

## Chapter 1: Introduction

FEMA defines mitigation as any sustained action taken to reduce or eliminate long-term risk to life and property from a hazard event. The goal of mitigation is to decrease the need for response as opposed to simply increasing the response capability. Thus, for the purposes of this plan, mitigation discussions focus on specific actions that can be taken to reduce loss of life and property from hazards by modifying the built environment and by undertaking other actions to reduce the risk and potential consequences of these hazards.

Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), 42 U.S.C. 5165 as amended by the Disaster Mitigation Act of 2000 (DMA 2000) (Public Law 106-390), provides for states, tribes, and local governments to undertake a risk-based approach to reducing risks of natural hazards through mitigation planning. FEMA implemented the hazard mitigation planning provisions through regulations at 44 CFR Part 201.

This Plan was prepared in accordance with the regulations governing the mitigation planning requirements for local mitigation plans as published under 44 CFR §201.6. Under 44 CFR §201.6, local governments must have a FEMA-approved Local Mitigation Plan in order to apply for and/or receive project grants under the following hazard mitigation assistance programs:

- Hazard Mitigation Grant Program (HMGP)
- Pre-Disaster Mitigation (PDM)
- Flood Mitigation Assistance (FMA)
- Severe Repetitive Loss (SRL)

This plan for Ringgold County is funded with a PDM grant, grant agreement number PDMC-PL-07-IA-2016-002-01, awarded through a FEMA/State partnership via the Iowa Homeland Security and Emergency Management Department (IHSEMD). The grant contract period is 1/19/2017 through 1/19/2019.

### 1.1: Planning Context

Ringgold County has an active plan in place, set to expire on 8/5/2018. If the update plan is completed and approved by that date, there will be no lapse in the local qualification for FEMA funding. Because this is a plan update, there are additional FEMA and State planning requirements, mostly related to the descriptions of changes to the plan and descriptions of progress of mitigation actions as proposed in the previous plan.

The HMGP grant was awarded to the Ringgold County Board of Supervisors. The Board has contracted with the Southern Iowa Council of Governments in Creston to prepare the plan in cooperation with the Ringgold County Emergency Management Agency (Coordinator Teresa Jackson is the grant's authorized representative). SICOG and the same coordinator were involved in the previous plan update prepared and adopted five years ago.

Hazard mitigation planning in rural counties in Iowa is often in the purview of the County Emergency Management Agency. The Emergency Management Agency may be the obvious choice but it is not necessarily the only choice.

While the Coordinator may be skilled in the area and is a champion when it comes to the issues, many hazard mitigation actions will not be lead or implemented by the Agency. Rather, the Agency and its hired Coordinator, and other staff, if any, should be highly involved in planning. The role of the Agency is overarching, often focusing on other elements of the emergency management.

Emergency management has four phases that often have gray areas when it comes to the process and the tasks and actions undertaken. The following figure illustrates the natural or normal flow of this process.

Because of the intricate nature of the emergency management effort, some mitigation actions in this plan could also fall into the categories of preparedness, response, and recovery. Further, hazard mitigation tasks make preparation, response, and recovery easier.



### 1.2: Plan Organization

The plan update looks much different than the original. This is mostly because a) planning processes have changed, b) the planning leadership has gained more experience and has seen many other good examples of well-written plans, and c) plan update requirements are found throughout. The goal is to make the plan more useful, compliant, and easy to read.

The number of chapters has been reduced to flow with the key steps in FEMA’s prescribed planning process. These steps are as follows:

- Organize resources
- Perform the risk assessment
- Prepare the hazard mitigation strategy
- Implement the plan

Throughout the plan, there are several highlighted headings pertaining to plan update issues and references to the DMA. These guides are for readers and reviewers to better understand where and why the information is provided as it is. Numerous appendices follow the plan and are designed to supplement the text of the plan, provide implementation guidance to local officials, and address FEMA planning requirements.

While FEMA mandates that applicable natural hazards be included in the plan, Ringgold County has followed the guidance of the State of Iowa in adding so-called “man-made” and “combination” hazards. The plan is a multi-jurisdictional hazard mitigation plan, meaning that multiple jurisdictions (local governments) participated in the plan to share in the process, although in some sections, details about each jurisdiction are provided.

In the Appendix section and throughout the plan are listings of data sources used in those sections of the plan. The following major resources were used in planning process:

- IHSEMD, *State of Iowa Hazard Mitigation Plan (2016)*
- FEMA *Local Multi-Hazard Mitigation Planning Guidance (2008)*
- FEMA Planning How-To Guides
- IHSEMD, *Multi-Jurisdictional Mitigation Strategy Guide (2009)*
- FEMA *Local Mitigation Planning Handbook (2013)*
- FEMA *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards*
- FEMA Risk Map resources
- FEMA *Local Mitigation Plan Review Guide (2011)*
- FEMA *Mitigation Planning Toolkit*
- FEMA “Understanding Your Risks” worksheet

### 1.3: Purpose of the Document

Building a disaster resistant community is a noble goal that challenges Ringgold County to undertake actions that protect families, businesses, and public facilities by reducing the effects of natural and other key disasters. Reducing the effects of these disasters makes economic sense and is good public policy because it protects the citizens and the future of the community.

This multi-jurisdictional multi-hazard mitigation plan (plan) has been prepared in order to:

- Comply with both, Federal and State disaster mitigation planning requirements;
- Provide a comprehensive hazard analysis/risk assessment that best defines the hazards most likely to impact Ringgold County, Iowa, and the various jurisdictions, including cities and schools, within the county;
- Identify hazard mitigation activities that would lessen or eliminate the effects of the hazards identified; and
- Outline a strategy for the implementation of hazard mitigation projects.

### 1.4: Key Definitions and Acronyms

Multi-hazard mitigation efforts are based on definitions and principals of good planning as a means to reduce losses. Key terms and definitions include:

- **Community Rating System (CRS):** Program that provides incentives for National Flood Insurance Program communities to complete activities that reduce flood hazard risk. When the community completes specified activities, the insurance premiums of the policyholders in those communities are reduced.
- **Exposure:** The part of the asset base in the path of or exposed to a given hazard.
- **Extent:** The size of an area affected by a hazard or hazard event (often in terms of percentage of total jurisdictional area)
- **Flood Hazard Area:** The area shown to be inundated by a flood of a given magnitude on a map (also known as the Special Flood Hazard Area).
- **Flood Insurance Rate Map (FIRM):** Map of a community, prepared by FEMA, shows both the special flood hazard areas and the risk premium zones applicable to the community under the National Flood Insurance

Program.

- **Flood Zone:** A geographical area shown on a FIRM that reflects the severity or type of flooding in the area.
- **Floodplain:** Any land area, including watercourse, susceptible to partial or complete inundation by water from any source.
- **Hazard:** A source of potential danger or adverse condition.
- **Hazard Event:** A specific occurrence of a particular type of hazard.
- **Hazard Mitigation:** Any sustained action taken to reduce or eliminate long-term risk to people and property from natural hazards and their effects
- **Magnitude:** A measure of the strength of a hazard event. The magnitude (also referred to as severity) of a given hazard event is usually determined using technical measures specific to the hazard
- **Mitigate:** To cause something to become less harsh or hostile, to make less severe or painful
- **Planning:** The act or process of making or carrying out plans; the establishment of goals, policies, and procedures for a social or economic unit.
- **Preparedness:** Actions that strengthen the capability of government, citizens, and communities to respond to disasters.
- **Probability:** A statistical measure of the likelihood that a hazard event will occur.
- **Recovery:** The actions taken by an individual or community after a catastrophic event to restore order and lifelines in a community.
- **Risk:** The estimated impact that a hazard would have on people, services, facilities, and structures in a community; the likelihood of a hazard event resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate, or low likelihood of sustaining damage above a particular threshold due to a specific type of hazard event. It also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.
- **Vulnerability or susceptibility:** Describes how exposed or susceptible to damage an asset is. Vulnerability depends on an asset's construction, contents, and the economic value of its functions. Like indirect damages, the vulnerability of one element of the community is often related to the vulnerability of another. For example, since many businesses depend on uninterrupted electrical power, if an electric substation is flooded it will affect not only the substation itself, but a number of businesses as well. Often, indirect effects can be much more widespread and damaging than direct ones.
- **Vulnerability (or risk) assessment:** The extent of injury and damage that may result from a hazard event of a given intensity in a given area. The vulnerability assessment should address impacts of hazard events on the existing and future built environment.

The following acronyms and abbreviations are found throughout this document:

- Committee or Team: The Ringgold County Hazard Mitigation Planning Committee or Team, the group of appointed and volunteer officials that directed the creation of this mitigation plan
- CRS: Community Rating System
- DMA 2000: Disaster Mitigation Act of 2000
- EMA: Emergency Management Agency
- EMC: Ringgold County Emergency Management Commission or Coordinator, depending on use/context
- EMS: Emergency Medical Services, such as ambulance and rescue teams
- EPA: United States Environmental Protection Agency
- FEMA: The Federal Emergency Management Agency
- HARA: Hazard Analysis and Risk Assessment (a step in the planning process)
- HAZMAT: Hazardous Materials, generally as defined by the EPA
- HMP: Hazard Mitigation Plan
- IHSEMD: Iowa Homeland Security and Emergency Management Division
- NCDC: National Climatic Data Center
- NFIP: National Flood Insurance Program
- NIMS: National Incident Management System
- PH: Ringgold County Public Health
- SICOG: Southern Iowa Council of Governments
- SIRWA: Southern Iowa Rural Water Association
- STAPLE-E: Social-Technical-Administrative-Political-Legal-Economic-Environmental

- USDA: United States Department of Agriculture

### 1.5: Planning Participation and Adoption

The plan is written using a FEMA prescribed process. To FEMA, the process is just as important as the plan itself.

This part of the plan addresses the following Stafford Act requirement:

**Section 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.**

#### Ringgold County Plan Update Changes to the Plan Structure

During this update, two local school districts and the local hospital, all of which are governed independently of the County and municipal governments, were invited and, with the exception of the hospital, did participate in the plan and adopted the plan. Other jurisdictions that participated in the past plan (three municipalities) did not wish to participate and are not included.

Using FEMA guidelines, the planning team selected minimum standards for participation. These are as follows:

- An official of the jurisdiction must attend at least five planning team meetings.
- Participate in surveys and data collection activities.
- Participate in a local planning session in the jurisdiction, as needed, to finalize local elements of the plan.
- Review the plan draft and provide comments.
- Adopt the final plan.

The following jurisdictions sufficiently participated in the plan:

- Ringgold County
- City of Benton
- City of Diagonal (mostly via mail and email)
- City of Ellston
- City of Kellerton
- City of Maloy
- City of Mount Ayr
- City of Tingley
- Diagonal School District
- Mount Ayr School District

Adoption resolutions are found in Appendix A of this plan.

Additionally, other organizations participated in the process and developed projects within one or more of the above jurisdictions. Such groups included, among others, Alliant Energy, Southwest Iowa REC, and local industry representatives. The list of individuals who attended planning meetings is in the following section.

The jurisdictions were directly involved in selecting the hazards to profile, in the profile itself, in the data collection about critical assets, in identifying the capabilities, in selecting goals and objectives, in analyzing mitigation actions, and in prioritizing those selected for implementation. Planning team involvement and input permeates this plan. Local governments have adopted this plan and intend to implement the plan over the next five years.

Each jurisdiction has adopted multiple mitigation actions. The actions include administrative projects, educational efforts, structural projects, and other efforts. Local officials are well aware that the plan ensures eligibility for federal funds and that they are not obligated to implement the plan exactly as presented, since issues, hazard risks, and funding availability change over time. The plan also details the related update information, including details about the status of projects listed in the previous plan for each jurisdiction.

### 1.6: Hazard Mitigation Planning Process

The Plan was developed by the Ringgold County Hazard Mitigation Planning Team (planning team), which included representatives from the county, incorporated cities, surrounding counties, state agencies, and local businesses and organization and local residents. Participants in the planning process and measures taken to solicit and encourage public participation are identified in the Planning Process section. As stated earlier, Ringgold County contracted with the

Southern Iowa Council of Governments to facilitate the planning process and produce a draft and final plan.

This part of the plan addresses the following Stafford Act requirement:

**Section 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.**

The Ringgold County Board of Supervisors, upon receiving the PDM grant, authorized the Emergency Management Coordinator (EMC) Teresa Jackson to begin the planning process. The County contracted with the Southern Iowa Council of Governments (SICOG) to assist the County in preparation of the plan. The Ringgold County EMA took a leadership role in collaboration with SICOG planning staff to develop the planning process and coordinate the planning team meetings. The contractor produced the draft and final plans and coordinated the review with the State of Iowa and FEMA.

The contractor and Ringgold County EMA established the framework and process using FEMA and IHSEMD planning guidance. The plan is organized around the four-phase process identified in these planning documents.

- Organize resources
- Assess risks
- Develop the mitigation plan
- Implement the plan

The table below shows how the mitigation plan requirements and the Community Rating Service (CRS) planning steps relate to the four phases of the mitigation planning process and the How-To Guides. The CRS is a voluntary program for NFIP-participating communities that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. Flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS: (1) Reduce flood losses; (2) Facilitate accurate insurance rating; and (3) Promote the awareness of flood insurance.

**Figure 1.1: Planning Context**

Mitigation Plan Requirements – 44 CFR §201.6	CRS Planning Steps	How-to Guides
Organize resources 201.6(c)(1)	1. Organize	<i>Getting Organized</i> (FEMA 386-1)
201.6(b)(1)	2. Involve the public	
201.6(b)(2) and (3)	3. Coordinate	
Assess Risks 201.6(c)(2)(i)	4. Assess the hazard	<i>Understanding Your Risks</i> (FEMA 386-2)
201.6(c)(2)(ii) and (III)	5. Assess the problem	
Develop the Mitigation Plan (Mitigation Strategy)		<i>Developing a Mitigation Plan</i> (FEMA 386-3)
201.6(c)(3)(i)	6. Set goals	
201.6(c)(3)(ii)	7. Review possible activities	
201.6(c)(3)(iii)	8. Draft an action plan	<i>Bringing the Plan to Life</i> (FEMA 386-4)
Implement and monitor progress		
201.6(c)(5)	9. Adopt plan	
201.6(c)(4)	10. Implement, evaluate, revise	

**Phase 1: Organize Resources**

**Step 1: Organize the Planning Effort**

Ringgold County Emergency Management led the charge in creating a planning team and set up a kick-off meeting in Mount Ayr, the county’s largest town and county seat. This meeting officially began the planning process. The planning process continued with several other meetings over the next year or more. The following table lists the planning team members that attended at least one of the planning team meetings or provided actual comments on the plan.

**Figure 1.2: Planning Team**

Name, Title	Organization	Jurisdiction(s) Representing
Mel Burton	City of Maloy*/Ringgold County EMA	Maloy, Ringgold County
Mitch Doolittle, council member	City of Kellerton	Kellerton
Paul Dykstra, member	Ringgold County Board of Supervisors	Ringgold County
Melinda England	Ringgold County	Ringgold County, Diagonal
Steve Fetty, mayor	City of Mount Ayr	Mount Ayr
Becky Fletchall	Ringgold County Public Health	Ringgold County
Vera Haley	Ringgold County Secondary Roads	Ringgold County
Don Hove, council member	City of Benton	Benton

Curt Jackson, mayor	City of Maloy	Maloy
Teresa Jackson	Ringgold County EMA *	Ringgold County
Travis Malone	Ringgold County Secondary Roads *	Ringgold County
Steve Marean	Alliant Energy	Countywide
Jerry McGill	Mount Ayr Fire	Mount Ayr, rural county
Lyle Minnick, member	Ringgold County Board of Supervisors	Ringgold County
Kristina Nail, city clerk	City of Kellerton	Kellerton
Sarah Ontiveros	City of Kellerton/Kellerton Fire	Kellerton, rural county
Kraig Pennington, member	Ringgold County Board of Supervisors	Ringgold County
Amelia Quick, council member	City of Tingley	Tingley
Daron Richie, council member	City of Benton	Benton
Ken Robertson, council member	City of Mount Ayr	Mount Ayr
Don Solliday, council member	City of Mount Ayr	Mount Ayr
Karleen Stephens, superintendent	Diagonal Community School	Diagonal Community School
Jerri Stewart, mayor	City of Ellston	Ellston
Michael Wimer	Mount Ayr Fire/Ringgold County Water Emergency Team	Mount Ayr, rural county

\* *These people are no longer in those positions but held them at time of involvement in plan.*

The Ringgold County planning team contributed to the process by:

- Providing facilities for meetings;
- Attending and participating in meetings;
- Collecting data;
- Promoting the plan to elected officials and other relevant organizations;
- Making decisions on planning processes and content;
- Assisting with the evaluation of goals, objectives, and alternative actions;
- Submitting worksheets (examples in appendices) as assigned by the contractor;
- Reviewing drafts;
- Assisted in setting up discussions with elected officials to adopt the plan;

Outside agencies and organizations also participated in the planning process by providing examples and technical assistance, including FEMA Region 7, IHSEMD, and the Iowa DNR floodplain section.

The planning team communicated throughout the planning process through face-to-face meetings, email, and phone conversations, as well as the official meetings and survey worksheets. The following table shows the flow of meetings for this hazard mitigation plan update. *Appendix B* to this plan includes the public notices, agendas, presentations, sign-in sheets, and minutes for the official planning meetings as well as the handouts, survey forms, and related data gathering documents used in meetings and in other parts of the planning process.

**Figure 1.3: Planning Meetings**

Official Meeting Date	Audience(s)	Main Topics
July 11, 2017	Entire planning team	Introduction to planning, the HMP process, and project expectations
September 27, 2017	Entire planning team	Hazard identification, hazard profile, assets at risk
December 14, 2017	Entire planning team	Hazard identification, hazard profile, assets at risk
January 25, 2018	Entire planning team	Hazard profile
April 19, 2018	Entire planning team	Problem/issue statements, goals/objectives, review previous actions
May 31, 2018	Entire planning team	STAPLE-E evaluation process of possible mitigation actions
August 28, 2018	Entire planning team	Review draft mitigation strategy, discuss plan review process
TBD	Entire planning team	Public comment meeting, discuss implementation/maintenance process

**Step 2: Involve the Public**

*44 CFR 201.6(b): 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 planning approval.*

The planning team and subgroups of that team met numerous times between July 2017 through February 2017 (see above table). All meetings complied with the Iowa Open Meetings Law. Iowa’s Open Meetings Law “Seeks to assure, through a requirement of open meetings of governmental bodies, that the basis and rationale of governmental decisions, as well as those decisions themselves, are easily accessible to the people. All actions and discussions at meetings of governmental bodies, whether formal or informal, including work sessions, must be conducted in open session unless exceptions or exemptions are specifically provided by law. Open session means a meeting to which all members of the public have access.”

The Ringgold County EMA webpage included a link to an online survey for the public to give opinions on hazard mitigations issues. Nearly 30 online and paper surveys were returned.

Additionally, as the plan was nearly completed, a significant media blitz involving all local newspapers covering all jurisdictions and the local radio station was initiated. The draft plan was provided online at [www.sicog.com](http://www.sicog.com) and as a hard copy at all participating city halls and the county courthouse, where the public could view the plan and make comments. The public comments could be made by phone, fax, email, or in person directly to the planning consultant or at the final planning team meeting. This meeting, held on **February 2, 2017**, was designed primarily to take public comment. A full draft of the plan with appendices and maps was presented.

While the general public, outside of the planning team, offered few comments, they are incorporated in the ideas and concepts found in this plan. There is no section of the plan with the listing of specific comments. Generally, local officials and residents offered comments specific to a statement and the statement was edited.

Finally, in accordance with State of Iowa Law, public meetings were held prior to the jurisdictions adopting the plan.

### Step 3: Coordinate with Other Departments and Agencies

*44 CFR 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.*

Ringgold County Emergency Management invited other local, state, and federal departments and agencies, local businesses, academia, private and non-profit agencies, and surrounding counties to attend the team meetings, provide input prior to the meetings, and review and comment on draft sections of the plan. Those that were part of the planning team and attended meetings are listed earlier in this chapter and are listed in the sign-in sheets in Appendix B. Certainly, some people and organizations that provided input may be missing or not listed accidentally.

Other sources of information and planning documents are referenced throughout the plan and in the appendices.

An effort was gained to solicit comments from surrounding counties. The planning consultant, SICOG, has worked with all the surrounding Iowa EMAs and has written most of the plans in the surrounding counties. That insight and those contacts were used in the planning process for the Ringgold County plan update. Further, as part of the review and public comment period, SICOG notified the organization's members via email and monthly newsletter of the availability of the plan for comment on the SICOG website, [www.sicog.com](http://www.sicog.com).

## **Phase 2: Assess Risk**

### Step 4: Assess the Hazards

This step involved identifying and profiling the hazards and assessing their impact on physical assets.

#### Step 4a: Identify the Hazards

During the second planning team meeting, the planning team worked on hazard identification. The presentation showing hazard definitions from the State of Iowa HMP and the survey for this purpose are found in Appendix B. *Chapter 3* of this plan details the hazard identification and results. At the third planning meeting, the results were discussed and corrections were made as needed.

#### Step 4b: Profile the Hazards

During the third and fourth planning team meetings, the planning team worked on hazard profiling, which covered only those hazards that were identified as having occurred in the jurisdictions and that could occur but are not yet reported. Because not all members attended the meeting and some members wanted more time to contemplate the hazard list, the survey process continued several weeks after the meeting. The scoring system and survey for this purpose are found in Appendix B. *Chapter 3* of this plan details the hazard profile and results. At the fifth planning meeting, the results were discussed and corrections were made as needed.

### Step 5: Assess the Problem

This step includes the determination of assets at risk and the estimation of losses.

#### Step 5a: Identify Assets at Risk

In order to link the kinds of hazards that can occur with the impact they have on humans and property, the risk assessment must identify the assets at risk. The vulnerability assessment on which the planning team worked during the fourth planning team meeting helped create a full assessment of properties and populations that are vulnerable to various hazards. Worksheets from *Understanding Your Risk* were used to create a risk assessment. Local asset data, such as valuation data from the County Assessor's Office, were also used. The forms used can be found in Appendix B. Chapter 3 of the plan details the assets at risk.

Further, as part of the risk assessment, the planning team developed a capability assessment. The relationship between risk and capabilities is notable. Strong capabilities should reduce the risk to lives and property. The capability assessment was incorporated into the community profile in Chapter 2 and the discussion of the mitigation problem statements and overall vulnerability assessment in Chapter 3. Worksheets used in this process are found in Appendix B.

#### Step 5b: Estimate Losses

All natural hazards were evaluated for annualized losses that may occur, based on current values of properties. Worksheets from *Understanding Your Risk*, which are found in Appendix B, were used to estimate losses on an annualized basis. The methodology used and the resulting estimations are found in Chapter 3.

### ***Phase 3: Develop the Mitigation Strategy***

#### Step 6: Set Goals and Objectives

While the goals of the original plan are noble and useful, the planning team thought that new goals and objectives should be considered. During the fifth planning team meeting, the planning team considered the hazard profile, vulnerability assessment, loss estimation, original goals and objectives, capability assessment, and a list of problem statements to determine relevant goals. Forms used in this process are found in Appendix B. The goals and objectives were determined in large part by a vote of members attending that meeting, in order to create the wording that made the most sense for the leaders of the jurisdictions in the county. This information is presented in Chapter 4.

#### Step 7: Review Possible Activities

As part of this plan update, the planning consultant and team spent considerable time reviewing the previous plan to determine the status of actions proposed for each jurisdiction. The group also used other plans in the region, other plans recommended by FEMA Region 7 and IHSEMD, and new resources, such as FEMA's project ideas guidance, to come up with a stronger "comprehensive range" of mitigation actions for each jurisdiction. Worksheets for this process are located in Appendix B and were distributed to planning team members and other key organizations and department heads in the county in order to learn of the status of mitigation actions. Chapter 4 details the status of hazard mitigation actions proposed for each jurisdiction in the previous plan and outlines possible actions for the new plan. As part of the evaluation, each jurisdiction was to update its list of mitigation actions from the previous plan in order to document what has been completed, what is still in consideration, and what is no longer relevant.

During the sixth planning team meeting, the results of this process were brought together and projects were discussed. Jurisdictions that have not completed the worksheets were able to work on them during the meeting. During this meeting, the team began work on a full list of mitigation actions to include in the plan, which would be evaluated more fully using the STAPLE-E evaluation worksheets, copies for each jurisdiction of which are found in Appendix B. Members were asked to turn in a single STAPLE-E worksheet for each jurisdiction. This process is detailed in Chapter 4. As requested, the contractor met with individual jurisdictions to evaluate, select, and prioritize mitigation measures.

After the STAPLE-E review, each jurisdiction was given at the seventh planning team meeting a draft mitigation strategy with total evaluation scores. The planning team selected projects from the list with consideration of scores and capabilities and prioritized those that were deemed relevant for the next five years. The planning team created for each jurisdiction a list of projects along with the timeframe for implementation and the assessment of responsibility. The process and results are found as the full mitigation strategy in Chapter 4.

#### Step 8: Draft the Plan

The draft of the hazard mitigation plan was completed in **February 2017**. At that time, the previously mentioned public comment period was completed and the draft plan was edited to consider public comments. At the eighth (final) planning team meeting, the draft was presented to consider further comments. The draft plan, once the planning team approved it, was submitted for approval and adoption by the local jurisdictions, the IHSEMD, and FEMA.

### ***Phase 4: Implement the Mitigation Plan***

#### Step 9: Adopt the Plan

Adoption by the local governing body demonstrates the jurisdiction's commitment to fulfilling the mitigation goals and strategies outlined in the plan. In addition, adoption legitimizes the plan and authorizes responsible agencies to execute

their responsibilities. Copies of the resolution adopting the plan are located in Appendix A.

**Step 10: Implement, Evaluate, and (if needed) Revise the Plan**

During the final planning meeting, the consultant described the prescribed FEMA and State process for the plan implementation, evaluation, and revisions. The final chapter of the plan, Chapter 5, details these processes and assigns responsibilities. Further, the chapter inserts current State and FEMA language about the topics. It was determined, based on minimal reviews and edits to the old plan, that a simple review method would be necessary.

**Plan Update**

*44 CFR 201.6(d)(3): A local jurisdiction must review and revise its plan to reflect changes in the development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within 5 years in order to continue to be eligible for mitigation project funding.*

In all phases of the planning process described above, the planning team reviewed the existing sections of the plan and provided comments on necessary changes. Many limitations were found in the review of the planning process used at that time, and FEMA has made some of planning requirements more stringent since its approval of that plan.

Because this is a plan update, the remaining chapters provide descriptions of the changes in the definitions, scoring criteria, evaluation criteria, processes, requirements, and results since the previous plan was prepared and approved.

The following table lists the main items that were modified as part of the new plan when compared to the plan adopted in 2013.

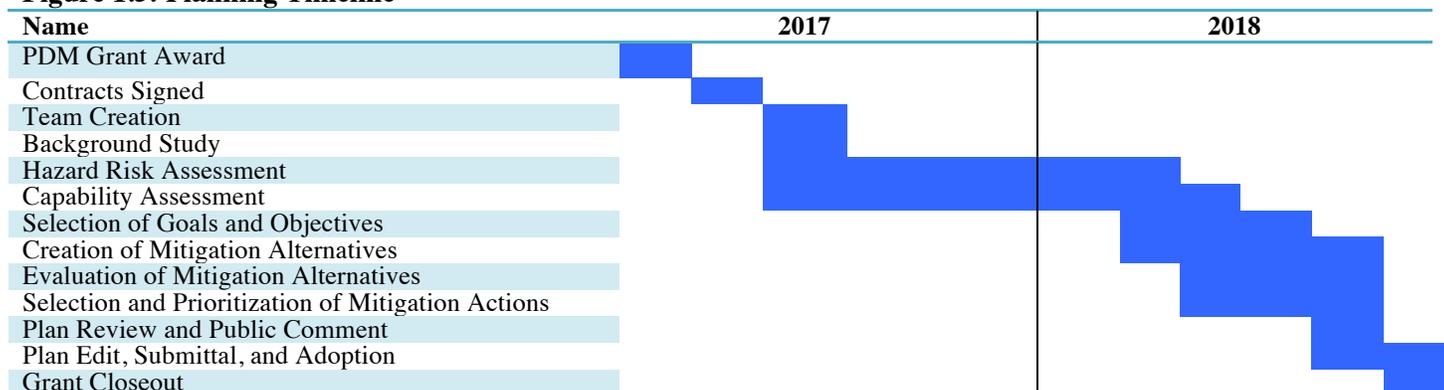
**Figure 1.4: Outline of Plan Content**

Chapter/Section/Topic	Description of Updates	Where Found in New Plan
Participation/prerequisites	More jurisdictions participating up-front: schools, hospital, greater involvement by local boards within jurisdiction	Chapter 1; Appendices A and B
Planning process	Updated with new language; expanded planning process descriptions; sited some FEMA regulation statements; expanded executive summary; expanded public participation items and meeting information; combined two chapters into one.	Chapter 1; introductions to each chapter; Appendix B
Community profile	Updated with 2010 Census data and Census estimates; removed data that did not have a direct mitigation value; expanded information on other plans in the community; provided more community specific information; updated valuation information; moved and improved capability assessment data to and within the profile chapter; updated NFIP and repetitive loss data.	Chapter 2
Risk assessment	Updated the list of possible hazards based on 2016 State plan; updated hazard definitions; updated profiles based on new information in State plan, other websites and experts, and local planning team data; updated flood, dam failure, and levee failure data and modified hazard classifications; updated FEMA declaration list; updated statutory language; modified scoring system; modified the data in appendices and added Appendix D to include FIRM maps; updated risk maps; updated the critical asset lists and the data about those assets; improved loss estimation; combined all aspects of risk assessment into one chapter.	Chapter 3 flood maps in Appendix D
Mitigation strategies	Full review of past mitigation strategies; updated list of possible strategies; improved capability assessment processes and data; updated goals and objectives; improved STAPLE-E processes and documentation of results; updated implementation table information with better process for prioritization; more realistic number of mitigation actions so better chance they will be undertaken; updated statutory language; separate or notated information for NFIP and repetitive loss related data on which FEMA focuses; combined all aspects of the mitigation strategy into one chapter.	Chapter 4; Appendix E
Plan maintenance, review, and evaluation	Updated statutory languages; expanded process for annual reviews; better example checklist(s); improved funding matrix and grant options list; clarified responsibilities for each jurisdiction for the annual and long-term maintenance, review, and evaluation.	Chapter 5
Inclusion of flood mitigation strategies	Provided a specific section to this issue outside of regular list of mitigation actions and described implementation based on NFIP and State law.	Chapter 4
Appendices	Updated and streamlined to shorten plan and take out non-useful data and maps; added approval letter and filled in plan review document; provided more documents to aid in local review and implementation;	Appendices A-G after plan document

**Summary and Timeline of the Planning Process**

The following chart outlines the timeframe of the preparation of the mitigation plan.

**Figure 1.5: Planning Timeline**



**1.7: Record of Participation**

Using FEMA 386-8 as a guide, the following table shows the level of participation by each jurisdiction. In order for the community to be considered a “participating jurisdiction,” in this plan, the jurisdiction must comply with a majority of the following.

**Figure 1.6: Participation Record**

Jurisdiction	Ringgold Co.	City of Benton	City of Diagonal	City of Ellston	City of Kellerton	City of Maloy	City of Mount Ayr	City of Tingley	Diagonal School	Mount Ayr School
Attended at least 4 meetings or work sessions.	✓	✓			✓	✓	✓			
Submitted inventory and summary of reports and plans relevant to hazard mitigation.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Submitted list of hazards that affect jurisdiction	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Submitted description of what is at risk (local critical facilities and infrastructure at risk).	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Submitted a description or map of local land use patterns (current and future).							✓			
Developed mitigation goals for the community (or attended goals creation process).	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Developed mitigation actions/participated in analysis.	✓	✓				✓	✓		✓	
Prioritized actions.	✓	✓	✓			✓	✓		✓	
Completed questionnaires.	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Reviewed previous plan information.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Reviewed and commented on draft plan.	✓	✓			✓		✓		✓	
Hosted opportunities for public involvement (a venue).	✓				✓					

\* Did not adopt the previous plan, so not applicable

**1.8: Acknowledgements and Special Thanks**

Numerous county and city officials provided valuable data and information throughout the planning process. We wish to give special thanks to the following:

- The HMGP program
- All the planning team members
- Ringgold County Emergency Management Agency and Coordinator Teresa Jackson
- Local governments and entities who participated and adopted the plan
- State and FEMA plan review staff

**1.9: Assurance to Compliance with FEMA Requirements**

This multi-jurisdictional mitigation plan complies with Iowa Homeland Security and Emergency Management Division’s and FEMA’s planning guidance; FEMA regulations, rules, guidelines, and checklists; Code of Federal Regulations; existing Federal and State laws; and such other reasonable criterion as the President/Governor, Federal/State legislatures and IHSEMD/FEMA may establish in consultation with local governments while the plan is

being developed. This plan also helps with the minimum planning requirements for all FEMA mitigation programs, such as the Flood Mitigation Assistance (FMA) Program, the Pre-Disaster Mitigation (PDM) Program, and the Hazard Mitigation Grant Program (HMGP), and where appropriate, other FEMA mitigation related programs such as the National Earthquake Hazards Reduction Program (NEHRP), the National Flood Insurance Program (NFIP) and the Community Rating System (CRS).

## Chapter 2: Community Profile

This chapter describes the planning area’s main characteristics and provides a description of each participating jurisdiction and their existing mitigation capabilities.

This part of the plan lays down the planning context and provides information that is useful in the development of a mitigation strategy and in understanding the issues, capabilities, and threats to the community. This chapter describes the planning area and the various jurisdictions and describes current planning and capabilities in place that can aid in the planning process.

### Ringgold County Plan Update Changes to the Plan Structure

The previous plan provided details in this chapter about the capabilities to implement hazard mitigation activities. These data is moved to Chapter 4 for this update so it can align with the goals and possible mitigation actions in each jurisdiction. This update also includes updated demographic and other data.

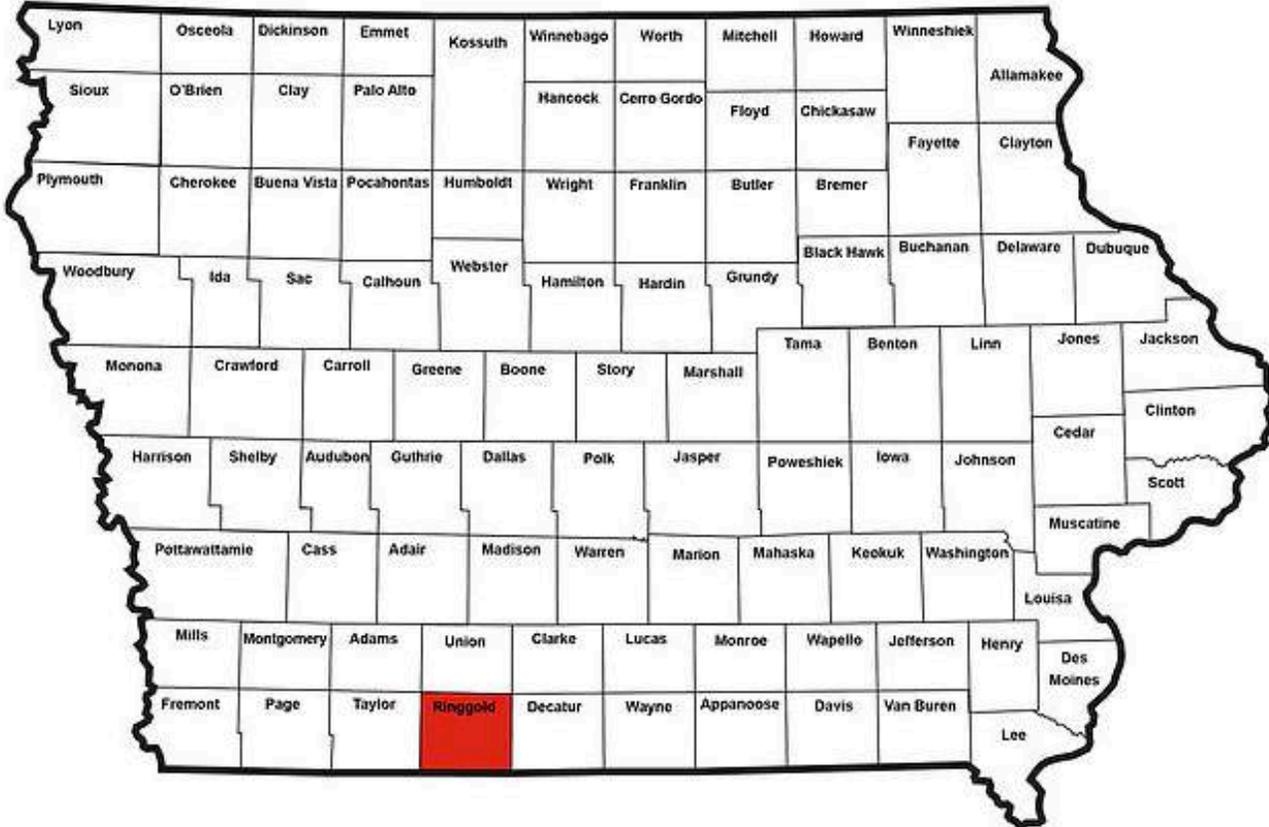
### 2.1: Planning Area Profile

This section outlines the main characteristics of the planning area, Ringgold County, that relate to hazard mitigation topics.

#### Location

Ringgold County is located in southwest Iowa and is in the southernmost tier of counties. Mount Ayr, the county seat, is located in the central part of the county, about 95 miles southwest of Des Moines and 125 miles southeast of Omaha, NE. The county is bordered by Taylor County to the west, Decatur County to the east, Union County to the south, and Worth and Harrison Counties in Missouri to the south. The dimensions of the county are approximately 22.5X24 miles, with a total area of 538 sq. miles. The following map shows the location of the county within Iowa.

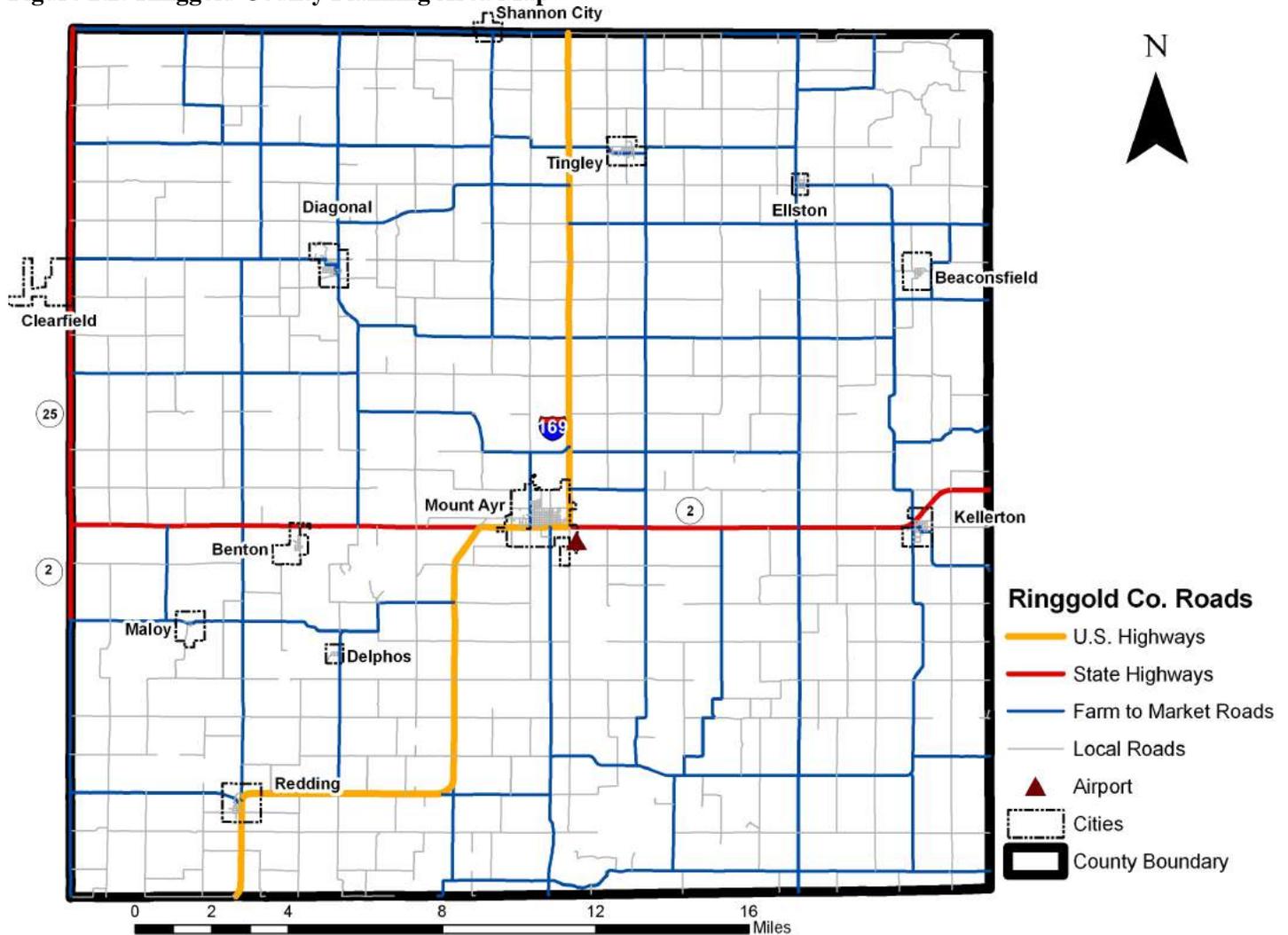
Figure 2.1: Location of Ringgold County in Iowa



Source: Ringgold County website, [www.ringgoldcounty.us](http://www.ringgoldcounty.us)

There are 10 incorporated cities or towns in the county (plus two that are mostly in neighboring counties but overlap into Ringgold County – Shannon City and Clearfield) and approximately 525 square miles of unincorporated rural area. This county is divided into 17 township governments). Most of the communities within Ringgold County are quite small, while the rural nature of the county is very evident.

Figure 2.2: Ringgold County Planning Area Map



The base map shows the incorporated jurisdictions and the road network within the planning area. Additional maps on the following pages show other data in the planning area and maps of specific jurisdictions participating in the plan.

### ***Brief History of Development***

The following is printed from the Ringgold County website.

“The area of Ringgold County is a little more than 540 square miles, divided at present into seventeen townships. The territory in Ringgold County was technically a part of Des Moines County from 1834 to 1836 under the territorial Governor of Wisconsin. Then the territory of Iowa was organized and for some years, this region remained undesignated, unsurveyed, and unsettled. In 1847 the boundaries of the county were established and the name of Ringgold given in honor of Major Samuel Ringgold, who was mortally wounded in the battle of Palo Alto, fought a little more than a year before in the Mexican War. For the next four years Ringgold was included in the temporary county of Taylor. Then it was attached to the newly organized county of Decatur. On April 18, 1855 the town of Mount Ayr was awarded the county seat.

Chas. H.Y. Schooler and wife were the first settlers in Ringgold County, settling near Ringgold City and for two years they were the only white family in the county. In 1846 Jas. M. Tethrow settled near Mr. Schooler, but for some reason, there appears to have been no farther immigration. These two families believed they were living in Missouri until the disputed territory on the southern boundary was surveyed and was awarded to Iowa in 1850.

The southern part of Ringgold County was involved in the famous dispute between Iowa and Missouri, which began in the autumn of 1839 and was not settled until 1850. This dispute arose in consequence of two surveys, having been made of the boundary line between the two states. The first survey began at the head of the rapids, in the Des Moines River, and the second began at the foot of the Des Moines rapids in the Mississippi River, the difference between the

two initial points being about 9 miles. Missouri assumed the northern line as her boundary and Iowa the southern line as hers. A conflict of jurisdiction over a strip of country nearly nine miles in width the entire distance across the state, it being claimed by both states. After Iowa had drawn on the territorial treasurer for \$1500 to defray the expenses of keeping a militia to protect the right of the people and the state, the governor of Iowa agreed with the governor of Missouri, for the commencement and speedy termination of a suit in the supreme court of the United States to determine the true location of the boundary line between the two states. The sum of \$1,000 was appropriated to defray the expenses of this suit.

The vexed question was settled in Iowa's favor in 1850, when the boundary was established by commissioners appointed by the supreme court of the United States, who had the line carefully surveyed. Posts were erected one mile apart, the entire distance between the two states. Every tenth post was to be an iron post 8 feet long, 4 inches square at one end, and 8 inches square at the other, to be set in the ground 3 1/2 feet. At the top end of the post, on one side is the word "Iowa" and on the opposite side, the word "Missouri" and on the other two sides, the word "boundary" cast into the post. The wooden posts between these iron posts have long since rotted out, but they served their purpose until the state line was established. These iron posts can be found in Riley and Clinton townships.”

More details of the county and its jurisdictions can be found at [www.ringgoldcounty.us](http://www.ringgoldcounty.us).

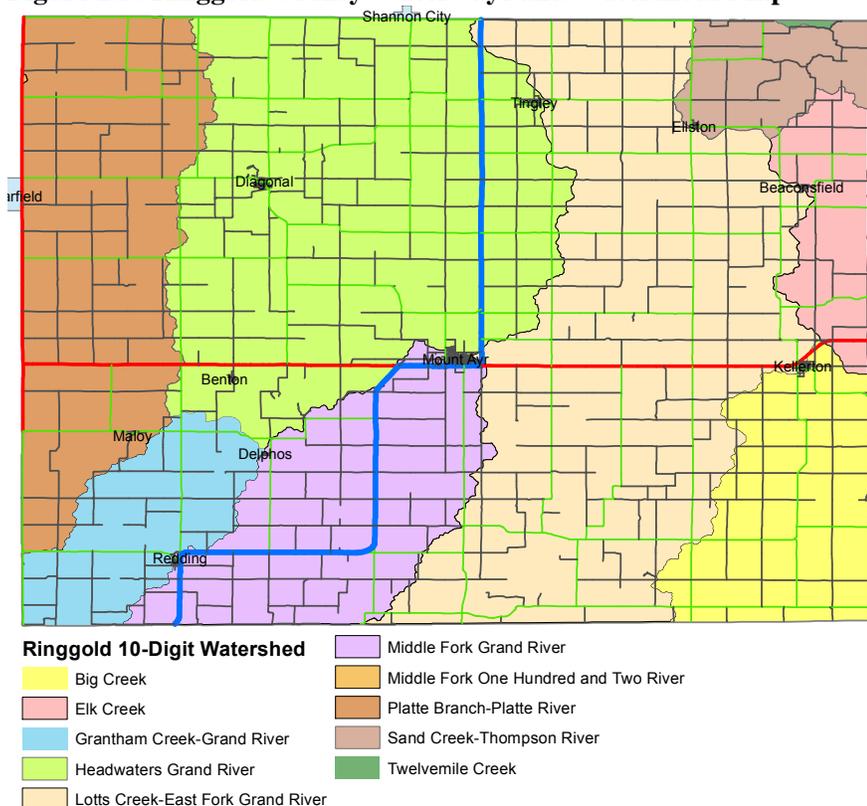
**Geography and Geology**

Understanding the surface water systems, topography, and geology of the region is vital for understanding hazard risks and identifying possible mitigation solutions related to the wide array of hazards affecting the area.

*Geology:* Ringgold County is wholly located in the landform region known as the Southern Iowa Drift Plain. Glacial deposits left by ice sheets that extended south into Missouri over millennia’s dominate this region. The deposits were carved by deepening episodes of stream erosion into steeply rolling, well-drained terrain. Numerous rills, creeks, and rivers branch out across the landscape shaping the old glacial deposits into steeply rolling hills and valleys.

*Surface Water Systems:* Ringgold County is well drained by numerous streams and rivers that flow through the county, and several significant waterways exist. Principally, the Grand River, the Platte River, East Fork Grand River, Lotts Creek, and various smaller streams are the main moving bodies of water in the county. The largest lake is Sun Valley Lake, which is located in the northeast corner of the county. A map of significant waterways and recognized watersheds can be found in Figure 2.3.

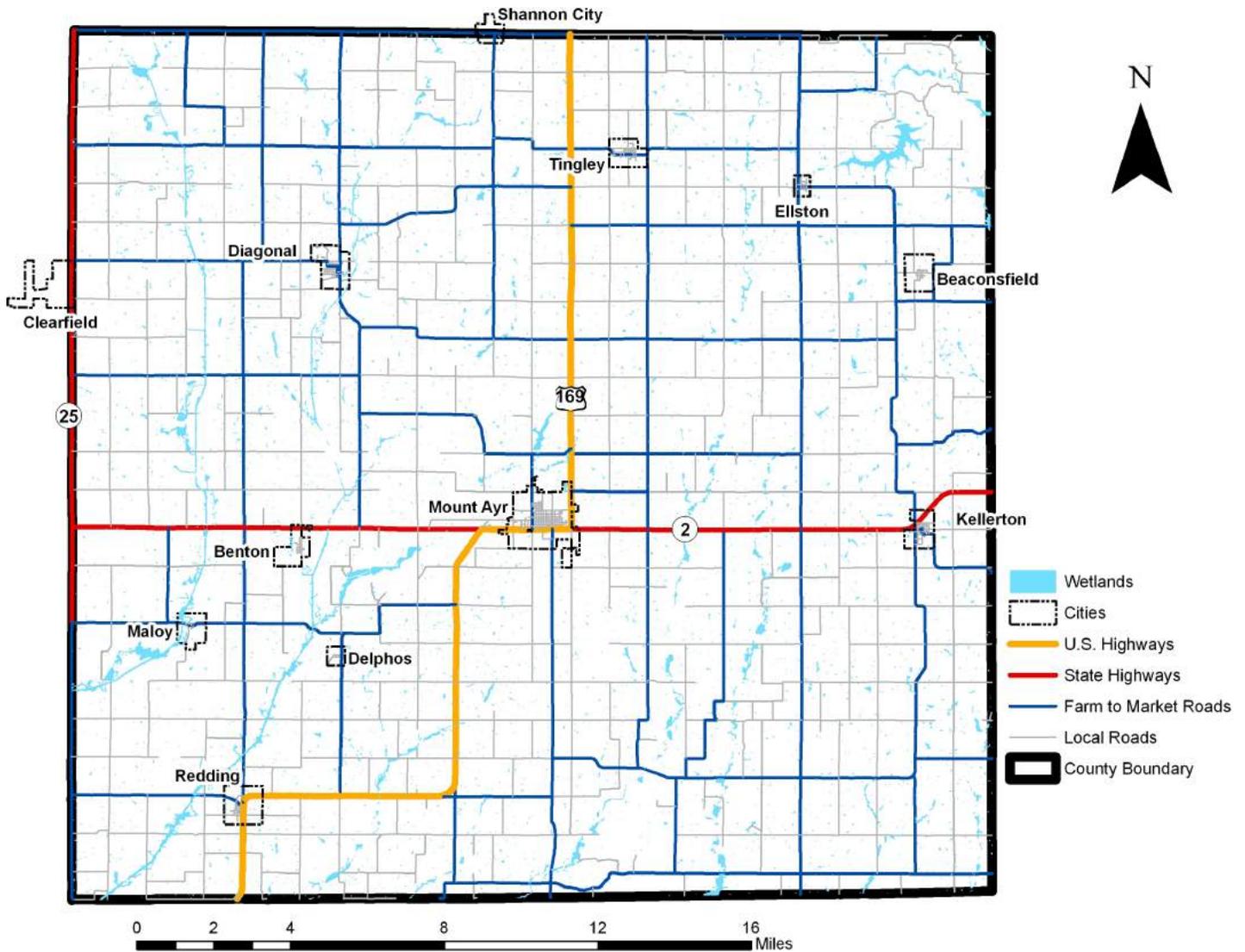
**Figure 2.3: Ringgold County Waterways and Watersheds Map**



Source: Iowa Department of Natural Resources, 8/2018

*Wetlands:* Wetlands, mostly small, exist on numerous private and public lands in the county. The US Army Corps of Engineers evaluates proposed construction activities in wetlands through the Section 404 permitting process when issues arise. There appears to be no known wetland-related issues in the county. The following is a wetlands map.

**Figure 2.4: Ringgold County Wetlands Map**



*Soils:* Ringgold County is within the Loess Ridges/Glacial – SW Iowa Soil Region. Deep loess soils make up a majority of upland hill slopes. Historically, Ringgold County was covered with tall grass prairie landscapes. Today, this area is dominated by agriculture and only about 5% of land cover is natural habitat. The following is a table with information about the main soil associations in the county.

**Figure 2.5: Soils in Ringgold County**

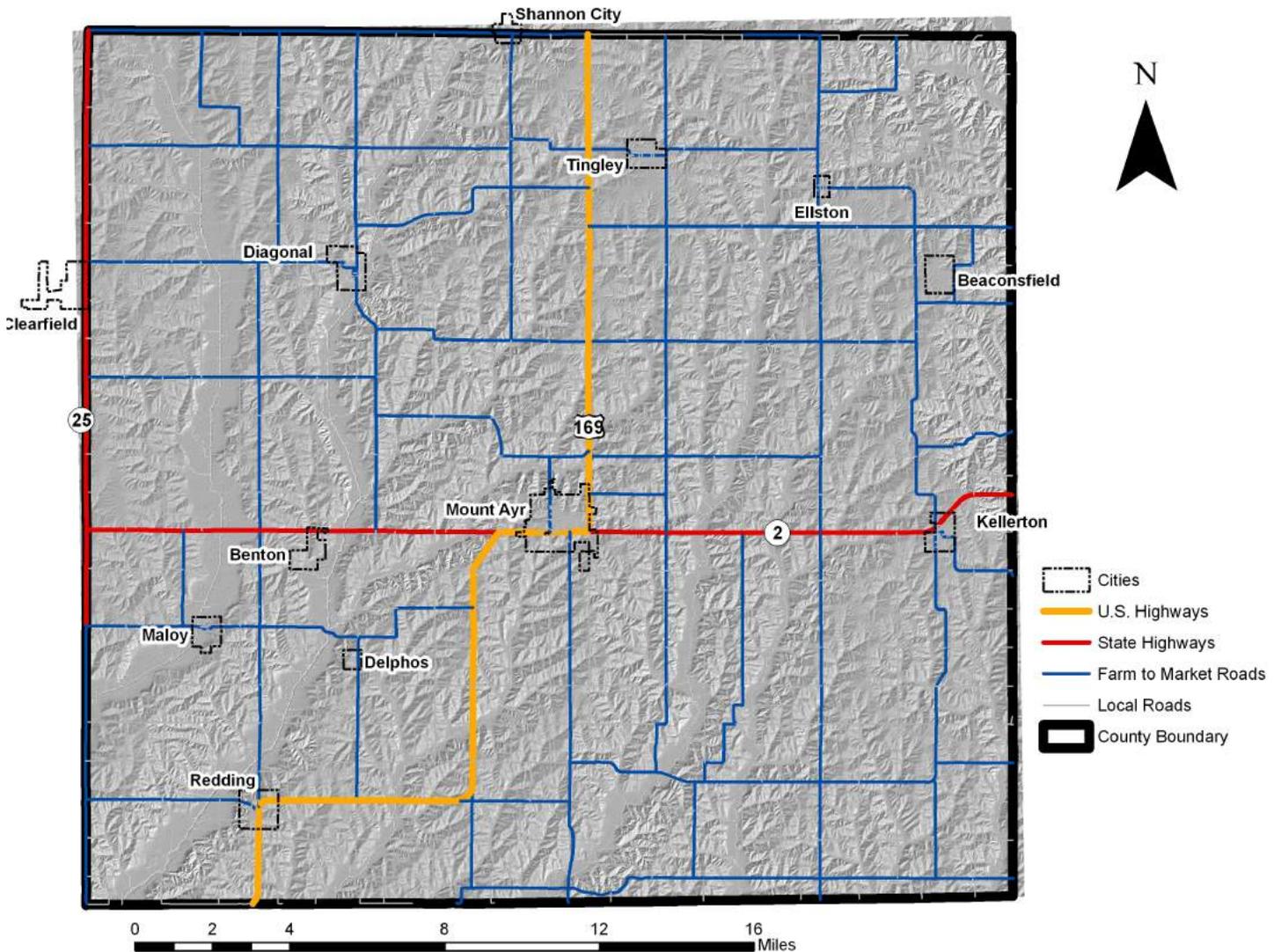
Soil Association	% of County	Description
Nira-Sharpsburg-Shelby	14%	Gently sloping to moderately steep, moderately well drained and well drained, silty and loamy soils formed in loess and glacial till; on uplands and stream benches.
Gara-Armstrong-Ladoga	11%	Moderately sloping to steep, well drained and moderately well drained, silty and loamy soils formed in glacial till, a paleosol derived from glacial till, and loess; on uplands.
Nodaway-Humeston-Wabash	8%	Nearly level and gently sloping, moderately well drained, poorly drained, and very poorly drained, silty and clayey soils formed on alluvium; on bottom land along streams.
Gara-Armstrong-Pershing	38%	Gently sloping to steep, well drained to somewhat poorly drained, loamy and silty soils formed in glacial till, a paleosol derived from glacial till, and loess; on upland and stream benches.
Arispe-Shelby-Lamoni	27%	Moderately sloping to moderately steep, somewhat poorly drained and well drained, silty and loamy soils formed in loess, glacial till, and a paleosol derived from glacial till; on uplands.

Soil Association	% of County	Description
Lindley-Keswick	1%	Moderately sloping to very steep, well drained and moderately well drained, loamy soils formed in glacial till and a paleosol derived from glacial till; on uplands.
Grundy-Haig	1%	Nearly level and gently sloping, somewhat poorly drained and poorly drained, silty soils formed in loess, and uplands.

Source: USDA Soil Survey of Ringgold County, 1992

**Topography.** The highest elevation in the county, approximately 1,280 feet, is found atop a few upland ridges along the northern border. The lowest place is approximately 970 feet above sea level. The larger stream valleys are commonly 110 to 170 feet below the adjacent upland ridges. Over 80% of the county is covered by land that is gently sloping to moderately steep (2-9% slope) and covered by soil over deep bedrock, with the other 20% being less than 2% slope or 10 to 20% slope. Ringgold County is nearly devoid of unique, fragile or hazardous landforms or landform regions. The county does not have significant outcroppings, limestone bluffs, or erosion areas. Little area of the county is rugged terrain, and most of such areas are in the southernmost parts of the county. No known hazards are found resulting from terrain or topography. A topographic/shaded relief map can be found on the following page.

**Figure 2.6: Ringgold County Topographic/Shaded Relief Map**

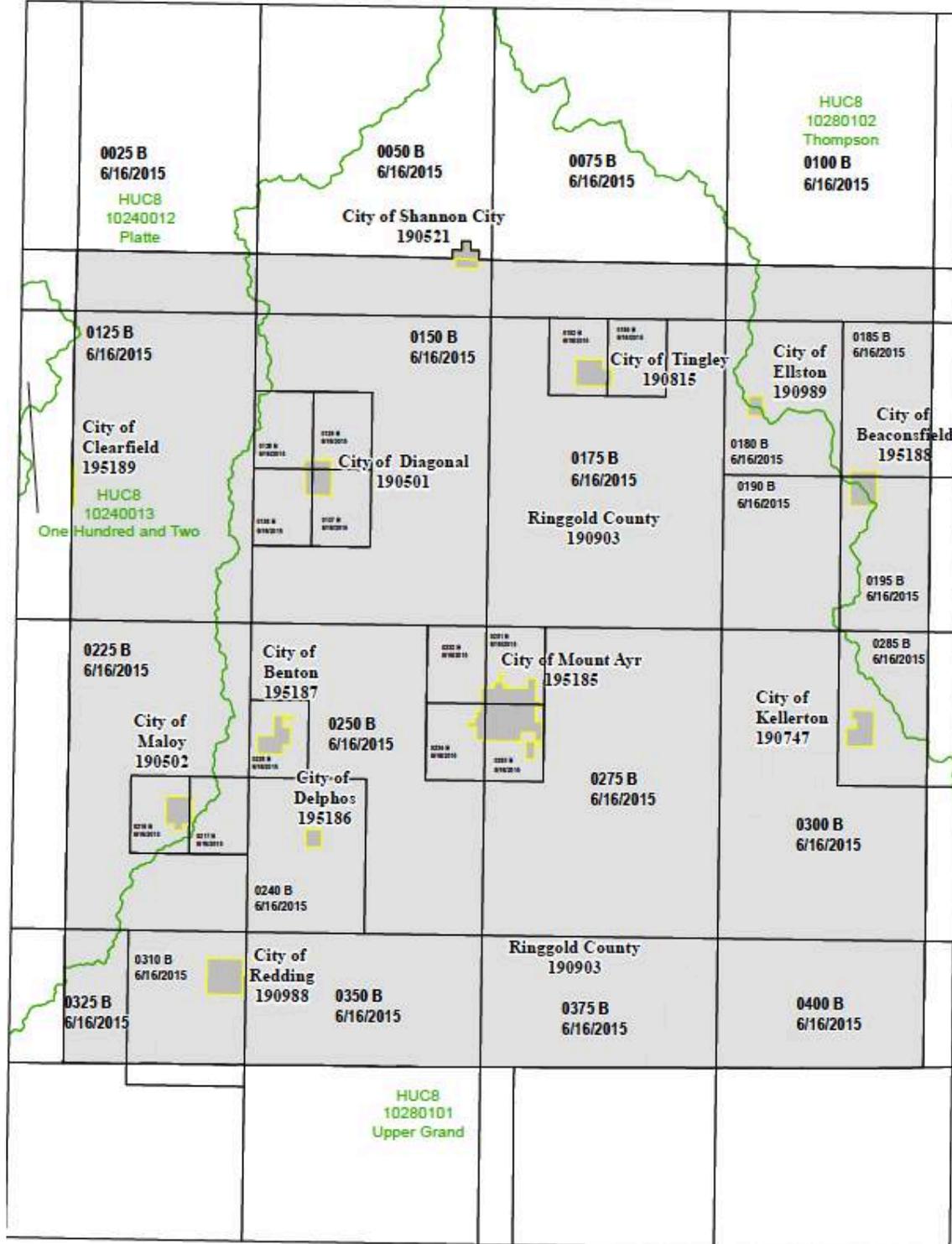


**Floodplains.** Floodplain mapping has been nonexistent on a countywide basis throughout history until the past few years. Through a partnership with FEMA, the Iowa DNR, and the Iowa Flood Center, using the FEMA Risk MAP process, countywide maps were prepared and in June 2015 were made official FIRM maps. For the purpose of this plan, Ringgold County’s planning team identifies a floodplain as a mapped Special Flood Hazard Area (SFHA), as identified in the FIS and FIRM maps (copies in Appendix E). Certainly flooding, generally of a flash flooding nature, can happen almost anywhere, but river flooding is recognized as a risk for planning purposes only in these areas.

Based on the maps recently created, the team has estimated the number of structures and people in the hazard area (see Chapter 3). Fortunately, most waterways are small streams, meaning that catastrophic flooding is not possible. In most cases, stream flooding is more descriptive of flash flooding, which means that small streams flood quickly and are short-lived. Gully, ditch, roadway, and bridge erosion and damage are common in individual sections of stream in individual events. The planning team estimates that 5% of the planning area is located in an alluvial floodplain area that might be subjected to flooding, based on the effective FIRM maps.

All existing flood maps, whether old 1970s paper FIRMs or FHBMs, have been superseded by the new maps.

**Figure 2.7: FEMA FIRM Map Index for Ringgold County**



Source: Ringgold County FIS, FEMA, June 16, 2015

**Transportation**

**Highway Access:** The principal highways in the county are listed in the table below, in addition to the approximate mileage of farm-to-market and secondary roads in Ringgold County. Ringgold County contains one Federal and one State highway. Overall traffic in low in the county, with Highway 2/169 in Mount Ayr being the busiest road, having fewer than 5,000 vehicles per day.

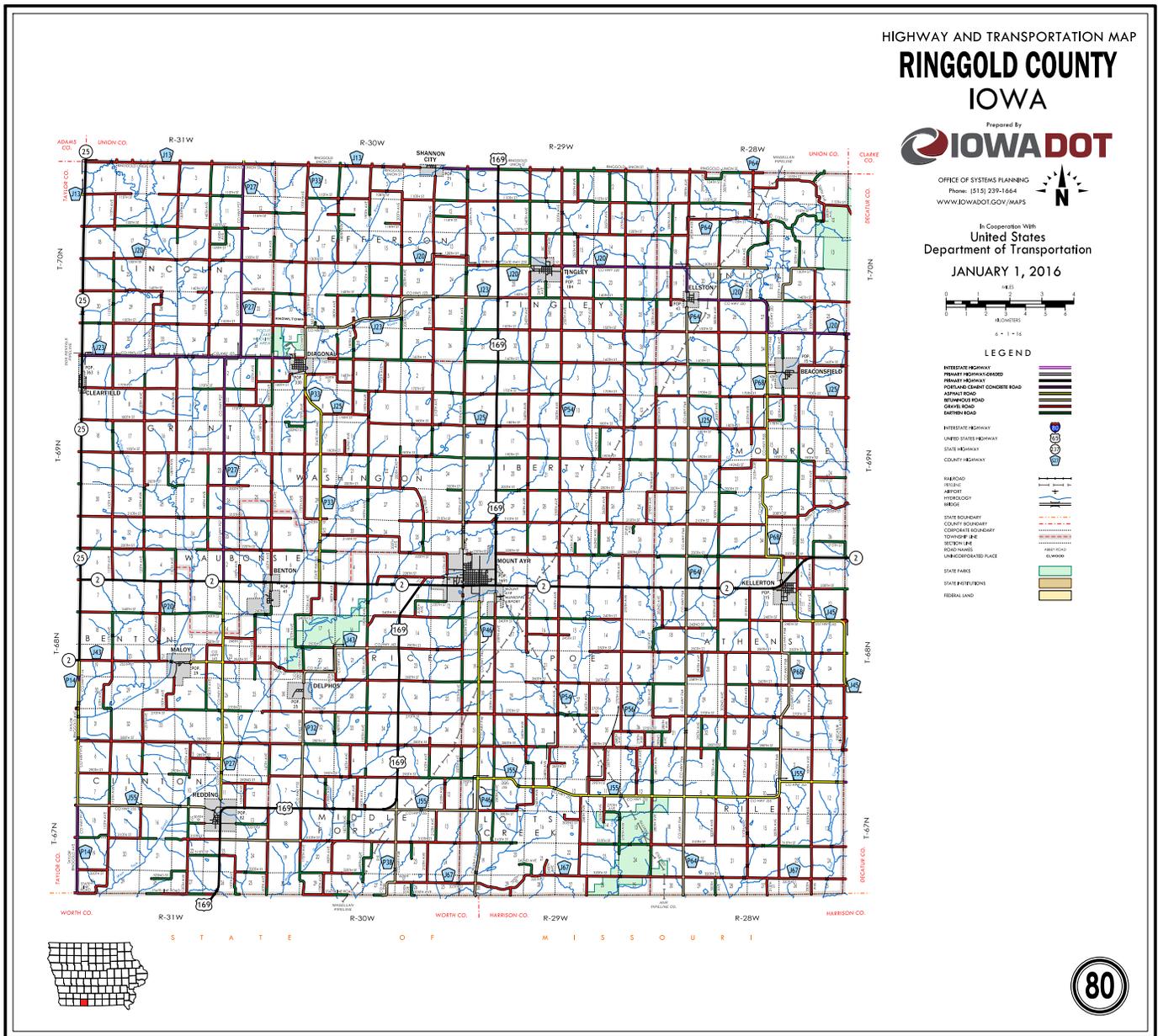
**Figure 2.8: Transportation Network**

Roadway	Mileage (approx.)	Communities Served
State Highway 2	27 miles	Mount Ayr and Kellerton
US Highway 169	30 miles	Mount Ayr and Redding
Farm-to-Market	300 miles	All
Secondary Roads (area service)	600 miles	All

Source: Iowa Department of Transportation

The following is a current transportation facilities map.

**Figure 2.9: Ringgold County Transportation Map**



Source: Iowa Department of Transportation, May 2017

**Streets & Roads:** The five participating communities in Ringgold County have roads to all developed areas. Most of the roads in the incorporated communities are seal coated or paved. Most communities have gravel roads as well. The Southern Iowa Trolley offers public bus transit using an “on-demand” service throughout the county. More details about the road network in each participating jurisdictions is found in the individual jurisdictional profiles.

**Railroads:** Ringgold County no longer has railroads. The nearest railroad is located in Union County, the closest point to Ringgold County being nine miles north.

**Airports:** Judge Lewis Field Mount Ayr Municipal Airport is the only airport located in Ringgold County. It is located within the east edge of Mount Ayr and is has a 2,800 foot hard-surface asphalt runway. This airport is owned and operated by the City of Mount Ayr. The Iowa Aviation System Plan identifies the Mount Ayr Municipal Airport as a Local Service airport and is a Class III facility that is suitable for minor commuter and cargo planes.

### ***Climatology***

Ringgold County lies in the humid continental zone, which covers all of Iowa. With a mean temperature of 73.3 degrees in the summer and 24.7 degrees in the winter, Ringgold County is slightly warmer on average than the state as a whole. Any season can fluctuate from very wet to very dry, and springs and autumns are typified by wide ranges of temperatures and wind patterns. Annual rainfall in the area is approximately 34.36 inches and snowfall is 28.0 inches. The frost-free season is 161 days on average. The following table shows climactic averages for the county.

**Figure 2.10: Temperature and Precipitation Information**

<b>Month</b>	<b>Avg. High</b>	<b>Avg. Low</b>	<b>Mean</b>	<b>Avg. Precipitation</b>	<b>Est. Record High</b>	<b>Est. Record Low</b>
January	32 F	12 F	22 F	0.71 “	67 F	-30 F
February	38 F	16 F	27 F	1.03 “	80 F	-29 F
March	50 F	26 F	38 F	2.18 “	90 F	-20 F
April	52 F	38 F	50 F	3.04 “	92 F	5 F
May	71 F	49 F	60 F	4.97 “	103 F	22 F
June	80 F	59 F	70 F	5.12 “	105 F	36 F
July	85 F	64 F	75 F	4.96 “	112 F	43 F
August	84 F	62 F	73 F	4.24 ”	111 F	37 F
September	76 F	52 F	64 F	3.53 “	105 F	24 F
October	64 F	40 F	52 F	2.79 “	93 F	0 F
November	49 F	28 F	39 F	2.17 “	82 F	-15 F
December	35 F	16 F	26 F	1.41 “	70 F	-28 F

*Source: Weather Channel*

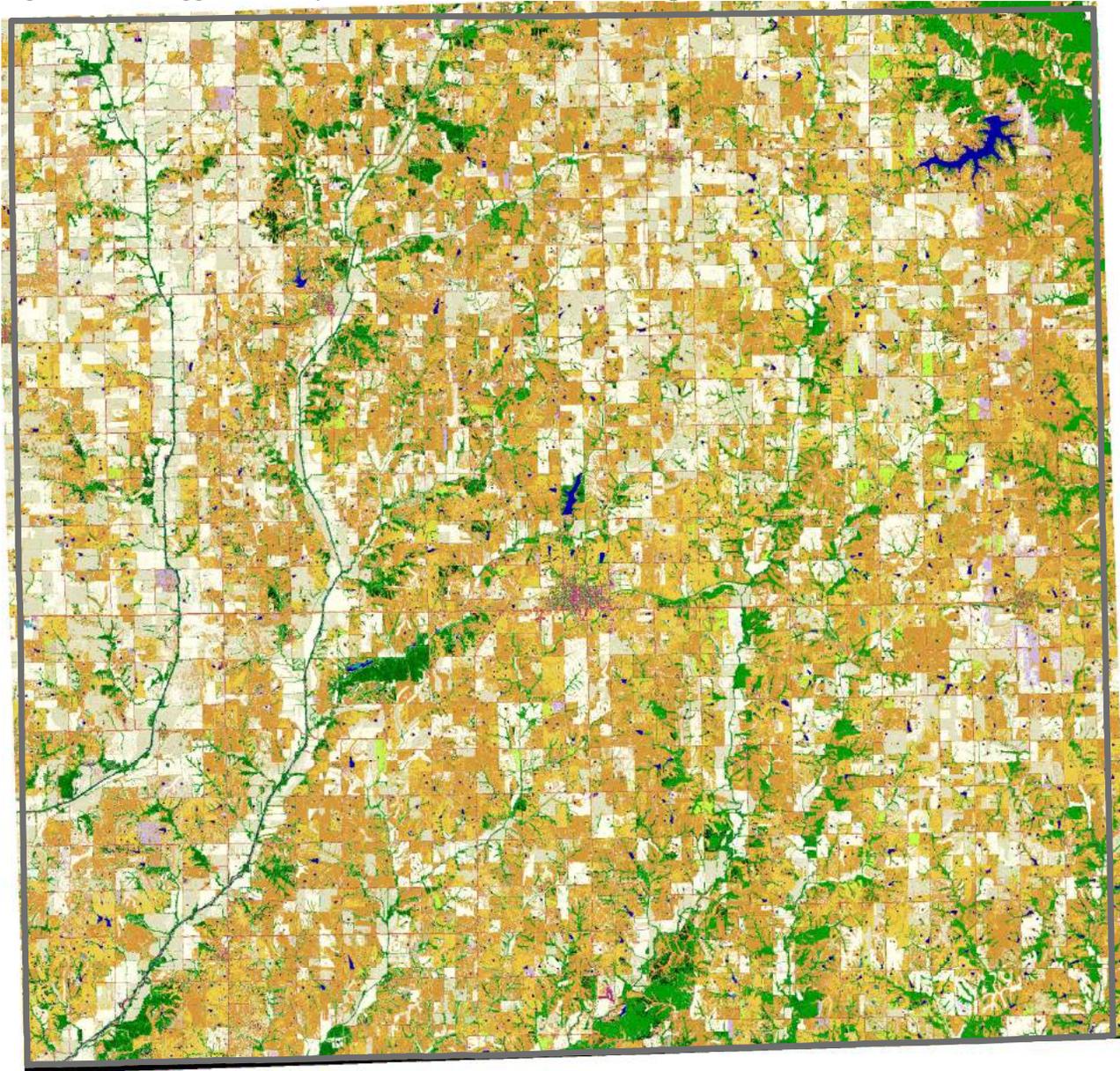
The average relative humidity in mid afternoon is about 60%. Humidity typically is higher at night, and the average at dawn is 80%. The sun shines 65% of the time possible in the summer and 50% in the winter. The prevailing wind is from the northwest but it often blows from the southwest, south, southeast, and west also. Average wind speed is highest, 13 MPH, in the spring. Summer tends to be the least windy season. Thunderstorms occur on about 50 days per year. Snow is on the ground roughly a third of the time during the typical winter season, but this varies greatly from year to year, and measurable snow has fallen as early as October and as late as May.

### ***Land Use Patterns***

The total area of the county is approximately 538 square miles or 344,320 acres. A vast majority of this area is devoted to agricultural uses, including row crop production, grazing and livestock production, and non-row crop farming. Data from the 2012 Census of Agriculture indicates that 269,777 acres or 78.4% of the county’s area was in farms. According to the 2007 Census, 264,886 acres or 76.6% of total land was in farms. During the five years, the amount of land in farms increased modestly, about seven square miles in total. In 2012, the amount of farmland used for cropland was 137,082 acres. Compared to most counties in Iowa, Ringgold County farmland is used for pasture land and forage crops in a much larger extent. Many farms include timber land and open space because that land is unsuitable for farming to do topography and poor soil quality. Other rural land uses include farm houses and outbuildings, rural roads, infrastructure such as bridges and water towers, and a small number of businesses and industries.

Roughly 2% of the land in the county is located in municipalities, most of which is developed for residential, commercial, and industrial purposes. Approximately 2% of the county’s surface area is also water, including streams, farm ponds, and a few larger public lakes. The countywide land use patterns map on the next page shows the types of land cover found in the county.

**Figure 2.11: Ringgold County Land Use and Land Cover Map**



 Background	 Grass 2
 Water	 Cut Hay
 Wetland	 Corn
 Coniferous Forest	 Soybeans
 Deciduous Short	 Barren / Fallow
 Deciduous Medium	 Structures
 Deciduous Tall	 Roads / Impervious
 Grass 1	 Shadow / No Data

Source: Iowa Department of Natural Resources, 8/2018

***Historic or Archaeological Sites & Districts***

There are seven properties that are listed on the National Register of Historic Places:

- |   |                      |              |
|---|----------------------|--------------|
| • Beaconsfield Supply Store             | 1621 Main Street     | Beaconsfield |
| • W.J. Buck Polygonal Barn              | Near US 169          | Diagonal     |
| • Middlefork Methodist Episcopal Church | South US 169         | Redding      |
| • Mount Ayr Public Library              | 121 W. Monroe Street | Mount Ayr    |

- Ringgold County Courthouse
- Ringgold County Jail
- Lee Shay Farmhouse

Madison Street                      Mount Ayr  
 201 E. Monroe Street              Mount Ayr  
 Off CR P27                              Maloy

Other historic sites of local interest include many other buildings and bridges located throughout the county. There are no known major archaeological sites in the county.

### **Planning Area Population Characteristics**

Like other counties in the region, Ringgold County is predominately rural with a centrally located county seat town that contains much of the population. The population of the county has been small for most of its modern history and has declined from its peak approximately a century ago. The population of the planning area has declined for several decades and the trend shows no sign of ending. The 2015 five-year Census estimate for the county is 5,061, a decline of 1.4% since 2010. The table below shows the population trends from 2000 to 2010, the change by jurisdiction, and the percentage of population in each jurisdiction in 2010 and then the population estimate for 2015 along with change statistics and the percent each jurisdiction is of all the jurisdictions.

**Figure 2.12: Population Characteristics**

<b>Jurisdiction</b>	<b>2000</b>	<b>2010</b>	<b>Change</b>	<b>% Change (00-10)</b>	<b>2015 Estimate</b>	<b>Change (10-15)</b>	<b>% Change (10-15)</b>	<b>2015 % of Total</b>
Ringgold County	5,469	5,131	-338	-6.2%	5,061	-70	-1.4%	100.0%
Beaconsfield	11	15	4	+36.4%	25	10	+66.7%	0.5%
Benton	40	41	1	+2.5%	43	2	+4.9%	0.8%
Delphos	25	25	0	0.0%	20	-5	-20.0%	0.4%
Diagonal	312	330	18	+5.8%	332	2	+0.6%	6.6%
Ellston	57	43	-14	-24.6%	23	-20	-46.5%	0.5%
Kellerton	372	315	-57	-15.3%	278	-37	-11.7%	5.5%
Maloy	28	29	1	+3.6%	24	-5	-17.2%	0.5%
Mount Ayr	1,822	1,691	-131	-7.2%	1,799	108	+6.4%	35.5%
Redding	78	82	4	+5.1%	61	-21	-25.6%	1.2%
Tingley	171	184	13	+7.6%	178	-6	-3.3%	3.5%
Balance of County	2,553	2,376	-177	-6.9%	2,278	-98	-4.1%	45.0%
Athens Twp.	542	434	-108	-24.9%	352	-82	-18.9%	7.0%
Benton Twp.	112	110	-2	-1.8%	111	1	+0.9%	2.2%
Clinton Twp.	203	208	5	+2.4%	226	18	+8.7%	4.5%
Grant Twp.	153	128	-25	-19.5%	151	23	+18.0%	3.0%
Jefferson Twp.	160	149	-11	-7.4%	161	12	+8.1%	3.2%
Liberty Twp.	185	152	-33	-21.7%	66	-86	-56.6%	1.3%
Lincoln Twp.	173	144	-29	-20.1%	169	25	+17.4%	3.3%
Lotts Creek Twp.	91	77	-14	-18.2%	127	50	+64.9%	2.5%
Middle Fork Twp.	157	238	81	+34.0%	198	-40	-16.8%	3.9%
Monroe Twp.	142	111	-31	-27.9%	122	11	+9.9%	2.4%
Mount Ayr city	1,822	1,691	-131	-7.7%	1,799	108	+6.4%	35.5%
Poe Twp.	229	169	-60	-35.5%	89	-80	-47.3%	1.8%
Rice Twp.	185	217	32	+14.7%	169	-48	-22.1%	3.3%
Riley Twp.	107	87	-20	-23.0%	44	-43	-49.4%	0.9%
Tingley Twp.	308	327	19	+5.8%	349	22	+6.7%	6.9%
Union Twp.	403	286	-117	-40.9%	323	37	+12.9%	6.4%
Washington Twp.	414	525	111	+21.1%	536	11	+2.1%	10.6%
Waubbonsie Twp.	83	78	-5	-6.4%	70	-8	-10.3%	1.4%

Source: U.S. Census Bureau, 5/2017

For a hazard mitigation plan, the population trends help us understand where hazard threats to human life are highest and where they are changing. Future mitigation actions should be targeted where they affect people. Population growth areas, in this case primarily in the Mount Ayr and Diagonal areas but also within a few rural townships, should be targeted for actions that protect future buildings and property, as outlined in the mitigation strategy in Chapter 4.

Some interesting conclusions were found in the analysis of trends from 2000 to 2010. The trend existing since the early 1900s continues, that of population loss, especially in rural areas of the county (10.8% decline in rural areas versus 7.5% countywide decline). The townships had varied and sometimes significant loss. Interestingly, the townships experiencing sharp growth and those experiencing sharp decline are located throughout the county, with no clear demographic change pattern.

The following 2010 Census data is helpful in identifying trends relevant to hazard mitigation issues outlined later in the document:

- Population by gender: male – 2,492 (48.6%); female – 2,639 (51.4%)
- Median age: 45.6 years
- Population aged 0-17: 1,243 (24.2%)
- Population aged 16-64: 2,812 (54.8%)
- Population aged 65 and older: 1,209 (23.6%)
- Race of population: White – 5,004 (97.5%); Black or African American – 17 (0.3%); American Indian – 14 (0.3%); Asian – 16 (0.3%); Native Hawaiian and other Pacific Islander – 0 (0.0%); Some other race – 42 (0.8%); two or more races – 38 (0.7%)
- Hispanic or Latino origin of any race: 91 (1.8%)
- Population composition: in households – 4,952 (96.5%); in group quarters – 179 (3.5%)
- Households: 2,047; average size: 2.42 persons
- Family households: 1,364; average size 3.00 persons

### **Planning Area Housing Characteristics**

The total number of housing units in Ringgold County decreased from 2,789 to 2,613 between 2000 and 2010, a %6.3 decrease. During that same period, the number of occupied units decreased from 2,245 to 2,047, while the number of vacant properties increased by 76.9%. The table below documents the jurisdictional data for various housing characteristics in Ringgold County.

**Figure 2.13: Housing Characteristics**

<b>Jurisdiction</b>	<b>Total Units</b>	<b>Occupied</b>	<b>Owner</b>	<b>Renter</b>	<b>Owner Median Value</b>	<b>Median Gross Rent</b>
Rural County	1,301	877	741	136	n/a	n/a
Beaconsfield	24	14	8	6	**	**
Benton	35	25	25	0	**	**
Delphos	15	10	3	7	**	\$394
Diagonal	151	118	80	38	\$55,800	\$517
Ellston	10	10	10	0	\$30,000	**
Kellerton	143	120	78	42	\$36,700	\$442
Maloy	12	9	8	1	\$73,300	**
Mount Ayr	778	743	532	211	\$72,900	\$483
Redding	35	27	25	2	**	**
Tingley	98	77	64	13	\$45,000	\$483
Total County	2,602	2,030	1,574	456	\$77,600	\$505

Sources: US Census ACS 2015 5-year Estimates; 5/2017 \*\* Too few respondents to disclose the data; n/a – not available

Because housing age, value, and condition are the key characteristics we must assess in terms of vulnerability and losses in the event of disasters, value and age data is provided in this section. Housing values in Ringgold County are far below the statewide average values for similar sized homes. A problem is that while the losses may be less, the replacement value is not diminished, and often the community is hurt because the insurance proceeds and family savings for replacement are inadequate. Another issue is how low values are often indicative of high vulnerability due to poor structural conditions and lack of maintenance. Vacant homes represent hazard risk because they are usually unmaintained and can diminish property value in surrounding areas. The following table shows the year built statistics for the planning area.

**Figure 2.14: Housing Year Built**

<b>Range of Years Built</b>	<b>Number</b>	<b>Percent</b>
2010 and newer	28	1.1%
2000-2009	419	16.1%
1990-1999	272	10.5%
1980-1989	189	7.3%
1970-1979	335	12.9%
1960-1969	203	7.8%
1950-1959	143	5.5%
1940-1949	141	5.4%
Pre-1940	872	33.5%
Median Year Built	1967	--

Sources: US Census ACS 2015 5-year Estimates; 5/2017

With a median year built of 1967, many of the county's homes are showing significant age. Older homes simply are more likely to be deteriorating and are not likely to have modern electrical wiring and plumbing systems. Such

structures are more likely to be damaged in hazard events. Interestingly, Ringgold County and Iowa share the same median year built.

In some areas, housing construction continues to occur, although Census estimates show relatively few homes actually being completed since 2010. The median value and median rent in the county is increasing and will likely continue to do so. Most homes built since 2000 are selling from \$120,000 to \$250,000. Virtually all the homes in the county have adequate gas or other fuel heating systems and kitchen facilities. Most homes are connected to public water and sewer, except in rural areas, where many homes are connected to individual septic tanks regulated by the Clarke County Environmental Health, which holds a contract with Ringgold County.

**Planning Area Educational Facilities and Attainment**

There are multiple school districts located within or partially within Ringgold County. The Mount Ayr and Diagonal Community School Districts have facilities located within the county. Outlying parts of Ringgold County are a part of the Creston, Lamoni, Bedford, Lenox, and East Union school districts, in addition to the Mount Ayr and Diagonal. The certified enrollment of students from Ringgold County (residents in the county versus where they attended) was approximately 725 for the 2013-14 school year (latest available) (*source: Iowa Dept. of Education*). No community college or other higher education facility exists in the county. Additional educational data is provided in the table below.

Approximately 665 students are enrolled in the public school districts in the county this year (2016-17), as outlined later in this chapter in the school district profiles. Estimates show that in over the past five years, the average number of people enrolled in school is 1,115, of which 951 were enrolled in pre-K through Grade 12 schools. There are no private schools and colleges in the county. The latest Census educational attainment estimates follow.

**Figure 2.15: Educational Attainment**

Maximum Level Attained	Number	Percent
Population 25 years and older	3,538	100.0%
Less than 9 <sup>th</sup> grade	94	2.7%
9 <sup>th</sup> to 12 <sup>th</sup> grade, no diploma	267	7.5%
High school graduate (incl. equivalency)	1,255	35.5%
Some college, no degree	824	23.3%
Associate’s Degree	363	10.3%
Bachelor’s Degree	511	14.4%
Master’s, Professional or Doctorate Degree	224	6.3%

*Sources: US Census ACS 2015 5-year Estimates; 5/2017*

A relatively high percentage of people in the county have achieved a Bachelor’s Degree or higher, compared to similar counties in the region. The higher level of education is an asset in terms of hazard risk awareness and likely level of preparedness.

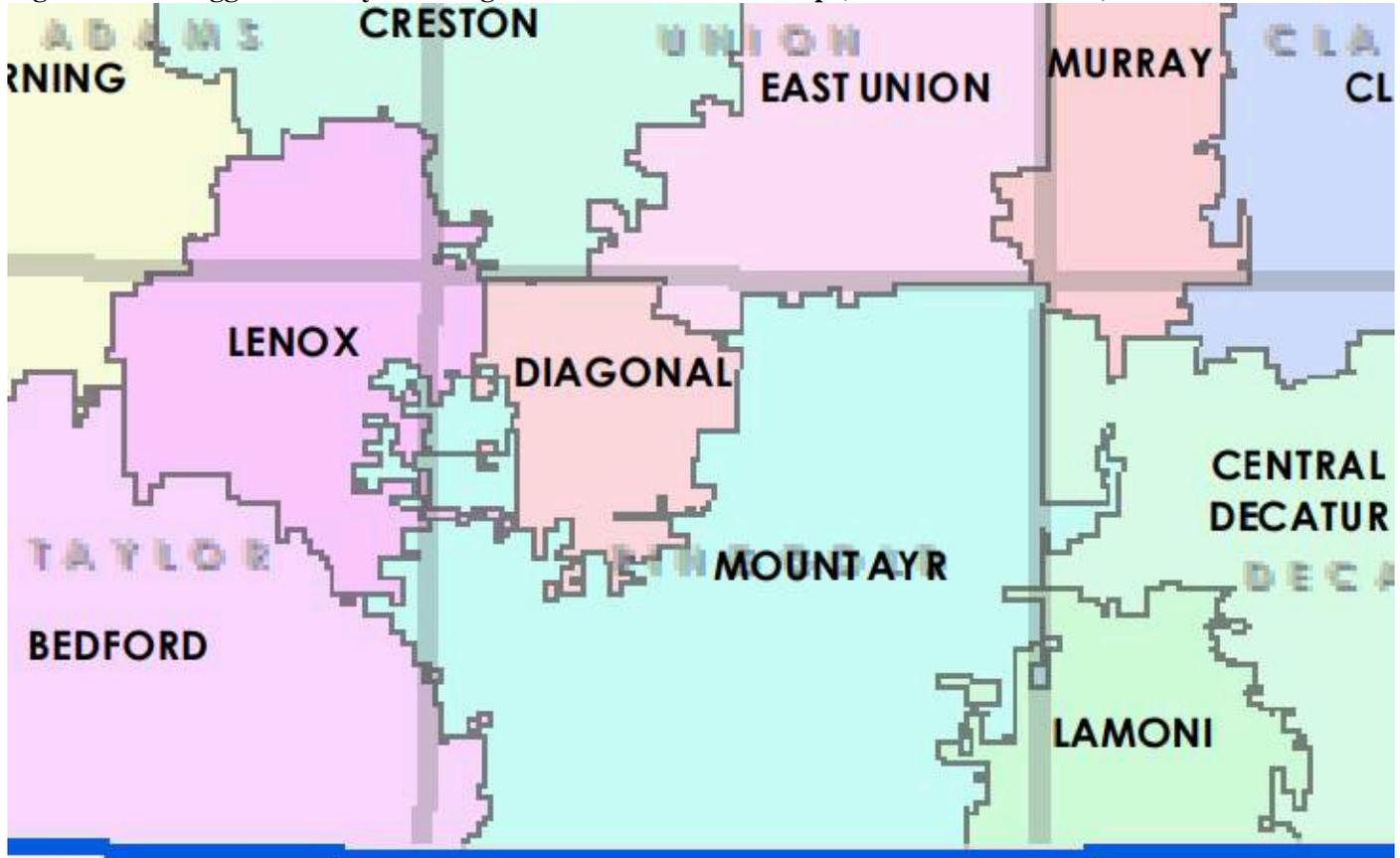
Additionally, the educational assets of Ringgold County are important to consider in the hazard mitigation planning process—particularly for the students and faculty utilizing facilities within the county. The valuation and vulnerability of these assets are discussed in later chapters of this plan. However, a brief list of school facilities located within the boundaries of Ringgold County is documented in the table below.

**Figure 2.16: School Asset Information**

District	Asset	Address	Community
Diagonal CSD	K-12 School	403 West 2 <sup>nd</sup> (all)	Diagonal
Mount Ayr CSD	K-12 School	607 East Jefferson (Elementary School) 1001 E. Columbus (Middle/High School)	Mount Ayr Mount Ayr

The map on the next page shows the current school district boundaries.

**Figure 2.17: Ringgold County Planning Area School Districts Map (2017-18 School Year)**



Sources: Iowa Department of Education website; 8/2018

**Planning Area Economic Characteristics**

The local economy is vital to the sustainability of the planning area. Understanding the implications of data about the economy helps with mitigation planning by providing insight into the kinds of jobs that are at risk, the ability of residents, based on their income, to implement mitigation actions, and the level of investment in economic activity, such as buildings and machinery that may be damaged in a disaster event. As the data implies, Ringgold County, once composed mostly of many small farms, is now increasingly mechanized and industrial. Agriculture is still vital, but fewer people are employed in farming activities. Most workers are employed in Mount Ayr or commute outside of the county to work in Creston, Lamoni, Osceola or the Des Moines or Kansas City metro areas.

Ringgold County has an active labor force, with a large percentage of both men and women participating. In 2015, an estimated 2,240 persons (56.6% of those aged 16 and older) were involved in the workforce, of which 100% were civilians. The total number that was employed was 2,118 and the number that was unemployed was 107 (2.7%). Traditionally, the planning area’s labor participation rate has been average compared to Iowa and somewhat higher than the national average. The unemployment rate has traditionally remained below average to Iowa and much lower than the national average. The latest employment data for the planning area, at the time this section was authored, was produced for March 2017. In that report, Ringgold County had a 3.6% unemployment rate, compared to 3.1% in Iowa and 4.8% nationally. This data, produced monthly by the Iowa Workforce Development, illustrates that the county is typical for the southwest region. The following table shows the county’s employment by industry.

**Figure 2.18: Employment Information**

Industry Sector of Employment	Number	Percent
Total civilian non-farm employment, 16 years and over	2,133	100.0%
Agriculture, Forestry, Fishing, Hunting, Mining	308	14.4%
Construction	151	7.1%
Manufacturing	263	12.3%
Wholesale Trade	89	2.4%
Retail Trade	187	8.8%
Transportation and warehousing and utilities	70	3.3%
Information	25	1.2%
Finance and insurance, and real estate and rental and leasing	45	2.1%

<b>Industry Sector of Employment</b>	<b>Number</b>	<b>Percent</b>
Professional, scientific, management, administrative, and waste management services	83	3.9%
Educational, health care, and social assistance	655	30.7%
Arts, entertainment, recreation, accommodation, and food services	94	4.4%
Other services, except public administration	110	5.2%
Public administration	53	2.5%

Sources: US Census ACS 2015 5-year Estimates, 5/2017

Overall, Ringgold County has a fairly stable economy with diverse industry sectors represented. The main notable change is the continued decline in manufacturing employment that is offset by educational and healthcare employment. This characteristic makes it somewhat easier to implement mitigation actions. While the national unemployment rates have fluctuated significantly in the past ten years, Iowa and Ringgold County have been more stable. The local construction industry is stable and a strong, but small, part of the economy. If a disaster does occur, this could be mobilized to repair homes, streets, and businesses damaged. Ringgold County has a limited supply of fuel sources and building materials dealers, but these can be accessed in nearby counties as well as places like Des Moines. Markets for food and materials can be accessed via Interstate 35 and Highways 2 and 169.

The composition of professional, technical, and other types of workers is important when mitigation planning because it tells us what kinds of skills the population has that can be harnessed in hazard mitigation efforts. The following table shows the occupation categories for employment.

**Figure 2.19: Employment Occupations**

<b>Occupation Type of Employment</b>	<b>Number</b>	<b>Percent</b>
Total civilian non-farm employment, 16 years and over	2,133	100.0%
Management, business, science, and arts occupations	765	35.9%
Service occupations	383	18.0%
Sales and office occupations	358	16.8%
Natural resources, construction, and maintenance occupations	300	14.1%
Production, transportation, and material moving occupations	327	15.3%

Sources: US Census ACS 2015 5-year Estimates, 5/2017

As the table shows, there are relatively few broad occupational categories. Notable, Ringgold County's employment is spread well among all the categories. The strong employment in the management and professional sector is a good sign because these jobs tend to pay more and involve significant leadership skills that are necessary to carry out mitigation actions.

According to the latest Census estimates, over 73% of the workforce living in Ringgold County also works in Ringgold County. Major employers include primarily public employers, such as Mount Ayr Schools and Ringgold County Hospital. Dozens of employees work for smaller organizations and businesses in the various towns of the county in most economic sectors. Some people work in rural area businesses and agricultural industries, such as cooperatives and grain storage facilities.

Generally, but not by a significant margin, people are commuting longer distances to work than in the past. The reasons for this are that more people commute longer distances from their homes to work in Creston, Lamoni, and Osceola and more people travel to the Des Moines and Kansas City metros to work than in the past. For this reason, the average commute time in 2015 was estimated at 18.0 minutes, and just over 88% that did not work at home drove a personal vehicle to work. The relevance of commuting trends is that it sheds light on a continual problem in southern Iowa where too few volunteers, which are the core of many emergency services, are available during working hours to respond to hazards, which limits local mitigation capabilities.

### **Planning Area Personal Income Characteristics**

Local income characteristics tell us very much about the ability of the community to support the costs of hazard mitigation. In this section, we summarize the household income data for the planning area. The table below shows estimated income and poverty statistics for the planning area in 2015.

**Figure 2.20: Ringgold County Personal Income and Poverty Data**

<b>Income Characteristic</b>	<b>Number</b>	<b>Percent</b>
Total households	2,030	100.0%
Less than \$10,000	102	5.0%
\$10,000 to \$24,999	408	20.1%
\$25,000 to \$49,999	585	28.8%
\$50,000 to \$74,999	483	23.8%
\$75,000 to \$99,999	152	7.5%

Income Characteristic	Number	Percent
\$100,000 or higher	296	14.6%
Median household income	\$47,042	--
Mean household income	\$64,398	--
Mean earnings for households with earnings	\$51,795	--
Per capita income	\$26,557	--
Median family income	\$55,646	--
Percent of the population below poverty level	--	10.6%
Percent of the population under age 18 years below poverty level	--	9.5%
Percent of the population age 65 and over below poverty level	--	12.4%

Source: US Census ACS 2015 5-year Estimates, 5/2017

Since 2000, the county has seen modest increases in incomes and earnings, consistent with rural southern/southwestern Iowa. However, the county is far below the state of Iowa in terms of income and earnings. Poverty rates have also remained high, especially for the senior population living on fixed incomes. This has resulted in a general decline in ability of the people in the county to afford home repairs, growing insurance premiums, and other investments to make the population less vulnerable to hazards. The individual cities and townships in the county have widely varying income and poverty statistics.

### Planning Area Agricultural Trends

Being a rural county in Iowa, it is important to consider economic, land use, and valuation levels of the local agricultural base. Select applicable planning data is included for the planning area.

**Figure 2.21: Ringgold County Agricultural Trends Data**

Characteristic	2012	2007	Change	Characteristic	2012	2007	Change
Total farms	651	733	-82	Farms with cattle	286	274	12
Average acres/farm	414	361	53	Number of cattle	54,933	37,406	17,527
Total acres	269,777	264,886	4,891	Farms w/ poultry	15	25	-10
Estimated square miles	421	413.9	7.1	Average farm sales/farm	\$179,161	\$95,956	\$83,205
Cropland acres	178,811	180,805	-1,994	Farms w/ government payments	500	599	-99
Pasture acres	30,582	29,989	593	Total payments (\$000)	\$6,034	\$5,878	\$156
Value of land per acre	\$4,211	\$2,126	\$2,085	Average payment per farm	\$12,068	\$9,813	\$2,255
Farms with hogs/pigs	29	34	-5	Farm employment (hired workers)	444	318	126
Number of hogs/pigs	96,204	83,070	13,134	Primary occupation is farming	46.2%	40.0%	6.2%

Sources: Iowa Community Indicators Program, Iowa State University, [www.icip.iastate.edu](http://www.icip.iastate.edu); USDA NASS, Census of Agriculture, [www.agcensus.usda.gov](http://www.agcensus.usda.gov)

Note that, while average farm size has increased, the number of farms continues to decline, yet not enough to reduce the total number of farmed acres (roughly 80% of the county's area). Woodland and pastureland is more common in this part of Iowa compared to central and northern Iowa, but, with increasing land values and commodity prices, this land is converted to row cropland, and the reverse occurs when prices and values decline. Livestock and other animal herd sizes have increased but the number of production farms has declined (especially for pigs/hogs) as a result of specialization and machination. Large confinements have become a special fire and waste management hazard in our area. Fewer farms are producing more on the same amount of acres. In fact, crop production trends fluctuate with the commodity markets, increasing when corn and soybean prices increase. Cattle and hog production decreases as a result of the same. The topography and soil quality for crops varies widely throughout the county, with Ringgold County overall hillier and less productive than the State of Iowa as a whole. Farm payments continue to heavily impact area farming. Most farmers are not able to support their families merely on farm production sales, even with government subsidies. Regardless, farm employment has actually grown over this period.

