Natural Hazard Mitigation Plan

November 2013

Prepared by: Kaysinger Basin Regional Planning Commission
And Pioneer Trails Regional Planning Commission

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Prerequisites

Requirement

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

Examples of adoption resolutions for the participation jurisdictions are included in Appendix A.

Executive Summary

Located at the eastern edge of the Great Plains near the center of the North American continent, Bates County, Missouri, has been fortunate to avoid many of the natural disasters that impact other areas of North America. The county is virtually unknown to hurricanes, tsunamis, tidal surges, landslides, and forest fires. However, Bates County is susceptible to other natural hazards. Tornadoes and severe thunderstorms, severe winter storms, drought, floodplain, and heat waves are all hazards that can impact the county, endangering both lives and property.

Bates County is in the west-central part of Missouri. It is bordered by Kansas on the west. It has an area of 544,365 acres, or 850.6 square miles. In 1980, the population of Bates County was 15,873. Butler, the county seat, is in the central part of the county. In 1980, it had a population of 4,107. Other towns in the county include Adrian, Amoret, Amsterdam, Hume, Foster, Merwin, Rich Hill, and Rockville.

Section One of this plan provides general background data for Bates County. This includes population statistics, identification of critical facilities, and general information regarding the county's infrastructure. Understanding "where you are" is a fundamental component of the planning process. It is hoped this section provides a snapshot of Bates County that will serve to assist in the implementation of this plan.

Section Two identifies and explores the types and likelihood of a hazard occurring in Bates County. It provides a general overview of each of the identified natural hazards; in addition to explaining the impact upon Bates County should such a hazard occur.

Section Three provides a capability assessment of Bates County should one of the identified disasters occur. It outlines the county's disaster response capabilities and seeks to identify those areas in which the county may improve in disaster mitigation. Specifically, it identifies key personnel, organizational leaders, and existing plans regarding emergency planning. Also, it provides a brief assessment of each municipality's readiness regarding hazard mitigation.

Section Four provides mitigation goals, objectives, and mitigation plans in response to each identified natural disaster. Each disaster has specific problems identified with its respective occurrence, overall goals to reduce a disaster's effect, specific objectives towards achieving those goals, and implementation plans for the county to pursue.

The overall goals of this and any mitigation plan are:

1) Protect the lives, property, and livelihood of all citizens
2) Ensure uninterrupted government and emergency function during a natural hazard event
3) Manage growth through sustainable principles and practices to limit development in hazard-prone areas. These goals, and the other information contained within this plan, will be reviewed every five years under the coordination of Bates County.

Section 1: Introduction and Planning

1.1 Purpose and Background

Following the severe weather, tornado, and flood disaster that was declared in the spring of 2002 (DR-1412), Missouri's State Emergency Management Agency (SEMA) received flood buyout project proposals from 23 communities across the state. Fortunately, they were able to help some of these communities with federal mitigation grant funding provided through the Federal Emergency Management Agency (FEMA). After November 1, 2010, communities like these will still be eligible for federal disaster assistance and individual assistance, but will not be eligible for mitigation assistance unless they have an approved hazard mitigation plan on file. For the nearly 1,000 cities and 114 counties in Missouri, mitigation plans will be required for all federally declared disasters such as flood, earthquake, ice storm, tornado, and fire. Under the rules for federal mitigation funding, local governments will be required to have FEMA-approved hazard mitigation plans in place as a condition to receiving federal mitigation grant funding as of the 2010 deadline.

Under the initiative set forth by SEMA, the Missouri Association of Councils of Government (MACOG) agreed to meet the challenge of developing county and municipal plans throughout the state. The 19 regional planning commissions of MACOG provide an effective way for local governments to work together to share technical staff and address common problems in need of an area-wide approach. They also can effectively deliver programs that might be beyond the resources of an individual county or municipal government.

The intent of the regional planning commissions in Missouri is to be of service to their member counties and municipalities and to bring an organized approach to addressing a broad cross-section of area-wide issues. They also are available to assist their member entities in coordinating the needs of the area with state and federal agencies or with private companies or other public bodies. SEMA's initiative further states that, due to time and funding limitations, the plans developed by Missouri's regional planning commissions should cover natural hazards only. Manmade and/or technological hazards are not addressed in this plan, except in the context of cascading damages.

Citizens and public organizations have participated in the process. This effort will be sustainable over the long term because it enjoys grassroots support that stems from a sense of local and individual ownership.

Through SEMA's Scope of Work, Bates County contracted with Kaysinger Basin Regional Planning Commission and participated fully in the preparation of the plan.

Once this plan is approved, Bates County and cities within the county will be eligible for future mitigation assistance from FEMA and will be able to more effectively carry out mitigation activities to lessen the adverse impact of future disasters within the county.

Most of the rural regional planning commissions in Missouri were formed under Chapter 251 of the Revised Statutes of the State of Missouri. All regional councils in Missouri operate as "quasi-governmental" entities. In Missouri, regional planning commissions are advisory in nature, county, and municipal governments hold memberships on a voluntary basis.

The final Bates County hazard mitigation Plan was prepared by the staff of the Kaysinger Basin Regional Planning Commission (KBRPC). KBRPC, a member of MACOG, was created October 14, 1968 by Governor Warren E. Hearnes. The commission serves the seven county areas of Bates, Hickory, Cedar, Henry, Hickory, St. Clair, and Vernon counties.

The plan was developed in accordance with FEMA's Mitigation Planning regulations under Code of Federal Regulations (CFR), Title 44, Part 201.6, *Local Mitigation Plan*s. Relevant requirements from CFR §201.6 are highlighted throughout the plan.

1.2 History of the Bates County Hazard Mitigation Plan

In November 2004, a "current and approved" hazard mitigation plan became a FEMA eligibility requirement for local jurisdictions applying for pre-disaster mitigation grants and the mitigation portion of post-disaster grant funds.

Due to this change in FEMA grant requirements, the Missouri State Emergency Management Agency (SEMA) contracted with the Missouri Council of Governments for the Regional Planning Commissions to direct hazard mitigation planning for interested counties within their respective regions. Hickory County, a member of the Kaysinger Basin Regional Planning Commission (KBRPC), contracted with the KBRPC to facilitate the development of a hazard mitigation plan for the county. The plan was approved by FEMA and adopted by the participating jurisdictions in the spring of 2005.

Maintenance of Hazard Mitigation Plan 2005-2012

The Bates County Hazard Mitigation Plan 2005 was written to be a working document to guide participating jurisdictions in the county in the work of mitigating potential hazards. To this effect, the plan will be publicly available on the website of the Kaysinger Basin Regional Planning Commission.

During the ensuing years, the Kaysinger Basin RPC has kept the jurisdictions informed of mitigation grant opportunities through letters and announcements at meetings of the RPC.

The maintenance plan in the original document called for an annual review of the plan by the Bates County Hazard Mitigation Planning Committee, facilitated by the Kaysinger Basin RPC. These annual reviews did not take place; lack of a defined time table for the reviews, shortage of time and personnel and personnel changes all played a role in this omission.

This plan update lays out a clearly defined maintenance process with a timetable for review and concrete tools to be employed in the review.

1.3 Participating Jurisdictions

Requirement

§201.6(a) (3): Multi-jurisdictional plans…may be accepted, as appropriate, as long as each jurisdiction has participated in the process….Statewide plans will not be accepted as multi-jurisdictional plans

The Bates County Hazard Mitigation Plan is a multi-jurisdictional plan. Planners from the Kaysinger Basin RPC adopted the following criteria from Mid-MO RPC for a jurisdiction to qualify as a participating jurisdiction:

1. Completion of a survey regarding capabilities, vulnerable assets, and future development
2. Review of a draft of the plan and provision of feedback, if warranted
3. Review of mitigation actions suggested for the jurisdiction; prioritization of actions deemed feasible for the jurisdiction based on benefit/cost and time/resources available for implementation and administration
4. Formal adoption of the plan by resolution
5. Attendance to at least one Hazard Mitigation Plan public informational meeting.

The participating jurisdictions in the original plan (2005) and those participating to any degree in the updated plan (2013) are the same. The term "Planning Area" is used in the plan to indicate, as a whole, all of the jurisdictions which participated in the planning process to any degree

Table 1.3-1

Participating Jurisdictions	2005	2013
Bates County	X	X
City of Adrian	X	X
City of Amoret	X	X
City of Amsterdam	X	X
City of Butler	X	X
Village of Foster	X	X
City of Hume	X	X
Village of Merwin	X	X
Village of Passaic	X	X
City of Rich Hill	X	X
City of Rockville	**X**	**X**
Hudson R-9		X
Miami R-I		X
Rich Hill R-IV		X

The chart in Figure 1.3-1 also tracks the completion of the criteria for inclusion as a participating jurisdiction in the plan. The column on the far right of the chart ("2013 Participating Jurisdictions") indicates those jurisdictions which have completed the above requirements and are requesting approval of the plan prior to formal adoption.

The primary representatives for each jurisdiction participating to any degree in the update process are shown in Figure 1.3-2. The representative indicated had the primary contact with the Plan Author for purposes of participation in the plan. It should be noted, however, that there was wider participation in the planning process within each jurisdiction.

