

# **2020 Iron County Multi-Jurisdictional Hazard Mitigation Plan**

5 Year Update



Southeast Missouri  
Regional Planning Commission

## CONTRIBUTORS

### Iron County Hazard Mitigation Planning Committee

#### Jurisdictional Representatives

Name	Title	Department	Jurisdiction/Agency/Organization
Jim Scaggs	Presiding Commissioner	County Commission	Iron County
Bob Lourwood	Mayor	City Administration	Ironton
Johnny Matthews	Chief	Police Dept	Ironton
John Tevis	Street Supervisor	Public Works	Ironton
Judd Marquis	Superintendent	School Administration	Belleview R-3

#### Stakeholder Representatives

Name	Title	Department	Agency/Organization
Heidi Wharton	Administrator	Administration	Iron County Health Dept.
Johnny Matthews	Chief	Police Department	Ironton
Capt. Jeffrey Vitale	Commanding Officer	Administration	MSHP Region E
John Singleton	CEO	Administration	Black River Electric Cooperative
Steve Besemer	Mitigation Planner	Mitigation	Missouri State Emergency Management Agency
Jackson Bostic	Director	Southeast Regional Office	Missouri Department of Natural Resources
Leslie Sebaugh	Coordinator	Regional Homeland Security Oversight Committee	SEMO Regional Planning Commission
Chris Harmon	Regional Disaster and Program Officer	Regional Response	American Red Cross - Eastern Missouri Chapter
Brian Okenfuss	Area Engineer	Engineering	Missouri Department of Transportation

Stakeholders are individuals or groups that are affected by a mitigation action or policy and include businesses, private organizations, and citizens. Unlike planning team members, stakeholders may not be

involved in all stages of the planning process, but they inform the planning team on a specific topic or provide input from different points of view in the community.

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## EXECUTIVE SUMMARY

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The purpose of hazard mitigation is to reduce or eliminate long-term risk to people and property from hazards. Iron County and participating jurisdictions and school/special districts developed this multi-jurisdictional local hazard mitigation plan update to reduce future losses from hazard events to the County and its communities and school/special districts. The plan is an update of a plan that was approved on January 24, 2014. The plan and the update were prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 to result in eligibility for the Federal Emergency Management Agency (FEMA) Hazard Mitigation Assistance Grant Programs.

The County Multi-Hazard Mitigation Plan is a multi-jurisdictional plan that covers the following three (3) jurisdictions that participated in the planning process:

- Unincorporated Iron County
- City of Ironton
- Belleview R-III School District

The other incorporated communities and public school districts in the county were invited to participate in the planning process, but did not meet all of the established requirements for official participation. When the future five-year update is developed for this plan, these jurisdictions will be invited again to participate.

Iron County and the entities listed above developed a Multi-Jurisdictional Hazard Mitigation Plan that was approved by FEMA on January 24, 2014 (hereafter referred to as the *2014 Hazard Mitigation Plan*). This current planning effort serves to update that previously approved plan.

The plan update process followed a methodology prescribed by FEMA, which began with the formation of a Hazard Mitigation Planning Committee (HMPC) comprised of representatives from Iron County and participating jurisdictions. The HMPC updated the risk assessment that identified and profiled hazards that pose a risk to Iron County and analyzed jurisdictional vulnerability to these hazards. The HMPC also examined the capabilities in place to mitigate the hazard damages, with emphasis on changes that have occurred since the previously approved plan was adopted. The HMPC determined that the planning area is vulnerable to several hazards that are identified, profiled, and analyzed in this plan. Riverine and flash flooding, winter storms, severe thunderstorms/hail/lightning/high winds, and tornadoes are among the hazards that historically have had a significant impact.

Based upon the risk assessment, the HMPC kept the goals from the previous plan for reducing risk from hazards. The goals are listed below:

1. Protect the health, safety, and welfare of residents and students.
2. Ensure the operation of critical facilities and services.
3. Protect public and private property.
4. Enhance informed decision making of mitigation actions.

To advance the identified goals, the HMPC developed recommended mitigation actions, which are detailed in Chapter 4 of this plan. The HMPC developed an implementation plan for each action, which identifies priority level, background information, ideas for implementation, responsible agency, timeline, cost estimate, potential funding sources, and more.

## **PREREQUISITES**

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This plan has been reviewed by and adopted with resolutions or other documentation of adoption by all participating jurisdictions and schools/special districts. The documentation of each adoption is included in Appendix A, and a model resolution is included on the following page.

The following jurisdictions participated in the development of this plan and have adopted the multi-jurisdictional plan.

- Unincorporated Iron County
- City of Ironton
- Belleview R-III School District

**Model Resolution**

Resolution # \_\_\_\_\_

Adopting the Iron County Multi-Jurisdictional Local Hazard Mitigation Plan

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

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

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

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

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

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

**Whereas**, the Missouri State Emergency Management Agency and the Federal Emergency Management Agency Region VII officials will review the “County A Multi-Jurisdictional Local Hazard Mitigation Plan,” and approved it as to form and content; and

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

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

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

**Now, therefore, be it resolved**, that the (Name of Government/District/Organization) has adopted the “Iron County Multi-Jurisdictional Local Hazard Mitigation Plan” as an official plan.

Date: \_\_\_\_\_

Certifying Official: \_\_\_\_\_



# 1 INTRODUCTION AND PLANNING PROCESS

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## 1.1 Purpose

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The purpose of hazard mitigation is to reduce or eliminate long-term risk to people and property from hazards. Hazard mitigation is generally considered to be the actions taken well in advance of a disaster event. Actions taken immediately prior to or during an event or immediately following an event are typically considered response and recovery actions, respectively. This plan has been developed to assist participating jurisdictions in identifying potential hazard exposures and defining actions that can limit such.

For jurisdictions to be eligible for federal Hazard Mitigation Grants, they must participate in this planning process and adopt the plan by resolution. Any jurisdictions that do not participate will be ineligible for such grants until the next plan update is undertaken. This plan is viable for five (5) years from the date of FEMA approval.

For additional information about the Hazard Mitigation Planning Process, please refer to: the Disaster Mitigation Act of 2000 (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the Federal Register on February 26, 2002, (44 CFR §201.6) and finalized on October 31, 2007 (hereafter referred to collectively as the Disaster Mitigation Act or DMA) and the Robert T. Stafford Disaster Relief and Emergency Act (Public Law 93-288).

## 1.2 Background and Scope

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This hazard mitigation plan (HMP) is an update to the 2014 Iron County HMP which was approved by FEMA on January 24, 2014. This plan is valid for a period of five years and will undergo a full update cycle in 2023.

The following table provides a list of participants during this plan update process as well as the previous one.

**Table 1.1. Plan Participants**

Jurisdiction	NFIP Participant	Participating Jurisdiction (2014)	Participating Jurisdiction Criteria (2017)				Participating Jurisdiction (2018)
			Meetings Attended	Actions Developed	Draft Reviewed	Formal Adoption	
Iron County	Y	X	X	X	X	X	X
Annapolis	Y	X			X		
Arcadia	Y	X					
Des Arc	Y	X					
Ironton	Y	X	X	X	X	X	X
Pilot Knob	Y	X					
Vibrunum	N	X					
Arcadia Valley R-II	N/A	X					
Bellevue R-III	N/A	X	X	X	X	X	X
Iron Co C-4	N/A	X					
South Iron Co R-I	N/A	X					

Information in this plan will be used to help guide and coordinate mitigation activities and decisions for local land use and development policy in the future. Actions from this plan will also be incorporated into local jurisdiction’s other planning efforts as appropriate.

### 1.3 Plan Organization

This HMP is organized into 5 main chapters, along with an executive summary and appendices, as follows:

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

Table 1.2 shows a comparison between this plan’s structure and that of the previous plan, along with a summary of changes in each section from the previous plan.

**Table 1.2. Changes Made in Plan Update**

Changes and Revisions	Current Plan Sections	Previous Plan Sections
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Participants, stakeholders, resolution of adoption	Executive Summary & Prerequisites	Introduction
		Prerequisites
Information on the current planning process, including dates, locations, participants, and meetings	Introduction and Planning Process	The Planning Process
Information on the planning area including demographics, economics, and assets as well as the capabilities of each jurisdiction	Planning Area Profile and Capabilities	Risk Assessment
Information on jurisdictions' exposure to hazards	Risk Assessment	
Jurisdictions' previous, continuing, and new actions as well as the goals and objectives for the plan	Mitigation Strategy	Hazard Mitigation Program
Information on implementation with other plans and the maintenance schedule and responsibilities	Plan Implementation and Maintenance	Plan Maintenance Process
Additional relevant data	Appendices	Appendices

## 1.4 Planning Process

The Southeast Missouri Regional Planning Commission (SEMO RPC) was contracted by SEMA to facilitate the update of the HMP. RPC staff assisted local jurisdictions in the establishment of an HMPC as defined by the DMA and updated the committee on current requirements for the HMP process. Planning staff determined the plan had been maintained in accordance with the methodology set forth in the previous plan through communications with all participating jurisdictions on a yearly basis to assess the need for revisions to the plan, of which there were none. SEMO RPC staff also ensured the updated plan met the DMA requirements as established by federal regulations and that it followed the most current planning guidance of FEMA.

The RPC also facilitated the entire plan development process by identifying the data which HMPC participants should provide and conducting research and documentation necessary to augment such data and by soliciting public input in the planning process. Commission staff also produced the draft and final plan update in a FEMA-approvable document and coordinated plan reviews with both SEMA and FEMA.

**Table 1.3. Jurisdictional Representatives Iron County Mitigation Planning Committee**

<b>Name</b>	<b>Title</b>	<b>Department</b>	<b>Jurisdiction/Agency/Organization</b>
Jim Scaggs	Presiding Commissioner	County Commission	Iron County
Bob Lourwood	Mayor	City Administration	Ironton
Johnny Matthews	Chief	Police Dept	Ironton
John Tevis	Street Supervisor	Public Works	Ironton
Judd Marquis	Superintendent	School Administration	Belleview R-3

### **1.4.1 Multi-Jurisdictional Participation**

Active participation in the hazard mitigation planning process is important to ensure each jurisdiction is adequately represented, that their needs and exposures are properly evaluated, and that their actions are appropriate and effective at addressing those needs and exposures. Representatives from the County, incorporated communities, public schools, and stakeholders were invited to participate in the planning process through certified mail and electronic communications. The DMA requires each jurisdiction to participate in the planning process and officially adopt the plan to be considered an eligible participant.

During its first meeting, the HMPC determined the criteria for being considered an eligible participant in this planning process, as follows:

- Representation (direct or through appointee) at a majority of the public HMPC meetings,
- Actively solicit public input and participation in planning process,
- Review prior plan,
- Complete HMP questionnaire,
- Update jurisdiction’s hazard mitigation actions from previous plan,
- Review and comment on new draft, and
- Adoption of new plan.

Three jurisdictions met all of the participation requirements: Iron County, Ironton, and Belleview R-III School Dist. The remaining incorporated communities and school districts did not meet the participation requirements. These jurisdictions will be invited to participate again in the next plan update process in five (5) years.

For small, rural jurisdictions, participation in planning processes such as these can be difficult. Many rural communities have no full-time staff, and in some cases have only a volunteer clerk. Making committee meetings, completing questionnaires, review previous plans, validating actions, and commenting on drafts are entirely different undertakings for officials who have a full-time day job and a full-time elected position. Additionally, acquiring public input in rural areas

can be challenging as well. Many residents lack adequate access to the internet, do not visit their local library or courthouse on a regular basis, and do not subscribe to other media. Limited resources, less population density, and longer commute times mean word of mouth spreads much more slowly in these areas. These issues make it more difficult for small communities and the rural public to participate in planning processes. RPC staff continues to work with jurisdictions to improve public outreach and engagement practices.

Table 1.4 shows the manner of participation for each participating jurisdiction. Meeting sign-in sheets can be found in the appendix. The non-participating jurisdictions stated they did not see the value in participating in the planning process given they had no ability to match any FEMA mitigation grants and would therefore not be applying. Planning staff stressed the value of hazard mitigation planning goes far beyond the opportunity to apply for grants, but these jurisdictions did not feel there was enough value. Planning staff will continue to work with the jurisdictions in question over the next five years to develop a greater understanding and appreciation for the comprehensive benefits of hazard mitigation planning.

**Table 1.4. Jurisdictional Participation in Planning Process**

Jurisdiction	Kick-off Meeting	Meeting #2	Data Collection Questionnaire Response	Update/Develop Mitigation Actions
Iron County	X	X	X	X
Ironton	X	X	X	X
Belleview R-III School Dist.	X	X	X	X

### 1.4.2 The Planning Steps

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

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

Into this process, SEMO RPC integrated a detailed 10-step planning process adapted from FEMA's Community Rating System (CRS) and Flood Mitigation Assistance programs. Thus, the process used for this plan meets the funding eligibility requirements of the Hazard Mitigation Grant Program, Pre-Disaster Mitigation Program, Community Rating System, and Flood Mitigation Assistance Program. Table 1.5 shows how this process fits into FEMA's original four-phase DMA process as well as the revised Nine Task Process outlined in the 2013 *Local Mitigation Planning Handbook* and the 10-step CRS process.

**Table 1.5. County Mitigation Plan Update Process**

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

**Phase I**

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

The planning process resulting in the preparation of this plan document officially began with Meeting #1 in Ironton, MO on January 8, 2018. Participants of the meeting included representatives from all three participating jurisdictions and RPC staff. The purpose of this meeting was to set planning meeting dates, determine hazards to be included in the plan update, discuss options for the flood risk assessment methodology, develop an initial public participation strategy, and discuss the plan update format. Meeting materials are included in the appendix. An HMPC was created that includes representatives from each participating jurisdiction.

After the initial meeting, a second planning meeting was held on February 12, 2018. A complete list of all representatives of the agencies and organizations that participated on the Iron County HMPC is provided in the appendix.

The HMPC communicated during the planning process with a combination of face-to-face meetings, phone interviews, and email correspondence. The meeting schedule and topics are listed in Table 1.6.

**Table 1.6. Schedule of HMPC Meetings**

Meeting	Topic	Date
Planning Meeting #1	General overview of planning process, requirements, and schedule. Introduction to DMA, hazard identification, and public input strategy. Distribution of data collection guide to jurisdictions. Preliminary hazard rankings. Determine process to monitor, evaluate, and update plan.	January 8, 2018
Planning Meeting #2	Review of draft Risk Assessment, distribution of critical facility inventories for jurisdictions to validate/correct, development of plan goals. Mitigation action update, development, and prioritization.	February 12, 2018

During the meetings, SEMO RPC presented information on the scope and purpose of the plan, participation requirements of HMPC members, and the proposed project work plan and schedule. Plans for public involvement (Step 2) and coordination with other agencies and departments (Step 3) were discussed. SEMO RPC also introduced hazard identification requirements and data needs. The HMPC discussed potential hazards as well as past events and impacts and refined the identified hazards relevant to the County. The HMPC made preliminary determinations of probability and magnitude for each hazard identified.

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

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

At the kickoff meeting, the HMPC discussed options for soliciting public input on the mitigation plan. To provide an opportunity for the public to comment during the drafting stage, the committee determined the most effective method would be to invite the public to the HMPC meetings to gather direct input.

The public was also given an opportunity to provide input on a draft of the complete plan prior to its submittal to the State and FEMA. The entire plan draft was made available on the RPC's website as a PDF document. In addition, two hard copies were made available; one at the Health Department and the other at the County Courthouse. The County and RPC announced the availability of the entire final draft plan and the two-week final public comment period on their websites. The final public comment period was from June 1-June 15, 2018.

The HMPC invited other targeted stakeholders to comment on the draft plan via e-mail, and phone conversations, which are described in greater detail in Step 3: Coordinate with Other Departments and Agencies. Minor comments were received and incorporated.

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

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### ***Incorporate Existing Information (Handbook Task 3)***

There are numerous organizations whose goals and interests interface with hazard mitigation in Iron County. Coordination with these organizations and other community planning efforts is vital to the success of this plan. The County invited neighboring counties, other local, state, and federal departments and agencies to the planning meetings to learn about the hazard mitigation planning initiative. In addition, the HMPC developed a list of additional stakeholders involved in hazard mitigation activities, to invite to review and comment on the draft of the Iron County Multi-jurisdictional Hazard Mitigation Plan prior to submittal to the State and FEMA. Those agencies invited to meetings and/or comment on the plan draft included emergency management officials of adjacent counties, the Iron County Economic Partnership, and various state agencies such as the Department of Natural Resources and MoDOT.

#### **Coordination with FEMA Risk MAP Project**

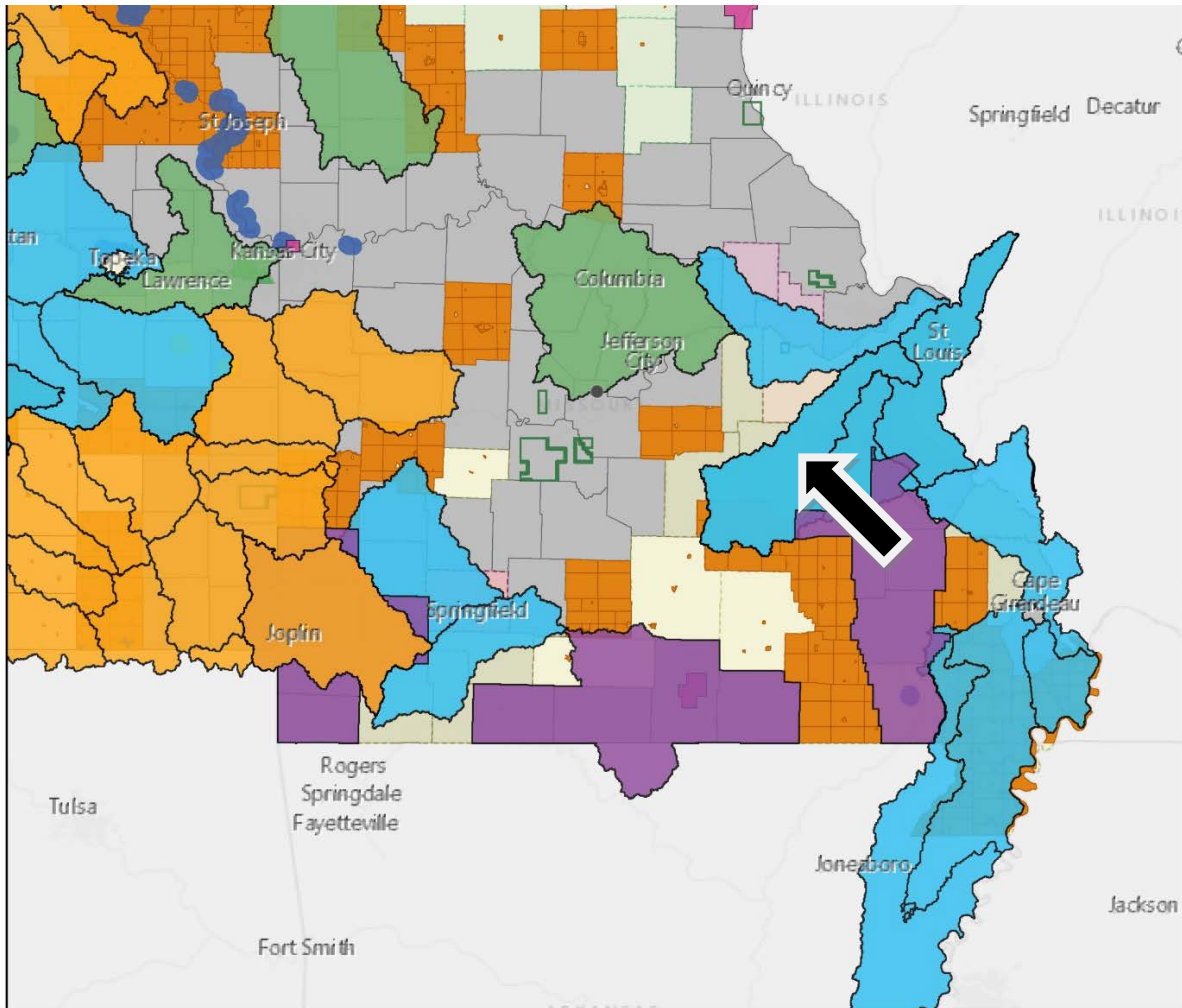
Iron County is designated as “Effective FIS/FIRM” for the Risk MAP project. Risk Mapping, Assessment, and Planning (Risk MAP) is the Federal Emergency Management Agency (FEMA) Program that provides communities with flood information and tools they can use to enhance their mitigation plans and take action to better protect their citizens.

Through collaboration with State, Tribal, and local entities, Risk MAP delivers quality data that increases public awareness and leads to action that reduces risk to life and property. This data is available for only a small portion of the County, though work is underway as the county falls into the Data Development Category. Figure 1.1 Risk MAP Status Map shows the status of regional counties.

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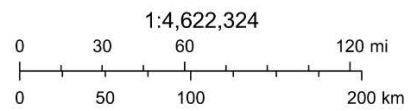
**Figure 1.1. RiskMAP Status Map (August 16, 2017)**





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- Watershed Projects - Automated Engineering
- Watershed Projects - Ongoing: Discovery
- Watershed Projects - Ongoing: Data Development
- Watershed Projects - Flood Risk Products Available
- Watershed Projects - On-Hold



Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

## Integration of Other Data, Reports, Studies, and Plans

In addition, input was solicited from many other agencies and organizations that provided information but were not able to attend planning meetings. As part of the coordination with other agencies, the HMPC collected and reviewed existing technical data, reports, and plans. These included:

- Missouri Hazard Mitigation Plan,
- Iron County Hazard Mitigation Plan (2014),
- National Flood Insurance Program’s Community Information System Reports,
- Digital Flood Insurance Rate Maps,
- DNR Dam and Reservoir Safety Program,

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- DNR Sinkhole Location Data,
  - MO Land Use Land Cover Data,
  - National Fire Incident Reporting System Fire Incident Data,
  - Various local plans such as Comprehensive Plans, Economic Development Plans, Emergency Operations Plans, Capital Improvement Plans, etc.

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

## ***Phase 2: Assess Risk (Handbook Task 5)***

### ***Step 4: Assess the Hazard: Identify and Profile Hazards***

SEMO RPC assisted the HMPC in a process to identify the hazards that have impacted or could impact communities in the County. At the first meeting, the HMPC examined the history of disaster declarations in Iron County, the list of hazards considered in the 2013 Missouri State Hazard Mitigation Plan, and the hazards identified in the previous hazard mitigation plan. The committee then worked through this list of all potential hazards that could affect the planning area. They discussed past hazard events, types of damage, and where additional information might be found. The committee identified 11 natural hazards that have the potential to impact the planning area. Additional information on the hazard identification process and which hazards were identified for each jurisdiction is provided in Chapter 3.

During the kick-off meeting, the HMPC refined the list of hazards to make the analysis relevant to Iron County, discussed past events and impacts and came to consensus on the preliminary probability and magnitude on a county-wide basis. In addition, each jurisdiction completed a Data Collection Guide, including information on previous hazard events in their community. Utilizing the information from the Data Collection Guides as well as existing plans, studies, reports, and technical information as well as information available through internet research and GIS analysis, a profile was developed for each hazard identified. More information on the methodology and resources used to identify and profile the hazards can be found in Chapter 3.

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

Assets for each jurisdiction were identified through a combination of several resources. A listing of critical facilities in each jurisdiction from the previous HMP was presented at Meeting #2 for correction and validation. Once the critical/essential facility lists were validated, they were geo-located to create a consolidated GIS layer of these facilities to be used in additional risk analysis. Methodologies and results of the analyses are provided in Chapter 3.

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

The HMPC also analyzed development trends from data available from the U.S. Census Bureau as well as information obtained from each jurisdiction such as Comprehensive Plans and Future Development Plans. For each hazard, there is a discussion regarding future development and how it may impact vulnerability to that specific hazard.

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After profiling the hazards that could affect the County and identifying assets, the HMPC collected information to describe the likely impacts of future hazard events on the participating jurisdictions.

Existing mitigation capabilities were also considered in developing loss estimates. This assessment consisted of identifying the existing mitigation capabilities of participating jurisdictions. This involved collecting information about existing government programs, policies, regulations, ordinances, and plans that mitigate or could be used to mitigate risk from hazards. Participating jurisdictions collected information on their regulatory, personnel, fiscal, and technical capabilities, as well as previous and ongoing mitigation initiatives. This information is included in Chapter 2 Planning Area Profile and Capabilities.

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

Taking into consideration the vulnerability and capability assessments, and where sufficient information was available, a variety of methods were used to estimate losses for each profiled hazard. For geographic hazards such as river flooding and wild fire, specific assets at risk and loss estimates were determined through GIS analysis. For other hazards such as weather-related hazards, loss estimates were developed based on statistical analysis of historic events and HMPC input. For dam and levee failure, GIS data was not available to identify specific geographic boundaries at risk. Therefore, the risk assessment is based on aerial photography analysis of development within an estimated hazard area. The methodologies for each loss estimate are described in detail in Chapter 3. Within each hazard section, the text provides details on how the hazard varies by jurisdiction, where applicable. In addition, at the conclusion of each hazard section, a summary table indicates the specific probability and magnitude of the hazard for each jurisdiction to show how the hazard varies. Where applicable, introductory text preceding the table highlights noted variables.

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

### ***Phase 3: Develop the Mitigation Plan (Handbook Task 6)***

#### ***Step 6: Set Goals***

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

This planning effort is an update to an existing hazard mitigation plan. As a result, the goals from the previous plan were reviewed. The planning committee decided that the 2014 goals are still valid. The goals for the plan update are provided below.

1. Protect the health, safety, and welfare of residents and students.
2. Ensure the operation of critical facilities and services.
3. Protect public and private property.
4. Enhance informed decision making of mitigation actions.

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### ***Step 7: Review Possible Mitigation Actions and Activities***

One of the focuses of Meeting #2 was to update the mitigation strategy by reviewing existing actions submitted in the previous mitigation plans as well as discuss relevant new actions considered necessary as a result of the updated risk assessment. The development of mitigation actions was facilitated through group discussion of the capabilities and risks of each jurisdiction. Consideration was given to the analysis results provided in the risk assessment and the anticipated success for each project type. Committee members discussed issues such as: availability of funds, prioritization of actions, and feasibility of implementation utilizing the STAPLEE methodology as a guide. Projects relating to emergency response were discussed, but participants were encouraged to focus on long-term mitigation solutions since response-related mitigation actions occur on a routine basis as requirements of other plans. Complex projects that would necessitate use of large numbers of county resources were also discussed. This opportunity to discuss a broad range of mitigation alternatives allowed the jurisdictions to understand the overall priorities of the committee and to allow for discussion of the types of project most beneficial to each jurisdiction. As part of this discussion, consideration was given to the potential cost of each project in relation to the anticipated future cost savings.

Since this plan is an update to the *2014 Hazard Mitigation Plan*, the update of the mitigation strategy included review and update of the status of all actions included in the previous hazard mitigation plan. Jurisdictions were encouraged to maintain a focused approach and continue forward only those actions that are aimed at implementing long-term solutions to prevent losses from hazards. To facilitate the update of previous actions, a spreadsheet was provided to each jurisdiction prior to Meeting #2 with the actions they submitted in the previous mitigation plan. The jurisdictions were also provided instructions for completing the status of each of the previous actions as well as the details to provide for continuing and newly developed actions. A modified form of the STAPLEE prioritization tool was provided to assist jurisdictions in determining the prioritization that should be assigned to each action. Each participating jurisdiction prioritized the projects they submitted by indicating high, moderate, or low local priority. The completed spreadsheets with action details were returned to SEMO RPC. Chapter 4 provides additional details regarding the process undertaken to refine the mitigation strategy to make the County and its jurisdictions more disaster resistant.

### ***Step 8: Draft an Action Plan***

A complete draft of the plan was made available online and in hard copy for review and comment by the public, other agencies and interested stakeholders. This review period was from June 1-June 15, 2018. Methods for inviting interested parties and the public to review and comment on the plan were discussed in Steps 2 and 3, and materials are provided in the appendix. Comments were integrated into a final draft for submittal to SEMA and FEMA.

### ***Step 9: Adopt the Plan (Handbook Task 8)***

To secure buy-in and officially implement the plan, the governing bodies of each participating jurisdiction adopted the plan. Scanned copies of resolutions of adoption are included in the appendix of this plan.

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

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The HMPC developed and agreed upon an overall strategy for plan implementation and for monitoring and maintaining the plan over time during Meeting #1. This strategy is described in Chapter 5, Plan Maintenance Process.

## 2 PLANNING AREA PROFILE AND CAPABILITIES

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<b>2 PLANNING AREA PROFILE AND CAPABILITIES.....</b>	<b>1</b>
<b>2.1 Iron County Planning Area Profile.....</b>	<b>1</b>
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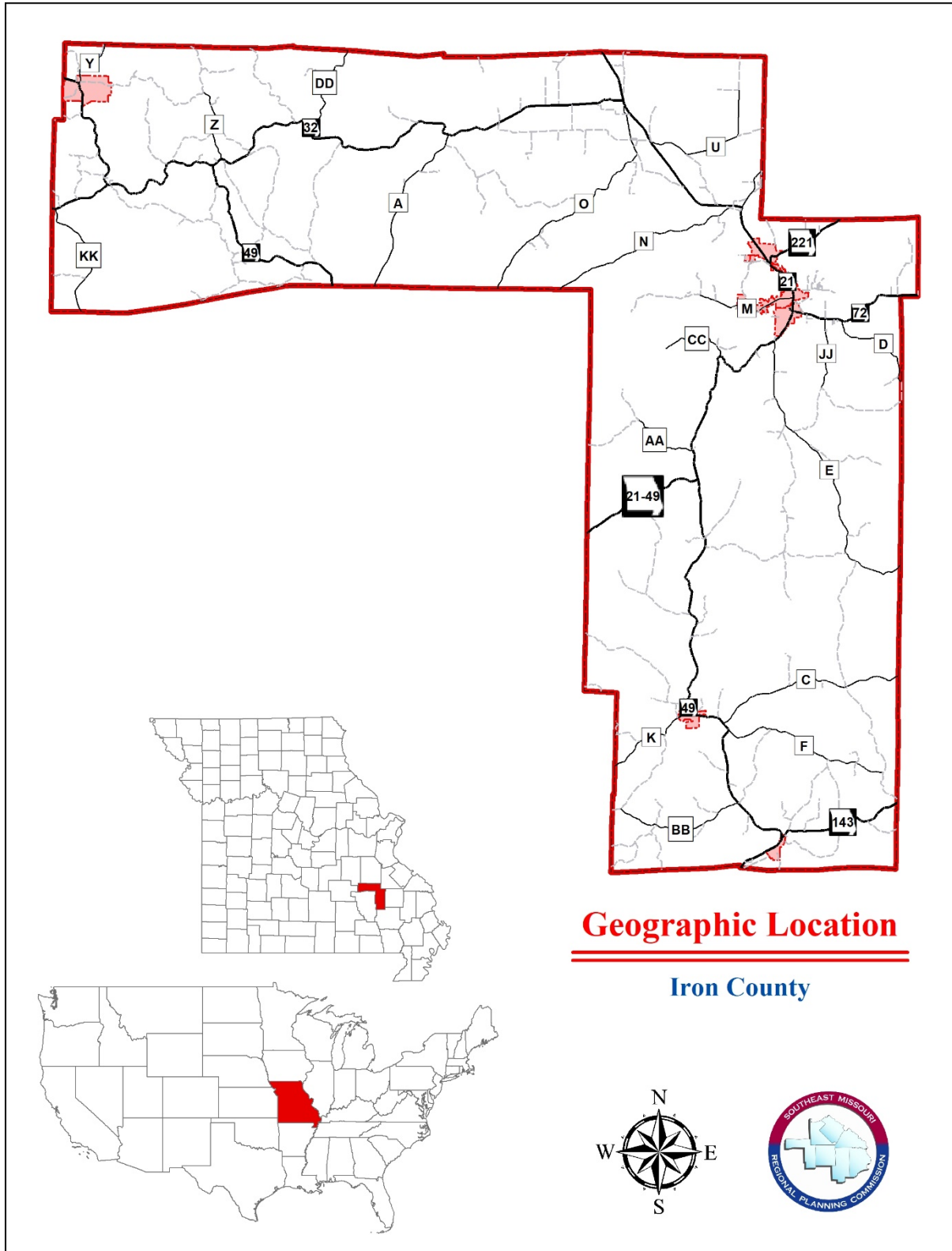
This chapter provides a general profile of Iron County followed by individual sections for each participating jurisdiction. The section for each jurisdiction provide an overview profile as well as details on existing capabilities, plans, and programs that enhance their ability to implement mitigation strategies.