Ringgold County produces a large variety of many different farm commodities and is average in terms of hogs and cattle among counties in Iowa. Ringgold County produces less corn and soybeans but much more forage crops compared to other counties. Iowa is the largest hog, egg, and corn producing state and is near the top in cattle and soybean production. Agriculture is a very important part of the local economy and, while the area is not solely dependent on the agriculture sector, it is relevant and vital that the planning team consider hazard impact on local crop and livestock production, even though crop and livestock insurance available and popular.

Another interesting facet is the total farmland value. Farmland values are produced annually by county through the Iowa State University's Farmland Value Survey. Ringgold has experienced rapid appreciation of farmland value, like all of Iowa, in the past ten years (until a decline in 2014), but the mean value per acre is somewhat lower than Iowa's average. The peak year was 2013 statewide and in most counties. In 2015, the mean value in Ringgold County was \$4,211 per acre, compared to an acreage value of \$7,633 in Iowa as a whole. In 2010, Ringgold County's median value of \$2,609 per acre compared to \$5,064 in Iowa. In 2000, the Ringgold County farmland had a value of \$918 per acre, compared to \$1,857 in all of Iowa. Generally, counties in the southern third of Iowa have less productive

farmland in part due to soil quality, topographical limitations, and to a lesser degree, proximity to infrastructure and markets.

During hazard mitigation planning meetings, one topic continued to arise. Ringgold County is home to dozens of large animal feeding operations, egg-laying facilities, and food processing facilities. Many of these are very rural, but some of them are in towns or near them. Unique risks, such as human and animal disease incidents, agro-terrorism, transportation and fixed hazardous materials incidents, and other hazards are much more likely when these large farms are developed. Ringgold County's greatest economic strength is its agriculture and the businesses that support it. Dozens of facilities in the county handle crops, manufacture implement parts, raise and process livestock, and ship products. Some of the vulnerable assets listed in Chapter 3 are these types of facilities.

Anhydrous ammonia is stored in many locations in rural areas and towns of Ringgold County, including several locations in and near Mount Ayr and Diagonal. These facilities are generally well monitored to prevent theft and vandalism. Local highways transport large amounts of dangerous chemicals but the routes are not specifically designated for this use.

### ***Demographic Comparison Between Ringgold County and the State of Iowa***

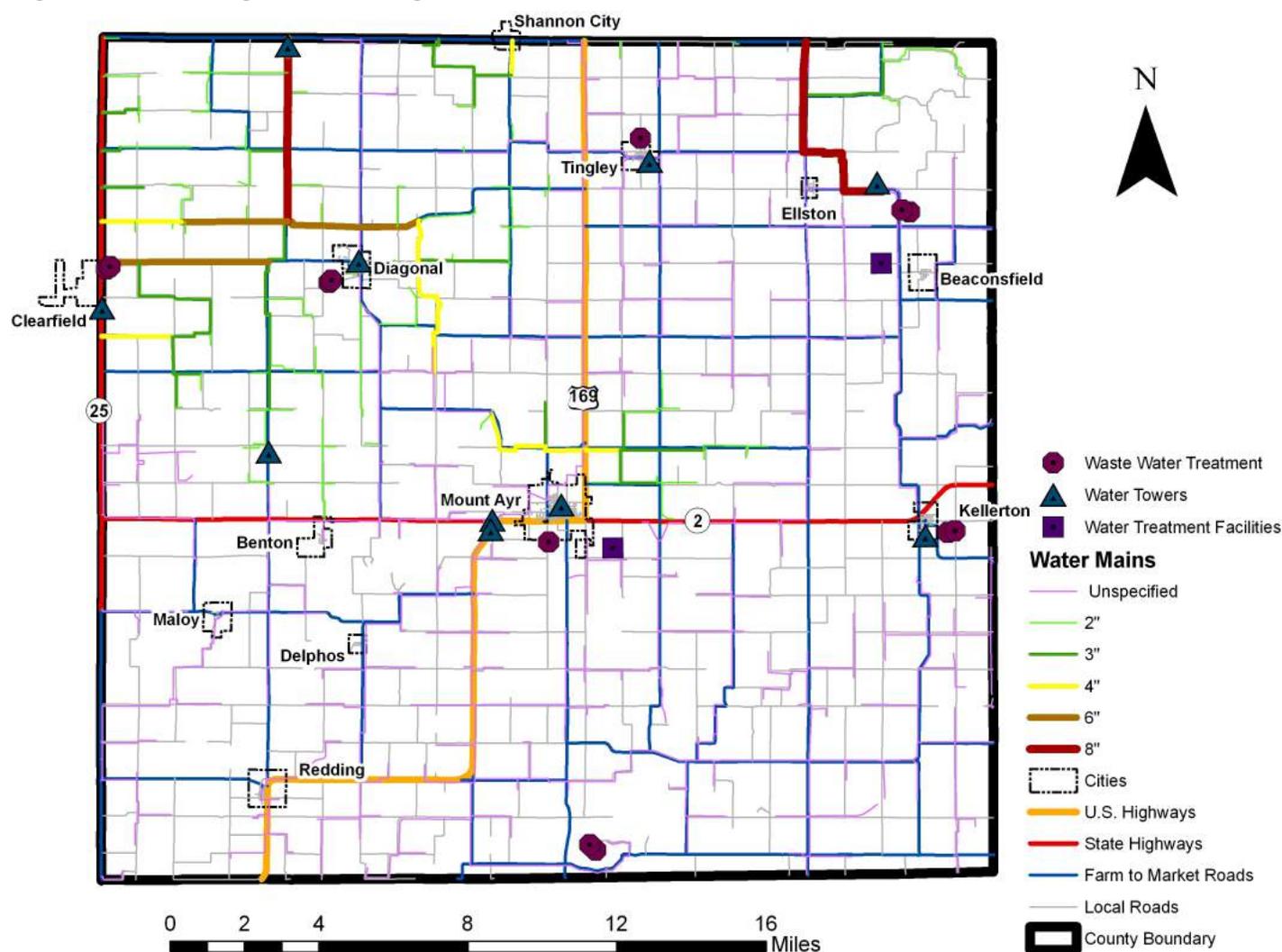
Using 2011-2015 Census estimate data the following is a summary of Adair County's demographics compared to the entire state of Iowa.

- Population Trend: Decline or slower growth
- Persons aged 65 and over: Higher
- Persons under age 18: Lower
- Percent minority population: Much lower
- Percent college educated: Similar
- Mean travel time to work: Similar
- Percent owner-occupied housing units: Higher
- Median housing value: Much lower
- Median income: Lower
- Percent of population in poverty: Lower
- Average household size: Lower
- Age of housing stock: Similar
- Retail sales per capita: Similar to slightly lower

### ***Potable Drinking Water and Wastewater Treatment Systems and Facilities***

95% of occupied or habitable property having potable water connections from a public or franchised source. The remaining properties are primarily rural properties still drinking from private wells. The vast majority of the county is served by the production plant at Twelve Mile Lake in Union County. The water from this plant serves the city of Creston, with the remaining water going to the Southern Iowa Rural Water Association (SIRWA) via a purchase agreement. SIRWA, a nonprofit group governed by public officials in eight counties, sells the water in portions of nine counties, including all of Ringgold County.

Figure 2.22: Planning Area Drinking and Waste Water Facilities



Water towers are found in many of the towns and at strategic locations in rural areas to ensure there is adequate storage for short-term outages and for fire protection needs. The towers and water lines are of various conditions and capacities. Hazard mitigation efforts may include the expansion of water production capacity, water system inspections, installation of new or larger lines, erection of larger towers in underserved locations, and installation of wet and dry hydrants. Generally existing towers meet seismic, high wind, and lightning protection standards.

*Note: the water treatment facility located at Mount Ayr is currently being removed, as all water is produced by SIRWA.*

The rural areas of the county are not served by centralized sewer systems, except for Sun Valley Lake development area in the northeast corner of the county, which has a sewer district. Ringgold County Public Health is in charge of rural sewer systems. While Environmental Health is required to enforce laws related to on-site pollution, the county has limited resources and capacity for adequate enforcement. Therefore, it can be ascertained that many of the nearly 1,500 rural residential and other occupied structures have noncompliant on-site systems.

Resources: SIRWA, Creston, Iowa, 641.782.5744, [www.sirwa.org](http://www.sirwa.org); City halls; Ringgold County Public Health, Osceola, Iowa, 641.464.0691, [www.rcph.net](http://www.rcph.net).

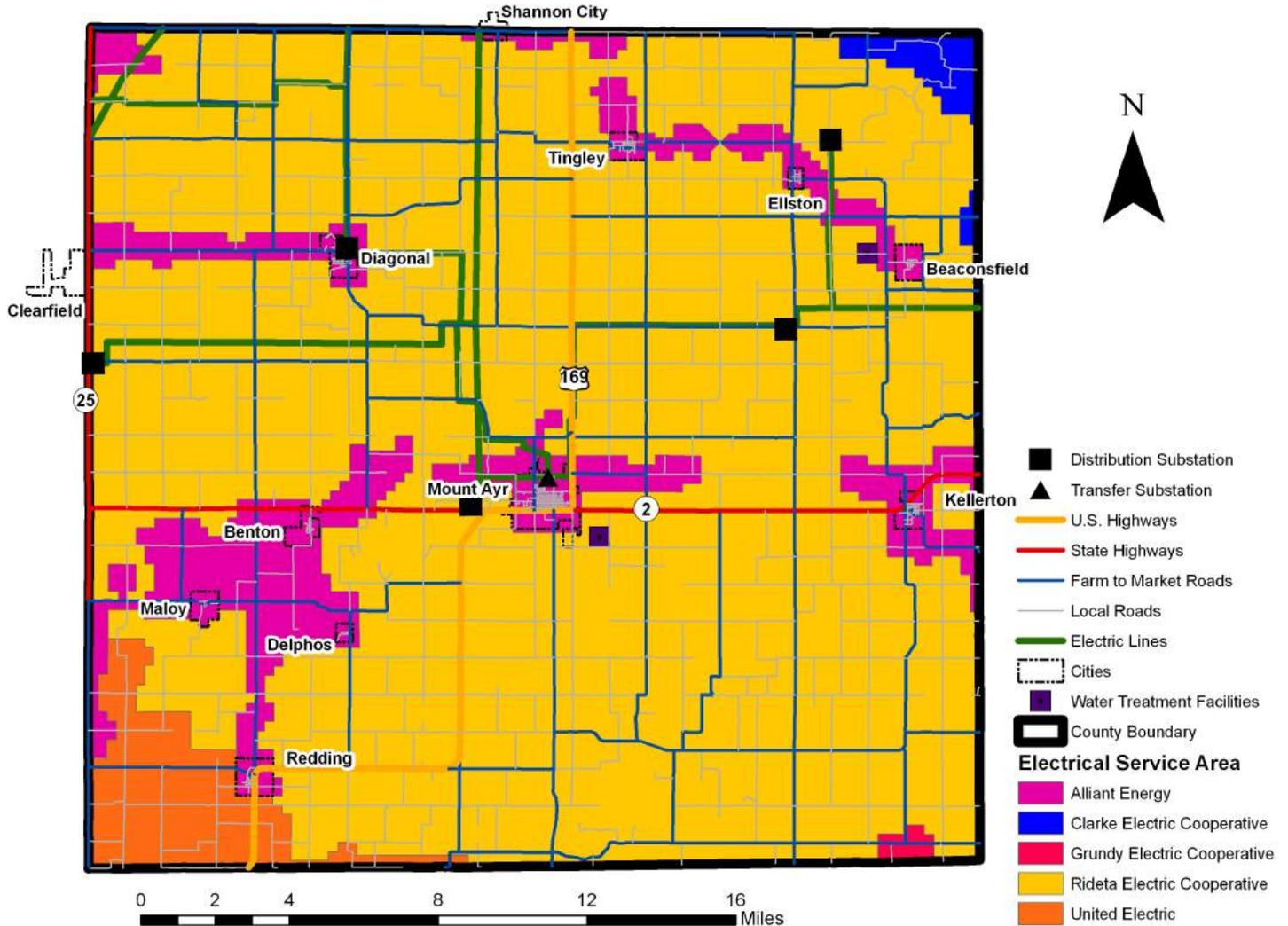
**Electrical Facilities and Services**

Rural electric systems are provided by Alliant Energy, Clarke Electric Coop, Grundy Electric Coop, Southwest Iowa Rural Electric Coop (formerly Rideta, as shown on the map), and United Electric to Ringgold County. The majority of the rural county is serviced by the Southwest Iowa REC. Several major power lines and substations are found in the rural part of the county. There are no rural production facilities. Some rural landowners utilize their own generators and/or wind turbines.

Both Alliant Energy and SWIREC have a power failure workforce plan and power recovery plan. The plans reportedly work well and meet local needs. Note also that, by law, electric companies must ensure tree trimming is done. Line and pole upgrades are continuously occurring. No other mitigation efforts are ongoing.

The map on the following page shows the general location of major electrical infrastructure.

**Figure 2.23: Planning Area Electric Facilities**



*Note: Rideta is now Southwest Iowa Rural Electric Cooperative.*

Weaknesses in the systems and services have been addressed following repeated tornadoes, high wind events, heavy snows, and ice storms in the past five years that have damaged high-voltage and low-voltage power lines, substations, and poles. The lack of redundancy remains an issue in some areas. Very few power facilities are buried; the cost of burial is very high. Human resources to repair damaged lines can only be obtained by drawing on resources from many surrounding counties. The cost of continual tree maintenance around lines is high.

Resources: Alliant Energy, 800.255.4268, [www.alliantenergy.com](http://www.alliantenergy.com); SWIREC, Mt. Ayr office, 641.464.2369, [www.swiarec.coop](http://www.swiarec.coop), City of Mount Ayr, 641.464.2402.

**Energy Facilities and Pipelines (heating and cooking fuel)**

Most areas of the county are served by some kind of liquid or gas heating and industrial fuel, either propane or natural gas. Only a small percentage of properties are served by wood, coal, corn, or other renewable or non-renewable fuels. Where it is economical to provide, natural gas is the best choice. However, communities must be large enough to support the cost of transporting large amounts of gas via pipelines from sources in other parts of the nation, almost all of which are out of Iowa. Natural gas pipelines generally do not serve the rural county. Several major natural gas

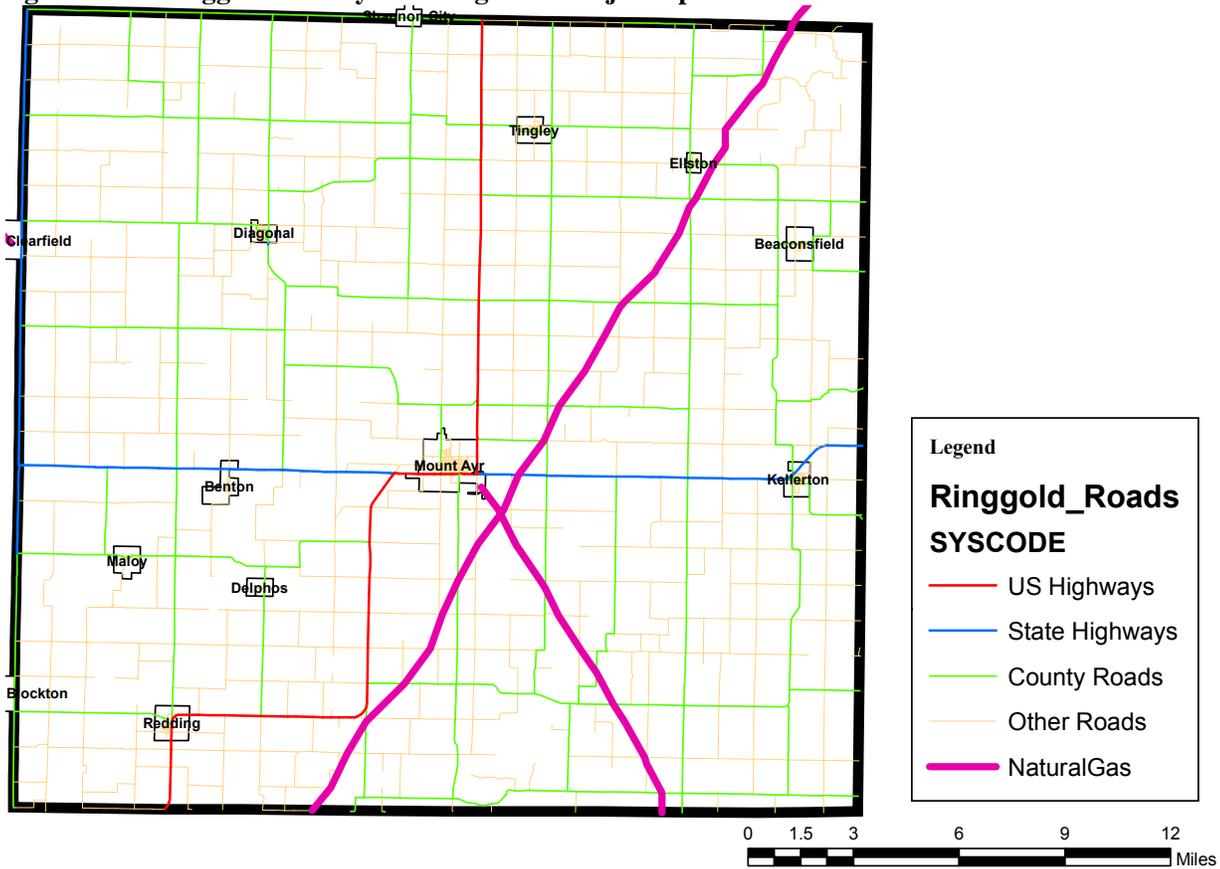
pipelines services the county. The IES Utilities Pipeline goes from Mount Ayr and runs southeast to the Missouri boarder. Another major pipeline runs the entire length of the county from the southwest to the northeast and is owned by Williams Pipeline. Liquid propane is available to most of these areas through individual tanks located in yards. The other areas of the county have individual propane tanks. Several suppliers in the region offer for sale this liquid fuel for purchase by residents. The fuel is hauled in on trucks to properties seasonally. This method makes sense for rural areas. Risks of natural gas are related to pipeline failure. Risks of propane include hauler spills and the effect of hazard events on exposed tanks in yards. Both kinds of fuels are very explosive.

Gas border stations are located at the southeast corner of Mount Ayr.

Gas and LP bills vary widely in the county, but as international energy demand has increased, the affordability of this source has decreased, especially for major industries and low-income, rural (out of town) families. Most households pay over \$100 per month in the winter for heating energy.

The main weaknesses in the natural gas systems are the lack of service in rural area, the lack of redundancy, and growing international demand.

**Figure 2.24: Ringgold County Planning Area Major Pipeline and Natural Gas Facilities**



Resources: City of Mount Ayr, 641.464.2402 Alliant Energy: 515.255-4268; Iowa Utilities Board.

**Storm Water Control Systems**

Flash and river flooding, as well as a host of other cascading hazards, are caused by uncontrolled storm water that floods buildings, washes out farmland and roads, and travels through contaminated sites. Most of the county has very limited means to control excessive storm water problems from the heaviest rains and rapid snowmelts. While building bridges, culverts, buffer strips, curb and gutter, and other methods exist in some areas, damages to homes, farms, sewer and water lines, and streets is still very high. One of the most significant recurring problems is with storm water getting into sanitary sewer systems. It is very important to invest in and maintain all these systems in order to prevent clogging of pipes and plugging of ditches and culverts. However, the cost is very high and resources are very limited. Underground systems in towns help, but they are often unmaintained and only cause storm water to enter streams faster, thereby exacerbating flash flooding.

Resources: city halls, Ringgold County Engineer, 641.464.3232, Iowa Flood Center, [www.iowafloodcenter.org](http://www.iowafloodcenter.org), FEMA, [www.fema.gov](http://www.fema.gov).

### ***Solid Waste Management***

Ringgold County partners with the Wayne-Ringgold-Decatur Landfill for solid waste removal. This facility serves almost 20,000 people in a 3-county area. The landfill is located approximately three miles east of Ringgold-Decatur County border. It is a full-service landfill with a hazardous materials site.

### ***Emergency Transportation Access***

Especially in dealing with multi-jurisdictional efforts, transportation access is vital to success of emergency management programs. A large portion of the Ringgold County budget goes to work on secondary roads, including road surfacing, shoulders, bridges, culverts, and overpasses. The county engineer (Secondary Roads Department) is responsible for construction and maintenance of the secondary roads, which are defined by Iowa Code 306.3 as those roads under county jurisdiction. Ringgold County's road system has 1,024.2 miles of roadway. Many paved roads are found in rural areas that connect towns and that access the many recreational areas available in the county. Also, many more gravel roads connect remote areas of the county to the towns of Ringgold County. The county also manages hundreds of miles of ditches and other road right of way areas. A similar length of streets in the incorporated cities. The county has an estimated 200 rural bridges. Generally, however, all parts of each city and the county can be accessed by emergency vehicles with minimal delay, despite seasonal or age-related road and bridge conditions. The worst areas where this impact could occur are a few remote areas in the most remote parts of the county, five miles or more off major paved state and county highways. No one area stands out due to a potential or actual 5-minute plus detour.

Fire departments and others cannot get large heavy vehicles to all areas of the county due to road conditions and bridge weight limits. However, each fire department has lighter grass fire vehicles. Further, this has necessitated all fire and EMS departments receiving a map of limited bridges and from that developing a route plan for any given incident. CIPCO's power restoration vehicles cannot get to all areas due to bridge tonnage limits, as 18 tons is needed. Access to power lines after disasters is often compromised. The problems have resulted in a concerted effort to improve the situation, but due to funding limitations, utility providers must solve the direst issues first. Cooperation with the county engineer is continuing in this regard.

Creston, Iowa, located 32 miles to the northwest of Mount Ayr, is home to the regional transit authority, the Southern Iowa Trolley. The Trolley is available to assist with emergency transportation by mobilizing regional resources into a local response effort.

With the E-911 systems in place, the county is well positioned to respond quickly and accurately. However, it is noted that some confusion with road names in surrounding counties is a problem. All first response agencies have updated color E-911 maps. Road name confusion has been solved by digital 911 mapping for dispatch (Phase II).

Resources: City halls; Iowa DOT, Ringgold County office: 641.464.2340; Ringgold County Engineer, 641.464.3232.

### ***Communications Facilities and Systems***

With limited services in this and other rural counties, communications among and with responders is vital. To address the problem, Ringgold County has implemented an E-911 system dispatched and managed through the Sheriff's Office in Mount Ayr. All areas of the county have been mapped and given an E-911 address. First responders have been trained on the system and know the territory.

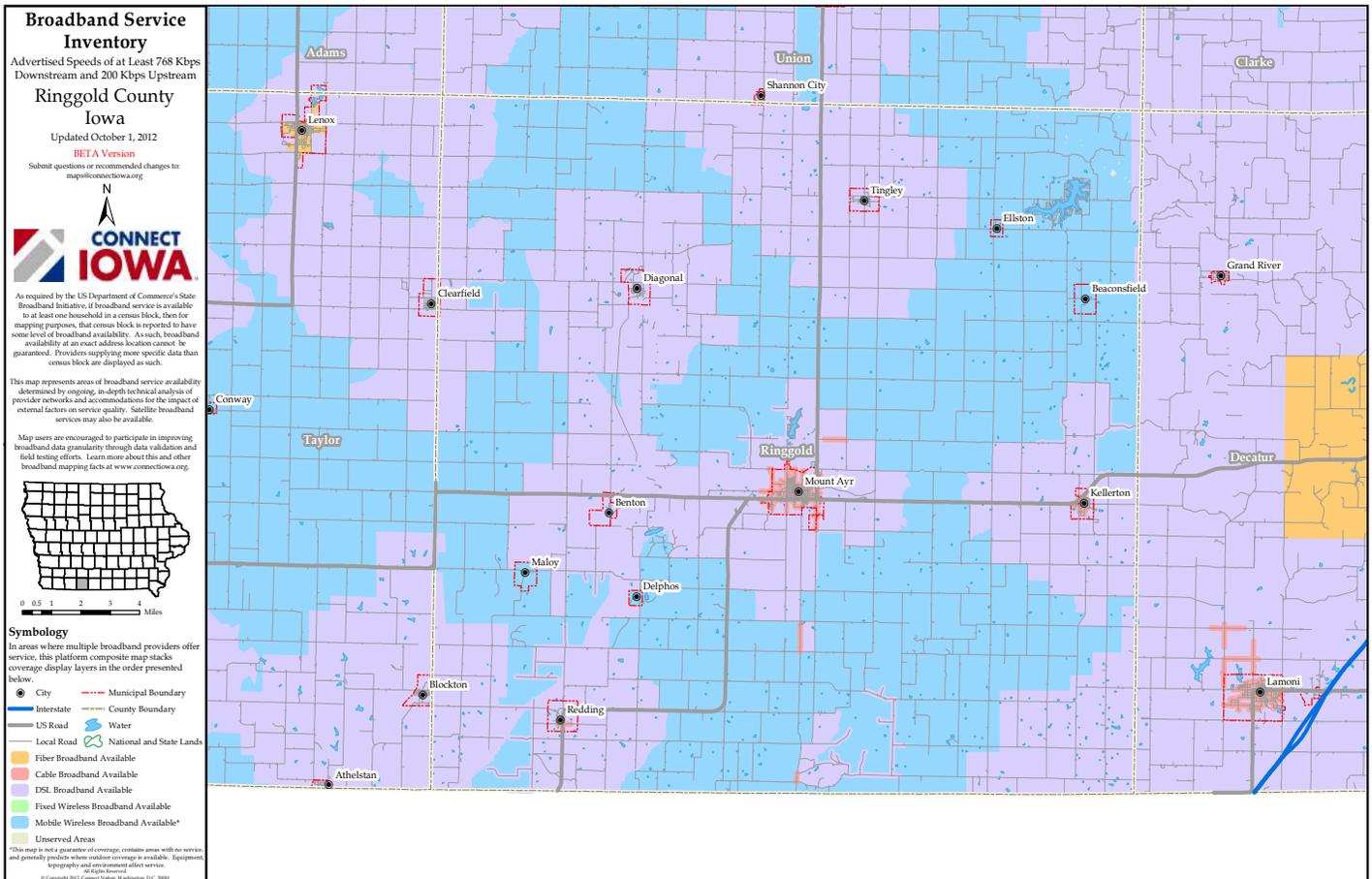
Vehicles, trained personnel, and volunteers have radios to communicate in all areas of the county. However, there are some shortcomings that continually need addressing. One of those is the quality of communication in remote areas of the county. To address this, repeaters have been installed on towers, buildings, and in vehicles in various jurisdictions. However, these repeaters were for the old technology of radios as the new narrow band radios have horrible range and are constantly being disconnected from one another. Many water towers and communications towers contain county and local communications equipment along with private data transfer equipment. It is not always known what is lightning protected and some areas have continued problems due to the hilly terrain. Another issue to which funding is limited is the new narrow-banding requirement, which will in 2013 make most existing emergency communications equipment obsolete. This most greatly affects small volunteer fire and EMS agencies.

Wireless and wired communications varies by area of the county. Figure 2.25 (next page) shows the extent of available Broadband Internet in Ringgold County. Mount Ayr and Kellerton has cable internet service available from Mediacom Communications, while Digital Subscriber Lines (DSL) provided by Windstream Communications (formerly Iowa Telecom) are the fastest Internet medium in other parts of the county. Large areas of Ringgold County do not have

access to wired Broadband Internet and only has access to Internet through wireless cellular service. The most reliable and largest cell phone network in Ringgold County is provided by US Cellular Corporation.

Ringgold County is connected to a statewide fiber optic communications network, the ICN (Iowa Communications Network), which allows for real-time videoconferencing services to one site in Mount Ayr and one site in Diagonal. The facilities are useful for disseminating, networking, and seminars for both general public and for emergency response personnel.

**Figure 2.25: Ringgold County Broadband Service Inventory Map**



**Alert Media Coverage**

The following public media exists in the area:

- KSIB 101.3 FM radio, Creston, <http://www.ksibradio.com/>, 641.782.2155
- KSOI 91.9 FM radio, Murray, 641.781.0854
- KNLS 97.9 FM radio, Lamoni, 319.273.6400
- KXCV 90.5 FM radio, Maryville, <http://www.kxcv.org/>, 660.562.1163
- ABC-WOI Channel 5 TV, <http://www.woi-tv.com/>, 515.457.9645
- CBS-KCCI Channel 8 TV, <http://www.kcci.com/>, 515.247.8888
- NBC-WHO Channel 13 TV, <http://whotv.com/>, 515.242.3500
- *Mount Ayr Record Newspaper*, <http://www.mtayrnews.com/>, 641.464.2440
- *Diagonal Progress*, 641-734-5507

Radio and television weather bulletins include both observation and radar methods of determining severe weather and other hazards. Ringgold County has an active spotter program and has access to the weather forecasters and alert staff at the stations and the National Weather Service. A map showing the warning spotter locations and routes is continually updated at the county EMA office.

***Emergency Services – Law Enforcement***

Law enforcement is provided by the Ringgold County Sheriff's Office. There are no municipal police forces. The Sheriff's Department has a Sheriff and five full-time deputies and volunteer reserve officers. Staff attrition continues to be a major problem in the county as funding to pay for officers is more limited; the most trained officers often eventually leave for larger jurisdictions. The Sheriff operates out of the new multi-jurisdictional law enforcement center in the southwest part of Mount Ayr, about eight blocks from the courthouse. Training is provided by the Iowa Law Enforcement Academy, ongoing training at nearby Southwestern Community College, and through training task forces, such as narcotics and terrorism. The Sheriff's Department has training in terrorism and WMD response. Emergency services, such as the countywide dispatch point, are based out of the same law enforcement center. This also houses the county jail. On this site are a communications tower and a fixed backup power generator. The law enforcement agencies of the county are active in drug enforcement and municipal infraction enforcement. The organizations operate a joint 28-E agreement for dispatching services, including EMS, HAZMAT, law enforcement, and fire. The State Patrol operates regionally but does not have infrastructure in Ringgold County. Most people view police protection as adequate.

Methamphetamines pose unique problems due to local production of this drug, often using stolen hazardous and combustible materials. The passage of stronger anti-methamphetamine laws has improved the situation in this county. Since the new laws have taken effect, very few meth labs have been found and seized in the county. Because I-35 is just east of the county, drug trafficking remains a continuous, notable problem. The county is also a member of the South Central Iowa Drug Task Force and maintains a drug dog.

The agencies in the county work hard to address local needs with limited resources. Street patrol activities can mitigate some hazards by discouraging crime. Funding for the necessary human resources to patrol areas and to respond rapidly to incidents would be the best method of mitigation at this time.

Resources: Ringgold County Sheriff's Office, 641.464.3921.

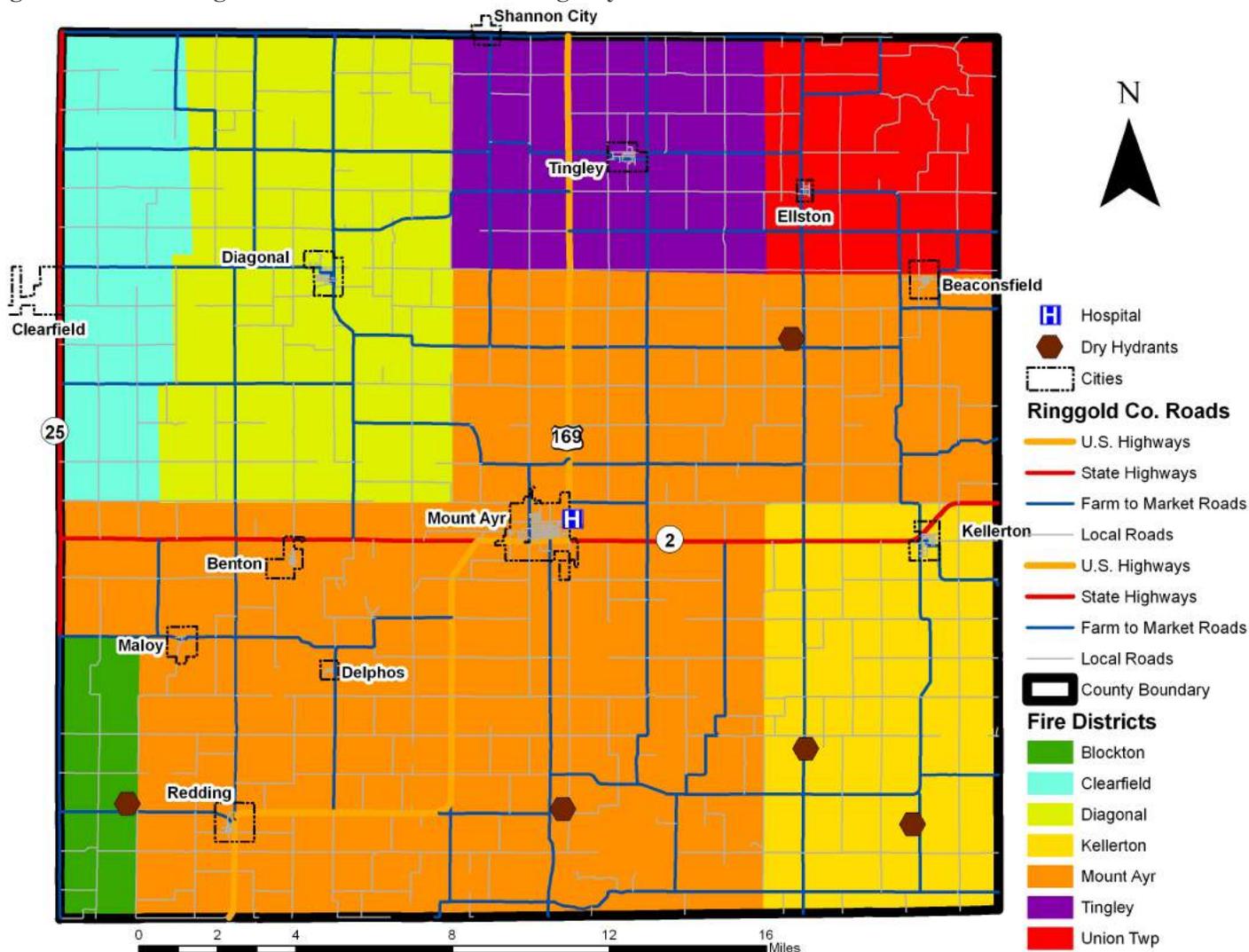
***Emergency Services – Fire Protection***

Fire services are provided by area fire departments, mostly in towns and communities. In contrast, nearly all EMS services are provided out of the Ringgold County Hospital. All fire departments serve rural areas that include both inside and outside towns, and all work together via mutual aid agreements through IMAC, the Iowa Mutual Aid Compact. The IMAC is an intrastate mutual aid agreement that allows jurisdictions to share resources during a disaster and to respond to emergency situations. Each fire department is housed in incorporated areas. There are several other fire departments from surrounding counties that serve in Ringgold County. Several rural fire hydrants and dry hydrants are found in strategic locations are the county. Most roads and bridges can accommodate fire trucks and rescue vehicles. The county's firefighting fleet includes pumpers, tankers, rescue vehicles, and small attack or grass rigs. Other equipment includes an available thermal imaging camera.

Training levels in fire service vary amongst fire departments. Some firefighters are rated Fire Fighter 1, others are trained to Fire Fighter 2, and some have HAZMAT certification and serve on the dive team. The regional dive team, based in Ringgold County, is fully trained and equipped for regional rescue service.

The map on the next page shows the fire districts and key emergency services and facilities.

Figure 2.26: Planning Area Fire Districts and Emergency Services/Facilities



The cities of Diagonal, Kellerton, Mount Ayr, and Tingley have hydrants in the city. Three (3) rural dry fire hydrants are also located in the southeastern part of the county, remotely positioned away from municipal water supplies.

Resources: City halls; local fire stations (many do not have manned phones).

**Emergency Services – EMS and Ambulance Service**

EMS services are offered through local fire departments, with the main specialized support and ambulance services provided by the Ringgold County Hospital. Most of the other services are run by volunteers, trained in the same manner as firefighters. The Ringgold County Hospital offers a facility-based care service. EMS operates via a 28-E agreement that also allows for the sharing of resources and rapid response. Not all EMS agencies transport patients, but some do. Poor Medicare reimbursement rates and the need to update transport vehicles makes it very difficult to maintain the transport services, and grants have been required to upgrade vehicles in recent years. Most of the county’s EMTs are trained and certified to EMT-B only (hospital staff have PS levels), but this meets the most urgent need. Hospital-based helicopters are dispatched when rapid transport is needed to Des Moines or Omaha facilities.

According to the Ringgold County Hospital website: “Ambulance services are provided within Ringgold and surrounding counties 24 hours a day, seven days a week, to initiate medical care prior to arrival at the hospital. Operating as part of the Emergency Department at Ringgold County Hospital, we are well equipped to respond quickly with three ambulances, specialized equipment such as the ZOLL cardiac monitor and the capability to call Mercy One (Mercy DSM), Life Flight (Methodist DSM) or Life Net (Clarinda) helicopters. Our first responder teams include professionals certified as EMTs, AEMTs or paramedics. Advanced level care is provided by AEMTs and paramedics in over 95% of emergency situations. We provide county 911 emergency coverage and transport to Ringgold County and other local hospitals, nearby hospitals out of state and local nursing homes, and Life Line services.

Our Emergency Department is here to help you all day, every day, if you are seriously ill, injured or have a potentially life-threatening emergency. Most people experience very little wait time as our emergency room is large enough to serve you, but small enough to make you feel comfortable. On staff are local physicians, contracted emergency physicians and nurses who are certified in advanced cardiac life support (ACLS), pediatric advanced life support (PALS) and trauma care use of state-of-the-art equipment to provide emergency care.”

Resources: Ringgold County Hospital, 504 N. Cleveland St., Mount Ayr, 641.464.3226, [www.rchmtayr.org/](http://www.rchmtayr.org/); all local fire and EMS departments.

#### ***Emergency Services – Hazardous Materials Response***

Response to hazardous materials (HAZMAT) incidents is an ongoing issue. The County currently has a HAZMAT contract with the Southeast Iowa Response Group (SIRG), based in Ottumwa, for Level A service. While this meets basic needs, the distance of over two hours drive time can become a significant concern in worst case scenarios. There are no substantially closer services. The State of Iowa does not provide HAZMAT services, other than an Iowa Department of Natural Resources (IDNR) advisor that provides contact resources and identification assistance to local teams but does not physically handle the material. The IDNR response is typically from Des Moines, about 1.5 hours away. Their purpose is cleanup enforcement. The county’s hospital has an official HAZMAT decontamination site.

Local fire departments have several trained HAZMAT individuals, both A and Operations Levels. Some members of local fire department have Technician level training through their employment. Only Tech level persons can actually contact the materials. This provides reasonable response capabilities until the SIRG crew arrives from Ottumwa or for incidents that do not require SIRG assistance.

Overall training is comprehensive in Ringgold County, with dozens of people in all jurisdictions trained to the applicable NIMS standards and specialty areas. During the mitigation alternatives and capabilities discussion, few jurisdictions noted a major concern over the need for more or better volunteers or massively improved training.

Resources: Local fire and EMS departments; Ringgold County Hospital, 641.464.3226; and Ringgold County EMA: 641.464.3344; SIRG, 641.683.0666.

#### ***Emergency Services – Intensive Health and Medical Care***

As previously stated, the Ringgold County Hospital is located centrally in Mount Ayr, just north of the Highways 2/169 intersection on Highway 169, and can be reached within 25 minutes of all part of the county. All surrounding counties, except Taylor County just to the west, have hospitals as well. In the past ten years a new facility was built that has full services, improved in-patient facilities, and room for expansion. For major emergencies or mass casualty events many are transported to Omaha or Des Moines area hospitals, via ambulance (2 hour) or helicopter (usually 1 hour or less). The hospital has an outpatient clinic in Mount Ayr.

Residential facilities offer long-term care at multiple sites in the Mount Ayr. In-home care is becoming more common and is available all over the county on an on-call basis.

The County Board of Health works to prevent and alleviate infectious diseases and outbreaks. With concerns growing of the H1N1 flu, bird flu, mad cow disease, anthrax, pertussis, and West Nile virus, among any number of growing threats from terrorist organizations, the county needs additional assistance in this area, especially in light of an outbreak at the same time as a major natural event, such as an ice storm in the winter leaving many seniors and others of poor health in the cold and susceptible to illness. Fortunately, the Iowa Dept. of Public Health has been assisting the county to be prepared for pandemic flu and other diseases. Further, the CDC (HRSA) has been requiring exercises over the past five years to increase the workforce capabilities of the county public health agency. The local county public health office was heavily involved in the mitigation plan and continues to provide efforts to alert the public to disease risks and dangers as well as invest in mitigation efforts. The EMS services and the County Public Health Department continue to work together to study the impacts and needs related to disease control. Public Health started a pandemic flu plan to help the county meet new state requirements. In this plan, schools and businesses will be included as a means to cut the spread of disease. Each school and business will have a sub-plan. The county also has mass vaccination and antibiotic distribution plans. Public Health notes that livestock disease is a major local issue. Cooperation in such issues with area and state veterinarians has been secured. The agency also performs water supply, septic tank, and radon testing as well as permit inspections.

Needs related to mass casualties are of great concern due to the limited funding, personnel, and treatment space available for County health services.

Resources: Ringgold County Hospital, 504 N. Cleveland St., Mount Ayr, 641.464.3226, [www.rchmtayr.org/](http://www.rchmtayr.org/); RCH clinic, 641.464.4470; Ringgold County Public Health, 641.464.0691, [www.rcph.net](http://www.rcph.net).

### ***Sheltering and Human Protection***

Safe places for human life during a severe storm or other disaster is vital in rural southwest Iowa, as this area is part of the notorious “Tornado Alley”. Sheltering is a highly effective mitigation to protect people during and after a hazard event, such as a tornado, severe winter storm, flood, extended power or energy failure, or during excessive heat or bitter cold. Often, the above events occur simultaneously during one severe storm. There are two forms of sheltering in consideration here: short-term (2 hour) protection during high wind events and long-term sheltering for a displaced population during and following a hazard event. The needs and standards of construction vary greatly.

While most people, even in rural Iowa, have decent homes with basements, up to 50% of homes in Ringgold County meet one of the following susceptibility criteria: manufactured home, no or shallow basement, or severe home deterioration. Non-modern manufactured homes and many poorly built homes offer little protection from severe weather. For the persons impacted, storm shelters are vital. Short-term sheltering is best provided by a FEMA-approved storm shelter known as a tornado safe room. This type of structure is built to withstand 250 MPH winds and any debris that may be thrown at or dropped on it from the storm. Since the first FEMA-approved mitigation plan went into effect in 2007, two FEMA grants were obtained to build safe rooms. One is a community safe room at Judge Lewis City Park that is used as a swimming pool bathhouse during normal weather conditions. This facility is approved for 230 people. The other shelter is a school safe room located in the Mount Ayr High School across town from Judge Lewis Park. This facility can hold approximately 500 persons. In the spring of 2017, the City of Kellerton began exploring the potential for a safe room as part of a new concession building as part of a park renovation project in the southeast part of town.

Long-term sheltering does not require the rigorous construction standards found in a tornado safe room. However, it must be available and with services to support populations for many hours and in many cases overnight. Food preparation and storage facilities, cots or beds, and other sundry supplies are necessary, as well as reliable power, ventilation, and heat. Several facilities exist, including community centers, senior and special needs housing facilities, churches, and other facilities that have food and lodging capabilities. Some are known to the public, some are stocked, and some are available for sleeping. However, few have on-site backup power sources and on-site medical supplies. Many are not formally designated and promoted to the public as safe places for emergencies. Groups like the American Red Cross are available to assist with proper promotion and use of shelters.

**Figure 2.27: Potential Sheltering Locations**

<b>Location/facility</b>	<b>Est. capacity</b>	<b>Location/facility</b>	<b>Est. capacity</b>
Mount Ayr Swimming Pool Bathhouse *	230	Diagonal School	200
Mount Ayr High School shelter *	500	Tingley Meal Site	100
Mount Ayr Schools cafeterias	500	Former Kellerton School	50
Ringgold County Hospital cafeteria	100	Dragoon Trace Nature Center (rural)	50
Mount Ayr Community Center	100	Heritage Park Apartments community room (Mt. Ayr)	50
Mount Ayr Legion Hall	100	Care facilities (2 in Mount Ayr)	100 total
Diagonal Community Center	100	Various churches (approximately 10)	500 total

Sources: Planning team \* Tornado Safe Room Meeting FEMA 361 standards

Certain populations, such as the elderly and infirm, should be sheltered adequately in place rather than transported to a community shelter location, such as above. All shelters should have permanent emergency generators or quick-connect capabilities for portable generators.

Resources: local city halls; Ringgold County Emergency Management, 641.464.3344.

### ***Emergency Alert Systems/Outdoor Warning***

Warning sirens are great alert systems for those who are outdoors in local cities with sirens. However, many rely upon them for alerting of hazards when they are indoors instead of listening to a weather radio (which is battery powered). Outdoor sirens are located on the west side of Mt. Ayr (South of the Clearview Nursing Home), east Side of Mt. Ayr (near the Elementary School), Intersection of Hwy 2 E/169N (Near Smith Oil/Mt. Ayr Inn), Sun Valley Lake, City of Diagonal and multiple indoor warning systems that were purchased through a community grant by Ringgold County EMA. Ringgold County Emergency Management and Ringgold County Sheriff's Dispatch test the outdoor and indoor warning systems (sirens) the monthly unless the weather is stormy or unless there is a real live emergency. Tingley, Ellston, Kellerton, and Redding have manually sounded sirens. As needed, sirens are upgraded using grants and other resources.

Weather radio and phone alerts can provide indoor and outdoor warnings because they are portable. With the installation of the NOAA weather radio transmitter on the Lenox and Van Wert towers in 2001, the county has good coverage. Key critical and population centers have NOAA weather radios. However, many individual households do not yet see the value of the weather/all hazards radio, despite the new all hazard and Amber Alert components. Weather radios are not widely used except in certain public buildings and critical care facilities, like nursing homes and the hospital. The EMA continues education and occasional incentives to increase the distribution and use of weather radios.

Phone alerts are now available through Alert Iowa. For more information on how to sign-up for Alert Iowa notifications in Ringgold county, visit [http://homelandsecurity.iowa.gov/about\\_HSEMD/alert\\_iowa.html](http://homelandsecurity.iowa.gov/about_HSEMD/alert_iowa.html) or talk with the Emergency Management Coordinator.



Local community radio and television stations also offer indoor alerts and warning information.

### **Emergency Operations**

The final parts of this chapter detail the level of planning and emergency operations protocols available. A full-time emergency management agency (EMA) handles the responsibilities of emergency operations planning as detailed in this chapter. An emergency operations center (EOC) is located in the county law enforcement center to manage incidents and disaster events and to serve as an informational database of disaster information. The work of the EMA is set out in Iowa Code and via funding agreements with FEMA and State agencies. Local cities and some other institutions have EOPs pertaining to their jurisdictions.

Resources: Ringgold County Emergency Management, 641.464.3344.

### **Local Fiscal Resources**

The fiscal capacity of jurisdictions in Ringgold County is an important consideration in a discussion of hazard mitigation. The following tables discuss these issues as they pertain to the communities included in this plan.

**Figure 2.28: Latest Tax Levies by Community**

Jurisdiction	Consolidated Levy	Urban/City	Rural/County	Schools	Debt Service	Other Districts Combined
Ringgold County	Varies, \$32.05299 to \$36.53755	\$8.05594	\$12.00594	Varies by district	\$0	Varies by township
Beaconsfield	\$36.45395	\$8.1	\$3.00375	\$16.35765	\$0	\$8.99
Benton	\$40.22574	\$11.87179	\$3.00375	\$16.35765	\$0	\$8.99
Delphos	\$36.45395	\$8.1	\$3.00375	\$16.35765	\$0	\$8.99
Diagonal	\$46.16556	\$14.58187	\$3.00375	\$17.31617	\$2.14138	\$9.12
Ellston	\$38.81188	\$10.45793	\$3.00375	\$16.35765	\$0	\$8.99
Kellerton	\$42.04656	\$13.69261	\$3.00375	\$16.35765	\$0	\$8.99
Maloy	\$36.45395	\$8.1	\$0	\$16.35765	\$0	\$12.00
Mount Ayr	\$44.32613	\$15.97218	\$3.00375	\$16.35765	\$4.2265	\$4.77
Redding	\$36.45395	\$8.1	\$0	\$16.35765	\$0	\$12.00
Tingley	\$41.12758	\$12.77363	\$3.00375	\$16.35765	\$0	\$8.99

Source: Iowa Department of Management, 5/2017

In Iowa, property owners in both rural areas and incorporated communities pay taxes to the county. However, the taxes on rural property owners are calculated on a larger percentage of the property's valuation, increasing the share of these county taxes paid on rural property. City tax levies vary greatly from community to community in Ringgold County. State law prohibits cities from levying more than \$8.1 per \$1,000 valuation to support the General Fund. However, the total tax levies noted in the table above include special funds. The variations largely reflect the needs of large versus small communities in maintaining infrastructure, emergency services, and insurance. Taxes levied by school district vary as well.

**Figure 2.29: Valuation by Jurisdiction (Includes Gas & Electric Utility Valuations)**

Jurisdiction	Residential	Ag Land	Ag Buildings	Commercial	Industrial	Multi-residential	Utilities	Gas/electric	Totals
Rural	\$195,229,429	\$280,219,997	\$21,191,466	\$4,256,487	\$352,492	\$103,990	\$4,878,496	\$18,708,734	\$524,691,821
Beaconsfield	\$375,360	\$471,545	\$10,565	\$76,640	\$0	\$0	\$14,937	\$68,406	\$1,015,601
Benton	\$882,801	\$328,364	\$5,243	\$16,080	\$0	\$0	\$16,081	\$82,460	\$1,292,320
Delphos	\$412,043	\$181,363	\$20,768	\$0	\$0	\$0	\$8,553	\$60,293	\$683,020
Diagonal	\$4,232,387	\$277,109	\$18,091	\$971,421	\$174,212	\$0	\$24,011	\$767,895	\$6,435,494
Ellston	\$509,712	\$95,335	\$60,565	\$203,473	\$0	\$0	\$11,022	\$95,260	\$969,811

Jurisdiction	Residential	Ag Land	Ag Buildings	Commercial	Industrial	Multi-residential	Utilities	Gas/electric	Totals
Kellerton	\$4,686,957	\$216,888	\$3,192	\$259,488	\$0	\$114,860	\$48,428	\$453,197	\$5,753,378
Maloy	\$469,324	\$381,082	\$93,194	\$2,200	\$0	\$0	\$10,902	\$78,761	\$966,163
Mount Ayr	\$46,153,362	\$679,695	\$98,833	\$11,330,523	\$1,400,523	\$3,307,190	\$185,486	\$4,894,395	\$67,850,321
Redding	\$1,258,377	\$396,809	\$45,091	\$114,250	\$0	\$0	\$23,550	\$179,802	\$1,979,767
Tingley	\$2,823,621	\$331,945	\$151,752	\$133,130	\$0	\$0	\$28,970	\$398,890	\$3,846,088
<b>Totals</b>	\$257,033,373	\$283,580,132	\$21,698,760	\$17,363,692	\$1,927,227	\$3,526,040	\$5,250,436	\$25,788,093	\$615,483,784

Source: Iowa Department of Management, 5/2017

Because of a rollback in property taxes on residential property in Iowa, approximately 45% of residential valuation is taxed. Therefore, approximately \$150,000,000 of valuation of the county is not taxed at the rates discussed previously. Property valuations vary greatly from community to community. Note that the rural areas of the county contain the vast majority of the tax base in the county– principally because of the vast tracts of agricultural land. Property in Mount Ayr comprises most of the non-rural valuation in Ringgold County.

**2.2: Participating Jurisdictions’ Profiles**

This part of the plan provides a summary of each of the participating and principal political jurisdictions and includes information provided from those jurisdictions and partners involved in the planning process. This summary lays out the context and framework for hazard mitigation planning information and ideas applicable to each jurisdiction in the following chapters. Some mitigation issues and alternatives will affect each jurisdiction equally, while others will be unique. The data in this chapter helps the reader understand these similarities and differences.

This plan’s jurisdiction profile includes an overview of the noted jurisdictions and their organizational structure, a description of staff, fiscal and technical resources, and information regarding existing hazard mitigation capabilities such as adopted plan policies and regulations, if any. The descriptions and capabilities assessments are based on available and applicable data, including information provided by the jurisdictions collected during the planning process. Jurisdictions provided available data for infrastructure details, prior planning details, previously completed and/or ongoing mitigation actions, et al. via phone, email, and/or during the public hazard mitigation planning meetings.

All participating jurisdictions assisted in the listing of and description of current mitigation actions and capabilities to implement other actions. All actions listed by jurisdiction in the previous plan, are outlined by jurisdiction in this plan to provide a summary of the status of those actions. Where applicable, those actions not yet completed will be considered for this update in the following chapters.

**Ringgold County Profile**

This section of the plan addresses the following two entities: a) the rural part of the county not included in incorporated areas (cities and towns), and b) county-owned assets located in any jurisdiction.

The County is run and managed by a board of supervisors composed of three elected members and approximately 12 department heads that cover numerous county functions. Several of the department heads, such as Sheriff, Auditor, Treasurer, and Recorder, are elected. Others are appointed as civil servants, including such departments as Engineer/Secondary Roads, Public Health, E911, Assessor, and the Emergency Management Coordinator. The EM Coordinator is the lead on hazard mitigation planning in the county and coordinates with other county officials and the various other jurisdictions, including schools, hospitals, cities, townships, and fire/EMS departments. Many of the departments serve under both the Board of Supervisors and separate elected or appointed commissions or committees. Townships and other rural jurisdictions fall under the participation requirements and planning status of the county for the purposes of this plan.

Additionally, there are several unincorporated towns in the county that fall under the Ringgold County plan. Other jurisdictions that fall into the County section of the plan include County parks (Fife’s Grove Park, Poe Hollow Park, and others).

**Ringgold County Jurisdictional Summary**

The following illustrates the key mitigation-related characteristics of the jurisdiction.

<i>Demographics and Governance</i>	
Total population in 2010 (unincorporated):	2,553
Leadership structure:	3 elected supervisors
Official website:	<a href="http://www.ringgoldcounty.us">www.ringgoldcounty.us</a>
Classification:	County
Official newspaper:	Mount Ayr Record News, Diagonal Progress
GIS mapping capabilities:	Yes, third party

<i>Key Planning and Capabilities</i>			
<u>Emergency operations plan:</u>	Yes	<u>Zoning regulations:</u>	No
<u>Building regulations:</u>	Limited	<u>Subdivision regulations:</u>	No
<u>Master plan:</u>	No	<u>NFIP participation:</u>	Yes
<u>Storm water regulations:</u>	No	<u>Floodplain regulations:</u>	No
<u>Hazard mitigation budget:</u>	Primary funding for EMA	<u>Budget process:</u>	Annual appropriations
<i>Essential Infrastructure and Services</i>			
<u>Major arterials:</u>	Iowa 2, US 169, Iowa 25	<u>Air service:</u>	Mount Ayr Airport, east edge of Mount Ayr
<u>Water service:</u>	mostly SIRWA, some wells, other providers	<u>Sewer service:</u>	Not municipal; individual septic systems
<u>Electric service:</u>	Alliant Energy, SWI REC, others	<u>Gas service:</u>	Limited; individual propane dealers
<u>Sanitation/solid waste:</u>	Local haulers	<u>Landfill:</u>	WRD Landfill, 2 mi east of county line in Decatur Co.
<u>Phone and Internet:</u>	Windstream, Mediacom, local, wireless	<u>Law enforcement:</u>	Ringgold Co. Sheriff
<u>Fire service:</u>	7 city departments (5 stations in county)	<u>Ambulance service:</u>	Ringgold County Hospital, Mount Ayr

### ***Ringgold County Historical Context***

The following paragraphs are excerpts from the county's website, referenced above.

The territory in Ringgold County was technically a part of Des Moines County from 1834 to 1836 under the territorial Governor of Wisconsin. Then the territory of Iowa was organized and, for some years, this region remained undesignated, unsurveyed, and unsettled. In 1847 the boundaries of the county were established and the name of Ringgold given in honor of Major Samuel Ringgold, who was mortally wounded in the Battle of Palo Alto, fought a little more than a year before in the Mexican War. For the next four years Ringgold was included in the temporary county of Taylor. Then it was attached to the newly organized county of Decatur. On April 18, 1855 the town of Mount Ayr was awarded the county seat.

Chas. HY. Schooler and wife were the first settlers in Ringgold County, settling near Ringgold City and for two years they were the only white family in the county. In 1846 Jas. M. Tethrow settled near Mr. Schooler, but for some reason, there appears to have been no farther immigration. These two families believed they were living in Missouri until the disputed territory on the southern boundary was surveyed and was awarded to Iowa in 1850.

The southern part of Ringgold County was involved in the famous dispute between Iowa and Missouri, which began in the autumn of 1839 and was not settled until 1850. This dispute arose in consequence of two surveys, having been made of the boundary line between the two states. The first survey began at the head of the rapids, in the Des Moines River, and the second began at the foot of the Des Moines rapids in the Mississippi River, the difference between the two initial points being about 9 miles. Missouri assumed the northern line as her boundary and Iowa the southern line as hers. A conflict of jurisdiction over a strip of country nearly nine miles in width the entire distance across the state, it being claimed by both states. After Iowa had drawn on the territorial treasurer for \$1500 to defray the expenses of keeping a militia to protect the right of the people and the state, the governor of Iowa agreed with the governor of Missouri, for the commencement and speedy termination of a suit in the Supreme Court of the United States to determine the true location of the boundary line between the two states. The sum of \$1,000 was appropriated to defray the expenses of this suit.

The vexed question was settled in Iowa's favor in 1850, when the boundary was established by commissioners appointed by the Supreme Court, who had the line carefully surveyed. Posts were erected one mile apart, the entire distance between the two states. Every tenth post was to be an iron post 8 feet long, 4 inches square at one end, and 8 inches square at the other, to be set in the ground 3 1/2 feet. At the top end of the post, on one side is the word "Iowa" and on the opposite side, the word "Missouri" and on the other two sides, the word "boundary" cast into the post. The wooden posts between these iron posts have long since rotted out, but they served their purpose until the state line was established. These iron posts can be found in Riley and Clinton Townships.

Over the years, Ringgold County grew from a remotely populated Native American community to a modern agricultural and industrial county with a diverse workforce. While the population has declined from its peak in the early 20<sup>th</sup> Century and some former towns have dis-incorporated, the county still has a vital and strong economy focused on industry and small businesses. None of several railroads that once crossed the county still remain. Major highway development since 1925 have more than replaced the economic impact of the railroads. However, many of the goods and services once provided in Ringgold County are no longer existent because it is fairly easy to travel to Des Moines, Omaha, and Kansas City for those goods and services at a competitive price.

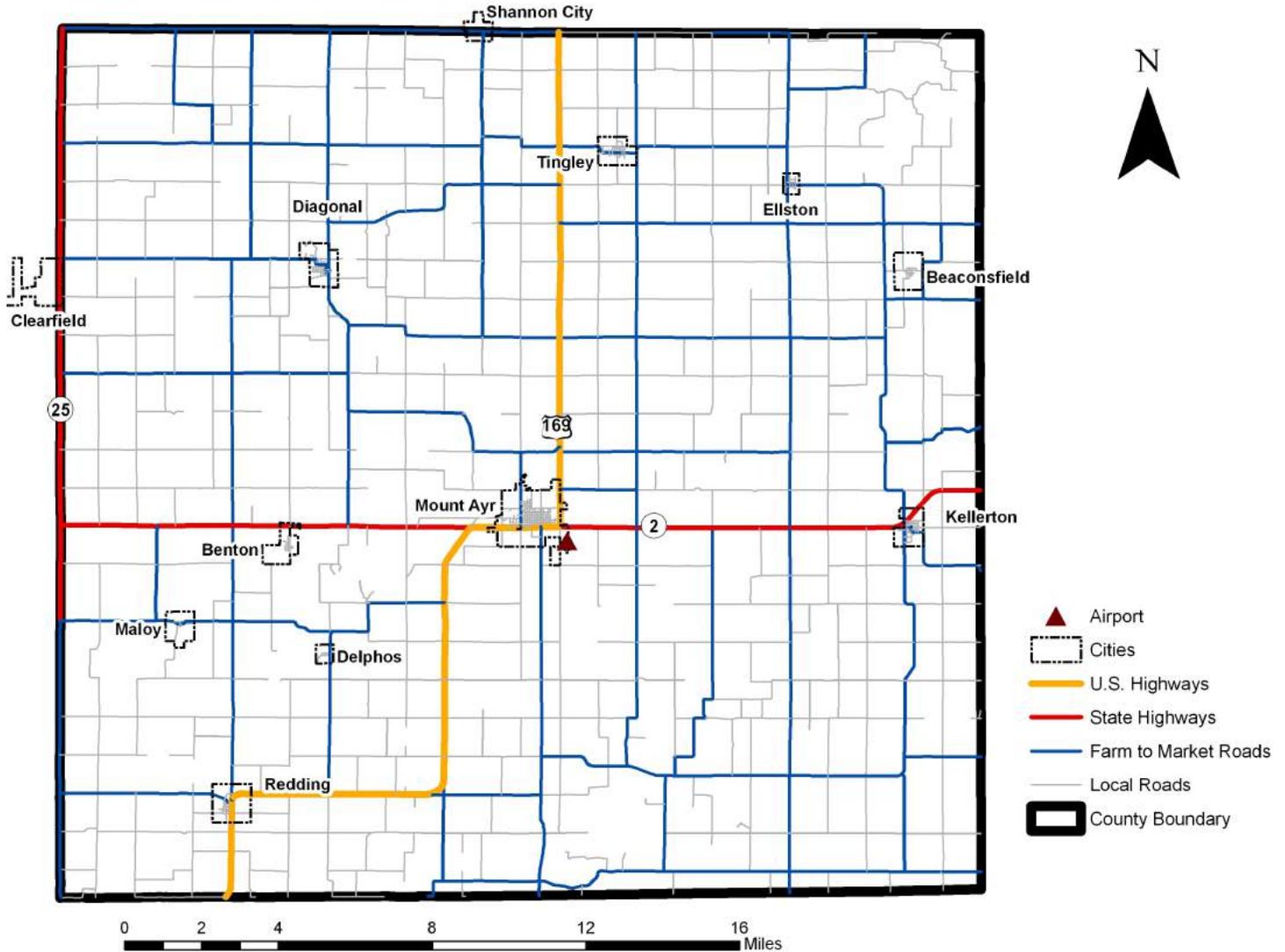
### ***Ringgold County Physical Profile***

Rural Ringgold County is located in the southern part of Iowa and occupies 533 square miles, 99% of the surface being land and 1% water. The vast majority of the county is rural land used for farming and open areas (forests and unused land). Much of the county is also used for rural transportation and recreational facilities. Approximately 1.5% of the

county’s land area is occupied by incorporated cities, of which 50% of the county’s population can be found. Topography is mostly rolling hills with a mean elevation of approximately 1,100 feet. Many streams and several small rivers are found in the county.

The following map shows the general layout of the county along with the incorporated municipalities.

**Figure 2.30: Road Map Ringgold County Planning Area**



***Ringgold County Infrastructure, Services, and Resources***

*Transportation.* Several relatively minor highways cross the county, namely US Highway 169 and Iowa Highway 2, along with several other highways located within and along the edge of the county and a local service airport in Mount Ayr. Numerous paved and unpaved county highways and secondary roads are under the jurisdiction of the Adair County Engineer’s Office/Secondary Roads Department. These roads and over 100 bridges handle various levels of traffic and are of varying surface types. Because of the hundreds of miles of such roads, number of bridges, and the limited funding available to maintain them, many are in substandard condition and cannot be adequately repaired. This makes them susceptible to hazards, especially flooding. The County Engineer was highly involved in the hazard mitigation plan and has submitted extensive data about the road infrastructure.

As of 2016, secondary road miles totaled 896.307, of which 877.248 miles were open and 19.059 miles were closed. A total of 30.333 miles were concrete paved, 54.453 miles were asphalt surfaced, 68.679 miles were bituminous surfaced, 524.605 miles were gravel surfaced, and 199.178 miles were earthen. A total of 288.627 miles of secondary roads are classified as Farm-to-Market roads, including the entire concrete surface, all of the asphalt surface, and three-fourths of the bituminous surface. In addition to secondary roads, the County contains 55.730 miles of primary roads, bringing the county’s total open road system to 932.978 miles. The county-owned road network contains approximately 150 through-route bridges, of which at least 80% bridge waterways. Almost all of the bridges are short

(less than 100' in length) and cross small streams. Many are aging and have weight limits. Most are not designed to withstand major flooding. The cost of maintaining these roads and bridges, along with implementing mitigation actions, is very high and a large part of the County's budget is used for road infrastructure.

Ringgold County in 2015 completed a five-year Secondary Roads Construction Program. This plan outlines an estimated \$9.4 million in road upgrades over the next five years. The County is halfway through this plan. The plan replaces three bridges and four culverts and replaces surfacing on 21.5 miles of roadways. While these projects are expensive, they address only a small part of the county roadway improvement need.

*Utilities.* Ringgold County is typical of rural counties in Iowa with relatively low population densities. Utilities development has been slow and behind the pace of urban areas, due to the cost per user. Despite this, and largely due to subsidies and loans, the development of electric and water utilities is complete. Rural sewer, broadband, and other communications infrastructure developments are spotty. Utilities like natural gas are virtually non-existent in the rural part of the county; most people purchase propane for heating, which is stored in aboveground tanks. Other infrastructure and utility services are provided generally to the local needs within the capabilities available. Utility limitations and the vast distances in which utilities must span to serve the needs of rural residents and businesses make them especially vulnerable to hazards in rural areas compared to areas within municipalities.

The WRD Landfill is located two miles east of the Ringgold-Decatur County line in Decatur County.

*Key Services.* Various county agencies and departments, in addition to the EMA, perform hazard mitigation functions incidental to their daily assignments and responsibilities. A few should be called out in this section.

The Adair County Sheriff's Office, with the assistance of the Iowa Highway Patrol and county/state conservation law enforcement, serve the needs of the rural area of the county and – under contract - the other jurisdictions. The Sheriff's Office is not trained in terrorism response and WMD crimes. Search and rescue capabilities are available to the County through other agencies. The Law Center and communications system are located in a new building in Mount Ayr.

The County is in charge of the first-response communications throughout the planning area, as coordinated through the Law Enforcement Center in Mount Ayr. The County has an emergency communications plan. It also has an emergency operations center (EOC). Cellular and broadband Internet coverage is rated as "good" by local communications personnel. Communications within some departments, such as the Secondary Roads Department, are separate but integrated with the law enforcement dispatch.

Other relevant county government services include environmental health, public health, County records maintenance (including land and property tax records), and contracting with a third party to operate the GIS mapping system. These services aid in mitigation by providing information and assistance in preparation, response, recovery, and mitigation activities.

Non-governmental and other jurisdictional organizations provide services to rural residents, businesses, and property owners. Seven fire departments (five from the various towns in the county) serve the rural part of the county. The hospital and some of the fire departments perform EMS and Ambulance transport services. The County is not responsible for fire and EMS services; rather, it partners with these organizations through Iowa intergovernmental 28-E agreements. Many, but by no means all, roads and bridges can accommodate fire trucks and rescue vehicles. All departments have small off-road grass and wildland fire vehicles. Dry hydrants are available throughout the rural part of the county provide extra water for firefighting, but these are miles apart and rely upon surface water bodies (such as small ponds) to supply the water.

The rural part of the county is served by numerous school districts, churches, civic groups, volunteer organizations, and key businesses. However, many rural residents and property owners must go to area towns to access community shelters, government services, lodging, banks, grocers, and medical care.

*Existing Mitigation Resources.* Few mitigation resources are physically located in rural areas. For example, there are no warning sirens in rural development and recreational areas. Those in these areas would have to rely upon the weather radio, phone alerts, and wireless Internet to be alerted to hazard event warnings. Some assets have fixed backup generators to provide emergency power. Some organizations have portable standby generators, such as fire departments, SIRWA, and the Secondary Roads Department. No facilities in the rural area are designated as tornado safe rooms capable of withstanding 250 MPH winds. No facilities in the rural area are designated as community shelters or feeding centers, although several buildings exist in rural areas that could be used for this purpose with some investment and planning.

*Budget and Financial Resources.* Ringgold County has taxation authority but must rely on outside funding for many of the programs and projects that are necessary for the safety of the public and mitigation of hazards. The fiscal year 2017 100% valuations for rural Ringgold County were \$525 million total (compared to \$615 million countywide). Of the rural property, approximately \$195 million is residential, \$280 million is agriculture land, \$21 million is agricultural buildings, \$4 million is commercial, \$0.4 million is industrial, \$4.9 million is private utilities, and \$19 million gas/electric utilities.

Ringgold County levied a tax rate of \$12.00594 for regular rural property; the extended tax rate was much greater and varied greatly based on the various taxing jurisdictions (schools, township, etc.) involved. Specifically, the General Basic rate was \$4.00, General Supplemental was \$3.23546, Rural Basic was \$3.95, county services was \$0.80037, and debt service was \$0. The total property tax generated was \$3,288,753. The FY 2018 budget for the County included \$9.29 million in revenues from all sources, including operating transfers in. There was a \$3.2 million in the beginning of the year balance. Total expenditures were \$9.35 million, including debt service and operating transfers out. The total ending fund balance is budgeted at \$3.15 million. A very small portion of the operating budget, an unspecified amount, is designated for mitigation activities.

### ***Ringgold County NFIP Participation***

Ringgold County recently received final flood maps and has since adopted them with an effective date of June 16, 2015. The County joined the NFIP on March 3, 2016, according to the FEMA Community Status Book. The FIRM maps exist and are attached in Appendix D. As a non-delegated jurisdiction, the Iowa DNR accepts, reviews, and approves or denies all flood plain permits when development is proposed in SFHAs.

### ***Complete, Underway, and Ongoing Mitigation Actions***

Numerous mitigation actions have been implemented or are now ongoing since the most recent plan update was adopted. The following table lists and describes actions listed in the previous plan for this jurisdiction.

**Figure 2.31: Status of Ringgold County Hazard Mitigation Actions Listed in the Previous Plan**

<b>Action</b>	<b>Status</b>	<b>Notes and Results</b>
Backup files and records – store digitally and in alternate locations	Complete	File system in place using modern technology, with some hard copy information held off-site.
Business and residential preparedness programs	Not started	No formal program in place locally – some expertise is provided by third parties.
Community drills	Ongoing	In place with proper staff and volunteers involved
Construct public safe rooms in or near existing and future critical assets	Not started	None existing outside of Mount Ayr.
Construct storm water drainage (underground, culverts, curb & gutter, etc.)	Underway	Rural storm water projects occurring as funding allows (culverts, etc.).
Develop/implement an extreme heat event medical response plan	Complete	As part of the county's EMS and public health planning process now in place.
Develop/implement a thorough recovery plan for power failure	Complete	County has no authority; energy suppliers now plan for such events.
Discourage/prohibit development in flood plain areas, join or continue participation in the NFIP	Complete	County is now active in NFIP and has flood plain ordinance.
Emergency generators available at key critical assets	Not started	Not in place for rural and county-owned infrastructure.
Erosion control projects	Underway	Projects proceed as funding is available.
Expand law enforcement capabilities	Not started	Funding is needed to add staff.
Formulate partnerships to gain legislation – be active in ISAC or similar organization(s)	Complete	County is member of applicable organizations.
Establish neighbor watch programs for vulnerable populations	Underway	Program is established on very informal level.
Evacuation plans in place	Complete	Plan in place.
Harden public buildings	Not started	Requires extensive funding
HAZMAT waste collection services	Complete	System in place
Implement a bomb squad program/team	Not started	Inadequate local expertise and resources
Improve transportation infrastructure	Underway	Annual projects, but need far strips funding
Improve emergency response structures and properties (i.e., fire and police stations)	Complete	New law center built five years ago.
Increase awareness of household hazardous materials	Complete	Educational effort provided by the landfill commission.
Install hazard signs in area campgrounds, parks, and open spaces.	Complete	Adequately addressed for the hazards specific to the site.
Integrate tornado safe rooms into critical assets/facilities	Not started	
Investigate alternative water sources for fire suppression	Not started	Will require multi-jurisdictional partnerships.

<b>Action</b>	<b>Status</b>	<b>Notes and Results</b>
Investigate and implement alternative energy sources	Not started	Will require multi-jurisdictional partnerships.
Locally managed/used GIS mapping system with hazard data included in the mapping system	Underway	Working on limited GIS system now, but county does not maintain system in-house.
Maintain ordinances related to hazard mitigation – flooding, wildfire control, etc.	Underway	Flood hazard ordinance in place; other issues not addressed.
Maintain watersheds; Develop/implement watershed studies and plans	Underway	Some sections of the county are involved.
Develop/implement watershed studies and plans		
NOAA Weather Radio program is in place that includes incentives for people to purchase	Not started	Cost is an issue, as well as evolving communications methods.
Participation on the NFIP (flood insurance program)	Complete	County is participating.
Planning for HAZMAT spills	Complete	LEPC planning in place.
Promote the construction of private in-home tornado safe rooms	Not started	
Public education about hazards	Ongoing	Modest efforts in place and continuing over time.
Purchase/install backup fixed power generators and water pumps	Not started	
Purchase standby portable pumps and generators	Complete	County and groups like SIRWA have equipment that can be used.
Purchase new fire trucks/ambulances	Not started	Not a county function. Cost is an issue for third parties to upgrade equipment.
Purchase needed emergency response equipment	Underway	Items purchased as funding is available.
Purchase road closure barricades	Complete	County has adequate supplies.
Purchase snow trucks, plows, and sanders	Complete	County has adequate supplies.
Raise grade to eliminate backup flooding	Not started	
Remove unused chemical containers	Not started	A private property function.
Repair structurally weak homes, implement weatherization programs	Ongoing	Modest efforts have been occurring but are underfunded.
Replace bridges and culverts	Ongoing	Annual projects, but need far strips funding
Ringgold County Water Emergency Team	Complete	Team is in place, well trained, and available for service.
Sustain already existing search and rescue teams	Ongoing	Funding provided as available.
Tornado safe room constructed in your jurisdiction	Not started	
Train first responders, EMTs, firefighters, and emergency disaster responders	Ongoing	Training is provided continually with many certified individuals.
Training for emergency personnel	Ongoing	Training is provided continually with many certified individuals.
Warning sirens located and used in jurisdiction	Underway	Limited use in rural areas, which exception of the main camping area at Fogle Lake.
Weapons of mass destruction and terrorism training	Ongoing	Sponsored by the State.
Work with the IDNR to reduce excess wildlife numbers	Not stated	IDNR activity with no legal county role.

The other mitigation actions listed in the previous mitigation plan for the rural properties and populations of the county were not implemented or initiated during the past five years.

### ***Outlook and Future Development***

The population of the rural part of the county is likely to continue a slow decline, as has been the case in recent years, with some growth likely in the northeastern part of the county (in the area of Sun Valley Lake). Most rural development will be residential and agricultural, but some may be commercial, government, institutional, and recreational. Conversion of farmland on a very modest scale is likely, but development is not likely in SFHAs and areas locally known to experience flash flooding. There is no zoning regulation in the county, but the County has adopted a flood plain management ordinance using the State's template. If in the future a comprehensive plan and zoning is prepared and adopted, hazard mitigation principals will be used within the planning process and document.

### ***City of Benton Profile***

This section of the plan addresses the City of Benton itself and all assets in the city boundary. Benton, home to 41 people, is located approximately 8 miles west of Mount Ayr just south of Highway 2 in Benton and Rice Townships. The small community is mostly residential and agricultural in nature, although a few small businesses operate in the community. The city is managed by a city council of 3 elected members and an elected mayor. A part-time city clerk administers the city. Most maintenance and other work, such as mowing, is contracted because the city is too small to support daily labor.

### ***Benton Jurisdictional Summary***

The following illustrates the key mitigation-related characteristics of the jurisdiction.

<u>Total population in 2010:</u>	41	<u>Classification:</u>	City (municipality)
<u>Leadership structure:</u>	3 elected council members, 1 mayor	<u>Official newspaper:</u>	Mount Ayr Record News
<u>Official website:</u>	none	<u>GIS mapping capabilities:</u>	Yes, third party
<i>Key Planning and Capabilities</i>			
<u>Emergency operations plan:</u>	Yes	<u>Zoning regulations:</u>	No
<u>Building regulations:</u>	No	<u>Subdivision regulations:</u>	No
<u>Master plan:</u>	No	<u>NFIP participation:</u>	Yes
<u>Storm water regulations:</u>	No	<u>Floodplain regulations:</u>	Yes
<u>Hazard mitigation budget:</u>	Very minimal and as needed	<u>Budget process:</u>	Annual appropriations
<i>Essential Infrastructure and Services</i>			
<u>Major arterials:</u>	Iowa 2	<u>Air service:</u>	Mount Ayr Airport, east edge of Mount Ayr
<u>Water service:</u>	SIRWA, some wells	<u>Sewer service:</u>	SIRWA, 4 cities collection and treatment
<u>Electric service:</u>	Alliant Energy, SWI REC	<u>Gas service:</u>	Individual propane dealers
<u>Sanitation/solid waste:</u>	Local haulers	<u>Landfill:</u>	WRD Landfill, 2 mi east of county line in Decatur Co.
<u>Phone and Internet:</u>	Windstream, wireless	<u>Law enforcement:</u>	Ringgold Co. Sheriff
<u>Fire service:</u>	Mount Ayr Fire Dept; mutual aid partners	<u>Ambulance service:</u>	Ringgold County Hospital, Mount Ayr

***Benton Historical Context***

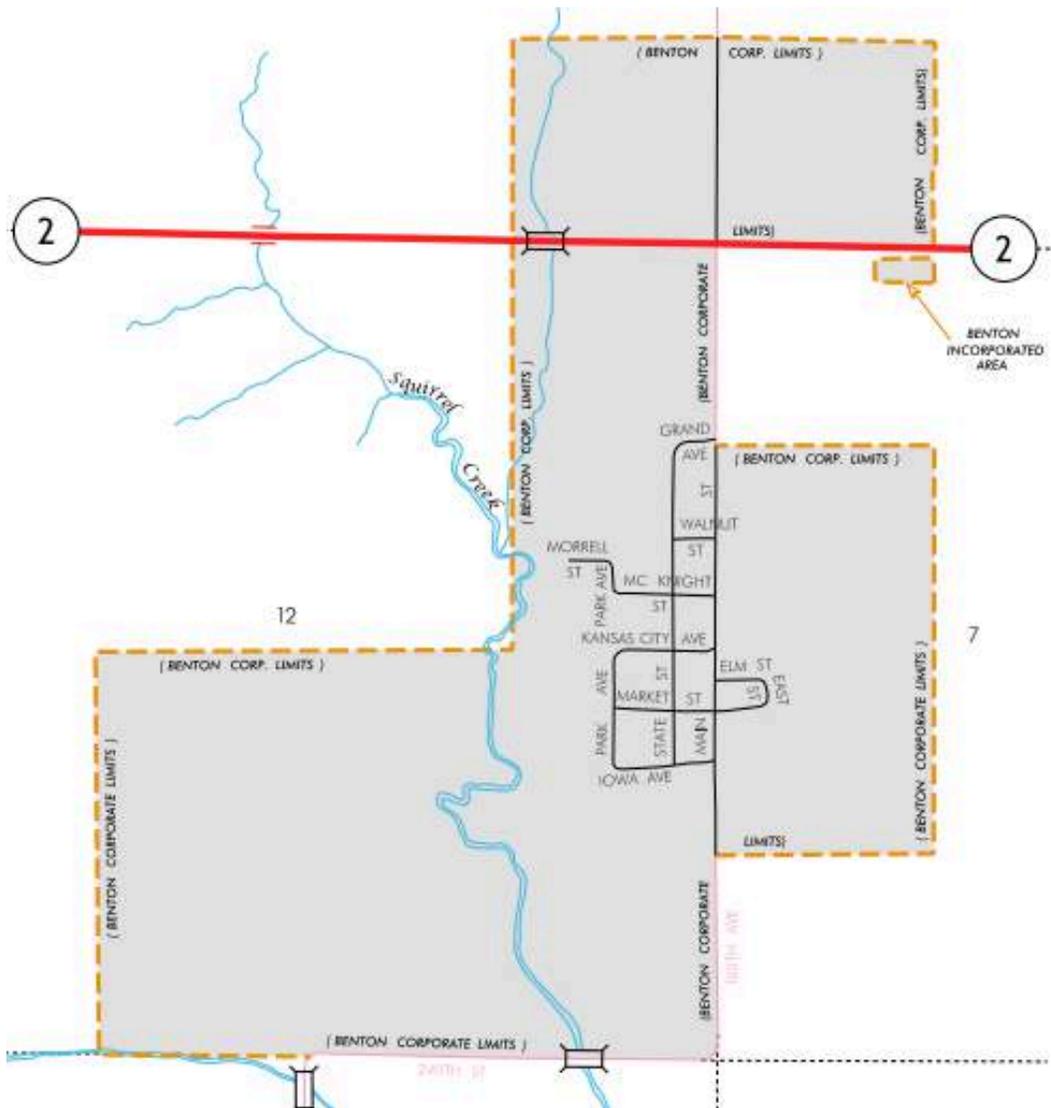
Benton was created with the Chicago Great Western Railroad ran through the western portion of Ringgold County in 1885 with a rail station in the area where the community resides. Before the depot, Benton was known as the post office Bloomington. There were no villages or towns nearby, which allowed Benton to benefit financially, and the town had included the community having three business streets. During its early history, the city was home to four churches.

***Benton Physical Profile***

Located in rolling hills with a river valley to the southeast, Benton occupies approximately 0.64 miles reaching from Highway 2 in the north to agricultural areas in the south. Forty-one residents live in approximately 15 occupied homes, surrounded by agricultural area and some timberland.

The following map shows the general layout of Benton.

**Figure 2.32: City of Benton Base Map**



Source: Iowa Department of Transportation, Office of Systems Planning, 8/2018

### ***Benton Infrastructure, Services, and Resources***

**Transportation.** Approximately 2.2 miles of mostly gravel roads are found in the city, which comprises a grid pattern. Hard-surface 160<sup>th</sup> Avenue (Main Street) connects the town with Highway 2. There are no railroads or air service within the city. Transit is available on demand from Southern Iowa Trolley based in Creston.

**Utilities.** Drinking water and sewer treatment are provided by SIRWA and meet State and Federal regulations. Water mains are designed for drinking needs but not for fire protection and industrial capacity. The production and treatment facilities are located miles outside of Benton. City leaders characterize the local water supply and quality as adequate with no concern over a shortage of water or need for major projects in the next five years. A few years ago, SIRWA built the four-cities sewer system that provides effective collection and treatment of sewage in each city and treatment in a lagoon system between the towns of Benton, Delphos, Redding, and Maloy. Alliant Energy provides electricity to homes and businesses from production outside of Ringgold County. There is no public natural gas or other heating system in town. People use individual systems, with liquid propane stored in backyard tanks as the primary source. Others use wood, corn, or other fuels. Other utilities, such as telecom infrastructure, are functional but inconsistent, as expected in low-density areas. Benton lacks a formal or complete storm water management system, but leadership is trying to address the storm water system by improving ditches and pipes in order to solve recurring storm damage. Some of these repairs have been funded in part by FEMA Public Assistance funds in the past five to ten years. To date, there are no maps or agreements with third parties to address storm water issues.

**Key Services.** Emergency services (fire, police, EMS) are provided outside of Benton, namely from Mount Ayr. Response comes along Highway 2 from the Ringgold County Law Enforcement Center, Mount Ayr Fire Station, and Ringgold County Hospital respectively. These services all collaborate through Mutual Aid Compacts and a central E911 dispatch via the Sheriff's Office and E-911 board. The public has high respect for these services, although

continued budget shortages and reliance on volunteers reduces their level of training, equipment, and effectiveness. Benton is within the Mount Ayr School District, which provides bussing in the community. All district schools are in Mount Ayr.

*Existing Mitigation Resources.* The community has a community center that also houses the city hall. It is a small building that is insufficient as a storm shelter or emergency shelter. There are no warning sirens, backup generators, community weather radios (except the local Waubonsie Building), or FEMA tornado safe rooms in the city or immediate surrounding area. The local leadership reports that communications and telecom infrastructure and facilities are modest and services can be improved. The City does not participate in regular drills or maintain its own road clearing and maintenance equipment.

*Budget and Financial Resources.* As outlined in the previous section, there are few financial resources available for hazard mitigation. In the past five years, the City has invested some of its limited resources to improve roads, ditches, and culverts, in part with matching FEMA Public Assistance funds. The City has worked with FEMA to secure the maximum amount of funds for storm water improvements and has talked with SICOG about possible grants for storm water mitigation projects. To date the mitigation projects have not come to fruition.

#### ***Benton NFIP Participation***

Ringgold County recently received final flood maps and has since adopted them with an effective date of June 16, 2015. The City of Benton joined the NFIP on June 16, 2015, according to the FEMA Community Status Book. The FIRM map is attached in Appendix D, showing the city contains land within Zone A (the SFHA). As a non-delegated jurisdiction, the Iowa DNR accepts, reviews, and approves or denies all flood plain permits when development is proposed in SFHAs.

#### ***Complete, Underway, and Ongoing Mitigation Actions***

Numerous mitigation actions have been implemented or are now ongoing since the most recent plan update was adopted. The following table lists and describes actions listed in the previous plan for this jurisdiction.

**Figure 2.33: Status of Benton’s Hazard Mitigation Actions Listed in the Previous Plan**

<b>Action</b>	<b>Status</b>	<b>Notes and Results</b>
Construct a tornado safe room in or near critical assets	Not started	Very expensive project; few resources
Construct public safe rooms in or near existing and future community assets and parks	Not started	Very expensive project; few resources
Develop an electronic directory of local and regional mitigation resources	Not started	Not really an identified issue for this single jurisdiction – maybe a county project.
Encourage citizen purchase and use of smoke detectors	Not started	Some have installed in homes – no local fire department to lead effort
Enforce burning restrictions	Ongoing	As needed at county level
Establish backup communications center or facility	Not started	No real need for such a small jurisdiction
Establish alert system for vulnerable populations	In place	Informal activities are ongoing – no formal identified vulnerable populations – seniors are watched over by neighbors
Expand law enforcement capabilities	Not started	Countywide activity
Formally designate and stock community post disaster shelters	Not started	Nothing suitable for designation at this time
HAZMAT waste collection services	Complete	Available from third-parties for users in the jurisdiction
Install a warning siren system	Not started	City has interest but limited funds
Install computers and/or GPS units in emergency vehicles	Not started	Not applicable – no emergency vehicles
Implement a NOAA Weather Radio purchase incentive program	Not started	Some people own them but no incentive available locally
Improve transportation infrastructure, such as roads, bridges, and culverts	Started, ongoing	Need continues but funds are limited
Integrate tornado safe rooms retrofits into critical assets and facilities	Not started	Very expensive project; few resources
Investigate and implement alternative energy sources	Not started	Very expensive project; few resources
Make all public facilities handicap accessible	Complete	City building was improved a few years ago
Maintain ordinances related to hazard mitigation issues	Not started	
Planning for HAZMAT spills	Ongoing	County-wide LEPC
Promote tree and vegetation maintenance on private properties	Ongoing	Alliant Energy provides this service to customers.
Public educational campaign about hazards and risks	Not started	Informal countywide and regional efforts
Purchase standby portable pumps and generators	Not started	
Purchase and install backup fixed emergency generators and pumps at critical assets	Not started	Expensive project; few resources
Purchase needed emergency response and firefighting equipment	Not started	Some have installed in homes – no local fire

Action	Status	Notes and Results
and services		department
Repair structurally weak homes/weatherization	Not started	Third party organizations offer regionally
Ringgold County water body task force	In place	Fire department is active on county/regional team
Training for emergency personnel	In place	No local emergency personnel located within Benton
Tree planting programs on public property and public ROWs	Not started	There is no resources to manage and maintain public tree and shrub projects
Update the sewer system	Complete	SIRWA installed within last five years

The above list is not exhaustive as to all possible mitigation actions that could be or that were implemented but is inclusive of all those listed for new or carryover projects in the last update.

### ***Outlook and Future Development***

Benton is likely to remain stable with very little growth and population change. The town remains active and is unlikely to dis-incorporate. Development trends are unlikely to impact the future hazard risks in ways unanticipated in this plan, as outlined in Chapter 3. The town does not utilize zoning or other land use regulations.

### ***City of Diagonal Profile***

This section of the plan addresses the City of Diagonal itself and all assets in the city boundary. Diagonal, home to 330 people, is located approximately 10 miles northwest of Mount Ayr, 7 miles north of Highway 2 on County Highway P33 at the junction of J23. The small community is mostly residential in nature, although several small businesses, a few manufacturers, small farms, and a school operate in the community. The city is managed by a city council of 5 elected members and an elected mayor. A part-time city clerk administers the city. The City also employs seasonal and full-time maintenance staff to maintain and operate City property and utilities.

### ***Diagonal Jurisdictional Summary***

The following illustrates the key mitigation-related characteristics of the jurisdiction.

<i>Demographics and Governance</i>			
<u>Total population in 2010 (unincorporated):</u>	330	<u>Classification:</u>	City (municipality)
<u>Leadership structure:</u>	5 elected council members; 1 mayor	<u>Official newspaper:</u>	Diagonal Progress
<u>Official website:</u>	none	<u>GIS mapping capabilities:</u>	Yes, third party
<i>Key Planning and Capabilities</i>			
<u>Emergency operations plan:</u>	Yes	<u>Zoning regulations:</u>	No
<u>Building regulations:</u>	Limited	<u>Subdivision regulations:</u>	No
<u>Master plan:</u>	No	<u>NFIP participation:</u>	No, Sanctioned
<u>Storm water regulations:</u>	No	<u>Floodplain regulations:</u>	No
<u>Hazard mitigation budget:</u>	Very minimal and as needed	<u>Budget process:</u>	Annual appropriations
<i>Essential Infrastructure and Services</i>			
<u>Major arterials:</u>	County J23 and P33	<u>Air service:</u>	Mount Ayr Airport, Creston Airport
<u>Water service:</u>	SIRWA from regional surface supplies	<u>Sewer service:</u>	Municipal central sewer system
<u>Electric service:</u>	Alliant Energy, SWI REC, others	<u>Gas service:</u>	Limited; individual propane dealers
<u>Sanitation/solid waste:</u>	Local haulers	<u>Landfill:</u>	WRD Landfill, 2 mi east of county line in Decatur Co.
<u>Phone and Internet:</u>	Windstream, wireless	<u>Law enforcement:</u>	Ringgold Co. Sheriff
<u>Fire service:</u>	Diagonal Fire Department	<u>Ambulance service:</u>	Ringgold County Hospital, Mount Ayr

### ***Diagonal Historical Context***

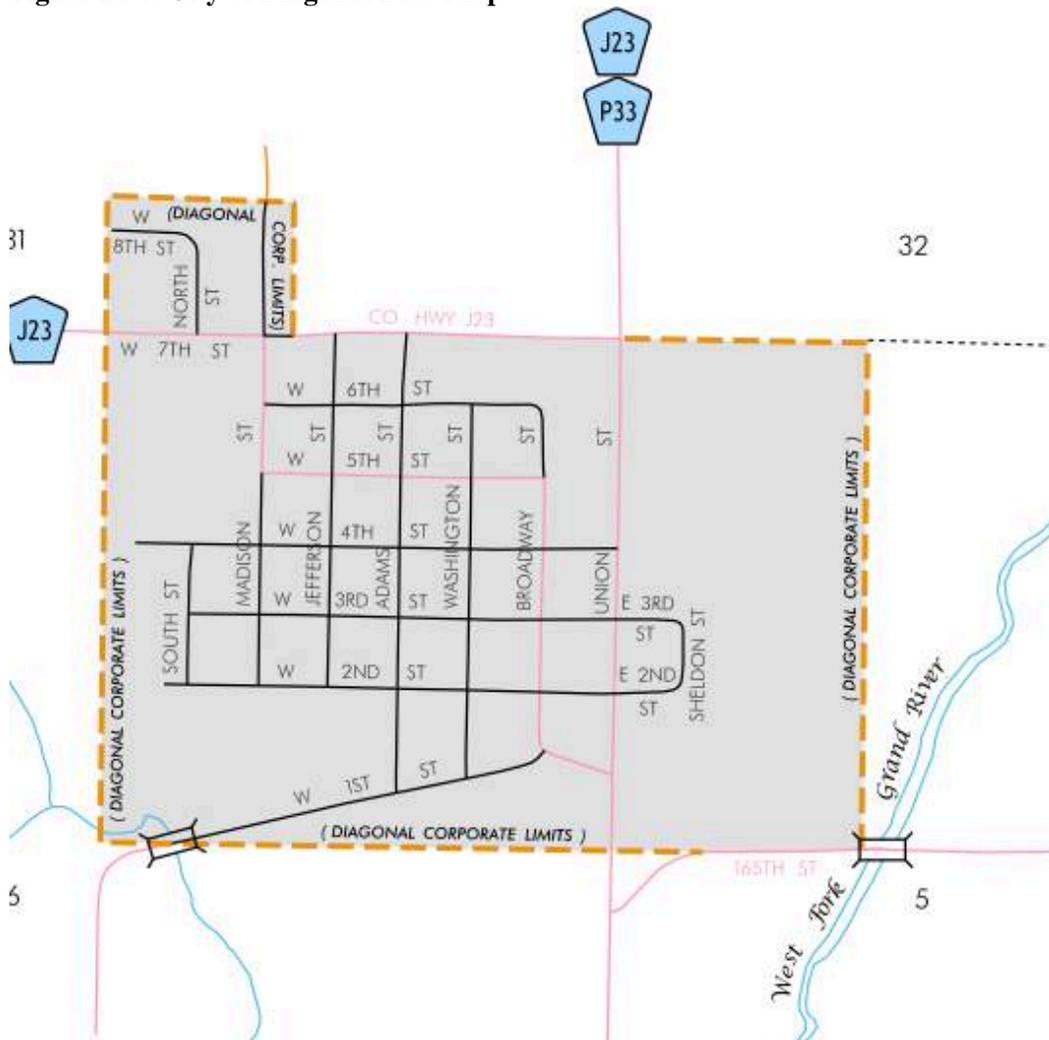
Diagonal was founded at the point between Goshen and Knowlton where two railroads crossed and was officially incorporated in 1888. Originally, the town was called Hak-a-dady but by 1889 was re-named Diagonal. A major fire swept through the business district in February of 1899. The town post office was built after the fire that same year, but was eventually moved to a different building in 1903. Diagonal reached its population and economic peak in the early part of the last century with stable to slow declining populations in the past one hundred years and a downtown that is converting to a significant industrial and commercial core.

### ***Diagonal Physical Profile***

Located in the northwest part of the county in Washington and Jefferson Townships with access to the community available (primarily) through County Roads J23 and P33, Diagonal has a population of 330. Two railroads once ran through and connected in the southeast part of the community, but have been abandoned since 1970. The town occupies 0.90 square miles, most of which is residential area, surrounded by agricultural land along the fringes of the city.

The following map shows the general layout of Diagonal.

**Figure 2.34: City of Diagonal Base Map**



Source: Iowa Department of Transportation, Office of Systems Planning, 8/2018

### ***Diagonal Infrastructure, Services, and Resources***

**Transportation.** Approximately 8.4 miles of mostly sealcoat and blacktop roads are found in the city, occupying a mostly grid pattern. The county routes through the city are paved and suitable as truck routes. Broadway Street is the main street through the downtown area. There are no railroads or air service within the city. Transit is available on demand from Southern Iowa Trolley based in Creston.

**Utilities.** Drinking water treatment is provided by SIRWA and meets State and Federal regulations. Water mains are designed for drinking needs and have some but limited fire protection and industrial capacity. Local leaders identify a concern that water supplies will be short, but the water quality was deemed good. No major water projects are planned. The City of Diagonal operates a municipal central sewer collection and treatment system, which also meets State and Federal regulations. The local officials deem the wastewater collection system is in good condition with no major projects planned. The City prohibits storm water connections to the sewer system. The production and treatment facilities for both utilities are located miles outside of Diagonal, the sewer lagoons being just southwest of town. Alliant Energy provides electricity to homes and businesses from production outside of Ringgold County. A small power substation is found on East 7<sup>th</sup> Street. There is no public natural gas or other heating system in town. People use individual systems, with liquid propane stored in backyard tanks as the primary source. Others use wood, corn, or other fuels. Other utilities, such as telecom infrastructure, are functional but inconsistent, as expected in low-density areas. Cellular coverage is acceptable but not strong. Broadband coverage is viewed as good. Diagonal lacks a formal or complete storm water management system but local officials deem the condition of the available

infrastructure as good. Most of the town is served by maintained ditches with some areas of curb and gutter, but there is no official system map. No major storm water projects are currently planned.

*Key Services.* Emergency services (fire, police, EMS) are provided outside of Diagonal, namely from Mount Ayr, except the Diagonal Fire Department, which operates from a station near the downtown. Diagonal Fire also provides rescue and EMS service, but not transport. Response by other services comes from Highway 2/P33 from the Ringgold County Law Enforcement Center and Ringgold County Hospital respectively. These services all collaborate through Mutual Aid Compacts and a central E911 dispatch via the Sheriff’s Office and E-911 board. The public has high respect for these services, although continued budget shortages and reliance on volunteers reduces their level of training, equipment, and effectiveness. Diagonal is within the Diagonal School District, which has its entire campus in the western part of Diagonal. Bussing is provided where needed, although most residents in town live within walking distance of the school.

*Existing Mitigation Resources.* The community has a community center that also houses the city hall. The community building, along with the Diagonal School and a few churches, provides emergency shelter for the public along with limited facilities for lodging and food preparation. The city’s warning siren is centrally located and functional but cannot be triggered within the city’s capabilities. The community houses no backup generators or FEMA tornado safe rooms in the city or immediate surrounding area. The City’s maintenance department maintains a portable generator that can provide a modest supply of backup power in emergencies.

City buildings including the community building, bathhouse at Fogle Lake (just northwest of town), restroom at the city park, and fire station. The community building is recognized as a public emergency shelter and has a weather radio. Buildings are recognized to be in good to excellent condition. No public buildings are sprinkled or contain a fixed power generator.

Diagonal maintains storage for road clearing equipment, traffic control equipment, and sand and salt supplies.

*Budget and Financial Resources.* As outlined in the previous section, there are few financial resources available for hazard mitigation. In the past five years, the City has invested some of its limited resources to improve roads, ditches, and culverts, in part with matching FEMA Public Assistance funds. The City has worked with FEMA to secure the maximum amount of funds for storm water improvements. The City’s limited financial resources are abundant compared to some of the very small towns in Ringgold County but still remain too limited, when combined with statutory debt limits and existing debt, to take on large mitigation projects.

**Diagonal NFIP Participation**

Ringgold County recently received final flood maps and has since adopted them with an effective date of June 16, 2015. The FIRM map is attached in Appendix D, showing the city contains land within Zone A (the SFHA). As of June 2017, Diagonal has not joined the NFIP. Most of the land in the SFHA is undeveloped farmland and there is little documented interest among property owners in purchasing flood insurance at the time this plan update was started.

**Complete, Underway, and Ongoing Mitigation Actions**

Numerous mitigation actions have been implemented or are now ongoing since the most recent plan update was adopted. The following table lists and describes actions listed in the previous plan for this jurisdiction.