Table 1.3.2

Jurisdiction	Participant	Worksheets	Email	Public Meetings	Signed Resolution
Bates County	Ron Nissen, Bates County Emergency Management Director	X		X	
City of Adrian	Brian Bearce, Adrian Emergency Management Director	X		X	
City of Amoret	Jane Hettinger City clerk	X		X	
City of Amsterdam	Tammy McLanahan West Alderman	X		X	
City of Butler	Jim Henry, Butler Emergency Management Director.	X		X	
Village of Foster	Arthur Swarnes Chairman of the Board.	X		X	
Village of Hume	Maxine Dixon Mayor	X		X	
Village of Merwin		X		X	
Village of Passaic	Charles Cole Chairman of the Board	X		X	
City of Rich Hill	Gordon Tucker City Superintendent	X		X	
City of Rockville	James Roberts, Chief Rockville Fire Department	X		X	
Hudson R-IX	Karen Warmbrodt, Superintendent	X	X	X	X
Rich Hill R-IV	Jeff Blackford, Supeerintendent	X	X	X	X
Miami R-I	Frank Dahman	X	X	X	X

All jurisdictions listed above have participated in the planning process and have been in further communication with the Plan Author and have completed all of the preliminary requirements for consideration as participating jurisdictions.

1.4 The Update Process

Requirement

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

A Hazard Mitigation Plan must be updated and adopted by the participating jurisdictions every five years to be considered current. The update of the Hickory County Hazard Mitigation Plan was directed by a planner from Kaysinger Basin RPC as specified in a Memorandum of Agreement (MOA) with the Missouri State Emergency Management Agency (SEMA).

The general planning process along with significant dates was as follows:

1. Preliminary update of technical data in charts and graphs (e.g. storm history events, population statistics, etc.) by PTRPC staff in expectation of an MOA from SEMA for update
2. Preliminary discussions between PTRPC and KBRPC and SEMA regarding the update of the Bates County Hazard Mitigation Plan
3. MOA for the update of the Bates County Hazard Mitigation Plan received from SEMA (March 2009)
4. Formation of a Technical Steering Committee to prepare preliminary draft of the update and provide input throughout the update process.
5. Draft of update due at SEMA for review Survey to official's o participating jurisdictions on capabilities, vulnerable assets, and future development.
6. Presentation of updated draft to officials of participating jurisdictions, neighboring jurisdictions, the public, interested agencies, businesses, and non-profits.
7. Feedback from participation jurisdiction on mitigation actions and their prioritization decisions for their jurisdictions.
8. Incorporation of survey information and mitigation actions feedback from participating jurisdictions in update draft.
9. Presentation of final draft for public comment before submission for SEMA/FEMA final approval.
10. Final plan due to SEMA for submission to FEMA (December 30th, 2009)
11. Presentation of the approved plan for participating jurisdictions approvals (after approval by FEMA)

Technical Steering Committee

The Technical Steering Committee was formed with the intention of having a diversity of members who would represent the interests of all participating jurisdictions. Planners from the Kaysinger Basin RPC, which works with communities throughout Hickory County, initiated the formation of the committee and participated in the committee meetings.

Summary of Update of the Plan

The Technical Steering Committee decided that each section of the plan needed to be updated. The original plan was written early in FEMA's decision making cycle regarding requirements for Hazard Mitigation Plans. It contained useful but vague information so as the goal for this update was to be as specific as possible. The goal was to produce a plan which is relevant, useful, and readable.

The plan was also restructured from its original organization to promote readability and flow. A general description of changes and updates made to the plan are shown in Table 1.4-1.

Table 1.2

Plan Section	Significant Plan Changes
All Sections	All sections have had the tables and figures updated to reflect the most current information available as of 10/01/2013. Some section titles have been changed and their order rearranged to improve readability.
Section 2- Planning Area Profiles	The list of critical facilities was brought up to date. All relevant community plans were addressed and reviewed by the public and hazard mitigation plan stakeholders. Listings of media relations and infrastructure were all made current and all city maps were updated. All demographic information has been updated.
Section 3 - Identified Hazards	All data pertaining to hazard occurrences brought up to 2013 events. Hazard profile worksheets were updated to reflect current vulnerability. Separate individual sections were added for High Winds, Hail, and Lightning with individual narratives.
Section 4 – Vulnerability Assessment	Two HAZUS based vulnerability assessments were added. 4.2.3A, 100 year flood scenario and 4.2.7A, HAZUS earthquake scenario.
Section 6- Mitigation Goals	Categories of mitigation reviewed and brought up to current categorization measures. All goals and actions were reviewed by the public, elected officials and emergency personnel to determine the best and most cost effective mitigation priorities in the County. Goals were analyzed and either remained, were deleted, revised or new goals were added. Jurisdictional specific goals and actions were also identified. The format of the all the goals and proposed actions has been changed to eliminate confusions and to eliminate repeated language in the section.
Appendices	Additional Bates County official maps were updated with current data.

§201.6(b): In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval; (2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process;

Minimum participation requirements are defined as follows:

Provide information to support plan update through **at least one** of the following methods:

- Completion of worksheets;
- Attendance at public meetings;
- Executed letters of authorization
- Alternately scheduled meetings with PTRPC staff for data collection; or
- Communicate with PTRPC staff through email concerning data collection.

Formal adoption of the mitigation plan update.

All of the jurisdictions listed as participants in the plan update met the minimum participation requirements as indicated in the table below. Documentation in the form of sign-in sheets for attendance at group meetings as well as time sheets for meetings with KBRPC staff is included in *Appendix F: Documentation of Public Participation*.

The lead member for the natural hazard mitigation planning team was Ron Nissen, Bates County Emergency Management Director. As the lead member, Ron coordinated with local officials and residents for input in the mitigation plan for the county. The lead regional planning commission working on the plan was Kaysinger Basin Regional Planning Commission for the first half of the planning process and Pioneer Trails Regional Planning Commission for the latter half. All public meetings occurred while PTRPC was the lead agency involved with the county plan. KBRPC staff developed initial hazard and demographic data. PTRPC staff was to finished the plan with final data analysis and map generation. Goals and objectives, as well as county mitigation activities, were reviewed with PTRPC staff and Bates County officials through several individual meetings.

Public participation was a key element in obtaining information for the plan update. A series of public meetings was held between September 2009 and August of 2010. The purpose of these meetings was:

- To educate the public on what hazard mitigation planning is and why it is important
- To gain valuable local insight into past disasters and the threats communities face
- To understand the capabilities of communities
- To develop mitigation action plans, goals and objectives
- Formally adopt the draft and final version of the plan

Meetings took place throughout the County at various locations and times to allow for maximum public participation.

Beginning in July 2010 and continuing through January 2011, KBRPC along with Pioneer Trails Regional Planning Commission and the public worked to update the Bates County Hazard Mitigation Plan.
The meeting schedule was as follows:

*July 19, 2010 – Bates County Office of Emergency Management
*September 3, 2010 - Bates County Office of Emergency Management
*September 13, 2010 - Bates County Office of Emergency Management
*Meetings hosted by Pioneer Trails Regional Planning Commission

The public meetings involved stakeholders from all jurisdictions participating in the plan. The meetings allowed for the public to review hazard and vulnerability data as well as review and analyze mitigation goals, objectives and actions.

Requirement

§201.6(b): In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

Many existing plans, studies, and reports were consulted in the development of this plan. These Include:

- Missouri State Hazard Mitigation Plan (2010), State Emergency Management Agency (SEMA)
- Hickory County Emergency Operations Plan (2004 edition)
- SEMA Situation Reports (http://sema.dps.mo.gov/SitReps/Situation%20Reports.htm)
- Long Range Transportation Plan (LRTP), Missouri Department of Transportation
- Regional Transportation Plan (2009), Kaysinger Basin Regional Planning Commission
- Atlas of Missouri Ecoregions, Missouri Department of Conservation
- Missouri Drought Plan (2002), Missouri Department of Natural Resources

Section 2: Planning Area Profiles

2.1 History

Bates County was named in honor of Frederick Bates, the second governor of Missouri, who died in office August 14, 1825. Missionaries from New York settled the first community in Bates County, Harmony Mission, for the purpose of educating Indians. When Bates County organized and separated from Cass County in 1841, county commissioners selected Harmony Mission as the first county seat, presumably because of the established development and central location.

After first meeting in a private home, subsequent courts met in the Mission House until 1847 when the county seat moved to Papinville, three miles southeast of Harmony Mission.

Orders for building the first courthouse, at Papinville, came in November 1852, when the court appointed Freeman Barrows superintendent and appropriated $2,500. The following month Barrows submitted a plan and the court accepted bids.

But, in August 1853 Abraham Redfield replaced Barrows as superintendent and produced plans and specifications prepared by Fitzpatrick and Hurt from Benton County (Fitzpatrick's name also appears as Fitzpatrick.) The court appropriated $4,200 for the 35-by-60-foot brick building. It was completed in 1855. After 1856, when the county seat moved to Butler, Philip Seal bought the courthouse and converted it to business use. Destruction by fire came in 1861, during the Civil War.

