
Average Farm Size (acres)	317
Average Age of Farmers	57.6
Market Value of All Farm Products	\$292,777,000
Market Value of All Crops	\$233,151,000
Market Value of All Livestock	\$59,625,000
Production Expenses	\$213,392,000
Hogs & Pigs Inventory (head)	77,182
Cattle as of January 1, 2015	
All Cattle and Calves (State Rank 58 (tied))	25,000
Crops-2014 Acreage, Yield, and Production	Harvested Acres
Corn for Grain (State Rank 25)	171,800
Soybeans (State Rank 40)	102,800

Source: Iowa Agricultural Statistics Bulletin, USDA, National Agricultural Statistics Service

3.3 Development Since 2014 Plan Update

This section provides information on development that has occurred since the 2014 Story County Multi-Jurisdictional Hazard Mitigation Plan Update.

According to data from the U.S. Census Bureau, Story County's population is growing. From 2010 to 2016, the population of Story County grew by 6 percent, exceeding the average for the State of Iowa, which grew 2.9 percent. However, some cities within the County saw significant declines. Additionally, from 2015 to 2016, employment grew by 0.3% in Story County, on par with the state's employment growth of 0.4%. Table 3.14 provides the population change statistics for all cities in Story County as well as the county as a whole.

Table 3.14: Story County Population Change, 2010-2016

Jurisdiction	2000 Census Population	2010 Census Population	2016 ACS Population Estimate	# Change 2010-2016	% Change 2010-2016
Ames	50,731	58,965	64,073	5,108	9%
Cambridge	819	827	853	26	3%
Collins	499	495	458	-37	-7%
Colo	868	876	886	10	1%
Gilbert	987	1,082	1,183	101	9%
Huxley	2,316	3,317	3,474	157	5%
Kelley	300	309	306	-3	-1%
McCallsburg	318	333	325	-8	-2%
Maxwell	807	920	839	-81	-9%
Nevada	6,658	6,798	6,796	-2	0%
Roland	1,324	1,284	1,312	28	2%
Sheldahl**	336	319	321*	3	1%
Slater	1,306	1,489	1,617	128	9%
Story City	3,228	3,431	3,423	-8	0%
Zearing	617	554	563	9	2%
Unincorporated	8,867	8,543	8,405	-138	-2%
Story County Total	79,981	89,542	94,834	5,292	6%

Source: U.S. Census Bureau: 2000 Decennial Census, 2010 Decennial Census, American Community Survey 2012-2016 5-Year Estimates. *from ACS 2016 Annual Estimate due to high margin of error in 5-Year Estimate **population figure is for the entire corporate limits, including areas outside of Story County.

Table 3.15 provides the change in numbers of housing units in the planning area from 2010 to 2016. Note that much of the decrease in the unincorporated county is likely due to annexations.

Table 3.15: Change in Housing Units, 2010-2016

Jurisdiction	2010 Housing Units	2016 Housing Units	# Change 2010-2016	% Change 2010-2016
Ames	23,425	25,604	2,179	9%
Cambridge	331	324	-7	-2%
Collins	211	196	-15	-7%
Colo	375	343	-32	-9%
Gilbert	395	402	7	2%
Huxley	1,069	1,375	306	29%
Kelley	127	150	23	18%
McCallsburg	131	154	23	18%
Maxwell	385	341	-44	-11%
Nevada	3,029	3,020	-9	0%
Roland	531	507	-24	-5%
Sheldahl	109	114	5	5%
Slater	640	591	-49	-8%

Jurisdiction	2010 Housing Units	2016 Housing Units	# Change 2010-2016	% Change 2010-2016
Story City	1,480	1,543	63	4%
Zearing	249	266	17	7%
Unincorporated	3,544	3,238	-306	-9%
Story County Total	36,031	38,168	2,137	6%

Source: U.S. Census Bureau: 2010 Decennial Census and 2016 American Community Survey, 5-year Estimates,

Note: Unincorporated Story County Housing Units were estimated by subtracting populations of incorporated cities from the total Story County populations.

The tables below provide information on the number of buildings and structure values for privately-owned residential building permits from 2012-2016.

Table 3.16: Privately-owned Residential Building Permits, 2012

Place Name	1-unit Buildings			2-unit Buildings			3-4 unit Buildings			5+ unit Buildings		
	Buildings	Units	Value	Buildings	Units	Value	Buildings	Units	Value	Buildings	Units	Value
Ames	70	70	\$18,076,381	0	0	0	0	0	0	13	291	\$17,430,600
Cambridge	1	1	\$116,342	0	0	0	0	0	0	0	0	0
Collins	0	0	0	0	0	0	0	0	0	0	0	0
Colo	0	0	0	0	0	0	0	0	0	0	0	0
Gilbert	5	5	\$960,959	0	0	0	0	0	0	0	0	0
Huxley	32	32	\$6,450,306	0	0	0	0	0	0	0	0	0
Kelley	0	0	0	0	0	0	0	0	0	0	0	0
McCallsburg	1	1	\$50,000	0	0	0	0	0	0	0	0	0
Maxwell	0	0	0	0	0	0	0	0	0	0	0	0
Nevada	10	10	\$3,750,000	0	0	0	0	0	0	0	0	0
Roland	1	1	\$22,700	2	4	\$330,000	0	0	0	0	0	0
Sheldahl	0	0	0	0	0	0	0	0	0	0	0	0
Slater	6	6	\$1,398,048	0	0	0	0	0	0	0	0	0
Story City	4	4	\$540,000	0	0	0	0	0	0	0	0	0
Zearing	0	0	0	0	0	0	0	0	0	0	0	0
Unincorporated	22	22	\$4,790,180	0	0	0	0	0	0	0	0	0
County Total	152	152	\$36,154,916	2	4	\$330,000	0	0	0	13	291	\$17,430,600

Source: U.S. Census Bureau, <https://www.census.gov/construction/bps/>

Table 3.17: Privately-owned Residential Building Permits, 2013

Place Name	1-unit Buildings			2-unit Buildings			3-4 unit Buildings			5+ unit Buildings		
	Buildings	Units	Value	Buildings	Units	Value	Buildings	Units	Value	Buildings	Units	Value
Ames	127	127	\$34,147,924	0	0	0	1	4	\$330,000	27	286	\$21,679,902
Cambridge	1	1	\$116,342	0	0	0	0	0	0	0	0	0
Collins	1	1	\$166,774	0	0	0	0	0	0	0	0	0
Colo	0	0	0	0	0	0	0	0	0	0	0	0
Gilbert	9	9	\$2,084,964	0	0	0	0	0	0	0	0	0
Huxley	45	45	\$10,247,187	0	0	0	0	0	0	0	0	0
Kelley	0	0	0	0	0	0	0	0	0	0	0	0
McCallsburg	1	1	\$90,618	0	0	0	0	0	0	0	0	0
Maxwell	0	0	0	0	0	0	0	0	0	0	0	0
Nevada	12	12	\$420,000	0	0	0	0	0	0	0	0	0
Roland	2	2	\$569,805	0	0	0	0	0	0	0	0	0
Sheldahl	0	0	0	0	0	0	0	0	0	0	0	0
Slater	6	6	\$1,176,131	0	0	0	0	0	0	0	0	0
Story City	2	2	\$382,000	0	0	0	0	0	0	0	0	0
Zearing	0	0	0	0	0	0	0	0	0	0	0	0
Unincorporated	40	40	\$10,842,654	0	0	0	0	0	0	0	0	0
County Total	246	246	\$60,244,399	0	0	0	1	4	\$330,000	27	286	\$21,679,902

Source: U.S. Census Bureau, <https://www.census.gov/construction/bps/>
Table 3.18: Privately-owned Residential Building Permits, 2014

Place Name	1-unit Buildings			2-unit Buildings			3-4 unit Buildings			5+ unit Buildings		
	Buildings	Units	Value	Buildings	Units	Value	Buildings	Units	Value	Buildings	Units	Value
Ames	91	91	\$26,796,461	0	0	0	0	0	0	22	350	\$39,751,304
Cambridge	1	1	\$116,342	0	0	0	0	0	0	0	0	0
Collins	0	0	0	0	0	0	0	0	0	0	0	0
Colo	0	0	0	0	0	0	0	0	0	0	0	0
Gilbert	6	6	\$1,230,829	0	0	0	0	0	0	0	0	0
Huxley	23	23	\$5,078,344	1	2	\$371,556	0	0	0	0	0	0
Kelley	1	1	\$100,000	0	0	0	0	0	0	0	0	0
McCallsburg	5	5	\$925,915	0	0	0	0	0	0	0	0	0
Maxwell	0	0	0	0	0	0	0	0	0	0	0	0
Nevada	9	9	\$2,700,000	4	8	\$1,400,000	0	0	0	0	0	0
Roland	5	5	\$1,115,807	0	0	0	0	0	0	0	0	0
Sheldahl	0	0	0	0	0	0	0	0	0	0	0	0
Slater	2	2	\$465,000	0	0	0	0	0	0	0	0	0
Story City	1	1	\$200,000	0	0	0	0	0	0	0	0	0
Zearing	0	0	0	0	0	0	0	0	0	0	0	0
Unincorporated	35	35	\$7,901,874	0	0	0	0	0	0	0	0	0
County Total	179	179	\$46,630,572	5	10	\$1,771,556	0	0	0	22	350	\$39,751,304

Source: U.S. Census Bureau, <https://www.census.gov/construction/bps/>

Table 3.19: Privately-owned Residential Building Permits, 2015

Place Name	1-unit Buildings			2-unit Buildings			3-4 unit Buildings			5+ unit Buildings		
	Buildings	Units	Value	Buildings	Units	Value	Buildings	Units	Value	Buildings	Units	Value
Ames	91	91	\$28,603,499	1	2	\$329,527	1	3	\$600,000	15	354	\$43,577,401
Cambridge	1	1	\$116,342	0	0	0	0	0	0	0	0	0
Collins	0	0	0	0	0	0	0	0	0	0	0	0
Colo	0	0	0	0	0	0	0	0	0	0	0	0
Gilbert	7	7	\$1,793,491	0	0	0	0	0	0	0	0	0
Huxley	36	36	\$7,425,681	0	0	0	0	0	0	0	0	0
Kelley	0	0	0	0	0	0	0	0	0	0	0	0
McCallsburg	5	5	\$910,073	0	0	0	0	0	0	0	0	0
Maxwell	0	0	0	0	0	0	0	0	0	0	0	0
Nevada	18	18	\$4,700,000	0	0	0	0	0	0	0	0	0
Roland	2	2	\$459,000	0	0	0	0	0	0	0	0	0
Sheldahl	1	1	\$150,000	0	0	0	0	0	0	0	0	0
Slater	2	2	\$500,000	0	0	0	0	0	0	0	0	0
Story City	8	8	\$1,621,130	0	0	0	0	0	0	0	0	0
Zearing	0	0	0	0	0	0	0	0	0	0	0	0
Unincorporated	25	25	\$6,852,879	0	0	0	0	0	0	0	0	0
County Total	196	196	\$53,132,095	1	2	\$329,527	1	3	\$600,000	15	354	\$43,577,401

Source: U.S. Census Bureau, <https://www.census.gov/construction/bps/>
Table 3.20: Privately-owned Residential Building Permits, 2016

Place Name	1-unit Buildings			2-unit Buildings			3-4 unit Buildings			5+ unit Buildings		
	Buildings	Units	Value	Buildings	Units	Value	Buildings	Units	Value	Buildings	Units	Value
Ames	110	110	\$35,475,630	0	0	0	0	0	0	24	459	\$52,606,344
Cambridge	1	1	\$116,342	0	0	0	0	0	0	0	0	0
Collins	1	1	\$80,000	0	0	0	0	0	0	0	0	0
Colo	0	0	0	0	0	0	0	0	0	0	0	0
Gilbert	9	9	\$2,196,624	0	0	0	0	0	0	0	0	0
Huxley	53	53	\$11,247,799	6	12	\$2,052,876	0	0	0	2	16	\$1,772,580
Kelley	0	0	0	0	0	0	0	0	0	0	0	0
McCallsburg	2	2	\$262,157	0	0	0	0	0	0	0	0	0
Maxwell	1	1	\$150,000	0	0	0	0	0	0	0	0	0
Nevada	12	12	\$3,240,000	3	6	\$960,000	0	0	0	0	0	0
Roland	2	2	\$250,000	0	0	0	0	0	0	0	0	0
Sheldahl	2	2	\$508,271	0	0	0	0	0	0	0	0	0
Slater	4	4	\$900,000	0	0	0	0	0	0	0	0	0
Story City	4	4	\$990,000	3	6	\$635,000	0	0	0	0	0	0
Zearing	0	0	0	0	0	0	0	0	0	0	0	0
Unincorporated	9	9	\$2,592,457	0	0	0	0	0	0	0	0	0
County Total	210	210	\$58,009,280	12	24	\$3,647,876	0	0	0	26	475	\$54,378,924

Source: U.S. Census Bureau, <https://www.census.gov/construction/bps/>

As demonstrated in the above tables, the City of Ames has had the most new residential construction, followed by the City of Huxley and the unincorporated county.

Since the last plan update, the following development was reported by participating school districts.

Ames CSD:

- 3 new Elementary School buildings
- 1 new District Office building
- 1 new Facilities Management building
- 2 renovated Elementary School buildings

Ballard CSD: None reported.

Collins-Maxwell CSD: None reported.

Colo-Nesco CSD: None reported.

Gilbert CSD:

- New high school
- Remodeled intermediate building

Nevada CSD:

- New Greenhouse
- New Ag Shop
- New Welding Facility
- New Cub Stadium
- New Baseball Facility

Roland-Story CSD:

- 2014: New bus barn in Roland
- 2015: Addition of preschool classrooms at the Elementary School. Addition of science classrooms and renovation of the Middle School.
- 2018: Addition of fine arts wing and renovation of the Elementary School.

3.4 Future Land Use and Development

The following sections provide details regarding future growth, land use and development. The information in this section comes from the Story County 2014 Multi-jurisdictional Hazard Mitigation Plan, information provided by each of the participating jurisdictions as well as other sources, cited throughout.

Table 3.21 provides the population projections for Story County by Woods & Poole Economics, Inc. It should be noted that the Story County population is growing at a slightly higher rate than projected. The American Community Survey 5-Year Estimate for 2016 population of 94,834 is already above the 2020 projection.

Story County

Table 3.21: Story County 2010 Population and Population Projections, 2020-2040

2010 Population	2020 Population Projection	2025 Population Projection	2030 Population Projection	2035 Population Projection	2040 Population Projection
89,542	96,415	100,689	104,962	109,258	113,593

Source: 2010 Population from the U.S. Census Bureau 2010 Decennial Census; Population Projections from the "2010 State Profile: Iowa", Woods & Poole Economics, Inc, www.woodsandpoole.com Prepared by: State Library of Iowa, State Data Center Program

Unincorporated County

In June 2016, Story County adopted the Cornerstone to Capstone (C2C) Comprehensive Plan. The plan sets the foundation for future growth and development for unincorporated areas of Story County through 2036.

City of Ames

None reported.

City of Cambridge

No development or land use changes are planned to occur within the next five years at this point due to agricultural lands that owners are unwilling to sell. In 2017 construction began on a new City Center that will house City Hall, the library, and a community center.

City of Collins

None reported.

City of Colo

There are no major development plans or expected growth areas in the City, however a housing development is expected to be constructed within the next five years.

City of Gilbert

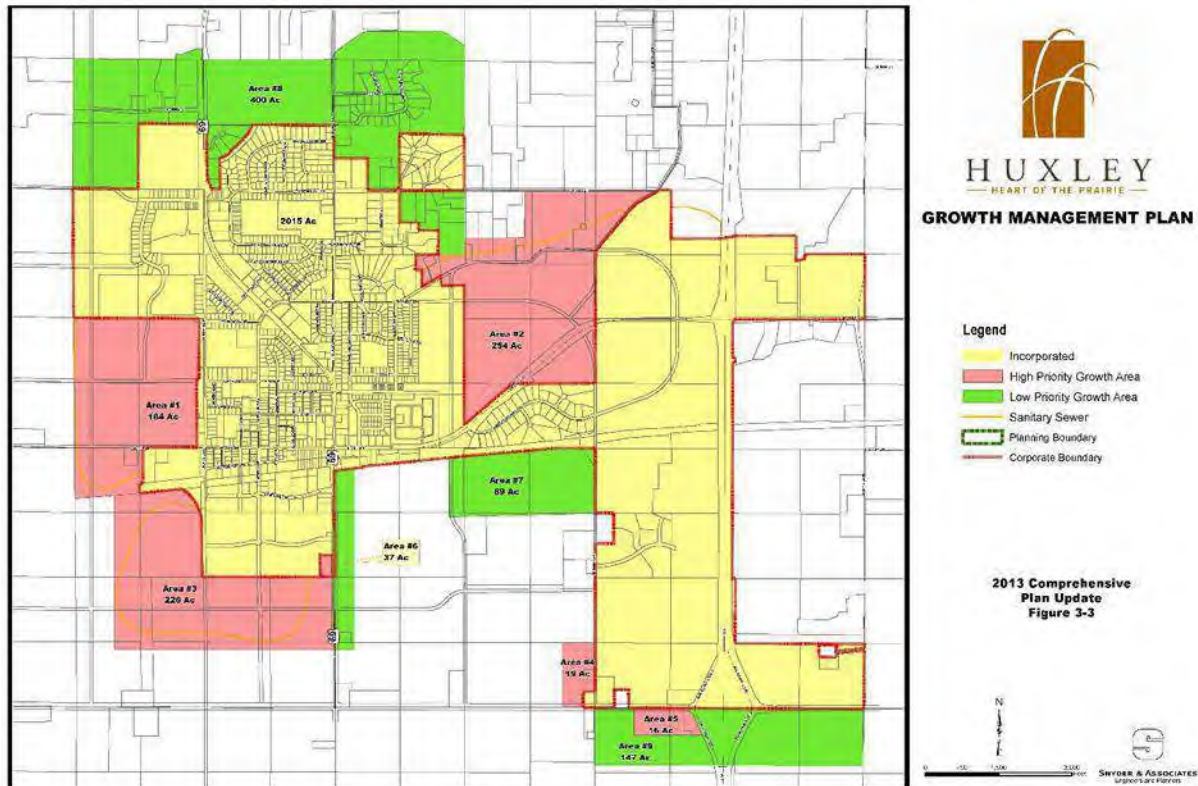
Growth is expected to occur in the southern portion of the City with a mix of residential and commercial development that will require annexation in the future.

Additionally, the City has several planned facility and infrastructure upgrades that will be constructed within the next five years. These plans include an upgrade of the City's lagoon system; an upgrade or new facility for the City's water plant; and installation of water lines, sewer lines, storm sewers, and new roads in the eastern commercial/residential development and in the southern annexation/development area.

City of Huxley

Per the Huxley 2013 Comprehensive Plan, two of the highest priority growth areas include the south of the City, adjacent to Highway 69 and Huxley Development Park, and the northwest of the City near Ballard High School. All priority growth areas are shown in the Growth Management Plan map from the City's Comprehensive Plan.

Figure 3.1: City of Huxley Growth Management Plan and Priority Growth Areas



The City does not have any facilities or infrastructure construction planned for the next five years.

City of Kelley

None reported.

City of Maxwell

The City has been involved in discussions to develop 50 acres in the northeast corner of the community. The area in question is not a known hazard area. Additionally, the City plans to upgrade the sewage treatment plant by 2020.

City of McCallsburg

None reported.

City of Nevada

The City of Nevada is expected to annex a 40-acre parcel south of the southern city limits in the next year that will have approximately 70 single family residential lots. None of the project is in the 100-year floodplain or any other known hazard area.

The City is also looking to building a recreation center at SCORE Park in the next two years. Improvements are also planned to occur in 2020 for the City's Central Business District, including new water mains, sewer mains, storm sewer installation, new curb and gutter streets, sidewalks, and street light replacement.

City of Roland

None reported.

City of Sheldahl

None reported.

City of Slater

The City of Slater does not anticipate any future development of growth areas. No new City facilities are planned for constructions, but the City is completing construction of a sewer lift station on 6th Avenue.

City of Story City

None reported.

City of Zearing

None reported.

School Districts' Future Development

This section summarizes future development for the participating school districts:

Ames CSD

A new high school building is planned for construction within the next five years. Design is currently underway.

Enrollment is expected to grow gradually.

Ballard CSD

Enrollment in Ballard CSD is expected to remain stable. Renovations are planned for the middle school, but no construction is expected to occur in any known hazard areas.

Collins-Maxwell CSD

No construction or remodeling is planned to occur within the next five years, but capital projects planning discussions for the District are underway.

Enrollment over the next five years is expected to remain stable, with the possibility for a slight increase in coming years due to the approval of a new housing development in Maxwell.

Colo-Nesco CSD

No remodeling or construction plans reported. Enrollment is expected to remain level.

Gilbert CSD

Improvements to multiple buildings in the Gilbert CSD are planned following approval of a bond referendum in 2018. Specific improvement plans were not reported, but no construction will occur in known hazard areas.

The District anticipates an enrollment increase of three percent per year.

Nevada CSD

Planned construction activities for the next five years include a middle school remodel, a wrestling room, a baseball facility, and acquisition of Gates Hall.

No change in enrollment is expected.

Roland-Story CSD

The District is considering replacing its track, which is in a known floodplain.

Enrollment is projected to remain stable over the next five years.

Iowa State University

The following projects are planned for within the next five years:

- Student Innovation Center

- Gerdin Building Expansion
- Student Athlete Performance Facility
- Poultry Teaching and Research Facility

Additionally, there is potential for construction to begin on a Veterinary Diagnostic Laboratory and a Feed Mill and Grain Science Facility.

3.5 Hazard Profiles and Vulnerability

Hazard Profiles

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the...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.

Each hazard identified in Section 3.1.4 is profiled individually in this section in alphabetical order.

The level of information presented in the profiles varies by hazard based on the information available. With each update of this plan, new information will be incorporated to provide for better evaluation and prioritization of the hazards that affect the planning area. Detailed profiles for each of the identified hazards include information categorized as follows:

Hazard Description

This section consists of a general description of the hazard and the types of impacts it may have on a community. It also includes the ratings assigned to the hazard relative to typical warning times and duration of hazard events as described in Table 3.5.

Geographic Location/Extent

This section describes the geographic location of the hazard in the planning area. Where available, maps are utilized to indicate the specific locations of the planning area that are vulnerable to the subject hazard. This section also provides information as to the extent of the hazard (i.e. the size or degree of impacts).

Previous Occurrences

This section includes information on historic incidents and their impacts.

Probability of Future Occurrence

The frequency of past events is used to gauge the likelihood of future occurrences. Where possible, the probability or chance of occurrence was calculated based on historical data. Probability was determined by dividing the number of events observed by the number of years and multiplying by 100. This gives the percent chance of the event happening in any given year. An example would be three droughts occurring over a 30-year period, which suggests a 10 percent chance of a drought occurring in any given year. For each hazard, the probability is assigned a rating as defined in Table 3.5.

Vulnerability Assessments

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.

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 areas.

Requirement §201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate.

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

Requirement §201.6(c)(2)(ii): (As of October 1, 2008) [The risk assessment] must also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged in floods.

Following the hazard profile for each hazard is the vulnerability assessment. The vulnerability assessment further defines and quantifies populations, buildings, critical facilities and other community assets at risk to natural hazards. The vulnerability assessments were conducted based on the best available data and the significance of the hazard.

Detailed profiles for each of the identified hazards include information categorized as follows:

Vulnerability Overview

This section consists of a general overview narrative of the planning area's vulnerability to the hazard. Within this section, the magnitude/severity of the hazard is discussed. The magnitude of the impact of a hazard event (past and perceived) is related directly to the vulnerability of the people, property and the environment it affects. This is a function of when the event occurs, the location affected, the resilience of the community and the effectiveness of the emergency response and disaster recovery efforts.

For each hazard, the magnitude/severity is assigned a rating as defined in Table 3.5.

Potential Losses to Existing Development

This section provides the potential losses to existing development. Where data is available, this section provides estimated financial losses as well as the methodology used. For hazards with an overall "Low" rating, potential losses may not be discussed.

Future Development

This section provides information on how vulnerability to this hazard will be impacted by planned future development, as well as information for jurisdictions to consider in planning future development.

Climate Change Impacts

This section will discuss any potential impacts to this hazard as a result of climate change.

Hazard Summary by Jurisdiction

For hazards that vary by jurisdiction, this section will provide an overview of how the hazard varies, followed by a table indicating the probability, magnitude, warning time and duration rankings for each participating jurisdiction with the resulting hazard score and level.

3.5.1 Animal/Plant/Crop Disease

Hazard Score Calculation					
Probability	Magnitude/Severity	Warning Time	Duration	Weighted Score	Level
1	3	1	4	1.90	Low

Profile

Hazard Description

Agricultural infestation is the naturally occurring infection of vegetation, crops or livestock with insects, vermin, or diseases that render the crops or livestock unfit for consumption or use. Because of Iowa's substantial agricultural industry and related facilities and locations, the potential for infestation of crops or livestock poses a significant risk to the economy of the State. Iowa cropland is vulnerable to disease and other agricultural pests.

Some level of agricultural infestation is normal in Iowa. 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.

Animal Disease

Agricultural incidents are naturally occurring infection of livestock with insects, vermin, or diseases that render the livestock unfit for consumption or use. The livestock inventory for the State of Iowa includes nearly 4 million cattle and calves. According to the USDA National Agricultural Statics Service, as of January 1, 2016, Story County ranked 59th in the state with 25,500 head of cattle and calves. According to the 2012 Census of Agriculture, there were also 77,182 head of hogs and pigs in Story County. The HMPC noted that there is limited poultry within the County.

With this substantial agricultural industry and related facilities throughout the County, the potential for infestation of livestock poses a significant risk to the economy in the planning area.

The Iowa Department of Agriculture and Land Stewardship (IDALS) monitors and reports on the following animal reportable diseases in Iowa:

- Avian Influenza
- Bovine Spongiform Encephalopathy (BSE) Disease
- Chronic Wasting Disease
- Exotic Newcastle Disease
- Foot and Mouth Disease
- Johne's Disease
- Pseudo rabies
- Scrapie, and
- West Nile Virus.

Producers are required by state law to report any of the reportable animal diseases to the IDALS's Bureau of Animal Industry. The IDALS's Bureau of The Center for Agriculture Security is the lead coordinating bureau for any emergency response for an agriculture incident.

Avian influenza continues to be of concern in Iowa as the State is number one in poultry egg layers (approximately 60 million). Source: Iowa Poultry Association, 2017.

Bovine Spongiform Encephalopathy (BSE) “mad cow” disease is a chronic, degenerative disease affecting the central nervous system of cattle. Cases have been found world-wide since 1986.

Chronic Wasting Disease (CWD) is a fatal, neurological disease of farmed and wild deer and elk. The disease has been identified in wild and captive mule deer, white-tailed deer and North American elk, and in captive black-tailed deer.

Exotic Newcastle Disease (END) is a contagious and fatal viral disease affecting all species of birds. There was an epidemic of END in California in 2003 that is resulting in the death of millions of chickens and other birds, and costing millions of dollars. END is probably one of the most infectious diseases of poultry in the world. END is so virulent that many birds die without showing any clinical signs.

Johne’s (yo-knees) disease is a contagious, chronic and eventually fatal infection that affects the small intestine of ruminants, including cattle, sheep and goats. Johne’s, also called Para tuberculosis, is a slow progressive wasting disease with an incubation period of usually 2 or more years. Johne’s is a reportable disease, but not a quarantinable disease.

Pseudo rabies is a viral disease most prevalent in swine, often causing newborn piglets to die. Older pigs can survive infection, becoming carriers of the pseudo rabies virus for life. Other animals infected from swine die from pseudo rabies, which is also known as Aujeszky’s disease and “mad itch.” Infected cattle and sheep can first show signs of pseudo rabies by scratching and biting themselves. In dogs and cats, pseudo rabies can cause sudden death. The virus does not cause illness in humans. Due to an extensive eradication program, Iowa and the rest of United States are free of pseudo rabies.

Scrapie is a fatal, degenerative disease affecting the central nervous system of sheep and goats that is very similar to BSE (mad cow disease), although it does not cause disease in humans, and has been present in the U.S. for over 50 years. Infected flocks that contain a high percentage of susceptible animals can experience significant production losses. In these flocks, over a period of several years, the number of infected animals increases and the age at onset of clinical signs decreases making these flocks economically unviable. Animals sold from infected flocks spread scrapie to other flocks. The presence of scrapie in the U.S. also prevents the export of breeding stock, semen and embryos to many other countries. Currently there is a national program underway to eradicate scrapie in the U.S.

Disease outbreaks can also occur in wild animal populations. The IDALS’s Bureau of Animal Industry also monitors wild animal species and game throughout the state as well as diseases that may impact them.

Crop Pests/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 across the U.S. The cascading net negative economic effects could result in wide-spread business failures, reduction of tax revenues, harm to other state economies, and diminished capability for this country to compete in the global market.

Many factors influence disease development in plants, including 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 two elements of coordination and communication are essential when plant diseases or pest infestations occur. The United States Department of Agriculture/ Animal Plant Health Inspection Service, Iowa Department of Agriculture and Land Stewardship, local producers, local government, assessment teams and state government entities

must work together to effectively diagnose the various plant hazards to determine if immediate crop quarantine and destruction is required.

The College of Agriculture and Life Sciences at Iowa State University (ISU) houses the Plant and Insect Diagnostic Clinic (<https://www.ent.iastate.edu/pidc/>); the Clinic provides diagnosis of plant problems (plant diseases, insect damage, and assessment of herbicide damage) and the identification of insects and weeds from the field, garden, and home. Specific plant pests can vary from year to year. For complete details of all insects and diseases that can impact crops in Story County, see the website above. ISU also has several farms throughout the County. Several other agricultural labs are located in the County, including USDA and APHIS.

Emerald Ash Borer

The Hazard Mitigation Planning Team is also aware of the emerald ash borer pest that threatens Iowa's forests and urban landscape. This pest is a slender, emerald green beetle that is ½ inch long, and responsible for the destruction of approximately 20 million ash trees in Ohio, Michigan, Indiana, Illinois, and Ontario, Canada. Emerald Ash Borer has made its way into Iowa and has become an increasing threat.

Wildlife

Iowa farmers lose a significant amount of crops each year as a result of wildlife foraging. This can be particularly problematic in areas where natural habitat has been diminished or in years where weather patterns such as early/late frost deep snow, or drought has caused the wild food sources to be limited.

Warning Time Score: 1—more than 24 hours

Duration Score: 4—more than 1 week

Geographic Location/Extent

All of Story County is subject to animal/livestock incidents and agricultural infestations. According to the 2012 Census of Agriculture there were 966 farms in the County covering 306,000 acres of land (83 percent of the 573 square miles of land area (366,720 acres) in the County).

Table 3.22 provides a summary of the value of agricultural products sold in the planning area. Agricultural infestation of crops or livestock in the planning area would severely affect the economy.

Table 3.22: Market Value of Agricultural Products Sold, 2012 - Story County, IA

Market Value of Products Sold	\$292,777,000
Market Value of Crops	\$233,151,000 / (80 percent)
Market Value of Livestock	\$59,625,000 / (20 percent)
Average Per Farm	\$303,082

Source: USDA National Agricultural Statistics Service, 2012 Census of Agriculture.

Animal Location/Extent

In addition to the animal farm operations, there are also confined and open feeding operations in Story County. According to data from the Iowa NRGIS Repository, there are 46 Animal Feeding Operations listed in the Iowa Department of Natural Resources Animal Feeding Operations Database. This includes 29 Confined Animal Feeding Operations and 9 Open Feedlots, and 8 combination Confined/Open feedlot.

Crop Location/Extent

According to the National Agricultural Statistics Service, in 2012 Story County's top crop items included the following:

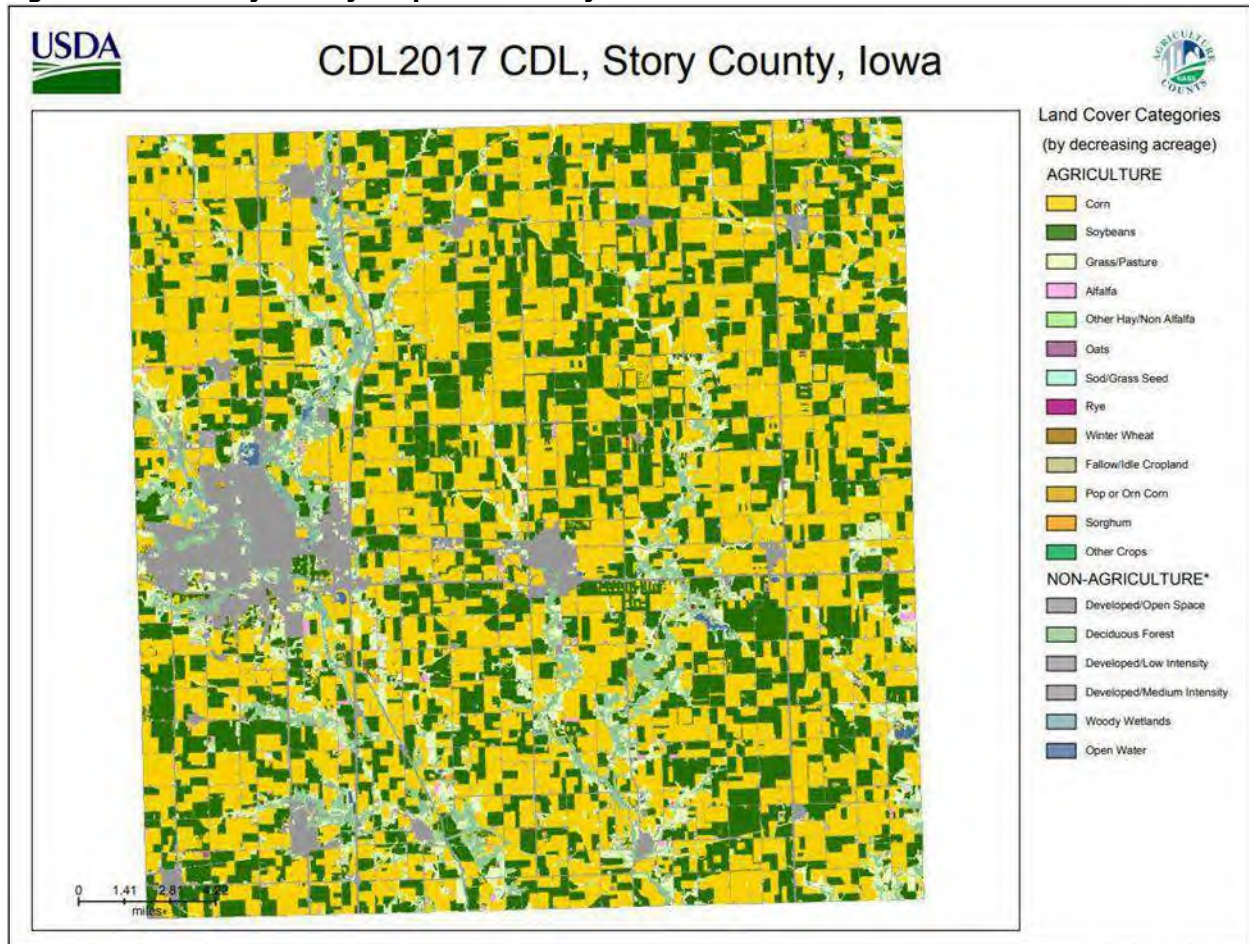
- Corn for Grain (State Rank 41) - 155,251 acres harvested

- Soybeans (State Rank 32) - 104,391 acres harvested

Additionally, the HMPC noted that the county is a center for seed development, with test fields located all over the county.

As can be seen in the USDA Cropland Data Layer (CDL) in Figure 3.2, the majority of land in Story County outside the incorporated areas is in agricultural use, with primary crops of corn and soybeans.

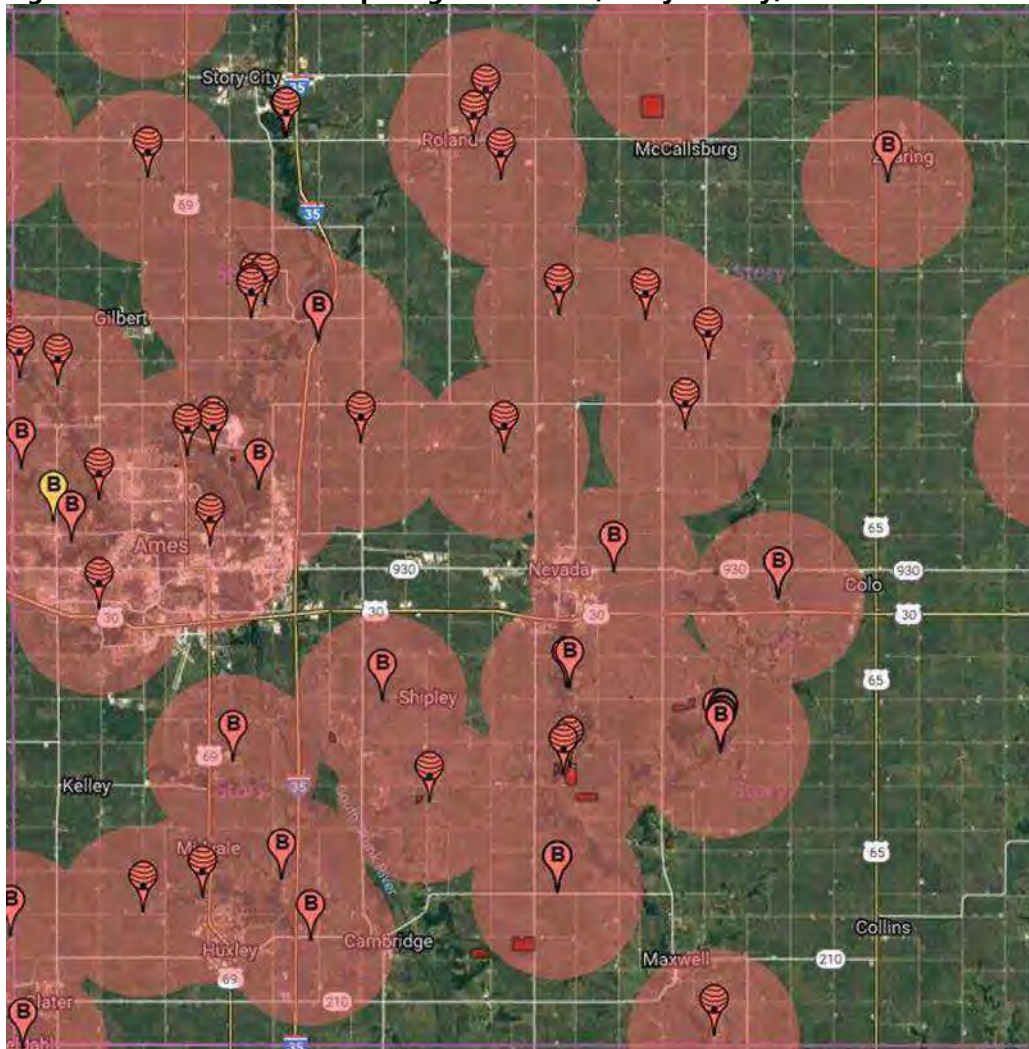
Figure 3.2: Story County Cropland Data Layer



Source: USDA, produced by CropScape, <https://nassgeodata.gmu.edu/CropScape/>

Figure 3.3 provides the locations of the sites included on the Sensitive Crops Registry according to the Iowa Department of Agriculture and Land Stewardship, Pesticide Bureau. The types of sensitive crops in the county include berries, fruits, grapes, non-specified organic, and beehives.

Figure 3.3: Sensitive Crops Registered Sites, Story County, IA

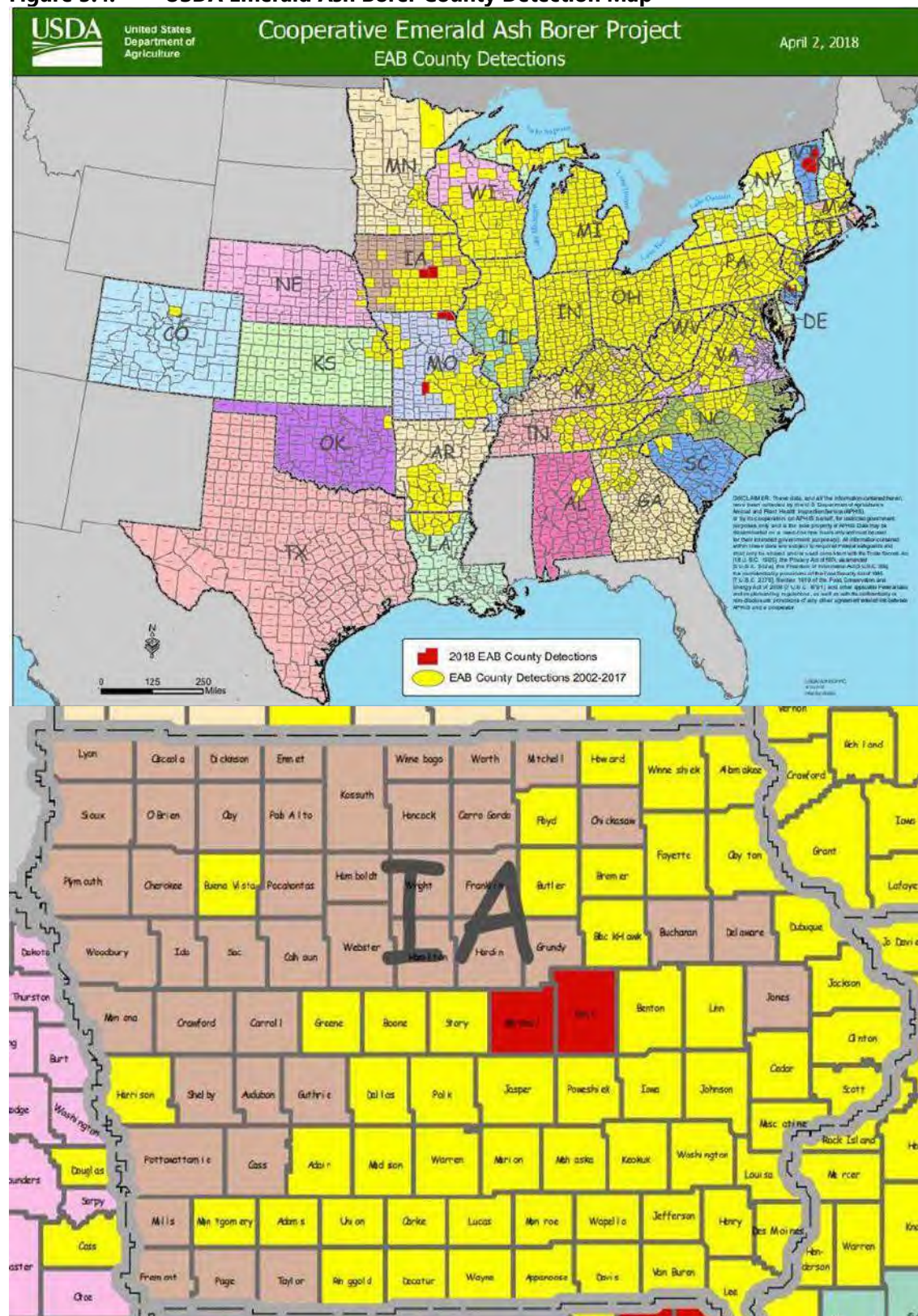


Source: Iowa Specialty Crop Site Registry, <https://ia.driftwatch.org/map>

Emerald Ash Borer Location/Extent

Figure 3.4 shows the counties in the U.S. in which the Emerald Ash Borer has been detected. Story County is shaded yellow indicating there has been Emerald Ash Borer detected in the County between 2002 and 2017. Two counties to the east of Story County, Marshall County and Tama County are shaded in red, indicating there has been Emerald Ash Borer detected in those counties in 2018.

Figure 3.4: USDA Emerald Ash Borer County Detection Map



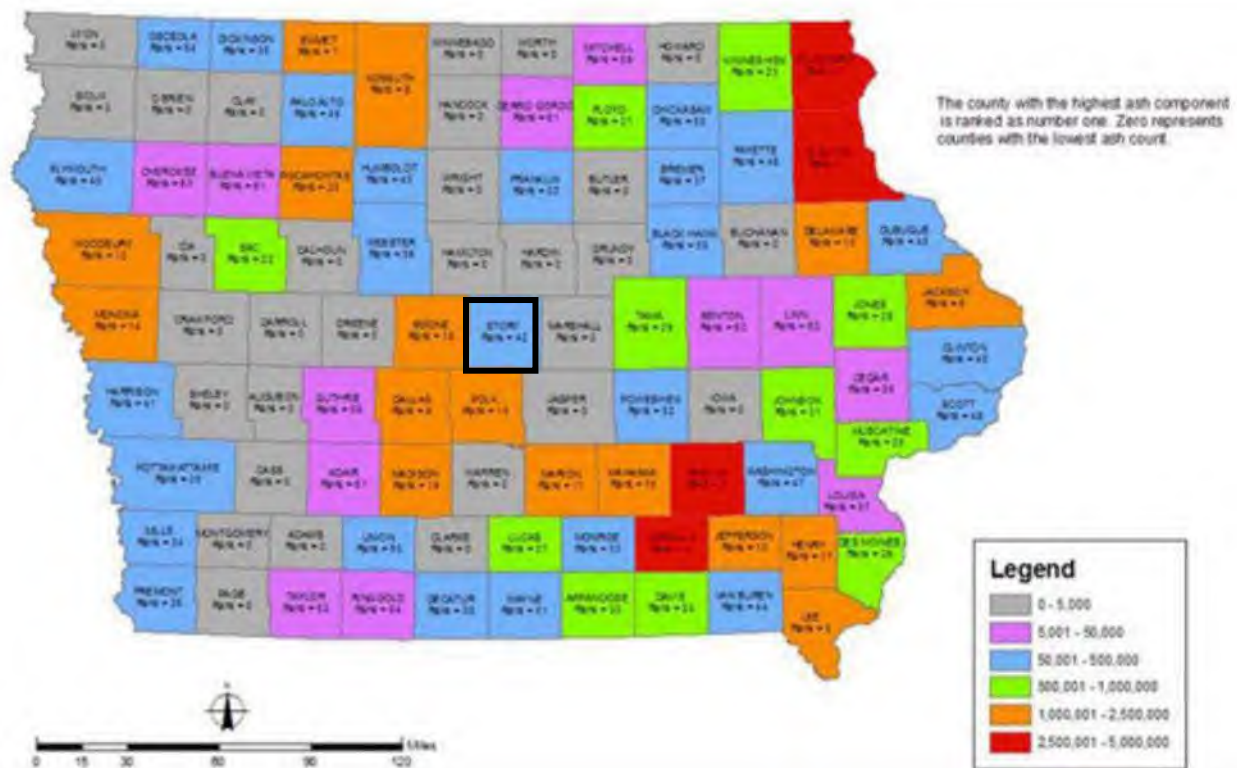
Source: http://www.aphis.usda.gov/plant_health/plant_pest_info/emerald_ash_b/index.shtml; Blue square identifies Story County

It is estimated by the Iowa Department of Natural Resources – Forestry Bureau that approximately 15-20 percent of public trees in Iowa cities are green ash. In some communities, ash comprises more than 60 percent of the public trees. Statewide, there are over 50 million ash trees (green, white and black) in bottomland and upland forests (2005 USDA Forest Service, Forest Inventory Data) and another 30 million urban ash trees (Iowa Department of Natural Resources – Forestry Bureau).

As seen in Figure 3.5 below, Story County ranks 42nd in the state with 50,001 to 500,000 ash trees in the County according to data from the U.S. Forest Service. Also, a cooperative state and federal effort has developed the “Iowa Emerald Ash Borer Readiness Plan”

<https://www.extension.iastate.edu/PSEP/Publications/EAB/IAEABReadinessPlan2JAN2013FINAL.pdf> to help stop this pest by education, monitoring, surveillance, containment and communication.

Figure 3.5: Distribution of Ash Trees in Iowa



Source: Iowa State University Extension Office

<http://www.extension.iastate.edu/pme/EAB%20other%20forms/Iowa%20Ash%20Tree%20Distribution%202006%20map.jpg>

Note: Story County is outlined in black.

Previous Occurrences

Beginning in April of 2015, there were a significant number of confirmed diagnoses of avian influenza in the State of Iowa. As a result, on Friday May 1, 2015, Governor Branstad declared a state of emergency. The last positive flock was detected on June 16, 2015. Confirmed cases occurred in the following counties: Buena Vista, Calhoun, Cherokee, Clay, Hamilton, Kossuth, Lyon, Madison, O'Brien, Osceola, Palo Alto, Plymouth, Pocahontas, Sac, Sioux, Webster, and Wright. Infected flocks were depopulated and composted and clean up and disinfection occurred. There were 77 total premises and 34 million birds affected. This included 35 commercial turkey flocks, 22 commercial egg production flocks, 13 pullet flocks, 1 breeding flock for a mail order hatchery, and 6 backyard flocks. More than 2,300 USDA staff and contractors were dispatched to Iowa to assist with the response to the avian influenza situation, including

a USDA Incident Management Team (IMT). More than 300 state employees also participated in the disaster response (<http://www.iowaagriculture.gov/AvianInfluenza.asp>).

Bovine Spongiform Encephalopathy (BSE) (A.K.A. Mad Cow Disease)

To date, BSE has been confirmed in Great Britain, Belgium, France, Germany, Spain, Switzerland, Japan, Canada, and the United States. In the United States, the first positive BSE cow was discovered in Washington. As a result of a surveillance program from June 2004 to March 2006, two additional positive domestic cows were found; one each in Texas and Alabama. Since 1997 FDA implemented a feed ban prohibiting the feeding of feedstuff derived from ruminants to other ruminants. The results of this ban and enhanced surveillance indicate that while BSE is present, it is at an extremely low level in U.S. cattle.

Chronic Wasting Disease

The first case of CWD in Iowa was found in 2012 on a hunting preserve in the southeastern part of the state. In that case, it was determined the CWD-positive mature buck had been transferred to the hunting preserve from a deer farm in north central Iowa. Subsequent testing found CWD at the deer farm. The farm was placed under quarantine, but the owners sued for compensation. The litigation prevented the farm from being depopulated of deer until August 2014. The Iowa Department of Agriculture and Land Stewardship conducted testing. Results were released in early October 2014, stating that 284 of 356 deer (80 percent) from a captive herd in north-central Iowa tested positive for chronic wasting disease. This finding represents the highest number of CWD-positive animals detected at a facility, according to wildlife health officials (Milwaukee-Wisconsin Journal Sentinel, October 4, 2014). In 2014, the first case of CWD was found in a wild deer in Allamakee County. Then in 2015, two wild deer tested positive for CWD in Allamakee County.

Scrapie

There has been a total of 37 sheep flocks in Iowa that have been found to be infected with Scrapie since the accelerated national Scrapie Eradication Program started in November 2001. Of those, 10 have been depopulated and 27 have completed, or are currently completing a genetic flock plan. Iowa's last infected flock was found in June 2010.

Rabies

In Story County, there have been six confirmed cases of rabies since 2011. Table 3.23 summarizes the occurrence of rabies in Iowa and Story County from 2011-2016.

Table 3.23: Rabies Cases in Iowa and Story County, 2011-2016

Year	Confirmed Rabies Cases in Story County (#/Animal)	Confirmed Rabies Cases in Iowa
2016	2/Bat	19
2015	0	12
2014	0	15
2013	0	12
2012	2 – 1/Bat, 1/Skunk	31
2011	2/Bat	25

Source: Iowa Department of Public Health, Center for Acute Disease Epidemiology, <https://idph.iowa.gov/rabies/resources>

According to the U.S. Department of Agriculture's Risk Management Agency, during the 10-year period from 2007-2016, combined crop insurance payments for damages resulting from disease was \$48,135 in Story County. The Iowa statewide average for insurable crop acres with insurance is 89 percent (USDA

Risk Management Agency, 2015 Iowa Crop Insurance Profile.) Table 3.24 provides a summary of insured crop losses as a result of crop infestations.

Table 3.24: Crop Insurance Payments for Crop Pests/Diseases 2007-2016

Damage Cause	Sum of Indemnity Amount	Sum of Determined Acres
Asian Soybean Rust	\$22,108.00	312
2014	\$22,108.00	312
Plant Disease	\$12,420.00	58
2010	\$3,416.00	5
2014	\$9,004.00	53
Mycotoxin (Aflatoxin)	\$13,607.00	42
2010	\$13,607.00	42
Grand Total	\$48,135.00	412

Source: USDA Risk Management Agency

Probability of Future Occurrence

The planning area experiences some level of agricultural loss every year as a result of naturally-occurring diseases that impact animals/livestock. The concern is when the level of an infestation escalates suddenly, or a new infestation appears, overwhelming normal control efforts. Normal control efforts include crop insurance and employment of various other agricultural practices that limit impact. For purposes of determining probability of future occurrence, the HMPC defined "occurrence" as an infestation occurring suddenly, a new infestation, or infestation that overwhelmed normal control efforts. Research did not reveal any infestations in Story County that have reached this level of defined "occurrence". Therefore, it was determined that the probability of this defined "occurrence" of agricultural infestation is "Unlikely".

Probability Score: 1—Unlikely

Vulnerability

Overview

A widespread infestation of animals/livestock and crops could impact the economy of the County. According to the USDA 2012 Census of Agriculture, Story County agriculture provides 7,496 jobs representing 13.20 percent of Story County's total workforce (Source: Coalition to Support Iowa's Farmers, <http://www.supportfarmers.com/Assets/2014/cntydata/Story.pdf>)

In 2012 the total market value of Story County's agricultural products sold was \$292,800,00. With this contribution of agriculture to the economy, a wide-scale agricultural infestation could severely impact the economic stability of the County.

Magnitude Score: 3—Critical

Potential Losses to Existing Development

Buildings, infrastructure, and critical facilities are not vulnerable to this hazard. Its impacts are primarily economic and environmental, rather than structural effects.

Rough estimates of potential direct losses from a maximum threat event fall in a range of 1-75 percent of livestock receipts. The market value of all livestock in Story County in 2012 was \$59,625,000. Based on a worst-case scenario where 75 percent of livestock is lost in a given year due to agricultural infestations, the total direct costs could exceed \$44.7 million.

Table 3.25 provides the annual crop losses for insurable crops. The insurable loss is adjusted to estimate losses to all insurable crops by considering that 89 percent of insurable crops in the State were insured (2015 Iowa Crop Insurance Profile from USDA's Risk Management Agency).

Table 3.25: Estimated Insurable Crop Losses Resulting from Disease, Infestation, and Wildlife

Crop Insurance Paid-10 yrs.	Adjusted 10-year Losses	Annual Estimated Losses
\$804,538.55	\$903,975.90	\$90,397.59

Source: USDA Risk Management Agency; adjust loss calculation by Amec Foster Wheeler

Rough estimates of potential direct losses from a maximum threat event fall in a range of 1-50 percent of annual crop receipts. The market value of all crops grown in Story County in 2012 was \$233,200,000. Based on a worst-case scenario where 50 percent of crop production is lost in a given year due to agricultural infestations, the total direct costs could exceed \$116 million.

The U.S. Forest Service estimates that Story County has up to 500,000 ash trees in the County. Removal of debris if an infestation would occur would be challenging and costly. If only 10 percent of the ash trees were impacted in Story County that could translate to 50,000 impacted. It is estimated that it costs \$682 to replace each Ash tree. In Story County, the cost of a 10 percent loss translates to over \$34.1 million.

Future Development

Future development is not expected to significantly impact the planning area's vulnerability to this hazard. However, if crop production and numbers of animals/livestock increases, the amount vulnerable to infestation also increases. Regarding the Emerald Ash Borer, the Iowa Department of Natural Resources recommends that other native tree species be planted in lieu of ash trees to avoid increasing vulnerability to infestation of the Emerald Ash Borer.

Climate Change Impacts

The climate change impacts below are excerpted from the 2010 Report on Climate Change Impacts on Iowa developed by the Iowa Climate Change Impacts Committee.

Crops

Despite great improvements in yield potential over the last several years, crop production remains highly dependent on climate in conjunction with other variables. The overall effect of climate change on crop productivity in Iowa remains unclear, as positive climatic events could be overridden by the impacts of poor management or genetics, or favorable management and genetics could override negative climate events.

Regardless of these interactions, it is certain that climate changes will affect future crop production. Greenhouse and growth chamber studies suggest increases in atmospheric carbon dioxide (CO₂) will generally have a substantial positive effect on crop yields by increasing plant photosynthesis and biomass accumulation.

Greater precipitation during the growing season, as we have been experiencing in Iowa, has been associated with increased yields; however, excessive precipitation early in the growing season adversely affects crop productivity. Waterlogged soil conditions during early plant growth often result in shallower root systems that are more prone to diseases, nutrient deficiencies and drought stress later in the season.

An increase in temperature, especially during nighttime, reduces corn yield by shortening the time in which grain is accumulating dry matter (the grain fill period). According to research, Iowa's nighttime temperatures have been increasing more rapidly than daytime temperatures.

The current changes in precipitation, temperature, wind speeds, solar radiation, dew-point temperatures, and cloud cover imply less ventilation of crops and longer dew periods. Soybean plants in particular readily absorb moisture, making harvest problematic. One adaptive approach to these conditions involves farmers purchasing larger harvesting equipment to speed harvest, compensating for the reduced daily time suitable for soybean harvest.

The recent extreme weather events involving greater intensity and amount of rainfall have increased the erosive power of Iowa’s precipitation, resulting in significant erosion of topsoil. The impact of climate change on the erosive force of precipitation in the U.S. is expected to increase by as much as 58%. These rates are expected to increase exponentially as precipitation continues to rise.

Plant disease can also increase as temperature, soil wetness, and humidity increase as these conditions favor the development of various plant diseases.

Animals

Despite the fact that Iowa ranks first in hog and fifth in cattle production nationwide, there is a lack of information about the effects of climate change on animal production in Iowa. Nevertheless, our general knowledge and principles pertaining to livestock and extreme weather events are applicable to Iowa’s changing climate conditions.

High temperatures have been shown to reduce summer milk production, impair immunological and digestive functions of animals, and increase mortality rates among dairy cattle.

In general, domestic livestock can adapt to gradual changes in environmental conditions; however, extended periods of exposure to extreme conditions greatly reduce productivity and is potentially life threatening.

Animal/Crop/Plant Disease Hazard Summary by Jurisdiction

The magnitude determinations discussed in the vulnerability overview sections were factored into the following hazard summary table to show how this hazard varies by jurisdiction. It has been determined that the magnitude of animal/crop/plant disease would be slightly less in the cities and for the school districts due to less agriculture within city limits. However, an infestation of the Emerald Ash Borer would likely have a larger impact in the incorporated areas. In addition, the economy of incorporated areas is heavily dependent on agriculture. As a result, the magnitude in the unincorporated area was determined to be a 3 and the magnitude in the incorporated areas was determined to be a 2. School districts would have limited Ash trees to dispose of in the event of infestation. Therefore, the magnitude was determined to be a 1.

Jurisdiction	Probability	Magnitude	Warning Time	Duration	Score	Level
Story County, Iowa	1	3	1	4	1.90	Low
City of Ames	1	1	1	4	1.30	Low
City of Cambridge	1	1	1	4	1.30	Low
City of Collins	1	1	1	4	1.30	Low
City of Colo	1	1	1	4	1.30	Low
City of Gilbert	1	1	1	4	1.30	Low
City of Huxley	1	1	1	4	1.30	Low
City of Kelley	1	1	1	4	1.30	Low
City of Maxwell	1	1	1	4	1.30	Low
City of McCallsburg	1	1	1	4	1.30	Low
City of Nevada	1	1	1	4	1.30	Low
City of Roland	1	1	1	4	1.30	Low
City of Sheldahl	1	1	1	4	1.30	Low
City of Slater	1	1	1	4	1.30	Low
City of Story City	1	1	1	4	1.30	Low
Ames Schools	1	1	1	4	1.30	Low
Ballard Schools	1	1	1	4	1.30	Low
Collins-Maxwell Schools	1	1	1	4	1.30	Low
Colo-Nesco Schools	1	1	1	4	1.30	Low
Gilbert Schools	1	1	1	4	1.30	Low
Nevada Schools	1	1	1	4	1.30	Low
Roland-Story Schools	1	1	1	4	1.30	Low
Iowa State University	1	1	1	4	1.30	Low

3.5.2 Dam/Levee Failure

Hazard Score Calculation					
Probability	Magnitude/Severity	Warning Time	Duration	Weighted Score	Level
1	2	4	4	2.05	Moderate

Profile

Hazard Description

Many of Iowa's community settlements were founded along rivers and streams due to their reliance on water resources. Often, these streams or rivers later needed a dam or levee for flood control or a reservoir for a constant water source. This section discusses both dam and levee failure.

Dam Failure

A dam is defined as a barrier constructed across a watercourse for the purpose of storage, control, or diversion of water. Dams are typically constructed of earth, rock, concrete, or mine tailings. Dam failure is the uncontrolled release of impounded water resulting in downstream flooding, affecting both life and property. Dam failure can be caused by any of the following: flooding; earthquakes, flow blockages, landslides, lack of maintenance, improper operation, poor construction, vandalism, or terrorism.

Levee Failure

Levee Failure is the uncontrolled release of water resulting from a structural failure. Possible causes of the failure could include flooding, earthquakes, blockages, landslides, lack of maintenance, improper operation, poor construction, vandalism, terrorism, erosion, piping, saturation, or under seepage.

Warning Time Score: 4—Minimal or no warning (up to 6 hrs. warning)

Duration Score: 4—More than 1 week

Geographic Location/Extent

Dams in Planning Area

The thresholds for when a dam falls under State regulation are outlined in Iowa Administrative Code 567-71.3 and are listed below. The thresholds are primarily based on both dam height and water storage volumes. State regulated dams are those dams that meet the following:

In rural areas:

- Any dam designed to provide a sum of permanent and temporary storage exceeding 50 acre-feet at the top of dam elevation, or 25 acre-feet if the dam does not have an emergency spillway, and which has a height of 5 feet or more.*
- Any dam designed to provide permanent storage in excess of 18 acre-feet and which has a height of 5 feet or more.*
- Any dam across a stream draining more than 10 square miles.*
- Any dam located within 1 mile of an incorporated municipality, if the dam has a height of 10 feet or more, stores 10 acre-feet or more at the top of dam elevation and is situated such that the discharge from the dam will flow through the incorporated area.*

In urban areas:

Any dam which exceeds the thresholds in 71.3 (1) "a", "b", or "d".

Low head dams:

Any low head dam on a stream draining 2 or more square miles in an urban area, or 10 or more square miles in a rural area.

Dams are classified by the State of Iowa into three categories based on the potential risk to people and property in the event of failure (see Table 3.26). The classification can change over time due to changes in development downstream from the dam. In addition, older dams may not have been built to the standards of their updated classification when this occurs. The Iowa Department of Natural Resources performs annual inspections on all high hazard dams in the State.

Table 3.26: Dam Hazard Classification Definitions

Hazard Class	Definition
High	A structure shall be classified as high hazard if located in an area where failure may create a serious threat of loss of human life or result in serious damage to residential, industrial, or commercial areas, important public utilities, public buildings, or major transportation facilities.
Moderate (Significant)*	A structure shall be classified as moderate hazard if located in an area where failure may damage isolated homes or cabins, industrial or commercial buildings, moderately traveled roads or railroads, or interrupt major utility services, but without substantial risk of loss of human life. In addition, structures where the dam and its impoundment are of themselves of public importance, such as dams associated with public water supply systems, industrial water supply or public recreation, or which are an integral feature of a private development complex, shall be considered moderate hazard for design and regulatory purposes unless a higher hazard class is warranted by downstream conditions.
Low	A structure shall be classified as low hazard if located in an area where damages from a failure would be limited to loss of the dam, loss of livestock, damages to farm outbuildings, agricultural lands, and lesser used roads, and where loss of human life is considered unlikely.

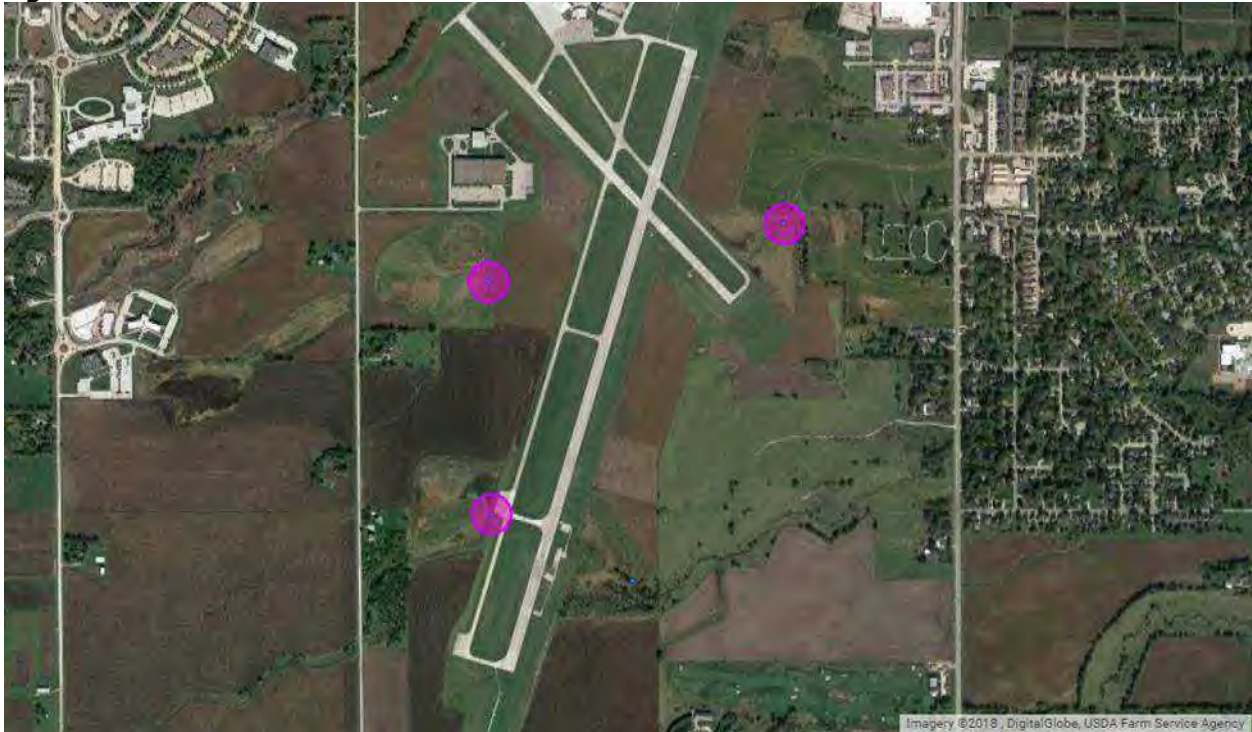
Source: Iowa Department of Natural Resources; *the term "moderate" is used by the Iowa Department of Natural Resources. However, the National Inventory of Dams uses the term "significant" to identify the same general hazard classification

For this plan update, both the National Inventory of Dams as well as the State-regulated dam inventory were consulted. There are 34 dams inside the county boundaries of Story County, including 3 high hazard dams and 4 moderate hazard dams.

In addition to these structures, there are several low head dams in Story County. The North River Valley Park Dam is not classified as a high or significant hazard dam, but its failure could present a significant problem to the City of Ames if it occurred during drought conditions. During drought conditions, the City pumps water from Ada Hayden Lake to the Skunk River, which pools above the low-head dam, recharging the aquifer. If the dam were to fail, it could threaten the City's ability to provide water during an extreme drought.

Table 3.27 provides the names, locations, and other pertinent information for all dams in the planning area. Aerial images of the high hazard dams are provided in Figure 3.6.

Figure 3.6: Ames Basin #2, Ames Basin #3, Ames Basin #4



Source: National Inventory of Dams

Dams Upstream of the Planning Area

Iowa DNR reported that there are no dams upstream of Story County that could be expected to impact County assets.

Table 3.27: Dams in the Story County Planning Area

Dam Name	NID #	Hazard Class	EAP	Dam Ht. (ft.)	Max Storage (acre-ft.)	Normal Storage (acre-ft.)	River	Nearest Downstream City/Distance (miles)
Ames Basin #2	IA02392	H	N	13	155	0	Tr- Skunk R.	Ames (0)
Ames Basin #3	IA02393	H	N	10	66	0	Tr- Skunk R.	Ames (0)
Ames Basin #4	IA02394	H	N	12	129	0	Tr- Skunk R.	Ames (0)
Arnold Lake Dam	IA01022	L	NR	36	49	35	Tr-Skunk River	Ames (1)
Ballard Country Club Dam	IA01706	L	NR	33	84	50	Tr-Ballard Creek	Cambridge (3)
Black Dam	IA02102	L	NR	42	88	43	Tr-South Skunk River	South Skunk River (I)
Carver Dam	IA02577	L	NR	26	57	28	Tr- Walnut Creek	Cambridge (6)
Dakins Lake Dam	IA04230	S	NR	39.5	406	238	Tr-Minerva Creek	Zearing (1)
Dakins Lake Dam (original dam)	IA01957	S	NR	24	77	35	Tr-Minerva Creek	Zearing (1)
Elliott Dam	IA01015	L	NR	30	54	29	Tr-Skunk River	Cambridge (4)
Groseclose Dam	IA01018	L	NR	29	109	57	Tr-Skunk River	Colfax (28)
Hansen Dam	IA02052	L	NR	25	50	32	Tr-Willow Creek	Mingo (13)
Hertz Dam	IA01026	L	NR	32	82	53	Tr-East Indian Creek	Maxwell (8)
Hickory Grove Lake Dam	IA01019	S	NR	56	3410	2141	Tr-East Indian Creek	Maxwell (10)
Indian Creek Country Club	IA02168	L	NR	32	77	39	Tr-W. Br. Indian Cr.	Maxwell (8)
Iowa Noname50	IA01012	L	NR	24	60	16	Tr-East Indian Creek	Maxwell (11)
ISU Dam	IA01027	L	NR	37	170	81	Tr- Skunk River	Ames (5)
Jennett Dam	IA02051	L	NR	32	51	30	Tr-West Indian Creek	Maxwell (5)
Larkin Dam	IA01017	L	NR	30	38	25	Tr-Skunk River	Colfax (28)
McDaniel Dam	IA01023	L	NR	38	179	147	Tr-West Indian Creek	Maxwell (5)
McFarland Lake Dam	IA01016	L	NR	27	99	56	Tr-Skunk River	Ames (6)
Northridge Heights Dam	IA03541	S	NR	19	55	26	Tr- Squaw Creek	Ames (0)

Dam Name	NID #	Hazard Class	EAP	Dam Ht. (ft.)	Max Storage (acre-ft.)	Normal Storage (acre-ft.)	River	Nearest Downstream City/Distance (miles)
Olson Dam	IA01013	L	NR	24	131	14	Tr-Skunk River	Cambridge (2)
Percival/Putnam Dam	IA01255	L	NR	26	43	20	Tr-Willow Creek	Mingo (8)
Rasmussen Dam	IA01020	L	NR	28	71	41	Tr-East Indian Creek	Maxwell (8)
Readhead Dam	IA03091	L	NR	34	67	47	Tr- East Indian Creek	Maxwell (4)
Reichard Dam	IA01968	L	NR	27	172	71	Tr-South Skunk River	Cambridge (2)
Rolling Hills Dam #1	IA01726	L	NR	37	83	59	Tr-Rock Creek	Maxwell (2)
Rolling Hills Dam #2	IA01728	L	NR	40	134	92	Tr-Rock Creek	Maxwell (2)
Smith Dam	IA01014	L	NR	33	72	44	Tr-East Indian Creek	Maxwell (9)
Stoeffer Dam	IA02523	L	NR	27	17	9	Tr- Indian Creek	Mingo (10)
Stratton Dam	IA01556	L	NR	39	50	31	Tr-Mud Creek	Clyde (3)
Three D Dam	IA01028	L	NR	34	209	96	Tr-Nest Indian Creek	Maxwell (11)
Twin Anchors Lake Dam	IA01025	L	NR	42	67	55	Tr-Dye Creek	Maxwell (12)

Source: Iowa Department of Natural Resources; L= Low; S= Significant; H= High; EAP = Emergency Action Plan; NR= Not Required; N/A = Not Available;

Levees in Planning Area

The National Levee Database (NLD) was consulted to identify levees in the planning area. The NLD does not list any levees in Story County. The 2014 Story County Hazard Mitigation Plan identified known levees in unincorporated Story County and the City of Cambridge. These flood protection structures are discussed in the 2014 Story County Flood Insurance Study (FIS) as follows:

- **Unincorporated County:** A few levees are constructed along Indian Creek. There is also a levee located along the north side of Fourmile Creek just south of Slater. These levees do not meet minimum FEMA requirements for flood protection and consequently the levees are not shown as providing protection from a 100-year flood on the Digital Flood Insurance Rate Maps (DFIRM).
- **City of Cambridge:** Ballard Creek flows across the northeast quadrant of Cambridge in a straightened and leveed channel, to a former channel of the south Skunk River. This former channel has also been straightened and leveed to serve as a new channel for Ballard Creek. The straightened and leveed reach conducts Ballard Creek southeast to the confluence with the South Skunk River, directly east of Cambridge. Again, this leveed channel does not meet minimum FEMA requirements for flood protection and is consequently not shown as providing flood protection on the DFIRM.

Previous Occurrences

Dam Failure

To determine previous occurrences of dam failure within Story County, the *2014 Story County Iowa Multi-Jurisdictional Hazard Mitigation Plan*, the *Iowa State Hazard Mitigation Plan*, and Stanford University's National Performance of Dams Program (<https://npdp.stanford.edu/>) were reviewed for historical dam failures. No record of dam failure within Story County boundaries was found.

Probability of Future Occurrence

Based on past performance, the Hazard Mitigation Planning Committee determined that the probability of future occurrence of dam failure is unlikely. Levee failure is unlikely given the lack of previous failures and the limited presence of levees in the county. A flood event surrounding the levees may occur, given that the structures identified would be overtopped by a 1-percent-annual-chance flood event, however these events will be discussed in the Flash Flooding and River Flooding sections.

Probability Score: 1--Unlikely

Vulnerability

Overview

Dam or levee failure is typically an additional or secondary impact of another disaster such as flooding or earthquake.

Major structures, most which are high or moderate hazard state-regulated dams, are routinely inspected every three to five years by the Iowa Department of Natural Resources.

The most recent inspection reports were provided for the following dams:

Ames Basin #2—5/25/2016, satisfactory rating indicating the dam is expected to have safe performance. However, rodent holes were spotted along the upstream slope and on the crest of the dam and require filling in to prevent further damage. Additionally, grass was very long and needs regular maintenance to prevent large brush and trees from growing. Some erosion along the toe of the dam was also noted.

Ames Basin #3—5/25/2016, satisfactory rating indicating the dam is expected to have safe performance. However, trees and brush growing around the outlet of the pipe need to be removed.

Ames Basin #4—5/25/2016, satisfactory rating indicating the dam is expected to have safe performance. Some improvements and maintenance are recommended. A 10-foot by 15-foot by 2-foot depression was noted in the embankment. There are also numerous animal burrows in the top of the dam.

Dakins Lake Dam—3/21/2014, satisfactory rating overall; normal operational and maintenance procedures should continue, including keeping the embankment well vegetated, clear of trees and brush, and free of surface erosion as well as keeping the spillway clear of obstructions.

Hickory Grove Lake Dam—10/02/2013, overall satisfactory rating along with recommendations for maintenance. Ongoing maintenance needs include keeping the embankment well vegetated, clear of trees and brush, and free of surface erosion; keeping the spillway clear of obstructions. Specific maintenance needs include placing earthfill across a low area on the top of the dam to return it to its constructed elevation, removing logs and other debris from around the spillway inlet, and operating the low level gate annually as well as performing needed maintenance on the gate.

Low Hazard state-regulated dams are not necessarily inspected regularly by the Iowa Department of Natural Resources. These structures are not expected to cause serious damage or any loss of life in the event of a failure, however, because they are not regularly inspected, it is unknown whether increased settlement since the dam's construction may have resulted in increased exposure and hazard risk.

A magnitude rating of "limited" is appropriate due to the physical vulnerability to dam or levee failure and the potential for dam or levee failure to result in the loss of life.

Magnitude/Severity Score: 2—Limited

Potential Losses to Existing Development

The jurisdictions that would be impacted in the event of failure of the high or significant hazard dams are provided in Table 3.28 relative to the applicable flood protection structure. The 2014 Story County Hazard Mitigation Plan was referenced for downstream assets at risk based on inspection reports. No additional information on downstream assets at risk was available in more recent inspection reports reviewed for this plan update.

Dam Failure

Table 3.28: Jurisdictions & Downstream Assets at Risk to Dam Failure in Story County, Iowa

Jurisdictions at Risk (miles from dam)	Dam Name	Hazard Class	River	Assets Downstream
Ames (0)	Ames Basin #2	H	Tr- Skunk R.	1,200 ft. of airport runways; 2,200 ft. of Ames Basin #3; 3,700 ft. of Highway 69; 5,000 ft. of residential development
Ames (0)	Ames Basin #3	H	Tr- Skunk R.	1,500 ft. of Highway 69; 2,800 ft. of residential development east of highway
Ames (0)	Ames Basin #4	H	Tr- Skunk R.	4,500 ft. of Highway 69; residential development east of highway
Zearing (1)	Dakins Lake Dam	S	Tr-Minerva Creek	
Maxwell (10)	Hickory Grove Lake Dam	S	Tr-East Indian Creek	
Ames (0)	Northridge Heights Dam	S	Tr- Squaw Creek	

Source: National Inventory of Dams; Iowa Department of Natural Resources

Based on the definition of high hazard dams, failure of these dams could create a serious threat of loss of human life or result in serious damage to residential, industrial, or commercial areas, important public utilities, public buildings, or major transportation facilities. For the significant hazard dams, failure could result in damage to isolated homes or cabins, industrial or commercial buildings, moderately traveled roads or railroads, or interrupt major utility services, but without substantial risk of loss of human life.

Based on dam hazard class and distance to nearest jurisdiction, the City of Ames faces the greatest risk of dam failure followed the City of Zeoring and the City of Maxwell. Those school districts with structures in these jurisdictions—Ames, Colo-Nesco, and Collins-Maxwell—may also be vulnerable to dam failure.

Inundation maps for high and significant hazard dams were not available from Iowa DNR; therefore, a detailed assessment of assets at risk to inundation could not be performed.

Levee Failure

As noted in the 2014 Story County Hazard Mitigation Plan, if the Ballard Creek levee system in Cambridge were to fail, there would be damage to the buildings and infrastructure on both sides of the project. If the levees along Indian Creek or Fourmile Creek in the unincorporated county were to fail, damages associated to the failure/overtopping would impact those areas behind the levees. Since the specific protected area has not been designated on the Digital Flood Insurance Rate Map, it is not possible to estimate specific losses. However, a 2008 flood event demonstrated that properties, including residences could be damaged in the event of failure or overtopping of the leveed channel in Cambridge.

Future Development

Future development located downstream from dams in floodplains or inundation zones and/or in levee protected areas would increase vulnerability to dam or levee failure. According to data on housing and population growth as well as development reported by committee members, the City of Ames has been experiencing significant growth and Ames School District has built several new buildings. The City of Zeoring has experienced only limited growth, while the City of Maxwell's population and housing unit numbers are declining.

Climate Change Impacts

Increased frequency of precipitation and precipitation extremes leading to flooding could cause additional stress on dam and levee structures.

Dam/Levee Failure Hazard Summary by Jurisdiction

The magnitude of "catastrophic" was assigned to the jurisdictions downstream of high hazard dams or in levee protected areas, or both, due to the potential for loss of life in the unlikely event of failure of any of these flood control structures. A magnitude of "limited" was assigned to jurisdictions downstream of significant hazard dams. For jurisdictions that would be impacted by failure of low hazard dams or levees or that would not be impacted by any dams or levees, this hazard was determined to be "not applicable".

Jurisdiction	Probability	Magnitude	Warning Time	Duration	Score	Level
Story County, Iowa	1	2	4	4	2.05	Moderate
City of Ames	1	4	4	4	2.65	Moderate
City of Cambridge	N/A	N/A	N/A	N/A	N/A	N/A
City of Collins	N/A	N/A	N/A	N/A	N/A	N/A
City of Colo	N/A	N/A	N/A	N/A	N/A	N/A
City of Gilbert	N/A	N/A	N/A	N/A	N/A	N/A
City of Huxley	N/A	N/A	N/A	N/A	N/A	N/A
City of Kelley	N/A	N/A	N/A	N/A	N/A	N/A
City of Maxwell	1	2	4	4	2.05	Moderate
City of McCallsburg	N/A	N/A	N/A	N/A	N/A	N/A
City of Nevada	N/A	N/A	N/A	N/A	N/A	N/A
City of Roland	N/A	N/A	N/A	N/A	N/A	N/A
City of Sheldahl	N/A	N/A	N/A	N/A	N/A	N/A
City of Slater	N/A	N/A	N/A	N/A	N/A	N/A
City of Story City	N/A	N/A	N/A	N/A	N/A	N/A
Ames Schools	1	2	4	4	2.05	Moderate
Ballard Schools	N/A	N/A	N/A	N/A	N/A	N/A
Collins-Maxwell Schools	1	2	4	4	2.05	Moderate
Colo-Nesco Schools	1	2	4	4	2.05	Moderate
Gilbert Schools	N/A	N/A	N/A	N/A	N/A	N/A
Nevada Schools	N/A	N/A	N/A	N/A	N/A	N/A
Roland-Story Schools	N/A	N/A	N/A	N/A	N/A	N/A
Iowa State University	N/A	N/A	N/A	N/A	N/A	N/A

3.5.3 Drought

Hazard Score Calculation					
Probability	Magnitude/Severity	Warning Time	Duration	Weighted Score	Level
3	2	1	4	2.5	Moderate

Profile

Hazard Description

Drought is generally defined as a condition where moisture levels are significantly below normal for an extended period of time and over a large area, which in turn adversely affects plants, animal life, and humans. There are four types of drought conditions relevant to Iowa:

Meteorological drought is defined on the basis of the degree of dryness (in comparison to some “normal” or average amount) and the duration of the dry period. A meteorological drought must be considered as region-specific since the atmospheric conditions that result in precipitation deficiencies are highly variable from region to region.

Hydrological drought is associated with the effects from periods of precipitation shortfalls (including snowfall) on surface or subsurface water supply (e.g., streamflow, reservoir and lake levels, ground water). The frequency and severity of hydrological drought is often defined on a watershed or river basin scale. Although all droughts originate with a deficiency of precipitation, hydrologists are more concerned with how this deficiency plays out through the hydrologic system. Hydrological droughts are usually out of phase with or lag the occurrence of meteorological and agricultural droughts. It takes longer for precipitation deficiencies to show up in components of the hydrological system such as soil moisture, streamflow, and ground water and reservoir levels. As a result, these impacts are out of phase with impacts in other economic sectors.

Agricultural droughts focus on soil moisture deficiencies, differences between actual and potential evaporation, reduced ground water or reservoir levels, and so forth. Plant water demand depends on prevailing weather conditions, biological characteristics of the specific plant, its stage of growth, and the physical and biological properties of the soil.

Socioeconomic drought refers to the effects on people from physical water shortages.

The four different types of drought can all occur 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 flow rights. An agricultural drought represents difficulty for Iowa’s agricultural-based economy but is relatively easy to monitor based on crop viabilities for different regions.

The National Drought Mitigation Center (NDMC), located at the University of Nebraska in Lincoln, provides a clearinghouse for information on the effects of drought, based on reports from media, observers, impact records, and other sources. NDMC’s website is found at <http://www.drought.unl.edu/>. Specific drought impacts by county are recorded at <http://droughtreporter.unl.edu/>.

The NDMC categorizes impacts of drought as 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. Droughts also bring increased problems with insects and disease to forests, frequently

reducing growth potentials. 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. Income loss is another indicator used in assessing the impacts of drought because so many sectors are affected.

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.

Additionally, drought can have cascading impacts, including the prevalence of grass fires caused in ditches, grass, and fields. Grass and Wildland Fire is discussed further in Section 3.5.8.

Warning Time Score: 1—24+ Hours

Duration Score: 4—more than 1 week

Geographic Location/Extent

According to the 2012 Census of Agriculture (the latest published, accessible at https://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_2_County_Level/Iowa/st19_2_001_001.pdf), of the 367,360 total acres of land area in Story County, about 83.3% (306,000 acres) of that is utilized for farming and agricultural purposes. There were 966 farms with an average size of 317 acres per farm. Although the entire planning area in Story County is at risk to drought, the agricultural areas are more vulnerable to the immediate effects of drought. The map in Figure 3.2 in the Animal/Plant/Crop Disease hazard section displays the locations of various cropland uses in Story County.

Previous Occurrences

Based on the National Centers for Environmental Information from NOAA, the mean annual precipitation for Story County is approximately 32 inches, based on the record range from 1895 to 2018. This total comes close to the State average of approximately 34 inches per year, representing enough rainfall to prevent drought. However, successive years of below-average rainfall are the cause of drought impacts in the planning area.

Table 3.29 provides the rainfall history at the Iowa – Central Climate Division weather station from 1893 to December 2017 (obtained from the Iowa Environment Mesonet). Rainfall totals for complete years with less than 32 inches of total rain are highlighted in blue. The lowest annual precipitation on record occurred in 1988, with a total of 18.73 inches.