### 2.1 Iron County Planning Area Profile

Figure 2.1 provides a map of the Iron County planning area. The planning area boundaries include all portions of the city limits of the following incorporated cities: Ironton.

As of 2010, the total Iron County population was 10,630, a decline of 0.6% since 2000. The population growth rate was below both the nation's (10%) and the State's (7%). Iron County median household income was \$29,803 in 2010, an increase of 14% over 2000, which is much lower than the national rate of 24% and state rate of 22%. Additionally, the county's 2010 MHI is markedly below that of both the nation and state, \$51,914 and \$46,262 respectively. Iron County median home value in 2015 was \$82,600, up 7% from 2010 census estimates. While median home value is well below state and national amounts (\$138,400 and \$178,600) the rate of growth outpaced both the state's rate of 1% and the nation's of -5%.

Figure 2.1. Geographic Location Map



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## 2.1.2 Geography, Geology and Topography

Iron County lies in the southeast part of the state. The St. Francois Mountains are the dominant topographic feature in the County. The mountains themselves are dominated by rounded knobs and ridges of granite and felsite, which generally have a thin soil cover and many exposures of bedrock.

The County can be broadly divided into five physiographic subregions. The St. Francois Mountains subregion covers most of Iron County. The Arcadia Valley subregion covers the area around the Cities of Arcadia, Ironton, and Pilot Knob. This subregion and the Belleview Valley subregion are two rather large, broad valleys floored with limestone and dolomite. These two valleys provide the best agricultural land in Iron County. The Meramec Hills subregion covers a small section of the County in the northwest. The area drains in a northward direction through the Big River and tributary creeks to the Meramec River. The fifth subregion is the Black River Hills. This subregion covers parts of the northwest and southwest areas of the County.

Local reliefs of 500 to 700 feet are common in the St. Francois Mountains, with many areas having reliefs of over 800 feet. The highest elevations in Missouri are present in Iron County, where a number of hills and ridge tops are above 1,600 feet. The lowest elevations along the northern edge of the division are slightly below 900 feet in the stream valleys and along the eastern edge of the unit, where valley elevations lower than 700 feet are found.

Iron County soils can be classified into three broad general types. The Captina-Clarksville-Doniphan Association is the first of these and covers areas in the western and southern part of the County. Captina soils are moderately well drained and have a fragipan, but they are formed on stream terraces that have slopes of 1% to 12%. They have a silt-loam topsoil and a slowly permeable, silty-clay-loam subsoil overlying a massive, compact, brittle fragipan. Clarksville soils are deep, somewhat extensively drained.

The second association, the Knobtop-Irondale-Delassus-Syenite, occurs in the St. Francois Mountains in Iron County. Knobtop soils have a silt-loam topsoil overlying a silty-clay-loam subsoil. They are found on the ridgetops of mountainous areas where slopes range from 2% to 12%. Irondale soils are found on steep, mountainous slopes and are characterized by a cobbly, silt-loam topsoil overlying a moderately permeable, cobbly, silt-loam subsoil. Slopes where these soils are found range from 15% to 40%. Delassus soils occur on slopes ranging from 2% to 9%. They have a silt-loam topsoil overlying a moderately permeable, silty-clay-loam subsoil. They also have a massive, compact, brittle, loamy fragipan underlying the subsoil. Syenite soils occur on the side slopes of mountainous areas. These soils have a silt-loam topsoil that contains boulders and overlies a silt-loam and light clay-loam subsoil with rock fragments. The slopes on which these soils occur range from 10% to 25%.

The third soil association present in the County is the Crider-Cantwell-Gasconade. This association typically consists of forested, long, moderately sloping to very steep side slopes. It also occurs in small pastures and cultivated land on gently to moderately sloping ridgetops. Crider soils occur on uplands with slopes ranging up to 20%. They consist of a silt-loam topsoil overlying a silty-clay-loam subsoil. Cantwell soils occur on slopes ranging from 2% to 20%. These soils consist of a silt-loam topsoil overlying a silty-clay-loam subsoil. The Gasconade soils are on steep upland slopes of from 2% to 50%. The soils have a flaggy (limestone), clay-loam topsoil over a flaggy, clay subsoil.

The predominate bedrock type in Iron County is dolomite with some limestone, sandstone and shale. This type of bedrock is present in the western and southern half of the county. An area of granite and felsite



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dominates the center of the County.

### 2.1.3 Climate

Because the County is located in the middle section of the United States, it is prone to several kinds of natural hazards. The county has a continental climate, meaning that the weather is changeable and has large variations in temperature and precipitation.

Iron County's climate parallels that of southeast Missouri. In general, the County has hot humid summers and mild to cold winters. Average temperatures fall in the 56° to 58° range. The warmest month is normally July, when average maximum temperatures are around 90° to 92°, and minimum temperatures range in the neighborhood of 62° to 68°. The coldest month is usually January, when maximum temperatures reach an average of only 45° to 46°, and minimum average temperatures run 25° to 28°. Below freezing temperatures usually occur on 80 to 100 days during the year.

Rainfall averages approximately 41 to 43 inches per year, while snowfall averages approximately 13 to 14 inches per year. Springtime and early summer are normally the seasons when much of the rainfall occurs during frequent thunderstorms. This is also the time when flooding normally occurs along the creeks and rivers in the County. On average, 70% to 80% of the annual rainfall occurs during the months from April through September.

### 2.1.4 Population & Demographics

According to the 2010 U.S. Census, the population of Iron County was 10,630, down 0.6 percent from the 2000 population of 10,697. Table 2.1 provides the populations for each city and the unincorporated county for 2000 and 2010 with the number and percent change. The unincorporated areas population was determined by subtracting the populations of the incorporated areas from the overall county population.

---

**Table 2.1. Iron County Population 2000-2010 by Community**

Population				
	2000	2010	Change	% Change
Iron County	10,697	10,630	-67	-0.6%
Ironton	1,471	1,460	-11	-0.7%
Unincorporated County	6,640	6,601	-39	-0.6%
Missouri	5,595,211	5,988,927	393,716	7%
United States	281,421,906	308,745,538	27,323,632	10%

Source: American FactFinder

According to the 2010 census, 6% of the county population is under the age of 5 and 18% is 65 and older. In 2010 there were 4,898 households with an average household size of 2.37 people.

The University of South Carolina developed an index to evaluate and rank the ability to respond to, cope with,

recover from, and adapt to disasters. The index synthesizes 30 socioeconomic variables which research literature suggests contribute to reduction in a community's ability to prepare for, respond to, and recover from hazards. SoVI<sup>®</sup> data sources include primarily those from the United States Census Bureau.

Figure 2.2 shows that Iron County has a Medium-High Social Vulnerability Index when compared to counties nation-wide and state-wide.

**Figure 2.2. Iron County Social Vulnerability Index (SoVI)**

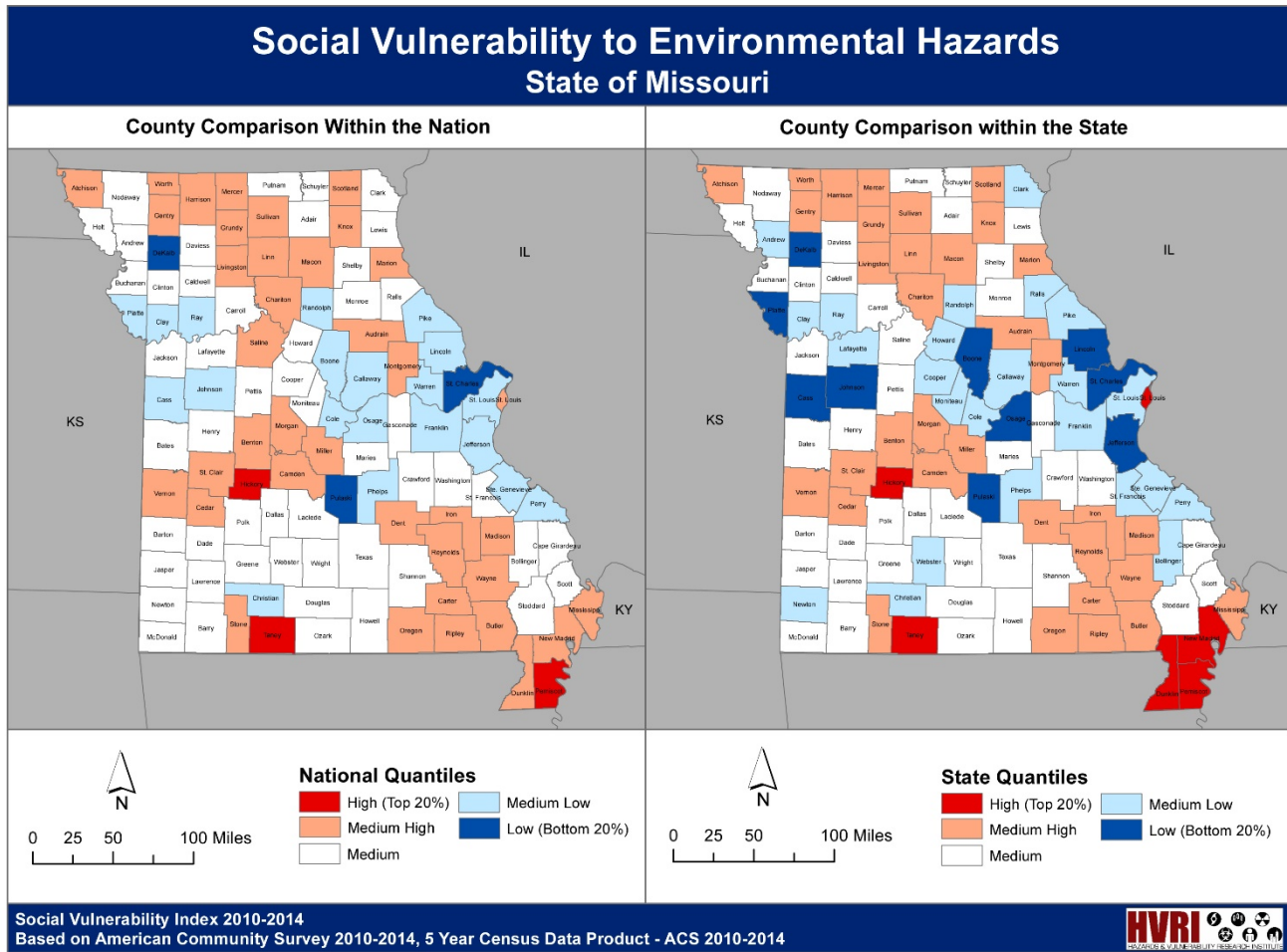


Table 2.2 provides additional demographic and economic indicators for Iron County. The County values are for all the County, including the incorporated cities.

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**Table 2.2. Unemployment, Poverty, Education, and Language Percentage Demographics, 2016**

Jurisdiction	% Labor Force Participation	% of Population Unemployed	% of Families Below the Poverty Level	% of Population (High School graduate)	% of Population (Bachelor's degree or higher)	% of Households (Limited English Proficiency)
Iron County	51.6	10.3	15.4	80.8	11.4	0
Ironton	47.6	8.4	23.2	81.6	15.9	0

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

## 2.1.5 History

Iron County is located in the Lead Belt region of Missouri. Its county seat and largest city is Ironton. The county was officially organized on February 17, 1857 and was named for the significant presence of iron ore in the county. Mining has been a key industry in the county, as well as this area of the state and nation.

## 2.1.6 Occupations

Table 2.3 provides occupation statistics for the participating cities and the entire county.

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**Table 2.3. Occupation Statistics, 2016**

Jurisdiction	Management, business, science, and arts	Service	Sales and office	Natural resources, construction, and maintenance	Production, transportation, and material moving
Iron County	20%	27%	21%	12%	20%
Ironton	24%	31%	19%	10%	16%

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

## 2.1.7 Agriculture

According to the USDA's 2012 Census of Agriculture, Iron County had 273 farms comprised of 70,500 acres, with an average size of 258 acres. Approximately half the farms in the county are less than 180 acres, with the other half 180+ acres. The majority of farms (116) are 50-179 acres. The average market value of land and buildings per farm was \$415,751. Crops account for approximately \$886,000 of agriculture sales in the county, while livestock and poultry account for \$5.1 million in sales.

## 2.1.8 FEMA Hazard Mitigation Assistance Grants in Planning Area

Since 1993, nearly \$9 million in Federal Hazard Mitigation Assistance grants have been awarded to subgrantees in Iron County. Table 2.4 provides details on the previous FEMA HMAG in the planning area.

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**Table 2.4. FEMA HMA Grants in County from 1993-2009**

<b>Disaster Number</b>	<b>Project Number</b>	<b>Project Title</b>	<b>Subgrantee</b>	<b>Type</b>
1403	0014	Residential Buyout - Annapolis	Annapolis	200.1: Acquisition of Private Real Property (Structures and Land) - Riverine; 200.5: Acquisition of Vacant Land
1412	0011	Acquisition and Demolition- City of Arcadia	Arcadia (RR name Arcadia-Ironton)	200.1: Acquisition of Private Real Property (Structures and Land) - Riverine

Source: Missouri State Emergency Management Agency,

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## **2.2 Jurisdictional Profiles and Mitigation Capabilities**

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This section includes individual profiles for each participating jurisdiction as well as a discussion of previous mitigation initiatives and a summary table indicating specific capabilities of each jurisdiction that relate to their ability to implement mitigation opportunities. The unincorporated county is profiled first, followed by the incorporated cities, and the public school districts.

### **2.2.1 Unincorporated Iron County**

The jurisdiction of Iron County includes all unincorporated areas within the county boundaries. The Iron County government is a County Commission comprised of a Presiding Commissioner voted on by the entire county and two Associate Commissioners voted on by their respective districts. The County government includes the following departments and offices:

- County Commissioners
- County Assessor
- County Attorney
- County Auditor
- County Recorder
- County Sheriff
- County Treasurer
- Emergency Management
- Health Department

#### **Mitigation Initiatives/Capabilities**

Table 2.5 shows the County's planning and hazard mitigation capabilities.

**Table 2.5. Unincorporated Iron County Mitigation Capabilities**

Element	Yes, No, N/A	Comments
<b>Planning Capabilities</b>		
<b><u>Comprehensive Plan</u></b>	Date: No	
Builder's Plan	Date: No	
Capital Improvement Plan	Date: Yes	
City Emergency Operations Plan	Date: N/A	
County Emergency Operations Plan	Date: Yes	
Local Recovery Plan	Date: No	
County Recovery Plan	Date: No	
City Mitigation Plan	Date: N/A	
County Mitigation Plan	Date: 2014	
Debris Management Plan	Date: No	
<b><u>Economic Development Plan</u></b>	Date: No	
Transportation Plan	Date: No	
Land-use Plan	Date: No	
Flood Mitigation Assistance (FMA) Plan	Date: No	
<b><u>Watershed Plan</u></b>	Date: No	
Firewise or other fire mitigation plan	Date: No	
Critical Facilities Plan (Mitigation/Response/Recovery)	Date: No	
<b>Policies/Ordinance</b>		
Zoning Ordinance	No	
Building Code	Version:	
Floodplain Ordinance	Date: Yes	
Subdivision Ordinance	No	
Tree Trimming Ordinance	No	
Nuisance Ordinance	No	
Storm Water Ordinance	No	
Drainage Ordinance	No	
Site Plan Review Requirements	No	
Historic Preservation Ordinance	No	
Landscape Ordinance	No	
<b>Program</b>		
Zoning/Land Use Restrictions	No	
Codes Building Site/Design	No	
Hazard Awareness Program	No	

Element	Yes, No, N/A	Comments
National Flood Insurance Program	Yes	
Community Rating System (CRS) program under the National Flood Insurance Program (NFIP)?	If so, what is your current level rating?	
National Weather Service (NWS) Storm Ready Certification	No	
Firewise Community Certification	No	
Building Code Effectiveness Grading (BCEGs)	No	
ISO Fire Rating	Rating:	
Economic Development Program	Yes	
Land Use Program	No	
Public Education/Awareness	Yes	
Property Acquisition	Yes	
Planning/Zoning Boards	No	
Stream Maintenance Program	No	
Tree Trimming Program	No	
<b>Engineering Studies for Streams (Local/County/Regional)</b>	No	
Mutual Aid Agreements	Yes	
Studies/Reports/Maps		
<b>Hazard Analysis/Risk Assessment (City)</b>	N/A	
<b>Hazard Analysis/Risk Assessment (County)</b>	Yes	
Evacuation Route Map	Yes	
<b>Critical Facilities Inventory</b>	No	
<b>Vulnerable Population Inventory</b>	No	
<b>Land Use Map</b>	No	

Staff/Department		Full Time or Part Time?
Building Code Official	No	
Building Inspector	No	
Mapping Specialist (GIS)	No	
Engineer	No	
Development Planner	No	
Public Works Official	Yes	
Emergency Management Coordinator	Yes	
NFIP Floodplain Administrator	Yes	
Bomb and/or Arson Squad	No	
Emergency Response Team	No	
Hazardous Materials Expert	No	
Local Emergency Planning Committee	No	
County Emergency Management Commission	No	

Element	Yes, No, N/A	Comments
Sanitation Department	Yes	
Transportation Department	Yes	
Economic Development Department	Yes	ICEP
Housing Department	No	
Historic Preservation	No	
Non-Governmental Organizations (NGOs)	Is there a local chapter? Yes or No	
American Red Cross	No	
Salvation Army	Yes	
Veterans Groups	Yes	
Local Environmental Organization	Yes	
Homeowner Associations	Yes	
Neighborhood Associations	No	
Chamber of Commerce	Yes	
Community Organizations (Lions, Kiwanis, etc.)	Yes	
Financial Resources	Is your jurisdiction able to? Yes or No	
Apply for Community Development Block Grants	Yes	
Fund projects thru Capital Improvements funding	Yes	
Authority to levy taxes for specific purposes	Yes	
Fees for water, sewer, gas, or electric services	No	
Impact fees for new development	No	
Incur debt through general obligation bonds	Yes	
Incur debt through special tax bonds	Yes	
Incur debt through private activities	Yes	
Withhold spending in hazard prone areas	Yes	



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## **2.2.2 Ironton**

The City of Ironton is located in central Iron County. It is governed by a Mayor and Board of Aldermen.

**Table 2.6. Ironton Mitigation Capabilities**

Element	Yes, No, N/A	Comments
<b>Planning Capabilities</b>		
<b><u>Comprehensive Plan</u></b>	Date: Yes	
Builder's Plan	Date: No	
Capital Improvement Plan	Date: Yes	
City Emergency Operations Plan	Date: No	
County Emergency Operations Plan	Date: N/A	
Local Recovery Plan	Date: No	
County Recovery Plan	Date: N/A	
City Mitigation Plan	Date: 2014	
County Mitigation Plan	Date: N/A	
Debris Management Plan	Date: No	
<b><u>Economic Development Plan</u></b>	Date: No	
Transportation Plan	Date: No	
Land-use Plan	Date: Yes	
Flood Mitigation Assistance (FMA) Plan	Date: No	
<b><u>Watershed Plan</u></b>	Date: No	
Firewise or other fire mitigation plan	Date: No	
Critical Facilities Plan (Mitigation/Response/Recovery)	Date: No	
<b>Policies/Ordinance</b>		
Zoning Ordinance	Yes	
Building Code	Version: 2015 International	
Floodplain Ordinance	Date: Yes	
Subdivision Ordinance	Yes	
Tree Trimming Ordinance	Yes	
Nuisance Ordinance	Yes	
Storm Water Ordinance	Yes	
Drainage Ordinance	Yes	
Site Plan Review Requirements	Yes	
Historic Preservation Ordinance	Yes	
Landscape Ordinance	No	
<b>Program</b>		
Zoning/Land Use Restrictions	Yes	
Codes Building Site/Design	Yes	
Hazard Awareness Program	Yes	
National Flood Insurance Program	Yes	

Element	Yes, No, N/A	Comments
Community Rating System (CRS) program under the National Flood Insurance Program (NFIP)?	If so, what is your current level rating?	
National Weather Service (NWS) Storm Ready Certification	No	
Firewise Community Certification	No	
Building Code Effectiveness Grading (BCEGs)	N/A	
ISO Fire Rating	Rating:	
Economic Development Program	Yes	
Land Use Program	Yes	
Public Education/Awareness	Yes	
Property Acquisition	Yes	
Planning/Zoning Boards	Yes	
Stream Maintenance Program	Yes	
Tree Trimming Program	Yes	
<b>Engineering Studies for Streams (Local/County/Regional)</b>	No	
Mutual Aid Agreements	Yes	
<b>Studies/Reports/Maps</b>		
<b>Hazard Analysis/Risk Assessment (City)</b>	Yes	
<b>Hazard Analysis/Risk Assessment (County)</b>	N/A	
Evacuation Route Map	Yes	
<b>Critical Facilities Inventory</b>	No	
<b>Vulnerable Population Inventory</b>	No	
<b>Land Use Map</b>	Yes	

Staff/Department		Full Time or Part Time?
Building Code Official	Yes	
Building Inspector	Yes	
Mapping Specialist (GIS)	No	
Engineer	No	
Development Planner	No	
Public Works Official	Yes	
Emergency Management Coordinator	Yes	
NFIP Floodplain Administrator	Yes	
Bomb and/or Arson Squad	No	
Emergency Response Team	No	
Hazardous Materials Expert	No	
Local Emergency Planning Committee	No	
County Emergency Management Commission	N/A	
Sanitation Department	Yes	
Transportation Department	Yes	

Element	Yes, No, N/A	Comments
Economic Development Department	Yes	
Housing Department	No	
Historic Preservation	Yes	
Non-Governmental Organizations (NGOs)	Is there a local chapter? Yes or No	
American Red Cross	No	
Salvation Army	Yes	
Veterans Groups	Yes	
Local Environmental Organization	Yes	
Homeowner Associations	Yes	
Neighborhood Associations	No	
Chamber of Commerce	Yes	
Community Organizations (Lions, Kiwanis, etc.)	Yes	
Financial Resources	Is your jurisdiction able to? Yes or No	
Apply for Community Development Block Grants	Yes	
Fund projects thru Capital Improvements funding	Yes	
Authority to levy taxes for specific purposes	Yes	
Fees for water, sewer, gas, or electric services	Yes	
Impact fees for new development	No	
Incur debt through general obligation bonds	Yes	
Incur debt through special tax bonds	Yes	
Incur debt through private activities	Yes	
Withhold spending in hazard prone areas	Yes	

## 2.2.3 Summary of County/Municipality Capabilities

Element	Yes, No, N/A	Yes, No, N/A
Planning Capabilities	Iron County	Ironton
<b><u>Comprehensive Plan</u></b>	Date: No	Date: Yes
Builder's Plan	Date: No	Date: No
Capital Improvement Plan	Date: Yes	Date: Yes
City Emergency Operations Plan	Date: N/A	Date: No
County Emergency Operations Plan	Date: Yes	Date: N/A
Local Recovery Plan	Date: No	Date: No
County Recovery Plan	Date: No	Date: N/A
City Mitigation Plan	Date: N/A	Date: 2014
County Mitigation Plan	Date: 2014	Date: N/A
Debris Management Plan	Date: No	Date: No
<b><u>Economic Development Plan</u></b>	Date: No	Date: No
Transportation Plan	Date: No	Date: No
Land-use Plan	Date: No	Date: Yes
Flood Mitigation Assistance (FMA) Plan	Date: No	Date: No
<b><u>Watershed Plan</u></b>	Date: No	Date: No
Firewise or other fire mitigation plan	Date: No	Date: No
Critical Facilities Plan (Mitigation/Response/Recovery)	Date: No	Date: No
<b>Policies/Ordinance</b>		
Zoning Ordinance	No	Yes
Building Code	Version:	Version: 2015 International
Floodplain Ordinance	Date: Yes	Date: Yes
Subdivision Ordinance	No	Yes
Tree Trimming Ordinance	No	Yes
Nuisance Ordinance	No	Yes
Storm Water Ordinance	No	Yes
Drainage Ordinance	No	Yes
Site Plan Review Requirements	No	Yes
Historic Preservation Ordinance	No	Yes
Landscape Ordinance	No	No
<b>Program</b>		
Zoning/Land Use Restrictions	No	Yes
Codes Building Site/Design	No	Yes
Hazard Awareness Program	No	Yes
National Flood Insurance Program	Yes	Yes
Community Rating System (CRS) program under the National Flood Insurance Program (NFIP)?	If so, what is your current level rating?	If so, what is your current level rating?

National Weather Service (NWS) Storm Ready Certification	No	No
Firewise Community Certification	No	No
Building Code Effectiveness Grading (BCEGs)	No	N/A
ISO Fire Rating	Rating:	Rating:
Economic Development Program	Yes	Yes
Land Use Program	No	Yes
Public Education/Awareness	Yes	Yes
Property Acquisition	Yes	Yes
Planning/Zoning Boards	No	Yes
Stream Maintenance Program	No	Yes
Tree Trimming Program	No	Yes
<b>Engineering Studies for Streams (Local/County/Regional)</b>	No	No
Mutual Aid Agreements	Yes	Yes
Studies/Reports/Maps		
<b>Hazard Analysis/Risk Assessment (City)</b>	N/A	Yes
<b>Hazard Analysis/Risk Assessment (County)</b>	Yes	N/A
Evacuation Route Map	Yes	Yes
<b>Critical Facilities Inventory</b>	No	No
<b>Vulnerable Population Inventory</b>	No	No
<b>Land Use Map</b>	No	Yes
Staff/Department		
Building Code Official	No	Yes
Building Inspector	No	Yes
Mapping Specialist (GIS)	No	No
Engineer	No	No
Development Planner	No	No
Public Works Official	Yes	Yes
Emergency Management Coordinator	Yes	Yes
NFIP Floodplain Administrator	Yes	Yes
Bomb and/or Arson Squad	No	No
Emergency Response Team	No	No
Hazardous Materials Expert	No	No
Local Emergency Planning Committee	No	No
County Emergency Management Commission	No	N/A
Sanitation Department	Yes	Yes
Transportation Department	Yes	Yes
Economic Development Department	Yes	Yes
Housing Department	No	No
Historic Preservation	No	Yes

Non-Governmental Organizations (NGOs)	Is there a local chapter? Yes or No	Is there a local chapter? Yes or No
American Red Cross	No	No
Salvation Army	Yes	Yes
Veterans Groups	Yes	Yes
Local Environmental Organization	Yes	Yes
Homeowner Associations	Yes	Yes
Neighborhood Associations	No	No
Chamber of Commerce	Yes	Yes
Community Organizations (Lions, Kiwanis, etc.)	Yes	Yes
Financial Resources	Is your jurisdiction able to? Yes or No	Is your jurisdiction able to? Yes or No
Apply for Community Development Block Grants	Yes	Yes
Fund projects thru Capital Improvements funding	Yes	Yes
Authority to levy taxes for specific purposes	Yes	Yes
Fees for water, sewer, gas, or electric services	No	Yes
Impact fees for new development	No	No
Incur debt through general obligation bonds	Yes	Yes
Incur debt through special tax bonds	Yes	Yes
Incur debt through private activities	Yes	Yes
Withhold spending in hazard prone areas	Yes	Yes

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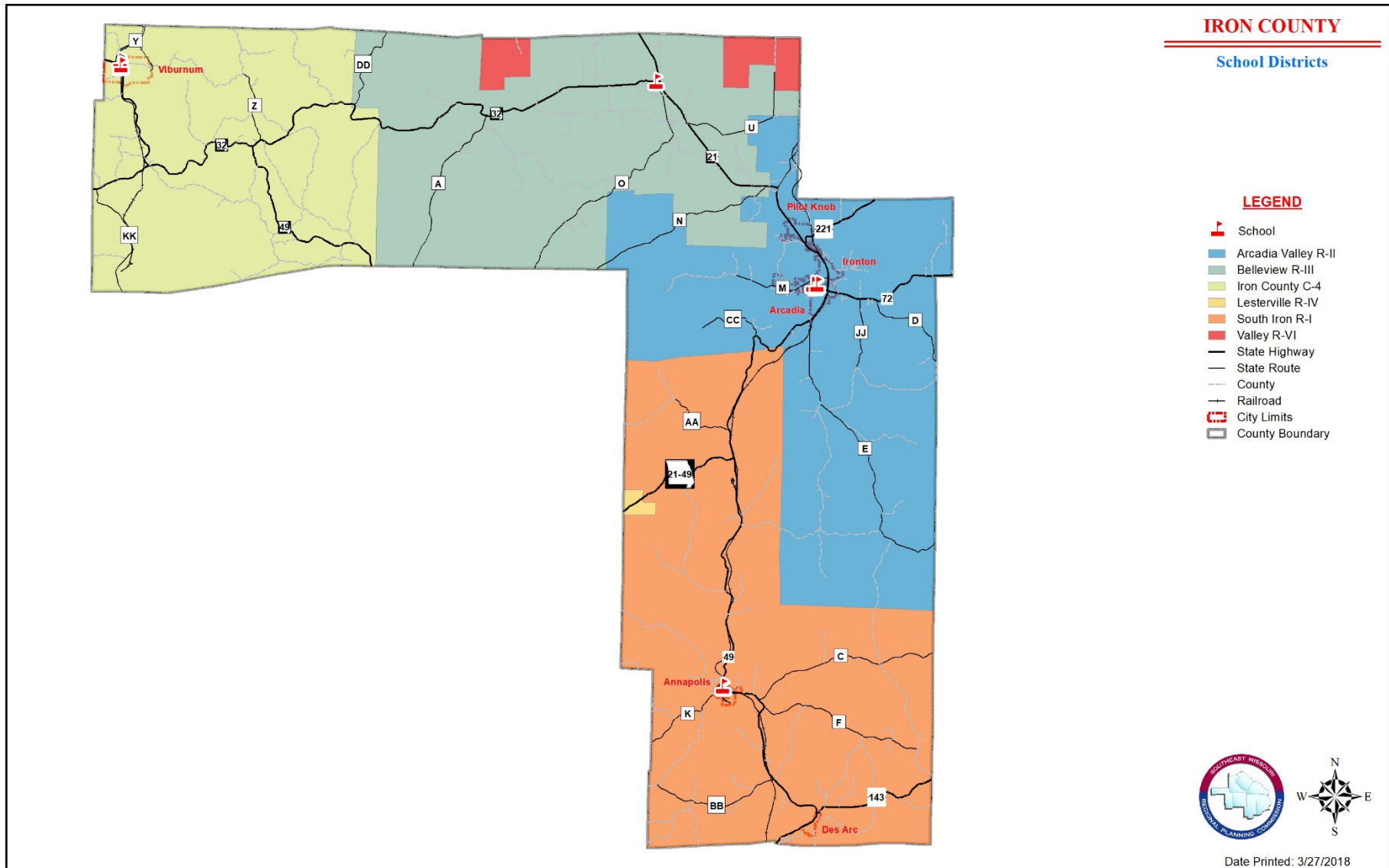
## **2.2.4 Public School District Profiles and Mitigation Capabilities**

This section includes general profile information for Belleview R-III School District. The district fully participated in the development process of this plan. Two additional school districts, Lesterville R-IV (Reynolds County) and Valley R-VI (Washington County) cover small portions of the County. However, neither of these districts have any structures or assets located in the County, and are therefore not included in this mitigation plan. For information on these school districts, see their respective county HMPs.

It should also be noted that Belleview R-III School District extends beyond the county boundaries in areas to the north and west of the County. Students in these areas are included in any enrollment or other statistics as data is by district.



Figure 2.3. Iron County School Districts



**Table 2.7. Belleview R-III Buildings and Enrollment Data, 2017**

District Name	Building Name	Building Enrolment
Belleview R-III	Belleview Elementary	122

<http://mcids.dese.mo.gov/quickfacts/Pages/District-and-School-Information.aspx>

**Table 2.8. Summary of Mitigation Capabilities-Belleview R-III School District**

Planning Elements	Yes/No	Date of Latest Version	Comments
Master Plan	no		
Capital Improvement Plan	no		
<b>School Emergency Plan</b> Shelter in place protocols Evacuation protocols	Yes		
Weapons Policy	Yes		

**Administrative/Technical**

Identify the technical and personnel resources responsible for activities related to hazard mitigation/loss prevention within your school district / institution.