In 1855, after an area separated to become Vernon County, Papinville was no longer near the geographic center of Bates County. The original plan for dividing Butler's land into building lots, commonly called a plat, was filed and recorded in August 1853. Fifty-five acres donated to the county induced officials to move the county seat to Butler in 1856. The court ordered 50-by-50-foot brick courthouse at an estimated cost of $5,000. Fitzpatrick and Hurt again served as contractors. This building, too, burned in 1861.

Because of the attack on Lawrence, Kansas by Missouri guerrillas, on August 25, 1863 the infamous Order #11 was issued by General Thomas Ewing. This order forced all residents of Bates and Cass Counties to vacate their homes within 15 days. Bates County was put to the torch as Missouri endured 1,100 of the 6,600 engagements and battles fought in the Civil War. During this time courts were held in locations other than the county seat. In May 1864 the court met at Johnstown. The legislature recognized Pleasant Gap as the official county seat in 1865, and the shaft the end of the Civil War, Bates County citizens returned to find burnt out structures, a devastated county seat and desolate land. At the November 1865 term, the court appropriated $750 for clerk's office and courthouse. The courthouse was to measure 16 by 24 feet, the clerk's office 16 feet square, and both 10 feet high. Later appropriations raised the sum to $1,100. John D. Meyers, county clerk, served as superintendent, and the court authorized him to select the location for this interim courthouse. Old settlers recalled the frame building situated in the northeast corner of the square.

After several attempts, plans for the 1869 courthouse crystallized. Plans of architect P. B. Leach and specifications submitted by Samuel Ward were adopted. In April 1869 the court awarded the building contract to J. B. Linkenpaugh for $23,000. Cornerstone ceremonies, held on July 15, 1869, were reported in the Bates County Record, then reprinted in the 1883 History.

This 75-foot-square brick building, in the center of the 300-foot public square, had five rooms on the first floor, three on the second and two large rooms on the third floor, leased by local civic or fraternal organizations. In 1899, after being declared unsafe, the building was sold for $500 to the highest bidder, J. S. Francisco. The court moved into temporary quarters in January 1900.

A successful election for $40,000 in bonds was supplemented by $10,000 from general funds. This provided $50,000 for a new courthouse. George McDonald was chosen architect for the 80-by-105-foot building. The courthouse of 1901 is similar to three other Missouri 19th century courthouses by the same architect: Andrew County, 1899; Johnson County, 1896; and Lawrence County, 1900. Contractors for this building, which was built with Carthage stone, were Bartlett and Kling, Galesburg, Illinois. Excavation began during July 1901; the cornerstone was laid October 10, 1901, and the court accepted the completed building in July of 1902. It is still in use as the Bates County courthouse.

2.2 Natural Hazard History

Bates County has been impacted by numerous natural hazards in the past including floods, tornadoes, thunderstorms, severe winter weather, and extreme heat.

According to the NOAA National Climatic Data Center Bates County has suffered 175 event(s) were which were reported between 01/01/1996 and 07/31/2013.Although there were no deaths reported from these events, these natural hazard events were responsible for more than 14 million dollars in property damage and 1 and a half million dollars in crop damage. Many of the specific event dates and damage estimates will be discussed in section 3 of this plan.

2.3 Geography and Ecology

Bates County is in the west-central part of Missouri. It is bordered by Kansas on the west. It has an area of 544,640 acres, or 851 square miles. In 2000, the population of Bates County was 16,653. Butler, the county seat, is in the central part of the county. In 2000, it had a population of 4,209. Other towns in the county include Adrian, Amoret, Amsterdam, Hume, Rich Hill, and Rockville.

Bates County is in the Cherokee Prairie major land resource area. The topography is a slightly dissected plain. The plain is interrupted by a series of ridges that have southeast-facing escarpments.

Most of the county was once drained by the Marais des Cygnes River and its tributaries. The Bates County Drainage Ditch, completed in 1911, now drains most of the county into the Osage River. This drainage ditch shortened the natural drainage system by 40 miles. Since much of the flood plain is in the flood pool area of Harry S. Truman Reservoir, drainage is sometimes reduced and flooding occurs. The rest of the county is drained by the South Grand River along the northern boundary of the county. Elevation in the county ranges from 1,053 feet in the northwestern, to 698 feet in the southeast along the Osage River.

Soybeans, corn, grain sorghum, and winter wheat are the principal cash crops. Beef cattle, dairy cattle, and hogs are the dominant livestock.

Soil scientists have identified about 18 different kinds of soil in Bates County. The soils range widely in texture, depth, natural drainage, and other characteristics. Most of the soils are suited to the cultivated crops that are commonly grown in the area. Controlling erosion on sloping cropland is the most important management concern. This survey updates the soil survey of Bates County published in 1910. It provides additional information and has larger maps, which show the soils in greater detail.

Climate

Bates County has cold winters and long, hot summers especially at low elevations. Heavy rains occur mainly in spring and early summer when moist air from the Gulf of Mexico interacts with the drier continental air. The annual rainfall is normally adequate for corn, soybeans, and all grain crops.

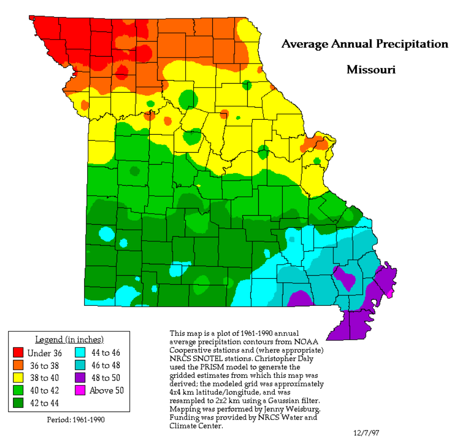
In winter, the average temperature is 34 degrees F and the average daily minimum temperature is 23 degrees. The lowest temperature on record for the City of Butler, the county seat of Bates County, is -26 degrees, which occurred on December 23, 1989. In summer, the average temperature is 77 degrees and the average daily maximum temperature is 88 degrees. The highest recorded temperature for the City of Butler is 117, which occurred on July 14, 1954, is 116 degrees.
The total annual precipitation is about 41 inches. Of this, 27 inches, or about 66 %, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 19 inches. The heaviest 1-day rainfall during the period of record was 8.67 inches in Butler, home of the nearest weather station, on June 11, 1981. Thunderstorms occur on about 49 days each year.

The average seasonal snowfall in the winter is about 9.8 inches. The greatest snow depth at any one time during the period of record was 14 inches. On the average, 16 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in mid-afternoon is about 55 %. Humidity is higher at night, and the average at dawn is about 75 %. The sun shines 70 % of the time possible in summer and 55 % in winter. The prevailing wind is from the south. Average wind speed is highest, 12 miles per hour, in spring.

Tornadoes and severe thunderstorms occur occasionally but are local and of short duration. Damage from these storms varies and is spotty. Hailstorms occur in small, scattered areas during the warmer part of the year.