**Figure 2.35: Status of Diagonal’s Hazard Mitigation Actions Listed in the Previous Plan**

Action	Status	Notes and Results
Establish neighbor watch programs for vulnerable populations hazard event	In place	Informal programs
Promote NOAA weather radio - citizen purchase (rebate incentive)	Not started	
Establish partnerships with other jurisdictions to control storm water	Not started	
Enforce burning restrictions	Ongoing	As needed at county/city levels
Install siren warning systems	Varies	Modern siren in place and functional in town but needed just outside of town at City-owned Fogle Lake campground.
Establish backup communications center or facilities	Not started	
Install computers and/or GPS in emergency vehicles	Complete	Equipment in place and in use as needed
Purchase/install backup fixed power generators and pumps	Not started	
Formally designate and stock community post disaster shelters	Complete	School and community center serve this purpose, and churches available informally.
Make all public facilities handicap accessible	Complete	Community building is accessible.
Repair structurally weak homes/weatherization	Not started	
Encourage citizen purchase/use of smoke detectors	Ongoing	Process underway by fire department, can be expanded with more funding.
Improve transportation infrastructure (resurface, pave, widen, increase	Ongoing	As funding allows; completed \$220,000

Action	Status	Notes and Results
bridge capacity, etc.)		road project this year.
Community drills	Ongoing	Annual drills in place; Diagonal participates in some of them.
Expand law enforcement capabilities	Not started	Countywide activity
Install and/or update anti-virus software	In place	City computers are maintained.
Purchase stand-by portable pumps and generators	Not started	
Develop local debris disposal sites	In place	Available and designated.
Purchase needed emergency response equipment (SCBA - self contained breathing apparatus, thermal imaging system, vehicle extrication equipment, etc.	Ongoing	Equipment updated as funds allow.
Investigate and implement alternative energy sources	Not started	Very expensive project; few resources
Work with DNR to reduce excess wildlife numbers	Not started	IDNR activity with no legal county role.
Tree planting programs on public property and ROW	Not started	
Clear and deepen ditches on right-of-ways	Not started	
Promote the construction of private in-home tornado safe rooms	Not started	
Integrate tornado safe room retrofits into critical assets/facilities	Not started	
Construct public safe rooms in or near existing and future community assets and parks	Not started	

The above list is not exhaustive as to all possible mitigation actions that could be or that were implemented but is inclusive of all those listed for new or carryover projects in the last update.

**Outlook and Future Development**

Diagonal is not likely to change much in population and development, but growth is certainly possible. Several growing businesses and industries are located in the area, and the location halfway between Creston and Mount Ayr means that the town can be a “bedroom community” for these towns. Several homes have been built in the past ten years. The most crucial issue that will determine the town’s future will be the fate of the local school. Being one of the smallest districts in Iowa, Diagonal School is always concerned about potential consolidation, and its closure would be a significant detriment to the local community and its economy.

**City of Ellston Profile**

This section of the plan addresses the City of Ellston itself and all assets in the city boundary. Ellston, home to 43 people, is located in the northeast corner of the county in Union Township with community access primarily given by County Roads P64 and J20. The city is managed by a city council of 5 elected members and an elected mayor. A part-time city clerk administers the city. Most maintenance and other work, such as mowing, is contracted because the city is too small to support daily labor.

**Ellston Jurisdictional Summary**

The following illustrates the key mitigation-related characteristics of the jurisdiction.

<i>Demographics and Governance</i>			
<u>Total population in 2010:</u>	43	<u>Classification:</u>	City (municipality)
<u>Leadership structure:</u>	5 elected council members, 1 mayor	<u>Official newspaper:</u>	Mount Ayr Record News
<u>Official website:</u>	none	<u>GIS mapping capabilities:</u>	Yes, third party
<i>Key Planning and Capabilities</i>			
<u>Emergency operations plan:</u>	Yes	<u>Zoning regulations:</u>	No
<u>Building regulations:</u>	No	<u>Subdivision regulations:</u>	No
<u>Master plan:</u>	No	<u>NFIP participation:</u>	Yes
<u>Storm water regulations:</u>	No	<u>Floodplain regulations:</u>	Yes
<u>Hazard mitigation budget:</u>	Very minimal and as needed	<u>Budget process:</u>	Annual appropriations
<i>Essential Infrastructure and Services</i>			
<u>Major arterials:</u>	P64 and J20	<u>Air service:</u>	Mount Ayr Airport, east edge of Mount Ayr
<u>Water service:</u>	SIRWA, some wells	<u>Sewer service:</u>	Individual on-site private septic systems
<u>Electric service:</u>	Alliant Energy, SWI REC	<u>Gas service:</u>	Individual propane dealers
<u>Sanitation/solid waste:</u>	Local haulers	<u>Landfill:</u>	WRD Landfill, 2 mi east of county line in Decatur Co.
<u>Phone and Internet:</u>	Windstream, wireless	<u>Law enforcement:</u>	Ringgold Co. Sheriff
<u>Fire service:</u>	Union Twp Fire Dept; mutual aid partners	<u>Ambulance service:</u>	Ringgold County Hospital, Mount Ayr

**Ellston Historical Context**

The community of Ellston was founded in 1881 when a general store was built in anticipation of a railroad coming through. The original name of the community was Wirt, but was later changed in 1895 to avoid confusion between

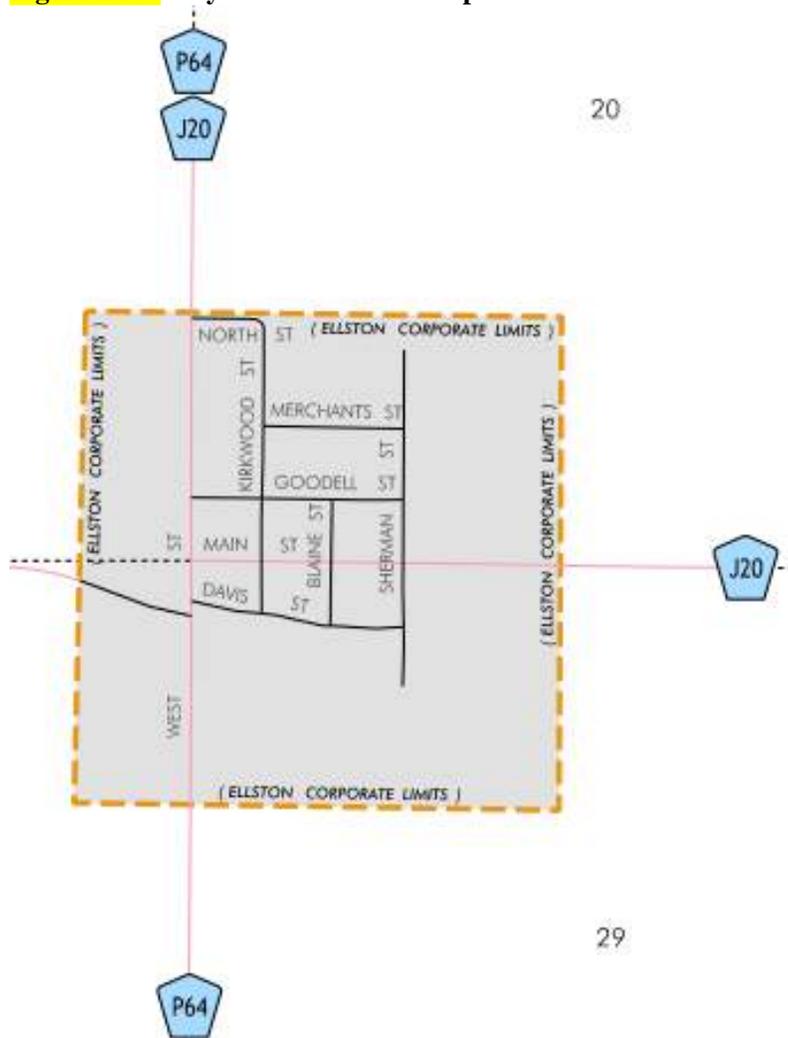
delivering mail to Van Wert of Decatur County and the community. A devastating fire caused most of the businesses in the community to burn down, however the community rebounded and saw a peak of population in the 1920s of 300.

### ***Ellston Physical Profile***

Located in rolling hills, the small community of approximately 0.2 square miles is mostly residential and agricultural in nature, although a few small businesses operate in the community. The town is in just three miles west of the Sun Valley Lake area, which has approximately 300 homes, many of them second homes not occupied by residents year-round, located in a rural improvement district entitled the Sun Valley Lake Association.

The following map shows the general layout of Ellston.

**Figure 2.36: City of Ellston Base Map**



Source: Iowa Department of Transportation, Office of Systems Planning, 8/2018

### ***Ellston Infrastructure, Services, and Resources***

**Transportation.** Approximately 3.0 miles of blacktop roads are found in the city, occupying a somewhat grid pattern. The two county roads are paved farm-to-market roads. There are no railroads or air service within the city. Transit is available on demand from Southern Iowa Trolley based in Creston.

**Utilities.** Drinking water is provided by SIRWA and meets State and Federal regulations. Water mains are designed for drinking needs but not for fire protection and industrial capacity. The production and treatment facilities are located miles outside of Ellston. SIRWA also provides the central sewer for the city. Both water and sewer systems are characterized as high quality with no major compliance issues, deterioration, or need for major improvements. No water shortage is projected. There are no known sewer backups into homes. Alliant Energy provides electricity to homes and businesses from production outside of Ringgold County. There is no public natural gas or other heating system in town. People use individual systems, with liquid propane stored in backyard tanks as the primary source. Others use wood, corn, or other fuels. Other utilities, such as telecom infrastructure, are functional but inconsistent, as

expected in low-density areas. Ellston lacks a formal or complete storm water management system. Storm water is conveyed into streams and waterways via maintained and unmaintained roadside ditches. The city has no storm water utility or fund for development of a managed system. There is no storm water system map.

*Key Services.* Emergency services (fire, police, EMS) are provided outside of Ellston, with the exception of fire. Union Township Fire Department is based from a fire station in Ellston. Law enforcement and EMS are based in Mount Ayr, 16 miles southwest. These services all collaborate through Mutual Aid Compacts and a central E911 dispatch via the Sheriff’s Office and E-911 board. The public has high respect for these services, although continued budget shortages and reliance on volunteers reduces their level of training, equipment, and effectiveness. Ellston is within the Mount Ayr School District, which provides bussing in the community. All district schools are in Mount Ayr. The City owns the Ellston Community Building and Park. Local leaders characterize the building as in good condition. The community building is not sprinkled.

*Existing Mitigation Resources.* Ellston has a manually operated warning siren located at the fire station in the community. Being manually operated and having a volunteer fire department with no one continually occupying the station, reliability is not maintained. The church in Ellston can serve as a public shelter for the community. None of the structures are officially dedicated and contracted with Red Cross as shelters, although the community building maintains a kitchen with food supplies. There are no backup generators, community weather radios, or FEMA tornado safe rooms in the city or immediate surrounding area. The City does not store and maintain its own road maintenance and road clearing equipment. No salt or sand storage is maintained in the city. Ellston participates in drills and exercises with the county and region.

*Budget and Financial Resources.* As outlined in the previous section, there are few financial resources available for hazard mitigation. However, the city does what it can with limited resources to implement small projects, mostly of an indirectly mitigation nature that incidentally helps with mitigation, such as maintaining and improving streets.

#### ***Ellston NFIP Participation***

Ringgold County recently received final flood maps and has since adopted them with an effective date of June 16, 2015. Ellston is mapped but there are no SFHAs in the city. The City is not participating.

#### ***Complete, Underway, and Ongoing Mitigation Actions***

Numerous mitigation actions have been implemented or are now ongoing since the most recent plan update was adopted. The following table lists and describes actions listed in the previous plan for this jurisdiction.

**Figure 2.37: Status of Ellston’s Hazard Mitigation Actions Listed in the Previous Plan**

<b>Action</b>	<b>Status</b>	<b>Notes and Results</b>
Construct public safe rooms in or near existing and future critical assets	Not started	Basement of a town church has been used for this purpose for the community, but it is not a FEMA 361 safe room
HAZMAT waste collection services	Started	Is part of a countywide effort associated with the regional landfill
Install warning siren	Complete	It is a manually operated siren, not able to be remotely triggered
Maintain ordinances related to hazard mitigation – flooding, wildfire control, etc.	Not started	In discussion phase
NOAA Weather Radio program is in place that includes incentives for people to purchase	Not started	In discussion phase
Planning for HAZMAT spills	Started	Fire department has training
Public educational campaign about hazards and risks	Not started	Fire department does some outreach on fire safety
Purchase needed emergency response equipment	Complete	Fire department routinely purchases
Ringgold County Water Emergency Team	In place	Fire department is active on county/regional team
Sanitary/storm sewer studies	Not started	
Train first responders, EMTs, firefighters, and emergency disaster responders	Ongoing	Fire department has training

The above list is not exhaustive as to all possible mitigation actions that could be or that were implemented but is inclusive of all those listed for new or carryover projects in the last update.

#### ***Outlook and Future Development***

Ellston is likely to remain stable with very little growth and population change. The town remains active and is unlikely to dis-incorporate, especially as long as there is growth and vitality at the Sun Valley Lake development area just east of town, causing Ellston to serve as a supporting community for lake residents and visitors. Development

trends are unlikely to impact the future hazard risks in ways unanticipated in this plan, as outlined in Chapter 3. The town does not utilize zoning or other land use regulations.

**City of Kellerton Profile**

This section of the plan addresses the City of Kellerton itself and all assets in the city boundary. Kellerton, home to 315 people, is located approximately 9 miles east of Mount Ayr along Highway 2. The small community is mostly residential and agricultural in nature, although several small businesses operate in the community. The city is managed by a city council of 5 elected members and an elected mayor. A part-time city clerk administers the city. The City also employs seasonal and full-time maintenance staff to maintain and operate City property and utilities.

**Kellerton Jurisdictional Summary**

The following illustrates the key mitigation-related characteristics of the jurisdiction.

<i>Demographics and Governance</i>			
<u>Total population in 2010 (unincorporated):</u>	315	<u>Classification:</u>	City (municipality)
<u>Leadership structure:</u>	5 elected council members; 1 mayor	<u>Official newspaper:</u>	Mount Ayr Record News
<u>Official website:</u>	none	<u>GIS mapping capabilities:</u>	Yes, third party
<i>Key Planning and Capabilities</i>			
<u>Emergency operations plan:</u>	Yes	<u>Zoning regulations:</u>	No
<u>Building regulations:</u>	Limited	<u>Subdivision regulations:</u>	No
<u>Master plan:</u>	No	<u>NFIP participation:</u>	No, no SFHA
<u>Storm water regulations:</u>	No	<u>Floodplain regulations:</u>	No
<u>Hazard mitigation budget:</u>	Very minimal and as needed	<u>Budget process:</u>	Annual appropriations
<i>Essential Infrastructure and Services</i>			
<u>Major arterials:</u>	Iowa 2, P68, J45	<u>Air service:</u>	Mount Ayr Airport, Lamoni Airport
<u>Water service:</u>	SIRWA from regional surface supplies	<u>Sewer service:</u>	Municipal central sewer system
<u>Electric service:</u>	Alliant Energy, SWI REC, others	<u>Gas service:</u>	Limited; individual propane dealers
<u>Sanitation/solid waste:</u>	Local haulers	<u>Landfill:</u>	WRD Landfill, 2 mi east of county line in Decatur Co.
<u>Phone and Internet:</u>	Windstream, wireless	<u>Law enforcement:</u>	Ringgold Co. Sheriff
<u>Fire service:</u>	Kellerton Fire Department	<u>Ambulance service:</u>	Ringgold County Hospital, Mount Ayr

**Kellerton Historical Context**

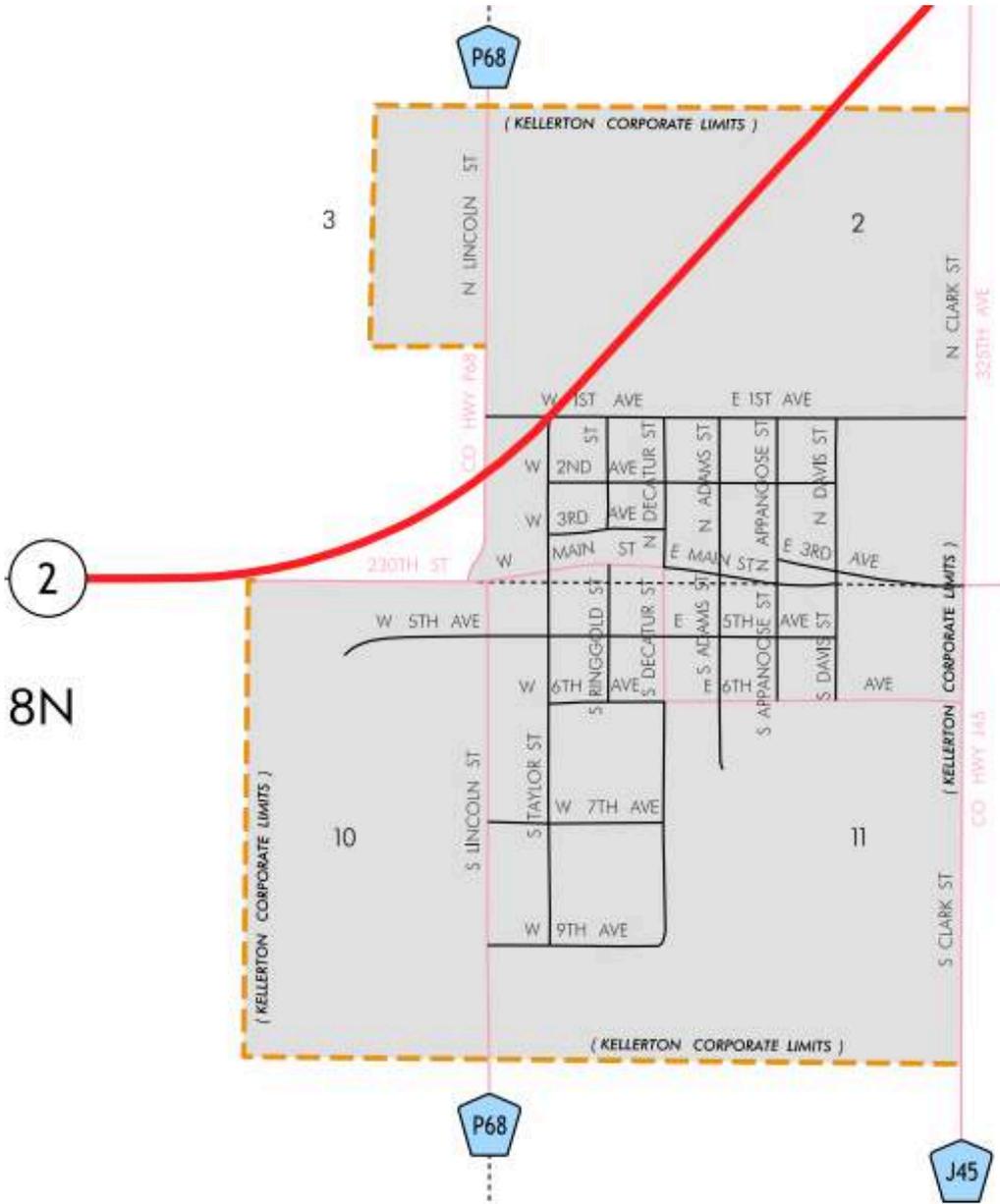
The Leon, Mount Ayr, and Southwestern Railroad arrived in 1879, which prompted the official establishment and incorporation in 1881. Kellerton was named in honor of Judge Isaac Keller, one of the leading Ringgold County citizens. The original newspaper that was established in Kellerton in 1881 was named *The Kellerton Mentor*. 1886 saw the relocation of New Chicago’s residents to Kellerton, causing the abandonment of that town. The community has remained primarily an agricultural town that has seen a fluctuation in population since the town’s peak of 693 people in 1920.

**Kellerton Physical Profile**

Located on the eastern edge of the county in Athens Township with access via State Highway 2 that runs from the west to the northeast part of the community, Kellerton is home to 315 people. The single-track railroad has since been abandoned and removed. The town occupies 0.66 square miles, which is roughly divided between agricultural land and residential properties.

The following map shows the general layout of Kellerton.

**Figure 2.38: City of Kellerton Base Map**



Source: Iowa Department of Transportation, Office of Systems Planning, 8/2018

***Kellerton Infrastructure, Services, and Resources***

**Transportation.** Approximately 6.1 miles of mostly sealcoat and blacktop roads are found in the city, occupying a mostly grid pattern. The only paved route is Highway 2, which crosses the corner of the city, which is fairly flat. Some of the side streets are narrow gravel roads. Most of the central business district is located on Decatur Street. There are no railroads or air service within the city. Transit is available on demand from Southern Iowa Trolley based in Creston.

**Utilities.** Drinking water treatment is provided by SIRWA and meets State and Federal regulations. Water mains are designed for drinking needs and have some but limited fire protection and industrial capacity. The City leadership characterizes water supply and quality as excellent with no threat of disaster-related shortages in the next twenty years. The City of Kellerton operates a municipal central sewer collection and treatment system, which also meets State and Federal regulations. The production and treatment facilities for both utilities are located miles outside of Kellerton, the sewer lagoons being just east of town. Alliant Energy provides electricity to homes and businesses from production outside of Ringgold County. There is no public natural gas or other heating system in town. People use individual systems, with liquid propane stored in backyard tanks as the primary source. Others use wood, corn, or other fuels. Other utilities, such as telecom infrastructure, are functional but inconsistent, as expected in low-density areas.

Kellerton lacks a formal or complete storm water management system. Most storm water is contained to roadside ditches, both maintained and unmaintained, and to natural waterways.

*Key Services.* Emergency services (fire, police, EMS) are provided outside of Kellerton, namely from Mount Ayr, except the Kellerton Fire Department, which operates from a station in downtown. Kellerton Fire also provides rescue and EMS service. Kellerton Fire is one of the few small-town fire services with transport EMS (ambulance) service. Response by other services comes from Highway 2 from the Ringgold County Law Enforcement Center and Ringgold County Hospital respectively. These services all collaborate through Mutual Aid Compacts and a central E911 dispatch via the Sheriff’s Office and E-911 board. The public has high respect for these services, although continued budget shortages and reliance on volunteers reduces their level of training, equipment, and effectiveness. Kellerton is within the Mount Ayr School District, which has its entire campus in Mount Ayr. Bussing is provided throughout the town. City leadership rates cellular coverage as mediocre in the city.

*Existing Mitigation Resources.* The community has a community center that also houses the city hall. The community building and a few churches provide emergency shelter for the public along with limited facilities for lodging and food preparation. The city’s warning siren is centrally located and functional. The community houses no fixed backup generators, community weather radios, or FEMA tornado safe rooms in the city or immediate surrounding area. The City’s maintenance department maintains a portable generator that can provide a modest supply of backup power in emergencies and has road maintenance and clearing equipment. Kellerton participates in countywide and regional drills and exercises.

*Budget and Financial Resources.* As outlined in the previous section, there are few financial resources available for hazard mitigation. In the past five years, the City has invested some of its limited resources to improve roads, ditches, and culverts, in part with matching FEMA Public Assistance funds. The City has worked with FEMA to secure the maximum amount of funds for storm water improvements. The City’s limited financial resources are abundant compared to some of the very small towns in Ringgold County but still remain too limited, when combined with statutory debt limits and existing debt, to take on large mitigation projects.

#### ***Kellerton NFIP Participation***

Ringgold County recently received final flood maps and has since adopted them with an effective date of June 16, 2015. According to the latest mapping, there are no SFHAs within the boundary of Kellerton. Consequently, because of this and the lack of public demand to be able to purchase flood insurance, the City has elected not to join the NFIP.

#### ***Complete, Underway, and Ongoing Mitigation Actions***

Numerous mitigation actions have been implemented or are now ongoing since the most recent plan update was adopted. The following table lists and describes actions listed in the previous plan for this jurisdiction.

**Figure 2.39: Status of Kellerton’s Hazard Mitigation Actions Listed in the Previous Plan**

<b>Action</b>	<b>Status</b>	<b>Notes and Results</b>
Backup files and records – store digitally and in alternate locations	Not started	
Business and residential preparedness programs	Not started	Relying on outside support
Construct public safe rooms in or near existing and future critical assets	Not started	Any shelters that exist are not FEMA-designed shelter; discussion in spring 2017 with community about this has not resulted in a plan to proceed with application.
Create a continuity of operations and succession plan for the jurisdiction	Not started	Relying on outside support
Develop an electronic directory of local and regional mitigation resources	Not started	Relying on outside support
Emergency response guidebooks in all emergency vehicles	Not started	Relying on outside support
Establish alert systems for vulnerable populations	Not started	Relying on outside support
Establish backup communications center or facility	Not started	Relying on outside support; repeaters are needed due to the new E911 radios
Evacuation plans in place	In place	As part of ongoing countywide planning efforts.
Formally designate and stock community post disaster shelters	Not started	Informally used but no formal designation
Harden public buildings	Not started	Very high cost
HAZMAT waste collection services	Started	Is part of a countywide effort associated with the regional landfill
Install and/or update anti-virus software	In place	
Install computers and/or GPS in emergency vehicles	Not started	Phones meet most GPS needs today.
Install warning siren	Complete	Manually operated siren located in the city
Integrate tornado safe rooms into critical assets/facilities	Not started	Not sure there is a building where it makes sense to retrofit a shelter into it.

Action	Status	Notes and Results
Investigate alternative water sources for fire suppression	Not started	
Investigate and implement alternative energy sources	Not started	Relying on outside support
Maintain ordinances related to hazard mitigation – flooding, wildfire control, etc.	Not started	
NIMS compliance for all officials	Complete; ongoing	All compliance issues for the city are met and officials continue training as needed
NOAA Weather Radio program is in place that includes incentives for people to purchase	Not started	An interest area if incentives and funding become available
Participate in a regional HAZMAT team agreement	In place	In place at county level, covering the city
Planning for HAZMAT spills	Started	Fire department has training
Promote tree and vegetation maintenance on private properties	Not started	
Promote the construction of private in-home tornado safe rooms	Not started	
Public educational campaign about hazards and risks	Not started	Provided on a countywide level to a limited extent; no formal programs.
Purchase needed emergency response equipment and communications	Ongoing	Fire department and city work on this issue as funding arises.
Purchase/install backup fixed power generators and water pumps	Not started	City is raising funding for a generator.
Purchase road closure barricades	Complete	10 road closure barriers were purchased in last ten years.
Recycling program	In place	Curbside program offered citywide
Remove dead vegetation on public properties and nuisance areas	Ongoing	City staff and utility company as needed
Repair structurally weak homes, implement weatherization programs	Not started	No formal or City-sponsored program in place
Restricted access procedures	Not started	
Retrofit/harden existing overhead utility lines	Not started	Relying on outside support from utility company that provides electric power
Ringgold County Water Emergency Team	In place	Fire department is active on county/regional team
Sanitary/storm sewer studies	Complete	Studies are current
Special needs/oxygen user registration program	Not started	
Tornado response plan	Not started	
Train first responders, EMTs, firefighters, and emergency disaster responders	In place; ongoing	Provided by countywide and regional agencies with local participation
Updated sewer system	Complete	System is modern and meets needs

The above list is not exhaustive as to all possible mitigation actions that could be or that were implemented but is inclusive of all those listed for new or carryover projects in the last update.

**Outlook and Future Development**

The population of Kellerton is likely to continue a slow to moderate decline, as has been the case for many years, especially now that the local school is closed. It is unlikely but certainly possible that new development will occur in the city, although it is likely to be limited to one or two individual homes. Conversion of farmland is not likely, nor is development in possible flood hazard areas (since there are no SFHAs in town). With this being said, a local development group is working on plans, as of 2017, to revamp and expand the ball field recreation area on the south edge of town and have discussed a potential safe room project to serve as a concession building when no severe weather is present.

**City of Maloy Profile**

This section of the plan addresses the City of Maloy itself and all assets in the city boundary. Maloy, home to 29 people, is located in the southwestern part of the county in Benton Township with community access primarily given by County Road J43. The city is managed by a city council of 3 elected members and an elected mayor. A part-time city clerk administers the city. Most maintenance and other work, such as mowing, is contracted because the city is too small to support daily labor.

**Maloy Jurisdictional Summary**

The following illustrates the key mitigation-related characteristics of the jurisdiction.

<i>Demographics and Governance</i>		
<u>Total population in 2010:</u>	29	<u>Classification:</u> City (municipality)
<u>Leadership structure:</u>	3 elected council members, 1 mayor	<u>Official newspaper:</u> Mount Ayr Record News
<u>Official website:</u>	none	<u>GIS mapping capabilities:</u> Yes, third party
<i>Key Planning and Capabilities</i>		
<u>Emergency operations plan:</u>	Yes	<u>Zoning regulations:</u> No
<u>Building regulations:</u>	No	<u>Subdivision regulations:</u> No

<u>Master plan:</u>	No	<u>NFIP participation:</u>	No - Sanctioned
<u>Storm water regulations:</u>	No	<u>Floodplain regulations:</u>	No
<u>Hazard mitigation budget:</u>	Very minimal and as needed	<u>Budget process:</u>	Annual appropriations
<i>Essential Infrastructure and Services</i>			
<u>Major arterials:</u>	J43	<u>Air service:</u>	Mount Ayr Airport, east edge of Mount Ayr
<u>Water service:</u>	SIRWA, some wells	<u>Sewer service:</u>	SIRWA provided municipal service
<u>Electric service:</u>	Alliant Energy, SWI REC	<u>Gas service:</u>	Individual propane dealers
<u>Sanitation/solid waste:</u>	Local haulers	<u>Landfill:</u>	WRD Landfill, 2 mi east of county line in Decatur Co.
<u>Phone and Internet:</u>	Windstream, wireless	<u>Law enforcement:</u>	Ringgold Co. Sheriff
<u>Fire service:</u>	Mount Ayr Fire Dept.; mutual aid partners	<u>Ambulance service:</u>	Ringgold County Hospital, Mount Ayr

**Maloy Historical Context**

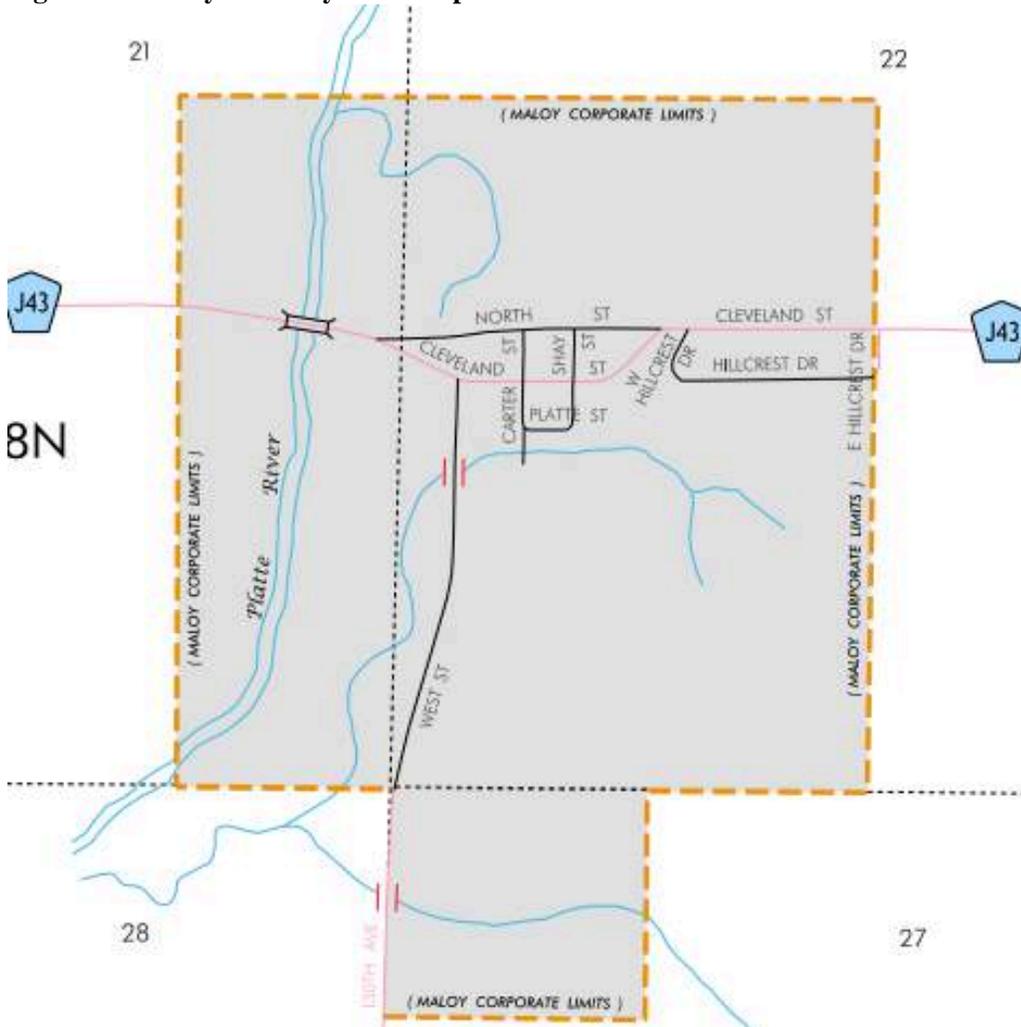
Originally named Delphi, Maloy was platted in 1887 after being designated as a rail town by the Chicago Great Western Railroad in 1875. The town was officially incorporated in 1901. The railroad tracks were removed in 1985 and the post office was closed in 1997.

**Maloy Physical Profile**

Located mostly in the Platte River valley and surrounded by rolling hills, the small community of approximately 0.62 square miles is mostly agricultural in nature, with several homes in the central part of the city.

The following map shows the general layout of Maloy.

**Figure 2.40: City of Maloy Base Map**



Source: Iowa Department of Transportation, Office of Systems Planning, 8/2018

**Maloy Infrastructure, Services, and Resources**

*Transportation.* Approximately 2.1 miles of mostly gravel and blacktop roads are found in the city, occupying somewhat of a grid pattern. There are no railroads or air service within the city. Transit is available on demand from Southern Iowa Trolley based in Creston.

*Utilities.* Drinking water and sewer treatment are provided by SIRWA and meet State and Federal regulations. Water mains are designed for drinking needs but not for fire protection and industrial capacity. The production and treatment facilities are located miles outside of Maloy. Local officials rate the water supply and quality high and do not envision a water shortage in the next twenty years. Water infrastructure is in good condition and no major water improvements are planned in the next five years. A few years ago, SIRWA built the four-cities sewer system that provides effective collection and treatment of sewage in each city and treatment in a lagoon system between the towns of Benton, Delphos, Redding, and Maloy. Local officials rate sewer treatment as “good” with no major deficiencies. No backups into homes are reported, and there are no plans for improvements in the next five years.

Alliant Energy provides electricity to homes and businesses from production outside of Ringgold County. There is no public natural gas or other heating system in town. People use individual systems, with liquid propane stored in backyard tanks as the primary source. Others use wood, corn, or other fuels. Other utilities, such as telecom infrastructure, are functional but inconsistent, as expected in low-density areas. Maloy lacks a formal or complete storm water management system. All storm water is managed via roadside ditches.

*Key Services.* Emergency services (fire, police, EMS) are provided outside of Maloy, namely from Mount Ayr. Response comes along Highway 2 from the Ringgold County Law Enforcement Center, Mount Ayr Fire Station, and Ringgold County Hospital respectively. These services all collaborate through Mutual Aid Compacts and a central E911 dispatch via the Sheriff’s Office and E-911 board. The public has high respect for these services, although continued budget shortages and reliance on volunteers reduces their level of training, equipment, and effectiveness. Maloy is within the Mount Ayr School District, which provides bussing in the community. All district schools are in Mount Ayr. The City owns only the city hall, which is a small modest building.

*Existing Mitigation Resources.* Maloy does not have a warning siren at this time. None of the structures are officially dedicated and contracted with the Red Cross as shelters. There are no backup generators, community weather radios, or FEMA tornado safe rooms in the city or immediate surrounding area. Maloy does not maintain its own road maintenance and clearing equipment and does not store sand and salt for this purpose. Maloy is current with NIMS and participates in countywide and regional emergency drills and practices.

*Budget and Financial Resources.* As outlined in the previous section, there are few financial resources available for hazard mitigation. However, the city does what it can with limited resources to implement small projects, mostly of an indirectly mitigation nature that incidentally helps with mitigation, such as maintaining and improving streets.

***Maloy NFIP Participation***

Ringgold County recently received final flood maps and has since adopted them with an effective date of June 16, 2015. The FIRM maps exist and are attached in Appendix D. These show that Maloy has SFHAs. The City of Maloy has not joined the NFIP, according to the FEMA Community Status Book. Based on Iowa law, no development shall occur in flood hazard areas. However, there is no local jurisdiction to prohibit this development, and the City is in “sanction” status.

***Complete, Underway, and Ongoing Mitigation Actions***

Numerous mitigation actions have been implemented or are now ongoing since the most recent plan update was adopted. The following table lists and describes actions listed in the previous plan for this jurisdiction.

**Figure 2.41: Status of Maloy’s Hazard Mitigation Actions Listed in the Previous Plan**

Action	Status	Notes and Results
Adopt tree trimming ordinance	Not started	Addressed primarily by third party utility without an ordinance
Create/promote literature to reduce property losses from wildlife	Not started	
Clear and deepen ditches on right-of-ways	Ongoing	Limited efforts as issues are urgent and funds are available
Construct public safe rooms in or near existing and future critical assets	Not started	
Demolish abandoned properties	Ongoing	Limited efforts as funds are available
Develop electronic directory of local and regional mitigation resources	Complete	At county level but accessible by the municipality
Discourage/prohibit development in flood plain areas, join or continue participation in the NFIP	Started	Process started – not yet joined
Install sustainable storm water control options, such as rain gardens, bioswales, and buffer strips	Not started	

Action	Status	Notes and Results
Integrate tornado safe rooms into critical assets/facilities	Not started	
Maintain ordinances related to hazard mitigation – flooding, wildfire control, etc.	Ongoing	Third party may need to review and update for BMPs.
NOAA Weather Radio program is in place that includes incentives for people to purchase	Not started	
Planning for HAZMAT spills	Not started	
Promote tree and vegetation maintenance on private properties	Not started	
Public educational campaign about hazards and risks	Not started	County has some activities that impact the city, but nothing is sustained.
Purchase needed emergency response equipment	Not started	Not really needed within city, as no responders operate from Maloy.
Purchase/install backup fixed power generators and water pumps	Not started	Not relevant to Maloy with lack of major assets.
Purchase standby portable pumps and generators	Not started	
Recycling program	Not started	
Remove dead vegetation on public properties and nuisance areas	Ongoing	Current and continuing as needs arise
Retrofit/harden existing overhead utility lines	Not started	
Ringgold County Water Emergency Team	In place	Countywide team is in place
Tornado response plan	Complete	County level with local contribution and involvement
Train first responders, EMTs, firefighters, and emergency disaster responders	Not started	Not really needed within city, as no responders operate from Maloy.
Updated sewer system	Complete	Installed by SIRWA in 2012-14

The above list is not exhaustive as to all possible mitigation actions that could be or that were implemented but is inclusive of all those listed for new or carryover projects in the last update.

**Outlook and Future Development**

Maloy is likely to remain stable with very little growth and population change. The town remains active and is unlikely to dis-incorporate. Development trends are unlikely to impact the future hazard risks in ways unanticipated in this plan, as outlined in Chapter 3. While there is a SFHA in the western third of the city, this area is mostly agricultural and is not likely to be subject to development pressure. The town does not utilize zoning or other land use regulations.

**City of Mount Ayr Profile**

This section of the plan addresses the City of Mount Ayr itself and all assets in the city boundary. As the largest and most centrally located city in Ringgold County, the 1,691 people represent one-third of the county’s population. Most of the County’s assets are also located in Mount Ayr, which also serves as the county seat. Located at the intersection of Iowa Highway 2 and US Highway 169, most of the town’s land use is for residential, although industrial, commercial, public/recreation, and agricultural land is significant. The city is managed by a city council of 5 elected members and an elected mayor. A full-time city clerk administers the city, assisted by a full-time utility clerk. The City also employs seasonal and full-time maintenance staff to maintain and operate City property and utilities.

**Mount Ayr Jurisdictional Summary**

The following illustrates the key mitigation-related characteristics of the jurisdiction.

<i>Demographics and Governance</i>			
<u>Total population in 2010 (unincorporated):</u>	1,691	<u>Classification:</u>	City (municipality)
<u>Leadership structure:</u>	5 elected council members; 1 mayor	<u>Official newspaper:</u>	Mount Ayr Record News
<u>Official website:</u>	none	<u>GIS mapping capabilities:</u>	Yes, third party
<i>Key Planning and Capabilities</i>			
<u>Emergency operations plan:</u>	Yes	<u>Zoning regulations:</u>	Yes
<u>Building regulations:</u>	Limited	<u>Subdivision regulations:</u>	Yes
<u>Master plan:</u>	Yes	<u>NFIP participation:</u>	No, Sanctioned
<u>Storm water regulations:</u>	Yes	<u>Floodplain regulations:</u>	No
<u>Hazard mitigation budget:</u>	Limited, project specific	<u>Budget process:</u>	Annual appropriations
<i>Essential Infrastructure and Services</i>			
<u>Major arterials:</u>	Iowa 2, US 169	<u>Air service:</u>	Mount Ayr Airport, east edge of Mount Ayr
<u>Water service:</u>	SIRWA from regional surface supplies	<u>Sewer service:</u>	Municipal
<u>Electric service:</u>	Alliant Energy, SWI REC	<u>Gas service:</u>	Alliant Energy to all properties
<u>Sanitation/solid waste:</u>	Municipal	<u>Landfill:</u>	WRD Landfill, 2 mi east of county line in Decatur Co.
<u>Phone and Internet:</u>	Windstream, Mediacom, wireless	<u>Law enforcement:</u>	Ringgold Co. Sheriff
<u>Fire service:</u>	Mount Ayr Fire Department	<u>Ambulance service:</u>	Ringgold County Hospital, Mount Ayr

### ***Mount Ayr Historical Context***

Mount Ayr was incorporated in 1875 after the town was moved and was renamed from “Urbana”. In 1880 the town created a fire department with the organization of a “new” hook and ladder company. An electric utility was incorporated to build an electric lighting plant, which was eventually built for \$20,000. The company was eventually purchased by the Iowa Southern Utility Company in 1917. That same year, the Mount Ayr Public Library was dedicated, in part thanks to the Carnegie Foundation. The new post office was built in 1940. Since that time, Mount Ayr has stabilized while converting from a traditional agriculture economy to an industrial economy until today it is primarily based on services, such as health care and education.

### ***Mount Ayr Physical Profile***

Mount Ayr is located in the center of the county as its own township and is accessible by State Highway 2 that runs east-west through the community and Highway 169 that goes north-south through Mount Ayr. The community is home to 1,691 people. The town occupies 2.69 square miles, which includes large areas of residential properties, surrounded by agricultural land along the fringes of the city. Much of the town is fairly flat with rolling hills towards the fringes of the town. A well-maintained courthouse square serves as the central business district, three blocks north of Highway 2. The bulk of the other commercial is located along Highway 2, along with some industrial uses. The main industrial park is located on the southeast corner of the city, near the airport.

The following map shows the general layout of Mount Ayr.

### **Figure 2.42: City of Mount Ayr Base Map**



mains are aging, and the City is starting on a \$4 million water main replacement project in 2017-18. These projects, when done, will greatly enhance the City's economic capacity and ability to support new residents and businesses. Inflow and infiltration is a problem with the sewer mains, but no major project is planned for the next five years to address this issue. There are periodic reports of wastewater backing up into homes and businesses. The City prohibits the connection of private storm water systems to the wastewater system.

Alliant Energy supplies electricity and natural gas service within the city, all produced outside of Ringgold County. Over 95% of the residents use both of these energy services, with a few property owners generating their own energy from wood, corn, solar, and other sources. An Alliant-owned electrical substation is located on North Taylor Street about three blocks north of downtown Mount Ayr.

All forms of storm water control exist, including curb and gutter, roadside ditches of all level of maintenance, and natural waterways. The City of Mount Ayr has current maps of this infrastructure. The City established its own storm water utility in 2015, which is generating funds to complete storm water projects, such as road repairs, curb and gutter, culverts, and stream-bank stabilization projects. In 2015, the City initially considered applying for non-FEMA federal funds to implement a storm water project in up to five priority areas, but to date the project has not proceeded. Other smaller localized projects are ongoing and more projects are planned for the next five years. Information on these storm water issues is found elsewhere in this plan.

*Key Services.* Emergency services (fire, police, EMS) are provided within Mount Ayr. Mount Ayr Fire operates a volunteer fire department just east of the downtown and provides rescue and EMS service, but not transport. The fire department has no means to trigger local warning sirens. The Ringgold County Law Enforcement Center, located along Highway 2 southwest of downtown, is the base for dispatch and law enforcement provided by the Sheriff. Transportation-based EMS is provided by the Ringgold County Hospital, located along Highway 169 in the northeast part of the city. These services all collaborate through Mutual Aid Compacts and a central E911 dispatch via the Sheriff's Office and E-911 board. The public has high respect for these services, although continued budget shortages and reliance on volunteers reduces their level of training, equipment, and effectiveness. Local leaders rate cellular coverage as "moderate" but broadband Internet coverage as "poor." Mount Ayr is within the Mount Ayr School District, which has its entire campus in the eastern part of Mount Ayr. Bussing is provided where needed, although many residents in town live within walking distance of the school buildings. Mount Ayr is also home to the bulk of the county's retail options for emergency supplies, banks and financial resources, and fuel supplies.

*Existing Mitigation Resources.* The City of Mount Ayr owns several properties with structures, including the city hall, city maintenance shop, wastewater treatment plant, water booster station, public library, fire station, the former train depot (not a museum), and the swimming pool with its bathhouse. No City structures are sprinkled and only the bathhouse/safe room has an in-use NOAA weather radio. Several outdoor warning sirens exist throughout the city in strategic locations. Several buildings in the city are suitable for temporary shelter during and after hazard events, although none are formally part of Red Cross or other agreements at this time. Schools and churches provide lodging and warm meals for those affected by severe weather and energy failures. The new hospital and a few other facilities where exposed populations exist have fixed power generators. Those with generators include no city buildings used for human occupation. The City owns emergency generators for the water and sewer facilities. However, the City maintains no portable generators for various needs. The City owns and maintains road clearing equipment and adequate space to store salt and sand. The City of Mount Ayr owns one of the first FEMA tornado safe rooms in the region, which was completed as a new swimming pool bathhouse in 2013 and is now open. This facility is located at Judge Lewis City Park in the western part of the city. Mount Ayr High School also has a FEMA tornado safe room, although the school safe room is not open to the general public.

*Budget and Financial Resources.* Mount Ayr has by far the most mitigation resources of all municipalities in Ringgold County, as outlined in the previous section of this chapter. However, much of the City's resources are tied up in general infrastructure projects, as outlined in this profile. The City continues to explore storm water/flash flood mitigation projects, but funding available for them is limited. In summary, in the past five years, the City has invested much of its resources to improve roads, ditches, and culverts, in part with matching FEMA Public Assistance funds. The City has worked with FEMA to secure the maximum amount of funds for storm water improvements.

#### ***Mount Ayr NFIP Participation***

Ringgold County recently received final flood maps and has since adopted them with an effective date of June 16, 2015. The FIRM map is attached in Appendix D, showing the city contains land within Zone A (the SFHA). As of June 2017, Mount Ayr has not joined the NFIP. Most of the land in the SFHA is undeveloped farmland and there is little documented interest among property owners in purchasing flood insurance at the time this plan update was started.

#### ***Complete, Underway, and Ongoing Mitigation Actions***

Numerous mitigation actions have been implemented or are now ongoing since the most recent plan update was adopted. The following table lists and describes actions listed in the previous plan for this jurisdiction.

**Figure 2.43: Status of Mount Ayr’s Hazard Mitigation Actions Listed in the Previous Plan**

Action	Status	Notes and Results
Adopt a thorough emergency operations plan (EOP) addressing multiple hazards and capabilities	Not current	Has worked with the EMA on past efforts
Conduct study on illegal use of sump pumps and sewer lines	In progress	
Construct storm water drainage (underground, culverts, curb & gutter, etc.)	In progress	
Create a continuity of operations and succession plan for the jurisdiction	Not started	
Develop/implement an extreme heat event medical response plan	Not started	
Develop/implement a thorough recovery plan for power failure	Not started	
Emergency response guidebooks in all emergency response vehicles	Not started	
Encourage citizen purchase/use of smoke detectors	Not started	Inconsistent fire prevention efforts in past years
Encourage private insurance purchase	Not started	
Enforce burning restrictions	In place	
Erosion control projects	Not started	Somewhat being addressed though general storm water control measures in past 3 years
Evacuation plans in place	Not started	
Formally designate and stock community post-disaster shelters	In place	Not city properties; others exist in the city
Formulate partnerships to gain legislation (such as Iowa League of Cities, etc.)	In place	
Full review of policy, procedure, and codes to include mitigation	Not started	
Harden public buildings	Not started	
HAZMAT waste collection services	Not started	Nothing formal in place; some private industries may use.
Increase awareness of household hazardous materials	Ongoing	Through the local landfill commission
Inspect water lines	Ongoing	
Install computers and/or GPS units in emergency vehicles	In progress	
Install and/or update anti-virus software	In place	
Install backflow devices	Complete	
Install fire protection/sprinkler systems	Not started	
Install impervious manhole covers	Not started	Identified as a current need
Install sustainable storm water control options, such as rain gardens, bioswales, and buffer strips	Just starting	As part of storm water strategy started 3 years ago
Install warning siren	In place	No more needed
Integrate tornado safe rooms into critical assets/facilities	Complete	School safe room is integrated into existing building; other locations may make sense for more of them.
Investigate and implement alternative energy sources	Not started	
Maintain ordinances related to hazard mitigation – flooding, wildfire control, etc.	In progress	
Maintain watersheds; Develop/implement watershed studies and plans	In progress	Must of the city has been studied
Make all public facilities handicap accessible	In progress	
NOAA Weather Radio program is in place that includes incentives for people to purchase	Not started	
Participation on the NFIP (flood insurance program)	Not started	
Planning for HAZMAT spills	Not started	
Promote tree and vegetation maintenance on private properties	Ongoing	Alliant Energy provides this for all customers; city public works also works with property owners as needed.
Public educational effort about hazards and risks	Not started	This is performed by third parties without City involvement.
Purchase/install backup fixed power generators and water pumps	Not started	
Purchase standby portable pumps and generators	Not started	
Purchase needed emergency response equipment	In progress	Fire and EMS equipment is constantly being sought; large fire truck needed.
Recycling program	In place	
Redundant systems and looping (water, sewer, gas, electric, etc.)	Not started	
Remove dead vegetation on public properties and nuisance areas	Ongoing	As needed by City and Alliant Energy
Restricted access procedures	Not started	
Ringgold County Water Emergency Team	In place	Countywide team is in place
Sanitary/storm sewer studies	Complete	
Train first responders, EMTs, firefighters, and emergency disaster responders	Ongoing	

Action	Status	Notes and Results
Tree planting projects on public property and right-of-way areas	Not started	

The above list is not exhaustive as to all possible mitigation actions that could be or that were implemented but is inclusive of all those listed for new or carryover projects in the last update.

### Outlook and Future Development

As the largest community in the county, there is always potential for growth, especially if housing for seniors, special needs, and commuting workforce members can be provided. As farmers retire and seek a simpler life, many will move to Mount Ayr to be close to church, grocery stores, the meal site, and health care facilities. However, many older people also move out of a small county such as Ringgold, so it is unlikely that the population will grow notably and ever reach 2,000. Likely, a few homes or even a dozen homes will be built in on infill lots in the next five years and the population will remain stable. A few businesses and industries may locate in Mount Ayr or expand within the community, but the net growth is likely to be marginal. Conversion of farmland and annexation are not likely. The same is true of development in SFHAs or perceived flash flood hazard areas.

### City of Tingley Profile

This section of the plan addresses the City of Tingley itself and all assets in the city boundary. Tingley, home to 184 people, is located approximately 11 miles north-northeast of Mount Ayr along Highway 2. The small community is mostly residential and agricultural in nature, although several small businesses operate in the community. The city is managed by a city council of 5 elected members and an elected mayor. A part-time city clerk administers the city. The City also employs seasonal and part-time maintenance staff to maintain and operate City property and utilities.

### Tingley Jurisdictional Summary

The following illustrates the key mitigation-related characteristics of the jurisdiction.

Demographics and Governance		
Total population in 2010 (unincorporated):	184	Classification: City (municipality)
Leadership structure:	5 elected council members; 1 mayor	Official newspaper: Mount Ayr Record News
Official website:	none	GIS mapping capabilities: Yes, third party
Key Planning and Capabilities		
Emergency operations plan:	Yes	Zoning regulations: No
Building regulations:	Limited	Subdivision regulations: No
Master plan:	No	NFIP participation: No, no SFHA
Storm water regulations:	No	Floodplain regulations: No
Hazard mitigation budget:	Very minimal and as needed	Budget process: Annual appropriations
Essential Infrastructure and Services		
Major arterials:	County Road J20	Air service: Mount Ayr Airport
Water service:	SIRWA from regional surface supplies	Sewer service: Municipal central sewer system
Electric service:	Alliant Energy, SWI REC, others	Gas service: Limited; individual propane dealers
Sanitation/solid waste:	Local haulers	Landfill: WRD Landfill, 2 mi east of county line in Decatur Co.
Phone and Internet:	Windstream, wireless	Law enforcement: Ringgold Co. Sheriff
Fire service:	Kellerton Fire Department	Ambulance service: Ringgold County Hospital, Mount Ayr

### Tingley Historical Context

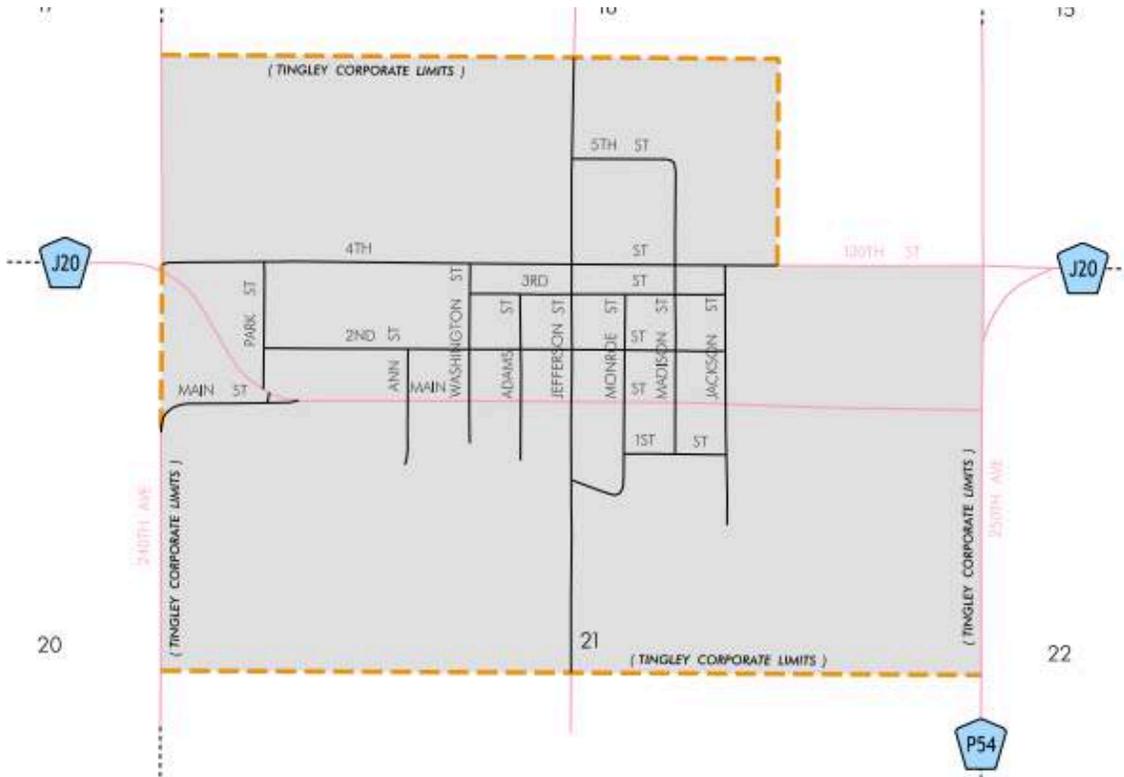
The community got its start when in 1867 a group of settlers met and decided to establish a post office at the home of William “Tingley” Cornwall, who was the person the town was named after. The Humeston and Shenandoah Railroad began service to the community in 1882 but was abandoned by 1945. The town of Eugene, located five miles to the north, was eventually absorbed into the town. Tingley was incorporated in 1883. Tingley was connected to telephone service in 1895 and a rural mail route was established in 1903. Since 1900 and a peak population of 488, the community has seen a generally slow decline to a population of 184 in 2010.

### Tingley Physical Profile

Located in the north central part of the county in Tingley Township with access via US Highway 169 to one mile west of town and then J20 into town, Tingley is home to 184 residents. Located on a relatively flat upland ridge, the town occupies 0.68 square miles, which is roughly divided between agricultural land and residential properties. A few small businesses remain along Main Street, as do a few churches.

The following map shows the general layout of Tingley.

**Figure 2.44: City of Tingley Base Map**



Source: Iowa Department of Transportation, Office of Systems Planning, 8/2018

### ***Tingley Infrastructure, Services, and Resources***

**Transportation.** Approximately 4.9 miles of mostly gravel and blacktop roads are found in the city, occupying a mostly grid pattern. The only paved route is County J20, which crosses the middle of the city, which is fairly flat. Some of the side streets are narrow gravel roads. The central business district is located on Main Street. There are no railroads or air service within the city. Transit is available on demand from Southern Iowa Trolley based in Creston.

**Utilities.** Drinking water treatment is provided by SIRWA and meets State and Federal regulations. Water mains are designed for drinking needs and have some but limited fire protection and industrial capacity. The City of Tingley operates a municipal central sewer collection and treatment system, which also meets State and Federal regulations. The production and treatment facilities for both utilities are located miles outside of Tingley, the sewer lagoons being just north of town. Alliant Energy provides electricity to homes and businesses from production outside of Ringgold County. There is no public natural gas or other heating system in town. People use individual systems, with liquid propane stored in backyard tanks as the primary source. Others use wood, corn, or other fuels. Other utilities, such as telecom infrastructure, are functional but inconsistent, as expected in low-density areas. Tingley lacks a formal or complete storm water management system.

**Key Services.** Emergency services (fire, police, EMS) are provided outside of Tingley, namely from Mount Ayr, except the Tingley Fire Department, which operates from a station in downtown. Kellerton Fire also provides rescue and EMS service, but not transport. Response by other services comes from Highway 169 from the Ringgold County Law Enforcement Center and Ringgold County Hospital respectively. These services all collaborate through Mutual Aid Compacts and a central E911 dispatch via the Sheriff's Office and E-911 board. The public has high respect for these services, although continued budget shortages and reliance on volunteers reduces their level of training, equipment, and effectiveness. Tingley is within the Mount Ayr School District, which has its entire campus in Mount Ayr. Bussing is provided throughout the town.

**Existing Mitigation Resources.** Tingley has a small city hall. A few churches provide emergency shelter for the public along with limited facilities for lodging and food preparation. The city's warning siren is centrally located and functional. The community houses no backup generators, community weather radios, or FEMA tornado safe rooms in the city or immediate surrounding area. The City's maintenance department maintains a portable generator that can provide a modest supply of backup power in emergencies.

**Budget and Financial Resources.** As outlined in the previous section, there are few financial resources available for hazard mitigation. In the past five years, the City has invested some of its limited resources to improve roads, ditches,

and culverts, in part with matching FEMA Public Assistance funds. As one of the county’s smaller towns, the City lacks funds to do many projects.

### ***Tingley NFIP Participation***

Ringgold County recently received final flood maps and has since adopted them with an effective date of June 16, 2015. According to the latest mapping, there are no SFHAs within the boundary of Tingley. Consequently, because of this and the lack of public demand to be able to purchase flood insurance, the City has elected not to join the NFIP.

### ***Complete, Underway, and Ongoing Mitigation Actions***

Numerous mitigation actions have been implemented or are now ongoing since the most recent plan update was adopted. The following table lists and describes actions listed in the previous plan for this jurisdiction.

**Figure 2.45: Status of Tingley’s Hazard Mitigation Actions Listed in the Previous Plan**

<b>Action</b>	<b>Status</b>	<b>Notes and Results</b>
Business and residential preparedness programs	Not started	
Clear and deepen ditches on right-of-way areas	Not started	
Community drills	Ongoing	City is part of countywide drills.
Construct public safe rooms in or near existing and future critical assets	Not started	
Construct storm water drainage (underground, culverts, curb & gutter, etc.)	Not started	
Demolish abandoned properties	Underway	Buildings are demolished as funding is available; more need exists.
Develop an electronic directory of local and regional mitigation resources	Complete	Countywide directory is available.
Develop/implement a thorough recovery plan for power failure	Complete	Third party (utility company) plan in place.
Emergency response guidebooks in all emergency vehicles	Complete	Fire vehicles.
Encourage citizen purchase/use of smoke detectors	Not started	
Establish alert systems for vulnerable populations (such as elderly, homebound, institutionalized)	In place	As provided by housing providers
Establish or review building codes	Not started	
Formulate partnerships to gain legislation – be active in Iowa League of Cities or similar organization(s)	In place	Membership in statewide organization.
HAZMAT waste collection services	In place	County landfill and private resources.
Harden public buildings	Not started	
Install and/or update anti-virus software	In place	City maintains standard computer software.
Install hazard signs in area campgrounds, parks, and open spaces.	Not started	
Install warning siren	Complete	City has functional warning siren.
Integrate tornado safe rooms into critical assets/facilities	Not started	
Maintain ordinances related to hazard mitigation – flooding, wildfire control, etc.	Not started	
NOAA Weather Radio program is in place that includes incentives for people to purchase	Not started	
Promote tree and vegetation maintenance on private properties	Ongoing	Alliant Energy promotes this to customers.
Public educational campaign about hazards and risks	Not started	
Purchase/install backup fixed power generators and water pumps	Not started	
Purchase needed emergency response equipment and communications	Underway	Being purchased as funds are available.
Purchase new fire trucks and ambulances	Not started	
Purchase road closure barricades	Complete	Adequate numbers of this are available.
Purchase snow trucks, plows, and sanders	Complete	Adequate supply available.
Purchase standby portable pumps and generators	Not started	
Retrofit/harden existing overhead utility lines	Not started	
Ringgold County Water Emergency Team	Complete	Team is in place and well trained.
Road bypass construction projects	Not started	
Sanitary/storm sewer studies	Complete	Relatively new sanitary system, inspected regularly.
Train first responders, EMTs, firefighters, and emergency disaster responders	Ongoing	Training continues as needed; up to current requirements.
Tree planting programs on public property and right-of-way areas	Not started	

The above list is not exhaustive as to all possible mitigation actions that could be or that were implemented but is inclusive of all those listed for new or carryover projects in the last update.

### ***Outlook and Future Development***

The population of Tingley is likely to continue a slow to moderate decline, as has been the case for many years. It is unlikely but certainly possible that new development will occur in the city, although it is likely to be limited to one or two individual homes. Conversion of farmland is not likely, nor is development in possible flood hazard areas (since

there are no SFHAs in town).

**Diagonal Community Schools Profile**

This section of the plan addresses the Diagonal School District itself and particularly the assets within the district, including buildings, athletic fields, busses, and access roads.

The Diagonal School District is a relatively small district in the northwest part of the county. The 2016-2017 enrollment was 119 students from pre-K to 12<sup>th</sup> Grade. The district serves the community of Diagonal and approximately 20% of the rural county. The Diagonal School District benefits from the support of residents, parents, and taxpayers in the northwest part of the county.

**Diagonal Community Schools Jurisdictional Summary**

The following illustrates the key mitigation-related characteristics of the jurisdiction.

<i>Demographics and Governance</i>			
<u>Total population (entire district):</u>	1,000 (estimated)	<u>Classification:</u>	Public School District
<u>Leadership structure:</u>	Superintendent, 5-member board	<u>Official newspaper:</u>	<i>Diagonal Progress</i>
<u>Official website:</u>	<a href="http://www.diagonal.k12.ia.us">www.diagonal.k12.ia.us</a>	<u>GIS mapping capabilities:</u>	Yes, third party
<i>Key Planning and Capabilities</i>			
<u>Emergency operations plan:</u>	Yes	<u>Zoning regulations:</u>	Yes, municipal
<u>Building regulations:</u>	Yes (standards for own buildings)	<u>Subdivision regulations:</u>	No
<u>Master plan:</u>	Yes	<u>NFIP participation:</u>	No
<u>Storm water regulations:</u>	No	<u>Floodplain regulations:</u>	No
<u>Hazard mitigation budget:</u>	Very limited	<u>Budget process:</u>	Annual appropriations
<i>Essential Infrastructure and Services</i>			
<u>Major arterials:</u>	County J23 and P33	<u>Air service:</u>	Mount Ayr Airport, Creston Airport
<u>Water service:</u>	SIRWA from regional surface supplies	<u>Sewer service:</u>	Municipal central sewer system
<u>Electric service:</u>	Alliant Energy	<u>Gas service:</u>	Limited; individual propane dealers
<u>Sanitation/solid waste:</u>	Local haulers	<u>Landfill:</u>	WRD Landfill, 2 mi east of county line in Decatur Co.
<u>Phone and Internet:</u>	Windstream, wireless	<u>Law enforcement:</u>	Ringgold Co. Sheriff
<u>Fire service:</u>	Diagonal Fire Department	<u>Ambulance service:</u>	Ringgold County Hospital, Mount Ayr

**Diagonal School District Historical Context**

Diagonal remains in solid operation despite being one of the state’s smallest school districts. Aging buildings are located on one campus in the western part of Diagonal, on the historical site for the school infrastructure.

**Figure 2.46: Diagonal School Enrollment Trends Data**

School Yr.	Facility	Enrollment	Facility	Enrollment	Total Enrollment
2012-13	Jr./Sr. High	63	Elementary	56	119
2013-14	Jr./Sr. High	60	Elementary	67	127
2014-15	Jr./Sr. High	53	Elementary	64	114
2015-16	Jr./Sr. High	56	Elementary	65	121
2016-17	Jr./Sr. High	58	Elementary	60	118

Sources: Iowa Department of Education, 7/2017

The enrollment has fluctuated moderately from year to year with an overall stable trend.

**Diagonal Community Schools Physical Profile**

The campus contains outdoor playgrounds and athletic facilities, and a bus barn exists in Diagonal.

For the purposes of this plan, the main focus is on the three main campus buildings and/or properties. The facilities include school instructional buildings, the administration building, the transportation center, playgrounds, athletic facilities, and parking areas. These facilities are subject to hazards that affect those areas within Diagonal where the school campus is located. The site includes approximately 10 acres of land. Buildings are brick and mortar but are not designed to withstand tornado-force winds. They are designed to withstand normal high wind events, winter storms, lightning, and other hazards, and are built with fire suppression capabilities and are fully handicap accessible.

The High School campus is located along the west fringe of Diagonal at 403 W. 2<sup>nd</sup> Street. Surrounding land uses include residential and agriculture.

**Diagonal Community Schools Infrastructure, Services, and Resources**

The approximately 10 acres of District property is fully developed and managed through the District’s own taxing authority, State appropriations, and occasional grants and fees for service. Consequently, the District owns its own transportation facility with busses and other vehicles, campus road network, and roadway snow clearing facilities. Parking areas (although small) and buildings create areas where storm water can accumulate, but surrounding ground handles most of the water on campus with no known flash flooding created that affects other properties. District staff members maintain property in order to reduce the risk of loss due to hazards.

Local city services, provided to the town of Diagonal, also serve the school campus property: hard-surface public streets, public water, public sewer collection, electric power, propane energy, and other vital infrastructure.

City police, County communications, and local fire and EMS also serve the area. Warning sirens are near schools, and each main instructional building has an active weather radio system. The District is tied into the countywide emergency response system and has access to resources provided by the State of Iowa Department of Education.

*Existing mitigation resources.* While not listed as designated shelters, the school campus can and has been used during and after emergencies because of the firm building construction, adequate space for housing people, and kitchen facilities. The District does not have fixed or portable emergency generators, but the campus has fixed NOAA weather radios. Students and staff participate in drills and educational programs related to hazards and the mitigation of them. No District facilities are designated as tornado safe rooms capable of withstanding 250 MPH winds. All buildings are located within a half mile of an outdoor warning siren. The District maintains its own equipment and supplies to maintain roads and walkways on campus.

*Budget and financial resources.* The fiscal year 2018 100% valuation for Diagonal School District was \$39 million total. In FY 2018, the District levied a tax rate of \$17.07220 for regular property for a total tax levy of \$0.66 million. The total budget for FY 2018 was \$2.5 million. A very small portion of the operating budget, an unspecified amount, is designated for mitigation activities.

#### ***Diagonal Community Schools NFIP Participation***

The Diagonal Community School District does not participate in the NFIP. The City of Diagonal does not participate either, despite SFHAs in parts of Diagonal. Newly completed FIRM maps, included in Appendix D of this plan, show no school district property within the SFHAs.

#### ***Complete, Underway, and Ongoing Mitigation Actions***

Numerous mitigation actions have been implemented or are now ongoing since the most recent plan update was adopted. The following table lists and describes actions listed in the previous plan for this jurisdiction.

**Figure 2.47: Status of Diagonal School’s Hazard Mitigation Actions Listed in the Previous Plan**

<b>Action</b>	<b>Status</b>	<b>Notes and Results</b>
Alternative bus routes and closure barricades	Not started	
Backup files and records – store electronically and in alternative location(s)	Complete	On file online and in separate location
Building tours in response to disasters	Complete	Annual and as needed
Construct public safe rooms in or near existing and future critical assets	Not started	
Create/promote literature to reduce losses to property from wildlife	Not started	
Create a continuity of operations and succession plan for the jurisdiction	Not started	
Develop and enforce snow removal policies	Not started	
Develop/implement an extreme heat event medical response plan	Not started	
Develop/implement a thorough recovery plan for power failure	Not started	
Enhance or increase relationships with the city and citizens	Complete	Efforts made using online/technologies
Establish alert systems vulnerable populations	Started	Efforts made using online/technologies
Establish backup communications center or facility	Not started	
Expand emergency fire plans	Started	
Implement a bomb squad program	Ongoing	Partnership with third parties
Increase awareness of household hazardous materials	Not started	
Install and/or update anti-virus software	Complete	Maintained and updated as needed
Integrate tornado safe rooms into critical assets/facilities	Not started	
Observe tornado week	Ongoing	
Public educational campaign about hazards and risks	Not started	
Purchase fire suppression materials	Complete	
Rail and highway safety education program for students	Complete	Ongoing program annually for students
Remove unused chemical containers	Complete	
Update school action/emergency plan	Ongoing	Effort continues each year

The above list is not exhaustive as to all possible mitigation actions that could be or that were implemented but is inclusive of all those listed for new or carryover projects in the last update.

**Outlook and Future Development**

The District population and enrollment is likely to continue to decline slowly, and in the future it is unlikely that new facilities will be needed. It is very unlikely that new facilities will be needed in the next five years. At best, total increase in enrollment might be up to 5% in the next five years, which would mean more people in the existing assets, buildings, and busses could be affected compared to today. There remains the potential that the District will be consolidated, although there are no public discussions about this issue to date.

**Mount Ayr Community Schools Profile**

This section of the plan addresses the Mount Ayr School District itself and particularly the assets within the district, including buildings, athletic fields, busses, and access roads.

The main campus buildings are located the eastern part of Mount Ayr with the District office at 1001 E. Columbus Street. The Middle/High School is located at this same address. The Elementary School is located at 607 East Jefferson Street. As stated on the Mount Ayr Community Schools website, “The school district serves some 4,200 residents who live in Ringgold and Taylor Counties, including the towns of Redding, Delphos, Kellerton, Maloy, Benton, Tingley, Ellston, Beaconsfield, and Mount Ayr. It is a rural district that was formed after re-organization in 1958. The 405 square miles, which is geographically the fourth largest in the state. Currently the district has 63 teachers in grades Pre-school through 12th. Approximately 650 students enroll from the district. In addition there are students from Clearfield who whole grade share at the secondary levels, and from 7-12 students from Diagonal High School attend the high school in the mornings.”

**Mount Ayr Community Schools Jurisdictional Summary**

The following illustrates the key mitigation-related characteristics of the jurisdiction.

<i>Demographics and Governance</i>			
<u>Total population (entire district):</u>	4,200 (estimated)	<u>Classification:</u>	Public School District
<u>Leadership structure:</u>	Superintendent, 5-member board	<u>Official newspaper:</u>	Mount Ayr Record News
<u>Official website:</u>	<a href="http://www.mtayschools.org">www.mtayschools.org</a>	<u>GIS mapping capabilities:</u>	Yes, third party
<i>Key Planning and Capabilities</i>			
<u>Emergency operations plan:</u>	Yes	<u>Zoning regulations:</u>	Yes, municipal
<u>Building regulations:</u>	Yes (standards for own buildings)	<u>Subdivision regulations:</u>	Yes, municipal
<u>Master plan:</u>	Yes	<u>NFIP participation:</u>	No
<u>Storm water regulations:</u>	No	<u>Floodplain regulations:</u>	No
<u>Hazard mitigation budget:</u>	Very limited	<u>Budget process:</u>	Annual appropriations
<i>Essential Infrastructure and Services</i>			
<u>Major arterials:</u>	Iowa 2, US 169	<u>Air service:</u>	Mount Ayr Airport, east edge of Mount Ayr
<u>Water service:</u>	SIRWA from regional surface supplies	<u>Sewer service:</u>	Municipal
<u>Electric service:</u>	Alliant Energy	<u>Gas service:</u>	Alliant Energy to all properties
<u>Sanitation/solid waste:</u>	Municipal	<u>Landfill:</u>	WRD Landfill, 2 mi east of county line in Decatur Co.
<u>Phone and Internet:</u>	Windstream, Mediacom, wireless	<u>Law enforcement:</u>	Ringgold Co. Sheriff
<u>Fire service:</u>	Mount Ayr Fire Department	<u>Ambulance service:</u>	Ringgold County Hospital, Mount Ayr

**Mount Ayr School District Historical Context**

It is a rural district that was formed after re-organization in 1958. School consolidation is unlikely. The table below includes a brief enrollment history.

**Figure 2.48: Mount Ayr Enrollment Trends Data**

School Yr.	Facility	Enrollment	Facility	Enrollment	Facility	Enrollment	Total Enrollment
2012-13	Jr./Sr. High	265	Elementary	356	Family Resource Center	51	672
2013-14	Jr./Sr. High	273	Elementary	331	Family Resource Center	48	652
2014-15	Jr./Sr. High	281	Elementary	348	Family Resource Center	47	676
2015-16	Jr./Sr. High	281	Elementary	349	Family Resource Center	44	674
2016-17	Jr./Sr. High	293	Jr. High	342	Elementary	47	682

Sources: Iowa Department of Education, 7/2017

The enrollment has fluctuated modestly from year to year but the overall trend has been stable

**Mount Ayr Community Schools Physical Profile**

Each campus (Elementary and Middle/High School) contains outdoor playgrounds and athletic facilities, and a bus barn exists in Mount Ayr. The two district campus areas are approximately one block apart and are separated by residential areas.

For the purposes of this plan, the main focus is on the two main campus buildings and/or properties. The facilities include school instructional buildings, the administration building, the transportation center, playgrounds, athletic facilities, and parking areas. These facilities are subject to hazards that affect those areas within Mount Ayr where the school campus sites are located. The sites include approximately 40 acres of land. Buildings are brick and mortar but are not designed to withstand tornado-force winds, with the exception of a FEMA-funded tornado safe room added to the high school approximately five years ago with a capacity of roughly 500 people. The remaining buildings are designed to withstand normal high wind events, winter storms, lightning, and other hazards, and are built with fire suppression capabilities and are fully handicap accessible.

The middle/high school campus is located along the northeast fringe of Mount Ayr. Surrounding land uses include residential and city streets. The 30-acre campus includes 65% of the valuation and property of the District. There have been upgrades and expansions to the middle/high school in the past ten years, including the safe room. The Elementary School is located one block west of the High School and is surrounded on all sides by residential. The 10-acre campus has also experienced expansions and a new playground in the past few years. The Family Resource Center is a third part of the school campus and is located across the street to the north from the elementary school. This smaller building and playground occupy approximately 1 acre. This building is made of traditional “stick-built” construction with a partial concrete basement and houses the early childcare services.

#### ***Mount Ayr Community Schools Infrastructure, Services, and Resources***

The approximately 40 acres of District property is fully developed and managed through the District’s own taxing authority, State appropriations, and occasional grants and fees for service. Consequently, the District owns its own transportation facility with busses and other vehicles, campus road network, and roadway snow clearing facilities. Large parking areas and buildings create areas where storm water can accumulate, but surrounding ground handles most of the water on campus with no known flash flooding created that affects other properties. District staff members maintain property in order to reduce the risk of loss due to hazards.

Local city services, provided to the town of Mount Ayr also serve the school campus properties: paved public streets, public water, public sewer collection, electric power, natural gas energy, and other vital infrastructure.

City police, County communications, and local fire and EMS also serve the area. Warning sirens are near schools, and each main instructional building has an active weather radio system. The District is tied into the countywide emergency response system and has access to resources provided by the State of Iowa Department of Education.

*Existing mitigation resources.* The two main school buildings are designated as official certified emergency shelters, and they can and have been used during and after emergencies because of the firm building construction, adequate space for housing people, and kitchen facilities. The District does not have fixed or portable emergency generators, but all have fixed NOAA weather radios. Emergency power is supplied to the safe room part of the middle/high school. Students and staff participate in drills and educational programs related to hazards and the mitigation of them. No District facilities are designated as tornado safe rooms capable of withstanding 250 MPH winds, except the safe room part of the middle/high school. All buildings are located within a half mile of an outdoor warning siren. The District maintains its own equipment and supplies to maintain roads and walkways on campus.

*Budget and financial resources.* The fiscal year 2018 100% valuation for Mount Ayr School District was \$287 million total. In FY 2018, the District levied a tax rate of \$14.04399 for regular property for a total tax levy of \$3.8 million. The total budget for FY 2018 was \$10.2 million. A very small portion of the operating budget, an unspecified amount, is designated for mitigation activities.

#### ***Mount Ayr Community Schools NFIP Participation***

The Mount Ayr Community School District does not participate in the NFIP. The City of Mount Ayr does not participate either, despite SFHAs in parts of Mount Ayr. Newly completed FIRM maps, included in Appendix D of this plan, show no school district property within the SFHAs.

#### ***Complete, Underway, and Ongoing Mitigation Actions***

Numerous mitigation actions have been implemented or are now ongoing since the most recent plan update was adopted. The following table lists and describes actions listed in the previous plan for this jurisdiction.

**Figure 2.49: Status of Mount Ayr School’s Hazard Mitigation Actions Listed in the Previous Plan**

Action	Status	Notes and Results
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Action	Status	Notes and Results
Backup files and records – store electronically and in alternative location(s)	Not started	
Community drills (fire, tornado, lockdown, evacuation, ALICE training, etc.)	Ongoing	Planning process in place, drills performed regularly.
Construct public safe rooms in or near existing and future critical assets	Complete	At Middle/High School
Create/promote literature to reduce losses to property from wildlife	Not started	
Develop an electronic directory of local and regional mitigation resources	Not started	
Develop/implement an extreme heat event medical response plan	Not started	
Develop/implement a thorough recovery plan for power failure	Complete	
Emergency response guidebooks in key school vehicles	Complete	
Formally designate and stock school facilities as community shelters	Started	
Full review of policy, procedures, and codes	Ongoing	
Full sprinkler systems	Started	
Install and/or update anti-virus software	Ongoing	Updated as needed
Integrate tornado safe rooms into critical assets/facilities	Complete	At Middle/High School
NOAA Weather Radio program within school buildings	Complete	In use
Pave existing streets	Ongoing	As needed when disrepair occurs
Public educational campaign about hazards and risks	Not started	
Purchase needed emergency response equipment and communications	Started	
Rail and highway safety education program for students	Not started	
Remove asbestos from schools	Complete	
Remove dead vegetation	Ongoing	As needed; plan and staff in place
Remove unused chemical containers	Ongoing	As needed
Review/update hazardous materials emergency plan	Ongoing	When needed
Review/update school evacuation plan	Complete	In place and practiced
Tree planting projects on school property	Started	Continues annually as funds allow

The above list is not exhaustive as to all possible mitigation actions that could be or that were implemented but is inclusive of all those listed for new or carryover projects in the last update.

### ***Outlook and Future Development***

The District population and enrollment is likely to decline slowly, and in the future it is unlikely that new facilities will be needed. It is very unlikely that new facilities will be needed in the next five years. At best, total increase in enrollment might be up to 3% in the next five years, which would mean more people in the existing assets, buildings, and busses could be affected compared to today.

### **2.3: Planning Area Planning Status and Planning-related Capabilities**

Ringgold County has a paid county emergency management coordinator, who is in charge of countywide programs and operations related to mitigation planning. Other offices address hazard mitigation issues mainly as they pertain to emergency response or infrastructure. The County EM commission calls, at a minimum, quarterly meetings where issues are discussed and business is undertaken. Several jurisdictions participate by sending representatives to the voting board. Regular exercises and trainings are undertaken. The county coordinator acts as the contact between state and federal agencies and the local public and governments in the event of a disaster and has a key role in hazard mitigation planning. This office is in charge of mitigation, preparedness, response, and recovery. Once this plan is in place, and greater resources are provided to the county emergency management office, the capacity of the county to undertake mitigation actions should increase. Implementing the NIMS process, where local elected officials are educated about these issues, should increase interest and likely funding.

The Ringgold County Emergency Management Agency (EMA) is responsible for county emergency response policies and for preparing local emergency personnel for emergency response. This duty includes cooperation with the county board of supervisors, who are responsible for approving appropriate countywide efforts. The countywide leadership by the EMA has advanced the county in terms of mitigation planning and activities. The emergency management commission includes representatives from each city, a county Supervisor, and the county Sheriff's. The city governments and school approve local mitigation efforts in their respective jurisdictions.

The Ringgold County Emergency Management Coordinator states that the Agency offers several services for all natural disasters, including but not limited to: a) handling incident cleanup, b) requests for State declaration and equipment c) formal report submission when required by FEMA for a Presidential Declaration, and d) capturing photos and completing basic paperwork. Hazard mitigation coordination with various local entities and agencies is also part of the Coordinator's workload. The EMA is also the Homeland Security contact for the county and distributes important information from state and federal agencies to local officials and response agencies.

As outlined in the county’s EMA webpage, the EMA does the following:

- Develops and maintains the County's Comprehensive Emergency Management Plan, providing emergency management planning for the entire county;
- Operates, maintains and enhances the Ringgold County Emergency Operations Center (EOC);
- Coordinates emergency management activities, services and programs within the county, including: teaching people how to get through a disaster;
- Helps equip local first responders;
- Makes disaster assistance available to our communities, businesses, and individuals;
- Hosts trainings and emergency simulations, including yearly drills and spotter training;
- Serves as liaison to the State Department of Emergency Management and other local emergency management agencies and organizations; and
- Serves as the liaison and the coordinator of municipalities’ requests for State and Federal assistance during pre- and post-disaster operation.

Many mitigation activities and some mitigation planning topics, such as hazard identification, are addressed in the countywide emergency operations plan (EOP). Per the State policy, each county EMA must adopt and maintain a plan, and the EMA assists various cities to adopt local EOPs. These EOPs are being revised throughout to a new format, the Emergency Services Format (ESF). Yet, the basic functions of the EOP remain the same: to address the needs of emergency management and response. Some parts must be updated and submitted to the State of Iowa annually and other parts must be submitted periodically. Several topics in the EOP relate to hazard mitigation. One of them is the “mitigation plan” which is really a mini HARA with a hazard scoring system. Other topics addressed include: a) command and control, b) communications and warning, c) damage assessment, d) emergency public information, e) evacuation, f) fire and EMS services, g) health and medical, h) law enforcement, i) mass care, j) sheltering, k) public works and utilities, l) radiological incidents, m) resource management, n) human resources, o) search and rescue, p) hazardous materials, and q) terrorism. The EOP helps tie the various resources at the local, county, state, and federal level as to how they collaborate in the emergency management efforts.

The EOP was reviewed briefly as part of this HMP, but both plans are stand-alone documents and details from one plan are not necessarily translated into the other. Many of the planning and emergency response capabilities are addressed adequately in the EOP plan and its implementation by the EMA and local officials in individual jurisdictions. Through many trainings, exercises, and workshops, local officials have a good idea of what resources are available within and to the county to address local needs. Responsibilities and provider descriptions were sufficient for initial mitigation planning purposes. There appears to be sufficient division of duties and elected official oversight. Each section has preparedness and response checklists that can be used before, during, and after an incident and an incident command flow chart. The EOP is current and compliant with the State of Iowa.

The county addresses several hazards with other plans on a multi-jurisdictional level. For example, communications are addressed by a communications plans and by an E-911 board. The Local Emergency Planning Committee (LEPC) addresses hazardous materials. Local fire departments and State agencies monitor and inspect individual hazardous materials sites. State officials lead many hazard mitigation efforts and regulate facilities, such as the Iowa DOT handling transportation incidents, the Iowa DNR and Utilities Board handling pipelines and hazardous materials sites, and Iowa Dept. of Public Health handling disease incidents.

These other plans address the capabilities to implement the hazard mitigation plan, but they alone are not a hazard mitigation strategy. The EOP and other local plans are still necessary because not all hazards can be prevented, and response, recovery, and preparation are still needed.

The following table shows the current mitigation-related planning, staffing, and related capabilities in place for the jurisdictions in the planning area.

**Figure 2.50: Planning Status by Jurisdiction**

Capability	County	Benton	Diagonal	Ellston	Kellerton	Maloy	Mount Ayr	Tingley	Diagonal School	Mount Ayr School
	<i>Planning Status</i>									
Comprehensive or land use plan							2014			
Capital improvements plan							✓			✓

Capability	County	Benton	Diagonal	Ellston	Kellerton	Maloy	Mount Ayr	Tingley	Diagonal School	Mount Ayr School
Emergency Operations Plan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Recovery or reinvestment plan										
Existing FEMA HMP	✓	✓	✓	✓	✓	✓	✓	✓		
Economic development plan	Completed regionally through SICOG for the Federal EDA.									
Transportation plan	Completed regionally through ATURA Transportation Affiliation; some jurisdictions have own more detailed five-year plans.									
Flood Mitigation Assistance Plan							✓			
Watershed plan	✓									
Firewise or fire mitigation plan										
Strategic plan										
Wetlands and riparian areas conservation plan	✓									
Debris management plan	✓						✓			
<b><u>Ordinances and Policies</u></b>										
Zoning ordinance							✓			
Building code				In progress	✓		✓			
Floodplain ordinance										
Subdivision ordinance							✓			
Tree trimming ordinance							✓			
Nuisance ordinance			✓	✓			✓			
Storm water ordinance							✓			
Drainage ordinance										
Site plan review requirements										
Historic preservation ordinance										
Landscaping ordinance										
Snow and ice removal policies					✓	✓	✓			
<b><u>Programs and Certifications</u></b>										
Active planning/zoning board							✓			
Site design criteria in place										
NFIP Participation – non-delegated	✓	✓	No			No	No			
NFIP Community Rating System										
Hazard awareness program	✓			✓						✓
NWS Storm Ready							✓			
Building Code Effectiveness										
Grading										
ISO Fire Rating	✓	n/a	✓	✓	✓	n/a	✓	✓	n/a	n/a
Economic development program	✓									
Land use program	✓									
Property acquisition program										
Stream maintenance program	✓						✓			
Tree trimming program for public property							✓			✓
Mutual aid agreements in place	✓	n/a	✓	✓	✓	n/a	✓	✓	✓	✓
<b><u>Studies, Reports, and Maps</u></b>										
Flood insurance study and map(s)	This is completed and published by FEMA in 2016 and covers the entire county.									
Evacuation map/crisis plan									✓	✓
Critical facilities inventory *										
Vulnerable population inventory *										
Future land use map							✓			
Property Insurance policy/inventory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<b><u>Staff and Department</u></b>										
Transportation department							✓		✓	✓
Building code official or inspector				✓			✓		✓	✓
GIS mapping specialist	This is offered by third party organizations in the area and available countywide.									
Engineer	✓						✓			
Development planner										

Capability	County	Benton	Diagonal	Ellston	Kellerton	Maloy	Mount Ayr	Tingley	Diagonal School	Mount Ayr School
Public works official/facilities manager			✓		✓		✓		✓	✓
Emergency mgt. coordinator	This is offered by the County and available countywide.									
NFIP floodplain administrator	✓									
Bomb or arson squad										
Emergency response team	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Hazardous materials expert	This is offered by third party organizations in the area and available countywide.									
LEPC	This is offered by third party organizations in the area and available countywide.									
Emergency mgt. commission	This is offered by the County and available countywide.									
Sanitation department			✓	✓			✓			
Economic development department	This is offered by third party organizations in the area and available countywide.									
Housing department/commission	This is offered by third party organizations in the area and available countywide.									
Regional planning agency	This is offered by third party organizations in the area and available countywide.									
Historic preservation agency or commission										
Active participation in periodic training exercises	✓		✓							
NIMS compliant	✓	✓	✓	✓	✓	✓	✓	✓		
<b><i>Non-governmental Organizations (NGOs)</i></b>										
American Red Cross	✓					✓	✓			✓
Salvation Army										✓
Veterans group(s)	✓						✓			
Environmental organization(s)							✓			
Homeowners/neighborhood assoc.	✓									
Chamber of commerce							✓			
Development corporation	✓		✓				✓			
PTO or parental groups									✓	✓
Local utilities active in mitigation	✓	✓	✓	✓	✓	✓	✓	✓		
Community/civic group(s) active in mitigation					✓					
AmeriCorps VISTA or Citizen Corps volunteer program										✓
Retiree volunteer programs	This is offered by third party organizations in the area and available countywide.									

Source: Community surveys during the planning process \* Other than what is in this plan.

This chapter provides the basic community and planning area information necessary to identify and profile hazards and determine how those hazards affect the entire planning area and all jurisdictions within. The following chapters build on this information in the determination of the hazards that are of greatest concern to the jurisdictions participating in this plan.

## Chapter 3: Hazard Analysis and Risk Assessment

The second phase of the planning process is to develop a hazard analysis and risk assessment (HARA). This chapter evaluates the potential risks caused by various hazards that can affect Ringgold County. The use of historical data from numerous sources as well as various hazard analysis resources are used to predict future risk. Upon the analysis of this chapter, the following chapters provide a mitigation strategy for the participating jurisdictions over the next five years.

This chapter addresses the following statutory parts of the Stafford Act and parts of the mitigation planning process:

- Hazard identification
- Hazard Profile
- Risk assessment (assets at risk)
- Loss estimation
- Development trends (future properties at risk)

Hazard analysis and risk assessment answers the following fundamental question: What hazards can occur and what would happen if a hazard event occurred in your community? Hazard analysis and risk assessment is the process of measuring the potential loss of life, injury, economic loss, and property loss resulting from hazards. Further, risk assessment teaches us:

- The hazards to which your community is susceptible;
- What these hazards can do to physical, social, and economic assets;
- What areas are most vulnerable to damage from these hazards; and
- The resulting costs of damages or costs avoided through future mitigation activities.

The hazard analysis identifies potential hazards that could affect Decatur County and the various jurisdictions in the county for the purposes of mitigation planning. It is important to note the focus of mitigation is on reducing long-term risks of damage or threats to public health and safety caused by hazards and their effects. Thus, in some cases, the hazards identified for mitigation will not necessarily include all of or the same hazards identified for preparedness, response, or recovery.

The risk assessment identifies how people, properties, and structures will be damaged by the event. If the hazard can harm people or damage their homes and other structures, they are vulnerable. Finding the weak points in the system, for example, identifying building types that are vulnerable to damage and anticipating the loss in high risk areas will help the community decide what mitigation measure should be undertaken and how to implement the activities they select.

The purpose of a hazard analysis and risk assessment (HARA) is to identify and prioritize threats and hazards that pose risk to the health and safety of Ringgold County's citizens, property, and economy. This HARA both describes the methodology the State of Iowa entered into in developing the HARA and describes the hazards identified through the process along with their resulting priority rank.

### **Ringgold County Plan Update Changes to the Plan Structure**

The previous plan divided the topics of the risk assessment into numerous chapters. Upon review of other recently approved plans, it was determined that a new format was easier to read and follow. This plan incorporates the assets at risk into the profile for each hazard and makes it easier to follow the analysis. The risk assessment summary at the end of chapter breaks down the data into a format for each jurisdiction in more detail.

### **Ringgold County Plan Update Changes to the Data Process**

This plan includes a significant update to the data in the previous plan related to the risk assessment. Not only is the data updated, but also the process of collecting external and local data is significantly different. The plan makes thorough consideration of statewide data, as found in the State's latest mitigation plan. It also takes a more comprehensive approach in examining local data gathered from many sources.

The risk assessment for Ringgold 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 rationale for acceptance and elimination of hazards from further consideration;
- **Section 3.2 Assets at Risk** provides the planning area’s total exposure to hazards, considering critical facilities and other community assets at risk;
- **Section 3.3 Development Since Previous Plan Update** provides information relative to development that has occurred since the previous plan update for each jurisdiction;
- **Section 3.4 Future Land Use and Development** discusses areas of planned future development;
- **Section 3.5 Hazard Profiles and Vulnerability** analyzes each hazard and its effects. The methodology utilized to score or rank the hazards is outlined. 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 defines and quantifies populations, buildings, critical facilities, and other community assets at risk to natural hazards;
- **Section 3.6 Risk Assessment Summary** provides a tabular summary of the hazard ranking for each jurisdiction, an annual loss estimation, and a consequence analysis for the hazards that have potential impact on the planning area. This section also includes a series of risk assessment issue or problem statements.

### 3.1: Hazard Identification

In this section we identify the hazards that could affect Ringgold County and assess the relative risk to the county and its jurisdictions using various criteria. Before a community can assess the on-going mitigation activities, evaluate mitigation measures that should be undertaken, or outline a strategy for implementing mitigation projects, it must be aware of those hazards that, if they occur, could harm the community.

This part of the plan addresses the following Stafford Act requirement:

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

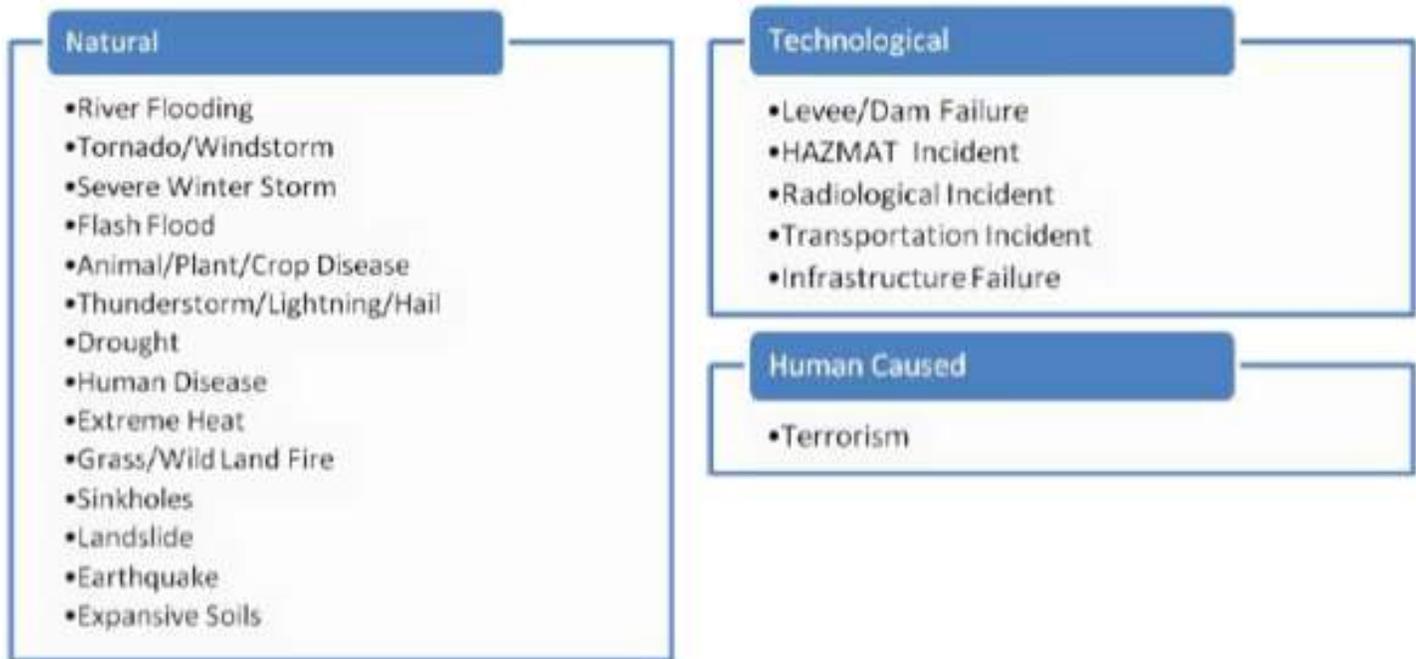
The State of Iowa Department of Homeland Security and Emergency Management (IHSEMD) has created a list of identified hazards that can occur in the State of Iowa. (Some of the FEMA identified hazards were not identified by the State, so those hazards are not considered for Ringgold County.) Such hazards include natural hazards, those that occur in nature, and non-natural (other) hazards, those that are technological or infrastructure-based, which may or may not be triggered by natural hazards. The local planning team involved in this update utilized the latest adopted and approved State of Iowa Plan (2013) to identify hazards. No hazards were removed from consideration or were added. The local planning team considered all natural hazards, as required by FEMA and the State, but also considered all “man-made” hazards because these hazards also cause damages to the county and, as much as possible, should be mitigated.

#### Ringgold County Plan Update Changes to the Hazard List

While the previous plan included 40 hazards that were used in the State plan at that time, this plan was condensed to 20 hazards. This is more concise and combines some hazards with similar levels and types of risk. Also, “wildlife” was not included in the update. Wildlife is a cause for other hazards on the list and is described accordingly.

The following graphic from the State’s plan helps the reader visualize the hazards to be considered.

**Figure 3.1: State of Iowa Hazard Mitigation Plan List of Hazards**



The following are the definitions for the 20 hazards considered in this plan, alphabetized:

- Animal/Crop/Plant Disease: An outbreak of disease transmitted from animal to animal or plant to plant.
- Dam and Levee Failure: The uncontrolled release of water resulting from a structural failure in a dam, wall, dike, berm, or area of elevated soil that causes flooding.
- Drought: A period of prolonged abnormally low precipitation producing severe dry conditions.
- Earthquake: Any shaking or vibration of the earth caused by the sudden release of energy that may impose a direct threat on life and property.
- Expansive Soils: Soils and soft rock that tend to swell or shrink excessively due to changes in moisture content.
- Extreme Heat: Summertime weather that is substantially hotter and/or more humid than average for a location at that time of year.
- Flash Flood: Any event when water levels rise at an extremely fast rate with little or no warning.
- Grass or Wildland Fire: An uncontrolled fire that threatens life and property in a rural or wooded area.
- Hazardous Materials Incident: An accidental release of flammable or combustible, explosive, toxic, noxious, corrosive, oxidizable, irritant, or radioactive substances or mixtures that can pose a risk to life, health, or property, possibly requiring evacuation.
- Human Disease: An incident defined as a medical, health, or sanitation threat to the general public, including contamination, epidemics, plagues, or infestations.
- Infrastructure Failure: An extended interruption, widespread breakdown, or collapse (part or all) of any public or private infrastructure that threatens life and property.
- Landslide: Incident when susceptible rock, earth, or debris moves down a slope under the force of gravity or water.
- Radiological: An occurrence resulting in a release of radiological material at a fixed facility or in transit.
- River Flood: A rising or overflowing of a tributary or body of water that covers adjacent land not usually covered by water when the volume of water in a stream exceeds the channel's capacity.
- Severe Winter Storm: Severe winter conditions including blizzard conditions, heavy snow, blowing snow, freezing rain, heavy sleet, and extreme cold/wind chills that can affect day-to-day activities and can cause fatalities and property damage.
- Sinkhole: The loss of surface elevation due to the removal of subsurface support.
- Terrorism: The use of multiple outlets to 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.

- Thunderstorm/Lightning/Hail: Atmospheric imbalance and turbulence that may result in thunder, heavy rains (which may cause flash flooding), and strong winds reaching or exceeding 58 mph resulting in tornadoes, or surface hail of at least 1 inch in diameter, and lightning; any storm that produces hail of at least 1” in diameter.
- Tornado/Windstorm: A high wind event involving either widespread straight-line winds of at least 64 knots/73 MPH (windstorm) or a violent whirling wind characteristically accompanied by a funnel shaped cloud extending down from a cumulonimbus cloud in a narrow, erratic path (tornado).
- Transportation Incident: An accident involving any mode of transportation that directly threatens life, property damage, injury, or adversely impacts a community’s capabilities to providing emergency services.