Table 3.29: Monthly and Annual Precipitation Totals, 1893 to 2017, Central Climate Division – Iowa Weather Station

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
1893	0.58	1.02	1.66	4.39	2.95	3.74	3.02	1.68	1.67	0.52	1.35	1.23	23.81
1894	1.23	1.19	1.73	2.37	1.61	2.19	0.44	1.43	3.86	2.36	0.91	1	20.32
1895	1.08	0.55	0.7	2.88	3.18	4.72	3.25	3.63	2.89	0.35	1.31	1.83	26.37
1896	0.54	0.68	1.13	4.21	6.21	2.99	7.06	4.23	4.13	2.89	1.29	0.57	35.93
1897	2.11	0.8	2.44	5.89	1.98	3.7	3.22	1.79	1.69	0.86	0.65	1.78	26.91
1898	1.72	1.21	2.08	2.72	4.51	5.56	2.19	2.47	2.64	3.68	1.64	0.54	30.96
1899	0.28	0.87	1.5	2.42	6.64	4.22	3.12	3.56	1.17	1.19	1.42	1.85	28.24
1900	0.64	1.12	2.75	3.11	3.72	4.24	5.49	5.91	4.3	3.9	1.03	0.43	36.64
1901	0.92	1.14	2.69	1.96	1.95	3.34	2.24	0.9	3.43	2.02	0.71	0.95	22.25
1902	0.87	0.7	1.45	1.64	5.26	6.94	7.07	6.95	4.41	2.87	1.83	1.99	41.98
1903	0.33	1.2	1.26	2.47	8.81	2.62	4.58	6.09	2.79	1.72	0.44	0.45	32.76
1904	1.3	0.42	1.92	4.35	3.69	2.56	5.38	3.03	2.65	1.46	0.13	1.79	28.68

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
1905	0.96	1.36	2.06	3.05	5.12	5.52	3.91	4.48	3.71	3.46	2.62	0.74	36.99
1906	2.14	1.22	2.21	2.61	2.69	3.42	2.95	4.11	3.32	1.49	1.74	1.49	29.39
1907	1.47	0.77	1.62	1.56	3.68	4.89	8.01	4.9	2.7	1.52	0.91	1.04	33.07
1908	0.36	1.69	1.52	2.44	8.73	5.66	2.83	5.31	1.11	3.14	1.43	0.4	34.62
1909	1.76	1.6	1.53	4.87	3.89	6.57	4.32	1.22	2.89	2.46	4.58	2.46	38.15
1910	1.69	0.47	0.25	1.68	3.42	2.29	1.39	3.08	3.6	0.72	0.26	0.46	19.31
1911	1.13	2.77	1	3.71	3.23	1.33	2.14	3.12	5.92	3.15	1.7	2.7	31.9
1912	0.53	1.39	2.3	2.49	3.81	2.61	3.82	4.05	4.19	3.27	1.07	0.6	30.13
1913	0.89	0.82	3	3.06	5.74	3.23	1.4	2.73	3.09	2.89	1.2	1.19	29.24
1914	0.89	1.03	1.49	2.05	3.87	4.89	1.58	2.01	11.04	3.45	0.28	1.33	33.91
1915	1.77	2.97	1	1.33	7.6	4.25	8.84	2.43	5.86	0.8	1.85	0.74	39.44
1916	2.81	0.54	1.02	2.42	4.37	3.15	1.62	2.68	3.07	2.4	1.5	0.87	26.45
1917	0.67	0.39	1.78	4.72	3.78	7.64	1.73	2.03	2.65	1.31	0.23	0.58	27.51
1918	0.93	1.11	0.45	2.05	6.03	5.56	2.42	2.75	1.37	3.54	2.09	1.28	29.58
1919	0.17	2.64	2.93	4.71	3.1	6.32	2.6	2.38	6.67	2.99	3.45	0.7	38.66
1920	0.4	0.57	3.18	4.27	3.26	2.37	4.77	2.58	3.16	1.89	1.86	1.2	29.51
1921	0.62	0.76	1.63	3.41	3.51	4.04	2.55	5.57	6.93	1.79	0.65	0.96	32.42
1922	0.75	1.43	2.24	2.94	5.18	1.55	6.59	4.3	2.59	2.44	3.06	0.29	33.36
1923	0.82	0.29	3.3	1.9	3.52	4.8	1.46	5.66	5.38	1.28	0.48	0.77	29.66
1924	0.84	1.6	2.89	1.11	1.7	8.23	3	4.94	2.99	0.83	0.56	1.76	30.45
1925	0.43	0.82	0.74	1.93	0.99	6.3	2.47	4.22	4.55	3.04	0.64	1.56	27.69
1926	1.04	0.88	1.23	1.1	2.39	4.82	3.86	3.29	9.96	1.47	2.45	1.07	33.56
1927	0.33	1.23	2.25	4.64	4.54	1.57	2.17	2.12	4.26	2.75	0.93	1.23	28.02
1928	0.19	2.32	1.55	2.32	2.53	5.96	4.72	7.13	2.65	3.52	4.55	1.03	38.47
1929	2.34	1.55	1.53	4.51	2.37	2.68	4.08	2.49	4.21	2.9	1.55	0.31	30.52
1930	1.41	0.65	0.98	2.69	3.62	4.75	1.29	1.66	1.83	2.31	1.87	0.51	23.57
1931	0.55	0.25	1.78	1.98	2.84	4.75	3.02	3.35	5.9	3.16	6.22	2.85	36.65
1932	1.88	0.92	1.37	1.5	3.58	4.31	2.95	7.89	2.02	1.63	1.82	1.72	31.59
1933	1.03	0.34	2.92	1.12	4.03	1.2	3.8	2.54	3.15	2.24	0.25	0.99	23.61
1934	0.98	0.63	1.24	1.02	1.08	3.28	3.38	2.26	5.62	1.54	4.44	0.54	26.01
1935	1.31	1.24	1.57	1.55	5.76	7.34	3.32	2.19	4.61	2.92	2.77	0.87	35.45
1936	1.75	1.18	1.45	1.25	2.26	3.58	0.46	3.15	7.83	1.19	0.65	1.54	26.29
1937	1.96	0.89	1.6	3.39	5.03	4.12	1.68	3.19	1.46	1.8	0.76	0.78	26.66
1938	1.48	0.95	2.46	3.19	5.24	3.6	3.5	3.32	4.21	1.11	2.68	0.76	32.5
1939	1.02	1.82	1.89	1.86	2.25	5.97	3.63	4.79	0.99	1.24	0.54	0.49	26.49
1940	0.8	1.44	1.54	3.28	2.04	2.71	4.51	7.58	1.01	2.01	2.33	1.37	30.62
1941	2.13	0.49	0.96	2.22	2.88	6.09	1.85	2.08	8.3	6.74	1.64	2.3	37.68
1942	1.13	1.23	1.79	1.04	5.41	6.65	5.89	2.87	3.62	1.87	2.17	1.59	35.26
1943	0.77	0.77	1.75	2.8	4.35	6.33	4.95	5.46	2.11	1.23	0.98	0.59	32.09
1944	1.14	0.9	2.31	4.47	6.46	5.75	2.95	5.31	2.4	0.94	1.54	1.42	35.59
1945	0.71	1.54	3.81	4.73	6.18	4.36	2.54	3.13	5.42	0.33	1.29	2.58	36.62
1946	2.37	0.34	4.28	1.33	3.76	6.53	2.13	4.45	4.14	3.56	1.36	0.5	34.75
1947	1.51	0.21	1.66	5.3	4.78	11.91	1.22	1.41	1.74	5.04	1.57	1.63	37.98
1948	0.33	1.94	3.21	2.41	2.21	3.76	5.37	1.78	1.6	1.71	3.11	1.41	28.84
1949	3.16	0.93	2.31	1.08	1.94	5.11	3.45	2.18	2.92	1.74	0.53	0.99	26.34
1950	1.41	1.73	0.88	2.64	5.33	5.36	3.52	2.17	1.67	1.21	0.49	0.53	26.94
1951	0.49	2.46	4.21	4.66	4.6	5.54	4.22	5.58	2.08	3.2	1.35	0.93	39.32
1952	1.18	0.56	3.68	1.56	3.9	5.87	3.43	4.25	0.59	0.02	3.14	1.06	29.24
1953	0.75	1.56	2.54	2.92	2.35	5.3	2.83	1.24	0.75	0.25	1.28	0.92	22.69
1954	0.13	1.36	1.65	4.11	3.98	6.83	1.2	10.31	2.37	3.85	0.14	0.65	36.58

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
1955	0.82	1.25	0.89	3.3	3.22	1.87	3.73	1.94	3.62	0.97	0.16	0.4	22.17
1956	0.38	0.36	0.61	1.72	3.15	2.17	3.71	4.17	2.13	1.73	1.74	0.45	22.32
1957	0.55	0.23	1.73	2.45	5.06	4.86	3.71	3.57	2.19	2.58	2.29	0.96	30.18
1958	0.63	0.33	0.52	1.71	1.83	4.51	8.74	2.21	3.61	0.68	1.75	0.21	26.73
1959	0.76	1.14	3.5	3.2	6.87	3.56	2.52	3.3	3.78	2.13	2.37	1.45	34.58
1960	2.65	1.18	1.52	3.37	6.5	3.32	2.61	5.56	3.47	1.87	0.54	0.62	33.21
1961	0.23	2.16	4.33	2.15	1.68	3.35	5.92	2.59	7.91	2.78	2.6	1.54	37.24
1962	0.4	1.83	1.45	1.82	5.54	2.96	5.14	2.54	1.8	2.61	0.43	0.29	26.81
1963	0.63	0.56	2.43	4.16	3.26	1.78	4.68	5.08	1.99	0.97	1.3	0.47	27.31
1964	0.39	0.25	1.14	5.03	3.99	5.48	4.61	3.69	3.84	0.25	0.92	0.91	30.5
1965	1.29	1.36	2.94	4.63	4.19	4.47	2.42	3.67	8.71	0.94	1.47	1.6	37.69
1966	1.04	0.46	2.03	1.51	4.83	6.18	2.29	2.29	0.67	0.99	0.43	0.77	23.49
1967	1.02	0.36	1.73	2.86	2.43	9.1	1.53	2.07	2.25	2.28	0.44	0.68	26.75
1968	0.71	0.15	1.12	4.81	2.06	3.92	3.62	3.76	3.2	2.99	1.22	1.96	29.52
1969	1.34	1.11	1.06	4.03	3.72	6.93	7.01	2.84	2.85	3.45	0.13	1.32	35.79
1970	0.21	0.07	2.58	1.85	5	2.75	3.09	5.16	5.24	4.21	1.67	1	32.83
1971	1.25	2.48	0.62	1.2	3.88	3.87	3.06	0.97	1.76	3.36	2.96	1.33	26.74
1972	0.45	0.88	0.99	3.02	4.39	5.15	4.64	5.02	5.25	3.21	2.53	1.73	37.26
1973	1.53	1.78	3.43	3.83	5.95	3.13	5.63	2.49	6.71	2.52	1.97	2.33	41.3
1974	1.31	0.75	1.4	4.21	7.81	5.22	2.07	4.54	1.97	3.88	1.43	1.33	35.92
1975	1.27	1.17	2.05	3.23	3.08	6.56	0.71	4.85	1.93	0.28	3.22	0.58	28.93
1976	0.12	1.89	3.2	5.72	3.2	4.39	2.14	1.08	0.8	1.18	0.04	0.28	24.04
1977	0.41	0.37	3.64	2.01	2.2	1.8	3.56	9.98	4.27	4.89	0.73	1.09	34.95
1978	0.59	0.86	0.6	4.8	3.1	4.1	5.1	3.41	6.53	1.31	2.69	0.95	34.04
1979	1.43	0.38	3.48	3.61	2.88	4.58	3.91	5.59	1.24	3.61	1.63	0.36	32.7
1980	1.43	0.68	0.7	1.14	2.43	5.05	1.88	5.66	1.96	1.82	0.37	0.71	23.83
1981	0.07	1.35	0.48	2.74	1.78	4.84	4.31	4.87	2.46	2.1	1.94	1.09	28.03
1982	2.03	0.38	2.71	2.89	7.18	3.01	6.34	3.45	2.99	3.48	2.94	3.44	40.84
1983	0.81	1.28	3.39	2.96	5.24	5.33	3.42	3.22	3.77	4.62	5.27	0.92	40.23
1984	0.6	0.9	1.65	6.16	4.54	6.1	5.54	0.45	2.8	4.4	2.16	1.75	37.05
1985	0.66	1.2	2.36	1.25	2.06	3.25	2.15	3.46	4.92	3.02	1.35	1.3	26.98
1986	0.18	1.24	2.05	4.51	5.54	6.36	4.5	3.99	6.37	3.68	1.19	0.83	40.44
1987	0.27	0.24	2.87	2.2	3.51	2.35	5.24	9.1	2.03	0.76	2.72	1.76	33.05
1988	0.39	0.4	0.58	1.29	1.51	1.43	2.33	3.66	3.4	0.5	2.67	0.57	18.73
1989	1.04	0.6	0.6	1.67	3.38	3.26	3.35	3.39	3.98	2.62	0.12	0.29	24.3
1990	0.7	0.48	5.16	2.33	6.31	8.68	7.12	3.36	1.4	1.73	1.57	1.43	40.27
1991	0.86	0.15	4.64	7.66	5.64	4.18	1.29	4.06	2.7	3.23	3.96	1.65	40.02
1992	0.94	1.46	1.98	3.76	1.35	1.15	9.23	2.01	4.77	0.56	4.8	1.72	33.73
1993	1.07	1.17	3.29	2.92	5.88	7.22	10.79	10.8	3.91	1.47	0.91	0.6	50.03
1994	1.13	1.16	0.11	2.09	2.16	5.88	2.92	3.55	3.97	2.03	1.83	1.31	28.14
1995	0.85	0.38	2.78	5.17	5.02	3.51	3.58	3.11	2.79	1.43	1.84	0.4	30.86
1996	2.02	0.28	1.33	1.51	7.28	4.99	3.31	2.95	3.15	2.79	2.92	0.87	33.4
1997	0.84	1.28	1.45	2.52	4.13	4.39	2.35	2.06	2.99	4.25	1.15	1.07	28.48
1998	0.94	1.71	3.45	2.97	4.92	9.82	3.56	4.74	1.31	4.5	1.3	0.29	39.51
1999	1.06	0.87	1.04	5.78	5.08	5.78	4.03	4.14	1.64	0.4	1.06	0.53	31.41
2000	0.61	1.26	0.75	1.47	3.75	6.53	4.47	2.04	1.47	1.45	2.1	1.72	27.62
2001	1.47	1.92	1.24	3.13	6.48	3.42	1.94	3.1	4.36	2.41	1.03	0.66	31.16
2002	0.3	0.92	0.84	3.8	3.96	3.1	4.79	5.63	1.64	3.43	0.19	0.1	28.7
2003	0.35	0.9	0.92	4.03	5.27	4.93	4.39	0.73	3.09	1.16	4.65	1.11	31.53
2004	0.99	1.47	3.67	2.04	7.89	3.16	3.72	5.11	1.34	1.5	2.6	0.48	33.97

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
2005	1.11	1.6	1.14	3.63	4.24	5.45	3.73	2.99	2.87	0.59	1.7	1.18	30.23
2006	0.66	0.21	3.11	3.84	2.65	1.35	4.68	6.03	5.03	1.79	1.87	2.14	33.36
2007	0.96	1.84	2.56	5.72	5.81	3.16	3.09	9.16	2.96	5.4	0.19	2.38	43.23
2008	0.54	1.69	1.25	6.42	6.11	9.74	7.59	1.76	3.57	3.2	2.11	1.63	45.61
2009	0.85	0.46	3.73	4.67	3.45	5.47	3.03	5.79	2.02	6.43	0.99	2.64	39.53
2010	1.35	1	1.57	4.02	4.4	11.02	8.5	7.27	5.67	0.54	1.97	0.49	47.8
2011	0.42	0.59	1.34	3.04	4.09	6.55	3.09	3.16	1.62	1.12	2.01	2.11	29.14
2012	1.78	1.4	1.79	3.56	2.34	1.76	1.08	1.76	1.38	2.85	0.91	1.11	21.72
2013	0.75	1.3	2.02	5.91	8.92	4.41	1.55	0.86	1.99	2.56	1.7	0.58	32.55
2014	0.25	1.78	0.89	5.32	3.7	9.76	4.2	6.17	5	3.59	0.73	1.16	42.55
2015	1.04	1.37	0.63	3.82	4.75	6.93	5.53	6.72	3.61	1.51	3.82	5.64	45.37
2016	0.95	1.63	2.52	2.45	3.81	2.97	5.35	5.61	5.97	1.25	1.3	1.47	35.28
2017	2.04	1.34	2.83	3.81	5.08	2.88	2.1	4	2.42	5.29	0.41	0.77	32.97
MEAN	1.00	1.06	1.95	3.10	4.14	4.66	3.72	3.82	3.43	2.29	1.67	1.16	32.01

Source: Iowa Environmental Mesonet, Report generated April 2018.

<https://mesonet.agron.iastate.edu/climodat/index.phtml?network=IACIMATE&station=IAC005&report=17>

According to the National Drought Mitigation Center's Drought Impact Reporter, during the 10-year period from January 2008 through December 2017, 120 listed drought impacts were noted for the State of Iowa. Of these impacts, 5 were reported to affect Story County. The following are the categories and reported number of impacts. Note that some impacts have been assigned to more than one category, and hence show duplicated:

- Agriculture – 4
- Relief, Response & Restrictions – 3
- Water Supply & Quality – 2

The impacts of recent drought periods in Iowa that affected Story County (from 2008 to 2017) are provided below.

July 2016 – Corn yield potential went down throughout Iowa, starting early July of 2016 and still ongoing. This event affects both agriculture and the water supply and quality systems.

September 2013 – Thirty-five Iowa counties, including Story County, received authorization from the Farm Service Agency for emergency haying and grazing, as hot and dry weather was heavily affecting the agriculture sector as well as relief, response, and restrictions services. The event took place from September 7, 2013 to the 29th of that month.

July 2013 – Soybean and corn crops were suffering from inadequate rain near Nevada, in Story County. This event began July 22, 2013 and lasted for an unspecified amount of time, hurting the agricultural sector.

January 2013 – Drought-related USDA disaster declarations in 2013 impacted the agricultural sector as well as relief, response, and restrictions services. This event took place from January 8, 2013 to May 15, 2013.

July 2012 – This event hurt relief, response, and restrictions services as well as the water supply and quality near Ames, Story County, as water transfers in that city needed to be conducted to bolster groundwater recharge rates. The event began July 26, 2012, lasting for an unknown amount of time.

Losses due to drought reported on the National Centers for Environmental Information (from NOAA) Storm Events database total \$12,650,000 in property damage and \$93,070,000 in crop damage for Story County, Iowa. The 9 events logged in the system date from August 2000 to August of 2013, though the entire period of recorded history was queried against the database (1950 to 2017).

Table 3.30, provided by the U.S. Drought Monitor, summarizes the historical drought conditions for Story County by intensity and percent area from 2008 through 2017. Portions of the county were in extreme drought intensity as recently as 2012.

Table 3.30: Historic Drought Intensity (Percent Area) in Story County, Iowa 2008-2017

Drought Intensity	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2008 - 2017 Average
None	100	100	100	64.95	35.64	21.93	68.62	100	83.57	65.06	73.93
D0 Abnormally Dry	0	0	0	35.05	64.36	78.07	31.38	0	16.43	34.94	26.07
D1 - Moderate	0	0	0	21.89	53.69	69.52	26.92	0	3.50	20.92	19.7
D2 - Severe	0	0	0	0.28	46.05	61.30	12.44	0	0	0	12.08
D3 - Extreme	0	0	0	0	41.95	0	0	0	0	0	4.18
D4 - Exceptional	0	0	0	0	0	0	0	0	0	0	0

Source: U.S. Drought Monitor, <http://droughtmonitor.unl.edu/Data/DataDownload/ComprehensiveStatistics.aspx>

According to the USDA's Risk Management Agency (RMA), during the time period from 2007-2017, the sum of claims paid for crop damage as a result of drought in Story County was \$31,985,653, or an average of \$2,907,786 in losses every year. The 2016 Iowa Crop Insurance Profile from USDA's Risk Management Agency claims that 89% of the insurable crops in Iowa are indeed insured with USDA Crop Insurance. Table 3.31 summarizes the last eleven years' agricultural losses as reported in the RMA system:

Table 3.31: Crop Losses Resulting from Drought in Story County, Iowa 2007-2017

Year	Commodity Affected	Determined Acres	Indemnity Amount
2007	Corn, Soybeans	1,048	\$83,132
2008	Corn, Soybeans	689	\$55,846
2011	Corn, Soybeans	2,881	\$243,271
2012	Corn, Soybeans, Hybrid Cornseed, Other Crops	33,546	\$5,386,633
2013	Corn, Soybeans, Hybrid Cornseed, Other Crops	122,501	\$25,922,640
2014	Corn, Soybeans	134	\$12,964
2016	Corn	22	\$2,652
2017	Corn, Soybeans, Hybrid Cornseed	5,323	\$278,515
TOTAL		166,145	\$31,985,653

Probability of Future Occurrence

NOAA's National Climatic Data Center uses the U.S. Palmer Drought Indices and the Standardized Precipitation Index to monitor and predict drought conditions. Lack of precipitation for a given area is the primary contributor to drought conditions. Since precipitation levels cannot be predicted in the long term, the following indices can be used to determine the probability of future occurrences of drought.

- Palmer Z Index monitors short-term monthly moisture conditions when depart from normal
- Palmer Drought Severity Index measures the duration and intensity of the long-term (meteorological) drought patterns

- Palmer Hydrological Drought Index measures long-term (hydrological) drought and wet conditions reflecting groundwater and reservoir levels
- Standardized Precipitation Index is a probability index that considers only precipitation. This is important to farmers to estimate soil moisture

Overall, given the few major drought events in the county through recorded history (as noted in sources such as the Drought Impact Reporter and NOAA's NCDC), it is not predicted that drought will significantly impact the local populations or economy in future times. Major drought events are those that incur losses in property or crops, for example, and hence have a quantifiable impact on the county and its populations.

However, droughts may begin to occur more and more with warming climates due to issues such as climate change, but those relationships may need to be explored in more detail in future studies and assessments about drought hazards. In addition, based on the reported drought events, the agricultural sector does become impacted by drought, and will likely continue to suffer occasionally due to this hazard. As such, the probability of future occurrence of drought within Story County is "Likely."

Probability Score: 2—Likely

Vulnerability

Overview

Story County jurisdictions are impacted by drought because it is an expensive weather disaster; it reduces agricultural productivity and causes a strain on water supplies. In the county, farmers bear the most direct stress from drought as wells may run dry, crops wilt and die, and forage for livestock becomes scarce and costly.

Story County contains 966 farms that cover 306,000 acres of land. This translates to 83.3% of the surface land in the County being used for agriculture. Therefore, the planning area has a high exposure to this hazard. Aside from agricultural impacts, other losses related to drought include increased costs of fire suppression and damage to roads and structural foundations due to the shrink dynamic of expansive soils during excessively dry conditions. Drought also presents hazards to public health in extreme cases, where drinking water production cannot keep up with demand, for example, or even air quality decreases from added dust particles. Water wells become less productive during drought and a failure of the remaining productive wells (due to power outage, etc.) can cause public drinking water supplies to become compromised.

According to the 2014 Iowa Hazard Mitigation Plan, of the 8 hazards for which data was available to estimate annualized losses, drought ranked 2nd with \$424 million in annualized losses for the entire state, based on data spanning an 18-year period. Losses associated with this hazard can be very high, depending on the region, particularly for agriculture. Crop insurance coverage mitigates some adverse economic impacts somewhat, but secondary impacts such as reduced revenue throughout the planning region or even the state may not be as easy to mitigate. Nevertheless, Story County in particular tends to suffer less frequently from drought hazards than other counties (especially those towards the south). As such, the expected magnitude of the hazard risk is "Limited." However, it was noted by the HMPC that Ames has shallow wells which make the City more vulnerable to drought due to their more limited capacity. Other communities have deeper wells that help to mitigate the potential impacts of drought.

Magnitude Score: 2—Limited

Potential Losses to Existing Development

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. Drought has no direct effect on houses and buildings, unless the hazard is coupled with the effects of expansive soils or landslides, in which case effects could be seen indirectly in property and infrastructure by drying out of the ground, for example. Drought impacts in Story County are likely to be minimal in terms of landscaping. However, if populations were forced to reduce or even stop irrigation altogether for prolonged periods of time, landscaping and other areas frequently watered would definitely be affected.

As mentioned under the Previous Occurrences sub-section of this chapter, according to the USDA's RMA database, Story County has received payments from insured crop losses as a result of drought. This means that droughts have been severe enough to incur losses in the past, and as such, the threat is rather moderate in significance throughout the county. Future losses, even if minor, could be expected in years to come.

Future Development

Increases in acreage planted with crops would increase the exposure to drought-related agricultural losses. In addition, increases in population impose additional strains on water supply systems to meet the growing demand for treated water, and these strains could prove impactful during times of drought.

Climate Change Impacts

Many climate change studies have shown increases in precipitation, rather than decreases, especially in areas that are usually cold and humid. However, drought cycles still continue in many parts of the world. Climate change studies have also shown some increases in average temperatures and decreases in the overall number of days with precipitation, though. If this occurs during a drought cycle, the drought impacts will be exacerbated and increased agricultural and other losses will be sustained (e.g., impacting the Recreation and Tourism economy sectors).

Drought Hazard Summary by Jurisdiction

As discussed in the previous occurrences and vulnerability sections, the majority of the damages seen historically as a result of drought in Story County affect agricultural activities, relief, response, and restrictions services, and the water supply and quality of the county. Therefore, the magnitude of the impacts of drought may be greater in the unincorporated areas, which tend to have larger areas of crops. In the cities, the frequency of drought conditions may remain the same, but the magnitude would increase with lawns and local gardens affected (including outdoor fields in school districts), further leading to expansive soil problems around foundations. If drought conditions are severe and prolonged, water supplies could also be affected, as again noted in previous reports of drought.

Jurisdiction	Probability	Magnitude	Warning Time	Duration	Score	Level
Story County, Iowa	3	2	1	4	2.50	Moderate
City of Ames	3	2	1	4	2.50	Moderate
City of Cambridge	3	2	1	4	2.50	Moderate
City of Collins	3	2	1	4	2.50	Moderate
City of Colo	3	2	1	4	2.50	Moderate
City of Gilbert	3	2	1	4	2.50	Moderate
City of Huxley	3	2	1	4	2.50	Moderate
City of Kelley	3	2	1	4	2.50	Moderate
City of Maxwell	3	2	1	4	2.50	Moderate
City of McCallsburg	3	2	1	4	2.50	Moderate
City of Nevada	3	2	1	4	2.50	Moderate
City of Roland	3	2	1	4	2.50	Moderate
City of Sheldahl	3	2	1	4	2.50	Moderate
City of Slater	3	2	1	4	2.50	Moderate
City of Story City	3	2	1	4	2.50	Moderate
Ames Schools	3	2	1	4	2.50	Moderate
Ballard Schools	3	2	1	4	2.50	Moderate
Collins-Maxwell Schools	3	2	1	4	2.50	Moderate
Colo-Nesco Schools	3	3	1	4	2.80	Moderate
Gilbert Schools	3	2	1	4	2.50	Moderate
Nevada Schools	3	2	1	4	2.50	Moderate
Roland-Story Schools	3	2	1	4	2.50	Moderate
Iowa State University	3	2	1	4	2.50	Moderate

3.5.4 Earthquake

Hazard Score Calculation					
Probability	Magnitude/Severity	Warning Time	Duration	Weighted Score	Level
1	1	4	1	1.45	Low

Profile

Hazard Description

An earthquake is a sudden motion or trembling that is caused by a release of energy accumulated within or along the edge of Earth's tectonic plates. Earthquakes occur primarily along fault zones, tears in the Earth's crust, along which stresses build until one side of the fault slips, generating compressive and shear energy that produces the shaking and damage to the built environment. Heaviest damage generally occurs nearest the epicenter which is that point on the Earth's surface directly above the point of fault movement. The composition of geologic materials between these points is a major factor in transmitting the energy to buildings and other structures on the Earth's surface.

Warning Time Score: 4—less than 6 hours

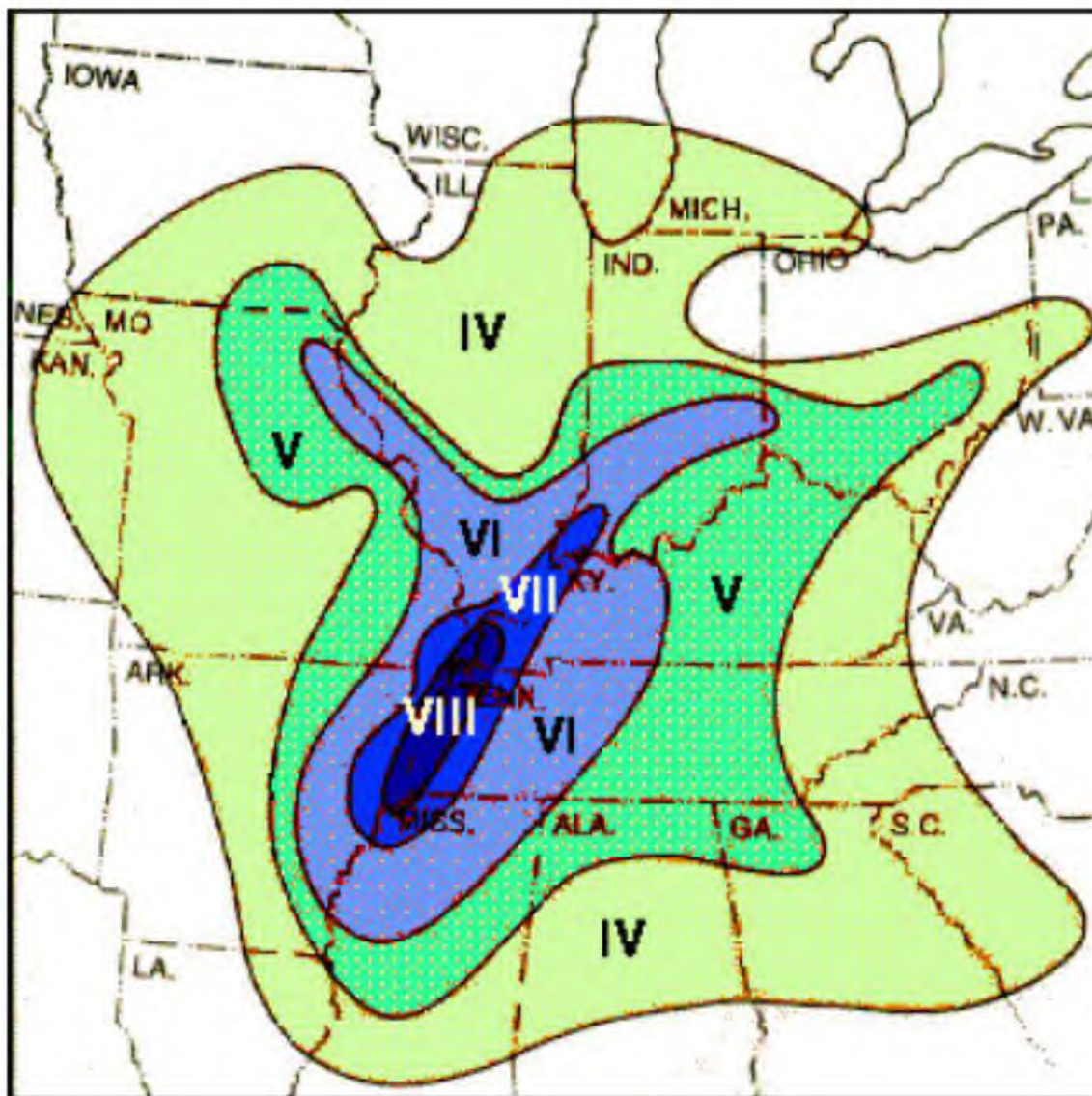
Duration Score: 1—less than 6 hours

Geographic Location/Extent

While geologists often refer to the Midwest as the "stable midcontinent," because of its lack of major crustal movements, there are two regions of active seismicity, the Nemaha Ridge and the New Madrid Fault Zone. The Nemaha Ridge in Kansas and Nebraska, associated with the Humboldt Fault, is characterized by numerous small earthquakes that release stresses before they build to dangerous levels. The fault is not considered a threat to Iowa. The New Madrid Fault Zone, on the other hand, has greater destructive potential. It is located along the valley of the Mississippi River, from its confluence with the Ohio River southward, and includes portions of Illinois, Kentucky, Tennessee, Missouri, Arkansas, and Mississippi. The Earth's crust in the midcontinent is older, and therefore thicker, cooler, and more brittle than that in California for example. Consequently, earthquake shock waves travel faster and farther in the Midwest, making quakes here potentially more damaging than similar sized events in other geologic settings.

Iowa counties are located in low risk zones as a whole. The southeastern part of the State is more at risk to earthquake effects from the New Madrid Fault Zone. Figure 3.7 shows the estimated effects of a 6.5 Richter magnitude earthquake scenario along the New Madrid Fault Zone. It suggests that Iowans in four southeast counties could experience trembling buildings, some broken dishes and cracked windows, movement and falling of small unstable objects, abrupt openings or closing doors, and liquids spilling from open containers. About 29 other counties, from Page to Polk to Muscatine, could experience vibrations similar to the passing of a heavy truck, rattling of dishes and windows, creaking of walls, and swinging of suspended objects. These effects will vary considerably with differences in local geology and construction techniques. There is also a minor fault in Southwest Iowa located near Fremont County.

Figure 3.7: 6.5 Richter Magnitude Earthquake Scenario, New Madrid Fault Zone

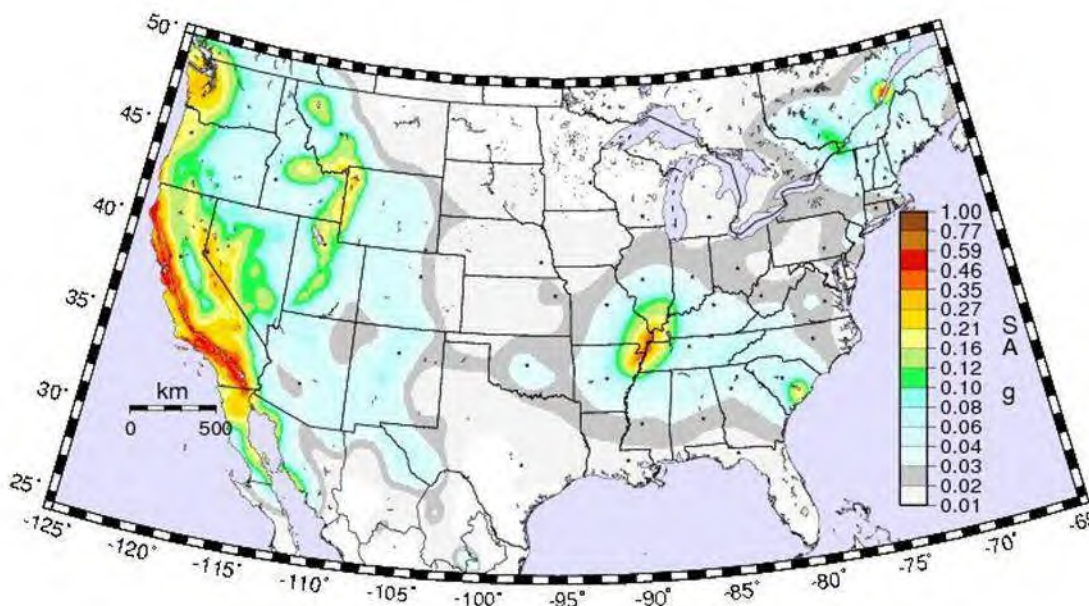


Source: <http://www.igsb.uiowa.edu/Browse/quakes/quakes.htm>

Figure 3.8 shows the Seismic Hazard Map for the U.S. showing the peak ground acceleration of 10 percent in a 50-year timeframe.

Figure 3.8: United States Seismic Hazard Map

PGA with 10% in 50 year PE. BC rock. 2008 USGS



Source: United States Geological Survey, <http://earthquake.usgs.gov/hazards/products/conterminous/2008/maps/>

The extent or severity of earthquakes is generally measured in two ways: 1) Magnitude Measurement utilizes the Richter Magnitude Scale and 2) Severity Measurement utilizes the Modified Mercalli Intensity Scale.

Richter Magnitude Scale

The Richter Magnitude Scale was developed in 1935 by Charles F. Richter of the California Institute of Technology as a mathematical device to compare the size of earthquakes. The magnitude of an earthquake is determined from the logarithm of the amplitude of waves recorded by seismographs. Adjustments are included for the variation in the distance between the various seismographs and the epicenter of the earthquakes. On the Richter Scale, magnitude is expressed in whole numbers and decimal fractions. For example, a magnitude 5.3 might be computed for a moderate earthquake, and a strong earthquake might be rated as magnitude 6.3. Because of the logarithmic basis of the scale, each whole number increase in magnitude represents a tenfold increase in measured amplitude; as an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value.

Modified Mercalli Intensity Scale

The effect of an earthquake on the Earth's surface is called the intensity. The intensity scale consists of a series of certain key responses such as people awakening, movement of furniture, damage to chimneys, and finally - total destruction. Although numerous intensity scales have been developed over the last several hundred years to evaluate the effects of earthquakes, the one currently used in the United States is the Modified Mercalli (MM) Intensity Scale. It was developed in 1931 by the American seismologists Harry Wood and Frank Neumann. This scale, composed of 12 increasing levels of intensity that range from

imperceptible shaking to catastrophic destruction, is designated by Roman numerals. It does not have a mathematical basis; instead it is an arbitrary ranking based on observed effects.

The Modified Mercalli Intensity value assigned to a specific site after an earthquake has a more meaningful measure of severity to the nonscientist than the magnitude because intensity refers to the effects actually experienced.

The lower numbers of the intensity scale generally deal with the manner in which the earthquake is felt by people. The higher numbers of the scale are based on observed structural damage. Structural engineers usually contribute information for assigning intensity values of VIII or above.

Previous Occurrences

Iowa has experienced minor effects from only a few earthquakes in the past 175 years. The epicenters of 13 earthquakes have been located in the State with the majority along the Mississippi River. The strongest earthquake in Iowa occurred in Davenport in 1934. The 1934 Davenport earthquake resulted in only slight damage. (Source: State of Iowa Hazard Mitigation Plan, 2013). Details of the 13 Iowa earthquakes are provided below:

Table 3.32: Historical Earthquakes in Iowa

Date	Nearest Town	Mercalli Intensity
4/28/1867	Sidney, IA / Nebraska City, NE	IV
12/9/1875	Sidney, IA / Nebraska City, NE	III
4/13/1905	Wayland, MO / Keokuk, IA	IV-V
1/26/1925	Waterloo, IA	II
11/12/1934	Davenport, IA \ Rock Island, IL	VI
1/5/1935	Rock Island, IL / Davenport, IA	III
1/5/1935	Rock Island, IL / Davenport, IA	IV
2/26/1935	Burlington, IA	III
10/11/1938	Inwood, IA	V
11/8/1938	Dubuque, IA	II
11/24/1939	Davenport, IA / Rock Island, IL	II-III
4/20/1948	Oxford, IA	IV
7/16/2004	Shenandoah, IA	III

Source: State of Iowa Hazard Mitigation Plan, 2013

Probability of Future Occurrence

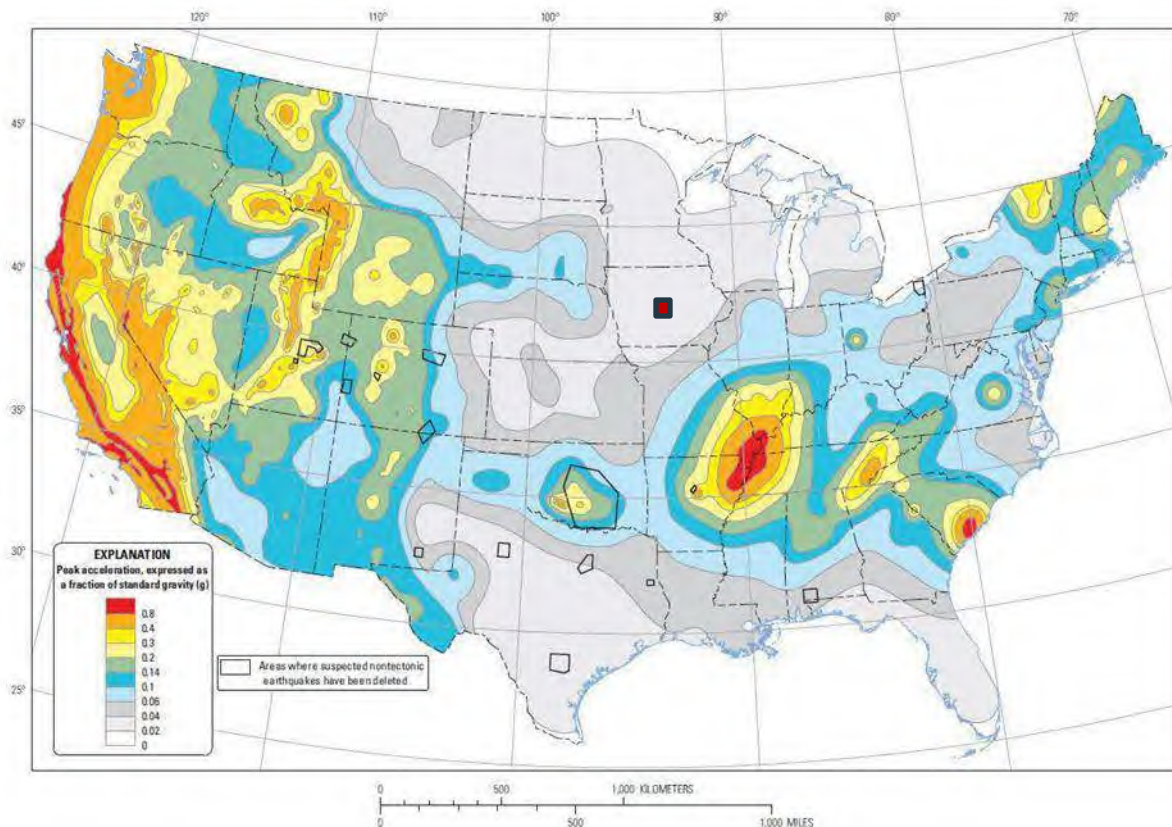
Figure 3.9 demonstrates the probabilistic ground motions with a 2 percent probability of exceedance. The red square shows the approximate Story County boundary. As shown in this graphic, the probabilistic ground motions with a 2 percent probability of exceedance in the next 50 years is 0.04 peak acceleration, expressed as a fraction of standard gravity (g). The probability of a significant earthquake in any given year is "Unlikely".

The 2014 U.S. Geological Survey (USGS) National Seismic Hazard Maps display earthquake ground motions for various probability levels across the United States and are applied in seismic provisions of building codes, insurance rate structures, risk assessments, and other public policy. The updated maps represent an assessment of the best available science in earthquake hazards and incorporate new findings on earthquake ground shaking, faults, seismicity, and geodesy. The USGS National Seismic Hazard Mapping Project developed these maps by incorporating information on potential earthquakes and associated ground shaking obtained from interaction in science and engineering workshops involving

hundreds of participants, review by several science organizations and State surveys, and advice from expert panels and a Steering Committee. The new probabilistic hazard maps represent an update of the seismic hazard maps; previous versions were developed by Petersen and others (2008) and Frankel and others (2002), using the methodology developed Frankel and others (1996). Algermissen and Perkins (1976) published the first probabilistic seismic hazard map of the United States which was updated in Algermissen and others (1990).

The National Seismic Hazard Maps are derived from seismic hazard curves calculated on a grid of sites across the United States that describe the annual frequency of exceeding a set of ground motions. Data and maps from the 2014 U.S. Geological Survey National Seismic Hazard Mapping Project are available for download below from the link listed with the image source. Maps for available periods (0.2 s, 1 s, PGA) and specified annual frequencies of exceedance can be calculated from the hazard curves. Figures depict probabilistic ground motions with a 2 percent probability of exceedance. Spectral accelerations are calculated for 5 percent damped linear elastic oscillators. All ground motions are calculated for site conditions with $V_{s30}=760$ m/s, corresponding to NEHRP B/C site class boundary.

Figure 3.9: Two-percent probability of exceedance in 50 years map of peak ground acceleration



Source: United States Geological Survey, <https://earthquake.usgs.gov/static/lfs/nshm/conterminous/2014/2014pga2pct.pdf>

Note: Red square shape is approximate location of Story County, IA

Probability Score: 1—Unlikely

Vulnerability

Overview

As discussed under the probability section, the probability of a 5.0 Magnitude or greater earthquake in the next 100 years is one percent. Although a damaging event is unlikely, the potential impacts could be costly in the more urban areas of the County. Most structures in Story County are not built to withstand earthquake shaking, but because of the relatively low magnitude of a possible quake, property damage would likely be very minor damage.

The main impacts to Story County from a New Madrid Earthquake would most likely be related to incoming evacuees from areas more heavily damaged by the event. This could result in a shortage of short-term lodging, such as hotel rooms and extended stay establishments. Depending on the magnitude of the earthquake, shelters may be designated in Story County as evacuee shelter locations. If this occurred, assistance would be coordinated through the Emergency Management Assistance Compact (EMAC) between the State of Iowa and State governments of impacted areas.

Magnitude Score: 1—Negligible

Potential Losses to Existing Development

FEMA's loss estimation software, HAZUS was utilized to analyze a 2,500-year probabilistic scenario earthquake event. This earthquake scenario is equivalent to a 2 percent probability of exceedance in 50 years. The earthquake scenario utilized is based on a probabilistic scenario, rather than a deterministic scenario. Therefore, this is not a magnitude-based scenario, but is rather based on ground shaking using the probabilistic mapping done by USGS (see <http://earthquake.usgs.gov/hazards/products/conterminousearthquake.usgs.gov/hazards/products/conterminous/>). The HAZUS Earthquake module reports earthquake damage by census tract. As a result, it is not possible to separate the resulting damage amounts by incorporated area, as the census tract boundaries are not the same as the incorporated area boundaries. Table 3.33 below provides the results of the HAZUS analysis for Story County. This analysis estimates that the total direct structural damage would be more than \$8 million. The combined building, contents and related economic losses such as lost wages, rental, and relocation costs are calculated to be over \$27 million.

Table 3.33: Story County, Iowa Estimated Economic Losses—2,500 Year Probabilistic Earthquake Event

	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses						
Wage	--	\$80,000	\$1,100,000	\$40,000	\$570,000	\$1,790,000
Capital-Relocated	--	\$40,000	\$950,000	\$30,000	\$220,000	\$1,230,000
Rental	\$160,000	\$580,000	\$530,000	\$20,000	\$230,000	\$1,520,000
Relocation	\$510,000	\$370,000	\$740,000	\$90,000	\$2,080,000	\$3,790,000
Subtotal	\$670,000	\$1,060,000	\$3,320,000	\$180,000	\$3,110,000	\$8,330,000
Capital Stock Losses						
Structural	\$1,120,000	\$1,080,000	\$1,030,000	\$260,000	\$1,360,000	\$4,850,000
Non-Structural	\$3,100,000	\$2,430,000	\$1,450,000	\$350,000	\$3,560,000	\$10,880,000
Content	\$620,000	\$370,000	\$520,000	\$200,000	\$1,440,000	\$3,150,000
Inventory	--	--	\$10,000	\$40,000	\$10,000	\$60,000
Subtotal	\$4,840,000	\$3,880,000	\$3,010,000	\$850,000	\$6,360,000	\$18,940,000
Total	\$5,500,000	\$4,940,000	\$6,330,000	\$1,030,000	\$9,470,000	\$27,270,000

Source: HAZUS-MH 4.0, January 2018

Table 3.34 provides the anticipated numbers of buildings by type and damage category that would result according to the HAZUS analysis. The estimated building types and counts are from the HAZUS damage outputs utilizing census block data. According to this analysis, 1 building would be completely destroyed, 21 buildings would have extensive damage, 186 would have moderate damage and 695 would have slight damage. The majority of buildings in the planning area (over 27,000) would not be damaged.

Based on the estimate of 76 single-family and 69 other residential buildings with moderate, extensive, or complete damage, and considering the average household size in the county of 2.2, the displaced population would be approximately 319 people.

Table 3.34: Expected Building Damage by Building Occupancy Type

Use Type	None	Slight	Moderate	Extensive	Complete
Agricultural	382	19	8	1	0
Commercial	1,757	83	30	4	0
Education	302	13	5	1	0
Government	74	3	1	0	0
Industrial	441	21	8	1	0
Other Residential	3,605	181	65	4	0
Religious	208	9	4	1	0
Single Family	20,637	366	66	9	1
Total	27,406	695	186	21	1

Source: HAZUS-MH 4.0

Future Development

Overall the planning area has a low vulnerability to earthquake risk. Future development is not expected to increase the risk other than contributing to the overall exposure of what could become damaged as a result of an unlikely event.

Climate Change Impacts

No information was available to discuss the impacts that climate change might have on the frequency or severity of earthquakes.

Earthquake Hazard Summary by Jurisdiction

The following hazard summary table shows that this hazard does not significantly vary by jurisdiction. Although damage amounts would be higher in the more urban areas, damage ratios would be relatively the same, and relatively low for the county as a whole.

Jurisdiction	Probability	Magnitude	Warning Time	Duration	Score	Level
Story County, Iowa	1	1	4	1	1.45	Low
City of Ames	1	1	4	1	1.45	Low
City of Cambridge	1	1	4	1	1.45	Low
City of Collins	1	1	4	1	1.45	Low
City of Colo	1	1	4	1	1.45	Low
City of Gilbert	1	1	4	1	1.45	Low
City of Huxley	1	1	4	1	1.45	Low
City of Kelley	1	1	4	1	1.45	Low
City of Maxwell	1	1	4	1	1.45	Low
City of McCallsburg	1	1	4	1	1.45	Low
City of Nevada	1	1	4	1	1.45	Low
City of Roland	1	1	4	1	1.45	Low
City of Sheldahl	1	1	4	1	1.45	Low
City of Slater	1	1	4	1	1.45	Low
City of Story City	1	1	4	1	1.45	Low
Ames Schools	1	1	4	1	1.45	Low
Ballard Schools	1	1	4	1	1.45	Low
Collins-Maxwell Schools	1	1	4	1	1.45	Low
Colo-Nesco Schools	1	1	4	1	1.45	Low
Gilbert Schools	1	1	4	1	1.45	Low
Nevada Schools	1	1	4	1	1.45	Low
Roland-Story Schools	1	1	4	1	1.45	Low
Iowa State University	1	1	4	1	1.45	Low

3.5.5 Expansive Soils

Hazard Score Calculation					
Probability	Magnitude/Severity	Warning Time	Duration	Weighted Score	Level
2	1	1	1	1.45	Low

Profile

Hazard Description

A relatively widespread geologic hazard for Iowa is the presence of soils that expand and shrink in relation to their water content. Expansive soils can cause physical damage to building foundations, roadways, and other components of the infrastructure when clay soils swell and shrink due to changes in moisture content. The effects of expansive soils are most prevalent in regions of moderate to high precipitation where prolonged periods of drought are followed by long periods of rainfall. These conditions can exist in Story County from time to time.

Warning Time Score: 1—24+ hours

The warning time for expansive soils is consistent with other geologic hazards that occur slowly overtime.

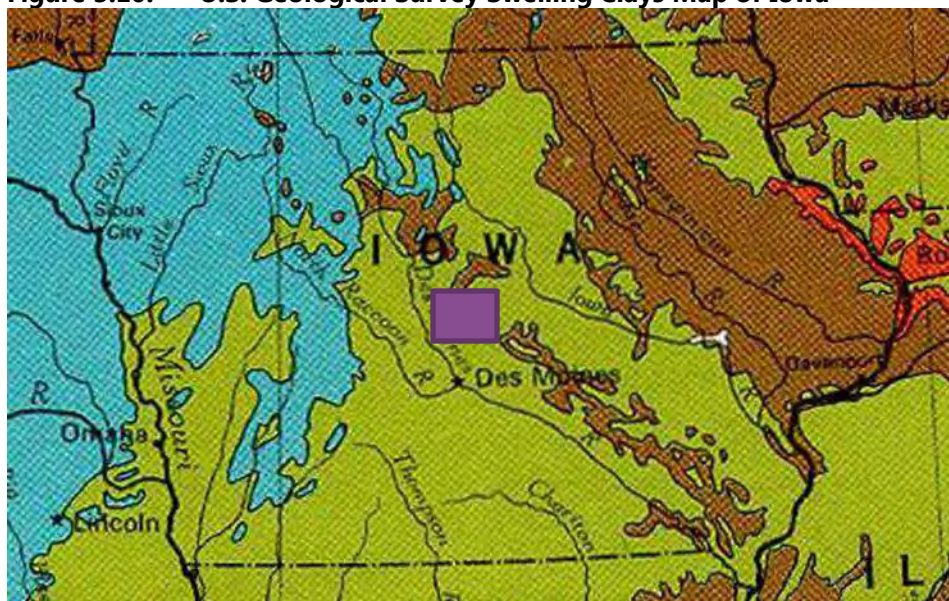
Duration Score: 1—Less than 6 hours

The duration of response to this hazard is limited in the State of Iowa. Although prolonged periods of drought are a primary indicator of risk followed by forecasted periods of precipitation, the response to expansive soils in Iowa is limited and is in large part coupled with response to flash flooding and river flooding.

Geographic Location/Extent

Figure 3.10 shows a map of the swelling potential of soils in Iowa. Story County is located in an area where generally less than 50 percent of the soil unit consists of clay having slight to moderate swelling potential (green shading) with some parts of the county having little or no swelling clay (brown shading).

Figure 3.10: U.S. Geological Survey Swelling Clays Map of Iowa



MAP LEGEND

- Unit contains abundant clay having high swelling potential
- Part of unit (generally less than 50%) consists of clay having high swelling potential
- Unit contains abundant clay having slight to moderate swelling potential
- Part of unit (generally less than 50%) consists of clay having slight to moderate swelling potential
- Unit contains little or no swelling clay
- Data insufficient to indicate clay content of unit and/or swelling potential of clay (Shown in westernmost states only)

Source: U.S. Geological Survey publication "Swelling Clays Map of the Conterminous United States" by W.W. Olive, A.F. Chleborad, C.W. Frahme, Julius Schlocker, R.R. Schneider, and R.L. Shuster, 1989: Purple square indicates approximate location of Story County.

Previous Occurrences

As reported in the 2014 *Story County Multi-Jurisdictional Hazard Mitigation Plan*, streets and parking lots throughout the County are damaged every year by the effects of expansive soils as well as underground water lines that are damaged as the soil expands and contracts at varying levels along a water line. The frequency of damage from expansive soils can be associated with the cycles of drought and heavy rainfall, which reflect changes in moisture content. There is no data regarding incidents of damages resulting from expansive soils because these damages are largely isolated incidents and the affected property owners, local governments, and businesses generally make any necessary repairs.

Probability of Future Occurrence

Although there will likely continue to be some damage to paved areas and foundations in Story County due to swelling soils, it is unlikely that these damages will become greater in the future. Even if development occurs in areas where the hazard is more severe, certain buildings and construction practices can be put in place to lessen these impacts.

Probability Score: 2—Occasional

Vulnerability

Overview

While the entire planning area is vulnerable to some structural damage as a result of shrinking and expanding soils, there is no data available to determine damage estimates for this hazard. In most cases, individual property owners, local governments, and businesses pay for repairs to damages caused by this hazard. The HMPC felt that underground utility lines such as water and sewer pipes may also be at risk to damages associated with expansive soils. Damages may occur gradually over time. There is no data to support damages and costs associated with this hazard at this time. This hazard does not impact human safety.

Magnitude Score: 1—Negligible

Potential Losses to Existing Development

Existing development may continue to be vulnerable to expansive soils, depending on location and soil conditions.

Future Development

Additional future development in the planning area may also be vulnerable to this hazard, especially if the proper construction practices intended to mitigate the effects of expansive soils are not used.

Expansive Soils Hazard Summary by Jurisdiction

This hazard does not vary substantially among jurisdictions.

Jurisdiction	Probability	Magnitude	Warning Time	Duration	Score	Level
Story County, Iowa	2	1	1	1	1.45	Low
City of Ames	2	1	1	1	1.45	Low
City of Cambridge	2	1	1	1	1.45	Low
City of Collins	2	1	1	1	1.45	Low
City of Colo	2	1	1	1	1.45	Low
City of Gilbert	2	1	1	1	1.45	Low
City of Huxley	2	1	1	1	1.45	Low
City of Kelley	2	1	1	1	1.45	Low
City of Maxwell	2	1	1	1	1.45	Low
City of McCallsburg	2	1	1	1	1.45	Low
City of Nevada	2	1	1	1	1.45	Low
City of Roland	2	1	1	1	1.45	Low
City of Sheldahl	2	1	1	1	1.45	Low
City of Slater	2	1	1	1	1.45	Low
City of Story City	2	1	1	1	1.45	Low
Ames Schools	2	1	1	1	1.45	Low
Ballard Schools	2	1	1	1	1.45	Low
Collins-Maxwell Schools	2	1	1	1	1.45	Low
Colo-Nesco Schools	2	1	1	1	1.45	Low
Gilbert Schools	2	1	1	1	1.45	Low
Nevada Schools	2	1	1	1	1.45	Low
Roland-Story Schools	2	1	1	1	1.45	Low
Iowa State University	2	1	1	1	1.45	Low

3.5.6 Extreme Heat

Hazard Score Calculation

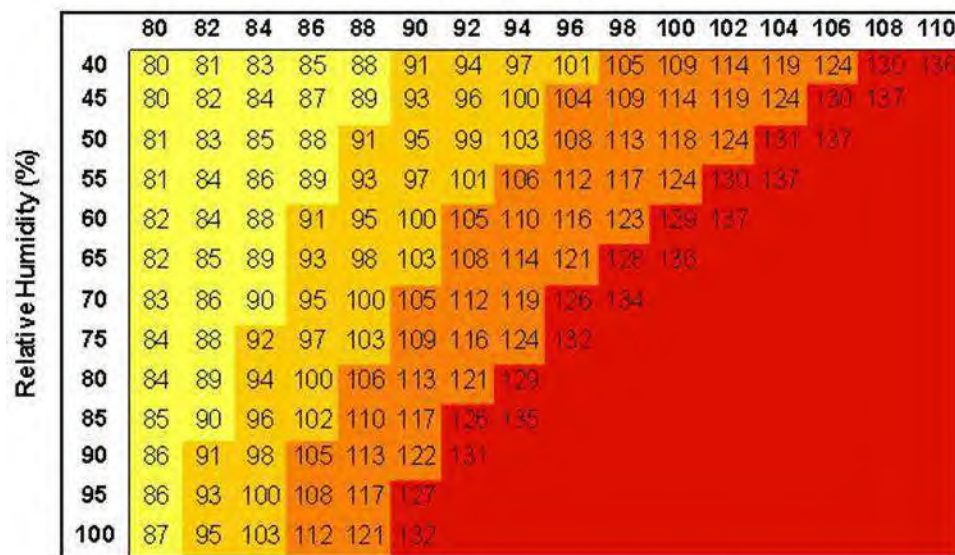
Probability	Magnitude/Severity	Warning Time	Duration	Weighted Score	Level
4	2	1	4	2.95	Moderate

Profile

Hazard Description

According to information provided by FEMA, extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. Ambient air temperature is one component of heat conditions, with relative humidity being the other. The relationship of these factors creates what is known as the apparent temperature. The Heat Index Chart in Figure 3.11 uses both of these factors to produce a guide for the apparent temperature or relative intensity of heat conditions.

Figure 3.11: Heat Index (HI) Chart
Temperature (°F)



Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution Extreme Caution Danger Extreme Danger

Source: National Weather Service (NWS) http://www.nws.noaa.gov/os/heat/heat_index.shtml

Note: Exposure to direct sun can increase Heat Index values by as much as 15°F. The shaded zone above 105°F corresponds to a HI that may cause increasingly severe heat disorders with continued exposure and/or physical activity.

During these conditions, the human body has difficulties cooling through the normal method of the evaporation of perspiration. Health risks rise when a person is overexposed to heat.

The most dangerous place to be is in a permanent home, with little or no air conditioning. Those at greatest risk for heat-related illness include people 65 years of age and older, young children, people with chronic health problems such as heart disease, people who are obese, people who are socially isolated, and people who are on certain medications, such as tranquilizers, antidepressants, sleeping pills, or drugs for Parkinson's disease. However, even young and healthy individuals are susceptible if they participate in strenuous physical activities during hot weather or are not acclimated to hot weather. In agricultural areas, the exposure of farm workers, as well as livestock, to extreme heat is a major concern. Table 3.35 lists typical symptoms and health impacts of exposure to extreme heat.

Table 3.35: Typical Health Impacts of Extreme Heat

Heat Index (HI)	Disorder
80-90° F (HI)	Fatigue possible with prolonged exposure and/or physical activity
90-105° F (HI)	Sunstroke, heat cramps, and heat exhaustion possible with prolonged exposure and/or physical activity
105-130° F (HI)	Heatstroke/sunstroke highly likely with continued exposure

Source: National Weather Service Heat Index Program, www.weather.gov/os/heat/index.shtml

The National Weather Service has a system in place to initiate alert procedures (advisories or warnings) when the Heat Index is expected to have a significant impact on public safety. The expected severity of the heat determines whether advisories or warnings are issued. A common guideline for issuing excessive heat alerts is when the maximum daytime Heat Index is expected to equal or exceed 105 degrees Fahrenheit (°F) and the night time minimum Heat Index is 80°F or above for two or more consecutive days. A heat advisory is issued when temperatures reach 105 degrees and a warning is issued at 115 degrees.

Warning Time Score: 1—More than 24 hours warning time

Duration Score: 4—More than one week

Geographic Location/Extent

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

Previous Occurrences

The 10-year average for heat related fatalities is 97. No heat-related deaths are reported for Iowa within the last 10 years; the last heat-related death in the state occurred in 2006.

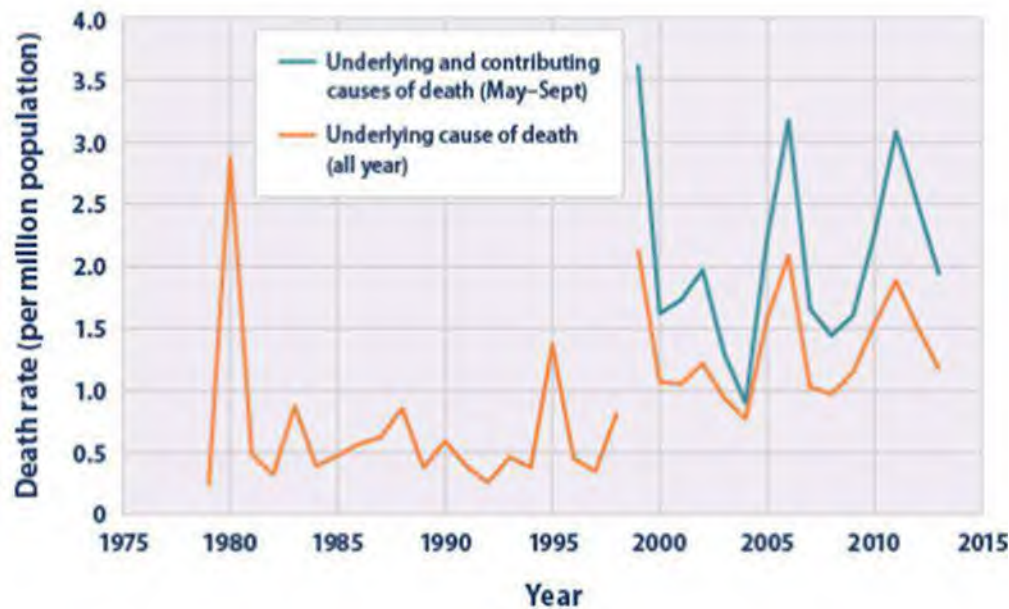
Table 3.36: National Heat-Related Deaths, 2008-2017

Year	Heat-Related Deaths
2008	71
2009	45
2010	138
2011	206
2012	156
2013	92
2014	20
2015	45
2016	94
2017	107

Source: National Weather Service, <http://www.nws.noaa.gov/om/hazstats.shtml>

Figure 3.12 shows heat-related deaths in the United States using two methodologies. One method shows deaths for which excessive natural heat was stated as the underlying cause of death from 1979 to 2013. The other data series shows deaths for which heat was listed as either the underlying cause or a contributing cause, based on a broader set of data that at present can only be evaluated back to 1999. For example, in a case where cardiovascular disease was determined to be the underlying cause of death, heat could be listed as a contributing factor because it can make the individual more susceptible to the effects of this disease. Because excessive heat events are associated with summer months, the 1999–2013 analysis was limited to May through September.

Figure 3.12: Deaths Classified as “Heat Related” in the United States, 1979-2015



Source: Environmental Protection Agency, https://www3.epa.gov/climatechange/pdfs/print_heat-deaths-2015.pdf

The 2013 Iowa State Hazard Mitigation Plan reports the following additional instances of agricultural losses due to extreme heat:

July 2011 – The Iowa Cattlemen’s Association reported that approximately 4,000 cattle died due to extreme heat.

1995 – Livestock-related economic losses due to heat stress were estimated to be \$31 million in Iowa.

On average, the hottest months of the year are July and August. According to the High Plains Regional Climate Center, the average temperature in Story County for the month of July is 73.2 degrees Fahrenheit (°F) with an average maximum temperature of 84.0 °F; and the average temperature for the month of August is 71.1 °F with an average maximum temperature of 82.4 °F. (Source: <http://climod.unl.edu/>)

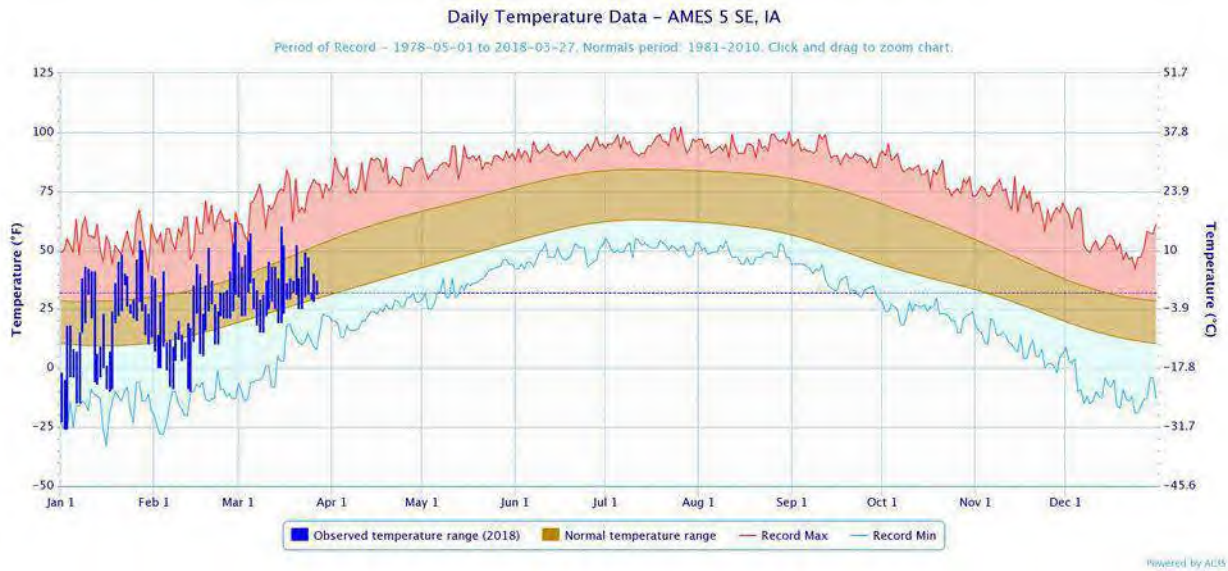
According to data from High Plains RCC, from 1996 to 2017, there were 88 days with temperatures 94 degrees Fahrenheit or above (at least 10 degrees above normal). When looking at only those events with a high temperature of 94 degrees Fahrenheit and higher that lasted for 3 consecutive days or more, there were nine occurrences during the 20-year period from 1996 through 2017.

The following summarizes the National Weather Service Advisories, Watches, and Warnings for Heat or Excessive Heat in Story County from 1996 through 2017 (22 years of data).

- 25 Advisories
- 6 Watches
- 5 Warnings

Figure 3.13 provides the daily temperature averages and extremes at the Ames, Iowa weather station for the period from 1981 to 2010 along with actual observed temperatures for the year to date in 2018 from the High Plains Regional Climate Center.

Figure 3.13: Daily Temperature Averages and Extremes, Ames, Iowa (1981 – 2010)



Source: High Plains Regional Climate Center, <http://climod.unl.edu/>

The National Climatic Data Center reported one regional heat event and two regional excessive heat events in and around the Story County planning area:

August 5, 2001 – Regional Heat Event - Very warm and humid conditions that began in the last part of July continued into August. Temperatures during the day warmed into the 90s, with overnight lows remaining in the 70s. Dew point temperatures held in the mid-70s to low 80s through most of the time. An elderly woman passed away in Des Moines on the 5th. She was found in her home with the windows closed and temperatures in the house in excess of 100 degrees F. She had succumbed to the heat.

July 15-28, 2011 – Regional Excessive Heat Event - A large area of high pressure developed in the upper atmosphere by the middle of July. Heat built up over Iowa, aided by the severe drought to the south across Kansas, Oklahoma, and Texas. Temperatures rose into the 90s each day through the period. Though most days did not see 100-degree heat, the dewpoint and overnight lows were very significant. Low temperatures during most of the nights were in the 70s, with many of the nights in the mid to upper 70s. Dewpoint temperatures failed to fall below 70 through most of the period, with frequent excursions in the upper 70s to low 80s. These conditions caused considerable stress on livestock. Reports indicated that at least 4000 head of cattle and thousands of turkeys were killed by the suffocating heat. Livestock losses were estimated in the \$5 to \$10 million-dollar range.

July 20-23, 2016 – Regional Excessive Heat Event - A warm front lifted through the state on the 20th, allowing southerly winds to bring about high temperatures in the low 90s along with dew points in the upper 70s to 80 at times. As a result, heat index values easily eclipsed the 100-105-degree range and at times exceeded 110. Additionally, overnight lows did not provide much in the way of relief with many areas seeing lows in the mid and even upper 70s.

According to the USDA's Risk Management Agency, insured payments in Story County for damages to crops as a result of heat and hot wind from 2007-2016 were limited to one hot wind event in 2016 which totaled \$32,902 in insurance paid.

Probability of Future Occurrence

Based on 11 National Weather Service Heat/Excessive Heat Warnings and Watches from 1996 to 2017 (22 years), the probability of occurrence is 50.0 percent. This translates to a probability rating of "Highly Likely".

Probability Score: 4—Highly Likely

Vulnerability

Overview

Those at greatest risk for heat-related illness and deaths include people 65 years of age and older, young children, people who are obese, and people who are ill or on certain medications. To determine jurisdictions within the planning area with populations that may be more vulnerable to extreme heat, demographic data was obtained from the U.S. Census Bureau on numbers of people in each jurisdiction that are over the age of 65 as seen in Table 3.37. Data was not available on rates of obesity or those on certain medications.

Overall, Iowa is already older than the country as a whole. About 15 percent of its population is over 65 years, compared with 13 percent nationally. Story County's population over 65 years is smaller than the national and state average at 10.8 percent. However, people aged 65 and older likely make up a smaller proportion of the county's population due to the presence of Iowa State University, which contributes to a higher proportion of persons aged 20 to 24 years in the county. It should still be noted that overall there are approximately 10,198 persons over the age of 65 who may face increased vulnerability to extreme heat events.

The jurisdictions with the highest percent of adults 65 and over in descending order are the cities of Story City, Zearing, and Sheldahl.

Table 3.37: Story County Population 65 years and Over, 2012-2016 American Community Survey 5-Year Estimates

Jurisdiction	Total Population	Population 65 yrs. and over	Percent 65 yrs. and over
Story County, Iowa (total)	94,834	10,198	10.8
City of Ames	64,073	5,863	9.2
City of Cambridge	853	80	9.4
City of Collins	458	62	13.5
City of Colo	886	140	15.8
City of Gilbert	1,183	80	6.8
City of Huxley	3,474	376	10.8
City of Kelley	306	28	9.2
City of Maxwell	839	113	13.5
City of McCallsburg	325	39	12.0
City of Nevada	6,796	982	14.4
City of Roland	1,312	116	8.8
City of Sheldahl*	249	41	16.5
City of Slater	1,617	159	9.8
City of Story City	3,423	840	24.5
City of Zearing	563	95	16.9

Source: U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates

* – City boundaries are within multiple counties

Magnitude Score: 2—Limited

Estimated Losses to Existing Development

According to the USDA's Risk Management Agency, during the ten-year period from 2007-2016, the sum of claims paid for crop damages as a result of heat and hot wind was \$32,902.00. According to the 2016 Iowa Crop Insurance Profile Report issued by the USDA's Risk Management Agency, 89 percent of Iowa insurable crops were insured. To factor in estimated losses to insurable crops that are not insured, the 89 percent crop insurance coverage was factored in to provide an adjusted estimate of losses. According to this calculation, estimated annualized losses total \$3,697 (see Table 3.38)

Considering the value of crops from the 2012 Census of Agriculture as baseline crop exposure, the estimated annual losses from heat and hot wind was determined to be negligible (less than 0.00%) compared to the value of the insurable crops.

Table 3.38: Estimated Insurable Annual Crops Lost Resulting from Heat

10-Year Extreme Heat Insurance Paid	Adjusted 10-Year Heat Losses (considering 89% insured)	Estimated Annualized Losses	2012 Value of Crops	Annualized Crop Loss Ratio (Losses/Value)
\$32,902	\$36,969	\$3,697	\$233,151,000	<0.00%

Source: Crop value is from USDA 2012 Census of Agriculture; Crop Insurance Paid is from the USDA's Risk Management Agency for 2007-2016.; Crop Insurance Coverage is from USDA's 2016 State Crop Insurance Profile for Iowa

Extreme heat can also cause a strain on electricity delivery infrastructure which can be overloaded during peak use of electricity to power air conditioning during extreme heat events. Another type of infrastructure damage that can occur as a result of extreme heat is road damage. When asphalt is exposed to prolonged extreme heat, it can cause buckling of asphalt-paved roads, driveways, and parking lots. According to Iowa DOT, repairs and replacement of pavement due to heat-caused buckling and rupture costs an average of \$400,000 annually across the State.

Future Development

Exposure to extreme heat will increase as Story County's population increases. People living in urban areas may experience higher vulnerability as impervious surface traps heat and creates an Urban Heat Island effect. As the largest city in the County and the city experiencing the most overall growth, Ames is likely to experience increases in extreme heat exposure and vulnerability.

Climate Change Impacts

The following climate change impacts relative to Extreme Heat were included in the 2010 Climate Change Impacts on Iowa report developed by the Iowa Climate Change Impacts Committee.

- 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 3 - 5 degree F rise in dew-point temperature. This fuels convective thunderstorms that provide more summer precipitation.

Both of these impacts could increase the number extreme heat events in the planning area as well as the potential for negative impacts on people and agriculture.

Extreme Heat Hazard Summary by Jurisdiction

This hazard does not vary substantially by jurisdiction.

Jurisdiction	Probability	Magnitude	Warning Time	Duration	Score	Level
Story County, Iowa	4	2	1	4	2.95	Moderate

Jurisdiction	Probability	Magnitude	Warning Time	Duration	Score	Level
City of Ames	4	2	1	4	2.95	Moderate
City of Cambridge	4	2	1	4	2.95	Moderate
City of Collins	4	2	1	4	2.95	Moderate
City of Colo	4	2	1	4	2.95	Moderate
City of Gilbert	4	2	1	4	2.95	Moderate
City of Huxley	4	2	1	4	2.95	Moderate
City of Kelley	4	2	1	4	2.95	Moderate
City of Maxwell	4	2	1	4	2.95	Moderate
City of McCallsburg	4	2	1	4	2.95	Moderate
City of Nevada	4	2	1	4	2.95	Moderate
City of Roland	4	2	1	4	2.95	Moderate
City of Sheldahl	4	2	1	4	2.95	Moderate
City of Slater	4	2	1	4	2.95	Moderate
City of Story City	4	2	1	4	2.95	Moderate
Ames Schools	4	2	1	4	2.95	Moderate
Ballard Schools	4	2	1	4	2.95	Moderate
Collins-Maxwell Schools	4	2	1	4	2.95	Moderate
Colo-Nesco Schools	4	2	1	4	2.95	Moderate
Gilbert Schools	4	2	1	4	2.95	Moderate
Nevada Schools	4	2	1	4	2.95	Moderate
Roland-Story Schools	4	2	1	4	2.95	Moderate
Iowa State University	4	2	1	4	2.95	Moderate

3.5.7 Flash Flood

Hazard Score Calculation					
Probability	Magnitude/Severity	Warning Time	Duration	Weighted Score	Level
4	3	3	1	3.25	High

Profile

Hazard Description

A flash flood is an event that occurs when water levels rise at an extremely fast rate as a result of intense rainfall over a brief period, sometimes combined with rapid snowmelt, ice jam release, frozen ground, saturated soil or impermeable surfaces.

Ice jam flooding is a form of flash flooding that occurs when ice breaks up in moving waterways, and then stacks on itself where channels narrow. This creates a natural dam, often causing flooding within minutes of the dam formation.

Riverine Flooding is discussed separately in Section 3.5.13 and flooding caused by dam failure is discussed in Section 3.5.2.

Most flash flooding is caused by slow-moving thunderstorms or thunderstorms repeatedly moving over the same area. Flash flooding is 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 by those in its path. Flash flood waters move at very fast speeds and can move boulders, tear out trees, scour channels, destroy buildings, and obliterate bridges. Flash flooding often results in higher loss of life, both human and animal, than slower developing river and stream 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. 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 sheet flooding, is becoming increasingly prevalent as development outstrips the ability of the drainage infrastructure to properly carry and disburse the water flow.

In certain areas, aging storm sewer systems are not designed to carry the capacity currently needed to handle the increased storm runoff. Typically, the result is water backing into basements, which damages mechanical systems and can create serious public health and safety concerns. This combined with rainfall trends and rainfall extremes all demonstrate the high probability, yet generally unpredictable nature of flash flooding in the planning area.

Although flash floods are somewhat unpredictable, there are factors that can point to the likelihood of flash floods occurring. Weather surveillance radar is being used to improve monitoring capabilities of intense rainfall. This, along with knowledge of the watershed characteristics, modeling techniques, monitoring, and advanced warning systems increases the warning time for flash floods.

Warning Time Score: 3—6 to 12 hours warning time. This refers to the period of time prior to the event with heightened awareness that a flash flood could occur, not the issuance of a “flash flood warning” by the National Weather Service.

Duration Score: 1—Less than 6 hours

Geographic Location/Extent

Story County is located in central Iowa. According to the 2014 Flood Insurance Study (FIS), the primary sources of flooding are the Ballard Creek, Clear Creek, College Creek, Onion Creek, Skunk River, Squaw

Creek, Unnamed Creeks A & B, and Worle Creek. However, flooding can also occur in the county as a result of rainfall and snowmelt.

Flash flooding occurs in those locations of the planning area that are low-lying and/or do not have adequate drainage to carry away the amount of water that falls during intense rainfall events. According to NCDC and specific reports from planning committee members, the following locations have a history of flash flooding events: Unincorporated Story County, Ames, Cambridge, Collins, Colo, Gilbert, Huxley, Kelley, Maxwell, Nevada, Roland, Slater, Story City, and Zearing. The HMPC identified that there are flash flooding issues throughout the county, and that basement flooding issues are prevalent.

The National Weather Service has various flash flooding products that are issued to the public to provide information regarding upcoming and current flash flood threats (see Table 3.39).

Table 3.39: National Weather Service Flash Flooding Products

Product	What It Means	You Should...
Hazardous Weather Outlook	Will there be any threat of flash flooding in the next several days?	If there is a threat of flash flooding, check back later for updated forecasts and possible watches and warnings.
Flash Flood Watch	There is a threat of flash flooding within the next 48 hours, either as a result of heavy rain, ice jams, or the threat of a dam break.	Monitor weather conditions closely, especially if you live in an area prone to flash flooding.
Flash Flood Warning	There is an immediate threat for flash flooding in the warned area, especially in low-lying and poor drainage areas. These warnings are updated frequently with Flash Flood Statements.	If you live in an area susceptible to flash flooding, be prepared to evacuate and head to higher ground. Be very cautious when driving in the warned area, especially at night or while it is still raining. You may not be able to see a flooded road until it is too late!
A Flash Flood Emergency may be declared when a severe threat to human life and catastrophic damage from a flash flood is imminent or ongoing. The declaration of a Flash Flood Emergency would typically be found in either a Flash Flood Warning or Flash Flood Statement. People are strongly encouraged to avoid the geographic area of concern in a Flash Flood Emergency. The Flash Flood Emergency wording is used very rarely and is reserved for exceptionally rare and hazardous events.		
Areal Flood Warning	The threat of flash flooding is over, but there is still significant standing water in the affected area.	Areal flood warnings will typically list locations and roads impacted by the flooding. Try to avoid these locations until the water has receded.

Source: National Weather Service

Previous Occurrences

Table 3.40 provides details regarding the flash flood and areal flood watches and warnings issued for Story County and the Story County forecast zone by National Weather Service. Areal flooding is a type of flash flooding that is generally over a large area usually due to the amount and duration of rainfall.

Table 3.40: Flash Flood-Related National Weather Service Watches and, Warnings Issued for Story County and Story County, Iowa Forecast Zone (1986 to 2017)

Type of Flood / Product Issued	1991	1993	1996	1998	2001	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Grand Total
Areal Flood																	
Advisory								6	2	5							13
Warning								13		3			1	2	4		23
Watch						3	4	2							1		10
Flash Flood																	
Warning	1	4	2	2	2			9		4	1		2	4	4	2	38
Watch							9	13	3	20	2		7	9	5	5	73
Grand Total	1	4	2	2	2	3	13	43	5	32	3	0	10	15	14	7	157

Source: Iowa State University Department of Agronomy <http://mesonet.agron.iastate.edu/vtec/search.php>

As discussed in the Description Section, flash flooding can be caused by intense rainfall over a brief period. Table 3.41 provides the top 30 rainfall events at the Ames Climate Station from January 1, 1951 to March 2018.

Table 3.41: Top 30 Rainfall Events, Ames Climate Station, 1951 to March 2018

Date	Amount (inches)	Date	Amount (inches)
1900-01-00	5.95	1966-06-12	4.02
1988-08-22	5.59	1912-05-11	3.88
2010-08-09	4.98	1899-06-20	3.71
1970-05-13	4.71	1944-05-20	3.68
1993-07-09	4.65	1964-06-22	3.65
2002-08-05	4.58	1960-05-06	3.62
1944-05-19	4.53	1943-07-31	3.58
2016-08-12	4.4	1926-09-08	3.51
1936-09-05	4.3	1998-06-14	3.4
1907-08-29	4.26	1919-09-29	3.4
2005-08-11	4.26	1917-06-06	3.4
2018-06-14	4.23	2007-05-24	3.33
1940-07-29	4.16	1963-05-12	3.31
1961-09-30	4.16	1922-05-24	3.2
1925-08-07	4.05	1933-05-20	3.2

Source: Iowa State University Department of Agronomy

<http://mesonet.agron.iastate.edu/climodat/index.phtml?network=IACIMATE&station=IA0200&report=02>

Information from the NCDC was obtained from 1996 through 2017 to determine previous occurrences for flash flood in the planning area. During this period, there were 49 flash flood events and 100 heavy rain events for a total of 149 flash flood related events. There were no injuries or deaths reported in association with any of these events. Total property damages for these events were estimated to be

\$4,692,000. There were an additional \$215,000 in crop losses reported. Table 3.42 provides a summary of the NCDC data.

Table 3.42: NCDC Story County, Iowa Flash Flood Events Summary, 1996-2017

Date	Property Loss	# Events
Flash Flood		
6/16/1996	\$1,500,000	1
6/18/1998	\$250,000	1
6/12/2001	\$250,000	1
5/22/2004	\$250,000	1
5/24/2004	\$60,000	3
3/2/2008	\$20,000	1
5/30/2008	\$325,000	3
6/3/2008	\$50,000	2
6/6/2008	\$101,000	3
6/11/2008	\$45,000	2
6/12/2008	\$50,000	2
8/4/2010	\$60,000	2
8/9/2010	\$155,000	5
8/10/2010	\$550,000	3
5/25/2013	\$10,000	1
5/26/2013	\$100,000	1
5/29/2013	\$675,000	5
5/20/2014	\$35,000	2
6/19/2014	\$25,000	1
7/6/2015	\$40,000	2
8/29/2016	\$40,000	2
9/22/2016	\$80,000	6
Total	\$4,671,000	49
Heavy Rain		
5/6/2008	\$10,000	2
6/11/2008	0	1
7/17/2008	\$10,000	1
4/26/2009	0	1
6/12/2010	\$1,000	1
7/18/2010	0	1
8/8/2010	0	2
8/10/2010	0	1
8/11/2010	0	1
8/31/2010	0	1
4/15/2012	0	2
4/17/2013	0	1
5/26/2013	0	1
5/29/2013	0	1
4/12/2014	0	2
5/20/2014	0	1
6/26/2014	0	1
7/12/2014	0	1
8/6/2014	0	1
8/29/2014	0	1
9/1/2014	0	7

Date	Property Loss	# Events
6/11/2015	0	1
6/23/2015	0	5
6/24/2015	0	2
7/5/2015	0	3
7/27/2015	0	1
7/28/2015	0	1
8/8/2015	0	9
8/27/2015	0	3
8/28/2015	0	1
9/6/2015	0	1
12/12/2015	0	5
7/18/2016	0	2
8/11/2016	0	9
8/19/2016	0	2
8/29/2016	0	3
9/7/2016	0	2
9/15/2016	0	3
9/21/2016	0	1
9/22/2016	0	12
4/19/2017	0	1
5/10/2017	0	1
7/20/2017	0	1
Total	\$21,000	100
Grand Total	\$4,692,000	149

Source: NCDC

Of the 149 flash flood events recorded in NCDC for the 22-year period:

- 53 were located in Ames and at the Ames Airport
- 25 were located in unincorporated areas
- 12 were located in Story City
- 12 were located in Zearing
- 9 were located in Nevada and Nevada Municipal Airport
- 7 were located in Maxwell
- 6 were located in Colo
- 6 were located in Slater
- 4 were located in Gilbert
- 3 were located in Cambridge
- 3 were located in Kelley
- 3 were located in Roland
- 2 were located in Collins
- 2 were located in Huxley
- 2 were reported as countywide

All reported flash flood events produced significant property damage. The most severe events in terms of damage include the following:

- June 16, 1996 - \$1.5 million property damage, \$100,000 crop damage
- June 18, 1998 - \$250,000 property damage, \$15,000 crop damage
- June 12, 2001 - \$250,000 property damage, \$10,000 crop damage
- May 22, 2004 - \$250,000 property damage, \$50,000 crop damage
- May 30, 2008 - \$325,000 property damage, \$35,000 crop damage
- June 6, 2008 - \$101,000 property damage
- August 9, 2010 - \$155,000 property damage
- August 10, 2010 - \$550,000 property damage
- May 26, 2013 - \$100,000 property damage
- May 29, 2013 - \$675,000 property damage

In addition to the above events, the HMPC reported multiple occurrences of flash flooding throughout the County, including one event that resulted in the need for a car rescue in the City of Gilbert, and a 2016 event in the City of Ames that damaged 100 homes. The City of Zearing has also identified flash flooding issues.

The US Army Corps of Engineers, Cold Regions Research and Engineering Laboratory (CRREL) maintains a database of historic ice jams. According to a query of that database, since 1950 one ice jam has occurred in the Story County planning area, on the Squaw Creek in Ames on March 10, 2010. (Source: <http://rsgisias.crrel.usace.army.mil/apex/f?p=524:1:0::NO>).

Probability of Future Occurrence

The frequency of past events is used to gauge the likelihood of future occurrences. The flash flood and heavy rain events from NCDC that occurred on the same day were combined to determine the total number of 34 damaging flash flooding events in the planning area over the 22-year period from 1996 through 2017. This translates to over a 100-percent likelihood of flash flooding somewhere in the planning area in any given year. Therefore, the probability rating is “Highly Likely”.

Probability Score: 4—Highly Likely

Vulnerability

Vulnerability Overview

Water over low-lying roads and bridges is the most frequent impact associated with flash flooding that has occurred in the planning area. This can cause washout of bridge abutments and erosion/scour damage on roads. There is potential for loss of life if motorists drive into moving water. However, public education campaigns have helped to educate citizens about not driving through moving water. Building damage is generally limited to water in basements where rain is too intense for drainage systems and natural drainage to carry water away from the structure. In addition, when combined storm/sanitary sewer systems are overloaded, this can result in sewer back-up. Generally, flash-flooding is short in duration and government services and business operations are not impacted.

Based on the number of historical occurrences, 34 days of flash flooding events within a 24-year period, and considering the damages caused by these events; the HMPC determined the magnitude to be critical.

Magnitude Score: 3—Critical

Potential Losses to Existing Development

When roads and bridges are inundated by water, damage often occurs as the water scours materials around bridge abutments and gravel roads.

The water can also cause erosion undermining road beds. In some instances, steep slopes that are saturated with water may cause mud or rock slides onto roadways. These damages can cause costly repairs for state, county, and city road/bridge maintenance departments. When sewer back-up occurs, this can result in costly clean-up for home and business owners as well as present a health hazard.

Based on loss estimates reported by NCDC, property losses averaged \$213,272 per year over the 22-year period from 1996 to 2017.

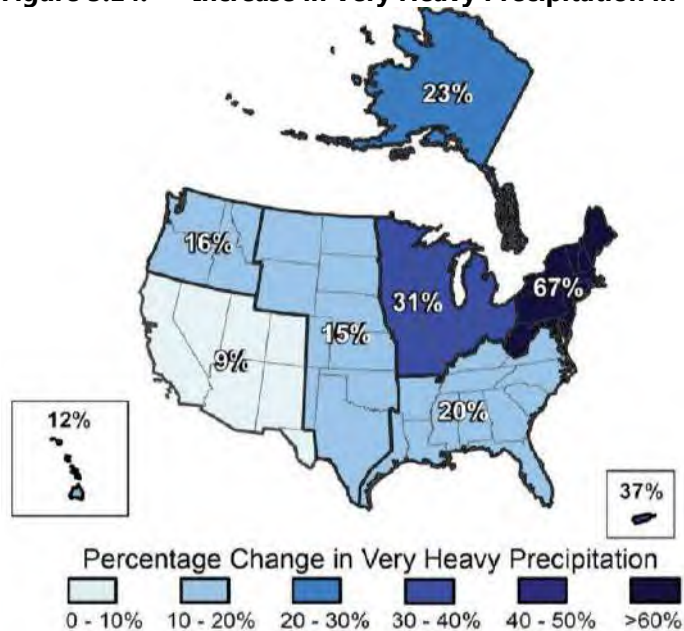
Future Development

In planning future development, jurisdictions in the planning area should avoid development in low-lying areas near rivers and streams or where interior drainage systems are not adequate to provide drainage during heavy rainfall events. Future development should also take into consideration the impact of additional impervious surfaces to water run-off and drainage capabilities during heavy rainfall events. Several jurisdictions in the County have reported efforts to mitigate flash flooding, including an updated storm sewer in the City of Cambridge, drainage projects in the City of Collins, as well as storm sewer work and elevation of a lift station in the City of Roland.

Climate Change Impacts

One of the climate change impacts noted in the 2010 Climate Change Impacts on Iowa report by the Iowa Climate Change Impacts Committee is the increase in frequency of severe precipitation events. Figure 3.14 shows that all of Iowa is in the region with a 31% increase in very heavy precipitation from 1958 to 2007. For this study, very heavy precipitation was defined as the heaviest 1% of all events.

Figure 3.14: Increase in Very Heavy Precipitation in the U.S., 1958-2007



Source: Karl, T.R., J.M. Melillo, and T.C. Peterson(eds). 2009. Global Climate Change Impacts in the United States. U.S. Global Climate Change Research Program. Cambridge University Press and <http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts> as cited in the 2010 Climate Change Impacts on Iowa report by the Iowa Climate Change Impacts Committee

If this trend increases, flash flooding events and their associated impacts will likely occur more often in the planning area.

Flash Flood Hazard Summary by Jurisdiction

For those jurisdictions with flash flooding events reported in NCDC and by planning representatives, the magnitude was determined to be critical. School districts with buildings in jurisdictions that have reported flash flooding events were assigned a magnitude of limited. For the remaining jurisdictions, the magnitude was determined to be negligible due to the small number of reported flash flooding events or no flash flooding events reported for these areas.