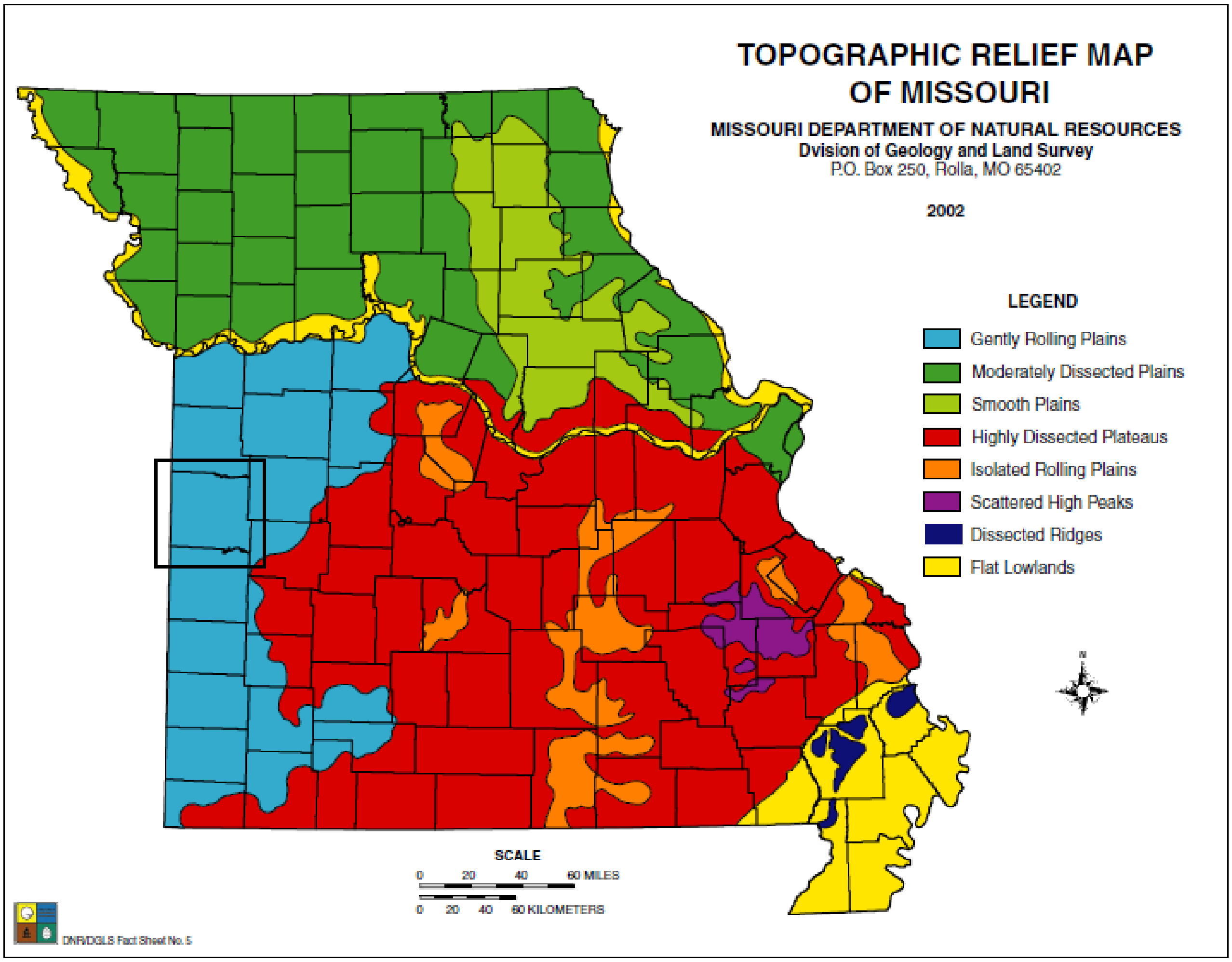
Figure 2.2-1



Rivers and Lakes

Bates County is characterized by a single physiographic region, the Osage Plains. The main topographic features of the county are gently rolling hills with most areas in the county well below 1000 ft. above sea level. With no major water features in the northern half of the county, most drainage occurs in the southern portion of the county at the Marais des Cygnes River. The Marais des Cygnes River is a tributary of the Osage River. The River stretches 140 miles from eastern Kansas into Missouri. The Marais des Cygnes River cuts through the southern half of Bates County and meets with the Little Osage River at the border of Bates and Vernon Counties to form the Osage River.

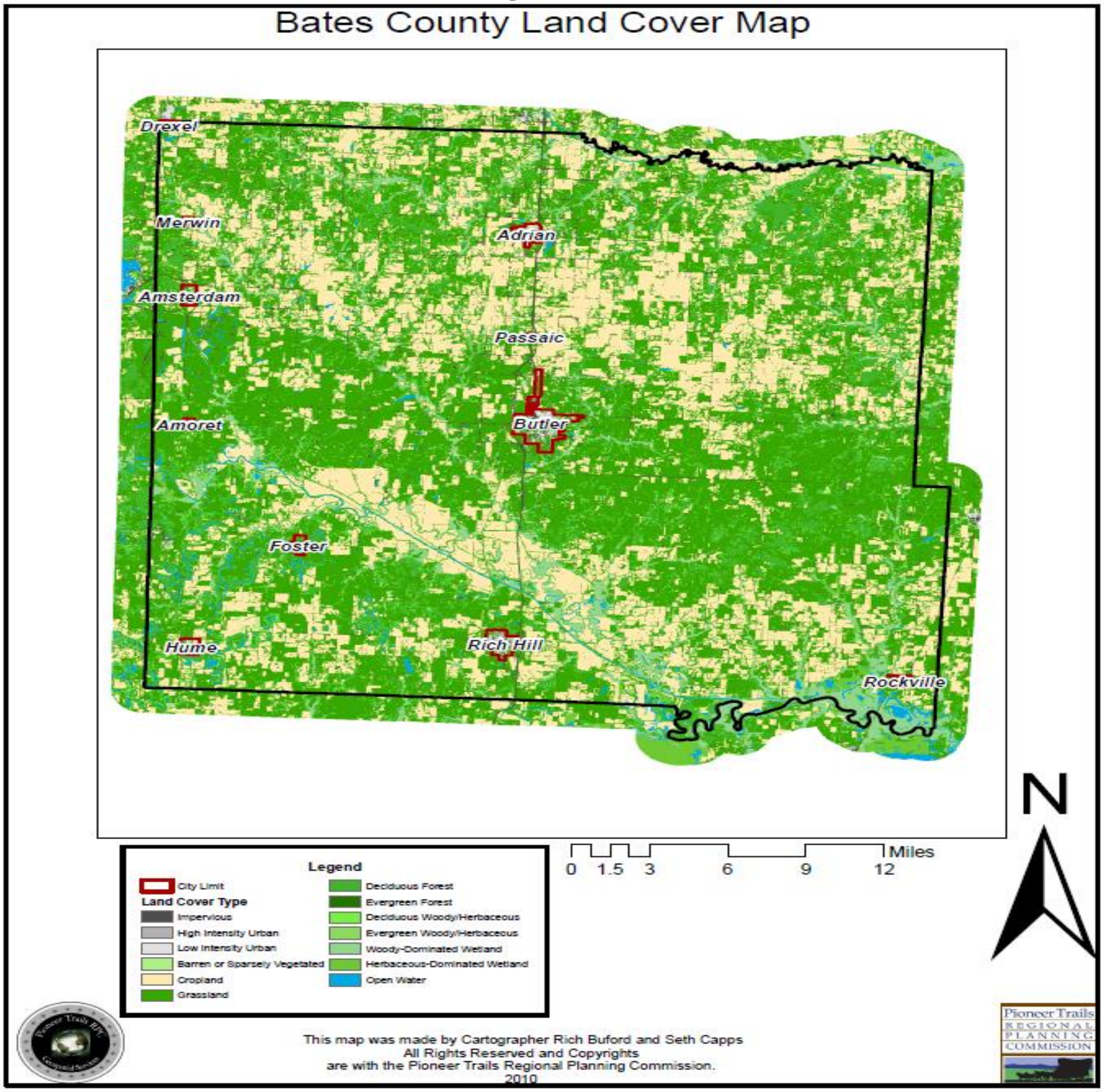
Figure 2.3-1



Land Use

There have been no significant changes in land use in the county as 2004 Hazard Mitigation Plan. Butler, the largest city in Bates County, remains the only community in the county with planning mechanisms in place and has seen fairly stagnant growth over the last five years.

Figure 2.4-1

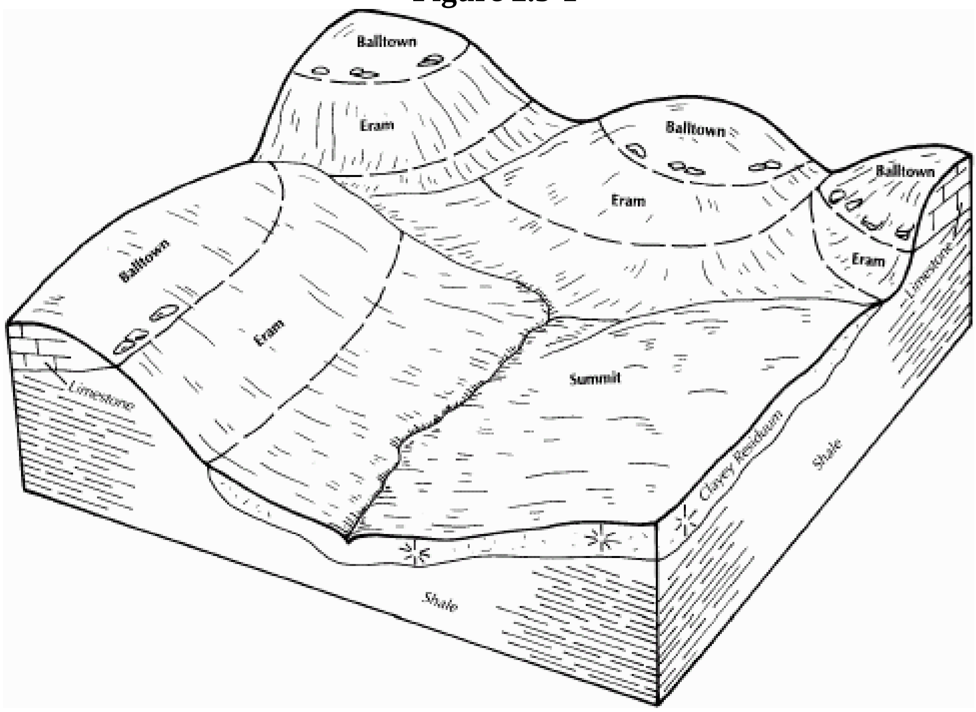


Soils

1. Summit-Eram-Balltown Association

Very deep, moderately deep, and shallow, gently sloping to moderately steep, moderately well drained and somewhat excessively drained soils that formed immaterial weathered from shale or limestone; on uplands.

Figure 2.5-1



This association is on ridge tops, side slopes and foot slopes that are dissected by drainage ways and small creeks. Slopes range from 1 to 20 percent.

This association makes up about 22 percent of the county. It is about 41 percent Summit soils, 23 percent Eram soils, 15 percent Balltown soils, and 21 percent minor soils.

Summit soils are very deep, gently sloping and moderately sloping and moderately well drained. They are on side slopes in the uplands and on foot slopes.