Please note that the above definitions have changed slightly in many cases and significantly in some cases since the original Ringgold County HMP was approved in 2013. The following table shows these how hazards were combined, modified, and otherwise changed.

**Figure 3.2: Comparison of Previous and Update Plan Hazard Lists**

Previous Plan Hazard	Previous Plan Type	Update Plan Hazard	Update Plan Type
Animal/crop/plant disease	“Man-made”	Animal/plant/crop disease	Natural
Dam failure	Natural	Dam/levee failure	Technological
Levee failure	Natural		
Drought	Natural	Drought	Natural
Earthquake	Natural	Earthquake	Natural
Expansive soils	Natural	Expansive soils	Natural
Extreme heat	Natural	Extreme heat	Natural
Flash flood	Natural	Flash flood	Natural
Grass and wildland fire	Natural	Grass and wildland fire	Natural
Fixed hazardous materials incident	“Man-made”	Hazardous materials incident	Technological
Pipeline transportation incident	“Man-made”		
Transportation hazardous materials incident	“Man-made”		
Human disease incident	“Man-made”	Human disease	Natural
Human disease pandemic	“Man-made”		
Communications failure	“Man-made”	Infrastructure failure	Technological
Energy failure	“Man-made”		
Structural failure	“Man-made”		
Structural fire	“Man-made”		
Landslide	Natural	Landslide	Natural
Fixed radiological incident	“Man-made”	Radiological	Technological
Transportation radiological incident	“Man-made”		
River flood	Natural	River flood	Natural
Severe winter storm	Natural	Severe winter storm	Natural
Sinkhole	Natural	Sinkhole	Natural
Agro-terrorism	“Man-made”	Terrorism	Human caused
Bioterrorism	“Man-made”		
Chemical terrorism	“Man-made”		
Conventional terrorism	“Man-made”		
Cyber terrorism	“Man-made”		
Enemy attack	“Man-made”		
Public disorder	“Man-made”		
Radiological terrorism	“Man-made”		
Hailstorm	Natural	Thunderstorm/Lightning/Hail	Natural
Thunderstorm/Lightning	Natural		
Tornado	Natural	Tornado/Windstorm	Natural
Windstorm	Natural		
Air transportation incident	“Man-made”	Transportation incident	Technological
Highway transportation incident	“Man-made”		
Rail transportation incident	“Man-made”		
Waterway/water body incident	“Man-made”		
Wildlife (not part of Iowa Mitigation Plan)	Natural		

**Ringgold County Presidential Disaster Declaration History, 1970-August 2017**

Information utilized to identify hazards relevant for Ringgold County 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.

The following table provides basic information about past disaster declarations that included the county. Since 1970, there have been thirteen declarations. Approximately a quarter of those made in Iowa have included Ringgold County.

**Figure 3.3: Iowa Presidential Declarations Including Ringgold County**

Declaration #	Declared	Type	Description
4181	7/14/2014	Public Assistance	Severe Storms, Tornadoes, Straight-line Winds, and Flooding
4119	5/31/2013	Public Assistance	Severe Storms, Straight-line Winds, and Flooding
1930	7/29/2010	Individual and Public Assistance	Severe Storms, Flooding, and Tornadoes
1880	3/2/2010	Public Assistance	Severe Winter Storms
1763	5/27/2008	Individual and Public Assistance	Severe Storms, Tornadoes, Flooding
1737	1/4/2008	Public Assistance	Severe Winter Storm
1705	5/25/2007	Public Assistance	Severe Storms, Flooding, and Tornadoes
3239	Sept. 2005	Emergency declaration	Hurricane Katrina Evacuation
1518	5/25/2004	Individual and Public Assistance	Severe Storms, Tornadoes, and Flooding
1121	6/24/1996	Public Assistance	Flooding
996	7/9/1993	Individual and Public Assistance	Flooding, Severe Storm
965	10/2/1992	Public Assistance	Flooding, Severe Storm
928	12/26/1991	Public Assistance	Ice Storm
354	9/26/1972	Public Assistance	Severe Storms, Flooding

Source: Federal Emergency Management Agency, [www.fema.gov](http://www.fema.gov), August 2017

Since 1964, Ringgold County has had an average to below average number of Presidential declarations for the county size and population area.

Obviously, the types of hazards that can affect Ringgold County include all those in which FEMA assistance was given, but many other hazards have occurred and affected the county.

Interestingly, when a report is run of National Climatic Data Center (NCDC) data from January 1, 2010 through May 30, 2017, we find the following data:

- 64 days with storm events
- 1 day with an event that caused a death
- 1 day with an event that caused an injury
- 36 days with events that caused property damage
- 13 days with events that caused crop damage
- 16 types of events reported.

**Recent FEMA Public Assistance History**

The IHSEMD provided information about recent public assistance awards. The following table shows some of the awards made.

**Figure 3.4: Ringgold County Public Assistance History**

Jurisdiction	Grant #	Projects (# total)	Amount	Year
Ringgold Co. Secondary Roads	1705	Roads, bridges, debris removal, emergency protection measures (11)	\$112,153.93	2007
Ringgold Co. Secondary Roads	1737	emergency protection measures (1)	\$25,848.09	2008
Ringgold Co. Secondary Roads	1763	Roads, bridges, debris removal, culverts (59)	\$3,075,791.75	2008
Ringgold Co. Secondary Roads	1930	Roads, bridges, culverts (33)	\$2,423,111.48	2010
Ringgold Co. Secondary Roads	4119	Roads, bridges, debris removal, culverts (10)	\$691,187.26	2013
Ringgold Co. Secondary Roads	4181	Roads and culverts (2)	\$543,306.61	2014
Ringgold County	1737	Donated resources, emergency protective measures, public buildings and facilities (3)	\$11,487.61	2009
Ringgold Co. Conservation Bd.	1705	Roads and bridges (1)	\$4,039.57	2008
Ringgold Co. Conservation Bd.	1737	Debris removal, recreational facilities (2)	\$17,673.01	2009
Beaconsfield	1737	Public buildings and facilities (1)	\$1,641.00	2008
Beaconsfield	1763	Roads (1)	\$1,376.00	2009
Beaconsfield	1930	Roads (1)	\$2,557.94	2013
Benton	1705	Roads and bridges (1)	\$1,250.67	2008
Benton	1737	Debris removal (1)	\$1,365.00	2009

Jurisdiction	Grant #	Projects (# total)	Amount	Year
Benton	1763	Roads, culverts (4)	\$26,815.96	2011
Benton	1930	Roads (1)	\$2,138.65	2012
Benton	4181	Culvert, roads (2)	\$21,253.00	Open
Diagonal	1737	Debris removal (1)	\$3,861.00	2009
Diagonal	1763	Culverts, roads, pumps, ditch (5)	\$26,851.62	2009
Diagonal	1930	City streets and parks (2)	\$26,793.03	2012
Ellston	1737	Debris removal (1)	\$1,837.00	2009
Kellerton	1737	Debris removal and donated resources (2)	\$6,243.31	2010
Kellerton	1930	City park and road (1)	\$1,930.37	2012
Kellerton	4119	Culvert and ditch (1)	\$2,693.91	2015
Maloy	1763	Roads and culverts (1)	\$2,431.42	2012
Maloy	1930	Road damage (1)	\$2,430.00	2012
Maloy	4181	Road and culvert (1)	\$11,618.47	2015
Mount Ayr	1737	Debris removal, roads and bridges, public buildings, emergency protective measures (4)	\$71,782.06	2008
Mount Ayr	1763	Roads, culverts, spillway (4)	\$22,105.73	2009
Mount Ayr	1930	Bridge and spillway, roads, park (3)	\$31,038.13	2012
Mount Ayr	4119	Road, ditch, and culvert damage (2)	\$5,527.27	2016
Redding	1737	Debris removal (1)	\$2,163.00	2009
Redding	4181	Road damage (1)	\$3,019.77	2016
Tingley	1705	Public utilities, roads and bridges (2)	\$6,030.02	2007
Tingley	1737	Debris removal (1)	\$3,116.38	2008
Tingley	1763	Debris removal, road (2)	\$2,762.78	2009
Diagonal School District	1763	Building repair (1)	\$8,233.56	2010
Mount Ayr School District	1737	Debris removal, public buildings and facilities (2)	\$9,522.80	2008
Mount Ayr School District	1763	Rain and wind damage to roof (1)	\$29,662.08	2010
Ringgold County Hospital	1737	Public buildings and facilities (1)	\$5,055.07	2009
Ringgold County Hospital	1763	Paging system (1)	\$1,141.00	2011

Source: Iowa Homeland Security and Emergency Management Department, August 2017

“FEMA and the Federal Government cannot vouch for the data or analyses derived from these data after the data have been retrieved from the Agency's website(s) and/or Data.gov.”

From Disaster #996 moving through the current time (nearly twenty years), there have been 176 projects involving \$7,250,847.31 in eligible funds in Ringgold County. As the above table shows, most of the losses have occurred in the past ten years, with 2008 the most significant disaster year involving State/FEMA funds. Note that this only includes Public Assistance and does not consider losses to households and businesses and on private property (Individual Assistance and private pay, such as insurance and owners).

### Recent FEMA Individual Assistance History

The IHSEMD provided information about recent individual assistance awards. The following table shows some of the awards made.

**Figure 3.5: Ringgold County Individual Assistance and SBA Loan History**

Jurisdiction	Grant #	Type of Award (# of Awards)	Amount	Year
Ringgold County (unspecified)	1763	Individual Assistance (10)	\$260,967.14	2008
Ringgold County (unspecified)	1930	Individual Assistance (12)	\$253,985.33	2010
Ringgold County (unspecified)	1763	Small Business Administration (1)	\$13,900.00	2008
Ringgold County (unspecified)	1930	Small Business Administration (3)	\$82,400.00	2010

Source: Iowa Homeland Security and Emergency Management Department, August 2017

“FEMA and the Federal Government cannot vouch for the data or analyses derived from these data after the data have been retrieved from the Agency's website(s) and/or Data.gov.”

From Disaster #996 moving through the current time (nearly twenty years), there have been 26 awards involving \$611,252.47 in eligible funds in Ringgold County. As the above table shows, most of the losses have occurred in the past ten years, with 2010 the most significant year involving State/FEMA and SBA funds. Note that this only includes Individual Assistance and does not consider losses to local governments and on public property (Public Assistance and funded by taxpayers).

### Identification of Hazards by Ringgold County Jurisdiction

The following table shows the hazards that have occurred, can occur but are not reported, and cannot occur by jurisdiction. These results are based on research and planning team comments.

## Ringgold County Plan Update Changes to the Identified Hazards

The planning team provided information on new hazard events that resulted in changes to the list of hazards that have occurred since that time. Some changes in definitions have also resulted in a new understanding of what hazards have occurred. Also, the list of jurisdictions considered includes only those who participated in the plan from the beginning.

**Figure 3.6: Hazard Identification by Jurisdiction**

Hazard	Rural County	Benton	Diagonal	Ellston	Kellerton	Maloy	Mount Ayr	Tingley	Diagonal School	Mount Ayr School
Animal/plant/crop disease	Has	Can	Can	Can	Can	Can	Has	Can	Can	Can
Dam/levee failure	Can	Cannot	Can	Cannot	Cannot	Cannot	Can	Cannot	Cannot	Cannot
Drought	Has	Has	Has	Has	Has	Has	Has	Has	Has	Has
Earthquake	Can	Can	Can	Can	Can	Can	Can	Can	Can	Can
Expansive soils	Has	Can	Can	Has	Has	Has	Has	Has	Can	Can
Extreme heat	Has	Has	Has	Has	Has	Has	Has	Has	Has	Has
Flash flood	Has	Has	Has	Has	Has	Has	Has	Can	Can	Has
Grass and wildland fire	Has	Can	Has	Has	Can	Can	Can	Can	Can	Cannot
Hazardous materials incident	Has	Can	Can	Can	Can	Can	Has	Can	Can	Can
Human disease	Has	Has	Has	Has	Has	Has	Has	Has	Has	Has
Infrastructure failure	Has	Has	Has	Has	Has	Has	Has	Has	Has	Has
Landslide	Has	Cannot	Can	Cannot	Cannot	Cannot	Can	Cannot	Cannot	Cannot
Radiological	Can	Cannot	Cannot	Cannot	Can	Cannot	Can	Cannot	Cannot	Can
River flood	Has	Has	Has	Cannot	Cannot	Has	Has	Cannot	Cannot	Cannot
Severe winter storm	Has	Has	Has	Has	Has	Has	Has	Has	Has	Has
Sinkhole	Has	Can	Can	Can	Can	Can	Can	Can	Can	Can
Terrorism	Yes	Can	Can	Can	Can	Can	Yes	Can	Can	Can
Thunderstorm/Lightning/Hail	Has	Has	Has	Has	Has	Has	Has	Has	Has	Has
Tornado/Windstorm	Has	Has	Has	Has	Has	Has	Has	Has	Has	Has
Transportation incident	Has	Can	Can	Has	Can	Can	Has	Can	Can	Can

Note: hazards that can occur near the boundaries of the city and county can flow over the boundaries involved. Even if not listed, for example, grass and wildland in a given city, the impacts of a hazard occurring just outside of town may impact the city.

Of the above 20 hazards, all of them can occur somewhere in the county and most of them have occurred in one or more jurisdictions. The hazard profile section details these hazards and includes a discussion of any that are not profiled in detail because the risk is extremely limited or because there is no or very little history of damage from the hazard in the planning area.

### 3.2: Assets at Risk

Step 3 of the HARA process involves the assessment of risk to the assets in the county’s jurisdictions. The assessment of risks includes an analysis of how each hazard affects: a) populations, b) structures, and c) land. Of notable interest is the impact on essential facilities, which are those facilities that are to be the target of potential mitigation projects because of the risk caused by hazards and importance to the community. The vulnerability assessment includes at a minimum: 1) assessment of each hazard and how it impacts the community, 2) types of structures and populations at risk, 3) the impact on future development, and 4) estimation of losses.

The data in this section is based on the best available or, in the absence of qualified data, estimated data. Data sources included the 2013 Iowa Hazard Mitigation Plan, US Census Bureau, local officials, Iowa Homeland Security and Emergency Management, Iowa DNR, the previous Ringgold County HMP, and other agencies and sources as cited.

This part of the plan addresses the following Stafford Act requirements:

- Section 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.**
- Section 201.6 (c)(iii): For multi-jurisdictional plans, the risk assessment section must assess each jurisdiction’s risks where they vary from the risks facing the entire planning area.**

This remainder of this chapter is organized into several parts related to the topic of assets at risk:

- Description and itemization of assets at risk;
- Assets at risk by hazard (for geographically specific hazards);
- Summary of development and new risks since the original plan was adopted;
- Estimation of future assets at risk and future growth; and

- General description of vulnerability.

### Ringgold County Plan Update Changes in Assets at Risk

In this update, the planning team focused on the hazards that have been identified as presenting the greatest concern to the county. Some new ways of analyzing these hazards have been incorporated along with an update of the quantitative impacts to properties, property values, and populations. Also, this new plan is organized quite differently than the existing plan, organized by hazard and then by jurisdiction.

**Figure 3.7: Risk Graphic**



Note: Modified from U.S. Geological Survey and Oregon Partnership for Disaster Resilience Models.

This chapter addresses the convergence of hazards with the structures, properties, and people that are in the area where hazards occur. The following illustrates this concept, calling risk the potential for loss due to the hazards interacting with assets. While this illustration is for natural hazards, it can apply to all kinds.

DMA 2000 calls for the determination of the assets at risk for various hazards, both hazards that can affect all assets and those that can affect only certain areas. The following tables show asset data by jurisdiction in the planning area. In the hazard profile section of this chapter are breakdowns of assets at risk to specific hazards.

FEMA requires that assets at risk are described in two ways, as outlined under the following headings.

#### Description of Assets at Risk By Structure/Land Use:

This assessment includes a summary of each hazard’s potential impact on the multiple jurisdictions’ vulnerable structures and properties. The following pages detail the estimated impacts of each hazard event on the assessed valuation of each property category, including infrastructure and government buildings. These estimates are not losses. Rather, this section covers the percentage of structures and the population *that can be* impacted negatively by the hazard, from minimal to total loss.

Notes for tables in this section:

- Estimated value is based on County Assessor data when possible, directly from the source when available, and from HAZUS when available
- Number of people is the total population, estimate during peak business hours, or facility census, as relevant. It will usually vary from the Census population because it takes in consideration the maximum regular population in each category.
- Taxable infrastructure includes private utilities, gas and electric, and railroads
- Government/institutional facilities are government facilities, schools, non-profit organizations, churches, parks/recreation, public roadways as a whole, and land used for public and non-profit purposes.

#### Description of Critical Assets:

The planning team used existing resources and FEMA “Understanding Your Risks” worksheets to determine what should be included as locally identified essential assets and lifeline utilities and transportation systems. Numerous tables in this chapter detail the assets. The values used in the tables provided from local data sources, where available, and the remaining values are estimated. The consultant worked with the planning team and others to determine approximate values. The team relied upon tables in the “Understanding Your Risks” and HAZUS as much as possible.

The following are the types of facilities and assets that the planning team defined as critical:

- Economic assets: Major employers that do not fall into the other critical asset categories but have a transformative nature on the local economy.
- Essential facilities: Those essential for the health and welfare of the whole population and are vital during and after hazard events. They include hospitals, medical facilities, police and fire stations, EOCs, schools, colleges, and shelters.
- Essential transportation systems: Those essential for the transportation of the emergency supplies to and within the community and evacuation from it.
- Lifeline utility systems: Those essential for basic public health and economic recovery, such as potable water, wastewater collection, gas pipelines, electric power systems, and central communications.

- High potential loss facilities: Those that would have a high loss associated with them, such as nuclear power plants, dams, large universities, and military installations. (None exist in Ringgold County)
- Vulnerable population centers: housing and other facilities that normally contain vulnerable populations, such as small children, elderly, disabled, or those that need other medical care. They might include nursing homes, senior apartments, childcare facilities, preschools, group homes, and mobile home parks.
- Historical and cultural resources: Those are historic and cultural facilities, landmarks, and other assets that create a sense of place and are important to the quality of life in the community.

**Rural Ringgold County Assets at Risk**

The following table shows the potential properties and populations affected by the various hazards listed here.

**Figure 3.8: Rural Ringgold County Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	870	\$205,383,799	2,365	100%
Commercial	25	\$4,582,748	35	100%
Industrial	5	\$503,816	50	100%
Ag Structures and Land	500 buildings; 270,000 acres	\$301,672,514	75	100%
Taxable Infrastructure	10	\$24,225,167	10	100%
Government/Institutional	15	\$200,000,000	100	100%
<b>Totals</b>	<b>1,425</b>	<b>\$736,368,044</b>	<b>2,635</b>	<b>100%</b>

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

As this table shows, 2,365 residents live in rural areas, according to the 2010 Census, and nearly 300 people are in or using other rural area assets at a given time. The total valuation of the rural area assets in approximately 1,425 properties exceeds \$736 million dollars, it is estimated.

The following table shows the current list of locally identified critical assets in the rural part of the county.

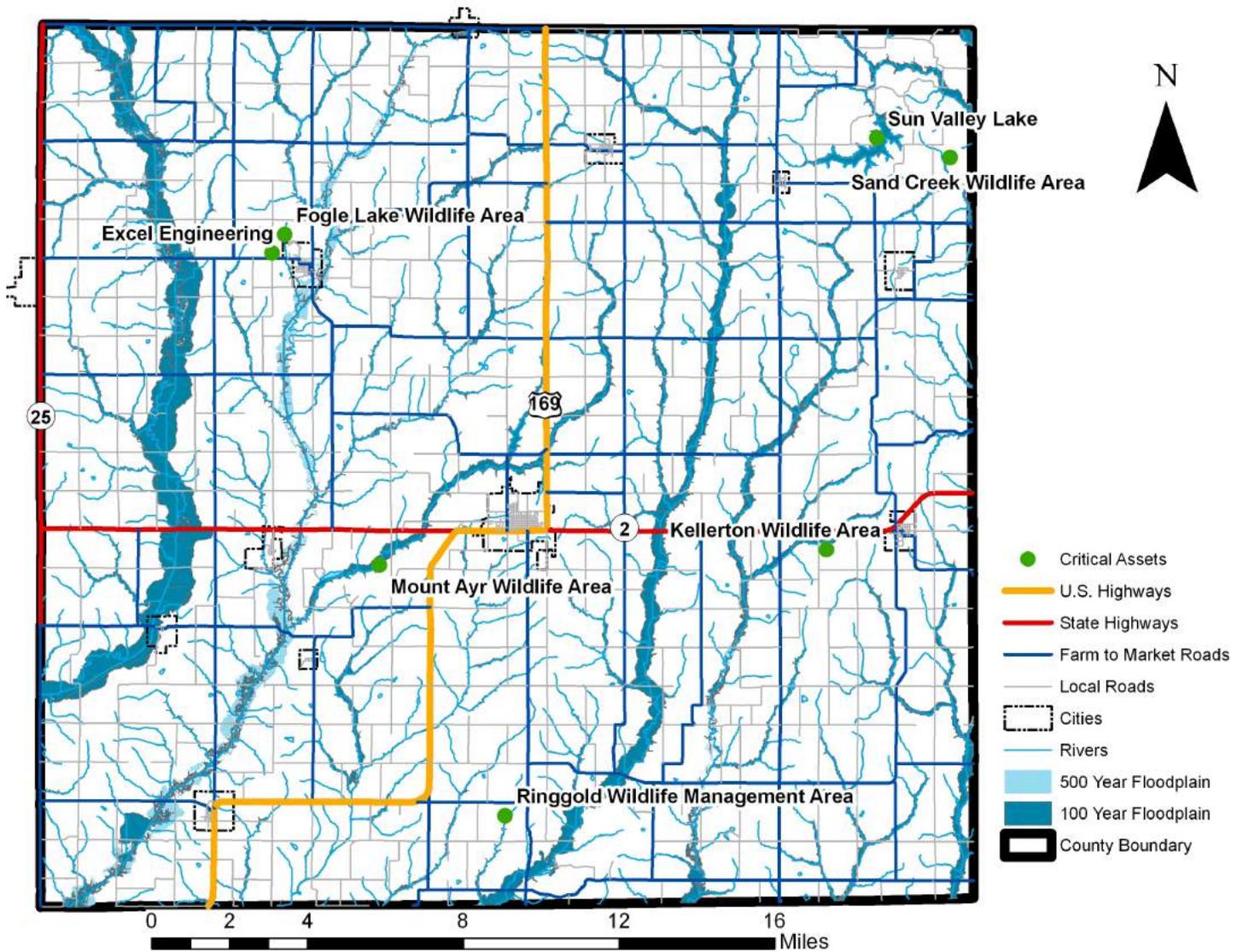
**Figure 3.9: Rural Ringgold County Critical Assets**

Facility	Location	Primary Type	Size	Replacement Value	Contents Value	Functional Use Value (\$)	Displacement Cost (\$/day)	Occupancy, Capacity (#)
Cell Towers (7)	Various	Critical facility	1 ac	\$5 M	\$2 M	\$2 M	\$1,000	--
Dragoon Trace	2 miles east of Mt. Ayr	Vulnerable pop.	5,000 SF	\$2 M	\$1 M	\$200 K	\$2,000	50
Nature Center	Ayr							
Electrical Substations	Various	Critical facility	1 ac	\$2 M	\$1 M	\$1 M	\$5,000	2
Excel Engineering	1587 160 <sup>th</sup> Avenue, Diagonal	Economic asset	15,000 SF	\$200 K	\$100 K	\$100 K	\$1,000	20
Gavilon Agricultural Services LLC	2401 County Highway P 27	Economic asset	20,000 SF	\$2 M	\$1 M	\$1 M	\$3,000	25
Mount Ayr Fish Hatchery	2 mi N of Mount Ayr	Special consideration	5 ac	\$5 M	\$2 M	\$500 K	\$1,000	10
Ramsey Farm at Lesanville	Highway 2 five mi east of Mt. Ayr	Historical/cultural	5 ac	\$3 M	\$1.5 M	\$1 M	\$1,000	150
Sun Valley Lake	2 mi NE of Elliston	Vulnerable pop.	500 ac	\$25 M	\$500 K	\$5 M	\$7,000	--
Sun Valley Sewer Lagoons	County Road J20	Critical facility	20 ac	\$3 M	\$100 K	\$500 K	\$5,000	--
Water Towers	Various	Critical facility	1 ac	\$10 M	\$1 M	\$5 M	\$5,000	--
Wildlife and Park Areas (4)	Various	Vulnerable pop.	600 ac	\$100 K	\$50 K	\$50 K	\$2,500	50

Sources: planning team, FEMA Understanding Your Risks, Ringgold County Assessor’s data, IDOT

The map on the following page shows the rural Ringgold County critical assets as listed in the above table.

**Figure 3.10: Rural Ringgold County Map of Critical Assets**



**City of Benton Assets at Risk**

The following table shows the potential properties and populations affected by the various hazards listed here.

**Figure 3.11: Benton Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	18	\$882,801	41	100%
Commercial	1	\$16,080	5	100%
Industrial	0	\$0	0	100%
Ag Structures and Land	1 buildings; 300 acres	\$333,607	1	100%
Taxable Infrastructure	1	\$110,908	1	100%
Government/Institutional	2	\$2,000,000	5	100%
Totals	23	\$3,343,396	53	100%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

As this table shows, 41 residents live in Benton, according to the 2010 Census, and nearly 12 people are in or using other city of Benton assets at a given time. The total valuation of the assets in 23 properties exceeds \$3 million dollars, it is estimated.

The following table shows the current list of locally identified critical assets in the city of Benton.

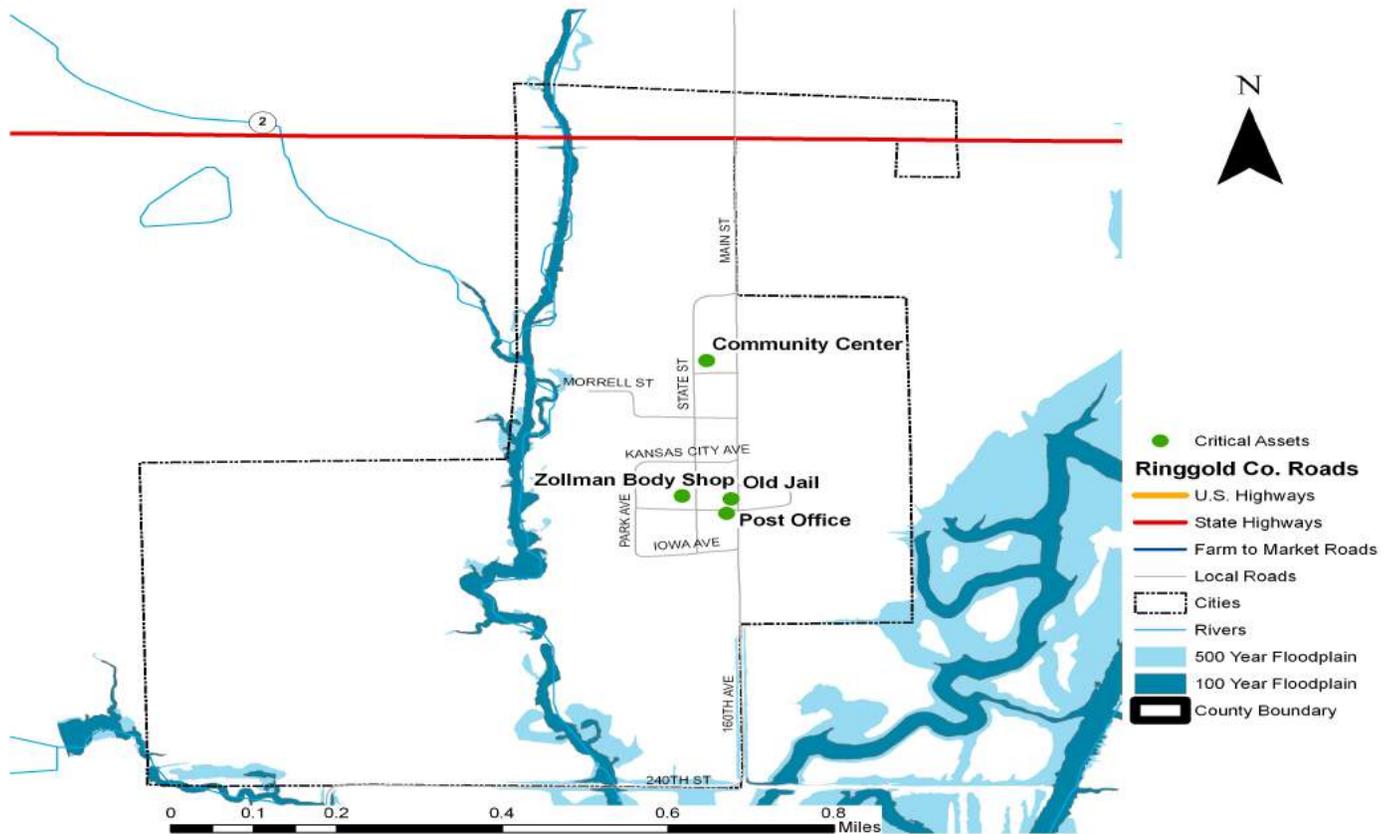
**Figure 3.12: Benton Critical Assets**

Facility	Location	Primary Type	Size	Replacement Value	Contents Value	Functional Use Value (\$)	Displacement Cost (\$/day)	Occupancy, Capacity (#)
Old Jail/City Building	Central city	Critical asset	250 SF	\$100 K	\$10,000	\$25,000	\$25	20
Community Center	Central city	Vulnerable populations	1,000 SF	\$100 K	\$25,000	\$25,000	\$25	15
Post Office	Central city	Critical asset	500 SF	\$50 K	\$25,000	\$25,000	\$50	10
Zollman Body Shop	Central city	Economic asset	1,000 SF	\$50 K	\$30,000	\$25,000	\$250	15

Sources: planning team, FEMA Understanding Your Risks, Ringgold County Assessor’s data, IDOT

The following map shows the city of Benton critical assets as listed in the above table.

**Figure 3.13: Benton Map of Critical Assets**



**City of Diagonal Assets at Risk**

The following table shows the potential properties and populations affected by the various hazards listed here.

**Figure 3.14: Diagonal Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	119	\$4,291,752	330	100%
Commercial	10	\$1,013,232	25	100%
Industrial	2	\$174,212	15	100%
Ag Structures and Land	2 buildings; 250 acres	\$1,295,200	1	100%
Taxable Infrastructure	2	\$884,891	2	100%
Government/Institutional	6	\$10,000,000	150	100%
Totals	141	\$17,659,287	523	100%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

As this table shows, 330 residents live in Diagonal, according to the 2010 Census, and nearly 200 people are in or using other city of Diagonal assets at a given time. The total valuation of the assets in 141 properties exceeds \$17 million dollars, it is estimated.

The following table shows the current list of locally identified critical assets in the city of Diagonal.

**Figure 3.15: Diagonal Critical Assets**

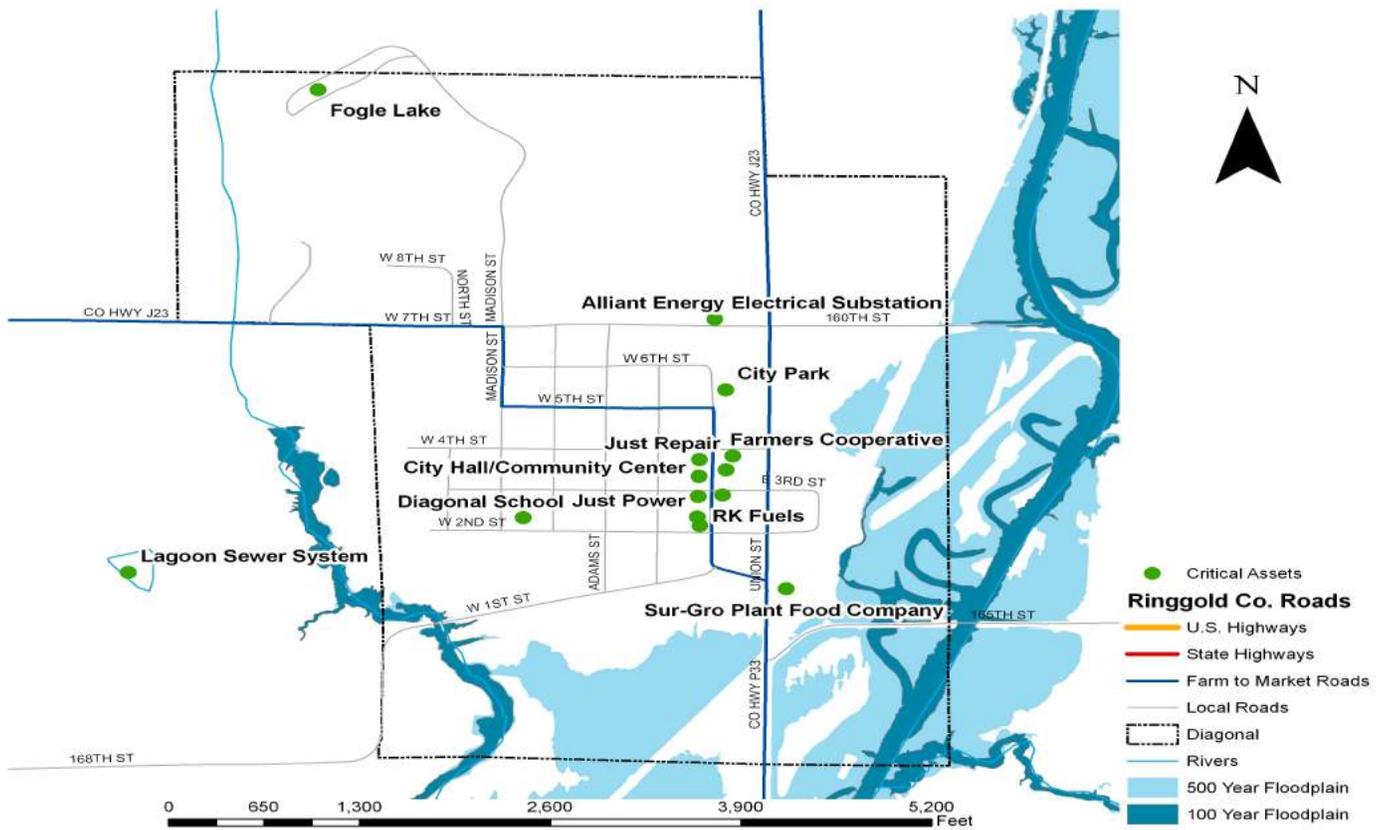
Facility	Location	Primary Type	Size (SF)	Replacement Value	Contents Value	Functional Use Value (\$)	Displacement Cost (\$/day)	Occupancy, Capacity (#)
Alliant Energy Substation	Edge of Diagonal	Critical facility	1,000	\$750 K	\$700 K	\$250 K	\$1,500	3
City hall/community center *	308 Broadway	Critical facility	5,000	\$350 K	\$100 K	\$100 K	\$750	150
City Park	500 Broadway	Vulnerable population	500 SF, 3 acres	\$75 K	\$50 K	\$50 K	\$250	50
City water tower	500 Broadway	Critical facility	--	\$500 K	\$50 K	\$150 K	\$1,000	--
Diagonal Building Products	309 Broadway	Economic asset	3,500	\$200 K	\$200 K	\$150 K	\$1,000	30
Diagonal School (4 buildings) *	403 West, 2 <sup>nd</sup> St.	Vulnerable population	30,000	\$7 M	\$2.5 M	\$1 M	\$2,500	200
Diagonal sewer system	SW corner of town	Critical asset	5 acres	\$1 M	\$0	\$100 K	\$5,000	--
Diagonal Volunteer Fire Dept.	2 <sup>nd</sup> St.	Critical facility	20,000	\$1 M	\$750 K	\$100 K	\$500	45
Farmer’s Co-op	317 Broadway	Economic asset	2,000	\$250 K	\$250 K	\$100 K	\$500	3
Fogle Lake – campground, shelter, shower house	NW corner of city	Vulnerable population	5,000 SF, 200 acres	\$5 M	\$1 M	\$250 K	\$2,000	250
Iowa State Savings Bank	223 Broadway	Economic asset	2,500	\$100 K	\$100 K	\$100 K	\$500	35
RK Fuels	301 Broadway	Economic asset	5,000	\$150 K	\$150 K	\$150 K	\$600	35
U.S. Post Office	221 Broadway	Critical facility	1,500	\$200 K	\$50 K	\$100 K	\$1,000	15

Sources: planning team, FEMA Understanding Your Risks, Ringgold County Assessor’s data, IDOT

\* locally designated shelter

The following map shows the city of Diagonal critical assets as listed in the above table.

**Figure 3.16: Diagonal Map of Critical Assets**



**City of Ellston Assets at Risk**

The following table shows the potential properties and populations affected by the various hazards listed here.

**Figure 3.17: Ellston Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	18	\$509,712	43	100%
Commercial	2	\$203,473	10	100%
Industrial	0	\$0	0	100%
Ag Structures and Land	5 buildings; 150 acres	\$159,900	2	100%
Taxable Infrastructure	1	\$120,162	1	100%
Government/Institutional	3	\$3,000,000	6	100%
Totals	29	\$3,789,977	62	100%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

As this table shows, 43 residents live in Ellston, according to the 2010 Census, and nearly 20 people are in or using other city of Ellston assets at a given time. The total valuation of the assets in 29 properties exceeds \$3.7 million dollars, it is estimated.

The following table shows the current list of locally identified critical assets in the city of Ellston.

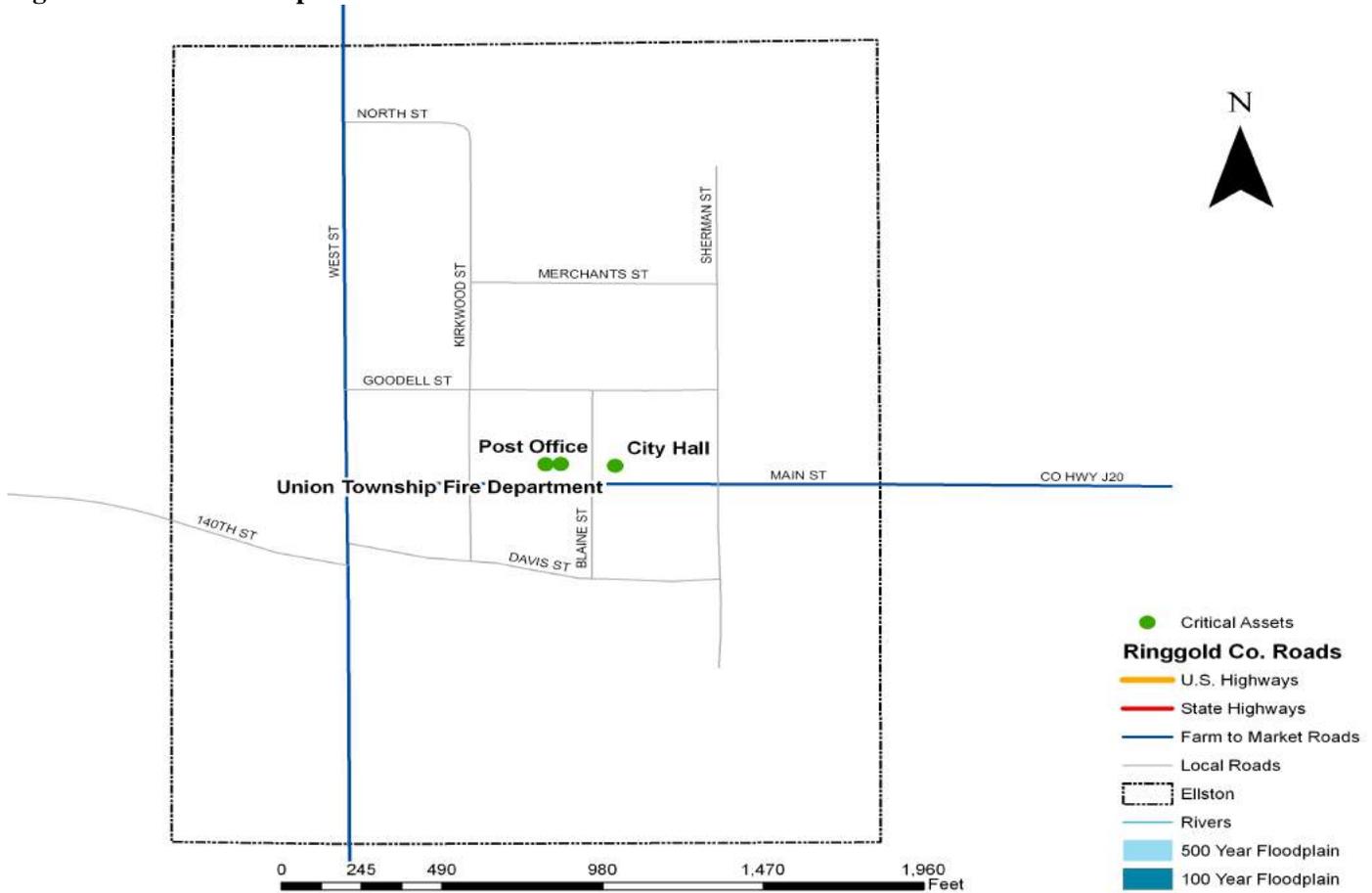
**Figure 3.18: Ellston Critical Assets**

Facility	Location	Primary Type	Size	Replacement Value	Contents Value	Functional Use Value (\$)	Displacement Cost (\$/day)	Occupancy, Capacity (#)
Union Twp. Fire Dept.	Ellston	Essential facility	20,000 SF	\$100 K	\$750 K	\$50 K	\$1,500	40
Post Office	105 E. Main St.	Essential facility	1,000 SF	\$50 K	\$150 K	\$50 K	\$100	10
City Hall	Ellston	Essential facility	2,000 SF	\$100 K	\$75 K	\$100 K	\$100	20

Sources: planning team, FEMA Understanding Your Risks, Ringgold County Assessor’s data, IDOT

The following map shows the city of Ellston critical assets as listed in the above table.

**Figure 3.19: Ellston Map of Critical Assets**



**City of Kellerton Assets at Risk**

The following table shows the potential properties and populations affected by the various hazards listed here.

**Figure 3.20: Kellerton Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	126	\$4,829,718	315	100%
Commercial	6	\$218,513	15	100%
Industrial	0	\$0	0	---
Ag Structures and Land	1 building; 200 acres	\$220,080	1	100%
Taxable Infrastructure	1	\$565,906	2	100%
Government/Institutional	6	\$5,000,000	10	100%
<b>Totals</b>	<b>140</b>	<b>\$10,834,217</b>	<b>343</b>	<b>100%</b>

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

As this table shows, 315 residents live in Kellerton, according to the 2010 Census, and nearly 30 people are in or using other city of Kellerton assets at a given time. The total valuation of the assets in 140 properties exceeds \$10 million dollars, it is estimated.

The following table shows the current list of locally identified critical assets in the city of Kellerton.

**Figure 3.21: Kellerton Critical Assets**

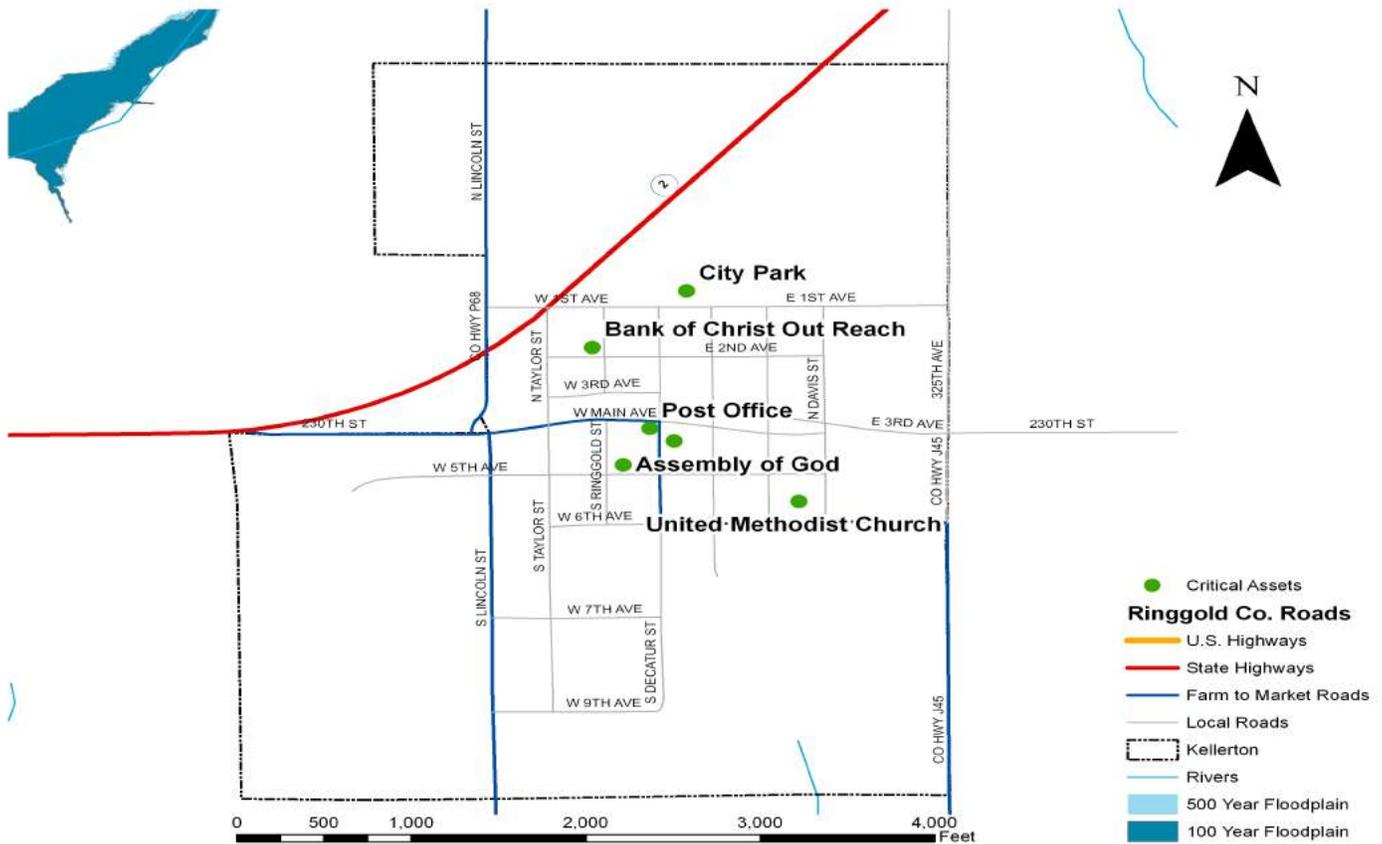
Primary Type	Replacement Value	Contents Value	Functional Use Value (\$)	Displacement Cost (\$/day)	Occupancy, Capacity (#)
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Facility	Location	Size (sf)						
Assembly of God	West 5 <sup>th</sup> & Ringgold	Vulnerable pop.	1,000	\$150 K	\$50 K	\$50 K	\$50	40
Bank of Christ Out Reach	201 West 2 <sup>nd</sup>	Vulnerable pop.	1,000	\$100 K	\$25 K	\$25 K	\$50	35
City Hall/ Community Center/ Fire Station/ Maintenance Garage *	108 S. Decatur Street	Critical facility	20,000	\$300 K	\$2 M	\$500 K	\$1,750	75
City Park	East 1 <sup>st</sup> Street	Vulnerable pop.	1,500	\$50 K	\$75 K	\$25 K	\$500	30
Electrical Substation	Edge of town	Critical facility	2,000	\$750 K	\$750 K	\$250 K	\$1,500	3
Kellerton sewer lagoons	East of Cemetery	Critical facility	--	\$750 K	\$0	\$250 K	\$2,500	--
Methodist Church *	East 5 <sup>th</sup> and Appanoose	Vulnerable pop.	1,000	\$200 K	\$50 K	\$50 K	\$50	40
Post Office	101 South Decatur Street	Critical facility	5,000	\$100 K	\$50 K	\$250 K	\$1,500	20
Water Tower	East 1 <sup>st</sup> Street	Critical facility	--	\$750 K	\$100 K	\$200 K	\$500	3

Sources: planning team, FEMA Understanding Your Risks, Ringgold County Assessor’s data, IDOT  
 \* designated shelter

The following map shows the city of Kellerton critical assets as listed in the above table.

Figure 3.22: Kellerton Map of Critical Assets



**City of Maloy Assets at Risk**

The following table shows the potential properties and populations affected by the various hazards listed here.

Figure 3.23: Maloy Structures, Values, and People at Risk

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	12	\$469,424	29	100%
Commercial	1	\$2,100	1	100%

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Industrial	0	\$0	0	---
Ag Structures and Land	4 buildings; 400 acres	\$474,276	1	100%
Taxable Infrastructure	1	\$101,235	1	100%
Government/Institutional	2	\$2,000,000	2	100%
Totals	20	\$3,047,035	34	100%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

As this table shows, 29 residents live in Maloy, according to the 2010 Census, and an estimated 5 people are in or using other city of Maloy assets at a given time. The total valuation of the assets in 20 properties exceeds \$3 million dollars, it is estimated.

The following table shows the current list of locally identified critical assets in the city of Maloy.

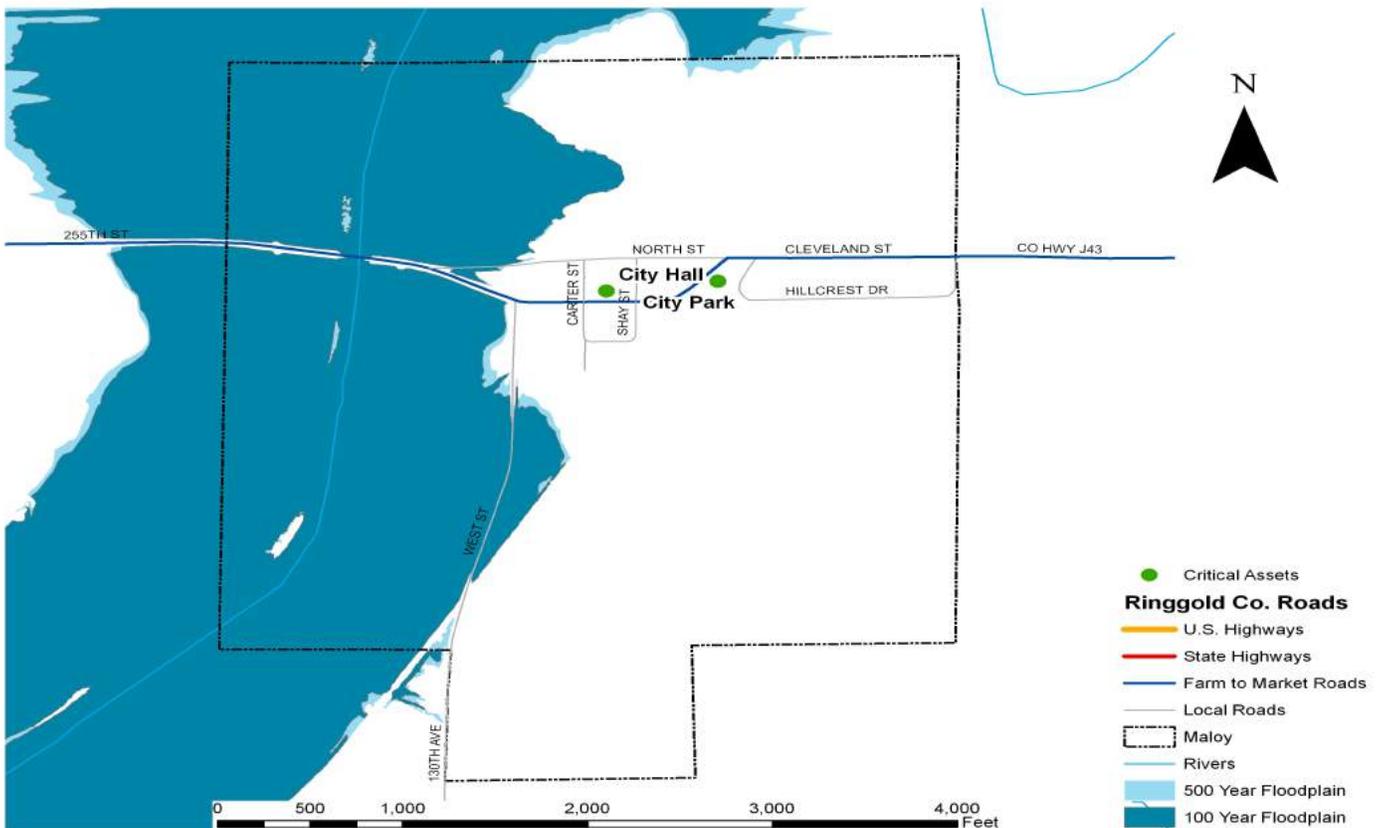
**Figure 3.24: Maloy Critical Assets**

Facility	Location	Primary Type	Size (sf)	Replacement Value	Contents Value	Functional Use Value (\$)	Displacement Cost (\$/day)	Occupancy Capacity (#)
City hall	Center of city	Critical asset	1,000	\$75 K	\$15 K	\$100 K	\$100	15
City park	City of city	Vulnerable pop.	1 ac	\$50 K	\$15 K	\$15 K	\$10	25

Sources: planning team, FEMA Understanding Your Risks, Ringgold County Assessor’s data, IDOT  
 \* designated shelter

The following map shows the city of Maloy critical assets as listed in the above table.

**Figure 3.25: Maloy Map of Critical Assets**



**City of Mount Ayr Assets at Risk**

The following table shows the potential properties and populations affected by the various hazards listed here.

**Figure 3.26: Mount Ayr Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	746	\$49,989,577	1,691	100%
Commercial	80	\$11,986,489	350	100%
Industrial	5	\$1,469,410	200	100%
Ag Structures and Land	7 buildings; 650 acres	\$780,999	2	100%
Taxable Infrastructure	5	\$5,503,642	4	100%
Government/Institutional	32	\$80,000,000	1,000	100%
<b>Totals</b>	<b>875</b>	<b>\$149,730,117</b>	<b>3,247</b>	<b>100%</b>

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

As this table shows, 1,691 residents live in Mount Ayr, according to the 2010 Census, and nearly 1,600 people are in or using other city of Mount Ayr assets at a given time. The total valuation of the assets in 875 properties exceeds \$149 million dollars, it is estimated.

The following table shows the current list of locally identified critical assets in the city of Mount Ayr.

**Figure 3.27: Mount Ayr Critical Assets**

Facility	Location	Primary Type	Size (sf)	Replacement Value	Contents Value	Functional Use Value (\$)	Displacement Cost (\$/day)	Occupancy, Capacity (#)
Airport	SE corner of city	Critical asset	20,000	\$1 M	\$1 M	\$500 K	\$500	50
CGI Foods	104 N. Fillmore St.	Economic asset	8,000	\$700 K	\$500 K	\$500 K	\$1,000	40
Churches (10)	Various	Vulnerable pop.	75,000	\$7 M	\$5 M	\$2 M	\$1,000	800
City Hall	200 South Taylor St.	Critical asset	5,000	\$500 K	\$200 K	\$100 K	\$1,500	50
City State Bank	Highway 2	Economic asset	3,000	\$600 K	\$500 K	\$175 K	\$1,000	10
County Courthouse	109 W. Madison St.	Critical asset	40,000	\$5 M	\$1 M	\$1 M	\$3,000	50
County Engineer's Office	707 S. Henderson St.	Critical asset	5,000	\$250 K	\$100 K	\$100 K	\$500	25
Electrical Substation		Critical asset	5,000	\$2.5 M	\$1 M	\$500 K	\$5,000	3
Elementary School	607 E Jefferson St.	Vulnerable pop.	30,000	\$4 M	\$1 M	\$1 M	\$10,000	300
Family Resource Center	302 N. Lincoln St.	Critical asset	2,500	\$500 K	\$250 K	\$75 K	\$250	25
Farmer's Co-op (3 locations)	Highway 2; Highway 169	Economic asset	50,000; 3 acres	\$5 M	\$2.5 M	\$1 M	\$5,000	100
Fire Station	201 E. Madison St.	Critical asset	10,000	\$500 K	\$2 M	\$1 M	\$2,500	30
G & I Feed & Grain	Jefferson Street	Economic asset	10,000	\$1 M	\$500 K	\$250 K	\$2,000	30
Great Western Bank	100 E. South St.	Economic asset	3,000	\$600 K	\$500 K	\$175 K	\$1,000	30
Hilltop Vet	501 Henderson St.	Economic asset	5,000	\$300 K	\$150 K	\$150 K	\$800	30
Hy-Vee	402 South Hayes St.	Economic asset	15,000	\$2.5 M	\$1.5 M	\$1 M	\$5,000	150
Industrial Park	South Cleveland St.	Economic asset	125,000	\$20 M	\$15 M	\$5 M	\$50,000	500
Judge Lewis Park, ball fields, swimming pool, bathhouse/safe room	Ringgold St.	Vulnerable pop.	40 acres, 10,000 SF	\$10 M	\$1 M	\$500 K	\$1,000	250
Law enforcement center	801 W. South St.	Critical asset	20,000	\$1 M	\$750 K	\$1 M	\$2,000	50
Library	121 W. Monroe St.	Vulnerable pop.	5,000	\$500 K	\$300 K	\$300 K	\$2,000	50
McDonald Appliance	121 S. Fillmore St.	Economic asset	10,000	\$850 K	\$650 K	\$750 K	\$1,500	40
Middle School/High School	1001 E. Columbus St.	Vulnerable pop.	50,000	\$6 M	\$2 M	\$2 M	\$20,000	600
Mount Ayr Depot Museum	N. Taylor St.	Historical/cultural	5,000	\$250 K	\$250 K	\$500 K	\$500	20
Mount Ayr Record News	122 West Madison	Critical asset	2,500	\$250 K	\$250 K	\$250 K	\$500	15
Nursing Homes (2)		Vulnerable pop.	40,000	\$5 M	\$500 K	\$750 K	\$2,500	250
PCSB Bank	Highway 2	Economic asset	3,000	\$600 K	\$500 K	\$200 K	\$1,000	30
Post Office	202 West Madison St.	Critical asset	5,000	\$700 K	\$700	\$500 K	\$2,000	50
Ringgold County Group Home	101 Ringgold St.	Vulnerable pop.	5,000	\$1 M	\$500 K	\$100 K	\$500	25
Ringgold County Hospital	504 N. Cleveland St.	Vulnerable pop.	75,000	\$15 M	\$5 M	\$5 M	\$50,000	400
Ringgold County	504 S. Henderson	Critical asset	2,500	\$500 K	\$250 K	\$75 K	\$250	25

Supportive Services	St.								
TEK Builders	201 N. Taylor St.	Economic asset	5,000	\$400 K	\$300 K	\$250 K	\$2,500	250	
U.S. Bank	101 S. Fillmore St.	Economic asset	3,500	\$650 K	\$500 K	\$200 K	\$1,000	30	
Wastewater Treatment Plant	1000 S. West St.	Critical asset	4,000	\$7 M	\$2 M	\$1 M	\$30,000	15	
Water Towers (3)	Various	Critical asset	--	\$3 M	\$100 K	\$700 K	\$500	10	

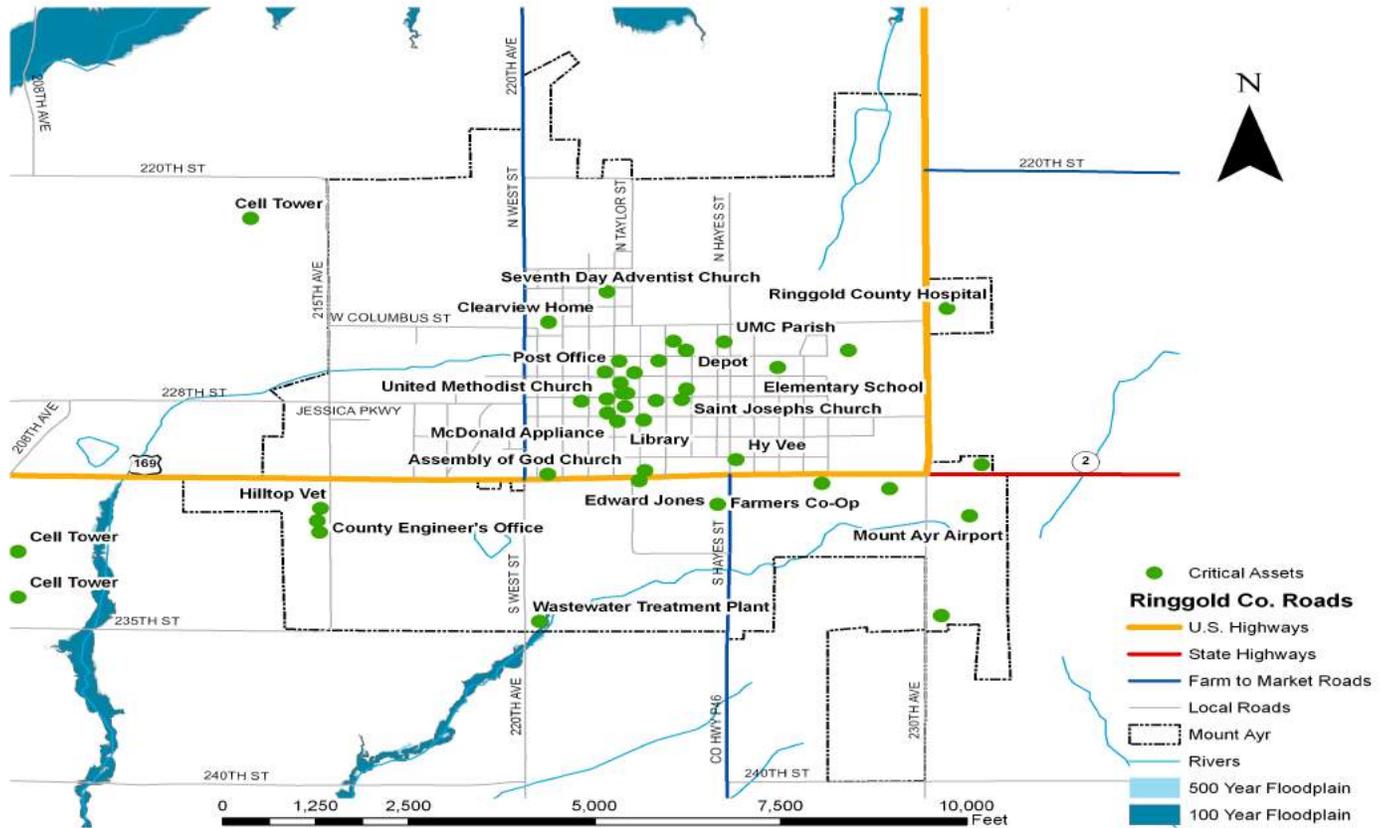
Sources: planning team, FEMA Understanding Your Risks, Ringgold County Assessor’s data, IDOT

\* locally designated shelter

Another asset that should be included on a future plan is a proposed new medical clinic to be located on the Mount Ayr Square. There are no specifications available about this proposed facility.

The following map shows the city of Mount Ayr critical assets as listed in the above table.

**Figure 3.28: Mount Ayr Map of Critical Assets**



**City of Tingley Assets at Risk**

The following table shows the potential properties and populations affected by the various hazards listed here.

**Figure 3.29: Tingley Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	76	\$2,804,246	184	100%
Commercial	4	\$133,130	10	100%
Industrial	0	\$0	0	---
Ag Structures and Land	2 buildings; 300 acres	\$498,906	1	100%
Taxable Infrastructure	1	\$229,697	1	100%
Government/Institutional	4	\$3,000,000	6	100%
<b>Totals</b>	<b>87</b>	<b>\$6,665,979</b>	<b>202</b>	<b>100%</b>

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

As this table shows, 184 residents live in Tingley, according to the 2010 Census, and nearly 20 people are in or using other city of Tingley assets at a given time. The total valuation of the assets in 87 properties exceeds \$6.6 million dollars, it is estimated.

The following table shows the current list of locally identified critical assets in the city of Tingley.

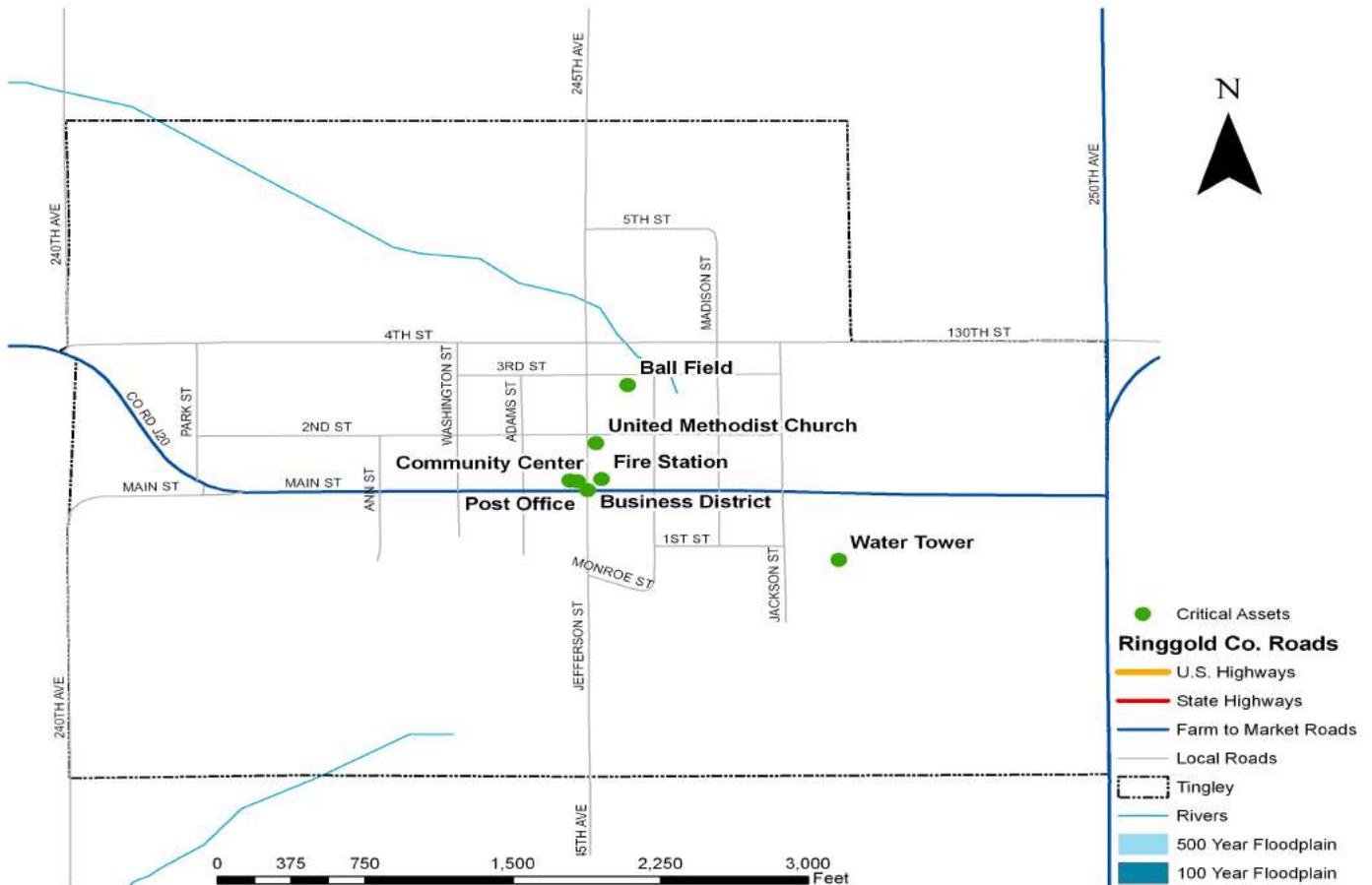
**Figure 3.30: Tingley Critical Assets**

Facility	Location	Primary Type	Size (sf)	Replacement Value	Contents Value	Functional Use Value (\$)	Displacement Cost (\$/day)	Occupancy, Capacity (#)
Ball Field	Jackson St.	Vulnerable pop.	--	\$15 K	\$10 K	\$10 K	\$200	100
Churches (3)	Various	Vulnerable pop.	6,000	\$400 K	\$150 K	\$200 K	\$1,500	100
Community Building	Main St.	Vulnerable pop.	3,500	\$150 K	\$100 K	\$100 K	\$1,000	40
Electrical Substation		Critical facility	1,500	\$500 K	\$250 K	\$250 K	\$2,500	5
Fire Station	Jefferson St.	Critical facility	2,000	\$50 K	\$250 K	\$50 K	\$500	10
Main St. Business District	Main St.	Economic asset	10,000	\$750 K	\$250 K	\$500 K	\$2,500	40
Post Office	101 W. Main St.	Critical facility	750	\$100 K	\$50 K	\$50 K	\$400	15
Sewer Lagoons	Jefferson St. (County)	Critical facility	---	\$750 K	\$50 K	\$250 K	\$2,500	0
Water Tower	Jackson Street	Critical facility	---	\$150 K	\$25 K	\$75 K	\$500	0

Sources: planning team, FEMA Understanding Your Risks, Ringgold County Assessor’s data, IDOT  
 \* designated shelter

The following map shows the city of Tingley critical assets as listed in the above table.

**Figure 3.31: Tingley Map of Critical Assets**



### 3.3: Development Since Adoption of the Previous Plan

Compared to the county’s total existing development, little development has occurred since the previous plan was adopted in 2013. The total net increase in assets during this time is approximately 1%, almost entirely in Mount Ayr and the Sun Valley Lake area. Importantly, the national economic downturn since 2007 has had little effect on

Ringgold County. The unemployment rate remained relatively stable, no large businesses closed, and housing prices did not decline. In fact, a few dozen new homes were built in rural locations, many of them at Sun Valley Lake. These new assets, for the most part, are constructed to modern standards and designed to withstand typical weather conditions and are well insured. There have been no major FEMA funded mitigation projects to date, except for regional rural electric line retrofits via the local REC and two FEMA-approved tornado safe rooms in Mount Ayr. No new habitable construction has occurred in known fixed hazard areas, including SFHAs. In fact, mitigation efforts in lowland and flood prone areas have reduced flood risk. Using grants and local funds, watershed protection projects, such as terraces, grassed waterways, grade stabilization ponds, shoreline stabilization efforts, and other developments have occurred in various locations with the intent of improving water quality and reducing the threat and magnitude of flooding.

### 3.4: Future Land Use and development

This part of the plan addresses the following Stafford Act requirements:

**Section 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.**  
**Section 201.6(c)(2)(ii)C: Vulnerability will be described 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.**

FEMA requires that local mitigation plans consider future development and population growth when considering mitigation strategies. As indicated in Chapter 2, the population is expected to decline in overall population, but some jurisdictions should grow, and in either case some new development will be likely. Population growth will be modest and centered in and around Mount Ayr and the Sun Valley Lake areas. Development planners should consider how new housing developments might affect future mitigation needs and strategies in the future in these areas. Generally, other areas will sustain stagnant populations with very minimal new development. The bulk of development occurring outside of the corporate areas of the cities is likely to be single-family homes, typically on larger lots surrounded by farmland and open space. Homes in subdivisions are possible and likely only in Mount Ayr and at Sun Valley Lake. It is very unlikely that there will be substantial new development of commercial or industrial facilities in the rural part of the county or anywhere outside of Mount Ayr. Some land annexation is possible by cities of the county, but the amount of land annexed is likely to be modest and should not require an amendment to this plan.

The number of assets is likely to increase at the same pace or more rapidly, since average household sizes continue to decline and new construction to replace older buildings may not mean the demolition of older buildings. When commodity prices rise, more land that was not farmed (CRP, forested, or pastured land) in the past may be converted to grow corn and soybeans. The opposite is occurring right now with low commodity prices. Some rural areas and small towns are likely to see declines in total numbers of assets, buildings, and values. Other land uses, such as institutional, educational, government, and utilities, are more difficult to project. These developments will depend on available funding but it is anticipated that growth will be limited in most parts of the county, with Mount Ayr as the county seat receiving most of the investment.

Overall, the net growth (+) or decline (-) in assets is likely to be as follows over the five-year life of the plan.

**Figure 3.32: Changes in Land Use over Next Five Years**

Structure/Land Use	Rural	Beaconsfield	Benton	Delphos **	Diagonal	Ellston	Kellerton	Maloy	Mt. Ayr	Redding	Tingley	County
Residential	+25	-1	0	-1	+1	0	0	0	+5	0	0	+29
Commercial	0	0	0	0	0	0	0	0	+1	0	0	+1
Industrial	0	0	0	0	0	0	0	0	+1	0	0	+1
Ag Structures	+15	0	0	0	0	0	0	0	0	0	0	+15
Ag Land (acres) *	-2,000	0	0	+2	0	0	0	0	-5	0	0	-2,003
Taxable Infrastructure	+1	0	0	0	0	0	0	0	+1	0	0	+2
Government/Institutional	+2	0	0	-1	0	0	0	0	+3	0	0	+4
Totals	+43	-1	0	-2	+1	0	0	0	+11	0	0	+52

\* In rural areas: through conversion of marginal land (pasture, forest, CRP, channeled waterways, as land values increase)

\*\* Maloy will be dis-incorporated and will become part of the rural county in five years.

Of course, the above table assumes there are no city boundary changes in the next five years, such as due to annexation, except for the dis-incorporation of Delphos, which is well into process. New development will be very

minor compared to the current composition of the county; therefore, development will not likely affect the risks in the county in a significant way. The exception may in property values as these inflate and fluctuate over time. In other words, it is not likely that new buildings and population will create appreciable new hazards that would not have occurred had the development not occurred.

There is one unique element of development in rural Ringgold County that may present unique future hazard risks. The Sun Valley Lake area is a rural development organized within what is called the Sun Valley Lake Census Designated Place. At the next Census, there were 79 occupied and 230 vacant units at Sun Valley Lake Census Designated Place with 161 permanent residents. There are many properties that are second lakefront homes not normally occupied. However, two things should be considered: a) the occupancy is exceptionally higher during summer weekends and b) the population and development of this area continues to grow at a much higher pace than other rural areas of Ringgold County.

Planning team members were asked to describe what new risks they could envision in the future due to new development. Some stated that the risks are no more significant than in other areas. Unfortunately from a mitigation standpoint, there is limited land use planning in effect or contemplated for the areas of the county, and most of the county lacks zoning. This means that it is almost impossible to project where and when development may occur and similarly impossible to enact some mitigation priorities and ideas in the location, siting, sizing, and building techniques of new development.

With the approval of FEMA FIRM maps in the past few years, most jurisdictions with SFHAs for 1%-chance events have joined the NFIP and have flood regulations that prohibit development in SFHAs. There are no policies for development of safe rooms and earthquake building codes or for wildland interface areas, which could be greater issues if new development occurs. With proper implementation of the mitigation plan, however, future development will not be in the risk area of any high-risk hazards except for hazards that can affect the entire county.

### 3.5: Hazard Profiles and Vulnerability

The hazard profile is a complicated part of the hazard mitigation plan. It is essentially a thorough analysis of each hazard included in the hazard mitigation plan. When completed, it provides a reasonable picture of what hazards are the most destructive to the planning area and each jurisdiction and what kind of damages are most likely to occur.

The hazard profile addresses the following information:

- Hazards to be profiled and reasons why
- Hazard profile methodology
- Detailed analysis of each hazard
- Description of its effect on the assets of the county
- Loss estimation for hazards where data is available
- Summary and vulnerability assessment, including listing of hazards by level of risk by jurisdiction

#### *Hazards to be Profiled*

Another change in this plan update is the revision of which hazards are profiled. In the last plan, all identified hazards were profiled in detail. After reviewing other FEMA approved plans, considering readability and brevity, this plan update excludes some hazards from profiling. The planning team feels this accomplishes the goals of the plan and the Stafford Act requirements because the information related to hazard risks is not compromised by these actions.

As part of identifying how to focus the profiling effort to the hazards that are of greatest concern, the planner created a survey (called the Preliminary Hazard Survey, found in *Appendix B*) and asked planning team members to fill it out. The survey asked the level of concern each person on the planning team had about the various hazards being considered. The responses from six people that completed the survey are itemized as follows, ranging from belief the hazard does not occur to very concerned.

**Figure 3.33: Survey of Planning Team Members**

Hazard	No Occurrences	Unconcerned	Moderately	Highly	Very
Animal/plant/crop disease	1	2	2	1	0
Dam/levee failure	1	5	0	0	0
Drought	0	1	3	1	1
Earthquake	0	6	0	0	0
Expansive soils	0	4	2	0	0
Extreme heat	0	0	5	0	1
Flash flood	0	1	4	0	1
Grass and wildland fire	0	1	4	1	0

Hazard	No Occurrences	Unconcerned	Moderately	Highly	Very
Hazardous materials incident	0	3	3	0	0
Human disease	0	1	5	0	0
Infrastructure failure	0	2	3	0	1
Landslide	1	5	0	0	0
Radiological	1	5	0	0	0
River flood	1	1	2	2	0
Severe winter storm	0	0	0	3	3
Sinkhole	0	5	1	0	0
Terrorism	0	3	3	0	0
Thunderstorm/Lightning/Hail	0	0	2	1	3
Tornado/Windstorm	0	0	0	3	3
Transportation incident	0	3	1	0	2

As this chart shows, the members of the planning team who completed the survey are most concerned with severe winter storm and tornado/windstorm followed by high concern for thunderstorm/lightning/hail and river flood. The least concern was given to dam/levee failure, earthquake, expansive soils, radiological, landslide, and sinkhole.

The following table shows the hazards that were eliminated and how and why this occurred, in consideration of and in addition to the lack of concern on the part of planning team members.

**Figure 3.34: Hazards Omitted from the Hazard Profile**

Hazard	Reason for Omission
Earthquake	Planning area is located in Seismic Zone 1, the second lowest in the U.S. (Sources: USGS, IDNR, State Mitigation Plan). There are no fault zones in the county itself, and the closest fault zone with some activity is in Fremont County, but events that occur in that zone rarely are even felt in Ringgold County. While very minor earthquakes have occurred regionally, no damage has ever been recorded in the planning area.
Landslide	Most of them occur in remote areas along streams and do not affect human development. Minor landslides along grade cuts for highways, bridges, and railroads have caused minimal damage and are mitigated easily without extensive planning and outside resources. This is no history of significant landslides in the planning area. (Sources: Iowa Map Book, State Mitigation Plan)
Radiological	The risk is very low and the supplies of radiological substances are small and highly regulated. Only a few well-controlled small supplies are located at a few fixed assets, such as the Ringgold County Hospital and a few clinics, as well as a few dental offices. Spent fuels are transported in specially designed casks on Highway 2 on rare occasion (Source: Iowa Hazard Mitigation Plan). The risk is well managed and should not present a threat to the general public.
Sinkhole	Minor sinkholes, mostly associated with human excavation activities, with no significant damage have occurred. The only way to mitigate these kinds of sinkholes is to properly compact soils during excavation and construction activities and to fill holes that occur. The risks to people and structures are limited. The Iowa DNR karst topography data also indicates no hazards in the planning area ( <a href="http://programs.iowadnr.gov/maps/coalmines/">http://programs.iowadnr.gov/maps/coalmines/</a> ). Small sinkholes are being mitigated through good construction standards and programs that fill old water wells.

At the conclusion of their review, the planning team selected the following hazards to profile as hazards that may present substantial risk to the planning area. This includes 11 natural hazards and 5 other hazards.

**Figure 3.35: List of Hazards to be Profiled**

Natural Hazards		Technological	Human Caused
Animal/crop/plan disease	Human disease	Dam/levee failure	Terrorism
Drought	River flood	Hazardous Materials Incident	
Expansive soils	Severe winter storm	Infrastructure failure	
Extreme heat	Thunderstorm/lightning/hail	Transportation incident	
Flash flood	Tornado/windstorm		
Grass and wildland fire			

**Hazard Profile Methodology**

The hazard profile is a more detailed investigation of each identified hazard to determine more precisely the potential impact each hazard could have on each jurisdiction. Data from various sources is used to determine how each hazard affects the county and its jurisdictions. This profile evaluates the relative impact of each potential hazard for each jurisdiction through several evaluation criteria. The profile is completed in order to rank the relative risk each hazard has on each jurisdiction, which will then enable the planning team to best develop goals, objectives, and mitigation actions for each jurisdiction later in this document.

This profiling is not new to communities in Ringgold County. The previous two hazard mitigation plans included a hazard profile. This process has also been used with success in surrounding counties.

Note that each of the following profiles covers each jurisdiction. Within each profile for each hazard is a description of whether and how different communities have different risks to hazards. The following risk assessment was conducted on a planning area wide basis rather than analyzing each hazard for each individual jurisdiction. Unique conditions within the participating jurisdictions are noted in each hazard profile. For example, flooding will likely impact jurisdictions with Special Flood Hazard Areas (SFHAs) more than those without SFHAs. Unless otherwise stated in the risk assessment, the partnering organizations and other non-incorporated jurisdictions not specifically profiled will have the same risk factors as that of the underlying jurisdiction in which the organizations and assets are located. School districts are profiled in terms of how hazards impact assets on their properties.

This part of the plan addresses the following Stafford Act requirement:

**Section 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.**

***Explanation of Hazard Scoring Criteria***

The following tables provide explanation of the scoring criteria. There are six overall criteria in which each hazard is scored, along with additional scores for one of the seven: severity of impact. While severity of impact is not necessarily a higher weighted score, it is complex and there are many factors related to the kinds of damages and their impacts. For this reason, the overall hazard score by jurisdiction is a sum of all the criteria. All criteria were rated on a scale of one (1) to nine (9), except the various severity of impact scores, which are rated on a scale of one (1) to five (5).

**Ringgold County Plan Update Changes in Profile Hazard Scoring**

In this update, the planning team took a completely different approach to hazard scoring compared to previous plans. First, the historical occurrence factor was discussed but is no longer being scored. Past history does not result in future loss. However, historical incidence provides useful data about future probability and risk of loss, as reflected throughout this profile. The scoring system overall is quite different, to make it true to the real risk factors.

Each planning team member attending the third and fourth community meetings helped score the assessment criteria, with some individualized data and some team discussion results.

The forms used for these discussions are found in *Appendix B*. FEMA guidance, “Understanding Your Risks,” the State Hazard Mitigation Plan, and other approved plans were used in the creation of the documentation.

Following the meetings, the planning consultant completed research to confirm and in some cases modify the scores for each jurisdiction. These scores are found in this plan. The sum of the scores for each hazard for each jurisdiction were then added and ranked by community. Following the profile, the remaining part of this chapter details the results of this analysis.

It was important for the assessment team to score each hazard as a single event. Only impacts from that particular hazard were to be considered in the analysis. The planning team profiled hazards without consideration of secondary or cascading impacts and events.

***Future Probability***

The probability score reflects the estimated frequency of the hazard occurrence in the future. Often the historical occurrence can be extrapolated into the future, but sometimes this is not accurate. If a hazard or its impacts have been mitigated, the future occurrence will most likely be less than the historical occurrence. The opposite can also be true. There may be new hazards that present themselves to the community. For example, a new industry that produces a hazardous material may move into the community where, before, the hazard did not exist.

**Figure 3.36: Future Probability Scoring Criteria**

Score	Description
1	Extremely rare: Less than 1% probability in the next year
2	Very Unlikely: Between 2% and 5% probability in the next year
3	Unlikely: Between 6% and 10% probability in the next year
4	Possible: Between 11% and 25% probability in the next year
5	Probable: Between 26% and 50% probability in the next year
6	Likely: Between 51% and 75% probability in the next year
7	Highly Likely: 76% and 90% probability in the next year
8	Often: Between 91% and 100% probability in the next year
9	Regularly: Most years this hazard will occur multiple times

***Vulnerability of the Population***

The vulnerability score represents adverse impacts to citizens, visitors, and emergency responders. It is important to consider only adverse affects as vulnerability. Many hazards, even those that are widespread, occur which do not significantly impact people, while others will have a direct impact on any person in the area of the hazard event.

**Figure 3.37: Vulnerability of the Population Scoring Criteria**

Score	Description
1	Indirect: Impacts exist but do not directly effect the lives of any people
2	Temporary: Quality of life is diminished temporarily – hazard in the area raises awareness/causes preventative action
3	Negligible: Less than 1% of the total population of the jurisdiction
4	Limited: 1% to 10% of the total population of the jurisdiction
5	Moderate: 11% to 25% of the total population of the jurisdiction
6	Significant: 26% to 50% of the population of the jurisdiction
7	Critical: 51% to 75% of the population of the jurisdiction
8	Severe: 76% to 90% of the population of the jurisdiction
9	Catastrophic: More than 90% of the total population of the jurisdiction

### **Maximum Area of Extent**

The maximum geographic extent is the percentage of the jurisdiction impacted by the hazard. As an example, a snowstorm will likely impact the entire community, whereas a hazardous materials incident or flash flood may cover only a few city blocks or farms.

**Figure 3.38: Maximum Area of Extent Scoring Criteria**

Score	Description
1	Indirect: Impacts exist but do not directly effect land, property, or an identifiable area
2	Random: Specific points randomly impacted, such as individual computers at scattered locations
3	Negligible: Less than 1% of the total area of the jurisdiction
4	Limited: 1% to 10% of the total area of the jurisdiction
5	Moderate: 11% to 25% of the total area of the jurisdiction
6	Large: 26% to 50% of the area of the jurisdiction
7	Significant: 51% to 75% of the area of the jurisdiction
8	Widespread: 76% to 90% of the area of the jurisdiction
9	Total: More than 90% of the total area of the jurisdiction

### **Severity of Impact**

The nine criteria used to score the severity of impact, as follows, are similar to those used by the Emergency Management Accreditation Program (EMAP) standards. The EMAP standards for a risk assessment require inclusion of a consequence analysis for the hazards that have potential impact on the planning area. The EMAP process considers the impact of each hazard on the following:

- General public
- First responders
- Continuity of government operations
- Property, facilities, and infrastructure
- Environment
- Economic conditions
- Public confidence in the jurisdiction’s governance

Notice how these are similar to the following nine scoring criteria that are analyzed in the “severity of impact” section of each hazard profile.

The rating of 1-5 rather than 1-9 is in place because the planning team did not want to give the total score for severity of impact too much influence over the overall score compared to other criteria, such as future probability.

### **Severity of Impact – Health and Safety of the Public**

Many hazards directly affect health and safety of the public, and protection of the public is a primary goal.

**Figure 3.39: Severity of Impact Health and Safety of the Public Scoring Criteria**

Score	Description
1	Negligible: No direct risk to health and safety
2	Limited: A few people may suffer minor injuries or become sick or lack food/water; fatalities are very unlikely
3	Moderate: Minor injuries are likely; major injuries and sickness are possible; fatalities are unlikely
4	Critical: Multiple injuries and sickness are probable; fatalities are likely
5	Catastrophic: Widespread fatalities are very likely; Federal and State emergency response will be necessary

**Severity of Impact – Health and Safety of Response Personnel**

Many hazards directly affect health and safety of those that respond to hazards, either because they are exposed to the original hazard or to resulting hazards and other risks associated with exposure.

**Figure 3.40: Severity of Impact Health and Safety of Response Personnel Scoring Criteria**

Score	Description
1	Negligible: No direct risk to health and safety; no response needed or response will occur after incident is over
2	Limited: Responders can be injured or made sick due to exposure but fatalities are unlikely
3	Moderate: Injury and sickness are likely and risk is high; fatalities are possible
4	Critical: Multiple injuries are probable; exposure can make many ill; fatalities are likely; secondary impacts such as radiation and explosions can cause adverse effects to a large part of the response community
5	Catastrophic: Widespread fatalities are very likely; Federal and State emergency response will be necessary

**Severity of Impact – Continuity of Government Operations, Utilities, and Related Services**

Many hazards have a direct impact on continuity of governments due to the impact on staffing, financial resources, and availability of reliable equipment and infrastructure. Utilities can become unreliable or even lost. Other necessary services can be compromised, and basic needs can go unmet or the public can become unprotected from crime and other risks.

**Figure 3.41: Severity of Impact Continuity of Government Scoring Criteria**

Score	Description
1	Negligible: Will not have a direct impact of any nature on public facilities, services, and infrastructure.
2	Limited: Services can be temporarily disrupted only if hazard directly impacts the central system/building; non-lifeline systems would be impacted for a few hours to one day
3	Moderate: Non-lifeline systems nonfunctional for days; lifeline systems such as electricity and water out for up to 6 hours
4	Critical: Lifeline systems out for 6 to 24 hours; government officials unable to serve for days; risk to life as a result of essential services being down
5	Catastrophic: Lifeline systems out for at least one day; multiple systems disrupted; complete shutdown of essential facilities for at least a day and many for weeks or more; government unable to operate and local officials unable to make decisions that will require Federal response

**Severity of Impact – Property, Facilities, and Infrastructure**

Property and infrastructure protection is vital to recovery. Most hazards affect properties, even if no people are injured or killed.

**Figure 3.42: Severity of Impact Property, Facilities, and Infrastructure Scoring Criteria**

Score	Description
1	Negligible: Will not have a direct impact of any nature on buildings, structures, and other infrastructure or will cause such little damaged that insurance can easily cover
2	Limited: Modern buildings and structures can be modestly damaged; weak buildings heavily damaged; sections of roads and utilities damaged but operable
3	Moderate: Key infrastructure and buildings can be moderately damaged – structurally insecure
4	Critical: Buildings are uninhabitable and some buildings destroyed; key facilities and infrastructure is not useful for days; detours needed on key roads
5	Catastrophic: Widespread destruction to strong buildings and infrastructure that will require Federal response

**Severity of Impact – Delivery of Services**

The public, non-profit, and private sectors deliver important services to the public and businesses in a community. The loss of these affects quality of life and hinders response and recovery.

**Figure 3.43: Severity of Impact Delivery of Services Scoring Criteria**

Score	Description
1	Negligible: Hazard will not result in any impact on delivery of services physically or via computers and technology
2	Limited: Services are disrupted temporarily both physically and electronically
3	Moderate: Detours will directly impact quality of life for many; deliveries delayed hours to days; Internet unavailable
4	Critical: Services are shut down for days; Internet unavailable for days; deliveries slowed by days
5	Catastrophic: Entire way of life is severely disrupted that will require Federal response

**Severity of Impact – Environmental Impact**

In a built environment, all kinds of hazards can cause undesirable short- and long-term environmental impacts.

**Figure 3.44: Severity of Impact Environmental Impact Scoring Criteria**

Score	Description
1	Negligible: No notable impact to the human or natural environment
2	Limited: Temporary impacts that will be cleaned immediately or by the natural environment
3	Moderate: Temporary impacts to the environment which can be cleaned up by local and regional personnel in days
4	Critical: Long-term environmental mitigation needed
5	Catastrophic: Severe damage that may alter wildlife populations and local ecology that will require Federal response

### ***Severity of Impact – Economic and Financial Conditions***

Economic and financial impacts of a more general nature can occur as a secondary effect of damage to property, equipment, and infrastructure and of death, injury, illness, and displacement of people.

**Figure 3.45: Severity of Impact Economic and Financial Conditions Scoring Criteria**

Score	Description
1	Negligible: No direct economic impact
2	Limited: Temporary local slowing of economic activity; a few small businesses temporarily damaged
3	Moderate: Large businesses temporarily damaged; small businesses closed or relocated
4	Critical: Large businesses closed; entire corridors of businesses significantly impacted
5	Catastrophic: Widespread economic losses that affect the regional quality of life that will require Federal response

### ***Severity of Impact – Regulatory and Contractual Obligations***

Another secondary impact of a hazard event can be the long-term loss of services so that contracts are broken and quality of life is directly impacted. Regulations may be temporarily ignored, which increases risks to those affected by the regulations. The confusion resulting from the upheaval in a community can raise tempers and distract people from what they are obligated to do.

**Figure 3.46: Severity of Impact Regulatory and Contractual Obligations Scoring Criteria**

Score	Description
1	Negligible: No direct impact on obligations
2	Limited: Regulations are no longer followed and obligations are not met temporarily
3	Moderate: Vital services and further physical losses directly result from temporary failures
4	Critical: Vital services and severe physical losses result over months and years; lawsuits likely; people financially ruined
5	Catastrophic: Widespread losses result that severely damage local way of life; communities financially ruined; Federal response

### ***Severity of Impact – Reputation of the Entity***

Hazard events today are highly visible and people all over the world can learn about them. If the response, cleanup, or other activity is performed poorly, or previous promised mitigation efforts are proved insufficient by an event, local, state, regional, and even federal reputations can be damaged.

**Figure 3.47: Severity of Impact Reputation of the Entity Scoring Criteria**

Score	Description
1	Negligible: No direct impact on reputation
2	Limited: Reputation of jurisdiction is damaged temporarily or relating to a service provider not directly affiliated with the jurisdiction
3	Moderate: Reputation damage is more than temporary or compromises services in the area temporarily
4	Damaging: Reputation of jurisdiction is severely damaged and trust/confidence is broken for some time; political ramifications to the jurisdiction are notable
5	Severe: other entities must take over responsibility or service/program is entirely terminated

### ***Speed of Onset***

The speed of onset is quite simply the amount of warning time available before the hazard occurs. This should be taken as an average warning time. Warning time and the speed the incident develops varies greatly by hazard and by hazard event. Reduced warning time and time to react can worsen the magnitude of damage.

**Figure 3.48: Severity of Impact Speed of Onset Scoring Criteria**

Score	Description
1	More than 2 days warning time
2	1 to 2 days warning time
3	13 to 24 hours warning time
4	7 to 12 hours warning time
5	2 to 6 hours warning time
6	1 to 2 hours warning time
7	31 minutes to 1 hour warning time

Score	Description
8	1 minute to 30 minutes warning time
9	No or virtually no warning (seconds)

### ***Duration of Event***

The duration of event is the length of time a typical event affects an area, not counting the cascading events, response, or recovery times. The duration will be from the genesis to the termination of the event in a given area, or the time when warning is sounded or damage begins until an all-clear signal or direct damage ends, not including cleanup, recovery, etc.

**Figure 3.49: Severity of Impact Duration of Event Scoring Criteria**

Score	Description
1	A few seconds to a minute
2	1 minute to 30 minutes
3	31 minutes to 1 hour
4	1 to 6 hours
5	7 to 12 hours
6	13 to 24 hours
7	25 to 36 hours
8	37 hours to 1 week
9	More than one week

### ***Loss Estimation Process***

The loss estimation phase includes: 1) the descriptions of loss estimation techniques, 2) the losses for each hazard event, 3) and the estimated losses for each year by hazard by jurisdiction. The chapter also considers future losses due to possible new development in the county.

To complete this process, the planning team considers various data sources. The team uses several loss formulas based on the likely damages that each asset may receive from each type of event. The following formulas can be used:

Structures: structure replacement value X percent damaged = loss to structure

Contents: contents replacement value X percent damaged = loss to contents

Functional/use: functional downtime cost (average daily operating budget X days) + displacement cost (displacement costs per day X days displaced) = functional loss

Total estimated losses to asset: structure loss + contents and inventory loss + functional loss = total

Human loss: value of a human life, as defined by FEMA, plus the value of a severe, as defined by FEMA, X the number of injuries and fatalities = total human loss

### **Ringgold County Plan Update Changes to the Loss Estimation Process**

The planning team looked at more outside resources and considered hazard-specific data in each estimation. Also, the hazard loss estimate is outlined within each hazard profile rather than a separate chapter. The overall assessment of annual losses by jurisdiction is outlined later in this chapter for comparative purposes. Like the previous plan, there is no estimate of losses by structure, as this data is not available.

### ***Animal/Plant/Crop Disease Profile***

Type: Natural

Definition: An outbreak of disease transmitted from animal to animal or plant to plant.

### ***Animal/Plant/Crop Disease Description***

The disease outbreak will likely have a significant economic implications or public health impact. The crop/plant pest infestation will likely have severe economic implications, cause significant crop production losses, or significant environmental damage. The crop/plant pests may also have implications for public health.

The introduction of some high consequence diseases may severely limit or eliminate our ability to move, slaughter, and export animals and animal products. The outbreak will have widespread economic and societal implications for the county. Response and recovery to infectious animal disease outbreaks will be lengthy, and many producers may never be able to return to business. There will be many indirect effects on our economy. Rumors of an infectious animal disease outbreak could cause significant damage to the markets, as was evidenced in an incident in Kansas in 2003 where the mere rumor of a Foot and Mouth Disease outbreak cause the markets to plummet. The same happened to pork sales in 2009 after an H1N1 flu outbreak was labeled as “swine flu” and to poultry and egg sales following an avian flu incident in 2015.

More information on common and emerging animal, crop, and plant diseases in Iowa, as well as impact maps, can be found at the websites of the following organizations, USDA ([www.usda.gov](http://www.usda.gov)), Iowa Dept. of Public Health ([www.idph.state.ia.us](http://www.idph.state.ia.us)), Iowa Dept. of Natural Resources ([www.iowadnr.com](http://www.iowadnr.com)).

Animal/Plant/Crop Disease Historical Occurrence:

According to the USDA Risk Management Agency, millions of dollars in crop losses have occurred in Iowa. The greatest causes include drought, excessive rain, falling commodity prices, hail, floods, and windstorms. To date, only a small part of crop losses have come from diseases, but the risk seems to be increasing. Every year the Iowa Department of Agriculture and Land Stewardship (IDALS) conducts numerous animal disease investigations. IDALS, under the direction of the state plant regulatory official, works with Iowa’s universities and industries to conduct regular crop and plant pest surveillance. More and more pests are being introduced in Iowa that affect livestock, wildlife, plants, and crops. Some of these have had isolated impact. Rabies and Asian soybean rust have been reported in domesticated animals and crops in the county. Other minor outbreaks of widespread diseases have been reported in rural areas, including West Nile Virus, Foot and Mouth Disease, aphids, emerald ash borer, chronic wasting disease, and others. Economic impact collectively to farmers, consumers, and property owners has been the most significant impact due to incidents to date.

In the summer of 2015 a major avian flu outbreak affected poultry producers all over Iowa. By June 2015, 75 farms were infected in 18 counties, most of them in northwest Iowa. Over 32 million turkeys and chickens succumbed to this disease, which greatly hurt the economy. Emerald ash borer has been found in surrounding counties and more recently was found in isolated locations in Ringgold County.

Animal/Plant/Crop Disease Future Probability:

The 2013 State of Iowa Hazard Mitigation Plan indicates the probability of a high-impact incident, one with statewide or larger significance, is low in a given year. The local planning team agrees, but more localized incidents that have a profound effect locally are more likely to occur. The issue is heightened because Ringgold County is very rural and resources to monitor pests are limited. The county is home to a large number of hog and cattle operations and corn and soybean fields. The risk is heightened due to potential deficiencies in communicating about these hazards across state lines (Iowa/Missouri). The production, processing, and transport of large quantities of various agricultural products as well as transport of non-indigenous plants and animals, and diseases that affect them, on local highways and nearby Interstate 35 also raise the level of risk. Many diseases and pests are easily transmitted, even when the risks are known. During the planning meeting, people had a wide range of ideas as to the future probability, but the consensus seemed to be that the probability for future events is higher than past history and that the rural area as whole is more likely to experience an outbreak than other areas. Further, with the impending emerald ash borer infestation making its way to Ringgold County, we know that some kind of incident is imminent. Every year the Iowa Department of Agriculture and Land Stewardship (IDALS) conduct numerous animal disease investigations.

The overall rating the community gave for this hazard’s future probability in a survey was: “likely.”

Score for Rural Ringgold County: 8	Score for Benton: 3	Score for Diagonal: 2	Score for Ellston: 2
Score for Kellerton: 4	Score for Maloy: 2	Score for Mount Ayr: 4	Score for Tingley: 2
Score for Diagonal School: 1	Score for Mount Ayr School: 1		

Animal/Plant/Crop Disease Vulnerability to the Population:

The movement of people, animals, animal products, wildlife, plants, crops and potential disease/pest vectors could cause the introduction of diseases/pests. Diseases/pests could also be introduced naturally, for example by hurricanes or jet streams. Emerging disease is also a threat, such as West Nile Virus, new more virulent influenza strains, etc. Because many diseases/pests are not present in Iowa, our populations of animals, crops, and plants have no immunity and are highly susceptible. Modern farming and animal practices mitigate major widespread losses. The vulnerability to populations in specific structures, such as schools, is somewhat less but still significant because contaminated food supplies can get into those facilities and people in close confinement can transmit diseases.