Jurisdiction	Probability	Magnitude	Warning Time	Duration	Score	Level
Story County, Iowa	4	3	3	1	3.25	High
City of Ames	4	3	3	1	3.25	High
City of Cambridge	4	3	3	1	3.25	High
City of Collins	4	3	3	1	3.25	High
City of Colo	4	3	3	1	3.25	High
City of Gilbert	4	3	3	1	3.25	High
City of Huxley	4	3	3	1	3.25	High
City of Kelley	4	3	3	1	3.25	High
City of Maxwell	4	3	3	1	3.25	High
City of McCallsburg	4	1	3	1	2.65	Moderate
City of Nevada	4	3	3	1	3.25	High
City of Roland	4	3	3	1	3.25	High
City of Sheldahl	4	1	3	1	2.65	Moderate
City of Slater	4	3	3	1	3.25	High
City of Story City	4	3	3	1	3.25	High
Ames Schools	4	2	3	1	2.95	Moderate
Ballard Schools	4	2	3	1	2.95	Moderate
Collins-Maxwell Schools	4	2	3	1	2.95	Moderate
Colo-Nesco Schools	4	2	3	1	2.95	Moderate
Gilbert Schools	4	2	3	1	2.95	Moderate
Nevada Schools	4	2	3	1	2.95	Moderate
Roland-Story Schools	4	2	3	1	2.95	Moderate
Iowa State University	4	3	3	1	3.25	High

3.5.8 Grass/Wildland Fire

Hazard Score Calculation					
Probability	Magnitude/Severity	Warning Time	Duration	Weighted Score	Level
3	1	4	1	2.35	Moderate

Profile

Hazard Description

Iowa's urban/rural interface (areas where development occurs within or immediately adjacent to wildland, near fire-prone trees, brush, and/or other vegetation), 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). The State has the largest number of CRP contracts in the nation, totaling over 1.5 million acres. Most of this land is located near cool and warm season grass plantings, tree plantings, and riparian buffer strips. There are an additional 230,000 acres in federal ownership and conservation easements.

Wildfires are frequently associated with lightning and periods of drought, as dry conditions make vegetation more flammable. As new development encroaches into the wildland/urban interface, furthermore, an increasing number of structures and people are at risk. On occasion, ranchers and farmers intentionally set fire to vegetation to restore soil nutrients or alter the existing vegetation growth. Also, individuals in rural areas frequently burn trash, leaves and other vegetation debris. These fires have the potential to get out of control and turn into wildfires.

The risk of wildfires is a real threat to landowners across the State. The National Weather Service monitors the conditions supportive of wildfires in the State on a daily basis, so that wildfires can be predicted, if not prevented.

Major wildfire risk factors considered are:

- High temperature
- High wind speed
- Fuel moisture (greenness of vegetation)
- Low humidity
- Little or no cloud cover

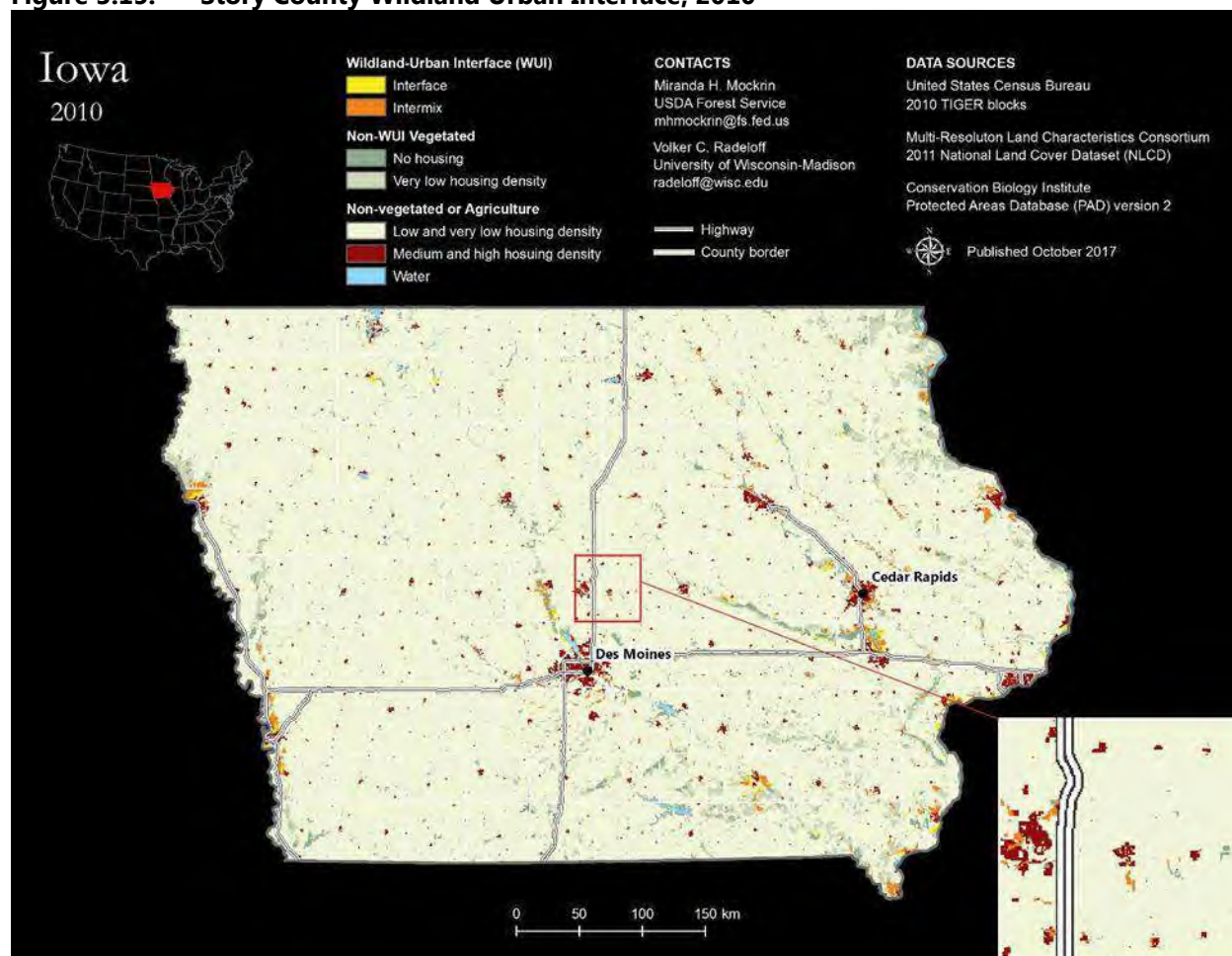
Warning Time Score: 4—Minimal or no warning time

Duration Score: 1—Less than 6 hours

Geographic Location/Extent

Wildland/Grass fires are most likely to occur in the Wildland Urban Interface (WUI). This is the area where houses meet or intermingle with undeveloped wildland vegetation. Within the WUI, there are two specific areas identified: 1) Interface and 2) Intermix. The interface areas are those that abut wildland vegetation, and the Intermix areas are those which intermingle with wildland areas. As can be seen in Figure 3.15, Story County has a moderate amount of intermix areas (orange) near Ames, Huxley, and Nevada, as well as sprinkled in minor amounts throughout other parts of the county. The WUI areas total 4,080 acres in Story County.

Figure 3.15: Story County Wildland Urban Interface, 2010



Source: SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin-Madison; WUI 2010, <http://silvis.forest.wisc.edu/maps/wui/state10>

Previous Occurrences

Data was requested from the Iowa Department of Public Safety, State Fire Marshal Division, to provide information on the latest occurrences of grass/wildland fires in the planning area. Through the National Fire Incident Reporting System (NFIRS), the Iowa State Fire Marshal's Office collects and reports fire incidents throughout the State. NFIRS is a repository of statistical data reported by participating fire departments.

While the State Fire Marshal's Division was unable to provide the historical grass/wildland fire data at this time, information from previous instances of wildfire were obtained from the Iowa Department of Natural Resources Forestry Bureau. According to the DNR system, there were 173 wildland or grass fires reported from 2005 to 2012 in Story County alone. Although only one person was injured during the fires taking place in the seven-year period, 1,753 acres were burned in total. The HMPC reported that several notable fires have occurred in recent years, each burning around 40-60 acres.

Probability of Future Occurrence

Updated historical data was not available to document the wildland/grass fires in late years, or information related to the events (e.g., losses incurred, population affected). Since updated statistical data was unavailable to determine a quantitative probability, a qualitative probability is based on the anecdotal

descriptions from the HMPC. The planning committee determined that, although damaging fires do not take place frequently, wildfires still occur on an annual basis. In addition, based on the reported fires from 2005 to 2012 mentioned in the subsection above, it can be estimated that there is an average of about 24 fires per year in the planning region. Therefore, the probability rating for events of this nature is “Likely.”

Probability Score: 3—Likely

Vulnerability

Overview

Most vulnerable to wildfire are agricultural areas where land is burned, rural areas where trash and debris are burned, and the wildland-urban interface/intermix areas. The HMPC noted that corn stover fires are a major issue in the County, and that areas along the river are particularly vulnerable to fire.

To demonstrate how vulnerability to this hazard varies by jurisdiction, the 2010 spatial data indicating acreage of Wildland Urban Interface/Intermix areas from the SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin-Madison was compared against the corporate boundary layer for the planning area. Table 3.43 and Table 3.44 provide additional details.

Table 3.43: Story County Wildland/Urban Interface and Intermix Acres

Jurisdiction	Intermix (acres)	Interface (acres)
Ames	649	-
Cambridge	76	-
Huxley	104	-
Maxwell	118	-
Nevada	58	-
Story City	89	-
Unincorporated	2,985	-
TOTAL	4,080	0

Source: SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin-Madison; WUI 2010, <http://silvis.forest.wisc.edu/maps/wui/2010/download>

Table 3.44: Story County Wildland Urban Intermix / Interface Acreage by WUI Class

WUI Class	Acres
High Density Intermix	1.15
Medium Density Intermix	882
Low Density Intermix	3,197
TOTAL	4,080

Source: SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin-Madison; WUI 2010, <http://silvis.forest.wisc.edu/maps/wui/2010/download>

Potential Losses to Existing Development

Wildfires can be responsible for extensive damage to crops, the environment, and occasionally residential or business facilities. Homes built in rural areas are more vulnerable since they are in closer proximity to land that is burned, plus homeowners are more likely to burn trash and debris in rural locations. The vulnerability of structures in rural areas is exacerbated due to the lack of hydrants for firefighting, coupled with the distance required for firefighting vehicles and personnel to travel to respond. Potential losses to crops and rangeland are additional concerns. The HMPC noted that several County departments have lost equipment due to grass fires. Nevertheless, Story County’s wildfire magnitude potential remains rather limited.

Magnitude Score: 2—Limited

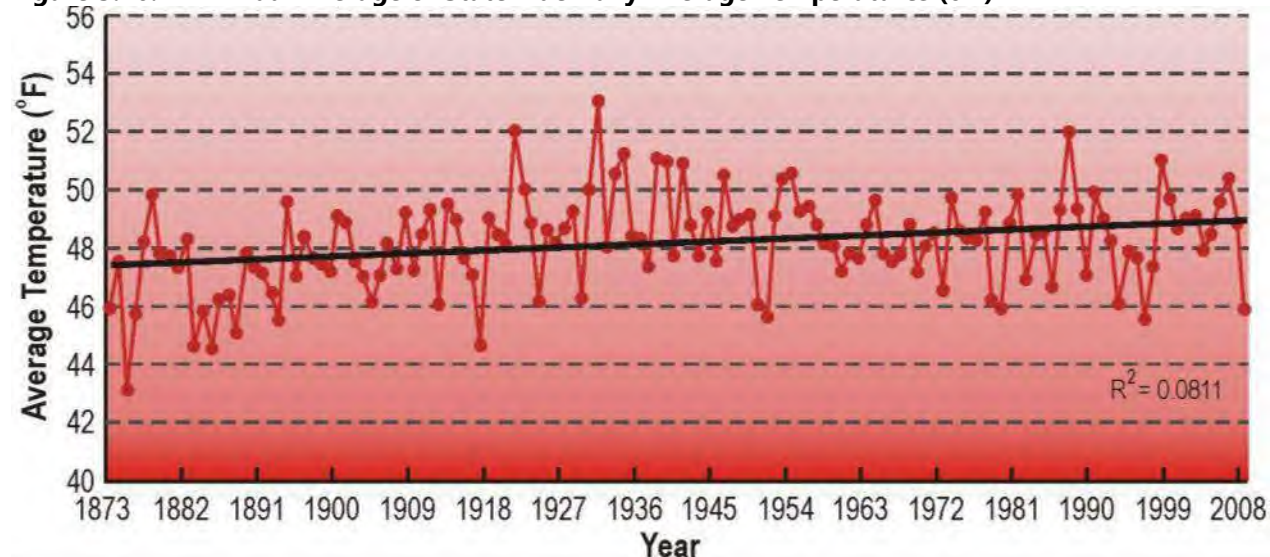
Future Development

Future development in the wildland-urban interface/intermix areas would increase vulnerability to this hazard.

Climate Change Impact

According to the 2010 Climate Change Impacts on Iowa report, by the Iowa Climate Change Impacts Committee, the annual average temperature has been increasing in the State over the last 136 years. Figure 3.16 shows this data graphically.

Figure 3.16: Annual Average of Statewide Daily Average Temperatures (0 F)



Source: 2010 Climate Change Impacts on Iowa report, by the Iowa Climate Change Impacts Committee, Data from the Iowa Climatology Bureau, 2010

If Iowa were to experience a severe drought, as has occurred frequently in the past, the slow and steady rise in statewide annual mean temperature, masked in summer by moist surface conditions during non-drought years, could lead to an abrupt switch to extreme summer heat comparable to the summers of 1983 or 1988. If these conditions occur, the occurrence of wildfire would be expected to increase as was seen recently in 2012. Conditions for Story County in particular might not be as harsh, however, given its history with exposure to more minimized effects from drought events. Regardless, tracking temperatures and being aware of extreme shifts in environmental conditions is a recommended mitigation strategy that can be carried out year-round, to prevent or minimize wildfire risk during hotter and drier months.

Grass or Wildland Fires Hazard Summary by Jurisdiction

Grass or Wildland fires can occur in all jurisdictions. However, the magnitude is potentially worse in jurisdictions with more wildland/urban intermix areas. Jurisdictions with more than 100 acres of intermix/interface were assigned a magnitude of 2, and jurisdictions with less than 100 acres of intermix/interface were assigned a magnitude of 1, negligible. There is less potential for wildland/grass fires impacting schools due to general locations away from Wildland Urban Interface Areas, although Iowa State University is found within exposed communities (i.e., Ames). Again, if a wildland/grass fire were to occur near school buildings, the magnitude would be lower due to close proximity to firefighting services and emergency responders. With regards to duration, jurisdictions prone to wildfires due to acreage within or around the WUI areas are given a duration ranking of 2 (more than 6 hours but less than 1 day), while those without WUI areas are given a rank of 1 (6 hours or less).

Jurisdiction	Probability	Magnitude	Warning Time	Duration	Score	Level
Story County, Iowa	3	2	4	2	2.75	Moderate
City of Ames	3	2	4	2	2.75	Moderate
City of Cambridge	3	2	4	2	2.75	Moderate
City of Collins	3	1	4	1	2.35	Moderate
City of Colo	3	1	4	1	2.35	Moderate
City of Gilbert	3	1	4	1	2.35	Moderate
City of Huxley	3	2	4	2	2.75	Moderate
City of Kelley	3	1	4	1	2.35	Moderate
City of Maxwell	3	2	4	2	2.75	Moderate
City of McCallsburg	3	1	4	1	2.35	Moderate
City of Nevada	3	2	4	2	2.75	Moderate
City of Roland	3	1	4	1	2.35	Moderate
City of Sheldahl	3	1	4	1	2.35	Moderate
City of Slater	3	1	4	1	2.35	Moderate
City of Story City	3	2	4	2	2.75	Moderate
Ames Schools	3	2	4	2	2.75	Moderate
Ballard Schools	3	1	4	2	2.45	Moderate
Collins-Maxwell Schools	3	1	4	2	2.45	Moderate
Colo-Nesco Schools	3	1	4	1	2.35	Moderate
Gilbert Schools	3	1	4	1	2.35	Moderate
Nevada Schools	3	2	4	2	2.75	Moderate
Roland-Story Schools	3	1	4	1	2.35	Moderate
Iowa State University	3	2	4	2	2.75	Moderate

3.5.9 Hazardous Materials

Hazard Score Calculation					
Probability	Magnitude/Severity	Warning Time	Duration	Weighted Score	Level
4	2	4	1	3.10	High

Profile

Hazard Description

A hazardous substance is one that may cause damage to persons, property, or the environment when released to soil, water, or air. Chemicals are manufactured and used in increasing types and quantities. Each year over 1,000 new synthetic chemicals are introduced and as many as 500,000 products pose physical or health hazards and can be defined as "hazardous chemicals". Hazardous substances are categorized as toxic, corrosive, flammable, irritant, or explosive. Hazardous material incidents generally affect a localized area. This 2009 Story County Hazard Mitigation Plan and 2007 Ames/ISU Hazard Mitigation Plan encompasses the following consolidated hazards:

Fixed Hazardous Materials Incident

A fixed hazardous materials incident is the accidental release of chemical substances or mixtures during production or handling at a fixed facility.

Transportation Hazardous Materials Incident

A transportation hazardous materials incident is the accidental release of chemical substances or mixtures during transport. Transportation Hazardous Materials Incidents in Story County can occur during highway or air transport. Highway accidents involving hazardous materials pose a great potential for public exposures. Both nearby populations and motorists can be impacted and become exposed by accidents and releases. If airplanes carrying hazardous cargo crash, or otherwise leak contaminated cargo, populations and the environment in the impacted area can become exposed.

Pipeline Incident

A pipeline transportation incident occurs when a break in a pipeline creates the potential for an explosion or leak of a dangerous substance (oil, gas, etc.) possibly requiring evacuation. An underground pipeline incident can be caused by environmental disruption, accidental damage, or sabotage. Incidents can range from a small, slow leak to a large rupture where an explosion is possible. Inspection and maintenance of the pipeline system along with marked gas line locations and an early warning and response procedure can lessen the risk to those near the pipelines.

Warning Time Score: 4—Less than six hours warning time

Duration Score: 1—Less than 6 hours

Geographic Location/Extent

This section provides geographic locations within Story County impacted by each type of potential hazardous materials incident.

Fixed Hazardous Materials Incident

According to the Iowa Department of Natural Resources, there are 78 sites in Story County that because of the volume or toxicity of the materials on site were designated as Tier II Facilities under the Superfund Amendments and Reauthorization Act.

Table 3.45 provides the number of Tier II Facilities for each jurisdiction in the planning area; the jurisdiction is assigned from the address. Some facilities do fall within the unincorporated areas but are identified with the nearest city. Figure 3.17 that follows is a map showing the locations of Tier II Facilities.

Figure 3.17: Tier II Facilities in Story County

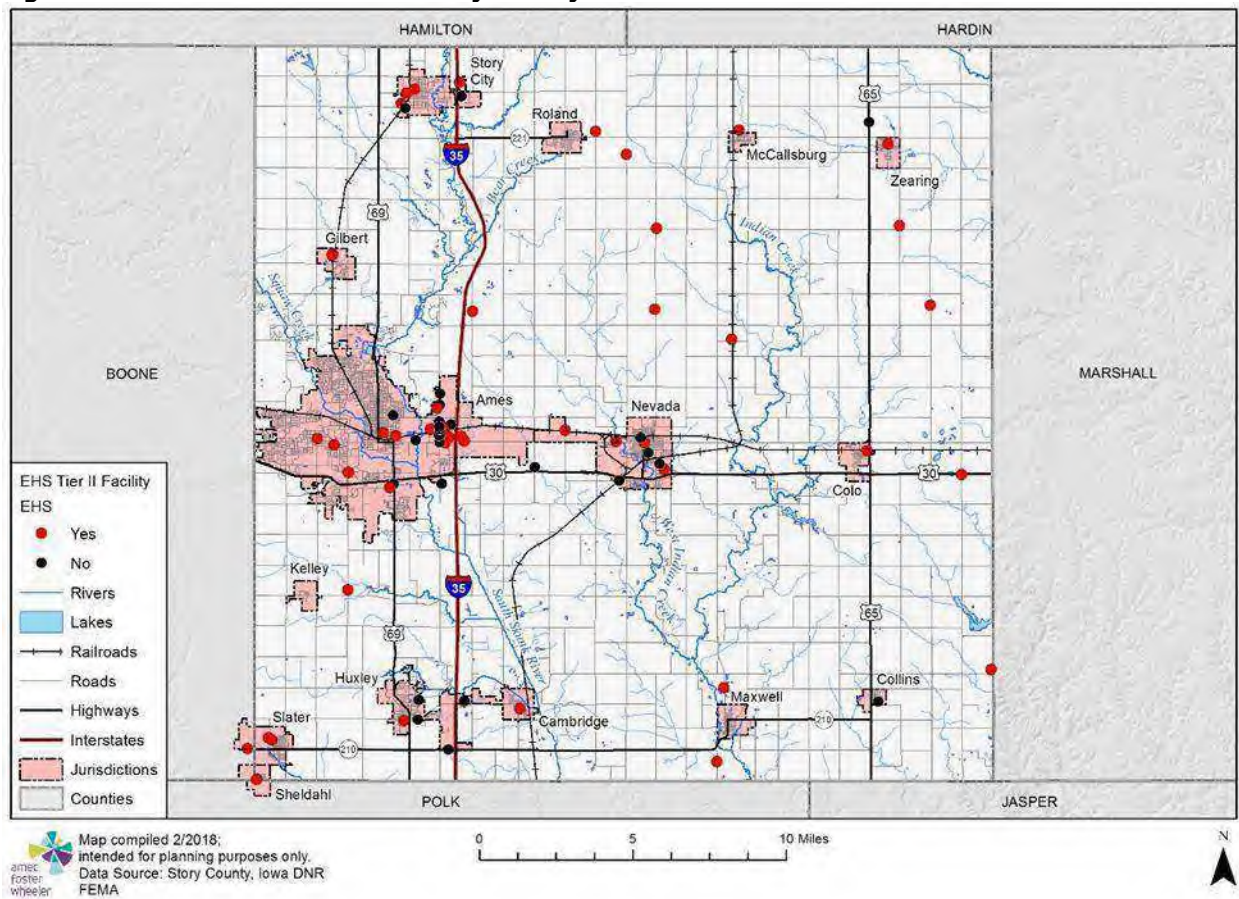


Table 3.45: Number of Tier II Facilities by Jurisdiction

Jurisdiction	# of Tier II Facilities
Ames	29
Cambridge	1
Collins	1
Colo	1
Gilbert	2
Huxley	5
Nevada	7
Slater	4
Story City	5
Zearing	1
Unincorporated	21
Total	77

Source: Department of Natural Resources

Transportation Hazardous Materials Incident

The 2001 *Story County Hazardous Commodity Flow Analysis* looked at both highway and rail transport of hazardous materials in Story County. The highways analyzed included Highway 30 and Interstate 35 and the railroad line analyzed is the Union Pacific Railroad. The highway analysis included four locations that were selected for observation of the number of hazardous materials being transported in a 4-hour period. The collected data was then extrapolated to a 24-hour time-frame. The following was revealed from the analysis:

- 2,061,000 combined gallons of the following classes of hazardous materials:
 - Corrosives
 - Cryogenic gases
 - Elevated Temperature Liquids
 - Explosives
 - Flammable and Combustible Liquids
 - Flammable Gas
 - Flammable Liquids
 - Non-flammable Gas
- 115,000 combined pounds of the following classes of hazardous materials
 - Corrosives
 - Dangerous Mixed Loads
 - Flammable Liquids
 - Flammable solids
 - Non-flammable Gas
 - Poison

The Commodity Flow Analysis also reported on the Transport of Hazardous Materials via Railroad in Story County for an 11-month period from January 1, 2000 to December 1, 2000. According to the 2007 Ames/ISU Hazard Mitigation Plan, approximately 80 trains a day pass through the community of Ames on the east-west Union Pacific Railroad. For the 2014 Story County Hazard Mitigation Plan, Union Pacific supplied data on quantities of hazardous materials transported for 5 Departure/Destination rail routes that pass through the County.

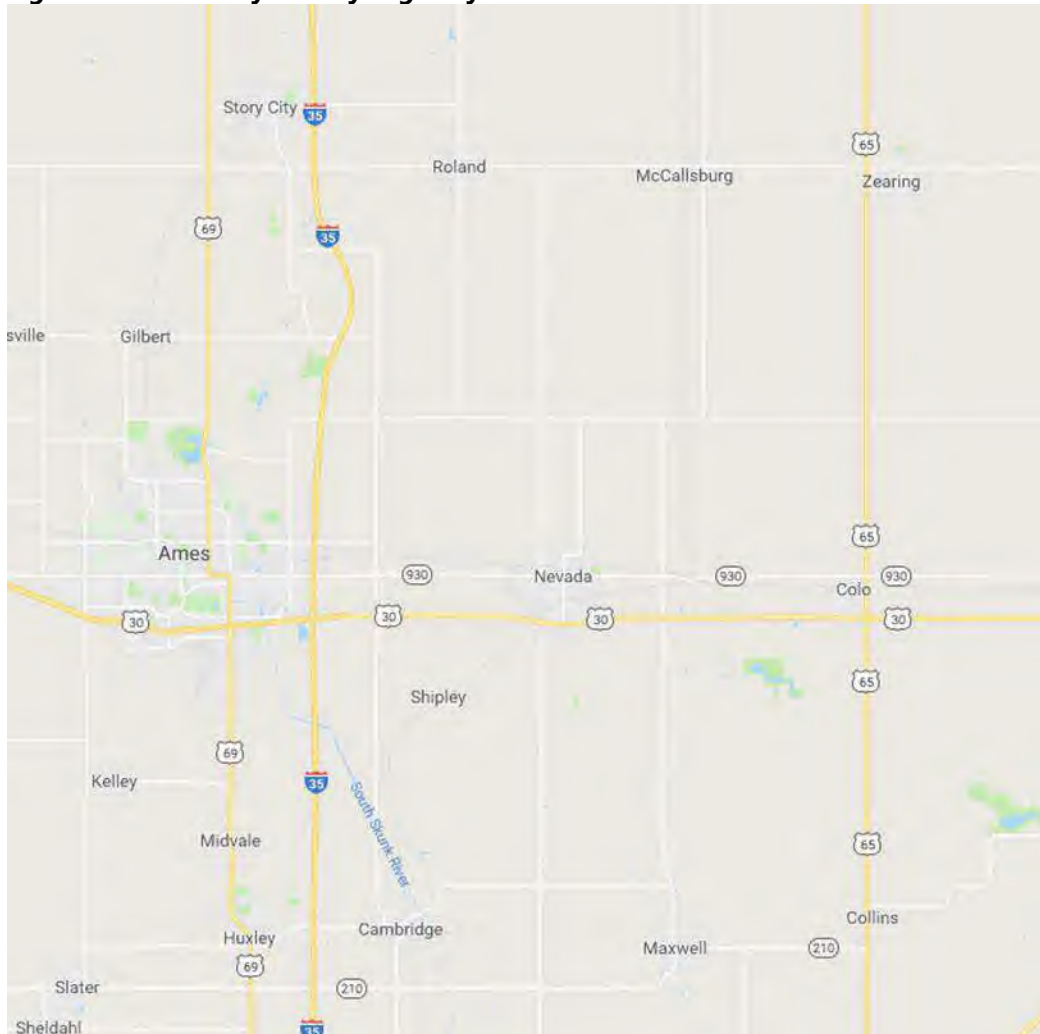
The following classes of hazardous materials pass through Story County via railroad:

- Flammable and Combustible Liquids
- Explosives
- Corrosive Liquids
- Non-Flammable Gases
- Flammable Gases
- Flammable Solids

- Oxidizers
- Poison Gases
- Liquid and Solid Poisons
- Radioactives
- Hazardous Waste

A track is being added west of Highway 30 to transport hazardous materials, which will further increase the County's vulnerability.

Figure 3.18: Story County Highways

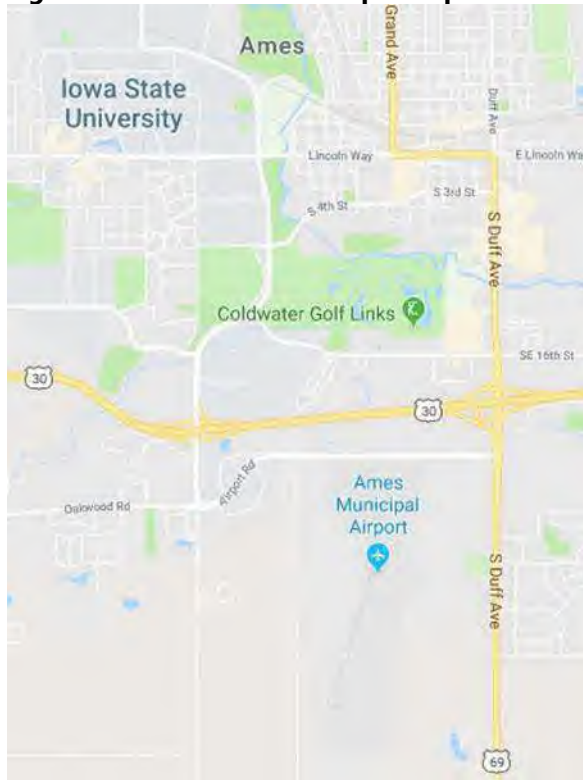


Source: Google Maps

Air Freight

Ames Municipal Airport is a publicly owned airport located 1 mile south of the city of Ames.

Figure 3.19: Ames Municipal Airport



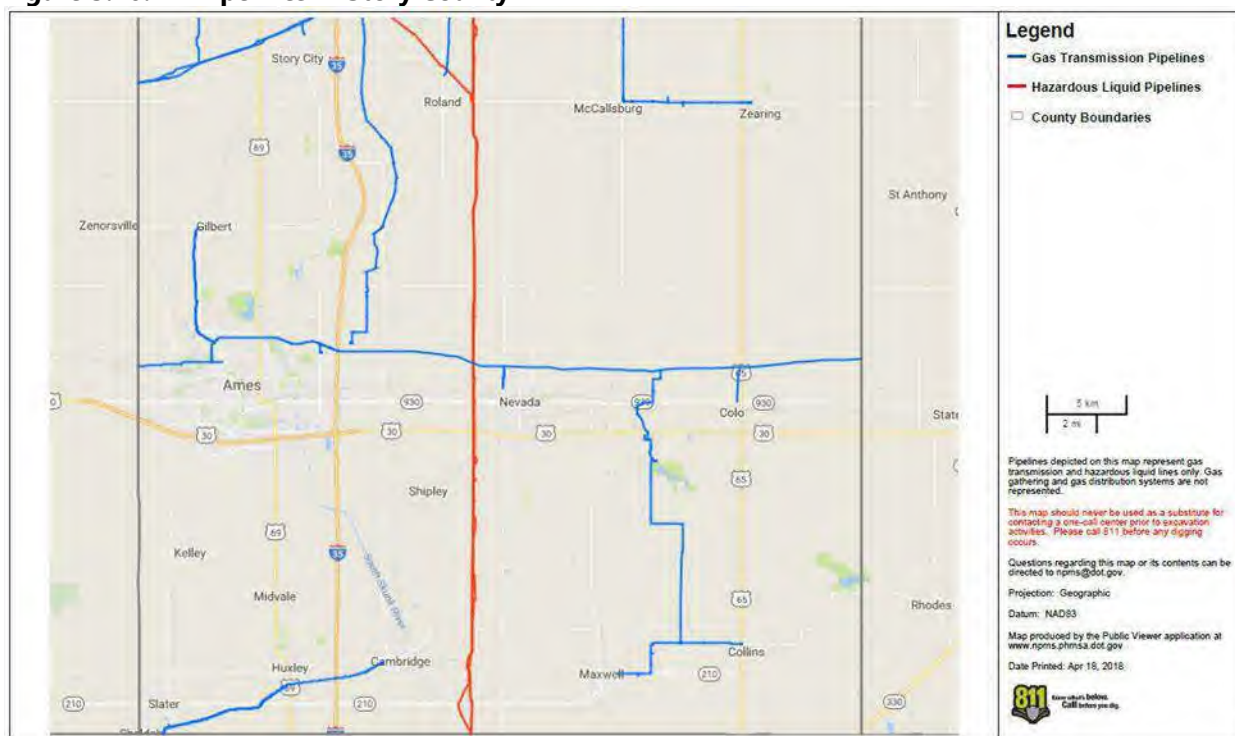
Source: Google Maps

Pipeline Incident

According to the National Pipeline Mapping System (NPMS), there are 92 miles of gas pipelines and 81 miles of liquid pipelines in Story County. Pipeline operators include: Alliant Energy/Interstate Power and Light Company, Koch Pipeline Company, L.P., Magellan Pipeline Company, L.P., Northern Natural Gas Company, Poet Biorefining-Jewell, and Sunoco Logistics Partners, which operates the Dakota Access Pipeline (not currently shown in NPMS). Approximately 7 miles to the east of the City of Ames, along the western edge of the City of Nevada, a major gas pipeline runs north and south that breaks off to supply most parts of Story County.

Figure 3.20 provides the locations of pipelines in Story County. The data for this map consists of gas transmission pipelines and hazardous liquid trunklines. It does not contain gathering or distribution pipelines, such as lines which deliver gas to a customer's home. Therefore, not all pipelines in the County will be visible, including the Dakota Access Pipeline.

Figure 3.20: Pipelines in Story County



Source: Pipeline and Hazardous Materials Safety Administration, National Pipeline Mapping System, <https://pvnpm.phmsa.dot.gov/PublicViewer/>

Any type of hazardous materials incident within a city that includes a large release of hazardous materials could affect large areas of the city in the right conditions, possibly even the entire city. This could necessitate evacuation of large areas. In the rural unincorporated areas where population densities are low, even in the event of a large release the number of homes that may need to be evacuated would be significantly lower than in an urban environment.

Immediate dangers from hazardous materials include fires and explosions. The release of some toxic gases may cause immediate death, disablement, or sickness if absorbed through the skin, injected, ingested, or inhaled. Contaminated water resources may be unsafe and unusable, depending on the amount of contaminant. Some chemicals cause painful and damaging burns if they come in direct contact with skin. Contamination of air, ground, or water may result in harm to fish, wildlife, livestock, and crops. The release of hazardous materials into the environment may cause debilitation, disease, or birth defects over a long period of time. Loss of livestock and crops may lead to economic hardships within the community. The occurrence of a hazmat incident many times shuts down transportation corridors for hours at a time while the scene is stabilized, the product is off-loaded, and reloaded on a replacement container.

Previous Occurrences

In Iowa, hazardous materials spills are reported to the Department of Natural Resources. According to Iowa Administrative Code Chapter 131, Notification of Hazardous Conditions, any person manufacturing, storing, handling, transporting, or disposing of a hazardous substance must notify the Department of Natural Resources and the local police department or the office of the sheriff of the affected county of the occurrence of a hazardous condition as soon as possible but not later than six hours after the onset of the hazardous condition or the discovery of the hazardous condition. The Department of Natural Resources maintains a database of reported spills.

According to the DNR database, from 2000 to April 2017, there have been 390 hazardous materials spills reported in Story County. Table 3.46 provides a summary of the reported spills during this time period for each jurisdiction indicated in the database as well as the mode of the spill. According to this data, the most spills occurred through handling and storage accidents. Table 3.47 that follows summarizes the spills by material type. Petroleum is the most common material type spilled with 196 spills of this type.

Table 3.46: Story County Hazardous Materials Spills by Mode Reported to Iowa DNR, 2000-2016

Jurisdiction	Dumping	Fire	Handling and Storage	Manure	Other	Pipeline	Railroad	Theft	Transformer	Transportation	Unknown	Not Reported	Grand Total
Ames	4	3	101	1	6			1	41	82	1		240
Cambridge			1			1	1	2	4	2			11
Collins			2	1					1	1			5
Colo			6	7	1			1	1	1		1	18
Gilbert									1				1
Huxley			4						1	2			7
Kelley								1					1
Maxwell			3						1	2			6
McCallsburg			1		1				3			1	6
Nevada	1		26	4	1		1		9	7			49
Roland			1	4		1			3	1			10
Slater			2							1	1		4
Story City		1	11	6						6		1	25
Zearing									2	1			3
Unspecified			2	1					1	3			7
Grand Total	5	4	160	24	9	2	2	5	68	109	2	3	393

Source: Iowa Department of Natural Resources, <https://programs.iowadnr.gov/hazardousspills/Introductory.aspx#&&BasicPageIndex=0>

Table 3.47: Story County Hazardous Materials Spills Reported to Iowa DNR, 2000-2016 by Material Type

Jurisdiction	Acids/Bases	Animal/Vegetable Product	Chlorine	Fertilizer/Pesticide	Inorganic Chemical	Manure	Organic Chemical	Paints/Dye/Organic Solvents	Petroleum	Transformer Oil/PCB	Unknown	Not Reported	Grand Total
Ames	7		1	9	4	1	25	2	144	41	1	5	240
Cambridge		1		1					3	4		2	11
Collins						1			3	1			5
Colo				7	4	1	1		2	1		2	18
Gilbert										1			1
Huxley				3					3			1	7
Kelley												1	1
Maxwell	1			1	1				1	1		1	6
McCallsburg									3	3			6
Nevada		4	1	4	3	1	3	1	22	7		3	49
Roland					2				3	3		2	10
Slater				1					1			2	4
Story City		1			3		2	2	13			4	25
Zearing										2		1	3
Unspecified				1		1	2		2	1			7
Grand Total	8	6	2	27	17	5	33	5	200	65	1	24	393

Source: Iowa Department of Natural Resources, <http://www.iowadnr.gov/InsideDNR/RegulatoryLand/EmergencyPlanningEPCRA/SpillReporting.aspx>

The Environmental Protection Agency's Toxics Release Inventory (TRI) tracks the management of over 650 toxic chemicals that pose a threat to human health and the environment. Facilities in the U.S. that manufacture, process, or otherwise use these chemicals in amounts above established levels must report how each chemical is managed through recycling, energy recovery, treatment, and releases to the environment. A "release" of a chemical means that it is emitted to the air or water, or placed in some type of land disposal. The information submitted by facilities to the EPA and states is compiled annually as the Toxics Release Inventory or TRI, and is stored in a publicly accessible database in Envirofacts.

TRI data is available for all facilities that have submitted a Form R or Form A to EPA since the program began in 1987. TRI facilities are legally required to report to EPA by July 1st of each year. Table 3.48 provides the TRI on-site and off-site reported disposed of or otherwise released reported for industries in Story County that have TRI reporting requirements for 2016.

Table 3.48: TRI On-site and Off-site Reported Disposed of or Otherwise Released (in pounds), for All Industries, for All Chemicals, Story County, Iowa, 2016

Chemical	Total On-site Disposal or Other Releases	Total Off-site Disposal or Other Releases	Total On- and Off- site Disposal or Other Releases
Acetaldehyde	18,860	-	18,860
Acrolein	1,340	-	1,340
Ammonia	22,899	-	-
Benzene	-	-	-
Copper Compounds	-	-	-
Diisocyanates	1	-	1
Dioxin and Dioxin-Like Compounds	.0730000	-	.0730000
Ethylbenzene	-	-	-
Formaldehyde	820	-	820
Lead	6	0	6
Lead Compounds	59	-	59
Maleic Anhydride	45	-	45
Manganese Compounds	-	-	-
Mercury Compounds	6	0	6
Methanol	2,600	-	2,600
N-Hexane	3,020	-	3,020
Toluene	-	-	-
Zinc Compounds	0	2,687	2,687
Total	49,656	2,687	52,343

Source: Environmental Protection Agency Toxics Release Inventory (TRI) https://iaspub.epa.gov/triexplorer/tri_release.chemical

TRI data reflects releases and other waste management activities of chemicals, not whether (or to what degree) the public has been exposed to those chemicals. Release estimates alone are not sufficient to determine exposure or to calculate potential adverse effects on human health or the environment. TRI data, in conjunction with other information can be used to begin to evaluate exposures that may result from releases and other waste management activities that involve toxic chemicals. The determination of potential risk is dependent on several factors including, toxicity of the chemical, the fate of the chemical, and the amount of and duration of human exposure after the chemical is released.

Specific Hazardous Materials Incidents reported by the planning committee are provided below:

- January 29, 2003
- January 25, 2001
- September 21, 1999
- November 10, 1999
- June 1997
- March 19, 1996

Pipelines

The U.S. Department of Transportation (DOT) Pipeline and Hazardous Materials Safety Administration maintains a database of pipeline incidents and mileage reports. From 1996 to 2017 there was one reported pipeline incident in Story County. The incident occurred on November 14, 2017 at the Dakota

Access Pipeline Cambridge pump station where a leak occurred due to a crack in a pipe and resulted in over \$19,000 in property damage and an additional \$19,000 in emergency costs.

There was one incident that was reported to U.S. DOT, but did not meet the qualifications of a “significant event”. On October 28, 2011 a Northern Natural Gas Company (NNG) line was hit near Huxley and Cambridge on NNGs Cambridge Iowa Branch Line. A tile contractor installing a drain tile hit the 2-inch natural gas line. Highway 210 was closed for 30 minutes and some private citizens were evacuated.

Probability of Future Occurrence

From 2000 to 2016 (17 years), there have been 337 spills reported to Iowa DNR. This computes to an annual average of over 19.8 hazardous materials spills per year. Therefore, the probability of future occurrence of hazardous materials incidents is determined to be “Highly Likely”.

Probability Score: 4—Highly Likely

Vulnerability

Vulnerability Overview

A hazardous materials incident can occur almost anywhere. So, all jurisdictions are considered to have at least some vulnerability to this hazard. People, pets, livestock, and vegetation in close proximity to facilities producing, storing, or transporting hazardous substances are at higher risk. Populations downstream, downwind, and downhill of a released substance are particularly vulnerable. Depending on the characteristics of the substance released, more people, in a larger area may be in danger from explosion, absorption, injection, ingestion, or inhalation.

Most of the hazardous materials incidents that have occurred in Story County are localized and are quickly contained or stabilized. Depending on the characteristic of the hazardous material or the volume of product involved, the affected area can be as small as a room in a building or as large as 5 square miles or more. Many times, additional regions outside the immediately affected area are evacuated for precautionary reasons. More widespread effects occur when the product contaminates the municipal water supply or water system such as river, lake, or aquifer. Spills can be costly to clean up due to the specialized equipment and training, and disposal sites that are necessary. The majority of spills in the county are small and quickly maintained within existing capabilities, but due to the presence of the pipelines and rail transport, the possibility of more serious events exists. Therefore, the magnitude was determined to be “Limited”.

Magnitude Score: 2—Limited

Potential Losses to Existing Development

The impact of this type of disaster will likely be localized to the immediate area surrounding the incident. The initial concern will be for people, then the environment. If contamination occurs, the spiller is responsible for the cleanup actions and will work closely with responders in the local jurisdiction, the Iowa Department of Natural Resources, and the Environmental Protection Agency to ensure that cleanup is done safely and in accordance with federal and state laws.

As mentioned, it is difficult to determine the potential losses to existing development because of the variable nature of a hazardous materials spill. For example, a spill of a toxic airborne chemical in a populated area could have greater potential for loss of life. By contrast a spill of a very small amount of a chemical in a remote rural area would be much less costly and possibly limited to remediation of soil.

Data provided by the Iowa Department of Natural Resources did not provide information relative to costs associated with cleaning up any of the spills or of any property damage that occurred. Without data on costs of previous events, it is not possible to determine potential costs associated with future spills.

To analyze critical facilities at risk in the planning area, the inventory of critical and essential facilities and infrastructure in the planning area was compiled from various sources including Story County, the Department of Natural Resources NRGIS, and HSIP Freedom 2015. The compiled inventory consisted of 686 critical facilities. A comparison was made of the critical facilities with the locations of Tier II Facilities to determine those critical/essential facilities/functions (other than Tier II facilities themselves) that are within ½ mile of Tier II fixed chemical facilities. This analysis revealed 321 critical or essential facilities within ½ mile of fixed chemical facilities with the Tier II reporting requirement. Appendix E contains the results of analysis. This Appendix is redacted from the public version of this plan. To obtain access for official use, contact the Story County Emergency Manager.

Future Development

The number and types of hazardous chemicals stored and transported through Story County will likely continue to increase. As populations grow, this also increases the number of people vulnerable to the impacts of hazardous materials spills. Population and business growth along major transportation corridors increases the vulnerability to transportation hazardous materials spills.

Hazardous Materials Hazard Summary by Jurisdiction

Transportation Hazardous Materials Incidents can occur in all jurisdictions. In addition, there are likely additional fixed facilities that have not been analyzed in this assessment due to quantities of chemicals below reportable thresholds. Therefore, all jurisdictions are considered to have some probability for transportation hazardous materials incidents. Similarly, all jurisdictions have pipelines near them. Therefore, all jurisdictions are considered to have some probability for pipeline hazardous materials incidents. However, fixed facility incidents at Tier II facilities are limited to those jurisdictions that have these facilities. Based on available data, it was determined that the following jurisdictions have less than 4 Tier II fixed facilities: Cambridge, Collins, Colo, Gilbert, Slater, Kelley, Maxwell, McCallsburg, Roland, Sheldahl, and Zearing. As a result, these cities and school districts that serve these cities were assigned a probability of 2, occasional.

Jurisdiction	Probability	Magnitude	Warning Time	Duration	Score	Level
Story County, Iowa	4	2	4	1	3.1	High
City of Ames	4	2	4	1	3.1	High
City of Cambridge	2	2	4	1	2.2	Moderate
City of Collins	2	2	4	1	2.2	Moderate
City of Colo	2	2	4	1	2.2	Moderate
City of Gilbert	2	2	4	1	2.2	Moderate
City of Huxley	4	2	4	1	3.1	High
City of Kelley	2	2	4	1	2.2	Moderate
City of Maxwell	2	2	4	1	2.2	Moderate
City of McCallsburg	2	2	4	1	2.2	Moderate
City of Nevada	4	2	4	1	3.1	High
City of Roland	2	2	4	1	2.2	Moderate
City of Sheldahl	2	2	4	1	2.2	Moderate
City of Slater	2	2	4	1	2.2	Moderate
City of Story City	4	2	4	1	3.1	High
Ames Schools	4	2	4	1	3.1	High
Ballard Schools	4	2	4	1	3.1	High
Collins-Maxwell Schools	2	2	4	1	2.2	Moderate
Colo-Nesco Schools	2	2	4	1	2.2	Moderate
Gilbert Schools	2	2	4	1	2.2	Moderate
Nevada Schools	4	2	4	1	3.1	High
Roland-Story Schools	4	2	4	1	3.1	High
Iowa State University	4	2	4	1	3.1	High

3.5.10 Human Disease

Hazard Score Calculation					
Probability	Magnitude/Severity	Warning Time	Duration	Weighted Score	Level
2	3	2	4	2.50	Moderate

Profile

Hazard Description

A human disease outbreak is a medical, health or sanitation threat to the general public (such as contamination, epidemic, plague and insect infestation). The outbreak may be spread by direct contact with an infected person or animal, ingesting contaminated food or water, vectors such as mosquitoes or ticks, contact with contaminated surroundings such as animal droppings, infected droplets, or by aerosolization.

Iowa's public health and health care communities work to protect Iowans from infectious diseases and preserve the health and safety of Iowans by rapidly identifying and containing a wide range of biological agents. Local public health departments and the Iowa Department of Public Health, Center for Acute Epidemiology investigate disease "outbreaks" of routine illnesses. There are a number of biological diseases/agents that are of concern to the State of Iowa such as vaccine preventable disease, foodborne disease and community associated infections having significant impact on the morbidity of Iowans. The following descriptions are general and it should be noted that individuals may experience more or less severe consequences.

Vaccine Preventable Disease

In the U.S., there are common infectious diseases that include polio, measles, diphtheria, pertussis, rubella, mumps, tetanus and Haemophilus influenzae type b that are now rare because of widespread use of vaccines. Routine childhood immunizations have helped protect both individuals and communities each year saving nearly \$14 billion in direct medical costs and \$69 billion in costs to society according to the U.S. Department of Health and Human Services, Centers for Disease Control and Prevention.

The immunization rates in Iowa are consistent with national average (see Table 3.52). Vaccine preventable diseases continue to threaten the health of Iowans when children, adolescents and adults are un-immunized or under-immunized.

Influenza

Influenza (flu) is a viral infection of the nose, throat, bronchial tubes, and lungs. There are two main types of virus: A and B. Each type includes many different strains, which tend to change each year. In Iowa, influenza occurs most often in the winter months. Illnesses resembling influenza may occur in the summer months, but these are usually the result of other viruses that exhibit symptoms commonly referred to as influenza-like illness or ILI.

Influenza is highly contagious and is easily transmitted through contact with droplets from the nose and throat of an infected person during coughing and sneezing. Typical symptoms include headache, fever, chills, cough, and body aches. Although most people are ill for only a few days some may have secondary infections, such as pneumonia, and may need to be hospitalized. Anyone can get influenza, but it is typically more serious in the elderly and people with chronic illnesses such as cancer, emphysema, or diabetes or weak immune systems. It is estimated that thousands of people die each year in the United States from flu or related complications.

Pandemic Influenza

A pandemic is a global disease outbreak. A pandemic flu is a human flu that causes a global outbreak, or pandemic, of serious illness. A flu pandemic occurs when a new influenza virus emerges for which people have little or no immunity, and for which there is no vaccine.

This disease spreads easily person-to-person, causing serious illness, and can sweep across the country and around the world in a very short time. The Centers for Disease Control and Prevention (CDC) has been working closely with other countries and the World Health Organization to strengthen systems to detect outbreaks of influenza that might cause a pandemic and to assist with pandemic planning and preparation.

During 2009 and 2010, health professionals around the globe worked to combat the H1N1 influenza virus. This relatively mild and stable influenza virus circulated across the globe and caused one of the most robust worldwide vaccination campaigns since the 1970s. Health professionals continue to monitor the possibility of an avian (bird) flu pandemic associated with a highly pathogenic avian H5N1 virus. Since 2003, avian influenza has been spreading through Asia. A growing number of human H5N1 cases contracted directly from handling infected poultry have been reported in Asia, Europe, and Africa, and more than half the infected people have died. There has been no sustained human-to-human transmission of the disease, but the concern is that H5N1 will evolve into a virus capable of human-to-human transmission.

An especially severe influenza pandemic could lead to high levels of illness, death, social disruption, and economic loss. Impacts could range from school and business closings to the interruption of basic services such as public transportation, health care, and the delivery of food and essential medicines.

Pandemics are generally thought to be the result of novel strains of viruses. Because of the process utilized to prepare vaccines, it is impossible to have vaccine pre-prepared to combat pandemics. A portion of the human and financial cost of a pandemic is related to lag time to prepare a vaccine to prevent future spread of the novel virus. In some cases, current vaccines may have limited activity against novel strains.

Foodborne Disease

There are several agents that can cause illness when consumer in contaminated food, beverages or water. Foodborne illness (food poisoning) can also be spread person-to-person as well as from contact with animals. Table 3.49 is a list of common foodborne diseases.

Table 3.49: Common Foodborne Diseases

Organism	Onset of Symptoms	Associated Food(s)
Botulism	12 - 36 hours	Canned fruits and vegetables
Campylobacter	2 - 5 days, range 1 - 10 days	Undercooked chicken or pork, unpasteurized milk
Cholera	12 - 72 hours	Undercooked or raw seafood, especially oysters
Cryptosporidium	7 days, range 1 - 12 days	Unpasteurized beverages, contaminated food or water, person-to-person
E. coli (shiga-toxin)	3 - 4 days, range 2 - 10 days	Undercooked ground meats, unpasteurized milk, contaminated fruits or vegetables, person-to-person
Giardia	7 - 10 days, range 3 - 25 days	Contaminated water, person-to-person
Hepatitis A	28 - 30 days, range 15 - 50 days	Raw produce, undercooked foods, person-to-person
Listeria	3 weeks, range 3 - 70 days	Soft cheeses, unpasteurized milk, ready-to-eat deli meats, hot dogs, undercooked poultry, unwashed raw vegetables
Norovirus	24 - 48 hours, range 10 - 50 hours	Contaminated ready-to-eat food, undercooked shellfish, person-to-person

Organism	Onset of Symptoms	Associated Food(s)
Salmonella	12 - 36 hours, range 6 - 72 hours	Contaminated eggs, poultry, beef, raw fruits and vegetables, unpasteurized milk or juice, cheese
Shigella	1 - 3 days, range 12 - 96 hours	Contaminated food or water, person-to-person
Trichinosis	8 - 15 days, range 5 - 45 days	Raw or undercooked pork or wild game meat

Source: Iowa Department of Public Health, Center for Acute Disease Epidemiology <http://www.idph.state.ia.us/Cade/Foodborne.aspx>.

Warning Time Score: 2—12-24 hours

Duration Score: 4—More than 1 week

Geographic Location/Extent

A human disease outbreak has no geographic boundaries. Because of our highly mobile society, disease can move rapidly through a school, business and across the nation within days, weeks or months. Many of the infectious diseases that are designated as notifiable at the national level result in serious illness if not death. Some are treatable, for others only the symptoms are treatable.

Previous Occurrences

The World Health Organization tracks and reports on epidemics and other public health emergencies through the Global Alert and Response (see historic epidemics at www.who.int/en/).

There have been four acknowledged pandemics in the past century:

2009 H1N1 Influenza—The 2009 H1N1 Pandemic Influenza caused 659 hospitalizations with lab confirmed H1N1 since 9/1/09 and resulting in 41 fatalities. Typically people who became ill were the elderly, the very young and people with chronic medical conditions and high risk behaviors.

1968–69 Hong Kong flu (H3N2) —This strain caused approximately 34,000 deaths in the United States and more than 700,000 deaths worldwide. It was first detected in Hong Kong in early 1968 and spread to the United States later that year. Those over age 65 were most likely to suffer fatal consequences. This virus returned in 1970 and 1972 and still circulates today.

1957–58 Asian flu (H2N2) —This virus was quickly identified because of advances in technology, and a vaccine was produced. Infection rates were highest among school children, young adults and pregnant women. The elderly had the highest rates of death. A second wave developed in 1958. In total, there were about 70,000 deaths in the United States. Worldwide deaths were estimated between one and two million.

1918–19 Spanish flu (H1N1) —This flu is estimated to have sickened 20-40 percent of the world's population. Over 20 million people lost their lives. Between September 1918 and April 1919, 500,000 Americans died. The flu spread rapidly; many died within a few days of infection, others from secondary complications. The attack rate and mortality was highest among adults 20-50 years old; the reasons for this are uncertain.

Other Reportable Diseases

In 2016, influenza and pneumonia combined was the 8th leading causes of death in Iowa with 483 deaths, followed by all infective and parasitic diseases with 429 deaths. In 2008, there were over 800 influenza/pneumonia deaths in Iowa. Table 3.50 shows the historical reported deaths in Story County and throughout Iowa from Influenza and Pneumonia as well as Infective and Parasitic Disease.

Table 3.50: Deaths by Year 2007-2016, Influenza and Pneumonia and Infective and Parasitic Disease, Story County and State of Iowa

Year	Influenza/Pneumonia Deaths, Story County	Influenza/Pneumonia Deaths, Iowa	Infective/Parasitic Disease Deaths, Story County	Infective/Parasitic Disease Deaths, Iowa
2016	8	483	10	429
2015	8	592	11	488
2014	6	549	8	448
2013	12	755	*	511
2012	12	656	*	511
2011	10	657	0	464
2010	9	557	0	441
2009	4	633	0	457
2008	13	825	9	493
2007	15	748	*	427

Source: Iowa Department of Public Health, Bureau of Health Statistics-Vital Statistics of Iowa in Brief, <http://idph.iowa.gov/health-statistics/data>

* Counts are suppressed to protect confidentiality.

Table 3.51 lists the number of common reportable diseases in Story County from 2007 to 2016 from the Iowa Department of Public Health, Center for Acute Epidemiology Annual Reports. The pertussis disease was reported in Iowa in 2012 because of the unexpected increase in cases. There were approximately 417 percent more persons with pertussis in 2012 compared to the average in the prior five years. In Story County, there were 70 confirmed and probably cases in 2012. The Iowa Department of Public Health Medical Director believes that most adults have not had a pertussis vaccination since childhood so they probably have no immunity left to pertussis. When they are infected with the disease, their symptoms are milder and are often mistaken for a lingering cough, but the disease can still spread to others.

A statewide mumps outbreak began in July 2015 and persisted in to 2017. Story County saw 73 confirmed cases in 2016. Iowa State University saw increase in cases likely due to students living in close proximity. The outbreak lead to the ISU campus to do a free vaccination campaign for those 24 years old and younger. The Iowa Department of Public Health reported that by the end on 2016 1,143 cases had been identified since the outbreak began in 2015.

Table 3.51: Iowa Common Reportable Diseases by Year in Story County

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
AIDS (Diagnosis)	0	0	0	*	0	*	2	0	N/A	N/A
HIV (Diagnosis)	0	0	*	*	*	*	3	2	N/A	N/A
Campylobacteriosis	8	10	16	15	17	13	11	14	25	13
Chlamydia	264	314	259	299	293	321	312	418	N/A	N/A
Cryptospora	17	8	11	10	7	1	32	6	9	10
E.Coli	3	7	3	1	4	5	3	3	4	15
Ehrlich (HME)	0	N/A	0	0	0	0	0	0	0	0
Giardia	9	9	9	9	1	7	4	6	2	8
Gonorrhea	30	22	28	34	25	32	33	31	N/A	N/A
HUS	1	1	0	1	2	0	0	0	0	0
Hep A	0	1	1	1	0	0	0	1	0	3
Hep B, Acute	0	0	0	11	1	0	0	0	1	0
Hep B, Chron	18	14	16	11	11	21	10	17	17	14
Legion	1	0	0	0	0	0	0	0	0	1
Listeria	1	0	0	0	0	0	0	0	0	0
Lyme	2	1	2	0	1	2	3	2	3	5

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Meningo.Inf	2	0	0	1	1	0	0	0	0	0
Mumps	0	1	1	0	0	1	0	0	4	73
Pertussis	1	5	1	2	4	70	10	1	1	0
Rabies (Animal)	1	1	1	1	2	2	0	0	N/A	N/A
RMSF	0	0	0	0	0	0	1	0	0	0
Salmonellosis	8	10	6	14	7	22	16	8	15	11
Shigella	11	2	0	0	0	0	2	1	4	1
Syphilis	1	1	0	2	1	10	15	4	N/A	N/A
TB	1	1	1	1	3	3	2	1	N/A	N/A
West Nile Virus	N/A	0	0	0	0	0	0	0	0	0

Source: Iowa Department of Public Health, Center for Acute Disease Epidemiology Annual Reports. 2007-2016, *only 1-3 HIV diagnoses reported, <http://idph.iowa.gov/CADE>

Probability of Future Occurrence

For purposes of determining probability of future occurrence, the HMPT defined “occurrence” of human disease outbreak as a medical, health or sanitation threat to the general public (such as contamination, epidemic, or plague). In the last century, there have been four pandemic flu events. With the swine flu (H1N1) outbreak in 2009-2010 within the last 10 years), the HMPT determined the possibility of a human disease outbreak causing a threat to the general public to be “Occasional”.

Probability Score: 2—Occasional

Vulnerability

Overview

Although infectious diseases do not respect geographic boundaries, several populations in Story County are at specific risk to infectious diseases. Communicable diseases are most likely to spread quickly in institutional settings such as prisons, dormitories, long-term care facilities, daycare facilities and schools. According to the critical facilities inventory provided by Story County GIS, there are 39 nursing homes, and 198 school facilities (including college/university, school and daycares) in the county.

According to the Iowa Department of Public Health 2016-2017 Immunization Program Audit Report, Story County had 99.73 percent with immunization certificates in kindergarten through 12th grade. The County Immunization Assessment for 2-year old and 13-15-year old coverage from the 2016 Annual Report is provided in Table 3.52. The percent of up-to-date children and adolescents is above the state average of 69 percent.

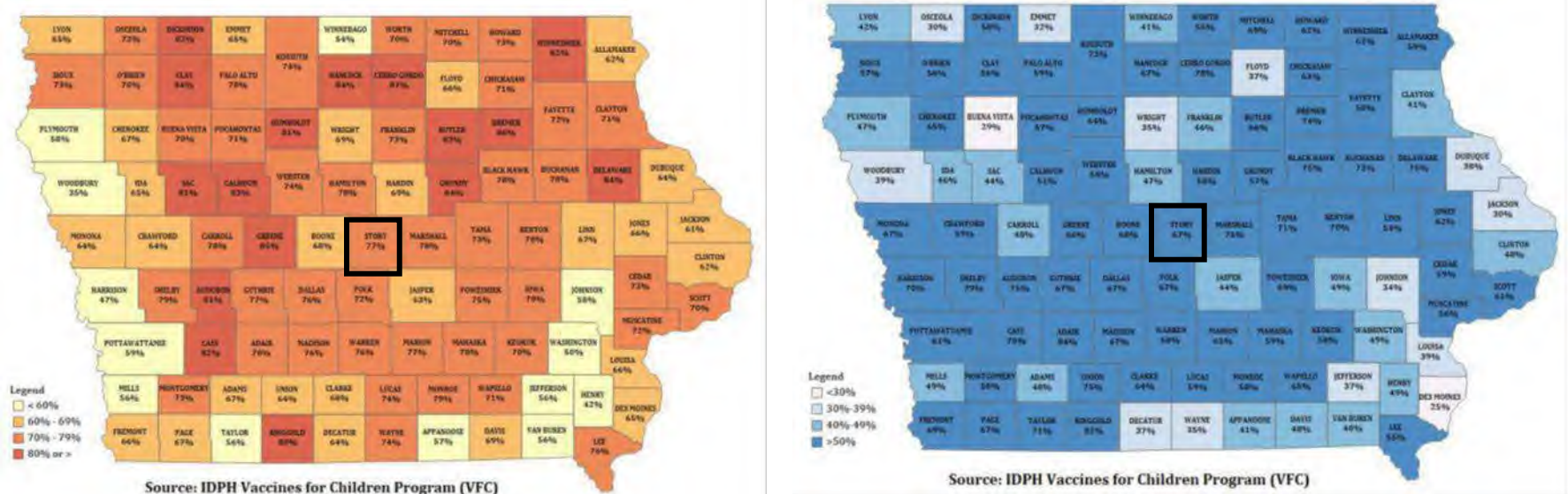
Table 3.52: 2016 Vaccination Coverage Percent of Individual Vaccines and Selected Vaccination Series in Story County (2-year old coverage and 13-15 year old coverage)

	County Population Born 2014 Estimate	Total Records Analyzed from IRIS	Percent of Population in IRIS	4 DTaP Coverage Percent	3 Polio Coverage Percent	1 MMR Coverage Percent	3 Hib Coverage Percent	3 Hep B Coverage Percent	1 Varicella Coverage Percent	4 PCV Coverage Percent	Up-To-Date 4-3-1-3-3-1-4 Coverage Percent
2-Year Old Coverage	926	990	106.9	83	90	88	89	88	87	82	77
	County Population 2014 Estimate	Total Records Analyzed from IRIS	Percent of Population in IRIS	3 Hep B Coverage Percent	1 Meningitis Coverage Percent	2 MMR Coverage Percent	1 Td/Tdap Coverage Percent	2 Varicella Coverage Percent	Up-to-Date 3-1-2-1-2 Coverage Percent	3 HPV Female Coverage Percent	3 HPV Male Coverage Percent
13-15 Year Old Coverage	2675	3061	114.4	93	72	89	86	83	67	29	26

Source: Iowa Department of Public Health, Iowa Immunization Program 2016 Annual Report, 2016 County Immunization Assessment, <http://www.idph.state.ia.us/ImmTB/Immunization.aspx?prog=Imm&pg=ImmHome>

* Note: Up-to-date are 2-year old children who have completed the 4 DTaP, 3 Polio, 1 MMR, 3 Hib, 3 Hep B, 1 Varicella, 4 PCV by 24 months of age or adolescents 13- to 15-year-olds who have completed the 3 Hep B, 1 Meng, 2 MMR, 1 Td or Tdap, 2 Varicella series.

Figure 3.21: County Immunization Assessment Maps (2-year Old Coverage-left, 13-15-year Old Coverage-right)



Source: Iowa Department of Public Health, Iowa Immunization Program Annual Report 2016 County Immunization Assessment, <http://www.idph.state.ia.us/ImmTB/Immunization.aspx?prog=Imm&pg=ImmHome>

Note: Story County is outlined in black

Human disease outbreak could be catastrophic based on a pandemic scenario. The magnitude of an infectious disease outbreak is related to the ability of the public health and medical communities to stop the spread of the disease. Most disease outbreaks that cause critical numbers of deaths are communicable in nature, meaning that they are spread from person to person. The key to reducing the critical nature of the event is to stop the spread of disease. This is generally done in three ways:

- 1) identification and isolation of the ill,
- 2) quarantine of those exposed to the illness to prevent further spread, and
- 3) education of the public about methods to prevent transmission.

The public health and health care providers in Story County routinely utilize all three methods to reduce morbidity and mortality from infectious disease.

Spread of disease in Story County is high due to the population density of 156.3 people per square mile of land area, which is above the national average of 87.4 people per square mile. During the school year the population increases due to the Iowa State University campus in the City of Ames. With students living in close proximity to one another the opportunity for disease to spread from person to person in the County is high.

Magnitude Score: 3—Critical

Potential Losses to Existing Development

According to *The Annual Impact of Seasonal Influenza in the US: Measuring Disease Burden and Costs* by Molinari et al., nationally the economic burden of influenza medical costs, medical costs plus lost earnings, and the total economic burden was \$10.4 billion, \$26.8 billion and \$87.1 billion respectively. The financial burden of healthcare-associated infections nationally has been estimated at \$33 billion annually. Specific amounts for Story County are not available.

The pandemic predictions for Iowa from the *Iowa Pandemic Influenza Annex*, 2006 are that 15-35 percent of the population may be affected with a “medium level” case scenario with no vaccine and no antiviral drugs, which could cause 900-2,000 deaths and 3,000-7,000 hospitalizations statewide. Using pandemic influenza as the worst-case scenario for estimating projected numbers of people affected, the Story County *Pandemic Influenza Response Plan 2009* states that 30 percent of the overall population could be ill in this scenario. Table 3.53 lists the number of persons affected by jurisdiction in Story County based on the 2010 census population.

Table 3.53: Pandemic Influenza Worst Case Scenario Projected Numbers of People Affected

Jurisdiction	2010 Population	30% of Population Affected
Ames	58,965	17,690
Cambridge	827	248
Collins	495	149
Colo	876	263
Gilbert	1,082	325
Huxley	3,317	995
Kelley	309	93
McCallsburg	333	100
Maxwell	920	276
Nevada	6,798	2,039
Roland	1,284	385
Sheldahl	319	96
Slater	1,489	447

Jurisdiction	2010 Population	30% of Population Affected
Story City	3,431	1,029
Zearing	554	166
Story County	8,543	2,563
Total	89,542	26,863

Source: U.S. Census, 2010 and Story County Pandemic Influenza Response Plan 2009

The Iowa Hospital Association has a comparison tool of hospital charges in Iowa for common/high volume services. Table 3.54 describes the inpatient costs for a respiratory, non-surgical pneumonia during January 2017 to December 2017 timeframe. The worst-case scenario compares the charges at the Mary Greeley Medical Facility in Ames and the Story County Medical Center in Nevada where if 30 percent of the population needs inpatient services. Table 3.54 shows the costs for minor, moderate, major and extreme severity cases of pneumonia per hospital.

Table 3.54: Hospital Inpatient Services and Described Costs at Mary Greeley Medical Facility and Story County Medical Center

	Mary Greeley Medical Facility in Ames	Story County Medical Center in Nevada
Minor Severity – 15% Affected		
Number of Discharges	20	< 5 cases
Average Length of Stay	2.1 Days	< 5 cases
Average Charge	\$10,593.00	< 5 cases
15% of Population Affected	8,845 from Ames	1,020 from Nevada
Total Cost	\$93,695,085	Not available
Moderate Severity – 10% Affected		
Number of Discharges	74	14
Average Length of Stay	3.9 Days	3.4 Days
Average Charge	\$20,365.00	\$9,886.00
10% of Population Affected	5,897 from Ames	679 from Nevada
Total Cost	\$120,092,405	\$6,712,594
Major Severity – 3% Affected		
Number of Discharges	80	10
Average Length of Stay	5.4 Days	3.0 Days
Average Charge	\$27,892.00	\$9,653.00
3% of Population Affected	1,769 from Ames	204 from Nevada
Total Cost	\$49,340,948	\$1,969,212
Extreme Severity – 2% Affected		
Number of Discharges	8	0
Average Length of Stay	8.1 Days	0
Average Charge	\$48,978.00	0
2% of Population Affected	1,179 from Ames	136 from Nevada
Total Cost	\$57,745,062	Not available

Source: Iowa Hospital Association <http://www.iowahospitalcharges.com/>

Based upon 2011 research on foodborne pathogens, the U.S. Centers for Disease Control and Prevention (CDC) estimates that 48 million people suffer foodborne illnesses each year in the United States, accounting for 128,000 hospitalizations and 3,000 deaths. Salmonella and norovirus cause the most illnesses and hospitalizations. Foodborne disease is extremely costly. According to 2013 estimates from the USDA's Economic Research Service, the 15 major pathogens that cause over 95 percent of the illnesses and deaths from foodborne illnesses in the U.S. cost over \$15 billion per year in direct medical

expenses and lost productivity. Infections with the bacteria Salmonella alone account for over \$3.5 billion yearly in direct and indirect medical costs.

Buildings, infrastructure, and critical facilities are not vulnerable to this hazard. It affects only persons susceptible to the illness. The impacts and potential losses are largely economic and are dependent on the type, extent and duration of the illness.

Future Development

As populations increase in Story County and cities continue to experience growth and development such as Ames, Huxley, Maxwell, Nevada, and Slater while the costs of health care increases, it is expected the potential loss to human disease is expected to rise.

Climate Change Impacts

The following is an excerpt from the 2010 Climate Change Impacts on Iowa Report.

Investigations of the past two decades indicate that the health effects of climate change can be serious. The World Health Organization estimated that in 2002, 2.4% of worldwide diarrhea cases, 6% of malaria cases, 7% of dengue fever cases, and 170,000 deaths (0.3% of worldwide deaths) were attributed to climate change (Beggs and Bambrick 2005, WHO 2002). A major 2010 study included a range of diseases in its listing of potential effects of climate change, ranging from obvious illnesses such as asthma and vector-borne disease to less obvious cancer and neurological disease (Portier 2010).

The report details the following as climate change contributors to negative consequences for public health in Iowa:

- Extreme Precipitation Events, Rising Humidity, and Associated Disease
- Illness and Death Associated with Extreme Heat and Heat Waves
- Warming, Air Quality and Respiratory Problems
- Pollen Production and Allergies
- Diseases Transferred by Food, Water, and Insects

Human Disease Hazard Summary by Jurisdiction

Due to disease spreading more quickly in areas with high density, the cities of Ames, Huxley, Nevada, and Story City; the unincorporated county; and the community school districts were given a magnitude of 4. Due to their smaller populations and low population densities, the remaining cities, which all have with populations less than 2,000, were given a magnitude of 3. The rest of the elements are not varied across jurisdictions.

Jurisdiction	Probability	Magnitude	Warning Time	Duration	Score	Level
Story County, Iowa	2	4	2	4	2.80	Moderate
City of Ames	2	4	2	4	2.80	Moderate
City of Cambridge	2	3	2	4	2.50	Moderate
City of Collins	2	3	2	4	2.50	Moderate
City of Colo	2	3	2	4	2.50	Moderate
City of Gilbert	2	3	2	4	2.50	Moderate
City of Huxley	2	4	2	4	2.80	Moderate
City of Kelley	2	3	2	4	2.50	Moderate
City of Maxwell	2	3	2	4	2.50	Moderate
City of McCallsburg	2	3	2	4	2.50	Moderate
City of Nevada	2	4	2	4	2.80	Moderate
City of Roland	2	3	2	4	2.50	Moderate
City of Sheldahl	2	3	2	4	2.50	Moderate
City of Slater	2	3	2	4	2.50	Moderate
City of Story City	2	4	2	4	2.80	Moderate
Ames Schools	2	4	2	4	2.80	Moderate
Ballard Schools	2	4	2	4	2.80	Moderate
Collins-Maxwell Schools	2	4	2	4	2.80	Moderate
Colo-Nesco Schools	2	4	2	4	2.80	Moderate
Gilbert Schools	2	4	2	4	2.80	Moderate
Nevada Schools	2	4	2	4	2.80	Moderate
Roland-Story Schools	2	4	2	4	2.80	Moderate
Iowa State University	2	4	2	4	2.80	Moderate

3.5.11 Infrastructure Failure

Hazard Score Calculation					
Probability	Magnitude/Severity	Warning Time	Duration	Weighted Score	Level
2	2	4	4	2.5	Moderate

Profile

Hazard Description

Critical infrastructure involves several different types of facilities and systems including: electric power, transportation routes, natural gas and oil pipelines, water and sewer systems, storage networks and internet/telecommunications systems. Failure of utilities or other components of the infrastructure in the planning area can seriously impact public health, functioning of communities and the economy.

Disruption of any of these services could result from the majority of the natural, technological, and manmade hazards described in this plan. In addition to a secondary or cascading impact from another primary hazard, utilities and infrastructure can fail as a result of faulty equipment, lack of maintenance, degradation over time, or accidental damage such as damage to buried lines or pipes during excavation.

To maintain consistency with the State plan, this hazard encompasses a variety of different types of infrastructure failure, including communications failure, energy failure, structural failure, and structural fire.

Communications Failure

Communications failure is the widespread breakdown or disruption of normal communication capabilities. This could include major telephone outages, internet interruption, loss of cellular telephone service, loss of local government radio facilities, long-term interruption of electronic broadcast services, or emergency 911. Law enforcement, fire, emergency medical services, public works, and emergency warning systems are just a few of the vital services which rely on communications systems to effectively protect citizens. In addition, business and industry rely heavily on various modes of communication. Mechanical failure, traffic accidents, power failure, line severance, and weather can all affect communications systems and disrupt service. Disruptions and failures can range from localized and temporary to widespread and long-term.

The types of hazards and impacts to internet and telecommunications infrastructure are very similar to electric power supply. Land line phone lines often utilize the same poles as electric lines. So, when weather events such as windstorm or winter weather cause lines to break, both electricity and telephone services experience outages. With the increasing utilization of cellular phones, hazard events such as tornado that can damage cellular repeaters can cause outages. In addition, during any hazard event, internet and telecommunications systems can become overwhelmed due to the surge in call/usage volume. The HMPC also noted the potential for hacking to disrupt or damage communications networks.

Energy Failure

Energy failure includes interruption of service to electric, petroleum, or natural gas. Disruption of electric power supply can be a cascading impact of several other hazards. Electric power is the type of energy failure that is most often a secondary impact of other hazard events. The most common hazards analyzed in this plan that disrupt power supply are: flood, tornado, windstorm, and winter weather as these hazards can cause major damage to power infrastructure. To a lesser extent, extreme temperatures, dam failure, lightning, and terrorism can disrupt power. Extreme heat can disrupt power supply when air conditioning use spikes during heat waves which can cause brownouts. Dam failure is similar to flood in that infrastructure can be damaged or made inaccessible by water. Lightning strikes can damage substations and transformers but is usually isolated to small areas of outage. Many forms of terrorism

could impact power supply either by direct damage to infrastructure or through cyber-terrorism targeting power supply networks.

Primary hazards that can impact natural gas and oil pipelines are earthquake, expansive soils, land subsidence, landslide, and terrorism.

Other Utility Failure

Interruption of other utilities such as water and sewer systems can be a devastating, costly impact. The primary hazards that can impact water supply systems are: drought, flood, hazardous materials, and terrorism. Winter storm can also impact water supply if low temperatures cause failure/breakage of water infrastructure. The primary hazard that impacts sewer systems is flood.

Structural Failure / Structure Fire

The collapse (partial or total) of any structure including roads, bridges, towers, and buildings is considered a structural failure. A road, bridge, or building may collapse due to the failure of the structural components or because the structure was overloaded. Natural events such as heavy snow may also cause the roof of a building to collapse (under the weight of snow). In 1983 a KWWL television tower collapsed due to ice buildup. Heavy rains and flooding can undercut and washout a road or bridge. This occurred twice in 2008 when railway bridges failed in Waterloo and Cedar Rapids due to flooding. The age of the structure is sometimes independent of the cause of the failure. Adoption and enforcement of building codes can better guarantee that structures are designed to hold-up under normal conditions. Routine inspection of older structures may alert inspectors to weak points. The level of damage and severity of the failure is dependent on factors such as the size of the building or bridge, the number of occupants of the building, the time of day, day of week, amount of traffic on the road or bridge, and the type and number of products stored in the structure. There have been structural failures across the state in the past as mentioned above. They have included homes, commercial structures, and communications towers. There is no central collection point for this information, but news articles document infrastructure failure.

A structural fire is an uncontrolled fire in a populated area that threatens life and property and is beyond normal day-to-day response capability. Structural fires present a far greater threat to life and property and the potential for much larger economic losses. Modern fire codes and fire suppression requirements in new construction and building renovations, coupled with improved fire-fighting equipment, training, and techniques lessen the chance and impact of a major urban fire. Most structural fires occur in residential structures, but the occurrence of a fire in a commercial or industrial facility could affect more people and pose a greater threat to those near the fire or fighting the fire because of the volume or type of the material involved. Less severe structural fires are almost a common occurrence in some communities.

Warning Time Score: 4—less than six hours warning time

Duration Score: 3—less than 1 week

Geographic Location/Extent

The entire planning area is at risk to all types of infrastructure failure included in the hazard description section, either from primary failure due to malfunction, degradation, or accidental or intentional damage or as a result of a secondary impact related to another hazard event.

Table 3.55 provides the names of electric and natural gas providers for each jurisdiction in Story County. Figure 3.22 that follows is the electric service area map for Story County.

Table 3.55: Electric and Natural Gas Providers

Jurisdiction	Electric Service Providers	Natural Gas Providers
Uninc. County	Consumer's Energy	Alliant/Interstate Power and Light

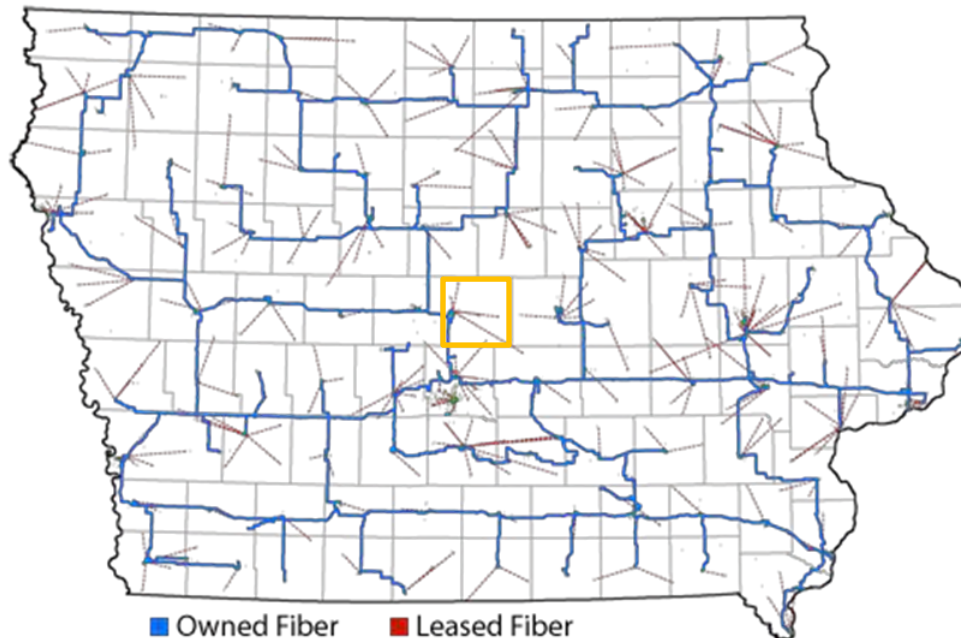
	Midland Power Cooperative	
Ames	Ames Municipal Alliant/Interstate Power and Light Consumer's Energy	Alliant/Interstate Power and Light
Cambridge	Alliant/Interstate Power and Light	Alliant/Interstate Power and Light
Collins	Alliant/Interstate Power and Light	Alliant/Interstate Power and Light
Colo	Alliant/Interstate Power and Light	Alliant/Interstate Power and Light
Gilbert	Alliant/Interstate Power and Light	Alliant/Interstate Power and Light
Huxley	Alliant/Interstate Power and Light	Alliant/Interstate Power and Light
Kelley	Alliant/Interstate Power and Light	-
Maxwell	Alliant/Interstate Power and Light	Alliant/Interstate Power and Light
McCallsburg	Alliant/Interstate Power and Light	Alliant/Interstate Power and Light
Nevada	Alliant/Interstate Power and Light Consumes Energy	Alliant/Interstate Power and Light
Roland	Alliant/Interstate Power and Light	Alliant/Interstate Power and Light
Sheldahl	Alliant/Interstate Power and Light	Alliant/Interstate Power and Light
Slater	Alliant/Interstate Power and Light	Alliant/Interstate Power and Light
Story City	Story City Municipal	Black Hills Energy
Zearing	Alliant/Interstate Power and Light	Alliant/Interstate Power and Light

Source: Iowa Utilities Board <https://iub.iowa.gov/sites/default/files/files/misc/town-provider-list.pdf>

Communications

Figure 3.22 shows the Iowa Communications Network (ICN) that administers Iowa's statewide fiber optic telecommunications network.

Figure 3.22: Map of Iowa Communication Network



Source: <http://icn.iowa.gov/about-icn/agency-information-icn-story>

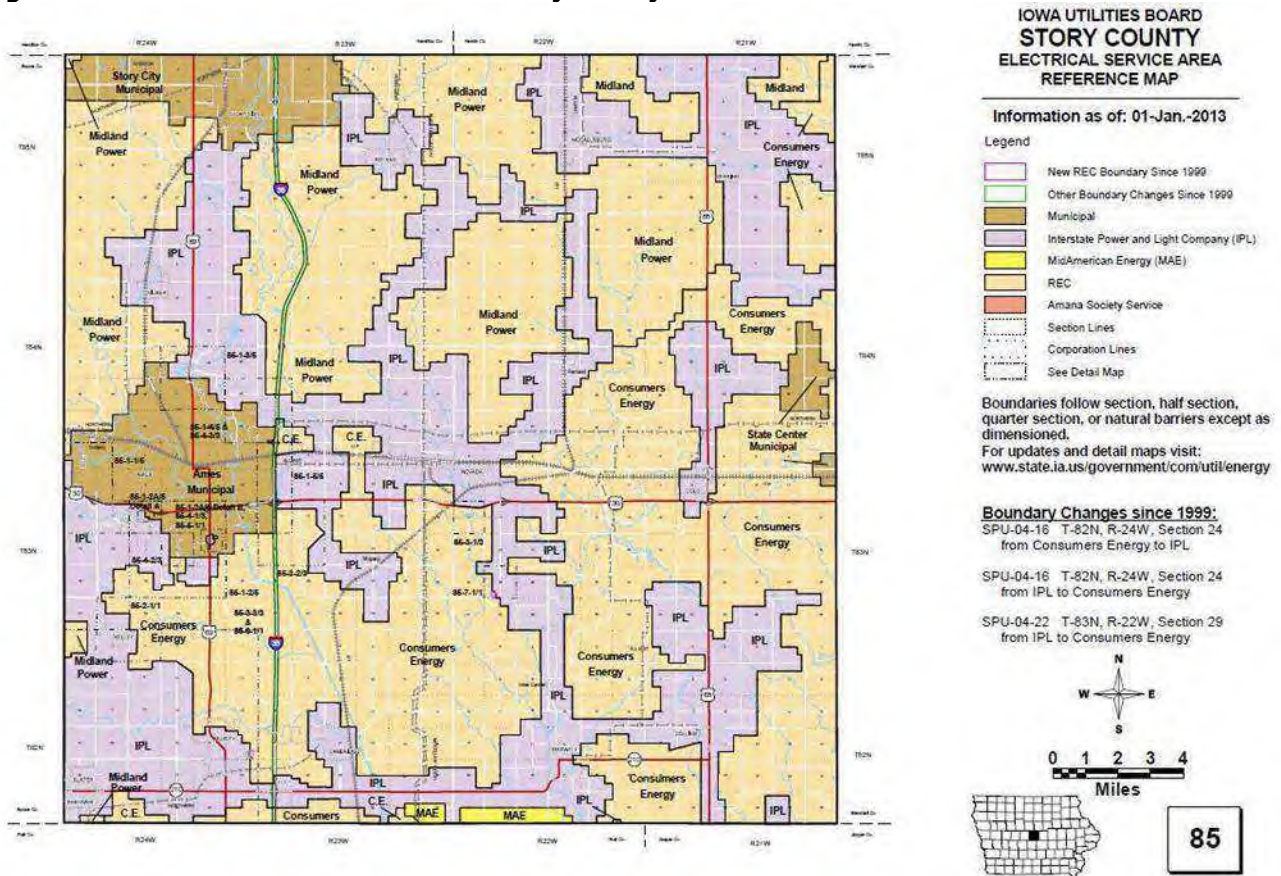
Note: Orange box outlines Story County.

Energy

Power outages can occur in outlying areas with more frequency than in more developed areas. A loss of electric power can also interrupt supply of water from a well. Food in freezers or refrigerators may also be lost. Power outages can cause problems with computers and other devices as well.

Figure 3.23 shows the electrical service area map for Story County.

Figure 3.23: Electrical Service Areas in Story County



Source: Iowa DOT https://iowadot.gov/maps/msp/electrical/story_85.pdf

Other Utilities (Water/Sewer)

Water

There are 19 Water Supply Systems in Story County, as shown in Table 3.56.

Table 3.56: Water Supply Systems in Story County

Water Supplier	Jurisdiction	Number of people served
Ames Water Treatment Plant	Ames	41,795
Iowa State University	Ames	28,178
Xenia Rural Water District	Ames	1,183
Squaw Valley South Subdivision	Ames	163
Crestview Mobile Home Park	Ames	95
Cambridge Water Supply	Cambridge	819
Central Iowa Rural Water Assoc.	Collins; McCallsburg; Colo	Unreported
Colo Water Supply	Colo	868
Collins Water Supply	Collins	499
Gilbert Water Supply	Gilbert	987
Huxley Waterworks Dept.	Huxley	2,959
Deer Creek HOA of Story County	Huxley	106
Kelley Water Supply	Kelley	300
Maxwell Water Department	Maxwell	807
McCallsburg Water Supply	McCallsburg	318
Nevada Water Supply	Nevada	6,658
Roland Water Supply	Roland	1,324
Slater Muni Water Dept.	Slater	1,306
Story City Water Dept.	Story City	3,228
Zearing Water Department	Zearing	617

Source: <https://www.nytimes.com/interactive/projects/toxic-waters/contaminants/ia/story/index.html>

Sewer

There are 28 permitted wastewater treatment discharge sites in Story County according to the Iowa Department of Natural Resources, as detailed in Table 3.57.