The typical sequence, depth and composition of the layers of the Summit soils are as follows:

Surface layer:	0-8 in., black, firm silty clay loam
Subsurface layer:	0-14 in., very dark gray, firm silty clay loam
Subsoil:	14-60 in., very dark gray, very dark grayish brown and dark grayish brown, mottled, very firm silty clay.

Eram soils are moderately deep, gently sloping to moderately steep, and moderately well drained. They are side slopes in the uplands.

The typical sequence, depth, and composition of the layers of the Eram soils are as follows:

Surface layer: 0-10 in, dark brown, friable silt loam
Subsoil: 10-21 in., brown, mottled, firm silty clay
Bedrock: 31 in., weathered shale

Baltown soils are shallow, moderately sloping to moderately steep, and somewhat excessively drained. They are on narrow ridge tops and side slopes in the uplands. The typical sequence, depth, and composition of the layers of the Balltown soils are as follows:

Surface layer: 0-8 in., black, friable very flaggy silt loam
Substratum: 8-15 in., very dark grayish brown, friable very flaggy silt loam
Bedrock: 15 in., hard limestone

Of minor extent in this association are Bates, Catoosa, Clareson, Coweta, Newtonia, and Verdigris soils. Bates, Catoosa and Clareson soils are:

Surface layer: 0-7 in, very dark grayish brown, friable silt loam
Subsoil: 7-13 in, dark brown, friable silt loam
13 to 37 in., brown and dark brown, mottled, friable and firm silty clay loam
37 to 60 in., multicolored, firm silty clay loam

Of minor extent in this association are Bates, Brazilton, Coweta, Eram, Hepler, Kanima, and Verdigris soils. The moderately deep Bates and Eram soils and the Shallow Coweta soils are on ridge tops and side slops. Brazilton soils are in excavated material that has been reconstructed. The strongly sloping to steep Kanima soils are excavated coal pits. The moderately slowly permeable Hepler soils and the well drained Verdigris soils are on flood plains.

About 90 percent of the acreage in this association is used for cultivated crops, such as corn, soybeans, wheat, and grain sorghum. Some areas are used for pasture and hay. The remaining acreage is uneven, moderately steep or steep areas that generally support native grasses and scattered mixed hardwoods.

This association is suited to cultivated crops, small grain, and grasses and legumes. Controlling water erosion and improving and maintaining fertility and tilt are the main management concerns in areas used for cultivated crops. Wetness is a limitation in areas of the Hartwell soils.

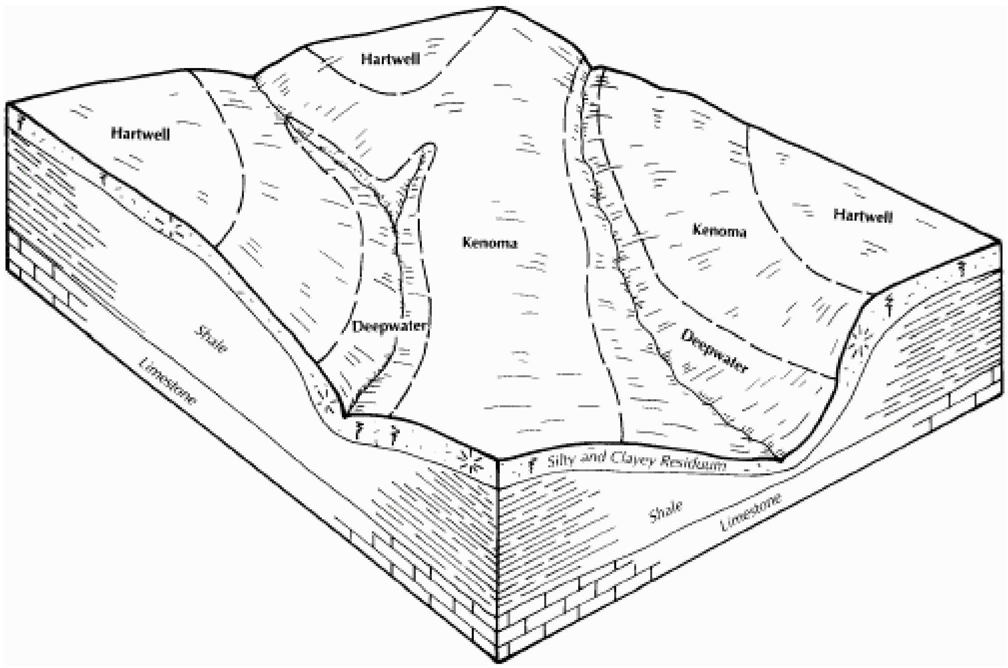
The main management concerns in areas used for pasture are the hazard of erosion during seedbed preparation, overgrazing, and the seasonal wetness.

These soils are suited to building site development and sanitary facilities. The wetness and the high shrink-swell potential in the clayey subsoil are limitations on sites for dwellings and septic tank absorption fields. The moderate to very slow permeability is a major concern. The soils are better suited to sewage lagoons for waste disposal than to septic tank absorption fields.

2. Kenoma-Hartwell-Deepwater Association

Very deep, nearly level to gently sloping, moderately well drained and somewhat poorly drained soils that formed in material weathered from shale; on uplands

Figure 2.5-2



This association is on broad, smooth ridge tops and side slopes that separate the watersheds in the county (fig. 3). Minor acreages are adjacent to the flood plains and terraces of major streams. Slopes range from 0 to 5 percent.

This association makes up about 60 percent of the county. It is about 60 percent Kenoma soils, 12 percent Hartwell soils, 8 percent deepwater soils, and 20 percent minor soils.

Kenoma soils are very gently sloping and gently sloping and are moderately well drained. They are on broad, convex ridge tops and side slopes in the uplands.

The typical sequence, depth, and composition of the layers of the Kenoma soils are as follows

Surface layer:	0-9 in., very dark grayish brown, friable silt loam
Subsoil:	9-16 in., very dark grayish brown, mottled, very firm silty clay
	16-60 in., dark yellowish brown, mottled, very firm and firm silty clay

Hartwell soils are nearly level and somewhat poorly drained. They are on broad, smooth divides in the uplands.

The typical sequence, depth, and composition of the layers of the Hartwell soils are as follows:

Surface layer: 0-9 in., very dark grayish brown, very friable silt loam
Subsurface layer: 9-14 in., grayish brown, very friable silt loam
Subsoil: 14-48 in., very dark gray, dark grayish brown and grayish brown mottled, firm silty clay and silty clay loam

Deepwater soils are gently sloping and moderately well drained. They are on side slopes in the uplands. The typical sequence, depth, and composition of the layers of the deepwater soils are as follows:

Surface layer: 0-7 in., very dark grayish brown, friable silt loam
Subsoil: 7-13 in., brown and dark brown, friable silt loam
13-37 in., brown and dark brown, bottled, friable and firm silty clay loam
37-60 in., inches, multicolored, firm silty clay loam

Of minor extent in this association are Bates, Brazilton, Coweta, Eram, Hepler, Kanima, and Verdigris soils. The moderately deep Bates and Eram soils and the shallow Coweta soils are on ridge tops and side slopes. Brazilton soils are in excavated material that has been reconstructed. The strongly sloping to steep Kanima soils are excavated coal pits. The moderately slowly permeable Hepler soils and the well drained Verdigris soils are on flood plains.

About 90 percent of the acreage in this association is used for cultivated crops, such as corn, soybeans, wheat, and grain sorghum. Some areas are used for pasture and hay. The remaining acreage is uneven, moderately steep or steep areas that generally support native grasses and scattered mixed hardwoods.

This association is suited to cultivated crops, small grain, and grasses and legumes. Controlling water erosion and improving and maintaining fertility and tilt are the main management concerns in areas used for cultivated crops. Wetness is a limitation in areas of the Hartwell soils.

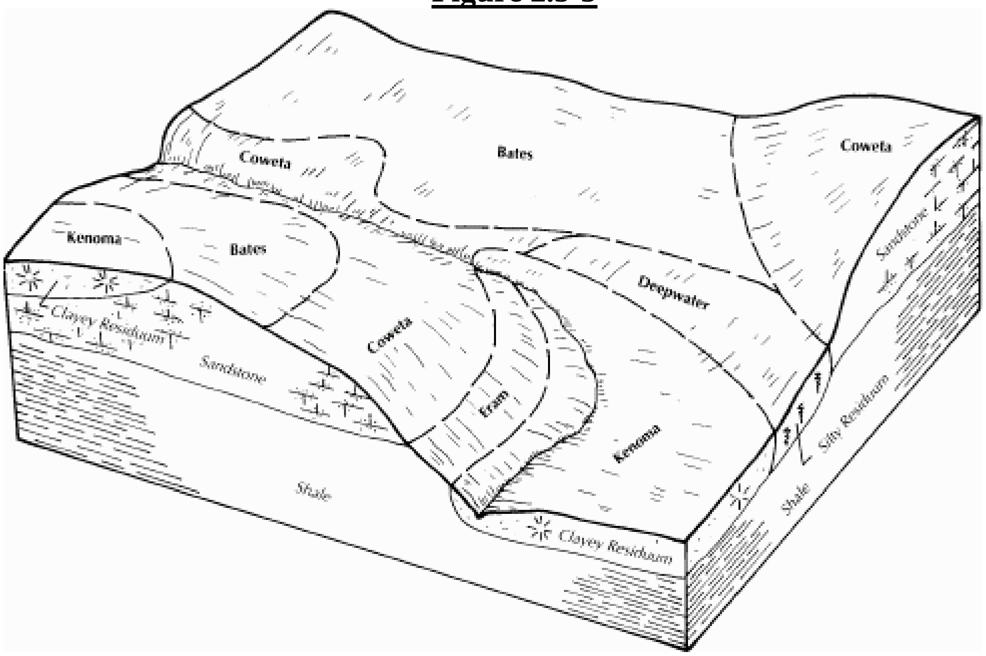
The main management concerns in areas used for pasture are the hazard of erosion during seedbed preparation, overgrazing, and the seasonal wetness.