Once infestation occurs, the pest may become endemic, causing repeated losses in subsequent growing years. Loss of production could affect all related industries including fuel, food, synthetics, processors, etc.

Score for Rural Ringgold County: 5	Score for Benton: 4	Score for Diagonal: 4	Score for Ellston: 4
Score for Kellerton: 4	Score for Maloy: 4	Score for Mount Ayr: 4	Score for Tingley: 4
Score for Diagonal School: 3	Score for Mount Ayr School: 3		

Animal/Plant/Crop Disease Area of Extent:

Pest infestations can cause widespread crop/plant loss and resulting economic hardships on farmers, landowners, and related businesses. Nonetheless, the impact will vary by disease/pest and the type of animal/crop/plant infected/infested. Because of the major transportation routes for food products and grain and the large part of the

county in agriculture, much of the county can be affected. No parts of the county are entirely immune from animal and plant disease. Indirect effects, such as economic and transmission to human populations outside of the farming community expand to towns, schools, and other populated areas.

Score for Rural Ringgold County: 4	Score for Benton: 3	Score for Diagonal: 3	Score for Ellston: 3
Score for Kellerton: 3	Score for Maloy: 3	Score for Mount Ayr: 3	Score for Tingley: 3
Score for Diagonal School: 3	Score for Mount Ayr School: 3		

Animal/Plant/Crop Disease Severity of Impact:

The severity will vary by disease/pest. The types of animals, crops, or plants affected will also significantly influence the severity.

The following provides a summary of the typical severity of impact throughout the county.

**Figure 3.50: Animal/Plant/Crop Disease Severity of Impact Scoring Matrix**

Severity Criteria	Discussion	Score
Health and safety of the public	If humans come into direct contact or consume the animal and plant products, illness and death are possible.	2
Health and safety of responders	Not likely to be affected, but inspectors and those handling diseased animals and plants can be infected.	2
Continuity of operations	Should not be impacted in a major scale, except for those agencies that depend on the food that is affected and that must take action to solve a widespread problem, such as quarantining animals and cutting trees.	1
Property, facilities, infrastructure	Should not be impacted in a major scale.	1
Delivery of services	Most would not be affected, but the delivery of food to stores and medicines/health care could be impacted if the diseases cause widespread illness requiring specialized antibiotics.	2
Environmental impacts	Diseases can penetrate the air and water supplies in a localized area.	3
Economic/financial conditions	If an area food processing facility is shut down to deal with such problems, or if extensive crops and livestock were lost, the economic impact would be very heavy. Should the disease/pest have public health implications, the economic and social impact would be even greater. Crop/plant pest infestations can cause widespread crop/plant loss and severe economic hardship on farmers, landowners, and related businesses. Once infestation occurs, the pest may become endemic causing repeated losses in subsequent growing years. Loss of production will affect all related industries, such as fuel, food, synthetics, processors, etc. If the reputation of the facility, food, or area is tarnished, the loss of food product sales could greatly affect the area economy.	3
Regulatory/contractual obligations	Not likely to be affected in a significant way in most situations but can be harmed if food cannot be supplied, for example.	3
Reputation	Depends on the quality and appropriateness of the response. If panic results, it would be more notable. For example, the nationwide salmonella poisoning scare in 2008 caused a major impact to the sales of tomatoes when it was later found to be caused by something else. The August 2010 egg contamination in northern Iowa has caused the recall of nearly a half billion eggs and hurt sales of Iowa eggs nationally.	3

The overall rating the community gave for this hazard’s magnitude in a survey was: “critical.”

Score for Rural Ringgold County: 20	Score for Benton: 20	Score for Diagonal: 20	Score for Ellston: 20
Score for Kellerton: 20	Score for Maloy: 20	Score for Mount Ayr: 20	Score for Tingley: 20
Score for Diagonal School: 20	Score for Mount Ayr School: 20		

Animal/Plant/Crop Disease Speed of Onset:

If the diseases and pests are highly infectious (many animals that are infected with disease can be transmitting disease before they show clinical signs), by the time they are discovered, they will likely have spread across the state or nation. This will put us at a severe disadvantage during response and recovery. Typically, there is warning, however, that diseases are spreading. Most disease incidents that require a massive State or Federal response are known and travel slowly.

Score for Rural Ringgold County: 3	Score for Benton: 3	Score for Diagonal: 3	Score for Ellston: 3
Score for Kellerton: 3	Score for Maloy: 3	Score for Mount Ayr: 3	Score for Tingley: 3
Score for Diagonal School: 3	Score for Mount Ayr School: 3		

Animal/Plant/Crop Disease Duration of Event:

Animal and plant diseases often can last weeks or months before they are discovered, addressed, or a remedy is found.

Score for Rural Ringgold County: 9	Score for Benton: 9	Score for Diagonal: 9	Score for Ellston: 9
Score for Kellerton: 9	Score for Maloy: 9	Score for Mount Ayr: 9	Score for Tingley: 9
Score for Diagonal School: 9	Score for Mount Ayr School: 9		

**Animal/Plant/Crop Disease Total Scores:**

The following total scores for animal/plant/crop disease indicate low to moderate risk to the public and the planning area where incidents can occur. Because the economic loss is most likely the highest in the unincorporated area, the rural part of the county has a somewhat elevated score.

Score for Rural Ringgold County: 49	Score for Benton: 42	Score for Diagonal: 41	Score for Ellston: 41
Score for Kellerton: 43	Score for Maloy: 41	Score for Mount Ayr: 43	Score for Tingley: 41
Score for Diagonal School: 39	Score for Mount Ayr School: 39		

**Animal/Plant/Crop Disease Vulnerability/Assets at Risk:**

A widespread infestation of animals/livestock and crops could impact the economic base of the county, and the greatest risk of this hazard is economic. Buildings, infrastructure, and critical facilities are not vulnerable to this hazard. However, virtually all structures, property, and people in the county, as outlined in Section 3.2, could suffer secondary effects of the economic loss. Likely, the most significantly impacted assets would be agricultural land and structures, with a total value of over \$300 million and the 2,500 people who live in agricultural (unincorporated areas).

All critical assets in the county, as outlined in Section 3.2, could be impacted by this hazard, although, again, it would be a secondary effect.

**Animal/Plant/Crop Disease Loss Estimation:**

Again, most of the quantifiable losses due to this hazard are economic.

Rough estimates of potential direct losses from a maximum threat event fall in the range of 1 to 75% of livestock receipts. The market value of all livestock sold in Ringgold County in 2012 was \$33,895,000, according to the 2012 Agricultural Census. Based on a worst-case scenario where 75% of livestock is lost in a given year due to agricultural infestations, the total loss could exceed \$25.4 million in economic activity.

Rough estimates to potential direct losses from a maximum threat event fall in the range of 1 to 50% of annual crop receipts. The market value of all crops sold in Adair County in 2012 was \$48,708,000, according to the 2012 Agricultural Census. Based on a worst-case scenario where 50% of crop production is lost in a given year due to agricultural infestations, the total loss could exceed \$24.3 million in economic activity.

In the past five years, only one crop insurance claim totaling \$1,185 has been made due to diseases. This represents less than 1% of claims and 0.01% of the dollar amount of claims.

According to the Iowa State University Extension and the U.S. Forest Service, there are between 5,001 and 50,000 ash trees in Ringgold County. An emerald ash borer infestation that impacts 10% of those trees could translate to millions in losses, assuming an average of \$675 in costs to remove and replace each dead tree.

Most of the above losses would be covered by insurance, in most cases crop insurance. Nonetheless, the risk of a major infestation could be significant in terms of asset contents, even though structures would not suffer loss and in most cases humans would not be infected. However, some pests can harm humans who ingest infected plants and meats.

**Future Development and Animal/Plant/Crop Disease:**

Future development is not expected to significantly impact the planning area’s vulnerability to this hazard unless crop and livestock numbers greatly increase. The most imminent future risk may be emerald ash borer, which will affect planting of trees in future development. This can be mitigated by planting other native trees in lieu of ash trees to avoid increasing the vulnerability to plant infestation. Avoiding the introduction of new species of plants and animals, including exotic pets, to the area will also ensure the risks do not increase.

**Dam and Levee Failure Profile**

Type: Technological

Definition: The uncontrolled release of water resulting from a structural failure in a dam, wall, dike, berm, or area of elevated soil that causes flooding.

***Dam and Levee Failure Description:***

Dams are constructed for a variety of uses, including flood control, erosion control, water supply impoundment, hydroelectric power generation, and recreation. Flooding, operating error, poor construction, lack of maintenance, damage due to burrowing animals, vandalism, terrorism, and earthquakes can cause dam failure. Dams are classified into three categories based on the potential risk to people and property should a failure occur: **High Hazard** - If the dam was to fail, lives would be lost and extensive property damage could result; **Moderate Hazard** - Failure could result in loss of life and significant property damage; and **Low Hazard** - Failure results in minimal property damage only. The classification may change over time due to development downstream from the dam since its construction. Older dams may not have been built to the standards of its new classification. Dam hazard potential classifications have nothing to do with the material condition of a dam, only the potential for death or destruction due to the size of the dam, the size of the impoundment, and the characteristics of the area downstream of the dam. The Iowa Department of Natural Resources tracks all dams in the state of Iowa with a height of at least 25 feet or a total storage of at least 50 acre feet of water. The inventory excludes all dams less than 6 feet high regardless of storage capacity and dams less than 15 acre feet of storage regardless of height. The current US Corps of Engineers National Inventory of Dams includes 165 dams in the county, most of which are small dams barely reaching the minimum threshold for inclusion. The county has four lakes with dams that have been given a moderate hazard class and none given a high hazard class by the State of Iowa. The following table shows the current dams in the county.

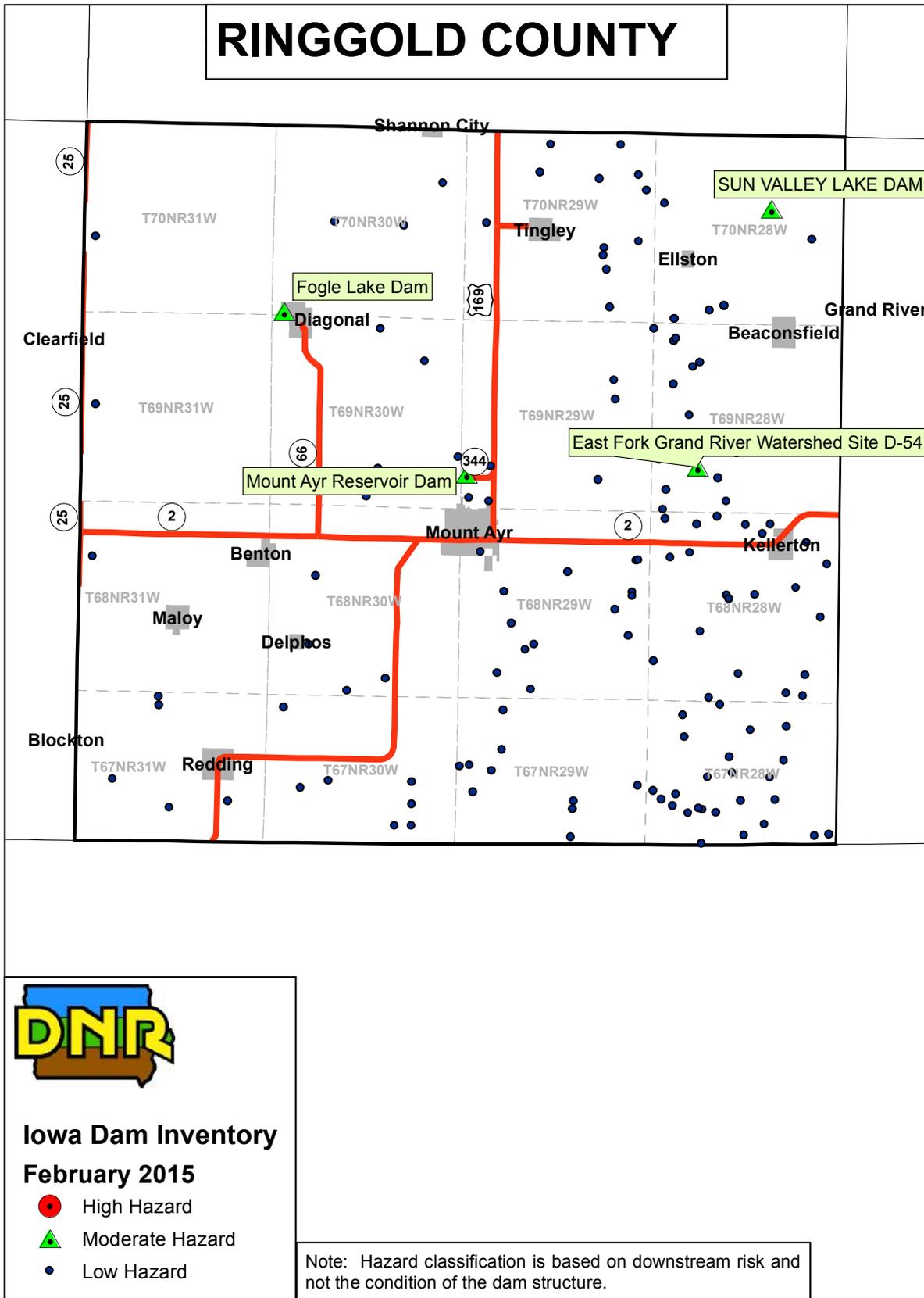
**Figure 3.51: High and Moderate Hazard Dam Information**

<b>Lake and Dam</b>	<b>Location</b>	<b>Height</b>	<b>Acre-Foot Storage</b>	<b>Classification</b>
East Fork Grant River Watershed Site D-54	40.7455, -94.1020, 3 miles northwest of Kellerton	23 ft.	102	Moderate
Fogle Lake Dam	40.8141, -94.3514, northwest corner of Diagonal	36 ft.	679	Moderate
Mount Ayr Reservoir Dam	40.7409, -94.2405, north edge of Mount Ayr	40 ft.	1,410	Moderate
Sun Valley Lake Dam	40.8637, -94.2262, 2 miles northeast of Ellston	67 ft.	11,940	Moderate

*Sources: Iowa DNR (Sept. 2017) and Iowa HSEMD*

The following map shows the dam inventory for the county.

**Figure 3.52: IDNR Dam Inventory Map**



Sources: IDNR Iowa Dam Inventory

Levees are man-made structures designed to control water and protect structure and property in normally flood-prone areas. These can include berms and dikes. These structures can fail when flooding is too severe, they are improperly designed and built, or when they are not maintained. According to the State of Iowa HMP and the planning team,

there are no National Levee Database (NLD) levees or other federal or non-federal levees in the county, nor are there any levees in upstream counties, so this hazard is not a major concern.

Dam and Levee Failure Historical Occurrence:

Two major failures have occurred in Iowa, both at least 150 miles from Ringgold County. There have been no notable or recorded dam failures in Ringgold County. Dam failures can occur in rural Ringgold County due to dams in the county and north of the county (in Union County). The four moderate hazard dams have experienced no failures nor do they show signs that one is likely in the future.

Dam and Levee Failure Future Probability:

With increased attention to sound design, quality construction, and continued maintenance and inspection, dam failure probability can be reduced, which is the case for the largest dams located within the county. The four moderate dams and any other public dams in the county are inspected regularly and the IDNR is contacted if evidence comes about that makes officials question their safety. Other private dams are small (a few acres at most) and do not pose any significant hazard to other property (private or public) outside of the dam owner’s property. The planning team estimates less than 1% chance of occurrence in the next year involving the listed dams or dams upstream of Ringgold County that could result in waters flowing through the rural parts of the county. No property within cities, except Mount Ayr and Diagonal, and schools are at risk due to the direct effects, although washing out of roads and power lines, and loss of water supplies can have an indirect effect.

The overall rating the community gave for this hazard’s future probability in a survey was: “unlikely.”

Score for Rural Ringgold County: 1	Score for Benton: 0	Score for Diagonal: 1	Score for Ellston: 0
Score for Kellerton: 0	Score for Maloy: 0	Score for Mount Ayr: 1	Score for Tingley: 0
Score for Diagonal School: 0	Score for Mount Ayr School: 0		

Dam and Levee Failure Vulnerability to the Population:

Iowa has 3,323 dams on the state’s dam registry, of with 165 are located in Ringgold County. Yet, the bulk of these are very small low-hazard dams, and none are high-hazard dams. No dams are considered a direct risk to a significant population. People and property along streams are most vulnerable to failures of these dams. Based on the topographical characteristics of these dams and outflow areas, it is possible that some bridges, buildings, and agricultural land could be impacted. The roads most vulnerable are County Road J23 west of Diagonal, County Road P64 north of Sun Valley Lake, and several other secondary roads within a few miles of these dams. Roads could be closed and a few homes could possibly be impacted. Fogle Lake and Mount Ayr Reservoir are relatively small impoundments but would have a direct impact on mostly undeveloped urban areas within Mount Ayr and Diagonal. A small number of people may need to be evacuated from exposed areas of these towns in case of a dam failure.

Score for Rural Ringgold County: 2	Score for Benton: 0	Score for Diagonal: 2	Score for Ellston: 0
Score for Kellerton: 0	Score for Maloy: 0	Score for Mount Ayr: 2	Score for Tingley: 0
Score for Diagonal School: 0	Score for Mount Ayr School: 0		

Dam and Levee Failure Area of Extent:

The area impacted following a dam failure would be limited to those areas in and near the floodplain. People and property outside the floodplain could also be impacted depending on the proximity to the dam and the height above the normal stream level. The team does not know specifically the size of inundation areas, but it is likely to be a very small part of any jurisdiction based on the amount of water involved in the initial flow. Even the moderate-hazard dams would flood a very small part of the county, Mount Ayr, or Diagonal and would damage roads, farmland, and small buildings within a few miles of the failing dam.

Score for Rural Ringgold County: 1	Score for Benton: 0	Score for Diagonal: 1	Score for Ellston: 0
Score for Kellerton: 0	Score for Maloy: 0	Score for Mount Ayr: 1	Score for Tingley: 0
Score for Diagonal School: 0	Score for Mount Ayr School: 0		

Dam and Levee Failure Severity of Impact:

Dam failure severity will depend on the size of the impoundment, how rapidly it occurs, the extent of failure, and land uses below the dam. The following table shows the relative risks of the worst-case realistic scenario for the size of dams in the county.

**Figure 3.53: Dam and Levee Failure Severity of Impact Scoring Matrix**

Severity Criteria	Discussion	Score
Health and safety of the public	No High Hazard Dams exist, but in inspecting the area around and downstream of those that exists, it is certainly possible that multiple people could be killed due to the sudden rush of water. There are few homes in the areas, but people outdoors on	4 Diagonal, County

	or below the dam or in vehicles near the stream could be caught in the flood.	2 Mt. Ayr
Health and safety of responders	Limited unless a further break occurs that widens the floodwater flow while responders are in the area; also, communications can be lost.	2
Continuity of operations	The loss of each lake would have impacts on continuation of recreation and wildlife services. Because no local lakes are used for daily water supplies or energy production, generally there will be little direct impact.	2
Property, facilities, infrastructure	Failure of each of the dams would result mostly in crop and livestock grazing land flooding and road and bridge damage or loss. Damage to roads and even some residential property is possible. Roads, culverts, and bridges can be damaged due to failures of any number of dams.	3
Delivery of services	Damage to roads and bridges would disrupt the delivery of freight and traffic to key areas of the county.	2
Environmental impacts	Fish populations and vegetation in the lakes would be harmed. Downstream flash flooding would harm vegetation and wildlife and may cause storage facilities below to fail, which may dump more contamination into the waterway.	2
Economic/financial conditions	Loss of the lakes themselves represents lost tourism and recreation spending. The lakes in the county have growing numbers of campers and other people who enjoy the outdoors. While not as significant as other counties, recreational tourism is significant in Ringgold County. The closure and detour of roads in the impacted area, including Highways 169 and 2 and county roads, would result in extensive costly detours to gravel roads to get to and from the towns and various rural areas. Tens to hundreds of acres of farmland would be submerged and livestock could be lost.	2
Regulatory/contractual obligations	Backup water supplies for farmers and fire protection needs could be out of service, thus hindering ability to meet contracted needs.	2
Reputation	If any rescue is botched or if funds allocated to improve dams are not spent property, leading to the dam failure, the impact could be severe; otherwise, limited.	1

The overall rating the community gave for this hazard’s magnitude in a survey was: “negligible.”

Score for Rural Ringgold County: 20	Score for Benton: 0	Score for Diagonal: 20	Score for Ellston: 0
Score for Kellerton: 0	Score for Maloy: 0	Score for Mount Ayr: 18	Score for Tingley: 0
Score for Diagonal School: 0	Score for Mount Ayr School: 0		

Dam and Levee Failure Speed of Onset:

A dam and levee failure can be immediate and catastrophic, leaving little or no time to warn those downstream of the imminent hazard. With maintenance and monitoring, weak areas and possible failure points can be identified, allowing time for evacuation and securing of the dam. Most dams are only inspected periodically, thus allowing problems to go undetected until a failure occurs. A sudden total failure of the dams in Ringgold County is unlikely, but a failure can build over minutes and complete within a few hours.

Score for Rural Ringgold County: 8	Score for Benton: 0	Score for Diagonal: 8	Score for Ellston: 0
Score for Kellerton: 0	Score for Maloy: 0	Score for Mount Ayr: 8	Score for Tingley: 0
Score for Diagonal School: 0	Score for Mount Ayr School: 0		

Dam and Levee Failure Duration of Event:

A dam failure may start slowly and take a moderate period of time to complete its destruction. The event could last from a few hours to days before all the water is released. The longer duration of event would likely result in less damage and fatalities because the initial torrent of water after the incident begins will be less. However, the long duration can also mean that responders cannot access the area until it is too late to rescue people and survey property and infrastructure. The score the planning team has used here factors the time required for enough water to be released so that responders can reach the site, based on the size of dams and impoundments in the county.

Score for Rural Ringgold County: 6	Score for Benton: 0	Score for Diagonal: 6	Score for Ellston: 0
Score for Kellerton: 0	Score for Maloy: 0	Score for Mount Ayr: 6	Score for Tingley: 0
Score for Diagonal School: 0	Score for Mount Ayr School: 0		

Dam and Levee Failure Total Scores:

The following total scores for dam and levee failure indicate low to moderate risk to the public and the planning area where incidents can occur.

Score for Rural Ringgold County: 38	Score for Benton: 0	Score for Diagonal: 38	Score for Ellston: 0
Score for Kellerton: 0	Score for Maloy: 0	Score for Mount Ayr: 36	Score for Tingley: 0
Score for Diagonal School: 0	Score for Mount Ayr School: 0		

Dam and Levee Failure Vulnerability/Assets at Risk:

This vulnerability assessment is based on the high and moderate hazard dams in the planning area. Only assets in rural Ringgold County and very small parts of Mount Ayr and Diagonal would be at risk. Only small percentage of the assets in these areas would be at risk, as outlined below, compared to the full lists of assets in Section 3.2.

**Figure 3.54: Rural Ringgold County Dam and Levee Failure Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	5	\$250,000	10	0.2%
Commercial	0	\$0	0	0%
Industrial	0	\$0	0	0%
Ag Structures and Land	10 buildings; 5,000 acres	\$10,000,000	2	2%
Taxable Infrastructure	1	\$3,000,000	0	3%
Government/Institutional	2	\$6,000,000	10	3%
Totals	18	\$19,250,000	22	2.0%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

As this table shows, an estimated 37 residents live or will be located in rural areas that are at risk of inundation of other loss when a dam failure occurs in Ringgold County. Based on data available, there is no direct risk due to dam failures in other upstream counties. The total valuation at risk of 18 properties exceeds \$19 million dollars, it is estimated. Only a small number of occupied properties are known to be at risk. No analysis was done to determine the extent of risk to occupied properties, such as the location of inundation versus the home situation on a lot or number of vehicles that may be on impacted county roadway at a given time of a dam failure.

The following critical assets in the county, as outlined in Section 3.2, could be impacted by this hazard because they are in or partly within the potential inundation areas:

- Sun Valley Lake
- Fogle Lake (partially within Diagonal)
- The Mount Ayr Fish Hatchery
- Approximately a dozen bridges in the county downstream from the various lakes
- Approximately five miles of rural roads and highways, including paved County Roads J23 and P64.

Within Diagonal and Mount Ayr very little value and few critical assets are likely to be impacted other than the impoundments themselves. A handful of people within the boundaries of each city could be impacted, but this impact would most likely be indirect.

Dam and Levee Failure Loss Estimation:

The main losses due to a dam failure in Ringgold County would be quality of life, unless the failure is a sudden complete failure of the entire dam. Based on the topography below local dams and the volume of water, a complete and sudden full failure where there is a wall of water suddenly released downstream would be required to cause significant damage more than immediately below the dam. It is possible in this situation that the above list of assets would be damaged. The damage would be greatest within the county park areas and private developments along Sun Valley Lake. Downstream from most of the county’s dams within a few miles are secondary roads, farmland, and bridges. Anything more than about a mile from the dam would likely suffer the same loss as during a flood event (see river flood profile). The farther the water reaches from the dam, the less severe the physical/structural loss would be. Physical losses from a total failure may reach over \$1 million dollars to crops and livestock lost, damage to docks and boats, bridges damaged or removed, roads washed away, and utilities damaged.

In any type of dam failure where the water drains from the lake, the loss would be significant for the local economy, because all the significant hazard dams are part of park and recreation areas that host fishing, camping, and other activities or are on private lakes that support high-value homes and watercraft. While the local economy is diverse, recreation and tourism are significant elements, and the economic loss could top \$1 million.

Fortunately, unlike surrounding counties, none of the local lakes that would be impacted provide surface water supplies.

Future Development and Dam and Levee Failure:

Future development located downstream from dams in floodplains or inundation zones would increase vulnerability. However, such development is unlikely, except perhaps road and bridge upgrades that must be located in the hazard area. While Ringgold County does not have development restrictions in rural areas, except within the SFHA, it is unlikely that private development would occur downstream within a few miles of a dam or anywhere in a floodplain.

**Drought Profile**

Type: Natural

Definition: A period of prolonged abnormally low precipitation producing severe dry conditions.

Drought Description:

There are four types of drought conditions that are relevant to Iowa: Meteorological drought, which refers to precipitation deficiency; hydrological drought, which refers to declining surface water and groundwater supplies; agricultural drought, which refers to soil moisture deficiencies, and socioeconomic drought, which refers to when physical water shortages begin to affect people. Droughts can be spotty or widespread and last from weeks to a period of years. A prolonged drought can have serious economic impact on a community. Increased demand for water and electricity may result in shortages of resources. Moreover, food shortages may occur if agricultural production is damaged or destroyed by a loss of crops or livestock. While droughts are generally associated with extreme heat, droughts can and do occur during cooler months.

Drought Historical Occurrence:

Drought has been a significant part of life in rural Iowa, including Ringgold County, for all of modern history. According to the NCDC, there have been 10 droughts from 1999 (none reported before that year) through September 2017. While damage and loss are not reported by county for this hazard, the events that affected Adair County caused no deaths and injuries but significant property and crop damage, \$12.65 million and \$97.65 million respectively, regionally. Drought years reported to the NCDC include 1999, 2000, 2001, 2003, 2012, and 2013. Most occurred in or involved the month of August. While some may have been more severe than others, agricultural areas were impacted more heavily than the metropolitan areas where impacts were indirect. The most common forms of drought historically in Iowa are agricultural and meteorological drought as a result of either low soil moisture or a decline in recorded precipitation. Note that the NCDC data provided does not go back before 1999. It also does not record the results of the drought that lasted through most of 2017.

Local planning team members point to droughts in 1977 and 1988 as especially severe. More prolonged droughts occurred around 1998, the early 2000s, and 2012-2013. In the past decade, southwest Iowa suffered from a mild but prolonged drought event that nearly drained all water supplies, even with regional water in place in the last decade. The multi-million dollar construction of a regional rural water system in the 1990s and early 2000s was the result of years of drought and its impacts on farmers and small towns in Ringgold and surrounding counties.

From 1895-1995, according to a map prepared by the National Drought Mitigation Center and presented in the State of Iowa Mitigation Plan, all of Iowa had a Palmer Drought Severity Index (PDSI) of less than -3 (severe drought) 10-14.9% of the time.

Drought Future Probability:

Drought is part of normal climate fluctuations and can last for years at a time. Research and observations of the El Nino/La Nina climate events are resulting in more predictable climate forecasts. Based on the evidence that drought periods seem to occur in cyclical patterns and that all of Iowa is in a drought about 10-14.9% of the time, it can be assumed that any given area of Iowa is at least this likely to have a disaster in a given year. The planning committee estimates that in a given year Ringgold County has a 10% to 19% chance of experiencing a severe drought event (-3.0 to -3.9 PDSI) or worse in a given year. The chance of a minor or moderate drought is even higher.

The overall rating the community gave for this hazard’s future probability in a survey was: “occasional” to “likely.”

Score for Rural Ringgold County: 4	Score for Benton: 4	Score for Diagonal: 4	Score for Ellston: 4
Score for Kellerton: 4	Score for Maloy: 4	Score for Mount Ayr: 4	Score for Tingley: 4
Score for Diagonal School: 4	Score for Mount Ayr School: 4		

Drought Vulnerability to the Population:

Being a rural county with mainly surface water supplies, Ringgold is likely to suffer heavily from an extended drought, both directly and indirectly. In 2006 and again in 2012/13, regional water supplies from some of the regional water source lakes were dangerously low. In the 1980s, before surface lakes were prevalent, many in the county were sick due to drinking from severely low water supply wells. Agriculture, agribusiness, and consumers (if the drought lasted long enough or impacted a large area) would be impacted. Fire suppression can also become a problem due to the dryness of the vegetation and possible lack of water. Farmers would be most impacted, but all county residents are susceptible. Schools and hospitals may suffer short water supplies and increased vulnerably populations due to dehydration. Particular groups most directly impacted include seniors, handicapped persons, and diabetics.

Score for Rural Ringgold County: 6	Score for Benton: 5	Score for Diagonal: 5	Score for Ellston: 5
Score for Kellerton: 5	Score for Maloy: 5	Score for Mount Ayr: 5	Score for Tingley: 5
Score for Diagonal School: 4	Score for Mount Ayr School: 4		

Drought Area of Extent:

A drought would likely affect most of Iowa if not the Midwest as a whole. While not all properties and people will be negatively impacted, the drought would occur countywide and in all jurisdiction at a given time.

Score for Rural Ringgold County: 9	Score for Benton: 9	Score for Diagonal: 9	Score for Ellston: 9
Score for Kellerton: 9	Score for Maloy: 9	Score for Mount Ayr: 9	Score for Tingley: 9
Score for Diagonal School: 9	Score for Mount Ayr School: 9		

Drought Severity of Impact:

The most commonly used indicator of drought and drought severity is the Palmer Drought Severity Index (PDSI) published jointly by NOAA and the United States Department of Agriculture. The PDSI measures the departure of water supply (in terms of precipitation and stored soil moisture) from demand (the amount of water required to recharge soil and keep rivers, lakes and reservoirs at normal levels). The result is a scale from +4 to -4, ranging from an extremely moist spell to extreme drought. By relating the PDSI number to a regional index, one can compile data that reflects long-term wet or dry tendencies. The following table illustrates the PDSI.

**Figure 3.55: PDSI Index Description**

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

Regional indicators such as the PSDI are limited in that they respond slowly to deteriorating conditions. On the other hand, observing surface conditions and groundwater measurements may provide only a snapshot of a very small area. Therefore, the use of a variety of drought indicators is essential for effective assessment of drought conditions. Other climatic factors such as high temperatures, prolonged high winds/and low relative humidity can aggravate the severity of a drought. Severity depends on duration, intensity, geographic extent and the demands made by human activities and vegetation of regional water supplies.

The following table illustrates the potential impacts of drought.

**Figure 3.56: Drought Impacts by Severity Classification**

Drought Severity	Return Period (years)	Description of Possible Impacts	Drought Monitoring Indices		
			Standardized Precipitation Index (SPI)	NDMC* Drought Category	Palmer Drought Index
Minor Drought	3 to 4	Going into drought; short-term dryness slowing growth of crops or pastures; fire risk above average. Coming out of drought; some lingering water deficits; pastures or crops not fully recovered.	-0.5 to -0.7	D0	-1.0 to -1.9
Moderate Drought	5 to 9	Some damage to crops or pastures; fire risk high; streams, reservoirs, or wells low, some water shortages developing or imminent, voluntary water use restrictions requested.	-0.8 to -1.2	D1	-2.0 to -2.9
Severe Drought	10 to 17	Crop or pasture losses likely, fire risk very high; water shortages common; water restrictions imposed.	-1.3 to -1.5	D2	-3.0 to -3.9
Extreme Drought	18 to 43	Major crop and pasture losses; extreme fire danger; widespread water shortages or restrictions.	-1.6 to -1.9	D3	-4.0 to -4.9
Exceptional Drought	44+	Exceptional and widespread crop and pasture losses; exceptional fire risk; shortages of water in reservoirs, streams, and wells creating water emergencies.	less than -2	D4	-5.0 or less

\*NDMC - National Drought Mitigation Center

Source: Iowa Hazard Mitigation Plan, 2013

The following table shows the relative risks of an extreme drought.

**Figure 3.57: Drought Severity of Impact Scoring Matrix**

Severity Criteria	Discussion	Score
Health and safety of the public	Health can be compromised due to the lack of quality water. While the bottled water industry can mitigate some of these issues temporarily, running water is necessary. The planning team indicates that the Jordan Aquifer is reported to be very unpleasant and unsafe to drink. Funds are too limited for any other alternative to surface water. Lake sources can shrink and result in the inability to dilute chemicals entering water sources. Wildfires are also increasingly likely. Hospitals indicate a high number of people needing treatment for dehydration taxes their service capacity.	2
Health and safety of responders	Limited unless firefighters are fighting a fire or other hazard and run out of water.	1
Continuity of operations	This impact would be minimal and not easily assessed. Some facilities and services may be unable to operate once the drought was severe enough.	2
Property, facilities, infrastructure	Extreme dry weather can cause lakes to dry up, pipes to heave, and roads and bridges to sustain damage, especially if the drought causes expansive (or contractive) soils. Again, crops and livestock could be lost.	2
Delivery of services	Except for delivery of surface water for humans, pets, and livestock, few services would be impacted. Large industry that requires large volumes of water would not be able to deliver services.	2
Environmental impacts	Fish populations and vegetation in the lakes and streams can be harmed. Sensitive plants and crops would be harmed. Mass vegetative death could impact wildlife negatively or cause greater risk of landslides, erosion, and other soil loss hazards. Land quality can be harmed by overgrazing during drought. Water quality can become degraded and can cause a large nitrate concentration in the rivers. Low stream flow will be negative impacts on riparian habitats and aquatic species.	4
Economic/financial conditions	Drought can lead to large and damaging impacts to the agricultural economy. Because of Iowa's reliance on the agricultural economy, the economic and financial impacts	4

	would certainly ripple out into other sectors. Rural areas can be especially affected by long-term drought. In 2012 alone crop damages from drought were \$4.992 billion in Iowa. If restrictions were put on manufacturers that use large amounts of water, the local economy would be severely impacted.	
Regulatory/contractual obligations	Area water suppliers would not be able to meet its obligated water supply production with the drop in lake supplies. Regulations in the agricultural sector can be and are often adjusted to provide some lenience for adverse conditions for livestock and crop loss.	3
Reputation	Local jurisdictions can suffer reputation damage if they do not provide source water to residents or respond in a satisfactory manner to provide an alternative supply.	2

The overall rating the community gave for this hazard’s magnitude in a survey was: “critical 1.”

Score for Rural Ringgold County: 22	Score for Benton: 22	Score for Diagonal: 22	Score for Ellston: 22
Score for Kellerton: 22	Score for Maloy: 22	Score for Mount Ayr: 22	Score for Tingley: 22
Score for Diagonal School: 22	Score for Mount Ayr School: 22		

Drought Speed of Onset:

Drought warning is based on a complex interaction of many different variables, water uses, and consumer needs. Drought warning is directly related to the ability to predict the occurrence of atmospheric conditions that produce the physical aspects of drought, primarily precipitation and temperature. There are so many variables that can affect the outcome of climatic interactions, and it is difficult to predict a drought in advance. In fact, an area may already be in a drought before it is even recognized. However, the weather that results in a drought, such as prolonged dry weather, requires weeks or months to produce drought conditions.

Score for Rural Ringgold County: 1	Score for Benton: 1	Score for Diagonal: 1	Score for Ellston: 1
Score for Kellerton: 1	Score for Maloy: 1	Score for Mount Ayr: 1	Score for Tingley: 1
Score for Diagonal School: 1	Score for Mount Ayr School: 1		

Drought Duration of Event:

A drought, especially a severe drought, almost always lasts for weeks before adequate rainfall occurs to alleviate the drought conditions.

Score for Rural Ringgold County: 9	Score for Benton: 9	Score for Diagonal: 9	Score for Ellston: 9
Score for Kellerton: 9	Score for Maloy: 9	Score for Mount Ayr: 9	Score for Tingley: 9
Score for Diagonal School: 9	Score for Mount Ayr School: 9		

Drought Total Scores:

The following total scores for drought indicate moderate to high risk to the public and the planning area where incidents can occur.

Score for Rural Ringgold County: 51	Score for Benton: 50	Score for Diagonal: 50	Score for Ellston: 50
Score for Kellerton: 50	Score for Maloy: 50	Score for Mount Ayr: 50	Score for Tingley: 50
Score for Diagonal School: 49	Score for Mount Ayr School: 49		

Drought Vulnerability/Assets at Risk:

While all structures, property, and people in the county would be at risk, the greatest risk of this hazard is economic. Buildings, infrastructure, and critical facilities, with rare exception, are not directly vulnerable to this hazard, although shrinking clay soils can cause secondary hazards to buildings and utilities (see expansive soils profile). However, virtually all assets in the county, as outlined in Section 3.2, could suffer secondary effects of the economic loss, namely to crops and livestock. However, the secondary effect of water rationing, soil loss, soil expansion/contraction, and reduction of recreational lake water levels could impact not just the economy but also structures and people in all parts of the county. In a long severe drought, all people would be adversely affected to some degree.

All critical assets in the county, as outlined in Section 3.2, could be impacted by this hazard, although, again, it would be a secondary effect in most cases.

Drought Loss Estimation:

According to the USDA’s Risk Management Agency, payments for drought crop losses top any other cause for insurance claims in total losses in Ringgold County. During the drought conditions in 2013, over \$9.1 million in claims were made in Ringgold County alone for drought loss (96%) of the total five-year drought claims (\$9,581,055.95). Farmers suffer the most because wells run dry, crops wilt and die, and forage for livestock becomes scarce and costly. With over 75% of the land in the planning area being used for agriculture, the exposure to drought is very high. 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 soils (see expansive soils profile) during excessively dry soils. Public health can be compromised due to the loss of water supply. Even with the regional water supplies in place, thousands of residents throughout the county, nearly all those living in the county, would likely suffer some level of risk to their health. Dozens both in town and in rural areas would likely suffer from sickness or other health problems during any drought event.

According to the 2013 Iowa Hazard Mitigation Plan, drought was ranked 2<sup>nd</sup> of eight hazards in annualized losses based on data spanning 18 years. Although losses from this hazard reach millions of dollars each time drought occurs, much of it is mitigated by crop insurance. However, losses to public health, industrial and business disruption, fire capabilities, tourism loss, and inconvenience are not covered. 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. If Mount Ayr, for example, would have to purchase potable water based on FEMA's potable water cost of \$93 per person per day, the potential cost would be approximately \$155,000 per day.

In the past nearly five years (2013-September 2017), there have been \$26.15 million in claims for crop insurance in Ringgold County, an average of \$5.56 million per year. Over 36% of crop insurance claims during this period in terms of dollars were as a result of drought. According to the 2013 Iowa Crop Profile from the USDA's Risk Management Agency, 90.5% of insurable crops in Iowa are insured with USDA crop insurance. Based on insured loss data for droughts that exceed \$26.15 million for the past five years, it can be stated that approximately \$2.6 million in uninsured losses occurred over that time for an average of \$555,000 per year. This is a total of an estimated \$10.1 million in drought losses per year. Based on the 2012 Census of Agriculture total crops sold of \$48,708,000, an estimated 21% of crop value is lost due to drought.

#### Future Development and Drought:

Increases in the amount of land used for crops and in new development resulting in new residents in the planning area both would result in an increase risk, simply because exposure is greater. Commodity prices will affect the economic cost per incident.

### ***Expansive Soils Profile***

Type: Natural

Definition: Soils and soft rock that tend to swell or shrink excessively due to changes in moisture content.

#### Expansive Soils Description:

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. The hazard occurs in many parts of the Southern, Central, and Western United States, including most areas of Iowa. Recent estimates put the annual damage from expansive soils as high as \$7 billion nationwide. However, because the hazard develops gradually and seldom presents a threat to life, expansive soils have received limited attention, despite their costly effects. Expansive soils can cause more immediate hazards in high-clay soils like found in Ringgold County, such as frost bubbles in roads and broken utility lines.

#### Expansive Soils Historical Occurrence:

In Ringgold County, high clay soils mean that buildings with weak foundations and basements can be and have been affected by shrinking and swelling soils. Historical events have been isolated and have impacted areas of less than 20 feet in diameter. The planning team notes that foundations of homes and some rural bridges have been damaged. The planning team indicates that frost boils have erupted under roads in early spring thaws, causing damage to those roads and to vehicles driving over them. Numerous rural bridges have experienced soil loss on bridge approaches. Numerous homes have suffered from cracked and broken basements over the course of time. At least one church building has reported damage. This is an actually pretty common hazard in a small scale and likely is very under-reported or only reported to a property owner's insurance company.

#### Expansive Soils Future Probability:

Probability and frequency analyses have not been prepared because of the nature of occurrence of this hazard. This is consistent with other geological hazards that occur slowly over time. The probability is much higher for an individual building suffering from expansive soils than for a widespread incidence affecting multiple properties and requiring a public response. It is likely that individual properties will be affected every year. Only on occasion, such as once every five years, will an expansive soils event occur in widespread areas of the county.

The committee anticipates a 5-10% probability in a given year of finding one or more expansive soils incidents that impact critical infrastructure, such as cause road closures or damage essential pipelines. House and other building foundations will continue to be subjected to this hazard due to Iowa's constantly changing weather conditions and contrasting seasons. Awareness of this hazard in the past ten years has resulted in mitigation through better

construction practices, soil testing before construction, and use of proper fill and drainage techniques around buildings and structures. The probability is likely to be less than past occurrence. However, the members of the planning committee representing the rural part of the county felt that the hazard will continue to be a problem for rural infrastructure and agreed the probability would be much higher.

The overall rating the community gave for this hazard’s future probability in a survey was: “occasional.”

Score for Rural Ringgold County: 9	Score for Benton: 2	Score for Diagonal: 2	Score for Ellston: 2
Score for Kellerton: 2	Score for Maloy: 2	Score for Mount Ayr: 3	Score for Tingley: 2
Score for Diagonal School: 2	Score for Mount Ayr School: 1		

Expansive Soils Vulnerability to the Population:

Information on clay soils is limited for most properties, but Ringgold County residents are accustomed to minor incidents resulting in bowing basement walls and cracking foundations. There is very little risk to human life in most cases. Impacts commonly involve swelling clays beneath areas covered by buildings and slabs of concrete and asphalt, such as those used in construction of highways, walkways, and airport runways. Most major new construction projects, such as government buildings and roads, involve extensive soil testing. Despite some minor variations by community, the committee believes the overall impact is pretty low overall. Minor road and foundation issues can impact hundreds of people mostly in the way of inconveniences and home repair costs, which are usually insurable. The planning team indicates that the hazard causes “long-term damage rather than an immediate impact.” Damaged or broken electrical facilities and water, sewer, or gas lines can impact a larger population. When organizations build large buildings, the design must often include structural fill to address the expansive nature of the local soils.

Score for Rural Ringgold County: 4	Score for Benton: 5	Score for Diagonal: 5	Score for Ellston: 5
Score for Kellerton: 5	Score for Maloy: 5	Score for Mount Ayr: 5	Score for Tingley: 5
Score for Diagonal School: 2	Score for Mount Ayr School: 2		

Expansive Soils Area of Extent:

According to the map in the 2013 State of Iowa Hazard Mitigation Plan from “Swelling Clays Map of the Conterminous United States,” all of Ringgold County is in the “part of unit (generally less than 50%) consists of clay having slight to moderate swelling potential.” Those who live in the area would agree that this category understates the shrink/swell potential, as evidenced in the common occurrence of damaged roads, sidewalks, driveways, basement walls, and building foundations. The amount of clay in area soils countywide is high, and often it shrinks and swells as a results of rain, drought, and ground frost. Nonetheless, the hazard is not entirely widespread because there are variations in soils and, in areas where development has not occurred, these soils are not hazards. Most occurrences in Ringgold County will be very limited in size and have no widespread significance.

Score for Rural Ringgold County: 2	Score for Benton: 2	Score for Diagonal: 2	Score for Ellston: 2
Score for Kellerton: 2	Score for Maloy: 2	Score for Mount Ayr: 2	Score for Tingley: 2
Score for Diagonal School: 2	Score for Mount Ayr School: 2		

Expansive Soils Severity of Impact:

The severity of expansive soils depends primarily on what structures and assets are located in the soils that expand. Often expansion and contraction will not cause any damage. Other times the result will be broken pipes, large cracks in roads and foundations, sinkholes, and other hazards. The cascading impacts can be significant if large populations and key assets are in the path of the damage due to hazards such as hazardous materials leaks.

The table below shows the relative risks of a typical expansive soils event.

**Figure 3.58: Expansive Soils Severity of Impact Scoring Matrix**

Severity Criteria	Discussion	Score
Health and safety of the public	Very little to no impact is projected directly. Natural gas or plumbing leaks in homes and buildings present risk in rare cases when undetected or addressed quickly enough. Cracks in basement walls can allow radon, which is a poisonous gas common to Iowa, to enter homes.	2
Health and safety of responders	Usually no response will be necessary, but when critical public infrastructure or pipelines are damaged, emergency response might be necessary.	1
Continuity of operations	Road detours may result, causing inconvenience. Water, sewer, and power facilities may be damaged, causing inconvenience, possible sickness, and possible fires, and other issues. Continuity on a wide scale is not likely to be disrupted.	2
Property, facilities, infrastructure	The most extensive damage from expansive soils occurs to highways and streets. Houses and one-story commercial buildings are more apt to be damaged by the expansion of swelling than are multi-story buildings, which usually are heavy enough to counter swelling pressures. The most obvious manifestations of damage to buildings	3

	are sticking doors, uneven floors, and cracked foundations, floors, walls, ceilings, and windows. Major lifeline systems can be affected, including water and sewer lines, gas pipelines, and high voltage power lines.	
Delivery of services	Delivery of services should not be impacted. Life threatening impacts from the loss of services would not be likely.	1
Environmental impacts	No direct or long-term affect on the environment unless a hazardous materials is leaked following pipeline failure or similar damages.	2
Economic/financial conditions	Economic and financial impacts would be limited, resulting from disruption of the flow of goods and services. Business disruption would likely be very short if any. Loss of infrastructure could cause greater concerns.	2
Regulatory/contractual obligations	The jurisdiction would have to repair the roads and surfaces impacted.	2
Reputation	No foreseeable impacts on the reputation of the entity unless the problem is ignored and allowed to worsen, such as potholes continuing to expand. Damage caused in ROW areas can be controversial related to property owner rights and responsibilities.	2

The overall rating the community gave for this hazard’s magnitude in a survey was: “limited.”

Score for Rural Ringgold County: 17	Score for Benton: 17	Score for Diagonal: 17	Score for Ellston: 17
Score for Kellerton: 17	Score for Maloy: 17	Score for Mount Ayr: 17	Score for Tingley: 17
Score for Diagonal School: 17	Score for Mount Ayr School: 17		

Expansive Soils Speed of Onset:

Soil issues in Ringgold County, including frost boils and foundation cracking, would occur rather slowly but could escape notice until suddenly significant damage has occurred. We would have some warning that events could occur soon due to prolonged weather patterns, such as excessive rain and winter weather. These signs might help us understand that expansive soils will likely cause damage but it will not provide details on where they will occur and which assets are affected. Underground pipes might be subject to slowly occurring events that are undetected until suddenly the pipe breaks. These sudden occurrences result in the greatest damage for which mitigation is necessary.

Score for Rural Ringgold County: 5	Score for Benton: 5	Score for Diagonal: 5	Score for Ellston: 5
Score for Kellerton: 5	Score for Maloy: 5	Score for Mount Ayr: 5	Score for Tingley: 5
Score for Diagonal School: 5	Score for Mount Ayr School: 5		

Expansive Soils Duration of Event:

An expansive soils incident will typically last from a few minutes to days or even weeks. If not corrected, the event can continue to occur and the damage can grow perpetually. Mitigation is most urgent for the most rapidly occurring events but long-term shifts in foundations and road cracking can be significant hazards also.

Score for Rural Ringgold County: 9	Score for Benton: 9	Score for Diagonal: 9	Score for Ellston: 9
Score for Kellerton: 9	Score for Maloy: 9	Score for Mount Ayr: 9	Score for Tingley: 9
Score for Diagonal School: 9	Score for Mount Ayr School: 9		

Expansive Soils Total Scores:

The following total scores for expansive soils indicate low to moderate risk to the public and the planning area where incidents can occur.

Score for Rural Ringgold County: 46	Score for Benton: 40	Score for Diagonal: 40	Score for Ellston: 40
Score for Kellerton: 40	Score for Maloy: 40	Score for Mount Ayr: 41	Score for Tingley: 40
Score for Diagonal School: 36	Score for Mount Ayr School: 36		

Expansive Soils Vulnerability/Assets at Risk:

Expansive soils are found throughout the county, but short of a site-by-site analysis of soil data, it is difficult to ascertain which specific properties and assets are at risk and which ones are not. For this reason, the analysis considers that all structures, property, and people, as outlined in Section 3.2, could be at risk. In reality, most structures and properties that do not have basements or that are well built will not experience damage due to this hazard.

All critical assets in the county, as outlined in Section 3.2, could be impacted by this hazard, although the damage to any individual building may be minor and most events or incidents will be of a localized nature, affecting only one or a few structures or portions of structures.

Expansive Soils Loss Estimation:

The losses due to this hazard depend mostly on the location in relation to structures and assets, the type of soil, the quality of construction, and how widespread the hazard is. Sometimes, the conditions, such as prolonged heavy rain, a severe frost followed by rapid thaw, or severe drought, can be widespread and impact dozens or even hundreds of

properties, cracking foundations, tipping utility poles, buckling roads, and snapping pipelines. In these extreme events, the effects can be sudden and can cause injuries or, although rare, even death. The greatest likelihood of loss is to foundations of structures, with dozens damaged each incident at an average cost of \$5,000 to the average structure. Physical losses throughout the planning area may exceed \$500,000 per year in years when incidents are widespread.

Future Development and Expansive Soils:

An increase in the amount of land used for new structures will increase risk simply because exposure is greater. Depending on the type and quality of construction of modern buildings, the risk could vary compared to existing development.

**Extreme Heat Profile**

Type: Natural

Definition: Summertime weather that is substantially hotter and/or more humid than average for a location at that time of year.

Extreme Heat Description:

In Iowa, extreme heat events (EHE) result from a prolonged period of excessive heat and humidity. Because how hot the temperature feels depends on the interaction of multiple meteorological variables (e.g., temperature, humidity, wind, cloud cover), extreme heat criteria typically shift by location and time of year. In other words, Boston, Philadelphia, Miami, Dallas, Chicago, San Diego, and Seattle are likely to have different criteria at any point in the summer to reflect different local standards for unusually hot summertime weather. In addition, these criteria are likely to change for each city over the summer. Excessive heat is the leading cause of weather fatalities in the nation (through 2009), edging flooding and hurricanes by a small margin. Heat fatality data may actually be under-representative because it might be difficult to see the role of heat in the death of people days or months after the event. Many people do not realize how deadly a heat wave can be. In contrast to the visible, destructive, and violent nature of floods, hurricanes, and tornadoes, a heat wave is a silent killer. Heat kills by overloading the human body's capacity to cool itself. In a normal year, about 117 Americans die as a direct result of excessive heat. In a heat wave in 1980, more than 1,250 people died nationwide.

Extreme Heat Historical Occurrence:

Even though the NCDC has reported only three EHE events, almost every summer there has been at least one EHE as defined by the planning team using the State plan's definition. Extreme heat has stressed crops, exacerbated droughts, and caused sickness to people and livestock. There are no known human fatalities directly attributed to EHE events in Ringgold County. The week of July 18, 2011 sustained a weeklong excessive heat warning with most of the week seeing 110-degree-plus heat indexes during the day and 90-plus heat indexes at night. In 2012-2014, Ringgold County experienced at least one day over 100 degrees. It was over 95 degrees for two straight weeks in 2012 and there were at least 12 days that exceeded 100 degrees that summer. The extreme heat affected people, livestock, and crops. Many elderly people suffered during these events.

According to the National Climatic Data Center, 3 extreme heat events were reported in Ringgold County, between 01/01/1995 and 9/30/2017. These events occurred in 2001, 2011, and 2016. No deaths or injuries were reported during these hazard events. Property damage was \$135,000. No crop damage was reported, but the planning team recognizes that crop damage does occur due to extreme heat.

Clearly, not all extreme heat events, as defined in this plan, are reported in the NCDC database. Perhaps this is because widespread damages and deaths attributed directly to the event are reported in only a few cases. The planning team indicates that high heat combined with humidity cause damage in some form (lost productivity, increased fire risk, sickness and death, infrastructure problems) almost every summer and sometimes for days at a time during spells in a given summer. The Ringgold County planning team indicates that the incidence of extreme heat is an at-least bi-annual event and has occurred at least 12 times in the past 25 years, most recently in 2017 as the result of a few days where the heat index exceeded 105 degrees. Ringgold County, being in southern Iowa, is typically slightly hotter than the state average.

The history of extreme heat can be measured in one way by looking at past high temperature records. The Iowa State University Department of Agronomy (<http://mesonet.agron.iastate.edu/request/coop/fe.phtml>) maintains records from the NWS weather station at Mount Ayr. These records include daily highs from January 1, 1893 through today (December 21, 2017). The recorded high temperature was 106 degrees F (two occasions). There have been 228 days where the temperature reached or exceeded 100 degrees, most recently on August 31, 2013.

Extreme Heat Future Probability:

Extreme heat is likely in any given summer, sometimes on multiple occasions. If temperature extremes continue to become more common in this region, the likelihood for extreme heat increases. The planning team estimates extreme heat will have a 60-75% chance of occurring in the next year. However, the probability will depend greatly on severity, as the following chart shows.

**Figure 3.59: Extreme Heat Probability by Level of Severity**

Heat Condition	Probability in Planning Area	Relative Severity
Heat index of 130 degrees F or higher	Very rare (1% chance)	Catastrophic
Heat index of 105 to 129 degrees F	Common (50%+ chance)	Critical
Heat index of 90 to 104 degrees F	Several times to regularly	Limited
Heat index of less than 90 degrees F	Most late spring and summer days	Negligible

For planning purposes, this probability assessment considers the conditions of a heat index of 105 to 129 degrees F.

The overall rating the community gave for this hazard’s future probability in a survey was: “occasional” to “highly likely.”

Score for Rural Ringgold County: 6	Score for Benton: 6	Score for Diagonal: 6	Score for Ellston: 6
Score for Kellerton: 6	Score for Maloy: 6	Score for Mount Ayr: 6	Score for Tingley: 6
Score for Diagonal School: 6	Score for Mount Ayr School: 6		

Extreme Heat Vulnerability to the Population:

Extreme heat events are known to be among the greatest cause of natural hazard death and illness to humans and pets. Recent information released by the NOAA Office of Climate, Water, and Weather Services states extreme heat is the number one, non-severe weather related, killer in the United States. Elderly persons, small children, chronic invalids, those on certain medications or drugs (especially tranquilizers and anticholinergics), and persons with weight and alcohol problems are particularly susceptible to heat reactions. The planning team mentions the high population of elderly people in the county. Healthy individuals working outdoors in the sun and heat are vulnerable. Low-income individuals and inner city dwellers can also be susceptible without access to air-conditioned rooms. While no reported deaths have been attributed directly to extreme heat in Ringgold County, illnesses have occurred and the stress of heat is certainly a factor in deaths of the elderly. Currently, there are designated cooling shelters, namely certain school buildings and community halls are available, as defined in the community profile chapter (Chapter 2).

Indirect effects of extreme heat will impact more people through loss of productivity in business, reduced water supplies, inability to participate in the outdoors, higher utility costs, and reduced agricultural productivity. However, not all people will be affected directly. In the general population the risk is greater than in schools and the hospital, because schools either have air conditioning or they close on extremely hot days and because the hospital has air conditioning.

Score for Rural Ringgold County: 6	Score for Benton: 5	Score for Diagonal: 5	Score for Ellston: 5
Score for Kellerton: 5	Score for Maloy: 5	Score for Mount Ayr: 5	Score for Tingley: 5
Score for Diagonal School: 3	Score for Mount Ayr School: 3		

Extreme Heat Area of Extent:

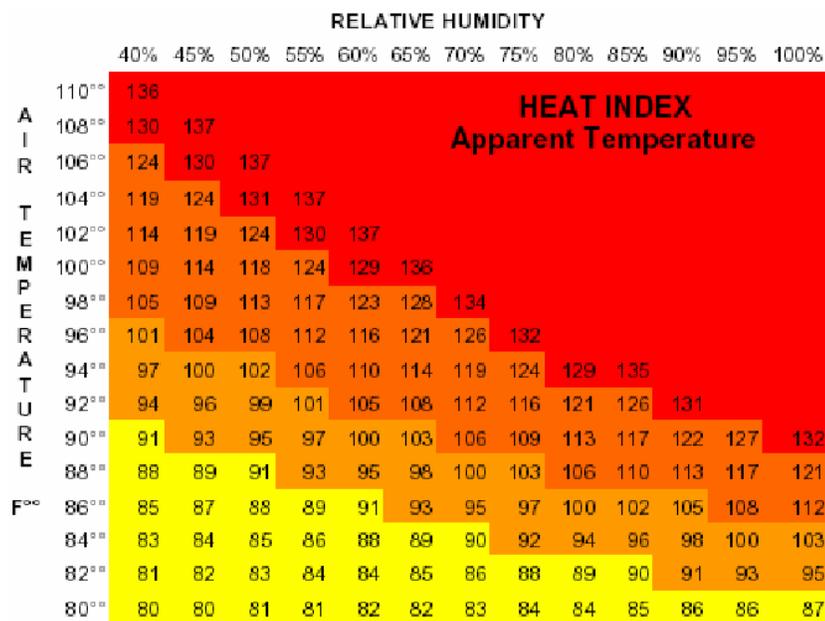
All of Ringgold County would be subjected to the extreme heat with vary rare exceptions.

Score for Rural Ringgold County: 9	Score for Benton: 9	Score for Diagonal: 9	Score for Ellston: 9
Score for Kellerton: 9	Score for Maloy: 9	Score for Mount Ayr: 9	Score for Tingley: 9
Score for Diagonal School: 9	Score for Mount Ayr School: 9		

**Extreme Heat Severity of Impact:**

Heat severity of impact relates to more than just the actual temperature. Air temperature is not the only factor to consider when assessing the likely effects of a heat wave. High humidity, which often accompanies heat in Iowa, can increase the harmful effects. Relative humidity must also be considered, along with exposure, wind, and activity. The heat index devised by the NWS combines air temperature and relative humidity to measure how hot it really feels. For example, if the air temperature is 102 degrees and the relative humidity is 55% then it feels like 130 degrees; 28 degrees hotter than the actual ambient temperature. To find the heat index from the figure shown to the right, find the air temperature along the left side of the table and the relative humidity along the top. Where the two intersect is the Heat Index for any given time of day. The new Mean Heat Index is a measure of how hot the temperatures actually feel to a person over the course of a full 24 hours. It differs from the traditional heat index in that it is an average from the hottest and coolest times of each day. Exposure to full sunshine can increase the heat index by at least 15 degrees.

**Figure 3.60: Heat Index Chart**



The National Weather Service can issue a Heat Advisory or Excessive Heat Warning:

- **Heat Advisory:** A heat index of 100°F or higher is expected for a period of 3 hours or more. A heat advisory shall be continued through the overnight hours, following a day with excessive heat, if the heat index is not expected to fall below "around 75°F". A heat advisory can be issued for a heat index less than 100°F when the cumulative effect of successive days of near advisory heat leads to potentially life threatening conditions.
- **Excessive Heat Warning:** A heat index of 105°F or higher is expected for a period of 3 hours or more. An excessive heat warning shall be continued through the overnight hours, following a day with excessive heat, if the heat index is not expected to fall below "around 75°F". An excessive heat warning can be issued for a heat index less than 105°F when the cumulative effect of successive days of near warning heat leads to life threatening conditions.

While no reported deaths have been attributed directly to extreme heat in Ringgold County, illnesses have occurred, and many people can suffer in many ways. In addition to the human toll are possible impacts such as electrical infrastructure damage and failure, highway damage, crop damage, water shortages, livestock deaths, fish kills, and lost productivity among outdoor-oriented businesses.

As referenced in the probability section, events in the critical stage are typical and are used for the basis of the severity assessment. The following table shows the relative risks of a typical extreme heat event.

**Figure 3.61: Extreme Heat Severity of Impact Scoring Matrix**

Severity Criteria	Discussion	Score
Health and safety of the public	While heat-related illness and death can occur due to exposure to intense heat in just one afternoon, heat stress on the body has a cumulative effect. The persistence of a heat wave increases the danger. Excessive heat can lead to illnesses and other stresses on people with prolonged exposure to these conditions. People can suffer because the effects creep upon them unawares. Excessive heat is the leading cause of weather fatalities in the nation (through 2009). Many people do not realize how deadly a heat wave can be. In contrast to the visible, destructive, and violent nature of floods, hurricanes, and tornadoes, a heat wave is a silent killer. Heat kills by overloading the human body's capacity to cool itself. In a normal year, about 117 Americans succumb to the bodily stresses of summer heat. In a heat wave in 1980, more than 1,250 people died nationwide.	4
Health and safety of responders	Response personnel could suffer heat stroke and dehydration working in extreme heat conditions. Firefighters in heavy gear are at the greatest risk.	4
Continuity of operations	Operations can be hindered due to heat impacts on workers and utility systems. All electric utility systems and Southern Iowa Rural Water report damages and strains on their capabilities. Some schools close for the day during extreme events.	2
Property, facilities, infrastructure	Transportation impacts include the loss of lift for aircrafts, softening of asphalt roads,	2

Severity Criteria	Discussion	Score
	buckling of highways and railways, and stress on automobiles and trucks (increase in mechanical failures). Extreme heat can also cause pavement to buckle and rupture. A 2011 article states that, in a typical year, Iowa DOT maintenance equipment operators spend 2,000 to 4,000 hours making temporary repairs of pavement blowups and another 6,000 hours replacing these pavement sections, costing an average of \$400,000 annually. Power lines and facilities can fail.	
Delivery of services	Electric transmission systems are impacted when power lines sag in high temperatures. High demand for electricity also outstrips supply, causing electric companies to have rolling black outs. The demand for water also increases sharply during periods of extreme heat. This can contribute to fire suppression problems for area fire departments.	3
Environmental impacts	No direct long-term effect on the environment. Livestock and other animals are adversely impacted by extreme heat. High temperatures at the wrong time inhibit crop yields and cause fish kills.	2
Economic/financial conditions	Economic costs in transportation, agriculture, production, energy, and infrastructure are high. Lost productivity, due to conditions that make work outside or in a poorly ventilated building intolerable, can impact many other economic sectors indirectly. Extreme heat can pose a threat to livestock and crops. High temperatures have been shown to reduce summer milk production, impair immunological and digestive function of animals, and increase mortality of livestock. In July 2011, according to The Iowa Cattlemen’s Association approximately 4,000 cattle died due to extreme heat. In 1995, livestock-related economic losses due to heat stress were estimated to be \$31 million in Iowa.	3
Regulatory/contractual obligations	Rural water and electric companies may have trouble providing contracted supplies and meeting sewer discharge regulations. Farmers and other producers may not produce what is required by contracts.	3
Reputation	None if response is adequate and timely.	1

The overall rating the community gave for this hazard’s magnitude in a survey was: “limited “ to “critical.”

Score for Rural Ringgold County: 24	Score for Benton: 24	Score for Diagonal: 24	Score for Ellston: 24
Score for Kellerton: 24	Score for Maloy: 24	Score for Mount Ayr: 24	Score for Tingley: 24
Score for Diagonal School: 9	Score for Mount Ayr School: 24		

Extreme Heat Speed of Onset:

As with other weather phenomena, periods of extreme heat are predictable within a few degrees within 3 days or so. Variations in local conditions can affect the actual temperature within a matter of hours or even minutes. The NWS will initiate alert procedures when the heat index is expected to exceed 105 degrees Fahrenheit for at least two consecutive days.

Score for Rural Ringgold County: 2	Score for Benton: 2	Score for Diagonal: 2	Score for Ellston: 2
Score for Kellerton: 2	Score for Maloy: 2	Score for Mount Ayr: 2	Score for Tingley: 2
Score for Diagonal School: 2	Score for Mount Ayr School: 2		

Extreme Heat Duration of Event:

An extreme heat event typically lasts for the afternoon and evening of a given day or consecutive days but can be all day long for a few days or even a week before cooler air arrives to an area.

Score for Rural Ringgold County: 7	Score for Benton: 7	Score for Diagonal: 7	Score for Ellston: 7
Score for Kellerton: 7	Score for Maloy: 7	Score for Mount Ayr: 7	Score for Tingley: 7
Score for Diagonal School: 7	Score for Mount Ayr School: 7		

Extreme Heat Total Scores:

The following total scores for extreme heat indicate moderate to high risk to the public and the planning area where incidents can occur.

Score for Rural Ringgold County: 54	Score for Benton: 53	Score for Diagonal: 53	Score for Ellston: 53
Score for Kellerton: 53	Score for Maloy: 53	Score for Mount Ayr: 53	Score for Tingley: 53
Score for Diagonal School: 51	Score for Mount Ayr School: 51		

Extreme Heat Vulnerability/Assets at Risk:

Virtually all structures, property, and people in the county, as outlined in Section 3.2, could suffer from the effects of extreme heat. While the heat itself will rarely damage buildings, it can damage infrastructure that supports buildings. Power lines, towers, roads, and bridges are at the most risk among structures. Contents losses are likely to be minor, even compared to structural losses. The greatest risk is to human health and life due to exposure to heat on the body.

Additionally, because of the reduced productivity due to the effects of heat on humans and infrastructure failures, economic losses could be severe in some sectors.

All critical assets in the county, as outlined in Section 3.2, could be impacted by this hazard, although, again, it would be a secondary effect in most cases, as outlined in the above paragraph.

***Extreme Heat Loss Estimation:***

The most significant losses due to extreme heat are to human health, exposed infrastructure, crops and livestock, and economic impacts due to reduced productivity. Rarely do buildings suffer loss, although power lines and other infrastructure can fail at the cost of millions of dollars.

The loss due to human life and health are significant due to extreme heat. Despite this risk, it is difficult to attribute to extreme heat a death that appears to be due to natural causes. People over the age of 65, which make up well over a thousand residents, people who are outside and cannot get indoors, and those with old homes and no air conditioning are all at greater risk than the general population. In a typical extreme heat event, it is estimated that death is possible, severe illness requiring hospitalization is very likely, and multiple minor illnesses are very likely. Because extreme heat is a silent killer and is more common in a given location than a tornado or other killer, this hazard is one of the most severe in Ringgold County as to the risk of death in a given year.

According to the USDA’s Risk Management Agency, the insured payments in Adair County for damages to crops as a result of heat from 2013-September 2017 totaled \$365,893.01, or 1.5% of all insured loss from three claims. Assuming about 90.5% of insurable cropland is insured, the actual loss is approximately \$400,000 over 4.7 years or \$85,000 annually.

Extreme heat also puts strain on electrical infrastructure, where wires and poles are exposed to the heat while having to generate and convey immense amounts of energy to power air conditioning during extreme heat events. Roads, especially asphalt, and bridges are also damaged due to expansion and buckling.

Metal buildings and towers, if built poorly, can also suffer damage or weakening that is not visible at the time but that may show up during future hazard events.

Economic losses can be severe, as certain factories and businesses are closed because of the heat. People who are not in good physical condition cannot be productive when they are hot. In Ringgold County, tens of thousands of dollars in lost productivity are likely due to each extreme heat event. Further, thousands of dollars are spent each year to provide cooling for local businesses during extreme heat events.

***Future Development and Extreme Heat:***

As long as the population remains stable or even declines, it is unlikely that future development will increase exposure or risk of loss.

***Flash Flood Profile***

***Type:*** Natural

***Definition:*** Any event when water levels rise at an extremely fast rate with little or no warning.

***Flash Flood Description:***

Flash flooding results from intense rainfall over a brief period, sometimes combined with rapid snowmelt, ice jam release, frozen ground, saturated soil, or impermeable surfaces. 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 roll 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.

Flash flooding can also be caused by inadequate or improper drainage systems including storm sewers, culverts, and drainage ditches. These systems are usually designed to carry up to a specific amount of water (design capacity). When heavy rainfall causes the design capacity of the systems to be exceeded, water will begin to back up and fill low-lying areas near system inlets and along open ditches. This is most common in urban areas. As land is converted from fields or woodlands to roads and parking lots, it loses its ability to absorb rainfall. Urbanization increases runoff two to six times over what would occur on natural terrain.

***Flash Flood Historical Occurrence:***

Flash flooding occurs more regularly and does more damage than riverine flooding in Ringgold County due to the topographic location of the county. There are few large streams, and most potential flood hazard areas are located where little development is at risk.

Floods are the most common and widespread of all-natural disasters except fire. In Iowa, as much as 21" of rain has fallen in a 24-hour period. Extreme rain events in 2008, 2009, 2010, 2011 and 2015 have occurred in Ringgold County. The main problem resulting from these rains was flash flooding, both urban and small stream events. Culverts, bridges, roads, and other infrastructure have been damaged in the rural areas and in several of the towns. In some cases FEMA PA funds were awarded for these damages. Many of the bridge failures reported in Ringgold County in recent years have been due to small streams rather than large rivers flood events. Many of the bridge closings reported in Ringgold County in recent years have been due to small stream rather than large river flood events. In the typical event, the main problems have included street damage, ditch deterioration, and flooded basements of homes.

It is likely that most instances have been relatively minor and are not remembered in other towns. Their main problems have been street damage, ditch deterioration, and flooded basements of homes. The schools have reported no incidences that have resulted in damage. Because of issues with flash flooding on the sloping terrain in Mount Ayr and Benton, each of these municipalities has sought state/federal funding for storm water control infrastructure and in 2015 the City of Mount Ayr established a storm water utility to raise funds to develop this infrastructure. Crop losses have been severe, although localized.

According to the National Climactic Data Center, there have been 46 flash flooding and heavy rain events in Ringgold County from 2001 through September 2017. Since 2001, \$980,000 in property losses and \$480,000 in crop losses have been reported. The county’s planning team believes that flash flooding is somewhat under-reported to the NCDC, but the Center’s reports are likely the largest events to occur in these areas. Dozens of smaller (more localized) events happen in the county during any wet year, many of which are not reported to state and federal authorities. They may damage a few blocks of street, a few basements, and the wastewater system, but do not result in a federal response in most cases. For example, the local newspaper reported \$300,000 in county road and bridge damages due to heavy rains and flash flooding in June 2014.

From January 2011 through December 21, 2017 there were 22 NWS flash flood warnings and 42 watches and three areal flood warnings issued of Ringgold County for flash flood events (<http://mesonet.agron.iastate.edu/vtec/search.php#byugc/IA/IAC001/20110101/20160318>).

As previously described, flash flooding can be caused by intense rainfall over a brief period. The following table shows the top 30 rainfall events, as reported in 24-hour calendar day periods from 1951 through December 21, 2017, at the Mount Ayr weather station.

**Figure 3.62: Heavy Rain Days at Mount Ayr Weather Station**

Date	Precipitation (in.)	Date	Precipitation (in.)	Date	Precipitation (in.)
9/19/2010	6.35	8/9/1977	4.52	4/18/2013	4.10
11/17/1952	6.22	8/6/1959	4.50	6/9/1974	4.08
6/5/2010	5.60	8/3/1943	4.40	10/31/1974	4.00
7/20/1990	5.50	7/21/1928	4.30	9/10/2014	4.00
8/1/1932	5.15	6/4/2014	4.27	6/17/1928	3.97
7/19/1895	5.00	7/24/2008	4.26	5/29/1962	3.93
9/14/1914	5.00	8/1/2016	4.25	7/5/1909	3.90
8/31/1980	4.90	9/12/1972	4.20	10/31/1947	3.84
9/12/1949	4.68	7/12/1915	4.10	10/11/1973	3.80
4/24/1897	4.55	5/15/1943	4.10	9/19/1986	3.80

Source: Iowa State University Department of Agronomy, <http://mesonet.agron.iastate.edu/request/coop/fe.phtml>

As can be seen, the largest daily rainfall totals are spread throughout the history of records, although a few years had multiple days: 1928, 1943, 1974, 2010, and 2014.

Most of the jurisdictions in the county received some damage from flash flooding that precipitated in Presidential Disaster #DR1930 in 2010.

*Flash Flood Future Probability:*

As land is converted from fields or woodlands to roads and parking lots, it loses its ability to absorb rainfall. Urbanization increases runoff 2 to 6 times over what would occur on natural terrain. While Ringgold County is very rural, there are areas within some towns containing significant expanses of impervious surfaces in some of the towns. As more development occurs in the watersheds, the amount of runoff produced also increases. Unless measures are taken to reduce the amount of runoff (or slow its movement), flash floods will continue to occur and possibly increase.

Often, aging storm sewer systems are not designed to carry the capacity currently needed to handle the increased storm runoff in certain areas. Rural areas may have more events because of the amount of area on which they can occur, but developed areas are more likely to have flash flooding during less significant rainfalls. Either way, evidence suggests that extreme rain events are becoming more commonplace. Because of this, with existing mitigation efforts or lack thereof, the future probability is likely to be higher than past history.

However, some mitigation measures are occurring to reduce these risks. Through partnerships between farmers and conservation officials, BMPs for storm water control in rural areas are occurring. The Ringgold County Secondary Roads Department continues to make improvements to culverts and bridges that might reduce the likelihood of flooding and damage when flooding occurs. Mount Ayr is working on a plan right now to develop a storm water system that will include traditional storm drains and “green” infrastructure such as bio-swales and retention basins.

According to Karl, T.R., J. M. Melillo, and T. C. Peterson, 2009: *Global Climate Change Impacts in the United States*, 2009, “One of the clearest trends in the United States observational record is an increasing frequency and intensity of heavy precipitation events... Over the last century there was a 50% increase in the frequency of days with precipitation over 101.6 mm (four inches) in the Upper Midwestern U.S.; this trend is statistically significant.” Research has also shown that in Iowa the trend is more heavy rain in the spring and less in the fall.

The overall rating the community gave for this hazard’s future probability in a survey was: “likely.”

Score for Rural Ringgold County: 6	Score for Benton: 4	Score for Diagonal: 4	Score for Ellston: 4
Score for Kellerton: 4	Score for Maloy: 4	Score for Mount Ayr: 5	Score for Tingley: 4
Score for Diagonal School: 3	Score for Mount Ayr School: 3		

Flash Flood Vulnerability to the Population:

Certainly, many buildings and much infrastructure can be damaged by flash floods that include urban small stream flooding, ditch flooding, basement flooding, and clogged storm water control systems. Due to aging infrastructure and lack of use of storm water control BMPs, much of the population can be impacted secondarily through inefficient sewer system flow and rapidly deteriorating streets. Closed roads, even if only temporarily, can disrupt the lives of people who otherwise are not impacted by floodwater.

People who are at the greatest risk of injury, death, and property loss are those close to waterways and in low-lying areas inside and outside of mapped SFHAs. Those downstream from dams, levees, and retention basins are also at risk. People and property in areas with insufficient storm sewers and other drainage infrastructure can also be put at risk because the drains cannot rid the area of the runoff quickly enough. Nearly half of all flash flood fatalities are auto-related. Motorists often try to traverse water-covered roads and bridges and are swept away by the current. Six inches of swiftly moving water can knock persons off their feet and only two feet of water can float a full-sized automobile. Recreational vehicles and mobile homes located in low-lying areas can also be swept away.

The following table shows the warnings and other alerts that address the risks to people.

**Figure 3.63: Flash Food Risk Chart**

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. <a href="#">Latest Hazardous Weather Outlook</a>
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!
<p>A <b>Flash Flood Emergency</b> 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 <b>Flash Flood Emergency</b> 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 <b>Flash Flood Emergency</b>. The <b>Flash Flood Emergency</b> wording is used very rarely and is reserved for exceptionally rare and hazardous events.</p>		
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: <http://www.floodsafety.noaa.gov/products.shtml>

The risk depends on the jurisdiction. For example, areas like the downtown area of Mount Ayr, schools, and the hospital have impervious surfaces in key areas (roofs, walkways, and streets) that limit the ability to take in storm water. Schools and the hospital have modern storm water facilities, unlike small towns and rural areas. The planning team indicates that the topography and rainfall trends make notable areas susceptible to flash flooding events. The scores are based on direct impacts: actual flooding on property and damage due to flooding in areas that directly impact safety and health of those outside of flood areas. Although the risks vary by jurisdiction, it is estimated 20 to 25% of any population is truly vulnerable to losses in a single event, somewhat less in rural areas because the population is spread out and surfaces are less impervious.

Score for Rural Ringgold County: 4	Score for Benton: 6	Score for Diagonal: 6	Score for Ellston: 6
Score for Kellerton: 6	Score for Maloy: 6	Score for Mount Ayr: 5	Score for Tingley: 6
Score for Diagonal School: 5	Score for Mount Ayr School: 4		

Flash Flood Area of Extent:

Areas in a floodplain, downstream from a dam or levee, or in low-lying areas can certainly be impacted. People and property located in areas with narrow stream channels, saturated soil, or on land with large amounts of impermeable surfaces are likely to be impacted in the event of a significant rainfall. Unlike areas impacted by a river/stream flood, flash floods can impact areas a good distance from the stream itself. Streets can become swift moving rivers, and basements can become deathtraps because flash floods can fill them with water in minutes. Rural areas, due to their expanse, would be less impacted by the heaviest rain in a storm. Cities, schools, and the hospital would have a greater percentage of land impacted by excessive rain events because of the impervious surfaces and smaller area under which a single storm can target. The scores are based on total area that is subjected to damage as a result of the event. Several areas of incorporated towns have non-existent, deteriorated, or undersized storm water control systems, so this expands the area that can be affected.

Score for Rural Ringgold County: 5	Score for Benton: 7	Score for Diagonal: 7	Score for Ellston: 6
Score for Kellerton: 6	Score for Maloy: 7	Score for Mount Ayr: 6	Score for Tingley: 6
Score for Diagonal School: 8	Score for Mount Ayr School: 8		

Flash Flood Severity of Impact:

The planning team is not aware of any fatalities directly resulting from flash flooding. Due to the location of Ringgold County away from large rivers associated with flooding, people can sometimes be naïve or forgetful that flash flooding is a real risk and it can occur with little warning. People are at risk when they may not be aware of the risk at a given location.

The following table shows the relative risks of a typical observed flash flood event.

**Figure 3.64: Flash Flood Severity of Impact Scoring Matrix**

Severity Criteria	Discussion	Score
Health and safety of the public	Flash floods are the #2 weather-related killer in the United States. This is likely in part because flash floods can quickly inundate areas thought to be safe. Flash flooding is a serious risk to people trapped in flooding areas and to those subjected to unforeseen flood impacts, such as flooding basements that cause mold growth.	3
Health and safety of responders	Rescuers are at significant risk when attempting to work in swift moving floodwaters associated with flash flooding. Special training in swift water rescue exists, and most are trained. However, sometimes equipment is lacking. A regional water rescue team, based in Ringgold County, is in place to address some of this concern.	3
Continuity of operations	Damage to infrastructure, detours as a result of damaged or covered roadways, and continuous duration of precipitation can result in delays in projects and in facility operation for hours to perhaps days in rare instances.	3
Property, facilities, infrastructure	Personal property can be extensively damaged and destroyed by swift moving water. Facilities and infrastructure can be scoured around and degrading its structural integrity. Because flash flood water is off premises quickly, damages related to standing water are often limited, but the current associated with flash floods causes abrasive type damages such as erosion and undercutting. Roads, culverts, and bridges in Ringgold County have been heavily damaged. A large part of the County budget is designated to deal with secondary road damages related to this hazard: washouts, damaged and lost bridges, culvert damage, etc.	4
Delivery of services	Flash flooding’s impacts on roads and other infrastructure can delay the delivery of essential services, including emergency response. It can immobilize normal function of sewer and water systems that are urgently needed in modern society.	3
Environmental impacts	Destruction of homes, illnesses, transportation accidents, and contamination of water supplies are very possible. Materials swept away by floodwaters can contaminate and leave a lasting impact on the environment.	3
Economic/financial conditions	Most impacts are indirect due to disruption of business and damage to infrastructure on which industry and services rely. Damaged to large buildings and to foundations can have a lasting impact on business. Extensive uninsured losses can have a great impact on local financial security.	3
Regulatory/contractual obligations	Impacts are likely to be temporary in most cases and likely indirect. When service providers fail to provide services, or when roads and bridges are closed for many months or years, it can result in political fallout.	2
Reputation	Flash floods can be damaging to the reputation of the community if proper notification and warning are not given. Often times the victim will blame development, deteriorated infrastructure, or other changes in the community as the cause of the flooding on their property.	2

The overall rating the community gave for this hazard’s magnitude in a survey was: “critical.”

Score for Rural Ringgold County: 26	Score for Benton: 26	Score for Diagonal: 26	Score for Ellston: 26
Score for Kellerton: 26	Score for Maloy: 26	Score for Mount Ayr: 26	Score for Tingley: 26
Score for Diagonal School: 26	Score for Mount Ayr School: 26		

***Flash Flood Speed of Onset:***

Flash floods are somewhat unpredictable, but there are factors related to speed of onset: soil type, soil covering/surfacing, topography, wetness of soil before the event, and direction of the water’s or storm’s origination. As the name implies, flash floods occur within a few minutes or hours of excessive rainfall, a dam or levee failure, or a sudden release of water held by an ice jam. Warnings may not always be possible for these sudden events. Predictability of flash floods depends primarily on the data available on the causal rain. Individual basins react differently to precipitation events. Weather surveillance radar is being used to improve monitoring capabilities of intense rainfall. Knowledge of the watershed characteristics, modeling, monitoring, and warning systems increase the predictability of flash floods. Depending on the location in the watershed, warning times can be increased. However, estimations for flash flood events are difficult at best.

Score for Rural Ringgold County: 7	Score for Benton: 7	Score for Diagonal: 7	Score for Ellston: 7
Score for Kellerton: 7	Score for Maloy: 7	Score for Mount Ayr: 7	Score for Tingley: 7
Score for Diagonal School: 7	Score for Mount Ayr School: 7		

Flash Flood Duration of Event:

Flash floods are usually brief but can last several hours, usually not more than 6 hours.

Score for Rural Ringgold County: 4	Score for Benton: 4	Score for Diagonal: 4	Score for Ellston: 4
Score for Kellerton: 4	Score for Maloy: 4	Score for Mount Ayr: 4	Score for Tingley: 4
Score for Diagonal School: 4	Score for Mount Ayr School: 4		

Flash Flood Total Scores:

The following total scores for flash flood indicate moderate to high risk to the public and the planning area where incidents can occur.

Score for Rural Ringgold County: 52	Score for Benton: 54	Score for Diagonal: 54	Score for Ellston: 53
Score for Kellerton: 53	Score for Maloy: 54	Score for Mount Ayr: 53	Score for Tingley: 53
Score for Diagonal School: 53	Score for Mount Ayr School: 52		

Flash Flood Vulnerability/Assets at Risk:

Virtually all structures, property, and people in the county, as outlined in Section 3.2, are susceptible to flash flooding. While the planning team does not believe all property is likely to be damaged and that it is a localized hazard, there is no definitive conclusion as to what properties are exempt from its effects. For this reason, the planning team has identified all properties and assets as potentially at risk. In reality, the properties most at risk include those on slopes, lower elevations, and at or near impervious surfaces. Almost anything can flood when there is enough rainfall in a short amount of time.

All critical assets in the county, as outlined in Section 3.2, could be impacted by this hazard. Exceptions may include a few assets that are above the ground and would likely not be damaged, including:

- Major overhead power lines anchored by heavy and deeply drilled poles
- Wind turbines
- Water towers

Flash Flood Loss Estimation:

The most significant losses include foundations and basements of structures on sloping and low-lying areas, not necessarily in a Special Flood Hazard Area (SFHA, see river flood profile), and infrastructure in the same area, namely streets, culverts, and bridges. Underground infrastructure, such as pipelines, can be damaged by scouring of flash flooding water, and overloaded sewer mains can back up into homes and businesses. Areas with large buildings and parking areas, such as in Mount Ayr, are likely to experience more flash flooding damage than other areas. In a given flash flood event, Mount Ayr and the rural area of the county are likely to experience the greatest loss to structures and property, topping hundreds of thousands of dollars. If one Secondary Road bridge is washed away, it can cost \$2 million to replace the bridge and create a traffic detour that can last for a year or more.

According to the National Climactic Data Center, there have been 46 flash flooding events in Ringgold County through September 2017. Since 2001, \$980,000 in property losses and \$480,000 in crop losses have been reported. Over a 17-year period, total reported losses were \$1.46 million, which averages \$86,000 per year.

According to [www.weather.gov](http://www.weather.gov), each year more people die from flash flooding than any other thunderstorm-related hazard. The loss of human life and health are significant due to flash flooding, mostly when people make a bad decision to drive into a flooded area. While rare in rural Iowa, extremely rapid rise of waters and flooding of impervious areas are more common in urban areas, where people get trapped and are killed by the raging torrent. However, it is certainly possible for death and injuries in Ringgold County. Fortunately, most people living in the county know where the risk is greatest and avoid those areas close to home when traveling during and after a rain event.

From 2013 through most of 2017, there were 59 crop insurance claims as a result of “excess moisture/precipitation/rain.” The results from these claims is a net \$11,394,868.44, which is over 40% of claims from that time period in terms of dollars, exceeding even drought. Considering that only about 90.5% of covered crop losses are claimed, the real loss over 4.7 years is approximately \$12.4 million or \$2.64 million per year.

Economic losses can be severe, depending on where flash flooding occurs. If it floods a major bridge accessing the factory or damages the building itself, it can shut down operations for a time. Contents and functional use losses can be significant when water gets into buildings and roads are closed, forcing a time-consuming detour.

Future Development and Flash Flood:

This impact depends mostly on the amount of new development and if mitigation measures are implemented. Mitigating flash flooding in new development is fairly simple with the combination of appropriate water quality practices (often called BMPs) and regulations, such as building codes and zoning, which force developers to consider hydrology in their building plans. Fortunately, the trend today is to consider these “green” principles and the reduction in impervious surfaces in development planning, often called “low-impact design.”

### ***Grass and Wildland Fire Profile***

Type: Natural

Definition: An uncontrolled fire that threatens life and property in a rural or wooded area.

#### Grass and Wildland Description:

Grass and wildland fires can occur when conditions are favorable such as during periods of drought when natural vegetation would be drier and subject to combustibility. In Iowa, landslides and wildfires often happen in similar circumstances. Both tend to occur in forest or sloping grassland areas. For wildfires, Iowa is in “Ag Land” and Model R. These are both “light fuel” according to the US Forestry Service. No specific information for the state on critical fire days was found. Based on climate information obtained, it would be suggested that 2 to 7 days per year would be a good level for southern Iowa. In 2 to 7 days/year fire weather frequency and light fuel, the state has a moderate hazard, no matter the slope of the area surveyed. Only in the more densely forested areas with steeper than 40% slopes is the hazard high in Iowa.

#### Grass and Wildland Fire Historical Occurrence:

Grass and wildland fire is the most common type of fire in Ringgold County, and all participating jurisdictions except the Mount Ayr Schools campus can be affected. A few jurisdictions have been affected, but by far most grass and wildland fires have occurred in the rural part of Ringgold County. Consistent and accurate data is not available for Ringgold County, but in total the area fire departments report multiple incidents per year. Most of these are small (less than five acres), impact only ditches and cropland or timberland, and can be handled with local fire department resources. Occasionally, more than one property, aboveground infrastructure, and structures are impacted, and a few times per year an incident occurs that requires more than one fire department to respond. During a planning meeting, a representative from Kellerton Fire reported that the department responds to “many wildland fires each year.” The Mount Ayr Fire Department representative echoed this same thought. Another representative reported a larger fire in or just outside of Diagonal in 2017. With local fire departments partnering through mutual aid compacts, it is relatively easy to gain assistance and put out fires before they become a major hazard.

According to the National Interagency Fire Center, there were 1,817 wildfires spanning 33,122 acres and 1,884 prescribed fires spanning 14,079 acres from 2002 through 2012 in Iowa. None of the state’s wildland fires reported to the Center have been considered historically significant. Again, grass and wildland fires are localized hazards.

The NCDC reports no wildfires in Ringgold County from 1950 through September 2017. There have been no known fatalities due to grass or wildland fires in the county.

#### Grass and Wildland Fire Future Probability:

There is nearly 100% chance that there will be a grass fire in each county in the state each year; however, the chance of a wildfire that requires more than day-to-day capabilities to handle is much less. Based on State Fire Marshal and National Interagency Fire Center, there is a very low probability of significant wildland fires impacting thousands of acres. Ringgold County planning team members indicate wildland fires are increasingly common, mostly with growth of CRP acres and rural acreages, many of which are in wild areas. The risk is much lower within incorporated communities. For wildfires, Iowa is in “Ag Land” and Model R. These are both “light fuel” according to the US Forestry Service. No specific information for the state on critical fire days was found. Based on climate information obtained, it would be suggested that 2 to 7 days per year would be a good level for southern Iowa. In 2 to 7 days/year fire weather frequency and light fuel, the state has a moderate hazard, no matter the slope of the area surveyed. Only in the more densely forested areas with steeper than 40% slopes is the hazard high in Iowa. Wildland fires are not possible at the Mount Ayr Schools campus because these buildings are separated from hazard areas, being inside built-up parts of Mount Ayr.

The overall rating the community gave for this hazard’s future probability in a survey was: “likely” to “highly likely.”

Score for Rural Ringgold County: 9	Score for Benton: 2	Score for Diagonal: 3	Score for Ellston: 2
Score for Kellerton: 3	Score for Maloy: 2	Score for Mount Ayr: 4	Score for Tingley: 2
Score for Diagonal School: 1	Score for Mount Ayr School: 0		

Grass and Wildland Fire Vulnerability to the Population:

People choosing to live in wildland settings are more vulnerable to wildfires, and the value of exposed property is increasing at a faster rate than the population. This is because many new homes are being built in forested and wildland areas, where the risk is greatest. Compared to forest fires, grass fires are often more easily contained and extinguished before there is damage to people or developed property, although farms, rural developments, and campgrounds are at risk. Fires often burn large portions of field crops in the fall when the crops are dry and the harvesting equipment overheats or throws sparks. This can be quite costly to the farmer in terms of lost production. Forest fires and cropland fires present a greater threat to firefighters than the general public. While most rural residents are at risk to fire, very few are at risk due to any one event due to the limited size of the fire. Those located at Mount Ayr Schools are not at risk. Risk is small at Diagonal School because it is only facing wildland or grassland on one side, and the users would be able to see the approaching fire and escape.

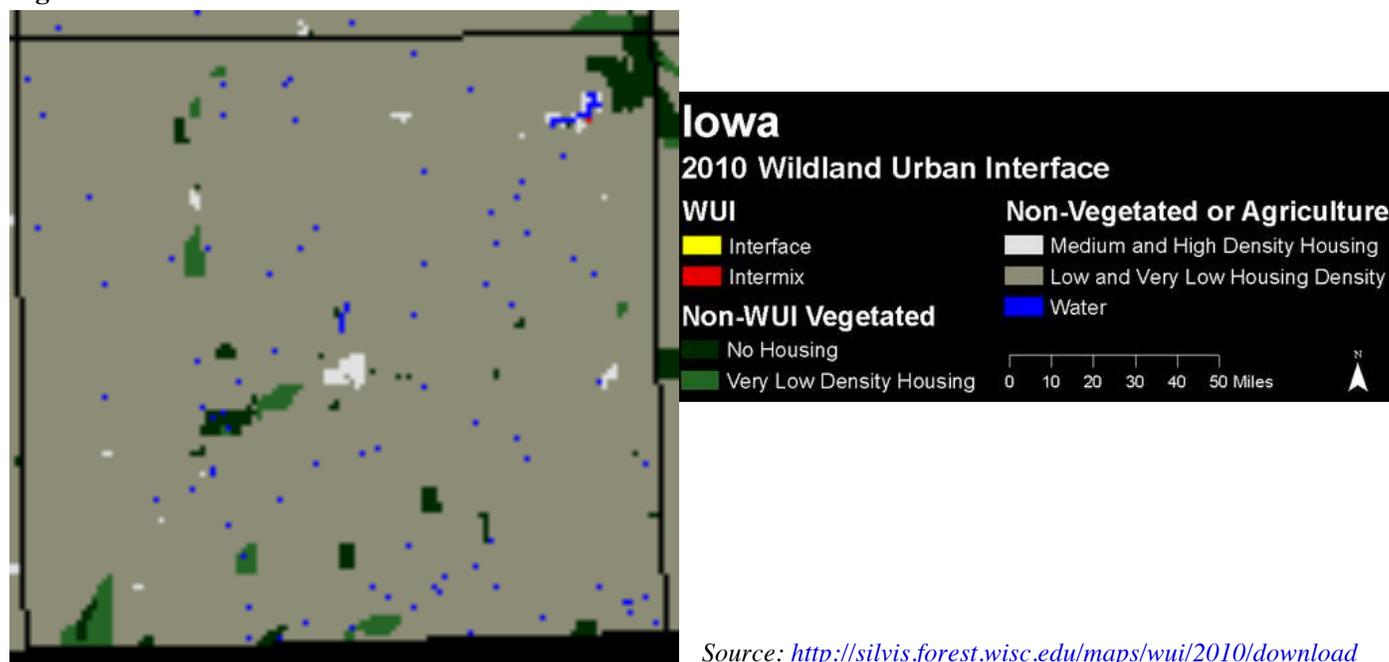
Score for Rural Ringgold County: 4	Score for Benton: 5	Score for Diagonal: 5	Score for Ellston: 5
Score for Kellerton: 5	Score for Maloy: 5	Score for Mount Ayr: 4	Score for Tingley: 5
Score for Diagonal School: 3	Score for Mount Ayr School: 0		

Grass and Wildland Fire Area of Extent:

Iowa is less vulnerable to large-scale wildland fire because of the large percentage of land that is developed. Most grass fires are contained to highway right-of-way and rail right-of-way ditches and are less than a few acres in size. However, the larger fires are possible. The extent is dependent upon conditions such as land use/land cover, moisture, and wind. For example, high winds can turn a small flame into a multi-acre grassfire within a matter of minutes or can change fire direction suddenly. Local fires rarely exceed 20 acres but can exceed a few thousand acres in the right locations during dry seasons.

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 areas that intermingle with wildland areas. As can be seen by the following graphic, Adair County has very few areas of WUI intermix and no WUI interface areas.

**Figure 3.65: WUI Intermix and Interface Areas**



Score for Rural Ringgold County: 4	Score for Benton: 5	Score for Diagonal: 5	Score for Ellston: 5
Score for Kellerton: 5	Score for Maloy: 5	Score for Mount Ayr: 4	Score for Tingley: 5
Score for Diagonal School: 5	Score for Mount Ayr School: 0		

Grass and Wildland Fire Severity of Impact:

Grass and wildlife fire severity is usually related to environmental factors in the area where the fire is occurring. The conditions that may exacerbate or mitigate the effects of wildfires include:

- Climatic conditions (dry air, high wind, and ambient heat worsen situation)

- Topography (steep slopes worsen situation)
- Geography—fuels, hazardous materials areas, open construction areas
- Flammable materials on exteriors of structures
- Narrow roadways
- Inadequate hydrants
- Combustible landscaping
- Development on the interface with the wildland area (adjacent to forests and row crops).

The following table shows the relative risks of a typical observed grass and wildland fire that exceeds normal day-to-day response capabilities.

**Figure 3.66: Grass and Wildland Fire Severity of Impact Scoring Matrix**

Severity Criteria	Discussion	Score
Health and safety of the public	Injuries and deaths from fires and from smoke inhalation are possible. Generally, people can escape the fire area.	3
Health and safety of responders	Injuries and deaths from fighting the fire most often occur by natural causes such as heart attack or stroke. Rapidly advancing fires in windy conditions can overtake a firefighter. Other weather conditions can also exacerbate risks due to exposure. The potential lack of water in rural areas (few hydrants and limited tanker capacity) increases risk in remote areas of the county.	3
Continuity of operations	Most operations would unlikely be disrupted.	1
Property, facilities, infrastructure	Property damage is usually limited to grass, small trees, etc. Occasionally a house or outbuilding can be damaged or destroyed. Major infrastructure, such as bridges and pipes, are unlikely to be damaged. Power lines, poles, and towers are at risk.	2
Delivery of services	Insignificant impacts for the most part. Fire services can be disrupted if equipment is lost.	2
Environmental impacts	Environmental impacts of grass and wild-land fires do not deviate much from the burning of the grasses, crops, or other low land cover. If a building or vehicle is burned, it could release damaging chemicals and gases.	3
Economic/financial conditions	The loss of crops could potentially lead to economic hardships within a community in the event of a widespread fire. Typically, if the farmer has insurance, his losses are limited.	2
Regulatory/contractual obligations	None known, unless water supplies are not available as promised.	2
Reputation	Grass fires occur frequently enough that they usually have little impact on reputation.	1

The overall rating the community gave for this hazard’s magnitude in a survey was: “limited.”

Score for Rural Ringgold County: 19	Score for Benton: 19	Score for Diagonal: 19	Score for Ellston: 19
Score for Kellerton: 19	Score for Maloy: 19	Score for Mount Ayr: 19	Score for Tingley: 19
Score for Diagonal School: 19	Score for Mount Ayr School: 0		

Grass and Wildland Fire Speed of Onset:

Most fires occur without warning and get out of hand in a hurry, perhaps within a few minutes.

Score for Rural Ringgold County: 8	Score for Benton: 8	Score for Diagonal: 8	Score for Ellston: 8
Score for Kellerton: 8	Score for Maloy: 8	Score for Mount Ayr: 8	Score for Tingley: 8
Score for Diagonal School: 8	Score for Mount Ayr School: 0		

Grass and Wildland Fire Duration of Event:

Grass and wildland fires that are likely in Iowa would not be to the size or magnitude of those in Western states, which can last for days or weeks. Usually, a fire can be extinguished in 6 hours. The rating is a bit shorter for fires within towns served by fire departments because the response is more likely to be quicker.

Score for Rural Ringgold County: 4	Score for Benton: 4	Score for Diagonal: 3	Score for Ellston: 3
Score for Kellerton: 3	Score for Maloy: 4	Score for Mount Ayr: 3	Score for Tingley: 3
Score for Diagonal School: 3	Score for Mount Ayr School: 0		

Grass and Wildland Fire Total Scores:

The following total scores for grass and wildland fire indicate low to moderate risk to the public and the planning area where incidents can occur.

Score for Rural Ringgold County: 48	Score for Benton: 43	Score for Diagonal: 43	Score for Ellston: 42
Score for Kellerton: 43	Score for Maloy: 43	Score for Mount Ayr: 42	Score for Tingley: 42
Score for Diagonal School: 39	Score for Mount Ayr School: 0		

**Grass and Wildland Fire Vulnerability/Assets at Risk:**

As evidenced by the previous wildland-type fires in the planning area, they have historically been the smaller brush/grass fires that can occur anywhere that has open grassy areas. Most of the assets at risk are located in rural areas. Note the following table of rural assets that could be at risk.