Table 3.57: Permitted Wastewater Sites in Story County

Facility Name	Facility City	Permit Type	Class	Sic Code	Treatment Type
Ames Water Pollution Control Facility	Ames	Municipal	Major	4952	Trickling Filter
Ames, City of MS4	Ames	Stormwater	Minor	4952	No Treatment
Arctic Glacier, Inc.	Ames	Industrial	Minor	2097	No Treatment
Cambridge City of STP	Cambridge	Municipal	Minor	4952	Aerated Lagoon
City of Ames Steam Electric Plant	Ames	Industrial	Minor	4911	Other
Collins City of STP	Collins	Municipal	Minor	4952	Waste Stabilization Lagoon
Colo City of STP	Colo	Municipal	Minor	4952	Waste Stabilization Lagoon
Country Living Court, LLC	Colo	Semi-Public	Minor	6515	Waste Stabilization Lagoon
Couser Cattle Company	Nevada	Agricultural	Minor	0211	Other
Dupont Cellulosoic Ethanol	Nevada	Industrial	Minor	2869	Other

Facility Name	Facility City	Permit Type	Class	Sic Code	Treatment Type
Gilbert City of STP	Gilbert	Municipal	Minor	4952	Waste Stabilization Lagoon
Hickory Grove Court, LLC	Ames	Semi-Public	Minor	6515	Septic Tank Sand Filter
Homestead Colony Mobile Home Park	Ames	Semi-Public	Minor	6515	Waste Stabilization Lagoon
Huxley, City of STP	Huxley	Municipal	Minor	4952	Activated Sludge
Iowa DOT Rest Area #19 I35	Story City	Semi-Public	Minor	4959	Waste Stabilization Lagoon
Iowa DOT Rest Area #20 I35	Story City	Semi-Public	Minor	4959	Waste Stabilization Lagoon
Iowa State University MS4	Ames	Stormwater	Minor	4952	No Treatment
Iowa State University Power Plant	Ames	Industrial	Minor	8221	Other
Lincolnway Energy, LLC	Nevada	Industrial	Minor	2869	No Treatment
Maxwell, City of STP	Maxwell	Municipal	Minor	4952	Aerated Lagoon
McCallsburg, City of STP	McCallsburg	Municipal	Minor	4952	Waste Stabilization Lagoon
Nevada, City of STP	Nevada	Municipal	Major	4952	Trickling Filter
Roland, City of STP	Roland	Municipal	Minor	4952	Aerated Lagoon
Rolling Hills Mobile Home Park	Maxwell	Semi-public	Minor	6515	Waste Stabilization Lagoon
Slater, City of STP	Slater	Municipal	Minor	4952	Aerated Lagoon
South Squaw Valley Association	Ames	Semi-public	Minor	4952	Activated Sludge
Story City, City of STP	Story City	Municipal	Minor	4952	Sequencing Batch Reactor
Zearing, City of STP	Zearing	Municipal	Minor	4952	Waste Stabilization Lagoon

Source: Iowa Department of Natural Resources, <http://www.iowadnr.gov/Environmental-Protection/Water-Quality/NPDES-Wastewater-Permitting/Current-NPDES-Permits>

Infrastructure/Structures

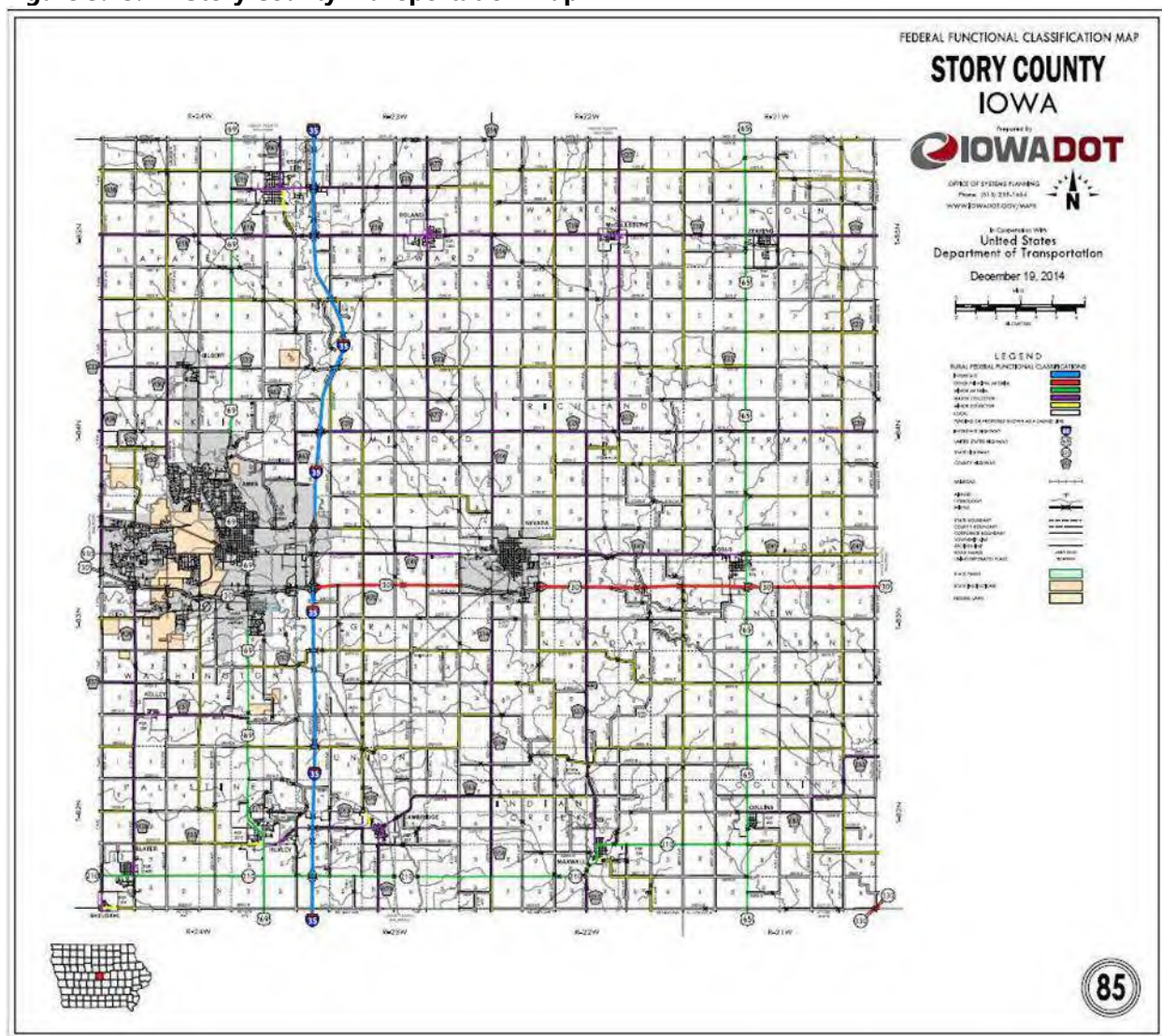
The highway map for Story County is provided in Figure 3.24. The detailed highway and transportation map that includes other transportation infrastructure in the county is provided in Figure 3.25.

Figure 3.24: Story County Highway Map



Source: Iowa Department of Transportation, <http://www.iowadot.gov/maps/msp/pdfview/counties.html>

Figure 3.25: Story County Transportation Map



Source: Iowa Department of Transportation, <http://www.iowadot.gov/maps>

Previous Occurrences

As indicated in the Hazard Description Section, Infrastructure Failure often occurs as a secondary impact to other hazard events. For specific descriptions, please see the Previous Occurrences section of the other hazards included in this plan. In addition to failure/impacts as a result of other hazard events, Infrastructure Failure can also occur as a result of lack of maintenance, human error, and age deterioration.

The infrastructure failure events provided below are some notable events in the planning area including some events where failure occurred as the primary event, not related to another hazard.

April 12, 2012—(primary) Xenia Rural Water Main Break. A water main break in Boone County affected rural residents in Story County. The break caused a loss of pressure in the Xenia system resulting in a 2-day boil order.

January 2011—(primary) Xenia Rural Water Main Break. A water main break in Boone County affected rural residents in Story County. The break caused a loss of pressure in the Xenia system resulting in a 2-day boil order.

August 10, 2010—(secondary from river flood) Ames Water Main Break. Three to five inches of rain fell on saturated ground, resulting in a very widespread flash flood event. Very intense rainfall in the Ames area resulted in a record crest on Squaw Creek. The creek crested 1.5 to 2.5 feet above the record high stage. Major flooding took place. A water main break resulted in the draining of the City of Ames water tower at State Ave and Mortensen Rd. This water main break and multiple smaller water main breaks caused a loss of pressure in the distribution system which ultimately resulted in the City of Ames issuance of a boil water advisory that lasted four days.

The HMPC noted several other infrastructure failure occurrences, including a damaged bridge in unincorporated Story County that restricted access to the wastewater treatment plant and a downed tree near Iowa State University which caused power loss for several hours. While there are no known previous occurrences, the HMPC also noted the possibility for cyber attacks and hacking to cause infrastructure failure. Cyber attack is discussed further in Section 3.5.16.

Probability of Future Occurrences

As discussed in other hazard sections in this plan, infrastructure failure occurs as a secondary or cascading impact from several primary hazards such as winter storm, wind storm, and tornado as well as lack of maintenance and age deterioration and other human-caused incidents such as human error, and various forms of terrorism. Structure fire events also occur annually. Therefore, the HMPC determined the probability of future occurrence of this hazard to be “Highly likely”.

Probability Score: 4—Highly Likely

Vulnerability

Vulnerability Overview

Iowa is almost entirely dependent on out-of-state resources for energy. Iowans purchase oil, coal, and natural gas from outside sources. As a result, world and regional fuel disruptions are felt in Iowa.

Every community in the planning area is at risk to some type of utility/infrastructure failure. Business and industry in the urban areas are reliant on electricity to power servers, computers, automated systems, etc. Rural areas of the County are vulnerable as well, as modern agricultural practices are reliant on energy, such as electric milking machines and irrigation pivots.

Generally, the smaller utility suppliers such as small electrical suppliers have limited resources for mitigation. This could mean greater vulnerability in the event of a major, widespread disaster, such as a major flood, severe winter storm or ice storm. The municipal utilities that exist in the County purchase power on the wholesale market for resale to their customers. This may make them more vulnerable to regional shortages as well, although they do vary their portfolios to avoid reliance on a sole provider.

In the event of a large-scale event impacting water supply or wastewater treatment, homes and businesses with well-supplied water and septic systems for waste treatment would be largely unaffected. However, these systems may be prone to individual failure and do not have back-up systems in place in the event of failure, as larger systems might.

The Iowa Department of Transportation has conducted inspections of bridges in the state. Table 3.58 provides a summary of the condition of the 293 bridges in Story County.

There is a total of 293 bridge structures in the County as follows:

- 73 state-owned Bridges

- 192 county-owned bridges
- 28 city-owned bridges

Table 3.58: Story County Bridge Condition, SDFO Ratings, Weight Restrictions

Condition Index Rating—State-Owned Bridges		
Good	Fair	Poor
44	29	0
Condition Index Rating—County-Owned Bridges		
Good	Fair	Poor
76	111	5
Condition Index Rating—City-Owned Bridges		
Good	Fair	Poor
14	12	2
Condition Index Rating—All Bridges in Story County		
Good	Fair	Poor
134	152	7
Structurally Deficient/Functionally Obsolete (SDFO) Rating—All Bridges in Story County		
Not Deficient	Structurally Deficient	Functionally Obsolete
237	56	N/A
Weight Restrictions—All Bridges in Story County		
Unrestricted	Restricted	Closed
202	83	3

Source: Iowa Department of Transportation,
<http://iowadot.maps.arcgis.com/apps/MapSeries/index.html?appid=db6cb43313354a4f85505089ab317e7a>

Magnitude Score: 2—Limited

Potential Losses to Existing Development

Since utility/infrastructure failure is generally a secondary or cascading impact of other hazards, it is not possible to quantify estimated potential losses specific to this hazard due to the variables associated with affected population, duration of outages, etc.

Although the variables make it difficult to estimate specific future losses, FEMA has developed standard loss of use estimates in conjunction with their Benefit-Cost Analysis methodologies to estimate the cost of lost utilities on a per-person, per-use basis (See Table 3.59).

Table 3.59: FEMA Standard Values for Loss of Service for Utilities and Roads/Bridges

Power Loss	Cost of Complete Loss of Service
Loss of Electric Power	
Total Economic Impact	\$126 per person per day
Loss of Potable Water Service	
Total Economic Impact	\$93 per person per day
Loss of Wastewater Service	
Total Economic Impact	\$41 per person per day
Loss of Road/Bridge Service	
Vehicle Delay Detour Time	\$38.15 per vehicle per hour
Vehicle Delay Mileage	\$0.55 per mile (or current federal mileage rate)

Source: FEMA BCA Reference Guide, June 2009, Appendix C

Future Development

Increases in development and population growth would increase the demand for utilities and use of infrastructure as well as the level of impacts when the utilities or infrastructure fail. Story County and the jurisdictions within the county have seen the population grow over the last 5 years. As technological advances are made and systems become more and more automated and dependent on power and communications infrastructure, the impacts of infrastructure failure could increase even though population is decreasing slightly.

Climate Change Impacts

Please refer to the Climate Change Impacts sections of the following primary hazards that can cause a cascading or secondary impact of infrastructure failure: River Flood, Severe Winter Storm, Tornado/Windstorm, Thunderstorm/Lightning Hail, Extreme Heat, Flash Flood and Terrorism.

Infrastructure Failure Incident Hazard Summary by Jurisdiction

All jurisdictions within the planning area are at risk to infrastructure failure.

Jurisdiction	Probability	Magnitude	Warning Time	Duration	Score	Level
Story County, Iowa	2	2	4	4	2.5	Moderate
City of Ames	2	2	4	4	2.5	Moderate
City of Cambridge	2	2	4	4	2.5	Moderate
City of Collins	2	2	4	4	2.5	Moderate
City of Colo	2	2	4	4	2.5	Moderate
City of Gilbert	2	2	4	4	2.5	Moderate
City of Huxley	2	2	4	4	2.5	Moderate
City of Kelley	2	2	4	4	2.5	Moderate
City of Maxwell	2	2	4	4	2.5	Moderate
City of McCallsburg	2	2	4	4	2.5	Moderate
City of Nevada	2	2	4	4	2.5	Moderate
City of Roland	2	2	4	4	2.5	Moderate
City of Sheldahl	2	2	4	4	2.5	Moderate
City of Slater	2	2	4	4	2.5	Moderate
City of Story City	2	2	4	4	2.5	Moderate
Ames Schools	2	2	4	4	2.5	Moderate
Ballard Schools	2	2	4	4	2.5	Moderate
Collins-Maxwell Schools	2	2	4	4	2.5	Moderate
Colo-Nesco Schools	2	2	4	4	2.5	Moderate
Gilbert Schools	2	2	4	4	2.5	Moderate
Nevada Schools	2	2	4	4	2.5	Moderate
Roland-Story Schools	2	2	4	4	2.5	Moderate
Iowa State University	2	2	4	4	2.5	Moderate

3.5.12 Landslide

Hazard Score Calculation					
Probability	Magnitude/Severity	Warning Time	Duration	Weighted Score	Level
1	1	2	1	1.15	Low

Profile

Hazard Description

A landslide is the downhill movement of masses of soil and rock by gravity. The basic ingredients for landslides are gravity, susceptible soil or rock, sloping ground and water. Landslides occur when susceptible rock, earth, or debris moves down a slope under the force of gravity and water. Landslides may be very small or very large and can move at slow to very high speeds. A natural phenomenon, small scale landslides have been occurring in slide-prone areas of Iowa long before human occupation. New landslides can occur because of rainstorms, fires, earthquakes and various human activities that modify slope and drainage.

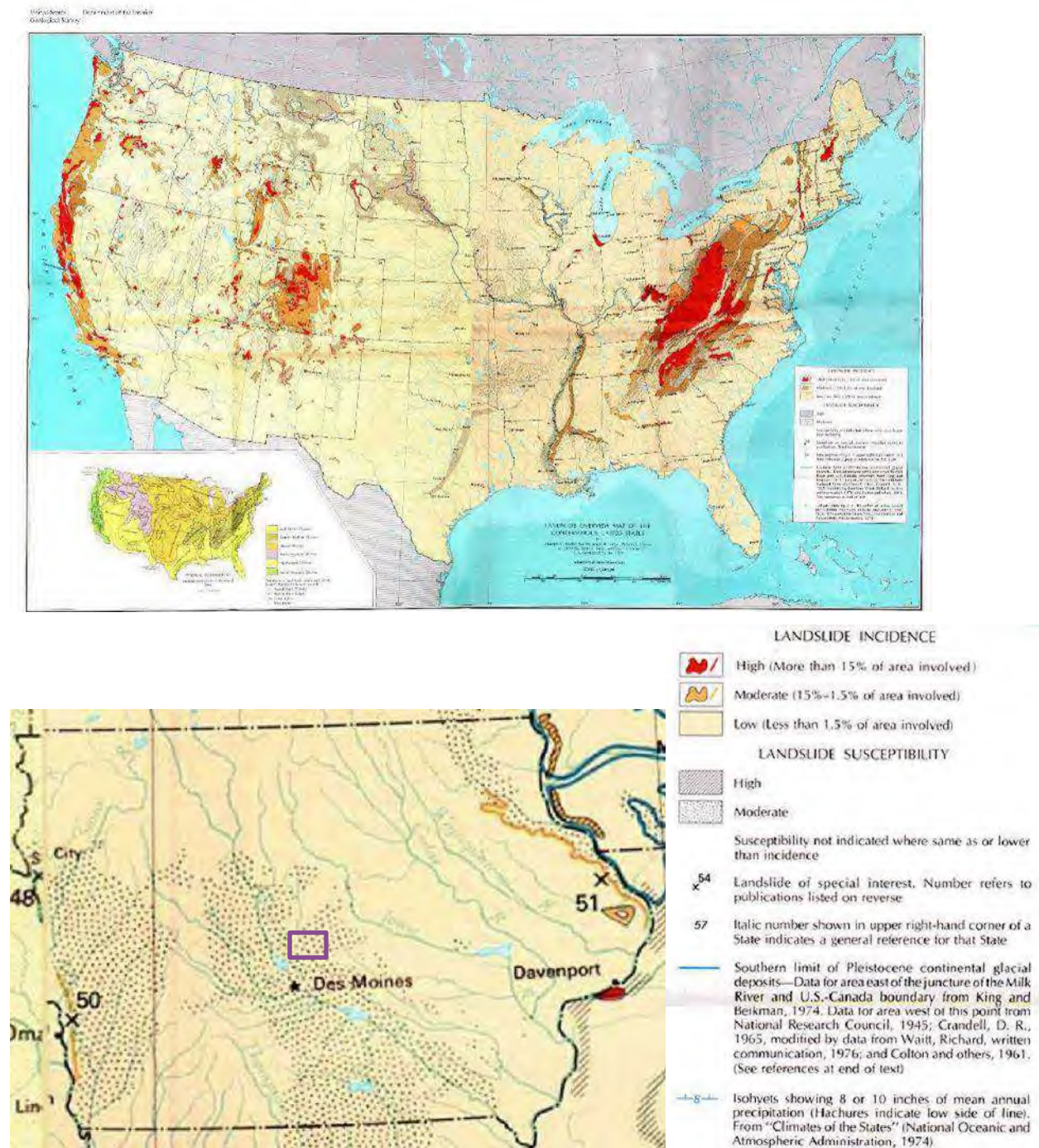
Warning Time Score: 2—12 to 24 hours warning time

Duration Score: 1—Less than 6 hours

Geographic Location/Extent

The map in Figure 3.26 depicts landslide susceptibility and incidents rates in Iowa according to the Iowa Department of Natural Resources. This shows that parts of Story County have a moderate susceptibility to landslide, but the entire County has a low landslide incidence rate.

Figure 3.26: Landslide Susceptibility and Incident Rates



Source: U.S. Geological Survey, <http://pubs.usgs.gov/pp/p1183/figures/map.jpg>; Approximate location of Story County is the purple rectangle.

Previous Occurrences

No specific previous occurrences of landslide were reported by the HMPC or discovered during research. However, it is anticipated that isolated events due occur when intense rainfall events saturate soils on slopes that are not stabilized.

Probability of Future Occurrence

The HMPC determined the probability of future occurrence of landslide in the planning area to be "Occasional".

Probability Score: 2—Occasional

Vulnerability

Vulnerability Overview

There will continue to be intense rainfall events that may cause landslides in the planning area. However, the damages are relatively minimal and not widespread.

Magnitude Score: 1—Negligible

Potential Losses to Existing Development

The planning committee did not identify any specific assets or areas of development that are vulnerable to landslide. Due to the lack of information on previous occurrences, it is not possible to estimate potential losses.

Future Development

Story County's population is growing and new development has been occurring in recent years, especially in the Cities of Ames, Gilbert, Huxley, Nevada, Slater, and Story City. Should these trends continue, future development is likely to increase vulnerability to this hazard, especially given there are areas with moderate susceptibility to landslide in the county.

Climate Change Impacts

One of the climate change impacts noted in the 2010 Climate Change Impacts on Iowa report by the Iowa Climate Change Impacts Committee is the increase in frequency of severe precipitation events. See the "Climate Change Impacts" discussion in the Flash Flood Hazard Section 3.5.7.

Landslide Hazard Summary by Jurisdiction

This hazard does not vary substantially by jurisdiction.

Jurisdiction	Probability	Magnitude	Warning Time	Duration	Score	Level
Story County, Iowa	1	1	2	1	1.15	Low
City of Ames	1	1	2	1	1.15	Low
City of Cambridge	1	1	2	1	1.15	Low
City of Collins	1	1	2	1	1.15	Low
City of Colo	1	1	2	1	1.15	Low
City of Gilbert	1	1	2	1	1.15	Low
City of Huxley	1	1	2	1	1.15	Low
City of Kelley	1	1	2	1	1.15	Low
City of Maxwell	1	1	2	1	1.15	Low
City of McCallsburg	1	1	2	1	1.15	Low
City of Nevada	1	1	2	1	1.15	Low
City of Roland	1	1	2	1	1.15	Low
City of Sheldahl	1	1	2	1	1.15	Low
City of Slater	1	1	2	1	1.15	Low
City of Story City	1	1	2	1	1.15	Low
Ames Schools	1	1	2	1	1.15	Low
Ballard Schools	1	1	2	1	1.15	Low
Collins-Maxwell Schools	1	1	2	1	1.15	Low
Colo-Nesco Schools	1	1	2	1	1.15	Low
Gilbert Schools	1	1	2	1	1.15	Low
Nevada Schools	1	1	2	1	1.15	Low
Roland-Story Schools	1	1	2	1	1.15	Low
Iowa State University	1	1	2	1	1.15	Low

3.5.13 River Flood

Hazard Score Calculation					
Probability	Magnitude/Severity	Warning Time	Duration	Weighted Score	Level
4	4	2	4	3.70	High

Profile

Hazard Description

A flood is characterized by partial or complete inundation of normally dry land areas. Heavy precipitation can cause flooding either in the region of precipitation or in areas downstream. 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 two main types of flooding in the planning area: riverine flooding, and flash flooding which includes ice jam flooding. Flash flooding is discussed separately in Section 3.5.7. A specific type of flash flooding can occur as a result of dam failure or levee failure. Flooding caused by dam or levee failure is discussed in Section 3.5.2.

Riverine flooding is defined as the overflow of rivers, streams, drains and lakes due to excessive rainfall, rapid snowmelt or ice melt. The areas adjacent to rivers and stream banks that carry excess floodwater during rapid runoff are called floodplains. A floodplain 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, which is defined as all the land into which a river and its branches/tributaries drain their water.

Gauges along streams, and rain gauges throughout the state provide for an early flood warning system. River flooding usually develops over the course of several hours or even days, depending on the basin characteristics and the position of the particular reach of the stream. The National Weather Service provides flood forecasts for Iowa. Flood warnings are issued over emergency radio, television messages, through NOAA Weather Radio, and electronically (e.g., online and sometimes via text messages to local citizens). People in the paths of river floods may have time to take appropriate actions to limit harm to themselves and their property.

Warning Time Score: 2—More than 12 to 24 hours warning time

Duration Score: 4—More than one week

Geographic Location/Extent

Story County crosses six HUC-8 watersheds, as follows (see Figure 3.27):

- South Skunk (07080105)—this watershed encompasses most of the county, covering it from northwest to southeast.
- North Skunk (07080106)—this watershed touches the east/southeast corner of the county very minimally.
- Upper Iowa (07080207)—this watershed crosses the county on the northeast corner, right above the South Skunk watershed.
- Middle Iowa (07080208)—this watershed barely touches the east-central boundary of the county, falling in between the Upper Iowa and the North Skunk watersheds.
- Middle Des Moines (07100004)—this watershed brushes the southwest corner of the corner very minimally, next to the South Skunk and Lake Red Rock watersheds.

- Lake Red Rock (07100008)— the southwest corner of Story county is crossed slightly by this watershed, which falls in between the Middle Des Moines and the South Skunk watersheds.

Figure 3.27: Story County, Iowa Watersheds (Story County is the red square)



Source: Environmental Protection Agency, https://cfpub.epa.gov/surf/county.cfm?fips_code=19169

For purposes of this hazard profile and vulnerability analysis, the geographic locations/coverages for river flooding will be considered as those areas at risk to a 1-percent annual chance flood (also known as a 100 year flood). The 1-percent annual chance flood has been adopted by FEMA as the base flood for floodplain management purposes.

Jurisdictional Flood Hazard Maps

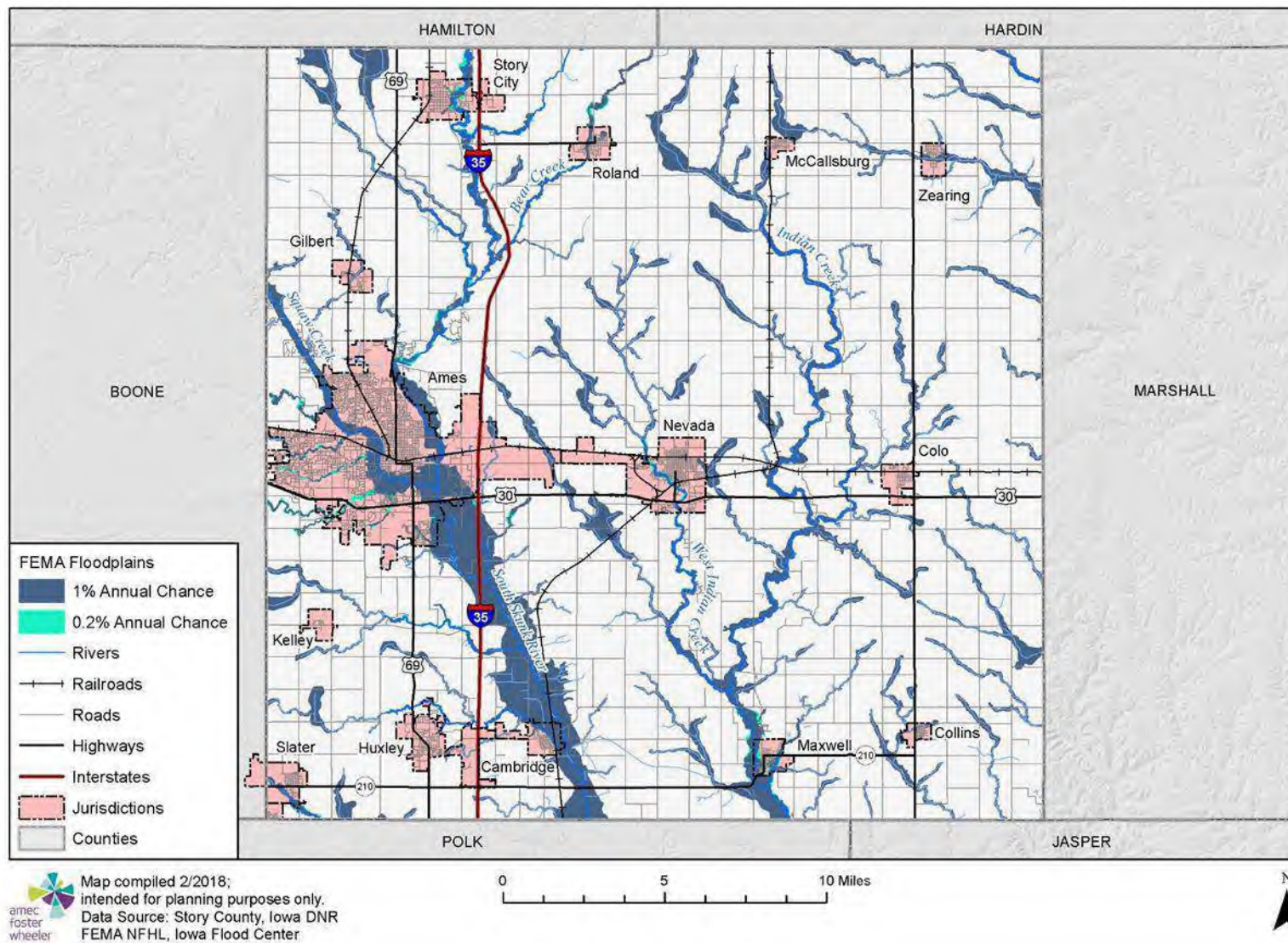
FEMA Special Flood Hazard Areas (SFHAs) in Story County were first mapped in June 1983. The most recent Flood Insurance Rate Maps (FIRMs) are dated October 16, 2014. The FIRMs delineate areas at-risk within the 1-percent annual floodplain (i.e., 100-year floodplain) and the 0.2-percent annual chance floodplain (the 500-year floodplain). Because of its size and location on the South Skunk River, Ames is the most heavily affected by flood. All other jurisdictions except Kelley, Colo, and Sheldahl are at risk of flooding from the 1-percent annual chance flood as well, but to lower degrees.

Figure 3.28 to Figure 3.44 provide the 1-percent annual floodplains for all jurisdictions in the planning area affected by this hazard. The county-level map is provided first for context, and city/town maps are next, in alphabetical order. The School Districts map is provided last. Preceding each map is a general description of the flooding sources applying to each jurisdiction.

Story County

The main flooding sources in Story County include the South Skunk River, the West Indian Creek, Bear Creek, Indian Creek, Squaw Creek, Rock Creek, and other smaller (less influencing) streams and tributaries throughout the county.

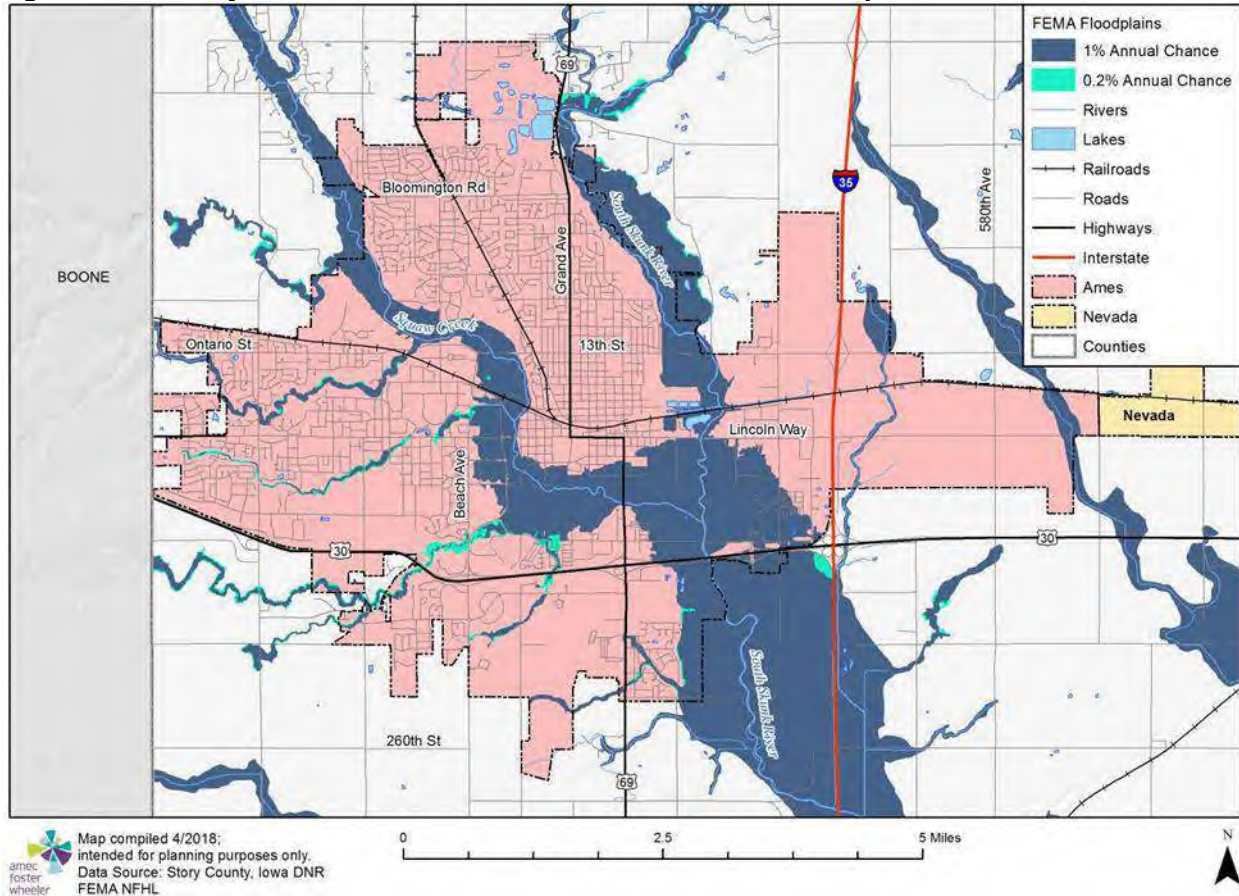
Figure 3.28: Story County 1- and 0.2-Percent Annual Chance Floodplains



Ames

The City of Ames is located adjacent to Nevada, to its west. It is on the edge of Story County, right about the middle-left boundary. Both the 1-percent and 0.2-percent annual chance floodplains affect the city, with the South Skunk River and Squaw Creek posing as the primary sources for flooding in the area. The South Skunk River crosses the city from the north to the southeast, while Squaw Creek feeds into the South Skunk River from the northwest, crossing through the middle of the city.

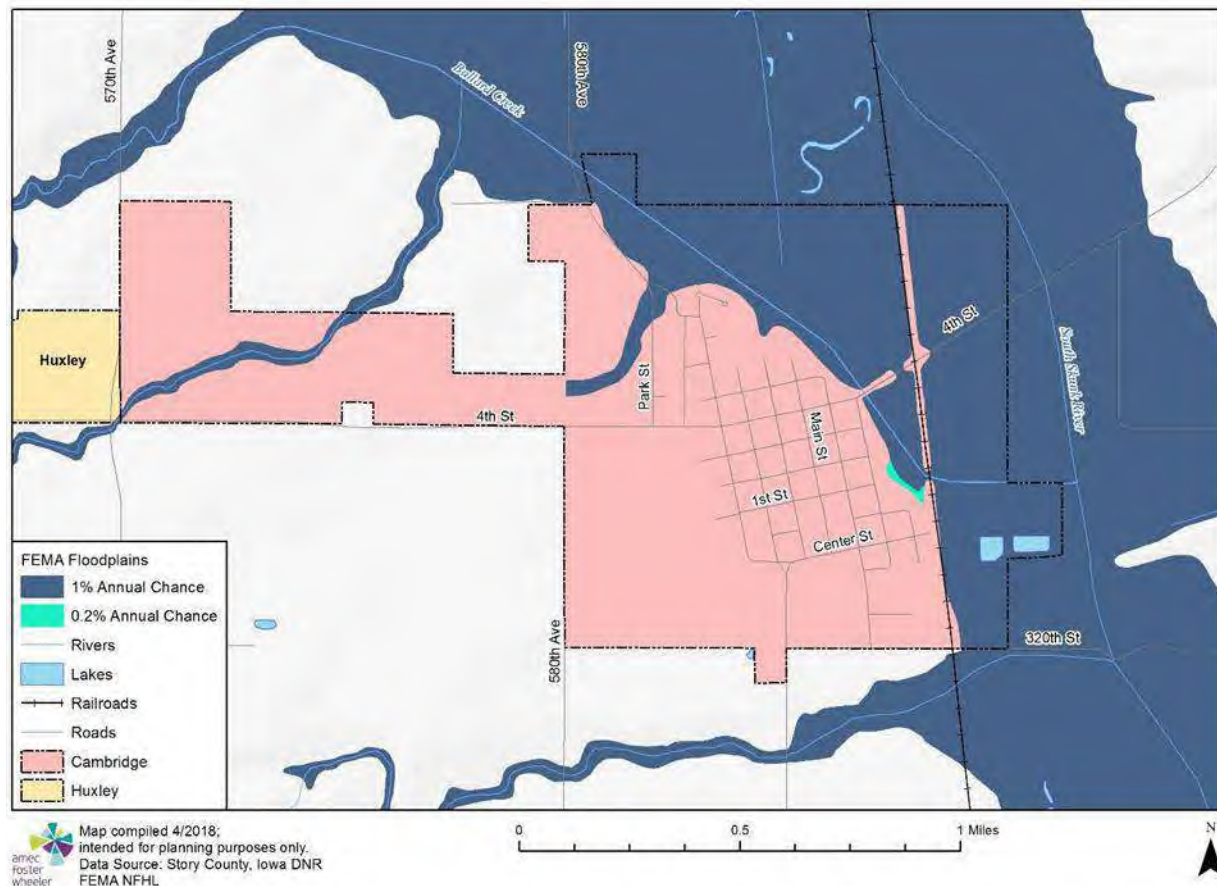
Figure 3.29: City of Ames 1- and 0.2-Percent Annual Chance Floodplains



Cambridge

The City of Cambridge is adjacent to Huxley, touching on its east-side boundaries. Cambridge is located close the edge with Polk County, towards the southwest of Story County, and about half a mile east of Interstate 35. Cambridge's main sources of flooding come from the South Skunk River to the northeast of the city, and Ballard Creek, which crosses it from northwest to southeast, meeting the South Skunk River just south of 4th Street. A small tributary from Ballard Creek also poses a risk to flooding, as it meets Ballard Creek by crossing city boundaries on the west portion of the jurisdiction.

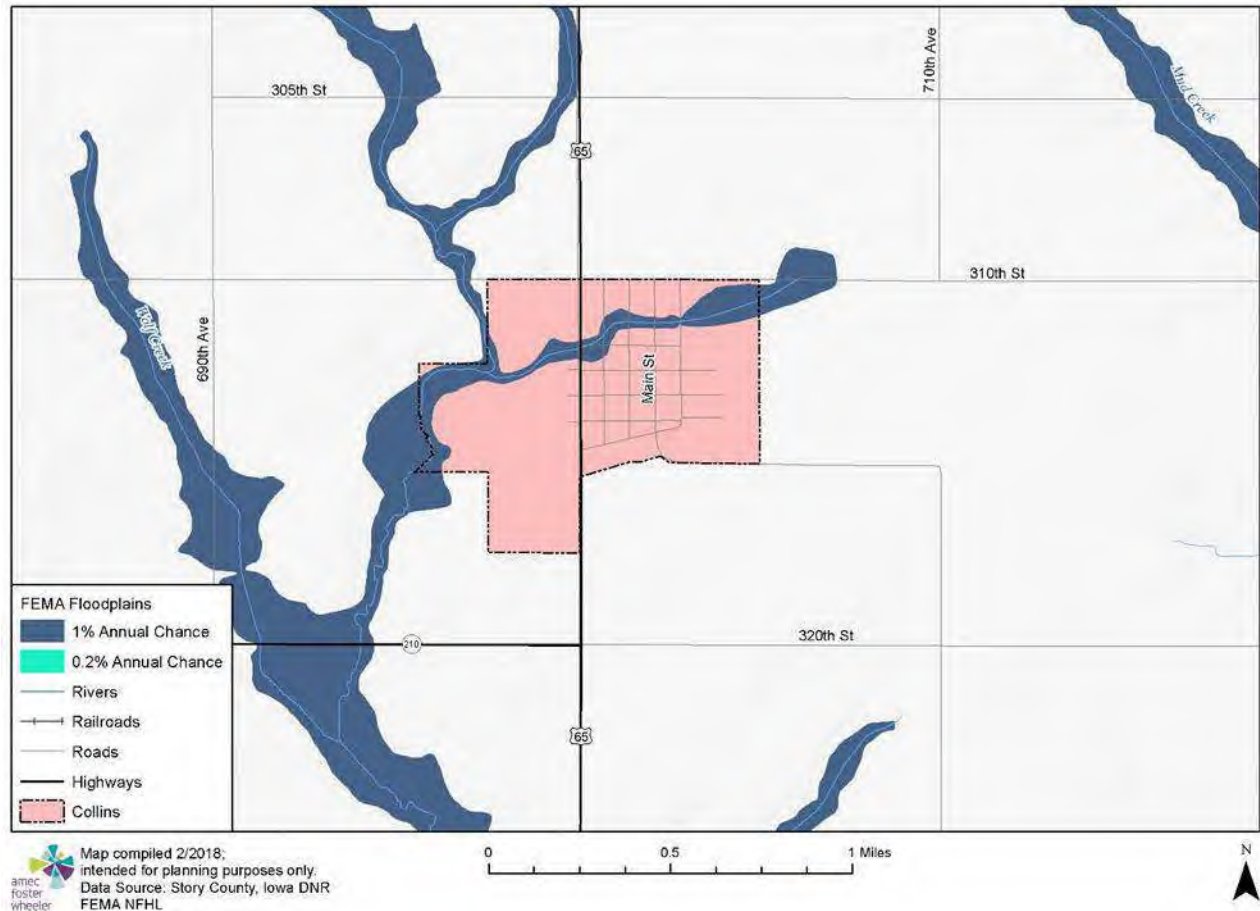
Figure 3.30: City of Cambridge 1- and 0.2-Percent Annual Chance Floodplains



Collins

The City of Collins is at risk of flooding from a tributary stemming from Wolf Creek. This small stream would affect the City in an almost diagonal fashion, crossing from southwest to northeast through the center-north portion.

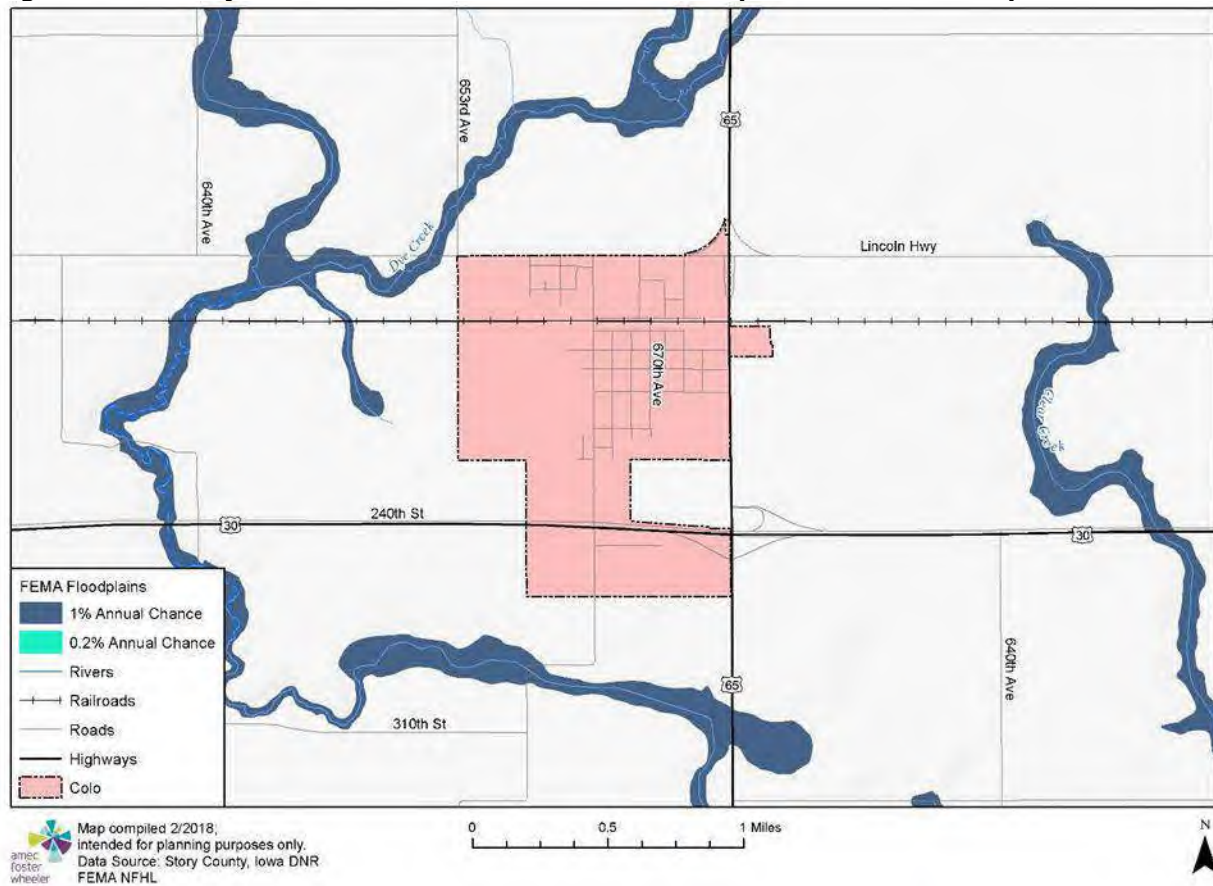
Figure 3.31: City of Collins 1-Percent Annual Chance Floodplain (100-Year Floodplain)



Colo

Colo is one of the only jurisdictions without any clear risk of flooding. However, Dye Creek flows close to its northwestern corner, and could impact the City in the future if it were to expand in that direction.

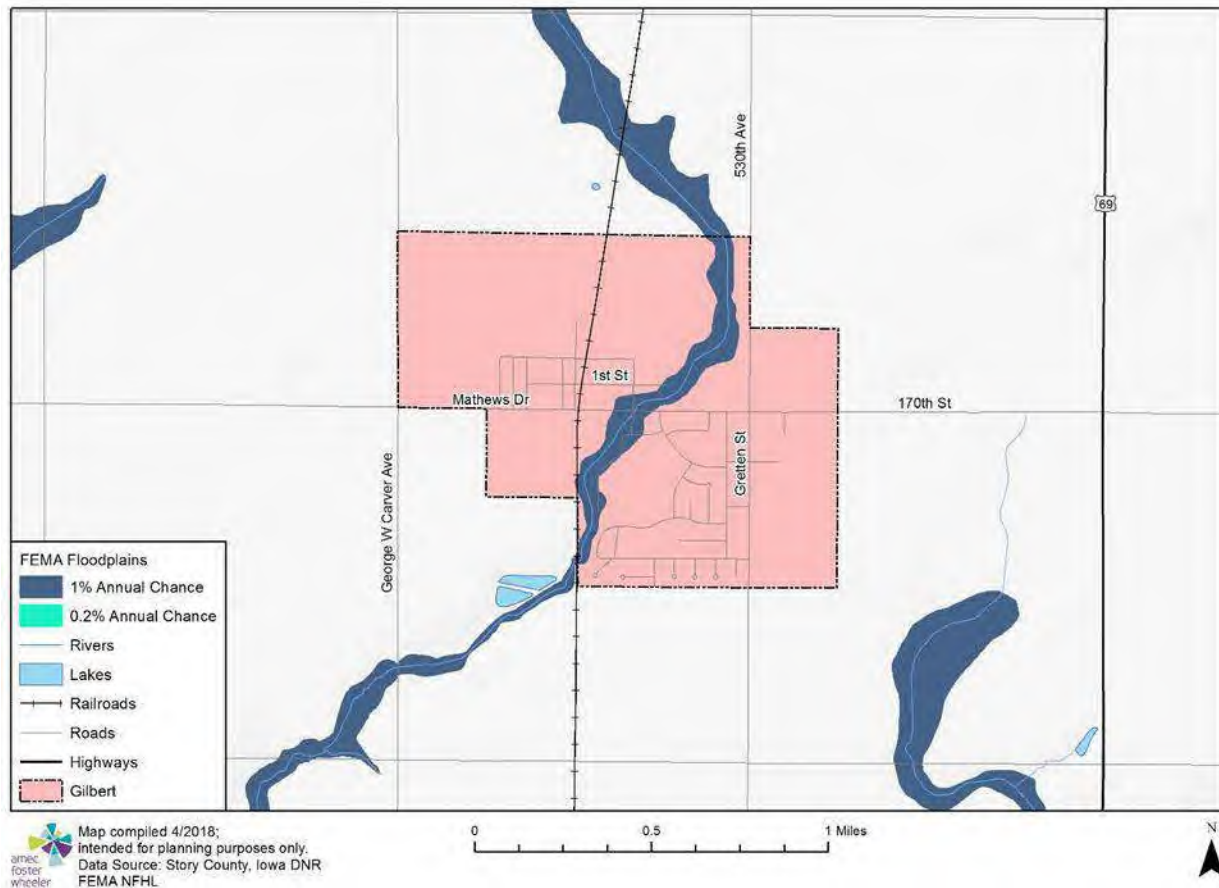
Figure 3.32: City of Colo 1-Percent Annual Chance Floodplain (100-Year Floodplain)



Gilbert

Gilbert is located approximately one and a half miles north of Ames. A small degree of flooding can occur from a tributary of the Squaw Creek, which crosses the city in a northeast-southwest fashion through the middle of the jurisdiction.

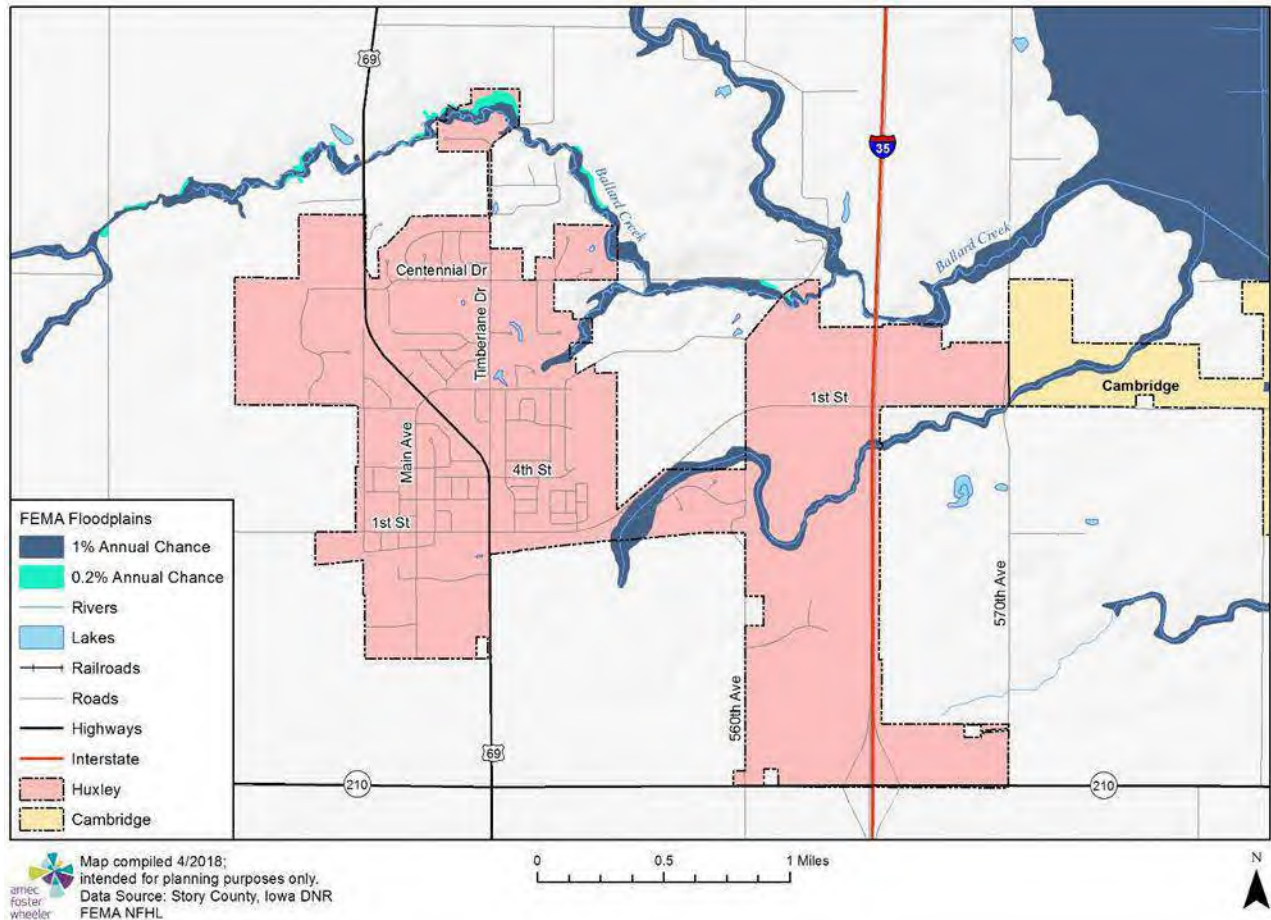
Figure 3.33: City of Gilbert 1-Percent Annual Chance Floodplain (100-Year Floodplain)



Huxley

The City of Huxley is located on the southwest part of Story County, adjacent to Cambridge, connecting to the east. Interstate 35 crosses it in a north-south fashion. Ballard Creek is the main source of flooding in the city, including a small tributary which connects to Ballard after crossing Cambridge. However, the degree of flooding in the city is very minimal, only affecting a northern tip of the jurisdiction (at the end of Timberlane Drive), and on edges in the northeast and central parts.

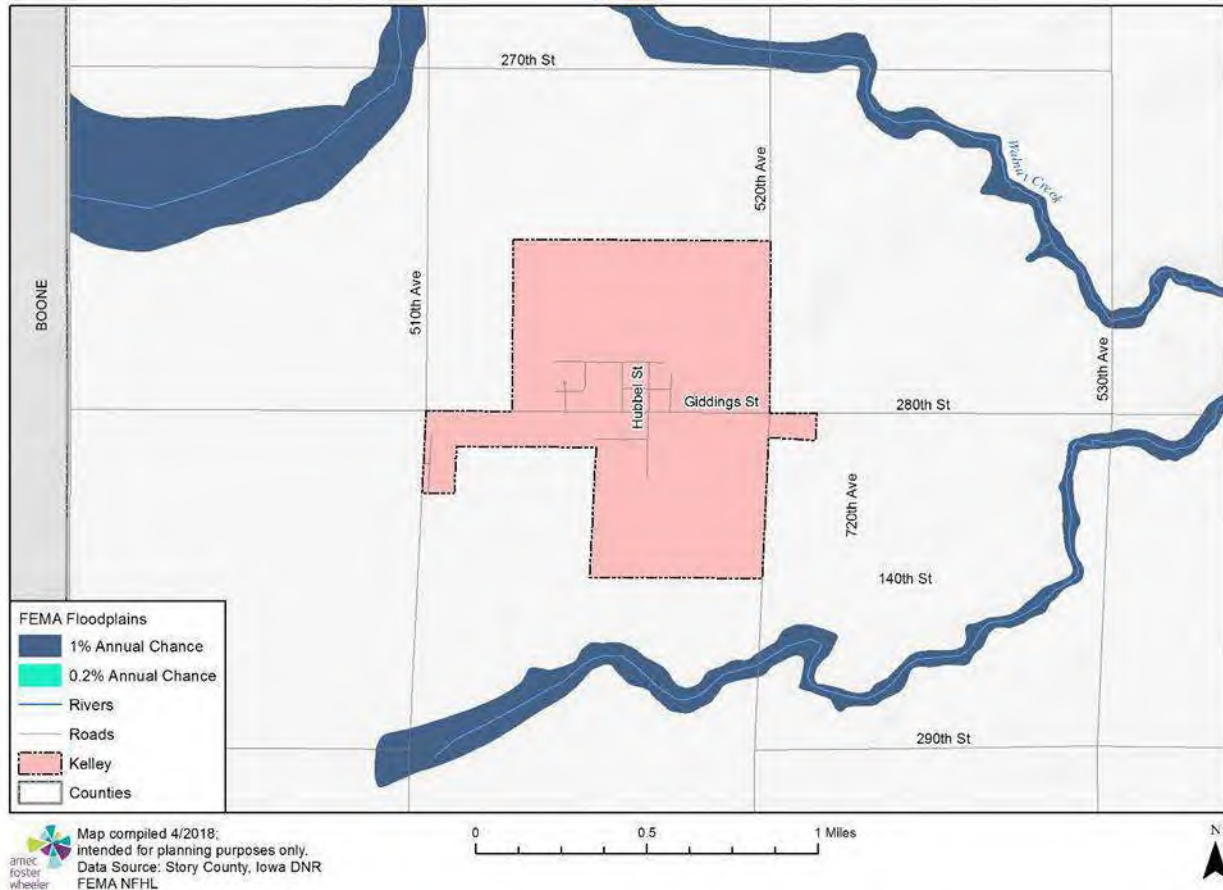
Figure 3.34: City of Huxley 1- and 0.2-Percent Annual Chance Floodplains



Kelley

The City of Kelley is found approximately one mile east of Boone County, and about four miles northeast of Slater. While there is not a floodplain crossing the city to pose a threat, parts of Walnut Creek surround its boundaries, falling about a quarter to a half a mile away from its northeast, northwest, and southern borders.

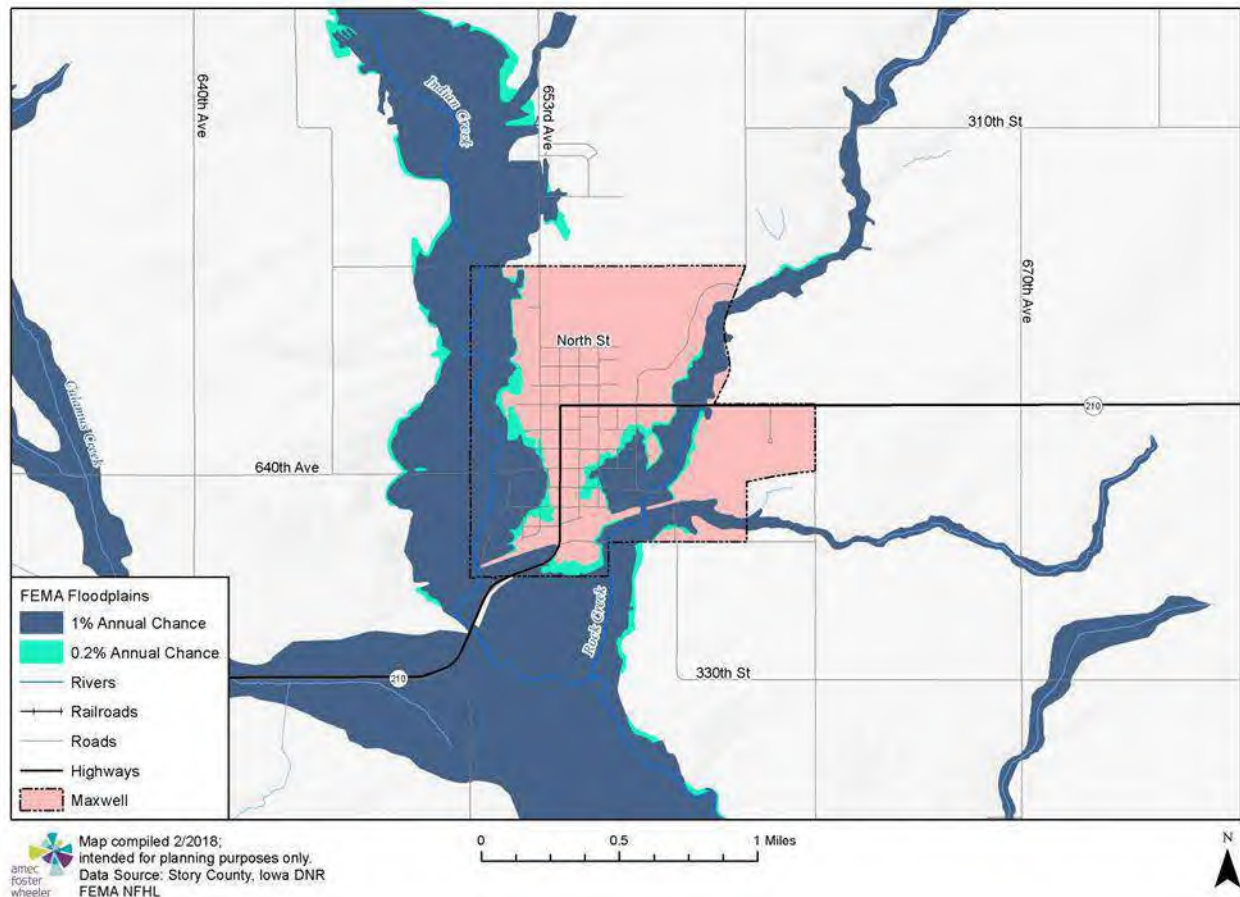
Figure 3.35: City of Kelley 1-Percent Annual Chance Floodplain (100-Year Floodplain)



Maxwell

The City of Maxwell is found within the paths of the Rock Creek River and Indian Creek. These two are its primary sources for flooding, with Rock Creek affecting the south, east, and northeast portions of the city, and Indian Creek feeding in a north-south fashion, flooding the entire eastern boundary.

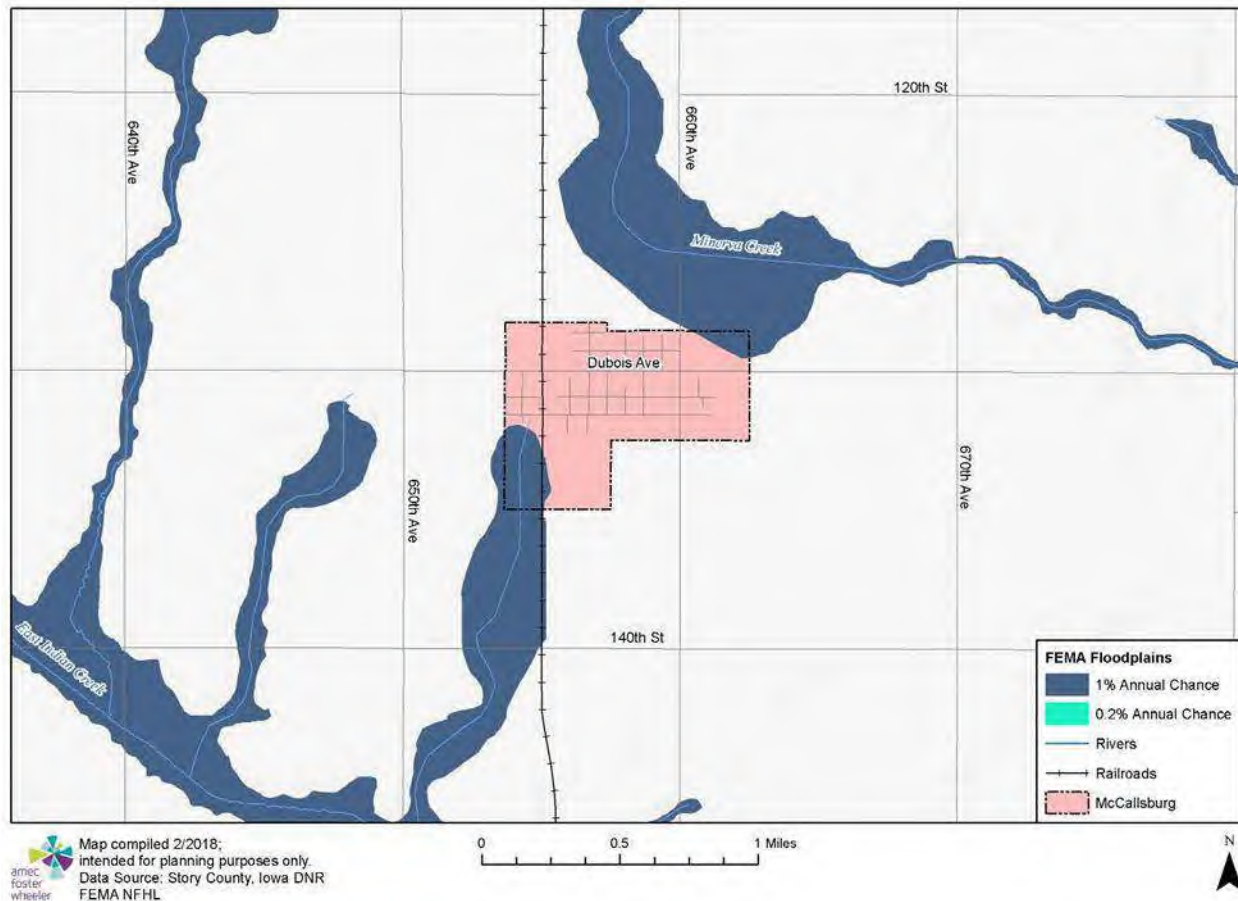
Figure 3.36: City of Maxwell 1- and 0.2-Percent Annual Chance Floodplains



McCallsburg

The City of McCallsburg is flooded slightly by Minerva Creek, right on the City's northeastern corner, then by a small tributary of East Indian Creek, on the City's southwestern corner.

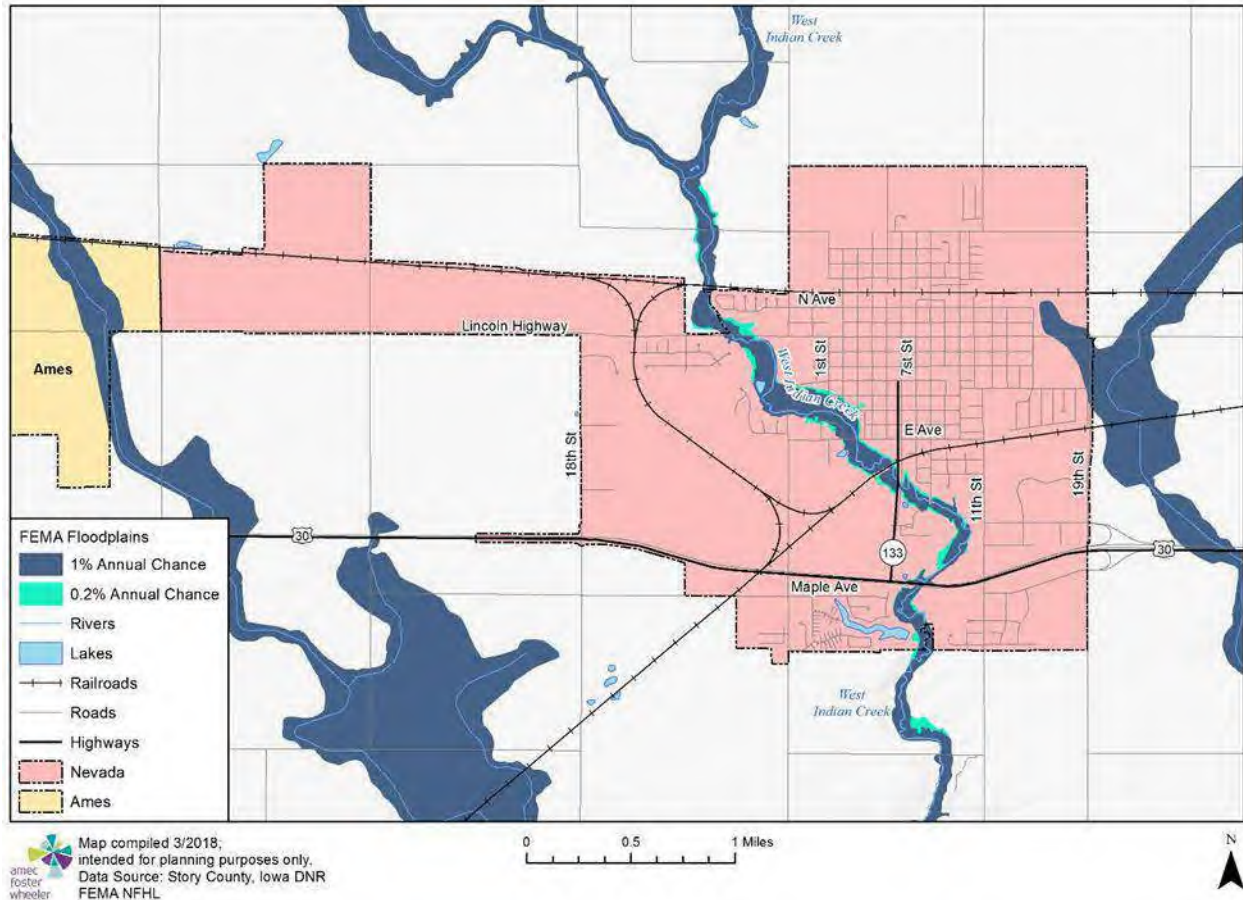
Figure 3.37: City of McCallsburg 1-Percent Annual Chance Floodplain (100-Year Floodplain)



Nevada

Nevada is located to the east of Ames, about two miles east of Interstate 35, near the middle of Story County. West Indian Creek is the main source of flooding in the city, as it crosses the boundaries in a north to south fashion. The floodplain does not have a large footprint in the city. A small portion of the floodplain of a tributary from Indian Creek also touches city boundaries on its eastern edge.

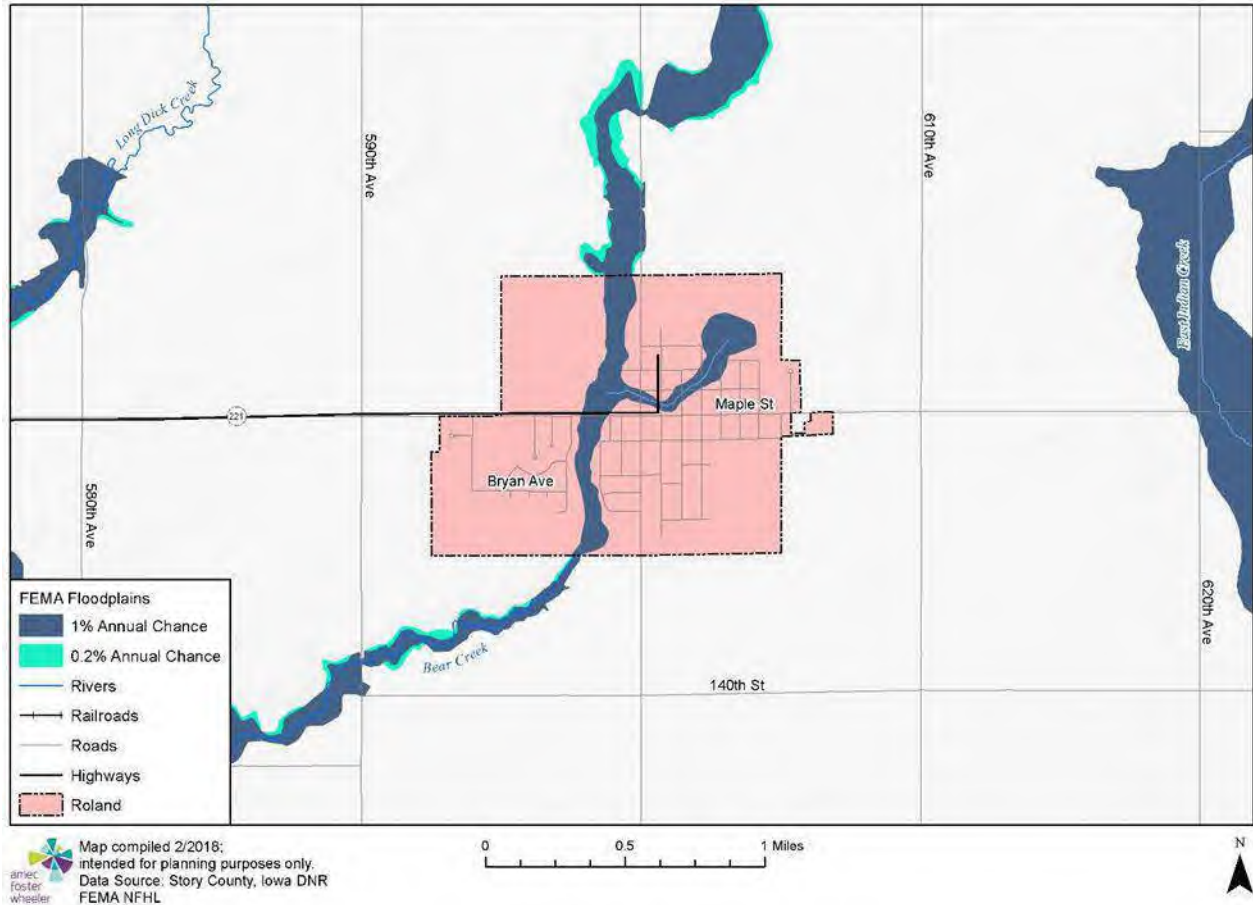
Figure 3.38: City of Nevada 1- and 0.2-Percent Annual Chance Floodplains



Roland

Roland is at risk of flooding from Bear Creek. The stream crosses city boundaries in a north-south fashion, with a small tributary branching off near the center of the city and causing small flooding towards the northeast.

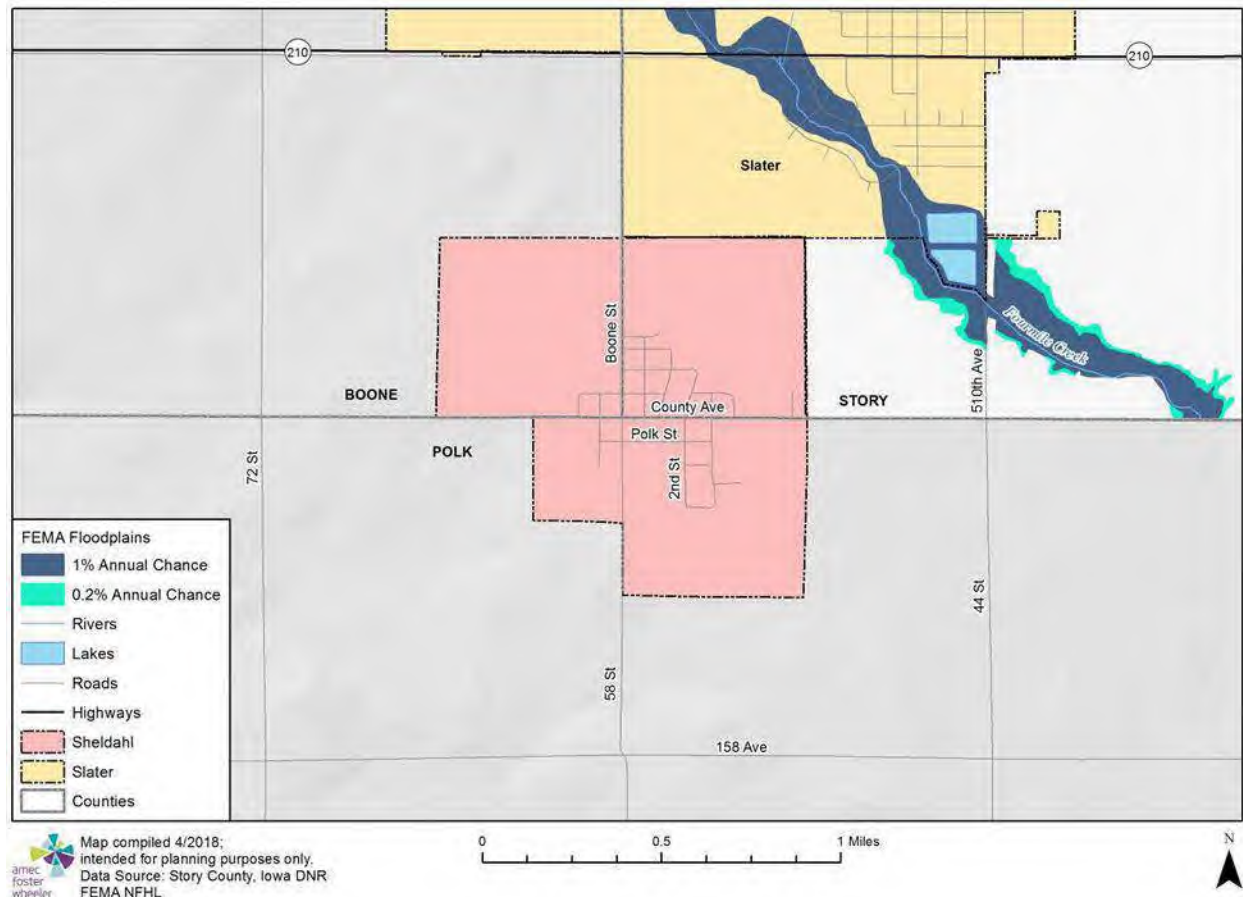
Figure 3.39: City of Roland 1- and 0.2-Percent Annual Chance Floodplains



Sheldahl

The City of Sheldahl falls right on the borders between the counties of Story, Polk, and Boone, with about one third of the city within each county. The city shares a boundary with Slater as well, towards its northeast. While there are no floodplains crossing Sheldahl, Fourmile Creek is located about two miles to the northeast of the city corner, on the side of Story County. As such, there is no direct risk of flooding from the 100-year or 500-year floodplains.

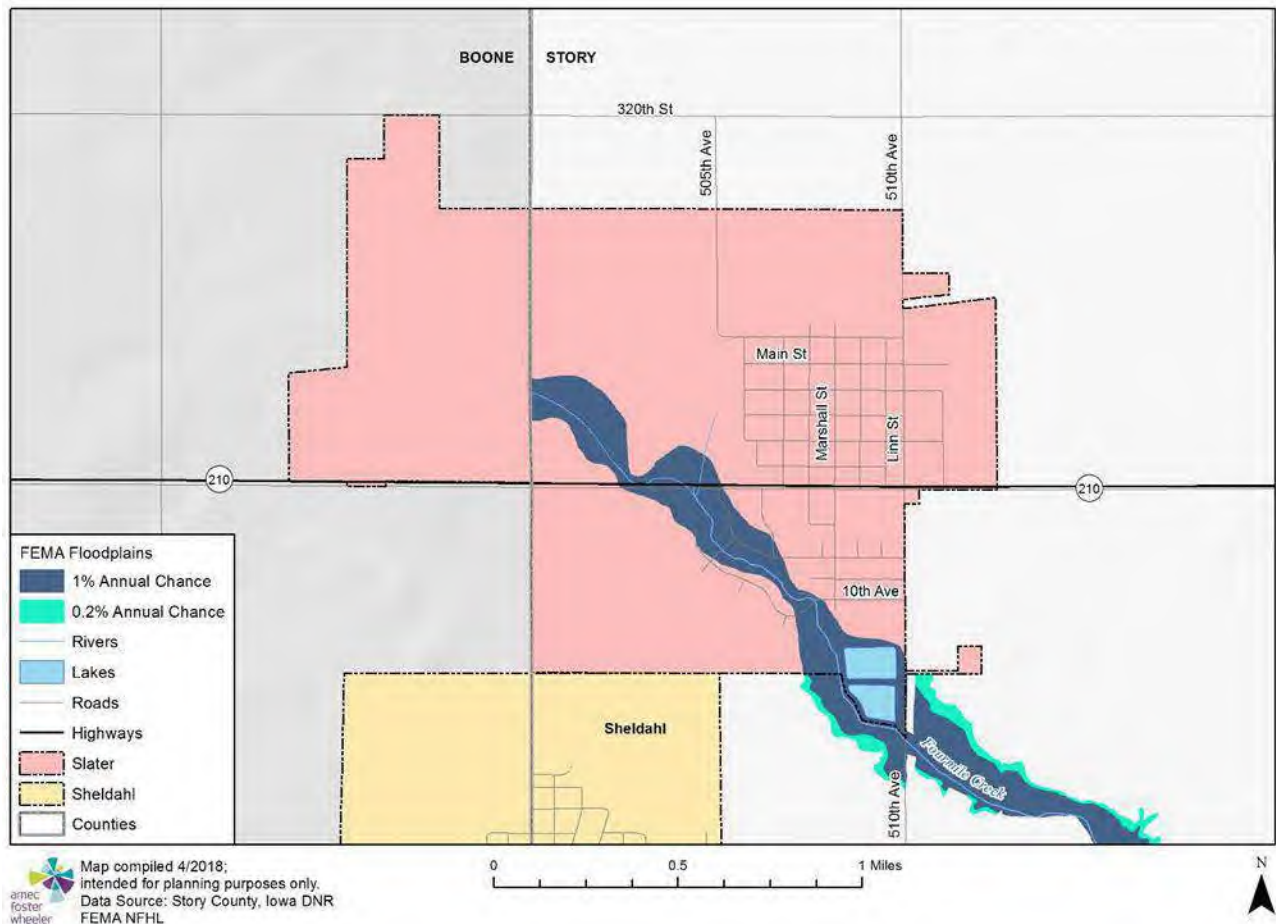
Figure 3.40: City of Sheldahl 1- and 0.2-Percent Annual Chance Floodplains



Slater

Slater shares its southwestern border with the City of Sheldahl, on the southwest corner of Story County, and also crosses into Boone County on the west. Fourmile Creek is Slater's only source of flooding, as the 100-year floodplain extends from the southeast corner, through to the middle of the city past Highway 210. While the floodplain intrusion into the city is not major, flooding is still very likely to occur in parts of the jurisdiction.

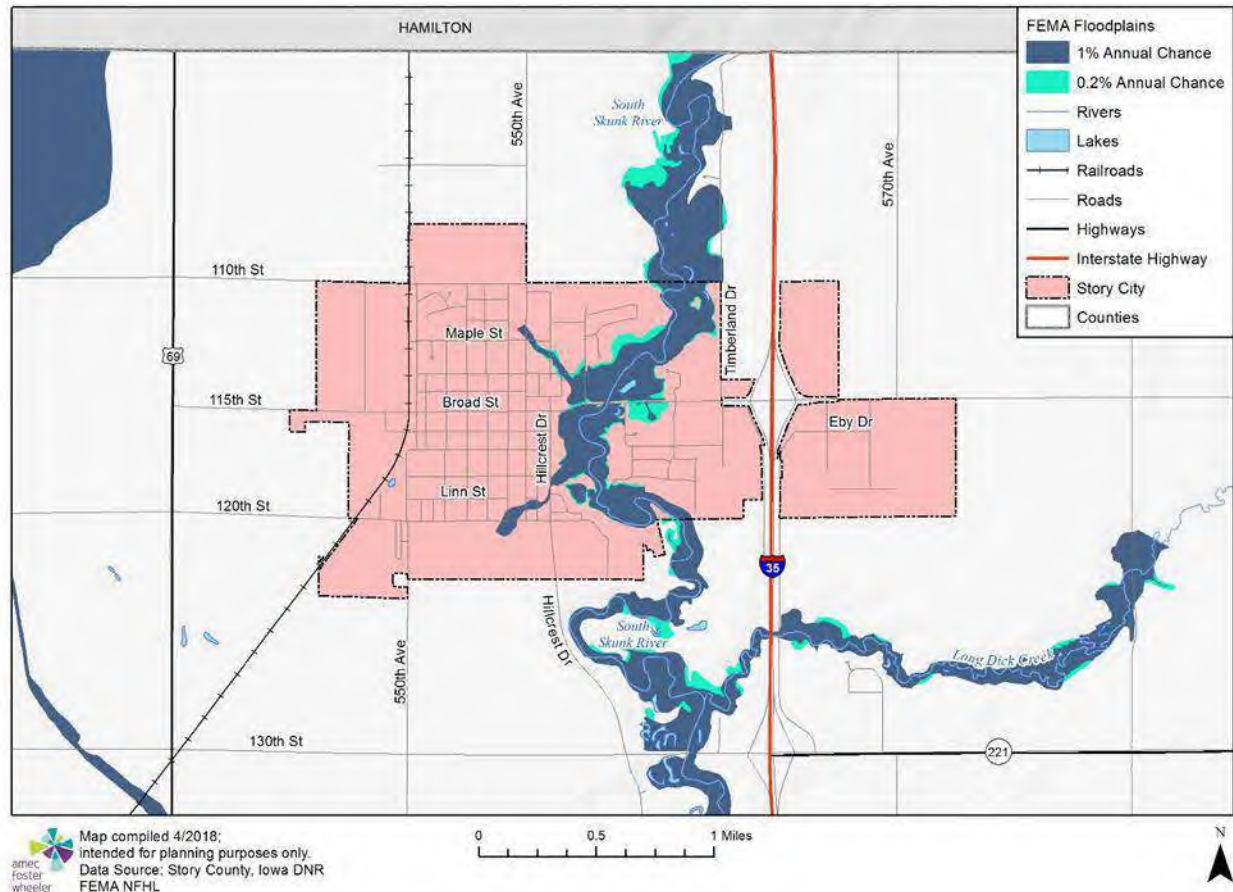
Figure 3.41: City of Slater 1- and 0.2-Percent Annual Chance Floodplains



Story City

Story City is located at the northwest part of Story County, near Hamilton County, and is crossed by Interstate 35 on the right portion of the city. The main source of flooding comes from the South Skunk River, which crosses the city in a north-south fashion through the middle, posing a risk to infrastructure and private property.

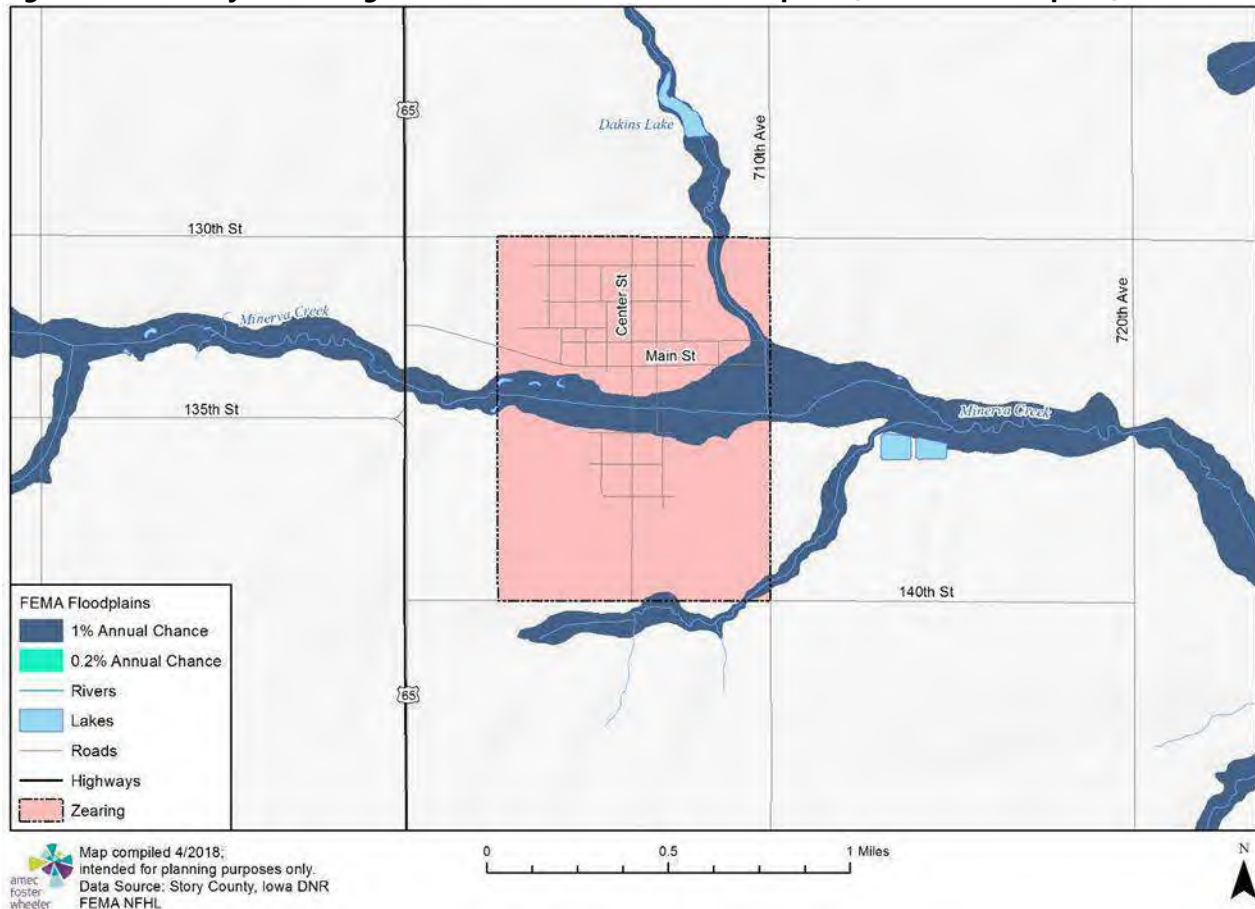
Figure 3.42: Story City 1- and 0.2-Percent Annual Chance Floodplains



Zearing

The City of Zearing is located near the northeastern boundary of Story County, near the Hardin and Marshall County edges. The City is crossed primarily by Minerva Creek, in an east-west fashion, with the Creek's floodplain covering about a fifth of the jurisdiction. In addition, a couple small tributaries from Minerva Creek connect to the main stream from the northeast and southeast, slightly crossing city boundaries as well, though is a minor way.

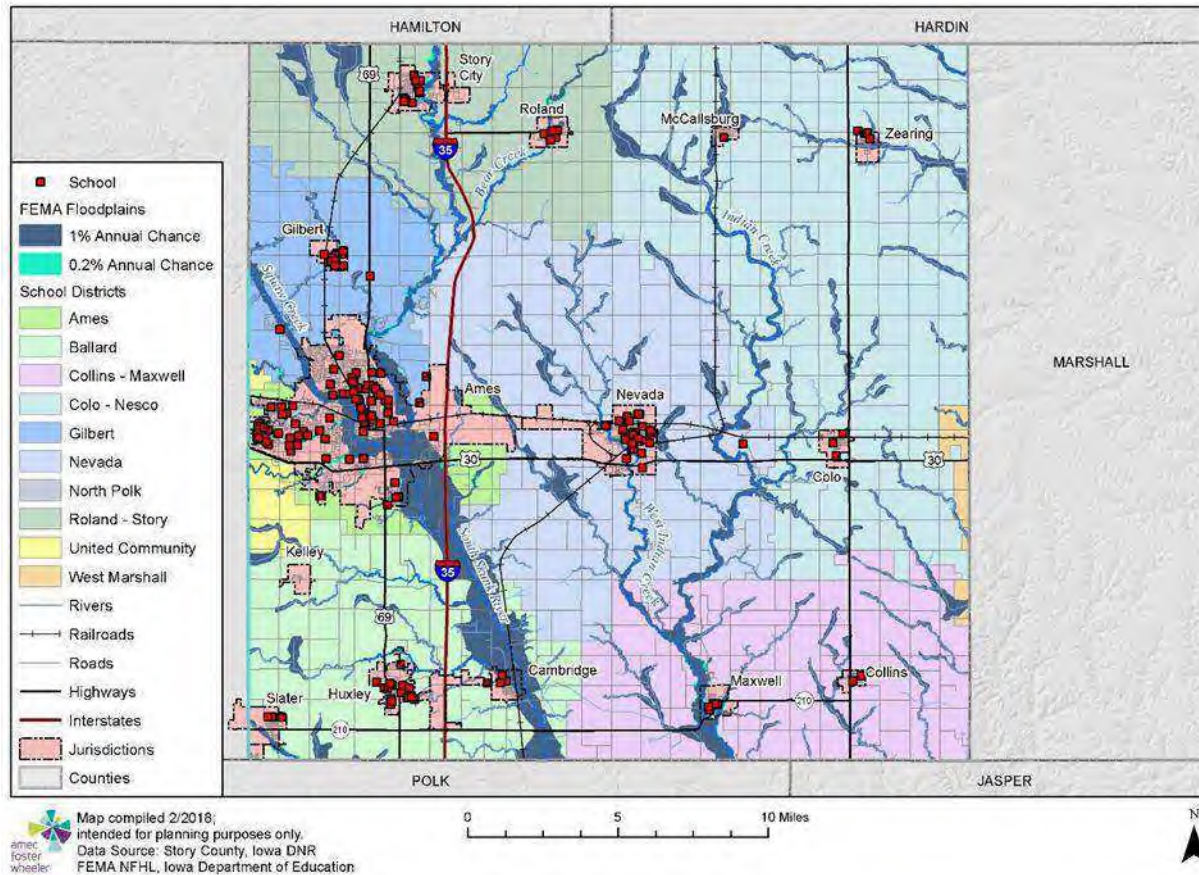
Figure 3.43: City of Zearing 1-Percent Annual Chance Floodplain (100-Year Floodplain)



Story County School Districts

All ten school districts are affected by flooding from the 1-percent annual chance floodplains, though to varying degrees. Districts such as Ames, Ballard, Colo–Nesco, or Collins–Maxwell appear to be most at-risk based, on having large areas covered by said floodplains.

Figure 3.44: Story County School Districts and the 1-Percent Annual Chance Floodplain (100-Year Floodplain)



Previous Occurrences

This section provides information on previous occurrences of riverine flooding in the planning area.