Personnel Resources	Yes/No	Department/Position	Comments
Full-time building official (i.e. Principal)	Yes	Principal	
Emergency Manager	No		
Grant Writer	No		
Public Information Officer	No		

**Financial Resources**

Identify whether your school district /institution has access to or is eligible to use the following financial resources for hazard mitigation.

Financial Resources	Accessible/Eligible to Use (Y/N)	Comments
Capital improvements project funding	Yes	
Local funds	Yes	
General obligation bonds	Yes	
Special tax bonds	Yes	
Private activities/donations	Yes	
State and federal funds	Yes	

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## 3 RISK ASSESSMENT

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The goal of the risk assessment is to estimate the potential loss in the planning area, including loss of life, personal injury, property damage, and economic loss, from a hazard event. The risk assessment process allows communities and school/special districts in the planning area to better understand their potential risk to the identified hazards. It will provide a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events.

There have been little changes in the County over the past 5 years. Since 2014, the County and Ironton have seen declines in population. Likewise, there has been little new commercial, office, and industrial development in the County, with most development being in-fill. These small changes mean that much of the exposure and risk in the planning area has remained relatively unchanged since the 2014 plan.

This chapter is divided into four main parts:

- **Section 3.1 Hazard Identification** identifies the hazards that threaten the planning area and provides a factual basis for elimination of hazards from further consideration;
- **Section 3.2 Assets at Risk** provides the planning area's total exposure to natural hazards, considering critical facilities and other community assets at risk;
- **Section 3.3 Future Land Use and Development** discusses areas of planned future development
- **Section 3.4 Hazard Profiles and Vulnerability Analysis** provides more detailed information about the hazards impacting the planning area. For each hazard, there are three sections: 1) Hazard Profile provides a general description and discusses the threat to the planning area, the geographic location at risk, potential severity/magnitude/extent, previous occurrences of hazard events, probability of future occurrence, risk summary by jurisdiction, impact of future development on the risk; 2) Vulnerability Assessment further defines and quantifies populations, buildings, critical facilities, and other community/school or special district assets at risk to natural hazards; and 3) Problem Statement briefly summarizes the problem and develops possible solutions.

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## 3.1 Hazard Identification

---

The 11 hazards identified for this plan update are listed below in alphabetical order:

- Dam & Levee Failure
- Drought
- Earthquake
- Extreme Cold
- Extreme Heat
- Flash & Riverine Flooding
- Severe Thunderstorms
- Severe Winter Weather
- Sinkholes
- Tornadoes
- Wild Fire

It should be noted that this mitigation plan, like most local HMP in the state, only includes natural hazards and does not address “man-made” hazards such as terrorism, structural fires, chemical spills, etc.

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

### 3.1.1 Review of Existing Mitigation Plans

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To determine which hazards to include in this plan update cycle, the HMPC considered all hazards from the previous Iron County HMP, hazards from surrounding counties’ HMPs, and the State’s current HMP. The HMPC decided to carry forward the hazards from the 2014 plan into this plan unchanged, as they felt there had been no significant changes in the county to warrant revision.

### 3.1.2 Review Disaster Declaration History

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Federal disaster declarations may be granted when the severity and magnitude of an event surpasses the ability of the local government to respond and recover. Disaster assistance is supplemental and sequential. When the local government’s capacity has been surpassed, a state disaster declaration may be issued, allowing for the provision of state assistance. If the disaster is so severe that both the local and state governments’ capacities are exceeded; a federal emergency or disaster declaration may be issued allowing for the provision of federal assistance.

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

**Table 3.1. FEMA Disaster Declarations that included Iron County, Missouri, 2007-Present**

Disaster Number	Description	Incident Period	Individual Assistance (IA) Public Assistance (PA)
DR-4317	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	4/28/2017 – 5/11/2017	IA, PA
DR-4250	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	12/23/2015 – 1/09/2016	PA
DR-4130	Severe Storms, Straight-line Winds, Tornadoes, and Flooding	5/29/2013 – 6/10/2013	PA
DR-1980	Severe Storms, Tornadoes, and Flooding	4/19/2011 - 6/6/2011	PA
DR-1847	Severe Storms, Tornadoes, and Flooding	5/8/2009 - 5/16/2009	IA, PA
DR-1749	Severe Storms and Flooding	3/17/2008 - 5/9/2008	IA, PA

Source: Federal Emergency Management Agency <http://www.fema.gov/disasters>

### 3.1.3 Research Additional Sources

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

- Missouri Hazard Mitigation Plan (2013)
- 2014 Iron County Hazard Mitigation Plan
- Federal Emergency Management Agency (FEMA)
- Missouri Department of Natural Resources (MDNR)
- National Drought Mitigation Center Drought Reporter
- US Department of Agriculture’s (USDA) Risk Management Agency Crop Insurance Statistics
- National Agricultural Statistics Service (Agriculture production/losses)
- Data Collection Questionnaires completed by each jurisdiction
- State of Missouri GIS data
- Environmental Protection Agency (EPA)
- Flood Insurance Administration
- Missouri Department of Transportation (MoDOT)
- Missouri Division of Fire Marshal Safety
- National Fire Incident Reporting System (NFIRS)
- National Oceanic and Atmospheric Administration’s (NOAA) National Centers for Environmental Information (NCEI);
- County and local Comprehensive Plans when available
- County Emergency Management
- County Flood Insurance Rate Map, FEMA
- SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin
- U.S. Army Corps of Engineers
- U.S. Department of Transportation
- United States Geological Survey (USGS)

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Note that the only centralized source of data for many of the weather-related hazards is the National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center (NCEI). Although it is usually the best and most current source, there are limitations to the data which should be noted. The NCEI documents the occurrence of storms and other significant weather phenomena having sufficient intensity to cause loss of life, injuries, significant property damage, and/or disruption to commerce. In addition, it is a partial record of other significant meteorological events, such as record maximum or minimum temperatures or precipitation that occurs in connection with another event. Some information appearing in the NCEI may be provided by or gathered from sources outside the National Weather Service (NWS), such as the media, law enforcement and/or other government agencies, private companies, individuals, etc. An effort is made to use the best available information but because of time and resource constraints, information from these sources may be unverified by the NWS. Those using information from NCEI should be cautious as the NWS does not guarantee the accuracy or validity of the information.

The NCEI damage amounts are estimates received from a variety of sources, including those listed above in the Data Sources section. For damage amounts, the NWS makes a best guess using all available data at the time of the publication. Property and crop damage figures should be considered as a broad estimate. Damages reported are in dollar values as they existed at the time of the storm event. They do not represent current dollar values.

The database currently contains data from January 1950 to March 2014, as entered by the NWS. Due to changes in the data collection and processing procedures over time, there are unique periods of record available depending on the event type. The following timelines show the different time spans for each period of unique data collection and processing procedures.

1. Tornado: From 1950 through 1954, only tornado events were recorded.
2. Tornado, Thunderstorm Wind and Hail: From 1955 through 1992, only tornado, thunderstorm wind and hail events were keyed from the paper publications into digital data. From 1993 to 1995, only tornado, thunderstorm wind and hail events have been extracted from the Unformatted Text Files.
3. All Event Types (48 from Directive 10-1605): From 1996 to present, 48 event types are recorded as defined in NWS Directive 10-1605.

Note that injuries and deaths caused by a storm event are reported on an area-wide basis. When reviewing a table resulting from an NCEI search by county, the death or injury listed in connection with that county search did not necessarily occur in that county.

### **3.1.4 Hazards Identified**

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Through the hazard identification review process, 11 natural hazards that have the potential to significantly affect the planning area were chosen for further analysis in the risk assessment. The hazards identified for this plan update are shown in Table 3.2. Although 11 hazards were identified, not all hazards impact every jurisdiction. In addition to listing the hazards selected for this plan, Table 3.2 also provides a summary of the jurisdictions impacted by each hazard. An "X" indicates the jurisdiction is impacted by the hazard, while a "-" indicates the hazard is not applicable to that jurisdiction.



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**Table 3.2. Hazards Identified for Each Jurisdiction**

Hazard	Iron County	Ironton	Belleview R-III
Dam/Levee Failure	X	X	-
Drought	X	X	X
Earthquake	X	X	X
Extreme Cold	X	X	X
Extreme Heat	X	X	X
Flash & Riverine Flooding	X	X	-
Severe Thunderstorm	X	X	X
Severe Winter Weather	X	X	X
Sinkhole	X	-	-
Tornado	X	X	X
Wild Fire	X	X	X

### **3.1.5 Multi-Jurisdictional Risk Assessment**

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

The hazards that have the potential to vary across the planning area in terms of geographic areas at risk include dam/levee failure, flash & riverine flooding, sinkhole, and wild fire.

## 3.2 Assets at Risk

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

### 3.2.1 Total Exposure of Population and Structures

#### Unincorporated County and Incorporated Cities

In the following three tables, population data is based on 2010 Census Bureau data. Building counts are based on the University of Missouri Structures Count, and building exposure values are HMPC and SEMO RPC estimates based on median home values in each jurisdiction. Contents exposure values were calculated by factoring a multiplier to the building exposure values based on usage type. The multipliers were derived from the HAZUS MH 2.1 and are defined below in Table 3.3. Land values have been purposely excluded from consideration because land remains following disasters, and subsequent market devaluations are frequently short term and difficult to quantify. Another reason for excluding land values is that state and federal disaster assistance programs generally do not address loss of land (other than crop insurance). It should be noted that this valuation methodology is an estimate only and will not equal other estimates or calculations (e.g. Assessor data) due to variations in the methodologies.

Table 3.3 shows the total population, building count, estimated value of buildings, estimated value of contents and estimated total exposure for the unincorporated county and each participating incorporated city. Table 3.4 that follows provides the building value exposures for the county and each participating city in the planning area broken down by usage type. Finally, Table 3.5 provides the building count total for the county and each participating city in the planning area broken out by building usage types (residential, commercial, industrial, and agricultural).

**Table 3.3. Maximum Population and Building Exposure by Jurisdiction**

Jurisdiction	2010 Population	Building Count	Building Exposure	Contents Exposure	Total Exposure
Iron County-Unincorporated	6,601	5,281	\$ 652,453,842	\$ 551,211,004	\$ 1,203,664,846
Ironton	1,460	1,840	\$ 206,271,720	\$ 159,953,220	\$ 366,224,940
Total	8,061	7,120	\$ 858,725,562	\$ 711,164,224	\$ 1,569,889,786

Sources: Population, 2010 Census; Building Count, SEMO RPC data; Building Exposure, HMPC and SEMO RPC data; Contents Exposure derived by applying multiplier to Building Exposure based on HAZUS MH 2.1 standard contents multipliers per usage type as follows: Residential (50%), Commercial (100%), Industrial (150%), Agricultural (100%).

---

**Table 3.4. Building Values/Exposure by Usage Type**

Jurisdiction	Residential	Commercial	Industrial	Agricultural	Total
Iron County-Unincorporated	\$ 224,984,083	\$ 22,498,408	\$ 22,498,408	\$ 382,472,942	\$ 652,453,842
Ironton	\$ 123,516,000	\$ 49,406,400	\$ 30,879,000	\$ 2,470,320	\$ 206,271,720
Total	\$ 348,500,083	\$ 71,904,808	\$ 53,377,408	\$ 384,943,262	\$ 858,725,562

---

**Table 3.5. Building Counts by Usage Type**

Jurisdiction	Residential	Commercial	Industrial	Agricultural	Total
Iron County-Unincorporated	2,750	138	55	2,338	5,281
Ironton	1,460	292	73	15	1,840
Total	4,210	430	128	2,352	7,120

Based on the data that is available from the districts' completion of the Data Collection Questionnaire and district maintained websites, the number of enrolled students at the participating public school districts is provided in Table 3.6 below. Additional information includes the number of buildings, building values (building exposure) and contents value (contents exposure).

---

**Table 3.6. Population and Building Exposure by Jurisdiction-Public School Districts**

Public School District	Enrolment	Building Count	Building Exposure (\$)	Contents Exposure (\$)	Total Exposure (\$)
Belleview R-III	122	1	10,000,000	5,000,000	15,000,000

Source: Enrollment - <http://mcids.dese.mo.gov/quickfacts/Pages/District-and-School-Information.aspx>. Building Count, Building Exposure, Contents Exposure, and Total Exposure amounts - Public School Districts.

### 3.2.2 Other Assets

Assessing the vulnerability of the planning area to disaster also requires data on the natural, historic, cultural, and economic assets of the area. This information is important for many reasons.

- These types of resources warrant more protection due to their unique and irreplaceable nature and contribution to the overall economy.
- Knowing about these resources in advance allows for consideration immediately following a hazard event, which is when the potential for damages is higher.
- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.
- The presence of natural resources can reduce the impacts of future natural hazards, such as wetlands and riparian habitats which help absorb floodwaters.
- Losses to economic assets like these (e.g., major employers or primary economic sectors) could have severe impacts on a community and its ability to recover from disaster.

**Table 3.7. Threatened and Endangered Species in Iron County**

#### Mammals

Gray Bat <i>Myotis grisescens</i>	Endangered
Indiana Bat <i>Myotis sodalist</i>	Endangered
Northern Long-eared Bat <i>Myotis septentrionalis</i>	Threatened

#### Clams

Pink Mucket (pearlymussel) <i>Lampsilis abrupta</i>	Endangered
Rabbitsfoot <i>Quadrula cylindrica cylindrica</i>	Threatened
Snuffbox Mussel <i>Epioblasma triquetra</i>	Endangered

#### Insects

Hine's Emerald Dragonfly <i>Somatochlora hineana</i>	Endangered
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#### Flowering Plants

Mead's Milkweed <i>Asclepias meadii</i>	Threatened
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Source: U.S. Fish and Wildlife Service

Although there are many structures in Iron County of significant historic importance, there are currently only five properties/sites in the County which are listed on the National Register of Historic Places. The County has one designated historic district.

- Fort Davidson (listed February 26, 1970).
- Immanuel Evangelical Lutheran Church (listed January 22, 1979).
- Iron County Courthouse (listed June 27, 1979).
- Ironton Lodge Hall (listed April 23, 2013).
- St. Paul's Episcopal Church (listed May 21, 1969).
- Ursuline Academy-Arcadia College Historic District (listed July 1, 1998).

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These National Register properties, and other historic structures found in Iron County, are probably most vulnerable to damage which could be caused by earthquakes, tornadoes or severe thunderstorms.

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### **3.3 Future Land Use and Development**

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As discussed in previous chapters, Iron County and Ironton have experienced only marginal population growth and new building starts. Given the County's and City's rural nature and historically flat (or declining) growth trends, there is little impact expected on hazards and mitigation actions due to future growth.

#### **School District's Future Development**

The school district anticipates only minor changes in student population and does not expect any future building development in the next five years.

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## 3.4 Hazard Profiles, Vulnerability, and Problem Statements

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Each hazard will be analyzed individually in a hazard profile. The profile will consist of a general hazard description, location, severity/magnitude/extent, previous events, future probability, a discussion of risk variations between jurisdictions, and how anticipated development could impact risk. At the end of each hazard profile will be a vulnerability assessment, followed by a summary problem statement.

### **Hazard Profiles**

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

**Hazard Description:** This section consists of a general description of the hazard and the types of impacts it may have on a community or school/special district.

**Geographic Location:** This section describes the geographic location of the hazard in the planning area. Where available, use maps to indicate the specific locations of the planning area that are vulnerable to the subject hazard. For some hazards, the entire planning area is at risk.

**Severity/Magnitude/Extent:** This includes information about the severity, magnitude, and extent of a hazard. For some hazards, this is accomplished with description of a value on an established scientific scale or measurement system, such as an EF2 tornado on the Enhanced Fujita Scale. Severity, magnitude, and extent can also include the speed of onset and the duration of hazard events. Describing the severity/magnitude/extent of a hazard is not the same as describing its potential impacts on a community. Severity/magnitude/extent defines the characteristics of the hazard regardless of the people and property it affects.

**Previous Occurrences:** This section includes available information on historic incidents and their impacts. Historic event records form a solid basis for probability calculations.

**Probability of Future Occurrence:** The frequency of recorded past events is used to estimate the likelihood of future occurrences. Probability was determined by dividing the number of recorded events by the number of years and multiplying by 100. This gives the percent chance of the event happening in any given year. For events occurring more than once annually, the probability will be reported 100% in any given year, with a statement of the average number of events annually.

### **Vulnerability Assessments**

Following the hazard profile for each hazard will be the vulnerability assessment. The vulnerability assessment further defines and quantifies populations, buildings, critical facilities, and other community assets at risk to damages from natural hazards. The vulnerability assessments will be based on the best available county-level data, which is in the Missouri Hazard Mitigation Plan (2010). The county-level assessments in the State Plan were based on the following sources:

- Statewide GIS data sets compiled by state and federal agencies; and
- FEMA's HAZUS-MH loss estimation software.

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The vulnerability assessments in the County A plan will also be based on:

- Written descriptions of assets and risks provided by participating jurisdictions;
- Existing plans and reports;
- Personal interviews with planning committee members and other stakeholders; and
- Other sources as cited.

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

**Vulnerability Overview**

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

**Potential Losses to Existing Development**

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

**Future Development**

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

**Hazard Summary by Jurisdiction**

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

**Problem Statement**

Provides a summary of the hazard’s probability, potential impacts on each jurisdiction, and mitigating factors or actions being taken or considered.



### 3.4.1 Dam Failure

#### Hazard Profile

##### *Hazard Description*

A dam is defined as a barrier constructed across a watercourse for storage, control, or diversion of water. Dams are typically constructed of earth, rock, concrete, or mine tailings. Dam failure is the uncontrolled release of impounded water resulting in downstream flooding, affecting both life and property. Dam failure can be caused by any of the following:

1. Overtopping - inadequate spillway design, debris blockage of spillways or settlement of the dam crest.
2. Piping: internal erosion caused by embankment leakage, foundation leakage and deterioration of pertinent structures appended to the dam.
3. Erosion: inadequate spillway capacity causing overtopping of the dam, flow erosion, and inadequate slope protection.
4. Structural Failure: caused by an earthquake, slope instability or faulty construction.

Dams in the NID are classified according to hazard potential, an indicator of the consequences of dam failure. A dam's hazard potential classification, presented in Table 3.9 does not indicate its condition. Dams assigned the high hazards potential classification are those where failure will potentially result in loss of human life. Significant hazard potential are those dams where failure results in no probable loss of human life but can cause economic loss. Dams assigned the low hazard potential classification are those where failure will result in no probable loss of human life and low economic or environmental losses. Losses are principally limited to the owner's property.

**Table 3.8. MDNR Dam Hazard Classification Definitions**

Hazard Class Definition	
Class I	The area downstream from the dam that would be affected by inundation contains ten (10) or more permanent dwellings or any public building. Inspections of these dams must occur every two years.
Class II	The area downstream from the dam that would be affected by inundation contains one to nine permanent dwellings, or one (1) or more campgrounds with permanent water, sewer and electrical services or one (1) or more industrial buildings. Inspections of these dams must occur once every three years.
Class III	The area downstream from the dam that would be affected by inundation does not contain any of the structures identified for Class I or Class II dams. Inspections of these dams must occur once every five years.

Source: Missouri Department of Natural Resources, [http://dnr.mo.gov/env/wrc/docs/rules\\_reg\\_94.pdf](http://dnr.mo.gov/env/wrc/docs/rules_reg_94.pdf)

**Table 3.9. NID Dam Hazard Classification Definitions**

Hazard Class Definition	
Low Hazard	Failure results in only minimal property damage
Significant Hazard	Failure could possibly result in the loss of life and appreciable property damage
High Hazard	If the dam were to fail, lives would likely be lost and extensive property damage would result

Source: National Inventory of Dams

There is not a direct correlation between the State Hazard classification and the NID classifications. However, most dams that are in the DNR's Class I and Class II are considered NID High Hazard Dams.

The following table shows the National Inventory of Dams listing for Iron County.

**Table 3.10. Iron County National Inventory of Dams Listing**

Dam Name	NIDID	Hazard Potential *	NID Height (Ft.)	River	Nearest City	Distance To City (Mi.)
VIBURNUM CITY LAKE DAM	MO31017	High	47	TR WEST PRONG OF INDIAN CREEK	COURTOIS	0
MAGMONT TAILINGS DAM	MO30917	High	135	TR-LEFT FORK NEALS CREEK	BIXBY	2
VIBURNUM TAILINGS DAM #5	MO31016	High	30	TR-INDIAN CR	COURTOIS	0
SCOTT LAKE DAM	MO31043	High	27	TR-MARBLE CREEK	LODI	30
CRANE LAKE	MO30069	High	46	CRANE POND LAKE	DES ARC	6
SCHULTZ LAKE DAM	MO31045	High	30	TR-GLADE CREEK	DES ARC	0
NEW VIBURNUM TAILINGS DAM	MO31231	High	170	TR-INDIAN CR	VIBURNUM	0
CLEARWATER LAKE DAM	MO30219	High	30	LEFT FORK	BLACK	15
WALNUT HOLLOW LAKE DAM	MO30619	High	32	TR-BIG CREEK	VULCAN	4
SHEPARD MOUNTAIN DAM	MO30324	High	33	TR-STOUTS CREEK	ARCADIA	2
WALNUT HOLLOW LAKE DAM SEC 2-SE	MO30620	High	25	TR-BIG CREEK	ANNAPOLIS	4
SNOW HOLLOW LAKE DAM	MO30337	High	41	TR-STOUTS CREEK	ARCADIA	5
ASARCO LAKE DAM	MO30216	High	51	TRIBUTARY TO BIG CREEK	GLOVER	1
OLD VIBURNUM TAILINGS DAM #1	MO30342	High	115	COURTOIS CREEK	VIBURNUM	3
QUEEN MARY DAM	MO31015	High	66	TR WEST PRONG OF INDIAN CREEK	COURTOIS	0
LAKE KILLARNEY DAM	MO30012	High	29	STOUTS CREEK	ROSELLE	2
ISP MINERALS PRIMARY DAM	MO32037	High	50	-	-	0
WEST PEAK QUARRY DAM #1	MO32051	High	90	TRIB. BIG CREEK	ANNAPOLIS	0
ISP MINERALS DAM	MO31988	High	25	BIG CREEK	ANNAPOLIS	0
WEST PEAK QUARRY DAM #2	MO32052	High	60	TRIB BIG CREEK	ANNAPOLIS	0
LAWLESS LAKE DAM	MO31717	High	28	TR-BIG CREEK	SABULA	1
RAINBOW CLUB FARM DAM	MO31917	High	20	BIG CREEK	SABULA	1
COUNCIL BLUFF DAM	MO31755	High	112	BIG RIVER	BLACK	11
VIBURNUM TAILINGS NO. 2	MO31013	Low	10	TR-INDIAN CR	COURTOIS	0
SHY LAKE	MO30974	Low	20	TR BIG CREEK	DES ARC	0
MITCHELL LAKE DAM	MO31415	Low	25	TR-MIDDLE FORK BLACK RIVER	BLACK	0

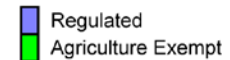
ASARCO SEC 11 LOWER DAM (SHALLOW)	MO31432	Low	25	TR BIG CREEK	SABULA	5
ASARCO SEC 11 UPPER DAM (SHALLOW)	MO31431	Low	25	TR BIG CREEK	SABULA	5
MONONAME 466	MO30621	Low	22	TR BIG CREEK OFFSTREAM	SABULA	0
MONONAME 812	MO30218	Low	25	TR COURTOIS CREEK OFFSTREAM	EAST END	0
COUNTY ROAD DAM/(DRY/TAILINGS)	MO31014	Low	27	WEST PRONG OF INDIAN CREEK	COURTOIS	0
LAKE 2 DAM	MO30490	Low	15	EAST BRANCH KNOB CREEK	PILOT KNOB	0
MONONAME 41	MO30853	Low	23	TR CROOKED CREEK	DILLARD	0
BUICK LOWER TREATMENT DAM	MO31142	Low	25	-	BLACK	35
AMAX IMPOUNDMENT A DAM	MO31760	Low	25	TR CROOKED CREEK	DILLARD	10
VIBURNUM #35 DAM	MO31956	Low	44	-	-	0
RAILROAD EMBANKMENT DAM	MO31779	Significant	48	TRIB-INDIAN CREEK	COURTOIS	3

Source: SEMA

## Dams in Planning Area



# Missouri Dam Report by County



### IRON

<u>ID Number</u>	<u>Location</u>	<u>Year Complete</u>	<u>Height (ft)</u>	<u>Length (ft)</u>	<u>Drainage Area (acre)</u>	<u>Lake Area (acre)</u>	<u>Hazard Class</u>	<u>Permit Number</u>
<b>AMAX IMPOUNDMENT A DAM</b>								
MO31760	S14 T34N R02W	1977	25.00	Unknown	80.00	4.00	3	
<b>ASARCO LAKE DAM</b>								
MO30216	S02 T32N R03E	1971	50.00	700.00	477.00	34.00	2	R-137
<b>ASARCO SEC 11 LOWER DAM (SHALLOW)</b>								
MO31432	S11 T32N R03E	1800	25.00	Unknown	100.00	3.00	3	
<b>ASARCO SEC 11 UPPER DAM (SHALLOW)</b>								
MO31431	S11 T32N R03E	1800	25.00	Unknown	80.00	4.00	3	
<b>CLEARWATER LAKE DAM</b>								
MO30219	S18 T34N R01W	1971	30.00	Unknown	2,400.00	27.00	2	
<b>COUNCIL BLUFF DAM</b>								
MO31755	S23 T35N R01E	1980	110.00	Unknown	8,960.00	440.00	3	
<b>COUNTY ROAD DAM/(DRY/TAILINGS)</b>								
MO31014	S25 T35N R02W	1959	27.00	Unknown	1,350.00	37.00	3	
<b>CRANE LAKE DAM</b>								
MO30069	S33 T32N R04E	1971	46.00	Unknown	5,568.00	99.00	3	
<b>IRON MTN TAILINGS POND DAM(BREACHED)</b>								
MO30354	S25 T35N R03E	1966	20.00	Unknown	510.00	14.00	3	
<b>ISP MINERALS DAM</b>								
MO31988	S23 T31N R03E	0	25.00	Unknown	0.00	5.00	2	
<b>ISP MINERALS PRIMARY DAM</b>								
MO32037	S22 T31N R03E	19880	50.00	250.00	99.00	36.00	1	S-068
<b>LAKE 2 DAM</b>								
MO30490	S26 T40N R01E	1968	15.00	Unknown	900.00	13.00	3	
<b>LAKE KILLARNEY DAM</b>								
MO30012	S01 T33N R04E	1911	29.00	Unknown	32,000.00	60.00	1	
<b>LAWLESS LAKE DAM</b>								
MO31717	S02 T31N R03E	1978	28.00	Unknown	65.00	4.00	1	
<b>MAGMONT TAILINGS DAM</b>								
MO30917	S24 T34N R02W	1979	135.00	1,190.00	655.00	106.00	1	R-033
<b>MITCHELL LAKE DAM</b>								
MO31415	S13 T34N R01W	1800	25.00	Unknown	240.00	6.00	3	
<b>MONONAME 41</b>								
MO30853	S14 T34N R02W	1965	23.00	Unknown	10.00	6.00	3	
<b>MONONAME 466</b>								
MO30621	S01 T31N R03E	1972	22.00	Unknown	29.00	5.00	3	
<b>MONONAME 807</b>								
MO30971	S14 T34N R02W	1972	12.00	Unknown	67.00	4.00	3	
<b>MONONAME 808</b>								
MO30972	S14 T34N R02W	1972	10.00	Unknown	21.00	5.00	3	
<b>MONONAME 809</b>								
MO30215	S11 T32N R03E	1973	14.00	Unknown	187.00	6.00	3	
<b>MONONAME 812</b>								
MO30218	S03 T34N R01W	1971	25.00	Unknown	43.00	4.00	3	
<b>MONONAME 830</b>								
MO30958	S03 T34N R01W	1971	20.00	Unknown	28.00	4.00	3	
<b>NEW VIBURNUM TAILINGS DAM</b>								
MO31231	S36 T35N R02W	1981	170.00	3,000.00	765.00	91.00	1	R-063
<b>OLD VIBURNUM TAILINGS DAM #1</b>								
MO30342	S19 T35N R01W	1968	115.00	1,140.00	1,970.00	93.00	1	R-058

# Missouri Dam Report by County

Regulated  
Agriculture Exempt

## IRON

ID Number	Location	Year Complete	Height (ft)	Length (ft)	Drainage Area (acre)	Lake Area (acre)	Hazard Class	Permit Number
<b>QUEEN MARY DAM</b>								
MO31015	S26 T35N R02W	1959	66.00	850.00	515.00	20.00	2	R-060
<b>RAILROAD EMBANKMENT DAM</b>								
MO31779	S26 T35N R02W	1978	48.00	1,659.00	384.00	20.00	2	R-061
<b>RAINBOW CLUB FARM DAM</b>								
MO31917	S02 T31N R03E	0	20.00	Unknown	13.00	5.00	1	
<b>SCHULTZ LAKE DAM</b>								
MO31045	S01 T30N R04E	1978	30.00	Unknown	54.00	6.00	2	
<b>SCOTT LAKE DAM</b>								
MO31043	S20 T33N R04E	1974	27.00	Unknown	155.00	11.00	2	
<b>SHEPARD MOUNTAIN DAM</b>								
MO30324	S01 T33N R03E	1955	33.00	Unknown	4,525.00	21.00	1	
<b>SHY LAKE</b>								
MO30974	S09 T30N R04E	1972	20.00	Unknown	205.00	12.00	3	
<b>SNOW HOLLOW LAKE DAM</b>								
MO30337	S26 T34N R03E	1957	39.00	530.00	481.00	31.00	2	R-209
<b>VIBURNUM #35 DAM</b>								
MO31956	S11 T34N R02W	19800	42.00	667.00	8.00	2.00	3	R-436
<b>VIBURNUM CITY LAKE DAM</b>								
MO31017	S26 T35N R02W	1959	47.00	675.00	815.00	10.00	2	R-059
<b>VIBURNUM TAILINGS DAM #5</b>								
MO31016	S26 T35N R02W	1977	30.00	Unknown	170.00	107.00	2	
<b>VIBURNUM TAILINGS NO. 2(TOO SMALL)</b>								
MO31013	S24 T35N R02W	1966	10.00	Unknown	1,720.00	115.00	3	
<b>WALNUT HOLLOW LAKE DAM</b>								
MO30619	S12 T31N R03E	1975	32.00	Unknown	35.00	7.00	1	
<b>WALNUT HOLLOW LAKE DAM SEC 2-SE</b>								
MO30620	S02 T31N R03E	1973	25.00	Unknown	240.00	4.00	2	
<b>WEST PEAK QUARRY DAM #1</b>								
MO32051	S22 T31N R03E	20010	90.00	500.00	30.00	25.00	1	S-085
<b>WEST PEAK QUARRY DAM #2</b>								
MO32052	S22 T31N R03E	20030	50.00	150.00	30.00	25.00	1	S-099

## SUMMARY

Regulated Dams: 12	Total:	65,984.00	1,531.00
Total Dams: 41	Average:	41.10	37.34

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### ***Severity/Magnitude/Extent***

The severity/magnitude of dam failure would be similar in some cases to the impacts associated with flood events (see the flood hazard vulnerability analysis and discussion). Based on the hazard class definitions, failure of any of the High Hazard/Class I dams could result in a serious threat of loss of human life, serious damage to residential, industrial or commercial areas, public utilities, public buildings, or major transportation facilities. Catastrophic failure of any high hazard dams has the potential to result in greater destruction due to the potential speed of onset and greater depth, extent, and velocity of flooding. Note that for this reason, dam failures could flood areas outside of mapped flood hazards.

### ***Previous Occurrences***

There have been no previous occurrences of dam or levee failures in the past 25 years. It should be noted that in December of 2005, the Taum Sauk Reservoir catastrophically failed, sending millions of gallons into the valley below. While both the reservoir and affected area are both in Reynolds County, if the reservoir had failed on the east side instead of the west, an uninhabited portion of Iron county could have been affected.