**Figure 3.67: Rural Ringgold County Grass and Wildland Fire Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	750	\$150,000,000	2,150	80%
Commercial	25	\$4,582,748	35	100%
Industrial	5	\$503,816	50	100%
Ag Structures and Land	500 buildings; 270,000 acres	\$301,672,514	75	100%
Taxable Infrastructure	8	\$21,000,000	8	80%
Government/Institutional	10	\$60,000,000	70	65%
Totals	1,298	\$537,759,078	2,388	85%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that about 85% of the assets in the unincorporated part of the county are at risk. The following critical assets listed in Section 3.2 are susceptible:

- Cell towers
- Electrical substations
- Excel Engineering
- Gavilon Agricultural Services, LLC
- Mount Ayr Fish Hatchery
- Ramsey Farm at Lesanville
- Water Towers
- Wildlife and park areas

The fringes of the town of Benton are also at risk. The following structures and properties are included.

**Figure 3.68: Benton Grass and Wildland Fire Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	5	\$250,000	11	26%
Commercial	0	\$0	0	0%
Industrial	0	\$0	0	100%
Ag Structures and Land	1 buildings; 300 acres	\$333,607	1	100%
Taxable Infrastructure	1	\$50,000	1	50%
Government/Institutional	1	\$500,000	2	25%
Totals	8	\$1,133,607	15	30%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that about 30% of the assets in Benton are at risk. None of the critical assets listed in Section 3.2 are susceptible because they are located in the developed part of the city and would very unlikely be impacted by a wildfire on the scale likely to be experienced in this area.

The fringes of the town of Diagonal are also at risk. The following structures and properties are included.

**Figure 3.69: Diagonal Grass and Wildland Fire Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	13	\$450,000	35	11%
Commercial	1	\$100,000	2	9%
Industrial	1	\$100,000	6	50%
Ag Structures and Land	2 buildings; 250 acres	\$1295,200	1	--
Taxable Infrastructure	1	\$250,000	1	0%
Government/Institutional	2	\$6,000,000	100	50%
Totals	20	\$8,195,200	145	25%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is estimated that about 25% of the assets in Bridgewater are at risk. The following critical assets listed in Section 3.2 are susceptible: Alliant Energy Substation

- Diagonal School
- Fogle Lake (and associated amenities)

The fringes of the town of Ellston are also at risk. The following structures and properties are included.

**Figure 3.70: Ellston Grass and Wildland Fire Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	5	\$150,000	13	30%
Commercial	0	\$0	0	0%

Industrial	0	\$0	0	--
Ag Structures and Land	5 buildings; 150 acres	\$159,900	2	100%
Taxable Infrastructure	1	\$50,000	0	40%
Government/Institutional	1	\$500,000	1	17%
Totals	12	\$859,900	16	25%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that about 25% of the assets in Ellston are at risk. None of the critical assets listed in Section 3.2 are susceptible because they are located in the developed part of the city and would very unlikely be impacted by a wildfire on the scale likely to be experienced in this area

The fringes of the town of Kellerton are also at risk. The following structures and properties are included.

**Figure 3.71: Kellerton Grass and Wildland Fire Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	20	\$600,000	45	16%
Commercial	0	\$0	0	0%
Industrial	0	\$0	0	0%
Ag Structures and Land	1 building; 200 acres	\$220,080	1	100%
Taxable Infrastructure	1	\$150,000	1	22%
Government/Institutional	1	\$750,000	2	17%
Totals	23	\$1,720,080	49	18%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that about 18% of the assets in Kellerton are at risk. The following critical assets listed in Section 3.2 are susceptible:

- City park
- Electrical substation

The fringes of the town of Maloy are also at risk. The following structures and properties are included.

**Figure 3.72: Maloy Grass and Wildland Fire Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	8	\$350,000	20	70%
Commercial	1	\$2,100	1	100%
Industrial	0	\$0	0	--
Ag Structures and Land	4 buildings; 400 acres	\$474,276	1	100%
Taxable Infrastructure	1	\$70,000	1	70%
Government/Institutional	1	\$500,000	1	25%
Totals	15	\$1,396,373	24	70%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that about 70% of the assets in Maloy are at risk. The following critical asset listed in Section 3.2 is susceptible:

- City Park

The fringes of the town of Mount Ayr are also at risk. The following structures and properties are included.

**Figure 3.73: Mount Ayr Grass and Wildland Fire Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	75	\$5,000,000	150	10%
Commercial	10	\$1,250,000	35	12%
Industrial	3	\$900,000	100	60%
Ag Structures and Land	7 buildings; 650 acres	\$780,999	2	100%
Taxable Infrastructure	1	\$1,100,000	1	20%
Government/Institutional	5	\$10,000,000	25	12%
Totals	101	\$19,030,999	313	12%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that about 12% of the assets in Mount Ayr are at risk. The following critical assets listed in Section 3.2 are susceptible:

- Airport
- County Engineer's office
- Electrical substation
- Farmer's Coop
- G & I Feed and Grain
- Industrial park

- Law enforcement center
- Ringgold County Hospital

The fringes of the town of Tingley are also at risk. The following structures and properties are included.

**Figure 3.74: Tingley Grass and Wildland Fire Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	20	\$700,000	50	25%
Commercial	0	\$0	0	0%
Industrial	0	\$0	0	0%
Ag Structures and Land	2 buildings; 300 acres	\$498,906	1	100%
Taxable Infrastructure	1	\$50,000	1	25%
Government/Institutional	1	\$500,000	1	17%
Totals	24	\$1,748,906	53	25%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that about 25% of the assets in Tingley are at risk. The following critical assets listed in Section 3.2 are susceptible: the ball field and electrical substation.

- Ball field
- Electrical substation

Grass and Wildland Fire Loss Estimation:

Wildfires can be responsible for extensive damage to crops, the environment, and occasionally residential and business facilities. Homes built in rural areas, and particularly in the WUI Interface are most vulnerable, especially where construction is occurring, on hilly land, or if the property owner burns trash and other debris. The vulnerability is exacerbated by the lack of hydrants in those areas and the distance from which fire departments housed in towns must respond.

For the purpose of loss estimation, it is believed that most of the grass and wildland fire loss in Ringgold County is to cropland. Buildings and vehicles (usually farm implements) are also vulnerable but most of the time they are not involved, partly due to the low density of development. In the typical wildland fire, 50 acres will be burned, impacting \$10,000 in crops. On average perhaps \$5,000 in structural loss will be experienced. Per the USDA’s crop insurance claim report, no claims have been made for wildland fire loss.

Injuries and fatalities to civilians and firefighters are certainly possible, although not common. In fact, the planning team estimates a very small probability of either injuries (10%) or fatalities (less than 1%) per incident.

Economic losses can be severe, depending on the size and location of the wildland fire. Most often it will be localized to a few fields, where crops and outbuildings will be lost. If the fire impacts a traveled road, it can result in detours that can be economically costly for businesses and farmers in that area.

The costs to area fire departments to respond to a fire are small compared to some hazard losses, but since most departments are underfunded, a very large fire (by Iowa standards) can drain resources quickly.

Future Development and Grass and Wildland Fire:

Future development in the wildland-urban interface/intermix areas would increase vulnerability. Such development is likely on a very small scale involving a few structures each year in the rural part of the county.

**Hazardous Materials Incident Profile**

Type: Technological

Definition: An accidental release of flammable or combustible, explosive, toxic, noxious, corrosive, oxidizable, irritant, or radioactive substances or mixtures that can pose a risk to life, health, or property, possibly requiring evacuation.

Hazardous Materials Description:

This profile includes the following hazards from the previous version of the Ringgold County plan: fixed hazardous materials incident, pipeline transportation incident, and transportation hazardous materials incident.

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 ever increasing types and quantities. As many as 500,000 products pose physical or health hazards and can be defined as “hazardous chemicals.” Each year, over 1,000 new synthetic chemicals are introduced. Under the Emergency Planning and Right to Know Act of 1986, the US Department of Transportation (USDOT) identified 308 specific hazardous chemicals from 20 chemical categories. USEPA sorts hazardous materials (HAZMAT) into the numerous categories as well.

Fixed hazardous materials incidents originate from fixed facilities. This does not mean that all hazardous materials spills originate from regulated facilities that handle them. Most major spills that affect life and property originate from specific materials handling fixed facilities. The following table shows the current EPA regulated facilities by jurisdiction as of December 2017. *This data is official EPA database results and not necessarily the current building occupant.*

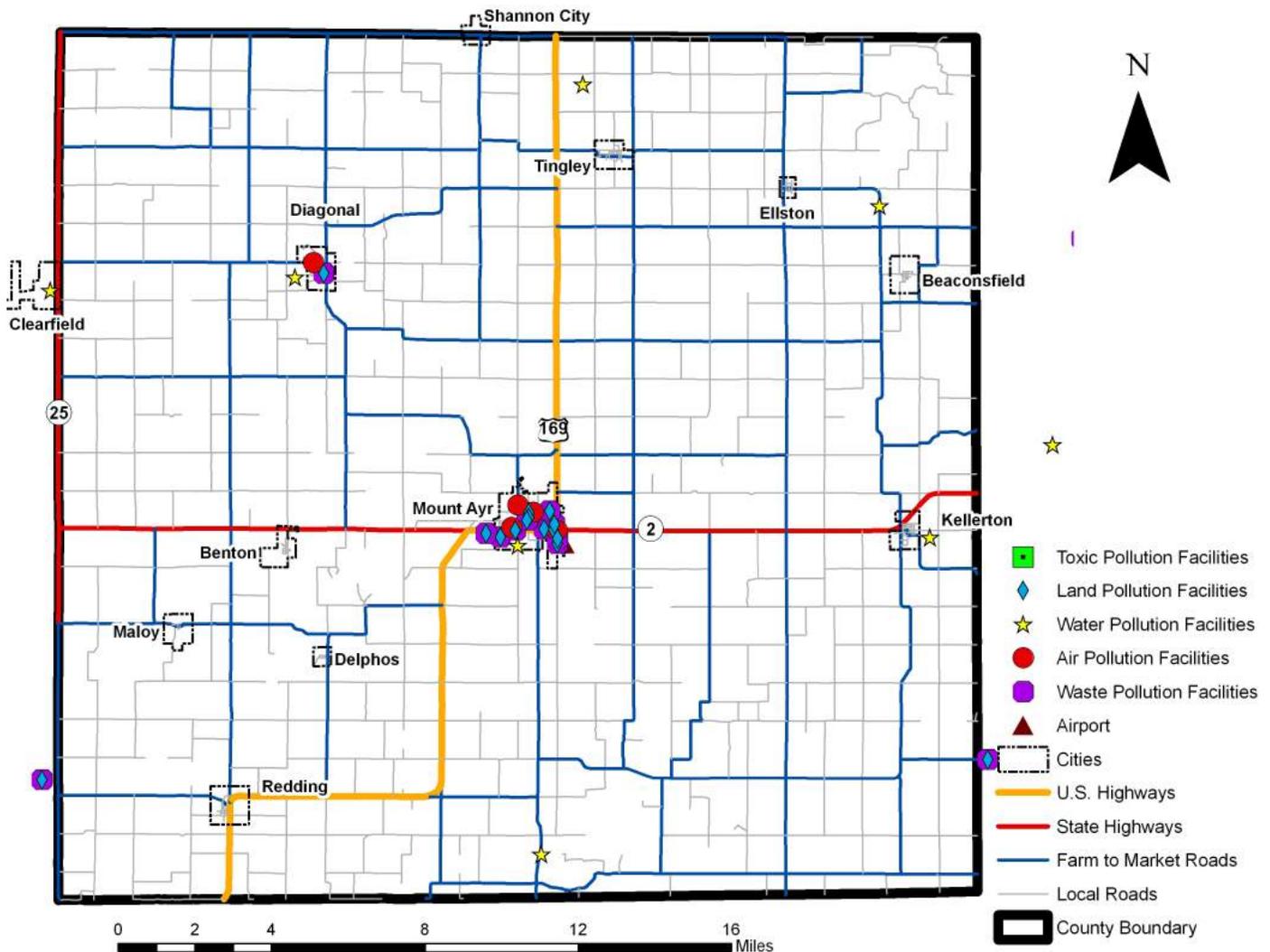
**Figure 3.75: List of Map Regulated Hazardous Materials Handlers**

Jurisdiction	Name	Address/Location	EPA Type(s)
Rural County	Diagonal City of STP	Just west of Diagonal	Water
	Kellerton WWTP	Just east of Kellerton	Water
	Sun Valley Sanitary District Lagoon	South of J-20 and 140 <sup>th</sup> Street	Water
	Tingley City of STP	Just north of Tingley	Water
	Watterson Quarry	RR2	Water
Diagonal	RK Fuels	605 W 7 <sup>th</sup> Street	Air
	Taylor Fiberglass Prod Inc.	222 Broadway	Waste, Land
Mount Ayr	American Concrete Products Incorporated	305 East Columbus Street	Air
	Bills Garage	702 E South Street	Waste, Land
	Case Power & Equipment – Former Site	201 N Taylor Street	Waste, Land
	Glendenning Motor	1100 E South Street, 204 S Taylor	Waste, Land
	Iowa Department of Transportation	RR #2-E of jct. of 169 & 2, 700 South Henderson	Waste, Land
	ITC Transmission – Midwest	468 N Taylor	Waste, Land
	MFA Oil Company	205 S Cleveland Street	Air
	Miracle Recreation Equipment	904 S Cleveland	Waste, Land
	Mount Ayr City of STP	Highway 169 & West Street	Water
	Mount Ayr High School	1001 E Columbus	Waste, Land
	Mount Ayr Products	808 S Cleveland	Waste, Land
	Mount Ayr Wastewater Treatment Plant	1000 S West Street	Air
	Mount Ayr Water Treating Plant	2195 US Highway 169	Waste
	Podium Ink	105 E Adams	Waste, Land
	Record News – Former Site	119 N Taylor	Waste, Land
	Ringgold County Hospital (Former location)	211 Shellway Drive	Air
	Vetter Equipment	Highway 2 W @ Highway 169	Waste

Source: EPA EnviroMapper Website, <http://www.epa.gov/myem/efmap/index.html>, 12/22/17; FSO – former site of

The map on the next page shows the above listed current EPA regulated sites. While the map does not have a label for each site, it shows the distributions of hazardous materials sites.

**Figure 3.76: Map of EPA Regulated Hazardous Materials Handlers**



Source: EPA EnviroMapper, 12/17; SICOG GIS mapping

Each year, thousands of hazardous materials are transported across the county via semi truck, aircraft, and trains. Hazardous substances are categorized as toxic, corrosive, flammable, irritant, or explosive. Hazardous materials incidents generally affect a localized area, and the use of planning and zoning can minimize the area of impact. *The scope of this update did not include obtaining data about the types and quantities of hazardous materials transported through the county. Such data should be gathered and included in the next plan update.*

Under the Emergency Planning and Right to Know Act of 1986, the US Department of Transportation (USDOT) identified as hazardous 308 specific chemicals from 20 chemical categories. The 1986 Act requires that companies report releases of designated hazardous chemicals to USEPA, even if releases do not result in human exposure. Hence, hazardous materials are greatly regulated, but the sheer volume of data involved can overwhelm local authorities. To identify the extent of the hazard in a particular community, planning personnel and others must determine what types of HAZMAT are stored, handled, processed, or transported and where and how those functions are performed. With limited staffing capabilities this is nearly impossible for Ringgold County.

The issue is complicated because some incidents are the result of failure to close valves on the vehicles, resulting in unnoticed releases that are not tied to a reportable event. At other times, events may not be reported if there are no witnesses besides the driver, pilot, or engineer.

Natural hazards may cause transportation HAZMAT events. Heavy rainfall during thunderstorms can cause slippery road conditions resulting in highway carrier accidents. Floods, lightning, fires, and severe winter storms cause pipelines to fail. Snow ice, and high-wind conditions during severe winter storms cause traffic accidents. High velocities and volumes of floodwaters wash out bridges and roads.

A good resource on hazardous materials safety is the USDOT site, <http://hazmat.dot.gov>.

Iowa is served by many high-pressure pipelines for residential and industrial uses. An underground pipeline incident can be caused by environmental disruption, accidental damage, or sabotage. Incidents can range from a small slow leak that is not ignited to a large rupture in which the gas is ignited. Inspection and maintenance of the pipeline system along with marked gas line locations and an early warning and response procedure can lessen the risk of those in close proximity to the pipelines. Pipeline transportation facilities are mapped in Chapter 2. Pipelines cross portions of rural areas and access several of the cities in the county, where natural gas is used for heating and other household and business needs.

*Hazardous Materials Incident Historical Occurrence:*

A high impact occurrence is one defined as an environmental emergency by the Environmental Protection Agency. An environmental emergency is a sudden threat to the public health or the well being of the environment, arising from the release or potential release of oil, radioactive materials or hazardous chemicals into the air, land, or water. Locally there have been very few incidences that would meet this definition. Nonetheless, releases do occur and do impact the planning area. According to the Iowa DNR Hazardous Spill Reporting System ([https://programs.iowadnr.gov/hazardousspills/Reports/DNRHSI\\_ReportPopUp.aspx](https://programs.iowadnr.gov/hazardousspills/Reports/DNRHSI_ReportPopUp.aspx)), there have been 43 reported spills in Ringgold County from 2001 through 2016. Nine have been identified as transportation, 24 have been identified as fixed (not necessarily at one of the identified fixed facilities), and 10 have been identified as other (dumping, transformer failure, pipeline break, field spill, etc.). This is consistent with statewide IDOT and IDNR data from 2000 to 2010 that shows about 60% of events at fixed facilities and 30% of events in transportation routes.

Based on the data provided by the DNR, the majority of spills in the past 16 years have occurred in the rural part of the county. Six were reported in Mount Ayr and one each in Tingley, Diagonal, Ellston, and Redding. Past events have been contained and cleaned within local response capabilities. They have involved mostly agricultural materials. In at least one of these incidents there was injury. In responding to one report of a leak, a Sheriff's deputy was overcome by fumes and rushed to the hospital but later recovered. Local gas stations, agricultural facilities, and manufacturing plants are common sites, as well as rural highways. The planning team notes that the risks for these incidents are highest with farm chemicals on farms and at cooperatives, where chemicals are handled.

The planning team recalls leaks at an ammonia facility and diesel fuel spills in and near Mount Ayr.

Ringgold County seems to be on top of this hazard so far, but the continued mechanization of agriculture means more and larger specialized chemicals and storage facilities. The County and most cities contract with the Southeast Iowa Response Group (SIRG), based in Ottumwa, (110 minutes away) for specialized response and cleanup and the service is used for larger incidents, but this group has been used very sparingly so far. The concern is the lack of significant capabilities locally in the event of a major catastrophe, which has yet to occur.

The Emergency Planning and Right to Know Act of 1986 requires the reporting to the EPA (designated through the IDNR in Iowa) of many kinds of events: Types of releases include:

- Air emissions of gases or particles from a pressure relief valve, smokestack, ruptured reaction vessel, broken pipe or other equipment at a chemical plant or other fixed-site facility; from broken, loose-fitting, or punctured equipment, containers, or cylinders on transportation vehicles; and from solid or liquid discharges onto ground or into water;
- Discharges into bodies of water from damaged ships, barges, underwater pipelines, and trucks or railroad cars that fall into the water;
- Discharges as outflows from sewer or drain outfalls, runoff from spills on land, runoff from water used to control fires, or contaminated groundwater;
- Discharges onto land;
- Solid waste disposal in onsite landfills;
- Injection of wastes into underground wells;
- Transfers of wastewater to public sewage plants;
- Transfers of wastes to offsite facilities for treatment or storage.

Despite this, it is likely that many events are not even reported and are not much of a hazard because losses are so minor.

According to the Iowa Utilities Board (IUB) and the United States Department of Transportation Pipeline and Hazardous Materials Safety Administration, there have been 56 significant pipeline events resulting in \$18.8 million in property damage and 9 injuries reported between 2002 and 2013 in Iowa. Of these, 6 serious pipeline accidents,

incidents, or service outages were reported between 2002 and 2013, including all of those with the 9 injuries. No deaths have been reported. Most incidents statewide have been minor. No known significant and serious incidents have originated in Ringgold County. There have been a few localized incidents due to construction activities. There have been no fatalities or long-term impacts in the county.

Hazardous Materials Incident Future Probability:

Combined, fixed and transportation hazardous materials incidents and pipeline transportation incidents are common. However, the percentage of significant or serious incidents that are beyond local capabilities or that threaten life or significant property is relatively low.

Fixed HAZMAT events from Tier II sites are possible in or affecting the following jurisdictions: Rural Adair County, Diagonal, Mount Ayr, Diagonal Schools, and Mount Ayr Schools. There are 24 sites in Ringgold County that, because of the volume or toxicity of the materials on site, are designated as Tier II facilities under the Superfund Amendments and Reauthorization Act. Despite increasing safeguards, more and more potentially hazardous materials are being used in commercial, agricultural, and domestic activities. While protection methods are improving, the probability is likely to increase over time in some jurisdictions. Ringgold County has numerous agricultural and energy facilities, including bulk plants, LP tanks, and anhydrous ammonia tanks. Fuel leaks can happen in most or all jurisdictions, whether or not they are Tier II facilities. With this being said, there are no major manufacturers or handlers with inordinately large amounts of chemicals or other materials.

Current planning is significant to address future probability. Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986 requires that each community establish a Local Emergency Planning Committee (LEPC) to be responsible for developing an emergency plan for preparing for and responding to chemical emergencies in that community. The plan is reviewed by the State Emergency Response Commission (SERC) and publicized throughout the community. It must include the following:

- An identification of local facilities and transportation routes where hazardous material are present;
- The procedures for immediate response to an incident (including a community-wide evacuation plan);
- A plan for notifying the community that an incident has occurred;
- The names of response coordinators at local facilities;
- A plan for conducting exercises to test the plan.

Ringgold County is generally current with LEPC planning and has the correct policies and trained personnel in place.

Transportation incidents that are of a major threat are limited to the Highways 169, 2, and 25, and paved county highways. The probability varies by jurisdiction; however, the probability is low in all jurisdictions of a significant event requiring extended road closures, large fires, evacuations, and/or full mobilization of outside response capabilities.

Pipelines are found in the county but are very well monitored. Petroleum and natural gas pipeline accidents occur with some regularity, but they usually have a limited impact and are quickly and adequately handled by pipeline company emergency crews and local and state responders. Pipeline operators are required to coordinate all safety preparedness and response activities with the communities. Planning, training, and exercising of emergency procedures with all involved parties help to limit the occurrence and severity of incidents. This risk is mainly limited to Mount Ayr and parts of the rural county where pipelines travel. In Ringgold County, as pipeline use continues to increase and more homes are put on natural gas, the probability of incidents will increase.

Overall, the chance of an incident that threatens life and property is greatest in the rural areas and Mount Ayr but is low overall. The following is the probability for an incident that requires response beyond local resources is a direct risk to the public or critical environmental resources, such as streams and waterways.

The overall rating the community gave for this hazard’s future probability in a survey was: “occasional” to “likely.”

Score for Rural Ringgold County: 6	Score for Benton: 2	Score for Diagonal: 3	Score for Ellston: 2
Score for Kellerton: 3	Score for Maloy: 2	Score for Mount Ayr: 5	Score for Tingley: 2
Score for Diagonal School: 2	Score for Mount Ayr School: 3		

Hazardous Materials Incident Vulnerability to the Population:

HAZMAT releases pose short- and long-term toxicological threats to humans and to terrestrial and aquatic plants and wildlife. Toxic materials affect people through one of three processes: a) inhalation, b) ingestion, and c) skin contact. People, pets, livestock, and vegetation in close proximity to facilities and transportation corridors 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, a larger area may be in danger from explosion, absorption, injection, ingestion, or inhalation. Occupants of areas previously contaminated by a persistent material may also be harmed either directly or through consumption of contaminated food and water.

Tier II Fixed Facilities are required to have an off-site consequence plan that addresses the population of the surrounding area. Responding personnel are required to be trained to HAZMAT Operations Level to respond to the scene, and those personnel that come into direct contact with the substances released are required to have HAZMAT Technician level training. However, for fixed HAZMAT purposes, risk is most pronounced at reporting facilities, even though they can occur at any “fixed” site. Reporting facilities are located in a few locations in the rural area and in the towns of Diagonal and Mount Ayr. People work in facilities that house chemicals. For the purpose of this plan, for simplicity, direct impacts will occur within a 1,000-foot radius of a facility. Schools scores are based on potential impacts to people who are outside or must be confined to the building during an incident.

Transportation incidents like train derailments, semi-truck spills, and agricultural implement spills are common and can occur where people are located. These are more difficult to regulate, contain, and cleanup because most of the spills occur outdoors and many times they occur in adverse weather conditions such as high winds and snowstorms. People, pets, livestock, and vegetation in close proximity to transportation corridors and populations downstream, downwind, and downhill of a released substance are particularly vulnerable. Depending on the characteristics of the substance released, a larger area may be in danger from explosion, absorption, injection, ingestion, or inhalation. Occupants of areas previously contaminated by a persistent material may also be harmed either directly or through consumption of contaminated food and water. Using a 1,000-foot buffer on paved highways, some areas are populated and some roads have considerable traffic. Some jurisdictions are greatly impacted; others will only see a small part of the population at risk. Through evacuations and sheltering in place, most people are not likely to be directly harmed if warned before the substance(s) reach them. People within critical assets are not likely to be widely affected.

People and property with pipelines on their land or nearby are the most at risk. People excavating earth near a pipeline are also at risk. Whether the greater hazard is posed to those upwind or downwind from a site depends on the product spilled, for example - natural gas is lighter than air. Private homes and business served by natural gas have smaller diameter pipelines connected to their structure. The underground pipelines cross public streets, roads, highways, and streams. Iowa’s natural environment is also vulnerable to contamination from an underground pipeline incident. People can suffer from the loss of gas service to their homes. The greatest potential impact as a percentage of population is the cities that have full gas service, which are Mount Ayr and Mount Ayr Schools. It can take days for personnel to go to each house and repressurize and re-light facilities for each building. Manufacturers would have to use other fuels to continue operating. Buildings like the schools and hospital use other heating that does not require much pipeline capacity.

The following assessment of the vulnerable population reflects the combined risk of any one event for any one of these forms of hazardous materials.

Score for Rural Ringgold County: 4	Score for Benton: 4	Score for Diagonal: 5	Score for Ellston: 4
Score for Kellerton: 5	Score for Maloy: 4	Score for Mount Ayr: 5	Score for Tingley: 4
Score for Diagonal School: 2	Score for Mount Ayr School: 2		

Hazardous Materials Incident Area of Extent:

Most of the hazardous materials incidents are localized and are quickly contained or stabilized by the highly trained fire departments and hazardous materials teams. To identify the extent of the hazard in a particular community, planning personnel must determine: a) what types of HAZMAT are stored, handled, processed, or transported, and b) where and how those functions are performed. 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 people 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 a river, lake, or aquifer. For direct impact, the planning committee assumes a 1,000-foot radius of the fixed facility, transportation corridor, or major pipeline. This would be a small part of the rural area but a larger part of each directly impacted city or individual building, campus, or property. Buildings and assets near the traveled routes would be impacted, even if people can be evacuated or taken indoors. The use of planning and zoning, which exists only in a few of the cities, can minimize the area of impact.

Identification and caution signs are posted wherever pipelines pass under roads, streams, fence lines, or at any aboveground utilities. Despite warnings, people excavating earth near a pipeline are at high risk. Because chemicals and gases vary in how they react when a pipeline is severed, people and property with pipelines on their land or nearby are the most at risk. Since pipelines are most common in populated areas, in order to serve residential and industrial

needs, the extent could be very high. Private homes and business served by natural gas have smaller diameter pipelines connected to their structure and the threat of failure in terms of explosion risk is low. Underground pipelines cross public streets, roads, highways, and streams. Iowa’s natural environment is also vulnerable to contamination from an underground pipeline incident. People can suffer from the loss of gas service to their homes. Mount Ayr has full gas service, so an outage could affect 90% of properties. However, these impacts, in most cases are an inconvenience at best. In the winter, during severe cold, a modest percentage of residents without gas due to the outage could be harmed. Pipelines have automatic shutoff valves installed so that damaged sections can be isolated and the volume of product escaping can be limited.

Score for Rural Ringgold County: 3	Score for Benton: 6	Score for Diagonal: 6	Score for Ellston: 6
Score for Kellerton: 6	Score for Maloy: 6	Score for Mount Ayr: 5	Score for Tingley: 6
Score for Diagonal School: 7	Score for Mount Ayr School: 7		

**Hazardous Materials Incident Severity of Impact:**

Severity of hazardous materials incidents is difficult to assess. The root cause of the incident can exacerbate conditions. Natural hazards, for example, can cause HAZMAT releases at fixed sites, on transportation systems, in the outdoors, and in pipelines. When a HAZMAT event occurs during a natural disaster, access to facilities may be restricted, water lines for fire suppression may be broken, and response resources (equipment and personnel mainly) may be limited.

The following provides a summary of the severity of impact throughout the county for a major or “environmental emergency” HAZMAT incident resulting from a natural hazard event. This summary is based on a scenario. Keep in mind the magnitude or severity will be greatly impacted by the chemical or gas involved, location, quantity, and capabilities to respond, in addition to the circumstances surrounding the incident (weather, time of day, etc.). Enforcing and/or facilitating either a shelter in place protocol or full evacuation of an area also can hinder response greatly.

**Figure 3.77: Hazardous Materials Incident Severity of Impact Scoring Matrix**

Severity Criteria	Discussion	Score
Health and safety of the public	The release of some toxic gases may cause immediate death, disablement, or sickness if absorbed through the skin, injected, ingested, or inhaled. Some chemicals may cause painful and damaging burns to skin if they come in direct contact with your body. Within fixed facilities and in close proximity of outdoor incidents the risks are very high. People evacuating an area are exposed to natural hazards. With pipeline failures, particularly, an explosion risk is high, which could instantly kill multiple people.	3
Health and safety of responders	Specialized training is needed to respond to these types of incidents. If inadequately trained personnel attempt to respond, the impacts could be the same as those for the general public exposed to the toxic materials. Proper training and equipment greatly reduce the risk to responders. Responders would also be exposed to any natural hazards that caused the incident. There are a limited number of trained people. The effort to locate and fix a ruptured pipeline offers additional great risk to responders.	4
Continuity of operations	None directly unless the incident occurs on or near critical facilities or services (which includes pipelines). Road closures and evacuations can also stall operations. Response agencies may lose equipment and members could be injured or sick and unable to respond. Proper decontamination may be needed before the facilities go back in service.	3
Property, facilities, infrastructure	Physical damage is usually limited to the immediate property involved. Proper decontamination is needed before the facilities go back in service. Fire and the decontamination process can damage buildings as much or more than the original hazardous material. Pipeline infrastructure can suffer from extensive damage.	3
Delivery of services	Contaminated water resources may be unsafe and unusable for days or longer. Other services can be delayed due to road closures, evacuations, and the cleanup process. Petroleum products will not be delivered or will be delivered in limited quantity.	2
Environmental impacts	Contamination of air, ground, or water may harm fish, wildlife, livestock, and crops. The release of hazardous materials into the environment may cause debilitation, disease, or birth defects over many years. The costs and time involved in cleanup can be months or even years and involve millions of dollars. Pipeline failures can cause the rapid and sudden erosion and contamination of soil.	4
Economic/financial conditions	Loss of livestock and crops, industrial fires and shutdowns, and evacuations may lead to economic hardships within the community. The time required for cleanup and decontamination can ruin a small business and cause hardship for those in the area. Insurance rates and costs may also increase.	3
Regulatory/contractual obligations	None directly, but EPA and related environmental violations can cause regulatory ramifications to the jurisdiction. Affected businesses and organizations may not meet demand from customers.	2
Reputation	Safe and timely response will greatly limit any damage to the jurisdiction’s reputation.	2

Proper warning and public information before, during, and after the incident can also limit reputation damage.

The overall rating the community gave for this hazard’s magnitude in a survey was: “limited.”

Score for Rural Ringgold County: 26	Score for Benton: 26	Score for Diagonal: 26	Score for Ellston: 26
Score for Kellerton: 26	Score for Maloy: 26	Score for Mount Ayr: 26	Score for Tingley: 26
Score for Diagonal School: 26	Score for Mount Ayr School: 26		

Hazardous Materials Incident Speed of Onset:

Most of the various kinds of incidents are unplanned accidents due to weather damage, human error, mechanical failure, and the like. The incident can be immediate and, although not common, severe from the start. There may be no warning that an incident is about to occur. Even if reported immediately, people in the area of the release have very little time to be warned and evacuated. During some events, sheltering in-place is the best alternative to evacuation because the material has already affected the area and there is no time to evacuate safely. Public address systems, television, radio, reverse E911, and the NOAA Weather Radios are used to disseminate emergency messages about hazardous materials incidents. Because some jurisdictions are not within the immediate area of a fixed incident, speed of onset in those areas is longer.

Score for Rural Ringgold County: 9	Score for Benton: 9	Score for Diagonal: 9	Score for Ellston: 9
Score for Kellerton: 9	Score for Maloy: 9	Score for Mount Ayr: 9	Score for Tingley: 9
Score for Diagonal School: 8	Score for Mount Ayr School: 8		

Hazardous Materials Incident Duration of Event:

The incident duration can vary greatly by the type of chemical or gas released, ambient conditions (wind, weather, darkness, etc.), how long it has been released, and the capacity of the local response team(s) to respond adequately in containing the hazard. If you include the process of cleanup so that the public can again enter the area, the duration could be hours to a day or more. The process of evacuations can delay containment.

Score for Rural Ringgold County: 6	Score for Benton: 6	Score for Diagonal: 6	Score for Ellston: 6
Score for Kellerton: 6	Score for Maloy: 6	Score for Mount Ayr: 6	Score for Tingley: 6
Score for Diagonal School: 6	Score for Mount Ayr School: 6		

Hazardous Materials Incident Total Scores:

The following total scores for hazardous materials incidents indicate moderate to high risk to the public and the planning area where incidents can occur.

Score for Rural Ringgold County: 54	Score for Benton: 53	Score for Diagonal: 55	Score for Ellston: 53
Score for Kellerton: 55	Score for Maloy: 53	Score for Mount Ayr: 56	Score for Tingley: 53
Score for Diagonal School: 51	Score for Mount Ayr School: 52		

Hazardous Materials Incident Vulnerability/Assets at Risk:

Generally, past hazardous materials incidents were very localized and usually had no effect beyond the immediate area. Nonetheless, government agencies regulate the areas where impact can occur in relation to a fixed facility based on the types of chemicals involved. However, based on past experience and likely future incidents where evacuations or sheltering in place may be needed, the planning team uses a 1,000-foot buffer around fixed facilities and main transportation routes (highways and railroads). Note the following table of rural assets that could be at risk.

**Figure 3.78: Rural Ringgold County Hazardous Materials Incident Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	50	\$13,000,000	125	6%
Commercial	10	\$1,800,000	13	40%
Industrial	4	\$400,000	40	80%
Ag Structures and Land	15 buildings; 10,000 acres	\$9,000,000	2	3%
Taxable Infrastructure	3	\$10,000,000	4	40%
Government/Institutional	8	\$50,000,000	25	25%
Totals	90	\$84,200,000	209	8%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that about 8% of the assets in the unincorporated part of the county are at risk. The following critical assets listed in Section 3.2 are susceptible:

- Excel Engineering
- Ramsey Farm at Lesanville
- Gavillon Agricultural Services
- Sun Valley Lake sewer lagoons

- Wildlife areas and parks
- All electrical substations

Highway 2 travels across the northern part of town. There is no Tier II fixed facilities, however. The following structures and properties are included.

**Figure 3.79: Benton Hazardous Materials Incident Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	2	\$100,000	5	12%
Commercial	0	\$0	0	0%
Industrial	0	\$0	0	0%
Ag Structures and Land	0 buildings; 100 acres	\$100,000	0	30%
Taxable Infrastructure	1	\$25,000	1	17%
Government/Institutional	1	\$400,000	1	20%
<b>Totals</b>	<b>4</b>	<b>\$625,000</b>	<b>7</b>	<b>15%</b>

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that about 15% of the assets in Benton are at risk. None of Benton’s critical assets identified in Section 3.2 are within 1,000 feet of the major transportation route. With no natural gas in Benton, there are no pipeline hazards.

Two fixed facilities are located in Diagonal, and there are highways and “truck” routes, so the risk within 1,000 feet covers most of the town of Diagonal. The following structures and properties are included.

**Figure 3.80: Diagonal Hazardous Materials Incident Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	100	\$3,500,000	270	85%
Commercial	10	\$1,013,232	25	100%
Industrial	2	\$174,212	15	100%
Ag Structures and Land	1 building; 150 acres	\$750,000	1	60%
Taxable Infrastructure	1	\$750,000	1	85%
Government/Institutional	5	\$9,500,000	145	95%
<b>Totals</b>	<b>119</b>	<b>\$15,687,444</b>	<b>457</b>	<b>87%</b>

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is estimated that about 87% of the assets in Diagonal are at risk. All the critical assets listed in Section 3.2 are susceptible, with the exception of the water tower.

There is one paved highway used by trucks and farm machinery through town but no natural gas or Tier II fixed facilities, so the risk within 1,000 feet covers most of the town of Ellston. The following structures and properties are included.

**Figure 3.81: Ellston Hazardous Materials Incident Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	18	\$509,712	43	100%
Commercial	2	\$203,473	10	100%
Industrial	0	\$0	0	--
Ag Structures and Land	4 buildings; 120 acres	\$130,000	2	80%
Taxable Infrastructure	1	\$100,000	1	80%
Government/Institutional	2	\$2,600,000	6	85%
<b>Totals</b>	<b>27</b>	<b>\$3,339,915</b>	<b>62</b>	<b>88%</b>

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that about 88% of the assets in Ellston are at risk. All critical assets listed in Section 3.2 are susceptible.

There are two paved highways used by trucks and farm machinery through town but no natural gas or Tier II fixed facilities, so the risk within 1,000 feet covers most of the town of Kellerton. The following structures and properties are included.

**Figure 3.82: Kellerton Hazardous Materials Incident Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	115	\$4,400,000	290	92%
Commercial	6	\$218,513	15	99%
Industrial	0	\$0	0	---
Ag Structures and Land	1 building; 150 acres	\$175,000	1	75%

Taxable Infrastructure	1	\$550,000	2	98%
Government/Institutional	6	\$4,800,000	10	92%
Totals	129	\$10,143,513	318	92%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that about 92% of the assets in Kellerton are at risk. All Kellerton’s critical assets listed in Section 3.2 are susceptible.

There is one paved highway used by trucks and farm machinery from the east to the town but no natural gas or Tier II fixed facilities. The risk within 1,000 feet covers most of the developed town of Maloy. The following structures and properties are included.

**Figure 3.83: Maloy Hazardous Materials Incident Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	11	\$425,000	27	92%
Commercial	1	\$2,100	1	100%
Industrial	0	\$0	0	---
Ag Structures and Land	3 buildings; 200 acres	\$300,000	1	60%
Taxable Infrastructure	1	\$95,000	1	95%
Government/Institutional	2	\$1,250,000	2	60%
Totals	18	\$2,072,100	32	80%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that about 80% of the assets in Maloy are at risk. All Maloy’s critical assets listed in Section 3.2 are susceptible.

Mount Ayr contains several paved highways with heavy truck traffic, several Tier II facilities, and city-wide natural gas service, so the risk within 1,000 feet covers most of the town of Mount Ayr. The following structures and properties are included.

**Figure 3.84: Mount Ayr Hazardous Materials Incident Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	650	\$43,000,000	1,450	85%
Commercial	80	\$11,986,489	350	100%
Industrial	5	\$1,469,410	200	100%
Ag Structures and Land	6 buildings; 400 acres	\$500,000	2	70%
Taxable Infrastructure	4	\$4,500,000	4	85%
Government/Institutional	25	\$65,000,000	950	80%
Totals	770	\$126,455,899	2,956	80%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that about 80% of the assets in Mount Ayr are at risk. All of Mount Ayr critical assets listed in Section 3.2 are susceptible, *except*:

- Water towers (3).

There is one paved highway used by trucks and farm machinery through town but no natural gas or Tier II fixed facilities. The risk within 1,000 feet covers most of the developed town of Tingley. The following structures and properties are included.

**Figure 3.85: Tingly Hazardous Materials Incident Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	74	\$2,650,000	178	96%
Commercial	4	\$133,130	10	100%
Industrial	0	\$0	0	---
Ag Structures and Land	1 buildings; 150 acres	\$250,000	1	50%
Taxable Infrastructure	1	\$200,000	1	90%
Government/Institutional	4	\$2,800,000	6	92%
Totals	84	\$6,033,130	196	96%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that about 96% of the assets in Tingley are at risk. All Tingley’s critical assets listed in Section 3.2 are susceptible.

Hazardous Materials Incident Loss Estimation:

The impact of this hazard will likely be localized to the immediate area surrounding the incident, but with the lack of other credible data, the planning team used 1,000 feet from locations where the incident is likely to occur, which are regulated fixed facilities, major transportation corridors, and major pipelines. The initial concern will be for people, and then for structures and the environment. The current practice is that the spiller is responsible for the cleanup actions and is to contact local responders and then the Iowa DNR and possibly the EPA to ensure that cleanup is done safely and in accordance with federal and state laws.

The losses would reflect the location, type of substance spilled or released, ambient conditions where it occurs, and response capabilities. It is difficult to determine the potential losses to existing development because of the variable nature of a hazardous materials spill. For example, a toxic airborne chemical or gas in a developed area could make dozens of people sick and kill numerous people. A simple spill of 500 gallons of anhydrous ammonia on a cornfield might only require modest soil remediation.

In Ringgold County, most incidents will have minor loss in terms of property, simply because the population density is low. However, in the worst case scenario, based on past history, a factory could be destroyed by fire, one or more vehicles can be destroyed, and surrounding buildings and properties can catch on fire or suffer damage from chemicals and gases. Typically, up to \$100,000 per occurrence in property loss is expected. Depending on the asset, contents losses could be as high.

Economic/functional use losses could be considerable if an entire factory or neighborhood is cordoned off and people cannot enter or leave the area. A mass evacuation would disrupt many people's lives and make it so they cannot contribute to the economy. Businesses that are not even responsible for the incident can be closed for hours or longer. Economic losses due to a typical incident might exceed \$100,000.

Rarely do hazardous materials incidents cause the loss of life, but injuries and illnesses are not uncommon. It is reasonable to assume that in the most severe cases that can be expected that one or more persons will be killed by an explosion or by exposure to fumes and gases.

According to the Pipeline and Hazardous Materials Safety Administration in the US DOT, the overall average per-gallon response cost for crude oil, gasoline, and other fuels is \$1,270. From January 2001 through December 2016, 16 years, there were 43 spills in Ringgold County, according to the Iowa DNR spill reporting system. Approximately 25% (10) involved one of these substances. An estimated 500 gallons was spilled. At the above cost per gallon, the total estimated cost for response was \$635,000. The average per year was \$40,000.

#### Future Development and Hazardous Materials Incident:

The number and types of hazardous chemicals stored and, even more so, transported through the county is likely to increase substantially. Population and business growth along major transportation corridors increases the vulnerability to transportation hazardous materials incidents. While the county's population is not likely to grow significantly, any growth is likely to occur in areas where this hazard exists.

### ***Human Disease Profile***

Type: Natural

Definition: An incident defined as a medical, health, or sanitation threat to the general public, including contamination, epidemics, plagues, or infestations.

#### Human Disease Description:

Public health action to control infectious diseases in the 21st century is based on the 19th century discovery of microorganisms as the cause of many serious diseases (e.g., cholera and TB). Disease control has resulted from improvements in sanitation and hygiene, the discovery of antibiotics, and the implementation of universal childhood vaccination programs. Scientific and technologic advances have played a major role in each of these areas and are the foundation for today's disease surveillance and control systems. Scientific findings also have contributed to a new understanding of the evolving relation between humans and microbes. As of 2013, a total of 67 infectious diseases were designated as notifiable at the national level. A notifiable disease is one for which regular, frequent, and timely information regarding individual cases is considered necessary for the prevention and control of the disease.

Of special concern are pandemics. Pandemic refers to a microbe that has the ability to spread across the world. The word, 'pandemic', means that a particular disease has caused illness in a person on nearly every continent. Many diseases throughout the history of the world have been pandemic. Examples are HIV/AIDS and influenza. A pandemic will have widespread economic and societal implications for our state. Response and recovery to a pandemic will likely be lengthy.

More information on human disease incidents and pandemics, as well as impact maps, can be found at the websites of the following organizations, Iowa Dept. of Public Health (<https://idph.iowa.gov/>), Centers for Disease Control and Prevention ([www.cdc.gov](http://www.cdc.gov)), and World Health Organization ([www.who.int](http://www.who.int)).

***Human Disease Historical Occurrence:***

The Iowa Department of Public Health tracks epidemiological statistics in Iowa. Their data indicate no major incidents of diseases that have high percentages of loss of life or severe illness in the last 25 years.

Minor outbreaks of things like pertussis, mumps, and salmonella have occurred in the county. Factories, schools, and medical facilities seem to have suffered the worst from human disease incidents, but fatalities directly from communicable diseases have been limited. Humans in Adair County have suffered from influenza, chicken pox, Lyme disease, pertussis, mumps, measles, Hepatitis C, and other diseases. Virtually all jurisdictions have been affected, although data to the city and school level is limited.

The County public health official on the planning team indicated that much effort was put into H1N1 preparation and response. Pandemic events with regional or national effect have harmed small numbers of people in Ringgold County all through the county’s history. More traditional non-pandemic disease incidents have impacted local schools, care facilities, and other areas where groups of people spend time in close quarters. Individual households have suffered from various diseases while not necessary having a dramatic impact on local quality of life or response capabilities.

The planning team reviewed data for the past five years for reportable diseases reported to the Iowa Department of Public Health Center for Acute Disease Epidemiology. The following table shows the annual number of reported incidents. Over five years, there have been 51 cases of the following reported diseases in the county.

**Figure 3.86: Disease Incident Data**

Disease	2012	2013	2014	2015	2016
AIDS (diagnosis)	0	0	0	--	--
HIV (diagnosis)	0	0	0	--	--
Babesiosis/Infant botulism	--	--	--	0	0
Brucellosis	--	--	--	0	0
Campylobacteriosis	0	1	0	1	0
Chikungunya	--	--	--	--	0
Chlamydia	6	6	11	--	--
Cholera	--	--	--	--	0
CRE E. coli	--	--	--	--	0
Cryptosporidiosis	1	4	1	1	2
Cyclosporioasis	--	--	--	0	0
Dengue Fever	--	--	--	0	0
E. Coli (STEC)	0	2	2	0	0
Ehrlich (HME)	0	0	0	0	0
Giardia	1	0	0	0	0
Gonorrhea	1	1	1	--	--
Hansen’s Disease (Leprosy)	--	--	--	--	0
Hantavirus	--	--	--	--	0
Haemophilis influenzae type b	--	--	--	0	--
Hemolytic Uremic Syndrome	0	0	0	0	0
Hepatitis A	0	0	0	0	0
Hepatitis B, Acute	0	0	0	0	0
Hepatitis B, Chronic	0	0	0	0	0
Hepatitis D	--	--	--	--	0
Hepatitis E	--	--	--	--	0
Legionella	0	1	0	0	0
Listeria	0	0	0	0	0
Lyme Disease	0	0	0	0	0
Malaria	--	--	--	0	0
Meningococcal Disease	0	0	0	0	0
Mumps	0	0	0	0	0
Pertussis	0	0	0	2	3
Q Fever (acute)	--	--	--	0	0
Q Fever (chronic)	--	--	--	0	0
Rabies (animal)	0	0	0	--	--
Rocky Mountain Spotted Fever	0	0	0	0	0
Salmonella	0	1	0	1	1
Shigella	0	0	0	0	0
Syphilis	0	0	0	--	--

Tetanus	--	--	--	--	0
Tuberculosis	0	0	0	--	--
Tularemia	--	--	--	--	0
Typhoid Fever	--	--	--	0	0
Vancomycin-intermediate S. aureus	--	--	--	--	0
West Nile Virus	0	1	0	0	0
Totals	9	16	15	5	6

Source: Iowa Dept. of Public Health Center for Acute Disease Epidemiology, <http://idph.iowa.gov/CADE>, 12/2017, annual reports -- this disease not reported this year.

Most disease outbreaks in recent history have been anticipated and are contained in reasonable time using existing mitigation measures.

Human Disease Future Probability:

Public health agencies work to protect Iowans from infectious diseases and preserve the health and safety of Iowans through disease surveillance, investigation of suspect outbreaks, education and consultation to county, local, and other agencies. Public health agencies also work to reduce the impact of communicable diseases in Iowa and to eliminate the morbidity associated with these diseases. Programs guide community-based prevention planning, monitor current infectious disease trends, prevent transmission of infectious diseases, provide early detection and treatment for infected persons, and ensure access to health care for refugees in Iowa. While vaccines are available for many diseases, Iowans remain vulnerable to various kinds of diseases. An example of this is the Ebola outbreak in 2015 that infected several Americans who died. The main factor that may increase the probability is the increase in travel and influx of refugees into the region. This risk is countered by better monitoring and improved tactics to combat the threat. The County’s director of public health indicates that many of the disease incidents come in three to four year cycles.

The overall rating the community gave for this hazard’s future probability in a survey was: “occasional” and “likely.”

Score for Rural Ringgold County: 5	Score for Benton: 4	Score for Diagonal: 4	Score for Ellston: 4
Score for Kellerton: 4	Score for Maloy: 4	Score for Mount Ayr: 5	Score for Tingley: 4
Score for Diagonal School: 5	Score for Mount Ayr School: 5		

Human Disease Vulnerability to the Population:

Public health agencies work to reduce the impact of communicable diseases in Iowa and to eliminate the morbidity associated with these diseases. Programs guide community-based prevention planning, monitor current infectious disease trends, prevent transmission of infectious diseases, provide early detection and treatment for infected persons, and ensure access to health care for refugees in Iowa. While vaccines are available for many diseases, Iowans remain vulnerable to other diseases. An estimated 20% of Iowans are considered high risk for disease incidents. Ringgold County has acute medical care and specialty care is available 90 miles away in Des Moines. The public health leaders state that the lack of staff and funding makes the concern over a major outbreak especially significant. However, local public health staff indicates the number of people in a typical event that would be directly impacted is limited. The exception to this is in confined areas, such as schools, where many children can contact disease in a short time. The public health leaders state that the lack of staff and funding makes the concern over a major outbreak especially significant. However, public health staff indicates that most of the effects can be addressed with current mitigation measures.

Pandemic disease response, however, exceeds local resources rather quickly. Influenza (flu) happens every year in nearly every country in the world. It spreads through a population for a few months and then will disappear or will move onto another country. Influenza usually occurs in the fall and winter months. Typically people who usually become ill are the elderly, the very young and people with chronic medical conditions and high-risk behaviors. Individuals that travel internationally and have high exposure to potential vectors of disease are also very susceptible. Greater than 20% of Iowa’s population is considered high risk. The recent H1N1 cycle impacted up to 30% of the population, mostly elderly, pregnant women, and children. The county has the Ringgold County Hospital to provide care as well as County Public Health resources.

Score for Rural Ringgold County: 5	Score for Benton: 5	Score for Diagonal: 5	Score for Ellston: 5
Score for Kellerton: 5	Score for Maloy: 5	Score for Mount Ayr: 5	Score for Tingley: 5
Score for Diagonal School: 7	Score for Mount Ayr School: 7		

Human Disease Area of Extent:

Because of our highly mobile society, these diseases can move rapidly across the state and across the nation within days, weeks, or months, impacting seemingly random areas. Individual buildings could see widespread impacts, while large areas like a county might see minimal areas of impact. There is no evidence the risk varies much by jurisdiction’s location. People live close enough to one another that any disease can impact any jurisdiction. Because

of our highly mobile society, diseases can move rapidly across the state and across the nation within days, weeks, or months, impacting seemingly random areas. It is likely that few areas are unexposed.

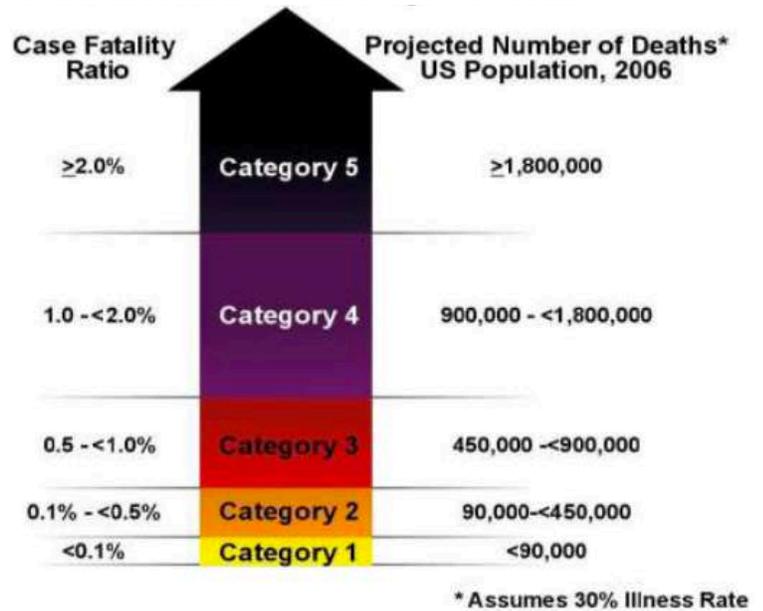
Score for Rural Ringgold County: 2	Score for Benton: 2	Score for Diagonal: 2	Score for Ellston: 2
Score for Kellerton: 2	Score for Maloy: 2	Score for Mount Ayr: 2	Score for Tingley: 2
Score for Diagonal School: 2	Score for Mount Ayr School: 2		

**Human Disease Severity of Impact:**

The severity of impact will be based on the magnitude of the event spatially and the severity of the disease on human life.

The Pandemic Severity Index chart from the Center for Disease Control shows fatality rates and projected deaths for each category. An example of the corresponding steps to take would be if the case-fatality rate during a pandemic is less than 1 percent (with estimated deaths nationwide under 90,000), the pandemic would be considered a category 1 and the only recommended community measure would be voluntary isolation of ill persons. However, communities could choose to take additional measures. In contrast, a category 5 pandemic (i.e., case fatality rate of 2 percent or higher and estimated deaths nationwide of nearly 2 million) would warrant recommendation of all of the community mitigation strategies.

**Figure 3.87: Pandemic Severity Index**



Ringgold County Public Health is proactive and aggressive. With limited resources they handle incidents well when they occur. Despite this, people can and do become ill from infectious diseases, and some die as a direct result or due to complications.

The following severity assessment looks at the local impact of the H1NI pandemic that passed through the region recently, or similar incident.

**Figure 3.88: Human Disease Severity of Impact Scoring Matrix**

Severity Criteria	Discussion	Score
Health and safety of the public	Many of the diseases on the national notification list result in serious illness if not death. Some are treatable; others only the symptoms are treatable. Because resources are limited and incidents can spread quickly, multiple deaths in Ringgold County, mostly to people that are aging or in poor health, are likely. Historically pandemics result in serious illness if not death. Some are treatable; others, only symptoms are treatable. The acute affect could result in numerous deaths in the county, but the spread of resources over many counties could dilute the response in one area, thus possibly resulting in unnecessary deaths.	4
Health and safety of responders	Doctors, nurses, paramedics, and emergency medical technicians are vulnerable to contagious diseases. Universal precautions can greatly diminish the transfer rate and risk responders face. Overworked public health and medical staff can be susceptible to other problems associated with stress.	4
Continuity of operations	It depends on the extent that local critical assets are able to operate during events where many are ill and health-care and first-response crews are occupied with the incident response. It is likely that some services will be highly compromised. Potential for severe or complete disruption involving multiple levels of government. Key workers and elected officials may not be able to serve. Schools and businesses can be closed because too many people are sick.	3
Property, facilities, infrastructure	No lasting impacts are likely.	1
Delivery of services	Limited impact on most critical services. Healthcare services may be at the limits of capacity. Sick workers can delay the delivery of services, as well as any services based within an area that is cordoned off for quarantine.	3
Environmental impacts	No direct impacts are likely in most cases. In a pandemic, if special treatment is needed that requires the use of certain chemicals and substances, it is likely that these substances and any disposal efforts could impact the environment.	2
Economic/financial conditions	Large outbreaks may warrant travel advisories to the area and will impact the tourism and general commerce in the area. Sick workers can also reduce productivity and could	2

	severely hurt small business. High number of ill human resources will affect the conduction of local businesses and will cost the community much in healthcare provision. Economic costs could be of greater impact than the direct impact of the disease itself.	
Regulatory/contractual obligations	Since the incident is widespread, local response will not be a focus. Local response and public health personnel may have trouble meeting other obligations because they are focused on the incident or pandemic.	2
Reputation	Adequate disease prevention programs and response to the outbreak can limit the damage to the jurisdiction’s reputation. If there is panic, the reputation can be hindered.	2

The overall rating the community gave for this hazard’s magnitude in a survey was: “limited.”

Score for Rural Ringgold County: 23	Score for Benton: 23	Score for Diagonal: 23	Score for Ellston: 23
Score for Kellerton: 23	Score for Maloy: 23	Score for Mount Ayr: 23	Score for Tingley: 23
Score for Diagonal School: 23	Score for Mount Ayr School: 23		

Human Disease Speed of Onset:

The private practitioner is the first line of defense and will undoubtedly be the first to witness the symptoms of human disease incidents. The Iowa Department of Public Health and the U.S. Centers for Disease Control monitor reports submitted by doctors, hospitals, and labs to identify patterns. The Department and CDC are tasked with providing information to the health care community on medical concerns. Scope and magnitude can escalate quickly and area resources - personnel, medications, and vaccinations – can be drained rather quickly. Pandemic disease tends to spread much more slowly and more warning time is possible.

Score for Rural Ringgold County: 2	Score for Benton: 2	Score for Diagonal: 2	Score for Ellston: 2
Score for Kellerton: 2	Score for Maloy: 2	Score for Mount Ayr: 2	Score for Tingley: 2
Score for Diagonal School: 2	Score for Mount Ayr School: 2		

Human Disease Duration of Event:

Human disease incidents can spread for days even before the cause can be identified and may take a few more days before the cause can be contained or addressed. Pandemic and particularly widespread incidents can remain a hazard in a given area for weeks or months.

Score for Rural Ringgold County: 9	Score for Benton: 9	Score for Diagonal: 9	Score for Ellston: 9
Score for Kellerton: 9	Score for Maloy: 9	Score for Mount Ayr: 9	Score for Tingley: 9
Score for Diagonal School: 9	Score for Mount Ayr School: 9		

Human Disease Total Scores:

The following total scores for human disease indicate moderate risk to the public and the planning area where incidents can occur.

Score for Rural Ringgold County: 46	Score for Benton: 45	Score for Diagonal: 45	Score for Ellston: 45
Score for Kellerton: 45	Score for Maloy: 45	Score for Mount Ayr: 46	Score for Tingley: 45
Score for Diagonal School: 48	Score for Mount Ayr School: 48		

Human Disease Vulnerability/Assets at Risk:

Any area where people live, work, learn, play, or visit are susceptible to the impacts of human disease. This hazard will primarily impact human health and life and will not have a direct impact on structures and contents. However, it will have a direct impact on functional use and the economy because of the number of people that will be unable to work and possible closure and quarantine of buildings.

Virtually all structures, property, and people in the county, as outlined in Section 3.2, are susceptible to human disease. Again, there should not be physical building or property losses, but people living in or using any building and property in the county can be at risk.

All critical assets in the county, as outlined in Section 3.2, could be impacted by this hazard.

Human Disease Loss Estimation:

There is no expected structural, building, or property losses to existing structures, buildings, and properties due to this hazard.

In the past five years, there have been 51 reported incidents of various communicable diseases in the county. In addition, there have been multiple deaths due to influenza or similar diseases.

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 Ringgold County are not available, but just from this data, based on the portion of the national population that is in Ringgold County, the losses are approximately \$2 million.

U.S. Centers for Disease Control and Prevention (CDC) estimates 76 million people suffer foodborne illnesses each year in the nation, accounting for 325,000 hospitalizations and more than 5,000 deaths. Health experts estimate that the yearly cost of all foodborne diseases in America is \$5 to \$6 billion in direct medical expenses and lost productivity. Infections with the bacteria Salmonella alone account for \$1 billion annually in direct and indirect medical costs. Prorated to the local population of Ringgold County, this cost is approximately \$100,000.

Future Development and Human Disease:

The overall population of the county is slowly declining but the median age continues to slowly increase, so overall the future incidence of human disease is likely to remain the same, barring any change in prevention, treatment, and other mitigation measures that may be introduced.

**Infrastructure Failure Profile**

Type: Technological

Definition: An extended interruption, widespread breakdown, or collapse (part or all) of any public or private infrastructure that threatens life and property.

Infrastructure Failure Description:

Infrastructure failure involves numerous types of infrastructure profiled in the previous plan: energy utilities, communications systems, and structural failures and fires. Pipelines, even though they are infrastructure, carrying hazardous materials are profiled under the hazardous materials profile. These types of infrastructure are vital to hazard warning, response, cleanup, and recovery. Improving the conditions of infrastructure, making them stronger to withstand the impact of hazards, and modernizing them all can mitigate hazards and can improve local quality of life and the economy. Infrastructure failure can result from hazard incidents, overuse, and normal age and deterioration. Because Ringgold County relies so much on infrastructure to support the various communities and widespread farms and to ensure the dynamic economy can flourish, mitigating their failure is essential beyond the damages caused by natural hazards, such as wind, ice, and tornadoes. This hazard includes an extended interruption, widespread breakdown, or collapse (part or all) of any public or private infrastructure that threatens life and property. One potential cause of infrastructure failure is space weather/solar flare.

The following paragraphs offer a brief description of the types of infrastructure considered.

Communications systems involve personal and emergency systems. 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 communication systems to effectively protect citizens. Business and industry rely heavily on various communication media as well. Mechanical failure, traffic accidents, power failure, line severance, and weather can affect communication systems and disrupt service. Disruptions and failures can range from localized and temporary to widespread and long-term. If switching stations are affected, outage could be more widespread. Key communications systems are shown in the communications map in Chapter 2.

Energy failure is the loss of power and other energy supplies needed for day-to-day human survival. International events could potentially affect supplies of energy-producing products, while local conditions could affect distribution of electricity, petroleum or natural gas. The magnitude and frequency of energy shortages are associated with international markets. Local and state events such as ice storms can disrupt transportation and distribution systems. If disruptions are long lasting, public shelters may need to be activated to provide shelter from either extreme cold or extreme heat. Stockpiles of energy products eliminate short disruptions, but can also increase the level of risk to the safety of people and property in proximity to the storage site. Key power and energy systems and pipelines are shown in applicable maps in Chapter 2.

A road, bridge, or building may collapse due to the failure of the structural components or because the structure was overloaded. Weather events such as heavy snow may cause a roof of a building to collapse under the weight of the snow. Heavy rains and flooding can undercut and wash out a road or bridge. The age of the structure is sometimes independent of the cause of the failure. 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 amount of products stored in the structure.

Structural fires present a great 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. Fire stations and response facilities are mapped in Chapter 2.

Infrastructure Failure Historical Occurrence:

Most infrastructure failure in Ringgold County has been caused by the combination of weather events and system/facility age, the latter making the infrastructure more vulnerable to weather events.

Local communications failure incidents due to weather conditions, equipment failure, excavation incidents, and traffic accidents have been reported, but outages have usually been resolved in a timely manner. Infrastructure is aging in the county, and minor events have occurred in several, mostly rural, locations. A few ice and windstorms have cost communications lines and systems for hours to days over the past twenty years in parts of Ringgold County. Emergency communications have improved with the updating to the new narrow-banding requirements and the construction of a modern central law enforcement center that serves as the emergency communications hub. However, much of the outlying infrastructure is aging, and the increased reliance on cellular phones is a problem when tower equipment fails, which happens from time to time due to various weather events. Rural areas have experienced the most E-911 incidents because of the lack of wired systems and distance to wireless facilities. There is only one incident that comes to mind locally. This is the major ice storm of December 2007, which resulted in the power failure throughout the county and subsequent loss of wired and wireless communications for a few days in some locations.

All areas of the county have experienced short-term and most areas have experienced long-term electrical failures. Short-term failures are common and may include loss of power to a neighborhood for a few minutes. The 2007 ice storm produced a prolonged power failure, where many rural residents were without electricity for several days and even city residents were without power for hours to a day or more. High wind events and heavy snow have also knocked out electricity for hours to a day or more in various areas of the county. Losses, mostly infrastructure and economic, due to the 2007 ice storm were significant but no figures have been discussed in the planning process. Kellerton's planning team representative reports a recent power failure due to a thunderstorm. Natural gas failures have been minimal and have been consistent with localized pipeline failures. With no local production capabilities, all power failures have been to facilities in other counties or to power lines and wires as they cross the county.

In the past ten years several rural culverts and bridges failed or were closed due to the threat of failure. In almost all the towns and in the rural area older buildings have collapsed, either slowly over time or suddenly. Most structures are not occupied or are used for storage. Structural failure affects Secondary Roads Department the most due to the large number of aging bridges and culverts in rural Ringgold County. As a preventative measure, some older buildings are being used for controlled burns before they collapse and before winds blow debris from them and cause other damage. Additionally, older downtown buildings in some of the smaller outlying towns have been a failure threat for many years. Finally, Mount Ayr in 2018 will be upgrading its water mains to address breakages that occasionally occur. Water main breaks can cause other structures, such as roads and bridges, to fail.

The county suffers from an average of roughly 25 occupied structure fires each year. While some totally destroy the structure, nearly all are quickly extinguished by on-site personnel or local fire departments. Local structural fires have required more than the local fire department capacity but are extinguished with mutual aid from one or more neighboring departments. Occasionally, incidents occur that require assistance from fire departments outside the county. Data from local fire departments is spotty, but it shows the trend is staying the same. 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. It is believed that larger communities tend to have more fires due to the larger number of structures. There have been 284 deaths in Iowa from fires from 2006 to March of 2013 according to the State Fire Marshall Division. The year 2017 was a record year with structural fire deaths, most of them occurring in rural towns like those found in Ringgold County. The local newspaper reported on a couple being killed in a structural fire in Benton in 2017 and another man seriously injured in a camper fire that same year.

Infrastructure Failure Future Probability:

Although infrastructure failure occurs on a routine basis, events that are life threatening, highly destructive, or otherwise impair the economy in the planning area are not as common.

Widespread communications failures are likely to be brief at best due to the extensive redundancy of systems. Local communications failures are likely not to affect large parts of the county. Generally, emergency communications are affected, but this problem is being mitigated to some degree with new equipment being purchased meeting national and state standards and with a new communications plan. In some places, the infrastructure is adequate and can withstand most hazards, but in other places it is not. Because our society is communications and information oriented, it stands to reason that the probability will increase in failures and the difficulty/expense of storing communications. However, technology and redundancy is improving and should reduce the probability of any given failure to be widespread and prolonged.

The State of Iowa has three strategies to limit the likelihood of an energy shortage: 1) through voluntary and mandatory demand reduction mechanisms; 2) the substitution of alternative energy sources when possible; 3) and state government programs to curtail excessive use, energy supply and demand. The federal government has a strategic petroleum reserve to supplement the fuel supply during energy emergencies. Shortages, especially electrical shortages, can be unpredictable with immediate effects. Natural events, human destruction, price escalation, and national security energy emergencies can cause unavoidable energy shortages. While Ringgold County does not have its own energy supplies to maintain, it becomes more urgent to ensure that utility lines bringing energy into the county are protected, and these lines are exposed. Further, most critical assets lack fixed power generators, although more are adding them due to the lessons learned from recent events. Widespread incidents are less likely in the future, but local areas are still at considerable risk.

Mount Ayr reports continual issues with water main failures, which are being addressed through a planned water main replacement project in 2018.

Civil structures may fail in a variety of modes. The unprecedented growth in technology has resulted in a host of problems related to complex structures, special materials, and severe operational and environmental loads, such as fire, excessive vibrations, explosion, high-energy piping failures, missiles, and earthquakes. With the possible exception of misuse, accidental or environmental loads, the causes of failure may be found in deficiencies of design, detailing, material, workmanship, or inspection. With the aging structures in the country along with problems with new materials discussed above, structural failures will continue to occur. Efforts to inspect and maintain these structures will lessen the probability of a failure, but not guarantee that it will not happen in the future. Internal weaknesses can be hidden from inspectors and not be realized until it is too late. In Ringgold County, old bridges, culverts, homes, and abandoned buildings pose a failure risk. These structures are only getting older, and resources to improve them are lacking.

Much of the fire prevention efforts have gone into nonresidential fires and the results have been highly effective. Even with an increase in the prevention efforts in residential fires, both residential and nonresidential fires will continue to occur. According to the Iowa State Fire Marshals Office, the most recent deaths from structural fires were in or near Blockton (likely in Taylor County) in 2000, where a person perished in a mobile home fire. During colder months, clogged chimneys, faulty furnaces and fireplaces, and use of space heaters can increase the probability of structural fires. Based on the current trends for new development and continued fire prevention efforts, the annual probability in any jurisdiction is low to moderate.

Considering the variety of infrastructure and the fact that infrastructure of one kind or another is found in all parts of the county, the probability of an incident with negative consequences (economic loss, health implications, etc.) to the community is high.

The overall rating the community gave for this hazard’s future probability in a survey was: “occasional.”

Score for Rural Ringgold County: 8	Score for Benton: 4	Score for Diagonal: 5	Score for Ellston: 4
Score for Kellerton: 5	Score for Maloy: 4	Score for Mount Ayr: 6	Score for Tingley: 4
Score for Diagonal School: 3	Score for Mount Ayr School: 3		

Infrastructure Failure Vulnerability to the Population:

Much of the county’s population could be impacted for up to 2 days, mostly indirectly, but with so many means to communicate today, the real impact is negligible in terms of human life. Phone and data transmission could be impacted temporarily. Various firms provide communications services, so the loss of one service will be very localized. Should underground fiber systems become damaged, the E911 service as well as contact with agencies outside the service areas may be impossible. Other avenues of communication such as cellular phones may also be affected. Radio communications would not be adversely affected by fiber loss but could be impacted if repeaters and towers are incapacitated. Rural facilities and assets are uniquely vulnerable in the event of fires and other emergencies. Cell

tower damage would make communications with physicians and other responders very difficult. People who cannot afford services or rural people that have limited reception would be most vulnerable.

Because Iowa is almost entirely dependent on out-of-state resources for energy, Iowans must purchase oil, coal, and natural gas from outside sources. World and regional fuel disruptions are felt in Iowa. It is likely that increasing prices will occur as market mechanisms are used to manage supply disruptions. This will greatly affect the low-income population because of their lower purchasing power. Agricultural, industrial, and transportation sectors are also vulnerable to supply, consumption, and price fluctuations. In Iowa, petroleum represents 97% of transportation fuel. Individual consumers such as commuters are also vulnerable. Many electrical systems are backed up and redundant systems prevail, making long-term vulnerability unlikely. Nursing homes, medical facilities, shelters, and assisted living facilities are especially vulnerable, due to the need to provide care to frail and sick individuals. Fortunately, because of past failures, many residents and public facilities owners have purchased backup power systems, but most people do not yet have access to these. Due to the distances involved, rural electric cooperative (REC) service areas are more vulnerable. The REC in Ringgold County is retrofitting lines and poles to reduce future risk, but some areas have not been retrofitted yet.

There are many structures in Ringgold County that are very old or which may become hazardous in the event of an earthquake, fire, high winds, or other natural events. All bridges are vulnerable to the effects of the elements and the deterioration that results. Increases in the amount and weight of traffic they are expected to support increase their vulnerability to failure. Ringgold County has many old homes and buildings that can collapse due to age and disrepair. In some locations of central Mount Ayr particularly, old downtown buildings could collapse and impact surrounding buildings and the public. Grain elevator failures can cause widespread damage in some towns. Because some buildings and structures can contain a large number of people, 10% or more of the population can be impacted. Schools and the hospital can be subject to a partial collapse that will directly impact up to half the population on those properties.

Older structures with outdated electrical systems not built to current fire codes are particularly vulnerable to fire. Combustible building materials obviously are more vulnerable than structures constructed of steel or concrete. Structures without early detection devices are more likely to be completely destroyed before containment by response agencies. Structures in areas served by older, smaller, or otherwise inadequate water distribution infrastructure such as water mains and hydrants are also at significant risk. Income and other demographics are also involved, because some people cannot afford home improvements that might prevent fires. The fire death risk for the elderly and children under 5 years of age is more than twice that of the average population. Industrial and business fires could affect hundreds of people due to lost employment. Some public and high-occupancy buildings are not sprinkled due to being built before sprinkling was required. The hospital is even more at risk because it is difficult to move people and expensive equipment if a fire occurs in occupied areas. Flammable chemicals and gases can also exacerbate a fire at the hospital.

The scores below reflect the relative impact on any given area of any one of these infrastructure hazards.

Score for Rural Ringgold County: 4	Score for Benton: 5	Score for Diagonal: 5	Score for Ellston: 5
Score for Kellerton: 5	Score for Maloy: 5	Score for Mount Ayr: 5	Score for Tingley: 5
Score for Diagonal School: 6	Score for Mount Ayr School: 6		

Infrastructure Failure Area of Extent:

Most communications failures would be limited to localized areas. In the event of a widespread communications failure, only portions of the county would likely be impacted, but long-term or emergency disruption is highly unlikely due to the support of other jurisdictions and secondary communication devices. The extremities of the county are the weakest in terms of reception through wireless devices due to topography. The increasing number of cell towers and improvement of fiber lines is reducing the areas where losses would be notable. Individual events are more likely to cause widespread impact on towns, schools, and the hospital due to their limited geographic area.

The effects of an energy shortage could be felt throughout the state if there is a loss of supply sources. Because the distribution systems are very developed, local shortages can quickly be covered by secondary sources in most cases; therefore, in normal conditions, most outages will be very localized and brief. Failures caused by weather events, however, can tax utility repair crews that must address local and regional damages. Most incidents will damage one power system or substation and impact a small part of the county or city. Smaller towns and individual buildings could see total loss until generators or other sources are provided.

The impacts of the failed structure would be contained to the immediate area and adjacent properties. This could be as small as the house and yard of a fallen chimney, or the area could be relatively extensive if the structure that failed was a multi-story downtown building, a grain elevator, and a tall communication tower. Dam and bridge failures and those

involving hazardous materials can impact a wider area. Bridge failures cause transportation delays, crashes, and hazardous materials spills.

With modern training, equipment, fire detection devices, and building regulations and inspections, most fires can be quickly contained and limited to the immediate structure involved. Certain circumstances, such as the involvement of highly combustible materials or high winds, can threaten a larger area. The age and density of a particular neighborhood can also make it more vulnerable to fire from neighboring structures. Flammable chemicals and gases can also exacerbate a fire at the hospital and in industrial facilities.

The scores below reflect the relative impact on any given area of any one of these infrastructure hazards.

Score for Rural Ringgold County: 4	Score for Benton: 5	Score for Diagonal: 5	Score for Ellston: 5
Score for Kellerton: 5	Score for Maloy: 5	Score for Mount Ayr: 5	Score for Tingley: 5
Score for Diagonal School: 7	Score for Mount Ayr School: 7		

***Infrastructure Failure Severity of Impact:***

The severity of communications failure will be related to the duration and area of effect. It will also depend on the specific system that is affected. For example, the loss of E911 communication would be more hazardous for public safety than the loss of one mile of phone line in a town where cell towers are available. The scoring considers more significant or widespread events than the common localized outage. Energy failure is often a result of other hazards and can cause various cascading effects, such as fires and economic disruption. Structural failure and fire can impact any structure, including those that have large and immobile populations, such as the elderly and young children.

The following provides a summary of the severity of impact throughout the county.

**Figure 3.89: Infrastructure Failure Severity of Impact Scoring Matrix**

Severity Criteria	Discussion	Score
Health and safety of the public	A communications or energy failure would not directly result in injuries or fatalities. If 911 systems were to fail due to phone communication disruption, secondary impacts could occur by the inability of citizens to reach responders. Injuries and fatalities can occur if energy was not available for heating during extreme cold periods or for cooling during extreme heat or if people relied upon power to supply equipment such as life support and breathing equipment. Personal injury, death, and property damage may occur in a building or structure failure or fire itself or by falling debris from nearby structures. Based on national averages in the 1990s, there is one death for every 119 residential structure fires and one injury for every 22 residential fires. In nonresidential fires, there is one death for every 917 fires and one injury for every 52 fires. From 2006-April 2010, Iowa sustained 167 fire fatalities. Fatalities are possible due to infrastructure failure.	4
Health and safety of responders	If health and safety personnel cannot communicate with other personnel, they are at risk when responding; for example, if a firefighter is in a building and cannot call for assistance. Responders can be electrocuted or response equipment, such as boom trucks, can fail. Structural collapse rescue is a specialized form of rescue and can result in injury or death to responders. Workers in or near the building or structure could be subject to further impacts. In the US, about 100 firefighters die annually while on duty. Typically, responders are at less risk than the general public because they are properly clothed, trained, and alert when at the scene. Adverse weather conditions, which often cause failures, can put responders at additional risk.	4
Continuity of operations	Operations can be hindered when service interruptions are prolonged. So many things today depend on reliable communications. Hospitals, shelters, emergency response vehicles and facilities, and other critical facilities would have priority during energy shortages. While the hospital and some other facilities have backup electrical power, none have backup heating energy. Functional purpose of the building would be terminated or suspended until the integrity of the structure could be restored or a new location is found. Responders can be overly taxed and could operate at diminished efficiency for a time.	4
Property, facilities, infrastructure	Communications failures are often the result of infrastructure failures. Critical facilities, such as technical water plants, and infrastructure can fail due to the loss of communications between system components. Depending on the cause of an energy failure, the impact on property, facilities, and infrastructure could be greatly impacted. If there is a regional blackout, it might have no direct impact on local infrastructure. However, if it is caused by a storm, the damage to the infrastructure could be very extensive. Sometimes power outages in one area can cause damage to other facilities, especially if there are no modern and well-maintained surge protections and other measures. Impacts could range from minor disruption to full destruction of the	4

	structure.	
Delivery of services	Service providers can be slowed by the lack of access to communications. Effects of energy failure could range from minor heating and air conditioning disruptions to transportation limitations all the way to civil unrest due to the high demand, low supply, and subsequent high price. Bridge failures and debris in the streets and sidewalks would interrupt normal routes of travel.	3
Environmental impacts	Failed communications and energy infrastructure could result in malfunctioning systems and the subsequent unplanned discharge of hazardous materials into the environment. The same is true if a structure fails or burns. Modern structural fires and many structural failures release a hazardous substance that could contaminate the air, water, or soil.	3
Economic/financial conditions	Financial losses would be incurred due to the direct damage to electronic equipment and the communication system infrastructure. Today, almost all businesses and industry require extensive and reliable communications and energy. With modern day electronic funds and data transfers, economic and financial losses in the public and private sectors could be enormous. In the event that power is lost due to infrastructure failure, business disruption and increased cost of business would have far-reaching financial implications across many sectors of the economy. When structures fail or experience fire, there would also be a considerable price tag to replace or fix the structure, not to mention the loss of revenue that would occur because the structure could not be used. Cleanup costs could be very high. The incident can also severely damage surrounding businesses through disruption.	3
Regulatory/contractual obligations	Obligations of service providers to customers can be unmet. Failure or fire during construction can be the liability of the contractor or owner. Code development and enforcement can play a significant role in limiting the impact from structural failures and fires.	2
Reputation	Widespread communication failures could moderately harm the reputation of the jurisdiction. If 911 systems and inter-agency and intra-agency are affected, the reputation damage could be more serious. Data transmission failure could also affect public trust. If caused by natural disasters, there would be no significant impact unless the response to the power outage was poor. If the structural collapse or fire could have been averted or limited in any way by code enforcement or if response is inadequate, the reputation could suffer from public outcry.	2

The overall rating the community gave for this hazard’s magnitude in a survey was: “critical1.”

Score for Rural Ringgold County: 29	Score for Benton: 29	Score for Diagonal: 29	Score for Ellston: 29
Score for Kellerton: 29	Score for Maloy: 29	Score for Mount Ayr: 29	Score for Tingley: 29
Score for Diagonal School: 29	Score for Mount Ayr School: 29		

Infrastructure Failure Speed of Onset:

The actual failure of any form of infrastructure, building, or other structure or any structural fire would likely occur suddenly with little or no warning. There are several events that could lead up to the failure that have various warning times. Causal hazards can include fire, explosion, overloading of ice and snow, vibration, earthquakes, flooding, high wind, erosion, tornado, flooding, chemical corrosion, subsidence, and lack of general upkeep. Sometimes structures begin failing long before there is a total collapse, but the planning team is concerned about those that have no warning, because if there is warning, the incident can be prevented or people can be out of the way.

Score for Rural Ringgold County: 9	Score for Benton: 9	Score for Diagonal: 9	Score for Ellston: 9
Score for Kellerton: 9	Score for Maloy: 9	Score for Mount Ayr: 9	Score for Tingley: 9
Score for Diagonal School: 9	Score for Mount Ayr School: 9		

Infrastructure Failure Duration of Event:

The kinds of failures most likely to be hazards are rapid and will not take more than six hours from beginning until stabilization of the remaining members or security of the site is achieved. Structural fires and especially energy failures and communications failures can take a day or more before any meaningful response is provided to those at risk in a rural area such as Ringgold County.

Score for Rural Ringgold County: 7	Score for Benton: 7	Score for Diagonal: 7	Score for Ellston: 7
Score for Kellerton: 7	Score for Maloy: 7	Score for Mount Ayr: 7	Score for Tingley: 7
Score for Diagonal School: 7	Score for Mount Ayr School: 7		

Infrastructure Failure Total Scores:

The following total scores for infrastructure failure indicate high risk to the public and the planning area where incidents can occur.

Score for Rural Ringgold County: 61	Score for Benton: 59	Score for Diagonal: 60	Score for Ellston: 59
Score for Kellerton: 60	Score for Maloy: 59	Score for Mount Ayr: 61	Score for Tingley: 59
Score for Diagonal School: 61	Score for Mount Ayr School: 61		

***Infrastructure Failure Vulnerability/Assets at Risk:***

All structures, property, and people in the county, as outlined in Section 3.2, are susceptible to infrastructure failure.

All critical assets in the county, as outlined in Section 3.2, could be impacted by this hazard.

***Infrastructure Failure Loss Estimation:***

It is very difficult to estimate losses to infrastructure for several reasons: a) it is impossible to know for sure about the loss due to regular wear and use versus damage due to hazard events, b) much of the infrastructure cannot be seen because it is underground, and c) trained specialized people are required in many instances to properly estimate and articulate the real impact of hazard events on a given failure. Typically, when a local official or an insurance agent estimates damages due to a hazard, they consider primarily the physical losses to structures and properties, sometimes including contents but rarely considering more abstract values, such as functional use, economic, or displacement costs. In this way, infrastructure failure is a considerable form of loss in itself but it is also a hazard that can cause other losses.

The purpose of this loss estimation is to consider the further losses caused by the infrastructure failure types outlined in the profile (communications failure, energy failure, structural failure, and structural fire). As can be imagined, the greatest losses will be to infrastructure. Energy and communications failures may result in further losses to those systems. Structural failures and fires can destroy surrounding structures and infrastructure in addition to the initial failure or fire.

The physical losses due to communications failure and energy failure are less likely to affect other physical infrastructure, compared to structural failure and fire. The failure of utilities, towers, stations, cables, pipes and other assets can cascade and cost millions of dollars to fix. Only in some situations will extensive cascading effects occur, such as when lightning strikes a power line, which then damages computers and other equipment in numerous homes and businesses. There are considerable life-threatening issues with all these failures. Communications failures can cause responders not to respond or to respond in a delayed or ineffective manner so that lives that are in danger are then lost due to poor response. Similarly, an energy failure can cause emergency equipment to quit working, such as life-preserving oxygen in a home setting, thereby indirectly causing death or sickness. The elderly can suffer when natural gas heat supplies are cut off from homes. Economic and functional use losses are also likely when equipment is not functional and business cannot be conducted. It is very difficult to calculate these losses because they are often secondary or indirect, but the population and duration of the outage are key factors.

Structural failure and fire are somewhat easier to account for losses because they are more tangible and localized. However, it is difficult to differentiate for the purpose of loss estimation the loss to a structure or property caused by another hazard and the cascading loss caused by the infrastructure failure. An attempt is made in this plan. In a given incident, likely only one or two buildings or structures will failure or burn, and the value of buildings ranges from a few thousand dollars to \$10 million or more for the hospital, courthouse, and larger school buildings. Rarely will a larger building suffer complete failure, so we can estimate something on the range of \$100,000 plus content loss and functional use loss per incident of a magnitude where life can be endangered.

Economic and functional use losses are even more difficult to ascertain. In most cases, these will involve the cost of loss of business, loss of records and contents that are required to conduct business, cost of detours and delays in delivery, and inability for people to report to work. These costs, depending on the type of structure lost could be very significant, topping a million dollars.

As an aid to loss estimation of this kind of hazard, FEMA has developed standard loss of use estimates in conjunction with their Benefit-Cost Analysis (BCA) methodologies to estimate the cost of lost utilities and infrastructure on a per-person, per-use basis. See the following table.

**Figure 3.90: Example Loss of Service Values for Various Types of Infrastructure Failure**

Type of 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
Loss of road/bridge service – Vehicle delay mileage	\$0.55 per mile (or current federal mileage rate)

Source: FEMA BCA Reference Guide, June 2009, Appendix C

***Future Development and Infrastructure Failure:***

Increases in development and population growth increase the demand for utilities and use of infrastructure as well as the level of impacts when the utilities and infrastructure fail. Because growth is projected to be very minimal, without mitigation measures the future should be similar to today. Because Ringgold County is hilly, it is unlikely that large numbers of wind turbines will be built, but those that are built will pose a new hazard due to events, such as high winds, thunderstorms, and winter storms.

***River Flood Profile***

Type: Natural

Definition: A rising or overflowing of a tributary or body of water that covers adjacent land not usually covered by water when the volume of water in a stream exceeds the channel's capacity.

***River Flood Description:***

River flooding is a natural and expected phenomenon that occurs annually, usually restricted to specific streams, rivers or watershed areas. Floodwaters can be extremely dangerous; the force of six inches of swiftly moving water can knock people off their feet and two feet of water can float a car. Floods can be slow or fast-rising but generally develop over a period of days.

River flooding is usually the result of heavy or prolonged rainfall or snowmelt occurring in upstream inland watersheds. Melting snow can combine with rain in the winter and early spring; severe thunderstorms can bring heavy rain in the spring or summer. Intense rainfall over a short period of time, or an ice or debris jam can also cause a river or stream to overflow. River floodwaters can occur quickly and move rapidly, as in a flash flood, or waters can rise slowly over a period of hours or even a few days as they often do where the land is gently sloping or flat. The National Flood Insurance Program (NFIP) defines flooding as a partial or complete inundation of normally dry land areas from:

1. The overland flood of a lake, river, stream, ditch, etc.
2. The unusual and rapid accumulation or runoff of stream waters.
3. Mudflows or the sudden collapse of shoreline land.

Unlike flash floods, river floods occur within defined areas of basins (watersheds) called flood plains. 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 of the floodplain that is subject to one percent or greater change of flooding in a given year. FEMA has mapped these areas and calls them "Special Flood Hazard Areas." For the purpose of this profile, river flooding only occurs within those mapped areas. Flooding caused by dam failure and flash flooding are profiled in other sections of this chapter.

***River Flood Historical Occurrence:***

The Floods of 1993 and 2008 are still fresh in the minds of Iowans. Flooding has been a regular and frequent hazard in Iowa. Iowa has been involved in 36 or more Presidential Declarations of a major disaster related to flooding since 1953. Several of those have been from 2008-2011, affecting virtually all of Iowa's counties.

Many of these have impacted Ringgold County. River floods, mostly of minor nature, have occurred in Ringgold County, resulting in relatively modest damage. Some of the major flooding events that have resulted in over 36 Presidential Disaster Declarations in Iowa have affected Ringgold County to some degree. Many minor events have occurred in Ringgold County that did not result in a Presidential declaration. In fact, according to the planning team, minor or moderate flooding is nearly an annual event in Ringgold County, including 2008, 2009, 2010, 2011, 2014, and 2015. Flooding has been known to occur in small areas of Mount Ayr and larger areas of Diagonal, Benton, and Maloy, and rural areas. Rivers such as the Grand/Thompson River, Middle Grand River, Platte River, and other smaller rivers have flooded hundreds of acres of mostly farmland on many occasions, but most of the events have lasted hours to a day at most and long-term damage is limited. Major flooding, however, has been rare within the county. The Middle River has flooded the most regularly, according to the planning team, and has caused the flooding of secondary roads and bridges.

Information on past events in Ringgold County is incomplete because most flood events reported for Adair County show the results of the larger flood event. Because flooding does not stop at a county boundary, flood events are reported regionally, and most or all the damages reported might be located outside of Ringgold County in some events.

The only official source is the NCDC. According to the National Climactic Data Center, there have been 11 river flooding events in Ringgold County in modern history (since 1996 through October 2017) with over \$337,500 in reported property damages and over \$20.3 million in crop losses. The majority of Ringgold County’s historical losses occurred in 2010.

The most recent serious flooding event in May and June of 2008 resulted in 86 of the State’s 99 counties included in Governor’s disaster declarations, and 84 being declared as presidentially declared (including Ringgold Co.). The event resulted in 18 fatalities and 106 injuries, the evacuation of approximately 38,000 Iowans and impacting 21,000 housing units. According to the NCDC, no damages occurred in Ringgold County due to flooding that year.

The most recent event recorded for the county by the NCDC includes \$20 million in crop loss. This is estimated loss due to a month of heavy rain that destroyed crops and prevented planting in June 2010 throughout much of Iowa. Likely less than \$1 million of the loss occurred in Ringgold County. Rural areas were impacted by stream and small river flooding in June, August, and September 2014, resulting in one Federal declaration in the county and two State declarations.

FEMA funds were awarded due to rural flooding in 1993 and 2008. FEMA has funded repairs to bridges and county assets along several rivers and streams. In 2008 and 2010, FEMA/State of Iowa has provided \$6.8 million in Public Assistance just for Secondary Roads alone in those two years. Likely most of this was due to flooding. This does not even include funds to several cities for road, bridge, and culver damage. Additionally, funding totaling \$514,952 in Individual Assistance for 22 households, and \$96,300 in SBA loans for four properties. Most or all of this assistance was due to the impacts of flooding. State Jumpstart funded 2 property for approximately \$37,000. The National Flood Insurance Program (NFIP) Repetitive Loss Properties (RLP) report identifies properties vulnerable to multiple flood losses. Through the end of 2017, there have been no RLPs in Ringgold County.

River flooding has not occurred (been reported) in Beaconsfield, Delphos, Ellston, Kellerton, Redding, and Tingley, at any of the schools, and at the hospital.

More information on river flooding and how it is addressed in Iowa can be found at <http://www.iowadnr.gov/Environmental-Protection/Land-Quality/Flood-Plain-Management>. This discusses the IDNR’s approach to this hazard.

### Ringgold County Plan Update Change to Future Flood Risk

The previous plan included flood risk in the various jurisdictions based on maps in place at that time. With the new official FIRM maps that show hazards in the rural area, Benton, Diagonal, Maloy, and Mount Ayr. These changes are based on the fact that, while flooding can occur outside of a SFHA, such flooding is unlikely based on past history, and, if it occurs, will likely be flash flooding in nature. No municipalities are likely to annex area that includes SFHAs not already in the city.

#### River Flood Future Probability:

Minor flooding, not necessarily to the 1% (100-year) flood elevation, is likely to continue in the rural county and the cities that have flood hazard areas. Major flooding requiring Federal response is moderately likely in the next five years. Although Ringgold County lacks large rivers, small rivers can cause significant damage to structures that remain in flood plains. The future probability, according to the planning team, will vary greatly by vulnerable jurisdiction. New and better efforts at mitigation in the past few years and planned for the next few years, such as updated flood maps, should reduce the loss of lives and property due to flooding. This is important because the noticeable increase in heavy rain events is likely to increase the prevalence of flooding and make it so 0.2% (500-year) flood events are likely to occur more often.

It is anticipated that minor to moderate floods will be occasional with impacts on developed parts of incorporated areas rarely occurring. The following scores assume that flooding is only occurring in areas with Special Flood Hazard Areas (SFHAs) as mapped by FEMA. This includes Benton, Diagonal, Maloy, Mount Ayr, and the unincorporated area. Any other flooding that might affect other areas is assumed to be flash flooding and is profiled as such in this plan.

The overall rating the community gave for this hazard’s future probability in a survey was: “unlikely” to “occasional.”

Score for Rural Ringgold County: 6	Score for Benton: 5	Score for Diagonal: 5	Score for Ellston: 0
Score for Kellerton: 0	Score for Maloy: 5	Score for Mount Ayr: 2	Score for Tingley: 0
Score for Diagonal School: 0	Score for Mount Ayr School: 0		

#### River Flood Vulnerability to the Population:

The vulnerability from river flooding is quite delineated to the 1%-chance level and with new mapping efforts to the 0.2%-chance level. Much work in the area of flood hazard mapping, where maps have been completed, has allowed many communities to restrict development in hazardous areas. Ringgold County now has countywide FIRMs (Flood Insurance Rate Maps) and an FIS (Flood Insurance Study). These have been attached in *Appendix D*. These maps are the result of collaboration among FEMA, the Iowa DNR, and Ringgold County using the Risk MAP process and LiDAR technology through the Iowa Flood Center to create modern maps. Previous to this, only a few of the cities were mapped back in the 1970s (FHBMs), all of which have previously been rescinded, or replaced by the new maps.

The FIS reports there are special flood hazard areas (SFHAs) in the following jurisdictions: unincorporated Ringgold County, Benton, Diagonal, Maloy, and Mount Ayr. Over 99% of the property in the SFHA is in the unincorporated area. As these maps show, river flooding primarily affects rural agricultural areas. Over 90% of the county’s flood hazard area (Zone A) is currently used for agriculture, so the greatest impact on private property due to flooding is agricultural land, crops, and potentially livestock and outbuildings. The maps show no occupied structures (homes, businesses, etc.) in flood hazard areas. However, infrastructure, such as bridges and roads, rather than private development, is more likely to be lost. Over 100 bridges are located in flood hazard areas or that cross over waterways that can flood around the base of the bridge. Some other public assets are also at risk of damage from floods, such as Fogle Lake near Diagonal and Sun Valley Lake near Ellston, where flooding could put pressure on the dam and cause its failure, thereby flooding occupied buildings to the northeast (See Map #190501028B and #1909890180B). Even in incorporated areas, there is no evidence that homes or other occupied structures are at risk of flooding.

The National Flood Insurance Program (NFIP) Repetitive Loss Properties (RLP) report identifies properties vulnerable to multiple flood losses. To date there are no repetitive loss properties (RLPs) in Ringgold County.

Currently, only Benton and Ringgold County (rural) are in the NFIP. Additionally, Shannon City, which is mostly in Union County, participates.

**Figure 3.90: FIRM Participation Information**

Community	CID	Initial FHBM * Identified	Initial FIRM ** Identified	Current Effective Map Date	Regular Program Entry Date	Sanction Date
Benton	195187A	n/a	06/16/2015	06/16/2015	06/16/2015	n/a
Diagonal	190501A	08/29/1975	06/16/2015	06/16/2015	n/a	08/29/1976
Maloy	190502A	n/a	06/16/2015	06/16/2015	n/a	06/16/2016
Mount Ayr	195185A	n/a	06/16/2015	06/16/2015	n/a	06/16/2016
Ringgold County	190903A	n/a	06/16/2015	06/16/2015	06/03/2016	n/a

Source: FEMA Community Status Book Report, 5/30/2017, <http://www.fema.gov/cis/IA.pdf>

\*Flood Hazard Boundary Map    \*\*Flood Insurance Rate Map    (NSFHA) – no SFHA exists

According to FEMA, at <https://bsa.nfipstat.fema.gov/reports/1040.htm#19>, there have been no (\$0) in losses reported by NFIP insurance product purchasers in Ringgold County from 1978 through 11/2017.

**Figure 3.91: Flood Insurance Information**

Community	Insurance Zone A			Insurance Zone B, C, and X		
	Policies in Force	# of Claims	\$ of Claims	Policies in Force	# of Claims	\$ of Claims
Benton	0	0	\$0	0	0	\$0
Ringgold County	1 (\$350,000)	0	\$0	0	0	\$0

Source: FEMA Community Information Service (CIS) <https://bsa.nfipstat.fema.gov/reports/1011.htm#IAT>, as of 11/2017

Ringgold County and its jurisdictions are non-delegated communities, which means a State floodplain permit must be issued prior to the community issuing the local permit. Iowa floodplain regulations establish higher standards than the minimum NFIP standards. One example of higher standards is that all new and substantially improved construction must be elevated one foot above base flood elevation. Additional DNR standards have been established for development in the floodway.

Future flooding is likely to impact some of the 200 bridges in Ringgold County along with dozens of culverts and numerous gravel and paved county roads that cross low-lying river basins. Thousands of acres of farmland are also likely to be submerged. Generally, however, unless the flooding is the result of dam failure, no residential or occupied buildings are likely to be flooded. Therefore, the impact to the population is likely to be economic and indirect: detours due to road closures, tax increases to fund new bridges, etc. The planning team is concerned that flooding may cut access to homes in some rural areas in the event of emergency.

The NFIP participating jurisdictions – in this case Benton and Ringgold County – have issued regulations to prohibit future development in flood areas. Infrastructure, such as bridges and roads, rather than private development, is more likely to be lost in a “100-year” flood. However, this infrastructure impacts people and vulnerable populations outside

of the flood hazard area. The ratings below are based on the direct impact to the population, as it is impossible to really measure the indirect impact, which will vary by location and severity of the flood event. Mount Ayr’s impact is most likely to be minor temporary disruption of the wastewater treatment facility operations.