Presidential Declarations for Flooding in Planning Area

Since 1965 there have been 7 Presidential Disaster Declarations that included flooding in Story County.

General Flooding Events in Planning Area

According to the National Climatic Data Center, 61 general flood events have taken place from 1996–2017 in the County alone. While no human deaths or injuries were caused from the recorded events during these years, flooding still occurs fairly frequently, and can prove costly with regards to property damages. Details are provided below in Table 3.60

Table 3.60: NCDC Flood Events in Story County, 1997-2017

Year of Flooding	Number of Events	Deaths	Injuries	Property Damages
1996	3	0	0	\$ 1,000,000
1997	2	0	0	\$ 0
1998	5	0	0	\$ 420,000
1999	5	0	0	\$ 317,000
2000	3	0	0	\$ 95,000
2001	5	0	0	\$ 262,500
2003	2	0	0	\$ 10,000
2004	1	0	0	\$ 100,000
2005	2	0	0	\$ 84,070
2006	1	0	0	\$ 10,000
2007	3	0	0	\$ 650,000
2008	8	0	0	\$ 600,000
2009	1	0	0	\$ 5,000
2010	10	0	0	\$ 51,900,000
2013	2	0	0	\$ 150,000
2015	8	0	0	\$ 1,000,000
TOTAL	61	0	0	\$ 56,603,570

Source: NCDC

Previous General Flooding Occurrence Details by Jurisdiction

The following section provides previous occurrences in the jurisdictions and unincorporated places within the planning area. First, historical events for the county are described, followed by reported events for each city/town/location.

Story County

While there have been many flooding events county-wide of varying scales, the most damaging one caused around 1 million dollars in property damages, and about half a million dollars in crop damages. This event took place mid-June of 1996, lasting three days. It began due to heavy rainfall around the Skunk River, which crested almost a foot over the all-time record stage. Overall, however, the county has suffered from flooding for over 46 days, 41 of which were subjected to property damages, and 23 to crop damages.

Ames

The City of Ames has been subject to 25 river flooding events since 1998. From August 9 to 11 of 2010 the two costliest flooding events took place, with a combined property damage cost of 51 million dollars, along with about \$5,000 in crop damages. The cause was heavy raining that hit record flooding over not just Ames in Story County, but other counties as well. These events turned into a Presidentially Declared Disaster. Major damage occurred along the Skunk Basin, and portions of US Highway 30 were covered with water from the South Skunk River. This event did take one life in central Iowa, but outside of the County boundaries. Many had to be evacuated during these floods, as cars and homes were heavily inundated, and infrastructure such as roads and even a water treatment facility being destroyed. The second costliest event affecting the City incurred around \$500,000 in property damages, and was caused by heavy thunderstorms and rainfall. This event began on April 25, 2007, and flooding occurred over a 2-day period. Many basements were flooded and parts of the city washed out.

Cambridge

One major event is noted affecting the City of Cambridge, which took place August 9, 2010. The flood incurred \$250,000 in property damages and resulted in power outages. The event was caused by heavy rains, which introduced 2 to 5 inches of added water in the area.

Gilbert

Gilbert suffered from three reported events, all taking place in 2015 due to heavy rains. The first two began on August 29, causing combined property damage losses of \$300,000. A rescue crew was sent to help a car that was pushed down Squaw Creek, stranding one person. The third event began mid-December, causing about \$50,000 in property damages. 1 to 3 inches fell across the area during a 2-day cycle. This flood caused many roads to close due to unsafe structural conditions.

Kelley

One large flood event began around the City of Kelley towards the end of May 2008. A hail storm coupled with tornado events turned into heavy rain, which caused widespread flooding. Property damages from this flooding amount to \$250,000, while about \$50,000 in crop damages were incurred.

Nevada

There are two main events on record, with a combined property loss of \$70,000. The first began around the historical Nevada Municipal Airport on May 30, 2008, caused by heavy rains carrying moisture from the previous days' tornadoes. The other flooding occurrence began a week later, on June 6, also sparked by heavy rains from tornado events. Indian Creek significantly flooded, inundating areas of a city park in Nevada.

Story City

Story City suffered from two recorded events. The first began mid-June of 2010, due to heavy rainfall. About \$20,000 in crop damages were suffered. The next event took place late August of 2015, when flooding occurred on the South Skunk River due to heavy rains. Around \$50,000 in property damages were incurred. Story County's Emergency Manager reported standing water over Forest Ave, between Broad St. and 8th St.

Unincorporated Areas

27 flood events have been reported in unincorporated areas across the county, totaling over \$2,418,000 in property damages, and over \$1,178,000 in crop damages. Two of these floods took place near Ontario St., west of the City of Ames. These two events incurred \$300,000 in property damages. The first flood took place towards the end of August 2015, caused by heavy rainfall which in turn inundated central Iowa rivers to rise above flood stage levels. Squaw Creek crested at 10.69 feet. During the second flood west of the City of Ames, which began December 15 of that same year, Squaw Creek rose to 10.36 feet.

Previous Agricultural Impacts

Flooding has historically taken a toll on crop production and harvesting in the planning area. According to the USDA's Risk Management Agency (RMA), payments for insured crop losses in the planning area as a result of riverine flooding alone (without taking into account excess moisture or other related conditions) from 2007-2017 totaled \$2,209,151. This translates to an annual average of \$220,915. According to the RMA's 2016 Iowa Crop Insurance Profile, 83% of insurable crops in Iowa were insured. summarizes the indemnity claims paid by year.

Table 3.61: Crop Insurance Claims Paid in Story County for Crop Losses as a Result of Floods/Flooding Events (2007-2017)

Year of Flooding Claim	Indemnity Amount	Determined Acres
2007	\$ 22,163	418
2008	\$ 841,538	2,908
2009	\$ 19,782	203
2010	\$ 1,055,867	2,605
2013	\$ 21,659	224
2014	\$ 24,954	257
2015	\$ 223,188	801
TOTAL	\$ 2,209,151	7,416

Source: USDA Risk Management Agency

National Flood Insurance Program (NFIP) Participation provides details on NFIP participation for the communities in the planning area as well as the number of policies in force, amount of insurance in force, number of closed losses, and total payments for each jurisdiction, where applicable. The claims information is for the period from January 1, 1978 to December 31, 2017.

Table 3.62: NFIP Participation, Policies, and Claim Statistics for Story County

Community Name	NFIP Participant	Current Effective Map Date	Reg Emer Date	Policies In-force	Insurance In-force	Closed Losses	Total Payments
Story County	Yes	10/16/14	06/01/83	23	\$5,706,300	10	\$ 167,219
Ames	Yes	10/16/14	01/02/81	163	\$58,966,600	173	\$ 12,148,454
Cambridge	Yes	02/20/08	06/15/81	0	\$0	5	\$ 29,034
Collins	Yes	02/20/08	12/12/07	6	\$743,300	2	\$ 16,130
Colo	No	NSFHA	N/A	N/A	N/A	N/A	N/A
Gilbert	Yes	02/20/08	01/01/87	2	\$440,000	2	\$ 51,811
Huxley	Yes	02/20/08	05/05/08	1	\$105,000	0	\$0
Kelley	Yes	NSFHA	10/14/10	0	\$0	0	\$0
Maxwell	Yes	02/20/08	02/15/84	15	\$1,925,500	12	\$ 142,554
McCallsburg	Yes	02/20/08	09/06/13	0	\$0	0	\$0
Nevada	Yes	02/20/08	08/03/81	5	\$772,600	15	\$ 245,712
Roland	Yes	02/20/08(M)	04/02/90	12	\$1,798,400	7	\$ 33,898
Sheldahl	No	Never Mapped	N/A	N/A	N/A	N/A	N/A
Slater	Yes	02/20/08(M)	02/15/08	0	\$0	0	0
Story City	Yes	02/20/08	01/16/81	6	\$1,048,200	7	\$ 99,920
Zearing	Yes	02/20/08(M)	05/01/87	5	\$605,100	3	\$13,993

Source: FEMA Community Information System; M= No elevation determined – all Zone A, C, and X; NSFHA = No Special Flood Hazard Area; E=Emergency Program: Loss Statistics from BureauNet, <https://bsa.nfipstat.fema.gov/reports/1040.htm> *Closed Losses are those flood insurance claims that resulted in payment. Loss statistics are for the period from January 1, 1978 to January 31, 2018

Repetitive Loss/Severe Repetitive Loss Properties

Repetitive Loss: Repetitive Loss Properties are those properties with at least two flood insurance payments of \$5,000 or more in a 10-year period.

Severe Repetitive Loss (SRL): SRL properties are defined as “a single family property” (consisting of one-to-four residences) that is covered under flood insurance by the NFIP and has incurred flood-related damage for which four or more separate claims payments have been paid under flood insurance coverage with the amount of each claim payment exceeding \$5,000 and with cumulative amounts of such claims payments exceeding \$20,000; or for which at least two separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

There is one repetitive loss property and no severe repetitive loss properties in Story County.

Probability of Future Occurrence

With the history of flooding in many areas across Story County, it is likely that flooding of various levels will continue to occur. According to the NCDC, 61 general flood events have taken place in the recorded time period alone (2007-2017). Therefore, the probability rating for Story County to suffer from riverine flooding in the future is “Highly Likely”.

Probability Score: 4—Highly Likely

Vulnerability

Overview

To determine vulnerability of people and property to riverine flood, an enhanced flood risk analysis was performed utilizing FEMA’s HAZUS software. The analysis used for Story County is a Level 1 Plus which is a standard Level 1 process but with Depth Grids imported to enhance the accuracy of flood risk modelling within HAZUS. Depth grids were provided by the Iowa Flood Center (IFC) at the University of Iowa. The Depth grids provided by the IFC were used as the best available data for flooding, since older FEMA depth grids are difficult to obtain and using the IFC data complements analysis that the Iowa Homeland Security and Emergency Management Department is conducting for the State Hazard Mitigation Plan. It should be noted that, while the IFC depth grids are very similar to the effective FEMA products, there are however some differences in the detailed areas for the 1-percent annual chance floodplain.

Default HAZUS inventories were left intact and the flood depth grids were imported as User Data into HAZUS. After the flood depth grids were imported into the HAZUS software, analysis was completed to determine potential losses as a result of a 1-percent annual chance flood. The following jurisdictions are the only communities that would not incur losses as a result of a 1-percent annual chance flood: Colo, Kelley, and Sheldahl; all other jurisdictions in the County would have losses from these 1-percent chance flooding events. The most losses would occur in Ames, followed by the Unincorporated County areas, then Story City and Nevada (though most other jurisdictions would also suffer less significant losses). The detailed results of this analysis are provided in the following section on Potential Losses to Existing Development.

For the planning area ranking, the HMPC determined the magnitude of river flooding to be “Critical”. Individual jurisdictional ratings are provided at the end of this hazard section.

Magnitude Score: 3—Critical (from 25% to 50% of property damages and injuries to populations)

Potential Losses to Existing Development

The potential losses to existing development will be provided for the following categories of losses:

- Building/Contents Losses

- Estimated Population Displaced
- Agricultural Impacts
- Critical Facilities and Infrastructure at Risk

Figure 3.45 provides the summary of potential flood loss estimates and impacted populations for the 1-percent annual chance flood by jurisdiction. These results are based on the HAZUS Level 1 Plus Analysis described in the Overview section above.

Figure 3.45: Story County 1-Percent Annual Chance Floodplain with Depth Grids

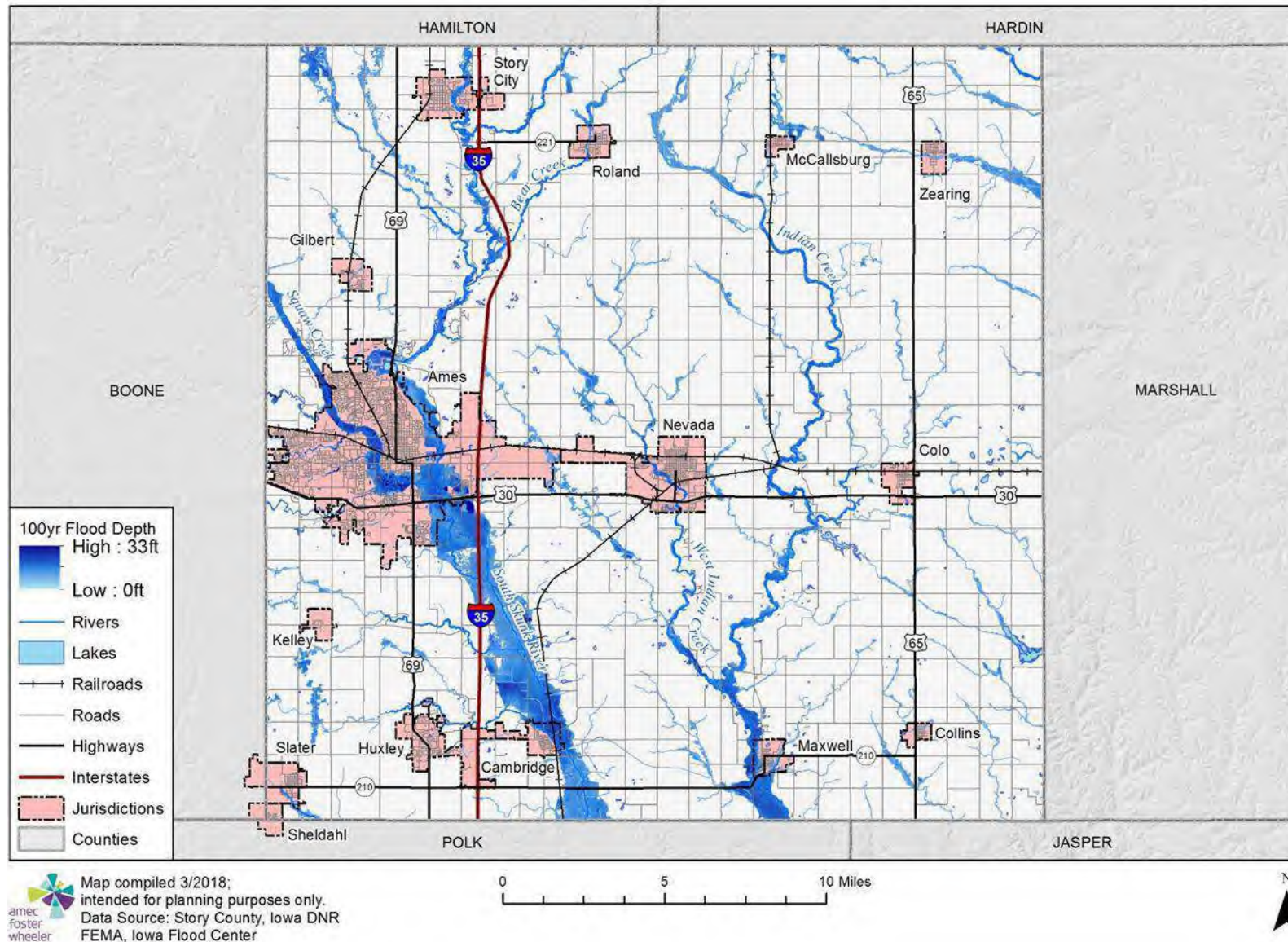


Table 3.63: HAZUS 100-year Flood Estimated Losses by Jurisdiction and Property Type

Jurisdiction	Property Type	Building Counts	Building Loss*	Contents Loss*	Inventory Loss*	Relocation Cost*	Income Loss*	Rental Income Loss*	Wage Loss*	Total Loss*
Ames	Agriculture	0	\$36	\$221	\$16	\$0	\$0	\$0	\$0	\$273
	Commercial	10	\$2,449	\$8,256	\$146	\$34	\$215	\$21	\$208	\$11,329
	Education	0	\$46	\$322	\$0	\$1	\$9	\$0	\$22	\$400
	Government	0	\$8	\$57	\$0	\$0	\$0	\$0	\$21	\$86
	Industrial	0	\$580	\$1,072	\$196	\$0	\$0	\$0	\$0	\$1,848
	Religious	0	\$167	\$1,359	\$0	\$4	\$6	\$0	\$20	\$1,556
	Residential	427	\$10,150	\$14,374	\$0	\$45	\$8	\$78	\$21	\$24,676
	Total	437	\$13,436	\$25,661	\$358	\$84	\$238	\$99	\$292	\$40,168
Cambridge	Agriculture	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Commercial	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Education	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Government	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Industrial	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Religious	0	\$1	\$31	\$0	\$0	\$0	\$0	\$0	\$32
	Residential	7	\$137	\$67	\$0	\$0	\$0	\$0	\$0	\$204
	Total	7	\$138	\$98	\$0	\$0	\$0	\$0	\$0	\$236
Collins	Agriculture	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Commercial	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Education	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Government	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Industrial	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Religious	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Residential	4	\$47	\$7	\$0	\$0	\$0	\$0	\$0	\$54
	Total	4	\$47	\$7	\$0	\$0	\$0	\$0	\$0	\$54
	Agriculture	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Commercial	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0

Jurisdiction	Property Type	Building Counts	Building Loss*	Contents Loss*	Inventory Loss*	Relocation Cost*	Income Loss*	Rental Income Loss*	Wage Loss*	Total Loss*
Gilbert	Education	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Government	0	\$0	\$0	\$0	\$0	\$0	\$0	\$3	\$3
	Industrial	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Religious	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Residential	0	\$43	\$14	\$0	\$0	\$0	\$0	\$0	\$57
	Total	0	\$43	\$14	\$0	\$0	\$0	\$0	\$3	\$60
Huxley	Agriculture	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Commercial	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Education	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Government	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Industrial	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Religious	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Residential	0	\$1	\$0	\$0	\$0	\$0	\$0	\$0	\$1
	Total	0	\$1	\$0	\$0	\$0	\$0	\$0	\$0	\$1
Maxwell	Agriculture	0	\$3	\$21	\$1	\$0	\$0	\$0	\$0	\$25
	Commercial	0	\$11	\$64	\$0	\$0	\$1	\$0	\$1	\$77
	Education	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Government	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Industrial	0	\$4	\$4	\$0	\$0	\$0	\$0	\$0	\$8
	Religious	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Residential	18	\$268	\$46	\$0	\$0	\$0	\$0	\$0	\$314
	Total	18	\$286	\$135	\$1	\$0	\$1	\$0	\$1	\$424
McCallsburg	Agriculture	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Commercial	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Education	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Government	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Industrial	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0

Jurisdiction	Property Type	Building Counts	Building Loss*	Contents Loss*	Inventory Loss*	Relocation Cost*	Income Loss*	Rental Income Loss*	Wage Loss*	Total Loss*
	Religious	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Residential	0	\$5	\$0	\$0	\$0	\$0	\$0	\$0	\$5
	Total	0	\$5	\$0	\$0	\$0	\$0	\$0	\$0	\$5
Nevada	Agriculture	0	\$2	\$12	\$0	\$0	\$0	\$0	\$0	\$14
	Commercial	0	\$90	\$257	\$4	\$0	\$1	\$0	\$2	\$354
	Education	0	\$2	\$11	\$0	\$0	\$0	\$0	\$0	\$13
	Government	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Industrial	0	\$2	\$2	\$0	\$0	\$0	\$0	\$0	\$4
	Religious	0	\$2	\$23	\$0	\$0	\$0	\$0	\$0	\$25
	Residential	21	\$879	\$483	\$0	\$1	\$1	\$0	\$3	\$1,367
	Total	21	\$977	\$788	\$4	\$1	\$2	\$0	\$5	\$1,777
Roland	Agriculture	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Commercial	0	\$0	\$1	\$0	\$0	\$0	\$0	\$0	\$1
	Education	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Government	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Industrial	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Religious	0	\$0	\$20	\$0	\$0	\$0	\$0	\$0	\$20
	Residential	9	\$175	\$73	\$0	\$0	\$0	\$0	\$0	\$248
	Total	9	\$175	\$94	\$0	\$0	\$0	\$0	\$0	\$269
Slater	Agriculture	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Commercial	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Education	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Government	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Industrial	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Religious	0	\$0	\$2	\$0	\$0	\$0	\$0	\$0	\$2
	Residential	10	\$86	\$27	\$0	\$1	\$0	\$0	\$0	\$114
	Total	10	\$86	\$29	\$0	\$1	\$0	\$0	\$0	\$116

Jurisdiction	Property Type	Building Counts	Building Loss*	Contents Loss*	Inventory Loss*	Relocation Cost*	Income Loss*	Rental Income Loss*	Wage Loss*	Total Loss*
Story City	Agriculture	0	\$0	\$2	\$0	\$0	\$0	\$0	\$0	\$2
	Commercial	0	\$30	\$213	\$0	\$0	\$10	\$0	\$7	\$260
	Education	0	\$0	\$11	\$0	\$0	\$0	\$0	\$0	\$11
	Government	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Industrial	0	\$86	\$109	\$37	\$0	\$0	\$0	\$0	\$232
	Religious	0	\$5	\$54	\$0	\$0	\$0	\$0	\$2	\$61
	Residential	36	\$428	\$208	\$0	\$2	\$3	\$3	\$8	\$652
	Total	36	\$549	\$597	\$37	\$2	\$13	\$3	\$17	\$1,218
Zearing	Agriculture	0	\$0	\$3	\$0	\$0	\$0	\$0	\$0	\$3
	Commercial	0	\$3	\$13	\$0	\$0	\$0	\$0	\$1	\$17
	Education	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Government	0	\$0	\$0	\$0	\$0	\$0	\$0	\$53	\$53
	Industrial	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Religious	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	Residential	2	\$23	\$5	\$0	\$0	\$0	\$0	\$0	\$28
	Total	2	\$26	\$21	\$0	\$0	\$0	\$0	\$54	\$101
Unincorporated	Agriculture	0	\$27	\$163	\$9	\$0	\$0	\$0	\$0	\$199
	Commercial	0	\$149	\$432	\$4	\$1	\$15	\$0	\$9	\$610
	Education	0	\$0	\$0	\$0	\$0	\$0	\$0	\$2	\$2
	Government	0	\$0	\$2	\$0	\$0	\$0	\$0	\$0	\$2
	Industrial	0	\$216	\$401	\$78	\$0	\$0	\$0	\$0	\$695
	Religious	0	\$48	\$409	\$0	\$0	\$1	\$0	\$8	\$466
	Residential	59	\$2,715	\$1,066	\$0	\$6	\$3	\$6	\$9	\$3,805
	Total	59	\$3,155	\$2,473	\$91	\$7	\$19	\$6	\$28	\$5,779
Grand Total		603	\$18,924	\$29,917	\$491	\$95	\$273	\$108	\$400	\$50,208

*All values are in thousands of dollars. A value of \$0 does not necessarily mean \$0 but less than \$1,000.

Source: HAZUS MH 4.0, Iowa Flood Center

The numbers in Table 3.54 are based on Hazus analysis; during HMPC review, Story County Emergency Management noted that residential numbers in the table for Ames, Maxwell, Slater and Story City seemed high.

Estimated Population Displaced

To estimate population displaced by a 1-percent annual chance flood, the number of residential structures impacted was multiplied by the average household size for each jurisdiction. Building count data were generated from block group and block level census data within HAZUS. According to the HAZUS Level 1 Plus analysis, there would be a total of 593 residential structures impacted for Story County, and 403 people would be displaced during a 100-year flood event. Table 3.64 provides the estimated population impacted for each jurisdiction that had estimated flood losses.

Table 3.64: Estimated Displaced Population

Jurisdiction	Estimated Residential Structures Impacted	Average Household Size	Estimated Displaced Population
Ames	427	2.24	0
Cambridge	7	2.81	19.67
Collins	4	2.68	10.72
Gilbert	0	3.03	0
Huxley	0	2.63	0
Maxwell	18	2.60	46.80
McCallsburg	0	2.50	0
Nevada	21	2.38	49.98
Roland	9	2.73	24.57
Slater	10	2.95	29.50
Story City	36	2.19	78.84
Zearing	2	2.35	4.70
Unincorporated	59	2.34	138.06
TOTAL	593		403

Source: HAZUS Analysis, U.S. Census Bureau, American Community Survey 2012-2016 5-Year Estimates

FEMA's HAZUS Average Annualized Losses

In 2010, FEMA conducted a Level 1 HAZUS MR4 flood analysis to estimate average annualized losses (AAL). This AAL study examined riverine and coastal flood hazards in the 48 contiguous states (including the District of Columbia) by county. Hawaii, Alaska, and Puerto Rico, and US territories were not analyzed as part of this study. The AAL study estimated flood losses for the following storm events, which were then used to develop the annualized loss estimate: 10% annual chance (10-year), 2% annual chance (50-year), 1% annual chance (100-year), 0.5% annual chance (200-year), and 0.2% annual chance (500-year).

The data from the AAL Study was calculated at the census block level, based on HAZUS' hydrology and hydraulic analysis of streams draining 10 square miles or greater and utilizing 30m Digital Elevation Model (DEM) data. It includes estimated replacement values and flood losses for both buildings and contents, based on 2000 census data, and is aggregated by structure type (residential, commercial, and other). For certain reaches of stream, the hydrology or hydraulics failed during the AAL study, and loss estimates were not able to be calculated. In some of the coastal areas, both riverine and coastal loss estimates were calculated, but may not be distinct in the AAL results. In spite of these known data gaps, the AAL study

represents a baseline level of flood risk assessment results which can be used where more refined analyses are not conducted or available.

The AAL Study estimates \$9,536,000 in Average Annual Losses (AAL) for Story County, Iowa.

Critical Facilities and Infrastructure at Risk

To analyze critical facilities at risk in the planning area, the inventory of critical and essential facilities and infrastructure in the planning area was compiled by analyzing datasets sourcing from the State of Iowa's Homeland Security and Emergency Management office, as well as the Iowa Flood Center. A comparison was made between Story County's 686 total critical facilities, bridge infrastructure from the National Bridge Inventory, and the Iowa Flood Center's flood data, to determine which facilities would be damaged in the 1-percent annual chance flood events. This analysis determined that there are 46 critical facilities/infrastructure in the 1-percent annual chance floodplain (100-year floodplain), and 5 critical facilities/infrastructure in the 0.2% annual chance floodplain (500-year floodplain). Table 3.65 and Table 3.66 provide a summary of the critical facilities in the 1-percent and 0.2-percent annual chance floodplains, respectively.

Table 3.65: Critical Facilities at risk to 1-percent Annual Chance Flood

Jurisdiction	Facility Type	Facility Name
Ames	Communications	1
	Eldercare/Vulnerable Needs Facility	1
	Medical Care	1
	Tier II Facility	1
	Transportation	1
	Water Facility	15
Cambridge	Water Facility	1
Collins	Water Facility	1
Nevada	Schools & Daycares	1
	Water Facility	1
Roland	Energy	1
Slater	Water Facility	1
Story City	Schools & Daycares	1
	Water Facility	1
Zearing	Emergency Response	1
	Water Facility	2
Unincorporated	Communications	2
	Energy	6
	Tier II Facility	1
	Water Facility	6
TOTAL		46

Source: HSIP Freedom 2015, Iowa Flood Center

Table 3.66: Critical Facilities at risk to 0.2-percent Annual Chance Flood

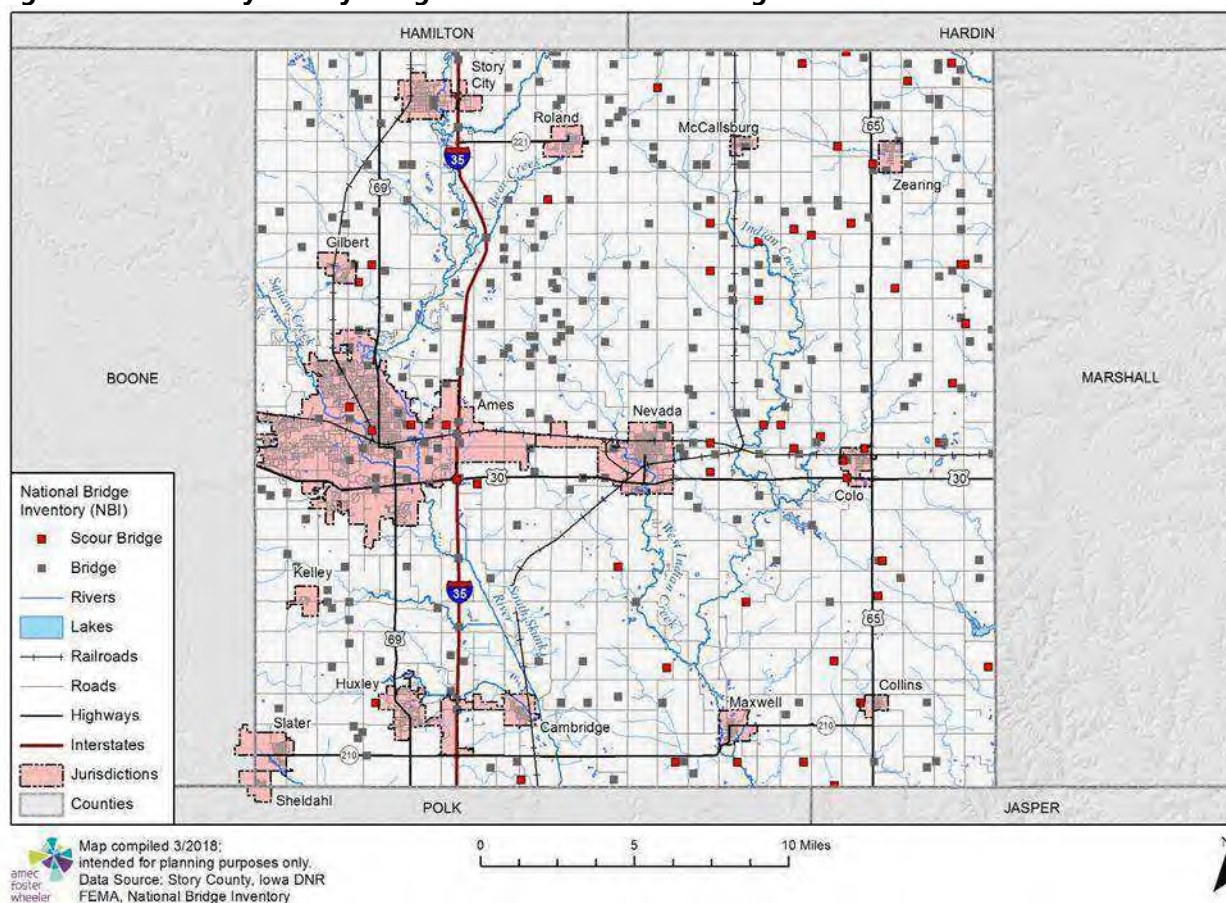
Jurisdiction	Facility Type	Facility Name
Ames	Schools & Daycares	1
Maxwell	Schools & Daycares	2
Story City	Water Facility	1
Unincorporated	Tier II Facility	1
TOTAL		5

Source: HSIP Freedom 2015, Iowa Flood Center

Appendix E provides the list of critical facilities that were inventoried and analyzed. This Appendix is redacted from the public version of this plan. To obtain access for official use, contact the Story County Emergency Management Agency.

According to the National Bridge Inventory, there are 55 scour critical bridges in Story County, and 377 total bridges. These bridges are depicted in Figure 3.46. Note that not every bridge infrastructure displayed on the map will be at risk of the 1-percent annual chance flood.

Figure 3.46: Story County Bridges with Scour Critical Bridges Identified



Future Development

Any future development in floodplains would increase risk in those areas. For those communities that participate in the National Flood Insurance Program, enforcement of the floodplain management regulations will ensure mitigation of future construction in those areas.

Climate Change Impacts

One of the climate change impacts noted in the 2010 Climate Change Impacts on Iowa report by the Iowa Climate Change Impacts Committee is the increase in frequency of severe precipitation events. This climate change impact was also noted in the Flash Flood hazard analysis. Although very heavy precipitation does not always result in riverine flooding, it can if/when the very heavy precipitation occurs frequently without enough time for the watershed to drain away the large amounts of water.

Figure 3.14 in the Flash Flood section shows that all of Iowa is in the region with a 31% increase in very heavy precipitation from 1958 to 2007. For this study, very heavy precipitation was defined as the heaviest 1% of all events. If this trend increases, riverine flooding events and their associated impacts will likely occur more often in the planning area, and potentially have more pressing consequences (e.g., financial losses, infrastructure at risk).

River Flooding Hazard Summary by Jurisdiction

To demonstrate how river flooding additionally varies by jurisdiction, all were rated in terms of their riverine flooding hazard characteristics. Probability scores are estimated from historical flood events. Magnitude ratings are based on the number of structures present or in very close proximity to the flooding area. Warning times of 24 hours or more (i.e., receiving a rank of 1) are plausible, given the many methods available to communicate hazard warnings thanks to technology and professional emergency management staff efforts. Durations are also estimated from historical flood events and patterns. For those jurisdictions with no floodplain areas found to intersect with city boundaries, all elements indicate Not Applicable (N/A).

Jurisdiction	Probability	Magnitude	Warning Time	Duration	Score	Level
Story County, Iowa	4	4	1	4	3.55	High
City of Ames	4	4	1	4	3.55	High
City of Cambridge	4	3	1	4	3.25	High
City of Collins	4	1	1	3	2.55	Moderate
City of Colo	N/A	N/A	N/A	N/A	N/A	N/A
City of Gilbert	4	2	1	2	2.75	Moderate
City of Huxley	3	1	1	2	2	Moderate
City of Kelley	N/A	N/A	N/A	N/A	N/A	N/A
City of Maxwell	4	4	1	4	3.55	High
City of McCallsburg	3	2	1	2	2.3	Moderate
City of Nevada	4	4	1	4	3.55	High
City of Roland	4	3	1	4	3.25	High
City of Sheldahl	N/A	N/A	N/A	N/A	N/A	N/A
City of Slater	4	2	1	3	2.85	Moderate
City of Story City	4	4	1	4	3.55	High
Ames Schools	4	4	1	4	3.55	High
Ballard Schools	4	3	1	3	3.15	High
Collins-Maxwell Schools	4	3	1	4	3.25	High
Colo-Nesco Schools	4	2	1	3	2.85	Moderate
Gilbert Schools	4	2	1	2	2.75	Moderate
Nevada Schools	4	4	1	4	3.55	High
Roland-Story Schools	4	3	1	4	3.25	High
Iowa State University	4	4	1	4	3.55	High

3.5.14 Severe Winter Storm

Hazard Score Calculation					
Probability	Magnitude/Severity	Warning Time	Duration	Weighted Score	Level
4	2	3	3	3.15	High

Profile

Hazard Description

Severe winter storms are an annual occurrence in Iowa. A major winter storm can last for several days and be accompanied by high winds, freezing rain or sleet, heavy snowfall, cold temperatures and drifting snow creating blizzards. The National Weather Service describes different types of winter storm events as follows:

- **Blizzard**—Winds of 35 mph or more with snow and blowing snow reducing visibility to less than ¼ mile for at least three hours.
- **Blowing Snow**—Wind-driven snow that reduces visibility. Blowing snow may be falling snow and/or snow on the ground picked up by the wind.
- **Snow Squalls**—Brief, intense snow showers accompanied by strong, gusty winds. Accumulation may be significant.
- **Snow Showers**—Snow falling at varying intensities for brief periods of time. Some accumulation is possible.
- **Freezing Rain**—Measurable rain that falls onto a surface with a temperature below freezing. This causes it to freeze to surfaces, such as trees, cars, and roads, forming a coating or glaze of ice. Most freezing-rain events are short lived and occur near sunrise between the months of December and March.
- **Sleet**—Rain drops that freeze into ice pellets before reaching the ground. Sleet usually bounces when hitting a surface and does not stick to objects.

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.

Severe winter storms include extreme cold, heavy snowfall, ice, and strong winds which can push the wind chill well below zero degrees in the planning area. Heavy snow can bring a community to a standstill by inhibiting transportation (in whiteout conditions), weighing down utility lines, and causing structural collapse in buildings not designed to withstand the weight of the snow. Repair and snow removal costs can be significant. Ice buildup can collapse utility lines and communication towers, as well as make transportation difficult and hazardous. Ice can also become a problem on roadways if the air temperature is high enough so that precipitation falls as freezing rain rather than snow.

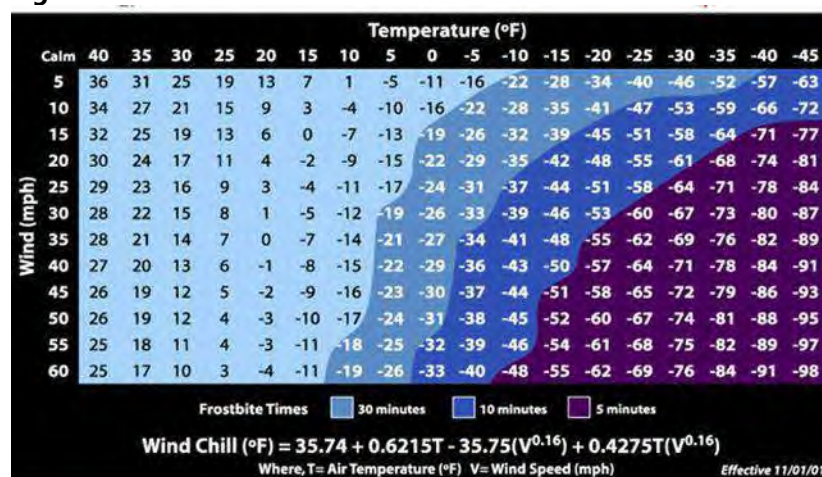
Extreme cold often accompanies severe winter storms and can lead to hypothermia and frostbite in people who are exposed to the weather without adequate clothing protection. Cold can cause fuel to congeal in storage tanks and supply lines, stopping electric generators. Cold temperatures can also overpower a building's heating system and cause water and sewer pipes to freeze and rupture. When combined with high winds from winter storms, extreme cold becomes extreme wind chill, which is extremely hazardous to health and safety.

The National Institute on Aging estimates that more than 2.5 million Americans are especially vulnerable to hypothermia, with the isolated elderly being most at risk. About 10 percent of people over the age of 65 have some kind of temperature-regulating defect, and 3-4 percent of all hospital patients over 65 are hypothermic.

Also at risk are those without shelter or who are stranded, or who live in a home that is poorly insulated or without heat. Other impacts of extreme cold include asphyxiation (unconsciousness or death from a lack of oxygen) from toxic fumes from emergency heaters, from household fires, which can be caused by fireplaces and emergency heaters, and from frozen/burst pipes.

Wind can greatly amplify the impact of cold ambient air temperatures. Provided by the National Weather Service, Figure 3.47 below shows the relationship of wind speed to apparent temperature and typical time periods for the onset of frostbite.

Figure 3.47: Wind Chill Chart



Source: National Weather Service

Warning Time Score: 3—6-12 hours

Duration Score: 3—More than 1 day but less than 1 week

Geographic Location/Extent

The High Plains Regional Climate Center reports the following temperature statistics for the planning area:

Month	Average Maximum Temperature	Average Minimum Temperature
December	31.14 °F	13.84 °F
January	27.89 °F	9.52 °F
February	32.75 °F	14.13 °F

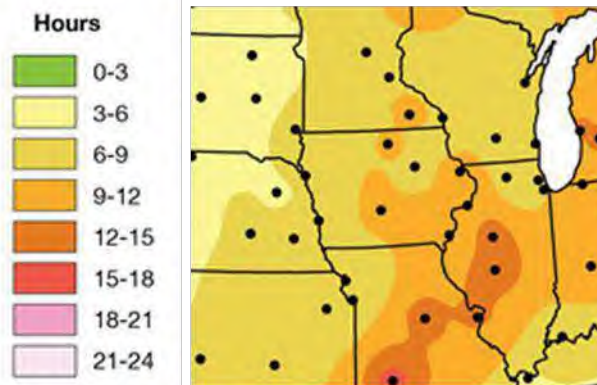
Source: HPRCC CLIMOD Monthly Climate Normals

Average snowfall is highest in December, January, and February with an annual average of 31 inches.

The entire State of Iowa is vulnerable to heavy snow, extreme cold temperatures and freezing rain. Generally, winter storms occur between the months of November and March, but can occur as early as October and as late as April.

Figure 3.48 shows that the planning area (approximated within the red square) is in the light-orange shaded area that receives 9-12 hours of freezing rain per year.

Figure 3.48: Average Number of Hours per Year with Freezing Rain



Source: Midwestern Regional Climate Center; http://mcc.sws.uiuc.edu/living_wx/icestorms/index.html

Note: Red square provides approximate location of planning area.

Previous Occurrences

Historically, there have been two Presidential Disaster Declarations for Severe Winter Storms that included Story County since 1965; a winter storm in 2007 and an ice storm in 2010 (See Table 3.2 in the Hazard Identification Section).

From 1996 thru 2017, the National Climatic Data Center reports the following 80 severe winter weather events:

- 15 - Blizzard
- 6 - Cold/Wind Chill
- 5 - Extreme Cold/Wind Chill
- 22 - Heavy Snow
- 11 - Ice Storm
- 20 - Winter Storm
- 1 - Winter Weather

During this 22-year period, 48 of the events caused property or crop damage. This translates to roughly two damaging winter storm/cold temperature events each year. The total property damage for these 48 events was \$2,575,680 with another \$2,894,118 in crop damage. The most damaging event occurred on October 26, 1997 causing \$640,000 in property damage and \$2,600,000 in crop damage resulting from an early winter storm that dumped up to 11" of snow across parts of the State.

NOAA's National Weather Service has issued 351 Advisories, Watches, and/or Warnings concerning winter weather phenomena affecting the planning area between 1986 and 2017 (see Table 3.67). The data is kept with Iowa Environmental Mesonet, Iowa State University Department of Agronomy website, (<http://mesonet.agron.iastate.edu/vtec/search.php>).

Table 3.67: National Weather Service Issuances for Winter Weather in Story County, IA

Phenomenon/Significance	Advisory	Warning	Watch	Total
Blizzard		12	9	21
Blowing Snow	8			8
Freeze		19	5	24
Freezing Fog	1			1
Freezing Rain	6			6
Frost	14			14
Heavy Snow		1		1
Ice Storm		5		5
Snow	12			12
Snow and Blowing Snow	8			8
Wind Chill	72	12	1	85
Winter Storm		34	43	77
Winter Weather	89			89
Grand Total	210	83	58	351

Source: Environmental Mesonet, Iowa State University Department of Agronomy website, <http://mesonet.agron.iastate.edu/vtec/search.php>

Agricultural Impacts

Winter storms, cold, frost and freeze take a toll on crop production in the planning area. According to the USDA's Risk Management Agency, payments for insured crop losses in the planning area as a result of winter weather from 2007-2016 totaled \$944,603 (see Table 3.68).

Table 3.68: Crop Insurance Claims Paid in Story County as a Result of Cold Conditions and Snow (2007-2016)

Year	Cold Wet Weather	Cold Winter Weather	Freeze	Total Insurance Claims Paid
2007	\$2,599			\$2,599
2008	\$29,677			\$29,677
2009	\$74,992	\$2,496	\$2,197	\$79,685
2010	\$7,214		\$2,745	\$9,959
2011	\$61,868			\$61,868
2012	\$979	\$31		\$1,010
2013	\$75,061	\$221		\$75,282
2014	\$670,136	\$11,826		\$681,962
2015	\$315	\$1,025		\$1,340
2016	\$1,221			\$1,221
Total	\$924,062	\$15,599	\$4,942	\$944,603

Source: USDA Risk Management Agency

Probability of Future Occurrence

According to NCDC, during the 22-year period from 1996 thru 2017, the planning area experienced a total of 48 damaging blizzards, winter storms, ice storms frost/freeze, and extreme cold events. This translates to an annual probability of about two blizzards, winter/ice storms, or extreme cold events per year. Therefore, the probability rating is "Highly Likely".

Probability Score: 4—Highly Likely

Vulnerability

Vulnerability Overview

The entire planning area is vulnerable to the effects of winter storm. Hazardous driving conditions due to snow and ice on highways and bridges lead to many traffic accidents and can impact the response of emergency vehicles. The leading cause of death during winter storms is transportation accidents. About 70 percent of winter-related deaths occur in automobiles due to traffic accidents and about 25 percent are from people caught outside in a storm. Emergency services such as police, fire, and ambulance may be unable to respond due to road conditions. Emergency needs of remote or isolated residents for food or fuel, as well as for feed, water and shelter for livestock are unable to be met. The probability of utility and infrastructure failure increases during winter storms due to freezing rain accumulation on utility poles and power lines. People, pets, and livestock are also susceptible to frostbite and hypothermia during winter storms. Those at risk are primarily either engaged in outdoor activity (shoveling snow, digging out vehicles, or assisting stranded motorists), or are the elderly. Schools often close during extreme cold or heavy snow conditions to protect the safety of children and bus drivers. Citizens' use of kerosene heaters and other alternative forms of heating may create other hazards such as structural fires and carbon monoxide poisoning.

According to the 2013 Iowa Hazard Mitigation Plan, of the 8 hazards for which data was available to estimate annualized losses, severe winter storm ranked 6th with \$2.2 million in annualized losses based on data spanning a 13-year period.

Magnitude Score: 2—Limited

Potential Losses to Existing Development

Vulnerable Buildings, Infrastructure, and Critical Facilities

Buildings with overhanging tree limbs are more vulnerable to damage during winter storms. Businesses experience loss of income as a result of closure during power outages. In general, heavy winter storms increase wear and tear on roadways though the cost of such damages is difficult to determine. Businesses can experience loss of income as a result of closure during winter storms.

Loss of Use

Overhead power lines and infrastructure are also vulnerable to damages from winter storms. In particular, ice accumulation during winter storm events can cause damages to power lines due to the ice weight on the lines and equipment, as well as damage caused to lines and equipment from falling trees and tree limbs weighted down by ice. Potential losses would include cost of repair or replacement of damaged facilities, and lost economic opportunities for businesses. 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. Specific amounts of estimated losses are not available due to the complexity and multiple variables associated with this hazard.

The electric power loss of use estimates provided in Table 3.69 below were calculated using FEMA's Standard Values for Loss of Service for Utilities published in the June 2009 *BCA Reference Guide*. These figures are used to provide estimated costs associated with the loss of power in relation to the populations in Story County's jurisdictions. The loss of use estimates for power failure associated with winter storms is provided as the loss of use cost per person, per day of loss. The estimated loss of use provided for each jurisdiction represents the loss of service of the indicated utility for one day for 10 percent of the population. It is understood that in rural areas, the typical loss of use may be for a larger percentage of the population for a longer time during weather extremes. These figures do not take into account physical damages to utility equipment and infrastructure.

Table 3.69: Loss of Use Estimates for Power Failure (One Day)

Jurisdiction	2016 Population Estimate	Estimated Affected Population 10%	Electric Loss of Use Estimate (\$126 per person per day)
Ames	64,073	6,407	\$ 807,320
Cambridge	853	85	\$ 10,748
Collins	458	46	\$ 5,771
Colo	886	89	\$ 11,164
Gilbert	1183	118	\$ 14,906
Huxley	3474	347	\$ 43,772
Kelley	306	31	\$ 3,856
Maxwell	839	84	\$ 10,571
McCallsburg	325	33	\$ 4,095
Roland	1312	131	\$ 16,531
Sheldahl	249	25	\$ 3,137
Slater	1617	162	\$ 20,374
Story City	3423	342	\$ 43,130
Unincorporated Story County	15,836	1,584	\$ 199,534
County Total	94,834	9,483	\$ 1,194,908

Source: Loss of Use Estimates from FEMA BCA Reference Guide, 2009; Population Estimates, U.S. Census Bureau, 5-year American Community Survey

Property Losses

The total property loss reported by the NCDIC for a total of 48 winter events that impacted the planning area during the 22-year time-period from 1996 thru 2017 was \$2,575,680. However, damages for winter and ice storms are reported for all weather zones impacted. So, it is extremely difficult to determine the damages from these events that apply specifically to Story County.

USDA crop insurance claims for cold conditions and snow for the ten-year period of 2007-2016 totaled \$575,600. The 2015 Iowa Crop Insurance Profile from USDA, RMA shows that 89 percent of crops are insured in Iowa and the adjusted losses calculate to \$646,761 for the period and \$64,676 in estimated annualized losses.

Considering the \$293 million market value of Story County crops from the 2012 Census of Agriculture as baseline crop exposure, the estimated annual losses from cold conditions and snow was determined minimal compared to the value of the insurable crops.

Increased Risk Populations

Elderly populations are considered to be at increased risk to Winter Storms and associated extreme cold events. Table 3.36 in the Extreme Heat Profile Section provides the number of population over 65 in each jurisdiction in the planning area.

Future Development

Future development could potentially increase vulnerability to this hazard by increasing demand on the utilities and increasing the exposure of infrastructure networks.

Climate Change Impacts

According to the 2010 report on Climate Change Impacts on Iowa, Iowa has experienced a long-term upward trend in temperature.

- Long-term winter temperatures have increased six times more than summer temperatures.
- Nighttime temperatures have increased more than daytime temperatures since 1970.

- Since 1970, daily minimum temperatures have increased in summer and winter; daily maximum temperatures have risen in winter, but declined substantially in summer.

If this trend continues, future occurrences of the extreme cold/wind chill aspects of winter storms should decrease. In addition, higher winter temperatures bring higher probability of rain, rather than snow. As a result, the amount of precipitation falling as snow should decrease.

Severe Winter Storm Hazard Summary by Jurisdiction

Although crop loss as a result of winter storm occurs more in the unincorporated portions of the planning area, the crop losses are not high since corn and soybeans are not in the ground during winter months and only get affected from unusual weather events. The density of vulnerable populations is higher in the cities. Transportation incidents related to winter storm could also impact all jurisdictions. With these vulnerabilities that apply to both urban and rural jurisdictions, the magnitude of this hazard is relatively equal. The factors of probability, warning time, and duration are also equal across the planning area. This hazard does not substantially vary by jurisdiction.

Jurisdiction	Probability	Magnitude	Warning Time	Duration	Score	Level
Story County, Iowa	4	2	3	3	3.15	High
City of Ames	4	2	3	3	3.15	High
City of Cambridge	4	2	3	3	3.15	High
City of Collins	4	2	3	3	3.15	High
City of Colo	4	2	3	3	3.15	High
City of Gilbert	4	2	3	3	3.15	High
City of Huxley	4	2	3	3	3.15	High
City of Kelley	4	2	3	3	3.15	High
City of Maxwell	4	2	3	3	3.15	High
City of McCallsburg	4	2	3	3	3.15	High
City of Nevada	4	2	3	3	3.15	High
City of Roland	4	2	3	3	3.15	High
City of Sheldahl	4	2	3	3	3.15	High
City of Slater	4	2	3	3	3.15	High
City of Story City	4	2	3	3	3.15	High
Ames Schools	4	2	3	3	3.15	High
Ballard Schools	4	2	3	3	3.15	High
Collins-Maxwell Schools	4	2	3	3	3.15	High
Colo-Nesco Schools	4	2	3	3	3.15	High
Gilbert Schools	4	2	3	3	3.15	High
Nevada Schools	4	2	3	3	3.15	High
Roland-Story Schools	4	2	3	3	3.15	High
Iowa State University	4	2	3	3	3.15	High

3.5.15 Sinkholes

Hazard Score Calculation					
Probability	Magnitude/Severity	Warning Time	Duration	Weighted Score	Level
1	1	4	4	1.75	Low

Profile

Hazard Description

The loss of surface elevation due to the removal of subsurface support defines a sinkhole. Sinkholes range from broad, regional lowering of the land surface to localized collapse.

Sinkholes are common where the rock below the land surface is limestone, carbonate rock, salt beds, or rocks that can naturally be dissolved by ground water circulating through them. As the rock dissolves, void spaces and caverns develop underground. The sudden collapse of the land surface can be dramatic and range in size from broad, regional lowering of the land surface to localized collapse. Although subsidence can be a naturally occurring hazard, the primary causes of most incidents of subsidence are human activities: underground mining of coal, groundwater or petroleum withdraw, and drainage of organic soils.

Karst is a landscape formed from the dissolution of soluble rocks including limestone, dolomite and gypsum. Sinkholes are a common indication of karst; caves and underground drainage systems are other indicators.

Land subsidence occurs slowly and continuously over time or on occasion abruptly, as in the sudden formation of sinkholes. Sinkholes can be aggravated by flooding.

Warning Time Score: 4—Less than 6 hours

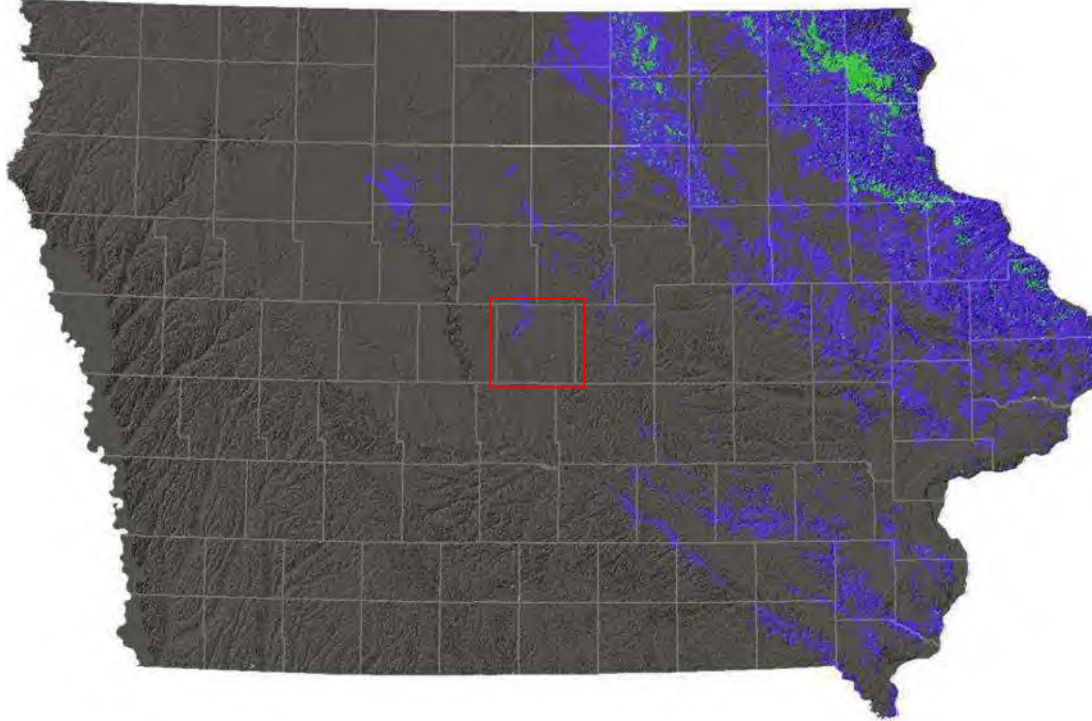
Duration Score: 4—More than 1 week

Geographic Location/Extent

There are three areas in Iowa where large numbers of sinkholes exist: 1) within the outcrop belt of the Ordovician Galena Group carbonates in Allamakee, Clayton, and Winneshiek Counties; 2) in Devonian carbonates in Bremer, Butler, Chickasaw and particularly Floyd and Mitchell Counties; and 3) along the erosional edge of Silurian carbonates in Dubuque and Clayton Counties. Pockets of karst terrain occur in isolated areas of central Iowa; parts of Story County have been identified as having potential for karst terrain.

The image in Figure 3.49 shows areas with sinkhole potential in Iowa. Areas identified as green are within 1,000 feet of a known sinkhole and the blue areas show greater than 1,000 feet but less than a mile from a known sinkhole or an area with carbonate bedrock close to the surface.

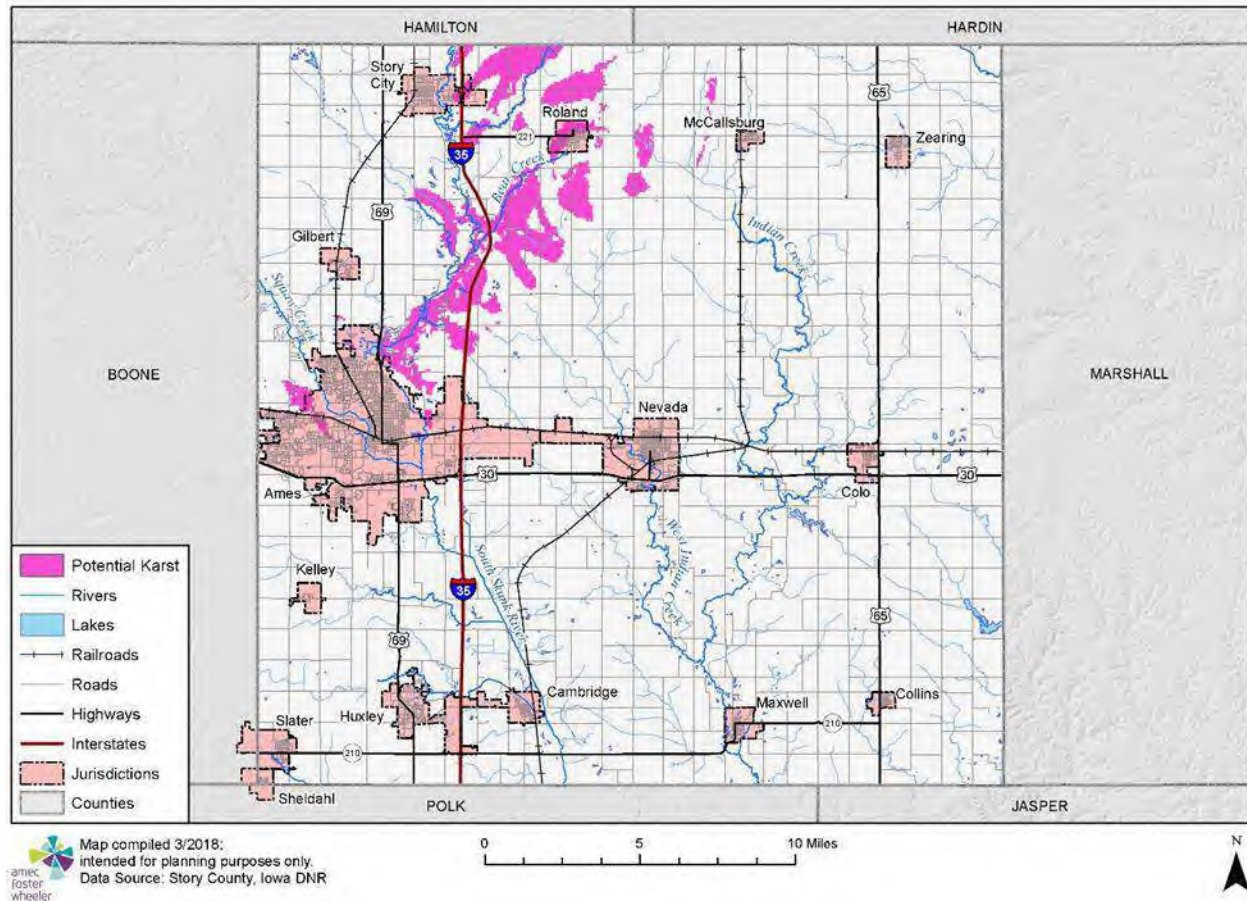
Figure 3.49: Karst Terrain (Sinkhole Location and Potential, Story County)



Source: Iowa Department of Natural Resources, <http://iagiservicebureau.blogspot.com/2013/05/caution-karst-below.html>

Figure 3.50 shows identified sinkhole location potential in Story County.

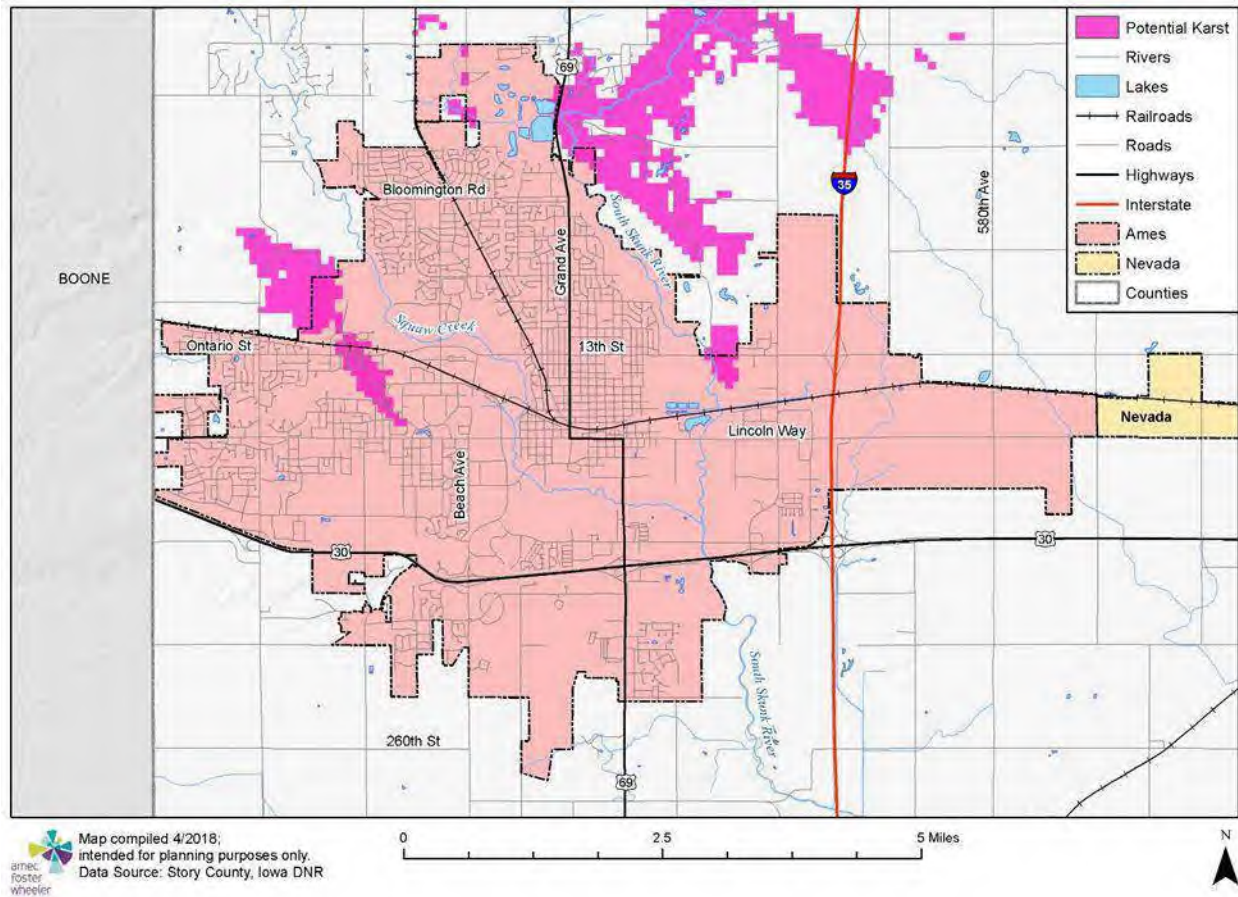
Figure 3.50: Karst Terrain in Story County (Sinkhole Location and Potential)



Source: Iowa Department of Natural Resources, <http://iagiservicebureau.blogspot.com/2013/05/caution-karst-below.html>

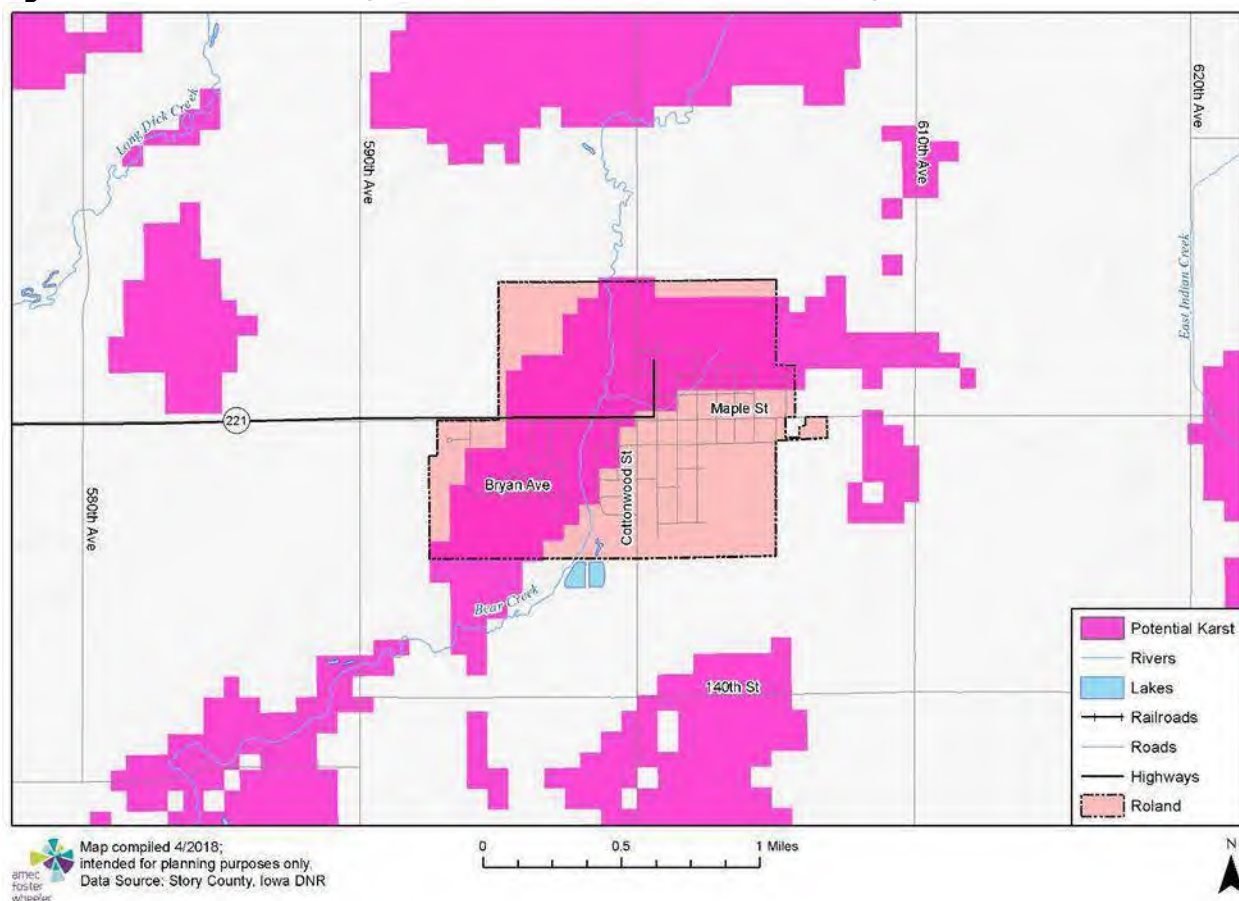
Per data provided by the Iowa Department of Natural Resources, and verified by the HMPC, potential karst terrain areas in the county exist in and around Ames, Roland and Story City. Figure 3.51, Figure 3.52, and Figure 3.53 show mapped areas of potential karst terrain in these communities.

Figure 3.51: Karst Terrain (Sinkhole Location and Potential, Ames)



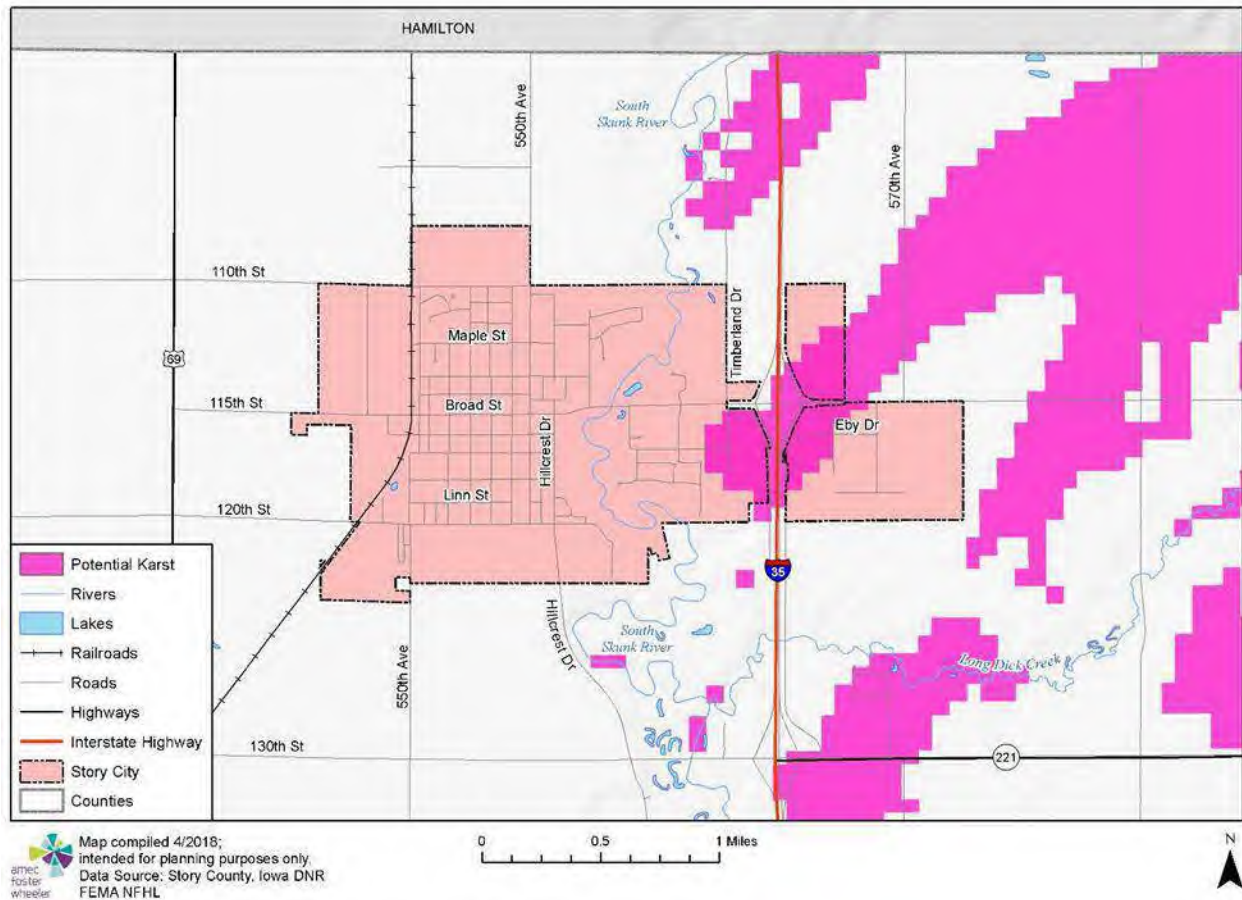
Source: Iowa Department of Natural Resources, <http://iagiservicebureau.blogspot.com/2013/05/caution-karst-below.html>

Figure 3.52: Karst Terrain (Sinkhole Location and Potential, Roland)



Source: Iowa Department of Natural Resources, <http://iagiservicebureau.blogspot.com/2013/05/caution-karst-below.html>

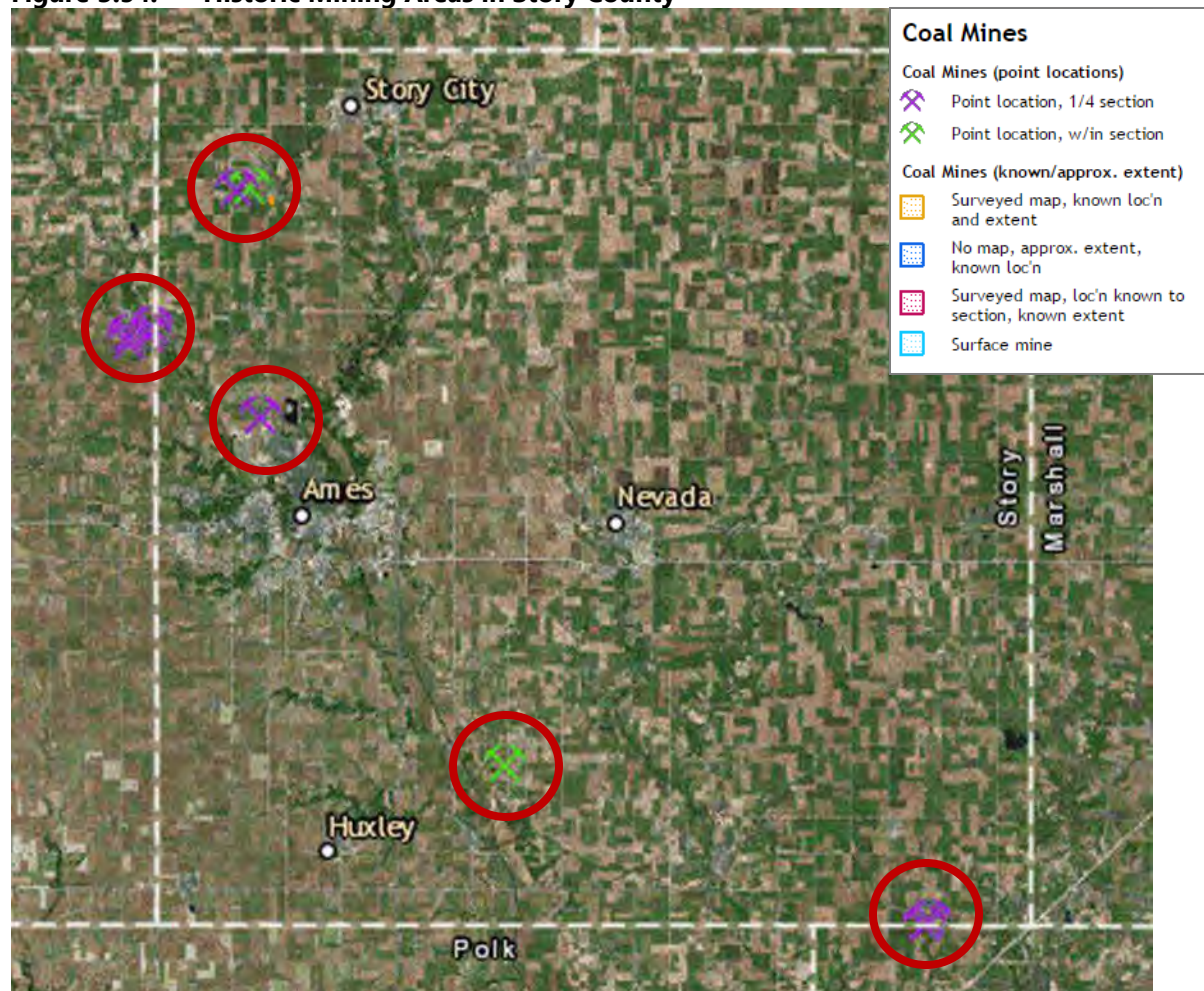
Figure 3.53: Karst Terrain (Sinkhole Location and Potential, Story City)



Source: Iowa Department of Natural Resources, <http://iagiservicebureau.blogspot.com/2013/05/caution-karst-below.html>

Mining activity can also lead to sinkhole development. Figure 3.54 shows historic coal mining areas in Story County as reported by the Iowa Department of Natural Resources.

Figure 3.54: Historic Mining Areas in Story County



Source: Iowa Department of Natural Resources; identified mines encircled in red

Table 3.70 shows coal mines mapped in Story County, according to the Iowa DNR.

Table 3.70: DNR-Identified Mines in Story County

Owner	Location	Area (acres)	Entrance Type	Shaft Depth	Coal Bed
Marshall & Crow Coal Company	SE Story County	Unknown	Shaft	142	Undetermined
Collins Fuel Company No. 1	SE Story County	Unknown	Shaft	150	Undetermined
No name	NE of Cambridge	Unknown	Unknown	Unknown	Undetermined
North Star Coal & Mining Company	North of Gilbert	Unknown	Shaft	135	Undetermined
Summit Coal Company	North of Gilbert	Unknown	Shaft	Unknown	Undetermined
Johnson Shaft	North of Ames	Unknown	Shaft	Unknown	Undetermined

Source: Iowa Department of Natural Resources

Previous Occurrences

The HMPC didn't identify any sinkholes that have previously occurred around the County.

Probability of Future Occurrence

During discussions on this hazard, the HMPC identified no known history of sinkhole issues; communities with mapped potential karst terrain areas confirmed no recent history, nor is karst terrain and sinkholes something that these communities plan around. Based on no known past history in Story County, the probability of this hazard is unlikely.

Probability Score: 1—Unlikely

Vulnerability

Vulnerability Overview

Sinkholes have not historically occurred in Story County, though there are abandoned coal mine sites and potential karst terrain areas that could present the conditions for sinkholes to occur. However, if subsidence or sinkholes were to occur, it would most likely be an isolated event with localized damages.

Magnitude Score: 1—Limited

Potential Losses to Existing Development

Due to the lack of information regarding previous occurrences of this hazard, it is not possible to estimate potential losses.

Future Development

Future development should avoid areas of known subsurface void spaces such as old coal mines.

Climate Change Impacts

There are no noted trends in climate change that would not have a significant effect on the occurrence of sinkholes.

Sinkhole Hazard Summary by Jurisdiction

The overall risk to sinkholes and land subsidence is low. Ames, Roland Story City and unincorporated Story County have mapped areas of potential karst terrain, though during the planning process, communities confirmed no major history of sinkholes. Communities with vulnerable areas were given a score; communities without mapped vulnerability areas were not due to no history of sinkholes.

Jurisdiction	Probability	Magnitude	Warning Time	Duration	Score	Level
Story County, Iowa	1	1	4	4	1.75	Low
City of Ames	1	1	4	4	1.75	Low
City of Cambridge	N/A	N/A	N/A	N/A	N/A	N/A
City of Collins	N/A	N/A	N/A	N/A	N/A	N/A
City of Colo	N/A	N/A	N/A	N/A	N/A	N/A
City of Gilbert	N/A	N/A	N/A	N/A	N/A	N/A
City of Huxley	N/A	N/A	N/A	N/A	N/A	N/A
City of Kelley	N/A	N/A	N/A	N/A	N/A	N/A
City of Maxwell	N/A	N/A	N/A	N/A	N/A	N/A
City of McCallsburg	N/A	N/A	N/A	N/A	N/A	N/A
City of Nevada	N/A	N/A	N/A	N/A	N/A	N/A
City of Roland	1	1	4	4	1.75	Low
City of Sheldahl	N/A	N/A	N/A	N/A	N/A	N/A
City of Slater	N/A	N/A	N/A	N/A	N/A	N/A
City of Story City	1	1	4	4	1.75	Low
Ames Schools	N/A	N/A	N/A	N/A	N/A	N/A
Ballard Schools	N/A	N/A	N/A	N/A	N/A	N/A
Collins-Maxwell Schools	N/A	N/A	N/A	N/A	N/A	N/A
Colo-Nesco Schools	N/A	N/A	N/A	N/A	N/A	N/A
Gilbert Schools	N/A	N/A	N/A	N/A	N/A	N/A
Nevada Schools	N/A	N/A	N/A	N/A	N/A	N/A
Roland-Story Schools	N/A	N/A	N/A	N/A	N/A	N/A
Iowa State University	N/A	N/A	N/A	N/A	N/A	N/A

3.5.16 Terrorism

Hazard Score Calculation					
Probability	Magnitude/Severity	Warning Time	Duration	Weighted Score	Level
1	4	4	4	2.65	Moderate

Profile

Hazard Description

This hazard encompasses the following sub-hazards: enemy attack, biological terrorism, agro-terrorism, chemical terrorism, conventional terrorism, cyber terrorism, radiological terrorism and public disorder. These hazards can occur anywhere and demonstrate unlawful force, violence, and/or threat against persons or property causing intentional harm for purposes of intimidation, coercion or ransom in violation of the criminal laws of the United States. These actions may cause massive destruction and/or extensive casualties. The threat of terrorism, both international and domestic, is ever present, and an attack can occur when least expected.

Enemy attack is an incident that could cause massive destruction and extensive casualties throughout the world. Some areas could experience direct weapons' effects, including blast and heat; others could experience indirect weapons' effect. International political and military activities of other nations are closely monitored by our federal government and the State of Iowa would be notified of any escalating military threats.

The use of biological agents against persons or property in violation of the criminal laws of the United States for purposes of intimidation, coercion or ransom can be described as biological terrorism. Liquid or solid contaminants can be dispersed using sprayers/aerosol generators or by point of line sources such as munitions, covert deposits and moving sprayers. Biological agents vary in the amount of time they pose a threat. They can be a threat for hours to years depending upon the agent and the conditions in which it exists.

Agro-terrorism consists of acts to intentionally contaminate, ruin, or otherwise make agricultural products unfit or dangerous for consumption or further use. Agriculture is an important industry in Iowa and Story County. The introduction of a biological agent into the population of 25,500 cattle and calves, or the 77,182 hogs and pigs, or the 155,251 acres of corn in Story County would be financially devastating and would have a major impact on the food supply of the state and the nation. A major attack involving the nation's food supply could be launched in a rural area that has little capacity to respond. Potential terrorists' targets for livestock disease introduction would be concentration points, such as the County's licensed feedlots or livestock markets discussed later in the Geographic Location section.

Chemical terrorism involves the use or threat of chemical agents against persons or property in violation of the criminal laws of the United States for purposes of intimidation, coercion or ransom. Effects of chemical contaminants are similar to biological agents.

Use of conventional weapons and explosives against persons or property in violation of the criminal laws of the United States for purposes of intimidations, coercion, or ransom is conventional terrorism. Hazard affects are instantaneous; additional secondary devices may be used, lengthening the time duration of the hazard until the attack site is determined to be clear. The extent of damage is determined by the type and quantity of explosive. Effects are generally static other than cascading consequences and incremental structural failures. Conventional terrorism can also include tactical assault or sniping from remote locations.

Electronic attack using one computer system against another in order to intimidate people or disrupt other systems is a cyber-attack. All governments, businesses and citizens that conduct business utilizing

computers face these threats. Cyber-security and critical infrastructure protection are among the most important national security issues facing our country today. As such, the Iowa Division of Criminal Investigation has a Cyber Crime Unit tasked with analysis and retrieval of digital information for investigations.

Radiological terrorism is the use of radiological materials against persons or property in violation of the criminal laws of the United States for purposes of intimidation, coercion or ransom. Radioactive contaminants can be dispersed using sprayers/aerosol generators, or by point of line sources such as munitions, covert deposits and moving sprayers or by the detonation of a nuclear device underground, at the surface, in the air or at high altitude.

Mass demonstrations, or direct conflict by large groups of citizens, as in marches, protest rallies, riots, and non-peaceful strikes are examples of public disorder. These are assembling of people together in a manner to substantially interfere with public peace to constitute a threat, and with use of unlawful force or violence against another person, or causing property damage or attempting to interfere with, disrupting, or destroying the government, political subdivision, or group of people. Labor strikes and work stoppages are not considered in this hazard unless they escalate into a threat to the community. Vandalism is usually initiated by a small number of individuals and limited to a small target or institution. Most events are within the capacity of local law enforcement.

The Southern Poverty Law Center reports four active hate groups in Iowa: National Socialist Movement (Neo-Nazi, National Socialist); Gallows Tree Wotansvolk Alliance (Neo-Nazi); the Daily Stormer (Neo Nazi); and ACT for America (Anti-Muslim).

Warning Time Score: 4—Minimal or no warning

Duration Score: 4—More than 1 week

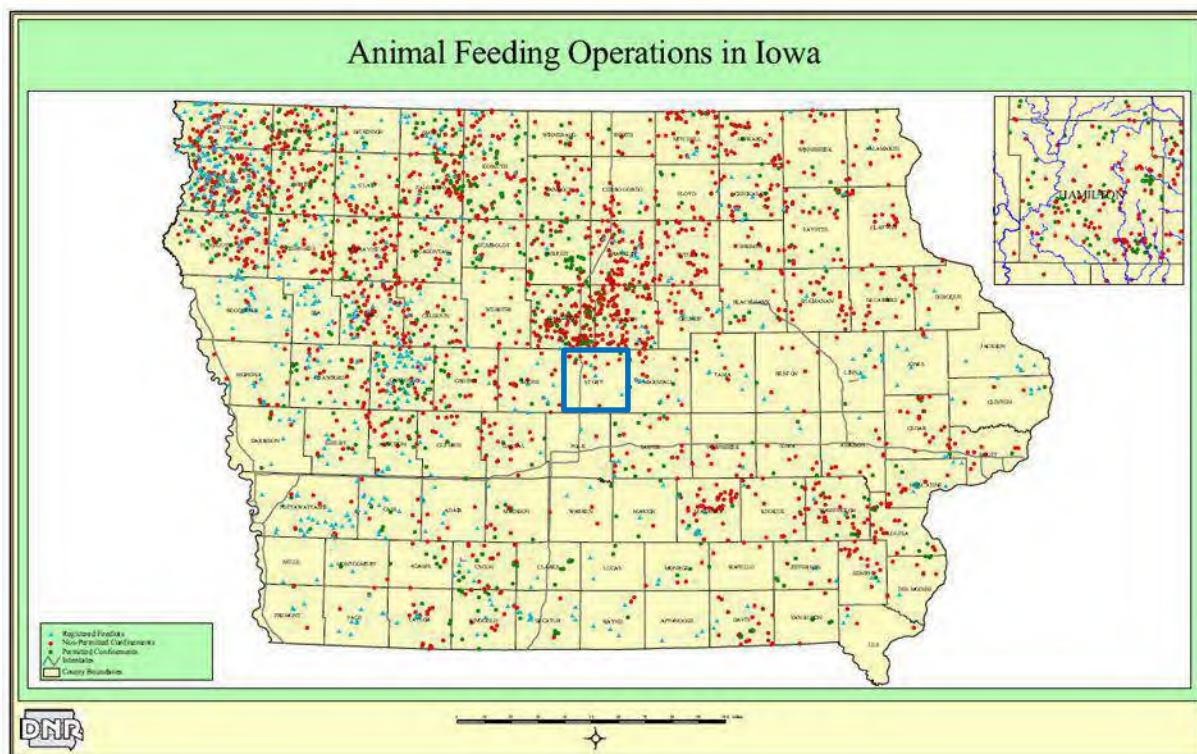
Geographic Location/Extent

The entire planning area has a low potential for terrorist activity. However, any venue with a large gathering of people could be a potential target for terrorists. The most likely targets of a conventional terrorism attack in Story County include public school system facilities, the County Justice Center, and law enforcement centers within the County. The presence of Iowa State University in Ames could also present an inviting target for terrorist activity.

In terms of cyber-terrorism, our society is highly networked and interconnected. An attack could be launched from anywhere on earth and could range in impacts from small and localized to a far-reaching global scale. Depending on the attack vector and parameters, a cyber-attack could impact all of Story County and its associated municipal jurisdictions.

For agro-terrorism planning, Figure 3.55 shows the locations of animal feeding operations in Iowa and Story County. Additional agricultural assets are discussed in Section 3.5.1, Animal/Plant/Crop Disease.

Figure 3.55: Animal Feeding Operations in Iowa



Source: Department of Natural Resources

*blue square shows the location of Story County

Previous Occurrences

There have not been any large-scale enemy attacks or acts of radiological terrorism in Iowa. There have been biological and chemical agent threats, animal rights activists' vandalism and many bomb threats. In 2002, pipe bombs were found in 18 states including Iowa and six people were injured in the bombings in Iowa and Illinois. In 2005 and 2006, pipe bombs were used in attempted murder cases in two Iowa cities.

The Iowa Department of Public Safety issued a 2016 Iowa Uniform Crime Report showing 18 hate/bias crimes were reported statewide in 2016.

According to the Southern Poverty Law Center, there were 47 hate incidents reported in Iowa from 2003 to 2016. Four of these incidents reported occurred in Story County.

Probability of Future Occurrence

While difficult to estimate, the probability for a terrorist event is "Unlikely" within the next 10 years in Story County.

Probability Score: 1—Unlikely

Vulnerability

Overview

A terrorism event could occur in either limited areas of a jurisdiction, or over the entire jurisdiction at once. This hazard has the ability to directly cause substantial structural losses and potentially loss of life. Hazard impacts are heavily influenced by the type and parameters of a terrorist attack.

Magnitude Score: 4—Catastrophic

Potential Losses to Existing Development

Potential losses from terrorism include fatalities to people, damage to property, infrastructure, critical facilities, crops, and animals. The degree of impact would be directly related to the type of incident and the target. Potential losses could include cost of repair or replacement of damaged facilities, lost economic opportunities for businesses, loss of human life, injuries to persons, loss of food supplies, disruption of the food supply chain, and immediate damage to the surrounding environment. Secondary effects of infrastructure failure could include public safety hazards, spread of disease, increased morbidity and mortality among the local and distant populations, public panic and long-lasting damage to the environment. Terrorism events are rare occurrences and specific amounts of estimated losses for previous occurrences are not available due to the complexity and multiple variables associated with these types of hazards. In some instances, information about these events is secure and unavailable to the public in order to maintain national security and prevent future attacks.

The HMPC noted that Iowa State University assets could be targets of an attack.

As discussed previously, it is difficult to quantify potential losses in terms of the jurisdictions most threatened by CBRNE (chemical, biological, radiological, nuclear, and high yield explosive) attack events due to the many variables and human element. Therefore, for the purposes of this plan, the loss estimates will take into account a hypothetical scenario. The attack scenario is staged at a Friday night high school football game. The hypothetical football stadium has approximately 500 persons in the stadium and concession areas on any home football game nights during the fall.

Analysis of vulnerable populations is aided by a program developed by Johns Hopkins University in 2006 called Electronic Mass Casualty Assessment and Planning Scenarios (EMCAPS) <http://www.hopkins-cepar.org/EMCAPS/EMCAPS.html> which utilizes scenarios developed by the Department of Homeland Security.