### ***Probability of Future Occurrence***

There are no documented dam failures in the county in the past 25 years. This makes a calculation of probability difficult. However, regulated dams are inspected regularly, which greatly reduces the chances of a failure.

---

## **Vulnerability**

### ***Vulnerability Overview***

According to the 2013 State Hazard Mitigation Plan, there are approximately 70 buildings in the county vulnerable to a failure of a state-regulated dam. There are, of course, other non-regulated dams in the county, but estimates are difficult due to data limitations.

### ***Potential Losses to Existing Development: (including types and numbers, of buildings, critical facilities, etc.)***

The 2013 State Hazard Mitigation Plan estimates potential losses due to the failure of state-regulated dams at \$5-\$15 million. As with the number of buildings exposed, it is difficult to make any estimates for non-regulated dams due to data limitations.

### ***Impact of Future Development***

There is little to no future development expected over the next five years in the estimated inundation areas of dams in the county.

### ***Hazard Summary by Jurisdiction***

Development density (low) in the presumed inundation zones for all dams in the county are similar across the county.

## **Problem Statement**

Dam failures primarily pose a problem for unincorporated areas of the county, which are generally less densely populated and have far less commercial or industrial development. While this limits the magnitude of potential loss of life due to a dam failure, damage to homes and agricultural assets still represent significant problems for county residents. Continued inspection of dams will help alleviate the chance of dam failure, and future mapping of inundation areas will help identify what structures are vulnerable.

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## 3.4.2 Drought

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### **Hazard Profile**

#### ***Hazard Description***

Drought is generally defined as a condition of moisture levels significantly below normal for an extended period over a large area that adversely affects plants, animal life, and humans. A drought period can last for months, years, or even decades. There are four types of drought conditions relevant to Missouri, according to the State Plan, which are as follows.

- Meteorological drought is defined in terms of the basis of the degree of dryness (in comparison to some “normal” or average amount) and the duration of the dry period. A meteorological drought must be considered as region-specific since the atmospheric conditions that result in deficiencies of precipitation are highly variable from region to region.
- Hydrological drought is associated with the effects of periods of precipitation (including snowfall) shortfalls on surface or subsurface water supply (e.g., streamflow, reservoir and lake levels, ground water). The frequency and severity of hydrological drought is often defined on a watershed or river basin scale. Although all droughts originate with a deficiency of precipitation, hydrologists are more concerned with how this deficiency plays out through the hydrologic system. Hydrological droughts are usually out of phase with or lag the occurrence of meteorological and agricultural droughts. It takes longer for precipitation deficiencies to show up in components of the hydrological system such as soil moisture, streamflow, and ground water and reservoir levels. As a result, these impacts also are out of phase with impacts in other economic sectors.
- Agricultural drought focus is on soil moisture deficiencies, differences between actual and potential evaporation, reduced ground water or reservoir levels, etc. Plant demand for water depends on prevailing weather conditions, biological characteristics of the specific plant, its stage of growth, and the physical and biological properties of the soil.
- Socioeconomic drought refers to when physical water shortage begins to affect people.

#### ***Geographic Location***

Given the nature of droughts, the entire county is equally exposed to this hazard. Droughts do tend to have greater impact on agricultural activities, and would therefore have more impact in the unincorporated county than the more urbanized areas.

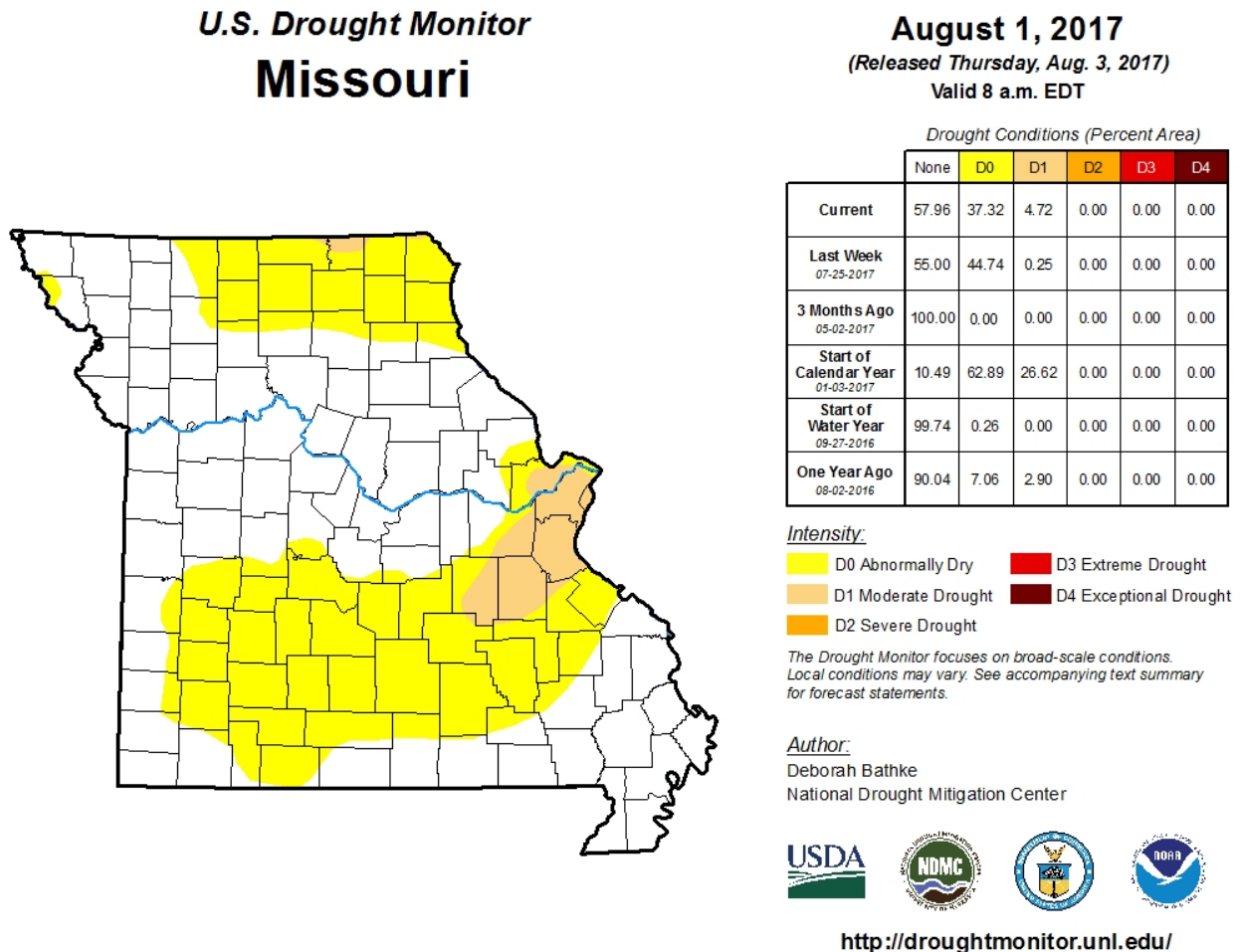
#### ***Severity/Magnitude/Extent***

The National Drought Monitor Center at the University of Nebraska at Lincoln summarized the potential severity of drought as follows. Drought can create economic impacts on agriculture and related sectors, including forestry and fisheries, because of the reliance of these sectors on surface and subsurface water supplies. In addition to losses in yields in crop and livestock production, drought is associated with increases in insect infestations, plant disease, and wind erosion. Droughts also bring increased problems with insects and disease to forests and reduce growth. The incidence of forest and range fires increases substantially during extended droughts, which in turn place both human and wildlife populations at higher levels of risk. Income loss is another indicator used in assessing the impacts of drought because so many sectors are



affected. Finally, while drought is rarely a direct cause of death, the associated heat, dust and stress can all contribute to increased mortality.

**Figure 3.1. U.S. Drought Monitor Map of Missouri on 8/1/2017**



Source: U.S. Drought Monitor, <http://droughtmonitor.unl.edu/Home/StateDroughtMonitor.aspx?MO>

The Palmer Drought Indices measure dryness based on recent precipitation and temperature. The indices are based on a “supply-and-demand model” of soil moisture. Calculation of supply is relatively straightforward, using temperature and the amount of moisture in the soil. However, demand is more complicated as it depends on a variety of factors, such as evapotranspiration and recharge rates. These rates are harder to calculate. Palmer tried to overcome these difficulties by developing an algorithm that approximated these rates, and based the algorithm on the most readily available data — precipitation and temperature.

The Palmer Index has proven most effective in identifying long-term drought of more than several months. However, the Palmer Index has been less effective in determining conditions over a matter of weeks. It uses a “0” as normal, and drought is shown in terms of negative numbers; for example, negative 2 is moderate drought, negative 3 is severe drought, and negative 4 is extreme drought. Palmer's algorithm also is used to describe wet spells, using corresponding positive numbers.

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Palmer also developed a formula for standardizing drought calculations for each individual location based on the variability of precipitation and temperature at that location. The Palmer index can therefore be applied to any site for which sufficient precipitation and temperature data is available.

### ***Previous Occurrences***

Since 1992, there have been 3 significant drought events to affect the county. The most severe was a months-long event in the summer of 2012.

### ***Probability of Future Occurrence***

Over the last 25 years there have been 3 major drought occurrences in the County. This equals a 12% annual chance of a drought.

## **Vulnerability**

### ***Vulnerability Overview***

Iron County has a relatively low vulnerability to drought compared to other areas of the State. The 2013 Missouri State Hazard Mitigation Plan indicates the county has \$0 in annualized crop insurance claims due to drought. Given that many counties have claims over \$1 million dollars, this indicates only slight vulnerability.

### ***Potential Losses to Existing Development***

Much of the impact would be felt by agricultural activities, especially for crop related uses. Most of Iron County's agricultural land use is in livestock, however, which has less vulnerability to drought of the two. This explains the County's very low annualized crop insurance claims and indicates that potential losses to existing development are low. Impacts on the city of Ironton and the school district will be lesser still.

### ***Impact of Future Development***

Given the decline of population the County is expected to experience over the next 5 years, impacts to future development will be almost identical to those on existing development.

### ***Hazard Summary by Jurisdiction***

All jurisdictions are equally exposed to a drought, but given the greater amount of agricultural activities in the County it has a greater vulnerability to drought than any of the other jurisdictions, relatively speaking.

## **Problem Statement**

While droughts have regional impacts, within the county the most vulnerable areas are the agricultural assets in the unincorporated county. Droughts have little to no impact on the school district, and the municipalities have had no issues with water source depletion in recent history.

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### **3.4.3 Earthquakes**

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#### **Hazard Profile**

##### ***Hazard Description***

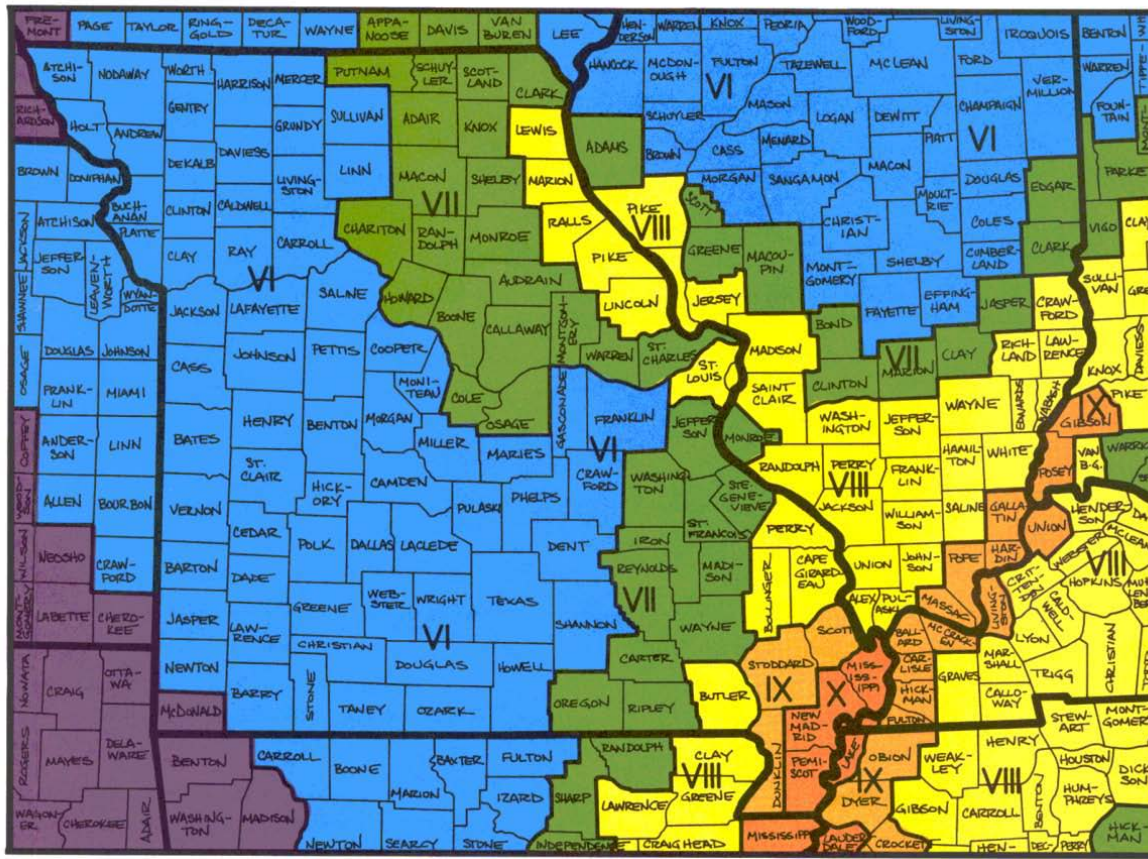
An earthquake is a sudden motion or trembling that is caused by a release of energy accumulated within or along the edge of the earth's tectonic plates. Earthquakes occur primarily along fault zones and tears in the earth's crust. Along these faults and tears in the crust, stresses can build until one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

##### ***Geographic Location***

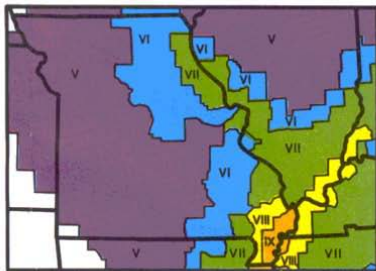
Iron County is located approximately 95 miles northwest of the New Madrid Fault. This fault was responsible for the famous 1811 earthquakes that registered up to 7.9 on the Richter Scale and rang church bells in Boston, MA.

The following Figures illustrate the potential impact the New Madrid Fault could have on Iron County.

**Figure 3.2. Impact Zones for Earthquake Along the New Madrid Fault**

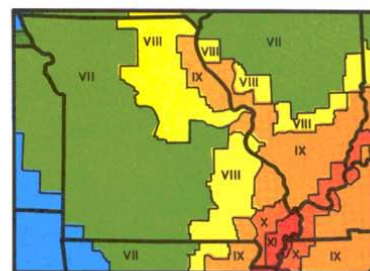


This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude - 7.6 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.



This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude - 6.7 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.

This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude - 8.6 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.



Source:

[http://sema.dps.mo.gov/docs/programs/Planning,%20Disaster%20&%20Recovery/State%20of%20Missouri%20Hazard%20Analysis/2012-State-Hazard-Analysis/Annex\\_F\\_Earthquakes.pdf](http://sema.dps.mo.gov/docs/programs/Planning,%20Disaster%20&%20Recovery/State%20of%20Missouri%20Hazard%20Analysis/2012-State-Hazard-Analysis/Annex_F_Earthquakes.pdf)

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## PROJECTED EARTHQUAKE INTENSITIES

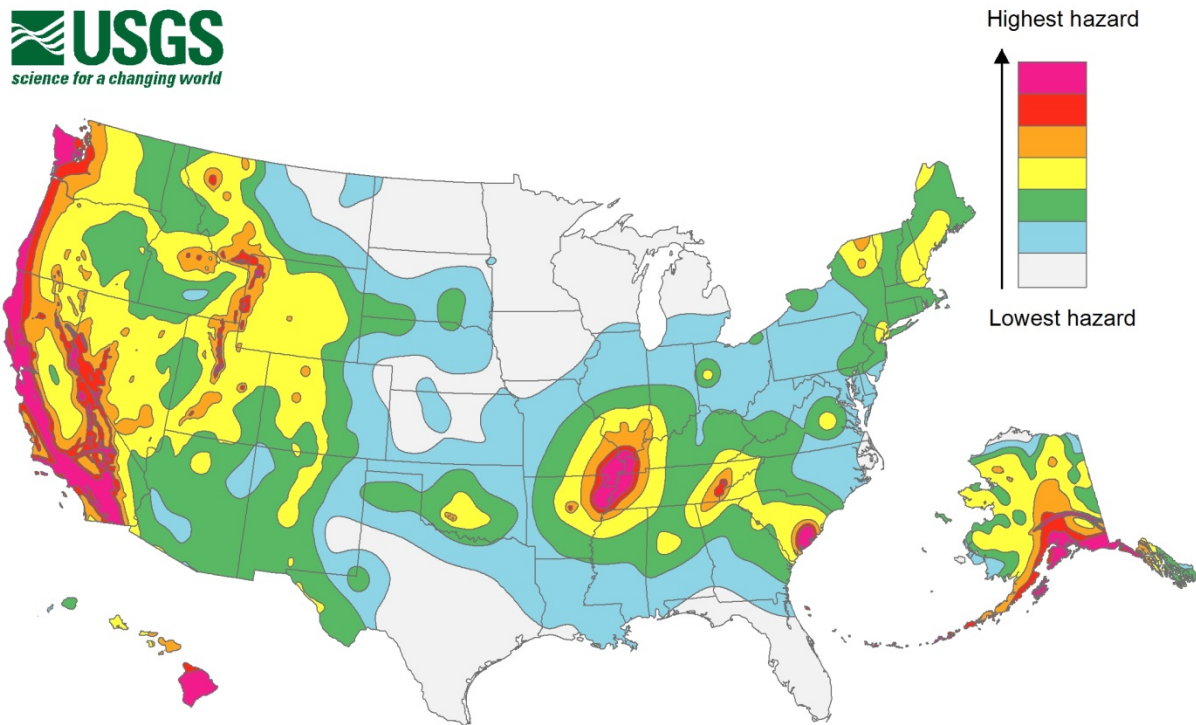
### MODIFIED MERCALLI INTENSITY SCALE

- I People do not feel any Earth movement.
- II A few people might notice movement.
- III Many people indoors feel movement. Hanging objects swing.
- IV Most people indoors feel movement. Dishes, windows, and doors rattle. Walls and frames of structures creak. Liquids in open vessels are slightly disturbed. Parked cars rock.
- V Almost everyone feels movement. Most people are awakened. Doors swing open or closed. Dishes are broken. Pictures on the wall move. Windows crack in some cases. Small objects move or are turned over. Liquids might spill out of open containers.
- VI Everyone feels movement. Poorly built buildings are damaged slightly. Considerable quantities of dishes and glassware, and some windows are broken. People have trouble walking. Pictures fall off walls. Objects fall from shelves. Plaster in walls might crack. Some furniture is overturned. Small bells in churches, chapels and schools ring.
- VII People have difficulty standing. Considerable damage in poorly built or badly designed buildings, adobe houses, old walls, spires and others. Damage is slight to moderate in well-built buildings. Numerous windows are broken. Weak chimneys break at roof lines. Cornices from towers and high buildings fall. Loose bricks fall from buildings. Heavy furniture is overturned and damaged. Some sand and gravel stream banks cave in.
- VIII Drivers have trouble steering. Poorly built structures suffer severe damage. Ordinary substantial buildings partially collapse. Damage slight in structures especially built to withstand earthquakes. Tree branches break. Houses not bolted down might shift on their foundations. Tall structures such as towers and chimneys might twist and fall. Temporary or permanent changes in springs and wells. Sand and mud is ejected in small amounts.
- IX Most buildings suffer damage. Houses that are not bolted down move off their foundations. Some underground pipes are broken. The ground cracks conspicuously. Reservoirs suffer severe damage.
- X Well-built wooden structures are severely damaged and some destroyed. Most masonry and frame structures are destroyed, including their foundations. Some bridges are destroyed. Dams are seriously damaged. Large landslides occur. Water is thrown on the banks of canals, rivers, and lakes. Railroad tracks are bent slightly. Cracks are opened in cement pavements and asphalt road surfaces.
- XI Few if any masonry structures remain standing. Large, well-built bridges are destroyed. Wood frame structures are severely damaged, especially near epicenters. Buried pipelines are rendered completely useless. Railroad tracks are badly bent. Water mixed with sand, and mud is ejected in large amounts.
- XII Damage is total, and nearly all works of construction are damaged greatly or destroyed. Objects are thrown into the air. The ground moves in waves or ripples. Large amounts of rock may move. Lakes are dammed, waterfalls formed and rivers are deflected.

Intensity is a numerical index describing the effects of an earthquake on the surface of the Earth, on man, and on structures built by man. The intensities shown in these maps are the highest likely under the most adverse geologic conditions. There will actually be a range in intensities within any small area such as a town or county, with the highest intensity generally occurring at only a few sites. Earthquakes of all three magnitudes represented in these maps occurred during the 1811 - 1812 "New Madrid earthquakes." The isoseismal patterns shown here, however, were simulated based on actual patterns of somewhat smaller but damaging earthquakes that occurred in the New Madrid seismic zone in 1843 and 1895.

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EMERGENCY MANAGEMENT AGENCY  
P.O. BOX 116  
JEFFERSON CITY, MO 65102  
Telephone: 573-526-9100

Figure 3.3. United States Seismic Hazard Map



Source: United States Geological Survey at [http://earthquake.usgs.gov/hazards/products/conterminous/2014/HazardMap2014\\_lg.jpg](http://earthquake.usgs.gov/hazards/products/conterminous/2014/HazardMap2014_lg.jpg)

### **Severity/Magnitude/Extent**

The extent or severity of earthquakes is generally measured in two ways: 1) the Richter Magnitude Scale is a measure of earthquake magnitude; and 2) the Modified Mercalli Intensity Scale is a measure of earthquake severity. The two scales are defined as follows:

#### *Richter Magnitude Scale*

The Richter Magnitude Scale was developed in 1935 as a device to compare the size of earthquakes. The magnitude of an earthquake is measured using a logarithm of the maximum extent of waves recorded by seismographs. Adjustments are made to reflect the variation in the distance between the various seismographs and the epicenter of the earthquakes. On the Richter Scale, magnitude is expressed in whole numbers and decimal fractions. For example, comparing a 5.3 and a 6.3 earthquake shows that the 6.3 quake is ten times bigger in magnitude. Each whole number increase in magnitude represents a tenfold increase in measured amplitude because of the logarithm. Each whole number step in the magnitude scale represents a release of approximately 31 times more energy.

#### *Modified Mercalli Intensity Scale*

The intensity of an earthquake is measured by the effect of the earthquake on the earth's surface. The intensity scale is based on the responses to the quake, such as people awakening, movement of furniture, damage to

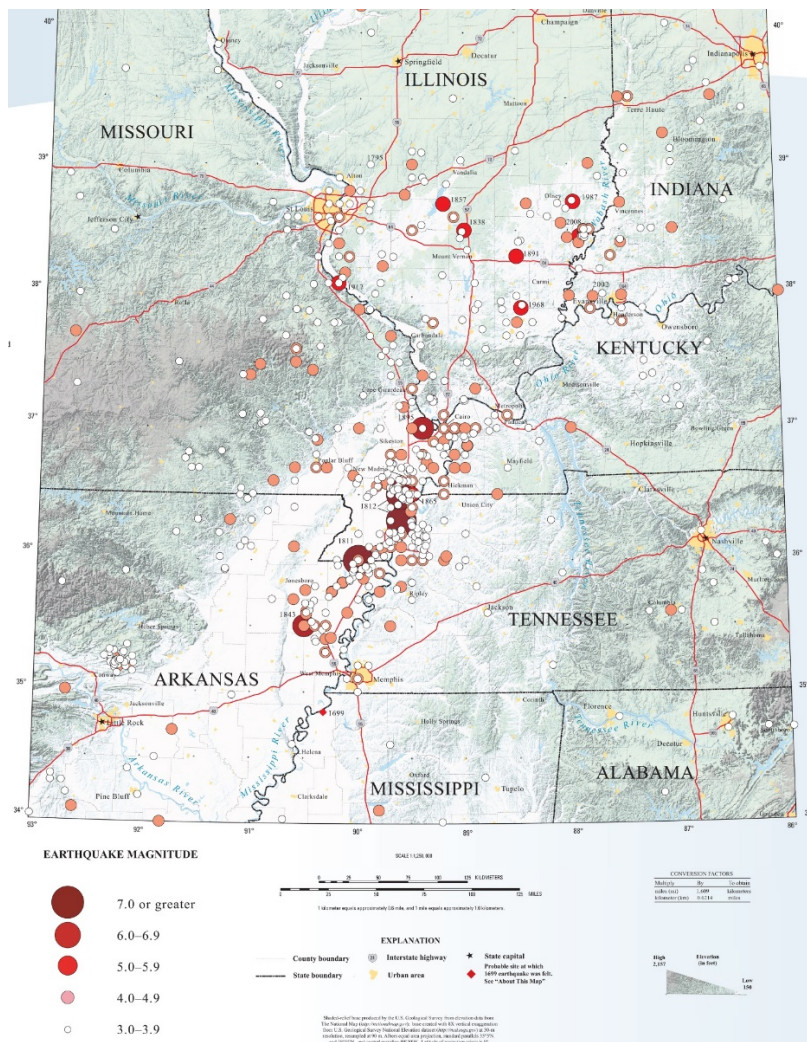
chimneys, etc. The intensity scale currently used in the United States is the Modified Mercalli (MM) Intensity Scale. It was developed in 1931 and is composed of 12 increasing levels of intensity. They range from imperceptible shaking to catastrophic destruction, and each of the twelve levels is denoted by a Roman numeral. The scale does not have a mathematical basis, but is based on observed effects. Its use gives the laymen a more meaningful idea of the severity.

### Previous Occurrences

According to the NCEI, from 1811 to 1985 (most recently available dataset) there were 2,495 earthquakes in the State of Missouri. Additionally, earthquakes from 1699 through 2009 throughout the multi-state region are presented below (Figure 3.4). In recent years, according to the NCEI and USGS, there have been earthquakes recorded in the county ranging in magnitude from 1 to 3, but no known serious damage has resulted.

The New Madrid Seismic Zone experiences more than 200 measurable earthquakes a year. Earthquakes of magnitude 2.5 to 3 on the Richter scale are felt annually, with a quake of 4 or more being released every 18 months. An earthquake of 5.0 or greater on the Richter scale occurs about once per decade.

**Figure 3.4. Earthquakes In Region 1699-2010**



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## ***Probability of Future Occurrence***

As stated previously, Iron County typically experiences at least one minor earthquake per year, while an earthquake of 5.0 or greater on the Richter scale has an annual probability of approximately 10%.

## **Vulnerability**

### ***Vulnerability Overview***

Iron County has a higher than average loss ratio for earthquake damages compared to the rest of the State due to its proximity to the New Madrid Seismic Zone.

### ***Potential Losses to Existing Development***

Given a scenario of 2% probability of exceedance in 50 years, Iron County would be projected to suffer over \$255,000,000 in total economic loss to buildings. Such an economic loss in a rural county could be catastrophic and devastate the population for decades.

### ***Impact of Future Development***

Future development is not expected to increase the risk of an earthquake other than by contributing to the overall exposure of what could become damaged because of an event. Given that little to no growth is anticipated in the County, even this increase in exposure is small.

### ***Hazard Summary by Jurisdiction***

Earthquake intensity will not vary in any meaningful way across the county; therefore, all jurisdictions are equally exposed to an earthquake, and the impacts are expected to be similar for all jurisdictions, given similar development patterns and structure types.

## **Problem Statement**

Earthquakes pose a serious threat to all jurisdictions in the county. A sufficiently strong earthquake will likely damage numerous private and public structures and facilities, including utility distribution and supply infrastructure. The disruption to transportation, water, sewer, electricity, and natural gas will leave residents, businesses, and schools unable to function reliably for potentially weeks after the event. Seismic retrofitting can help, but is often cost prohibitive, and seismic requirements for new development can drive costs up and stymie the growth of communities. Emergency generators can help alleviate the potential loss of power presented by an event.



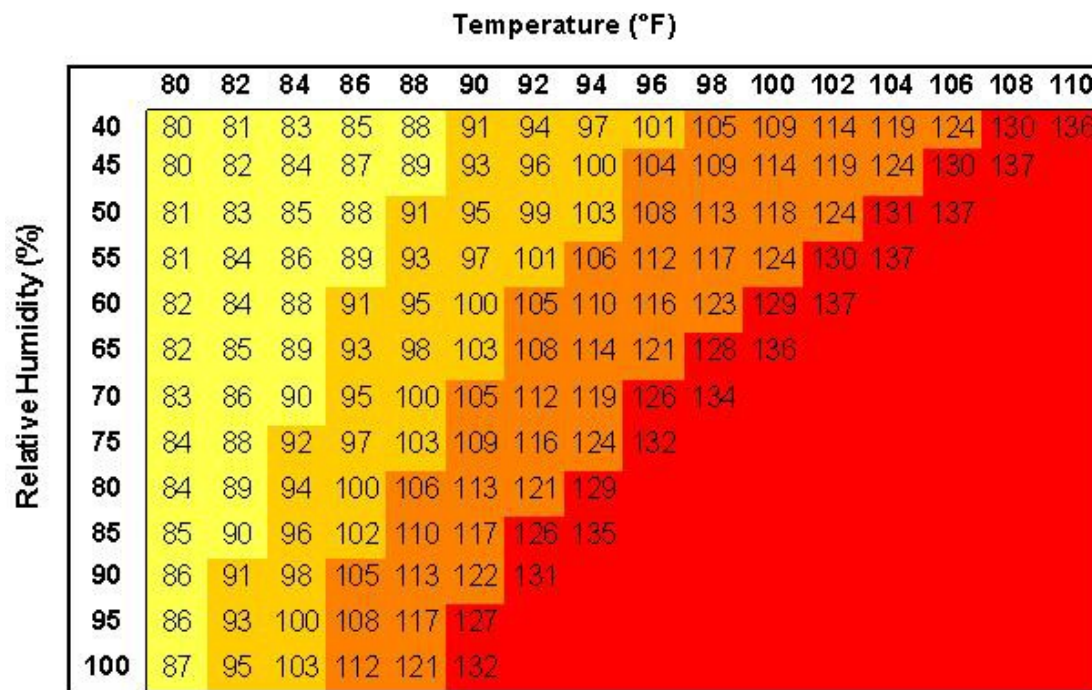
### 3.4.4 Extreme Heat

#### Hazard Profile

##### *Hazard Description*

Extreme temperature events, both hot and cold, can impact human health and mortality, natural ecosystems, agriculture and other economic sectors. The remainder of this section profiles extreme heat. Extreme cold events are profiled in combination with Winter Storm. According to information provided by FEMA, extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. Ambient air temperature is one component of heat conditions, with relative humidity being the other. The relationship of these factors creates what is known as the apparent temperature. The Heat Index chart shown in **Figure 3.5** uses both of these factors to produce a guide for the apparent temperature or relative intensity of heat conditions.

**Figure 3.5. Heat Index (HI) Chart**



#### Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

■ Caution   
 ■ Extreme Caution   
 ■ Danger   
 ■ Extreme Danger

Source: National Weather Service (NWS)

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

#### *Geographic Location*

Extreme heat is an area-wide hazard event, the risk of extreme heat does not vary across the planning area.

#### *Severity/Magnitude/Extent*

Extreme heat can strain crops, livestock, and human health, as well as electricity delivery infrastructure overloaded during peak use of air conditioning during extreme heat events. Another type of infrastructure damage from extreme heat is road damage. When asphalt is exposed to prolonged extreme heat, it can cause buckling of asphalt-paved roads, driveways, and parking lots.

From 1988-2011, there were 3,496 fatalities in the U.S. attributed to summer heat. This translates to an annual national average of 146 deaths. Thankfully, during the same period, no deaths were recorded in the planning area, according to NCEI data. The National Weather Service stated that among natural hazards, no other natural disaster—not lightning, hurricanes, tornadoes, floods, or earthquakes—causes more deaths.