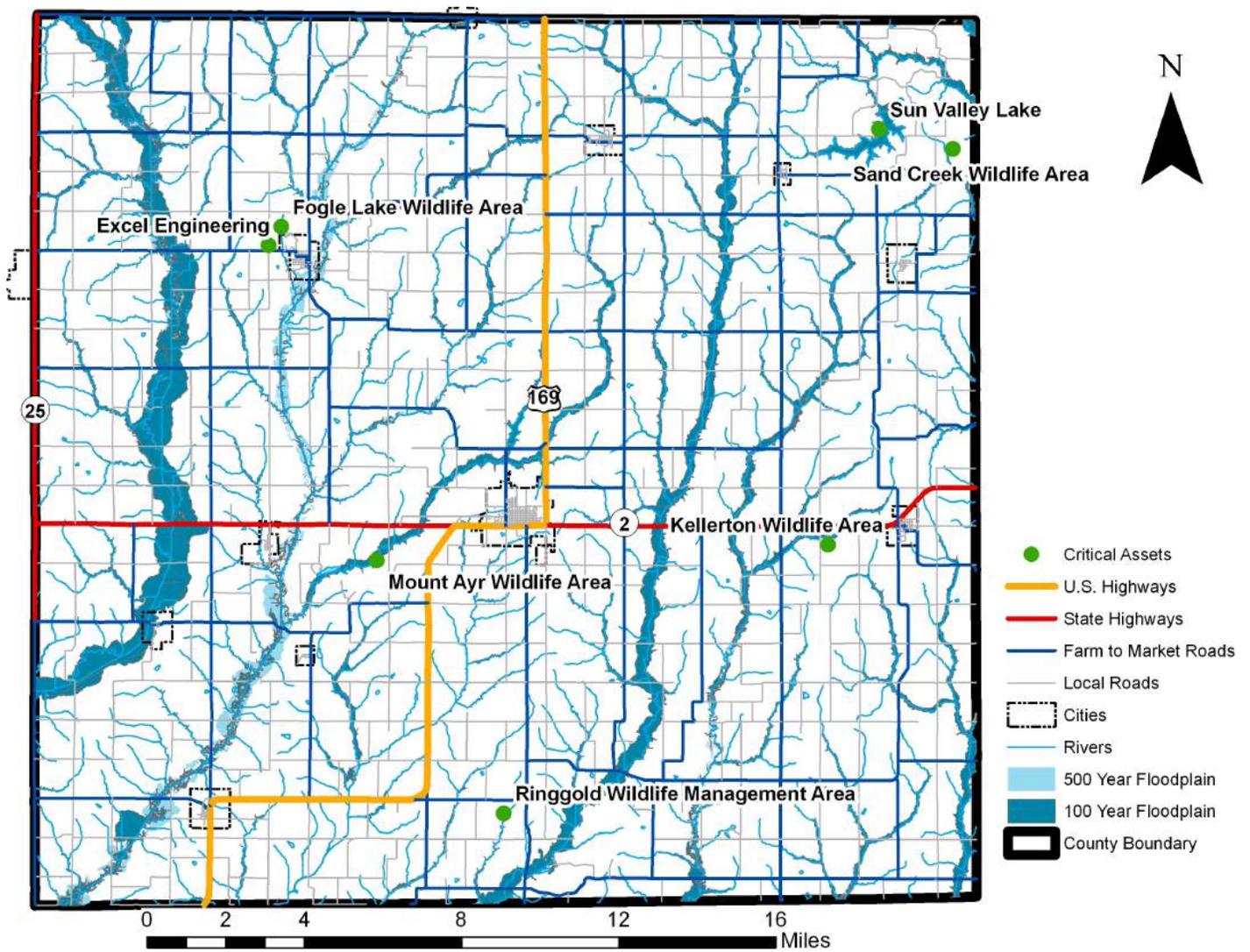
Score for Rural Ringgold County: 5	Score for Benton: 2	Score for Diagonal: 3	Score for Ellston: 0
Score for Kellerton: 0	Score for Maloy: 3	Score for Mount Ayr: 2	Score for Tingley: 0
Score for Diagonal School: 0	Score for Mount Ayr School: 0		

**River Flood Area of Extent:**

Flood mapping helps delineate risk. Fortunately, FIRM maps are now in place. Printed copies of these are in *Appendix D*. Note from the maps that there are special flood hazard areas (SFHAs) in the following jurisdictions: unincorporated Ringgold County, Benton, Diagonal, Maloy, and Mount Ayr. Over 99% of the property in the SFHA is in the unincorporated area. As these maps show, river flooding primarily affects rural agricultural areas. In total, the estimated number of parcels located in the SFHAs of Ringgold County would be 250 agricultural parcels in rural areas and 20 agricultural parcels in incorporated cities. In Benton, Maloy, and Diagonal, large sections of mostly undeveloped area is in the SFHA. In Mount Ayr, only a tiny part of the area is in the SFHA, but it includes a sliver of land used for the wastewater treatment facility outflow area.

The following is an unofficial version of the FIRM map.

**Figure 3.92: Flood Hazard Areas (Unofficial)**



It is important to know that there is a difference between being unmapped and having no SFHA:

- Unmapped: If a community is unmapped, there has been no formal effort to determine if or where flood risk areas may be located. The community has no flood map. The “unmapped” community requires a level “a” ordinance. (No parts of the county are “unmapped.”)
- No SFHA: If a community was studied and mapped, and it was found that there were no SFHAs within that jurisdiction, FEMA has determined the community has no special flood hazard areas. (Rescinded FHBMs fall within this category.) The NSFHA community does not require an ordinance.

(Sources: Iowa Flood Center; IHSEMD Regulation “Staircase”)

Rural areas are becoming less susceptible due to flood mitigation measures in watersheds, such as basins, terracing, grassed waterways, and large water source lakes. However, major flooding could possibly cause water source dam failure (although the risk is very remote). Flooding remains possible in any SFHA, even if the risk and extent of the flood impacts decline as a result of mitigation measures used to date. With this said, only small parts of any jurisdiction experience a direct threat of flooding.

It is possible (although very difficult) to perform a scenario analysis to determine where flooding could occur in a given storm event, and in most storm events the resulting flooding would not cover the entire planning area’s SFHA. However, for the planning team’s purposes, simply using the entire SFHA in each jurisdiction is adequate for planning purposes. The following list summarizes the flood hazards impacting each of the jurisdictions in this plan:

- Rural Ringgold County: Several small rivers and streams pass through the county, most of them originating in the county or in Union County to the north. Almost 5% of the land surface in the unincorporated area is within SFHAs. Most of these areas run from north to either the southwest or southeast.
- City of Benton: One of the branches of the Grand River flows through the southeast part of the city, and a small tributary of that river flows through the western part of the city. Approximately 5% of the town is within the 1% flood area.
- City of Diagonal: One of the branches of the Grand River flows through the southeast part of the city, and a small tributary of that river flows through the western part of the city. Approximately 5% of the town is within the 1% flood area.
- City of Ellston: No Special Flood Hazard Areas.
- City of Kellerton: No Special Flood Hazard Areas.
- City of Maloy: One of the branches of the Platte River flows through the western part of the city. Approximately 35% of the town is within the 1% flood area.
- City of Mount Ayr: A small tributary of one of the branches of the Grand River originates in town and becomes a flood hazard just before leaving the southern part of the Mount Ayr. Less than 1% of the city’s land is in the 1% flood risk area.
- Tingley: No Special Flood Hazard Areas.
- Diagonal School District: Rural areas within the district have SFHAs, but no land owned by the District or under its responsibility is within those areas.
- Mount Ayr School District: Rural areas within the district have SFHAs, but no land owned by the District or under its responsibility is within those areas.

Score for Rural Ringgold County: 4	Score for Benton: 4	Score for Diagonal: 4	Score for Ellston: 0
Score for Kellerton: 0	Score for Maloy: 6	Score for Mount Ayr: 1	Score for Tingley: 0
Score for Diagonal School: 0	Score for Mount Ayr School: 0		

River Flood Severity of Impact:

The extent of damage caused by floods is determined by many factors including depth, frequency, velocity, rate of rise, duration and the potential presence of ice and debris. These factors also determine which mitigation methods will work best.

*Depth* is the primary factor in evaluating the potential for flood damage. Every floodplain is unique in terms of the different levels of flooding that can be expected.

- Very shallow flooding, usually defined as a depth of 1 foot or less, is not life threatening, but can still cause considerable amounts of damage to a building.
- Shallow flooding of 1 to 3 feet in depth can result in significant amounts of damage both to structures and their contents.
- Moderate flooding, depths of 3 to 6 feet, can destroy buildings and threaten lives due to the large flood forces involved.
- Deep flooding, depths exceeding 6 feet, are the most destructive and dangerous.

*Frequency*, or how often the flooding occurs, is usually the second factor considered. All floodplains are subject to floods of differing depths, with the lower depths occurring more frequently than higher levels. Although historical flood depths provide some indication of the level of risk, there is no certain method to predict future flood levels. A method of estimating flood frequencies has been developed to determine the statistical probability of specific flood levels. For example, the flood that has a 1-percent (1 in 100) probability of being equaled or exceeded in any year is referred to as the 100-year flood event. However, this does not mean that a 100-year event is one that happens every 100 years or that once a 100-year event happens it will not occur again for another 100 years. This is only a statistical tool used to estimate the risk of certain flood levels. The 100-year flood is known as the base flood elevation or BFE. Once a BFE has been established, it is published on a Flood Insurance Rate Map (FIRM). These maps delineate areas of a specific community that are subject to the base flood.

*Velocity* is the speed at which floodwaters move. Slow moving floodwaters are usually defined as those having a velocity of less than three feet per second and they usually do not present substantial problems. Fast moving floodwaters, those moving over five feet per second, can quickly erode or scour the soil leading to foundation failure or even moving the house off its foundation. Historical flood event information is often the best way to determine potential flood velocities, although it is possible to hydraulically calculate theoretical velocities.

The speed floodwaters rise, or *Rate of Rise*, is the primary factor in determining the amount of warning time. In steep topography or when large amounts of rainfall occur within a short period of time, flash floods can occur. In low, flat areas the warning time can be several hours or even days. The rate of rise is also important because of the effects of hydrostatic pressure. For example, if the water rises quickly, water may not be able to flow into the building fast enough for the pressure inside to rise as quickly as the level outside. When the internal and external pressures (pressure of the water inside the building and the water outside the building) are significantly different, it could cause serious structural damage and even collapse.

The *duration* of the flood is how long it lasts. Often duration is related to rate of rise and rate of fall. Usually water that rises and falls rapidly will recede more rapidly and water that rises and falls slowly will recede more slowly. How long the structural members, interior finishes, service equipment, and building contents are affected by floodwaters is related to how much damage will occur. Duration also determines how long buildings remain uninhabitable.

Ice and/or debris can often pose a greater danger than the floodwater itself. For example ice floes, caused by ice breakup, can often strike a building causing serious damage or the ice may form around a flooded building causing uplift and structural damage. Floodwaters can carry all types of debris, including trees, portions of flood damaged buildings, storage tanks, mobile homes, as well as dirt and other substances such as oil, gasoline, sewage and chemicals. At low velocities the debris can cause damage and pose a health and safety threat; at higher velocities it can destroy structures, including buildings and bridges.

Most floods in Ringgold County will have modest depth and frequency but, because they are more likely to be flash floods initially, they will likely have a rapid rate of rise and velocity. They will also likely have a short duration compared to other floods in Iowa. The following assessment is based on these characteristics.

**Figure 3.93: River Flood Severity of Impact Scoring Matrix**

Severity Criteria	Discussion	Score
Health and safety of the public	Flooding impacts include potential loss of life. River flooding has less risk than flash flooding because of the slower onset of the river flood. In Ringgold County, large floods with large areas of deep water are unlikely. Despite this, the risk of death remains. The 2008 floods resulted in 18 fatalities and 106 injuries, the evacuation of approximately 38,000 Iowans and impacting 21,000 housing units (none in Ringgold County).	2
Health and safety of responders	Responding to river flooding often includes sandbagging and working in floodwaters. Response personnel should have current tetanus and hepatitis shots. Rescuing victims often requires rescue from boat. Wearing personal protective gear such as life vests at all times can prevent most injuries.	2
Continuity of operations	Operations could be disrupted from direct impacts if facilities are in the floodplain and indirectly from loss of critical services (such as electricity) to maintain operations. Back up power and other services can eliminate the impact to operations. Water and wastewater treatment plants are often located in floodplains because they must either take or deposit water into a waterway. This is the case in Mount Ayr. Other operational elements can be damaged in other communities and the rural area.	2
Property, facilities, infrastructure	Facilities and infrastructure can be scoured around, which degrades its structural integrity. Most losses in Ringgold County have been limited to bridges and serving rural areas; some have been destroyed. Because a large area can be impacted, flood damages could be severe.	3; Mt. Ayr 2 Benton 2

Delivery of services	Damage and disruption of communications, transportation, electric service, and community services are likely in severe cases. Water and wastewater treatment facilities are located in or near the floodplain and are at some risk of flooding and eventually being taken offline.	3
Environmental impacts	Hazards of fire, health and transportation accidents, and contamination of water supplies are likely affects of flooding situations. In Ringgold County, hazardous materials facilities are not in flood hazard areas.	3
Economic/financial conditions	Crop and livestock losses and interruption of businesses either from direct flooding or loss of the delivery of critical services can have damaging impacts on the local economy. The magnitude and location of flooding in the county, however, is not likely to have a long-term impact on the overall economy. Counties covered in the 2011 disasters ranged from the western border due to flooding on the Missouri River to eastern counties along the Mississippi River. Crop losses in Iowa alone from Missouri River flooding were an estimated \$162 million.	3; Mt. Ayr 1
Regulatory/contractual obligations	None are known – unlikely to be significant to the population.	1
Reputation	The jurisdiction should pay careful attention to disclosing flood risk in the community. Participation in the National Flood Insurance Program and providing accurate and up to date flood insurance rate maps should mitigate this concern.	1

The overall rating the community gave for this hazard’s magnitude in a survey was: “limited” to “critical1.”

Score for Rural Ringgold County: 20	Score for Benton: 19	Score for Diagonal: 20	Score for Ellston: 0
Score for Kellerton: 0	Score for Maloy: 20	Score for Mount Ayr: 17	Score for Tingley: 0
Score for Diagonal School: 0	Score for Mount Ayr School: 0		

River Flood Speed of Onset:

Gages along streams and rain gages 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 and television messages as well as the NOAA Weather Radio. People in the paths of river floods may have time to take appropriate actions to limit harm to themselves and their property. The planning team recognizes that Ringgold County is the source or is near the source for several rivers and streams, so in most cases flooding originates in the county rather than approaches the county from farther upstream. Therefore, the speed of onset is often much quicker than areas like Des Moines, Davenport, and Ottumwa but not as quick as places like Adair County, where no larger rivers exist. Towns with SFHAs in this county are at or near the very upper reach of the river, so they will occur relatively quickly.

Score for Rural Ringgold County: 4	Score for Benton: 3	Score for Diagonal: 3	Score for Ellston: 0
Score for Kellerton: 0	Score for Maloy: 3	Score for Mount Ayr: 6	Score for Tingley: 0
Score for Diagonal School: 0	Score for Mount Ayr School: 0		

River Flood Duration of Event:

River floods can last for days to even one week in a given area of a river. Most flooding in Ringgold County will be of a shorter duration because the streams generally originate in or near the county and will flow through the county before going to downstream locations like Ottumwa or Des Moines. Typically, the river floods in the county are much briefer as a result, although there can be exceptions if rain persists for days or there is an exceptional snowmelt over several days. Mount Ayr is at the very upper reach of the stream, so floods will be relatively brief.

Score for Rural Ringgold County: 8	Score for Benton: 5	Score for Diagonal: 5	Score for Ellston: 0
Score for Kellerton: 0	Score for Maloy: 6	Score for Mount Ayr: 3	Score for Tingley: 0
Score for Diagonal School: 0	Score for Mount Ayr School: 0		

River Flood Total Scores:

The following total scores for river flood indicate low to moderate risk to the public and the planning area where incidents can occur.

Score for Rural Ringgold County: 47	Score for Benton: 38	Score for Diagonal: 40	Score for Ellston: 0
Score for Kellerton: 0	Score for Maloy: 43	Score for Mount Ayr: 31	Score for Tingley: 0
Score for Diagonal School: 0	Score for Mount Ayr School: 0		

River Flood Vulnerability/Assets at Risk:

With the availability of Digital Flood Insurance Rate Maps (DFIRMs) as well as detailed parcel data with assessed values, analysis is possible to quantify the risk to structures, properties, and people. This will allow for analysis of actual structures and values by type that fall within the boundaries of the regulatory floodplain (SFHA). At the time

this plan update was written, the County’s GIS system did not have a flood hazard layer, so the estimates are tentative at best. It is hoped that by the next update the GIS system will have this data.

As stated earlier, about 5% of the rural (unincorporated) area is within a SFHA. Primarily the area within the floodplains is made up of farmland and timber/wildland. Very few inhabited structures are found in this area. Note the following table of rural assets that could be at risk.

**Figure 3.94: Rural Ringgold County River Flood Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	5	\$400,000	12	<1%
Commercial	0	\$0	0	0%
Industrial	0	\$0	0	0%
Ag Structures and Land	10 buildings; 25,000 acres	\$30,000,000	2	10%
Taxable Infrastructure	2	\$8,000,000	1	15%
Government/Institutional	5	\$40,000,000	20	25%
<b>Totals</b>	<b>22</b>	<b>\$78,400,000</b>	<b>35</b>	<b>8%</b>

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that about 8% of the assets in the unincorporated part of the county are at risk. As can be seen, most of them are agricultural lands/crops and infrastructure that is necessary in rural areas, such as bridges, roads, culverts, and utilities that must cross over waterways. The cost/value of bridges and culverts, which is a major budget concern for the County, inflate the asset valuation in comparison with the percentage of the planning area that is within SFHAs. For the estimated five residential property and one commercial property above, these are properties that are partially in the SFHA but the County GIS maps seem to show the structures themselves are not in the flood hazard area. The following critical assets listed in Section 3.2 are susceptible:

- Mount Ayr Fish Hatchery
- Sun Valley Lake
- Wildlife and Park Areas

Approximately five acres in the west-central, southwest, and southeast parts of Benton are also at risk. The following structures and properties are included.

**Figure 3.95: Benton River Flood Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	0	\$0	0	0%
Commercial	0	\$0	0	0%
Industrial	0	\$0	0	--
Ag Structures and Land	0 buildings; 5 acres	\$5,000	0	1.5%
Taxable Infrastructure	0	\$0	0	0%
Government/Institutional	1	\$50,000	1	5%
<b>Totals</b>	<b>1</b>	<b>\$55,000</b>	<b>1</b>	<b>2%</b>

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is estimated that about 2% of the assets in Benton are at risk, mostly in the form of agricultural land and low-traffic roadways that can be flooded. None of the critical assets listed in Section 3.2 are susceptible.

Approximately 15 acres in the southwest and southeast corners of Diagonal are also at risk. The following structures and properties are included.

**Figure 3.96: Diagonal River Flood Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	0	\$0	0	--
Commercial	0	\$0	0	--
Industrial	0	\$0	0	--
Ag Structures and Land	0 buildings; 15 acres	\$20,000	0	3%
Taxable Infrastructure	1	\$5,000	0	1%
Government/Institutional	1	\$500,000	1	5%
<b>Totals</b>	<b>1</b>	<b>\$525,000</b>	<b>1</b>	<b>1%</b>

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that approximately 1% of the assets in Diagonal are at risk. None of the critical assets listed in Section 3.2 are susceptible. It should be stated but a much larger area of undeveloped Diagonal is subject to the 0.2% flood, so these figures would double if that flood hazard is considered.

Approximately 160 acres in the western half of Maloy are also at risk. The following structures and properties are included.

**Figure 3.97: Maloy River Flood Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	0	\$0	0	--
Commercial	0	\$0	0	--
Industrial	0	\$0	0	--
Ag Structures and Land	1 buildings; 120 acres	\$150,000	0	30%
Taxable Infrastructure	0	\$20,000	0	20%
Government/Institutional	1	\$1,000,000	1	50%
Totals	2	\$1,170,000	1	33%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that 33% of the assets in Maloy are at risk, with most of the value being the bridge on the county road crossing the river. None of the critical assets listed in Section 3.2 are susceptible.

Approximately one acre on the south central edge of Mount Ayr are also at risk. The following structures and properties are included.

**Figure 3.98: Mount Ayr River Flood Structures, Values, and People at Risk**

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	0	\$0	0	--
Commercial	0	\$0	0	--
Industrial	0	\$0	0	--
Ag Structures and Land	0 buildings; 1 acre	\$1,000	0	<1%
Taxable Infrastructure	0	\$0	0	--
Government/Institutional	1	\$1,000,000	1	1.5%
Totals	1	\$1,001,000	1	1%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that 1% of the assets in Mount Ayr are at risk. Only one of the critical assets listed in Section 3.2 are susceptible. This is the outflow structure area of the wastewater treatment plant. The \$5 million plant as a whole is not at risk of damage, but it could be shut down temporarily because of flooding at the outflow area.

River Flood Loss Estimation:

The potential losses to existing development will be provided for the following categories of losses:

- Building losses – this will include counts and values for buildings exposed to potential damage from the 1-percent annual chance flood for each jurisdiction in the planning area;
- Estimated population displaced;
- Agricultural impacts; and
- Critical facilities and infrastructure at risk.

When estimating potential losses to structures, it is important to remember that, when a flood occurs, it rarely causes total destruction of the properties in the floodplain. As stated in the severity of impacts section of this profile, factors like depth, velocity, and building type are also important. Based on FEMA Flood Insurance Administration (FIA) flood depth-damage curves, the percent of damage is directly related to the flood depth. FEMA’s HAZUS flood loss estimation tool and the flood benefit/cost module both use this simplified approach to model flood damage based on building type and flood depth. A damage estimation of 20 percent of the total value was used based on FIA depth-damage curves for a one-story structure with no basement flooded to two feet. While there are several limitations to this model, it does present a methodology to estimate potential damages. This model may include structures within the 1-percent annual chance floodplain that may be elevated above the level of the base flood elevation, according to local floodplain development requirements, and thus mitigate the risk. Additionally, structures with finished basements and commercial properties would likely sustain a higher percentage of damage.

To determine the population that would be impacted and potentially displaced by a 1-percent annual chance flood event, the average household size, as determined by the 2010 census, was multiplied by the number of residential structures in the 1-percent annual chance floodplain for each jurisdiction. The population impacted is somewhat underestimated since some of the residential structures are multi-family structures. However, data was not available to determine the number of households in each multi-family structure.

The following table outlines this analysis and provides an estimate of losses due to flooding caused by a 1-percent annual chance flood on structures (not including contents).

**Figure 3.99: Estimated Loss in Ringgold County Due to River Flood**

Jurisdiction	Total Improved Value	Improved Value in SFHA	Estimated Loss	Loss Ratio	Residential Properties in SFHA	Average Household Size	Estimated Impacted Population
Rural Ringgold County	\$736,368,044	\$78,400,000	\$15,680,000	2.13%	5	2.40	12
City of Benton	\$3,343,396	\$55,000	\$11,000	0.33%	0	1.72	0
City of Diagonal *	\$17,659,287	\$525,000	\$105,000	0.59%	0	2.16	0
City of Ellston	\$3,789,977	\$0	\$0	0.00%	0	2.12	0
City of Kellerton	\$10,834,217	\$0	\$0	0.00%	0	2.30	0
City of Maloy	\$3,047,035	\$1,170,000	\$234,000	7.68%	0	2.71	0
City of Mount Ayr *	\$149,730,117	\$1,001,000	\$200,200	0.13%	0	2.25	0
City of Tingley	\$6,665,979	\$0	\$0	0.00%	0	2.36	0
Totals	\$931,438,052	\$81,151,000	\$16,230,200	1.74%	5	--	12

Sources: Ringgold County DFIRM, Ringgold County GIS, US Census Bureau, 2/2018 \* Includes school and hospital property.

While flawed, the model provides a rough idea of what could happen. In Ringgold County, the clear majority of physical losses will be to county infrastructure, and residential properties are likely to suffer damage but not to the residential structures themselves. In reality no people will likely be displaced by a flood event in the county, but access to rural homes and farms will be impacted, and there is slight risk of people being injured and killed in a river flood event. Recall from the flash flood profile that river flooding is much less likely to cause death and injury than the more sudden and rapid flash flooding.

USDA crop insurance claims for excess moisture/precipitation/rain and flood conditions for the five year period of 2012-2016 show 61 claims, more than for any other individual hazard and over one-third of the total claims during this period. The total amount of claims was \$11,453,170.44, which is the highest amount all causes of crop loss, including drought. This averages to \$2,278,973.69 annually. It is likely that much of these losses occurred outside of the SFHA, but data is not available to determine this.

Due on the limited information available about properties, structures, and infrastructure in SFHAs, it is difficult to estimate losses due to a flood event. Likely the greatest losses, based on past history, will be to County-owned infrastructure, namely roads, bridges, and culverts. These will be partially to totally washed-out either through one flood event or the compound impacts of multiple floods. A new bridge over a small stream or river will cost over \$1 million dollars. A larger bridge required to address the traffic demands of a major State/US highway would be upwards of \$2 million. Culverts for smaller streams are less expensive but can cost over \$100,000. There are approximately 100 to 150 bridges and a similar number, if not more, culverts within SFHAs, almost all of them in unincorporated areas.

Economic losses include more than crops. When infrastructure is washed out, vehicles must take costly detours and some businesses that are isolated will lose sales. The functional use value of businesses, organizations, and governments can be diminished to some degree.

#### Future Development and River Flood:

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 by preventing future construction in those areas. However, even if mitigation actions occur, evacuation may still be necessary due to rising waters. In addition, floods that exceed mitigated levels may still cause damages.

#### **Severe Winter Storm Profile**

Type: Natural

Definition: Severe winter conditions including blizzard conditions, heavy snow, blowing snow, freezing rain, heavy sleet, and extreme cold/wind chills that can affect day-to-day activities and can cause fatalities and property damage.

#### Severe Winter Storm Description:

Winter storms can take on many forms and involve many elements. Typically, the severity of the weather is dependent on the temperature. Because temperature can change in various seasons, severe winter weather is relatively common from October to April. Winter weather winds can be so much more dangerous at 25 MPH than the same winds during the summer because of the cold. Varying weather conditions, combined with cold, can bring about severe conditions due to the impact of ice and snow on surfaces such as roadways and power lines. Wind is not just cold but also causes snow to drift, causing more impassable roads and damaged infrastructure and buildings. For the purposes of the local HMP, severe winter storms are the kinds of events that significantly impact commerce and cause widespread damage,

whether or not they are accompanied by some form of advisory or warning. The planning team indicates that any winter weather that causes imminent danger to the public is severe, no matter its statistical magnitude.

***Severe Winter Storm Historical Occurrence:***

Ringgold County experiences a great variety of winter weather every year, including heavy snow, blizzards, high winds, extreme wind chill, ice storms, and bitter cold. While most Iowans are accustomed to the cold, extreme weather is dangerous and causes extensive damage almost every winter. Some winters have multiple severe winter storms.

According to the NCDC, there have been 69 recorded severe snow, ice, extreme cold, freeze, blizzard and wind chill events affecting the county, causing \$1.895 million in property damage and \$6.891 million in crop damages but 0 fatalities and injuries from 1996 through November 2017. It is unknown how much of the reported damages occurred in Ringgold County versus part of a larger storm. The actual casualties from severe winter weather is much higher when we add in traffic injuries and deaths due to icy roads, people that die due to exposure or over-exertion, and other causes. Many times these casualties are not included in NCDC reports. Three winter storm related Presidential Declarations for Major Disaster have been declared in Ringgold County since 1996 (through November 2017).

Perhaps the worst winter storm in recent memory was the December 2007 ice storm that knocked out power for hours in all parts of the county and days in many rural areas. This storm destroyed thousands of trees, and caused millions of dollars in power line losses in the county. Many rural electric cooperatives and other providers are now undertaking FEMA mitigation projects to strengthen power lines as result. The local economy was at a near standstill for a few days because of this storm. One planning team member mentioned being without power in the home for three days.

Another major event was the 12+-inch snowfall that covered the county in December 2009. The winter of 2009-10 was one of the top snow-makers in Iowa’s recorded history, with over 70” of snow in this area. The State of Iowa declared a disaster area and authorized up to \$5,000 in state individual assistance for damages due to ice and snow in early 2010. From 2007-2011 there have been severe winter storms each year with the exception of 2008. While the past few years (2015-18) have been mild, there have been short periods with severe cold and wind chill conditions.

Planning team members state that road drifting is common in the rural areas and County has had to bring in snow blower and local contractors with caterpillars. Problems are not like they were historically due to better roads and clearing technology, but large storms still cause tremendous problems for local jurisdictions and especially the local economy. Days of school are cancelled each year. Ice storms are usually the greatest problem because they virtually shut down the county for days.

From January 2013 through March 2018 there were numerous NWS winter storm warnings and watches issued in Ringgold County for winter storm events (<http://mesonet.agron.iastate.edu/vtec/search.php#byugc/IA/IAC159/20180309/20180309>). The following were issued.

**Figure 3.100: Historical Winter Weather Events**

Type of Winter Weather	Warning	Watch	Advisory	Total
Blizzard	0	0	0	0
Freeze	7	1	0	8
Freezing fog	0	0	0	0
Freezing rain	0	0	3	3
Frost	0	0	7	7
Ice storm	1	0	0	1
Wind chill	3	1	24	28
Winter storm	7	13	0	20
Winter weather	0	0	31	31
Totals	18	15	65	98

Source: Iowa State University Department of Agronomy, <http://mesonet.agron.iastate.edu/vtec/search.php#byugc/IA/IAC001/20110101/20160318>

The history of severe winter storm events can be visualized by looking at heavy snow events as a proxy. The following table shows the top 30 snow days, as reported in 24-hour calendar day periods from 1950 through March 8, 2018, at the Mount Ayr weather station.

**Figure 3.101: Historical Heavy Snow Days at Mount Ayr Weather Station**

Date	Snow (in.)	Date	Snow (in.)	Date	Snow (in.)
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Date	Snow (in.)	Date	Snow (in.)	Date	Snow (in.)
12/09/2009	12	01/18/1955	7	02/04/1955	6
12/23/1961	10	01/03/1971	7	03/08/1980	6
01/27/1996	10	03/09/1998	7	03/04/1892	6
11/10/1986	9	02/22/2013	7	02/20/2010	6
12/22/2013	8.5	02/01/2015	7	03/25/1957	5.7
03/16/2001	8.2	02/06/2008	6.8	11/14/1972	5.5
04/12/1980	8	12/19/1973	6.5	01/13/1979	5.5
12/07/1995	8	02/06/2004	6.5	10/27/1997	5.5
04/11/1997	8	04/03/1950	6	01/17/2008	5.2
03/03/1952	7	03/08/1952	6	02/13/1950	5

Source: Iowa State University Department of Agronomy, <http://mesonet.agron.iastate.edu/request/coop/fe.phtml>

As can be seen, the largest daily snowfall totals are spread throughout the history of records, although a few years had multiple days: 1950, 1952, 1955, 1980, 1997, 2008, and 2013.

The same data source was accessed about the recorded low temperature. The coldest low recorded was -33.9 degrees F, with 604 days of recorded temperatures below -20 degrees F. The coldest day in the past five or so years was Christmas Eve 2013 (-31.1 degrees F).

Severe Winter Storm Future Probability:

Winter storms regularly move easterly and use both the southward plunge of arctic cold air from Canada and the northward flow of moisture from the Gulf of Mexico to produce heavy snow and sometimes blizzard conditions in Iowa and other parts of the Midwest. The cold temperatures, strong winds, and heavy precipitation are the ingredients of winter storms. Ringgold County can usually expect a half dozen winter storms a season, but not all of them are severe. Almost every winter we can expect one severe winter storm with high winds, heavy snows, and/or crippling ice and cold. Sometimes high winds and crippling cold can last for days after or in the absence of a snow event. A snow of 10 inches or more occurs about half of the winters. A severe ice storm occurs about every three to five years.

The annual probability of an event in Ringgold County is highly related to the severity.

<u>Winter Event</u>	<u>Probability in Ringgold County</u>	<u>Severity</u>
Heavy Snow	Highly Likely	Limited
Ice Storm	Likely	Moderate to High
Extreme Cold	Highly Likely	Moderate
Blizzard	Likely	Moderate to High

The overall rating the community gave for this hazard’s future probability in a survey was: “highly likely.”

Score for Rural Ringgold County: 7	Score for Benton: 7	Score for Diagonal: 7	Score for Ellston: 7
Score for Kellerton: 7	Score for Maloy: 7	Score for Mount Ayr: 7	Score for Tingley: 7
Score for Diagonal School: 7	Score for Mount Ayr School: 7		

Severe Winter Storm Vulnerability to the Population:

Due to the large number of low-income and elderly people in Ringgold County, the limited sheltering, and the demand for nearly all people to travel on area roads, nearly all people of the county are vulnerable. Heavy snows cause immobilized transportation systems, downed trees and power lines, collapsed buildings, and loss of livestock and wildlife. Heavy snows of more than 6 inches in a 12-hour period or freezing rain greater than 1/4 inch accumulation causing hazardous conditions in the community can slow or stop the flow of vital supplies as well as disrupt emergency and medical services. Loose snow begins to drift when the wind speed reaches 9 to 10 mph. The potential for some drifting is substantially higher in open country than in urban areas where buildings, trees, and other features obstruct the wind. Ice storms result in fallen trees, broken tree limbs, downed power lines and utility poles, fallen communications towers, and impassable transportation routes. Hazardous driving conditions due to snow and ice on highways and bridges lead to many traffic accidents, which is the leading cause of winter storm deaths. About 70% of winter-related deaths occur in automobiles and about 25% are people caught out in the storm. The majority of these are males over 40 years of age. Emergency services such as police, fire, and EMS are unable to respond due to road conditions. Emergency needs of remote or isolated residents for food or fuel and for livestock care are unable to be met. 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 or very young. Use of kerosene heaters and other alternative forms of heating may create other hazards such as structural fires and carbon monoxide poisoning. Elderly and others can slip and fall and can die due to exposure. Because schools are closed in severe storm situations, the vulnerability is slightly less, although buses can still crash or become stuck hours or days after a storm. The county hospital is somewhat insulated because the hospital can function in severe weather, although employees and responders may not be able to travel. Rural roads require tons

of rock to meet demand after the winter thaw. Thawing conditions also exacerbate expansive soils conditions and cause water line breakage.

Score for Rural Ringgold County: 8	Score for Benton: 8	Score for Diagonal: 8	Score for Ellston: 8
Score for Kellerton: 8	Score for Maloy: 8	Score for Mount Ayr: 8	Score for Tingley: 8
Score for Diagonal School: 7	Score for Mount Ayr School: 7		

**Severe Winter Storm Area of Extent:**

Winter storms are quite vast and would likely impact multiple counties. Certain areas may experience local variations in storm intensity and quantity of snow or ice and thus severity within the parent storm.

Score for Rural Ringgold County: 9	Score for Benton: 9	Score for Diagonal: 9	Score for Ellston: 9
Score for Kellerton: 9	Score for Maloy: 9	Score for Mount Ayr: 9	Score for Tingley: 9
Score for Diagonal School: 9	Score for Mount Ayr School: 9		

**Severe Winter Storm Severity of Impact:**

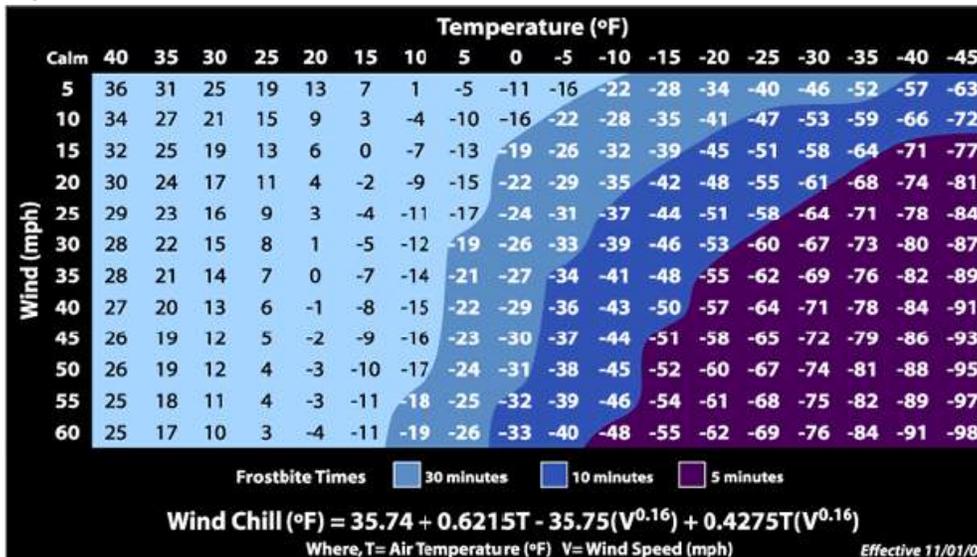
The National Weather Service bases winter weather warnings on stages of severity, as follows:

- **Blizzard Warning:** the most dangerous of all winter weather is occurring or imminent. A blizzard is defined as a combination of winds 35 mph or greater with snow or blowing snow reducing visibility to less than 1/4 mile for three or more hours. In blizzards, whiteout conditions, deep snowdrifts, and frigid wind chills form a life-threatening partnership. You should seek refuge immediately.
- **Winter Storm Warning:** severe winter weather is occurring or imminent. You should already be prepared and should take protective actions immediately. This warning is issued when 6 inches of snow are expected in 24 hours at lower elevations (below 7500 feet). Travel can become difficult or impossible, especially for vehicles without four-wheel drive.
- **High Wind Warning:** hazardous winds are occurring or will soon occur across a significant area. For elevations below 7500 feet, sustained winds of 40 mph or greater or gusts to 60 mph or more are expected. Travel can be dangerous, especially for high profile vehicles.
- **Wind Chill Warning:** wind chill is the combined effect of cold temperatures and wind in chilling the body. A warning is issued when wind chills of minus 40 degrees F or colder with winds of at least 10 mph are occurring or imminent. Frostbite can occur in seconds, and hypothermia within minutes. The effects of temperature and wind chill increase the severity of a winter storm. Wind blowing across exposed skin drives down the skin temperature and eventually the internal body temperature. Exposure to low wind chills can be life threatening to humans and animals.

Additionally, winter weather advisories and other bulletins are issued to help the public understand the relative severity and risks posed by a winter weather event.

As referenced below, wind chills exacerbate cold weather by making it feel even colder. The current Wind Chill Temperature Index took effect in 2001, replacing the original index devised in 1945. To find the Wind Chill Temperature Index from the chart, find the air temperature along the top of the table and the wind speed along the left side. The point where the two intersect is the wind chill temperature.

**Figure 3.102: Wind Chill Chart**



The severity of various events relates the probability and type of event. The following events are assessed for Ringgold County.

**Figure 3.103: Probability of Severe Winter Storm Events by Severity**

Event Type	Probability in Ringgold County	Severity Description
Heavy snow	Highly likely in a given year	Limited, mostly economic and delivery of services
Ice storm (half inch plus)	Occasionally to likely in a given year	Moderate to critical in many severity categories
Extreme cold & wind chill	Highly likely in a given year	Moderate, mostly to health and safety of the public
Blizzard	Likely in a given year	Moderate to critical to safety of the population and economy, limited to infrastructure

The following provides a summary of the severity of impact throughout the county.

**Figure 3.104: Severe Winter Storm Severity of Impact Scoring Matrix**

Severity Criteria	Discussion	Score
Health and safety of the public	Injuries and deaths occur every year in Iowa due to the impacts of severe winter storms, including the direct impacts of the cold and wind, such as frostbite, hypothermia, and various illnesses. Direct impacts of heavy snow, blizzards, and ice storms include structural failure, auto crashes, and inability to access emergency care. People also get sick, injured, or killed as a result of overexertion during and after severe weather. Severity is exacerbated by the inability to access health and emergency care, loss of power, and lack of access to fresh food. People living in older homes with poor heating systems, the elderly, the chronically ill, and the very young are at most risk. Deaths directly as the result of severe weather are not common, but injuries and illnesses are very common. Motorists, outdoor workers and recreationists, and those with energy dependent medical needs are at higher risk of death.	4
Health and safety of responders	Response personnel are exposed to cold temperatures and traffic accidents when responding to the victims' needs. They also succumb to overexertion when performing their work.	3
Continuity of operations	Operations can be limited or halted when critical services are not available. Staff may not be able to make it to the place of work thus, limiting the continuity of operations. Damage to infrastructure may also hinder continuity of operations. Local government workers may have to work long hours to clear roads and maintain government facilities and will not be available for other essential tasks.	4
Property, facilities, infrastructure	Immobilized transportation (including emergency vehicles), downed trees and electrical wires, building and communication tower collapse, and bodily injury/death are just a few of the impacts of a severe winter storm. Vehicle batteries and diesel engines are stressed and the fuel often gels in extreme cold weather. This impacts transportation, trucking, and rail traffic, all of which are vital to Ringgold County (except rail). In recent ice storms, rural electric providers sustained many millions of dollars in damage to lines and equipment, some of it in Ringgold County. Water lines, roadways, and other infrastructure fail on a widespread basis during thawing conditions. Millions of losses are sustained most winters as a result to infrastructure damage and simply being overworked. In the December 2007 ice storm, rural electric providers sustained many millions of dollars in damage to lines and equipment, some of it in Ringgold County.	4
Delivery of services	Fire during winter storms presents a great danger because water supplies may freeze and firefighting equipment may not function effectively, or personnel and equipment may be unable to get to the fire. If power is out, interiors of homes become very cold and lead to pipes freezing and possibly bursting. Rivers and lakes freeze and subsequent ice jams threaten bridges and can close major highways. Ice jams can also create flooding problems when temperatures begin to rise. Ice coating at least one-fourth inch in thickness is heavy enough to damage trees, overhead wires, and similar objects and to produce widespread power outages. Buried water pipes can burst causing massive ice problems and loss of water and subsequent evacuations during sub-zero temperatures.	3
Environmental impacts	Winter storms are a natural occurrence and there would be no direct significant impact on the environment. Localized impacts are possible if infrastructure such as natural gas lines burst as a result of the event.	2
Economic/financial conditions	The cost of snow removal, repairing damage, and loss of business can have large economic impacts on the community. The State estimates \$76,159,000 in property damage, and \$346,900,000 in lost crops due to heavy snow, ice storm, or extreme wind-chill events statewide from 1993 through 2006. More than this is the economic loss due to employees being unable to get to work, freight being stranded, and people	3

	being able to perform business transactions.	
Regulatory/contractual obligations	Enforced snow ordinances allow the jurisdiction to more effectively open transportation routes. Delivery and adequate supplies of salt, sand, and saline are important inputs to the snow removal process. These contracts should be in place. Removal of debris and reinstatement of energy are vital to safety of the public as well. Agreements should be in place with the power company to ensure power is restored in an effective and timely manner following the storm.	2
Reputation	Effective and timely response to the snowstorm is key to maintaining a good reputation. Streets clear of snow and ice are important factors to the mobile public.	2

The overall rating the community gave for this hazard’s magnitude in a survey was: “critical1.”

Score for Rural Ringgold County: 27	Score for Benton: 27	Score for Diagonal: 27	Score for Ellston: 27
Score for Kellerton: 27	Score for Maloy: 27	Score for Mount Ayr: 27	Score for Tingley: 27
Score for Diagonal School: 27	Score for Mount Ayr School: 27		

Severe Winter Storm Speed of Onset:

The NWS has developed effective weather advisories that are promptly and widely distributed. Radio, TV, and Weather Radios provide the most immediate means to do this. Accurate information is made available to public officials and the public up to days in advance. Notifications made by the NWS include winter storm watch, winter storm warning, blizzard warning, winter weather advisory, and a frost/freeze advisory. While the magnitude and severity of winter storms can vary greatly from place to place within a storm, typically warning is adequate so that people can make preparations for the given storm.

Score for Rural Ringgold County: 2	Score for Benton: 2	Score for Diagonal: 2	Score for Ellston: 2
Score for Kellerton: 2	Score for Maloy: 2	Score for Mount Ayr: 2	Score for Tingley: 2
Score for Diagonal School: 2	Score for Mount Ayr School: 2		

Severe Winter Storm Duration of Event:

Severe winter storms can last up to 2 days. It may take another day or two before some sense of normalcy to return.

Score for Rural Ringgold County: 8	Score for Benton: 8	Score for Diagonal: 8	Score for Ellston: 8
Score for Kellerton: 8	Score for Maloy: 8	Score for Mount Ayr: 8	Score for Tingley: 8
Score for Diagonal School: 8	Score for Mount Ayr School: 8		

Severe Winter Storm Total Scores:

The following total scores for severe winter storm indicate high risk to the public and the planning area where incidents can occur.

Score for Rural Ringgold County: 61	Score for Benton: 61	Score for Diagonal: 61	Score for Ellston: 61
Score for Kellerton: 61	Score for Maloy: 61	Score for Mount Ayr: 61	Score for Tingley: 61
Score for Diagonal School: 61	Score for Mount Ayr School: 61		

Severe Winter Storm Vulnerability/Assets at Risk:

All structures, property, and people in the county, as outlined in Section 3.2, could suffer from the effects of winter storms. Power lines, utility poles, towers, and poorly built buildings are at the most risk among structures. Contents losses are likely to be minor, even compared to structural losses. The greatest risk may be to human health and life due to exposure to cold by the body. Thousands of trees and shrubs can be damaged or even destroyed by heavy snow, wind, and ice accumulation. Additionally, because of the reduced productivity due to the effects of cold, ice, and snow on humans and infrastructure failures, economic losses could be severe in some sectors.

All critical assets in the county, as outlined in Section 3.2, are exposed to severe winter weather.

Severe Winter Storm Loss Estimation:

Severe winter storm events cause extensive damage to property, human health and life, and the local economy. While storms happen every winter, only once in a while are they truly severe. Many losses simply occur because of the combined effects of prolonged cold, winds, and heavy snow and ice, even in the absence of a single severe storm. This analysis attempts to address these facts.

Structural losses vary greatly by the kind of storm. Normal snowfall, extreme cold, and wind chill events generally don’t cause direct structural losses. However, the combined effects of these conditions over one or more winters can bring about deterioration and failure of structures. Some building elements can become very brittle during extreme cold and break or fail easily when hit by another force. Heavy wet snow can cause failure of weak or old buildings, power lines and poles, and other infrastructure. The freeze-thaw cycle can cause underground pipes to burst and frost

bubbles to form in roads and parking areas. All these problems occur commonly in Ringgold County. These can cause millions of dollars in losses in the planning area during any given storm or winter to both public and private structures and infrastructure.

Ice storms are more likely than any other form of winter storm to cause structural damage. Damage to overhead utilities, trees, towers, and even buildings can be extensive with only a half-inch of ice. Yet, storms delivering over an inch of ice occur once in a while. Past ice storms have caused millions of dollars in damage in Ringgold County. Costs include clearing debris, removing trees, repairing utility lines, restoring power to individual homes and businesses, and lost business and functional use loss.

USDA crop insurance claims for winter storms, cold, freeze/frost, and snow conditions for the five-year period of 2013-2017 show 37 claims. The total amount of claims was \$1,000,679.70, which is very small compared to drought and flood/rainfall hazards, but is nonetheless significant. This averages to \$200,136 annually. Clearly most of these losses occurred during early planting season or near harvest, during unseasonably cool weather but not during a severe winter storm.

Economic losses can be severe simply because people cannot get to work, people are not conducting business, and transportation of goods comes to a standstill. When a storm is severe enough, the entire planning area's economy can virtually shut down for a day or more, at a cost of millions of dollars. Additional loss is suffered by businesses and government entities having to turn up the thermostat to heat their buildings and repair buildings damaged by storms. Local governments face functional use losses due to the costs of storm debris removal, snow removal, sanding and salting streets/roads, and fixing potholes and other road/bridge damage that comes with Iowa's winters.

The loss due to human life and health are significant due to winter storms. Despite this risk, it is difficult to attribute to winter storms a death that appears to be due to natural causes, with the exception of highway transportation incidents caused by ice and snow. People over the age of 65, which make up well over a thousand residents, people who are outside and cannot get indoors, and those with old homes and no reliable heating and insulation are all at greater risk than the general population. People can die to exposure to the cold, health issues like heart attacks triggered by exertion (such as when scooping snow), and fires caused to use of unsafe heating systems during extreme cold. In a typical winter storm event, it is estimated that death is possible, severe illness requiring hospitalization is very likely, and multiple minor illnesses are very likely. Because extreme cold is a silent killer and is more common in a given location than a tornado or other killers, this hazard is one of the most severe in Ringgold County as to the risk of death.

Future Development and Severe Winter Storm:

As long as the population remains stable or even declines, it is unlikely that future development will increase exposure or risk of loss.

**Terrorism Profile**

Type: Human Caused

Definition: The use of multiple outlets to 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.

Terrorism Description:

This hazard encompasses a wide variety of human caused threats including enemy attack, biological terrorism, agro-terrorism, chemical terrorism, conventional terrorism, cyber terrorism, radiological terrorism, and public disorder. This includes the use of multiple outlets to 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 following paragraphs outline the types of hazards included in this terrorism profile.

Enemy attack is an incident that would cause massive destruction and extensive casualties. An all-out war would affect the entire population. Some areas would experience direct weapons' effects: blast, heat, and nuclear radiation; others would experience indirect weapons' effect, primarily radioactive fallout.

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 groups of people assembling together to substantially interfere with public peace and constitute a threat. Use of unlawful force or violence against another person, causing property damage or attempting to interfere with, disrupting, or destroying the government, political subdivision, or

group of people are potential methods employed. 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 group or institution. Most events are within the capacity of local law enforcement.

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.

Causing intentional harm to an agricultural product or vandalism of an agricultural/animal related facility is classified as agro-terrorism. Activities could include: intentional introduction of disease, animal rights activists who release animals; disgruntled employees who intentionally contaminate bulk milk tanks or poison animals; eco-terrorists who destroy crops/facilities; theft of agricultural products, machinery, or chemicals; or criminals who vandalize agricultural facilities. Depending upon the type of action taken, the implications will vary greatly.

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. Liquid/aerosol or dry contaminants can be dispersed using sprayers or other aerosol generators, liquids vaporizing from puddles/containers, or munitions. Contamination can be carried out of the initial target area by persons, vehicles, water and wind.

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. Conventional terrorism can also include tactical assault or sniping from remote locations. For the planning team's purposes, any bomb threat in a public setting, such as a school, is considered a conventional terrorism incident.

Electronic attack using one computer system against another in order to intimidate people or disrupt other systems is a cyber attack.

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.

Useful information and mitigation ideas for terrorism incidents can be found at [www.ready.gov](http://www.ready.gov).

#### Terrorism Historical Occurrence:

According to the 2013 Iowa Hazard Mitigation Plan, most terrorism events have been threats that did not result in actual acts. Data in that plan was from 2007-2009. Nearly 85% of those reported in the State plan were conventional terrorism events, with 10% being biological terrorism (all threats), 5% being actual public disorder incidents, and the remaining 1% being chemical terrorism threats. Ringgold County has not experienced serious terrorism events resulting in deaths.

Agro-terrorism is difficult to define, but events have occurred that some may consider terrorism. Vandalism to agricultural facilities or incidents of disgruntled employees causing damage to animals and animal products has occurred. Locally, there have been cases of theft of agricultural machinery, products, and chemicals. Angst among farmers or against confinement feeding operations has brought about incidents in recent years in rural southwest and south central Iowa related to poisoning of animal feed and release of animals. No notable incidents have occurred in Ringgold County.

Iowa has experienced many threats of bio-terrorism, but no confirmed biological terrorism events have occurred in Ringgold County. Locally and all over Iowa there has been many releases of anhydrous ammonia by persons engaged in clandestine drug manufacturing, which is the closest thing to chemical terrorism in the county.

The most common type of terrorism in Iowa is conventional terrorism. Annually, there are numerous threats and some actual acts of terrorism violence involving conventional weapons. Most of these have been small in nature, such as random pipe bombs in mailboxes, hostage taking by criminals, individual snipers, and the like. Most of these events have been in urban areas, such as Des Moines, but random events intended to bring about fear and intimidation have

occurred in rural areas, and there have been several bomb and other violence threats at Mount Ayr Schools. Other isolated threats or minor acts of violence have occurred.

Cyber-security and critical infrastructure protection are among the most important national security issues facing our country today. Recent attacks on Iowa’s infrastructure components have taught us that security has been a relatively low priority in the development of computer software and Internet systems. These attacks not only have disrupted electronic commerce, but also have had a negative effect on public confidence in the Internet. While no widespread events have occurred that have affected large numbers of people in Ringgold County (isolated hacking and ID theft have been reported), an attack from anywhere can impact the county easily.

Iowa has not received any radiological terrorism events or threats.

There have been no enemy attacks on or in Iowa in modern times. The only history of enemy attack dates back to the days of settlement and the Civil War in the 1800s.

No public disorder incidents have occurred in Ringgold County’s modern history. Relatively few have occurred in Iowa, and most of these have occurred in urban areas. None of the jurisdictions is large enough that a mass incident is likely, but in the right or very unique circumstances an incident could occur just about anywhere. The planning team indicates that periodic events are most likely to spawn an incident, such as the RAGBRAI bicycling event, motorcycle rally, or some other incident that attracts many people to the county. The Sheriff believes that a true public disorder in rural areas due to these events is very unlikely and that criminal activity would be handled before it got out of hand.

Terrorism Future Probability:

The probability for most forms of terrorism is higher than past history. The animal rights issue continues to become more organized, and farming is becoming more mechanical and industrial in nature, with more concentrated feeding facilities. Domestic terrorism is becoming more probable and sophisticated. Political angst continues to grow and the public is more polarized. While international terrorist cells have been weakened, they still exist and can attack. The nation’s focus on school shootings has raised attention on this area, but it seems like these events are becoming more common in schools of all sizes (Centers for Disease Control, Statistic Brain). Shootings, stabbings, and bombings at military installations, sporting events, malls and shopping centers, and workplaces are being reported several times per year across the nation. There is no evidence that these trends will reverse. Cyber terrorism is difficult to identify, but security specialists indicate major attacks are imminent and very difficult to prevent and/or resolve. Planning team members overall feel that cyber terrorism is the most likely event in the next year. All forms of terrorism are relatively unlikely in a given year in Ringgold County but are certainly possible except radiological terrorism, which will likely be too difficult to implement for a terrorist to use in this area. Major highways in the county also add to the risk due to ease of access to the area.

The probability of a successful attack that will affect Ringgold County in any direct way will be very low. While weapons of mass destruction exist in various parts of the world, Ringgold County would not be a primary target. The Federal government monitors global political situations and provides security from international attacks.

Although destructive civil disturbances are rare, the potential is always there for an incident to occur. The chances are very small in all but the largest towns because the populations are not really large enough to support a major dispute. The risk of a major event is likely to increase because television, radio, and the Internet provide the ability to instantly broadcast information (factual or not), in real time, to the entire community. Oftentimes, that coverage helps to spread the incident to other, uninvolved or unaffected areas, exacerbating an already difficult situation. Alcohol is often involved in public disorder, especially related to college campuses, sporting events, and concerts. Because of so limited resources, a small crowd, once out of control, can take some time to subdue.

The overall rating the community gave for this hazard’s future probability in a survey was: “unlikely.”

Score for Rural Ringgold County: 3	Score for Benton: 2	Score for Diagonal: 2	Score for Ellston: 2
Score for Kellerton: 2	Score for Maloy: 2	Score for Mount Ayr: 3	Score for Tingley: 2
Score for Diagonal School: 2	Score for Mount Ayr School: 3		

Terrorism Vulnerability to the Population:

While the vulnerability varies by the type of event, most of the population will not be at direct risk of death, injury, or illness or through the loss of property. However, the spreading fear and increase in inconvenience can diminish the quality of life throughout the county. Agro-terrorism is likely to directly impact the farms and agribusiness facilities attacked and other production facilities within a mile or two, depending on wind patterns. Agro-terrorism will not have a direct impact on the schools and the hospital. Bioterrorism will directly impact a contaminated facility. State and local agencies developed the Biological Chemical Threat Agent (BCTA) Protocol Model to guide response agencies. The American public is not vaccinated for many of the agents used as weapons by terrorist groups. Despite

this, most of the people in a given area will not likely be adversely affected, with the exception of concentrated populations, such as in schools and the hospital. Chemicals travel through Ringgold County on highways and railroads; these can be used to produce a bomb or can be released in the air and water to cause harm. Chemical agents may pose viable threats for hours to weeks depending on the agent and the conditions in which it exists. Shielding in the form of sheltering in place can protect people and property from harmful effects. There are a limited number of antidotes available to reduce the vulnerability from chemical agents. The planning team indicates that water supplies in the area are very vulnerable to chemical attacks because surface drinking water is easy to contaminate. Conventional terrorism is most likely to cause serious harm to the public. Terrorists can bring in and detonate a bomb within a populated area, can issue threats that shut down critical assets, and can seriously damage the local economy. A large blast can kill and injure hundreds of people. Security professionals argue that current cyber security approaches are inadequate. With companies increasingly using the Internet to connect to suppliers and customers, they say organizations place too much faith in technology to protect their data, and do not pay enough attention to security education and awareness. Inadequate security can facilitate access to critical computer systems, allowing them to be used to conduct attacks. Depending on the intensity of attack on local systems, hundreds of individuals, students, and businesses can be subject to negative impacts. Random homes and properties far from the origin of the attack can be affected. Radiological terrorism can be very destructive, even in a low-density area, but it is very difficult for terrorists to develop, transport, and detonate a bomb of a size necessary to maximize effect. There are no radiological materials production facilities in or within 50 miles of Ringgold County. The radiological impacts of the blast might have a greater impact, even if it occurs in a more populated area such as Des Moines. The electromagnetic pulse (EMP) can destroy communications and damage computer systems upon which Ringgold County residents, businesses, and governments depend. Public disorder is likely to occupy only a small area but could have considerable impact on the population where they occur. Enemy attack impacts would likely be residual as a result of attacks on realistic targets, such as Des Moines and Omaha. Overall rural areas are less vulnerable because they have low population densities.

Score for Rural Ringgold County: 6	Score for Benton: 6	Score for Diagonal: 6	Score for Ellston: 6
Score for Kellerton: 6	Score for Maloy: 6	Score for Mount Ayr: 6	Score for Tingley: 6
Score for Diagonal School: 8	Score for Mount Ayr School: 8		

Terrorism Area of Extent:

Generally, the area of extent of the event is less significant than the affected population and might only be a single building or a few square miles of land or water. Due to shielding and other anti-terrorism actions, some of the population in the exposed area may not be directly affected due to most forms of terrorism events, but public fear, economic and financial loss, and inconvenience often exceeds the area of extent. Agro-terrorism and bioterrorism, specifically, can contaminate food systems and cause contagious diseases in people that can spread to people beyond the area of extent. Agro-terrorism is likely only to have direct spatial impact on a single herd of animals, a single farm, or a few farms downwind. Biological incidents are likely to involve only a very small amount of powder, so the direct effect might be one building or a room in a building or a playground. Chemical contamination can be carried out of the initial target area by persons, vehicles, water and wind. The micro-meteorological effects of buildings and terrain can alter travel and duration of agents. The extent is largely determined by the type of chemical, the method of dispersal, and the conditions at the time it is released. Extent of damage is determined by type and quantity of explosive. Effects are generally static other than cascading consequences, incremental structural failure, etc. The likely size and type of explosive used in a terrorism event in Ringgold County would only impact a small part of the county but could affect a large part of a town or critical asset. Cyber terrorism could be very widespread, covering all parts of the county but not likely impacting all systems and computers. Initial effects of radiological terrorism will be localized to site of attack; depending on meteorological conditions, subsequent behavior of radioactive contaminants may be dynamic. Public disorder is likely to occupy only a small area but could have considerable impact on the population where they occur. Enemy attack would almost certainly not impact any area of the county directly, as Ringgold County and surrounding counties would not be realistic targets.

Score for Rural Ringgold County: 4	Score for Benton: 5	Score for Diagonal: 5	Score for Ellston: 5
Score for Kellerton: 5	Score for Maloy: 5	Score for Mount Ayr: 5	Score for Tingley: 5
Score for Diagonal School: 7	Score for Mount Ayr School: 7		

Terrorism Severity of Impact:

Clearly, the severity will depend on the size and type of terrorism event. However, Americans are very sensitive to the threat of terrorism since the September 11, 2001 attacks. Likely, the greatest harm will originate from a conventional terrorism attack in a community or populated area, such as a critical asset. The size of attack will be relatively small compared to something found in a more urban part of the nation. However, the discovery of slightly elevated radiation levels, heightened media attention, and conveyed threats from a terrorist group would incite public hysteria. The hysteria can cause great economic, financial, and transportation disruption far beyond the size and scope of the physical destruction.

The effects of an enemy attack are likely to be indirect at best.

The severity of public disorder will vary by type and size of the crowd, the value of the assets involved, and the duration of event. Because local response resources are limited, it might take an hour or more to bring in an adequate number of law enforcement personnel to gain control of the situation.

The severity assessment matrix considers the impacts if a crowd in a public place gets out of hand and the incident spills into surrounding neighborhoods and considers the impacts of a terrorist attack of the likely magnitude in Ringgold County, impacting one critical asset directly. In the worst-case (but very unlikely) scenario, the impacts would be more severe.

**Figure 3.105: Terrorism Severity of Impact Scoring Matrix**

Severity Criteria	Discussion	Score
Health and safety of the public	The potential for mass casualties is great if the event were to take place in the right location. However, in order for this event to take place with its full magnitude, a number of factors must be addressed: a) the amount of material that was used to make the device; b) the type of material that was used; c) the construction of the device; d) the site of detonation, including population; and e) the wind direction. It is possible that hundreds of people can be killed and injured. A massive attack killing thousands of people is very unlikely to target Ringgold County. Major civil unrest causes injury and can cause widespread fatalities. People involved in the disorder and bystanders can be injured or killed.	5
Health and safety of responders	In a detonation, there could be a significant risk to the health and safety of personnel that would respond to the site. Again, it is completely dependent upon the magnitude of the explosion, and the infrastructure in the area. Soil and rubble may be unstable and unsafe for response operations. Precautions must be made prior to deploying emergency services. Careful consideration to safety in the removing of hazardous rubble as to not further harm the victims as well as the responders should be a priority. Radiation detection and protection equipment must be available and utilized in the event of such an attack. These measures greatly reduce the risk of health and safety of responders. Despite this, secondary attacks designed to harm responders are very possible. Medical staff and volunteers can be overworked and supplies in local care facilities can run out. Response personnel are at high risk of injury or death when trying to quell a public disorder.	5
Continuity of operations	Dependent upon many factors, especially location of detonation compared to the critical operations. There could be a great impact on operations due to the lack of resources to handle the situation. The continuity of operations will depend upon the capabilities of all responders. The blast may also disrupt communication lines and some equipment. Resulting fear and targeting of government leaders and officials can greatly disrupt local government. Many community operations can be severely stretched and can run the risk of temporary failure. Equipment and supplies of operators can run out or be damaged in the violence, thus reducing future response. Courts can be jammed with prosecutions of crimes. Public buildings and assets are often the targets.	4
Property, facilities, infrastructure	The extent of destruction to property and infrastructure is dependent on the size and the location of the blast itself. Entire buildings can be destroyed, and impacts to surrounding utilities, roads, rail, and other infrastructure can affect a larger area. Private, local, state, and federal property, facilities, and infrastructure can be the target of disputes, thereby suffering the loss of the facilities and infrastructure for months or years and expensive repairs and replacement.	4
Delivery of services	Delivery services from within the blast area will be rendered incapable. All delivery services outside the blast ring will be affected by the range and capabilities of their own services. Radiation may also disrupt some equipment. Services can be severely hampered due to the actual violence, the cleanup, or the fear of future violence that keeps people from providing services in an area or to a business or organization. For example, fires can sometimes burn uncontrolled because firefighters are unable to respond due to resistance from rioters.	3
Environmental impacts	Depending on the type of terrorism, the environmental impact may be severe. Most likely the impact would be minor and temporary. Depending on the type of public disorder incident and damages that result, short-term and long-term environmental damage is likely.	3
Economic/financial conditions	Physically the impacts may be small, but the widespread fear and panic can greatly impact the area economy by reducing economic activity in the area and causing people to make unplanned financial choices that reduce long-term stability of the area. Damaged facilities disrupt productivity, and many times have difficulty reopening and may eliminate jobs in the area. A major blast could permanently displace businesses and laborers. Perhaps even more tragic has been the lingering, negative impact and loss of investment in the communities ravaged by the uprisings. Many riot areas do not fully recover from the damage, destruction, and negative image brought on by such events.	3

	Looting, burning, and sniping can occur during severe civil disturbances. Businesses and industry may shut down and move to a safer area.	
Regulatory/contractual obligations	No significant impact known unless someone or an organization failed to prepare. Events can cause the failure to keep and meet contracts and can be the result of contracts and regulations, thereby putting local business and government in strain. Labor disputes and disputes over government regulations can bring about tighter regulations, fines, and litigation.	2
Reputation	Reputation of the entity can be very damaging because of the high profile of these events. Certain events involving chemicals, radioactive materials, and cyber destruction can cause long-term mistrust in governments and a black mark on the area for fear of contamination or infection. How the response is conducted and political leaders respond will determine the local reputation. It is likely that public disorders will hurt local reputation more than terrorism.	3

The overall rating the community gave for this hazard’s magnitude in a survey was: “negligible.”

Score for Rural Ringgold County: 32	Score for Benton: 32	Score for Diagonal: 32	Score for Ellston: 32
Score for Kellerton: 32	Score for Maloy: 32	Score for Mount Ayr: 32	Score for Tingley: 32
Score for Diagonal School: 32	Score for Mount Ayr School: 32		

Terrorism Speed of Onset:

Acts of terrorism can be immediate and often come after little or no warning. There are occasions where terrorists have warned the targeted organization beforehand, but often the attack comes without previous threat. Even after a threat, the actual event will often be immediate and without time for preparation. Enemy attack similarly could come with no warning or not enough warning to react adequately. Public disorder might have some warning or at least signs that things are “about to get out of hand.” A crowd is needed, so in that way there may be some warning that it could happen.

Score for Rural Ringgold County: 9	Score for Benton: 9	Score for Diagonal: 9	Score for Ellston: 9
Score for Kellerton: 9	Score for Maloy: 9	Score for Mount Ayr: 9	Score for Tingley: 9
Score for Diagonal School: 9	Score for Mount Ayr School: 9		

Terrorism Duration of Event:

This depends on the type of event and if it is connected to a more widespread attack affecting other jurisdictions. While consequences, such as contamination and cascading events can continue for hours to weeks, the typical terrorism event is likely to be brief, no more than a few hours. Stopping or capturing the perpetrator(s) may take hours to one day on average. Public disorder could take a day or more to stop the carnage, round up the perpetrators, and restore some sense of order. Enemy attack and cyber terrorism could last for months or longer, but the direct effects in Ringgold County might last a shorter amount of time.

Score for Rural Ringgold County: 7	Score for Benton: 7	Score for Diagonal: 7	Score for Ellston: 7
Score for Kellerton: 7	Score for Maloy: 7	Score for Mount Ayr: 7	Score for Tingley: 7
Score for Diagonal School: 7	Score for Mount Ayr School: 7		

Terrorism Total Scores:

The following total scores for terrorism indicate high risk to the public and the planning area where incidents can occur.

Score for Rural Ringgold County: 61	Score for Benton: 61	Score for Diagonal: 61	Score for Ellston: 61
Score for Kellerton: 61	Score for Maloy: 61	Score for Mount Ayr: 62	Score for Tingley: 61
Score for Diagonal School: 66	Score for Mount Ayr School: 66		

Terrorism Vulnerability/Assets at Risk:

All structures, property, and people in the county, as outlined in Section 3.2, could suffer from the effects of terrorism. While terrorism is more likely in some areas of the county, and more remote areas are less likely to suffer direct effects, there is no way to be sure that any area is totally immune or unexposed.

All critical assets in the county, as outlined in Section 3.2, are at risk.

Terrorism Loss Estimation:

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.

Ringgold County is likely to suffer only modest loss due to carried out terrorism event that occur within the county. Most incidents will be threats only or will be very localized, such as individual pipe bombs or suspicious packages and powders. These will not have an impact on the greater community in terms of death, injury, or property damage. However, the risk remains that local terrorism will be severe with the loss of dozens of lives and destruction of dozens or hundreds of buildings.

Structural losses can be very severe. With a nuclear explosion or large conventional bomb explosion, entire neighborhoods could be destroyed. Physical costs could exceed \$100 million in Ringgold County alone, not including contents loss. In most situations, the loss will be much less. A typical event might cause \$25,000 in damage, such as a fire in a home or government office or damage to a classroom in a school.

Social, economic, and functional use losses are actually likely to be much higher for the kind of terrorism (domestic without coordination with a major terrorism network) incidents that are probable in Ringgold County. Other losses include loss economic opportunities for businesses, loss of food supplies (including livestock), destruction of computers and electronic equipment, and damage to the food supply chain. Changes in activities, spending patterns, and family lifestyle decisions will result, and the community may become somewhat less cohesive, which can cause population loss, business loss, decline in property values, and damage to the environment. Government entities may have to increase staffing and investing in counter- or anti-terrorism activities and in addressing the loss or attrition of response personnel and equipment.

A cyber attack would greatly impact computer networks and the infrastructure (pipelines, electrical systems, sewer plants, etc.) and businesses that depend on them, and can indirectly cause structural losses, but directly there will be few structural losses.

For the purposes of this plan, the planning team estimates losses using a hypothetical scenario. The attack scenario is staged at a Friday night Mount Ayr 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.htm1>, 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 cleanup. There might also be a fear by the public of long-term contamination of the stadium and the high school subsequent 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; and (3) the rate of “worried well” is equal to 9 times the number of infected cases.

The following table describes health-related losses from such an incident. Other losses may include the suspension of high school sports during the duration of the investigation and the economic losses that result.

**Figure 3.106: Estimated Loss Scenario – Chemical Attack**

<b>Loss Description</b>	<b>Loss Value</b>
Eye pain & swelling, headache, restricted airflow – difficulty breathing, possible chemical burns	26 persons
Eye pain & swelling, headache, rapid breathing, skin irritation	49 persons
Eye pain & swelling, headache, rapid breathing, coughing, chest pain, skin irritation	97 persons
Eye irritation, headache, throat irritation, coughing, skin irritation	122 persons
Eye irritation, headache, coughing, skin irritation	82 persons
Total “Worried Well” Cases (9 times the number of affected cases)	234 persons
Deaths	17 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 =704.	\$8,448

#### 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 /100 square feet; (2) the quantity of ANFO used is 500 lbs.

The following table describes health-related losses from such an incident. Other losses may include the suspension of high school sports during the duration of the investigation and the economic losses that result.

**Figure 3.107: Estimated Loss Scenario – Explosive Device**

Loss Description	Loss Value
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 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. )	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

The above are simply examples. These examples give one an idea of what could realistically happen in a county like Ringgold, even if the probability of these scenarios is very small.

*Future Development and Terrorism:*

As public events are held at the courthouse, county fairgrounds, schools, and many other locations, the potential exists for these locations to become targets of attack. With human-caused hazards such as this that can have multiple variables involved, increases in development is not always a factor in determining risk, although the physical cost of the event may increase with the increased or newly developed areas due to additional exposure.

**Thunderstorm/Lightning/Hail Profile**

*Type:* Natural

*Definition:* Atmospheric imbalance and turbulence that may result in thunder, heavy rains (which may cause flash flooding), and strong winds reaching or exceeding 58 mph resulting in tornadoes, or surface hail of at least 1 inch in diameter, and lightning.

*Thunderstorm/Lightning/Hail Description:*

Most thunderstorms are small and do not cause any notable damage. These common storms in Iowa contain mostly cloud-to-cloud lightning, moderate but short-lived rain, and little or no wind. Such storms of this nature are not a concern for the hazard mitigation plan. However, occasionally, the combination of moisture in the air, the collision of air masses (fronts), and the rise of unstable warm air cause severe storms, especially during the months of April through June, although they can occur during any month. Severe thunderstorms are dangerous because they can result in multiple hazards, including strong straight-line winds, heavy rain, hail, dangerous cloud-to-ground lightning, and even tornadoes. High winds, and tornadoes are profiled in greater detail in the tornado/windstorm profile.

Lightning in its own right is very dangerous and is found in any thunderstorm, although in most thunderstorms there are no or very few bolts that reach the ground. Not just does it reach up to 50,000 degrees Fahrenheit in a spit second, it packs enough energy to kill people and animals instantly, start fires, and destroy infrastructure. The electromagnetic effects of lightning can destroy and render unreliable other equipment and systems not even directly hit. Lightning can also occur far (up to 10 miles) from the base of the storm, even in areas where sunshine remains overhead, where people may not have started to take cover. Things can be confusing for the public because storms can occur singly, in clusters, and in lines, sometimes without warning or meteorological explanation.

Hail is a fairly common ingredient in thunderstorms that are severe or that occur on cool days. Large hail over one inch in diameter becomes a hazard because of its destructive power.

Thunderstorm winds can be very light to very strong. At 58 MPH, thunderstorm winds become severe. Thunderstorm winds can be unpredictable because they originate within various parts of the storm and might blow in different directions in the forms of updrafts, downdrafts, microbursts, derechos, outflow boundaries, and other phenomena.

Most high wind events in Iowa are associated with thunderstorms. Those that are not are covered in the tornado/windstorm profile.

***Thunderstorm/Lightning/Hail Historical Occurrence:***

Severe thunderstorms have occurred many times in Adair County and are an annual event somewhere in the county. Most years, multiple severe thunderstorm warnings are issued. The most common cause for the severe thunderstorm warnings are strong straight-line winds, but small hail and heavy rain over 1” per hour is also common. Large hail and tornadoes are relatively rare, but have occurred on numerous occasions. Dangerous lightning is common, although most lightning strikes do not cause damage to personal property or cause injuries and death, due to the relatively low density of development in most of the county. The total number of historical events increases (compared to the previous plan) because hail is now included in the thunderstorm/lightning profile rather than as a separate hazard.

The NCDC provides data about severe thunderstorms, lightning, and hail events. This data includes reports of damaging events. Not all declared severe storms end up causing local damage that is reported in to the NCDC, and some damaging storms that are reported by the NCDC are not necessary deemed severe storms at the time they occur.

The NCDC has reported 188 events since 1950, through November 2017, with an average reported loss of \$70,000 per storm event. The 188 recorded events clearly illustrate that large numbers of thunderstorm events with damaging wind (93), hail (94), and lightning (1) occur in Ringgold County. While the report goes back to 1950, most of the events in the record are since 1993. There have been 4 deaths and 2 injuries reported; all but one of the deaths was from storms in 1984. Over \$12.4 million in property damage and \$0.7 million in crop damage in the county attest to the destruction due directly to thunderstorms. Some of these losses may not have occurred in the county but were part of a larger storm that also caused damage in the county. Iowa is among the top states in the nation in lightning-related fatalities and the annual property damages sustained by lightning. There have been 9 Presidential Declarations of Major Disaster in Ringgold County since 1953 due to severe thunderstorms.

Most of the above listed hazards losses are due to hail. According to the National Climactic Data Center, there have been 94 hailstorm events in Ringgold County from 1950 through November 2017, resulting in no deaths and injuries but in over \$10.5 million in property damages and over \$0.5 million in crop damage (note that most events before 1995 did not include damage information). Most of these events occurred since 1990, when better reporting was initiated. Of these, 58 were hailstorms that produced hail at or exceeding 1 inch in diameter. Most but not all of the damage reported had resulted from the hailstorms of this magnitude. Hail events were reported in all parts of the county, including the rural area and all municipalities. Most reports did not show the exact location of events, and it is likely that an event that reported from a specific area also affected other jurisdictions not on the list. The following is the summary of the number of events reported by the NCDC that meet the plan definition of a hailstorm listed by reported hail size.

**Figure 3.108: Historical Events by Hail Intensity**

Hail Size (inches)	Intensity (TORRO Hail Intensity Scale)	# of Events – 1950-11/2017
1.00	Severe	30
1.25	Severe	5
1.50	Severe	1
1.75	Destructive	11
2.00	Destructive	8
2.25	Destructive	0
2.50	Destructive	0
2.75 or more	Destructive	3 (largest is 4.5”)

Source: National Climactic Data Center, 3/2018 (data available through 11/2017)

Note that these events/losses do not include windstorms, tornadoes, and other damages, even though most of those damages are spawned by or related to severe thunderstorms. It is likely the actual losses are somewhat under-reported, as many storms cause slight or modest damage to properties on a wide scale, and often these losses are not reported or are only reported to individual owner’s insurance.

Additionally, the planning team reports many events from memory. Kellerton and Mount Ayr reports severe thunderstorms in June 2017 that damaged trees and knocked out power. Hazards included large hail, high wind, and lightning. Maloy reports a similar thunderstorm in 2014. Ellston reports several trees having been hit to lightning in recent years. Local officials also reported large hail in recent years in Benton and Kellerton. Diagonal reported a thunderstorm/wind event that took off part of the City’s maintenance shed (no date given).

The following is the number of severe thunderstorm watches and warnings issued by NOAA’s NWS. The data is housed on the Iowa Environmental Mesonet, Iowa State University Department of Agronomy website, (<http://mesonet.agron.iastate.edu/vtec/search.php>).

**Figure 3.109: Historical Severe Thunderstorm Events**

Year	Warning	Watch	Total
2013	9	12	18
2014	23	6	29
2015	13	8	21
2016	9	6	15
2017	10	5	15
Totals	64	37	101

Source: Iowa State University Department of Agronomy, <http://mesonet.agron.iastate.edu/vtec/search.php#byugc/1A/IAC001/IAC159/20130101/20180309>

The average over the past five years is 12.8 warnings and 7.4 watches per year.

Thunderstorm/Lightning/Hail Future Probability:

Thunderstorms are an annual event in all jurisdictions of the county, and hail of any size is expected two or three times annually. Southern Iowa experiences between 40 and 50 thunderstorm days annually, according to the NCDC. Severe thunderstorms occur nearly every year in all jurisdictions. During most summers, more than one severe thunderstorm occurs in the county, and any given storm affects multiple jurisdictions. Because large hail tends to occur only in some severe storms and occupies only part of the thunderstorm cell, the probability of 1” or larger hail is not as high as generic severe thunderstorms in any given jurisdiction on a given year. With Iowa’s location in the interior of the U.S., and with the noted trend of increasing severity of weather in recent years, there is a very high likelihood that this trend will continue. According to the NWS, Ringgold County is subject to 2 to 4 lightning cloud-to-ground strikes per square kilometer per year (roughly 6 to 11 per square mile).

The overall rating the community gave for this hazard’s future probability in a survey was: “highly likely.”

Score for Rural Ringgold County: 9	Score for Benton: 8	Score for Diagonal: 8	Score for Ellston: 8
Score for Kellerton: 8	Score for Maloy: 8	Score for Mount Ayr: 8	Score for Tingley: 8
Score for Diagonal School: 8	Score for Mount Ayr School: 8		

Thunderstorm/Lightning/Hail Vulnerability to the Population:

During a storm, those in unprotected areas, mobile homes, or automobiles are at risk. Sudden strong winds often accompany a severe thunderstorm and may blow down trees across roads and power lines. Lightning presents the greatest immediate danger to people and livestock during a thunderstorm. It is the second most frequent weather-related killer in the U.S. (after flash flooding) with nearly 100 deaths and 500 injuries each year. Livestock and people who are outdoors, especially under a tree or other natural lightning rods, in or on water, or on or near hilltops are at risk from lightning. Cascading events, such as tornadoes, power loss, and flooding, can also cause significant loss. The planning team noted that lightning has knocked out power and key facilities for many hours. TV, computer, refrigeration, and power line losses cause hardship particularly for the low-income and elderly population. Generally schools and the hospitals have lower population vulnerability because of sturdy modern design and in many cases lightning protections in place. In a given storm, fewer of the rural residents might be directly impacted due to the low density of population, but rural residents tend to have extensive exposed assets that are susceptible to storms.

Hail 1” in diameter or greater, which is not uncommon in severe thunderstorms, can be very dangerous to people, pets, and livestock if shelter is not available. Additionally, hail has destroyed windows, siding, vehicles, and roofs. Agricultural crops such as corn and beans are particularly vulnerable to hailstorms stripping the plant of its leaves. Hail only rarely results in loss of life directly, although minor injuries are not uncommon. People outside away from buildings are most vulnerable to injury, such as those at parks and campgrounds or those out on a lake. People watching the storm inside, but near windows or inside cars can also be hurt if glass is broken. Because most hailstorms impact largely rural areas and people can find safety, the planning team indicates that the vulnerable population is somewhat lower than the percentage of area impacted. Schools are more likely than the hospital to be vulnerable because large numbers of children can be outside, such as on a playground, bus stop, or ball field when the storm hits.

Score for Rural Ringgold County: 7	Score for Benton: 6	Score for Diagonal: 6	Score for Ellston: 6
Score for Kellerton: 6	Score for Maloy: 6	Score for Mount Ayr: 6	Score for Tingley: 6
Score for Diagonal School: 4	Score for Mount Ayr School: 4		

Thunderstorm/Lightning/Hail Area of Extent:

Severe thunderstorms can be quite expansive with areas of localized severe conditions. Most severe thunderstorm cells are 5 to 25 miles wide with a larger area of heavy rain and strong winds around the main cell. Most non-severe thunderstorms have a lifespan of 20 to 30 minutes, while severe thunderstorms often last longer than 30 minutes.

Because Adair is a small county, thunderstorms can impact the entire county very easily, with the severe area covering half of the county and all of any other jurisdictions.

The land area affected by individual hail events is not much smaller than that of parent thunderstorm, an average of 15 miles in diameter around the center of the storm. The largest and most damaging hail usually covers a relatively small part of the hail path. The area of extent is likely to be larger than the true vulnerability of the population and consists of wherever the hail at or exceeding 1” falls. The hazard mitigation planning team indicates that up to 20% of the rural part of the county would be affected by a single storm event, but a much larger part of cities would be affected, and an event would likely cover the entire campus of schools and hospital.

Score for Rural Ringgold County: 7	Score for Benton: 8	Score for Diagonal: 8	Score for Ellston: 8
Score for Kellerton: 8	Score for Maloy: 8	Score for Mount Ayr: 8	Score for Tingley: 8
Score for Diagonal School: 9	Score for Mount Ayr School: 9		

**Thunderstorm/Lightning/Hail Severity of Impact:**

The severity of thunderstorms is related to the severity of the other hazards that come from the storm clouds: high winds, tornadoes, flood-producing rains, hail, and lightning. Severity, therefore, is a measure of combined impacts of these hazards in a typical storm, which includes winds at the low limit of severe level, hail at 1”, cloud-to-ground lightning, heavy rain, and slight potential for a small tornado. Note that tornadoes and flash floods are covered in their own profile.

Severity of hailstorms is mostly a factor of the size of hail but also is influenced by the location of the storm and time of day. Most of the past hail events, as reported by the NCDC, were 1” in size or less and were defined as “significant” and “severe” events. However, a quarter of them were “destructive” events. For the assessment in this plan, the planning team is considering the severity of a “destructive event.” Below is a scale showing the classifications of hailstone intensity created by the Tornado and Storm Research Organization (TORRO).

**Figure 3.110: Potential Damages by Hail Intensity**

Intensity Category	Typical Diameter (in)	Size Description	Typical Damage Impacts
Hard hail	0.2-0.4	Pea	No damage
Potentially damaging	0.4-0.6	Mothball	Slight general damage to plants and crops
Significant	0.6-0.8	Marble, grape	Significant damage to fruit, crops, and vegetation
Severe	0.8-1.2	Walnut	Severe damage to crops; damage to glass and plastic structure; paint and wood scored
Severe	1.2-1.6	Pigeon’s egg	Widespread glass damage, vehicle bodywork damage
Destructive	1.6-2.0	Golf ball	Wholesale destruction of glass; damage to tiled roofs; significant risk of injuries
Destructive	2.0-2.4	Hen’s egg	Bodywork of grounded aircraft dented, brick walls pitted
Destructive	2.4-3.0	Tennis ball	Severe roof damage; risk of serious injuries
Destructive	3.0-3.5	Large orange, softball	Severe damage to aircraft bodywork; increased risk of serious injuries; slight risk of death.
Super hailstorm	3.5-3.9	Grapefruit	Extensive structural damage; risk of severe or even fatal injuries to persons caught in the open.
Super hailstorm	4.0+	Melon	Extensive structural damage; risk of severe or even fatal injuries to persons caught in the open. Damage could be catastrophic if the hail is large enough.

Source: TORRO, [www.torro.org/uk/site](http://www.torro.org/uk/site)

The following provides a summary of the severity of impact throughout the county.

**Figure 3.111: Thunderstorm/Lighting/Hail Severity of Impact Scoring Matrix**

Severity Criteria	Discussion	Score
Health and safety of the public	Thunderstorms and lightning can cause death, serious injury, and substantial property damage. The power of lightning’s electrical charge and intense heat can electrocute people and livestock on contact, split trees, ignite fires, and cause electrical failures. Lightning is the greatest thunderstorm cause of death in Iowa, but the probability of being struck is very low. 128 injuries and 4 deaths are attributed to hail in Iowa since 1980 (through April 2013). “Destructive” hailstorms rarely cause death, but it is always possible when people are exposed and cannot get to shelter quickly. Injuries of minor nature are likely if enough people are exposed. Triggered hazards can greatly increase the risk of and number of people injured or killed. Despite this, most severe thunderstorms do not cause severe injury and death.	3
Health and safety of responders	Response personnel are exposed to the same risk as the general public when caught in the storm without shelter. Work on ladders and other apparatus during lightning can expose responders to higher risk situations. The same as the risk to others without	3

	shelter from the hail. Typically they will not respond to the incident until hail has passed but sometimes they have no choice.	
Continuity of operations	Continuity of operations would be affected through indirect impacts such as loss of critical services. Destruction and disruption of communications equipment, computers, and electronics will make it impossible to complete some tasks at least temporarily. Operations should not be affected to any significant degree by hail, unless utilities are damaged. Impacts might delay services up to one day to electrical systems and other exposed infrastructure and facilities.	3
Property, facilities, infrastructure	High winds can damage trees, homes (especially mobile homes), and businesses and can knock vehicles off of the road. Power lines and related electrical facilities are lost to lightning and high winds. Straight-line winds are responsible for most thunderstorm damage. Hail damage to property, facilities, and infrastructure is usually limited to broken windows, damaged siding, damaged roofs, and vehicle damage. Hail has damaged many properties in the past ten years in Adair and surrounding counties. Most of the losses were insured. Utilities, crops, and trees have been damaged.	3
Delivery of services	One or more severe thunderstorms occurring over a short period (especially on saturated ground) can lead to flooding and cause extensive power and communication outages as well as agricultural damage. Delivery of services should not be affected to any significant degree due to hail. Disruptions are likely to come from high winds and lightning, which damage power systems and block roads.	2
Environmental impacts	High winds and hail can damage trees and other plants, but this is a naturally occurring hazard and the environment proves to be resilient following these and other natural hazards. The destruction of plants and crops can adversely affect the environment temporarily at best. Blowing debris and fire hazards caused by wind and lightning can cause temporary modest impacts.	2
Economic/financial conditions	Thunderstorm wind and lightning occur rapidly and can damage any exposed assets. The aftermath may cause moderate economic impacts, but most will be related to cascading hazards such as flooding. Hailstorms cause nearly \$1 billion dollars annually in property and crop damage in the United States. The peak hail activity coincides with the Midwest's peak agricultural season. Financial impacts resulting from damage to property is in the millions of dollars every year, most of which is covered by crop and hazard insurance. Damage to homes, vehicles, and electrical facilities could greatly disrupt local business and possibly cause business failure.	3
Regulatory/contractual obligations	These are not likely to be affected in any significant way.	1
Reputation	Reputation is not likely to be affected unless any response and cleanup is inadequate or delayed.	1

The overall rating the community gave for this hazard's magnitude in a survey was: "limited" to "critical."

Score for Rural Ringgold County: 21	Score for Benton: 21	Score for Diagonal: 21	Score for Ellston: 21
Score for Kellerton: 21	Score for Maloy: 21	Score for Mount Ayr: 21	Score for Tingley: 21
Score for Diagonal School: 21	Score for Mount Ayr School: 21		

Thunderstorm/Lightning/Hail Speed of Onset:

Some thunderstorms can be seen approaching, while others hit without warning, as they develop rather quickly in warm unstable air not necessarily associated with a frontal boundary. The NWS issues severe thunderstorm watches and warnings as well as statements about severe weather and localized storms. These messages are broadcast over NOAA Weather Radios and area TV and radio stations. Advances in weather prediction and surveillance have increased warning times. The resolutions of radar and Doppler radar have increased the accuracy of storm location and direction as well as intensity and likelihood/size of hailstones. Weather forecasting and severe weather warnings issued by the NWS usually provide residents and visitors alike adequate time to prepare. Isolated problems arise when warnings are ignored. Warnings in the 20 to 30 minute range are usually available prior to the occurrence of the storm. Often the warning that the conditions are right for large hail is given hours or even days ahead of time, although sometimes isolated areas of hail at least 1" in diameter can occur in storms that were not expected to produce such hail.

Score for Rural Ringgold County: 7	Score for Benton: 7	Score for Diagonal: 7	Score for Ellston: 7
Score for Kellerton: 7	Score for Maloy: 7	Score for Mount Ayr: 7	Score for Tingley: 7
Score for Diagonal School: 7	Score for Mount Ayr School: 7		

Thunderstorm/Lightning/Hail Duration of Event:

Individual thunderstorm and lightning events generally last up to one hour, although a cluster or line of severe storms can last a few hours over a given area. Hailstorms typically last only a few minutes and always less than 1 hour over a given area. Because of the size of the rural area, it is more likely to see the effects of a storm for a longer duration before the storm moves to another county.

Score for Rural Ringgold County: 4	Score for Benton: 3	Score for Diagonal: 3	Score for Ellston: 3
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Score for Kellerton: 3	Score for Maloy: 3	Score for Mount Ayr: 3	Score for Tingley: 3
Score for Diagonal School: 3	Score for Mount Ayr School: 3		

**Thunderstorm/Lightning/Hail Total Scores:**

The following total scores for thunderstorm/lightning/hail indicate moderate to high risk to the public and the planning area where incidents can occur.

Score for Rural Ringgold County: 53	Score for Benton: 53	Score for Diagonal: 53	Score for Ellston: 53
Score for Kellerton: 53	Score for Maloy: 53	Score for Mount Ayr: 53	Score for Tingley: 53
Score for Diagonal School: 52	Score for Mount Ayr School: 52		

**Thunderstorm/Lightning/Hail Vulnerability/Assets at Risk:**

All structures, property, and people in the county, as outlined in Section 3.2, could suffer from the effects of thunderstorms and their associated cloud-to-ground lightning, hail, and thunderstorm winds. Power lines, utility poles, towers, and poorly built buildings are at the most risk among structures. Contents losses are likely to be minor, even compared to structural losses.

All critical assets in the county, as outlined in Section 3.2.

**Thunderstorm/Lightning/Hail Loss Estimation:**

Most lightning damages occur to electronic equipment located inside buildings. However, structural damage can also occur when a lightning strike causes a building fire. In addition, lightning strikes can cause damages to crops if fields light on fire. Communications equipment and warning transmitters and receivers can also be knocked out by lightning strikes. Thunderstorm winds and hail can cause damage to property, vehicles, trees, and crops.

Loss estimation for structures can be obtained from NCDC historical data on for structures. From 1996 through late 2017, there have been \$2.1 million in property damages due to lightning and wind and \$10.5 million in property damages due to hail, for a total of \$12.6 million. The annualized loss is \$575,000 to structure and properties (not including contents).

In the past five years (2013-2017), there has been \$526,796.10 in claims for crop insurance in Ringgold County, an average of \$105,359 per year, due to hail damage. According to the 2013 Iowa Crop Profile from the USDA’s Risk Management Agency, 90.5% of insurable crops in Iowa are insured with USDA crop insurance. Based on insured loss data for hail that exceed \$0.5 million for the past five years, it can be stated that approximately \$50,000 in uninsured losses occurred over that time for an average of \$10,000 per year. An estimated \$115,000 in total hail crop losses occur per year. Based on the 2012 Census of Agriculture total crops sold of \$48,708,000, an estimated 0.2% of crop value is lost due to thunderstorms.

Usually severe thunderstorms do not have a long-term impact on the local economy. Typical storms have only a temporary impact on the economy other than as a direct result of structural damage or damage caused by electrical damage from lightning. Sometimes fallen trees will disrupt commerce by damaging power lines and other utilities and blocking roads. Again, this is usually temporary in nature. Functional use losses are also usually minor in nature.

The loss due to human life and health are small for most storms. The greatest risk of death is from lightning, but the probability of any one person being struck by lightning during their lifetime is very small, let alone in one given storm. Falling and flying debris from storms and exceptionally large hail can also cause death. The risk of injuries is much higher. There is a 1% chance of death, 5% of serious injury, and 25% of a minor injury in a given year directly as a result of a thunderstorm.

**Future Development and Thunderstorm/Lightning/Hail:**

As long as the population remains stable or even declines, it is unlikely that future development will increase exposure or risk of loss.

**Tornado/Windstorm Profile**

Type: Natural

Definition: A high wind event involving either widespread straight-line winds of at least 64 knots/73 MPH (windstorm) or a violent whirling wind characteristically accompanied by a funnel shaped cloud extending down from a cumulonimbus cloud in a narrow, erratic path (tornado).

**Tornado/Windstorm Description:**

A tornado is a violent whirling wind characteristically accompanied by a funnel shaped cloud extending down from a

cumulonimbus cloud that progress in a narrow, erratic path. Rotating wind speeds can exceed 300 mph and travel across the ground at average speeds of 25-30 mph. A tornado can be a few yards to around a mile wide where it touches the ground. An average tornado is a few hundred yards wide. A tornado can move over land for distances ranging from short hops to many miles, causing damage and destruction wherever it descends. The funnel is made visible by the dust and debris sucked up and condensation of water droplets in the center of the funnel.

Windstorms are extreme winds associated with severe winter storms, severe thunderstorms, downbursts, and very steep pressure gradients. Windstorms, other than tornados, are experienced in all regions of the United States. It is difficult to separate the various wind components that cause damage from other wind-related natural events that often occur with or generate windstorms. Although Iowa does not experience direct impacts from hurricanes, the state is no stranger to strong, damaging winds. Unlike tornadoes, windstorms may have a destructive path that is miles wide and duration of the event could range from hours to days. These events can produce straight-line winds in excess of 64 knots (73 mph) causing power outages, property damage, impaired visibility, and crop damage.

It is often difficult to separate windstorm and tornado damage when winds get above 64 knots. For this reason the SHMT and the Ringgold County planning team chose to combine the formerly separate hazards of tornado and windstorm.

Existing weather reporting systems always have wind speeds recorded in knots. The conversion table below will provide a quick conversion for winds from calm to 99 knots. The converted values are all rounded to the nearest integer. The formula for exact conversion is 1 Knot=1.15155 MPH. The following is a conversion chart through 99 knots.

**Figure 3.112: MPH/Knots Wind Speed Conversion Chart**

Knots	+0 MPH	+1 MPH	+2 MPH	+3 MPH	+4 MPH	+5 MPH	+6 MPH	+7 MPH	+8 MPH	+9 MPH
0	0	1	2	3	5	6	7	8	9	10
10	12	13	14	15	16	17	18	20	21	22
20	23	24	25	26	28	29	30	31	32	33
30	35	36	37	38	39	40	41	43	44	45
40	46	47	48	49	51	52	53	54	55	56
50	58	59	60	61	62	63	64	66	67	68
60	69	70	71	72	74	75	76	77	78	79
70	81	82	83	84	85	86	87	89	90	91
80	92	93	94	96	97	98	99	100	101	102
90	104	105	106	107	108	109	110	112	113	114

Tornado/Windstorm Historical Occurrence:

Each year approximately 1,000 tornadoes are spawned by severe thunderstorms in our nation. Although most tornadoes remain aloft, those that touch ground are forces of destruction. Though the description of “tornado alley” varies slightly, Iowa is generally considered to be included in, or on the edge of, the geographic area. Between 2000 and 2013, Iowa has averaged more than 17 tornadoes per year and is ranked third in the number of tornadoes per 10,000 square miles. Most occur in April, May, and June, although Iowa has experienced tornadoes during all seasons/months. Tornadoes tend to be the most common in the late afternoon or evening, but they can occur at any time of day. The vast majority of tornadoes in Iowa’s history have been EF0 and EF1, although tornadoes of all sizes have occurred. The NCDC identifies 224 tornado events in Iowa from 2000-2013. Since the first time in 1968, Iowa has received eleven Presidential Disaster Declarations that include tornadoes in the description.

Twenty-two tornadoes, many of them F2 and F3 (pre-Enhanced Fujita scale) in magnitude and some even larger, have impacted Ringgold County and have caused over \$34 million in property damages, \$15,000 in crop damage, one fatality, and three injuries. The only fatality and injuries were due to an F2 reported in 1984, when warnings and mitigation measures were very limited. The NCDC has also reported 1 funnel cloud with no reported damages. Five Presidential Declarations have been declared for Ringgold County due to tornado events. Many of the local jurisdictions have been directly impacted by tornadoes, especially the rural area. The following table summaries the NCDC data about tornadoes to date.

**Figure 3.113: Historical Tornado Events by Fujita Scale Intensity**

Scale *	Number	Years	Locations	Fatalities	Injuries	Avg. Property Damage	Avg. Crop Damage
F0	6	1992, 1996, 2004, 2009,	Rural, Diagonal, Ellston,	0	0	\$17,125	\$0

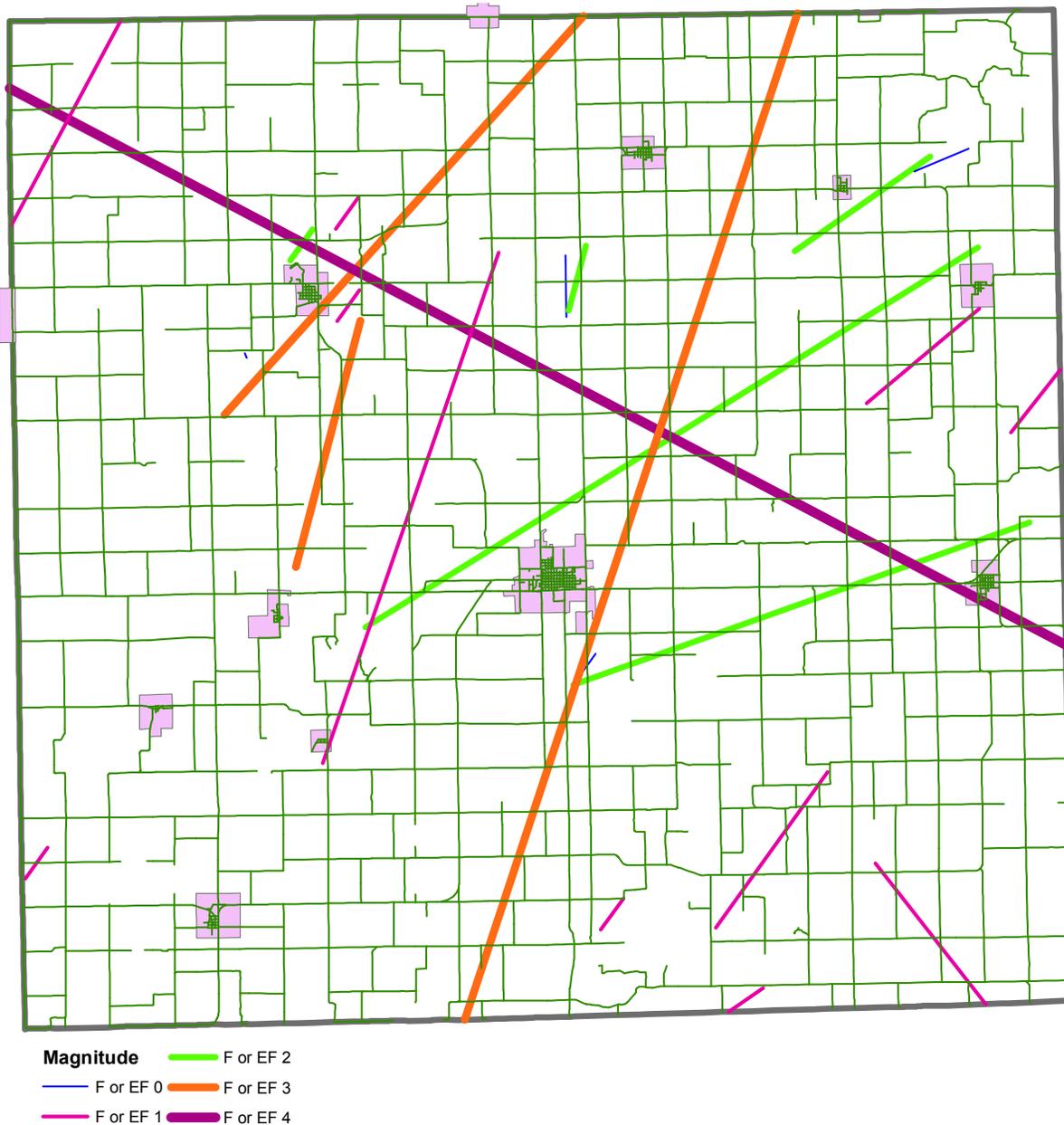
Scale *	Number	Years	Locations	Fatalities	Injuries	Avg. Property Damage	Avg. Crop Damage
F1	7	2013, 2015 1966, 1972, 1973, 1995, 2005, 2015 (2)	Mount Ayr Rural, Clearfield, Delphos	0	0	\$57,862	\$800
F2	5	1971, 1981, 1984, 1990, 2010	Rural	1	3	\$1,405,000	\$2,000
F3	2	1955, 2001	Rural, Mount Ayr	0	0	\$305,000	\$0
F4	1	1989	Rural	0	0	\$2,500,000	\$0
F5	0	n/a	n/a	n/a	n/a	n/a	n/a

Source: National Climactic Data Center, 3/2018 (data available through 11/2017) \*Most were pre-Enhanced Fujita Scale

The planning team reports tornadoes having damaged sections of the rural part of the county, but there is no report of tornado damages to the municipalities or school buildings of the county. In the past ten years, several tornadoes have damaged or even destroyed homes, outbuildings, and farm machinery north and east of Mount Ayr. The local newspaper reports of a damaging tornado impacting farms and property west and north of Mount Ayr in early autumn 2015. The report said: “One funnel cloud was confirmed crossing Highway 2 approximately 5 miles west of Mount Ayr. The storm also downed power lines in Delphos and west of Mount Ayr, and power poles were reportedly broken off northeast of Diagonal. Feedlots sustained considerable damage in the northern part of the county.” A 2001 tornado did \$1.1 million in crop damage and \$400,000 in property damage, traveling through the entire county from Missouri north well beyond the boundary of the county, passing just east of Mount Ayr and Tingley. Several homes were destroyed or severely damaged. The latest tornado confirmation was in late June 2018, when at least one tornado touched down in rural Ringgold County near Redding. No damage report has been published.