******THE FOLLOWING HYPOTHETICAL SCENARIO IS FOR INSTRUCTIONAL AND ILLUSTRATIVE PURPOSES ONLY******

Chemical Attack – Toxic Gas – Chlorine Release

Scenario Overview: A bomb is attached to a truck trailer tanker carrying compressed chlorine and enters the high school football stadium parking lot. The entire contents of the tank escape to the atmosphere and the plume spreads to the stadium and the immediate surrounding parking lot area. This particular type of attack would cause harm to humans and could render portions of the stadium unusable for a short time period in order to allow for a costly clean-up. There might also be a fear by the public of long-term contamination of the stadium and the high school, subsequently closing the high school.

Assumptions: (1) The population density is approximately 500 persons around the high school stadium. (2) Chlorine is toxic and may damage eyes, skin and respiratory tract. (3) The rate of “worried well” is equal to 9 times the number of infected cases or the full exposed population, whichever is least.

Table 3.71: Described Losses from a Chemical Attack – Chlorine Scenario

Eye pain & swelling, headache, restricted airflow – difficulty breathing, possible chemical burns	22 persons
Eye pain & swelling, headache, rapid breathing, skin irritation	42 persons
Eye pain & swelling, headache, rapid breathing, coughing, chest pain, skin irritation	86 persons
Eye irritation, headache, throat irritation, coughing, skin irritation	119 persons
Eye irritation, headache, coughing, skin irritation	82 persons
Total “Worried Well” Cases (total exposed population)	500 persons
Deaths	16 persons
Cost of Decontamination @ \$12/person (assumes all persons with skin injuries will require decontamination and approximately 1/10 of the worried well will demand to be decontaminated) - total persons =417	\$5,004

Notes: Victims will require decontamination and both long and short-term treatment.

Improvised Explosive Device Attack – ANFO

Scenario Overview: An Improvised Explosive Device (IED) utilizing an ammonium nitrate/fuel oil (ANFO) mixture is carried in a panel van to a high school parking area at the beginning of a home football game when people are leaving their cars and entering the stadium. Potential losses with this type of scenario include both human and structural assets.

Assumptions: (1) The population density in the parking lot during the beginning and ending of the game is high, at least 1 person /1 square feet. (2) The quantity of ANFO used is 500 lbs.

Table 3.72: Described Losses from an Improvised Explosive Device Attack – ANFO

Total Dead	86 persons
Total Traumatic Injuries	151 persons
Total Urgent Care Injuries	745 persons
Injuries not Requiring Hospitalization	279 persons
Structures and Other Physical Assets (Damages would certainly occur to vehicles and depending on the proximity of other structures, damages would occur to the stadium complex itself. The exact amount of these damages is difficult to predict because of the large numbers of factors, including the type of structures nearby and the amount of insurance held by vehicle owners.)	Vehicles – Replacement cost for approximately 350 vehicles @ \$10,000 per vehicle inside the 200 ft. BATF described Lethal Air Blast range = \$ 3,500,000 Repair / repainting cost for approximately 70 vehicles @ \$ 4,000 per vehicle inside the BATF described Falling Debris Hazard = \$280,000

Note: These are the numbers of persons that could be injured from an IED Attack if they are in the area.

Future Development

As public events are held at various venues in the County, the potential may exist for these locations to become targets of attack. With human-caused hazards such as this that can have multiple variables involved, increase in development is not always a factor in determining risk.

Climate Change Impacts

There are no known climate change impacts relevant to this hazard.

Terrorism Hazard Summary by Jurisdiction

The overall rating for any type of terrorism in the County is 2.65, or "Moderate". This rating score applies to all jurisdictions in the planning area due to the variables and unknowns involved in terrorism events. If a wide scale event occurred in any jurisdiction, it could have devastating consequences.

Jurisdiction	Probability	Magnitude	Warning Time	Duration	Score	Level
Story County, Iowa	1	4	4	4	2.65	Moderate
City of Ames	1	4	4	4	2.65	Moderate
City of Cambridge	1	4	4	4	2.65	Moderate
City of Collins	1	4	4	4	2.65	Moderate
City of Colo	1	4	4	4	2.65	Moderate
City of Gilbert	1	4	4	4	2.65	Moderate
City of Huxley	1	4	4	4	2.65	Moderate
City of Kelley	1	4	4	4	2.65	Moderate
City of Maxwell	1	4	4	4	2.65	Moderate
City of McCallsburg	1	4	4	4	2.65	Moderate
City of Nevada	1	4	4	4	2.65	Moderate
City of Roland	1	4	4	4	2.65	Moderate
City of Sheldahl	1	4	4	4	2.65	Moderate
City of Slater	1	4	4	4	2.65	Moderate
City of Story City	1	4	4	4	2.65	Moderate
Ames CSD	1	4	4	4	2.65	Moderate
Ballard CSD	1	4	4	4	2.65	Moderate
Collins-Maxwell CSD	1	4	4	4	2.65	Moderate
Colo-Nesco CSD	1	4	4	4	2.65	Moderate
Gilbert CSD	1	4	4	4	2.65	Moderate
Nevada CSD	1	4	4	4	2.65	Moderate
Roland-Story CSD	1	4	4	4	2.65	Moderate
Iowa State University	1	4	4	4	2.65	Moderate

3.5.17 Thunderstorm with Lightning and Hail

Hazard Score Calculation					
Probability	Magnitude/Severity	Warning Time	Duration	Weighted Score	Level
4	2	2	2	2.90	Moderate

Profile

Hazard Description

A thunderstorm is defined as a storm that contains lightning and thunder which is caused by unstable atmospheric conditions. When the colder upper air sinks and warm moist air rises, storm clouds or 'thunderheads' develop, resulting in thunderstorms. This can occur singularly, in clusters or in lines. Severe thunderstorms most often occur in Iowa in the spring and summer, during the afternoon and evenings, but can occur at any time. Other hazards associated with thunderstorms and lightning include: heavy rains causing flash flooding (discussed separately in Section 3.5.7) and tornadoes and windstorms (discussed further in Section 3.5.18).

Lightning

All thunderstorms produce lightning, which often strikes outside of the area where it is raining and is known to fall more than 10 miles away from the rainfall area. Thunder is simply the sound that lightning makes. Lightning is a huge discharge of electricity. When lightning strikes, electricity shoots through the air and causes vibrations creating the sound of thunder. Nationwide, lightning kills 75 to 100 people each year. Lightning strikes can also start building fires and wildland fires, and damage electrical systems and equipment.

Hail

According to the National Oceanic and Atmospheric Administration (NOAA), hail is precipitation that is formed when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere causing them to freeze. The raindrops form into small frozen droplets and then continue to grow as they come into contact with super-cooled water which will freeze on contact with the frozen rain droplet. This frozen rain droplet can continue to grow and form hail. As long as the updraft forces can support or suspend the weight of the hailstone, hail can continue to grow.

At the time when the updraft can no longer support the hailstone, it will fall down to the earth. For example, a ¼" diameter or pea sized hail requires updrafts of 24 mph, while a 2 ¾" diameter or baseball sized hail requires an updraft of 81 mph. The largest hailstone recorded in the United States was found in Vivian, South Dakota on July 23, 2010, measuring eight inches in diameter, almost the size of a soccer ball. Soccer-ball-sized hail is the exception, but even small pea sized hail can do damage.

Hailstorms in Iowa cause damage to property, crops, and the environment, and kill and injure livestock. In the United States, hail causes more than \$1 billion in damage to property and crops each year. Much of the damage inflicted by hail is to crops. Even relatively small hail can shred plants to ribbons in a matter of minutes. Vehicles, roofs of buildings and homes, and landscaping are the other things most commonly damaged by hail. Hail has been known to cause injury to humans; occasionally, these injuries can be fatal.

Table 3.73 below describes typical damage impacts of the various sizes of hail.

Table 3.73: Tornado and Storm Research Organization Hailstorm Intensity Scale

Intensity Category	Diameter (mm)	Diameter (inches)	Size Description	Typical Damage Impacts
Hard Hail	5-9	0.2-0.4	Pea	No damage
Potentially Damaging	10-15	0.4-0.6	Mothball	Slight general damage to plants, crops
Significant	16-20	0.6-0.8	Marble, grape	Significant damage to fruit, crops, vegetation
Severe	21-30	0.8-1.2	Walnut	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
Severe	31-40	1.2-1.6	Pigeon's egg > squash ball	Widespread glass damage, vehicle bodywork damage
Destructive	41-50	1.6-2.0	Golf ball > Pullet's egg	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
Destructive	51-60	2.0-2.4	Hen's egg	Bodywork of grounded aircraft dented, brick walls pitted
Destructive	61-75	2.4-3.0	Tennis ball > cricket ball	Severe roof damage, risk of serious injuries
Destructive	76-90	3.0-3.5	Large orange > Soft ball	Severe damage to aircraft bodywork
Super Hailstorms	91-100	3.6-3.9	Grapefruit	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
Super Hailstorms	>100	4.0+	Melon	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

Source: Tornado and Storm Research Organization (TORRO), Department of Geography, Oxford Brookes University

Notes: In addition to hail diameter, factors including number and density of hailstones, hail fall speed and surface wind speeds affect severity.

The onset of thunderstorms with lightning and hail is generally rapid. However, advancements in meteorological forecasting allow for some advance warning.

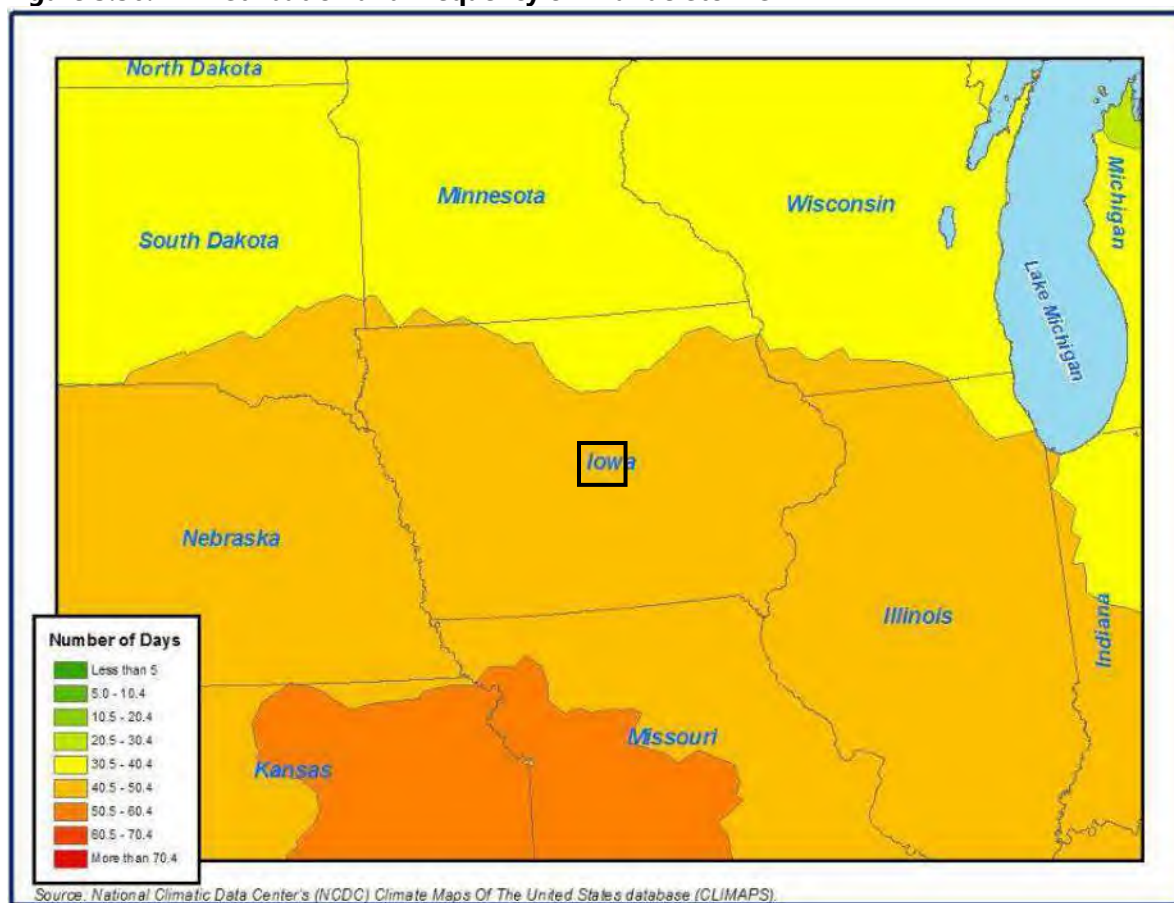
Warning Time Score: 2—12-24 hours

Duration Score: 2—Less than 1 day

Geographic Location/Extent

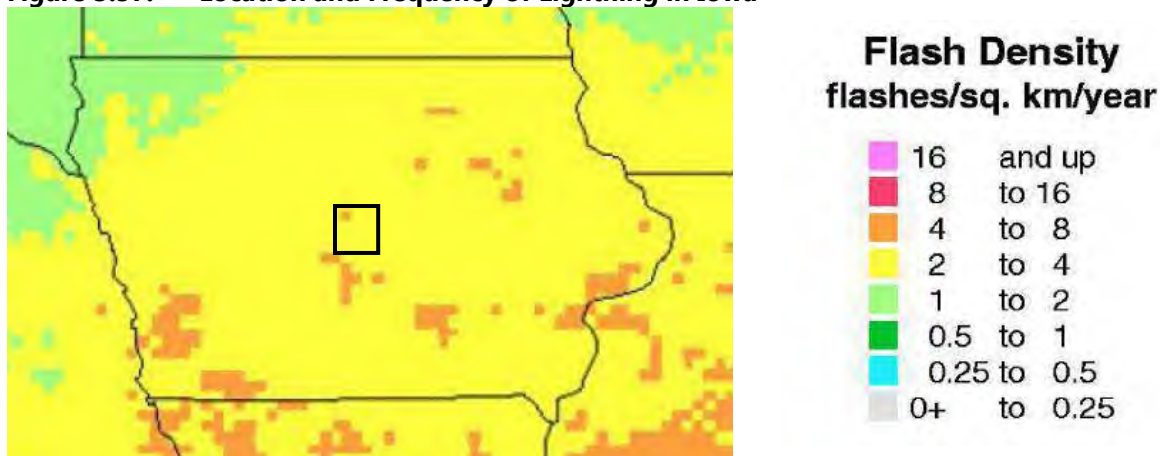
Thunderstorms and the associated hail and lightning impact the entire County with relatively similar frequency. Although these events occur similarly throughout the planning area, they are more frequently reported in more urbanized areas. In addition, damages are more likely to occur in more densely developed urban areas, as well as cropland. Figure 3.56 displays the average number of days with thunder experienced throughout different areas of the county each year, showing the County experiences between 40.5 to 50.4 days with thunder per year. Figure 3.57 shows 2 to 4 lightning strikes per square kilometer per year throughout the County, with 4-8 strikes per square kilometer per year in isolated areas (the orange areas).

Figure 3.56: Distribution and Frequency of Thunderstorms



Note: Black Square indicates approximate location of Story County

Figure 3.57: Location and Frequency of Lightning in Iowa



Source: National Weather Service, www.lightningsafety.noaa.gov/lightning_map.htm

Note: Black Square indicates approximate location of Story County

Previous Occurrences

Since 1965, Story County has been included in twelve Presidential Disaster declarations that included severe storms/weather (see Table 3.2 in the Hazard Identification Section). Some of the damages that resulted in the declarations were from tornadoes and flooding that accompanied the severe weather.

The NCDC reported 497 total thunderstorm events for the Story County planning area from January 1996 through December 2017. Of the reported events, there was \$7,258,222 in total property damage, seven injuries, and no fatalities.

Table 3.74: Thunderstorm Summary for Story County (1996-2017)

Hazard type	Total Events	Events with Damage	Property Damage	Injuries	Fatalities
Hail	208	130	\$2,498,000	0	0
Lightning	10	9	\$222,222	2	0
Thunderstorm Wind	279	266	\$4,538,000	5	0
Totals	497	405	\$7,258,222	7	0

Source: NCDC

Hail

Table 3.75 shows the number of hail events in Story County of 0.75 inches and larger by the size of the hail.

Table 3.75: Hail Events Summarized by Hail Size, Story County

Hail Size (inches)	# of Events 1996-2017
5.50	1
5.0	1
4.0	2
3.0	2
2.75	4
2.6	1
2.5	2
2.0	5
1.75	23
1.5	5
1.25	8
1.0	49
0.88	34
0.75	39
Grand Total	176

Thunderstorm Winds

Information concerning tornadoes and windstorms, separate from thunderstorms, can be found in Section 3.5.17.

The National Weather Service (NWS) will issue a Severe Thunderstorm Warning whenever a thunderstorm is forecasted to produce wind gusts to 58 miles per hour (50 knots) or greater and/or hail size one-inch (quarter-size) diameter which can produce significant damage (source: <http://www.nws.noaa.gov/oneinchhail/>). The data is kept on Iowa Environmental Mesonet, Iowa State University Department of Agronomy website, (<http://mesonet.agron.iastate.edu/vtec/search.php>). During the 32-year period from 1986 through 2017, there were 119 severe thunderstorm watches and 349 warnings. This calculates to an annual average of 3.7 watches and 10.9 warnings.

Although NCDC provides estimates of crop losses, crop insurance payment statistics are considered a more accurate resource for this data. According to the USDA Risk Management Agency, insured crop losses in Story County from 2007 to 2016 as a result of hail totaled \$274,273,851, for an average of \$27.4M per year (see Table 3.76). Damage from windstorms during the same period totaled \$78,230,646, for an average of \$7.8M per year. There was no crop damage reported from lightning.

Table 3.76: Crop Insurance Claims Paid in Story County from Hailstorms and Windstorms, 2007-2016

Year	Hail	Wind/Excess Wind	Insurance Paid
2007	\$8,373,150	\$9,599,962	\$17,973,112
2008	\$29,008,058	\$7,618,755	\$36,626,813
2009	\$77,495,505	\$992,887	\$78,488,392
2010	\$5,622,225	\$986,632	\$6,608,857
2011	\$39,438,679	\$26,819,731	\$66,258,410
2012	\$6,402,785	\$10,475,134	\$16,877,919
2013	\$9,487,633	\$4,217,003	\$13,704,636
2014	\$90,247,363	\$11,484,015	\$101,731,378
2015	\$3,139,914	\$2,714,320	\$5,854,234
2016	\$5,058,539	\$3,322,207	\$8,380,746
Total	\$274,273,851	\$78,230,646	\$352,504,497

Source: USDA Risk Management Agency

Probability of Future Occurrence

NCDC-reported damaging lightning events occurred nine times from 1996 through 2017. Since lightning accompanies thunderstorms, it can be assumed that lightning occurs more often than damages are reported. These rates of occurrence are expected to continue in the future.

Based on NCDC data, there have been 176 damaging hail events and 405 damaging thunderstorm wind events. This translates to an annual average of 8 and 18.4 damaging events per year, respectively. Based on this history, damaging hail and thunderstorm wind occur in the planning area multiple times each year making the probability for damaging events “Highly Likely” in any given year.

Probability Score: 4—Highly Likely

Vulnerability

Overview

In general, assets in the County are vulnerable to thunderstorms, winds, lightning and hail including people, crops, vehicles, and built structures. According to the 2013 Iowa Hazard Mitigation Plan, of the 8 hazards for which data was available to estimate annualized losses, thunderstorm with lightning and hail ranked 4th with \$30 million in annualized losses based on data spanning a 17-year period. Although this hazard results in high annual losses, generally private property insurance and crop insurance cover the majority of losses. Considering insurance coverage as a recovery capability and therefore mitigation of devastating impacts to the economy, the overall impact on jurisdictions is reduced; therefore, this hazard’s magnitude score to the planning area is “limited”.

Magnitude Score: 2—Limited

Potential Losses to Existing Development

Most lightning damages occur to electronic equipment located inside buildings. But structural damage can also occur when a lightning strike causes a building fire. In addition, lightning strikes can cause crop damages if fields light on fire. Communications equipment and warning transmitters and receivers can

also be knocked out by lightning strikes. There have not been any fatalities in Story County from lightning strikes. Thunderstorm winds and hail can cause damage to property, vehicles, trees, and crops.

Property and Crop Losses

Table 3.77 provides the estimated annualized property damages resulting from thunderstorms, including lightning, hail and wind.

Table 3.77: Estimated Annualized Property Damages Resulting from Severe Thunderstorms (Hail/Lightning/Wind, 1996-2017)

Hail/Lightning/Thunderstorm	Wind Property Damages	Annualized Property Damages
Hail	\$2,498,000	
Lightning	\$222,222	
Thunderstorm Wind	\$4,538,000	
Total	\$7,258,222	\$329,919

Source: NCDC

Table 3.78 provides the insured crop losses resulting from hail and wind. The insured loss has been adjusted to estimate losses to all insurable crops by considering that 89 percent of insurable crops in the State were insured (2016 Iowa Crop Insurance Profile from USDA's Risk Management Agency).

Table 3.78: Estimated Insurable Annualized Crop Damages Resulting from Severe Thunderstorms (Hail//Wind)

Crop Exposure (2012)		Insurance Paid (2007 – 2016)	Adjusted Crop Damages Considering 89% Insured	Annualized Adjusted Crop Damages
	Hail	\$274,273,851		
\$233,151,000	Wind/Excess Wind	\$78,230,646	\$396,072,469	\$39,607,247
	Total	\$352,504,497		

Source: Crop Exposure Value is from USDA 2012 Census of Agriculture; Crop Insurance Paid is from the USDA's Risk Management Agency for 2007-2016; Crop Insurance Coverage is from USDAs 2016 State Crop Insurance Profile for Iowa

Future Development

Any additional future development will result in more property being vulnerable to damages from severe thunderstorms, lightning and hail. To minimize vulnerability, protective measures could be implemented such as wind-resistant construction, lightning rods, surge protection, and use of materials less prone to hail/wind damage.

Climate Change Impacts

According to the 2010 Climate Change Impacts on Iowa report, growing evidence points to stronger summer storm systems in the Midwest. Studies have not been done to conclusively say that severe storms, including hail, lightning, and strong winds, are increasing. However, with summer temperatures becoming warmer and humidity levels increasing, an increase in the likelihood of these hazards is plausible.

Thunderstorm, Lightning and Hail Hazard Summary by Jurisdiction

The following hazard summary table shows that this hazard does not vary significantly by jurisdiction. Although structural property damages are higher in the urban areas, the rural areas have higher damages to agriculture.

Jurisdiction	Probability	Magnitude	Warning Time	Duration	Score	Level
Story County, Iowa	4	2	2	2	2.90	Moderate
City of Ames	4	2	2	2	2.90	Moderate
City of Cambridge	4	2	2	2	2.90	Moderate
City of Collins	4	2	2	2	2.90	Moderate
City of Colo	4	2	2	2	2.90	Moderate
City of Gilbert	4	2	2	2	2.90	Moderate
City of Huxley	4	2	2	2	2.90	Moderate
City of Kelley	4	2	2	2	2.90	Moderate
City of Maxwell	4	2	2	2	2.90	Moderate
City of McCallsburg	4	2	2	2	2.90	Moderate
City of Nevada	4	2	2	2	2.90	Moderate
City of Roland	4	2	2	2	2.90	Moderate
City of Sheldahl	4	2	2	2	2.90	Moderate
City of Slater	4	2	2	2	2.90	Moderate
City of Story City	4	2	2	2	2.90	Moderate
Ames Schools	4	2	2	2	2.90	Moderate
Ballard Schools	4	2	2	2	2.90	Moderate
Collins-Maxwell Schools	4	2	2	2	2.90	Moderate
Colo-Nesco Schools	4	2	2	2	2.90	Moderate
Gilbert Schools	4	2	2	2	2.90	Moderate
Nevada Schools	4	2	2	2	2.90	Moderate
Roland-Story Schools	4	2	2	2	2.90	Moderate
Iowa State University	4	2	2	2	2.90	Moderate

3.5.18 Tornado/Windstorm

Hazard Score Calculation					
Probability	Magnitude/Severity	Warning Time	Duration	Weighted Score	Level
4	4	4	1	3.70	High

Profile

Hazard Description

This section discusses both tornado and windstorm hazards.

Tornado: The NWS defines a tornado as “a violently rotating column of air extending from a thunderstorm to the ground.” It is usually spawned by a thunderstorm and produced when cool air overrides a layer of warm air, forcing the warm air to rise rapidly. Often, vortices remain suspended in the atmosphere as funnel clouds. When the lower tip of a vortex touches the ground, it becomes a tornado and a force of destruction.

Tornadoes are the most violent of all atmospheric storms and are capable of tremendous destruction. Wind speeds can exceed 250 miles per hour, and damage paths can be more than one mile wide and 50 miles long. Tornadoes have been known to lift and move objects weighing more than 300 tons a distance of 30 feet, toss homes more than 300 feet from their foundations, and siphon millions of tons of water from water bodies. Tornadoes also generate a tremendous amount of flying debris or “missiles,” which often become airborne shrapnel that causes additional damage. If wind speeds are high enough, missiles can be thrown at a building with enough force to penetrate windows, roofs, and walls. However, the less spectacular damage is much more common.

Windstorm: For purposes of this plan, windstorms refer to any non-tornadic damaging winds of thunderstorms including downbursts, microbursts, and straight-line winds. Downbursts are localized currents of air blasting down from a thunderstorm, which induce an outward burst of damaging wind on or near the ground. Microbursts are minimized downbursts covering an area of less than 2.5 miles across. They include a strong wind shear (a rapid change in the direction of wind over a short distance) near the surface. Microbursts may or may not include precipitation and can produce winds at speeds of more than 150 miles per hour. Straight-line winds are generally any thunderstorm wind that is not associated with rotation. It is these winds, which can exceed 100 mph, which represent the most common type of severe weather and are responsible for most wind damage related to thunderstorms. Since thunderstorms do not have narrow tracks like tornadoes, the associated wind damage can be extensive and affect entire (and multiple) counties. Objects like trees, barns, outbuildings, high-profile vehicles, and power lines/poles can be toppled or destroyed, and roofs, windows, and homes can be damaged as wind speeds increase.

Strong winds can occur year-round in Iowa. These winds typically develop with strong pressure gradients and gusty frontal passages. The closer and stronger two systems are, (one high pressure, one low pressure) the stronger the pressure gradient and, therefore, the stronger the winds are. Downbursts can be particularly dangerous to aviation.

The NWS issues High Wind Watch, High Wind Warning, and Wind Advisory to the public. The following are the definitions of these issuances:

- **High Wind Watch**—This is issued when there is the potential of high wind speeds developing that may pose a hazard or are life-threatening.
- **High Wind Warning**—The 1-minute surface winds of 35 knots (40 mph) or greater lasting for one hour or longer, or winds gusting to 50 knots (58 mph) or greater, regardless of duration, that are either expected or observed over land.

- **High Wind Advisory**—This is issued when high wind speeds may pose a hazard. Sustained winds 25 to 39 mph and/or gusts to 57 mph.

Warning Time Score: 4— Minimal or no warning time (up to 6 hours warning)

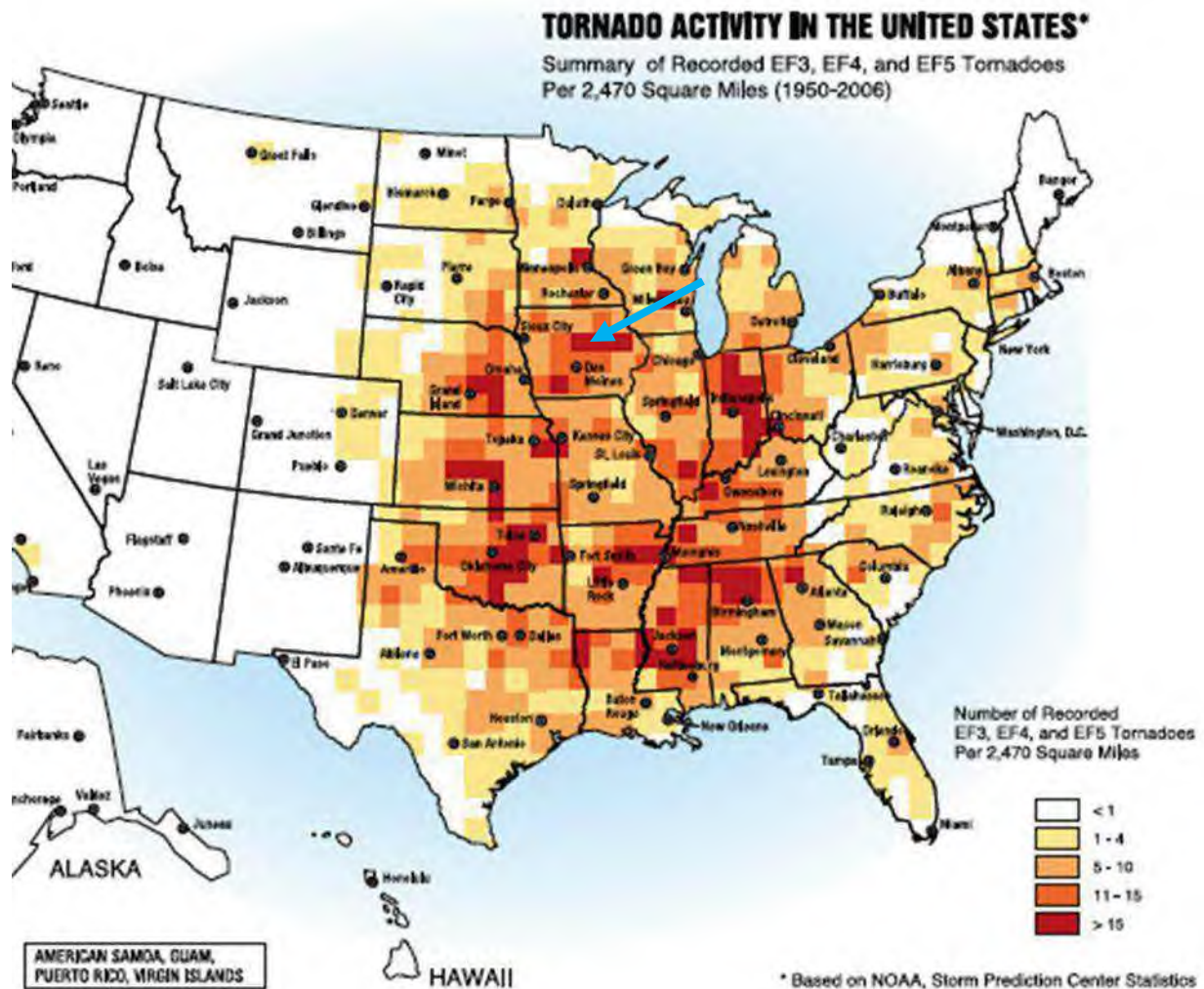
Duration Score: 1—less than 6 hours

Geographic Location/Extent

Iowa is located in a part of the United States where tornadoes are a common occurrence. According to TornadoHistoryProject.com, Iowa has experienced 2,468 tornadoes from 1950 through 2016 (67-year period), of which 56 passed through Story County. Six F5 rated tornados have occurred in Iowa during this timeframe, one of which affected Story County. Since 1950, there have been on average 37 tornadoes per year in Iowa. Most tornadoes occurred in May and June but can occur during any month. Also, mid-afternoon until around sunset is the peak time of day for tornado activity. Since 1950 there have been 2,274 injuries and 87 deaths attributable to tornadoes (Source: <http://www.tornadohistoryproject.com/tornado/Iowa/map>).

Tornadoes can occur in the entire planning area. Figure 3.58 illustrates the number of F3, F4, and F5 tornadoes recorded in the United States per 3,700 square miles between 1950 and 2006. Story County is in the section with orange and red shading, indicating 5 to 10, or even more than 15 tornadoes of this magnitude occurring during this 57-year period.

Figure 3.58: Tornado Activity in the United States



Source: FEMA 320, Taking Shelter from the Storm, 3rd edition

Note: Blue arrow is approximate location of Story County

Tornadoes are classified according to the Enhanced Fujita (EF) Scale (see Table 3.79), which attempts to rank tornadoes according to wind speed based on the damage caused. This update to the original F scale was implemented in the U.S. on February 1, 2007.

Table 3.79: Enhanced F Scale for Tornado Damage

FUJITA SCALE			DERIVED EF SCALE		OPERATIONAL EF SCALE	
F Number	Fastest 1/4-mile (mph)	3 Second Gust (mph)	EF Number	3 Second Gust (mph)	EF Number	3 Second Gust (mph)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over 200

Source: The National Weather Service, www.spc.noaa.gov/faq/tornado/ef-scale.html

The wind speeds for the EF scale and damage descriptions are based on information on the NOAA Storm Prediction Center as listed in Table 3.80. The damage descriptions are summaries. For the actual EF scale, it is necessary to look up the damage indicator (type of structure damaged) and refer to the degrees of damage associated with that indicator. Information on the Enhanced Fujita Scale's damage indicators and degrees of damage is located online at www.spc.noaa.gov/efscale/ef-scale.html.

Table 3.80: Enhanced Fujita Scale with Potential Damage

Enhanced Fujita Scale			
Scale	Wind Speed (mph)	Relative Frequency	Potential Damage
EF0	65-85	53.5%	Light. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage (i.e. those that remain in open fields) are always rated EF0).
EF1	86-110	31.6%	Moderate. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	10.7%	Considerable. Roofs torn off well constructed houses; foundations of frame homes shifted; mobile homes complete destroyed; large trees snapped or uprooted; light object missiles generated; cars lifted off ground.
EF3	136-165	3.4%	Severe. Entire stores of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	166-200	0.7%	Devastating. Well-constructed houses and whole frame houses completely levelled; cars thrown and small missiles generated.
EF5	>200	<0.1%	Explosive. Strong frame houses levelled off foundations and swept away; automobile-sized missiles fly through the air in excess of 300 ft.; steel reinforced concrete structure badly damaged; high rise buildings have significant structural deformation; incredible phenomena will occur.

Source: NOAA Storm Prediction Center

All of Story County is susceptible to high wind events. The County is located in Wind Zone IV, which is susceptible to winds up to 250 mph. All of the participating jurisdictions are vulnerable to this hazard. Figure 3.59 shows the wind zones of the United States based on maximum wind speeds; the entire state of Iowa is located within wind zone IV, the highest inland category.

Figure 3.59: Wind Zones in the United States



Source: FEMA; http://www.fema.gov/plan/prevent/saferoom/tsfs02_wind_zones.shtm

Note: Blue square indicates approximate location of Story County

The advancement in weather forecasting has provided for the ability to predict severe weather that is likely to produce tornadoes days in advance. Tornado watches can be delivered to those in the path of these storms several hours in advance. Lead time for actual tornado warnings is about 30 minutes. Tornadoes have been known to change paths very rapidly, thus limiting the time in which to take shelter. Tornadoes may not be visible on the ground if they occur after sundown or due to blowing dust or driving rain and hail.

Previous Occurrences

Tornadoes

NOAA statistics record 57 tornado events in Story County from 1950 to 2017. Of these, one was an F5, one was an F4, four were an F3; ten were rated F2; 16 were rated F1/EF1; 22 were rated F0/EF0; and three received no rating. These tornadoes caused one fatality and 19 injuries, over \$34 million in property damages and \$39,500 in damage to crops. Historically, tornadoes in the county have occurred in undeveloped areas and had relatively little impact. Table 3.81 summarizes these events.

Table 3.81: Recorded Tornadoes in Story County, 1950 - 2017

Date	Magnitude	Deaths	Injuries	Property Damage	Crop Damage	Length (miles)	Width (yards)
6/15/1950	F3	0	5	\$-	\$-	5.6	300
5/20/1953	F3	1	0	\$-	\$-	22.7	400

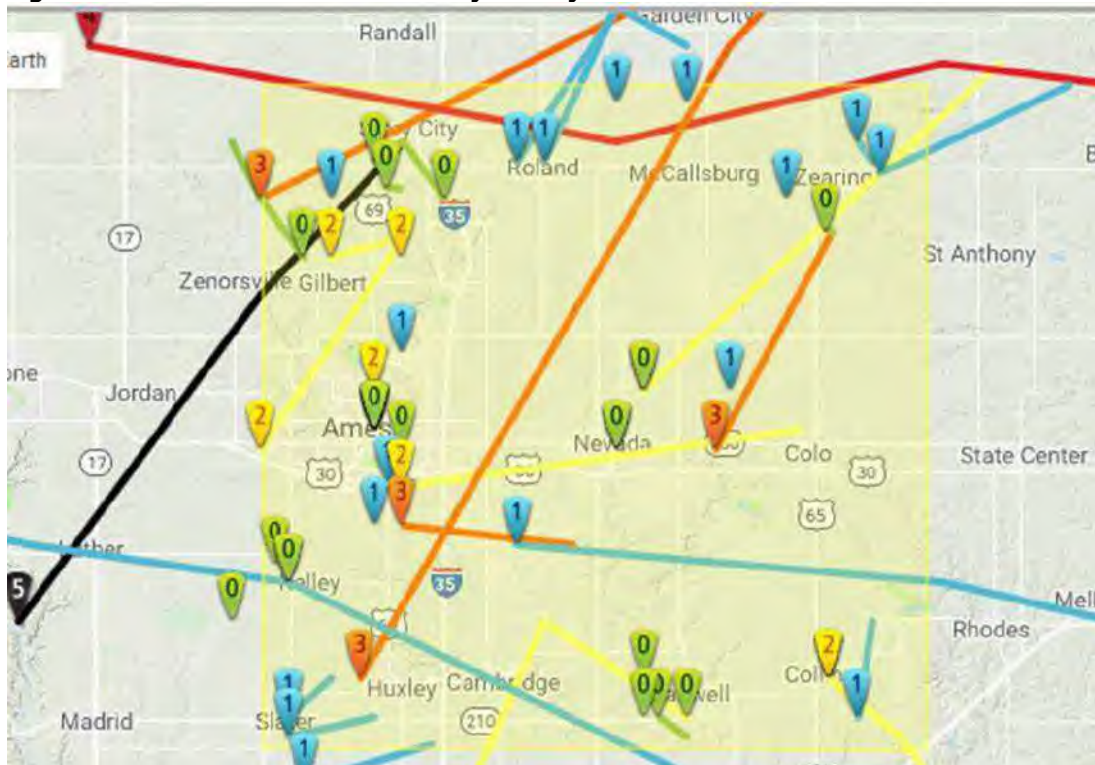
Date	Magnitude	Deaths	Injuries	Property Damage	Crop Damage	Length (miles)	Width (yards)
5/30/1957		0	0	\$25,000	\$-	0	33
5/31/1959	F2	0	0	\$250,000	\$-	17	440
6/28/1959	F0	0	0	\$25,000	\$-	2	300
5/7/1962	F2	0	0	\$250,000	\$-	0	150
7/4/1965		0	0	\$250	\$-	0	33
8/26/1965	F2	0	2	\$25,000	\$-	1.9	100
9/16/1965	F2	0	0	\$25,000	\$-	0.5	100
6/11/1966	F1	0	0	\$25,000	\$-	2	150
6/7/1967	F2	0	0	\$25,000	\$-	1	100
6/8/1967	F1	0	0	\$25,000	\$-	2.3	100
6/8/1967	F2	0	0	\$250,000	\$-	14.4	100
6/29/1969	F1	0	0	\$250,000	\$-	0	200
5/10/1970		0	0	\$-	\$-	0	33
5/12/1970	F1	0	0	\$30	\$-	0	33
5/12/1970	F1	0	0	\$25,000	\$-	0	33
5/7/1973	F0	0	0	\$-	\$-	0.5	60
7/1/1973	F1	0	0	\$25,000	\$-	0	33
6/18/1974	F2	0	0	\$250,000	\$-	2	200
6/12/1976	F1	0	0	\$25,000	\$-	0	33
6/13/1976	F5	0	0	\$250	\$-	7.3	880
6/13/1976	F2	0	0	\$25,000	\$-	1.3	200
8/28/1979	F0	0	0	\$-	\$-	1.3	60
6/12/1984	F0	0	0	\$-	\$-	0	33
6/22/1984	F0	0	0	\$-	\$-	0	33
5/24/1989	F4	0	0	\$25,000,000	\$-	13	150
3/13/1990	F2	0	0	\$2,500,000	\$-	3	60
3/13/1990	F3	0	1	\$250,000	\$-	9	100
3/22/1991	F3	0	0	\$2,500,000	\$-	27	70
3/22/1991	F0	0	0	\$250	\$-	0.1	20
6/19/1994	F1	0	0	\$50,000	\$500	7	60
6/5/1995	F0	0	0	\$15,000	\$1,000	5	20
5/30/1998	F1	0	0	\$5,000	\$1,000	14	45
4/8/1999	F1	0	2	\$800,000	\$-	2	75
5/16/1999	F0	0	0	\$5,000	\$-	0.2	30
6/6/1999	F1	0	0	\$2,000	\$-	0.7	30
5/10/2001	F0	0	0	\$5,000	\$-	0.3	30
5/22/2004	F0	0	0	\$2,000	\$2,000	1.4	50
8/3/2004	F1	0	0	\$75,000	\$15,000	3	100
8/26/2004	F0	0	0	\$-	\$2,000	0.5	50
8/26/2004	F0	0	0	\$10,000	\$2,000	0.5	50
9/5/2004	F1	0	0	\$30,000	\$2,000	2.7	40

Date	Magnitude	Deaths	Injuries	Property Damage	Crop Damage	Length (miles)	Width (yards)
9/8/2005	F1	0	8	\$150,000	\$-	0.7	75
11/12/2005	F0	0	0	\$2,000	\$-	0.2	30
11/12/2005	F2	0	1	\$250,000	\$-	9	100
11/12/2005	F0	0	0	\$50,000	\$-	1.6	50
11/12/2005	F1	0	0	\$580,000	\$-	4	75
6/21/2007	EF0	0	0	\$-	\$2,000	0.1	30
6/8/2010	EF0	0	0	\$-	\$-	0.44	20
6/8/2010	EF0	0	0	\$-	\$-	0.24	20
5/19/2013	EF0	0	0	\$15,000	\$-	0.46	100
6/30/2014	EF0	0	0	\$20,000	\$5,000	2.01	90
6/7/2015	EF1	0	0	\$90,000	\$-	0.92	35
03/06/2017	EF0	0	0	\$75,000	\$-	5.34	85
08/21/2017	EF0	0	0	\$-	\$4,000	1.37	80
08/21/2017	EF0	0	0	\$-	\$3,000	1.08	10
TOTAL		1	19	\$34,006,780	\$39,500	198.66	5,917.00

Source: NOAA

The map in Figure 3.60 shows the paths of the previous events in Story County. Note: Not all events had available latitude and longitude coordinates. As a result, only those events with geographic information are displayed.

Figure 3.60: Tornado Paths in Story County, 1950-2016



Source: tornadohistoryproject.com

Story County has been included in five Presidential Disaster Declarations that involved tornadoes since 1998. See Table 3.2 in the Hazard Identification Section for additional details. Descriptions of notable previous tornado events are provided below:

March 13, 1990 – Wind damage was reported at several locations. Buildings were damaged at Zearing. A semi-truck was upended into a ditch with the driver sustaining minor injuries. About \$60,000 in damage was sustained on one farm where four buildings were destroyed and six others were damaged. This tornado was the remnants of an EF4 tornado that caused approximately \$2,000,00 in damage in Ankeny in Polk County previously and had a total path of 22 miles.

April 8, 1999 – At the beginning of the event, the main weather feature was in the form of hail. There were numerous reports of hail three quarters to one and three quarters inch in diameter. The largest hail fell in Guthrie and Dallas Counties with reports of golf ball size hail. One of the storms in the initial wave of afternoon activity became stronger as it moved into southern Story County. Initially, high winds of 60 MPH or more swept through the Sheldahl area of Boone County. Greene County was also affected by high winds from the storms. A tornado dropped out of the storm as it moved into the Slater area and was on the ground for about 2 miles. Initial estimates showed 44 homes and businesses damaged in Story County, one was destroyed with major damage to another. Thirty-six homes and four businesses were damaged in the town of Slater. Two people were injured during the passage of the tornado. One of the injuries involved a 70-year-old man who was picked up by the tornado's winds and thrown about 10 feet before he latched on to something. His shoulder was dislocated and he required 6 stitches due to his injuries in his hand. High winds northeast of Slater knocked several cars off a Burlington Northern freight train off the tracks after they were blown more than one quarter mile down the track. It was not possible to determine if the cars were knocked off by the tornado or high winds however. This band of storms continued to race and develop northeast through the afternoon. Damage became more sporadic, however high winds occurred as far northeast as Hardin County, with 70 MPH winds reported near New Providence. As the storms moved north, high winds were produced over Story County east of Story City. High winds toppled a tractor semi-trailer truck east of Story City on Interstate 35, injuring the driver. Twenty counties in Iowa experienced serious damage from the storms of the day. Iowa Governor Vilsack declared several counties in Iowa State disaster areas.

November 12, 2005—A long-lived tornado tracked through several counties across central Iowa during the late afternoon hours of November 12, 2005. This tornado occurred just prior to an ISU home football game. Many fans were evacuated to adjacent facilities for shelter. The tornado path across all counties involved is estimated at 27.5 miles long and between 100 and 150 yards wide along the damage path. The path in Story County, was around 15 miles long and 100 yards wide. Initially the storms produce quarter to golf ball size hail, with 2 1/2 inch diameter hail falling in Dallas County. Hail up to baseball size fell in Greene County as well. The system transitioned into a tornadic system within an hour with several tornadoes touching down in the central sections of the state. At least 9 communities were hit by tornadoes and 65 homes damaged or destroyed in all. An 82 year old woman was killed in Stratford when the tornado demolished her home. In a 2 or 3 block area of downtown Woodward, at least 12 houses were totally destroyed. There was one minor injury in Ames, two serious injuries in the Woodward area, and three injuries in Stratford. Due to the extensive damage to property caused by the tornadoes, Iowa Governor Vilsack declared Boone, Story, Webster, Dallas and Hamilton Counties state disaster areas. In all, 11 separate tornadoes were described as part of this system.

Roland reported no property damage while Story City reported only minor damage to roofs and foundation skirting on a few mobile homes near the south edge of town. In west Ames, numerous homes

received damage, some substantial with one home destroyed. There was also heavy tree damage and many out buildings damaged or destroyed in the rural area along the tornado's path.

Heavy debris and power line destruction forced the closure of 170th street from HWY 69 east and 530th Ave north from 180th Street into Gilbert. Story County Sheriff deputies and Iowa State Patrol officers established a perimeter and conducted traffic control around Gilbert. 170th Street remained closed until Tuesday while power crews worked to restore service.

Windstorms

According to the NCDC database, there were 36 high wind events in Story County from 1996 to 2016. During this time period, there were no reported deaths, but two injuries did occur. There were an estimated \$1.477 million in property damages, and over \$30,000 in crop damages recorded. Recorded wind gusts ranged from a high of 61 knots (70.19 mph) to a low of 35 knots (40.28 mph). Table 3.82 provides a summary of the wind speeds reported for the wind events.

Table 3.82: Reported Wind Speeds, NCDC Events from 1996 to 2016

Wind Speed	# of Events
35-40	12
41-45	0
46-50	6
51-55	9
56-60	6
60+	1
N/A	2
TOTAL	36

Source: NCDC; N/A – data not available

In addition to these events, the HMPC noted that the City of Sheldahl incurred substantial damages from a straight line wind event in July 2011 that brought down many trees.

Probability of Future Occurrence

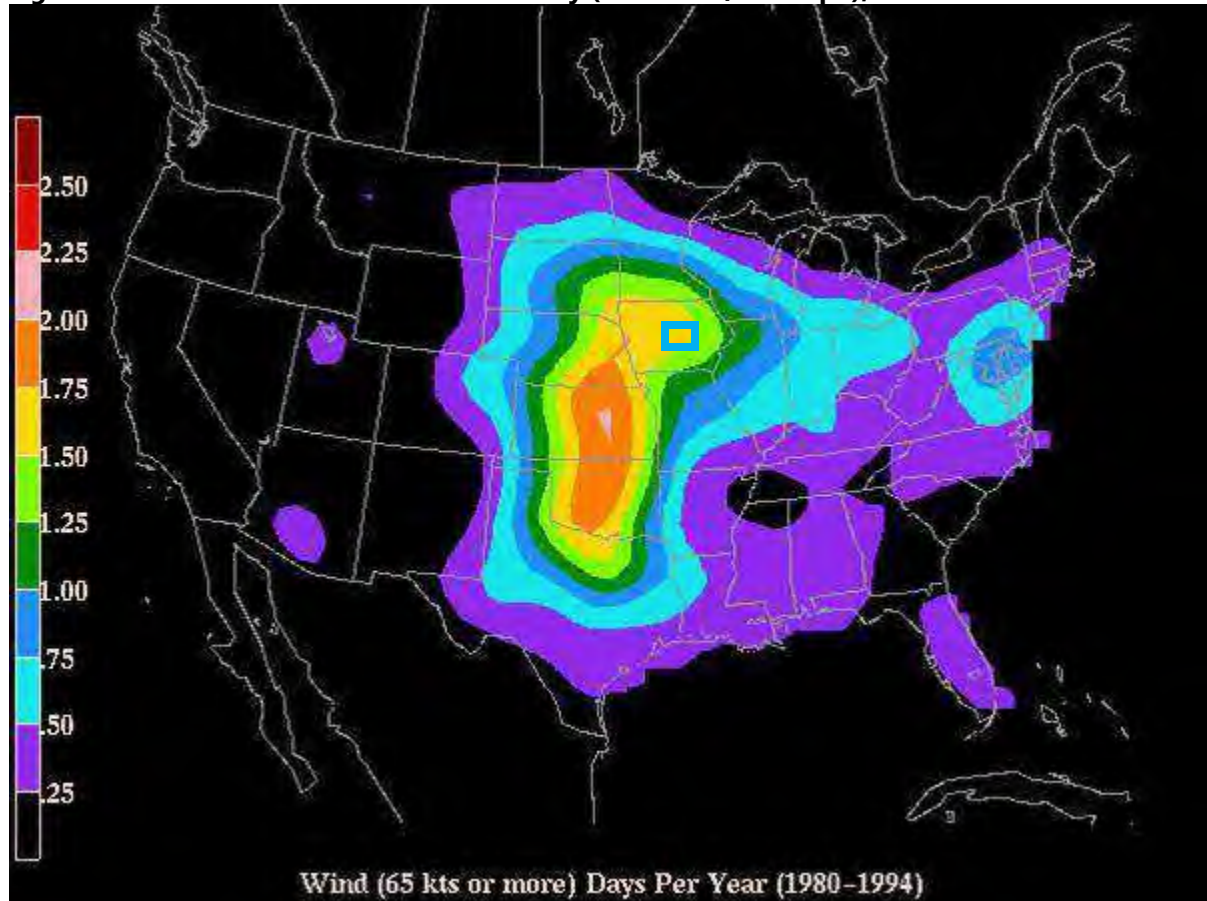
NOAA reported 54 tornadoes in Story County in a 67-year time period, which calculates to 80% chance of a tornado occurring somewhere in the County in any given year. Therefore, it is a high probability that some portion of Story County will experience tornado activity in any given year.

According to NCDC, there were 36 separate high wind events from 1996 to 2016 (21-year period) in Story County. Based on this data there is an over 100-percent annual probability of high wind events in any given year. Therefore, the probability rating is "Highly Likely".

Probability Score: 4—Highly Likely

Figure 3.61 shows the probability of a windstorm event (65 knots or greater) in the U.S. The Story County planning area is colored yellow, showing that 65+ knot winds are probable to occur 1.50 to 1.75 times a year. Wind speeds of 65 knots converts to approximately 75 mph.

Figure 3.61: Annual Windstorm Probability (65+ knots/75+ mph), United States 1980-1994



Source: NSSL, http://www.nssl.noaa.gov/users/brooks/public_html/bigwind.gif;

Note: Blue square indicates approximate location of Story County

Vulnerability

Overview

Story County is located within a region of the U.S. with high frequency of dangerous and destructive tornadoes and is referred to as "Tornado Alley". Figure 3.62 is based on areas where dangerous tornadoes are most likely to take place.

Figure 3.62: Tornado Alley in the U.S.



Source: <http://www.tornadochaser.net/tornalley.html>

Light frame structures, such as mobile homes, outbuildings and sheds are considered especially vulnerable to damage from tornadoes. Those most at risk from tornadoes include people living in mobile homes, campgrounds, and other dwellings without secure foundations or basements. People in automobiles are also very vulnerable to tornadoes. According the US Census Bureau American Community Survey results for 2016, 3.3% of homes in Iowa are considered mobile homes, and in Story County 743 housing units are mobile homes. In Story County, there are seventeen mobile home parks – eight in Ames, three in Nevada, two in Huxley, and Slater, Maxwell, Colo and Story City each have one. (Note that some of these mobile home parks may actually be located in the unincorporated County despite having addresses in a particular city.)

The elderly (65 and older), young (less than 18 years old), and the physically and mentally handicapped are most vulnerable to tornadoes and wind due to lack of mobility to escape the path of destruction. People who may not understand watches and warnings due to language barriers are also at risk.

According to the 2013 Iowa Hazard Mitigation Plan, of the 8 hazards for which data was available to estimate annualized losses, tornadoes ranked 3rd with \$36 million in annualized losses based on data spanning a 63-year period.

Due to the potential for damaging tornadoes in the planning area, the magnitude was determined to be a 4, "Catastrophic."

Magnitude Score: 4—Catastrophic

Potential Losses to Existing Development

In Story County, the NCDC estimate for past property damages resulting from tornadoes from 1950 – 2016 (67 years) was \$33,931,780. This translates to an annualized loss of over \$506,444. For windstorms, NCDC loss estimates were \$1,477,110 from 1996 to 2016 (21 years). This translates to an annualized loss of over \$70,339.

Loss of Use

Overhead power lines and infrastructure are also vulnerable to damages from windstorms. Potential losses would include cost of repair or replacement of damaged facilities, and lost economic opportunities for businesses. Public safety hazards include risk of electrocution from downed power lines. Specific amounts of estimated losses are not available due to the complexity and multiple variables associated with this hazard. Refer to the electric power loss of use estimates provided in Table 3.69 in the Winter Storm hazard section.

Crop Losses

Crop insurance payments for wind damage are discussed in Section 3.5.17, Thunderstorms with Lightning and Hail.

Future Development

Story County has seen an estimated population growth of 8.9% between 2010 and 2017. With population growth comes new development; this new development increases the County's vulnerability to a tornado and its impacts. Future development that does occur in growing cities should consider tornado hazards at the planning, engineering and architectural design stages. Public buildings such as schools, government offices, as well as other buildings with a high occupancy and mobile home parks, should consider inclusion of a tornado safe room to shelter occupants in the event of a tornado.

Windstorm is primarily a public safety and economic concern, and the planning area is located in a region with very high frequency of occurrence. Windstorm 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.

Although windstorms occur frequently in the planning area and damages to property occur, much of the damage is generally covered by private insurance. This results in less impact to individuals and the community since recovery is facilitated by insurance.

Climate Change Impacts

According to the 2010 Climate Change Impacts on Iowa report, growing evidence points to stronger summer storm systems in the Midwest. Studies have not been done to conclusively say that severe storms, including tornadoes, are increasing. However, with summer temperatures becoming warmer and humidity levels increasing, an increase in the likelihood of tornadic activity is plausible.

Tornado/Windstorm Hazard Summary by Jurisdiction

The magnitude was rated as High 4 for all the participating jurisdictions, as they are all vulnerable to tornado and windstorm damage. The factors of probability, warning time, and duration are also equal across the planning area. This hazard does not substantially vary by jurisdiction.

Jurisdiction	Probability	Magnitude	Warning Time	Duration	Score	Level
Story County, Iowa	4	4	4	1	3.7	High
Ames	4	4	4	1	3.7	High
Cambridge	4	4	4	1	3.7	High
Collins	4	4	4	1	3.7	High
Colo	4	4	4	1	3.7	High
Gilbert	4	4	4	1	3.7	High
Huxley	4	4	4	1	3.7	High
Kelley	4	4	4	1	3.7	High
Maxwell	4	4	4	1	3.7	High
McCallsburg	4	4	4	1	3.7	High
Nevada	4	4	4	1	3.7	High
Roland	4	4	4	1	3.7	High
Sheldahl	4	4	4	1	3.7	High
Slater	4	4	4	1	3.7	High
Story City	4	4	4	1	3.7	High
Ames Schools	4	4	4	1	3.7	High
Ballard Schools	4	4	4	1	3.7	High
Collins-Maxwell Schools	4	4	4	1	3.7	High
Colo-Nesco Schools	4	4	4	1	3.7	High
Gilbert Schools	4	4	4	1	3.7	High
Nevada Schools	4	4	4	1	3.7	High
Roland-Story Schools	4	4	4	1	3.7	High
Iowa State University	4	4	4	1	3.7	High

3.5.19 Transportation Incident

Hazard Score Calculation					
Probability	Magnitude/Severity	Warning Time	Duration	Weighted Score	Level
3	2	4	1	2.65	Moderate

Profile

Hazard Description

This hazard encompasses the following: air transportation, highway transportation, and rail transportation. The transportation incidents can involve any mode of transportation that directly threatens life and which results in property damage and/or death(s)/injury(s) and/or adversely impact a community's capabilities to provide emergency services. Incidents involving buses and other high occupancy vehicles could trigger a response that exceeds the normal day-to-day capabilities of response agencies.

An air transportation incident may involve a military, commercial or private aircraft. Air transportation is playing a more prominent role in transportation as a whole. Airplanes and helicopters are used to transport passengers for business and recreation as well as thousands of tons of cargo. A variety of circumstances can result in an air transportation incident; mechanical failure, pilot error, enemy attack, terrorism, weather conditions and on-board fire can all lead to an air transportation incident.

Highway transportation incidents are very complex. Contributing factors can include a roadway's design and/or pavement conditions (e.g. rain, snow and ice), a vehicle's mechanical condition (e.g. tires, brakes, lights), a driver's behavior (e.g. speeding, inattentiveness and seat belt usage), the driver's condition (e.g. alcohol use, age-related conditions, physical impairment) and driver inattention by using a wireless device. In fact, the driver's behavior and condition factors are the primary cause in an estimated 67 percent of highway crashes and a contributing factor in an estimated 95 percent of all crashes.

A railway transportation incident is a train accident that directly threatens life and/or property, or adversely impacts a community's capabilities to provide emergency services. Railway incidents may include derailments, collisions and highway/rail crossing accidents. Train incidents can result from a variety of causes; human error, mechanical failure, faulty signals, and/or problems with the track. Results of an incident can range from minor "track hops" to catastrophic hazardous material incidents and even human/animal casualties. With so many miles of track in Iowa, vehicles must cross the railroad tracks at numerous at-grade crossings.

Warning Time Score: 4—Minimal or no warning

Duration Score: 1—Less than 6 hours

Geographic Location/Extent

Highways/Roads

The entire planning area and all participating jurisdictions are subject to transportation incidents. The transportation routes include Interstate 35 running north/south bisecting the County, U.S. Highways 30, 65 and 69, Iowa Highways 210 and 330 and 15 county highways. Numerous paved county roads connect the incorporated cities and unincorporated towns throughout the county.

Figure 3.24 in the Infrastructure Failure Incident section shows the major highways in Story County. The Figure is repeated below.

Figure 3.63: Story County Highway Map



Source: Iowa Department of Transportation, <http://www.iowadot.gov/maps/msp/pdfview/counties.html>

According to the Iowa Department of Transportation, the total daily traffic across all Story County bridges is 936,531 and the total daily truck traffic is 22,699,045. (Source: <http://iowadot.maps.arcgis.com/apps/MapSeries/index.html?appid=db6cb43313354a4f85505089ab317e7a>)

Rail Transport

Story County has three railway lines owned and operated by the Union Pacific Railroad Company. The line commonly referred to by Union Pacific as the Overland Route runs east to west through Story County on its route from Chicago, Illinois to Oakland, California. The Overland Route travels through the incorporated communities of Colo, Nevada and Ames. The line commonly referred to by Union Pacific as the Spine Line runs north to south through Story County on its route through the incorporated communities of McCallsburg, Nevada and Cambridge. The third line in Story County, whose origin is in Ames, routes through the incorporated communities of Gilbert and Story City.

In Ames, the railroad that travels east/west/north in the community is a vulnerability issue, as most of the rail crossings in the community are at-grade. Stopped or derailed trains have the potential to severely limit the ability of emergency responders to arrive at locations on the other side of those tracks. Figure 3.64 shows the railroads that operate in Story County.

Figure 3.64: Railroad Lines in Story County



Source: Iowa Department of Transportation, <http://www.iowadot.gov/iowarail/railroads/maps/maphome.htm> Note. UP represents Union Pacific

Air Transport

There is one airport in Story County, the Ames Municipal Airport, which is located on the south side of Ames, just south of U.S. Highway 30. It is mainly used for private and hobby pilots. The Des Moines International Airport is located south of Des Moines and is 30 to 60 miles away from Story County depending on where you are traveling from. The third airport nearby is the Ankeny Regional Airport, which provides commercial and general aviation services, is operated by the Polk County Aviation Authority Board, and is accessible off I-35 exit 90.

The Mary Greeley Medical Center in Ames does not maintain a helipad at the medical facility but utilizes the Ames Airport when there is a need for a medical helicopter landing. The Story County Hospital in Nevada maintains a helipad at its facility for medical helicopters. There are no military installations in Story County but Camp Dodge in Johnston, Iowa is the closest active military installation, although the Department of Defense classifies it as a major training center.

Figure 3.65: Ames Municipal Airport



Source: Google Maps

Previous Occurrences

Rail Transportation Incidents

According to the Iowa Department of Transportation there were 37 derailments in Iowa in 2015, and none occurred in Story County. Of those incidents, 73 percent took place in yards, on siding or on industry tracks when the speeds are low. The Department of Transportation reports that rail car traffic throughout Iowa has increased but the number of derailments in relationship to the traffic is trending downward.

Air Transportation Incidents

There has been one aviation incident in Story County that has been reported to the National Transportation Safety Board (NTSB) during the ten-year period from January 1, 2002 to December 31, 2012.

January 30, 2003 in Ames - A private plane was coming into land at the Ames Airport under moderate snowfall. The NTSB determined that the pilot failed to maintain the proper glide path during the final approach and struck a power pole and went through electric wires, causing the plane to crash in a field $\frac{1}{4}$ mile short of the runway. There were no injuries. The plane wing and tail section were damaged.

Highway Transportation Incidents

The Iowa Department of Transportation's Office of Traffic and Safety maintains traffic crash statistics and location maps by county and city in Iowa. Table 3.83 that follows shows the reportable crash history for rural crashes in Story County for 2007-2011.

Table 3.83: Story County Rural Crashes 2007 – 2011

Year	Crash Counts/Classification						Injury/Fatality Counts/Classification					
	Crashes	Fatal	Major	Minor	Poss/Unk	Property Damage	Injuries	Fatalities	Major	Minor	Possible	Unknown
2007	541	5	16	63	54	403	198	8	23	82	81	4
2008	552	0	10	47	76	419	162	0	10	59	90	3
2009	536	6	8	52	34	436	141	7	12	65	56	1
2010	490	1	8	43	43	398	126	1	8	58	53	6
2011	420	4	15	51	33	317	139	4	22	61	48	4
Totals	2539	16	57	253	240	1973	766	20	75	325		346

Source: Iowa Department of Transportation's Office of Traffic and Safety

Probability of Future Occurrence

A major transportation incident can occur at any time. Even though traffic engineering, inspection of traffic facilities and land use management of areas adjacent to roads and highways has increased, incidents continue to occur as the volume of traffic in the county increases. The combination of cars and trucks, farm equipment, wildlife, unpredictable weather conditions, potential mechanical problems and human error always leaves the potential for a transportation accident.

Based on the available information, the probability of air transportation or highway incident that directly threatens life and which results in property damage and/or death(s)/injury(s) and/or adversely impact a community's capabilities to provide emergency services is "Highly Likely" with greater than 33 percent likelihood to occur in any given year.

Probability Score: 4—Highly Likely

Vulnerability

Overview

Transportation incidents can almost always be expected to occur in specific areas, on or near airports, roadways or other transportation infrastructure. The exception is air transportation incidents, which can occur anywhere. However, it is difficult to predict the magnitude of any specific event because these types of events are generally accidental and the circumstances surrounding these events will impact the extent of damage or injuries that occur.

Magnitude Score: 2—Limited

Potential Losses to Existing Development

The U.S. Department of Transportation Federal Highway Administration issued a technical advisory in 1994 providing suggested estimates of the cost of traffic crashes to be used for planning purposes. These figures were converted from 1994 dollars to 2016 dollars using an annual inflation rate of 2.85 percent. The costs are listed below in Table 3.84.

Table 3.84: Costs of a Traffic Crash

Severity	Cost per injury (in 2016 dollars \$)
Fatal	\$4,412,996
Evident Injury	\$61,101
Possible Injury	\$32,250
Property Damage Only	\$3,395

Source: U.S. Department of Transportation Federal Highway Administration Technical Advisory T 7570.2, 1994. Adjusted to 2016 dollars.

Using the traffic crash costs per type of severity from Table 3.84 and combining major and minor injuries as "evident injury" and possible and unknown as "possible injury" the total costs of traffic crashes is figured in Table 3.85 for Story County, City of Ames, and City of Nevada from 2007-2011.

Table 3.85: Costs of Traffic Crashes in Story County, 2007-2016

	Fatalities	Evident Injury	Possible Injury	Property Damage
Story County				
Number of incidents	16	57	253	1,973
Total Cost	\$64,389,264	\$3,176,097	\$7,440,447	\$6,108,408
5-year Average Cost	\$12,877,853	\$635,219	\$1,488,095	\$1,221,682
City of Ames				
Number of incidents	8	87	405	3,716
Total Cost	\$32,194,632	\$4,847,727	\$11,910,645	\$11,504,736
5-year Average Cost	\$6,438,926	\$969,545	\$2,383,129	\$2,300,947
City of Nevada				
Number of incidents	1	4	30	344
Total Cost	\$4,024,329	\$390,047	\$882,270	\$1,065,024
5-year Average Cost	\$804,865	\$78,009	\$176,454	\$213,005

Sources: U.S. Department of Transportation Federal Highway Administration Technical Advisory T 7570.2, 1994. Adjusted to 2012 dollars and Iowa Department of Transportation's Office of Traffic and Safety, <http://www.iowadot.gov/crashanalysis/index.htm>

Estimated losses as a result of railway transportation and air transportation are not available for this analysis.

Future Development

The Iowa Department of Transportation, Office of Aviation, has an Aviation System Plan 2010-2030 that makes recommendations for future development of the air transportation system until 2030. The plan describes the role of air transportation for Iowans for moving people and goods. A 2009 Iowa Department of Transportation study determined that the Iowa air transportation system contributes about \$5.4 billion a year to Iowa's economy and supports an estimated 47,034 jobs (source: <http://www.iowadot.gov/aviation/studiesreports/systemplanreports.html>)

According to the Iowa Department of Transportation, there are no major federal interstate or state highway projects scheduled in Story County at the time of this planning effort.

The Ames Area Metropolitan Planning Organization has a 2035 Ames Area Long Range Transportation Plan to address its growing population and employment that are supplemented with increased transportation needs. This plan includes roadways, pedestrian, bicycle and transit system of the Ames area and makes recommendations for future transportation needs in the Ames area. The County's 5-year Plan and Capital Improvements Program also address future road development.

Climate Change Impact

If projections regarding milder winters come to fruition, climate change impacts may reduce the number of transportation incidents associated with some severe weather. However, if ice occurs, rather than snow, this could result in higher incidents of weather-related accidents.

Transportation Hazard Summary by Jurisdiction

All jurisdictions within the planning area are at risk to some kind of transportation incident. The probability level is at a Level 2 for the smaller populated jurisdictions and for the jurisdictions that do not have any railways in their jurisdictions: Collins, Huxley, Kelley, Maxwell, Roland, Sheldahl, Slater and Zearing.

Jurisdiction	Probability	Magnitude	Warning Time	Duration	Score	Level
Story County, Iowa	3	2	4	1	2.65	Moderate
City of Ames	3	2	4	1	2.65	Moderate
City of Cambridge	2	2	4	1	2.2	Moderate
City of Collins	2	2	4	1	2.2	Moderate
City of Colo	2	2	4	1	2.2	Moderate
City of Gilbert	2	2	4	1	2.2	Moderate
City of Huxley	2	2	4	1	2.2	Moderate
City of Kelley	2	2	4	1	2.2	Moderate
City of Maxwell	2	2	4	1	2.2	Moderate
City of McCallsburg	2	2	4	1	2.2	Moderate
City of Nevada	3	2	4	1	2.65	Moderate
City of Roland	2	2	4	1	2.2	Moderate
City of Sheldahl	2	2	4	1	2.2	Moderate
City of Slater	2	2	4	1	2.2	Moderate
City of Story City	2	2	4	1	2.2	Moderate
Ames Schools	3	2	4	1	2.65	Moderate
Ballard Schools	2	2	4	1	2.2	Moderate
Collins-Maxwell Schools	2	2	4	1	2.2	Moderate
Colo-Nesco Schools	2	2	4	1	2.2	Moderate
Gilbert Schools	2	2	4	1	2.2	Moderate
Nevada Schools	3	2	4	1	2.65	Moderate
Roland-Story Schools	2	2	4	1	2.2	Moderate
Iowa State University	3	2	4	1	2.65	Moderate

3.6 Hazard Analysis Summary

This table below provides a tabular summary of the hazard ranking for each jurisdiction in the planning area.

Table 3.86: Hazard Ranking Summary by Jurisdiction

Jurisdiction	Animal / Plant / Crop Disease	Dam/Levee Failure	Drought	Earthquake	Expansive Soils	Extreme Heat	Flash Flood	Grass/Wildland Fire	Hazardous Materials	Human Disease	Infrastructure Failure	Landslide	River Flood	Severe Winter	Sinkholes	Terrorism	Thunderstorm / Lightning / Hail	Tornado/Windstorm	Transportation Incident
Story County, Iowa	L	M	M	L	L	M	H	M	H	M	M	L	H	H	L	M	M	H	M
City of Ames	L	M	M	L	L	M	H	M	H	M	M	L	H	H	L	M	M	H	M
City of Cambridge	L	N/A	M	L	L	M	H	M	M	M	M	L	H	H	N/A	M	M	H	M
City of Collins	L	N/A	M	L	L	M	H	M	M	M	M	L	M	H	N/A	M	M	H	M
City of Colo	L	N/A	M	L	L	M	H	M	M	M	M	L	N/A	H	N/A	M	M	H	M
City of Gilbert	L	N/A	M	L	L	M	H	M	M	M	M	L	M	H	N/A	M	M	H	M
City of Huxley	L	N/A	M	L	L	M	H	M	H	M	M	L	M	H	N/A	M	M	H	M
City of Kelley	L	N/A	M	L	L	M	H	M	M	M	M	L	N/A	H	N/A	M	M	H	M
City of Maxwell	L	M	M	L	L	M	H	M	M	M	M	L	H	H	N/A	M	M	H	M
City of McCallsburg	L	N/A	M	L	L	M	M	M	M	M	M	L	M	H	N/A	M	M	H	M
City of Nevada	L	N/A	M	L	L	M	H	M	H	M	M	L	H	H	N/A	M	M	H	M
City of Roland	L	N/A	M	L	L	M	H	M	M	M	M	L	H	H	L	M	M	H	M
City of Sheldahl	L	N/A	M	L	L	M	M	M	M	M	M	L	N/A	H	N/A	M	M	H	M
City of Slater	L	N/A	M	L	L	M	H	M	M	M	M	L	M	H	N/A	M	M	H	M
City of Story City	L	N/A	M	L	L	M	H	M	H	M	M	L	H	H	L	M	M	H	M
Ames Schools	L	M	M	L	L	M	M	M	H	M	M	L	H	H	N/A	M	M	H	M
Ballard Schools	L	N/A	M	L	L	M	M	M	H	M	M	L	H	H	N/A	M	M	H	M
Collins-Maxwell Schools	L	M	M	L	L	M	M	M	M	M	M	L	H	H	N/A	M	M	H	M
Colo-Nesco Schools	L	M	M	L	L	M	M	M	M	M	M	L	M	H	N/A	M	M	H	M
Gilbert Schools	L	N/A	M	L	L	M	M	M	M	M	M	L	M	H	N/A	M	M	H	M
Nevada Schools	L	N/A	M	L	L	M	M	M	H	M	M	L	H	H	N/A	M	M	H	M
Roland-Story Schools	L	N/A	M	L	L	M	M	M	H	M	M	L	H	H	N/A	M	M	H	M
Iowa State University	L	N/A	M	L	L	M	H	M	H	M	M	L	H	H	N/A	M	M	H	M

Note: H = High, M = Medium, L = Low, N/A = Not Applicable

4 MITIGATION STRATEGY

4 Mitigation Strategy.....	4-1
4.1 Goals	4-1
4.2 Identification and Analysis of Mitigation Actions	4-2
4.3 Implementation of Mitigation Actions	4-4

44 CFR 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 existing tools.

This section presents the mitigation strategy updated by the Hazard Mitigation Planning Committee (HMPC) based on the updated risk assessment. The mitigation strategy was developed through a collaborative group process and consists of updated general goal statements to guide the jurisdictions in efforts to lessen disaster impacts, as well as specific mitigation actions that can be put in place to directly reduce vulnerability to hazards and losses. The following definitions are based upon those found in the March 2013 Local Mitigation Planning Handbook:

- Goals are general guidelines that explain what the community wants to achieve with the plan. They are usually broad policy-type statements that are long-term, and they represent visions for reducing or avoiding losses from the identified hazards.
- Mitigation Actions are specific actions that help achieve goals.

4.1 Goals

44 CFR 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.

This planning effort is an update to an existing hazard mitigation plan. Therefore, the goals from the 2014 Story County Hazard Mitigation Plan were reviewed to determine if they are still valid. The HMPC participated in a facilitated discussion during their second meeting to review and update the plan goals. To ensure that the goals are comprehensive and support State goals, the 2013 State Hazard Mitigation Plan goals were reviewed as well. The HMPC also reviewed common categories of mitigation goals from other plans.

The goal from the 2014 plan were:

- Goal 1: Protect live and reduce injury.
- Goal 2: Minimize or reduce damage to property, including critical facilities and infrastructure.
- Goal 3: Develop and implement mitigation strategies in plans, policies, and programs that optimize public funds in an efficient and cost-effective way.
- Goal 4: Reduce utility outages during times of severe weather.
- Goal 5: Strengthen communication among agencies and between agencies and the public.

The HMPC recommended combining Goals 2 and 4, editing the language of Goal 2, removing Goal 3, and adding mitigation-specific language to Goal 5. The resulting three validated plan goals for the Story County Multi-jurisdictional Hazard Mitigation Plan are below:

- Goal 1: Protect lives and reduce injury.
- Goal 2: Minimize or reduce damage to property, especially critical facilities and infrastructure.
- Goal 3: Strengthen communication among agencies and between agencies and the public regarding hazard mitigation.

4.2 Identification and Analysis of Mitigation Actions

44 CFR 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.

During the second meeting of the HMPC, sample results of the risk assessment update were provided to the HMPC members. To lay the framework for the impacts to be addressed by the updated mitigation strategy, the full draft of the Risk Assessment Chapter was also provided for review by the HMPC members. Also at Meeting #2, each jurisdiction was provided with a handout listing the actions they included in the previous hazard mitigation plan. The mitigation strategy of the previous plan consisted of 73 individual jurisdictional actions.

Jurisdictional representatives were instructed to work with others in their jurisdiction to update the status of each of the previous actions. The status updates were provided between Meeting #2 and Meeting #3. Of the 133 previous actions, 25 have been completed, 83 are continuing (68 Continue In-process and 15 Continue Not Started), and 25 were deleted (see Table 4.1). The list of the completed and deleted actions is provided in Appendix C with comments providing additional details, as available. Note that because Zeiring was not a participant in this plan, the status of their actions is not known or reported on in this table.

Table 4.1: Status of Previous Actions

Jurisdiction	Completed	Delete	Continue In-Progress	Continue Not Started	Grand Total
Unincorporated Story County	1	0	8	0	9
Ames	1	1	8	2	12
Cambridge	0	0	3	1	4
Collins	3	0	5	1	9
Colo	0	1	3	6	10
Gilbert	2	1	1	0	4
Huxley	2	0	2	0	4
Kelley	0	0	5	0	5
Maxwell	4	6	1	2	13
McCallsburg	0	0	2	0	2
Nevada	1	0	6	0	7
Roland	3	1	2	0	6
Slater	4	9	7	0	20

Jurisdiction	Completed	Delete	Continue In-Progress	Continue Not Started	Grand Total
Story City	0	4	2	0	6
Ames CSD	3	0	0	0	3
Ballard CSD	0	0	1	0	1
Collins-Maxwell CSD	0	1	0	0	1
Colo-NESCO CSD	0	0	0	1	1
Gilbert CSD	0	0	0	1	1
Nevada CSD	1	0	0	0	1
Roland-Story CSD	0	0	0	1	1
Iowa State University	0	1	12	0	13
Grand Total	25	25	68	15	133

For a comprehensive range of mitigation actions to consider, the jurisdictions were provided relevant information and sources to be used in development of new mitigation actions including:

- Validated Plan Goals
- Previous Actions from 2013 Plan
- Key Issues from Risk Assessment
- FEMA's Mitigation Ideas booklet
- State Priorities for Hazard Mitigation Assistance Grants
- Public Opinion from Surveys

To facilitate discussion and ideas on new actions that jurisdictions may want to submit to the plan update, the planning committee reviewed the plan goals that were updated at Meeting #2. Key issues/problem statements for sample hazards in the risk assessment were also discussed, as well as the actions from the 2014 plan that were identified relative to each hazard. The discussion was geared toward identifying any gaps that may exist between the problems identified and actions already developed to address the problems to develop new actions. To provide consideration of a comprehensive range of alternatives, FEMA's Mitigation Ideas Booklet was also reviewed for additional ideas/alternatives for new actions. After the committee meeting, jurisdictions reviewed the materials to determine final mitigation actions to submit to the plan update.

The jurisdictions were encouraged to be comprehensive and include all appropriate actions to work toward becoming more disaster resistant. They were encouraged to maintain a realistic approach and were reminded that the hazard mitigation plan is a "living document". As capabilities, vulnerabilities, or the nature of hazards that threaten each jurisdiction change, the mitigation actions can and should be updated to reflect those changes, including addition or deletion of actions, as appropriate.

As part of the meeting discussion, jurisdictions were instructed to consider the potential cost of each project in relation to the anticipated future cost savings. This type of discussion allowed the committee as a whole to understand the broad priorities and enable discussion of the types of projects most beneficial to all jurisdictions within Story County.

4.3 Implementation of Mitigation Actions

44 CFR Requirement §201.6(c)(3)(ii): The mitigation strategy shall include an action strategy describing how the actions identified in paragraph (c)(2)(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 benefits review of the proposed projects and their associated costs.

Jurisdictional representatives worked with others in their community to finalize the actions to be submitted to the updated mitigation strategy. Throughout the discussion of the types of projects that the committee would include in the mitigation plan, emphasis was placed on the importance of a benefit-cost analysis in determining project priority. The Disaster Mitigation Act regulations state that benefit-cost review is the primary method by which mitigation projects should be prioritized. Recognizing the federal regulatory requirement to prioritize by benefit-cost, and the need for any publicly funded project to be cost-effective, the HMPC decided to pursue implementation according to when and where damage occurs, available funding, political will, jurisdictional priority, and priorities identified in the State of Iowa Hazard Mitigation Plan. Due to many variables that must be examined during project development, the benefit/cost review at the planning stage primarily consisted of a qualitative analysis. For each action, the jurisdictions included a narrative describing the types of benefits that could be realized with implementation of the action. Where possible, the cost was estimated as closely as possible with further refinement to occur as project development occurs. Cost-effectiveness will be considered in additional detail if/when seeking FEMA Hazard Mitigation Assistance grant funding or other grant funding for eligible projects identified in this plan. At that time, additional information will be researched to provide for a quantitative benefit-cost analysis.

To provide a mechanism for jurisdictions to prioritize actions, a modified STAPLEE worksheet was completed by the jurisdictions for each new and continued action submitted for the updated mitigation strategy. The modified STAPLEE worksheet includes elements to consider protection of life and reduction of damages. Although a similar STAPLEE method was a component of the prioritization method utilized for the 2014 plan, the scoring elements were slightly different. For the plan update, the modified STAPLEE worksheet was chosen to re-evaluate all continuing and new actions, as this was deemed a more simplified approach and ensured a consistent methodology for all continuing and new actions.

The STAPLEE prioritization method in general is a tool used to assess the costs, benefits, and overall feasibility of mitigation actions. STAPLEE stands for the following:

- **Social:** Will the action be acceptable to the community? Could it have an unfair effect on a particular segment of the population?
- **Technical:** Is the action technically feasible? Are there secondary impacts? Does it offer a long-term solution?
- **Addministrative:** Are there adequate staffing, funding, and maintenance capabilities to implement the project?
- **Political:** Will there be adequate political and public support for the project?
- **Legal:** Does your jurisdiction have the legal authority to implement the action?
- **Economic:** Is the action cost-beneficial? Is there funding available? Will the action contribute to the local economy?
- **Environmental:** Will there be negative environmental consequences from the action? Does it comply with environmental regulations? Is it consistent with community environmental goals?

Additional questions were added to the modified STAPLEE worksheet to include elements to consider mitigation effectiveness related to protection of life and reduction of damages as well as reduction in the need for response actions, and the potential for benefits to exceed the cost.

Figure 4.1 is a sample of the Action Plan worksheet. The Prioritization Section is at the bottom of the worksheet. There is a total possible prioritization score of 19. Those actions that scored 13 or higher were given a priority rating of "High". Those actions that scored 7-12 were given a priority rating of "Medium". Actions that scored less than 7 were given a rating of "Low".

Figure 4.1: Action Plan Worksheet
Story County Multi-Jurisdictional Hazard Mitigation Plan
Mitigation Action Plan Worksheet

Jurisdiction:	2018 Action Status <input type="checkbox"/> Continue Not Started <input type="checkbox"/> Continue In-Progress <input type="checkbox"/> New		Action ID: Refer to handout for continuing actions For new actions number with next sequential number after last action #.
Hazards Addressed: <input type="checkbox"/> Animal/Plant/Crop Disease <input type="checkbox"/> Dam /Levee Failure <input type="checkbox"/> Drought <input type="checkbox"/> Earthquake <input type="checkbox"/> Expansive Soils <input type="checkbox"/> Extreme Heat <input type="checkbox"/> Flash Flood	Check all that apply <input type="checkbox"/> Grass/Wildland Fire <input type="checkbox"/> Hazardous Materials Incident <input type="checkbox"/> Human Disease <input type="checkbox"/> Infrastructure Failure <input type="checkbox"/> Landslide <input type="checkbox"/> River Flooding <input type="checkbox"/> Severe Winter Storm <input type="checkbox"/> Sinkholes <input type="checkbox"/> Terrorism <input type="checkbox"/> Thunderstorm/Lightning/Hail <input type="checkbox"/> Tornado/Windstorm <input type="checkbox"/> Transportation Incident		
Action Title/Description:			
Applicable Goal Statement: Check one	<input type="checkbox"/> Goal 1 <input type="checkbox"/> Goal 2 <input type="checkbox"/> Goal 3		
Issue/Background: Why is this action needed? What is the problem?			
Obstacles to Implementing?			
Responsible Office: Which department in Jurisdiction would implement/track?			
Partners: Who would help?			
Potential Funding Source: (Grants-specific if known, local funds, combination, etc.) Check all that may apply	<input type="checkbox"/> FEMA Hazard Mitigation Assistance Grant (HMGP, PDM, or FMA) <input type="checkbox"/> Local funds, <input type="checkbox"/> In-Kind (donated), <input type="checkbox"/> Private Non-Profit, <input type="checkbox"/> Other (specify)		
Cost Estimate:	<input type="checkbox"/> Little or no cost <input type="checkbox"/> Less than \$10,000 <input type="checkbox"/> \$10,000 to \$50,000 <input type="checkbox"/> \$50,000 to \$100,000 <input type="checkbox"/> \$100,000 to \$500,000 <input type="checkbox"/> \$500,000 to \$1,000,000 <input type="checkbox"/> Over \$1,000,000		
Benefits: (Describe Losses Avoided)			
Timeline: How many years to complete?	<input type="checkbox"/> 1 yr <input type="checkbox"/> 2-3 yrs <input type="checkbox"/> 3-5 yrs	<input type="checkbox"/> More than 5 yrs. <input type="checkbox"/> Other	Completed by: (name/title/phone #)
Prioritization: Rate the questions from 0-3 0-unlikely, 1-maybe, 2-probably, or 3-definitely	If implemented, will the action result in lives saved? <input type="checkbox"/> 0, <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3 If implemented, will the action result in reduced property damages? <input type="checkbox"/> 0, <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3 If implemented, will the action reduce the need for response actions? <input type="checkbox"/> 0, <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3 If implemented, will the benefits exceed the cost? <input type="checkbox"/> 0, <input type="checkbox"/> 1, <input type="checkbox"/> 2, <input type="checkbox"/> 3		
STAPLEE Rating: Give the action a rating for each element as follows: Positive (+) Neutral (0) Negative (-)	Socially Acceptable Technically Feasible Administrative Capability Politically Desirable Legal Authority Exists Economically Beneficial Environmentally Beneficial	<input type="checkbox"/> +, <input type="checkbox"/> 0, <input type="checkbox"/> - <input type="checkbox"/> +, <input type="checkbox"/> 0, <input type="checkbox"/> - <input type="checkbox"/> +, <input type="checkbox"/> 0, <input type="checkbox"/> - <input type="checkbox"/> +, <input type="checkbox"/> 0, <input type="checkbox"/> - <input type="checkbox"/> +, <input type="checkbox"/> 0, <input type="checkbox"/> - <input type="checkbox"/> +, <input type="checkbox"/> 0, <input type="checkbox"/> - <input type="checkbox"/> +, <input type="checkbox"/> 0, <input type="checkbox"/> -	

The mitigation action summary table presenting the summary of continuing and new mitigation actions for each jurisdiction is provided in Table 4.2. In addition to the 83 actions that were continued from the previous plan, 23 new actions were identified, for a combined total of 106 actions in this updated mitigation strategy. Actions related to continued compliance with the NFIP are denoted by an asterisk.

The Action ID for each action has been carried over from the 2013 plan for continuing actions. As a result of completed and deleted actions, the Action ID does not follow a sequential order. New actions were assigned the next sequential Action ID for each jurisdiction. Following the action summary table, additional details are provided for each continuing and new action in Table 4.3. The detailed table serves as the action plan describing how each action will be implemented and administered by the local jurisdiction. The final table, Table 4.4, provides the results from the action prioritization.