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

**Table 3.11** lists typical symptoms and health impacts due to exposure to extreme heat.

**Table 3.11. Typical Health Impacts of Extreme Heat**

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

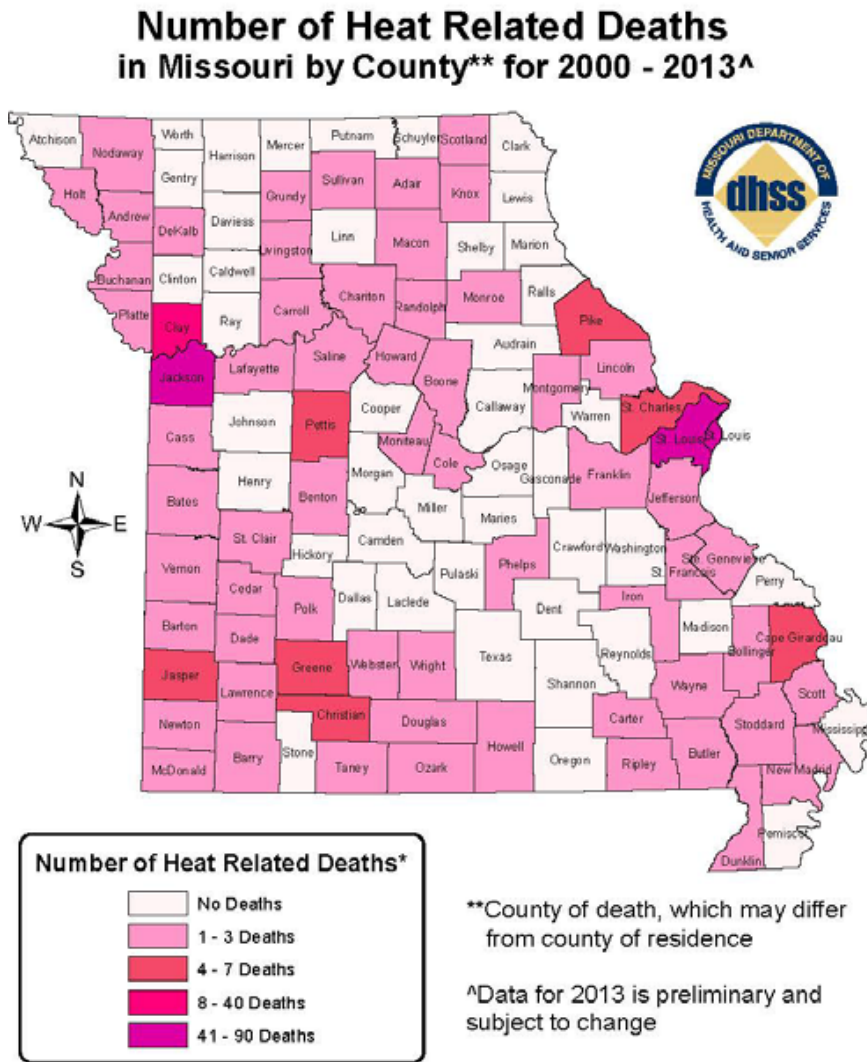
Source: National Weather Service Heat Index Program, [www.weather.gov/os/heat/index.shtml](http://www.weather.gov/os/heat/index.shtml)

The National Weather Service has an alert system in place (advisories or warnings) when the Heat Index is expected to have a significant impact on public safety. The expected severity of the heat determines whether advisories or warnings are issued. A common guideline for issuing excessive heat alerts is when for two or more consecutive days: (1) when the maximum daytime Heat Index is expected to equal or exceed 105 degrees Fahrenheit (°F); and the nighttime minimum Heat Index is 80°F or above. A heat advisory is issued when temperatures reach 105 degrees and a warning is issued at 115 degrees.

***Previous Occurrences***

The NCEI lists 22 recorded events in the past 25 years, with no deaths reported. However, Figure 3.6 shows there have been 1-3 heat-related deaths in the County between 2000 and 2013.

Figure 3.6. Heat Related Deaths in Missouri 2000 - 2013



\*Source: Bureau of Environmental Epidemiology

Date: 6/5/2014

**Probability of Future Occurrence**

While Extreme Heat events can potentially be under-reported in the NCEI, a total of 22 reported events in 25 years calculates to an annual probability of an event of 88%.

**Vulnerability**

**Vulnerability Overview**

The State HMP lists concentrations of elderly populations as one of the best indicators of vulnerability to extreme Heat events. For Iron County, the adults age 65 and older make up 18% of the population. This puts the County near the median of all counties in the state. This moderate percentage of elderly in the county along with 1-3 reported deaths in the past 25 years due to extreme heat indicate the county is marginally vulnerable to extreme heat events.

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### ***Potential Losses to Existing Development***

Given few heat-related deaths in the past quarter century and the median concentration of elderly in the County, the potential losses to existing development are marginal.

### ***Impact of Future Development***

Population growth can result in increases in the age-groups that are most vulnerable to extreme heat. Population growth also increases the strain on electricity infrastructure, as more electricity is needed to accommodate the growing population. While no jurisdictions are experiencing major growth, the aging of the Baby Boomers is likely to lead to a growth in the percentage of elderly in the County.

### ***Hazard Summary by Jurisdiction***

Those at greatest risk for heat-related illness and deaths include children up to five years of age, people 65 years of age and older, people who are overweight, and people who are ill or on certain medications. To determine jurisdictions within the planning area with populations more vulnerable to extreme heat, demographic data was obtained from the 2010 census on population percentages in each jurisdiction comprised of those under age 5 and over age 65. Data was not available for overweight individuals and those on medications vulnerable to extreme heat. Table 3.12 below summarizes vulnerable populations in the participating jurisdictions. Note that school and special districts are not included in the table because students and those working for the special districts are not customarily in these age groups.

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**Table 3.12. County Population Under Age 5 and Over Age 65, 2010 Census Data**

<b>Jurisdiction</b>	<b>Population Under 5 yrs</b>	<b>Population 65 yrs and over</b>
Iron County	6%	18%
Ironton	7%	20%

Source: U.S. Census Bureau, (\*) includes entire population of each city or county

### **Problem Statement**

Extreme heat is most problematic for the elderly and youth in the entire county. While schools host much of the youth population for a period of time each day, the buildings are temperature controlled and offer a reprieve to students from the heat if they lack air conditioning at home. Likewise, the senior center offers an oasis for senior residents seeking a break from extreme heat.

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## 3.4.5 Wildfires

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### **Hazard Profile**

#### ***Hazard Description***

The incident types considered for wildfires include: 1) natural vegetation fire, 2) outside rubbish fire, 3) special outside fire, and 4) cultivated vegetation, crop fire.

The Missouri Division of Fire Safety (MDFS) indicates that approximately 80 percent of the fire departments in Missouri are staffed with volunteers. Whether paid or volunteer, these departments are often limited by lack of resources and financial assistance. The impact of a fire to a single-story building in a small community may be as great as that of a larger fire to a multi-story building in a large city.

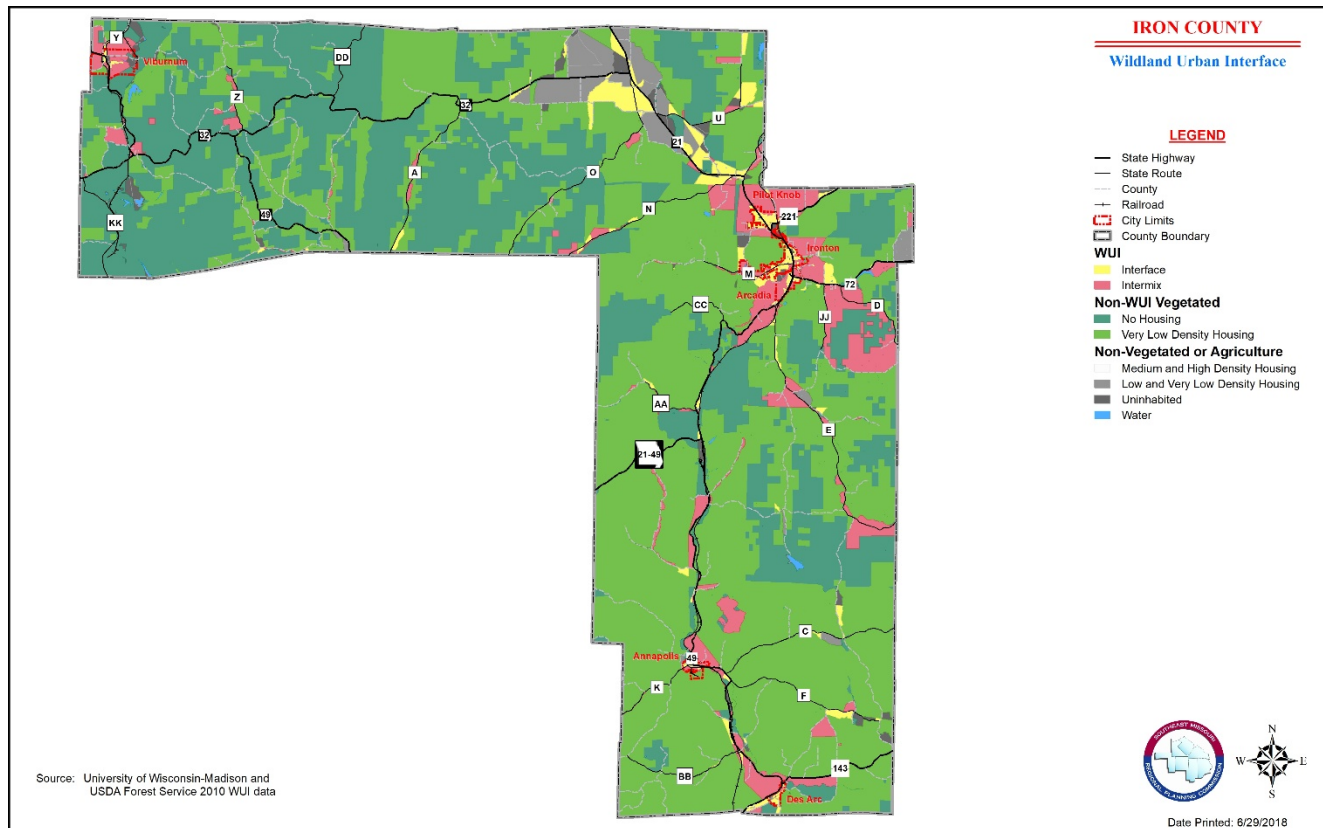
The Forestry Division of the Missouri Department of Conservation (MDC) is responsible for protecting privately owned and state-owned forests and grasslands from wildfires. To accomplish this task, eight forestry regions have been established in Missouri for fire suppression. The Forestry Division works closely with volunteer fire departments and federal partners to assist with fire suppression activities. Currently, more than 900 rural fire departments in Missouri have mutual aid agreements with the Forestry Division to obtain assistance in wildfire protection if needed.

Most of Missouri fires occur during the spring season between February and May. The length and severity of both structural and wildland fires depend largely on weather conditions. Spring in Missouri is usually characterized by low humidity and high winds. These conditions result in higher fire danger. In addition, due to the recent lack of moisture throughout many areas of the state, conditions are likely to increase the risk of wildfires. Drought conditions can also hamper firefighting efforts, as decreasing water supplies may not prove adequate for firefighting. It is common for rural residents burn their garden spots, brush piles, and other areas in the spring. Some landowners also believe it is necessary to burn their forests in the spring to promote grass growth, kill ticks, and reduce brush. Therefore, spring months are the most dangerous for wildfires. The second most critical period of the year is fall. Depending on the weather conditions, a sizeable number of fires may occur between mid-October and late November.

#### ***Geographic Location***

The risk of structural fire does not vary widely across the planning area. However, damages due to wildfires are likely to be higher in communities with more wildland–urban interface (WUI) areas. WUI refers to the zone of transition between unoccupied land and human development. Within the WUI, there are two specific areas identified: 1) Interface and 2) Intermix. The Interface areas are those areas that abut wildland vegetation and the Intermix areas are those areas that intermingle with wildland areas. Figure 3.7 illustrates the most vulnerable areas of the county based on Interface and Intermix, primarily Ironton and areas along major transportation corridors.

**Figure 3.7. Iron County Woodland-Urban Interface Map**



### **Severity/Magnitude/Extent**

Wildfires damage the environment, killing some plants and occasionally animals. Firefighters have been injured or killed, and structures can be damaged or destroyed. The loss of plants can heighten the risk of soil erosion and landslides. Although Missouri wildfires are not the size and intensity of those in the Western United States, they could impact recreation and tourism in and near the fires.

Wildland fires in Missouri have been mostly a result of human activity rather than lightning or some other natural event. Wildfires in Missouri are usually surface fires, burning the dead leaves on the ground or dried grasses. They do sometimes “torch” or “crown” out in certain dense evergreen stands like eastern red cedar and shortleaf pine. However, Missouri does not have the extensive stands of evergreens found in the western US that fuel the large fire storms seen on television news stories.

While very unusual, crown fires can and do occur in Missouri native hardwood forests during prolonged periods of drought combined with extreme heat, low relative humidity, and high wind. Tornadoes, high winds, wet snow and ice storms in recent years have placed a large amount of woody material on the forest floor that causes wildfires to burn hotter and longer. These conditions also make it more difficult for fire fighters suppress fires safely. See <http://www.firewisemissouri.org/wildfire-in-missouri.html>

Often wildfires in Missouri go unnoticed by the general public because the sensational fire behavior that captures the attention of television viewers is rare in the state. Yet, from the standpoint of destroying homes and other property, Missouri wildfires can be quite destructive.

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Information on severity of damages from wildfires is not currently available.

### ***Previous Occurrences***

The Missouri Department of Conservation lists 203 instances of wildfires in the county from 1999 to 2018, with 76 of these burning more than 10 acres.

### ***Probability of Future Occurrence***

Based on 203 instances in 20 years, there is a 100% chance of a wildfire in the county in any given year.

## **Vulnerability**

### ***Vulnerability Overview***

The 2013 State HMP indicates Iron County has a “Low” vulnerability to wildfires. The woodland-urban interface map indicates that while this is true for the county, Ironton likely has a “Medium-Low” to “Medium” vulnerability.

### ***Potential Losses to Existing Development***

Data was sought from the National Fire Incident Reporting System, the Department of Conservation, and DNR. However, no data is readily available.

### ***Impact of Future Development***

Future development is most likely to occur in areas of Intermix on the WUI map. This will increase the number of structures in the area while also reducing the amount of vegetation to serve as fuel. These two factors are expected to balance one another, leading to no significant impact from future development.

### ***Hazard Summary by Jurisdiction***

Ironton has the most WUI Intermix and Interface areas, indicating a greater vulnerability to wildfires. The County certainly has more forest cover than Ironton, but the lack of development minimizes the impacts of a wildfire on human life and structures.

## **Problem Statement**

Wildfires are a common occurrence in the county, though the majority of these events are small, impacting 10 acres or less. However, any wildfire does pose the threat to grow quickly and impact a much larger area if not addressed quickly. Local fire departments are equipped and trained to handle these common events.

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## 3.4.6 Flooding (Flash and River)

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### **Hazard Profile**

#### ***Hazard Description***

A flood is partial or complete inundation of normally dry land areas. Riverine flooding is defined as the overflow of rivers, streams, drains, and lakes due to excessive rainfall, rapid snowmelt, or ice. There are several types of riverine floods, including headwater, backwater, interior drainage, and flash flooding. Riverine flooding is defined as the overflow of rivers, streams, drains, and lakes due to excessive rainfall, rapid snowmelt or ice melt. The areas adjacent to rivers and stream banks that carry excess floodwater during rapid runoff are called floodplains. A floodplain is defined as the lowland and relatively flat area adjoining a river or stream. The terms “base flood” and “100- year flood” refer to the area in the floodplain that is subject to a one percent or greater chance of flooding in any given year. Floodplains are part of a larger entity called a basin, which is defined as all the land drained by a river and its branches.

Flooding caused by dam and levee failure is discussed in the Dam and Levee Failure section. It will not be addressed in this section.

A flash flood occurs when water levels rise at an extremely fast rate because of intense rainfall over a brief period, sometimes combined with rapid snowmelt, ice jam release, frozen ground, saturated soil, or impermeable surfaces. Flash flooding can happen in Special Flood Hazard Areas (SFHAs) as delineated by the National Flood Insurance Program (NFIP), and can also happen in areas not associated with floodplains.

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

In some cases, flooding may not be directly attributable to a river, stream, or lake overflowing its banks. Rather, it may simply be the combination of excessive rainfall or snowmelt, saturated ground, and inadequate drainage. With no place to go, the water will find the lowest elevations – areas that are often not in a floodplain. This type of flooding, often referred to as sheet flooding, is becoming increasingly prevalent as development outstrips the ability of the drainage infrastructure to properly carry and disburse the water flow.

Most flash flooding is caused by slow-moving thunderstorms or thunderstorms repeatedly moving over the same area. Flash flooding is a dangerous form of flooding which can reach full peak in only a few minutes. Rapid onset allows little or no time for protective measures. Flash flood waters move at very fast speeds and can move boulders, tear out trees, scour channels, destroy buildings, and obliterate bridges. Flash flooding can result in higher loss of life, both human and animal, than slower developing river and stream flooding.

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

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



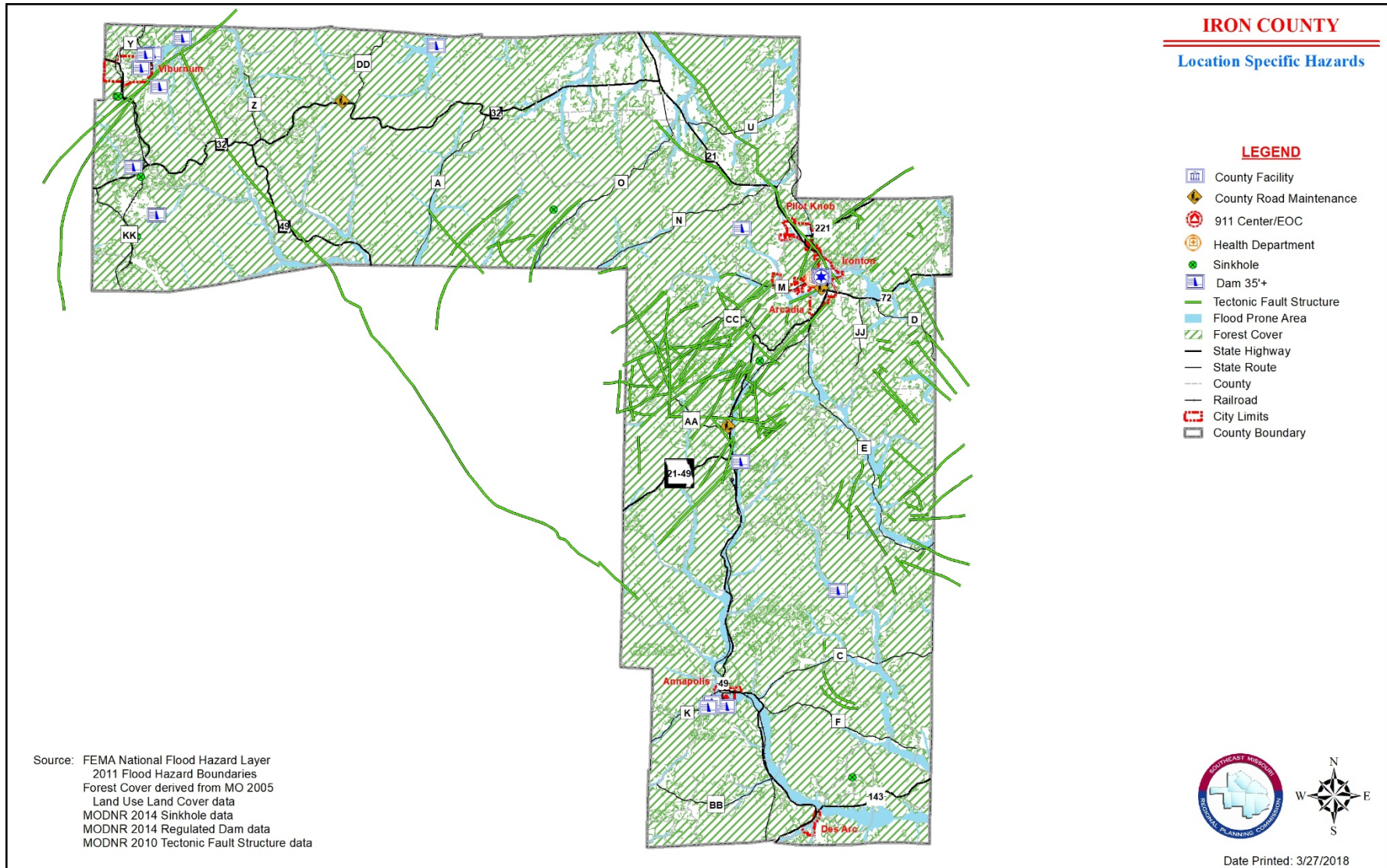
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advanced warning systems has increased the warning time for flash floods.

***Geographic Location***

River flooding is most likely to occur in SFHAs. The following maps illustrate the SFHAs for all participating jurisdictions.

**Figure 3.8. Iron County SFHAs**



**Figure 3.9. Ironton SFHAs**

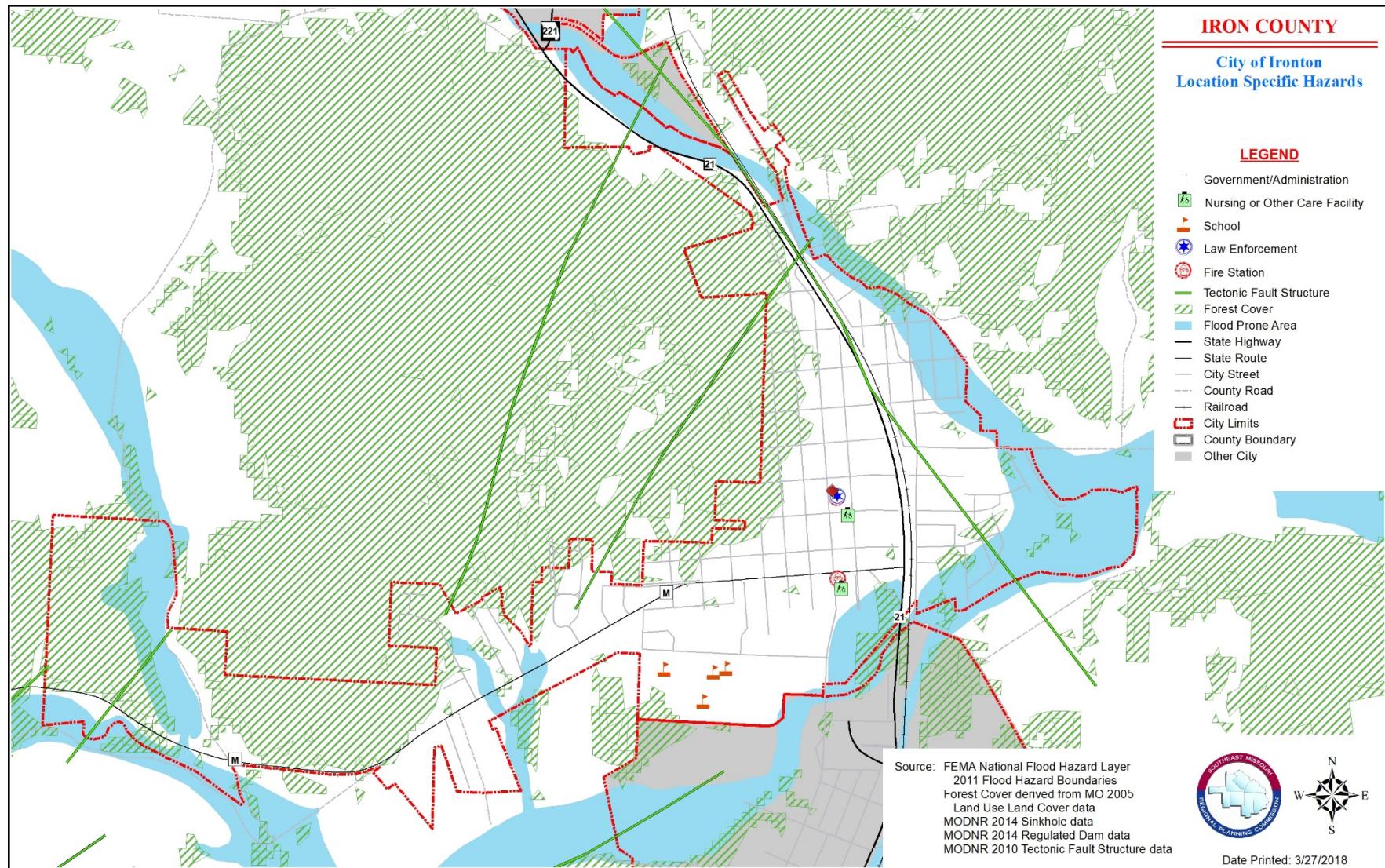
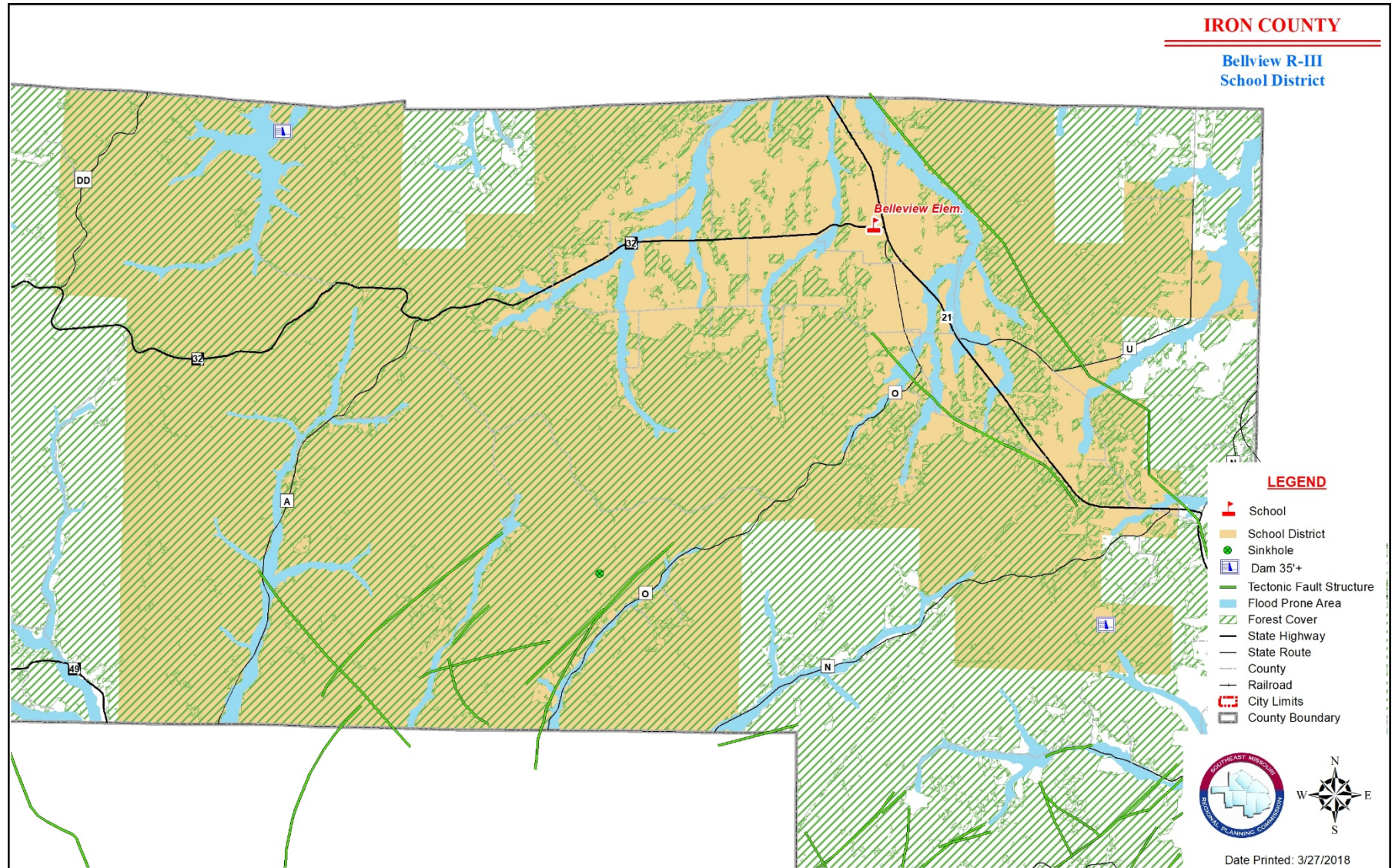


Figure 3.10. Belleview R-III School District SFHAs



## Severity/Magnitude/Extent

Missouri has a long and active history of flooding over the past century, according to the 2013 State Hazard Mitigation Plan. Flooding along Missouri's major rivers generally results in slow-moving disasters. River crest levels are forecast several days in advance, allowing communities downstream sufficient time to take protective measures, such as sandbagging and evacuations. Nevertheless, floods exact a heavy toll in terms of human suffering and losses to public and private property. By contrast, flash flood events in recent years have caused a higher number of deaths and major property damage in many areas of Missouri.

Flooding presents a danger to life and property, often resulting in injuries, and in some cases, fatalities. Floodwaters themselves can interact with hazardous materials. Hazardous materials stored in large containers could break loose or puncture because of flood activity. Examples are bulk propane tanks. When this happens, evacuation of citizens is necessary.

Public health concerns may result from flooding, requiring disease and injury surveillance. Community sanitation to evaluate flood-affected food supplies may also be necessary. Private water and sewage sanitation could be impacted, and vector control (for mosquitoes and other entomology concerns) may be necessary.

When roads and bridges are inundated by water, damage can occur as the water scours materials around bridge abutments and gravel roads. Floodwaters can also cause erosion undermining road beds. In some instances, steep slopes that are saturated with water may cause mud or rock slides onto roadways. These damages can cause costly repairs for state, county, and city road and bridge maintenance departments. When sewer back-up occurs, this can result in costly clean-up for home and business owners as well as present a health hazard.

### National Flood Insurance Program (NFIP) Participation

Table 3.13 shows the participation status of all jurisdictions in the planning area, regardless of participation status in this plan. Table 3.14 shows the NFIP policy and claim statistics of participating jurisdictions of this plan. As Viburnum has not chosen to participate in this plan, their reasons for not participating in the NFIP are difficult to determine.

Both Iron County and Ironton have adopted and enforce floodplain management regulations which meet the requirements of the NFIP. This includes the regulation of new construction in SFHAs. The county and city also both request FIRM map updates when conditions have changed, and also assist property owners in obtaining Letter of Map Amendments when appropriate.

**Table 3.13. NFIP Participation in Iron County**

Community ID #	Community Name	NFIP Participant (Y/N)	Current Effective Map Date	Regular-Emergency Program Entry Date
290815	Iron County	Y	2/16/2006	3/6/2009
290763	Annapolis	Y	2/16/2006	8/01/1986
290168	Arcadia	Y	2/16/2006	7/17/1989
290613	Des Arc	Y	2/16/2006	8/07/2012
290720	Ironton	Y	2/16/2006	12/04/1984
290679	Pilot Knob	Y	2/16/2006	4/16/1990
290646	Viburnum	N	2/16/2006	2/21/1976

Source: NFIP Community Status Book, 8/17/2017; BureauNet, <http://www.fema.gov/national-flood-insurance-program/national-flood-insurance-program-community-status-book>; M= No elevation determined – all Zone A, C, and X; NSFHA = No Special Flood Hazard Area; E=Emergency Program

**Repetitive Loss/Severe Repetitive Loss Properties**

Repetitive Loss Properties, according to the State Hazard Mitigation Officer, are “those properties for which two or more losses of at least \$1,000 each have been paid under the National Flood Insurance Program (NFIP) within any 10-year period since 1978.”

Severe Repetitive Loss Properties are defined, by the National Flood Insurance Reform Act of 2004, as: a single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP and has incurred flood-related damage for which 4 or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding \$5,000 and with cumulative amount of such claims payments exceeding \$20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

According to the Flood Insurance Administration, jurisdictions included in the planning area have a combined total of 3 repetitive loss properties, with 1 property having been mitigated (1 residential), leaving 2 unmitigated repetitive loss properties (2 residential). There are no severe repetitive loss properties in Iron County.