The following map shows the historical tornado tracks from 1950 and 2017, as identified by the NWS.

**Figure 3.114: Map of Historical Tornado Paths**



NOAA NWS Storm Prediction Center GIS mapping (<http://www.spc.noaa.gov/gis/svrgis/>), 3/2018

One look at the statewide thunderstorm and wind event map in the State of Iowa HMP shows that Ringgold County has fewer reported events than most counties. The counties with the most events are much more urban; it is therefore believed that the number of events is under-reported in the rural area due to the relatively lesser damages to human property and fewer people available to witness the event in remote areas.

According to the NCDC, there have been 21 high wind events in Ringgold County from 1996 through November 2017, the most recent in 2014. Winds exceeded 70 MPH in some areas, destroying trees, flattening crops, and damaging or destroying outbuildings. Again, like winter storms and river floods, it is difficult to determine from the NCDC data how much of the high wind damage is located in Ringgold County, due to the large area such wind events often cover. The reported damages are 0 death, 0 injuries, over \$787,000 in property damage, and \$7,600 in crop damage. It is possible that significant wind damage has occurred due to storms that have not reached windstorm warning levels, so possible millions of dollars of accrued losses may not be reported.

Over the recent history of Ringgold County, windstorms have affected all jurisdictions and have caused widespread damage to trees, crops, buildings, and property in yards and on farms. The planning team has no information on specific storms. No fatalities are known, but injuries have occurred.

Ringgold County has had two Presidentially Declared Disasters that included straight-line winds in the disaster

description (2013 and 2014). The NCDC shows Iowa has experienced 4 instances where recorded wind speeds equaled or exceeded 100 knots since 2009. Since 2000 Iowa has experienced 78 instances of wind speeds at or exceeding 70 knots.

The total number of high wind events not directly part of a thunderstorm in recent history is difficult to estimate. However, some thunderstorms have caused exceptional damage due to wind gusts associated with microbursts, derechoes, and squalls.

The following is the number of tornado watches and warnings issued by NOAA’s NWS. The data is housed on the Iowa Environmental Mesonet, Iowa State University Department of Agronomy website (<http://mesonet.agron.iastate.edu/vtec/search.php>).

**Figure 3.115: Tornado and High Wind Historical Event Data**

Year	Tornado Warning	Tornado Watch	Wind Advisory	Red Flag Warning	Red Flag Watch	High Wind Warning	High Wind Watch	Total
2013	3	3	3	0	0	0	0	9
2014	3	11	12	2	1	1	0	30
2015	1	5	3	5	2	0	1	17
2016	1	4	4	0	0	0	0	9
2017	0	3	7	1	0	0	0	11
Totals	8	26	29	8	3	1	1	76

Source: Iowa State University Department of Agronomy, <http://mesonet.agron.iastate.edu/vtec/search.php#byugc/1A/IAC159/20130101/20180309>

The average over the past five years is 6.8 tornado watches/warnings and 8.4 wind watches/warnings per year.

Tornado/Windstorm Future Probability:

May and June are peak Iowa tornado months. In the future, the chances of tornadoes do not increase notably, but more developed areas are likely to be affected. Developed areas occupy a small but slowly growing portion of Ringgold County and stand a likely chance of having a damaging tornado occur in the next ten years. Because of the large expanse of rural Ringgold County, it has the greatest chance of experiencing a tornado. Larger towns have a greater chance of experiencing the effects compared to the smaller towns. An EF2 tornado is considered typical for this assessment and is used for the estimate of probability.

Based on historical averages, Iowa would expect to have about 15 to 20 wind events each year in which wind speeds exceed 64 knots. According to NOAA, Ringgold County has a probability of 1.50 to 1.75 days of winds at or over 65 knots per year, based on historical data.

The overall rating the community gave for this hazard’s future probability in a survey was: “highly likely.”

Score for Rural Ringgold County: 7	Score for Benton: 7	Score for Diagonal: 7	Score for Ellston: 7
Score for Kellerton: 7	Score for Maloy: 7	Score for Mount Ayr: 7	Score for Tingley: 7
Score for Diagonal School: 7	Score for Mount Ayr School: 7		

Tornado/Windstorm Vulnerability to the Population:

Those most at risk from tornadoes include people living in mobile homes, campgrounds, and other dwellings without secure foundations or basements, and people in vehicles. The elderly, very young, and the physically and mentally handicapped are most vulnerable because of the lack of mobility to escape the path of destruction. Because most Iowa tornadoes occur from 4 to 9 PM, especially EF3 and larger tornadoes, when people are commuting or recreating outside, Ringgold County, with its large commuter population and high Interstate traffic, faces greater risk. People who may not understand watches and warnings due to language barriers, such as those of Hispanic origin, are also at risk. Because of the concentration of homes in a city, the percentage of the population at risk is higher. Using the size and typical path of an EF3 tornado as an example, the percentage of the people directly impacted is modest, especially in rural areas of the county. Small towns are likely to have a higher percentage of the town’s population impacted by an EF3. Single assets, like schools, could receive significant impacts unless they are constructed to FEMA 361 standards. At this time, there are two certified safe rooms in the county (both located in Mount Ayr). People are always at risk if they are not in a FEMA 361 structure when a tornado makes a direct hit.

For this assessment, the planning team based its vulnerability or risk scenario on an EF3 tornado, which is typical of the more damaging tornadoes, although the true vulnerability will vary greatly based on the location and size/strength of the twister.

Those most at risk from windstorms include people living in mobile homes, campgrounds, and other dwellings without secure foundations or basements, as are those in vehicles, especially large and high profile vehicles. Large sections of Interstate 80 are exposed to high winds. Several sections in the area known for high crosswinds contain signs to warn travelers of this risk. The elderly, very young, and the physically and mentally handicapped are most vulnerable because of the lack of mobility to seek shelter or escape the path of destruction. Wind can precede a storm when people are not prepared for it. People who may not understand watches and warnings due to language barriers are also at risk. Winds can pick up rapidly even on sunny days and clear nights, when the public is not expecting it. An estimated 30% of the population is at direct risk by being outdoors or traveling when high winds hit. A small percentage of properties in the path of the storm are likely to be damaged significantly. Generally those in schools and the hospital are less vulnerable than the general public because these properties contain modern, well-built brick structures.

The following scores reflect the fact that windstorms are likely to impact more area, and therefore, more people, but that tornadoes are likely to be a true hazard to a larger percentage of the people in a smaller area. In this way, adding these hazards together produces a higher score, especially for schools and the hospital, which are likely not at great risk to a typical windstorm. Mount Ayr Schools has a lower score due to the decreased exposure as a result of the tornado safe room currently in the middle/high school.

Score for Rural Ringgold County: 7	Score for Benton: 7	Score for Diagonal: 7	Score for Ellston: 7
Score for Kellerton: 7	Score for Maloy: 7	Score for Mount Ayr: 7	Score for Tingley: 7
Score for Diagonal School: 9	Score for Mount Ayr School: 6		

Tornado/Windstorm Area of Extent:

The area of extent varies greatly between tornados and windstorms. For this assessment, the planning team elected to consider the larger damage path of a potential windstorm. The risk assessment looks at the part of the windstorm path that is most destructive, which is perhaps more in line with a large tornado.

Generally the destructive path of a tornado is only a couple hundred feet in width, but stronger tornadoes can leave a path of devastation up to a mile wide. Normally a tornado will stay on the ground for no more than 20 minutes; however, one tornado can touch ground several times in different areas. Large tornadoes can follow a wide path across an entire county. Damages will be greater as a percentage of area in the towns because a single tornado can be as wide as a small community.

In 1973 Dr. Fujita and Dr. Allen Pearson added in factors related to the width and length of the tornado path and called the scale the Fujita-Pearson Scale. This additional information helps estimate the area that may be impacted and the number of people and property that could be affected.

**Figure 3.116: Tornado Damage Path Information by Intensity**

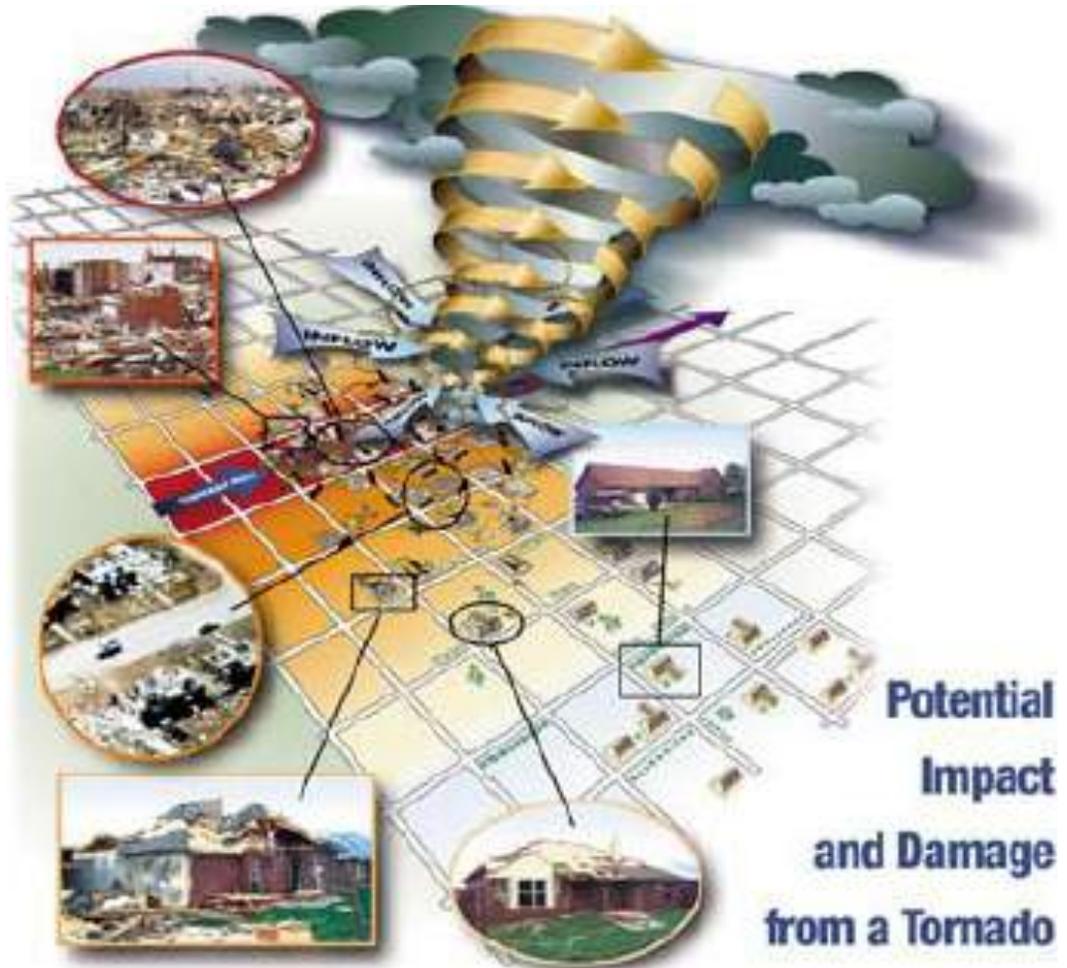
Scale	Wind Speed (mph)	Pearson Path Length (miles)	Pearson Path Width
F0	40-72	0.3-0.9	6-17 yards
F1	73-112	1.0-3.1	18-55 yards
F2	113-157	3.2-9.9	56-175 yards
F3	158-206	10-31	176-566 yards
F4	207-260	32-99	0.3-0.9 miles
F5	261-318	100-315	1.0-3.1 miles

**Figure 3.117: Tornado Damage Path Graphic**

The graphic to the right shows possible damage as it relates to the tornado path. Based on the size of communities and the distances from the center of a tornado, small towns could easily be devastated by one tornado. As shown, a few blocks from even an EF-3's center can experience significant damage.

Clearly, the area that could be impacted varies greatly depending on the intensity of the tornado. A typical EF-3 tornado (10-31 mile long and 1776-566 yard wide path) will impact a small portion of rural area, a moderate portion of a city, and a larger portion of a small jurisdiction like a school campus. Storms can also spawn additional tornadoes and other damaging phenomenon that extend the area of impact.

Unlike tornadoes, windstorms may have a destructive path that is tens of miles wide and several hundred miles long. Wind speed can vary greatly in the affected area, but damage can be found throughout the windstorm area if exposure to wind below 64 knots continues for hours unabated. Certainly, entire individual buildings and properties will be impacted. The rural county will feel widespread impacts but not necessary the entire area. Adair County is part of Wind Zone IV, which includes winds up to 250 MPH, the highest wind zone in the nation. This wind zone covers most of the interior Midwest from northern Texas to western Pennsylvania.



Score for Rural Ringgold County: 7	Score for Benton: 8	Score for Diagonal: 8	Score for Ellston: 8
Score for Kellerton: 8	Score for Maloy: 8	Score for Mount Ayr: 8	Score for Tingley: 8
Score for Diagonal School: 9	Score for Mount Ayr School: 9		

Tornado/Windstorm Severity of Impact:

Severity of a tornado relates to the size, wind speed, length of time and distance traveled on the ground, and the assets and population in the exposed area where the tornado occurs. Generally, no matter the size and strength of the twister, if people are exposed and the area has many weak and poorly built buildings, severity is greatly increased.

Tornadoes are very unique in that they can vary greatly in size, strength, and damage path. The rating scale used to rate tornado intensity is called the Enhanced Fujita Scale. The Enhanced Fujita Scale (EF) is used to assign a tornado a 'rating' based on estimated wind speeds and related damage. When tornado-related damage is surveyed, it is compared to a list of Damage Indicators and Degrees of Damage, which helps estimate better the range of wind speeds the tornado likely produced. From that, a rating (from EF0 to EF5) is assigned. The National Weather Service is the only federal agency with authority to provide 'official' tornado EF Scale ratings. The following chart shows the relationship between structure damage and wind speeds as it pertains to EF tornado ratings.

**Figure 3.118: Tornado Damage Potential by Intensity**

EF Rating	Wind Speeds	Expected Damage	
<b>EF-0</b>	65-85 mph	'Minor' damage: shingles blown off or parts of a roof peeled off, damage to gutters/siding, branches broken off trees, shallow rooted trees toppled.	
<b>EF-1</b>	86-110 mph	'Moderate' damage: more significant roof damage, windows broken, exterior doors damaged or lost, mobile homes overturned or badly damaged.	
<b>EF-2</b>	111-135 mph	'Considerable' damage: roofs torn off well constructed homes, homes shifted off their foundation, mobile homes completely destroyed, large trees snapped or uprooted, cars can be tossed.	
<b>EF-3</b>	136-165 mph	'Severe' damage: entire stories of well constructed homes destroyed, significant damage done to large buildings, homes with weak foundations can be blown away, trees begin to lose their bark.	
<b>EF-4</b>	166-200 mph	'Extreme' damage: Well constructed homes are leveled, cars are thrown significant distances, top story exterior walls of masonry buildings would likely collapse.	
<b>EF-5</b>	> 200 mph	'Massive/incredible' damage: Well constructed homes are swept away, steel-reinforced concrete structures are critically damaged, high-rise buildings sustain severe structural damage, trees are usually completely debarked, stripped of branches and snapped.	

The following table gives more details about the relative frequency of each EF scale in Iowa.

**Figure 3.119: Tornado Frequency by Intensity**

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. NOTE: 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 completely 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 leveled; cars thrown and small missiles generated.
EF5	>200	<0.1%	Explosive. Strong frame houses leveled 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.

In this profile, the local planning team performed analysis based on a scenario. The team considers a risk due to a typical EF3 tornado because smaller tornadoes do not need extensive mitigation actions not already in place, and larger tornadoes are fairly rare. Larger tornadoes are less common but are much more severe.

Severity of a windstorm depends primarily on a) wind speed, b) duration, c) size of area of impact, and d) existing conditions of the area where the windstorm occurs. Higher wind speeds produce more damage, as does the size of impact area, which causes damage to more properties. Sustained winds tend to exacerbate conditions, even if below the threshold of a windstorm, because the continuous strain on power lines, trees, and buildings over hours or even days weakens them. Delays in business and construction activities caused by high wind, i.e., wind is too strong to allow work to continue, also have economic impacts. Existing conditions, such as excessive debris, old structures, and exposed hazardous materials can exacerbate windstorm severity by exposing people and surrounding properties to those conditions.

The Land Beaufort Scale was originally developed in 1805 by Sir Francis Beaufort as a system for estimating wind strength without the use of instruments. It is currently still in use for this same purpose as well as to tie together various components of weather (wind strength, sea-state, observable effects) into a unified picture. This table details the scale.

**Figure 3.120: Windstorm Potential Damage by Wind Speed**

Force	Speed (knots)	Speed (MPH)	Land Conditions
0	<1	<1	Calm, smoke rises vertically
1	1-3	1-3	Light air, direction of wind shown by smoke drift only
2	4-6	4-7	Light breeze, wind felt on face, leaves rustle, vanes moved by wind
3	7-10	8-12	Gentle breeze, leaves and small twigs in constant motion, wind extends light flag
4	11-16	13-18	Moderate breeze, raises dust and loose paper, small branches move
5	17-21	19-24	Fresh breeze, small trees in leaf begin to sway
6	22-27	25-31	Strong breeze, large branches in motion, umbrellas used with difficulty
7	28-33	32-38	Near gale, whole trees in motion, inconvenience felt walking against the wind
8	34-40	39-46	Gale, breaks twigs off trees, impedes motion
9	41-47	47-54	Strong gale, slight structural damage occurs
10	48-55	55-63	Storm, trees uprooted, considerable damage occurs
11	56-63	64-73	Violent storm, widespread damage
12	64+	74+	Hurricane, extreme destruction

In this profile, the planning team looks at the severity of a widespread windstorm that lasts a few hours and includes at least one gust over 64 knots.

The NWS can issue 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 is 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.

The following provides a summary of the severity of impact throughout the county.

**Figure 3.221: Tornado and High Wind Severity of Impact Scoring Matrix**

Severity Criteria	Discussion	Score
Health and safety of the public	Injury or death related to tornadoes and windstorms most often occurs when buildings collapse, people are hit by flying objects, or when they are caught trying to escape the tornado in a vehicle. From 1950-2006, Iowa has had 2007 injuries related to tornadoes and 67 deaths over the same time period. There were 12 deaths and 561 injuries from 1980-2006. Over a dozen people died in several tornadoes in 2008. All people not within a reinforced building are at risk. High winds can blow trucks and cars off highways, causing severe injury and death. People are more likely to exposed to the hazards from straight-line winds because they can precede a storm or occur on an otherwise “nice” day.	4
Health and safety of responders	Response personnel are exposed to the same risk as the general public when caught in the storm without shelter. Typically, responders will be aware of conditions and will be in shelter during the initial storm but could be at risk to the secondary effects, such as fire, downed power lines, traffic accidents, lightning, and follow-up tornadoes. They may be more prepared than the average person and alert that the event is approaching, but many responders are also active storm watchers, so they are exposed as the storm approaches.	4

Severity Criteria	Discussion	Score
Continuity of operations	Tornadoes and windstorms can destroy government facilities just as they could other property. Disruption of critical services can also affect operations. Employees may be affected and unable to attend to work-related issues. The widespread loss of utilities and facilities can stop numerous government and other essential operations. Power lines and emergency equipment can be blown down and lost. Extended windstorm events can delay response and repair for hours to days.	4
Property, facilities, infrastructure	Impacts can range from broken tree branches, shingle damage to roofs, and some broken windows all the way to complete destruction and disintegration of well-constructed structures, infrastructure, and trees. While not likely due to an EF3 storm, entire neighborhoods can be destroyed. Based on the level of destruction due to an EF3 tornado and the size of its path, its impact could be catastrophic in some cases, if the tornado impacts areas of highly vulnerable structures. Windstorms are likely to cause less damage to an individual structure but their widespread impact could be critical to catastrophic.	4
Delivery of services	Tornadoes can impact many critical services, mainly electrical power and communications. Buried services are not as vulnerable, but can be affected by their system components that are above ground. Because of the extent of damage and lack of funds and resources to repair facilities, areas can be off-limits and systems may be off-line for days or more. Roads can be closed and bridges can be destroyed, so deliveries can be slowed. Items like bottled water and basic supplies may need to be brought in, and roads can be clogged with response vehicles.	4
Environmental impacts	Tornadoes and windstorms are naturally occurring phenomena. Damages to the environment could result from spills and other contaminants from the built environment. Debris can fly for tens of miles, delivering substances to areas not in the direct path of the storm. Sometimes debris is not spotted for some time, so leaks can persist. Damage to infrastructure can cause persistent environmental damage.	3
Economic/financial conditions	Whole towns have been destroyed. Economic impacts can result from direct damages to facilities or business disruption from the lack of critical services such as power, gas, or water. If a tornado causes great damage to a residential area away from the business, and many workers are dramatically affected, it can cause excessive loss in employee productivity, even if the business is not hit. Crop damage is often associated with windstorms; laying down crops, breaking stalks, and twisting plants, reducing crop yield and making it difficult to harvest. Wind-related road closures are rare but can delay business road, rail, and air travel.	4
Regulatory/contractual obligations	Debris removal is a vital service that is often too vast for the jurisdiction to do without contractual assistance. These plans should be in place and monitored. When services and response are postponed too long, lawsuits are likely due to the failure to provide contractual services. When property is destroyed, it is difficult to maintain any level of service in the immediate aftermath of a storm.	3
Reputation	Adequate warning is key to the positive reputation of the jurisdiction. Responding in a timely manner and reconstructing the community is also important. Bringing critical services back on line quickly will ensure the residents can recover.	2

The overall rating the community gave for this hazard’s magnitude in a survey was: “catastrophic.”

Score for Rural Ringgold County: 32	Score for Benton: 32	Score for Diagonal: 23	Score for Ellston: 23
Score for Kellerton: 32	Score for Maloy: 32	Score for Mount Ayr: 32	Score for Tingley: 32
Score for Diagonal School: 32	Score for Mount Ayr School: 32		

Tornado/Windstorm Speed of Onset:

Tornadoes can form and strike in seconds. Wind speeds may exceed 300 miles per hour and the storm can travel across the ground at more than 70 mph. These winds turn harmless objects into deadly missiles in a matter of seconds. The advancement in weather forecasting has allowed watches to be delivered to those in the path of these storms up to hours in advance. The best lead-time for a specific tornado 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 due to blowing dust or driving rain and hail.

The NWS has developed a windstorm warning system similar to other events such as tornado, winter storm, and thunderstorm watches that are issued when conditions are favorable for high winds to develop; these are often issued 12 to 24 hours in advance. Advisories are issued when existing or imminent high winds cover part or all of the area and pose a mere inconvenience. High wind warnings are issued when existing or imminent high winds cover part or all of the forecast area and pose a threat to life and property.

While warning times might be nearly a day, the best warning lead-time for a specific severe storm is about 30 minutes, because these storms can precede a parent thunderstorm by tens of miles and can move across the ground at or

exceeding 50 MPH. Further, in Iowa, high winds are associated with strong air pressure gradients, which means that winds can pick up with no warning (not a cloud in the sky) and can change speed and direction rather rapidly.

Score for Rural Ringgold County: 8	Score for Benton: 8	Score for Diagonal: 8	Score for Ellston: 8
Score for Kellerton: 8	Score for Maloy: 8	Score for Mount Ayr: 8	Score for Tingley: 8
Score for Diagonal School: 8	Score for Mount Ayr School: 8		

Tornado/Windstorm Duration of Event:

Tornado events last up to 1 hour, with the passing of a supercell or line of storms containing multiple tornadoes taking up to 2 hours on rare occasions. FEMA tornado safe rooms are designed to house people for two hours.

Windstorms typically last from a few minutes to a few hours with damaging winds at or above 64 knots, but the storm can last a day or longer with occasional wind gusts approaching or even exceeding 64 knots. The total duration of the severe part of a windstorm might be 6 hours with rare exceptions.

Score for Rural Ringgold County: 4	Score for Benton: 4	Score for Diagonal: 4	Score for Ellston: 4
Score for Kellerton: 4	Score for Maloy: 4	Score for Mount Ayr: 4	Score for Tingley: 4
Score for Diagonal School: 4	Score for Mount Ayr School: 4		

Tornado/Windstorm Total Scores:

The following total scores for tornado/windstorm indicate high risk to the public and the planning area where incidents can occur.

Score for Rural Ringgold County: 65	Score for Benton: 66	Score for Diagonal: 66	Score for Ellston: 66
Score for Kellerton: 66	Score for Maloy: 66	Score for Mount Ayr: 66	Score for Tingley: 66
Score for Diagonal School: 69	Score for Mount Ayr School: 66		

Tornado/Windstorm Vulnerability/Assets at Risk:

All structures, property, and people in the county, as outlined in Section 3.2, could suffer from the effects of tornadoes and windstorms. Severity can vary greatly depending on the actual wind speed and other factors.

All critical assets in the county, as outlined in Section 3.2.

Tornado/Windstorm Loss Estimation:

Structural loss can be very severe, as tornadoes are considered one of the greatest causes for structural loss among the hazards listed. Although death is less likely than structural loss, tornadoes are more likely than almost any other hazard to cause death (and serious injury).

In Ringgold County, the NCDC estimate for past property damage resulting from tornadoes from 1950-late 2017 was \$34 million. This averages \$507,500 per year in property damage. In Ringgold County, the NCDC estimate for past property damage resulting from windstorms from 1996-late 2017 was \$788,000. This averages \$36,000 per year in property damage. The total average annual structural loss would be \$550,000. Keep in mind that much of the historical loss data might not reflect modern inflation values, but it provides a basis for future loss estimates.

Crop insurance payments for the period from 2013-2017 were \$2,562 for wind damage (1 claim). Considering that 90.5 percent of insurable crops are insured in Iowa (2013 Iowa Crop Insurance Profile, USDA, RMA), the adjusted losses calculate to \$2,800 for all insurable crops for the period. This results in an average annual loss of \$600 to insurable crops as a result of wind damage. Note that this is not typical, and most five-year terms experience multiple claims.

A very useful way to analyze the potential losses for a tornado is through a potential scenario. As described earlier, the planning team used an EF3 as a basis for this risk assessment. This scenario involves a tornado track through the middle of each jurisdiction at a 45-degree angle, such as southwest to northeast, a common angle. Since school districts and the hospital own relatively few structures all in one place, school and hospital loss data in this scenario are included in the town in which they are located. As much as possible, parcel and public building/asset value, as outlined in Section 3.2, are utilized to determine possible losses.

With the infinite variables associated with tornado occurrences such as wind speed, direction, length, width, and time on the ground, etc., it is not possible to accurately estimate future losses. However, this methodology provides loss estimates for a defined scenario. Utilizing GIS data with associated building values considers variations in density of the built environment as well as variations in values. Again, it makes it possible for local jurisdictions to imagine or picture their risks in defined values to allow for some level of comparison.

An EF3 tornado is used here but most of the tornadoes will be smaller and cause less damage. However, some will be even larger, so it is realistic to use this scenario. Once the number of buildings within the hypothetical tornado track is determined, a 50% damage calculation was made within the base. The base is defined as within 566 yards (roughly 1,700 feet or one-third of a mile) of width of the tornado. A 10-mile long track was used. This damage percent is based on information from the NOAA Storm Prediction Center, which estimates an EF-3 tornado can do “severe” damage: entire stories of well constructed homes destroyed, significant damage done to large buildings, homes with weak foundations blown away, cars thrown, and significant tree damage. Clearly the amount of damage to a structure will vary within the path, but this provides a reasonable scenario for planning purposes.

The following table provides the results of the analysis in terms of the number and value of buildings in the scenario tornado path and estimated losses in Ringgold County. A planning area total was not calculated, as this scenario is not meant to indicate that these damages would occur simultaneously. Notice that in each of the tornado track scenarios, a portion of the county is impacted along with each incorporated city. This is due to the 10-mile average length, which exceeded the city boundaries at the approximate center and 45-degree angle for all tracks.

**Figure 3.122: Tornado/Windstorm Loss Estimate**

Jurisdiction and Track Location	Property Type	Number of Impacted Properties	Estimated Values	Estimated Contents Values	50% Loss Estimate
<b>Rural County (No Cities)</b>	Residential	25	\$2,500,000	\$1,250,000	\$1,875,000
	Commercial	1	\$100,000	\$50,000	\$75,000
	Industrial	0	\$0	\$0	\$0
	Agricultural	25	\$4,000,000	\$2,000,000	\$3,000,000
	Taxable Infrastructure	1	\$2,000,000	\$500,000	\$1,250,000
	Government/Institutional	1	\$5,000,000	\$2,500,000	\$3,750,000
	<b>Totals</b>	<b>53</b>	<b>\$13,600,000</b>	<b>\$6,300,000</b>	<b>\$9,950,000</b>
<b>Benton</b>	Residential	16	\$800,000	\$400,000	\$600,000
	Commercial	1	\$16,080	\$16,080	\$16,080
	Industrial	0	\$0	\$0	\$0
	Agricultural	1	\$300,000	\$150,000	\$225,000
	Taxable Infrastructure	1	\$100,000	\$25,000	\$62,500
	Government/Institutional	2	\$1,250,000	\$625,000	\$937,500
	<b>Totals</b>	<b>21</b>	<b>\$2,466,080</b>	<b>\$1,216,080</b>	<b>\$1,841,080</b>
<b>Rural and Benton</b>	Residential	20	\$1,800,000	\$900,000	\$1,350,000
	Commercial	0	\$0	\$0	\$0
	Industrial	0	\$0	\$0	\$0
	Agricultural	25	\$4,000,000	\$2,000,000	\$3,000,000
	Taxable Infrastructure	1	\$2,000,000	\$500,000	\$1,250,000
	Government/Institutional	1	\$1,000,000	\$500,000	\$750,000
	<b>Totals</b>	<b>47</b>	<b>\$8,800,000</b>	<b>\$3,900,000</b>	<b>\$6,350,000</b>
<b>Diagonal</b>	Residential	100	\$3,500,000	\$1,750,000	\$2,625,000
	Commercial	8	\$800,000	\$400,000	\$600,000
	Industrial	2	\$174,212	\$174,212	\$174,212
	Agricultural	1	\$750,000	\$375,000	\$562,500
	Taxable Infrastructure	1	\$750,000	\$375,000	\$562,500
	Government/Institutional	5	\$9,000,000	\$4,500,000	\$6,750,000
	<b>Totals</b>	<b>92</b>	<b>\$14,974,212</b>	<b>\$7,574,212</b>	<b>\$11,574,212</b>
<b>Rural and Diagonal</b>	Residential	20	\$1,800,000	\$900,000	\$1,350,000
	Commercial	0	\$0	\$0	\$0
	Industrial	0	\$0	\$0	\$0
	Agricultural	25	\$4,000,000	\$2,000,000	\$3,000,000
	Taxable Infrastructure	1	\$2,000,000	\$500,000	\$1,250,000
	Government/Institutional	2	\$2,000,000	\$1,000,000	\$1,500,000
	<b>Totals</b>	<b>48</b>	<b>\$9,800,000</b>	<b>\$4,400,000</b>	<b>\$7,100,000</b>
<b>Ellston</b>	Residential	16	\$450,000	\$225,000	\$337,500
	Commercial	2	\$203,473	\$101,737	\$152,612
	Industrial	0	\$0	\$0	\$0
	Agricultural	4	\$100,000	\$50,000	\$75,000
	Taxable Infrastructure	1	\$100,000	\$50,000	\$75,000
	Government/Institutional	2	\$1,500,000	\$750,000	\$1,125,000
	<b>Totals</b>	<b>25</b>	<b>\$9,800,000</b>	<b>\$4,400,000</b>	<b>\$7,100,000</b>
<b>Rural and Ellston</b>	Residential	20	\$1,800,000	\$900,000	\$1,350,000
	Commercial	0	\$0	\$0	\$0
	Industrial	0	\$0	\$0	\$0
	Agricultural	25	\$4,000,000	\$2,000,000	\$3,000,000
	Taxable Infrastructure	1	\$2,000,000	\$500,000	\$1,250,000
	Government/Institutional	1	\$1,000,000	\$500,000	\$750,000

	<b>Totals</b>	<b>47</b>	<b>\$8,800,000</b>	<b>\$3,900,000</b>	<b>\$6,350,000</b>
<b>Kellerton</b>	Residential	115	\$4,250,000	\$2,125,000	\$3,187,500
	Commercial	6	\$218,513	\$110,000	\$164,257
	Industrial	0	\$0	\$0	\$0
	Agricultural	1	\$150,000	\$75,000	\$112,500
	Taxable Infrastructure	1	\$450,000	\$225,000	\$337,500
	Government/Institutional	5	\$3,500,000	\$1,750,000	\$2,625,000
	<b>Totals</b>	<b>128</b>	<b>\$8,568,513</b>	<b>\$4,285,000</b>	<b>\$6,426,757</b>
<b>Rural and Kellerton</b>	Residential	20	\$1,800,000	\$900,000	\$1,350,000
	Commercial	0	\$0	\$0	\$0
	Industrial	0	\$0	\$0	\$0
	Agricultural	25	\$4,000,000	\$2,000,000	\$3,000,000
	Taxable Infrastructure	1	\$2,000,000	\$500,000	\$1,250,000
	Government/Institutional	1	\$1,000,000	\$500,000	\$750,000
	<b>Totals</b>	<b>47</b>	<b>\$8,800,000</b>	<b>\$3,900,000</b>	<b>\$6,350,000</b>
<b>Maloy</b>	Residential	12	\$469,424	\$240,000	\$354,712
	Commercial	15	\$2,100	\$1,100	\$1,600
	Industrial	0	\$0	\$0	\$0
	Agricultural	4	\$400,000	\$200,000	\$300,000
	Taxable Infrastructure	1	\$90,000	\$45,000	\$67,500
	Government/Institutional	2	\$1,000,000	\$500,000	\$750,000
	<b>Totals</b>	<b>34</b>	<b>\$1,961,524</b>	<b>\$986,100</b>	<b>\$1,473,812</b>
<b>Rural and Maloy</b>	Residential	20	\$1,800,000	\$900,000	\$1,350,000
	Commercial	0	\$0	\$0	\$0
	Industrial	0	\$0	\$0	\$0
	Agricultural	25	\$4,000,000	\$2,000,000	\$3,000,000
	Taxable Infrastructure	1	\$2,000,000	\$500,000	\$1,250,000
	Government/Institutional	1	\$1,000,000	\$500,000	\$750,000
	<b>Totals</b>	<b>47</b>	<b>\$8,800,000</b>	<b>\$3,900,000</b>	<b>\$6,350,000</b>
<b>Mount Ayr</b>	Residential	500	\$33,000,000	\$16,500,000	\$24,750,000
	Commercial	70	\$10,500,000	\$5,250,000	\$7,875,000
	Industrial	3	\$800,000	\$400,000	\$600,000
	Agricultural	3	\$300,000	\$150,000	\$225,000
	Taxable Infrastructure	4	\$3,500,000	\$1,750,000	\$2,625,000
	Government/Institutional	20	\$50,000,000	\$30,000,000	\$40,000,000
	<b>Totals</b>	<b>600</b>	<b>\$98,100,000</b>	<b>\$54,050,000</b>	<b>\$76,075,000</b>
<b>Rural and Mount Ayr</b>	Residential	25	\$2,400,000	\$1,200,000	\$1,800,000
	Commercial	1	\$100,000	\$50,000	\$75,000
	Industrial	0	\$0	\$0	\$0
	Agricultural	25	\$4,000,000	\$2,000,000	\$3,000,000
	Taxable Infrastructure	1	\$2,000,000	\$500,000	\$1,250,000
	Government/Institutional	2	\$2,000,000	\$1,000,000	\$1,500,000
	<b>Totals</b>	<b>54</b>	<b>\$10,500,000</b>	<b>\$4,750,000</b>	<b>\$7,625,000</b>
<b>Tingley</b>	Residential	73	\$2,600,000	\$1,300,000	\$1,950,000
	Commercial	4	\$133,130	\$66,000	\$99,565
	Industrial	0	\$0	\$0	\$0
	Agricultural	1	\$300,000	\$150,000	\$225,000
	Taxable Infrastructure	1	\$150,000	\$75,000	\$112,500
	Government/Institutional	3	\$2,000,000	\$1,000,000	\$1,500,000
	<b>Totals</b>	<b>82</b>	<b>\$5,183,130</b>	<b>\$2,591,000</b>	<b>\$3,887,065</b>
<b>Rural and Tingley</b>	Residential	20	\$1,800,000	\$900,000	\$1,350,000
	Commercial	0	\$0	\$0	\$0
	Industrial	0	\$0	\$0	\$0
	Agricultural	25	\$4,000,000	\$2,000,000	\$3,000,000
	Taxable Infrastructure	1	\$2,000,000	\$500,000	\$1,250,000
	Government/Institutional	1	\$1,000,000	\$500,000	\$750,000
	<b>Totals</b>	<b>47</b>	<b>\$8,800,000</b>	<b>\$3,900,000</b>	<b>\$6,350,000</b>

The above table shows that, if an EF-3 tornado makes a path through the county, it will cause millions or tens of millions of dollars of damages to properties in the county. The actual losses will be directly affected by its path. Fortunately, only about 10% of the future projected tornadoes will reach or exceed the EF-3 intensity.

Overhead power lines and infrastructure are also vulnerable to damages from windstorms. 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. Other potential losses 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. The electric power loss of use estimates can be 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 Ringgold County's jurisdictions. The loss of use estimates for power failure associated with windstorms is provided as the loss of use cost per person, per day of loss, totaling \$126. 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. For the entire planning area, with a population of 5,131, this loss would amount to \$64,651 per day.

Windstorm is primarily a public safety and economic concern, and the planning area is located in a region with very high frequency of occurrence. Both windstorm and tornado are hazards that can have substantial economic impacts, including business building destruction, power loss shutdown, inability for people to get to work, and inability to make and receive shipments. Depending on where the hazard occurs, economic losses can be very severe.

The loss due to human life and health is not high for the typical windstorm and even for most tornadoes. However, in the event of an EF-3 tornado, the risk could be high for multiple deaths and injuries, especially if the tornado makes a direct hit on a municipality. The chance of death and serious injury greatly increases with no or limited warning or if warning is not heeded or if people are exposed with nowhere to go, such as in a campground. There is a 10% chance of death, 25% of serious injury, and 50% of a minor injury in a given year directly as a result of a storm.

#### Future Development and Tornado/Windstorm:

As long as the population remains stable or even declines, it is unlikely that future development will increase exposure or risk of loss. While Sun Valley Lake area continues to develop, most of the new construction is very modern with high quality materials and full basements. In the past five to ten years, FEMA and the State of Iowa have made great effort to promote the use of public safe rooms as part of construction of new projects where vulnerable populations will be. Assuming that some organizations building new structures heed this advice and take advantage of funding, the new development might actually reduce the risk to human life and limit the increase of risk to buildings.

### ***Transportation Incident Profile***

Type: Technological

Definition: An accident involving any mode of transportation that directly threatens life, property damage, injury, or adversely impacts a community's capabilities to providing emergency services.

#### Transportation Incident Description:

This hazard encompasses air transportation, highway transportation, railway transportation, and waterway incidents. The following paragraphs describe each mode of transportation.

An air transportation incident may involve a military, commercial, or private aircraft. Airplanes, helicopters, and other modes of air transportation 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 including mechanical failure, pilot error, weather conditions, or an on-board fire could all lead to an incident at or near the airport.

A highway transportation incident can be single or multi-vehicle requiring responses exceeding normal day-to-day capabilities. If the designed capacity of the roadway is exceeded, the potential for a major highway incident increases. Weather conditions play a major factor in the ability of traffic to flow safely as does the time of day and week. Incidents involving buses and other high-occupancy vehicles could trigger a response that exceeds the normal day-to-day capabilities of response agencies.

A railway transportation incident is a train accident that directly threatens life, property, or adversely impacts a community's capabilities ability to provide emergency services. Railway incidents may include derailments, collisions, and highway/rail crossing accidents. Train incidents can result from a variety of causes including human error, mechanical failure, faulty signals, or problems with the track. Results of an incident can range from minor "track hops" to catastrophic hazardous material incidents with human/animal casualties.

A waterway incident is an accident involving any water vessel that threatens life, property, or adversely affects a community's capability to provide emergency services. Waterway incidents primarily involve pleasure craft on rivers

and lakes. Waterway incidents may also include events in which a person, persons, or object falls through the ice on partially frozen bodies of water. Impacts include fuel spillage, drowning, and property damage.

Transportation Incident Historical Occurrence:

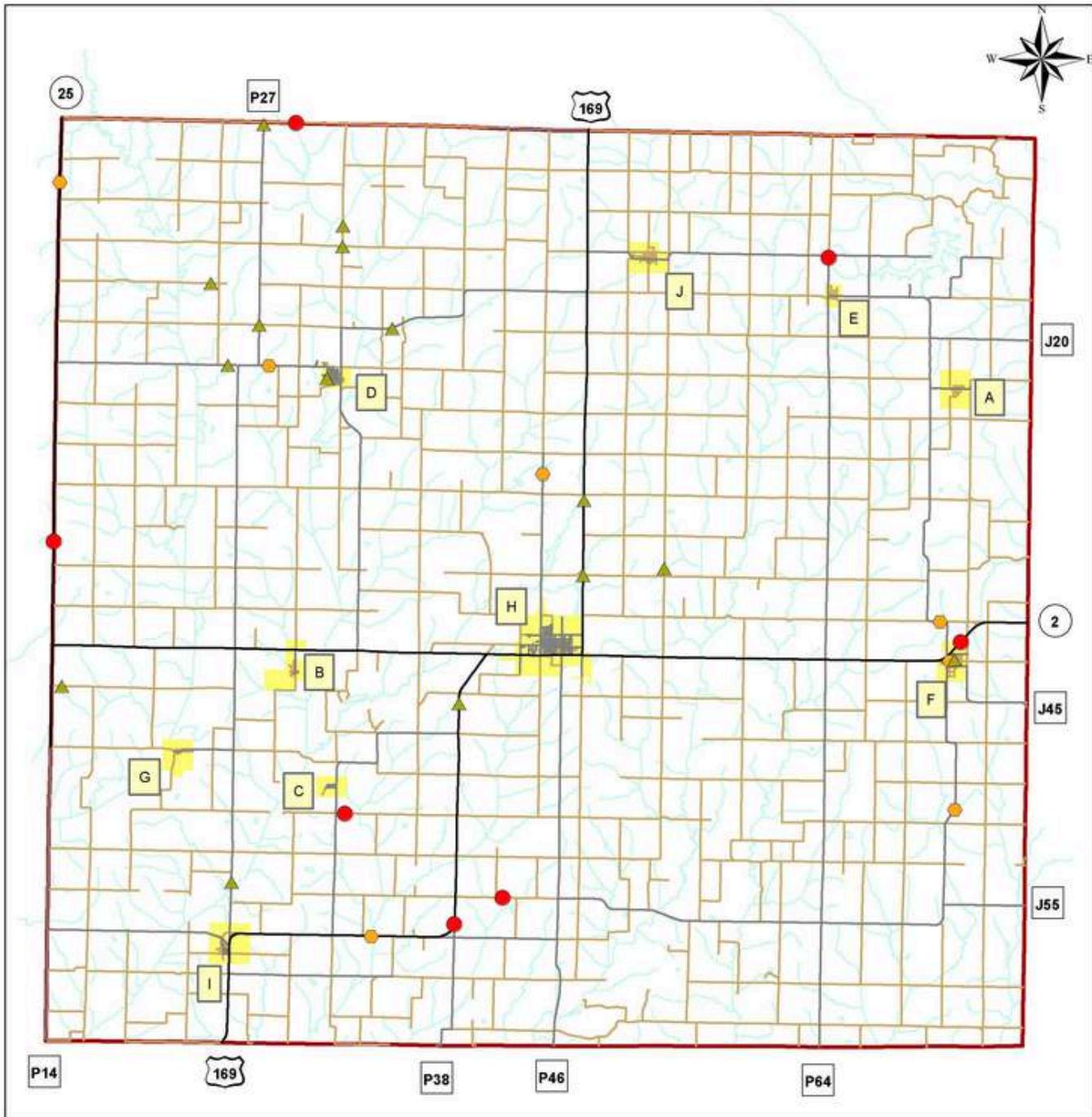
There have been or can be air, rail, and highway transportation incidents in Ringgold County.

From 1962 to 2010, there were approximately 2,035 (around 40 per year) air transportation incidents/accidents in Iowa according to the National Transportation Safety Board. Since the year 2000 only 214 air transportation incidents (around 16 per year), so the number of incidents is dropping due to advances in air transportation safety. The vast majority of fatalities are from large airline crashes, but the vast majority of crashes, including those in rural Ringgold County, have been small planes. Four incidents have happened near the Mount Ayr Airport and once incident happened near Redding. There are no known fatalities or serious injuries from small plane crashes in Ringgold County.

According to the Iowa Department of Transportation (IDOT) accident website, [www.iowadot.gov/crashanalysis/data/county/ringgold.aspx](http://www.iowadot.gov/crashanalysis/data/county/ringgold.aspx), there have been 218 crashes from 2007-2011. In that time, there were 7 fatal crashes with 8 fatalities; there were 10 major injuries and 20 minor injuries reported. Most of these incidents were not of the magnitude of exceeding local first response agencies, but some incidents have exceeded capabilities. All county fire departments have responded to highway transportation incidents. Sometimes, although very rare, traffic detours are needed. These instances increase risk of additional crashes until normality is restored. Recent large auto crashes reported by the planning team include an incident near Mount Ayr in 2016 resulting in response from multiple agencies.

The following map shows historic crash data reported to the Iowa Department of Transportation.

**Figure 3.123: Recent Historical Transportation Incident Map**



**Ringgold County  
2007 - 2011 Reportable Crash History  
All Rural Crashes  
By Crash Severity**



- A BEACONSFIELD
- B BENTON
- C DELPHOS
- D DIAGONAL
- E ELLSTON
- F KELLERTON
- G MALOY
- H MOUNT AYR
- I REDDING
- J TINGLEY

- Interstate
- US
- Iowa
- County

**Legend**

- Crash Severity**
- Fatal
  - Major Injury
  - Minor Injury

The planning team has reported only minor railroad transportation incidents within the county in past history (on lines that no longer exist), but no dates were produced. None have occurred in modern times. No casualties are known. There are no railroad lines in Ringgold County today and no real potential for new railroads in the future.

There are few significant waterways and water bodies in Ringgold County, consisting of several lakes and a few rivers. Only Sun Valley Lake is used routinely for recreation. An incident that stands out is a drowning at Sun Valley Lake in 2004, which helped spawn the multi-county water rescue task force serving the region and housed in Ringgold County. Limited official data about past incidents is available, but it is recognized that drownings have occurred due to people falling through the ice or out of boats.

Transportation Incident Future Probability:

Mount Ayr’s Judge Lewis Airport handles a relatively small number of planes and the likelihood is small in a given year that an incident will occur, despite the popularity of the local airport for recreational flying. Air traffic overall is limited and any planes that crash are likely to be small planes with no more than a pilot and one passenger. However, since there are many commercial planes that fly over the county, there is always a chance for a major crash. More and more people are utilizing air travel now than in the past. The trend of increasing numbers of people flying is likely to continue as will the crowdedness of airports and the skies above Iowa.

Although traffic engineering, inspection of traffic facilities, land use management of areas adjacent to roads and highways, and the readiness of local response agencies have increased, highway incidents continue to occur. As the volume of traffic on the state’s streets, highways, and interstates increases, the number of traffic accidents will likely also increase. The combination of large numbers of people on the road, wildlife, unpredictable weather conditions, potential mechanical problems, and human error always leaves open the potential for a transportation accident. Local jurisdictions continue to look at where traffic signals and speed limit changes are needed in order to protect the public. Greatest risks are on US Highway 169, State Highways 2 and 25, and paved county roads for major incidents that require more than local response.

There are no railroads and no real potential for new railroads within the county.

Several ponds, rivers, and lakes are used for recreation, including angling, boating, and swimming. The number of users of Iowa lakes and rivers is increasing. Minor incidents involving one or two boats and/or individuals can occur that tie up response resources and cause death and injury are possible but unlikely in a given year. Incidents will be recreational-related, as opposed to transportation-related, because the waterways are too small to support barges. Only in rural areas, Benton, Diagonal, Maloy, and Mount Ayr can a waterway incident occur.

The following probabilities are based on incidents that cause fatalities and/or require response beyond local capabilities. The potential for an incident is virtually impossible on school and hospital property due to the slow speeds involved, with the exception of air transportation incidents.

The overall rating the community gave for this hazard’s future probability in a survey was: “likely” to “highly likely.”

Score for Rural Ringgold County: 7	Score for Benton: 2	Score for Diagonal: 3	Score for Ellston: 2
Score for Kellerton: 3	Score for Maloy: 2	Score for Mount Ayr: 4	Score for Tingley: 2
Score for Diagonal School: 1	Score for Mount Ayr School: 1		

Transportation Incident Vulnerability to the Population:

People aboard airplanes are the most vulnerable to air transportation incidents. Statistics from the National Transportation Safety Board and the airline industry show that the majority (over 75%) of airplane crashes and accidents occur during the takeoff or landing phases of a flight. As a result, developed areas adjacent to the airports and in airport flight paths are particularly vulnerable to this hazard. The Mount Ayr Airport is surrounded by industries and traveled roads on two sides. Airport zoning is now being implemented to ensure that development will be limited and low-impact near the airport. For areas away from the airport, a smaller percentage of the population would be directly in the area of impact. However, because of the concentration of populations in smaller areas, especially for schools and the hospital, the percentage of persons in the impact area of an incident would be higher even though the probability of an incident is actually less than the immediate area around an airport.

Those who use the surface transportation system are most vulnerable to highway transportation incidents. Travelers, truckers, delivery personnel, and commuters are at risk at all times when they are on the road. During rush hours and holidays, the number of people on the road in Iowa is significantly higher. This is also true before and after major gatherings such as sporting events, concerts, and conventions. Pedestrians and bystanders of the community are less vulnerable unless they are in the roadway. Any individual incident will have a direct impact on only a few people.

People and property in close proximity to the railway lines, crossings, sidings, switching stations, and loading/unloading points are most at risk of rail transportation incidents. Those away from railroad tracks and facilities are vulnerable only to large-scale incidents including those in which hazardous materials are involved. No railroads are located within a few miles of the county, so this hazard will not have a direct impact on the planning area.

Operators and passengers of pleasure craft are vulnerable to a waterway incident. The environment is vulnerable to contents and fuels that come from boats and vehicles/equipment on the top of winter ice; however, only a very small percentage of the population is at risk of a single incident. Vulnerability may be reduced by the improved water rescue training and equipment capabilities of regional first response departments. Warning signs and law enforcement are also important mitigation measures.

Score for Rural Ringgold County: 3	Score for Benton: 4	Score for Diagonal: 4	Score for Ellston: 4
Score for Kellerton: 4	Score for Maloy: 4	Score for Mount Ayr: 4	Score for Tingley: 4
Score for Diagonal School: 5	Score for Mount Ayr School: 5		

Transportation Incident Area of Extent:

While the area of extent can vary greatly based on materials involved, size of plane, and location of crash, compared to many other hazards, an air transportation accident would occupy a relatively small area. The extent to which the impacts would be felt would depend on the materials involved. For example, if a cargo plane transporting volatile or hazardous substances were involved in an accident, the area of concern would be significantly larger than the area for an accident involving a small personal aircraft carrying stable materials. The most severe of accidents would likely affect only a few city blocks. In any case, only a small part of most jurisdictions would be directly affected.

Highway incidents are usually contained to areas on the roadway or directly adjacent to the roadway. Very few highway incidents affect areas outside the traveled portion of the road and the right-of-way. Extensive segments of the transportation system can be impacted during significant weather events, such as a large snowstorm, when multiple separate accidents occur. While incidents may affect a larger part of a small jurisdiction, like a small town, generally a typical crash will affect only 1% of the area. (When hazardous materials are involved, the impact is likely to a larger area. See the hazardous materials profile for more information.)

Vehicle/train collisions will not impact Ringgold County’s population except for those living in the county and traveling in another county where railroads exist.

The maximum extent of a waterway incident would be limited. Impacts would not extend beyond the immediate incident scene. The only exception would include a search and rescue event that could expand downstream. In the case of a hazardous material being released to the waterway, the impact could expand considerably but still would be a very small part of any jurisdiction.

Score for Rural Ringgold County: 3	Score for Benton: 4	Score for Diagonal: 4	Score for Ellston: 4
Score for Kellerton: 4	Score for Maloy: 4	Score for Mount Ayr: 4	Score for Tingley: 4
Score for Diagonal School: 5	Score for Mount Ayr School: 5		

Transportation Incident Severity of Impact:

The level of severity would depend on the type of transportation mode used. Air transportation incidents are likely to be the most destructive. Severity depends aircraft involved, the type of cargo being transported, and the area on the ground on which the accident occurred. Because of the limited number of response personnel in Ringgold County, a crash of a major airliner would very quickly exceed local capabilities. For this assessment, the planning team looks at a mid-sized passenger plane flying over the county and crashing in a random location.

Highway transportation incidents claimed more lives in Ringgold County than any other of the profiled hazards during the past 25 years. Often they can be prevented through education, roadway improvements, law enforcement, and restrictions during severe weather, but some fatal accidents will still occur. The following severity assessment considers the worst types of incidents found in the county’s history: a fatal multiple-vehicle incident during severe weather and rush hour traffic that results in closure of a main highway and a detour through the county.

A rail transportation incident will not have an impact on the county.

The following is the severity assessment that considers the impacts of a waterway or water body incident involving multiple pleasure boats in adverse weather conditions that complicate response, search, and rescue. Because there are no high traffic lakes with high-speed boats and no cargo ships using waterways in the county, this risk is fairly low.

The following provides a summary of the severity of impact throughout the county. For the sake of discussion, it is assumed that no large quantities of hazardous materials are involved, as these are profiled in another profile. If hazardous materials were involved, the severity would increase.

**Figure 3.124: Transportation Incident Severity of Impact Scoring Matrix**

Severity Criteria	Discussion	Score
Health and safety of the public	Multiple deaths and injuries are likely to almost any form of transportation incident. The lives and health of the pilot, crew, passengers, and the population on the ground would be at risk. There are very few injuries and fatalities when compared to the number of people involved in travel as a whole, but if there is an accident, it is very likely that injuries will be serious or fatal. During adverse weather conditions, people may not see a crash in front of them and may run into it, causing a big pile-up. Fires in vehicles, planes, and trains can cause more deaths and injuries. Exposure to cold and other conditions can exacerbate the problem until they are rescued and able to be taken in an ambulance. People are also at risk of further crashes on busy detour routes. In adverse weather conditions, people are more likely to drown or suffer hypothermia after an incident on a body of water.	4
Health and safety of responders	Response personnel would likely be exposed to fire hazards and other hazards associated with crashes such as sharp objects, glass, and confined spaces. Responders are at risk while traveling to the scene and while dealing with traffic, including directing detours. The sheer number of vehicles in the incident area presents increasing risk to those responding. Gawkers and other distracted drivers passing through can add to risk. Responders are also exposed to the severe weather that caused the crash. Because of the number of hours that law enforcement are on the road, they have a higher risk than do other response personnel in a given year. During cold weather or storms, water rescue personnel engaged in a rescue attempt are at even greater risk. Fuel spills can result in health and safety (fire or explosion) issues for those involved.	3
Continuity of operations	In all forms of transportation incidents, local government and partners are able to continue operating, but things like closed roads, exhausted rescue teams, and damaged infrastructure and facilities will have a short-term effect. A long-term effect is likely if a critical asset essential for continuity of operations takes a direct hit. The site or the community as a whole may be restricted until the rescue, salvage or possible cleanup/decontamination operations have been completed. For example, salvage operations may not be able to get underway until a successful testing and decontaminating operation is completed.	3
Property, facilities, infrastructure	Significant damage can also occur to property on the ground as well as the vehicles that crashed. Often buildings, fences, utility lines, and trees are damaged or destroyed in the event of a plane crash. The cargo aboard a plane, truck, or train that has crashed can also sustain damage or destruction. This too can be extremely costly. Property damage would be limited to vehicles and cargo involved; roads, bridges, and other infrastructure; utilities such as light and power poles; and third party property adjacent to the accident scene such as buildings and yards. Bridges can be damaged and thus disrupt other transportation modes.	3
Delivery of services	In all forms of transportation incidents, services can be delayed if transportation routes are blocked, bridges are destroyed, or lengthy detours are required. Often local emergency responders suffer when response capabilities are tied up. There may be short term localized impacts if utility poles are affected and the like. Also, major routes, like Highway 2, can be closed down, thus slowing transportation of people and materials for up to several hours. Cargo will be delayed significantly and services that depend on cargo can be diminished or delayed. Water search and rescue efforts could tie up considerable first response and medical resources. The area's only water rescue team, based in Ringgold County, is composed of volunteers from all over the region.	3
Environmental impacts	Fuel and other fluids can be spilled from the affected vehicles and affect the environment, including air, water, and soil. When no HAZMAT is involved, the impacts are negligible in the long-term.	2
Economic/financial conditions	Damage would be much localized, and the economic impact to the local economy will be mostly due to damage of business property at the crash site. Damage to the aircraft itself is costly to the owner in terms of direct value lost and amount lost because the airplane is now out of commission. The area impacted could be isolated for weeks or months, thus hindering economic activity in the area. Business and traffic disruptions could last several days until the cleanup efforts are complete. In a waterway, if major contamination results or a lake were closed for recreation, the costs of cleanup and lost tourism spending could be considerable.	3
Regulatory/contractual obligations	Major airline crashes will mobilize the FAA and other regulatory agencies and may bring about changes in laws and regulations and impact the manufacturing contracts for new planes. The Iowa DOT and State Patrol are responsible for highway law enforcement and maintenance and local governments and police forces are responsible for local roadway law enforcement and maintenance. The Army Corps of Engineers is	2

Severity Criteria	Discussion	Score
Reputation	responsible for the upkeep on the state’s waterways, as well as accurately recording and mapping topographical data. They then must locate and designate dangerous areas in the water and mark them accordingly. The DNR monitors watercraft regulations and polices the state’s waterways. Ringgold County Conservation also has a role in this process. Reputation is based on effective and timely response. Crashes occur often enough that reputations will not be damaged unless the responders do a poor job, such as respond too slowly or without adequate resources or the detour and closure time is too excessive. When State and Federal agencies get involved, it is essential that a chain of command is established early, but if there is a failure, it can harm multiple agencies.	2

The overall rating the community gave for this hazard’s magnitude in a survey was: “limited.”

Score for Rural Ringgold County: 25	Score for Benton: 25	Score for Diagonal: 25	Score for Ellston: 25
Score for Kellerton: 25	Score for Maloy: 25	Score for Mount Ayr: 25	Score for Tingley: 25
Score for Diagonal School: 25	Score for Mount Ayr School: 25		

Transportation Incident Speed of Onset:

Most transportation incidents involving any of the modes included here (highway, air, rail, or waterway) will be unanticipated. Had they been anticipated, in most cases they would have been prevented. Because of this, these incidents will usually occur with no warning. There may be no or a limited amount of time to warn those in the pathway of the harmful effects.

Score for Rural Ringgold County: 9	Score for Benton: 9	Score for Diagonal: 9	Score for Ellston: 9
Score for Kellerton: 9	Score for Maloy: 9	Score for Mount Ayr: 9	Score for Tingley: 9
Score for Diagonal School: 9	Score for Mount Ayr School: 9		

Transportation Incident Duration of Event:

Transportation incidents will likely occur rather quickly from the time the incident begins until motion stops. Stopping oncoming trains and other immediate actions may prolong the incident up to several minutes to an hour. Securing the site and ensuring secondary crashes/cascading events don’t occur will add minutes to even hours. The real immediate impact, to where responders have “things under control” might be 1 to 6 hours for incidents such as a major airliner crash or a train derailment.

Score for Rural Ringgold County: 4	Score for Benton: 4	Score for Diagonal: 4	Score for Ellston: 4
Score for Kellerton: 4	Score for Maloy: 4	Score for Mount Ayr: 4	Score for Tingley: 4
Score for Diagonal School: 4	Score for Mount Ayr School: 4		

Transportation Incident Total Scores:

The following total scores for transportation incident indicate moderate risk to the public and the planning area where incidents can occur.

Score for Rural Ringgold County: 51	Score for Benton: 48	Score for Diagonal: 49	Score for Ellston: 48
Score for Kellerton: 49	Score for Maloy: 48	Score for Mount Ayr: 50	Score for Tingley: 48
Score for Diagonal School: 49	Score for Mount Ayr School: 49		

Transportation Incident Vulnerability/Assets at Risk:

All structures, property, and people in the county, as outlined in Section 3.2, could suffer from the effects of transportation incidents. This is because an air transportation incident can occur anywhere. Clearly rail transportation incidents, highway transportation incidents, and waterway incidents will only occur on those facilities or directly adjacent to them.

All critical assets in the county, as outlined in Section 3.2, are at risk of an air transportation incident. Generally none of them are at direct risk from the other assessed modes.

Transportation Incident Loss Estimation:

The bulk of the losses from transportation incidents will be to human life and injury. Those at risk include drivers, pilots, engineers, and passengers of vehicles, trains, boats, and airlines as well as pedestrians and bystanders. During response, responders can also be injured or killed. In a plane crash, one or more people can be killed inside buildings or while exposed outdoors if they cannot get out of the way of the falling plane.

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 2014 dollars using an annual inflation rate of 2.85 percent. The costs are listed below.

**Figure 3.125: Loss Estimate by Transportation Incident Matrix**

Severity	Cost Per Injury (in 2014 dollars)
Fatal	\$4,171,814
Evident Injury	\$57,782
Possible Injury	\$30,487
Property Damage Only	\$3,209 (mostly the vehicle(s) involved)

Source: U.S. Department of Transportation Federal Highway Administration Technical Advisory T 7570.2, 1994. Adjusted to 2014 dollars

Using this crash severity data combined with historical crash data outlined in the “historical occurrence” section of this profile, the planning team estimates the following loss data per year for the planning area:

- Fatalities (1.6 per year): \$6,674,902.
- Major injuries (2.0 per year): \$115,564.
- Minor injuries (4.0 per year): \$121,948.
- Property damage (31.2 per year): \$100,121.

Based on this analysis, the estimated average annual cost of traffic accidents for the planning area is \$6,781,407. Virtually all the losses will occur in rural areas, with 1% of losses in Mount Ayr. At least half of the annual losses are anticipated on Highways 2 and 169.

Associated costs of a highway transportation incidents include the economic cost of detours, the cost of response and cleanup, and possible environmental costs if hazardous materials are spilled or released. These costs can translate to functional use losses for local governments, response agencies, and businesses. In a given year, these costs can exceed \$1 million.

Waterway incidents involving watercraft are unlikely because the local lakes are small and boats are limited to no-wake speed in most instances. More likely, the greatest future risk of life and health is due to falling off a small boat or falling through the ice. The regional water/ice rescue response capabilities are improving.

Airplane crashes involving more than a single-seated plane are more likely to cause significant casualties and destroy property but rarely occur. When they occur, up to and over 100 people on the plane can perish along with dozens or even hundreds on the ground, depending, of course, on where the plane crashes. Because of many risks involved in response to major airliner crashes, it is very possible that responders could also die.

Future Development and Transportation Incident:

According to the *Impacts of Rural Development on Iowa’s Secondary Road System*, September 2010, completed by Iowa State University, Institute for Transportation, the development of new rural agricultural and residential uses in rural areas, and now the development of wind turbines, increases construction-related and long-term new traffic patterns on secondary roads. Local development will not have a great impact in other local modes of transportation, and there are no plans to build new airports or railroads. Development, if any, is not likely to result in new railroad-road crossings.

**3.6: Risk Assessment Summary**

As can be seen, the various hazards can/will affect any or all of the population and assets in the county, depending on the nature of the impacts and locational restrictions placed on them. This section provides a summary of the potential impact. Please note that more information, such as flooding base floor elevations (BFEs) and soil types, is needed to identify specific risks and magnitude of impact on a particular property. This mitigation plan provides only the basic information that is known for the hazards and assets that are impacted.

This part of the plan addresses the following Stafford Act requirement:

**Section 201.6I(2)(ii): [The risk assessment shall include a] description of the jurisdiction’s vulnerability to the hazards described in paragraph I(2)(i) of this section. The description shall include an overall summary of each hazard and its impact on the community.**

**Total Scores and Hazard Priority Groupings**

The following matrix shows the total scores for each profiled hazard as it impacts each jurisdiction.

**Figure 3.126: Total Hazard Risk Assessment Scoring**

Hazard	Rural Ringgold Co.	Benton	Diagonal	Ellston	Kellerton	Maloy	Mount Ayr	Tingley	Diagonal School	Mount Ayr Schools
Animal/plant/crop disease	49	42	41	41	43	41	43	41	39	39
Dam/levee failure	38	--	38	--	--	--	36	--	--	--
Drought	51	50	50	50	50	50	50	50	49	49
Expansive soils	46	40	40	40	40	40	41	40	36	36
Extreme heat	54	53	53	53	53	53	53	53	51	51
Flash flood	52	54	54	53	53	54	53	53	53	52
Grass and wildland fire	48	43	43	42	43	43	42	42	39	--
Hazardous materials incident	54	53	55	53	55	53	56	53	51	52
Human disease	46	45	45	45	45	45	46	45	48	48
Infrastructure failure	61	59	60	59	60	59	61	59	61	61
River flood	47	38	40	--	--	43	31	--	--	--
Severe winter storm	61	61	61	61	61	61	61	61	61	61
Terrorism	61	61	61	61	61	61	62	61	66	66
Thunderstorm/Lightning/Hail	53	53	53	53	53	53	53	53	52	52
Tornado/Windstorm	65	66	66	66	66	66	66	66	69	66
Transportation incident	51	48	49	48	49	48	50	48	49	49

-- Hazard does not affect/occur in the jurisdiction.

The above table is simply a snapshot that allows the reader to compare the relative risks from various hazards by jurisdiction. It is not perfect. First, it only considers the direct impact of a hazard event, but in reality hazard events often occur simultaneously and consecutively, causing triggered hazards. Second, the table shows the scores based on fixed criteria for each hazard without consideration of the differences among hazards. In other words, the scores are not meant to compare the hazards. Third, the results are based on available information combined with planning team opinions of risk. Despite these factors, the scores in the table paint a picture of relative risk.

Using the State Hazard Mitigation Plan for guidance, the local planning team created a three-tier system to prioritize the hazards in terms of which should receive the most attention and resources in the hazard mitigation process over the next five years. The following illustrates the priority groupings.

**Figure 3.127: Priority Groupings for Mitigation Actions Graphic**

<b>Priority Group 1</b>	<b>Unacceptable Consequences</b>	Maximum possible effort should be given to eliminate unacceptable risk factors, including injury, death, economic loss, property loss, and other damages
<b>Priority Group 2</b>	<b>Risk Reduction</b>	Mitigation actions, when feasible and affordable, should be taken to address these, especially when they can be part of the effort to mitigate Priority 1 hazards.
<b>Priority Group 3</b>	<b>Risk Acceptance</b>	Typically these hazards are not a focus with the limited resources available but might be addressed incidentally as part of Priority 1 hazard mitigation efforts.

Priority Group 1 hazards, as identified by jurisdiction, should be the focus of sustained and new mitigation actions. Current mitigation measures, as outlined in Chapter 4, should be sufficient to address Priority Group 3 hazards and might help with mitigation of other hazards. The remaining part of the hazard mitigation plan considers the risks to the jurisdictions due to Priority Group 1 hazards. It is important to understand that not all hazards affect individual jurisdictions in the planning area equally; therefore, the Priority 1 hazards vary by jurisdictions. The classifications result from the total individual hazard scores for each jurisdiction, as shown a few paragraphs earlier.

The following matrix shows the risk assessment ratings and priority groups for all participating jurisdictions. The hazards are listed by jurisdiction alphabetically by type. Natural hazards are *italicized*.

**Figure 3.128: Priority Groupings Matrix by Jurisdiction**

Jurisdiction	Priority Group 1 Hazards	Priority Group 2 Hazards	Priority Group 3 Hazards
Rural Ringgold County	Hazardous materials incident Infrastructure failure <i>River flood</i> ** <i>Tornado/windstorm</i> Transportation incident	<i>Animal/plant/crop disease</i> <i>Drought</i> <i>Flash flood</i> <i>Grass and wildland fire</i> <i>Severe winter storm</i> <i>Thunderstorm/lightning/hail</i>	Dam/levee failure <i>Expansive soils</i> <i>Extreme heat</i> <i>Human disease</i> Terrorism
Benton	Infrastructure failure <i>River flood</i> ** <i>Severe winter storm</i>	<i>Flash flood</i> <i>Grass and wildland fire</i> Hazardous materials incident	<i>Animal/plant/crop disease</i> <i>Drought</i> <i>Expansive soils</i>

Jurisdiction	Priority Group 1 Hazards	Priority Group 2 Hazards	Priority Group 3 Hazards
	<i>Tornado/windstorm</i>	<i>Human disease</i>	<i>Extreme heat Terrorism Thunderstorm/lightning/hail Transportation incident</i>
Diagonal	<i>River flood ** Severe winter storm Tornado/windstorm</i>	<i>Animal/plant/crop disease Expansive soils Flash flood Grass and wildland fire Hazardous materials incident Infrastructure failure Thunderstorm/lightning/hail Transportation incident</i>	<i>Dam/levee failure Drought Extreme heat Human disease Terrorism</i>
Ellston	<i>Severe winter storm Tornado/windstorm</i>	<i>Flash flood Grass and wildland fire Human disease Infrastructure failure Thunderstorm/lightning/hail</i>	<i>Animal/plant/crop disease Drought Expansive soils Extreme heat Hazardous materials incident Terrorism Transportation incident</i>
Kellerton	<i>Severe winter storm Tornado/windstorm</i>	<i>Flash flood Grass and wildland fire Hazardous materials incident Human disease Infrastructure failure Thunderstorm/lightning/hail</i>	<i>Animal/plant/crop disease Drought Expansive soils Extreme heat Terrorism Transportation incident</i>
Maloy	<i>River flood ** Severe winter storm Thunderstorm/lightning/hail Tornado/windstorm</i>	<i>Drought Flash flood Infrastructure failure</i>	<i>Animal/plant/crop disease Expansive soils Extreme heat Grass and wildland fire Hazardous materials incident Human disease Terrorism Transportation incident</i>
Mount Ayr	<i>Extreme heat Hazardous materials incident Infrastructure failure River flood ** Tornado/windstorm Transportation incident</i>	<i>Dam/levee failure Flash flood Grass and wildland fire Human disease Severe winter storm Thunderstorm/lightning/hail</i>	<i>Animal/plant/crop disease Drought Expansive soils Terrorism</i>
Tingley	<i>Thunderstorm/lightning/hail Tornado/windstorm</i>	<i>Extreme heat Human disease Infrastructure failure Severe winter storm Transportation incident</i>	<i>Animal/plant/crop disease Drought Expansive soils Flash flood Grass and wildland fire Hazardous materials incident Terrorism</i>
Diagonal School	<i>Human disease Severe winter storm Thunderstorm/lightning/hail Tornado/windstorm Transportation incident</i>	<i>Animal/plant/crop disease Drought Extreme heat Flash flood Grass and wildland fire Hazard materials incident Infrastructure failure Terrorism</i>	<i>Expansive soils</i>
Mount Ayr Schools	<i>Human disease Terrorism Tornado/windstorm</i>	<i>Drought Hazard materials incident Infrastructure failure Severe winter storm Transportation incident</i>	<i>Animal/plant/crop disease Expansive soils Extreme heat Flash flood Thunderstorm/lightning/hail</i>

*\*\* In most jurisdictions, the committee recommended a lower rating for river flood hazards; however, they are being mitigated as part of this plan (Chapter 4) as a NFIP requirement.*

### **Annual Loss Estimation**

This section itemizes the results of possible *direct* structural, economic/functional use, and human losses on an annual basis from the hazards outlined in the hazard profile. Direct effects are those resulting from the hazard, not including cascading events. When using the formula, Damage per Event X (multiplied by) Number of Events Per Year, we can

come up with the total losses in one year. Doing this provides a clearer picture of which hazards are likely to impact the community in a given year in terms of expected losses in today’s dollars.

The following table shows the annual estimate for structural and property loss in today’s dollars.

**Figure 3.129: Total Annual Loss Estimate for Properties and Structures**

Hazard	Rural Ringgold County	Benton	Diagonal	Ellston	Kellerton	Maloy	Mount Ayr	Tingley	Diagonal School	Mount Ayr Schools
Animal/plant/crop disease	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Dam/levee failure	\$30 K	--	\$5,000	--	--	--	\$5,000	--	--	--
Drought	\$50 K	\$1,000	\$2,000	\$1,000	\$2,000	\$1,000	\$5,000	\$250	\$250	\$250
Expansive soils	\$100 K	\$1,000	\$10 K	\$1,000	\$10 K	\$1,000	\$50 K	\$2,000	\$1,000	\$1,000
Extreme heat	\$10 K	\$500	\$2,500	\$500	\$2,500	\$500	\$20 K	\$1,000	\$500	\$500
Flash flood	\$500 K	\$2,000	\$25 K	\$2,000	\$15 K	\$2,000	\$100 K	\$4,000	\$2,000	\$2,000
Grass and wildland fire	\$200 K	\$100	\$500	\$100	\$500	\$100	\$2,000	\$150	\$100	--
Hazardous materials incident	\$250 K	\$2,000	\$25 K	\$2,000	\$15 K	\$2,000	\$50 K	\$4,000	\$1,000	\$2,500
Human disease	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Infrastructure failure	\$500 K	\$2,000	\$10 K	\$2,000	\$10 K	\$2,000	\$100 K	\$4,000	\$1,000	\$2,000
River flood	\$4 M	\$5,000	\$10,000	--	--	\$10 K	\$10,000	--	--	--
Severe winter storm	\$500 K	\$5,000	\$25 K	\$5,000	\$25 K	\$5,000	\$150 K	\$15 K	\$5,000	\$5,000
Terrorism	\$25 K	\$5,000	\$15 K	\$5,000	\$10 K	\$5,000	\$50 K	\$10 K	\$5,000	\$10 K
Thunderstorm/Lightning/Hail	\$300 K	\$2,500	\$25 K	\$2,500	\$25 K	\$2,500	\$150 K	\$7,500	\$2,500	\$5,000
Tornado/Windstorm	\$2.5 M	\$50 K	\$250 K	\$50 K	\$200 K	\$50 K	\$2 M	\$125 K	\$75 K	\$500 K
Transportation incident	\$100 K	\$2,500	\$5,000	\$2,500	\$5,000	\$2,500	\$15 K	\$3,000	\$2,500	\$2,500
<b>Totals</b>	<b>\$9.1 M</b>	<b>\$79 K</b>	<b>\$410 K</b>	<b>\$74 K</b>	<b>\$320 K</b>	<b>\$84 K</b>	<b>\$2.7 M</b>	<b>\$176 K</b>	<b>\$96 K</b>	<b>\$531 K</b>

-- Hazard has no direct effect on this jurisdiction.

The total estimated annual physical property/structural loss due to the above hazards is \$13,540,300.

The following table shows the annual estimate for contents and functional use loss in today’s dollars.

**Figure 3.130: Total Annual Loss Estimate for Contents and Functional Use**

Hazard	Rural Ringgold County	Benton	Diagonal	Ellston	Kellerton	Maloy	Mount Ayr	Tingley	Diagonal School	Mount Ayr Schools
Animal/plant/crop disease	\$400 K	\$2,000	\$5,000	\$2,000	\$1,000	\$2,000	\$5,000	\$2,000	\$2,000	\$2,000
Dam/levee failure	\$25 K	--	\$1,000	--	--	--	\$1,000	--	--	--
Drought	\$5 M	3,000	\$10 K	3,000	\$10 K	3,000	\$750 K	\$7,000	\$1,000	\$1,000
Expansive soils	\$25 K	\$1,000	\$2,500	\$1,000	\$2,500	\$1,000	\$10 K	\$2,000	\$500	\$500
Extreme heat	\$75 K	\$1,000	\$5,000	\$1,000	\$5,000	\$1,000	\$25 K	\$2,500	\$1,000	\$1,000
Flash flood	\$100 K	\$3,000	\$20 K	\$3,000	\$10 K	\$3,000	\$40 K	\$10 K	\$500	\$500
Grass and wildland fire	\$50 K	\$1,500	\$2,500	\$1,500	\$2,500	\$1,500	\$5,000	\$2,500	\$1,000	--
Hazardous materials incident	\$500 K	\$2,500	\$50 K	\$2,500	\$20 K	\$2,500	\$250 K	\$10 K	\$4,000	\$4,000
Human disease	\$100 K	\$10 K	\$35 K	\$10 K	\$35 K	\$10 K	\$250 K	\$25 K	\$50 K	\$50 K
Infrastructure failure	\$1.5 M	\$20 K	\$75 K	\$20 K	\$75 K	\$20 K	\$400 K	\$50 K	\$25 K	\$25 K
River flood	\$1 M	\$100	\$2,500	--	--	\$1,000	\$10 K	--	\$0	\$0
Severe winter storm	\$400 K	\$5,000	\$25 K	\$5,000	\$25 K	\$5,000	\$25 K	\$20 K	\$2,500	\$5,000
Terrorism	\$25 K	\$5,000	\$25 K	\$5,000	\$20 K	\$5,000	\$25 K	\$10 K	\$25 K	\$50 K
Thunderstorm/Lightning/Hail	\$1 M	\$10 K	\$50 K	\$10 K	\$50 K	\$10 K	\$50 K	\$40 K	\$25 K	\$25 K
Tornado/Windstorm	\$1 M	\$10 K	\$50 K	\$10 K	\$50 K	\$10 K	\$50 K	\$40 K	\$30 K	\$50 K
Transportation incident	\$100 K	\$500	\$1,500	\$500	\$1,500	\$500	\$1,500	\$1,000	\$2,500	\$2,500
<b>Totals</b>	<b>\$11.3 M</b>	<b>\$75 K</b>	<b>\$360 K</b>	<b>\$75 K</b>	<b>\$308 K</b>	<b>\$76 K</b>	<b>\$1.9 M</b>	<b>\$222 K</b>	<b>\$170 K</b>	<b>\$217 K</b>

-- Hazard has no direct effect on this jurisdiction.

The total estimated annual contents/functional use loss due to the above hazards is \$14,698,100.

The table on the next page shows annual direct human losses. For human life, the planning team used \$90,000 for the value of a minor injury/sickness, \$1,088,000 for a major injury/sickness, and \$5.8 million for a fatality, based on FEMA BCA values.

**Figure 3.131: Total Annual Loss Estimate for Fatalities and Injuries**

Hazard	Rural Ringgold County	Benton	Diagonal	Ellston	Kellerton	Maloy	Mount Ayr	Tingley	Diagonal School	Mount Ayr Schools
Animal/plant/crop disease	\$90 K	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Dam/levee failure	\$80 K	--	\$10 K	--	--	--	\$10 K	--	--	--
Drought	\$500 K	\$3,000	\$25 K	\$3,000	\$25 K	\$3,000	\$100 K	\$10 K	\$1,000	\$1,000
Expansive soils	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000
Extreme heat	\$2 M	\$25 K	\$250 K	\$25 K	\$200 K	\$50 K	\$750 K	\$30 K	\$90 K	\$180 K
Flash flood	\$1 M	\$3,000	\$25 K	\$3,000	\$25 K	\$3,000	\$200 K	\$25 K	\$10 K	\$10 K
Grass and wildland fire	\$250 K	\$1,500	\$10 K	\$1,500	\$10 K	\$1,500	\$20 K	\$2,500	\$1,000	--
Hazardous materials incident	\$1 M	\$2,500	\$100 K	\$2,500	\$50 K	\$2,500	\$1 M	\$25 K	\$50 K	\$50 K
Human disease	\$10 M	\$10 K	\$1 M	\$10 K	\$1 M	\$10 K	\$5 M	\$1 M	\$1 M	\$2 M
Infrastructure failure	\$1 M	\$20 K	\$150 K	\$20 K	\$150 K	\$20 K	\$500 K	\$100 K	\$5,000	\$5,000
River flood	\$90 K	\$100	\$100	--	--	\$100	\$100	--	--	--
Severe winter storm	\$4 M	\$50 K	\$500 K	\$50 K	\$500 K	\$50 K	\$2 M	\$50 K	\$90 K	\$180 K
Terrorism	\$250 K	\$5,000	\$100 K	\$5,000	\$100 K	\$5,000	\$500 K	\$50 K	\$250 K	\$500 K
Thunderstorm/Lightning/Hail	\$50 K	\$10 K	\$7,000	\$10 K	\$7,000	\$10 K	\$30 K	\$5,000	\$2,000	\$2,500
Tornado/Windstorm	\$1 M	\$10 K	\$200 K	\$10 K	\$200 K	\$10 K	\$1 M	\$150 K	\$125 K	\$250 K
Transportation incident	\$6 M	\$500	\$200 K	\$500	\$200 K	\$500	\$750 K	\$150 K	\$75 K	\$150 K
<b>Totals</b>	<b>\$27.3 M</b>	<b>\$142 K</b>	<b>\$2.6 K</b>	<b>\$142 K</b>	<b>\$2.5 K</b>	<b>\$167 K</b>	<b>\$11.9 M</b>	<b>\$1.6 K</b>	<b>\$1.7 K</b>	<b>\$3.3 K</b>

-- Hazard has no direct effect on this jurisdiction.

The total estimated annual human loss due to the above hazards is \$51,295,900.

The total loss in the planning area per year is \$79,534,300. Of this total estimated annualized loss, two-thirds is human loss. Approximately half the overall loss will occur in the rural unincorporated area. The hazards with the greatest overall loss (over \$5 million) in the planning area are as follows:

- Human disease: \$21,605,000
- Tornado/windstorm: \$10,055,000
- Severe winter storm: \$8,727,500
- Transportation incident: \$7,779,000
- Drought: \$6,521,750
- River flood: \$5,139,000

Those with the least overall annual losses include dam failure and expansive soils, each of which total under \$520,000 per year.

These results vary wildly from the 2013 Iowa Hazard Mitigation Plan. This can be for many reasons: 1) the loss estimation process is quite different, 2) the data used is quite different, and 3) the way that hazards are categorized can be quite different. The Ringgold County process looked more at the value of fatalities and injuries, which greatly changed the rank and value of losses. Further, only 8 hazards were itemized in the State plan, and they are not the same as Ringgold County’s list. The State plan’s annual total losses for Ringgold County is \$18.096 million, of which nearly half is flood loss (\$8,973 million, not broken down by river vs. flash flood). Drought is the only other hazard in the State plan that even approaches \$1 million (\$7.822 million).

See the individual hazard profiles to read more detailed information about hazard losses by type of structure, infrastructure, and other types of losses and how future development may affect the future losses for each hazard.

The above loss tables are not for insurance purposes or detailed planning and budgeting. At best, the tables should be used for comparison purposes when developing goals and objectives. Losses that cannot be included in such tables are considerations such as emotional anguish, losses of records and unique items, losses to pristine forests, water quality deterioration, and pollution creation. For many hazards a large area is at risk, but damage to any property will be very limited, and hazard effects would be mostly economic and operational. Items like water and sewer systems may or

may not be damaged by an event, and it may be difficult to determine whether the deterioration of underground systems is due simply to age or from hazard events over the years.

**Description of the Nature of Vulnerability to Key Hazards**

This final section categorized, as much as possible, the effects the profiled hazards have on the physical planning area. It is important to understand the nature of vulnerability that considers the impact of hazards in terms of *how* they affect the community most. While each hazard can cause damage to the planning area, the risks vary greatly by hazard. While any hazard event can impact a number of asset types, the overall risk is higher in some categories than in others. The following table provides a summary of the relative nature of hazard risk among six categories. The purpose of this table is to illustrate how assets are at risk. This gives the reader an idea that, while one hazard might destroy more property than another, the overall impact of any hazard is significant when we consider sometimes overlooked impacts. This helps fulfill the “overall summary of each hazard and its impact on the community” requirement of Section 201.6(c)(2)(ii) of the Stafford Act.

**Figure 3.132: Description of Overall Vulnerability by Hazard**

<b>Hazards (<i>natural italicized</i>)</b>	<b>Jurisdictions Affected</b>	<b>Areas at Risk</b>	<b>People</b>	<b>Structures</b>	<b>Land, Resources</b>	<b>Economic</b>	<b>Personal Property</b>	<b>Intangible, Quality of Life*</b>
<i>Animal/plant/crop disease</i>	All	Anywhere where there are animals, crops, and plants				1	2	3
Dam/levee failure	Rural, Diagonal, Mount Ayr	The impoundment itself and several miles downstream		1	2			3
<i>Drought</i>	All	Widespread/anywhere			2	1	3	
<i>Expansive soils</i>	All	Most areas of the county, but depends on soil type		1		3	2	
<i>Extreme heat</i>	All	Widespread/anywhere	1	3		2		
<i>Flash flood</i>	All	Widespread, but depends on topography and surface conditions	3	1	2			
<i>Grass and wildland fire</i>	Mainly rural, not Mt. Ayr Schools	On or near un-managed vegetation, crop, wildland areas; interface areas		3	1	2		
Hazardous materials incident	All	1,000 feet of fixed sites and transportation routes	1	2		3		
<i>Human disease</i>	All	Anywhere where people are found, particularly highly concentrated areas	1			3		2
Infrastructure failure	All	Widespread, anywhere where infrastructure is found	2	1		3		
<i>River flood</i>	Rural, Benton, Diagonal, Malay, Mt. Ayr	Within identified flood hazard areas and unmapped areas identified as flood prone		2	1	3		
<i>Severe winter storm</i>	All	Widespread/anywhere	2	3		1		
Terrorism	All	Anywhere where people can access with a weapon, primarily developed areas	1	2				3
<i>Thunderstorm/lightning/hail</i>	All	Widespread/anywhere	2	1		3		
<i>Tornado/windstorm</i>	All jurisdictions	Widespread/anywhere	1	2			3	
Transportation incident	All jurisdictions	Widespread/anywhere (air), on or near transportation routes (others)	1	3			2	

\* Intangibles are things of intrinsic value: vital/financial records, emotional loss, personal financial loss, fear and intimidation, reputation, etc.

The planning team assessed the risks caused by 16 hazards in the planning area. Many of these hazards have acceptable levels of risk or are already being mitigated using current mitigation measures. However, each jurisdiction used the results from this chapter to select several “Priority I” hazards that will be the focus of a five-year mitigation strategy, outlined in the next chapter. For this remainder of this plan, only Priority I hazards, as selected by each jurisdiction, will be considered. Other hazards, while causing harm to the planning area, are not the focus of the strategy.

In conclusion, it is important to remember that specific assets will be affected by specific hazards depending on factors the type of building materials, roofing, size of site, elevation, soils on which asset is located, slopes, quality of

construction, topography, and location related to hazard zones (for fires, floods, etc.). This data is not always readily available, nor can it be analyzed easily, and it is not often needed for the level of planning performed here. What is presented is a basis for prioritizing mitigation actions and ensuring they make sense with the data available. More detailed analysis is necessary for specific mitigation projects involving specific infrastructure. This being said, Ringgold County has extensive assets that can be impacted by many different hazards, and the remaining part of this plan should be focused on addressing those assets at direct risk due to the hazards that cause the most harm.

### ***Risk Assessment Problem/Issue Statements***

After researching and scoring the hazards and presenting findings to the planning team at the fifth committee meeting, information was gathered to provide summary statements as to the risk for each hazard in the plan. The following statements lead to the development of goal statements in the next chapter. Only hazards identified as Priority I hazards for at least one jurisdiction are included in this statement. Also, there are several statements related to hazards in general.

#### *Issue Statements for All Hazards:*

- The limited resources and lack of capacity for personnel is a continuous concern and always will be in remote parts of rural Iowa, a long way from large quantities of state and federal resources.
- People generally believe that the community is “getting more prepared” for hazards.
- The need exists to continue to improve severe weather awareness. People seem to become too reliant on their cell phones and no longer observe weather conditions. If cell coverage fails during severe weather, people are not ready to know what is going on.
- Committee members feel that there is enough work ethic, care, and resources to address most modest incidents, but the county is wholly unprepared for a catastrophic incident due to the share size and limited availability of financial and staffing resources. Most feel that the local government entities and elected officials work well together, bring their best ideas and talents to policy-making, and are willing to share their unique perspectives.
- Several mentioned that the loss of communications combined with injuries would jeopardize the community. Emergency communications remain a very expensive element to the overall emergency management program, which affects the ability of local jurisdictions to properly mitigate hazards.
- The large and growing senior population presents a disadvantage of concern to the committee when it comes to hazard mitigation because of the greater difficulty to alert them, their reduced mobility, and greater risk of spreading human disease. One committee member mentioned that it can be difficult to get the older generation to try new things that can reduce risks.
- We have the key assets in place, such as modern utilities, a modern hospital, and modern emergency services, but keeping the people to serve in these roles in rural areas is very difficult. Keeping training current is a concern for committee members.
- Groups like SICOG can provide valuable help with grant applications for mitigation projects, but obtaining state and federal assistance can be difficult because the programs and funding streams constantly change.
- The lack of funding at the state and federal level in the past few years diminishes the incentive to continue this level of future hazard mitigation planning.
- Iowa’s evolving efforts to address mental health presents concern for at least one of the schools, as it is revealed that some school shootings (terrorism) are perpetrated by those suffering from mental health issues.

#### *Issue Statements for Extreme Heat:*

- Mount Ayr rated extreme heat as a Priority I hazard, but the hazard is a concern to all jurisdictions in the county.
- Annual loss due to extreme heat is in the middle of the range for the various hazards (just over \$3.7 million). Human loss is the highest loss category with an average of \$3.6 million per year.
- More than most other hazards, 35% of online survey participants stated that they were “very concerned” with extreme heat.
- The aging population and high rate of obesity in the county are specific and unique concerns. Many older homes are not properly weatherized to protect people from extreme heat or to allow for appropriate ventilation. Low income residents do not have access to air conditioning.

#### *Issue Statements for Hazardous Materials Incident:*

- Rural Ringgold County and Mount Ayr rated hazardous materials incident as a Priority I hazard.
- Annual loss due to hazardous materials incident is in the middle of the range for the various hazards (just under \$3.0 million). Human loss is the highest loss category with an average of \$2.28 million per year.

- Among online survey respondents, people range equally from unconcerned to very concerned.
- The combination of local industrial producers and users of chemicals, the extensive use of farm chemicals, and the busy Highway 2 truck traffic exacerbate the concerns over this hazard.
- Local capabilities, mainly trained and certified staffing and volunteers, are limited. The County’s contracted professional response team, SIRG of Ottumwa, is a solid two hours driving distance from Ringgold County.
- Traffic detours and evacuations can tax local responder resources to the limit and increase risk of hazards in other areas where detours and new traffic flow.
- Hazardous materials incidents will also cause or worsen water quality issues, which are a considerable local concern.

Issue Statements for Human disease:

- The two schools rated human disease as a Priority I hazard, but the hazard is a concern to all jurisdictions in the county.
- Annual loss due to human disease is by far the most damaging hazard per year in the loss estimation (over \$21 million) due to the threat of multiple fatalities annually.
- Among online survey respondents, people range from unconcerned to very concerned, with more than any others rating it as “somewhat concerned.”
- Local resources are greatly strained because human disease incidents are widespread. It would not be difficult to exceed local resources for months if an incident is severe enough.
- The problem is compounded because often a local outbreak is part of a larger incident such that surrounding counties and the state as a whole are burdened, so that there are no resources from surrounding areas that can help Ringgold County.
- Because of the demographics of the community, the county and especially schools and care facilities are highly vulnerable.
- Tingley’s representative did not rate this is a Priority 1 hazard but did mention that this is a concern to her and others because of the number of seniors that come together for congregate meals in the community and sometimes spread infectious diseases to other vulnerable seniors. A bad flu season could be very detrimental to communities where populations congregate.

Issue Statements for Infrastructure Failure:

- Rural Ringgold County, Mount Ayr, and Benton rated infrastructure failure as a Priority I hazard.
- Annual loss due to infrastructure failure is in the middle of the range for the various hazards (just over \$4.8 million). Contents and functional use is the highest loss category with an average of \$2.21 million per year.
- Among online survey respondents, 35% each give this hazard “somewhat concerned” and “very concerned” ratings.
- The breadth of infrastructure included in this hazard and that so much of the vital infrastructure is exposed to other hazards elevates its importance for mitigation.
- The local and national population and economy are more dependent on reliable and efficient infrastructure than ever before in our connected world.
- Even a few minutes of energy failure can cause casualties in populations of elderly, sick, or others in special care who rely on oxygen and other technology. Few facilities have fixed power generators.
- There is a lack of human resources (staff or volunteers) in event of major event that causes extensive utility/infrastructure damage throughout the county.
- Severe thunderstorms, windstorms, and winter storms damage power lines all over the county nearly every year. An Alliant Energy representative on the committee stated this hazard is a very major concern in all parts of the county because of the exposed power lines. He shared that the company would have difficulty getting enough help to the county to restore power and fix a widespread failure.
- Energy failure slows local emergency response time and affects communications facilities.
- Many buildings are very old and/or lack proper maintenance and are at higher risk of failure or fire.
- Fire departments rely on limited funding and limited numbers of volunteers, many of which are not available when a fire alarm sounds.
- Infrastructure failure will also cause or worsen water quality issues, which are a considerable local concern.
- Benton’s representative states that it has a lot of concern over water supplies for fire protection. SIRWA will not allow local fire departments to tap into their water mains because they are not designed to handle the water flow and the lines will fail.

Issue Statements for River Flood:

- This is considered a Priority I hazard wherever SFHAs exist, because FEMA has a strong interest in implementing the NFIP nationally. These communities include: rural Ringgold County, Benton, Diagonal, Maloy, and Mount Ayr.
- Annual loss due to river flood is in the middle to high end of the range for the various hazards (just over \$5.1 million). Most of the losses are property losses, especially bridges and culverts in rural areas.
- Among online survey respondents, more than half are unconcerned but a high 43% are “moderately concerned.”
- Mount Ayr did not rate flooding issues and dam failure very high but did reflect on the need to improve the Loch Ayr dam just north of town to ensure it does not fail. The loss of recreation and damage downstream is a considerable concern.
- Benton has received FEMA funding for flooding damage, mostly caused by flash flooding on city streets and ditches.
- Maloy experiences damage due to flood-related erosion around a county road bridge embankment.
- Rainfall totals seem to be increasing, so true river flood events are likely to become more common than in the past.
- Adopted regulatory maps are in place, which will make mitigation easier over the next five years.

Issue Statements for Severe Winter Storm:

- Nearly all the jurisdictions rated severe winter storm as a Priority I hazard.
- Annual loss due to severe winter storm is the third highest for the various hazards (over \$8.72 million). Human loss is the highest loss category with an average of \$7.47 million per year.
- Among online survey respondents, more than half are “very concerned.”
- Humans are very susceptible to severe winter weather, especially seniors who live in homes that lose power or that go outside when it is slippery and travel on slippery roads.
- Winter weather in general costs local government tens to hundreds of thousands of dollars annually in road clearing and repair costs alone.
- Ringgold County has many homes built before insulation was used. These homes can be very cold and can pose a hazard to infants, elderly, and sick persons. Weatherization programs are available but cannot possibly meet all the need with funding limitations.
- Ice and snow cause many highway transportation incidents in the county each year, some of them fatal.
- Smaller towns and remote rural areas are affected more because of the lack of alternative power sources and emergency services. Emergency services have difficulty traveling and working in severe winter weather.
- Early and late season (April and September) winter weather can cause extensive crop loss.

Issue Statements for Terrorism:

- Mount Ayr Schools rated terrorism as a Priority I hazard, and a few others commented on chemical terrorism risks.
- Annual loss due to terrorism is in the lower end of the range for the various hazards (\$2.1 million). Human loss is the highest loss category with an average of \$1.76 million per year.
- Among online survey respondents, roughly equal numbers are concerned and unconcerned about this hazard.
- This hazard is very difficult to mitigate at the local level and minimal efforts have been attempted. More attention, it is believed, is necessary, but it will require hard work among multiple agencies.
- Schools as a whole are the most susceptible jurisdictions, but local government and larger business facilities are also more likely targets. Computer systems can be attacked randomly.
- Incidents in Ringgold County are likely to be limited to relatively simple or small domestic terrorism incidents, such as bomb threats, suspicious powders, and pipe bombs in mailboxes, but fear and economic impact of such events could be significant.
- Some jurisdictions mentioned a concern over chemical attacks, but only Mount Ayr Schools was specific about potential new mitigation actions.

Issue Statements for Thunderstorm/Lighting/Hail:

- Maloy, Tingley, and Diagonal School rated thunderstorm/lighting/hail as a Priority I hazard.

- Annual loss due to thunderstorm/lightning/hail is in the lower range of the range for the various hazards (over \$1.92 million). Contents and structural use value loss is the highest loss category with an average of \$1.27 million per year.
- Among online survey respondents, more than half are “very concerned.”
- One committee mentioned that climate change issues will continue to spawn more damaging severe storms with more large hail and dangerous lightning as well as excessive downpours.
- In an increasingly wired society, the risks of energy and communications failure due to lightning continue to increase. More and more equipment, towers, and utility lines are exposed to lightning, hail, and high winds.

Issue Statements for Tornado/Windstorm:

- All the jurisdictions rated tornado/windstorm as a Priority I hazard.
- Annual loss due to tornado/windstorm is second highest for the various hazards (over \$10.0 million). Structural/physical/property loss is the highest loss category with an average of \$5.8 million per year.
- Among online survey respondents, more than 65% are “very concerned.” This hazard received the strongest level of concern of all hazards in the online survey.
- Several committee members answered that the one issue that would get the planning area in “big trouble” is an EF-4 or EF-5 tornado.
- Diagonal reports that its biggest concern is tornado safety at Fogle Lake, where a warning siren and shelter or safe room is needed.
- Two safe rooms exist in the county, both in Mount Ayr. While there are other sturdy buildings, and most homes have basements and/or cellars, few properties are designed to protect people from large tornados that can exist. Most homes are aging no longer sturdy. Rural areas and smaller towns are not as well served.
- Planning team members continue to point to the seemingly increasing intensity and frequency of severe weather, including tornadoes and high wind events.
- Several tornadoes of all sizes have impacted rural parts of the county.

Issue Statements for Transportation Incidents:

- Rural Ringgold County, Mount Ayr, and Diagonal School rated transportation incident as a Priority I hazard.
- Annual loss due to transportation incident is in the upper end of the range for the various hazards (over \$7.7 million). Human loss (injury and fatality) is the highest loss category with an average of nearly \$7.5 million per year.
- Among online survey respondents, the level of concern was generally equally distributed among the level of concern categories.
- Over half of the Ringgold County rural budget is used for road maintenance, repair, and construction. Much of the funds are used for roads, bridges, and culverts.
- Diagonal Schools are interested in this issue because buses much travel on rural roads.
- One of the county supervisors mentioned transportation incidents, especially involving hazardous materials, will become a bigger issue over time because semi-trailer traffic continues to increase in Highway 2.

Certainly, there are risks and problems related to other hazards on the identified hazard list, and some of them are profound. They should not be ignored but rather should be addressed as necessary outside of or incidental to the implementation of this plan. Thankfully, most of the issues caused by other hazards are addressed by other existing plans and mitigation efforts.