Table 4.2: Mitigation Action Summary—Continuing and New Actions

Action ID	Action Title	2018 Action Status	2018 Action Status Comment	Hazards Addressed	Applicable Goal	Score	Priority
Story-1	Increase and support public education in preparedness, response and recovery relating to all hazards affecting Story County.	Continue In-Progress		All Hazards	1	12	M
Story-2	Development and implementation of a COOP/COOG plan for Story County government	Continue In-Progress		All Hazards	2	10	M
Story-3	Fixed and mobile generation capabilities on county owned buildings in order to continue operations and provide essential services in the event of a disaster or emergency.	Continue In-Progress		All Hazards	2	12	M
Story-4	Indoor warning systems to be required in all county buildings with public access	Continue In-Progress		All Hazards	1	8	M
Story-5	Promote and construct tornado safe rooms on county owned properties.	Continue In-Progress		Tornado	1	14	H
Story-6*	Continued promotion and participation in the National Flood Insurance Program (NFIP).	Continue In-Progress		River Flood	3	14	H
Story-8*	Enrollment and support of the NFIP Community Rating System (CRS) Program for the unincorporated areas of the county.	Continue In-Progress		River Flood	3	14	H
Story - 12	Develop and implement a program to provide wildfire training and preventative measures	Continue In-Progress		Grass or Wildland Fire	2	15	H
Story - 13	Develop a density-based zoning program	NEW	N/A	Animal/Plant/Crop Disease, Infrastructure Failure	2	6	L

Action ID	Action Title	2018 Action Status	2018 Action Status Comment	Hazards Addressed	Applicable Goal	Score	Priority
Story - 14	Continue participation in HUD Lead Hazard Control Program and encourage communities to consider joining when opportunity arises	NEW	N/A	Human Disease	1	16	H
Story - 15	Continue offering radon test kits	NEW	N/A	Human Disease	1	14	H
Story - 16	Communicate with IDOT, UP, IEDA, and IDOT Freight Optimization Program to determine freight train capacities and plans	NEW	N/A	Hazardous Materials Incident, Transportation Incident	1, 2	7	M
Story - 17	Develop and implement information regarding public safety to be available at community facilities	NEW	N/A	All Hazards	1, 2	14	H
AMES-1	Develop and enhance capabilities to communicate hazard-related information to City employees, other jurisdictions, and the public.	Continue In-Progress	Radio selection process underway. Consultant under contract. WPC Implemented "LoggerNet" app to more easily disseminate rainfall and river stage data from the City's monitoring network to W&PC staff responsible for flood modeling.	All Hazards	5	13	H
AMES-2	Plan for and install backup power supplies to critical facilities	Continue In-Progress	Adding backup power for new North River Valley well field. Awaiting funding for backup power in Hunziker Youth Sports Complex.	All Hazards	4	13	H

Action ID	Action Title	2018 Action Status	2018 Action Status Comment	Hazards Addressed	Applicable Goal	Score	Priority
AMES-3	Identify security and environmental vulnerabilities in utility infrastructure. Develop procedures and policies, install equipment, or modify facilities to reduce the threat of utility infrastructure failure.	Continue In-Progress	Ongoing. New water plant includes security cameras, access control, and other physical measures. Electric is animal guarding select locations where squirrels and raccoons have gotten into the system. Tree trimming is ongoing, and the entire city is trimmed on a 5-year cycle.	All Hazards	2	12	M
AMES-4	Develop plans and preventative actions, train personnel, and obtain equipment to be used to address hazards in the community in concert with other jurisdictions. These jurisdictions include other local, state, and federal agencies, and private organizations.	Continue In-Progress	Cost limits the availability of response resources.	All Hazards	3	11	M
AMES-5	Protect properties from river and flash flooding through the construction of water storage areas, building of flood protection structures, implementation of non-structural measures such as buy-outs of flood-prone properties, implementation of policies, and other measures to reduce the risk of property damage and threats to resident safety.	Continue In-Progress	Squaw Creek flood mitigation project was not selected for FEMA funding in 2018. A new application will be made.	River Flood	1	17	H

Action ID	Action Title	2018 Action Status	2018 Action Status Comment	Hazards Addressed	Applicable Goal	Score	Priority
AMES-6	Install equipment to protect critical facilities from fire	Continue In-Progress	Completed Resource Recovery Plant & WPC. Improvements were made to the fire suppression system in the Resource Recovery Plant. The new Water Plant is fully sprinkled and alarmed. Fire suppression has been completed at the Gas Turbine site. Engineering for fire suppression at the steam turbine site has started. Staff is looking at priorities of next projects.	Infrastructure Failure	2	13	H
AMES-7	Evaluate sanitary sewer infrastructure for deficiencies and improve them to reduce potential service backups in the sanitary sewer system and reduce peak flows to the treatment plant. Evaluate storm sewer infrastructure for deficiencies and improve them to reduce the potential for localized flooding.	Continue In-Progress	The sanitary sewer system evaluation is completed, and recommended improvements are being made. The study of the stormwater system should commence in FY18/19.	Flash Flood	2	16	H
AMES-9	Develop and enhance a Continuity of Operations Plan	Continue In-Progress	Project will begin in next fiscal year.	Infrastructure Failure	3	12	M
AMES-10	Evaluate the costs and benefits and consider joining the NFIP community Rating System	Continue Not Started	City Council has not initiated study.	River Flood	2	16	H

Action ID	Action Title	2018 Action Status	2018 Action Status Comment	Hazards Addressed	Applicable Goal	Score	Priority
HC-1 (Ames)	Incorporate Crime Prevention Through Environmental Design strategies into future enhancements and revisions to community design guidelines.	Continue In-Progress	Radio selection process underway. Consultant under contract. WPC Implemented "LoggerNet" app to more easily disseminate rainfall and river stage data from the City's monitoring network to W&PC staff responsible for flood modeling.	All Hazards	5	13	H
Cambridge-5	Backup generator for new Cambridge Community Center	NEW	N/A	Extreme Heat, Flash Flood, Infrastructure Failure, Severe Winter Storm, Thunderstorm/Lightning/Hail	1	16	H
Collins-3	Establish recreational area/community saferooms.	Continue In-Progress	Have identified several places with generators; don't have saferooms	Thunderstorm/Lightning/Hail, Tornado/Windstorm	1	10	M
Collins-4	Provide indoor NOAA weather radios to critical facilities, community shelters, city facilities, schools, and other identified areas.	Continue Not Started	Very little movement on this project; not set up in public buildings	Extreme Heat, Flash Flood, Severe Winter Storm, Thunderstorm/Lightning/Hail, Tornado/Windstorm	3	11	M
Collins-5	Provide training for City employees and landowners on dealing with flash flood events.	Continue In-Progress	Training for employees but not local land owners	Flash Flood	3	11	M
Collins-7	Update Stormwater System	Continue In-Progress	Completed a large portion of it, but still phases to be completed; approximately 80% of north side of town completed	Flash Flood	2	13	H

Action ID	Action Title	2018 Action Status	2018 Action Status Comment	Hazards Addressed	Applicable Goal	Score	Priority
Collins-8	Work with Story County Emergency Management to disseminate public information regarding steps citizens can take to prevent or minimize damages and risk to natural and human-caused hazards.	Continue In-Progress	Community will pass info to folks in town	Extreme Heat, Flash Flood, Hazardous Materials Incident, Infrastructure Failure, Severe Winter Storm, Sinkholes, Terrorism, Thunderstorm/Lightning/Hail, Tornado/Windstorm, Transportation Incident	3	10	M
Collins-9	Annually Review Floodplain Management Ordinance	Continue In-Progress	Not reviewed annually but will be reviewed annually into the future	River Flood	3	11	M
Colo-1	Provide multi-hazard public information	Continue Not Started		All Hazards	1	11	M
Colo-2	Develop and maintain pipeline mapping using GIS.	Continue In-Progress		Hazardous Materials Incident	1	11	M
Colo-3	Encourage adoption of manufactured home development storm shelter ordinances.	Continue In-Progress		Tornado/Windstorm	1	11	M
Colo-4	Encourage installation of protective fencing surrounding propane tanks, anhydrous ammonia tanks, and other applicable hazardous materials.	Continue Not Started		Hazardous Materials Incident	1	11	M
Colo-5	Establish policies and procedures for obtaining water from alternate sources.	Continue Not Started		Drought	1	11	M
Colo-6	Establish recreational area storm shelters.	Continue Not Started		Thunderstorm/Lightning/Hail	1	11	M
Colo-7	Identify, inventory and map areas that contain hazardous materials.	Continue Not Started		Hazardous Materials Incident	1	11	M
Colo-8	Install backup power supplies for outdoor warning sirens.	Continue Not Started		Flash Flood	1	11	M
Colo-9	Promote water conservation landscaping practices.	Continue In-Progress		Extreme Heat	1	11	M
Colo-11	Place weather radios in all public buildings	NEW	N/A	Thunderstorm/Lightning/Hail, Tornado/Windstorm	1	11	M

Action ID	Action Title	2018 Action Status	2018 Action Status Comment	Hazards Addressed	Applicable Goal	Score	Priority
Gilbert-4*	Annually review Floodplain Management Ordinance to ensure it addresses concerns related to development in the floodplain	Continue In-Progress		River Flood	1	16	H
Gilbert-5	Protection of Transformer at City Hall / Fire Station	NEW	N/A	Infrastructure Failure	2	17	H
Gilbert-6	Dutch Elm Disease Study	NEW	N/A	Animal/Plant/Crop Disease, Infrastructure Failure, Severe Winter Storm, Tornado/Windstorm	2	15	H
Gilbert-7	Protection of Ammonia Tank and Valving	NEW	N/A	Hazardous Materials Incident, Transportation Incident	1	17	H
Huxley-3	Maintain a list of sites that could be used as cooling shelters as public retreats during extreme heat events.	Continued In-Progress		Extreme Heat	1	13	H
Huxley-4*	Annual Floodplain Management Ordinance Review	Continued In-Progress		Flash Flood, River Flood, Thunderstorm/Lightning/Hail	2	16	H
Huxley-5	Safe room, continued protection	NEW	N/A	Tornado/Windstorm	1	13	H
Huxley-6	Shelter for extreme winter weather	NEW	N/A	Severe Winter Storm	1	13	H
Kelley-1	Amend and enforce ordinance regarding connection of sump pumps.	Continue In-Progress		Flash Flood, Infrastructure Failure	2	8	M
Kelley-2	Review stormwater management plan. Identify and plan flood control projects. Budget and complete improvements as needed.	Continue In-Progress		Flash Flood, Infrastructure Failure	2	16	H
Kelley-3	Provide training for City employees and landowners on dealing with flash flood events.	Continue In-Progress		Flash Flood	2	16	H

Action ID	Action Title	2018 Action Status	2018 Action Status Comment	Hazards Addressed	Applicable Goal	Score	Priority
Kelley-7	Work with Story County Emergency Management to disseminate public information regarding earthquake, hailstorm, structural failure, thunderstorm and lightening. Tornado, windstorm, and winter storm - related emergencies	Continue In-Progress		Earthquake, Infrastructure Failure, Severe Winter Storm, Thunderstorm/Lightning/Hail, Tornado/Windstorm	1	15	H
Kelley-8*	Promote Availability of Flood Insurance	Continue In-Progress		Flash Flood, River Flood	2	11	M
Maxwell-10*	Review and develop an acquisition program to remove structures from area prone to flash flooding.	Continue Not Started	Continue in plan update	Flash Flood	2	10	M
Maxwell-11*	Review and develop an acquisition program to remove structures from area prone to river flooding.	Continue In-Progress	Ongoing. Only 20 dwellings still exist in the 100-year flood plain area. City continues to work with FEMA on buyouts	River Flood	1	15	H
Maxwell-12*	Review potential to participate in the Community Rating System.	Continue Not Started	Continue in plan update	Flash Flood, River Flood	3	10	M
McCallsburg-1	Purchase/install backup power generators.	Continue In-Progress		Severe Winter Storm, Tornado/Windstorm, Flash Flood	1	12	M
McCallsburg-2*	Annually review Floodplain Management Ordinance to ensure it addresses concerns related to development in the floodplain	Continue In-Progress		River Flood	1	12	M
Nevada-1	Install backup power supplies for outdoor warning sirens.	Continue In-Progress	Reviewing testing and replacement needs; looking at batter backup	Flash Flood, Thunderstorm/Lightning/Hail, Tornado/Windstorm	1	10	M

Action ID	Action Title	2018 Action Status	2018 Action Status Comment	Hazards Addressed	Applicable Goal	Score	Priority
Nevada-2	Purchase and install outdoor warning systems.	Continue In-Progress	Reviewing testing and replacement needs; looking at batter backup	Flash Flood, Thunderstorm/Lightning/Hail, Tornado/Windstorm	1	10	M
Nevada-3*	Review potential to participate in the Community Rating System.	Continue In-Progress	Trying to improve storm sewer system	Flash Flood, River Flood	2	7	M
Nevada-4	Establish recreational area saferooms.	Continue In-Progress	Planning a rec center at Score Park in 2018	Extreme Heat, Severe Winter Storm, Thunderstorm/Lightning/Hail, Tornado/Windstorm	1	14	H
Nevada-6	Work with Story County Emergency Management to disseminate multi-hazard public information	Continue In-Progress	Part of the Alert Iowa System - Promote it	Extreme Heat, Flash Flood, Hazardous Materials Incident, River Flooding, Severe Winter Storm, Thunderstorm/Lightning/Hail, Tornado/Windstorm, Transportation Incident	1, 2, 3	18	H
Nevada-7*	Annually review Floodplain Management Ordinance to ensure it addresses concerns related to development in the floodplain	Continue In-Progress	Monitor building permit in flood plain river and stormwater system	Flash Flood, River Flood	2	13	H

Action ID	Action Title	2018 Action Status	2018 Action Status Comment	Hazards Addressed	Applicable Goal	Score	Priority
Roland-3*	Identify and plan flood control projects. Budget and complete improvements as needed.	Continue In-Progress	Work has been completed to help with sanitary sewer backup into basements with a new trunk line, interceptor sewer, and lift station. Work is continuing to be looked at for sanitary sewer rehab. Some storm sewer work has been completed, more needs done. A sump pump ordinance has been adopted and properties were initially inspected and are again at time of sale. A storm water retention basin has been looked at for the SE area of town. A storm water retention wetland has been looked at for the start of the small stream going through town. The timeline goal is 5 years.	River Flood	5	15	H

Action ID	Action Title	2018 Action Status	2018 Action Status Comment	Hazards Addressed	Applicable Goal	Score	Priority
Roland-4	Work with Story County Conservation Board which makes specialized equipment available for rent to assist in planting native grasses, trees, and shrubs for erosion control and water quality improvements.	Continue In-Progress	A water quality project paid for through the SRF Sponsored Project is currently being worked on with support from the County and IDNR. The wetland storm project also has support of the County and IDNR.	All Hazards	5	14	H
Roland-7	W. Maple Street Bridge Replacement	NEW	N/A	Infrastructure Failure, River Flooding, Transportation Incident	1	15	H
Sheldahl-1	City-wide pump replacement for weakened or old pumps	NEW	N/A	Flash Flood, Infrastructure Failure	2	13	H
Slater-2*	Create and maintain a GIS-based review system to document local floodplain permits, LOMRs, LOMAs, and additional studies regarding the floodplain.	Continue In-Progress	Continue in plan update	River Flood	2	8	M
Slater-3	Develop and adopt a stormwater management plan.	Continue In-Progress	working with Four Mile Creek Watershed Management	Flash Flood, River Flood	2	12	M
Slater-4	Disseminate information on flood proofing to community residents.	Continue In-Progress	Ongoing	Flash Flood, River Flood	2	13	H
Slater-8	Identify, inventory and map areas that contain hazardous materials.	Continue In-Progress	Ongoing	Hazardous Materials Incident	1	15	H
Slater-13	Utilize Iowa Public Television wild land fire awareness video as a training film for volunteer fire departments with a certification process.	Continue In-Progress	Ongoing	Grass or Wildland Fire	2	4	L

Action ID	Action Title	2018 Action Status	2018 Action Status Comment	Hazards Addressed	Applicable Goal	Score	Priority
Slater-14	Work with Story County Conservation Board which makes specialized equipment available for rent to assist in planting native grasses, trees, and shrubs for erosion control and water quality improvements.	Continue In-Progress	Continue to work with Story County Conservation on plantings along creek and north of creek	Flash Flood, River Flood	2	8	M
Slater-15	Work with Story County Emergency Management to disseminate public information regarding Severe weather-related emergencies and provide a storm shelter / safe room.	Continue In-Progress	Ongoing / As needed; storm shelter added to this action	Severe Winter Storm, Thunderstorm/Lightning/Hail, Tornado/Windstorm	1	9	M
Story City-1	Create a water conservation public awareness and educational campaign, including educational materials on water conservation measures to implement during drought periods.	Continue In-Progress	Met with Riverbend Golf Course and school officials on this item	Drought	3	11	M
Story City-6*	Annually review Floodplain Management Ordinance to ensure it addresses concerns related to development in the floodplain	Continue In-Progress	Reviewed	River Flood	3	14	H
Story City-7	Tornado Safety / Conference Emergency Room	NEW	N/A	Tornado/Windstorm	3	13	H
Story City-8	Update Tornado Sirens	NEW	N/A	Tornado/Windstorm	1	12	M
Story City-9	Wastewater Treatment Plant - Flood Control	NEW	N/A	River Flooding	2	10	M
USD Ames-4	Assure safe areas are available at school facilities for personnel to seek refuge or protection during severe weather events	NEW	N/A	Extreme Heat, Severe Winter Storm, Terrorism, Thunderstorm/Lightning/Hail, Tornado/Windstorm	1	11	M

Action ID	Action Title	2018 Action Status	2018 Action Status Comment	Hazards Addressed	Applicable Goal	Score	Priority
USD Ames-5	Install systems inside buildings to monitor and stop unauthorized intruders from terrorism or vandalism. Install camera systems inside buildings. Install additional barriers and devices to compartmentalize interior building spaces to reduce unauthorized access inside the entire building. New installation – 7 buildings, upgrades to 2 buildings. Provide communications link to rescue/response resources.	NEW	N/A	Terrorism	1, 3	12	M
USD Ballard-1	Revise Evacuation/Emergency Plans and practice drills	Continue In-Progress	Working with an outside vendor to conduct a comprehensive rewriting of plans	All Hazards	1, 2, 3	16	H
USD Collins-Maxwell-2	Crisis Management Plan Development and Implementation	NEW	N/A	Hazardous Materials Incident, Severe Winter Storm, Thunderstorm/Lightning/Hail, Tornado/Windstorm, Transportation Incident	1, 2, 3	16	H
USD Colo-Nesco-1	Tornado Saferoom	Continue Not Started		Tornado/Windstorm	1	10	M
USD Gilbert-1	Construct a saferoom	Continue Not Started		Tornado/Windstorm	1	13	H
Nevada CSD-3	Room-level emergency notification help buttons	NEW	N/A	Terrorism	3	13	H

Action ID	Action Title	2018 Action Status	2018 Action Status Comment	Hazards Addressed	Applicable Goal	Score	Priority
Nevada CSD-4	Emergency notification system	NEW	N/A	Extreme Heat, Hazardous Materials Incident, Human Disease, Infrastructure Failure, Severe Winter Storm, Terrorism, Thunderstorm/Lightning/Hail, Tornado/Windstorm, Transportation Incident	2	14	H
Nevada CSD-5	Construct facilities at new baseball field for shelter due to inclement of weather	NEW	N/A	Thunderstorm/Lightning/Hail, Tornado/Windstorm	1	13	H
USD Roland-Story-1	Construct Saferooms in Schools	Continue Not Started		Thunderstorm/Lightning/Hail, Tornado/Windstorm	1	14	H
ISU-1	Protect properties and structures from river and flash flooding through the construction of water storage areas, building of flood protection structures, removal of flood-prone properties, implementation of policies, and other measures to reduce the risk of property damage and threats to resident safety.	Continue In-Progress	On going. ISU modified three flood prone facilities with flood gates and berms to protect them from flood events. Lied Recreation Facility, Scheman Building, Hilton Coliseum. ISU modified storm water routing at General Services Building to reduce flooding exposure to lower levels of building.	River Flood	1	15	H
ISU-2	Evaluate storm sewer and sanitary infrastructure for deficiencies and improve them to reduce service backups and localized flooding.	Continue In-Progress	Ongoing. ISU modifying storm water infrastructure on west side of campus to reduce service backups and localized flooding, FY18/19 project.	Flash Flood	2	15	H

Action ID	Action Title	2018 Action Status	2018 Action Status Comment	Hazards Addressed	Applicable Goal	Score	Priority
ISU-3	Construct safe rooms or retrofit current structures to provide protection to occupants in the event of tornado or severe weather.	Continue In-Progress	1-2 years after funding is secured	Tornado	1	14	H
ISU-4	Purchase and install monitoring equipment for creeks & rivers along with flood monitoring software to increase flood warning time.	Continue In-Progress	On going. Currently utilizing Iowa Flood Information System and USGS National Streamflow Information Program to monitor Squaw Creek and Skunk River.	River Flood	2	11	M
F-11	Conduct regular creek maintenance in creeks and floodplain areas. This program clears and removes debris that could contribute to blockage and flooding and may include the removal of silt in areas of high risk to flood damage.	Continue In-Progress	Ongoing	River Flood	2	15	H
HC-13	Develop plans and preventative actions, train personnel, and identify key resources to be used to address hazards on campus in concert with other jurisdictions. These jurisdictions include local, state, and federal agencies, and private organizations.	Continue In-Progress	Ongoing	All Hazards	3	12	M
HC-5	Prepare a site-specific vulnerability assessment of critical facilities that use the best available science and technology with regard to human- caused hazards.	Continue In-Progress	Ongoing	Terrorism	2	19	H

Action ID	Action Title	2018 Action Status	2018 Action Status Comment	Hazards Addressed	Applicable Goal	Score	Priority
HC-9	Purchase detection equipment and/or canines to allow bomb sweeps prior to high consequence events and as needed. Also implement training and procedures to allow effective use of equipment/canines.	Continue In-Progress	1-2 years after funding is secured	Terrorism	1	18	H
MH-10	Address vulnerabilities to critical infrastructure [including utilities, power plant, sanitation, water wells, people (student, staff), large venues, communications/IT, electronic information, research enterprises (viral/bacterial agents, genetics, intellectual capital/property, field research, etc.), security, heavy equipment, mass transportation, and food storage and distribution] to determine plans, resources and equipment necessary to mitigate risks and provide continuity of operations during catastrophic events.	Continue In-Progress	Ongoing	All Hazards	2	19	H

Action ID	Action Title	2018 Action Status	2018 Action Status Comment	Hazards Addressed	Applicable Goal	Score	Priority
MH-8	Develop Comprehensive Emergency Operations Plan and identify necessary resources to support planning, training and exercises.	Continue In-Progress	Ongoing. ISU has developed a Comprehensive Emergency Operation Plan. A web-based departmental emergency plan is being developed and will be available to university units by end of year. Funding must be secured for training and exercising plans.	All Hazards	3	19	H
SW-2	Develop and implement education/outreach programs to improve preparedness efforts to minimize property damage and minimize injury or loss of life.	Continue In-Progress	Ongoing	All Hazards	1	18	H
SW-4	Develop and enhance capabilities (warning systems and facilities) to communicate hazard-related information to university community, City of Ames, other jurisdictions, and the public.	Continue In-Progress	Ongoing. ISU has new mass notification vendor and will be exploring additional warning capabilities (apps, etc.). Current EOC has been retrofitted with back-up power, but hardening facilities to tornado shelters will take additional funding.	All Hazards	5	18	H

Note: * denotes actions related to continued compliance with the NFIP; Priority ratings: H=High, M=Medium, L=Low

Table 4.3: Mitigation Action Implementation Strategy—Continuing and New Actions

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
Story-1	Public Education of the risks and hazards and how to prepare the public is key to protect lives and reduce injury during disaster. The public will also understand expectations during disaster response and recovery.	Staff time to complete and publish the materials. Staff time to go out into the County for presentations. Staff time to complete and publish the materials. Staff time to go out into the County for presentations.	Story County Board of Supervisors will set objectives and will be lead for education for those with access and functional needs. The BOS can set objectives for Planning and Development and the BOS representative on the County Conservation Board can bring suggestion to this organization.	Story County Board of Supervisors, County Conservation, Planning and Development, Medical Reserve Corp, Retired and Senior Volunteer Program, Heartland, members of the Coalition for Disaster Recovery, Story County Emergency Management Agency	Potential Funding Source Local funds and Citizen Corp Program grant funds	Unknown	The public will be better prepared to care for themselves for the first 72 hours of a disaster relieving the pressure on local responders and resources. Conservation/Planning and Development education on water management could lead to reduced flooding.	Other - Ongoing

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
Story-2	Story County government consists of critical facilities and infrastructure that currently do not have adequate plans to ensure the continuation of government in the event of a disaster or emergency. Development of this plan will ensure that County government will allow Story County government the ability to enhance their ability to continue operations when impacted by disaster or emergency with a minimum investment of resources.	Elected officials cannot be required to participate, well trained staff to conduct COOP/COOG training, and staff time.	Story County Board of Supervisors and establish objectives and require implementation with department heads while requesting compliance with elected officials.	Story County Emergency Management Agency	Local funds	Unknown, staff time	The Story County Administration has responsibilities that range from providing law and order to long term storage of official documents. Failure to provide these services can result in injury/death due to lawlessness and failure to provide first responder communications along with significant disruption of commercial interest.	Other - Ongoing

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
Story-3	Not all Story County buildings have adequate back up power to provide essential services during a disaster or emergency electrical service is lost. Many essential services would cease during prolonged power outages and endangering public health and negatively impacting commerce.	Cost	Each department will need to identify essential functions and develop concepts of operations to execute these activities with minimal electrical needs. Story County Facilities Management will need to facilitate the engineering studies.	Story County Board of Supervisors, Story County Emergency Management	Hazard Mitigation Grant funds and local funds	Unknown	Electrical power is essential for Story County Administration provide law and order and other essential functions. Failure to provide these services can result in injury/death due to lawlessness to significant disruption of commercial interest.	More than 5 years
Story-4	Story County buildings do not have the capability to warn the public who access the building other than by face to face communication of the event of severe weather or other threats. There are parts of county building where the public may not interact with county staff to warn them of the event.	Cost and staff time to develop, conduct training, and testing of procedures to use system	Story County Facilities Management	Story County Board of Supervisors, Story County Emergency Management, Story County Information Technology	Local funds	Unknown	Notification of the public in county buildings will save lives as it will notify them of the need to seek shelter in a severe weather event or avoid accident and intentional threats.	3-5 years

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
Story-5	Currently no county building has a tornado safe room for the public who utilize County facilities daily. County Conservation manages public camp grounds during the summer that only have limited sheltering capabilities which is undersized and inadequate to withstand a significant tornado event.	Cost	Story County Facilities Maintenance, Planning and Development, and Board of Supervisors	The Story County Safety Committee, department heads, and elected officials	FEMA Hazard Mitigation Assistance Grants, Local funds	Over \$1,000,000	Lives can be saved for county employees and the public who access county buildings or conservation sites.	3-5 years
Story-6	Story County has participated in the NFIP program in the past. This action was not included in the County mitigation strategies in the 2009 plan. Through the provisions of NFIP, flood risk is studied and documented, and the public becomes more aware of flooding risk when purchasing properties.	None	Story County Planning & Development	Story County Board of Supervisors	N/A	Unknown	The NFIP should help encourage plans and policies to reduce the risk of flooding	3-5 years

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
Story-8	With adoption of the revised FIRMS in 2008, the number of properties with structures location in the special flood hazard area increased substantially, along with increasing interest and requirements by lenders for flood insurance. As the Biggert-Waters Act of 2012 is implemented, many of the policies based upon use of grandfathering clauses (post 2008) will lose this benefit and experience substantial premium increases.	Time and staff resources	Story County Board of Supervisors	Emergency Management, Story County Engineer's Officer, Story County Conservation, IDNR, Planning and Development	N/A	Minimal-staff time	Story County, with our regulations already in place along with the state minimums which exceed the NFIP, should likely go in at a CRS level 7. This will result in reduced premiums for those with flood insurance.	Other - Ongoing
Story - 12	Wildfire fighting in many aspects is fundamentally different than structure fire fighting. Wildfire fighting capacity within the county could be significantly improved by facilitating training of local fire departments.	Staff time to schedule and conduct training. Favorable weather and environmental conditions.	Story County Board of Supervisors and Story County Conservation Board will set objectives. Story County Conservation Board will be responsible for implementation.	Story County Board of Supervisors, Story County Conservation Board, Story County Emergency Management Agency, Iowa Department of Natural Resources, Story County Fire Chiefs	Local funds and Living Roadways Trust Fund grants	Unknown	Fire Departments will be better prepared to respond to wildfires	Other - Ongoing

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
Story - 13	Potential conflicts exist between agricultural and non-agricultural uses. The majority of land in unincorporated Story County is agricultural, and there are potential impacts of non-ag uses on those ag uses nearby.	Staff time to develop and ability to adopt and enforce regulations.	Story County Planning and Development	Story County Board of Supervisors, Story County Conservation Board, Story County Planning and Zoning Commission	Local funds	Staff time	Farmers may have viable alternatives to converting large parcels of productive agricultural land to a non-agricultural use. with a density-based zoning program and may help minimize conflicts.	2-3 years
Story - 14	Story County has an older housing stock, and many of the structures could potentially contain lead-based paints and materials.	Staff time to promote program and ability to adopt and enforce regulations. Lack of interest of incorporated communities to participate.	Story County Environmental Health Department	Story County Board of Supervisors, Story County Planning and Development	Local funds, Other - HUD Grant funds	\$10,000 to \$50,000	Ensuring that housing has healthy indoor air that is free from pollutants such as mold, carbon monoxide, and radon, and is constructed from materials that do not contain hazardous elements, such as lead or asbestos reduces potential negative health impacts.	Other - Ongoing

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
Story - 15	Radon is a naturally occurring gas that is invisible, odorless, and tasteless that can be found throughout the United States. Radon comes from the natural (radioactive) breakdown of uranium occurring in soil, rock, and water. Radon gas can enter into any type of building (homes, offices, schools) which can then lead to a high indoor radon gas level in the air you breathe. Lung cancer is the only health effect which has been definitively linked to radon gas exposure. Radon gas is the second leading cause of lung cancer in the United States.	Staff time to promote program and ability to purchase kits if grant funding is not available.	Story County Environmental Health Department	Story County Board of Supervisors, Story County Planning and Development	Local funds, Other - Grant funds	Less than \$10,000	Ensuring that housing has healthy indoor air that is free from pollutants such as mold, carbon monoxide, and radon, and is constructed from materials that do not contain hazardous elements, such as lead or asbestos reduces potential negative health impacts.	Other - Ongoing

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
Story - 16	The Union Pacific (UP) Railroad controls three major rail lines running through and within Story County and permitting 143 tons gross weight cars and unit trains. As these pass-through communities, materials are being carried that if derailment were to occur, could have costly impacts.	Communication amongst all entities is necessary for addressing issues.	Story County Board of Supervisors	Story County Emergency Management Agency, Story County Planning and Development, Story County Engineer, IEDA, IDOT, UP	Local funds	Less than \$10,000	Collaboration allows partners to identify and prioritize investment opportunities for an optimized freight transportation network to lower transportation costs for Iowa businesses and promote business growth in Iowa while addressing connectivity and security issues.	More than 5 years
Story - 17	The County is committed to protecting people and maintaining a high level of communication to ensure County residents remain safe and informed. Safety and communication are vital to the welfare of the Story County residents	None	Story County Board of Supervisors	Story County Emergency Management Agency, Story County Sheriff's Office, Story County Facilities Management, Story County Information Technology, Story County Conservation	Local funds	Little or no cost	Strategy allows Story County to support and maintain high-quality County facilities and services to meet the needs of residents.	2-3 years

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
AMES-1	Continued coverage of the outdoor warning system is needed as the City grows, and newer technologies to model and communicate hazards citywide or to specific groups are needed to help provide directions in the event of an imminent disaster. The City must continue to upgrade communications equipment to effectively marshal resources before, during, and after disasters of all types.	Cost	Police, Water & Pollution Control, Electric, Fire, Information Services	ISU	Hazard Mitigation Assistance Grants	Unknown	Reduces risk of personal injury through warnings of severe weather. Communication technologies that are tied to utility users can provide faster identification of infrastructure failure and faster repair, therefore limiting economic losses. Newer radio systems reduce interference, have better coverage areas, and provide encryption and security of messages.	2-3 yrs
AMES-2	All of the City's water wells are connected to just one source of electricity. In the event of an extended power outage, water production would stop, and the safety of the drinking water supply could be threatened.	Cost	Water and Pollution Control, Electric		Water Fund	\$570,000	Reduces the risk of a water utility shutdown in the event of an extended power outage to the water wells	2-3 yrs

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
AMES-3	Portions of the City's utilities infrastructure are not fully controlled for remote site access, leaving open the possibility of unauthorized access and tampering. Portions of the City's electrical infrastructure require additional guarding to reduce outages associated with high winds, ice, tornadoes, and animals.	Cost	Water and Pollution Control, Public Works, Electric	ISU	Water fund, Electric Fund	\$100,000 (remote site access); \$308,000 annually (tree trimming)	Reduces the risk of tampering with utility infrastructure, contamination of water supply, or electrical outages	3-5 yrs
AMES-4	The City of Ames is home to several local, state, and federal offices. Planning is required to ensure that responses of these offices are coordinated with the City's response. This is particularly important for law enforcement responses coordinated with Iowa State University Police. Specialized equipment is necessary to train and effectively protect unique facilities.		Police, Fire	ISU, Story County, State of Iowa, U.S. Department of Agriculture, U.S. Department of Energy	Unknown		Improves response communication and sharing of resources during an emergency, which can shorten duration or lessen the impact of a hazard event. This would reduce the danger to lives and property	2-3 yrs

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
AMES-5	The City of Ames has experienced substantial river flooding and localized flooding on multiple occasions. This flooding has caused interruptions in utilities and services, lost productivity, and property damage.	Cost, access to land, disruption or destruction of historic structures and wildlife, political opposition	Water and Pollution Control, Public Works, Planning and Housing	ISU, Story County, Iowa DOT, Iowa DNR	General Fund, Transit Fund, grants, loans	Up to \$1.5 billion	Reduce the extent of flooding within the City limits. The more radical potential measures have estimated annual benefits of \$3,250,900	More than 5 yrs
AMES-6	Part of the Resource Recovery Plant's facility does not have adequate fire protection. Additionally, the City Power Plant has no fire protection systems in the turbine/generators, either gas turbines, the maintenance shop, or over the coal handling system. These locations are all parts of critical facilities. A fire in any of these systems could significantly diminish the City's ability to provide essential utilities to residents.	Cost, technical challenges	Electric, Public Works, Water & Pollution Control		Electric Fund, G.O. Bonds	\$1,603,969 (Power Plant/Gas Turbines); \$505,370 (Resource Recovery System)	Reduces the likelihood of a catastrophic fire at the utilities, and subsequent reduction of service	2-3 yrs

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
AMES-7	During heavy rains, residents in some portions of Ames experience sanitary or storm sewer backups on their property. Excess flow to the Water Pollution Control Facility increases treatment costs and presents environmental challenges	Cost	Public Works	Storm Sewer Fund, Sewer Fund, State Revolving Loan Fund	Storm Sewer Fund, Sewer Fund, State Revolving Loan Fund	\$19,665,000	Reduction in property damage due to sanitary and storm sewer backups	More than 5 yrs
AMES-9	In the event of a disaster that disrupts the City's ability to provide essential services, there is currently no plan to provide services from temporary locations. This increases the risk of infrastructure failure immediately after an initial disaster.	Large scale of project	Risk Manager		Unknown	unknown	Provides a plan to resume providing essential City services in the event of a disaster. This prevents shutdowns of service (infrastructure failure) following an initiating disaster.	2-3 yrs

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
AMES-10	The City of Ames is susceptible to river flooding and participates in the National Flood Insurance Program. The Community Rating System would encourage the City to consider above-and-beyond measures to reduce flooding risk. It would also reduce flood insurance premiums for those residents that are insured and increase awareness of flood plain regulations and restrictions.	Staff time	Planning and Housing		General Fund	Unknown	Reduced destruction during a flood event due to mitigation measures required by the program, reduced premiums for flood-insured properties. Increased community awareness of flood plain regulations and restrictions	1 yr
HC-1 (Ames)	City-owned or critical facilities may present a target for criminal activity. As new facilities are added, a review using CPTED principles may reduce the propensity for crime to occur at those facilities. These principles can also be applied to reduce crime in neighborhoods.	Training needed or cost for consultant. Time for developing a program	Police, Planning and Housing		General Fund, Grant Funding	unknown	Reduced crime in the community, lowered risk for crime at critical facilities	2-3 yrs

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
Cambridge-5	Existing fire station is inadequate for City of Cambridge's Emergency Shelter Requirements	Sources of funding	Cambridge Public Works		FEMA Grant, Local funds	\$10,000 to \$50,000	Provides superior location for Cambridge Elementary School students in case of an emergency requiring an evacuation. Would also provide shelter for hazards addressed as listed.	1 year
Collins-3	Limited areas to take refuge from storms. Not all homes in town have basements ... many that do, experience flooding during heavy rains.	Funding	Elected Officials-City council/Mayor, Public Works	FEMA; IEMD; possibly another entity who would benefit from a dual-purpose facility.	FEMA Grant, Local funds, In-Kind	\$100,000 to \$500,000	Loss of life or physical harm	Determined by funding
Collins-4	Source of early notification is needed for inclement weather that has the potential for destruction and loss of life	Funding (city hall did receive a free NOAA radio from story county excess inventory several years ago).	Public Works, Elected Officials	City, Hazard Mitigation Assistance Grant	FEMA Grant, Local funds, In-Kind	Little or No Cost	Loss of life or physical harm	Other
Collins-5	Collins is prone to flash flooding	Finding training opportunities for citizens	Public Works, Elected Officials		FEMA Grant, Local funds, In-Kind	Little or No Cost	Individual Safety and minimization of individual property loss	Other

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
Collins-7	City of Collins is prone to flooding issues. The existing stormwater system is insufficient; runoff from agricultural land inundates system.	Funding	Elected Officials/ Public Works Dept.	City, CDBG, FEMA, SRF, Grants	FEMA Grant, Local funds, In-Kind	Over \$1,000,000	Minimize flooding and potential property loss	3-5 yrs
Collins-8	Communication between City and County	None	Story County, Collins Public Works & Elected Officials	Story County & City of Collins	Other: Minimal Cost - Basic Communication	Little or No Cost	Communication	Other
Collins-9	The City of Collins participates in the NFIP and has a floodplain management ordinance to regulate development in the floodplain; not currently reviewed annually but will be reviewed annually in the future	None	City Clerk, Public Works, Elected Officials	Iowa Department of Natural Resources	Local funds	Little or No Cost	Minimize flood risk to future development	Other
Colo-1	Citizens need to be aware of potential hazards	None	Fire & Rescue	Mayor City Council Clerk, Story Co, Emergency Manager	Local Funds	Little or no cost	Avoid potential loss to life and property	Ongoing
Colo-2	Supplement paper mapping system/faster access to gather pipeline information	Cost	City Clerk	Story County GIS Coordinator/ City Engineer	Local Funds	Little or no cost	Less down-time for utilities	3-5 yrs
Colo-3	Possible loss of life in manufactured housing developments	Mfg. housing developers	City Attorney	City Attorney/Mayor/ City council	FEMA Grant, Local funds	No estimate	Prevent loss of life or personal injury	3-5 yrs

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
Colo-4	Propane/anhydrous ammonia tanks stored in open-possible access by unauthorized individuals	Cost	City Attorney/ Mayor/ Council/ Clerk, Fire & Rescue	Story County Emergency Management/L ocal Coop	Local Funds	No Estimate	Prevent loss of life or personal injury	3-5 yrs
Colo-5	Need for water supply if local supply is interrupted/contaminated	Cost	Mayor/Council/ City Clerk	Story County Emergency Management	Local	No Estimate	Prevent loss of life and property	3-5 yrs
Colo-6	Protection for participants/spectators using recreation areas	Cost	Mayor/Council, Recreation Board	Story County Emergency Management	FEMA Grant, Local funds	No Estimate	Prevent loss of life	3-5 yrs
Colo-7	Hazardous Material storage areas need to be identified	Cooperation from private business	Fire & Rescue	Story County Emergency Management	Local	Little or no cost	Prevent loss of life and property	3-5 yrs
Colo-8	Outdoor warning sirens need to be operable at all times	Cost	Fire & Rescue	Story County Emergency Management	FEMA Grant, Local funds	No Estimate	Prevent loss of life	3-5 yrs
Colo-9	Excessive water runoff needs to be minimized	Public acceptance	Mayor/Council/ City Attorney	Local landscape architects and contractors	Local funds	Little or no cost	Minimize property damage	3-5 yrs
Colo-11	Citizens need to be informed if a storm is moving in	None	City	Local Fire Dept.	Local funds, Private Non-Profit	Little or no cost	Increase warning time to citizens	1 yr
Gilbert-4	To insure compliance with applicable federal rules and regulations	None	City Clerk/City Council	Iowa Department of Natural Resources	None	Unknown	N/A	Ongoing
Gilbert-5	Currently is vulnerable to being hit by car or truck turning into parking lot or veering off street	Funding, utility approval	City of Gilbert	Fire Dept., Fire Agency	FEMA Grant, Local funds	\$10,000 to \$50,000	Loss of electrical service is reduced to City Hall and Fire Dept.	2-3 yrs
Gilbert-6	Determining size and number of trees affected with their location	funding, staffing	City of Gilbert	DNR, County Conservation	FEMA Grant, Local funds	\$10,000 to \$50,000	Define scope of tree disease	2-3 yrs

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
Gilbert-7	Tank and valve are vulnerable to being hit by truck causing accidental release	funding, business cooperation	City of Gilbert	Business	FEMA Grant, Local funds, Other - business	\$50,000 to \$100,000	Protect from release for workers, public, students	2-3 yrs
Huxley-3	Give public a place to go to escape extreme heat periods or power outages during summer months	None	Police Dept. / Fire Dept.		Local funds	Little or no cost	Avoid loss of life due to extreme heat	1 year
Huxley-4	This is necessary to ensure the city is doing what it needs to protect city and private property from flooding. Flash floods due to heavy short period rains.	None	Public Works/ Administration/ Engineers		Local funds	Unknown	Residential and street flooding	Other - Annually
Huxley-5	To protect lives during tornado and windstorm events, give shelter	None	Police Dept. / Fire Dept.		Local funds	Little or no cost	Avoid loss of life	1 year
Huxley-6	For stranded travelers, people with loss of heat	None	Police Dept. / Fire Dept.		Local funds	Little or no cost	Avoid loss of life	1 year
Kelley-1	Storm water drainage entering sanitary sewers from illegal connections causing enormous spikes in the costs for sanitary treatment.	gaining access to private residents for inspections; cost of correcting	Safe Building & Compliance	City Staff	Local funds	Less than \$10,000	Lower sanitary sewer treatment costs	3-5 yrs
Kelley-2	Localized flooding into low lying area causes property damage to public and private property - chronic issue	Funding	Outside engineering contractors, farm land owner, DNR, County Conservation	City of Kelley, elected officials, Story Co. Emergency Management, USACE	FEMA Grant	\$500,000 to \$1,000,000	Reduce damages to private and public property as a result of flooding	More than 5 yrs

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
Kelley-3	Provide educations materials for current and future staff and landowners so that may be more proactive with their property	Public Participation	Elected Officials	City Hall, Story County Emergency Management	Local funds	Little or no cost	Reduce damages to private and public property	1 yr
Kelley-7	Need ongoing/updated info to new residents as needed	Public Awareness	City of Kelley City Clerk	Story County Emergency management	Local funds	Little or no cost	reduce losses as a result of public awareness	1 yr
Kelley-8	Citizens may not be aware of the availability of flood insurance	Public Awareness	City of Kelley City Clerk	Story County Emergency management	Local funds	Little or no cost	increase flood insurance coverage for residential and commercial property in the City; reduce "out of pocket" loss	1 yr
Maxwell-10	The City has little storm drainage infrastructure and, consequently, storm water during heavy rains drain across backyards where it ponds or causes flooded basements. Curbs, gutters, and storm drains along with targeted acquisitions will reduce property damage.	Funding of improvements	City Council / Mayor		Local funds	Over \$1,000,000	Reduced damage to private and public property due to prolonged ponding from flash flooding	More than 5 yrs
Maxwell-11	The city is bordered on the East and West by creeks that have a tendency to flood. Flooding damages residential properties costing residents money and time to repair and clean up damages.	Availability of FEMA funding	City Council/Mayor		FEMA Grants, Local funds	Over \$1,000,000	Minimize property damages and personal injuries related to major flash flooding.	More than 5 yrs

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
Maxwell-12	The city is bordered on the East and West by creeks that have a tendency to flood. Flooding damages residential properties costing residents money and time to repair and clean up damages. Participating in the CRS could provide reduced insurance rates and other benefits to the city and residents.	Staff time to research problem for City Council action	Council/Mayor		Local funds	Little or no cost	Potential to reduce expenses related to flood insurance premiums	2-3 yrs
McCallsburg-1	In case of power failure, McCallsburg is not set up to provide shelter to citizens with appropriate heat or air conditioning. By hopefully installing a generator on the new geothermal system, emergency shelter can be provided when electricity non-functional.	Cost	City Clerk/ City Council in conjunction with Fire Department	Fire Department	Tax Increment Funding	Unknown	Avoid injuries or fatalities associated with extreme temperature conditions (cold and heat) that could occur with power failure	3-5 years
McCallsburg-2	To insure compliance with applicable federal rule and regulation	None	City Clerk/City Council	Iowa Department of Natural Resources	None	Unknown	N/A	Other-Ongoing
Nevada-1	1999 sirens have no batteries; no sirens when we have a power failure	Lack of funding	City of Nevada Public Safety Dept.	NPSD, City of Nevada	FEMA Grant, Local funds	\$10,000 to \$50,000	Back up to activate siren in power outage	2-3 yrs
Nevada-2	Unsure of age, working to get tested and in a replacement schedule	Lack of funding and time to remove & test	Nevada Public Safety Dept.	City of Nevada	Local funds	\$50,000 to \$100,000	Malfunction of siren	3-5 yrs

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
Nevada-3	Trying to evaluate storm sewer system in low areas to improve flooding potential	Staff limitations & lack of funding	City of Nevada P&Z, Streets, WWTP	IDNR	Local funds	Unknown	Minimize flash flood conditions	More than 5 yrs
Nevada-4	No saferoom @ SCORE Park	Lack of funding, planning for a rec center 2019/20	City of Nevada, Parks & Rec Dept.	Private Donation, City of Nevada, Story County	FEMA Grant, Local funds, Private Non-Profit, Other - Naming Rights Revenue	Over \$1,000,000	Storm shelter - cooling area	2-3 yrs
Nevada-6	Need to get info out to public in times of emergencies	None	Nevada Public Safety Dept.	Story Co, EM & SO, NFD, State EMS & EM	FEMA Grant, Local funds	Little or no cost	Imp.	1 yr
Nevada-7	Prevent possible damage to structures, utilities, roadways	None	City of Nevada, P&Z Dept, Streets Dept.	Story County Assessor & Recorder	Local funds	Little or no cost	Lower risk of property damage	Other - Ongoing
Roland-3	Previous events have caused damages that may be preventable if flood control projects are implemented	None	Street Dept.	None Identified	Combination of funds; local, grants, etc.	Unknown	Better understanding of problems and plan to minimize damages	3-5 yrs
Roland-4	Assistance is needed to help prevent erosion	None	City Clerk	None Identified	Combination of funds; local, etc.	Unknown	Reduce erosion	3-5 yrs
Roland-7	The bridge has been deemed structurally deficient by inspectors	Funding, closing road would cut town in half causing an eight-mile detour for residents	Public Works Director	Federal Grants, City Engineer, City Council	Local funds	Unknown	None provided	2-3 years

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
Sheldahl-1	Excessive and repeating rains have overloaded individual systems and there was excessive property damage on many properties during this past rain on 6/30/2018. With this last rain, 8 pumps were weakened significantly.	Cost. Future weather incidents	City of Sheldahl City worker Matt Rardin and various City Council members	Story County Emergency Management, Polk County Emergency Management, Boone County Emergency Management	FEMA Grant, Local Funds, In-Kind	\$100,000 to \$500,000	Per pump replacement cost is approximately \$1,200. Replacing the 8 weakened pumps would avoid almost \$10,000 worth of losses. Replacing the entire town's pumps (135) would reach approximately \$162,000. This number does not include the cost of household damage that insurance may not cover.	3-5 years
Slater-2	Changes regarding recognized floodplain areas, requiring insurance occur w/ LOMA/LOMR, etc. The City needs a good GIS-based system to track this.	funding, staff resources	City Administration, Public Works	None	Local funds	Less than \$10,000	Information for property owners	2-3 yrs
Slater-3	Prevent flooding and damage to property	change in condition with each rainfall	Public Works Department	Four Mile Creek Watershed Management	FEMA Grant, Local funds	\$10,000 to \$50,000	holds property values	3-5 yrs
Slater-4	Change in floodplain areas and change in property ownership	constant change in ownership	City Administration	None	Local funds	Little or no cost	maintaining property valuation	Other - Ongoing
Slater-8	identify hazards	unknown storage	Fire Department	HazMat Services	None identified	Little or no cost	Lives saved, injuries reduced	Other - Ongoing

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
Slater-13	Grassland and cropland directly next to housing and infrastructure	None	Slater Volunteer Fire Dept. and First Responders	Slater EMS and Slater Public Works	Local funds	Little or no cost	Structure and crop loss	Other - Ongoing
Slater-14	Erosion control to minimize flooding potential and to improve water quality	None	Public Works Department, Story County Conservation	DNR, Story County Conservation, Garden Club Chapter	Local funds, In-Kind, Private Non-Profit	Little or no cost	Watershed maintenance benefits all	More than 5 yrs
Slater-15	Ongoing issue - need quicker weather updates and more accurate weather forecasts	none	City Staff, Fire Chief, EMS, Story County Emergency Management	FEMA/State	FEMA Grant, Local funds, Other	Over \$1,000,000	Property loss and damage to structures	1 yr
Story City-1	To educate public on water conservation. Getting the information to the public. Continue meeting with golf course and school on water conservation.	Time	City Administration	None identified	None identified	Little or no cost	By educating the public your water usage will be decreased and the need for more costly remedies will be avoided.	1 yr
Story City-6	Annually review floodplain ordinance to insure compliance with applicable federal rule and regulation	Time	City Administration	Iowa Department of Natural Resources	None identified	Little or no cost		2-3 yrs
Story City-7	Community safety	Logistics and Cost	Undetermined	None identified	Private Non-Profit, Other	\$100,000 to \$500,000		More than 5 yrs
Story City-8	Old sirens have significant age to them and don't have battery backup	Cost	Fire Department	None identified	Local funds	\$50,000 to \$100,000		3-5 yrs

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
Story City-9	Build a concrete wall around the Parshall flume (where water comes into the plant). Required to sandbag each time threat of flood.	Cost	Wastewater Department	None identified	Local funds	Unknown	Help with potential flooding of plant	3-5 yrs
USD Ames-4	Assure a safe area of the new High School building for occupants to seek refuge or protection during severe weather events	Time, Money	Facilities Planning and Management	N/A	Local funds	Over \$1,000,000		3-5 years
USD Ames-5	In response to school shootings, we want to increase safety features within buildings to mitigate loss of life in the event of a shooter in the building.	Time, Money	Facilities Planning and Management	N/A	Local funds	\$100,000 to \$500,000		2-3 years
USD Ballard-1	The school district has new buildings and new additions. As a result, plans need to be revised to ensure safety of students and staff.	Time and resources	District Safety Coordinator	Story Co. Emergency Management, Story Co Sherriff, Huxley, Slater, and Cambridge first responders	Local funds	\$10,000 to \$50,000	Life safety, avoid injury	2-3 yrs
USD Collins-Maxwell-2	Campus safety and crisis management plans need to reflect current best practice and adhere to legal requirements	time and resources	Superintendent's Office	Story Co Emergency Management, Story Co. Sherriff, Collins and Maxwell first responders	Not identified	Not identified	Not identified	2-3 yrs

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
USD Colo-Nesco-1	Story Co. has a history of tornadic conditions. Over eight million dollars of damage have been done over a period of the last 60 years. While the county has a great deal of open area communities and schools are at risk for major damage and loss of life. Our students are in multiple communities and buildings putting all of them in danger. There is no real place to go in case of tornado	Lack of funding	Colo-NESCO Community School District	None	FEMA Hazard Mitigation Assistance Grant; Private Non-Profit	\$500,000 to \$1,000,000	By providing a protected space the odds of saving lives increases dramatically by providing a safe place for students and staff to go should a tornado hit.	3-5 years
USD Gilbert-1	The school district has constructed one saferoom in accordance with FEMA design standards and would like to construct another one; need more room to handle more students	Lack of funding	District Office	FEMA, State and County officials, Story County Emergency Management	FEMA Hazard Mitigation Assistance Grant, Local Funds, Private Non-Profit	\$500,000 to \$1,000,000	Prevent injuries and loss of life	1 year
Nevada CSD-3	Need ability for individual classrooms to contact out in case of emergencies	Price, technology choice	Admin, Technology, Buildings	Vendor	Local funds	\$50,000 to \$100,000	Human	1 yr
Nevada CSD-4	Need ability to contact groups of people in various emergencies	Price, technology	Technology, Admin	Vendor	Local funds	Less than \$10,000	Human	1 yr
Nevada CSD-5	Unexpected weather at our remote site	Price	Buildings & Grounds, Admin	City of Nevada	Local funds	Over \$1,000,000	Human	1 yr

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
USD Roland-Story-1	Schools do not currently have saferooms to provide a safe area of refuge for students and staff during extreme weather events	Cost	Superintendent's Office	Iowa Homeland Security & Emergency Management, FEMA	FEMA Hazard Mitigation Assistance Grant; school district revenue	Over \$1,000,000	Avoid injury and loss of life for students, staff, and community	3-5 yrs
ISU-1	The City of Ames and ISU have experienced substantial river flooding on multiple occasions. This flooding has caused interruptions in utilities and services, lost productivity, and property damage.	Cost, access to land, disruption or destruction of historic structures and wildlife, political opposition	ISU Facilities Planning & Management	Ames Water and Pollution Control, Ames Public Works, Story County, Iowa DOT, Iowa DNR	ISU Funding, Grant Funding	Up to \$1.5 billion	Reduce the extent of flooding within the City limits. The more radical potential measures have estimated annual benefits of \$3,250,900.	10 years
ISU-2	During heavy rains, some ISU buildings experience sanitary or storm sewer backups.	Cost	ISU Facilities Planning & Management	Ames Public Works	ISU Funding, Grant Funding	\$19,665,000	Reduction in property damage due to sanitary and storm sewer backups	5 years
ISU-3	ISU has locations of conferencing, gathering, and general operations which can be enhanced with addition and construction of storm shelters.	Cost/Time	ISU Facilities Planning & Management	ISU Police, ISU FP&M, ISU Risk Management, ISU EH&S, City of Ames	ISU Funding, Grant Funding	TBD	Protect life and reduce personal injury.	1-2 years after funding is secured
ISU-4	Ability to forecast flood activity accurately and implement flood response plans effectively will reduce property damage.	Cost	ISU Facilities Planning & Management	City of Ames, NWS, Corp of Engineers, Iowa Flood Monitoring System	ISU Funding, Grant Funding	TBD	Reduction in property damage and improving utilization of emergency personnel.	1-2 years after funding is secured

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
F-11	University and City of Ames are vulnerable to flooding and flash flooding events. Significant flooding events occurred in 1993 and 2010 with many minor flooding events occurring prior to these years.	Cost/Time	ISU Facilities Planning & Management	City of Ames, Story County, State of Iowa	ISU Funding, Grant Funding	TBD	Reduce property damage.	Ongoing
HC-13	ISU has many research facilities and large event venues. Planning is required to ensure response to these facilities is coordinated with local response agencies. This is particularly important for law enforcement response coordinated with Ames Police.	Cost/Time	ISU Police	City of Ames, Story County, State of Iowa, U.S. Department of Agriculture, U.S. Department of Energy	ISU Funding, Grant Funding	TBD	Improve response communication and sharing of resources during an emergency, which can shorten duration or lessen the impact of a hazard event. This would reduce the danger to lives and property	Ongoing

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
HC-5	ISU has large, robust, and highly integrated infrastructures. Identifying critical linkages and vulnerabilities in the infrastructures is important to ensure ISU facilities and properties are safe for use by emergency personnel, displaced persons, and for routine operations.	Cost/Time	ISU Facilities Planning & Management, IT Services, ISU Police	City of Ames, Story County	ISU Funding, Grant Funding	TBD	Reduce the risk of tampering with utility infrastructure, contamination of water supply, electrical outages, tampering with electronic data, communications outages, safety of research, safety of students, faculty, staff, visitors, animals, plants.	Ongoing
HC-9	ISU has many research facilities and large event venues that could be targets for terrorists. Having the ability to conduct bomb sweeps with canines or detection equipment would enhance the safety of these facilities.	Cost	ISU Police	Ames Police	ISU Funding, Grant Funding	TBD	Reduce property damage and risk of personal injury.	1-2 years after funding is secured

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
MH-10	ISU has large, robust, and highly integrated infrastructures. Identifying critical linkages and vulnerabilities in the infrastructures is important to ensure ISU facilities and properties are safe for use by emergency personnel, displaced persons, and for routine operations.	Cost/Time	ISU Facilities Planning & Management, IT Services, ISU Police	City of Ames, Story County	ISU Funding, Grant Funding	TBD	Reduce the risk of tampering with utility infrastructure, contamination of water supply, electrical outages, tampering with electronic data, communications outages, safety of research, safety of students, faculty, staff, visitors, animals, plants.	Ongoing
MH-8	Many ISU departments have their own Emergency Operations Plan, but they are not tied together by a single comprehensive plan for the entire university.	Cost/Time	ISU Environmental Health & Safety	ISU Police, ISU FP&M, ISU Risk Management	ISU Funding, Grant Funding	TBD	Protect life and reduce personal injury.	Ongoing
SW-2	University and City of Ames are responsible for their communities' public awareness and education to improve emergency preparedness and minimize property damage and personal injury.	Cost/Time	Environmental Health and Safety Department, University Police, Facilities Planning & Management	City of Ames, Story County, State of Iowa	ISU Funding, Grant Funding	TBD	Reduce property damage and risk of personal injury.	Ongoing

Action ID	Issue/Background	Obstacles	Responsible Office	Partners	Potential Funding Source(s)	Cost Estimate	Benefits	Timeline
SW-4	Expanded coverage of outdoor warning system is needed as City/university grows, and newer technologies to model and communicate hazards are needed to help provide directions in the event of an imminent disaster. Upgrading communication centers to tornado safe shelters to be able to continue to both receive vital requests for assistance and to be able to provide emergency information to the community before, during and after an event. Upgrading emergency operation centers to tornado shelters to be able to continue to both receive vital requests for assistance and to be able to provide information to the community before, during and after an event.	Cost	ISU Police, ISU FP&M	Ames Police, City of Ames	ISU Funding, Grant Funding	TBD	Reduce risk of personal injury through warnings of severe weather. Communication technologies that are tied to utility users can provide faster identification of infrastructure failure and faster repair, therefore limiting economic losses.	5 years

Table 4.4: Action Prioritization

Action ID	Mitigation Action Title / Description	Lives Saved?	Reduced Property Damages ?	Reduce need for response actions?	Will benefits exceed cost?	Social	Technical	Administrative	Political	Legal	Economic	Environment	Score	Priority
		0-unlikely, 1-maybe, 2-probably, or 3-definitely				Positive (1) Neutral (0) Negative (-1)								
Story-1	Increase and support public education in preparedness, response and recovery relating to all hazards affecting Story County.	1	1	2	2	1	1	1	1	1	1	0	12	M
Story-2	Development and implementation of a COOP/COOG plan for Story County government	1	1	0	2	1	1	1	1	1	1	0	10	M
Story-3	Fixed and mobile generation capabilities on county owned buildings in order to continue operations and provide essential services in the event of a disaster or emergency.	1	0	2	3	1	1	1	1	1	1	0	12	M
Story-4	Indoor warning systems to be required in all county buildings with public access	1	0	0	2	1	1	1	1	1	0	0	8	M
Story-5	Promote and construct tornado safe rooms on county owned properties.	3	0	2	3	1	1	1	1	1	1	0	14	H
Story-6	Continued promotion and participation in the National Flood Insurance Program (NFIP).	1	2	1	3	1	1	1	1	1	1	1	14	H
Story-8	Enrollment and support of the NFIP Community Rating System (CRS) Program for the unincorporated areas of the county.	1	2	2	2	1	1	1	1	1	1	1	14	H
Story - 12	Develop and implement a program to provide wildfire training and preventative measures	1	2	2	3	1	1	1	1	1	1	1	15	H
Story - 13	Develop a density-based zoning program	0	1	0	1	0	1	1	-1	1	1	1	6	L
Story - 14	Continue participation in HUD Lead Hazard Control Program and encourage communities to consider joining when opportunity arises	3	1	2	3	1	1	1	1	1	1	1	16	H
Story - 15	Continue offering radon test kits	3	1	0	3	1	1	1	1	1	1	1	14	H
Story - 16	Communicate with IDOT, UP, IEDA, and IDOT Freight Optimization Program to determine freight train capacities and plans	2	2	0	2	1	-1	-1	0	0	1	1	7	M

Action ID	Mitigation Action Title / Description	Lives Saved?	Reduced Property Damages ?	Reduce need for response actions?	Will benefits exceed cost?	Social	Technical	Administrative	Political	Legal	Economic	Environment	Score	Priority
		0-unlikely, 1-maybe, 2-probably, or 3-definitely				Positive (1) Neutral (0) Negative (-1)								
Story - 17	Develop and implement information regarding public safety to be available at community facilities	1	2	1	3	1	1	1	1	1	1	1	14	H
AMES-1	Develop and enhance capabilities to communicate hazard-related information to City employees, other jurisdictions, and the public.	2	1	2	3	1	1	1	1	1	0	0	13	H
AMES-2	Plan for and install backup power supplies to critical facilities	1	1	2	3	1	1	1	1	1	1	0	13	H
AMES-3	Identify security and environmental vulnerabilities in utility infrastructure. Develop procedures and policies, install equipment, or modify facilities to reduce the threat of utility infrastructure failure.	1	1	2	2	1	1	1	1	1	1	0	12	M
AMES-4	Develop plans and preventative actions, train personnel, and obtain equipment to be used to address hazards in the community in concert with other jurisdictions. These jurisdictions include other local, state, and federal agencies, and private organizations.	1	1	1	2	1	1	1	1	1	1	0	11	M
AMES-5	Protect properties from river and flash flooding through the construction of water storage areas, building of flood protection structures, implementation of non-structural measures such as buy-outs of flood-prone properties, implementation of policies, and other measures to reduce the risk of property damage and threats to resident safety.	3	3	2	3	0	1	1	1	1	1	1	17	H
AMES-6	Install equipment to protect critical facilities from fire	1	2	2	2	1	1	1	1	1	1	0	13	H

Action ID	Mitigation Action Title / Description	Lives Saved?	Reduced Property Damages ?	Reduce need for response actions?	Will benefits exceed cost?	Social	Technical	Administrative	Political	Legal	Economic	Environment	Score	Priority
		0-unlikely, 1-maybe, 2-probably, or 3-definitely				Positive (1) Neutral (0) Negative (-1)								
AMES-7	Evaluate sanitary sewer infrastructure for deficiencies and improve them to reduce potential service backups in the sanitary sewer system and reduce peak flows to the treatment plant. Evaluate storm sewer infrastructure for deficiencies and improve them to reduce the potential for localized flooding.	1	3	2	3	1	1	1	1	1	1	1	16	H
AMES-9	Develop and enhance a Continuity of Operations Plan	1	1	2	3	1	1	1	1	1	0	0	12	M
AMES-10	Evaluate the costs and benefits and consider joining the NFIP community Rating System	2	2	2	3	1	1	1	1	1	1	1	16	H
HC-1 (Ames)	Incorporate Crime Prevention Through Environmental Design strategies into future enhancements and revisions to community design guidelines.	1	2	2	2	1	1	1	1	1	1	0	13	H
Cambridge-5	Backup generator for new Cambridge Community Center	3	1	3	3	1	1	1	1	1	1	0	16	H
Collins-3	Establish recreational area/community saferooms.	1	0	2	2	1	1	1	1	1	0	0	10	M
Collins-4	Provide indoor NOAA weather radios to critical facilities, community shelters, city facilities, schools, and other identified areas.	1	0	2	3	1	1	1	1	1	0	0	11	M
Collins-5	Provide training for City employees and landowners on dealing with flash flood events.	1	0	2	3	1	1	1	1	1	0	0	11	M
Collins-7	Update Stormwater System	0	3	2	2	1	1	1	1	1	0	1	13	H
Collins-8	Work with Story County Emergency Management to disseminate public information regarding steps citizens can take to prevent or minimize damages and risk to natural and human-caused hazards.	1	1	2	0	1	1	1	1	1	0	1	10	M

Action ID	Mitigation Action Title / Description	Lives Saved?	Reduced Property Damages ?	Reduce need for response actions?	Will benefits exceed cost?	Social	Technical	Administrative	Political	Legal	Economic	Environment	Score	Priority
		0-unlikely, 1-maybe, 2-probably, or 3-definitely				Positive (1) Neutral (0) Negative (-1)								
Collins-9	Annually Review Floodplain Management Ordinance	1	1	2	0	1	1	1	1	1	1	1	11	M
Colo-1	Provide multi-hazard public information	3	1	1	1	1	1	1	0	1	0	1	11	M
Colo-2	Develop and maintain pipeline mapping using GIS.	3	1	1	1	1	1	1	0	1	0	1	11	M
Colo-3	Encourage adoption of manufactured home development storm shelter ordinances.	3	1	1	1	1	1	1	0	1	0	1	11	M
Colo-4	Encourage installation of protective fencing surrounding propane tanks, anhydrous ammonia tanks, and other applicable hazardous materials.	3	1	1	1	1	1	1	0	1	0	1	11	M
Colo-5	Establish policies and procedures for obtaining water from alternate sources.	3	1	1	1	1	1	1	0	1	0	1	11	M
Colo-6	Establish recreational area storm shelters.	3	1	1	1	1	1	1	0	1	0	1	11	M
Colo-7	Identify, inventory and map areas that contain hazardous materials.	3	1	1	1	1	1	1	0	1	0	1	11	M
Colo-8	Install backup power supplies for outdoor warning sirens.	3	1	1	1	1	1	1	0	1	0	1	11	M
Colo-9	Promote water conservation landscaping practices.	3	1	1	1	1	1	1	0	1	0	1	11	M
Colo-11	Place weather radios in all public buildings	2	1	1	1	1	1	1	1	1	1	0	11	M
Gilbert-4	Annually review Floodplain Management Ordinance to ensure it addresses concerns related to development in the floodplain	1	2	3	3	1	1	1	1	1	1	1	16	H
Gilbert-5	Protection of Transformer at City Hall / Fire Station	2	3	3	3	1	1	1	1	1	1	0	17	H
Gilbert-6	Dutch Elm Disease Study	1	2	3	3	1	1	1	1	0	1	1	15	H
Gilbert-7	Protection of Ammonia Tank and Valving	3	3	3	3	1	1	0	1	0	1	1	17	H
Huxley-3	Maintain a list of sites that could be used as cooling shelters as public retreats during extreme heat events.	3	0	0	3	1	1	1	1	1	1	1	13	H

Action ID	Mitigation Action Title / Description	Lives Saved?	Reduced Property Damages ?	Reduce need for response actions?	Will benefits exceed cost?	Social	Technical	Administrative	Political	Legal	Economic	Environment	Score	Priority
		0-unlikely, 1-maybe, 2-probably, or 3-definitely				Positive (1) Neutral (0) Negative (-1)								
Huxley-4	Annual Floodplain Management Ordinance Review	1	3	2	3	1	1	1	1	1	1	1	16	H
Huxley-5	Safe room, continued protection	3	0	0	3	1	1	1	1	1	1	1	13	H
Huxley-6	Shelter for extreme winter weather	3	0	0	3	1	1	1	1	1	1	1	13	H
Kelley-1	Amend and enforce ordinance regarding connection of sump pumps.	0	0	0	3	0	1	1	0	1	1	1	8	M
Kelley-2	Review stormwater management plan. Identify and plan flood control projects. Budget and complete improvements as needed.	0	3	3	3	1	1	1	1	1	1	1	16	H
Kelley-3	Provide training for City employees and landowners on dealing with flash flood events.	0	3	3	3	1	1	1	1	1	1	1	16	H
Kelley-7	Work with Story County Emergency Management to disseminate public information regarding earthquake, hailstorm, structural failure, thunderstorm and lightening. Tornado, windstorm, and winter storm - related emergencies	2	1	2	3	1	1	1	1	1	1	1	15	H
Kelley-8	Promote Availability of Flood Insurance	0	1	0	3	1	1	1	1	1	1	1	11	M
Maxwell-10	Review and develop an acquisition program to remove structures from area prone to flash flooding.	0	2	3	1	0	1	1	1	1	0	0	10	M
Maxwell-11	Review and develop an acquisition program to remove structures from area prone to river flooding.	1	3	3	1	1	1	1	1	1	1	1	15	H
Maxwell-12	Review potential to participate in the Community Rating System.	0	1	1	3	1	1	1	1	1	0	0	10	M
McCallsburg-1	Purchase/install backup power generators.	3	2	1	3	1	1	1	1	-1	-1	1	12	M

Action ID	Mitigation Action Title / Description	Lives Saved?	Reduced Property Damages ?	Reduce need for response actions?	Will benefits exceed cost?	Social	Technical	Administrative	Political	Legal	Economic	Environment	Score	Priority
		0-unlikely, 1-maybe, 2-probably, or 3-definitely				Positive (1) Neutral (0) Negative (-1)								
McCallsburg-2	Annually review Floodplain Management Ordinance to ensure it addresses concerns related to development in the floodplain	3	2	1	3	1	1	1	1	-1	-1	1	12	M
Nevada-1	Install backup power supplies for outdoor warning sirens.	3	0	0	3	1	1	1	1	-1	0	1	10	M
Nevada-2	Purchase and install outdoor warning systems.	3	0	0	3	1	1	1	1	-1	0	1	10	M
Nevada-3	Review potential to participate in the Community Rating System.	0	3	2	1	1	-1	0	1	0	-1	1	7	M
Nevada-4	Establish recreational area saferooms.	3	0	3	3	1	1	1	1	-1	1	1	14	H
Nevada-6	Work with Story County Emergency Management to disseminate multi- hazard public information	3	2	3	3	1	1	1	1	1	1	1	18	H
Nevada-7	Annually review Floodplain Management Ordinance to ensure it addresses concerns related to development in the floodplain	0	3	1	3	1	1	1	1	0	1	1	13	H
Roland-3	Identify and plan flood control projects. Budget and complete improvements as needed.	2	2	1	3	1	1	1	1	1	1	1	15	H
Roland-4	Work with Story County Conservation Board which makes specialized equipment available for rent to assist in planting native grasses, trees, and shrubs for erosion control and water quality improvements.	0	2	2	3	1	1	1	1	1	1	1	14	H
Roland-7	W. Maple Street Bridge Replacement	1	2	3	3	1	1	1	1	1	1	0	15	H
Sheldahl-1	City-wide pump replacement for weakened or old pumps	0	3	2	3	1	1	1	-1	1	1	1	13	H
Slater-2	Create and maintain a GIS-based review system to document local floodplain permits, LOMRs, LOMAs, and additional studies regarding the floodplain.	0	3	1	2	0	0	1	0	0	0	1	8	M

Action ID	Mitigation Action Title / Description	Lives Saved?	Reduced Property Damages ?	Reduce need for response actions?	Will benefits exceed cost?	Social	Technical	Administrative	Political	Legal	Economic	Environment	Score	Priority
		0-unlikely, 1-maybe, 2-probably, or 3-definitely				Positive (1) Neutral (0) Negative (-1)								
Slater-3	Develop and adopt a stormwater management plan.	0	3	2	3	1	0	0	0	1	1	1	12	M
Slater-4	Disseminate information on flood proofing to community residents.	0	3	2	2	1	1	1	0	1	1	1	13	H
Slater-8	Identify, inventory and map areas that contain hazardous materials.	3	3	0	3	1	1	1	0	1	1	1	15	H
Slater-13	Utilize Iowa Public Television wild land fire awareness video as a training film for volunteer fire departments with a certification process.	1	2	0	0	0	0	1	0	1	-1	0	4	L
Slater-14	Work with Story County Conservation Board which makes specialized equipment available for rent to assist in planting native grasses, trees, and shrubs for erosion control and water quality improvements.	0	1	1	2	1	1	1	0	0	0	1	8	M
Slater-15	Work with Story County Emergency Management to disseminate public information regarding Severe weather-related emergencies and provide a storm shelter / safe room.	1	3	2	0	1	1	0	0	1	0	0	9	M
Story City-1	Create a water conservation public awareness and educational campaign, including educational materials on water conservation measures to implement during drought periods.	1	0	2	3	1	1	1	-1	1	1	1	11	M
Story City-6	Annually review Floodplain Management Ordinance to ensure it addresses concerns related to development in the floodplain	0	3	2	2	1	1	1	1	1	1	1	14	H
Story City-7	Tornado Safety / Conference Emergency Room	3	1	2	2	1	1	1	1	1	0	0	13	H
Story City-8	Update Tornado Sirens	3	2	2	0	1	1	1	1	1	1	-1	12	M
Story City-9	Wastewater Treatment Plant - Flood Control	0	2	2	1	1	1	1	1	1	0	0	10	M
USD Ames-4	Protected refuge is in building for storms in New High School	1	1	0	3	1	1	1	1	0	1	1	11	M

Action ID	Mitigation Action Title / Description	Lives Saved?	Reduced Property Damages ?	Reduce need for response actions?	Will benefits exceed cost?	Social	Technical	Administrative	Political	Legal	Economic	Environment	Score	Priority
		0-unlikely, 1-maybe, 2-probably, or 3-definitely				Positive (1) Neutral (0) Negative (-1)								
USD Ames-5	Install systems inside buildings to monitor and stop unauthorized intruders from terrorism or vandalism. Install camera systems inside buildings. Install additional barriers and devices to compartmentalize interior building spaces to reduce unauthorized access inside the entire building. New installation – 7 buildings, upgrades to 2 buildings. Provide communications link to rescue/response resources.	2	1	0	3	1	1	1	1	0	1	1	12	M
USD Ballard-1	Revise Evacuation/Emergency Plans and practice drills	3	3	0	3	1	1	1	1	1	1	1	16	H
USD Collins-Maxwell-2	Crisis Management Plan Development and Implementation	3	3	0	3	1	1	1	1	1	1	1	16	H
USD Colo-Nesco-1	Tornado Saferoom	1	0	2	1	1	1	1	1	1	0	1	10	M
USD Gilbert-1	Construct a saferoom	3	0	1	3	1	1	1	1	1	1	0	13	H
Nevada CSD-3	Room-level emergency notification help buttons	3	0	0	3	1	1	1	1	1	1	1	13	H
Nevada CSD-4	Emergency notification system	3	1	0	3	1	1	1	1	1	1	1	14	H
Nevada CSD-5	Construct facilities at new baseball field for shelter due to inclement of weather	1	0	2	3	1	1	1	1	1	1	1	13	H
USD Roland-Story-1	Construct Saferooms in Schools	3	0	3	3	1	1	1	1	1	0	0	14	H

Action ID	Mitigation Action Title / Description	Lives Saved?	Reduced Property Damages ?	Reduce need for response actions?	Will benefits exceed cost?	Social	Technical	Administrative	Political	Legal	Economic	Environment	Score	Priority
		0-unlikely, 1-maybe, 2-probably, or 3-definitely				Positive (1) Neutral (0) Negative (-1)								
ISU-1	Protect properties and structures from river and flash flooding through the construction of water storage areas, building of flood protection structures, removal of flood-prone properties, implementation of policies, and other measures to reduce the risk of property damage and threats to resident safety.	2	3	3	2	1	1	1	1	0	1	0	15	H
ISU-2	Evaluate storm sewer and sanitary infrastructure for deficiencies and improve them to reduce service backups and localized flooding.	1	3	3	2	1	1	1	1	0	1	1	15	H
ISU-3	Construct safe rooms or retrofit current structures to provide protection to occupants in the event of tornado or severe weather.	3	0	2	3	1	1	1	1	1	1	0	14	H
ISU-4	Purchase and install monitoring equipment for creeks & rivers along with flood monitoring software to increase flood warning time.	2	0	1	2	1	1	1	1	1	1	0	11	M
F-11	Conduct regular creek maintenance in creeks and floodplain areas. This program clears and removes debris that could contribute to blockage and flooding and may include the removal of silt in areas of high risk to flood damage.	1	3	3	2	1	1	1	1	0	1	1	15	H
HC-13	Develop plans and preventative actions, train personnel, and identify key resources to be used to address hazards on campus in concert with other jurisdictions. These jurisdictions include local, state, and federal agencies, and private organizations.	3	1	0	2	1	1	1	1	1	1	0	12	M

Action ID	Mitigation Action Title / Description	Lives Saved?	Reduced Property Damages ?	Reduce need for response actions?	Will benefits exceed cost?	Social	Technical	Administrative	Political	Legal	Economic	Environment	Score	Priority
		0-unlikely, 1-maybe, 2-probably, or 3-definitely				Positive (1) Neutral (0) Negative (-1)								
HC-5	Prepare a site-specific vulnerability assessment of critical facilities that use the best available science and technology with regard to human-caused hazards.	3	3	3	3	1	1	1	1	1	1	1	19	H
HC-9	Purchase detection equipment and/or canines to allow bomb sweeps prior to high consequence events and as needed. Also implement training and procedures to allow effective use of equipment/canines.	3	3	3	3	1	1	1	1	1	1	0	18	H
MH-10	Address vulnerabilities to critical infrastructure [including utilities, power plant, sanitation, water wells, people (student, staff), large venues, communications/IT, electronic information, research enterprises (viral/bacterial agents, genetics, intellectual capital/property, field research, etc.), security, heavy equipment, mass transportation, and food storage and distribution] to determine plans, resources and equipment necessary to mitigate risks and provide continuity of operations during catastrophic events.	3	3	3	3	1	1	1	1	1	1	1	19	H
MH-8	Develop Comprehensive Emergency Operations Plan and identify necessary resources to support planning, training and exercises.	3	3	3	3	1	1	1	1	1	1	1	19	H
SW-2	Develop and implement education/outreach programs to improve preparedness efforts to minimize property damage and minimize injury or loss of life.	3	3	3	3	1	1	1	1	1	1	0	18	H

Action ID	Mitigation Action Title / Description	Lives Saved?	Reduced Property Damages ?	Reduce need for response actions?	Will benefits exceed cost?	Social	Technical	Administrative	Political	Legal	Economic	Environment	Score	Priority
		0-unlikely, 1-maybe, 2-probably, or 3-definitely				Positive (1) Neutral (0) Negative (-1)								
SW-4	Develop and enhance capabilities (warning systems and facilities) to communicate hazard-related information to university community, City of Ames, other jurisdictions, and the public.	3	3	3	3	1	1	1	1	1	1	0	18	H

5 PLAN MAINTENANCE PROCESS

5 Plan Maintenance Process.....	5-1
5.1 Previous Efforts to Monitor, Evaluate, and Update the Plan	5-1
5.2 Monitoring, Evaluating, and Updating the Plan	5-1
5.2.1 Hazard Mitigation Planning Committee (HMPC)	5-4
5.2.2 Plan Maintenance Schedule	5-5
5.2.3 Plan Maintenance Process	5-5
5.3 Incorporation into Existing Planning Mechanisms	5-1
5.3.1 Incorporation of Updated Hazard Mitigation Plan into existing Planning Mechanisms	5-1
5.4 Continued Public Involvement	5-6

This chapter provides an overview of the overall strategy for plan maintenance and outlines the method and schedule for monitoring, updating and evaluating the plan. The chapter also discusses incorporating the plan into existing planning mechanisms and how to address continued public involvement.

5.1 Previous Efforts to Monitor, Evaluate, and Update the Plan

Since approval of the *2014 Story County Multi-Jurisdictional Hazard Mitigation Plan*, Story County and the HMPC have demonstrated a commitment to monitoring, evaluating, and updating the plan with formal annual meetings. These meetings included a review of the plan, a discussion of progress in implementation of mitigation actions, and a discussion of available mitigation action funding.

5.2 Incorporation into Existing Planning Mechanisms

44 CFR 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.

Many of the small jurisdictions in Story County do not have standing formal planning mechanisms such as a Comprehensive Plan through which formal integration of mitigation actions can be documented. As a result, activities that occur in these small communities are developed through annual budget planning, regular City Council Meetings and other community forums rather than a formal planning process. Planning mechanisms that do exist to some degree within the participating jurisdictions include:

- Comprehensive Plans
- Various ordinances of participating jurisdictions
- Emergency Operations Plans
- Infrastructure Plans
- Capital Improvement Plans

For a detailed summary of planning mechanisms and other mitigation-related capabilities, see Chapter 2.

5.2.1 Incorporation of Updated Hazard Mitigation Plan into existing Planning Mechanisms

Where possible, plan participants will use existing plans and/or programs to implement hazard mitigation actions.

Table 5.1 provides additional details on each jurisdiction regarding how the 2014 Hazard Mitigation Plan was integrated into existing planning mechanisms as well as the strategy going forward to integrate this plan update into existing planning mechanisms.

Table 5.1: Integration of Previous Plan and Strategies to Integrate Plan Update

Jurisdiction	Incorporation of 2014 Plan into Existing Planning Mechanisms	Integration Process for Plan Update
Story County	The previous plan was incorporated into the Continuity of Operations and Continuity of Government Plan (COOP-COG), C2C Comprehensive Plan, Strategic Plan, and Capital Improvements Plan.	This update will be incorporated into C2C annual reviews, COOP-COG annual reviews, the Strategic Plan update, and annual CIPs.
Ames	Hazard mitigation activities were incorporated in the City's Capital Improvement Plan (CIP), which is reviewed and updated every fiscal year.	This update will continue to be incorporated into the City's CIP. Additionally, it can be integrated into the City of Ames' new Comprehensive Plan, which is under development and will include land use and growth policies in coordination with a broader range of issues related to mitigation such as environmental/ sustainability policies and public infrastructure capacity.
Cambridge	The City incorporated the plan into infrastructure improvements: In 2017, the City of Cambridge installed a branch storm sewer line connecting the existing storm water system of approximately 1000 feet long and 24-inch diameter to the corner of Race and Center street. Two large intakes were installed to facilitate flow of storm water and help minimize flash flooding in that area.	This update will also be incorporated into the City's infrastructure plan: 2018 plans are to install a branch line at the sanitary sewer lift station located at the corner of 4th Street and Vine. During heavy rain events the sanitary sewer system becomes overburdened causing backups into the basements allowing storm water to drain from an area prone to localized flooding during a flash flooding event.
Collins	The plan was incorporated through community surveys, the development of the capital improvement plan, and the stormwater improvement plan.	This update will be integrating when the City reviews and revises its capital improvement plan.
Colo	Integration efforts not reported.	Plans for integration not reported.
Gilbert	The previous plan was integrated into the City's Emergency Operations Plan.	The plan update will be reviewed when planning future capital investments and when updating the land use plan.
Huxley	The City incorporated the plan into infrastructure improvements: a stormwater lines project was completed, and sump pump lines were connected into storm sewers.	The City could incorporate mitigation planning into the upcoming CIP and into new development within the town.
Kelley	The City implemented and finished a fresh water project connected the City of Kelley with Xenia rural water district.	The City can incorporate mitigation plans into flash flood issues and work on a water/wetland program with area farmers and DNR. The plan will be incorporated into the City's infrastructure plan.

Jurisdiction	Incorporation of 2014 Plan into Existing Planning Mechanisms	Integration Process for Plan Update
Maxwell	The plan was integrated into annual staff and Council reviews on handling heavy rain events and river flooding. It was also incorporated into spring and fall newsletters to the public, providing information on what to do in the event of storm damage, flash flooding, and river flooding. Emergency weather radios are available upon request to residents through integration of the plan with City funding.	The plan update will continue to be incorporated into the annual staff and Council reviews, the spring and fall newsletters, and the provision of emergency weather radios. The plan will also be integrated with a facility improvement plan to improve storm sewers to better handle flash flooding and with the City's Capital Improvements Plan and Infrastructure Plan.
McCallsburg	No integration occurred.	The community will be going through infrastructure planning initiatives in the next few years and will incorporate the hazard mitigation plan into this effort.
Nevada	The City of Nevada used the Hazard Mitigation Plan in preparing their internal disaster recovery plan. The Hazard Mitigation Plan was a driver in the Comprehensive Plan in planning for the upcoming Recreation Center at SCORE Park as well as the flood plain management. We also used the Hazard Mitigation Plan in the CIP as we prepare to put the warning sirens on a replacement schedule moving forward.	The plan will continue to be integrated in comprehensive planning and capital improvements planning. Both the Comp Plan and CIP caused the City of Nevada to review their infrastructure planning in preparation of the siren locations and recreation Center. The City will continue to review its infrastructure plan to integrate hazard mitigation.
Roland	No integration occurred.	The plan will be taken into consideration next time City Council meets to come up with a comprehensive plan, which includes CIP and infrastructure plan.
Sheldahl	No integration occurred.	This mitigation action plan will be reviewed when planning future tile work and infrastructure projects as well as potential growth areas of the city. The plan will be incorporated into the City's infrastructure plan.
Slater	The plan was incorporated into stormwater retention and control. Completed permeable paver project to slow down runoff into creek bed.	Safe building planning will proceed for school safety and trailer park housing safety. The plan will be incorporated into the comprehensive plan, capital improvement plan, and City infrastructure plan.
Story City	The plan was reviewed as part of the update to the City Comprehensive Plan completed in 2016 and was considered with the CIP and Financial Forecasting Plans.	The updated plan will continue to be considered with CIP and Financial Planning and integrated with any updates or implementation of the Comprehensive Plan.
Ames CSD	The plan was included in the construction program that began in 2014.	The district's mitigation actions will be integrated with school infrastructure and emergency planning. Funding is approved for camera systems and the project is in process. The safe areas in the new high school will be included in the design which is underway.
Ballard CSD	No integration occurred	The plan will be incorporated into campus safety planning for capital improvement projects and new construction and will be integrated into the school infrastructure plan.

Jurisdiction	Incorporation of 2014 Plan into Existing Planning Mechanisms	Integration Process for Plan Update
Collins-Maxwell CSD	No integration occurred	The plan will be incorporated into campus safety planning for capital improvement projects and new construction and will be integrated into the school infrastructure plan.
Colo-NESCO CSD	No integration occurred	The plan will be integrated with the Capital Improvement Plan, School Infrastructure Plan, and School Emergency Plan, and action could happen with a bond issue.
Gilbert CSD	No integration occurred	As the school looks at future facility planning, the hazard mitigation plan may be included in that planning.
Nevada CSD	The plan was integrated with construction and infrastructure plans, and a tornado saferoom was constructed.	The plan update will continue to be integrated with the school's infrastructure and emergency plans as well as Nevada's comprehensive plan, capital improvement plan, and infrastructure plan.
Roland-Story CSD	The previous plan was incorporated into the school infrastructure plan, but those phases of the plan were never completed.	This update will be incorporated into the School Infrastructure Plan and the School Emergency Plan
Iowa State University	The hazard risk analysis was used when the Iowa State University Comprehensive Emergency Operations Plan was developed and is reviewed and updated during each EOP revision.	The plan update will be reference when applying for mitigation funds. It will continue to be integrated into the Iowa State University Comprehensive Emergency Operations Plan.

5.3 Monitoring, Evaluating, and Updating the Plan

44 CFR Requirement 201.6(c)(4): 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.

5.3.1 Hazard Mitigation Planning Committee (HMPC)

With adoption of this plan, HMPC representatives will continue to be tasked with plan monitoring, evaluation and maintenance. The participating jurisdictions and agencies, led by the Story County Emergency Management Coordinator, agree to:

- Meet annually to review the Hazard Mitigation Plan;
- Act as a forum for hazard mitigation issues;
- Disseminate hazard mitigation ideas and activities to all participants;
- Pursue the implementation of high priority, low- or no-cost recommended actions;
- Maintain vigilant monitoring of multi-objective, cost-share, and other funding opportunities to help the community implement the plan's recommended actions for which no current funding exists;
- Monitor and assist in implementation and update of this plan;
- Keep the concept of mitigation in the forefront of community decision making by identifying plan recommendations when other community goals, plans, and activities overlap, influence, or directly affect increased community vulnerability to disasters;

- Report on plan progress and recommended changes to participating jurisdictions; and
- Inform and solicit input from the public.

The HMPC representatives can only make recommendations to county, city, town, or district elected officials. Their primary duty is to see the plan successfully carried out and to report to jurisdictional executives and the public on the status of plan implementation and mitigation opportunities. Other duties include reviewing and promoting mitigation proposals, hearing stakeholder concerns about hazard mitigation, passing concerns on to appropriate entities, and posting relevant information in areas accessible to the public.

5.3.2 Plan Maintenance Schedule

HMPC representatives agree to provide inputs as required annually to monitor progress, discuss recent hazard events and changes in development that impact vulnerability, and update the mitigation strategy. The Story County Emergency Management Coordinator will be responsible for initiating the plan reviews.

In coordination with the other participating jurisdictions, a written update of the plan should be submitted to the Iowa Homeland Security and Emergency Management Department and FEMA Region VII for approval within the required five-year cycle per Requirement §201.6(c)(4)(i) of the Disaster Mitigation Act of 2000, unless disaster or other circumstances (e.g., changing regulations) require a change to this schedule.

5.3.3 Plan Maintenance Process

Evaluation of progress can be achieved by monitoring changes in vulnerabilities identified in the plan. Changes in vulnerability can be identified by noting:

- Decreased vulnerability as a result of implementing recommended actions,
- Increased vulnerability as a result of failed or ineffective mitigation actions, and/or
- Increased vulnerability as a result of new development (and/or annexation).

The annual reviews and updates to this plan will:

- Consider changes in vulnerability due to action implementation,
- Document success stories where mitigation efforts have proven effective,
- Document areas where mitigation actions were not effective,
- Document any new hazards that may arise or were previously overlooked,
- Incorporate new data or studies on hazards and risks,
- Incorporate new capabilities or changes in capabilities,
- Incorporate growth and development-related changes to inventories, and
- Incorporate new action recommendations or changes in action prioritization.

In order to best evaluate the mitigation strategy during plan review and update, the participating jurisdictions will follow the following process:

- A representative from the responsible office identified in each mitigation action will be responsible for tracking and reporting the action status on an annual basis to the jurisdictional HMPC representative

providing inputs on any completion details or whether the action still meets the defined objectives and is likely to be successful in reducing vulnerabilities.

- If the action does not meet identified objectives, the jurisdictional HMPC representative will determine what additional measures may be implemented, and an assigned individual will be responsible for defining action scope, implementing the action, monitoring success of the action, and making any required modifications to the plan.
- As part of the annual review process, the Story County Emergency Management Coordinator will provide the current Mitigation Strategy with the status of each mitigation action to the jurisdictions participating in the plan, requesting notification of proposed changes to jurisdictional data prior to the July Emergency Management Commission meeting. A public meeting to allow comment on proposed changes to the Hazard Mitigation Plan will be held immediately prior to the July Story County Emergency Management Commission Meeting. Jurisdictions will have the opportunity to modify proposed changes based on public inputs. After jurisdictions have finalized their changes to their information in the Plan, they will submit these changes to the Story County Emergency Management Agency who will forward them to HSEMD for action.

Changes will be made to the plan to accommodate for actions that have failed or are not considered feasible after a review of their consistency with established criteria, time frame, community priorities, and/or funding resources. Actions that were not ranked high but were identified as potential mitigation activities will be reviewed as well during the monitoring and update of this plan to determine feasibility of future implementation. Updating of the plan will be by written changes and submissions, as jurisdictions deem appropriate and necessary.

5.4 Continued Public Involvement

44 CFR 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.

The public will be involved in the plan maintenance process through an invitation to provide comments on proposed changes during a public meeting prior to the July Story County Emergency Management Commission Meeting. Additionally, there will be a press release after each annual review indicating the committee has provided inputs to the plan and providing a summary of mitigation action status updates and highlights of specific completed mitigation actions, as applicable.

The update process provides an opportunity to publicize success stories from the plan's implementation and seek additional public comment. Public notices will be posted through available website postings, community message boards, and social media outlets.