These soils are suited to building site development and sanitary facilities. The wetness and the high shrink-swell potential in the clayey subsoil are limitations on sites for dwellings and septic tank absorption fields. The moderate to very slow permeability is a major concern. The soils are better suited to sewage lagoons for waste disposal than to septic tank absorption fields.

3. Bates-Coweta-Kenoma Association

Moderately deep, shallow, and very deep, very gently sloping to strongly sloping, moderately well drained and well drained soils that formed in material weathered from sandstone and shale; on uplands

Figure 2.5-3



This association is on ridge tops and side slopes and in the steeper areas along drainage ways. Slopes range from 1 to 14 percent.

This association makes up about 5 percent of the county. It is about 42 percent Bates soils, 26 percent Coweta soils, 19 percent Kenoma soils, and 13 percent minor soils.

Bates soils are moderately deep, gently sloping and moderately sloping, and well drained. They are on ridge tops and side slopes in the uplands.

The typical sequence, depth, and composition of layers of the Bates soils are as follows:

Surface layer:	0 to 8 inches, very dark grayish brown, very friable loam
Subsurface layer:	8 to 16 inches, very dark grayish brown, friable loam
Subsoil:	16 to 24 inches, dark yellowish brown, friable sandy clay loam
	24 to 34 inches, strong brown, firm sandy clay loam
Bedrock:	34 inches, soft, weathered sandstone

Coweta soils are shallow, moderately sloping and strongly sloping, and well drained. They are on ridge tops and side slopes and in the steeper areas along drainage ways in the uplands. The typical sequence, depth, and composition of layers of the Coweta soils are as follows

Surface layer:	0 to 6 inches, very dark grayish brown, friable loam
Subsoil:	6 to 12 inches, dark brown, friable gravelly fine sandy loam
Bedrock:	12 inches, weathered sandstone

Kenoma soils are very deep, very gently sloping and gently sloping, and moderately well drained. They are ridge tops and side slopes in the uplands. The typical sequence, depth, and composition of layers of the Kenoma soils are as follows

Surface layer:	0 to 9 inches, very dark grayish brown, friable silt loam
Subsoil:	9 to 16 inches, very dark grayish brown, mottled, very firm silty clay
	16 to 60 inches, dark yellowish brown, mottled, firm and very firm silty clay

Of minor extent in this association are Deepwater, Eram, and Verdigris soils. The moderately well drained deepwater soils have less clay in the subsoil than the Kenoma soils. They are on ridge tops and side slopes. The moderately deep Eram soils have more clay than the Bates and Coweta soils. They are on side slopes and in the steeper areas along drainage ways. Verdigris soils are very deep and have less clay in the subsoil than the Kenoma soils. They are on narrow flood plains.

About 70 percent of the acreage in this association is used for pasture, hay, or small grain. Grain sorghum and soybeans are grown in some of the very gently sloping and gently sloping areas. The remaining acreage is strongly sloping, uneven areas that support native grasses.

Bates and Kenoma soils are suited to cultivated crops. Coweta soils are best suited to warm-season grasses. Controlling water erosion and improving and maintaining fertility and tilt are the main management concerns in areas used for cultivated crops. Gullies are a problem in some areas.

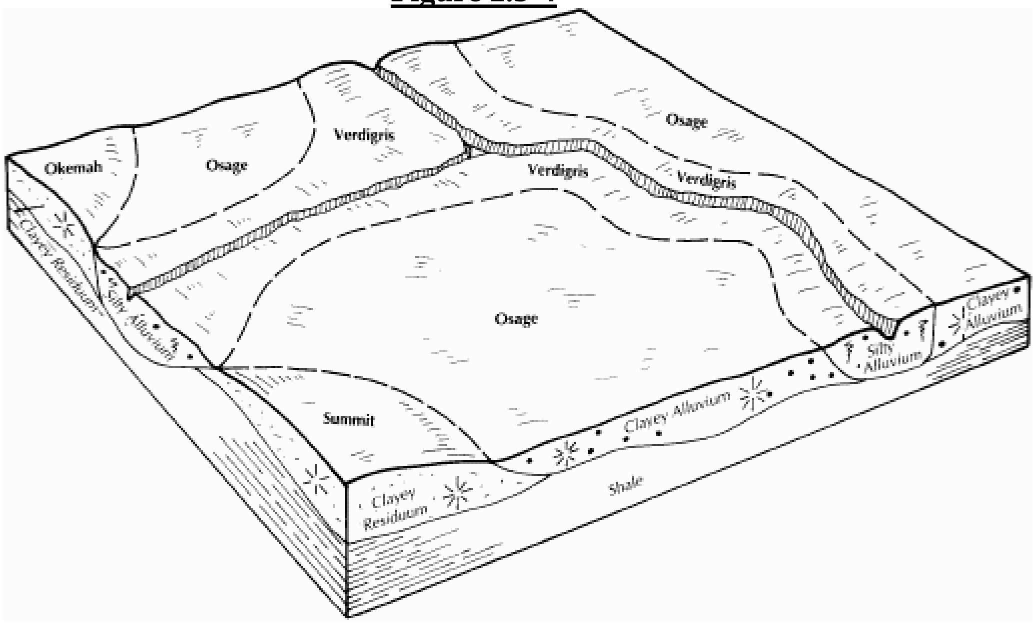
The major soils are suited to grasses and legumes. The hazard of erosion during seedbed preparation and overgrazing are management concerns. Drought is a hazard in areas of the Bates and Coweta soils during the hot summer months.

Bates and Kenoma soils are suited to building site development and sanitary facilities. The shrink-swell potential in areas of the Kenoma soils and the moderate depth to bedrock in areas of the Bates soils are limitations. Coweta soils are generally unsuited to building site development because of the shallow depth to bedrock.

4. Osage-Verdigris Association

Very deep, nearly level, poorly drained and well drained soils that formed in alluvium; on flood plains

Figure 2.5-4



This association is on flood plains along medium and large streams throughout the county. The width of the flood plain ranges from about 200 feet to more than 3 miles. Slopes range from 0 to 2 percent.

This association makes up about 13 percent of the county. It is about 50 percent Osage soils, 40 percent Verdigris soils, and 10 percent minor soils. Osage soils are nearly level and poorly drained. They are on wide flood plains. The typical sequence, depth, and composition of the layers of the Osage soils are as follows:

Surface layer: 0-7 in., black, firm silty clay
Subsurface layer: 7-15 in., black, firm silty clay
Subsoil: 15-60 in., black mottled, firm and very firm silty clay

Verdigris soils are nearly level and well drained. They are on low flood plains adjacent to streams.

The typical sequence, depth, and composition of the layers of the Verdigris soils are as follows:

Surface layer: 0-12 in., very dark grayish brown, friable silt
Subsurface layer: 12-39 in., dark brown, friable silt loam
Substratum: 39-60 in., dark yellowish brown, friable silty clay loam

Of minor extent in this association are Hepler, Okemah, and Summit soils. The somewhat poorly drained Hepler soils are in landscape positions similar to those of the major soils and on the higher flood plains along medium-sized streams. The moderately well drained Okemah and Summit soils are mainly on adjacent terraces and foot slopes. Some areas of the Summit soils are on upland side slopes.

This association is used mainly for cultivated crops, pasture, or hay. The soils are suited to small grain, soybeans, grain sorghum, and grasses and legumes.

Frequent flooding, wetness, and the deterioration of tilt and fertility are the main management concerns in areas used for cultivated crops. Overgrazing and the wetness are the main management concerns in areas used for pasture.

This association is suited to trees. Many areas that are too small for cultivated crops are used as woodland. Existing stands are predominantly oak, hickory, and pecan. The main management concerns are the equipment limitation, seedling mortality, and the wind throw hazard, which is caused by wetness.

This association is unsuited to building site development and sanitary facilities. The wetness and the flooding are difficult to overcome.

2.4 County Government

Located in Southwest Missouri, Bates County has a population of 16,709. Among Missouri's 114 counties plus the city of St. Louis, Bates County ranks 66 in terms of population. Bates County's unemployment rate in 2012 was 8.2%. This was higher than the statewide unemployment rate of 6.9%. In 2011, the poverty rate was 16.8% which was higher than the statewide poverty rate of 15.8%. The median income of the county was $40,376.