**Table 3.14. Iron County Repetitive Loss Properties**

**Iron County Non-Mitigated Repetitive Loss**

County Name	Community Name	Building Payments	Contents Payments	Total Payments	Average Payment	Losses	Properties
IRON COUNTY	Ironton, City Of	18,661.71	0	18,661.71	3,732.34	5	2
Residential	2						
Commercial	0						

**Iron County Mitigated Repetitive Loss**

County Name	Community Name	Building Payments	Contents Payments	Total Payments	Average Payment	Losses	Properties
IRON COUNTY	Ironton, City Of	8,940.44	0	8,940.44	4,470.22	2	1
Residential	1						
Commercial	0						

Source: SEMA

**Previous Occurrences**

Table 3.15 shows flash flood events in the county from the past 25 years. Table 3.16 shows riverine flood events in the County for the same time.

**Table 3.15. NCEI Iron County Flash Flood Events Summary, 1993 to 2017**

LOCATION	DATE	DEATHS	INJURIES	DAMAGE PROPERTY	DAMAGE CROPS
COUNTYWIDE	4/19/1996	0	0	0	0

COUNTYWIDE	4/22/1996	0	0	0	0
COUNTYWIDE	7/26/1998	0	0	200000	0
COUNTYWIDE	4/3/1999	0	0	0	0
ANNAPOLIS	7/28/2001	0	6	0	0
COUNTYWIDE	5/12/2002	1	0	5500000	0
COUNTYWIDE	11/15/2005	0	0	0	0
GLOVER	9/8/2007	0	0	1000	0
PILOT KNOB	2/5/2008	0	0	0	0
VULCAN	3/18/2008	0	0	200000	0
GLOVER	4/10/2008	0	0	5000	0
VIBURNUM	4/23/2011	0	0	0	0
VIBURNUM	4/18/2013	0	0	0	0
BRUNOT	12/28/2015	0	0	220000	0
MINIMUM	8/13/2016	0	0	0	0
MIDDLE BROOK	8/15/2016	0	0	0	0
VIBURNUM	4/29/2017	0	0	0	0
GLOVER	7/14/2017	0	0	0	0

Source: NCEI, data accessed 3/6/18

**Table 3.16. NCEI Iron County Riverine Flood Events Summary, 1995 to 2015**

LOCATION	DATE	DEATHS	INJURIES	DAMAGE PROPERTY	DAMAGE CROPS
COUNTY	5/1/1996	0	0	0	0
IRONTON	1/13/2007	0	0	0	0
DES ARC	1/12/2013	0	0	0	0

Source: NCEI, data accessed 3/6/18

### ***Probability of Future Occurrence***

For flash flood events, NCEI reports 18 events in the past 25 years, equaling an annual chance of 72%. Six events resulted in damages or losses, equaling a 24% chance of occurrence in a year with annual damages of \$245,000. For river flooding, there are only 3 reported events in the past 25 years, for an annual chance of 12%. There were no reported deaths in that time due to river flooding.

## **Vulnerability**

### ***Vulnerability Overview***

Ironton and the County both have extensive amounts of areas designated as SFHAs but the small number of riverine floods indicates this hazard poses less risk than that of flash flooding, which occurs at a much greater rate.

### ***Potential Losses to Existing Development***

Table 3.17 shows the number of buildings in the floodplain in the County and Ironton. The table also shows the value of those buildings and their contents.

The school district has no structures in floodplains.

**Table 3.17. Maximum Potential Flood Losses**

Jurisdiction	Building Count	Building Exposure	Contents Exposure	Total Exposure
Iron County-Unincorporated	150	\$ 23,254,888	\$ 22,876,648	\$ 46,131,536
Ironton	15	\$ 2,199,600	\$ 2,199,600	\$ 4,399,200
Total	165	\$ 25,454,488	\$ 25,076,248	\$ 50,530,736

Sources: Population, 2010 Census; Building Count, SEMO RPC data; Building Exposure, HMPC and SEMO RPC data; Contents Exposure derived by applying multiplier to Building Exposure based on HAZUS MH 2.1 standard contents multipliers per usage type as follows: Residential (50%), Commercial (100%), Industrial (150%), Agricultural (100%).

***Impact of Future Development***

Future development which occurs in floodplains, low-lying areas near rivers or streams or where drainage systems are not adequate to provide drainage during heavy rainfall events will face a much higher risk of flooding. Additionally, future development will also increase impervious surfaces, leading to additional run off, putting more strain on existing drainage systems. However, with little future development expected, there is little impact expected.

***Hazard Summary by Jurisdiction***

GIS analysis of data from the University of Missouri of structures in the County indicates the County has approximately 23 residences, 7 commercial structures, 3 industrial structures, and 117 agricultural structures in SFHAs. Likewise, the city of Ironton has 10 residences, 3 commercial, 2 industrial, and 0 agricultural structures in SFHAs.

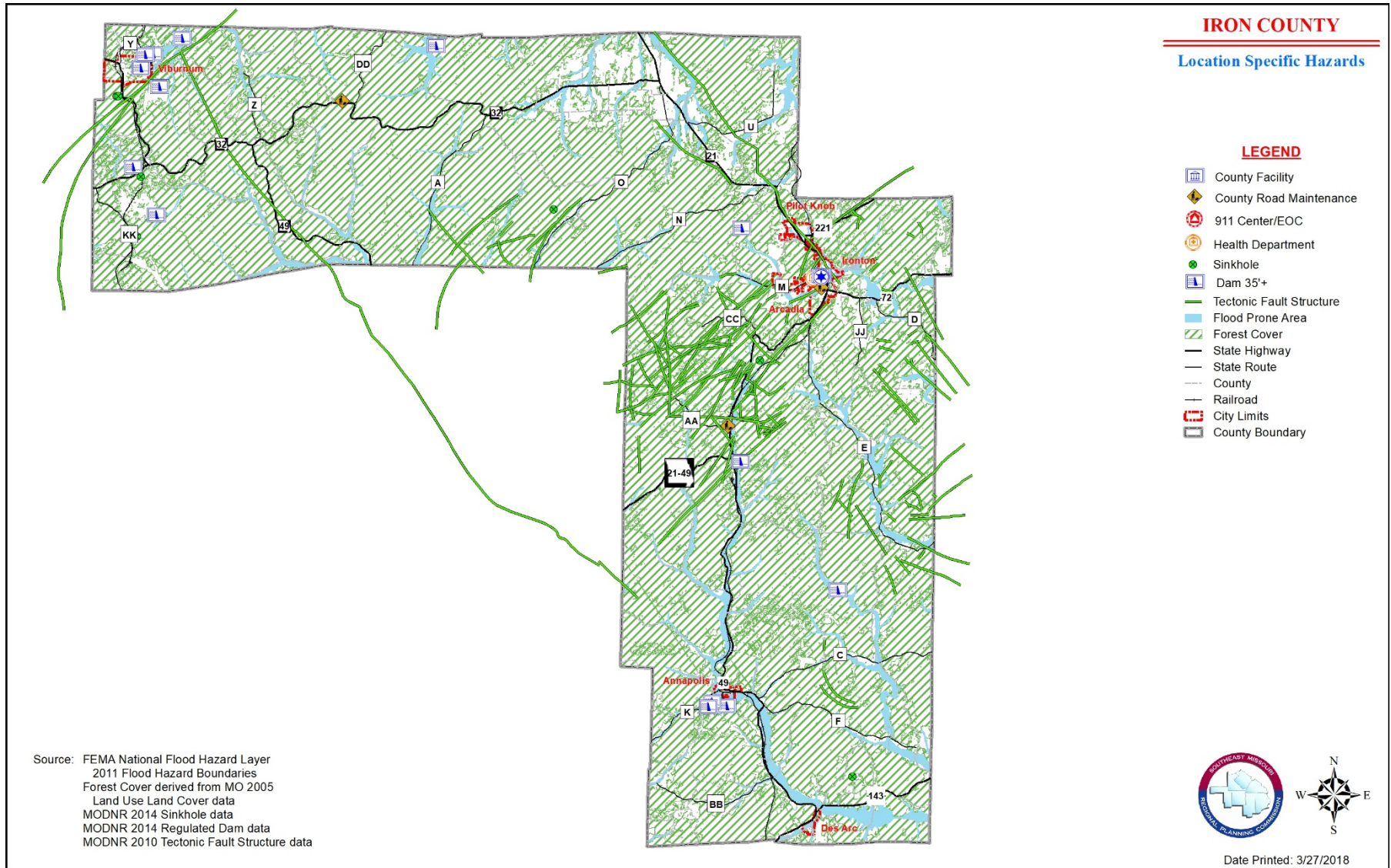
The school district has no structures in the floodplain.

**Problem Statement**

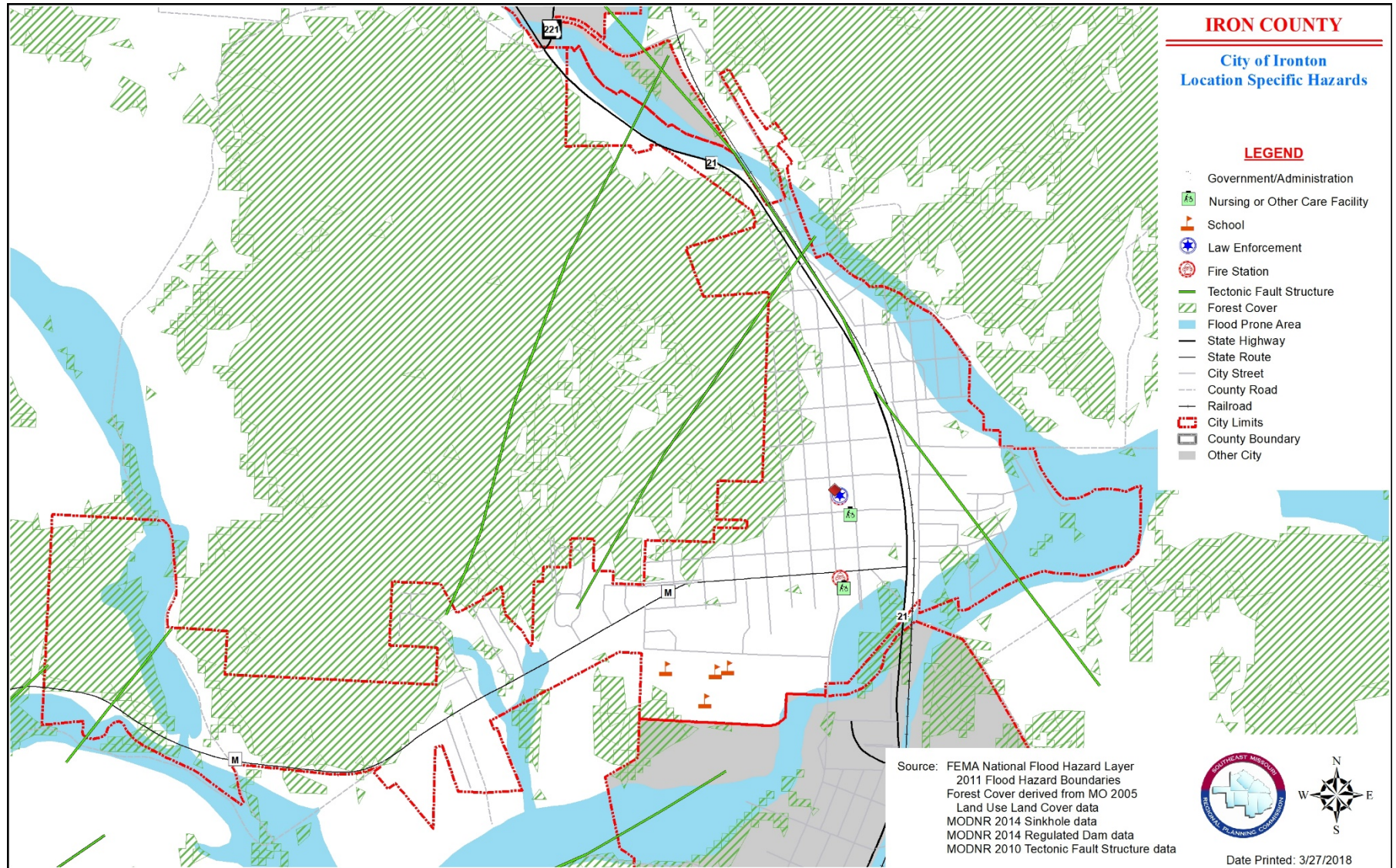
Due to the hilly terrain of the county, flood prone areas are primarily relegated to limited areas immediately adjacent to the county’s rivers. The municipalities have little if any development in these areas (mostly recreational) and the county limits development in SFHAs. Other than roadways, there is no critical infrastructure in the SFHA.



Figure 3.11. Iron County SFHA



**Figure 3.12. Ironton SFHA**



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## 3.4.7 Sinkholes

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### **Hazard Profile**

#### ***Hazard Description***

Sinkholes are common where the rock below the land surface is limestone, carbonate rock, salt beds, or rocks that naturally can be dissolved by ground water circulating through them. As the rock dissolves, spaces and caverns develop underground. The sudden collapse of the land surface above them can be dramatic and range in size from broad, regional lowering of the land surface to localized collapse. However, the primary causes of most subsidence are human activities: underground mining of coal, groundwater or petroleum withdrawal, and drainage of organic soils. In addition, sinkholes can develop as a result of subsurface void spaces created over time due to the erosion of subsurface limestone (karst).

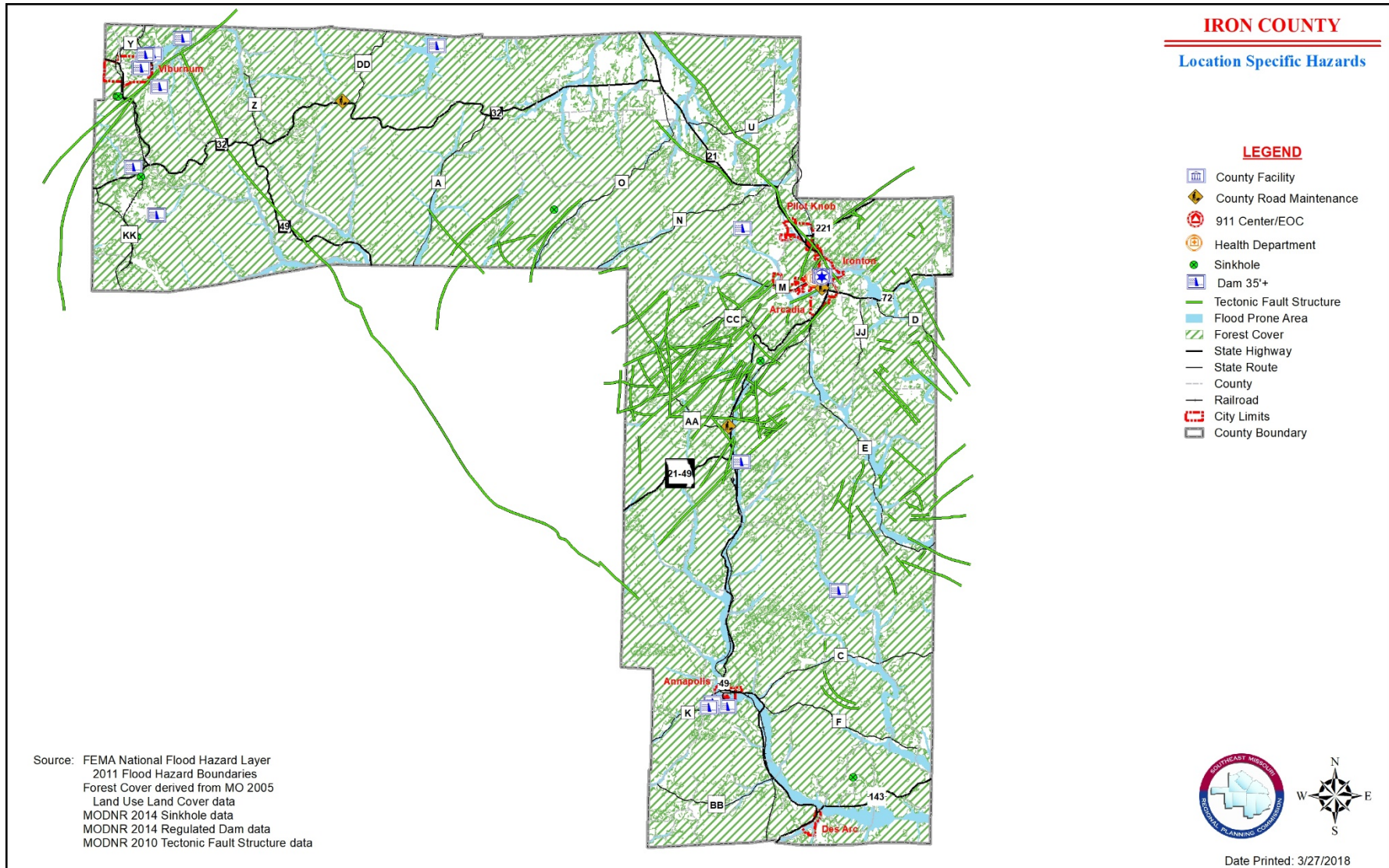
In the case of sinkholes, the rock below the surface is rock that has been dissolving by circulating groundwater. As the rock dissolves, spaces and caverns form, and ultimately the land above the spaces collapse. In Missouri, sinkhole problems are usually a result of surface materials above openings into bedrock caves eroding and collapsing into the cave opening. These collapses are called “cover collapses” and geologic information can be applied to predict the general regions where collapse will occur. Sinkholes range in size from several square yards to hundreds of acres and may be quite shallow or hundreds of feet deep.

According to the U.S. Geological Survey (USGS), the most damage from sinkholes tends to occur in Florida, Texas, Alabama, Missouri, Kentucky, Tennessee, and Pennsylvania. Fifty-nine percent of Missouri is underlain by thick, carbonate rock that makes Missouri vulnerable to sinkholes. Sinkholes occur in Missouri on a fairly frequent basis. Most of Missouri’s sinkholes occur naturally in the State’s karst regions (areas with soluble bedrock). They are a common geologic hazard in southern Missouri, but also occur in the central and northeastern parts of the State. Missouri sinkholes have varied from a few feet to hundreds of acres and from less than one to more than 100 feet deep. The largest known sinkhole in Missouri encompasses about 700 acres in western Boone County southeast of where Interstate 70 crosses the Missouri River. Sinkholes can also vary in shape like shallow bowls or saucers whereas other have vertical walls. Some hold water and form natural ponds.

#### ***Geographic Location***

There are only a handful of known sinkholes located in Iron County, shown in Figure 3.13.

**Figure 3.13. Sinkhole Locations In Iron County**



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### ***Severity/Magnitude/Extent***

Sinkholes vary in size and location, and these variances will determine the impact of the hazard. A sinkhole could result in the loss of a personal vehicle, a building collapse, or damage to infrastructure such as roads, water, or sewer lines. Groundwater contamination is also possible from a sinkhole. Because of the relationship of sinkholes to groundwater, pollutants captured or dumped in sinkholes could affect a community's groundwater system. Sinkhole collapse could be triggered by large earthquakes. Sinkholes located in floodplains can absorb floodwaters but make detailed flood hazard studies difficult to model.

The 2013 State Plan included only seven documented sinkhole "notable events". The plan stated that sinkholes are common to Missouri and the probability is high that they will occur in the future. To date, Missouri sinkholes have historically not had major impacts on development nor have they caused serious damage. Thus, the severity of future events is likely to be low.

### ***Previous Occurrences***

While there are 9 known sinkholes in the County, there have been no significant events related to them.

### ***Probability of Future Occurrence***

It is difficult to predict the probability of future occurrence of sinkholes given the complexities involved with bedrock conditions and the unknown "start" dates of the existing sinkholes. Given the karst topography of the county additional sinkholes are likely to occur eventually.

### **Vulnerability**

#### ***Vulnerability Overview***

With only 9 known sinkholes and no significant events associated with them, the County's vulnerability to such events is low.

#### ***Potential Losses to Existing Development***

There are no structures in the county within 100 ft. of a known sinkhole. The occurrence of new sinkholes is possible, but it is virtually impossible to predict the exact location, making potential losses impractical to estimate.

#### ***Impact of Future Development***

Additional future development will statistically increase the risk of damage to development, though not in any significant amount.

#### ***Hazard Summary by Jurisdiction***

Sinkholes, while present and possible, pose little threat to any jurisdiction.

### **Problem Statement**

Sinkholes do occur in parts of the county. Development of new sinkholes is likely to occur but there is no way to predict precisely where given the dispersed nature of existing sinkholes, or to what magnitude.



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## 3.4.8 Levee Failure

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### **Hazard Profile**

#### ***Hazard Description***

Levees are earth embankments constructed along rivers and coastlines to protect adjacent lands from flooding. Floodwalls are concrete structures, often components of levee systems, designed for urban areas where there is insufficient room for earthen levees. When levees and floodwalls and their appurtenant structures are stressed beyond their capabilities to withstand floods, levee failure can result in injuries and loss of life, as well as damages to property, the environment, and the economy.

Levees can be small agricultural levees that protect farmland from high-frequency flooding. Levees can also be larger, designed to protect people and property in larger urban areas from less frequent flooding events such as the 100-year and 500-year flood levels. For purposes of this discussion, levee failure will refer to both overtopping and breach as defined in FEMA's Publication "So You Live Behind a Levee" (<http://content.asce.org/ASCELeveeGuide.html>). Following are the FEMA publication descriptions of different kinds of levee failure:

#### **Overtopping: When a Flood Is Too Big**

Overtopping occurs when floodwaters exceed the height of a levee and flow over its crown. As the water passes over the top, it may erode the levee, worsening the flooding and potentially causing an opening, or breach, in the levee.

#### **Breaching: When a Levee Gives Way**

A levee breach occurs when part of a levee gives way, creating an opening through which floodwaters may pass. A breach may occur gradually or suddenly. The most dangerous breaches happen quickly during periods of high water. The resulting torrent can quickly swamp a large area behind the failed levee with little or no warning.

Earthen levees can be damaged in several ways. For instance, strong river currents and waves can erode the surface. Debris and ice carried by floodwaters—and even large objects such as boats or barges—can collide with and gouge the levee. Trees growing on a levee can blow over, leaving a hole where the root wad and soil used to be. Burrowing animals can create holes that enable water to pass through a levee. If severe enough, any of these situations can lead to a zone of weakness that could cause a levee breach. In seismically active areas, earthquakes and ground shaking can cause a loss of soil strength, weakening a levee and possibly resulting in failure. Seismic activity can also cause levees to slide or slump, both of which can lead to failure.

### ***Geographic Location***

Missouri is a state with many levees. Currently, there is no single comprehensive inventory of levee systems in the state. Levees have been constructed across the state by public entities and private entities with varying levels of protection, inspection oversight, and maintenance. The lack of a comprehensive levee inventory is not unique to Missouri.

There are two concurrent nation-wide levee inventory development efforts, one led by the United State Army Corps of Engineers (USACE) and one led by Federal Emergency Management Agency (FEMA). The National Levee Database (NLD), developed by USACE, captures all USACE related levee projects, regardless of design levels of protection. The Midterm Levee Inventory (MLI), developed by FEMA, captures all levee data (USACE

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and non-USACE) but primarily focuses on levees that provide 1% annual-chance flood protection on FEMA Flood Insurance Rate Maps (FIRMs).

It is likely that agricultural levees and other non-regulated levees within the planning area exist that are not inventoried or inspected. These levees that are not designed to provide protection from the 1-percent annual chance flood would overtop or fail in the 1-percent annual chance flood scenario. Therefore, any associated losses would be taken into account in the loss estimates provided in the Flood Hazard Section.

There are no levees listed in the USACE NLD in the County.

### ***Severity/Magnitude/Extent***

Levee failure is typically an additional or secondary impact of another disaster such as flooding or earthquake. The main difference between levee failure and losses associated with riverine flooding is magnitude. Levee failure often occurs during a flood event, causing destruction in addition to what would have been caused by flooding alone. In addition, there would be an increased potential for loss of life due to the speed of onset and greater depth, extent, and velocity of flooding due to levee breach.

As previously mentioned, agricultural levees and levees that are not designed to provide flood protection from at least the 1-percent annual chance flood likely do exist in the planning area. However, none of these levees are shown on the Preliminary DFIRM, nor are they enrolled in the USACE Levee Safety Program. As a result, an inventory of these types of levees is not available for analysis. Additionally, since these types of levees do not provide protection from the 1-percent annual chance flood, losses associated with overtopping or failure are captured in the Flood Section of this plan.

The USACE regularly inspects levees within its Levee Safety Program to monitor their overall condition, identify deficiencies, verify that maintenance is taking place, determine eligibility for federal rehabilitation assistance (in accordance with P.L. 84-99), and provide information about the levees on which the public relies. Inspection information also contributes to effective risk assessments and supports levee accreditation decisions for the National Flood Insurance Program administered by the Federal Emergency Management Agency (FEMA).

The USACE now conducts two types of levee inspections. Routine Inspection is a visual inspection to verify and rate levee system operation and maintenance. It is typically conducted each year for all levees in the USACE Levee Safety Program. Periodic Inspection is a comprehensive inspection led by a professional engineer and conducted by a USACE multidisciplinary team that includes the levee sponsor. The USACE typically conducts this inspection every five years on the federally authorized levees in the USACE Levee Safety Program.

Both Routine and Periodic Inspections result in a rating for operation and maintenance. Each levee segment receives an overall segment inspection rating of Acceptable, Minimally Acceptable, or Unacceptable. Figure 3.14 below defines the three ratings.

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**Figure 3.14. Definitions of the Three Levee System Ratings**

#### Levee System Inspection Ratings

Acceptable	All inspection items are rated as Acceptable.
Minimally Acceptable	One or more levee segment inspection items are rated as Minimally Acceptable or one or more items are rated as Unacceptable and an engineering determination



	concludes that the Unacceptable inspection items would not prevent the segment/system from performing as intended during the next flood event.
Unacceptable	One or more levee segment inspection items are rated as Unacceptable and would prevent the segment/system from performing as intended, or a serious deficiency noted in past inspections (previous Unacceptable items in a Minimally Acceptable overall rating) has not been corrected within the established timeframe, not to exceed two years.

***Previous Occurrences***

There are no documented occurrences of a levee failure in Iron County.

***Probability of Future Occurrence***

The only levees in the County are low-level, non-regulated agricultural levees, the failure of which would have only very localized impact. As such, the probability of a significant levee failure in the County is 0%.

**Vulnerability**

***Vulnerability Overview***

Due to data limitations, there is no reliable method to determine vulnerability for the County or other jurisdictions at this time.

***Potential Losses to Existing Development***

No losses are anticipated. Data limitations prevent further analysis at this time.

***Impact of Future Development***

No impacts are anticipated, as there are no regulated, significant levees in the County. Data limitations prevent further analysis at this time.

***Hazard Summary by Jurisdiction***

There are no regulated, significant levees in the County.

**Problem Statement**

There are no regulated, significant levees in the County.

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## 3.4.9 Thunderstorm/High Winds/Lightning/Hail

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### **Hazard Profile**

#### ***Hazard Description***

##### **Thunderstorms**

A thunderstorm is defined as a storm that contains lightning and thunder which is caused by unstable atmospheric conditions. When cold upper air sinks and warm moist air rises, storm clouds or 'thunderheads' develop resulting in thunderstorms. This can occur singularly, as well as in clusters or lines. The National Weather Service defines a thunderstorm as "severe" if it includes hail that is one inch or more, or wind gusts that are at 58 miles per hour or higher. At any given moment across the world, there are about 1,800 thunderstorms occurring. Severe thunderstorms most often occur in Missouri in the spring and summer, during the afternoon and evenings, but can occur at any time. Other hazards associated with thunderstorms are heavy rains resulting in flooding and tornadoes (discussed separately).

##### **High Winds**

A severe thunderstorm can produce winds causing as much damage as a weak tornado. The damaging winds of thunderstorms include downbursts, microbursts, and straight-line winds. Downbursts are localized currents of air blasting down from a thunderstorm, which induce an outward burst of damaging wind on or near the ground. Microbursts are minimized downbursts covering an area of less than 2.5 miles across. They include a strong wind shear (a rapid change in the direction of wind over a short distance) near the surface. Microbursts may or may not include precipitation and can produce winds at speeds of more than 150 miles per hour. Damaging straight-line winds are high winds across a wide area that can reach speeds of 140 miles per hour.

##### **Lightning**

All thunderstorms produce lightning which can strike outside of the area where it is raining and has been known to strike more than 10 miles away from the rainfall area. Thunder is simply the sound that lightning makes. Lightning is a huge discharge of electricity that shoots through the air causing vibrations and creating the sound of thunder.

##### **Hail**

According to the National Oceanic and Atmospheric Administration (NOAA), hail is precipitation that is formed when thunderstorm updrafts carry raindrops upward into extremely cold atmosphere causing them to freeze. The raindrops form into small frozen droplets. They continue to grow as they come into contact with super-cooled water which will freeze on contact with the frozen rain droplet. This frozen droplet can continue to grow and form hail. As long as the updraft forces can support or suspend the weight of the hailstone, hail can continue to grow before it hits the earth.

At the time when the updraft can no longer support the hailstone, it will fall down to the earth. For example, a ¼" diameter or pea sized hail requires updrafts of 24 miles per hour, while a 2 ¾" diameter or baseball sized hail requires an updraft of 81 miles per hour. According to the NOAA, the largest hailstone in diameter recorded in the United States was found in Vivian, South Dakota on July 23, 2010. It was eight inches in diameter, almost the size of a soccer ball. Soccer-ball-sized hail is the exception, but even small pea-sized hail can do

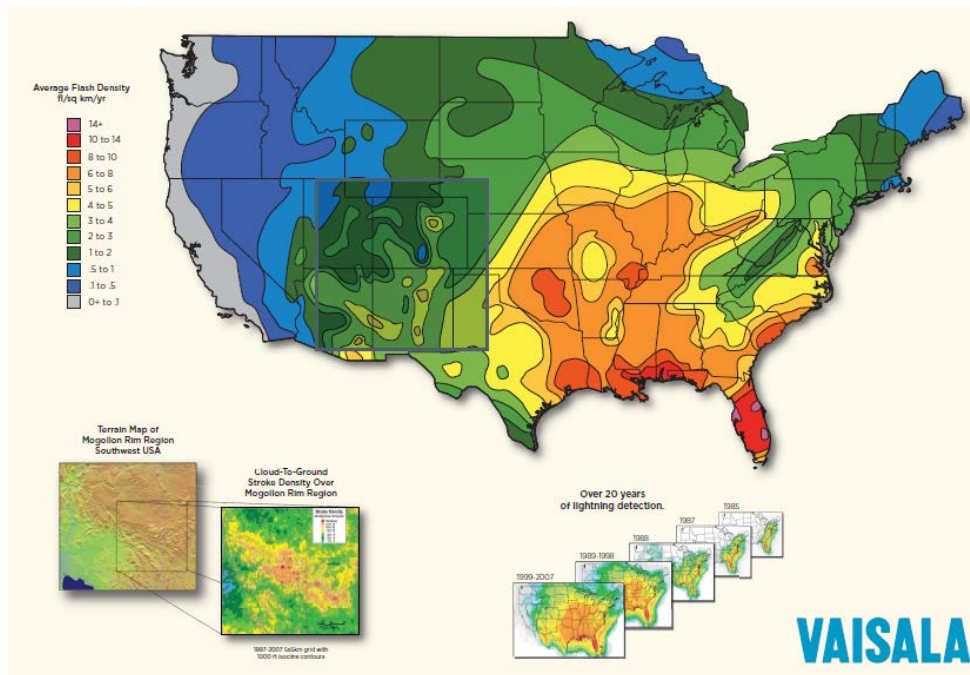
damage.

### Geographic Location

Thunderstorms/high winds/hail/lighting events are an area-wide hazard that can happen anywhere in the county. Although these events occur similarly throughout the planning area, they are more frequently reported in more urbanized areas. In addition, damages are more likely to occur in more densely developed urban areas.

Figure 3.15 shows lightning frequency in the state, with Iron County located in the 6 to 8 category.

**Figure 3.15. Location and Frequency of Lightning in Missouri**



Source: National Weather Service, [http://www.lightningsafety.noaa.gov/stats/08\\_Vaisala\\_NLDN\\_Poster.pdf](http://www.lightningsafety.noaa.gov/stats/08_Vaisala_NLDN_Poster.pdf). Note: indicate location of planning area with a colored square or arrow.