APPENDIX A: REFERENCES

- Coalition to Support Iowa's Farmers
- Des Moines Register News Data Central
- Environmental Protection Agency, heat-related deaths
- Environmental Protection Agency, Surf Your Watershed
- Federal Emergency Management Agency, BCA Reference Guide, 2009
- Federal Emergency Management Agency, Community Status Book
- Federal Emergency Management Agency, National Flood Hazard Layer
- Federal Emergency Management Agency, Presidential Disaster Declarations
- Federal Emergency Management Agency, Taking Shelter from the Storm, 3rd Edition
- Federal Emergency Management Agency, Story County Flood Insurance Study (Effective October 16, 2014)
- Flood Insurance Administration, Policy and Loss Statistics
- Hazards US MH 2.2 (HAZUS)
- Hazards US MH 4.0 (HAZUS)
- Hazards Vulnerability Research Institute, Social Vulnerability Index
- High Plains Regional Climate Center
- Iowa Communications Network
- Iowa Department of Agriculture and Land Stewardship, Division of Soil Conservation
- Iowa Department of Agriculture and Land Stewardship, Pesticide Bureau - Sensitive Crop Registry
- Iowa Department of Agriculture, Agricultural Statistics bulletin
- Iowa Department of Education, Bureau of Planning, Research and Evaluation
- Iowa Department of Natural Resources, Animal Feeding Operations
- Iowa Department of Natural Resources, Dam Safety Program
- Iowa Department of Natural Resources, NPDES
- Iowa Department of Natural Resources, NRGIS Library
- Iowa Department of Public Health Center for Acute Disease Epidemiology
- Iowa Department of Transportation's Office of Traffic and Safety
- Iowa Homeland Security and Emergency Management Department
- Iowa State Hazard Mitigation Plan, 2013
- Iowa State University, College of Agriculture and Life Sciences
- Iowa State University, Department of Agronomy, Environmental Mesonet
- Iowa State University, Extension Office, Distribution of Ash Trees in Iowa
- Karl, T.R., J.M. Melillo, and T.C. Peterson (eds). 2009. Global Climate Change Impacts in the United States. U.S. Global

- Midwestern Regional Climate Center
- National Drought Mitigation Center, U.S. Drought Monitor & Drought Impact Reporter
- National Inventory of Dams
- National Oceanic and Atmospheric Administration, Storm Prediction Center
- National Oceanic and Atmospheric Administration, National Climatic Data Center
- National Park Service, National Register of Historic Places
- National Severe Storms Laboratory
- National Transportation Safety Board
- National Weather Service
- New York Times.com, Water Supply Systems
- Pipeline and Hazardous Materials Safety Administration
- Stanford University, National Performance of Dams Program
- Story County Assessor's Office
- Story County Conservation Board
- Story County, Iowa Multi-jurisdictional Hazard Mitigation Plan, 2014
- Tornado and Storm Research Organization (TORRO), Department of Geography, Oxford Brooks University
- TornadoChaser.net
- TornadoHistoryProject.com
- U.S. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory
- U.S. Army Corps of Engineers, National Inventory of Dams
- U.S. Army Corps of Engineers, National Levee Database
- U.S. Census Bureau, American Community Survey, 5-Year Estimates, 2016
- U.S. Census Bureau, Building Permit Data
- U.S. Census Bureau, Decennial Census, 2000, 2010
- U.S. Census Bureau, Population Estimates, 2016
- U.S. Department of Agriculture Cropland Data Layer (CropScape)
- U.S. Department of Agriculture National Agricultural Statistics Service, 2012 Census of Agriculture
- U.S. Department of Agriculture, Emerald Ash Borer County Detection Map
- U.S. Department of Agriculture, Risk Management Agency Crop Insurance Statistics
- U.S. Department of Agriculture, Secretarial Disaster Declarations
- U.S. Department of Transportation
- U.S. Fish and Wildlife Service, Threatened and Endangered Species
- U.S. Geological Survey

- University of Nebraska, National Drought Mitigation Center
- University of Wisconsin-Madison, Department of Forest Ecology and Management, SILVIS Lab

APPENDIX B: PLANNING PROCESS

B-1. Story County Hazard Mitigation Planning Committee (HMPC) Members

Jurisdictional and Stakeholder Representatives that Attended Meetings

First Name	Last Name	Department/Title	Jurisdiction/Organization
Lindsey	Beecher	Superintendent	Gilbert CSD
Andrew	Coree		City of Collins
Jennifer	Davies	City Administrator/Clerk	Slater
Chris	Erickson	Mayor	McCallsburg
Steven	Gast	Public Works	Maxwell
Nicole	Goeser	City Councilperson	Sheldahl
Jason	Grubbs	Deputy Sheriff	Story County
LeAnne	Harter	County Outreach and Special Projects Manager	Story County
Brent	Horn	City Councilperson	Collins
Nathan	Hovick	Public Works Director	Roland
Mark	Jackson	City Administrator	Story City
Bob	Jamison		City of Colo
Mike	Jensen		City of Story City
Angie	Jewett	Emergency Manager	Iowa State University
John	Kahler	Mayor	Slater
Tasheik	Kerr	Management Analyst	Ames
Kenneth	Kling	Mayor	Kelley
Steven	Kovarik	Mayor	Cambridge
David	Kroese	Facilities Director	Nevada CSD
Jeff	Larson	Fire Chief	Roland
Bill	Lytle	Buildings and Grounds	Colo-Nesco CSD
Matt	Mardesen	City Administrator	Nevada
Ottie	Maxey	Superintendent	Ballard CSD/Collins Maxwell CSD
Lysle	McDonald	Fire Chief	Story City
Keith	Morgan	EM Coordinator	Story County
Tony	Ness	Public Works	Maxwell
Lauris	Olson	Supervisor	Story County
Matt	Patton	Superintendent	Roland-Story CSD
Gerry	Peters	Facilities Director	Ames CSD
Jon	Popp	Mayor	Gilbert
Steve	Ransom	City Councilperson	Slater
Charles	Robertson		City of Maxwell
Stephen	Simpson	Director Emergency Management	Iowa State University
Melissa	Spencer	Deputy EM Coordinator	Story County

First Name	Last Name	Department/Title	Jurisdiction/Organization
Gary	Stoll	Police Chief	Huxley
David	Thom	City Councilperson	Cambridge
Andy	Webb	Mayor	Roland

Stakeholder Representatives Invited to Provide Comments

First Name	Last Name	Title	Agency	Type
Tony	Loeser	Water Resources Engineer	Iowa State University, Iowa Flood Center	Academia
Dylan	Hagen	Emergency Management Coordinator	Hamilton County EM	Adjacent County
Dave	McDaniel	Emergency Management Interim Coordinator	Hardin County EM	Adjacent County
Kimberly	Elder	Emergency Management Coordinator	Marshall County EM	Adjacent County
Jim	Sparks	Emergency Management Coordinator	Jasper County EM	Adjacent County
A.J.	Mumm	Emergency Management Coordinator	Polk County EM	Adjacent County
David E.	Morlan	Emergency Management Director	Boone County EM	Adjacent County
Tom	Taylor		EPA/Water Resources Protection Branch	Federal Agency
Joe	Chandler		FEMA Region VII	Federal Agency
Jeff	Johnson		NWS	Federal Agency
Jeff	Zogg		NWS	Federal Agency
Andrew	Leichty		USCOE Rock Island District	Federal Agency
Steve	Russell		USCOE Rock Island District	Federal Agency
Jerry	Skalak		USCOE Rock Island District	Federal Agency
Rob	Middlemis-Brown		USGS	Federal Agency
Terry	Jensen		Dept of Ag & Land Stewardship	State Agency
Scott	Ralston	Floodplain Mapping Coordinator	DNR	State Agency
Casey	Welty	Dam Safety Engineer	DNR, Dam Safety Program	State Agency
Gail	Kantak	Wildland Fire Supervisor	DNR-Forestry	State Agency
Aimee	Bartlett	State Hazard Mitigation Officer	Iowa Homeland Security and Emergency Management	State Agency
Terry	Brown	GIS Coordinator	Iowa Homeland Security and Emergency Management	State Agency
Jim	Marwedel	Mitigation Planner	Iowa Homeland Security and Emergency Management	State Agency
Jennifer	Jones	Project Officer	Iowa Homeland Security and Emergency Management	State Agency
Jessica	Turba	Planner	Iowa Homeland Security and Emergency Management	State Agency

B-2. Kick-Off Meeting Invite

Subject: Story County Hazard Mitigation Plan Revision Meeting - February 21 (Skype information)

Location: Skype Meeting

Start: Wed 2/21/2018 6:00 PM

End: Wed 2/21/2018 8:00 PM

Recurrence: (none)

Meeting Status: Meeting organizer

Organizer: Karsjen, Kyle

Required Attendees: Karsjen, Kyle; Story County Emergency Management; Alex Rainey; Angie Jewett (asjewett@iastate.edu); Brett Comegys- Collins Mayor; Collins Clerk; Colo Clerk; Craig Henry- Huxley Mayor; Deana Nichols; Diane Voss; Don Towers- Sheldahl Mayor; Gilbert Clerk; Huxley Clerk; J Lettow- Huxley City; Jeff Larson; Jennifer Davies; John Wilson- Colo Mayor; Jon Popp- Gilbert Mayor; Keith W. Morgan; Kenneth Kling; Kerin Wright; Martin Herr; Maxwell Clerk; McCallsburg Clerk; Melissa K. Spencer; Mike Jensen- Story City Mayor; Nancy Pritchard; Paul H. Fitzgerald; Rick G. Sanders; Roland Clerk; sccadmin@iowatelecom.net; Shaun Bayouth; Sheldahl Clerk; Steve Gast; Steve Ransom- Slater Council; Rob Bowers; Steven Kovarik (skovarik@me.com); John Kahler (jfkahler@hotmail.com); Brett Barker (bbarker@midiaowa.net); Andrew Webb - City of Roland (webbahmj1@aol.com); Chris Erickson; John Haila (jhaila@city.ames.ia.us); Lindsey Beecher Gilbert; Matt Patton- Roland Story; Ottie Maxey Ballard/CMB; Steve Gray- Nevada/Colo NESCO; Tim Taylor- Ames

Optional Attendees: Jon Popp; Nancy Pritchard; Ray Reynolds; Matthew Mardesen

All – one last reminder of the kickoff meeting for the Story County Hazard Mitigation Planning process. I have updated this invitation with all of the handouts we'll use during the meeting. If your community has not yet identified a representative to attend this meeting, please do so and RSVP so we can get an accurate attendance count.

Thanks!

All,

You received an email yesterday from Keith Morgan, Story County Emergency Management regarding the hazard mitigation update planning process. Our first meeting will be held February 21 at 7 PM CST. The meeting will be held via Skype, accessible via any computer connected to the internet. Alternately, you may also come to the Public Meeting Room on the second floor of the Story County Administration Building, 900 6th Street in Nevada at that time, and emergency management will be presenting the meeting from there.

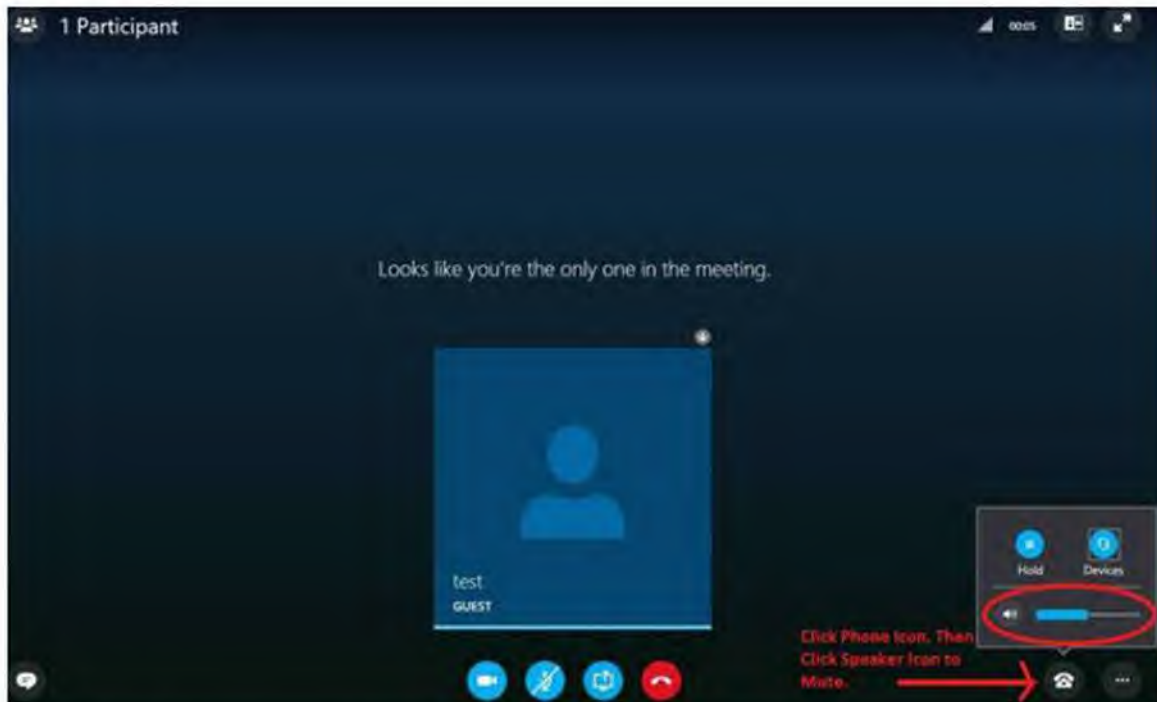
How to Access the Webinar from Your Computer

At meeting time, please click on the 'Join Skype Meeting' to link to the presentation (**located at the end of this email**). In addition, call in to the meeting using the toll-free number listed below. Please mute your phones.

Please log in early to ensure that you can join the webinar. If you have trouble joining, please click the Try

Skype Web App; you will have to download the app plug in. Once you join the meeting, please type your name, the jurisdiction you represent and your title or role in the Guest Name Box.

You will need to mute your computer in two ways, one by actually muting your computer speakers and the other by muting your speaker in the Skype Conference. I have added a picture to show where mute is in the conference.



I will update this invitation with the meeting materials before the meeting, including a copy of the presentation if you aren't able to access Skype. If you have any questions, please let me or Keith Morgan know. Thanks, and I look forward to kicking off this process with you on the 21st.

Kyle

→ [Join Skype Meeting](#)

Trouble Joining? [Try Skype Web App](#)

Join by Phone

Toll-free number: +1 (866) 324-4184, access code: 8618846

Toll number: +1 (216) 706-7032, access code: 8618846

[Find a local number](#)

Conference ID: 8618846 (same as access code above)

B-3. Kick-Off Meeting Agenda

**Story County
Multi-jurisdictional Hazard Mitigation Plan**

Agenda

- Hazard Mitigation Planning Purpose
- Grant Programs Linked to Approved Plan
- Multi-jurisdictional Approach
- Planning/Participation Requirements
- Public Involvement
- Data Collection Guides
- Discussion/Prioritization of Hazards
- Critical Facilities
- Next Steps in the Planning Process

B-4. Kick-Off Meeting Minutes

To **Story County Hazard Mitigation Planning Committee**
 Through **Keith Morgan, Emergency Management Coordinator**
 From **Kyle Karsjen, Amec Foster Wheeler**
 Date **3/1/2018**
 Subject **Minutes from Story County Hazard Mitigation Planning Kickoff Meeting held on 2/21/2018**

This document is a record of attendance and a summary of the issues discussed during the above meeting. The presentation began with an introduction to the purpose of hazard mitigation planning, grant programs linked to an approved plan, and the benefits of a multi-jurisdictional approach. The hazard mitigation planning process was reviewed to include requirements for participation and public involvement and the use of data collection guides. The planning committee participated in a discussion of the hazards that have the potential to impact Story County, and identifying hazards that may not need a full assessment. The hazard ranking method adopted by the Iowa Homeland Security and Emergency Management Department for the 2013 State Hazard Mitigation Plan was introduced and the sources for compiling a GIS layer of critical facilities were discussed. The meeting concluded with a discussion of the next steps in the planning process.

The meeting was held over Skype Webinar/Conference Call at 7:00 pm CST.

Attendees

Name	Jurisdiction
Mike Jensen	Iowa State University
Jon Popp	City of Gilbert
John Kahler	City of Slater
Mike Jensen	City of Story City
Steven Kovarik	City of Cambridge
Andrew Coree	City of Collins
Bob Jamison	City of Colo
Bill Lytle	Colo-Nesco Schools
Kenneth L. Kling	City of Kelley
Chris Erickson	City of McCallsburg
Jason Grubbs	Story County
Steven Gast	City of Maxwell
Tony Ness	City of Maxwell
Charles Robertson	City of Maxwell
Melissa Spencer	Story County
Keith Morgan	Story County
LeAnne Harter	Story County

Mark Jackson	City of Story City
Matt Martesen	City of Nevada
Lindsey Beecher	Gilbert Schools
Nicole Goeser	City of Sheldahl
Tasheik Kerr	City of Ames
Matt Patton	Roland Story School District

Introductions

The meeting began with a welcome and thank you to all attendees for calling in.

Hazard Mitigation Planning Purpose

Mr. Karsjen presented information on the purpose of Hazard Mitigation Planning and the Disaster Mitigation Act of 2000. The attendees were reminded this is an update of the Story County Hazard Mitigation Plan, previously approved in 2014. A summary of the 15 Presidential Disaster Declarations including Story County since 1970 was presented.

Grant Programs Linked to Approved Plan

Mr. Karsjen briefly discussed the FEMA Hazard Mitigation Assistance grants that require participation in an approved Hazard Mitigation Plan for jurisdictions to be eligible to apply. These include: Hazard Mitigation Grant Program, Pre-Disaster Mitigation Program, and Flood Mitigation Assistance Program. All programs are available for jurisdictions covered under an approved Hazard Mitigation Plan. It was noted in the presentation that Story County had taken advantage of almost \$4 million in hazard mitigation funds to implement mitigation projects throughout the County.

Multi-Jurisdictional Approach

An overview of the nine Planning Tasks that will be followed during the planning process was given and Mr. Karsjen addressed the benefits for jurisdictions participating in this mitigation plan update including improved coordination and communication among local jurisdictions. Impacts of hazards do not stop at jurisdictional boundaries. This multi-jurisdictional approach allows for a more comprehensive risk assessment and resulting mitigation strategy tailored to benefit all participating jurisdictions in the planning area. The following jurisdictions have been invited to participate as "official participants" in the Story County Multi-Jurisdictional Hazard Mitigation Plan Update:

- Unincorporated Story County
- Ames
- Nevada
- Story City
- Huxley
- Slater
- Roland
- Gilbert
- Maxwell
- Colo
- Cambridge
- Zearing
- Collins
- McCallsburg
- Sheldahl
- Kelley
- Ames Community School District
- Nevada Community School District
- Ballard Community School District
- Gilbert Community School District
- Roland-Story Community School District
- Colo-Nesco Community School District
- Collins-Maxwell Community School District
- Iowa State University

Mr. Karsjen also described the role of the HMPC. Each jurisdiction participating in development of the plan must meet the following minimum requirements:

- Designate a representative to serve on the Story County HMPC, which will meet **three** times during the planning process,
- Provide data for and assist in the development of the updated risk assessment that describes how various hazards impact your jurisdiction,
- Provide data to describe current capabilities,
- Develop/update mitigation actions (at least one) specific to your jurisdiction,
- Provide comments on plan drafts as requested,
- Inform the public, local officials, and other interested parties about the planning process and provide opportunities for them to comment on the plan, and
- Formally adopt the mitigation plan.

Jurisdictions that choose not to participate in development of a FEMA-approved mitigation plan **will not** be eligible applicants for FEMA Hazard Mitigation Assistance Grants.

Planning for Public Involvement

The local hazard mitigation plan requirements state that the public needs to have the opportunity to comment on the plan. The public will be given two opportunities to comment on the plan, once during the drafting stage and another when the plan is complete in the final draft stage.

A survey has been created to both provide information about the plan update under development as well as gain input from the public on the hazards they are most concerned about and mitigation strategies that they think will be most effective. The survey was shared with the attendees, and can be found at <https://www.surveymonkey.com/r/Story-CO-IA>. The survey will remain open until April 30th, 2018. Additionally, communities were provided an electronic copy of the survey, and invited to share it with community members as appropriate via email or hard copy.

As part of the documentation for the planning process, participating jurisdictions were asked to provide copies of any advertisements, social media posts etc. that advertised the survey to the public. If you have any questions regarding what to provide or how to provide it, please ask Kyle or Keith.

The public will also be provided the opportunity to comment on the plan before it is finalized and sent to FEMA. The County and its communities will be asked to post a link to the draft plan on the internet, as well as place two hard copies somewhere in the County for in-person review.

Data Collection Process

Amec Foster Wheeler provided electronic files of the Data Collection Guides prior to the meeting via email. The guides are specific for local units of government and schools.

The Data Collection Guide is designed to collect information on existing capabilities within each jurisdiction to implement mitigation initiatives as well as collect information on previous hazard events. For the hazards that were included in the existing 2014 plan, information is especially needed for the events that have occurred from 2014 to the present. For hazards not included in the 2013 plan, all known previous events are needed in order to give the HMPC the opportunity to verify a given hazard's potential significance in the planning area.

Deadline for submittal of the Data Collection Guides to Amec Foster Wheeler is March 14, 2018.

Discussion/Prioritization of Hazards

Mr. Karsjen presented initial research information on the 20 hazards included in the 2013 State Hazard Mitigation Plan that have the potential to impact Story County; Kyle also identified which hazards were profiled in the previous county plan. Details of the information provided are in the PowerPoint presentation. Upon further review, the HMPC recommended that due to low perceived risk, landslide and radiological incidents would not require a full analysis.

Hazard	2013 State Hazard Mitigation Plan	2019 Story County Mitigation Plan
Animal/Plant/Crop Disease	x	x
Dam/Levee Failure	x	x
Drought	x	x
Earthquake	x	x
Expansive Soils	x	x
Extreme Heat	x	x
Flash Flood	x	x
Grass/Wildland Fire	x	x
Hazardous Materials Incident	x	x
Human Disease	x	x
Infrastructure Failure	x	x
Landslide	x	
Radiological Incident	x	
River Flooding	x	x
Severe Winter Storm	x	x
Sinkholes	x	x
Terrorism	x	x
Thunderstorm/Lightning/Hail	x	x
Tornado/Windstorm	x	x
Transportation Incident	x	x

Kyle discussed information about the hazard profiles in the plan and introduced the HMPC to the elements of probability, magnitude, warning time, and duration to rank the hazards. The table below provides additional information on the elements and rating levels.

Element/Level	Characteristics
Probability	
4 - Highly Likely	Event is probable within the calendar year. Event has up to 1 in 1 year chance of occurring (1/1=100%) History of events is greater than 33% likely per year. Event is "Highly Likely" to occur
3 - Likely	Event is probable within the next three years. Event has up to 1 in 3 years chance of occurring (1/3=33%) History of events is greater than 20% but less than or equal to 33% likely per year Event is "Likely" to occur
2 - Occasional	Event is probable within the next five years. Event has up to 1 in 5 years chance of occurring (1/5=20%) History of events is greater than 10% but less than or equal to 20% likely per year Event could "Possibly" occur
1 - Unlikely	Event is possible within the next 10 years Event has up to 1 in 10 years chance of occurring (1/10=10%) History of events is less than or equal to 10% likely per year Event is "Unlikely" but is possible of occurring
Magnitude / Severity**	
4 - Catastrophic	Multiple deaths Complete shutdown of facilities for 30 or more days More than 50 percent of property is severely damaged
3 - Critical	Injuries and/or illnesses result in permanent disability Complete shutdown of critical facilities for at least two weeks 25-50 percent of property is severely damaged
2 - Limited	Injuries and/or illnesses do not result in permanent disability Complete shutdown of critical facilities for more than one week 10-25 percent of property is severely damaged
1 - Negligible	Injuries and/or illnesses are treatable with first aid Minor quality of life lost Shutdown of critical facilities and services for 24 hours or less Less than 10 percent of property is severely damaged
Warning Time	
4	Less Than 6 Hours
3	6-12 Hours
2	12-24 Hours
1	24+ Hours
Duration	
4	More Than 1 Week
3	Less Than 1 Week
2	Less Than 1 Day
1	Less Than 6 Hours

These elements are used in the 2013 Iowa State Hazard Mitigation Plan to determine a final Hazard Assessment Score for each hazard. The score provides a hazard ranking mechanism as well as a planning significance rating, to focus planning efforts on those hazards with the highest scores. Using the ranking described in the table above, the formula used to determine each hazard's score, which includes weighting factors defined by the State of Iowa's Hazard Mitigation Plan is:

$$(\text{Probability} \times .45) + (\text{Magnitude/Severity} \times .30) + (\text{Warning Time} \times .15) + (\text{Duration} \times .10) = \text{Weighted Score}$$

The scores for each element may be revised throughout the course of the risk assessment update based on additional information. Additionally, individual hazard ranking scores will be developed for each participating jurisdiction to demonstrate how hazards vary across jurisdictions. The revised planning area hazard ranking results and results for each participating jurisdiction will be available for comment in the draft risk assessment which will be provided to the planning committee prior to the 2nd planning meeting.

For hazards excluded from full review in the plan due to lack of risk/non-occurrence in the county, the HMPC will be notified and the plan update will provide justification for exclusion.

Critical Facilities

Kyle explained that the Risk Assessment will include information on critical facilities for each jurisdiction. An inventory of the critical facilities will be developed from GIS layers available from Story County, the Iowa Department of Natural Resources as well as a national Homeland Security database of critical facilities.

Next Steps

- Attendees were asked to complete their jurisdiction's Data Collection Guide by **March 14, 2018**
- The 2nd meeting of the Hazard Mitigation Planning Committee for this plan update will be held **April 25th, 2018** at 7 PM CST in Nevada; the meeting will involve a review of the risk assessment results and update of the plan's goals.
- The public survey will close **April 30th, 2018**
- The 3rd and final planning meeting is scheduled for **June 27, 2018**. Additional details on this meeting will be provided at a later date.

B-5. Meeting #2 Agenda

**Story County
Multi-Jurisdictional Hazard Mitigation Plan Update
Planning Meeting #2
April 25, 2018
7:00 - 9:00 pm CST**

Agenda

- Welcome/Introductions
- Brief Review
- Public Survey Update
- Participation Requirements/Status
- Plan Update Format
- Sample Results of Countywide Risk Assessment Update
- Update Mitigation Goals
- Discuss Mitigation Action Updates
- Next Steps



B-6. Meeting #2 Minutes

To **Story County Hazard Mitigation Planning Team**
 From **Kyle Karsjen, Wood PLC Planner**
 Tel / E-mail **303-820-4661 / kyle.karsjen@woodplc.com**
 Date **5/3/2018**
 Subject **Minutes from Story County Hazard Mitigation Planning Meeting #2 held on 4/25/2018**

This document is a record of attendance and a summary of the issues discussed during the above meeting, including: a brief review of the purpose of a Hazard Mitigation Plan, an update on the public survey for the plan update, discussion of participation requirements and the status of each jurisdiction, presentation of the plan update format, sample results of the risk assessment update, a discussion to update the plan's mitigation goals, discussion of status updates of previous mitigation actions, and the next steps in this process.

Attendees

First Name	Last Name	Title	Jurisdiction/Organization
Nicole	Goeser	City Councilperson	Sheldahl
Angie	Jewett	Emergency Manager	Iowa State University
Andy	Webb	Mayor	Roland
John	Kahler	Mayor	Slater
Jennifer	Davies	City Administrator/Clerk	Slater
Kenneth	Kling	Mayor	Kelley
Jon	Popp	Mayor	Gilbert
Mark	Jackson	City Administrator	Story City
Matt	Mardesen	City Administrator	Nevada
Ottie	Maxey	Superintendent	Ballard CSD/Collins Maxwell CSD
Steven	Kovarik	Mayor	Cambridge
LeAnne	Harter	County Outreach and Special Projects Manager	Story County
Tasheik	Kerr	Management Analyst	Ames
Brent	Horn	City Councilperson	Collins
Tony	Ness	Public Works	Maxwell
Steven	Gast	Public Works	Maxwell
Jason	Grubbs	Deputy Sheriff	Story County
Chris	Erickson	Mayor	McCallsburg
Bill	Lytle	Buildings and Grounds	Colo-Nesco CSD
Jeff	Larson	Fire Chief	Roland
Lysle	McDonald	Fire Chief	Story City
Lindsey	Beecher	Superintendent	Gilbert CSD
Matt	Patton	Superintendent	Roland-Story CSD
Gerry	Peters	Facilities Director	Ames CSD
David	Kroese	Facilities Director	Nevada CSD
Melissa	Spencer	Deputy EM Coordinator	Story County
Lauris	Olson	Supervisor	Story County
Keith	Morgan	EM Coordinator	Story County
Kyle	Karsjen	Project Manager	Wood PLC

Introductions

Story County Emergency Management Coordinator Keith Morgan began the meeting by welcoming and thanking the attendees. Kyle Karsjen, with Wood PLC (previously Amec Foster Wheeler Environment & Infrastructure, Inc.), the firm contracted to assist in the development of the Story County multi-jurisdictional hazard mitigation plan update, facilitated the remainder of the presentation.

Purpose/Public Survey/Participation Status

Kyle provided a brief summary of the purpose of the Hazard Mitigation Plan and the Disaster Mitigation Act of 2000, which codified the requirement of local governments to adopt a hazard mitigation plan to maintain eligibility for FEMA Hazard Mitigation Assistance Grants. The nine-task planning process was summarized and participants were informed that at the conclusion of the meeting, the planning team will have completed at least portions of Tasks 1-6. Kyle also provided a status update and summary of responses to date for the Public Survey that has been disseminated via survey monkey at: <https://www.surveymonkey.com/r/Story-CO-IA>. Planning team representatives were encouraged to publicize the availability of the surveys and to notify Kyle of these efforts so that they can be described in the planning process section of the plan. To date, 16 surveys have been collected. The survey will close June 15, 2018.

A review of the requirements for jurisdictions to officially participate in the Multi-Jurisdictional Hazard Mitigation Plan was provided as well as a table summarizing each jurisdiction's participation to date.

Plan Format/Sample Results of Countywide Risk Assessment

Kyle provided the overall format of the plan update document as follows:

- Executive Summary
- Chapter 1—Planning Process
- Chapter 2—Jurisdiction Profiles
- **Chapter 3—Risk Assessment**
- Chapter 4—Mitigation Strategy
- Chapter 5—Plan Maintenance
- Appendices

Once additional information identified by the HMPC has been added to the draft Hazard Identification and Risk Assessment (HIRA), a PDF file of the Chapter 3 draft risk assessment will be shared via Google drive. Kyle asked that the planning committee, along with other representatives from their jurisdictions, review the risk assessment and provide comments and additional data, with a deadline of two weeks after the HIRA release date. Jurisdictions were specifically requested to review the hazard ranking tables at the end of each hazard section to review/validate the ranking of each hazard for their jurisdiction. There are several areas in the draft risk assessment that are highlighted in blue, indicating information is needed from jurisdictions. Green highlighting in the risk assessment indicates further analysis or research to be completed by Wood PLC.

Kyle provided a summary of the hazard ranking for the overall planning area and requested that the planning committee provide any comments on these rankings along with other comments on the risk assessment. The overview presentation provided just some of the details that are included in the full Draft Risk Assessment. All hazards identified for Story County are included in the Draft Risk Assessment chapter that will be available for review.

The group discussed several hazards that threaten the county. Highlights of the discussion are noted by hazard in the table below.

Hazard or Topic	Meeting Discussion
Animal/Plant/Crop Disease	<ul style="list-style-type: none"> The county is a hotbed for seed development; test fields all over in the county Ash borer is in the county, and communities are encouraged to identify how to mitigate its impacts Multiple ag labs in the County, including USDA, APHIS and the ISU diagnostic laboratory ISU has farms throughout the County Not much poultry throughout the County
Drought	<ul style="list-style-type: none"> Ames has shallow wells; other communities have deep wells that help mitigate potential drought impacts Ames has conducted drought mitigation efforts Cascading impact of drought is prevalence of grass fires caused in ditches, grass and fields
Flash Flood	<ul style="list-style-type: none"> Committee recommended raising the magnitude score Gilbert had a car rescue due to flash flood Zearing identified flash flooding issues Cambridge has updated storm sewer Collins has worked on drainage projects to alleviate flash flood impacts Roland did flood projects, including raising lift station and storm sewer work Ames had 100 homes damaged by flash flood in 2016
Wildfire	<ul style="list-style-type: none"> Stover fires are a big issue in the County Areas along the river are vulnerable Departments in the county have lost equipment due to grass fires A few notable fires, 40-60 acres
Hazardous Materials Incident	<ul style="list-style-type: none"> Committee recommended the magnitude go higher, due to pipeline and rail County is doing hazmat study currently; will provide to Wood Train track is being added west of Highway 30 to transport hazardous materials, which will add to vulnerability
Human Health	<ul style="list-style-type: none"> Committee recommended that the probability was too low; ISU will review their score to ensure it is correct
Infrastructure Failure	<ul style="list-style-type: none"> Most outages last hours at most Ames noted a damaged bridge that restricted access to the Water District plant University noted a power line damaged by tree, causing power loss for hours Recommendation to discuss hacking as part of infrastructure failure
Flooding	<ul style="list-style-type: none"> Committee recommended warning time be moved to a score of "2"
Sinkholes	<ul style="list-style-type: none"> Counties noted for having potential karst terrain vulnerability
Terrorism	<ul style="list-style-type: none"> Many potential targets in the county, including University assets
Radiological	<ul style="list-style-type: none"> Little to no impact – committee recommended not profiling further

Mitigation Goals

Following the discussion of the risk assessment, Kyle facilitated a discussion of the mitigation goals. Common categories of mitigation goals were presented, as well as the 2013 State Hazard Mitigation Plan goals.

This planning effort is an update to an existing hazard mitigation plan. As a result, the goals from the 2014 *Story County Multi-Jurisdictional Hazard Mitigation Plan* were reviewed. The goals from that plan were:

- **Goal 1:** Protect lives and reduce injury
- **Goal 2:** Minimize or reduce damage to property, including critical facilities and infrastructure
- **Goal 3:** Develop and implement mitigation strategies in plans, policies, and programs that optimize public funds in an efficient and cost-effective way
- **Goal 4:** Reduce utility outages during times of severe weather
- **Goal 5:** Strengthen communication among agencies and between agencies and the public

The planning committee recommended combining existing Goals 2 and 4, editing the language in Goal 2, removing Goal 3 and adding mitigation-specific language to Goal 5. The following are the **new** goals to be used in the 2019 plan:

- **Goal 1:** Protect lives and reduce injury
- **Goal 2:** Minimize or reduce damage to property, especially critical facilities and infrastructure
- **Goal 3:** Strengthen communication among agencies and between agencies and the public regarding hazard mitigation

The group also recommended removing Goal 3 (optimizing public funds) as a specific goal, as this should be true for all mitigation actions; the language will still be included in the plan during discussion of implementation.

Mitigation Action Status Updates

The planning team members in attendance were provided handouts of the actions that were included in the previous plan and were instructed to provide status updates and comments; **the targeted deadline to return the information is May 18, 2018**. The table below provides a summary of the previous actions for each jurisdiction.

Jurisdiction	# of Previous Actions
Unincorporated Story County	8
Ames	11
Cambridge	4
Collins	9
Colo	10
Gilbert	4
Huxley	4
Kelley	8
Maxwell	13
McCallsburg	2
Nevada	7
Roland	6
Slater	20
Story City	6

Jurisdiction	# of Previous Actions
Zearing	13
Iowa State University	13
Ames CSD	3
Ballard CSD	1
Collins-Maxwell CSD	1
Colo-Nesco CSD	1
Gilbert CSD	1
Nevada CSD	1
Roland-Story CSD	1

Instruction was provided on how to give feedback on each jurisdiction's mitigation measures; communities are asked to explain whether a mitigation measure meets one of four categories:

1. *Completed* – the project has been implemented. Provide date completed and funding amount if applicable
2. *Delete* – the project should not be rolled over into the new plan, and should be deleted; jurisdictions are asked to provide an explanation
3. *Continue in-progress* – the project has been started, but is not complete and should be included in the new plan
4. *Continue not started* – the project has not been started, but should be rolled over into the plan update

The group was provided an example in the presentation on each of these categories.

The third and final meeting planned for **June 27th, 2018** will focus on development of any new mitigation actions. Planning team members were asked to consider what actions could reduce/eliminate damages as they review the Draft Risk Assessment, as well as discuss mitigation alternatives with other representatives from their jurisdiction.

Timeline

The following is the timeline for the planning process:

- 5/4 Risk assessment released for review (targeted, pending additional analysis)
- 5/18 Risk assessment comments due
- 5/18 Community action statuses due
- 6/15 Public survey closes
- 6/27 Final meeting of planning process (focused on mitigation strategies)

B-7. Meeting #2 Sign-In Sheets

STORY COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN UPDATE MEETING #2—SIGN-IN SHEET					
Project:	Story County, Iowa Multi-Jurisdictional Hazard Mitigation Plan Update		Meeting Date/Time:	April 25, 2018 7:00-9:00 pm	
Facilitator:	Kyle Karsjen, Wood PLC		Place/Room:	Story County Administration Building 900 6 th Street, Nevada	

Name	Title	Department/Agency	Email	Phone #	Signature
Nicole Groeser	Sheldahl City Council		nemcevoy@gmail.com	515-291-4415	
Angie Jewett	Emergency manager	Iowa State Univ.	asjewett@iastate.edu	515-294-8090	
Andy Webb	Mayor	Roland	webbaj1@gmail.com	515-338-0905	
John Kahler	Mayor	Slater	jkahler@hotmail.com	515-202-4061	
Jennifer Davies	City Admin/ Clerk	City of Slater	cityofslater@huxcomm.net	515-685-2531	
Kenneth L Kling	Mayor	Kelley	KandKling@huxama.net	515-231-1484	
Jon Popp	MAYOR	GILBERT	JPopp@POPPENGINEERINGINC.COM	515-351-8003 575-733-2121	
Mark A. Jackson	CA	Story City	scadmin@windstream.net	515-382-5466	
MATT MARJESSEN	CA	NEVADA	m.mardesen@cityofnevada.iowa.org		
Offie Maxey	Superintendent	Ballard & Collins-Maxwell	omaxey@ballardkiz.ia.us	515 597 2811	
"	"	Collins-Maxwell	omaxey@collins-maxwell.kiz.ia.us		

wood.

STORY COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN UPDATE MEETING #2—SIGN-IN SHEET

Project:	Story County, Iowa Multi-Jurisdictional Hazard Mitigation Plan Update	Meeting Date/Time:	April 25, 2018 7:00-9:00 pm
Facilitator:	Kyle Karsjen, Wood PLC	Place/Room:	Story County Administration Building 900 6th Street, Nevada

Name	Title	Department/Agency	Email	Phone #	Signature
Steven Kovarik	Mayor	Cambridge	SKovarik@ story gmail.com	515 450 6250	
LEANNE HARTER	COUNTY OUTREACH AND SPECIAL PROJECTS MANAGER	STORY COUNTY (UNINCORPORATED)	lharter@storycounty.iowa.gov	(515) 382-7247	
Tasneik Kerr	Management Analyst	City Manager's Office City of Ames	tkerr@city.ames.iowa.gov	515 239 5227	
Brent Horn	City Council	Collins	Brent.Horn78@gmail.com	515-218-6046	
Tony Ness	Public Works	Maxwell	tnyness@gmail.com	515-215-0153	
Steven GAST	Mayor	Maxwell	steven5d6@gmail.com	515 975 0816	
Jason Grubbs	Deputy Sheriff	Story County Sheriff's Office	jgrubbs@storycounty.iowa.gov	515-382-7525	
Chris Erickson	Mayor	McCallsburg	chris32582@gmail.com	515-460-6709	
Bill Lytle	Buildings Grounds	Colo-NESCO Schools	blytle@colo-nesco.k12.iowa.us	515-338-0707	
Jeff Larson	Fire Chief	Roland	larson.j@mcgmc.com	515-291-9182	
Lusk Macdonald wood.	Fire Chief	Story City	lusk.macdonald@ story woodwall.com	515-235-9183	

STORY COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN UPDATE MEETING #2—SIGN-IN SHEET

Project:	Story County, Iowa Multi-Jurisdictional Hazard Mitigation Plan Update	Meeting Date/Time:	April 25, 2018 7:00-9:00 pm
Facilitator:	Kyle Karsjen, Wood PLC	Place/Room:	Story County Administration Building 900 6th Street, Nevada

Name	Title	Department/Agency	Email	Phone #	Signature
Lindsay Beecher	Supt	Gilbert	beecher@gilbert.k12.iowa.us	515-232-3740	Lindsay Beecher
Matt Patton	Superintendent	Roland-Story	mpatton@roland-story.k12.iowa.us	(515) 733-4301	Matt Patton
Gerry Peters	FACILITIES DIRECTOR	AMES CSD	gerry.peters@ames.k-12.iowa.us	515-458-2514	Gerry Peters
David J Kroese	Facilities Director	Nevada Schools	dkroese@nevadaclubs.org	(515) 382-7650	David J Kroese
Melissa Spencer	Deputy Coordinator	Story Co. EMA	mispencer@storycounty.iowa.gov	515-382-7316	Melissa Spencer
Lauris Olson	COUNTY Supervisor	Story County	lolson@storycounty.iowa.gov	515-382-7203	Lauris Olson
Keith Morgan	Coordinator	Story County EMA	kmorgan@storycounty.iowa.gov	515-382-7315	Keith Morgan

wood.

B-8. Meeting #3 Agenda

**Story County Multi-Jurisdictional
Local Hazard Mitigation Plan**

Meeting Purpose

- Review Purpose/Requirements
- Public Survey Results
- Updating the Mitigation Strategy
 - Review Updated Plan Goals
 - Status of Previous Actions
 - Development of New Actions
- Hazard Mitigation Assistance Grants
- Plan Maintenance
- Next Steps

B-9. Meeting #3 Minutes

To **Story County Hazard Mitigation Planning Team**
 Through **Keith Morgan, Emergency Management Coordinator**
 From **Kyle Karsjen, Amec Foster Wheeler Mitigation Planner**
 Tel / E-mail **303-820-4661 / kyle.karsjen@woodplc.com**
 Date **7/3/2017**
 Subject **Minutes from Story County Hazard Mitigation Planning Meeting #3 held on 6/27/2018**

This document is a record of attendance and a summary of the issues discussed during the above meeting, including: a brief review of the purpose of a Hazard Mitigation Plan, the public survey results, updating the mitigation strategy, Hazard Mitigation Assistance grants, plan maintenance, and the next steps in this process.

Attendees

Kyle Karsjen, with Wood plc, the firm contracted to assist in the development of the Story County multi-jurisdictional hazard mitigation plan update, facilitated the meeting.

Note: The PowerPoint presentation utilized during the meeting is available, along with other planning materials at the following Google Drive link:

[Story County, IA Hazard Mitigation Plan](#)

Review Purpose/Participation Status

Kyle provided a brief summary of the purpose of the Hazard Mitigation Plan and the Disaster Mitigation Act of 2000 that codified the requirement of local governments to adopt a hazard mitigation plan to maintain eligibility for FEMA Hazard Mitigation Assistance Grants. The nine-task planning process was summarized and participants were informed that by the conclusion of the meeting, the planning committee will have completed at least portions of Tasks 1-6.

A review of the requirements for jurisdictions to officially participate in the Multi-jurisdictional Hazard Mitigation Plan was provided along with the status of each jurisdiction to-date with regard to meeting attendance, completion of Data Collection Guides, and provision of Action Status Updates.

Public Survey Results

Kyle reviewed the results of the public survey released by the Story County HMPC; the survey had 48 responses prior to the meeting, though the City of Ames provided a stack of hard copy responses that are currently being input into the system. The survey results will be posted in the Google Drive folder for HMPC access.

According to the survey responses, of the hazards evaluated, the top three in terms of perceived probability of occurrence were Severe Winter Storm, Extreme Heat, and Drought.

wood.

Page 1

The top three hazards in terms of perceived potential magnitude were Tornado/Windstorm, Thunderstorm/Lightning/Hail, and Severe Winter Storm.

Mitigation Strategy

Kyle reviewed the following information related to update of the mitigation strategy:

- Plan Goals
- Previous Actions from 2013 Plan
- Public Opinion from Surveys
- State Priorities for Hazard Mitigation Assistance Grants
- Key Issues from Risk Assessment (sample hazards)
- FEMA's Mitigation Ideas booklet

Goals

To facilitate discussion and ideas on new actions that jurisdictions may want to submit to the plan update, Kyle reminded the planning of the plan goals that were reviewed and revised at Meeting #2.

- Goal 1:** Protect lives and reduce injury
- Goal 2:** Minimize or reduce damage to property, especially critical facilities and infrastructure
- Goal 3:** Strengthen communication among agencies and between agencies and the public regarding hazard mitigation

Previous Actions

Kyle provided handouts to each jurisdiction listing all previous actions with action status updates where provided by jurisdictions in advance of the meeting. Those jurisdictions that have not yet provided mitigation status updates were asked to please do so as soon as possible, to ensure plan progress is not held up.

Public Opinion

The following opinion statements were collected through the public survey:

- Change the zoning code and quit allowing building in the floodway fringe (Ames)
- Update tornado sirens (Slater)
- Develop emergency preparedness (Huxley)
- Protect infrastructure valves, meters, regulators and transformers (Gilbert)
- Fortify emergency resources to deal with mass casualty events caused by a hazmat release, EF5 tornado or terrorist attack (Ames)
- Require tornado shelters for mobile home parks (Slater)
- Improve storm drainage (Gilbert)
- Encourage citizen preparedness for emergencies (Huxley)
- Develop or encourage tornado shelters for apartment buildings (Ames)

State Priorities

Kyle also discussed the priorities set by the Iowa Homeland Security and Emergency Management Division for use of Hazard Mitigation Assistance Grants.

- Flood-prone Property Acquisition & Structure Demolition /Relocation
- Flood-Prone Structure Elevation
- Dry Floodproofing of Historical Residential Structures
- Dry Floodproofing of Non-residential Structures
- Minor Localized Flood Reduction Projects (storm water management or localized flood control projects)
- Structural Retrofitting of Existing Buildings (adding a tornado safe room)
- Non-structural Retrofitting of Existing Buildings, and Facilities from wind damage.
- New Tornado Safe Room Construction
- Electrical Utilities Infrastructure Retrofit
- Soil Erosion Stabilization
- Wildfire Mitigation

Key Issues / Action Ideas

Key issues/problem statements for select hazards in the risk assessment were discussed for the following hazards: Tornado/Windstorm, River Flooding, Severe Winter Storm, Flash Flood and Hazardous Materials. The discussion was geared toward identifying any gaps that may exist between the problems identified and actions already developed to address the problems. Action ideas were also discussed for these hazards. The group also discussed the current situation in Kelley, focusing on situational awareness and potential mitigation actions that have come from the response. The planning committee was encouraged to develop new actions to fill any gaps.

Planning committee members will work with others in their jurisdiction to review the risk assessment to determine any additional new mitigation actions that are necessary for these and the remaining hazards in the plan.

FEMA Mitigation Ideas Booklet

FEMA's Mitigation Ideas Booklet and the link <http://www.fema.gov/hazard-mitigation-planning-resources> was provided to the HMPC to help identify additional new mitigation actions. Action ideas from this booklet were reviewed for select hazards. Jurisdictions were encouraged to review this document with others in their jurisdiction to determine final mitigation actions to submit to the plan update.

Mitigation Action Plans

Kyle discussed the Action Plan Form that has been created to capture each jurisdiction's continuing and new actions. Communities participating in the National Flood Insurance Program were informed that they must have at least one action addressing continued compliance with the National Flood Insurance Program.

The due date for completion and return of the Action Plan worksheets for all Continuing and New actions is July 18, 2018. Planning team members may also request a MS Excel Worksheet to record Action Plan details, if desired.

In discussing the action plans, the concept of cost-effectiveness of actions was discussed. For planning purposes, benefits will be recorded for each action in qualitative terms. For example, an action to construct a community safe room will provide life-safety benefits. Kyle explained that for actions that will be submitted as Hazard Mitigation Assistance grant applications, a quantitative benefit-cost analysis must be completed to demonstrate that the benefits that will be realized after implementation outweigh the cost of completing the project. FEMA has benefit-cost analysis modules available for this purpose.

Action Prioritization

The Action Plan Worksheet includes questions to assist in the prioritization of mitigation actions. The STAPLEE method of analyzing the Social, Technical, Administrative, Political, Legal, Economic and Environmental aspects of a project was utilized in the 2013 plan and is being carried forward in this plan update. In addition to the STAPLEE criteria, four additional mitigation-effectiveness criteria have been added to the Action Plan Worksheet. Therefore, the STAPLEE criteria and mitigation effectiveness prioritization exercise must be completed for all continuing and new actions for the plan update.

Hazard Mitigation Assistance Grants

The Hazard Mitigation Plan is a requirement for jurisdictions to be eligible to apply for FEMA's Hazard Mitigation Assistance (HMA) Grants. The three grant programs that fall under HMA were summarized with details on current funding available and application due dates. Jurisdictions were informed that Iowa's Homeland Security and Emergency Management Department is the State agency responsible for administration of these grants. Kyle also presented a list of agencies and other state and federal grant programs that fund mitigation activities.

Plan Maintenance

Kyle discussed the requirements for the plan to provide a formal plan maintenance process to ensure that the mitigation plan remains an active and relevant document. After discussion, the following plan maintenance process was agreed to by group consensus:

- The HMPC will meet annually to review the Hazard Mitigation Plan, or after a disaster;
- Each jurisdiction designate representative to monitor progress on plan actions and reporting annually
- Change plan as appropriate based on changing priorities
- Publish annual update information in newspapers and on the County website

There was a recommendation during the meeting that each HMPC member make sure that their portion of the plan is reviewed with city councils and school boards at least once per year.

During the meeting, Kyle distributed an "Integration in Existing Planning Mechanisms" questionnaire to determine how the mitigation plan was incorporated into other planning mechanisms in the last 5 years as well as report on the method to incorporate the mitigation plan into jurisdictional planning mechanisms moving forward. Questionnaires were received from Kelley, Slater, Roland, Huxley, Unincorporated Story County and the Roland-Story Community School District. Other jurisdictions were asked to return this form with their mitigation action worksheets. The questionnaire asks each jurisdiction how they incorporated the hazard mitigation plan into other planning mechanisms, and how the plan will be incorporated into planning over the next five years. Kyle reiterated that the questionnaire is not a test.

Next Steps

The meeting concluded with a discussion of the remaining steps to complete the planning process as follows:

- | | |
|-------------------------|--|
| • ASAP | Missing Data Collection Guides, Mitigation Action Reporting |
| • July 18, 2018 | Action Forms Due for Continuing and New Actions |
| • July 18, 2018 | Integration in Existing Planning Mechanisms Questionnaire |
| • September 2018 | Committee Comment Period Target |
| • November 2018 | Final Public Comment Period / IA HSEMD Review Target |
| • December 2018 | Submit Plan to FEMA |
| • March 2019 | Anticipate FEMA's Approval Pending Adoption |
| • April 2019 | Jurisdictions Adopt Plan |




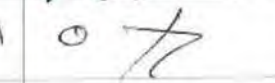





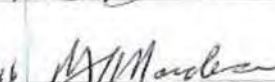
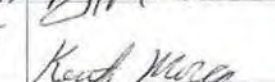
B-10. Meeting #3 Sign-In Sheets

STORY COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN UPDATE MEETING #3—SIGN-IN SHEET					
Project: Story County, Iowa Multi-Jurisdictional Hazard Mitigation Plan Update			Meeting Date/Time: June 27, 2018 7:00-9:00 pm		
Facilitator: Kyle Karsjen, Wood PLC			Place/Room: Story County Administration Building 900 6th Street, Nevada		
Name	Title	Department/Agency	Email	Phone #	Signature
Kenneth L. Kling	Mayor	Kelley	Kandrkling@hux.com	(515) 271-1484	
Steve Ransom	Councilman	Slater	sternia1970@hux.com	515-228-3584	
John Kahler	Mayor	Slater	jfkahler@hux.com	515-202-4044	
Tasheik Kerr	Management Analyst	AMES	TKerr@cedy.amesia	515-239-5227	
Nicole Groeser	Councilwoman	Sheldahl	nermcevoy@gmail.com	515-291-4415	
Nathan Horvick	Public Works Director	Roland	rolandpublicworks@rolandpublicworks.com	515-241-4844	
Matt Patton	Superintendent	Roland-Story	mpatton@roland-story.k12.ia.us	515-735-4301	
Chris Erickson	Mayor	McGillsburg	chris32582@gmail.com	515-460-6709	
Garry Stoll	Police Chief	Huxley	gstoll@huxleyiowa.org	515-231-4724	
Jon Popp	MAYOR	GILBERT	JRPOPP@HUXLEYIOWA.ORG	515-351-8003	
Bob Jamison	FP	Colo	jamison@agrepair.com	641-277-6005	

wood.

STORY COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN UPDATE MEETING #3—SIGN-IN SHEET

Project:	Story County, Iowa Multi-Jurisdictional Hazard Mitigation Plan Update	Meeting Date/Time:	June 27, 2018 7:00-9:00 pm
Facilitator:	Kyle Karsjen, Wood PLC	Place/Room:	Story County Administration Building 900 6th Street, Nevada

Name	Title	Department/Agency	Email	Phone #	Signature
David J. Kroese	Director Budget Level	Nevada Schools	d/kroese@nevada.cws.org	382-2783	
Jason Grubbs	Deputy Sheriff	Story County S.O.	j.grubbs@storycountyia.gov	382-7525	
David Thom	City Council	Cambridge IA	dave.thom@veogan.com	220-4551	
Ottie Maxey	Superintendent	Ballard K12, IA, US	omaxey@ballard.k12.ia.us	597-2811	
Tony Ness	Director Public Works	Maxwell County	tonyness@gmail.com	215-2153	
Leann Harter	County Circuit Clerk Special Projects Manager	Story County	lharter@storycountyia.gov	382-7247	
Stephen Simpson	Director Emerg. Mgt	Iowa State Univ.	ssimpson@iastate.edu	515-294-7625	
Lindsey Baucher	Supt	Gilbert LSO	baucher-legisl@gilbert.k12.ia.us	515-232-3240	
Lauris Olson	Supervisor	Story County	lolson@storycountyia.gov	515-382-7203	
MATT MARAZZEN	CITY ADMINISTRATOR	NEVADA	mmarazzen@cityofnevadaia.org	515-387-5446	
Keith Morgan	Coordinator Story EMA	Story Co EMA	kmorgan@storycountyia.gov	515-382-7315	
wood.					

B-11. Public Notice During Drafting Stage

Input requested on Hazard Mitigation Plan update

Ames Tribune

Subscribe Now

VIETNAM Special content section

Surprise: Ames gets unexpected federal funds

VetMeasure working on real-time health monitoring for pets

Main Street makeover

Men's Basketball: Weller-Babb's summer consists of internship and hoops

Let the games begin

In the Middle of Anywhere

CLICK HERE

US Cellular

Input requested on Hazard Mitigation Plan update

Posted May 16, 2018 at 12:12 PM
Updated May 16, 2018 at 11:04 PM

TOP DOG IN PLUMBING DRAINTECH
PLUMBING DRAINAGE VIDEO ATING
BEST
Family Owned & Operated
515-233-3700

MOST POPULAR

- 1 Lawsuit against Luther BBQ joint settled
May 14 at 10:25 PM
- 2 Presence of homeless in Ames often overlooked
May 12 at 9:27 PM

The city of Ames is working with Story County, public school districts, Iowa State University, and others to update the comprehensive Story County Multi-Jurisdictional Hazard Mitigation Plan, according to a news release on the city's website.

The plan update will address a comprehensive list of hazards — ranging from severe winter storms and flooding to hazardous materials incidents and tornadoes — and will assess the likely impacts of these hazards.

The Story County Hazard Mitigation Planning Committee is seeking public input for the plan update. A summary of the plan update effort underway, as well as a questionnaire to capture public opinion and comments, is available online at www.surveymonkey.com/s/Story-CO-IA.

For those who prefer hard copies, the questionnaire is available at the Ames Public Library during normal operating hours. The survey will be available until Friday, June 15.

Activate Windows
Go to Settings to activate Windows

Input requested on Hazard Mitigation Plan update

Ames Tribune

Subscribe Now

VIETNAM Special content section

Surprise: Ames gets unexpected federal funds

VetMeasure working on real-time health monitoring for pets

Main Street makeover

Men's Basketball: Weller-Babb's summer consists of internship and hoops

Let the games begin

4 Special Olympian ready for 'the thrill' of the games
May 16 at 9:51 AM

Never Miss A Story
Subscribe to The Ames Tribune

Subscribe Now

OUR PICKS

The latest on your teams

TOP DOG IN PLUMBING DRAINTECH
PLUMBING DRAINAGE VIDEO ATING
BEST
Family Owned & Operated
515-233-3700

funding programs administered by the Federal Emergency Management Agency (FEMA).

Feedback from the public will be incorporated into the draft plan, which will be available for public review and comment later this fall. After approval by Iowa Homeland Security and Emergency Management Department and FEMA, the plan will be presented to the Story County Board of Supervisors, city councils, and school boards of each participating jurisdiction for formal adoption.

For more information on this project, contact City of Ames Management Analyst Tashek Kerr at tkerr@city.ames.iowa.us.

SIGN UP FOR DAILY E-MAIL
Wake up to the day's top news, delivered to your inbox

READ NEXT


- 14 gallery walls that will inspire you
Posted May 17 at 11:02 PM
- Hourz Quiz: What color should you paint your bedroom walls?
Posted May 16 at 11:21 PM
- Home Help: 5 tips to create a personalized shed
Posted May 15 at 11:21 PM
- Finding the right light: What to look for when buying bulbs
Posted May 14 at 11:02 PM
- 10 inspiring setups for outdoor dining
Posted May 13 at 11:02 PM
- Whether to ward off spirits, bugs or boring design, blue ceilings are ...
Posted May 8 at 11:02 PM

Login with: f g+ t in

0 Comments


Write your comment here

Activate Windows
Go to Settings to activate Windows



Story County

IOWA • 1853



Search

[Your Government](#)
[Departments](#)
[Services](#)
[For Business](#)
[For Visitors](#)

- Agendas & Minutes
- Employment
- How Do I...?
- County Offices
- E-Services
- Employee Intranet
- Social Networking
- Farm Watch
- The C2C Plan
- Privacy Notice
- Crisis Assistance

Home > News Flash

Home

Posted on: March 6, 2018

Public Input Sought for the Story County Hazard Mitigation Plan

Would you like the opportunity to provide your thoughts to your community's disaster and emergency mitigation plan? Story County communities, school districts, and Iowa State University have begun the review and revision of the Story County Hazard Mitigation Plan and would like the public's input. Please take a few minutes and follow this link to the [Story County Hazard Mitigation Public Survey](#) doodle poll and share your thoughts and suggestions.

If you would like more information on the hazard mitigation planning process please contact Story County Emergency Management at storycntyiaem@storycountyjowa.gov or 515-382-7315

Facebook Twitter YouTube Instagram

Next: Magical Mooring March

Search

All categories

Tools

RSS

Categories

- All Categories
- Auditor & Elections
- Board of Supervisors
- Engineer & Secondary Roads
- Environmental Health

Page | Inbox | Notifications | Insights | Publishing Tools

Story County Emergency Management

@storycountyema

Home

About

Photos

Reviews

Videos

Events

Notes

Posts

Services

Shop

Groups

Offers

Jobs

Community

Promote

Manage Promotions

Liked Following Share

Story County Emergency Management

Published by Melissa Anderson Spencer (?) - March 6 at 4:00pm

Public Input Sought for the Story County Hazard Mitigation Plan

Would you like the opportunity to provide your thoughts on your community's disaster and emergency mitigation plan? Story County communities, school districts, and Iowa State University have begun the review and revision of the Story County Hazard Mitigation Plan and would like the public's input. Please take a few minutes and go to <https://www.surveymonkey.com/r/Story-CO-IA> and share your thoughts and suggestions.

If you would like more information on the hazard mitigation planning process please contact Story County Emergency Management at storycntyiaem@storycountyjowa.gov or 515-382-7315



Story County, Iowa Multi-jurisdictional Hazard Mitigation Plan Survey

Web survey powered by SurveyMonkey.com. Create your own online survey now with...

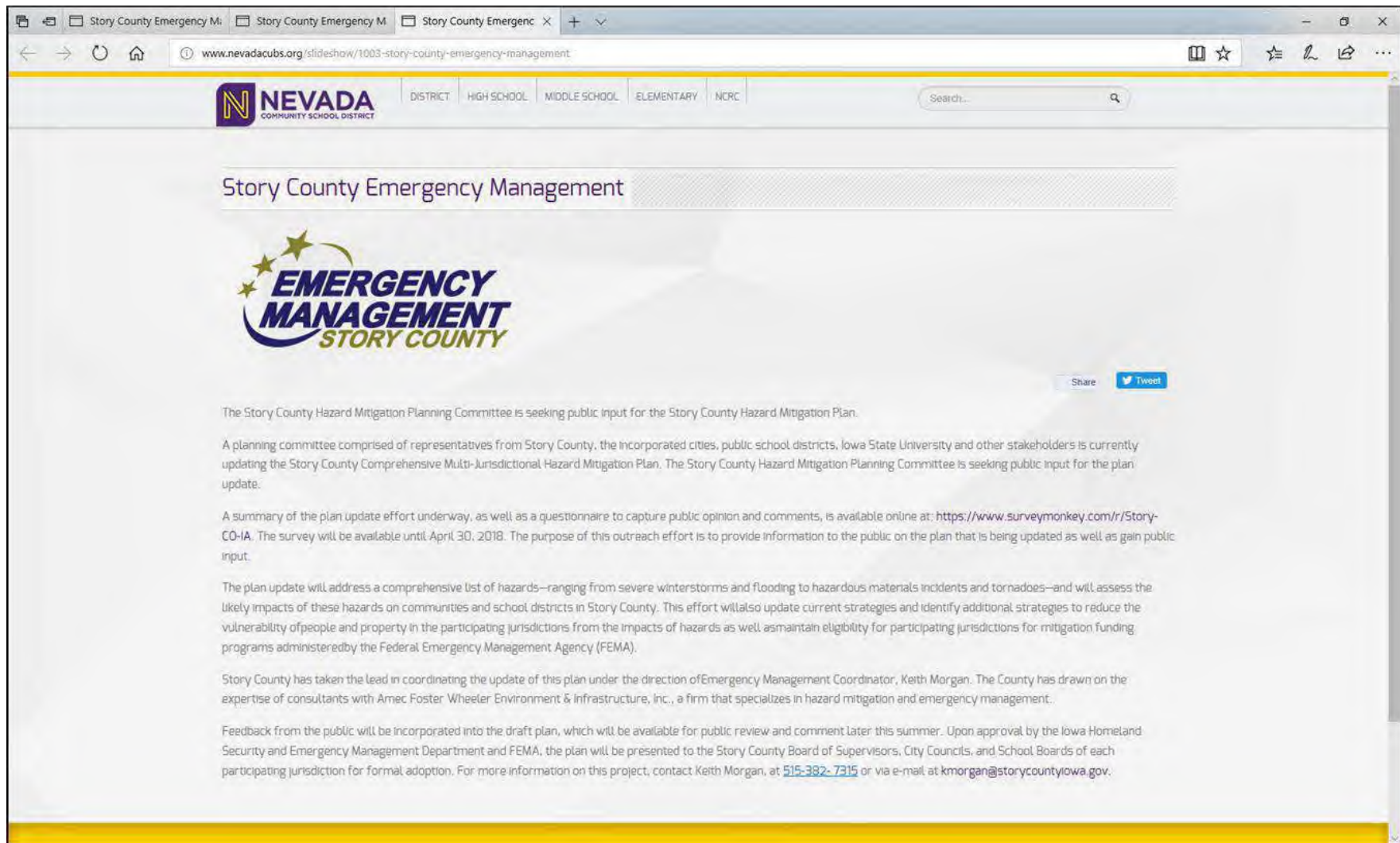
SURVEYMONKEY.COM

290 people reached

Boost Post

Like Comment Share

Angie Westphal Jewett and John Halbrook



Story County Emergency Management

EMERGENCY MANAGEMENT
STORY COUNTY

The Story County Hazard Mitigation Planning Committee is seeking public input for the Story County Hazard Mitigation Plan.

A planning committee comprised of representatives from Story County, the incorporated cities, public school districts, Iowa State University and other stakeholders is currently updating the Story County Comprehensive Multi-Jurisdictional Hazard Mitigation Plan. The Story County Hazard Mitigation Planning Committee is seeking public input for the plan update.

A summary of the plan update effort underway, as well as a questionnaire to capture public opinion and comments, is available online at: <https://www.surveymonkey.com/r/Story-CO-IA>. The survey will be available until April 30, 2018. The purpose of this outreach effort is to provide information to the public on the plan that is being updated as well as gain public input.

The plan update will address a comprehensive list of hazards—ranging from severe winterstorms and flooding to hazardous materials incidents and tornadoes—and will assess the likely impacts of these hazards on communities and school districts in Story County. This effort will also update current strategies and identify additional strategies to reduce the vulnerability of people and property in the participating jurisdictions from the impacts of hazards as well as maintain eligibility for participating jurisdictions for mitigation funding programs administered by the Federal Emergency Management Agency (FEMA).

Story County has taken the lead in coordinating the update of this plan under the direction of Emergency Management Coordinator, Keith Morgan. The County has drawn on the expertise of consultants with Amec Foster Wheeler Environment & Infrastructure, Inc., a firm that specializes in hazard mitigation and emergency management.

Feedback from the public will be incorporated into the draft plan, which will be available for public review and comment later this summer. Upon approval by the Iowa Homeland Security and Emergency Management Department and FEMA, the plan will be presented to the Story County Board of Supervisors, City Councils, and School Boards of each participating jurisdiction for formal adoption. For more information on this project, contact Keith Morgan, at [515-382-7315](tel:515-382-7315) or via e-mail at kmorgan@storycountyia.gov.



City of Sheldahl

Published by Margie McKinney (?) · 20 hrs · 🌐

Public Input Sought for the Story County Hazard Mitigation Plan

Would you like the opportunity to provide your thoughts on your community's disaster and emergency mitigation plan? Story County communities, school districts, and Iowa State University have begun the review and revision of the Story County Hazard Mitigation Plan and would like the public's input. Please take a few minutes and go to <https://www.surveymonkey.com/r/Story-CO-IA> and share your thoughts and suggestions.

If you would like more information on the hazard mitigation planning process please contact Story County Emergency Management at storycntyaem@storycountyia.gov or 515-382-7315



Story County, Iowa Multi-jurisdictional Hazard Mitigation Plan Survey

Web survey powered by SurveyMonkey.com.
Create your own online survey now with...

[SURVEYMONKEY.COM](https://www.surveymonkey.com)

 **151 people** reached

[Boost Post](#)

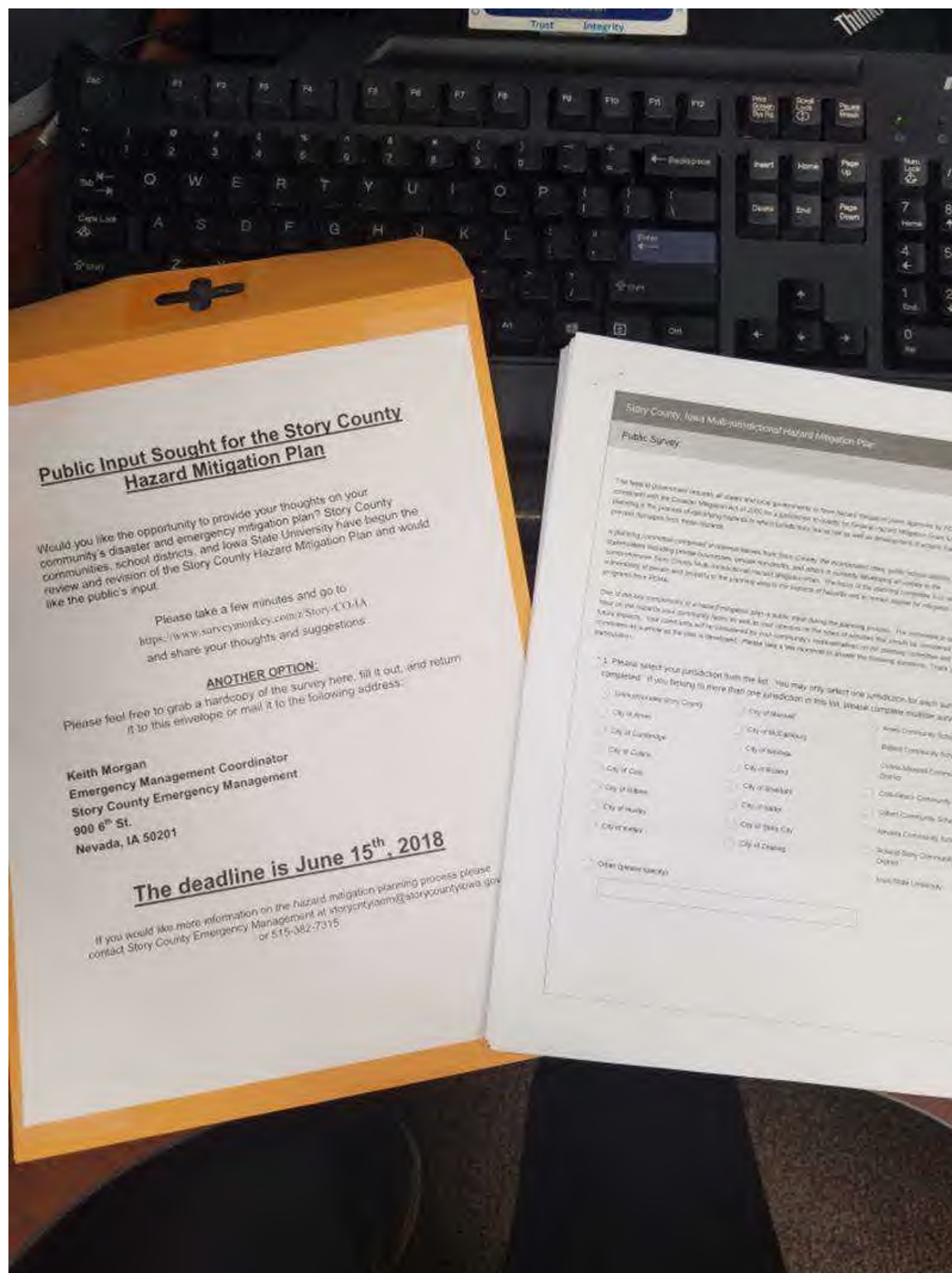
 **Like**

 **Comment**

 **Share**



 **City of Sheldahl and Nicole Goesser**





The City of Ames is working with Story County, public school districts, Iowa State University, and others to update the comprehensive Story County Multi-Jurisdictional Hazard Mitigation Plan. The plan update will address a comprehensive list of hazards - ranging from severe winter storms and flooding to hazardous materials incidents and tornadoes - and will assess the likely impacts of these hazards.



A summary of the plan update effort underway, as well as a questionnaire to capture public opinion and comments, is available online at: <https://www.surveymonkey.com/r/Story-CO-IA>

Ask a Librarian for a Hard Copy of the survey.



B-12. Plan Summary/Questionnaire for Public Comment during Drafting Stage

Online Survey was available at SurveyMonkey.com and hard copies were available at post office locations and public libraries throughout the County.

Story County, Iowa Multi-jurisdictional Hazard Mitigation Plan

Public Survey

The federal government requires all states and local governments to have hazard mitigation plans approved by FEMA that are consistent with the Disaster Mitigation Act of 2000 for a jurisdiction to qualify for Federal Hazard Mitigation Grant funds. Mitigation planning is the process of identifying hazards to which jurisdictions are at risk as well as development of actions that will reduce or prevent damages from those hazards.

A planning committee comprised of representatives from Story County, the incorporated cities, public school districts, and other stakeholders including private businesses, private non-profits, and others is currently developing an update to the comprehensive Story County Multi-Jurisdictional Hazard Mitigation Plan. The focus of the planning committee is to reduce the vulnerability of people and property in the planning area to the impacts of hazards and to remain eligible for mitigation funding programs from FEMA.

One of the key components of a hazard mitigation plan is public input during the planning process. The committee is seeking your input on the hazards your community faces as well as your opinions on the types of activities that should be considered to reduce future impacts. Your comments will be considered by your community's representatives on the planning committee and the planning committee as a whole as the plan is developed. Please take a few moments to answer the following questions. Thank you for your participation.

*** 1. Please select your jurisdiction from the list. You may only select one jurisdiction for each survey completed. If you belong to more than one jurisdiction in this list, please complete multiple surveys.**

<input type="radio"/> Unincorporated Story County	<input type="radio"/> City of Maxwell	<input type="radio"/> Ames Community School District
<input type="radio"/> City of Ames	<input type="radio"/> City of McCallsburg	<input type="radio"/> Ballard Community School District
<input type="radio"/> City of Cambridge	<input type="radio"/> City of Nevada	<input type="radio"/> Collins-Maxwell Community School District
<input type="radio"/> City of Collins	<input type="radio"/> City of Roland	<input type="radio"/> Colo-Nesco Community School District
<input type="radio"/> City of Colo	<input type="radio"/> City of Sheldahl	<input type="radio"/> Gilbert Community School District
<input type="radio"/> City of Gilbert	<input type="radio"/> City of Slater	<input type="radio"/> Nevada Community School District
<input type="radio"/> City of Huxley	<input type="radio"/> City of Story City	<input type="radio"/> Roland-Story Community School District
<input type="radio"/> City of Kelley	<input type="radio"/> City of Zearing	<input type="radio"/> Iowa State University
<input type="radio"/> Other (please specify) <div></div>		

* 2. The hazards addressed in the Multi-jurisdictional Hazard Mitigation Plan Update are listed below. Please indicate your opinion on the likelihood for each hazard to impact YOUR JURISDICTION (identified above).

	Unlikely (less than 10% probability in any given year)	Occasional (between 10% and 20% probability in any given year)	Likely (between 20% and 33% probability in any given year)	Highly Likely (greater than 33% probability in any given year)
Animal/Plant/Crop Disease	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dam/Levee Failure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Drought	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Earthquake	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Expansive Soils (soils that expand and contract when wet or dry)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Extreme Heat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flash Flood	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Grass or Wildland fire	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hazardous Materials Incident	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Human Disease	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Infrastructure Failure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Landslide	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Radiological Incident	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
River Flooding	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Severe Winter Storm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sinkholes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Terrorism	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Thunderstorm/Lightning/Hail	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tornado/Windstorm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Transportation Incident	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

3. Please indicate your opinion on the potential magnitude of each hazard's impact on YOUR JURISDICTION (identified above).

	Negligible (less than 10% property severely damaged)	Limited (10% to 25% property severely damaged)	Critical (25% to 50% property severely damaged)	Catastrophic (more than 50% of property severely damaged)
Animal/Plant/Crop Disease	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dam/Levee Failure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Drought	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Earthquake	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Expansive Soils	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Extreme Heat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flash Flood	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Grass or Wildland Fire	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hazardous Materials Incident	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Human Disease	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Infrastructure Failure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Landslide	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Radiological Incident	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
River Flooding	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Severe Winter Storm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sinkholes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Terrorism	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Thunderstorm/Lightning/Hail	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tornado/Windstorm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Transportation Incident	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

4. FEMA Hazard Mitigation Assistance Grants can be used to fund mitigation actions identified in the hazard mitigation plan. These grants are administered by the Iowa Homeland Security & Emergency Management Department. Listed below are some types of projects considered. Please check all those that would benefit your jurisdiction, in your opinion.

- ☐ Flood-prone Property Acquisition & Structure Demolition/Relocation
- ☐ Flood-prone Structure Elevation
- ☐ Floodproofing of Historical and/or Non-residential Structures
- ☐ Minor Localized Flood Reduction Projects (stormwater management or other localized flood control projects)
- ☐ Structural Retrofitting of Existing Buildings to Add a Tornado Safe Room
- ☐ Retrofitting of Existing Buildings and Facilities to Prevent Wind Damage
- ☐ New Tornado Safe Room Construction
- ☐ Electrical Utilities Infrastructure Retrofit (i.e. strengthening lines/connections to withstand ice/wind damages, burying power lines)
- ☐ Soil Erosion Stabilization
- ☐ Wildfire Mitigation

Other (please specify)

5. What is the worst event that has affected your jurisdiction that you are aware of? Please provide as many specifics as possible including approximate date, locations impacted, and impacts.

6. Please comment on any other issues that the Story County Hazard Mitigation Planning Committee should consider in developing a strategy to reduce future losses caused by hazard events.

B-13. Announcement for Final Public Comment Period



STORY COUNTY EMERGENCY MANAGEMENT AGENCY

900 6TH STREET, NEVADA, IA 50201

PH: (515) 382-7315 FAX (515) 382-7328

EMAIL: storycountiagem@storycountyia.gov

WEB SITE: www.storycountyia.gov/ema

Keith Morgan, Coordinator

Melissa Spencer, Deputy Coordinator

Story County, Iowa Multi-jurisdictional Hazard Mitigation Plan

Contact: Keith Morgan-Coordinator

Phone: 515-382-7315

Email: storycountiagem@storycountyia.gov

Story County Planning Team Seeks Public Input

Story County, IA —

Taxpayers pay billions of dollars each year for disaster recovery. Some events are predictable, and often, damages can be reduced or eliminated. Story County Emergency Management and local jurisdictions have been working to develop a hazard mitigation plan to guide our efforts at reducing future risk due to natural or man-made disasters.

A draft of the revised Story County Multi-jurisdictional Hazard Mitigation Plan Update is now available and public input is requested before the plan is finalized. From **December 1 to December 14**, residents can view hard copies the final draft plan, during normal business hours at the Ames Public Library, 515 Douglas Ave, at the Adult Services Desk and at the **Story County Emergency Management Office** in the Story County Administrative Building, 900 6th Street, Nevada. Please contact the Story County Emergency Management office to schedule an appointment to ensure staff are available to provide access to the documents. The final draft plans are also available online through google docs at <http://bit.ly/StoryCountyHMP>. If the public has inputs or comments on the plan, they can be provided through a survey site at the following link: <https://www.surveymonkey.com/r/storyHMPcomments>

"Jurisdictions want residents to be informed about strategies in the Multi-jurisdictional Hazard Mitigation Plan Update and they are looking public input ensure they meet the community's needs." Keith Morgan, Story County EMA Coordinator explained. "Public comments will be considered by the Hazard Mitigation Planning Team and incorporated into the final plan, as appropriate."

The updated plan will also be reviewed by the Iowa Homeland Security and Emergency Management Department (Iowa HSEMD) and then submitted to FEMA for review and approval. The final plan must be approved by the governing body of each participating jurisdiction, Iowa HSEMD and FEMA before becoming official.

Story County Emergency Management invited representatives from County departments, the incorporated cities, public school districts, Iowa State University and other mitigation planning stakeholders to work together to develop this plan update. The planning Team addressed 19

PREVENTION	PREPAREDNESS	RESPONSE	RECOVERY	MITIGATION
Proudly serving the communities of:				
Ames – Cambridge – Collins – Colo – Gilbert – Huxley – Kelley – McCallsburg – Maxwell- Nevada- Reinold – Sheldahl – Slater – Story City – Story County – Zeeland				

hazards—ranging from drought and severe winter storms to tornadoes and flooding—and considered the impacts of these events on local communities. Based on the results of an updated risk assessment of the hazards, team members updated the strategies for their jurisdictions to reduce damages caused by the various hazards. The team consulted with Wood Environment & Infrastructure, Inc. to assist with the plan update and ensure that the final plan meets federal regulations.

For more information on this planning effort, or to schedule an appointment to view a hard copy of the plan, please contact Keith Morgan, Story County Emergency Management Coordinator at 515-382-7315 or via email at storycntylaem@storycountyowa.gov.

END####

[Home](#)
[+](#)

[www.facebook.com/storycountyema/](#)
[MB3 Grants System](#)
[Facebook Home](#)
[NWS Des Moines, IA](#)
[Work Email](#)
[WebEOC 7.8 Login](#)
[WENS Primary Site](#)
[DOT Cameras](#)
[NetReg, Iowa State](#)

[Story County Emergency Management](#)

[Page](#)
[Index](#)
[Notifications](#)
[Insights](#)
[Publishing To...](#)
[Ad Center](#)

[Like](#)
[Following](#)
[Share](#)

[Create Post](#)
[Go Live](#)
[Event](#)
[Video](#)

[Write a post...](#)
[Photo/Video](#)
[Get Messages](#)
[FeelingActiv...](#)

[Story County Emergency Management](#)

Published by Melissa Anderson Spencer [2] · Just now ·

Story County Emergency Management and local jurisdictions have been working to develop a hazard mitigation plan to guide our efforts at reducing future risk due to natural or man-made disasters. Now we would like to hear from you, the public.

Between Dec 1 & 14, you can view the draft plan online at <http://bit.ly/StoryCountyHMP>. If you have comments on the plan those can be shared online at: <https://www.surveymonkey.com/r/storyHMPcomments>.

If you would like to view a hard copy of the plan they will be available at the Ames Library at 515 Douglas or the Story County EMA Office at 900 6th Street in Nevada. If you would like to view the copy at the EMA office, we ask you call to make an appointment to ensure staff are available to provide access to the documents.

DRIVE.GOOGL.COM

Public Review Draft - Google Drive

[Like](#)
[Comment](#)
[Share](#)

[Boost Post](#)

[Sign Up](#)

5.0

9 OUT OF 9 · Based on the opinion of 10 people

Our Story

Welcome to the Story County Emergency Management Facebook Page. This page is not monitored 24/7 and ...

+ Finish your story to tell people more about your business.

Page Tips

Create a Group for Your Page

Help your audience connect in a group. Groups are separate spaces for people to have discussions, plan events, share photos and more. You can interact with people in the group as your Page or yourself.

Know Friends Who Might Like Your Page?

Invite friends to like Story County Emergency Management and help you connect with more people.

[Manage Promotions](#)



APPENDIX C: COMPLETED/DELETED MITIGATION ACTIONS

The table below provides the disposition of actions from the previous Story County Hazard Mitigation Plan that the jurisdictions did not continue forward in the mitigation strategy of this plan update. This includes actions with the following statuses:

- Completed
- Deleted

Action ID	Action Title	2018 Action Status	2018 Action Status Comment
Story-7	Study the value of adoption and enforcement of building codes to include construction of buildings to withstand a natural disaster	Completed	
AMES-8	Construct a facility to produce salt brine for treatment of roads during severe winter weather	Delete	Our potential partners were not interested in a joint project.
AMES-11	Complete a Physical Map Revision for College and Worle Creeks	Completed	Finalize and went into effect on October 14, 2016.
Collins-1	Designate community shelters and educate the public on areas that are air conditioned.	Completed	Notified everyone through school district TAG class - went through each home and designated who had basements and A/C
Collins-2	Enforce burning restrictions.	Completed	
Collins-6	Purchase/install backup power generators.	Completed	two locations - community center and fire department
Colo-10	Review and develop an acquisition program to remove structures from area prone to flash flooding.	Delete	
Gilbert-1	Establish policies and procedures for obtaining water from alternate sources.	Delete	No longer applicable
Gilbert-2	Encourage the development of wellhead protection ordinances and practices.	Completed	
Gilbert-3	Construct saferooms for recreational areas.	Completed	Completed during new high school construction
Huxley-1	Storm Water Line Improvement	Completed	Completed in 2016
Huxley-2	Adopt and enforce ordinance regarding connection of sump pumps.	Completed	Completed in 2016
Maxwell-1	Distribute educational materials on sediment and erosion control as well as best management practices for stormwater mitigation with development applications.	Completed	Maxwell continues to provide educational materials concerning sediment and erosion with all requests for development permits

Action ID	Action Title	2018 Action Status	2018 Action Status Comment
Maxwell-2	Establish educational campaign to provide information to public on various hazards, possibly during Severe Weather Awareness Week.	Completed	Maxwell includes campaign information in the newsletters distributed with water bills and to individuals residing in town who do not get water bills. The same information will be posted on the City Facebook page.
Maxwell-3	Establish recreational area saferooms	Delete	Not yet funded. Seeking grants. Continue with CIP priority.
Maxwell-4	Identify and plan flood control projects. Budget and complete improvements as needed.	Delete	Not yet funded. Seeking grants. Continue with CIP priority.
Maxwell-5	Install backup power supplies for outdoor warning sirens.	Delete	Not yet funded. Seeking grants. Continue with CIP priority.
Maxwell-6	Install buffer strips to assist absorption of water and provide property protection in event of flash flooding.	Delete	Not yet funded. Seeking grants. Continue with CIP priority.
Maxwell-7	Install flood gauges.	Delete	Not yet funded. Seeking grants. Continue with CIP priority.
Maxwell-8	Provide indoor NOAA weather radios to critical facilities, community shelters, city facilities, schools, and other identified areas.	Completed	Radios have been purchased and are available in public facilities
Maxwell-9	Provide training for City employees and landowners on dealing with flash flood events.	Delete	Staff attends training bi-annually
Maxwell-13	Work with Story County Emergency Management to disseminate public information regarding various hazards.	Completed	Maxwell includes campaign information in the newsletters distributed with water bills and to individuals residing in town who do not get water bills. The same information will be posted on the City Facebook page.
Nevada-5	Provide indoor NOAA weather radios to critical facilities, community shelters, city facilities, schools, and other identified areas.	Completed	
Roland-1	Establish a debris removal program and identify agencies responsible for debris removal on an as-needed basis and develop debris disposal sites for community members to transfer debris.	Completed	City Public Works will remove yard waste debris from right-of-way after a disaster. A yard waste dump site will be made available to the public south east of the City Shed if the current site is not accessible. If there is a declared disaster, residents can take yard waste to the right-of-way to be picked up, from typical storms they will be responsible for transporting their own debris. Garbage and man-made materials will have to be disposed of through a trash contractor.
Roland-2	Establish educational campaign to provide information to public on flash flooding, possibly during Severe Weather Awareness Week.	Delete	Mayor and staff do not see a benefit to sending out information. The NWS has "turn around, don't drown" campaigns that reach Roland.

Action ID	Action Title	2018 Action Status	2018 Action Status Comment
Roland-5	Adopt building codes.	Completed	Roland contracted a building official/inspector and adopted building codes.
Roland-6	Annually review Floodplain Management Ordinance to ensure it addresses concerns related to development in the floodplain	Completed	Chapter 160 of the Roland Code of Ordinances addresses Floodplain Management. It will be reviewed as necessary.
Slater-1	Adopt ordinance requiring tree-trimming.	Completed	
Slater-5	During events of extreme heat, provide community citizens with information on extreme heat, by posting information in city buildings, schools, primary employers, critical facilities, gathering points, website and other locations.	Delete	
Slater-6	Encourage realtors and local insurance agents to promote the use of weather radios.	Delete	
Slater-7	Identify and plan flood control projects. Budget and complete improvements as needed.	Completed	Dredging of Four Mile Creek completed 2011; will continue identifying projects and budget
Slater-9	Install buffer strips to assist absorption of water and provide property protection in event of flash flooding.	Completed	
Slater-10	Promote water conservation landscaping practices.	Delete	
Slater-11	Provide training for City employees and landowners on dealing with flash flood events.	Completed	Ongoing
Slater-12	Review potential to participate in the Community Rating System.	Delete	Continuing to work with Story County Conservation on plantings along creek
Slater-16	Work with Story County Emergency Management to disseminate public information regarding structural failure-related emergencies.	Delete	Consolidated into action 15
Slater-17	Work with Story County Emergency Management to disseminate public information regarding thunderstorm and lightning-related emergencies.	Delete	Consolidated into action 15
Slater-18	Work with Story County Emergency Management to disseminate public information regarding tornado-related emergencies.	Delete	Consolidated into action 15
Slater-19	Work with Story County Emergency Management to disseminate public information regarding windstorm-related emergencies.	Delete	Consolidated into action 15

Action ID	Action Title	2018 Action Status	2018 Action Status Comment
Slater-20	Work with Story County Emergency Management to disseminate public information regarding winter storm-related emergencies.	Delete	Consolidated into action 15
Story City-2	Encourage installation of protective fencing surrounding propane tanks, anhydrous ammonia tanks, and other applicable hazardous materials.	Delete	
Story City-3	Encourage realtors and local insurance agents to promote the use of weather radios.	Delete	Not sure about this item. However, met with area ham radio operators in their utilization in case of need
Story City-4	Establish recreational area storm shelters	Delete	
Story City-5	Install backup power supplies for outdoor warning sirens.	Delete	Our sirens not capable
USD Ames-1	Saferooms in new/remodeled elementary school buildings	Completed	Provided structure enhanced spaces for severe weather
USD Ames-2	Relocate High School Varsity Baseball Complex out of floodplain	Completed	Built new baseball/softball complex at 2005 24th Street. Location out of floodplain area.
USD Ames-3	Safety Enhanced Entry Vestibule	Completed	Included security vestibule with enhanced glazing, electronic controlled locks, video door station to screen and monitor visitors for access management. Exterior doors are locked during the day.
USD Collins-Maxwell-1	Construct a saferoom located at Collins- Maxwell MS-HS in Maxwell	Delete	Discontinuing project due to lack of funding
Nevada CSD-2	Tornado Saferoom	Completed	Completed saferoom 8/9/2013
HC-1	Incorporate Crime Prevention Through Environmental Design strategies into future enhancements and revisions to community design guidelines.	Delete	Ongoing, but not necessary to carry forward in HMP.

APPENDIX D: ADOPTION RESOLUTIONS

<Placeholder for resolutions after FEMA provides approval pending adoption letter>