Bates County has a local county government of publicly elected officials.

Table 2.4-1

Name	Position
Donna Gregory	Presiding Commissioner
Jim Scott	Northern Commissioner
Larry Berry	Southern Commissioner
Hugh Jenkins	Prosecuting Attorney
Sharon Cumpton	Public Administrator
Gary Schowengerdt	Coroner
Chad Anderson	County Sheriff
Jimmy Platt	Treasurer
Roger Pruden	Assessor
Marlene Wainscott	County Clerk
Lucille Mundey	Recorder
Lucille Mundey	Recorder of Deeds

2.5 Transportation

Bates County has good transportation facilities. The major thoroughfares are Federal Highway 71 and State Highways 52 and 18. Many farm-to-market roads exist throughout the county.

Bates County also is served by three railroads. One runs north to south along the western part of the county, one runs north to south in the center of the county, and one runs through the southeast corner of the county.

2.6 Demographic Information

Bates County is one of 115 counties in Missouri. It is not part of a Metropolitan Area and its 2000 population of 16,653 ranked 64th in the State.

Table 2.6-1 County Population

Bates County	2010 Census		2000 Census		2000-2010 Change	
	Counts	Percentages	Counts	Percentages	Change	Percentages
Total Population	17,049	100.00%	16,653	100.00%	-396	2.38%
Population by Race						
American Indian & Alaska Native Alone	104	0.61%	99	0.59%	-5	5.05%
Asian	27	0.16%	25	0.15%	-2	8.00%
Black or African American	150	0.88%	101	0.61%	-49	48.51%
Native Hawaiian & Other Pacific Native	2	0.01%	2	0.015	0	0%
Some Other Race	66	0.39%	65	0.39%	-1	1.54%
Two or More Races	236	1.38%	153	0.92%	-83	54.25%
White Alone	16,464	96.57%	16,208	97.33%	-256	1.58%
Hispanic or Latino	275	1.61%	179	1.07%	-96	53.63%

Source: http://censusviewer.com/county/MO/Bates

Bates County has a population density of 19.6 persons per square mile, which is well below the state average of 81.2. This county has eleven incorporated communities: the Cities of Rich Hill, Rockville, Hume, Amoret, Amsterdam, Butler, Drexel (portion of), Adrian and the Villages of Merwin, Passaic, and Foster.

The eleven incorporated communities included in Bates County have had a steady, although minimal, increase of population since the 1960's.The slight increase of people living in Bates County creates more community exposure, and changes how agencies prepare for and respond to natural hazards. For example, more people living in a rural area can increase risk of fire. Wildfire has an increased chance of starting due to human activities in this area, and has the potential to injure more people and cause more property damage. Furthermore, increased density can affect risk. For example, narrower streets are more difficult for emergency service vehicles to navigate; the higher ratio of residents to emergency responders affects response times.

Natural hazards do not discriminate, but the impacts in terms of vulnerability and the ability to recover vary greatly among the population. According to Peggy Stahl of the Federal Emergency Management Agency (FEMA) Preparedness, Training, and Exercise Directorate, 80% of the disaster burden falls on the public, and within that number, a disproportionate burden is placed upon special needs groups: women, children, minorities, and the poor.

According to the 2010 census, 1.61% of the population of Bates County is of Hispanic or Latino origin. 0.16% of the population is Asian. 0.61% is of American Indian or Alaskan Native origin, and 0.88% of the population is of African American descent. The ethnic and cultural diversity although low, still suggest a need to address multi-cultural needs and services.

Although the percentage of poverty in Bates County is only 18.7% of the population, it is still a great deal more than the 11.7% in the state of Missouri. Vulnerable populations, including seniors, disabled citizens, women, and children, as well as those people living in poverty, may be disproportionately impacted by natural hazards. Examining the reach of hazard mitigation policies to special needs populations may assist in increasing access to services and programs. FEMA's Office of Equal Rights addresses this need by suggesting that agencies and organizations planning for natural disasters identify special needs populations, make recovery centers more accessible, and review practices and procedures to remedy any discrimination in relief application or assistance.
The cost of natural hazards recovery can place an unequal financial responsibility on the general population when only a small proportion may benefit from governmental funds used to rebuild private structures. Discussions about natural hazards that include local citizen groups, insurance companies, and other public and private sector organizations can help ensure that all members of the population are a part of the decision-making processes.

The following table is demographic information of Bates County compared to the State of Missouri.

Table 2.6-2

People QuickFacts	Bates County	Missouri
Population, 2012 estimate	16,709	6,021,988
Population, 2010 (April 1) estimates base	17,049	5,988,924
Population, percent change, April 1, 2010 to July 1, 2012	-2.0%	0.6%
Population, 2010	17,049	5,988,927
Persons under 5 years, percent, 2012	6.1%	6.3%
Persons under 18 years, percent, 2012	24.2%	23.3%
Persons 65 years and over, percent, 2012	18.7%	14.7%
Female persons, percent, 2012	50.7%	51.0%
White alone, percent, 2012 (a)	96.8%	83.9%
Black or African American alone, percent, 2012 (a)	1.0%	11.7%
American Indian and Alaska Native alone, percent, 2012 (a)	0.7%	0.5%
Asian alone, percent, 2012 (a)	0.2%	1.8%
Native Hawaiian and Other Pacific Islander alone, percent, 2012 (a)	Z	0.1%
Two or More Races, percent, 2012	1.3%	2.0%
Hispanic or Latino, percent, 2012 (b)	1.9%	3.7%
White alone, not Hispanic or Latino, percent, 2012	95.2%	80.6%
Living in same house 1 year & over, percent, 2007-2011	87.6%	83.5%
Foreign born persons, percent, 2007-2011	1.0%	3.8%
Language other than English spoken at home, percent age 5+, 2007-2011	2.2%	6.1%
High school graduate or higher, percent of persons age 25+, 2007-2011	82.8%	86.8%
Bachelor's degree or higher, percent of persons age 25+, 2007-2011	10.4%	25.4%
Veterans, 2007-2011	1,284	503,720
Mean travel time to work (minutes), workers age 16+, 2007-2011	28.5	23.3
Housing units, 2011	7,862	2,723,415
Homeownership rate, 2007-2011	76.4%	69.5%
Housing units in multi-unit structures, percent, 2007-2011	7.7%	19.6%

2.7 Economy, Employment, and Industry

As of the last scheduled Bureau of Labor Statistics quarterly wage and employment report (9/2012), Bates County had around 3,628 employed workers with an weekly wage of $497.00

Table 2.7-1

Area	Employment September 2012	Average weekly wage (3)
United States (4)	132,624,657	$906
Missouri	2,628,774	793
Bates	3,628	497

Source: http://www.bls.gov/ro7/qcewmo.htm

As of 2012 Bates County had a population of 16,709 with a Per Capita income of $32,429 and taxable sales total revenue of $113,073,340.

Table 2.7-2

Area	Population 2012	Income 2011		Taxable Sales Total Revenue 2012
		Total Personal Income	Per Capita Income	
Bates County	16,709	$551,545,000	$32,429	$113,073,340

Source: http://www.missourieconomy.org/regional/profile/?ac=2915000012

Bates County occupation information is shown in table 2.7-3.

Table 2.7-3

OCCUPATION				
Civilian employed population 16 years and over	7,315	+/-322	7,315	(X)
Management, business, science, and arts occupations	1,790	+/-194	24.5%	+/-2.4
Service occupations	1,109	+/-178	15.2%	+/-2.4
Sales and office occupations	1,743	+/-230	23.8%	+/-2.7
Natural resources, construction, and maintenance occupations	1,237	+/-156	16.9%	+/-2.1
Production, transportation, and material moving occupations	1,436	+/-215	19.6%	+/-2.9
INDUSTRY				
Civilian employed population 16 years and over	7,315	+/-322	7,315	(X)
Agriculture, forestry, fishing and hunting, and mining	560	+/-124	7.7%	+/-1.6
Construction	835	+/-155	11.4%	+/-2.1
Manufacturing	847	+/-176	11.6%	+/-2.3
Wholesale trade	159	+/-58	2.2%	+/-0.8
Retail trade	1,169	+/-222	16.0%	+/-2.9
Transportation and warehousing, and utilities	509	+/-115	7.0%	+/-1.5
Information	67	+/-42	0.9%	+/-0.6
Finance and insurance, and real estate and rental and leasing	246	+/-71	3.4%	+/-1.0
Professional, scientific, and management, and administrative and waste management services	399	+/-87	5.5%	+/-1.1
Educational services, and health care and social assistance	1,700	+/-225	23.2%	+/-2.7
Arts, entertainment, and recreation, and accommodation and food services	206	+/-72	2.8%	+/-1.0
Other services, except public administration	436	+/-140	6.0%	+/-2.0
Public administration	182	+/-72	2.5%	+/-1.0

Source: http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_11_5YR_DP03

2.8: Education

As of 2013, there are approximately 2,807 students and 321 certified staff members in seven public schools districts.

Students are a vulnerable population as they are dependent on others for natural hazard information during the school day. A mitigation plan must take this into account. Often, this has been done by building schools out of floodplains and having safe areas within the school where the students can assemble in the event of a disaster. School buildings can also act as safe rooms and shelters during a natural disaster.