Figure 3.16 shows the wind zones in the nation, with Iron county located in Zone 4.

**Figure 3.16. Wind Zones in the United States**



Source: FEMA 320, Taking Shelter from the Storm, 3rd edition, [http://www.weather.gov/media/bis/FEMA\\_SafeRoom.pdf](http://www.weather.gov/media/bis/FEMA_SafeRoom.pdf)

**Severity/Magnitude/Extent**

Severe thunderstorm losses are usually attributed to the associated hazards of hail, downburst winds, lightning and heavy rains. Losses due to hail and high wind are typically insured losses that are localized and do not result in presidential disaster declarations. However, in some cases, impacts are severe and widespread and assistance outside state capabilities is necessary. Hail and wind also can have devastating impacts on crops. Severe thunderstorms/heavy rains that lead to flooding are discussed in the flooding hazard profile. Hailstorms cause damage to property, crops, and the environment, and can injure and even kill livestock. In the United States, hail causes more than \$1 billion in damage to property and crops each year. Even relatively small hail can shred plants to ribbons in a matter of minutes. Vehicles, roofs of buildings and homes, and landscaping are also commonly damaged by hail. Hail has been known to cause injury to humans, occasionally fatal injury.

In general, assets in the County vulnerable to thunderstorms with lightning, high winds, and hail include people, crops, vehicles, and built structures. Although this hazard results in high annual losses, private property insurance and crop insurance usually cover the majority of losses. Considering insurance coverage as a recovery capability, the overall impact on jurisdictions is reduced.

Most lightning damages occur to electronic equipment located inside buildings. But structural damage can also occur when a lightning strike causes a building fire. In addition, lightning strikes can cause damages to crops if fields or forested lands are set on fire. Communications equipment and warning transmitters and receivers can also be knocked out by lightning strikes.

Based on information provided by the Tornado and Storm Research Organization (TORRO), Table 3.18 below describes typical damage impacts of the various sizes of hail.

**Table 3.18. Tornado and Storm Research Organization Hailstorm Intensity Scale**

Intensity Category	Diameter (mm)	Diameter (inches)	Description	Size	Typical Damage Impacts
Hard Hail	5-9	0.2-0.4	Pea		No damage
Potentially Damaging	10-15	0.4-0.6	Mothball		Slight general damage to plants, crops
Significant	16-20	0.6-0.8	Marble, grape		Significant damage to fruit, crops, vegetation
Severe	21-30	0.8-1.2	Walnut		Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
Severe	31-40	1.2-1.6	Pigeon's egg > squash ball		Widespread glass damage, vehicle bodywork damage
Destructive	41-50	1.6-2.0	Golf ball > Pullet's egg		Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
Destructive	51-60	2.0-2.4	Hen's egg		Bodywork of grounded aircraft dented, brick walls pitted
Destructive	61-75	2.4-3.0	Tennis ball > cricket ball		Severe roof damage, risk of serious injuries
Destructive	76-90	3.0-3.5	Large orange > Soft ball		Severe damage to aircraft bodywork
Super Hailstorms	91-100	3.6-3.9	Grapefruit		Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
Super Hailstorms	>100	4.0+	Melon		Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

Source: Tornado and Storm Research Organization (TORRO), Department of Geography, Oxford Brookes University

Notes: In addition to hail diameter, factors including number and density of hailstones, hail fall speed and surface wind speeds affect severity. <http://www.torro.org.uk/site/hscale.php>

Straight-line winds are defined as any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). It is these winds, which can exceed 100 miles per hour, which represent the most common type of severe weather. They are responsible for most wind damage related to thunderstorms. Since thunderstorms do not have narrow tracks like tornadoes, the associated wind damage can be extensive and affect entire (and multiple) counties. Objects like trees, barns, outbuildings, high-profile vehicles, and power lines/poles can be toppled or destroyed, and roofs, windows, and homes can be damaged as wind speeds increase.

The onset of thunderstorms with lightning, high wind, and hail is generally rapid. Duration is less than six hours and warning time is generally six to twelve hours. Nationwide, lightning kills 75 to 100 people each year. Lightning strikes can also start structural and wildland fires, as well as damage electrical systems and equipment.

### **Previous Occurrences**

Table 3.19, Table 3.20, and Table 3.21 show the previous occurrences of high wind events, lightning events, and hail events in the County. All data is from the NCEI.

Limitations to the use of NCEI reported lightning events include the fact that only lightning events that result

in fatality, injury and/or property and crop damage are in the NCEI.

**Table 3.19. High Wind Events (60 knots or higher) 1993-2017**

LOCATION	DATE	SPEED (KTS)	DEATHS	INJURIES	DAMAGE PROPERTY	DAMAGE CROPS
IRONTON	3/24/1996	60	0	0	1000	0
IRONTON	8/2/2003	60	0	0	0	0
BELLEVIEW	7/19/2006	60	0	0	0	0
BIXBY	5/8/2009	87	0	0	0	0
IRONTON	7/2/2012	61	0	0	0	0
PILOT KNOB	7/7/2012	61	0	0	0	0
BELLEVIEW	7/6/2016	61	0	0	0	0
ARCADIA	5/27/2017	61	0	0	0	0

**Table 3.20. Lighting Events 1993-2017**

LOCATION	DATE	DEATHS	INJURIES	DAMAGE PROPERTY	DAMAGE CROPS
ARCADIA	7/15/2000	0	4	0	0

**Table 3.21. Hail Events (1" or larger) 1992-2016**

LOCATION	DATE	SIZE (IN)	DEATHS	INJURIES	DAMAGE PROPERTY	DAMAGE CROPS
Graniteville	10/1/1993	1	0	0	0	0
Annapolis	10/1/1993	1.75	0	0	5000	0
Annapolis	10/1/1993	2	0	0	5000	0
Viburnum	4/26/1994	1.75	0	0	0	0
Viburnum	4/27/1994	1	0	0	0	0
Annapolis	4/27/1994	1	0	0	0	0
IRONTON	4/19/1996	1.75	0	0	0	0
BELLEVIEW	4/19/1996	1	0	0	0	0
VIBURNUM	5/14/1996	1	0	0	0	0
VIBURNUM	10/17/1996	1.75	0	0	0	0
IRONTON	4/13/1998	1.75	0	0	100	0
IRONTON	4/15/1998	1.75	0	0	0	0
ANNAPOLIS	9/8/2001	1.75	0	0	0	0
IRONTON	4/24/2002	1	0	0	0	0
SABULA	4/24/2002	1	0	0	0	0
IRONTON	4/29/2003	1.75	0	0	0	0
PILOT KNOB	5/14/2003	1	0	0	0	0
PILOT KNOB	5/14/2003	1	0	0	0	0
IRONTON	8/21/2003	1.75	0	0	0	0

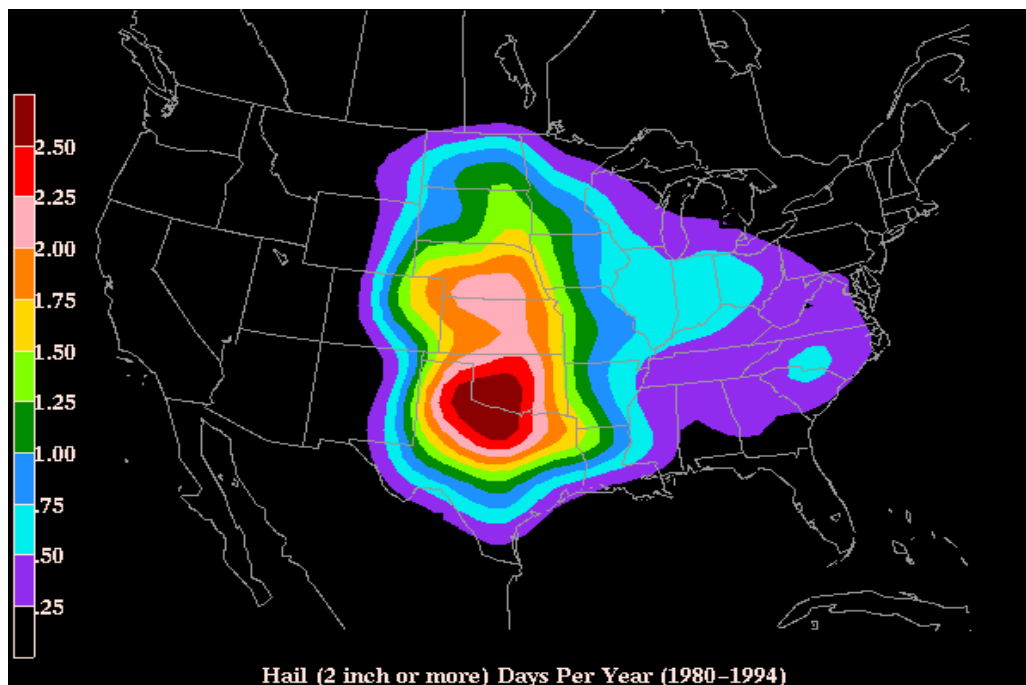
VIBURNUM	10/18/2004	1.75	0	0	0	0
ARCADIA	3/11/2006	2.75	0	0	0	0
BELLEVIEW	9/22/2006	1.25	0	0	0	0
PILOT KNOB	9/22/2006	1	0	0	0	0
ANNAPOLIS	4/3/2007	1	0	0	0	0
VIBURNUM	5/8/2009	1	0	0	0	0
VIBURNUM	6/8/2009	1	0	0	0	0
SABULA	6/15/2009	1.75	0	0	0	0
ANNAPOLIS	8/4/2009	1	0	0	0	0
IRONTON	6/18/2010	1.5	0	0	0	0
PILOT KNOB	3/28/2012	1.25	0	0	0	0
ANNAPOLIS	7/23/2013	1	0	0	0	0
ANNAPOLIS	4/26/2017	1	0	0	0	0
SABULA	5/27/2017	2	0	0	0	0
VIBURNUM	11/5/2017	1	0	0	0	0

**Probability of Future Occurrence**

Only 8 events of winds of 60 knots or higher in past 25 years are listed in the NCEI, leading to a probability of 32%. While only one lighting event is listed in the NCEI, data limitations are the leading factor in this phenomenon, not the lack of any actual events. The HMPC believes it is safe to assume that at least one lightning strike will occur each year in the County.

NCEI lists 34 events of hail at least 1" in size in the past 25 years, equaling a probability of 100%. Additionally, NOAA's NSSL indicates hail of 2" or more is likely to occur 1 day every two years in the County (see Figure 3.17)

**Figure 3.17. Annual Hailstorm Probability (2" diameter or larger), U 1980- 1994**



## **Vulnerability**

### ***Vulnerability Overview***

Based on the state's 2013 HMP, Iron County has a summarized thunderstorm vulnerability rating of "Medium-Low."

### ***Potential Losses to Existing Development***

Available data indicates \$11,000 in losses due to any element of a severe thunderstorm, though anecdotal evidence exists indicating that roof and vehicle damage do often result during very strong thunderstorms.

### ***Future Development***

Additional development will result in the exposure of more structures to damages from severe thunderstorms.

### ***Hazard Summary by Jurisdiction***

Ironton is the most exposed jurisdiction simply due to the higher density of development. Other than this difference, all jurisdictions are equally at risk to such hazard events.

## **Problem Statement**

Impacts from these events are typically property related, with debris, falling trees, and hail damage. Advanced warnings typically keep residents inside during such events, which limits potential injuries and loss of life. While all jurisdictions can be impacted by these events, the cities and county are most affected due to their size compared to the relatively small campuses of the school districts. Of the cities and the county, the cities are the most affected due to the density of development and concentration of higher property values.



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## 3.4.10 Tornado

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### **Hazard Profile**

#### ***Hazard Description***

The NWS defines a tornado as “a violently rotating column of air extending from a thunderstorm to the ground.” It is usually spawned by a thunderstorm and produced when cool air overrides a layer of warm air, forcing the warm air to rise rapidly. Often, vortices remain suspended in the atmosphere as funnel clouds. When the lower tip of a vortex touches the ground, it becomes a tornado.

High winds not associated with tornadoes are profiled separately in this document in Section 3.4.9, Thunderstorm/High Wind/Hail/Lightning.

Essentially, tornadoes are a vortex storm with two components of winds. The first is the rotational winds that can measure up to 500 miles per hour, and the second is an uplifting current of great strength. The dynamic strength of both these currents can cause vacuums that can overpressure structures from the inside.

Although tornadoes have been documented in all 50 states, most of them occur in the central United States due to its unique geography and presence of the jet stream. The jet stream is a high-velocity stream of air that separates the cold air of the north from the warm air of the south. During the winter, the jet stream flows west to east from Texas to the Carolina coast. As the sun moves north, so does the jet stream, which at summer solstice flows from Canada across Lake Superior to Maine. During its move northward in the spring and its recession south during the fall, the jet stream crosses Missouri, causing the large thunderstorms that breed tornadoes.

A typical tornado can be described as a funnel-shaped cloud in contact with the earth’s surface that is “anchored” to a cloud, usually a cumulonimbus. This contact on average lasts 30 minutes and covers an average distance of 15 miles. The width of the tornado (and its path of destruction) is usually about 300 yards. However, tornadoes can stay on the ground for upward of 300 miles and can be up to a mile wide. The National Weather Service, in reviewing tornadoes occurring in Missouri between 1950 and 1996, calculated the mean path length at 2.27 miles and the mean path area at 0.14 square mile.

The average forward speed of a tornado is 30 miles per hour but may vary from nearly stationary to 70 miles per hour. The average tornado moves from southwest to northeast, but tornadoes have been known to move in any direction. Tornadoes are most likely to occur in the afternoon and evening, but have been known to occur at all hours of the day and night.

#### ***Geographic Location***

Tornadoes can occur at any location in the planning area with equal probability.

#### ***Severity/Magnitude/Extent***

Tornadoes are the most violent of all atmospheric storms and are capable of tremendous destruction. Wind speeds can exceed 250 miles per hour and damage paths can be more than one mile wide and 50 miles long. Tornadoes have been known to lift and move objects weighing more than 300 tons a distance of 30 feet, toss homes more than 300 feet from their foundations, and siphon millions of tons of water from water bodies. Tornadoes also can generate a tremendous amount of flying debris or “missiles,” which often become

airborne shrapnel that causes additional damage. If wind speeds are high enough, missiles can be thrown at a building with enough force to penetrate windows, roofs, and walls. However, the less spectacular damage is much more common.

Tornado magnitude is classified according to the EF- Scale (or the Enhance Fujita Scale, based on the original Fujita Scale developed by Dr. Theodore Fujita, a renowned severe storm researcher). The EF- Scale (see Table 3.22) attempts to rank tornadoes according to wind speed based on the damage caused. This update to the original F Scale was implemented in the U.S. on February 1, 2007.

**Table 3.22. Enhanced F Scale for Tornado Damage**

FUJITA SCALE			DERIVED EF SCALE		OPERATIONAL EF SCALE	
F Number	Fastest ¼-mile (mph)	3 Second Gust (mph)	EF Num	3 Second Gust (mph)	EF Number	3 Second Gust (mph)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over 200

Source: The National Weather Service, [www.spc.noaa.gov/faq/tornado/ef-scale.html](http://www.spc.noaa.gov/faq/tornado/ef-scale.html)

The wind speeds for the EF scale and damage descriptions are based on information on the NOAA Storm Prediction Center as listed in Table 3.23. The damage descriptions are summaries. For the actual EF scale it is necessary to look up the damage indicator (type of structure damaged) and refer to the degrees of damage associated with that indicator. Information on the Enhanced Fujita Scale’s damage indicators and degrees or damage is located online at [www.spc.noaa.gov/efscale/ef-scale.html](http://www.spc.noaa.gov/efscale/ef-scale.html).

**Table 3.23. Enhanced Fujita Scale with Potential Damage**

Enhanced Fujita Scale			
Scale	Wind Speed (mph)	Relative Frequency	Potential Damage
EF0	65-85	53.5%	Light. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage (i.e. those that remain in open fields) are always rated EF0).
EF1	86-110	31.6%	Moderate. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	10.7%	Considerable. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes complete destroyed; large trees snapped or uprooted; light object missiles generated; cars lifted off ground.
EF3	136-165	3.4%	Severe. Entire stores of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	166-200	0.7%	Devastating. Well-constructed houses and whole frame houses completely levelled; cars thrown and small missiles generated.
EF5	>200	<0.1%	Explosive. Strong frame houses levelled off foundations and swept away; automobile-sized missiles fly through the air in excess of 300 ft.; steel reinforced concrete structure badly damaged; high rise buildings have significant structural deformation; incredible phenomena will occur.

Source: NOAA Storm Prediction Center, <http://www.spc.noaa.gov/efscale/ef-scale.html>

Enhanced weather forecasting has provided the ability to predict severe weather likely to produce tornadoes days in advance. Tornado watches can be delivered to those in the path of these storms several hours in advance. Lead time for actual tornado warnings is about 30 minutes. Tornadoes have been known to change paths very rapidly, thus limiting the time in which to take shelter. Tornadoes may not be visible on the ground if they occur after sundown or due to blowing dust or driving rain and hail.

**Previous Occurrences**

Prior to 1993, only very destructive tornadoes were recorded in the NCEI. It is necessary to go back as far as possible due to the random and intermittent nature of tornado events, but data limitations hinder this.

There are additional limitations to the use of NCEI tornado data that must be noted. For example, one tornado may contain multiple segments as it moves geographically. A tornado that crosses a county line or state line is considered a separate segment for the purposes of reporting to the NCEI. Also, a tornado that lifts off the ground for less than 5 minutes or 2.5 miles is considered a separate segment. If the tornado lifts off the ground for greater than 5 minutes or 2.5 miles, it is considered a separate tornado. Tornadoes reported in Storm Data and the Storm Events Database are in segments.

Figure 3.18 shows the approximate paths of all NCEI listed tornadoes in the County from 1950 to present.

**Table 3.24. Recorded Tornadoes in Iron County, 1993-2016**

None Listed

Source: National Center for Environmental Information, <http://www.NCEI.noaa.gov/stormevents/>



Figure 3.19. Tornado Alley in the U.S.



Source: <http://www.tornadochaser.net/toralley.html>

### ***Potential Losses to Existing Development***

According to the 2013 State HMP, Iron County has annualized tornado damages of only \$138,000. Compared to some surrounding counties with amounts 3-10 times higher, and given the rural nature of the county, potential losses are relatively low. This is not to say though that impacts on individuals may not be catastrophic.

### ***Future Development***

Additional development in any jurisdiction will lead to greater exposure of structures to a tornado event. Given the low growth history of the County recently though, increases are expected to be minimal.

### ***Hazard Summary by Jurisdiction***

A tornado event is equally likely to happen in any area of the County. With its higher density development though, Ironton is the single most exposed jurisdiction.

### **Problem Statement**

Any participant can be affected by a tornado. While the cities are the most exposed due to population and development density, the school districts are also densely populated during session. Given the low population density in the county, saferooms are not typically cost effective, unless developed on a county property in one of the communities.

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### 3.4.11 Winter Weather/Snow/Ice/Severe Cold

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#### **Hazard Profile**

##### ***Hazard Description***

A major winter storm can last for several days and be accompanied by high winds, freezing rain or sleet, heavy snowfall, and cold temperatures. The National Weather Service describes different types of winter storm events as follows.

**Blizzard**—Winds of 35 miles per hour or more with snow and blowing snow reducing visibility to less than ¼ mile for at least three hours.

**Blowing Snow**—Wind-driven snow that reduces visibility. Blowing snow may be falling snow and/or snow on the ground picked up by the wind.

**Snow Squalls**—Brief, intense snow showers accompanied by strong, gusty winds. Accumulation may be significant.

**Snow Showers**—Snow falling at varying intensities for brief periods of time. Some accumulation is possible.

**Freezing Rain**—Measurable rain that falls onto a surface with a temperature below freezing. This causes it to freeze to surfaces, such as trees, cars, and roads, forming a coating or glaze of ice. Most freezing-rain events are short lived and occur near sunrise between the months of December and March.

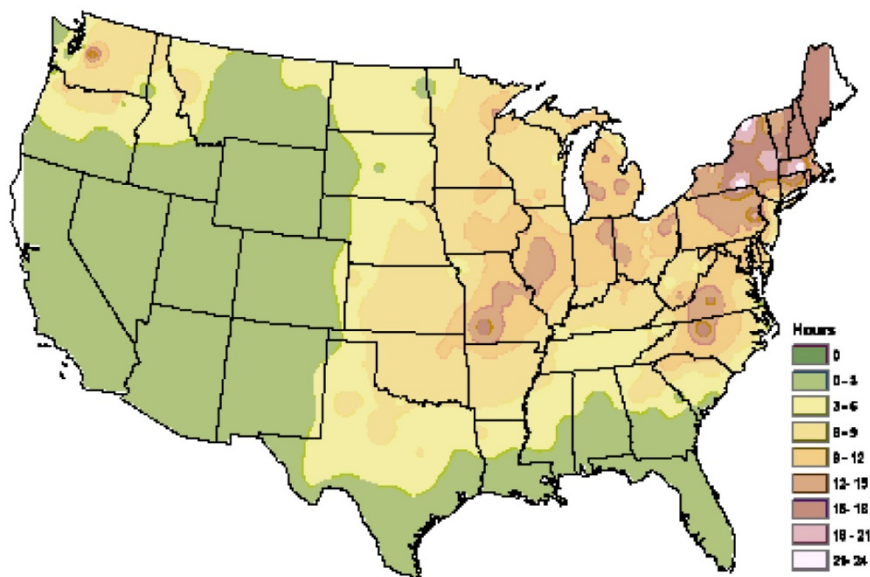
**Sleet**—Rain drops that freeze into ice pellets before reaching the ground. Sleet usually bounces when hitting a surface and does not stick to objects.

##### ***Geographic Location***

The entire county is vulnerable to heavy snow, ice, freezing rain, and extreme cold temperatures. Figure 3.20 shows the average number of hours per year with freezing rain, with Iron County sitting on the line between 9-12 hours and 12-15 hours.

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**Figure 3.20. NWS Statewide Average Number of Hours per Year with Freezing Rain**



Source: American Meteorological Society. "Freezing Rain Events in the United States." <http://ams.confex.com/ams/pdfpapers/71872.pdf>

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## ***Severity/Magnitude/Extent***

Severe winter storms include extreme cold, heavy snowfall, ice, and strong winds which can push the wind chill well below zero degrees in the planning area. Heavy snow can bring a community to a standstill by inhibiting transportation (in whiteout conditions), weighing down utility lines, and by causing structural collapse in buildings not designed to withstand the weight of the snow. Repair and snow removal costs can be significant. Ice buildup can collapse utility lines and communication towers, as well as make transportation difficult and hazardous. Ice can also become a problem on roadways if the air temperature is high enough that precipitation falls as freezing rain rather than snow.

Extreme cold often accompanies severe winter storms and can lead to hypothermia and frostbite in people without adequate clothing protection. Cold can cause fuel to congeal in storage tanks and supply lines, stopping electric generators. Cold temperatures can also overpower a building's heating system and cause water and sewer pipes to freeze and rupture. Extreme cold also increases the likelihood for ice jams on flat rivers or streams. When combined with high winds from winter storms, extreme cold becomes extreme wind chill, which is hazardous to health and safety.

The National Institute on Aging estimates that more than 2.5 million Americans are elderly and especially vulnerable to hypothermia, with the isolated elders being most at risk. About 10 percent of people over the age of 65 have some kind of bodily temperature-regulating defect, and 3-4 percent of all hospital patients over 65 are hypothermic.

Also at risk are those without shelter, those who are stranded, or who live in a home that is poorly insulated or without heat. Other impacts of extreme cold include asphyxiation (unconsciousness or death from a lack of oxygen) from toxic fumes from emergency heaters; household fires, which can be caused by fireplaces and emergency heaters; and frozen/burst pipes.

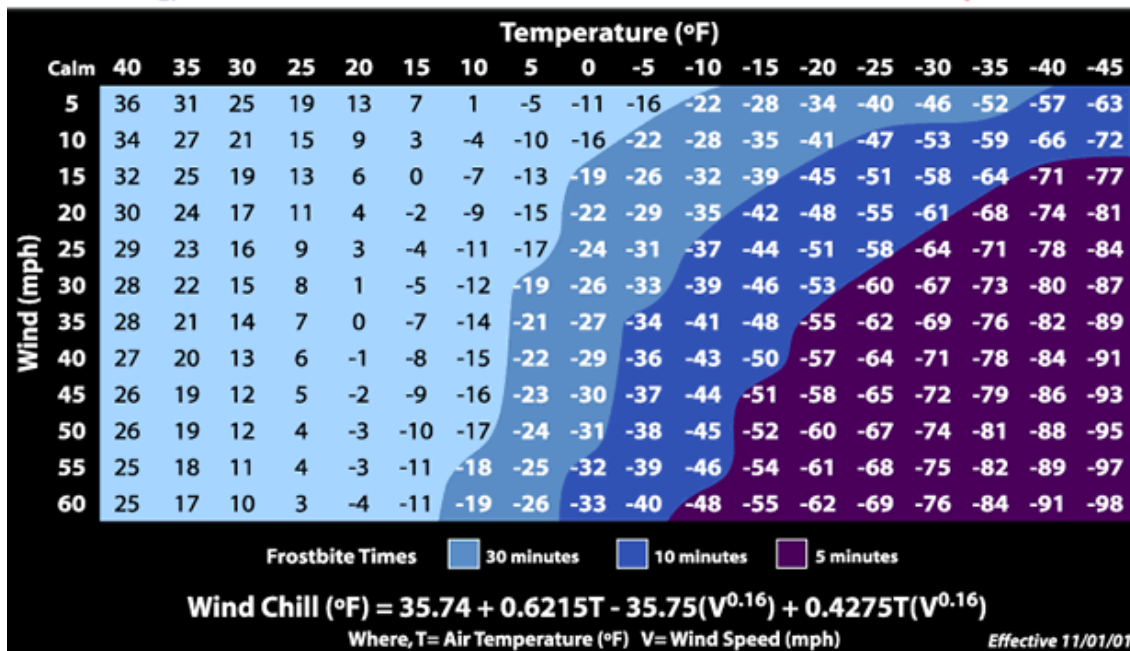
Buildings with overhanging tree limbs are more vulnerable to damage during winter storms when limbs fall. Businesses experience loss of income as a result of closure during power outages. In general heavy winter storms increase wear and tear on roadways though the cost of such damages is difficult to determine. Businesses can experience loss of income as a result of closure during winter storms.

Overhead power lines and infrastructure are also vulnerable to damages from winter storms. In particular ice accumulation during winter storm events damage to power lines due to the ice weight on the lines and equipment. Damages also occur to lines and equipment from falling trees and tree limbs weighted down by ice. Potential losses could include cost of repair or replacement of damaged facilities, and lost economic opportunities for businesses.

Secondary effects from loss of power could include burst water pipes in homes without electricity during winter storms. Public safety hazards include risk of electrocution from downed power lines. Specific amounts of estimated losses are not available due to the complexity and multiple variables associated with this hazard. Standard values for loss of service for utilities reported in FEMA's 2009 BCA Reference Guide, the economic impact as a result of loss of power is \$126 per person per day of lost service.

Wind can greatly amplify the impact of cold ambient air temperatures. Provided by the National Weather Service, Figure 3.21 below shows the relationship of wind speed to apparent temperature and typical time periods for the onset of frostbite.

**Figure 3.21. Wind Chill Chart**



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

**Previous Occurrences**

The National Center for Environmental Data lists 37 winter weather events in the past 25 years. Table 3.25 provides a list of the events.

**Table 3.25. NCEI Iron County Winter Weather Events Summary, 1992-2016**

LOCATION	DATE	EVENT TYPE	DEATHS	INJURIES	DAMAGE PROPERTY	DAMAGE CROPS
IRON (ZONE)	1/2/1996	Winter Storm	0	0	0	0
IRON (ZONE)	11/25/1996	Ice Storm	0	0	0	0
IRON (ZONE)	1/8/1997	Winter Storm	0	0	0	0
IRON (ZONE)	1/22/1998	Winter Storm	0	0	0	0
IRON (ZONE)	3/8/1998	Winter Storm	0	0	0	0
IRON (ZONE)	12/21/1998	Winter Storm	0	0	0	0
IRON (ZONE)	1/1/1999	Winter Storm	0	0	0	0
IRON (ZONE)	1/13/1999	Ice Storm	0	0	0	0
IRON (ZONE)	3/13/1999	Winter Storm	0	0	0	0
IRON (ZONE)	1/28/2000	Winter Storm	0	0	0	0
IRON (ZONE)	12/13/2000	Heavy Snow	0	0	0	0
IRON (ZONE)	12/16/2000	Extreme Cold/Wind Chill	0	0	0	0
IRON (ZONE)	2/21/2001	Ice Storm	0	0	0	0
IRON (ZONE)	12/4/2002	Winter Storm	0	0	0	0
IRON (ZONE)	12/24/2002	Winter Storm	0	0	0	0
IRON (ZONE)	2/23/2003	Winter Storm	0	0	0	0
IRON (ZONE)	1/25/2004	Winter Storm	0	0	0	0
IRON (ZONE)	2/5/2004	Winter Storm	0	0	0	0
IRON (ZONE)	12/22/2004	Winter Storm	0	0	0	0



IRON (ZONE)	12/8/2005	Winter Storm	0	0	0	0
IRON (ZONE)	11/30/2006	Winter Storm	0	0	0	0
IRON (ZONE)	12/1/2006	Winter Storm	0	0	98000	0
IRON (ZONE)	2/11/2008	Sleet	0	0	0	0
IRON (ZONE)	2/21/2008	Sleet	0	0	0	0
IRON (ZONE)	3/3/2008	Winter Storm	0	0	0	0
IRON (ZONE)	1/26/2009	Winter Storm	0	0	0	0
IRON (ZONE)	1/1/2010	Cold/Wind Chill	0	0	0	0
IRON (ZONE)	1/28/2010	Heavy Snow	0	0	0	0
IRON (ZONE)	1/31/2011	Winter Storm	0	0	0	0
IRON (ZONE)	2/1/2011	Winter Storm	0	0	0	0
IRON (ZONE)	2/21/2013	Winter Storm	0	0	0	0
IRON (ZONE)	12/5/2013	Winter Storm	0	0	0	0
IRON (ZONE)	1/5/2014	Winter Storm	0	0	0	0
IRON (ZONE)	1/6/2014	Cold/Wind Chill	0	0	0	0
IRON (ZONE)	3/1/2014	Winter Storm	0	0	0	0
IRON (ZONE)	2/15/2015	Heavy Snow	0	0	0	0
IRON (ZONE)	2/20/2015	Heavy Snow	0	0	0	0

Source: NCEI

### ***Probability of Future Occurrence***

With 37 events in 25 years, the County is projected to experience 3 winter storm events every 2 years.

### **Vulnerability**

#### ***Vulnerability Overview***

The 2013 State HMP lists Iron County with a “Medium-Low” vulnerability to winter storm events. This determination is made based on multiple factors, including housing density, likelihood of the event, property and crop losses, and social vulnerability.

#### ***Potential Losses to Existing Development***

According to the 2013 State HMP, Iron County has had annualized property losses of \$263,000 per year.

#### ***Future Development***

Additional development will increase a jurisdictions exposure to the hazard by adding structure and people to the study area. The minor growth rate of the county and communities indicates little future impact due to development trends.

#### ***Hazard Summary by Jurisdiction***

All jurisdictions are equally exposed to severe winter weather, though the event will have different impacts on different jurisdictions. Schools are typically closed during these events, making property damage their primary concern. While Iron County has far less population density compared to Ironton, county residents can far more easily have transportation and communications severed by winter storms, leaving them isolated for days or even weeks in extreme cases. For Ironton, the inverse is true; residents continue to have services and

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contacts in close proximity, but there are far more people affected by the event.

**Problem Statement**

Winter weather can affect any of the participants. While the school districts typically close during severe events, in some cases children are present when an event occurs sooner or stronger than expected. Transportation of students during such an event can be dangerous, and power failures are also possible. The density of development in the cities increases its exposure, but residents are also closer to emergency services when compared to county residents. Because of this, each jurisdiction is impacted by these events in a slightly different manner.

## 4 MITIGATION STRATEGY

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<b>4</b>	<b>MITIGATION STRATEGY .....</b>	<b>4.1</b>
4.1	<i>Goals.....</i>	4.1
4.2	<i>Identification and Analysis of Mitigation Actions.....</i>	4.1
4.3	<i>Implementation of Mitigation Actions .....</i>	4.2

This section presents the mitigation strategy updated by the HMPC based on the updated risk assessment. The mitigation strategy was developed through a collaborative group process. The process included review of updated general goal statements to guide the jurisdictions in lessening disaster impacts as well as specific mitigation actions to directly reduce vulnerability to hazards and losses. The following definitions are taken from FEMA's *Local Hazard Mitigation Review Guide (October 1, 2012)*.

- **Mitigation Goals** are general guidelines that explain what you want to achieve. Goals are long-term policy statements and global visions that support the mitigation strategy. The goals address the risk of hazards identified in the plan.
- **Mitigation Actions** are specific actions, projects, activities, or processes taken to reduce or eliminate long-term risk to people and property from hazards and their impacts. Implementing mitigation actions helps achieve the plan's mission and goals.

### 4.1 Goals

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This planning effort is an update to Iron County's existing hazard mitigation plan approved by FEMA in 2012. Therefore, the goals from the previous HMP were reviewed to see if they were still valid, feasible, practical, and applicable to the defined hazard impacts. The HMPC conducted a discussion session during their second meeting to review and update the plan goals. To ensure that the goals developed for this update were comprehensive and supported State goals, the 2013 State Hazard Mitigation Plan goals were also reviewed. SEMO RPC also presented common goals from other county HMPs.

After discussion, the HMPC decided the 2012 goals were still valid. The goals for this plan update are:

1. Protect the health, safety, and welfare of residents and students.
2. Ensure the operation of critical facilities and services.
3. Protect public and private property.
4. Enhance informed decision making of mitigation actions.

### 4.2 Identification and Analysis of Mitigation Actions

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During the second MPC meeting, the results of the risk assessment update were provided to the HMPC members for review and the key issues were identified for specific hazards. Changes in risk since adoption of the previously approved plan were discussed. The second meeting concluded with the distribution of a list of possible mitigation actions to prompt discussions within and among the jurisdictions. The discussions occurred during jurisdictional break-out meetings. The list included possible new mitigation actions, as well as actions from the previously approved plan. Actions from the previous plan included completed actions, on-

going actions, and actions upon which progress had not been made. The HMPC discussed SEMA's identified funding priorities and the types of mitigation actions generally recognized by FEMA.

The HMPC then updated the mitigation strategy of each jurisdiction during Meeting 2 and through electronic correspondence afterward. For a comprehensive range of mitigation actions to consider, the HMPC reviewed the following information:

- A list of actions proposed in the previous mitigation plan, the current State Plan, and approved plans in surrounding counties,
- Key issues from the risk assessments,
- State priorities established for Hazard Mitigation Assistance grants, and
- Public input during meetings, responses to Data Collection Questionnaires, and other efforts to involve the public in the plan development process.

Individual jurisdictions, including school and special districts, then developed final mitigation strategies for inclusion in the plan. They were encouraged to review the details of the risk assessment vulnerability analysis specific to their jurisdiction. They were also provided a link to the FEMA's publication, *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (January 2013)*. This document was developed by FEMA as a resource for identification of a range of potential mitigation actions for reducing risk to natural hazards and disasters.

The MPC reviewed the actions from the previously approved plan for progress made since the plan had been adopted, using worksheets included in the appendix of this plan. Each jurisdiction was instructed to provide information regarding the "Action Status" with one of the following status choices:

- Completed, with a description of the progress,
- Not Started/Continue in Plan Update, with a discussion of the reasons for lack of progress,
- In Progress/Continue in Plan Update, with a description of the progress made to date or
- Deleted, with a discussion of the reasons for deletion.

### 4.3 Implementation of Mitigation Actions

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Jurisdictions were encouraged to meet with others in their community to finalize the actions to be submitted for the updated mitigation strategy. Throughout the HMPC consideration and discussion, emphasis was placed on the importance of a benefit-cost analysis in determining project priority. The Disaster Mitigation Act requires benefit-cost review as the primary method by which mitigation projects should be prioritized. The HMPC decided to pursue implementation according to when and where damage occurs, available funding, political will, and jurisdictional priority. The benefit/cost review at the planning stage primarily consisted of a qualitative analysis, and was not the detailed process required for grant funding applications. For each action, the plan sets forth a narrative describing the types of benefits that could be realized from action implementation. The cost was estimated as closely as possible, with further refinement to be supplied as project development occurs.

FEMA's STAPLEE methodology was used to assess the costs and benefits, overall feasibility of mitigation actions, and other issues impacting project. During the prioritization process, the HMPC used worksheets to assign scores. The worksheets posed questions based on the STAPLEE elements as well as the potential mitigation effectiveness of each action. Scores were based on the responses to the questions as follows:

Definitely yes = 3 points

Maybe yes = 2 points

Probably no = 1  
Definitely no = 0

The following questions were asked for each proposed action.

S: Is the action socially acceptable?

T: Is the action technically feasible and potentially successful?

A: Does the jurisdiction have the administrative capability to successfully implement this action?

P: Is the action politically acceptable?

L: Does the jurisdiction have the legal authority to implement the action?

E: Is the action economically beneficial?

E: Will the project have an environmental impact that is either beneficial or neutral? (score "3" if positive and "2" if neutral)

Will the implemented action result in lives saved?

Will the implanted action result in a reduction of disaster damage?

A blank action worksheet is shown in Figure 4.1

**Figure 4.1. Blank Action Worksheet**

<b>Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	Provide a brief description of the problem that the action will address
<b>Hazard(s) Addressed:</b>	List the hazard or hazards that will be addressed by this action
<b>Action or Project</b>	
<b>Action/Project Number:</b>	Insert a unique action number for this action for future tracking purposes. This can be a combination of the jurisdiction name, followed by the goal number and action number (i.e. Joplin1.1)
<b>Name of Action or Project:</b>	
<b>Action or Project Description:</b>	Describe the action or project.
<b>Applicable Goal Statement:</b>	Choose the goal statement that applies to this action
<b>Estimated Cost:</b>	Provide an estimate of the cost to implement this action. This can be accomplished with a range of estimated costs.
<b>Benefits:</b>	Provide a narrative describing the losses that will be avoided by implementing this action. If dollar amounts of avoided losses are known, include them as well.
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	Which organization will be responsible for tracking this action? Be specific to include the specific department or position within a department.
<b>Action/Project Priority:</b>	Include the STAPLEE score and Priority (H, M, L)
<b>Timeline for Completion:</b>	How many months/years to complete.
<b>Potential Fund Sources:</b>	List specific funding sources that may be used to pay for the implementation of the action.
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	
<b>Progress Report</b>	
<b>Action Status</b>	Indicate status as New, Continuing Not Started, or Continuing in Progress)
<b>Report of Progress</b>	For Continuing actions only, indicate the report on progress. If the action is not started, indicate any barriers encountered to initiate the action. If the action is in progress, indicate the activity that has occurred to date.

**Figure 4.2. Iron County Actions**

<b>Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	Iron County
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	Flood impacts to residents and businesses
<b>Hazard(s) Addressed:</b>	Flood
<b>Action or Project</b>	
<b>Action/Project Number:</b>	Iron 1.1
<b>Name of Action or Project:</b>	NFIP Participation
<b>Action or Project Description:</b>	Enforce floodplain management ordinances, regulate new construction in SFHA, work with residents to identify flood prone areas, assist residents with map amendment process.
<b>Applicable Goal Statement:</b>	Protect public and private property
<b>Estimated Cost:</b>	\$0-\$50,000 per year
<b>Benefits:</b>	Eligibility for flood insurance for residents and businesses, technical assistance with flood mitigation planning
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	Emergency Management
<b>Action/Project Priority:</b>	31, H
<b>Timeline for Completion:</b>	Ongoing
<b>Potential Fund Sources:</b>	Local funds
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	None
<b>Progress Report</b>	
<b>Action Status</b>	Continuing (ongoing)
<b>Report of Progress</b>	County is a participant in NFIP

<b>Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	Iron County
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	Earthquake Impacts
<b>Hazard(s) Addressed:</b>	Earthquake
<b>Action or Project</b>	
<b>Action/Project Number:</b>	Iron 2.1
<b>Name of Action or Project:</b>	Earthquake retrofit
<b>Action or Project Description:</b>	Seismically retrofit the courthouse
<b>Applicable Goal Statement:</b>	Protect public and private property
<b>Estimated Cost:</b>	\$1-\$5 million
<b>Benefits:</b>	Maintain operability of critical facility after an earthquake
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	County Commission
<b>Action/Project Priority:</b>	15, L
<b>Timeline for Completion:</b>	5 years +
<b>Potential Fund Sources:</b>	Local funds, Federal grants (USDA, CDBG, etc.)
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	None
<b>Progress Report</b>	
<b>Action Status</b>	New
<b>Report of Progress</b>	N/A



<b>Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	Iron County
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	Power outages
<b>Hazard(s) Addressed:</b>	Earthquake, Severe Thunderstorm, Severe Winter Weather, Tornado
<b>Action or Project</b>	
<b>Action/Project Number:</b>	Iron 3.1
<b>Name of Action or Project:</b>	Purchase emergency generators
<b>Action or Project Description:</b>	Purchase emergency generators for critical facilities, including courthouse and sheriff's office
<b>Applicable Goal Statement:</b>	Ensure operation of critical facilities and services
<b>Estimated Cost:</b>	\$50,000-\$100,000
<b>Benefits:</b>	Continued operation of critical facilities and services during and after hazard event
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	Emergency Management
<b>Action/Project Priority:</b>	25, M
<b>Timeline for Completion:</b>	3 years
<b>Potential Fund Sources:</b>	Local funds, Federal grants
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	None
<b>Progress Report</b>	
<b>Action Status</b>	Continuing (not started)
<b>Report of Progress</b>	

<b>Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	Iron County
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	Loss of life due to hazard events
<b>Hazard(s) Addressed:</b>	Tornado, Severe Thunderstorms, Extreme Heat, Extreme Cold
<b>Action or Project</b>	
<b>Action/Project Number:</b>	Iron 4.1
<b>Name of Action or Project:</b>	Safe room
<b>Action or Project Description:</b>	Construct safe room
<b>Applicable Goal Statement:</b>	Protect health, safety, and welfare of residents and students
<b>Estimated Cost:</b>	\$2,000,000-\$4,000,000
<b>Benefits:</b>	Reduce or eliminate loss of life and injuries resulting from hazard events
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	County Commission
<b>Action/Project Priority:</b>	28, M
<b>Timeline for Completion:</b>	5 years
<b>Potential Fund Sources:</b>	Local funds, Federal Grants
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	None
<b>Progress Report</b>	
<b>Action Status</b>	Continuing (not started)
<b>Report of Progress</b>	

**Figure 4.3. Ironton Actions**

<b>Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	Ironton
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	Flood impacts to residents and businesses
<b>Hazard(s) Addressed:</b>	Flood
<b>Action or Project</b>	
<b>Action/Project Number:</b>	Ironton 1.1
<b>Name of Action or Project:</b>	NFIP Participation
<b>Action or Project Description:</b>	Enforce floodplain management ordinances, regulate new construction in SFHA, work with residents to identify flood prone areas, assist residents with map amendment process.
<b>Applicable Goal Statement:</b>	Protect public and private property
<b>Estimated Cost:</b>	\$0-\$40,000 per year
<b>Benefits:</b>	Eligibility for flood insurance for residents and businesses, technical assistance with flood mitigation planning
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	City administrator
<b>Action/Project Priority:</b>	30, H
<b>Timeline for Completion:</b>	Ongoing
<b>Potential Fund Sources:</b>	Local funds
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	None
<b>Progress Report</b>	
<b>Action Status</b>	Continuing (ongoing)
<b>Report of Progress</b>	City is a participant in NFIP

<b>Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	Ironton
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	Bridge collapse or damage
<b>Hazard(s) Addressed:</b>	Earthquake
<b>Action or Project</b>	
<b>Action/Project Number:</b>	Ironton 2.1
<b>Name of Action or Project:</b>	Bridge retrofit
<b>Action or Project Description:</b>	Seismically retrofit top priority bridge
<b>Applicable Goal Statement:</b>	Protect public and private property
<b>Estimated Cost:</b>	\$250,000-\$1,000,000
<b>Benefits:</b>	Reduce or eliminate damage and failure of bridge due to earthquake
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	Public Works
<b>Action/Project Priority:</b>	22, M
<b>Timeline for Completion:</b>	5 years
<b>Potential Fund Sources:</b>	Local funds, MODOT, Federal Grants
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	Comprehensive plan
<b>Progress Report</b>	
<b>Action Status</b>	Continuing (not started)
<b>Report of Progress</b>	

<b>Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	Ironton
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	Loss of life due to hazard events
<b>Hazard(s) Addressed:</b>	Tornado, Severe Thunderstorms, Extreme Heat, Extreme Cold
<b>Action or Project</b>	
<b>Action/Project Number:</b>	Ironton 3.1
<b>Name of Action or Project:</b>	Safe room
<b>Action or Project Description:</b>	Construct safe room
<b>Applicable Goal Statement:</b>	Protect health, safety, and welfare of residents and students
<b>Estimated Cost:</b>	\$2,000,000-\$4,000,000
<b>Benefits:</b>	Reduce or eliminate loss of life and injuries resulting from hazard events
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	City administrator
<b>Action/Project Priority:</b>	27, M
<b>Timeline for Completion:</b>	5 years
<b>Potential Fund Sources:</b>	Local funds, Federal Grants
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	None
<b>Progress Report</b>	
<b>Action Status</b>	Continuing (not started)
<b>Report of Progress</b>	

**Figure 4.4. Belleview R-III School District Actions**

<b>Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	Belleview R-III School District
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	Damage to buildings
<b>Hazard(s) Addressed:</b>	Earthquake
<b>Action or Project</b>	
<b>Action/Project Number:</b>	R-III 1.1
<b>Name of Action or Project:</b>	Seismically retrofit priority building
<b>Action or Project Description:</b>	Seismically retrofit building ranking highest in priority based on impacts, cost, and timeline
<b>Applicable Goal Statement:</b>	Protect health, safety, and welfare of residents and students
<b>Estimated Cost:</b>	\$2,000,000-\$10,000,000
<b>Benefits:</b>	Reduce damage to, or failure of, school facilities
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	Superintendent
<b>Action/Project Priority:</b>	19, L
<b>Timeline for Completion:</b>	5 years +
<b>Potential Fund Sources:</b>	Local funds, Federal Grants
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	None
<b>Progress Report</b>	
<b>Action Status</b>	Continuing (not started)
<b>Report of Progress</b>	

<b>Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	Belleview R-III School District
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	Power outages
<b>Hazard(s) Addressed:</b>	Earthquake, Severe Thunderstorms, Severe Winter Weather, Tornado
<b>Action or Project</b>	
<b>Action/Project Number:</b>	R-III 2.1
<b>Name of Action or Project:</b>	Purchase Emergency Generators
<b>Action or Project Description:</b>	Purchase emergency generators to keep critical facilities functional during and after event
<b>Applicable Goal Statement:</b>	Ensure operation of critical facilities and services
<b>Estimated Cost:</b>	\$50,000-\$100,000
<b>Benefits:</b>	Keep facilities and services operational
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	Superintendent
<b>Action/Project Priority:</b>	30, H
<b>Timeline for Completion:</b>	5 years
<b>Potential Fund Sources:</b>	Local funds, Federal Grants
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	None
<b>Progress Report</b>	
<b>Action Status</b>	Continuing (not started)
<b>Report of Progress</b>	

<b>Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	Belleview R-III School District
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	Loss of life due to hazard events
<b>Hazard(s) Addressed:</b>	Tornado, Severe Thunderstorms, Extreme Heat, Extreme Cold
<b>Action or Project</b>	
<b>Action/Project Number:</b>	R-III 3.1
<b>Name of Action or Project:</b>	Safe room
<b>Action or Project Description:</b>	Construct safe room
<b>Applicable Goal Statement:</b>	Protect health, safety, and welfare of students
<b>Estimated Cost:</b>	\$2,000,000-\$4,000,000
<b>Benefits:</b>	Reduce or eliminate loss of life and injuries resulting from hazard events
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	Superintendent
<b>Action/Project Priority:</b>	30, H
<b>Timeline for Completion:</b>	5 years
<b>Potential Fund Sources:</b>	Local funds, Federal Grants
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	None
<b>Progress Report</b>	
<b>Action Status</b>	Continuing (not started)
<b>Report of Progress</b>	



# 5 PLAN MAINTENANCE PROCESS

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<b>5 PLAN MAINTENANCE PROCESS .....</b>	<b>5.1</b>
<i>5.1 Monitoring, Evaluating, and Updating the Plan.....</i>	<i>5.1</i>
5.1.1 Responsibility for Plan Maintenance .....	5.1
5.1.2 Plan Maintenance Schedule .....	5.1
5.1.3 Plan Maintenance Process.....	5.1
5.2 Incorporation into Existing Planning Mechanisms .....	5.2
5.3 Continued Public Involvement.....	5.4

This chapter provides an overview of the overall strategy for plan maintenance and outlines the method and schedule for monitoring, updating and evaluating the plan. The chapter also discusses incorporating the plan into existing planning mechanisms and how to address continued public involvement.

## **5.1 Monitoring, Evaluating, and Updating the Plan**

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### **5.1.1 Responsibility for Plan Maintenance**

The MPC is an advisory body and can only make recommendations to county, city, town, or district elected officials. Its primary duty is to see the plan successfully carried out and to report to the community governing boards and the public on the status of plan implementation and mitigation opportunities. Other duties include reviewing and promoting mitigation proposals, hearing stakeholder concerns about hazard mitigation, passing concerns on to appropriate entities, and posting relevant information in areas accessible to the public.

### **5.1.2 Plan Maintenance Schedule**

The MPC agrees to meet annually and after a state or federally declared hazard event as appropriate to monitor progress and update the mitigation strategy. The Iron County Emergency Management Director will be responsible for initiating the plan reviews and will invite members of the MPC (or other designated responsible entity) to the meeting.

In coordination with all participating jurisdictions, a five-year written update of the plan will be submitted to the Missouri State Emergency Management Agency (SEMA) and FEMA Region VII per Requirement §201.6(c)(4)(i) of the Disaster Mitigation Act of 2000, unless disaster or other circumstances (e.g., changing regulations) require a change to this schedule.

### **5.1.3 Plan Maintenance Process**

Progress on the proposed actions can be monitored by evaluating changes in vulnerabilities identified in the plan. The MPC, during the annual meeting, should review changes in vulnerability identified as follows:

- Decreased vulnerability as a result of implementing recommended actions,
- Increased vulnerability as a result of failed or ineffective mitigation actions,

- Increased vulnerability due to hazard events, and/or
- Increased vulnerability as a result of new development (and/or annexation).

Future 5-year updates to this plan will include the following activities:

- Consideration of changes in vulnerability due to action implementation,
- Documentation of success stories where mitigation efforts have proven effective,
- Documentation of unsuccessful mitigation actions and why the actions were not effective,
- Documentation of previously overlooked hazard events that may have occurred since the previous plan approval,
- Incorporation of new data or studies with information on hazard risks,
- Incorporation of new capabilities or changes in capabilities,
- Incorporation of growth data and changes to inventories, and
- Incorporation of ideas for new actions and changes in action prioritization.

In order to best evaluate any changes in vulnerability as a result of plan implementation, the participating jurisdictions will adopt the following process:

- Each proposed action in the plan identified an individual, office, or agency responsible for action implementation. This entity will track and report on an annual basis to the jurisdictional MPC member on action status. The entity will provide input on whether the action as implemented meets the defined objectives and is likely to be successful in reducing risk.
- If the action does not meet identified objectives, the jurisdictional MPC member will determine necessary remedial action, making any required modifications to the plan.

Changes will be made to the plan to remedy actions that have failed or are not considered feasible. Feasibility will be determined after a review of action consistency with established criteria, time frame, community priorities, and/or funding resources. Actions that were not ranked high but were identified as potential mitigation activities will be reviewed as well during the monitoring of this plan. Updating of the plan will be accomplished by written changes and submissions, as the MPC deems appropriate and necessary. Changes will be approved by the Iron County Commission and the governing boards of the other participating jurisdictions.

## **5.2 Incorporation into Existing Planning Mechanisms**

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Where possible, plan participants, including school and special districts, will use existing plans and/or programs to implement hazard mitigation actions. Based on the capability assessments of the participating jurisdictions, communities in Iron County will continue to plan and implement programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through the following plans:

- General or master plans of participating jurisdictions;
- Ordinances of participating jurisdictions;
- Iron County Emergency Operations Plan;
- Capital improvement plans and budgets;
- Other community plans within the County, such as water conservation plans, storm water management plans, and parks and recreation plans;

- School and Special District Plans and budgets; and
- Other plans and policies outlined in the capability assessment sections for each jurisdiction in Chapter 2 of this plan.

The MPC members involved in updating these existing planning mechanisms will be responsible for integrating the findings and actions of the mitigation plan, as appropriate. The MPC is also responsible for monitoring this integration and incorporation of the appropriate information into the five-year update of the multi-jurisdictional hazard mitigation plan.

Additionally, after the annual review of the Hazard Mitigation Plan, the Iron County Emergency Management Director will provide the updated Mitigation Strategy with current status of each mitigation action to the County Commission as well as all Mayors, City Clerks, and School District Superintendents. The Emergency Manager Director will request that the mitigation strategy be incorporated, where appropriate, in other planning mechanisms.

Table 5.1 below lists the planning mechanisms by jurisdiction into which the Hazard Mitigation Plan will be integrated if/when these planning efforts are undertaken.

**Table 5.1. Planning Mechanisms Identified for Integration of Hazard Mitigation Plan**

Jurisdiction	Planning Mechanisms	Integration Process for Previous Plan	Integration Process for Current Plan
Iron County	County Emergency Operations Plan	County officials identified actions relating to emergency operations that were included in the update to the EOP	County officials identified new or ongoing actions relating to emergency operations that will be included in the next update to the EOP
Iron County	Floodplain Management Plan	County officials identified actions relating to floodplain management that were included in the update to the floodplain management plan.	County officials identified new or ongoing actions relating to floodplain management that will be included in the next update to the management plan.
Ironton	Annual Budget Review & Development	City officials identified actions that were discussed during annual budget process	City officials identified new or ongoing actions that will be discussed during the next annual budget process
Ironton	Comprehensive Plan	Plan was not updated since previous HMP process	City officials identified new or ongoing actions relating to future development that will be included in the next Comprehensive Plan update

Ironton	Floodplain Management Plan	City officials identified actions relating to floodplain management that were included in the update to the floodplain management plan.	City officials identified new or ongoing actions relating to floodplain management that will be included in the next update to the management plan.
Bellevue R-III School Dist.	Facilities Plan	Plan was not updated since previous HMP process	School representatives identified new or ongoing actions relating to future development that will be included in the next Facilities Plan update

### 5.3 Continued Public Involvement

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The hazard mitigation plan update process provides an opportunity to publicize success stories resulting from the plan's implementation and seek additional public comment. Information about the annual reviews will be posted in the local newspaper following each annual review of the mitigation plan. When the MPC reconvenes for the five-year update, it will coordinate with all stakeholders participating in the planning process. Included in this group will be those who joined the MPC after the initial effort, to update and revise the plan. Public notice will be posted and public participation will be actively solicited, at a minimum, through available website postings and press releases to local media outlets, primarily newspapers.

## APPENDIX A: ADOPTION RESOLUTIONS

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1.1 <i>Adoption Resolutions</i> .....	1

### 1.1 Adoption Resolutions

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Resolution No. 2018-02

**A RESOLUTION OF THE IRON COUNTY COMMISSION ADOPTING THE  
IRON COUNTY ALL-HAZARD MITIGATION PLAN (UPDATED 2018)**

**WHEREAS**, the Iron County Commission recognized the threat that natural hazards pose to people and property within Iron County; and

**WHEREAS**, the Iron County Commission has participated in the preparation of a multi-hazard mitigation plan, hereby known as the *Iron County All-Hazard Mitigation Plan (Updated 2018)*, hereafter referred to as the *Plan*, in accordance with the Disaster Mitigation Act of 2000; and

**WHEREAS**, the *Plan* identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in Iron County from the impacts of future hazards and disasters; and

**WHEREAS**, the Iron County Commission recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the county will endeavor to integrate the *Plan* into the comprehensive planning process and

**WHEREAS**, adoption by the Iron County Commission demonstrates their commitment to hazard mitigation and achieving the goals outlined in the *Plan*

**NOW, THEREFORE, BE IT RESOLVED BY THE** Iron County, in the State of Missouri, THAT:

**SECTION 1.** In accordance with local rule for adopting resolutions, the Iron County Commission adopts the final FEMA-approved plan.

ADOPTED by a vote of 3 in favor and 0 against, and 0 abstaining, this 28<sup>th</sup> day of JUNE, 2018.

By Jim Scaggs  
Presiding Commissioner  
JIM SCAGGS

ATTEST  
  
By Virginia Queen  
Clerk,  
VIRGINIA QUEEN

APPROVED AS TO FORM:

By \_\_\_\_\_

Print name: \_\_\_\_\_

RESOLUTION NO. 106

**A RESOLUTION OF THE CITY OF IRONTON, MISSOURI, ADOPTING  
THE IRON COUNTY ALL-HAZARD MITIGATION PLAN (UPDATED  
2018)**

WHEREAS, the City of Ironton recognizes the threat that natural hazards pose to people and property within the City of Ironton; and

WHEREAS, the City of Ironton has participated in the preparation of a multi-hazard mitigation plan, hereby known as the *Iron County All-Hazard Mitigation Plan (Updated 2018)*, hereafter referred to as the *Plan*, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS, the *Plan* identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the City of Ironton from the impacts of future hazards and disasters; and


WHEREAS, the Board of Aldermen of the City of Ironton recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the Board of Aldermen will endeavor to integrate the *Plan* into the comprehensive planning process; and

WHEREAS, adoption by the City of Ironton demonstrates their commitment to hazard mitigation and achieving the goals outlined in the *Plan*


NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF ALDERMEN OF THE CITY OF IRONTON, IN THE STATE OF MISSOURI, THAT:

Section 1. The Board of Aldermen, on behalf of the City of Ironton, Missouri, adopts the final FEMA-approved plan.


ADOPTED by a vote of 3 in favor and 0 against and 1 absent  
abstaining, this 11th day of June, 2018.

  
Robert W. Lourwood, Mayor

ATTEST:

  
Donna D. Jackson, City Clerk

APPROVED AS TO FORM:

By (Sig.):   
Print name: Donna D. Jackson

The following resolution was adopted by the Belleview R-3 School District Board on \_\_\_\_\_, 2019

Resolution No. 2019-1

**A RESOLUTION OF INTENT TO PARTICIPATE IN NATURAL HAZARD MITIGATION AND TO WORK TOWARD BECOMING A SAFER COMMUNITY.**

**WHEREAS**, the **Belleview R-3** School District recognizes that no community is immune from hazards whether it be tornado/severe thunderstorm, flood, severe winter weather, drought, heat wave, earthquake, dam failure or wildfire and recognizes the importance of enhancing its ability to withstand natural hazards as well as the importance of reducing the human suffering, property damage, interruption of public services and economic losses caused by those hazards; and

**WHEREAS**, the **Belleview R-3** School District has previously pursued measures such as building codes, fire codes, floodplain regulations, emergency management procedures to minimize the impact of natural hazards; and

**WHEREAS**, the Federal Emergency Management Agency and the State Emergency Management Agency have developed a natural hazard mitigation program that assist communities in their efforts to become Disaster-Resistant Communities which are sustainable communities after a natural disaster that focus, not just on disaster relief, but also on recovery and reconstruction that brings the community to at least pre-disaster conditions in an accelerated orderly and preplanned manner; and

**WHEREAS**, by participating in the Natural Hazards Mitigation program, the **Belleview R-3** School District will be eligible to apply for post-disaster mitigation funds; and

**WHEREAS**, the **Belleview R-3** School District desires to commit to working with government partners and community partners to implement the Natural Hazard Mitigation Plan; and

**WHEREAS**, the **Belleview R-3** School District will implement pertinent precepts of the mitigation plan by incorporation into other community plans and mechanisms where appropriate; and

**WHEREAS**, all aspects pertaining to the School District in the Laclede County Multi-Jurisdictional Hazard Mitigation Plan attached hereto and incorporated by reference herein be approved; and

**WHEREAS**, the **Belleview R-3** School District will participate in the evaluation and review of the Plan after a disaster as well as complete a mandated five-year update submitted to the State Emergency Management Agency and the Federal Emergency Management Agency for review and approval; and

**NOW, THEREFORE BE IT RESOLVED BY THE SCHOOL BOARD Belleview R-3 SCHOOL DISTRICT, Belleview, MISSOURI AS FOLLOWS:** The **Belleview R-3** School District hereby adopts the Iron County Multi-Jurisdictional Natural Hazard Mitigation Plan attached hereto for the purpose of building a safer community by reducing natural hazard vulnerability.

Brandelyn Sanders

School Board President, Brandelyn Sanders

9/23/2019

Date

Lois Yates

School Board Secretary, Lois Yates

9/23/2019

Date



# APPENDIX B: MEETING AND NOTICE MATERIALS

**APPENDIX B: MEETING AND NOTICE MATERIALS**.....1  
*1.1 Meeting and Notice Materials* .....1

## **1.1 Meeting and Notice Materials**

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# **PUBLIC NOTICE**

Iron County and Participating Jurisdictions, along with the Southeast Missouri Regional Planning Commission (SEMO RPC) are beginning the plan update process for the **2018 Iron County Hazard Mitigation Plan.**

**This process is open to the public.**

Meeting notices will be posted at this location, the County Courthouse, participating jurisdictions City Halls/offices, at the SEMO RPC office, and on the RPC's website: [www.semorpc.org](http://www.semorpc.org).

Public participation is encouraged to help develop the best plan possible. All meetings are open to the public and any comments, concerns, ideas, or suggestions are welcome at any time during this plan update, regardless of meeting attendance.

The draft plan can be found at:

[http://www.semorpc.org/hazard\\_mitigation\\_planning.html](http://www.semorpc.org/hazard_mitigation_planning.html)

For more information or to provide comments or feedback on the draft, please contact:

Drew Christian  
Director of Planning  
Southeast Missouri Regional Planning Commission  
1 W. St. Joseph Street  
P.O. Box 366 Perryville, MO 63775  
Phone: 573-547-8357 ext 315  
Fax: 573-547-7283  
[dchristian@semorpc.org](mailto:dchristian@semorpc.org)  
[www.semorpc.org](http://www.semorpc.org)

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# **PUBLIC NOTICE**

Iron County and Participating Jurisdictions, along with the Southeast Missouri Regional Planning Commission (SEMO RPC), are holding a **Hazard Mitigation Planning Committee meeting** for the **2018 Iron County Hazard Mitigation Plan** on

**Monday, January 8th, 2018 at 1:30 p.m. at the  
Ozark Regional Library  
402 N. Main,  
Ironton, MO 63650.**

**This meeting is open to the public.**

Public participation is encouraged to help develop the best plan possible. The draft plan can be found at: [http://www.semorpc.org/hazard\\_mitigation\\_planning.html](http://www.semorpc.org/hazard_mitigation_planning.html)

For more information or to provide comments or feedback on the draft, please contact:

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Director of Planning  
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1 W. St. Joseph Street  
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[dchristian@semorpc.org](mailto:dchristian@semorpc.org)  
[www.semorpc.org](http://www.semorpc.org)

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# **PUBLIC NOTICE**

Iron County and Participating Jurisdictions, along with the Southeast Missouri Regional Planning Commission (SEMO RPC), are holding a **Hazard Mitigation Planning Committee meeting** for the **2018 Iron County Hazard Mitigation Plan** on

**Monday, February 12th, 2018 at 1:30 p.m. at the  
Ozark Regional Library  
402 N. Main,  
Ironton, MO 63650.**

**This meeting is open to the public.**

Public participation is encouraged to help develop the best plan possible. The draft plan can be found at: [http://www.semorpc.org/hazard\\_mitigation\\_planning.html](http://www.semorpc.org/hazard_mitigation_planning.html)

For more information or to provide comments or feedback on the draft, please contact:

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