Adrian R-III **<u>Tables 2.8-3 through 9</u>**

	Schools	Cert. Staff	Residents	Non-Res.	Total
Elementary Schools	1	33	357		357
Middle Schools	0	0	0		**0**
Jr. High Schools	0	0	0		**0**
High Schools	1	38	382		**382**
Total	**2**	**71**	**739**		**739**

Ballard R-II

	Schools	Cert. Staff	Residents	Non-Res.	Total
Elementary Schools	1	16	85	0	
Middle Schools	0	0	0	0	**0**
Jr. High Schools	0	0	0	0	**0**
High Schools	1	15	75	1	**7**
Total	**2**	**31**	**160**	**1**	**161**

Butler R-V

	Schools	Cert. Staff	Residents	Non-Res.	Total
Elementary Schools	1	52	627	0	627
Middle Schools	0	0	0	0	**0**
Jr. High Schools	0	0	0	0	**0**
High Schools	1	44	431	5	**436**
Total	**2**	**96**	**1,058**	**5**	**1,063**

Hudson R-IX

	Schools	Cert. Staff	Residents	Non-Res.	Total
Elementary Schools	1	15	50	21	71
Middle Schools	0	0	0	0	**0**
Jr. High Schools	0	0	0	0	**0**
High Schools	0	0	0	0	**0**
Total	**1**	**15**	**50**	**21**	**71**

Hume R-VIII

Elementary Schools	Schools 1	Cert. Staff 14	Residents 99	No n-	Total 99
Middle Schools	0	0	0		**0**
Jr. High Schools	0	0	0		**0**
High Schools	1	13	64		**64**
Total	**2**	**27**	**163**		**163**

Miami R-I

Elementary Schools	Schools 1	Cert. Staff 16	Residents 112	N o	Total 112
Middle Schools	0	0	0		**0**
Jr. High Schools	0	0	0		**0**
High Schools	1	15	79		**79**
Total	**2**	**31**	**191**		**191**

Rich Hill R-IV

Elementary Schools	Schools 1	Cert. Staff 25	Residents 192	N o	Total 192
Middle Schools	0	0	0		**0**
Jr. High Schools	0	0	0		**0**
High Schools	1	25	227		**227**
Total	**2**	**50**	**419**		**419**

2.9: Community Partnerships

Bates County and its cities collaborate on numerous issues, such as infrastructure, law enforcement, and emergency services. Missouri Department of Transportation (MoDOT), Kaysinger Basin Regional Planning Commission, the county, and cities collaborate concerning transportation issues. The Missouri Department of Conservation and local firefighters work together to safeguard the county's forested areas. Missouri Department of Economic Development and the county also work together on community development projects.

Media Relations

There are three newspapers published in Bates County. The *Adrian Journal*, the *News Express*, and the *Rich Hill Mining Review* are all weekly papers.

There are a number of regional news and/or public radio stations nearby that cover Bates County events. A list of stations is provided below:

AM STATIONS

- KNEM (1240 AM; Nevada, MO)
- KDKD (1280 AM; Clinton, MO)
- KMAM (1530 AM; Butler, MO)
- KESM (1580 AM; El Dorado Springs, MO)
- KMDO (1600 AM; Fort Scott, KS)
- KMOE (92.1 FM; Butler, MO)
- KDKD (95.3 FM; Clinton, MO)
- KNMO (97.5 FM; Nevada, MO)
- KOMB (103.9 FM; Ft. Scott, KS)
- KVCY (104.7 FM; Ft. Scott, KS; VCY America)

There is no television station located in Bates Country, but a number of Kansas City and Springfield stations provide Bates County residents with news and weather updates. A list of stations is provided below:

FM STATIONS

- KMBC, ABC, Kansas City
- KCTV, CBS, Kansas City
- WDAF, FOX, Kansas City
- KSHB, NBC, Kansas City
- KCPT, PBS, Kansas City
- KCWE, UPN, Kansas City
- KPXE, PAX, Kansas City
- KMCI, NBC, Kansas City
- KMOS, PBS, Sedalia
- KYTV, NBC, Springfield
- KOLR, CBS, Springfield
- KSPR, ABC, Springfield
- KOZK, PBS, Springfield
- KSFX-TV, FOX, Springfield

The media plan for increasing hazard mitigation awareness will be initiated through the appropriate local agencies as specific hazard seasons occur. At these times, residents are more attuned to receiving prevention information. Various prevention instructions from the FEMA website are also a source of information to be distributed through the media.

Historic Properties

Bates County has four listings on the National Register of Historic Places. According to the Archaeological Survey of Missouri (ASM), there are a reported 127 other recorded archaeological sites located in Bates County. The exact locations cannot be shown in order to protect the individual resources.

Table 2.9-1

Bates County Courthouse (added 2001 - - #01000684)
1 North Delaware , Butler

Historic Significance:	Event, Architecture/Engineering
Architect, builder, or engineer:	McDonald, George E., Bartlett and Kling
Architectural Style:	Romanesque
Area of Significance:	Architecture, Politics/Government
Period of Significance:	1950-1974, 1925-1949, 1900-1924
Owner:	**Local**
Historic Function:	Government
Historic Sub-function:	Courthouse
Current Function:	Government
Current Sub-function:	Courthouse

Hudson City School (added 2002 - - #02001110)
Also known as Hudson School; Hudson Community Center; Brown's Chapel
Approx. 1 mi. NW of MO 52 and Hwy. W , Appleton City

Historic Significance:	Event
Area of Significance:	Education
Period of Significance:	1950-1974, 1925-1949, 1900-1924
Owner:	**Private**
Historic Function:	Education, Religion
Historic Sub-function:	Religious Structure, School
Current Function:	Social
Current Sub-function:	Clubhouse

Palace Hotel (added 2002 - - #02000795)
Also known as Ross Hotel; J.C. Penney Co.
2-4 W. Ohio St. , Butler

Historic Significance:	Architecture/Engineering, Event
Architect, builder, or engineer:	Shaw, T.A., Hannah, Capt. John Wesley
Architectural Style:	Italianate
Area of Significance:	Architecture, Commerce
Period of Significance:	1950-1974, 1925-1949, 1900-1924, 1875-1899
Owner:	**Private**
Historic Function:	Commerce/Trade, Domestic, Social
Historic Sub-function:	Business, Department Store, Hotel, Meeting Hall, Specialty Store
Current Function:	Commerce/Trade, Recreation And Culture, Work In Progress
Current Sub-function:	Specialty Store, Sport Facility

Papinville Marais des Cygnes River Bridge (added 2002 - - #02001192) **Also known as Papinville Pinned Pratt Truss Bridge** **Cty. Rd. 648 over the Marais des Cygenes R. , Papinville**	
Historic Significance:	Architecture/Engineering, Event
Architect, builder, or engineer:	Kansas City Bridge and Iron Co.
Architectural Style:	Other
Area of Significance:	Transportation, Engineering
Period of Significance:	1875-1899
Owner:	**Private**
Historic Function:	Transportation
Historic Sub-function:	Road-Related
Current Function:	Transportation
Current Sub-function:	Pedestrian Related

Source: http://www.historicdistricts.com/MO/Bates/state.html

Existing Community Plans

Bates County Emergency Operations Plan: The purpose of the Bates County Emergency Operations Plan (EOP) is "to save lives, minimize injuries, protect property, preserve functioning civil government, and maintain economic activities essential to Bates County." The chief elected official is ultimately responsible for emergency management activities within the boundaries of the jurisdiction. The Presiding Commissioner of Bates County is responsible for those activities in the unincorporated areas of the county and in those incorporated communities that do not have a local emergency management organization (See Title XI, Division 10, and Chapter 11, of the Missouri Code of Regulations). The chief elected official of each municipality (i.e., Mayor) has a similar responsibility within their corporate boundaries. These officials can delegate their authority but never their responsibility.

Bates County emergency management is set up along the following functional lines: direction and control; communications and warning; emergency public information; damage assessment; law enforcement; fire and rescue; civil disorder, hazardous material response, public works; evacuation; in-place shelter; reception and care; health and medical, terrorism response, and resource and supply. The plan also defines lines of succession for continuity of government during a disaster as well as preservation of records and the logistics of administrative functions such as procedures for obtaining temporary use of facilities. The EOP is reviewed annually and revised as needed.

Comprehensive Economic Development Strategy CEDS: The 2007 CEDS plan provides demographic, economic and environmental analysis of Benton, Bates, Cedar, Henry, Hickory, St. Clair, and Vernon counties. It also includes detailed information on infrastructures and resources available.

Currently the only community with existing planning mechanisms is the City of Butler. Butler has a comprehensive plan to control future development as well as a zoning ordinance.

Development Trends and Annexation

Bates County has had seen a slight population decrease over the past several years. Many factors contributed to this slow growth and its annual decrease; some not directly related to Bates County such as several years of a robust national and regional economy, low unemployment and reasonable interest rates. These previous growth factors more recently have been dampened by the economic slowdown and uncertainty in the employment picture. The overall demand for owner-occupied housing could slow in the near future.

2.10 County / Community Facilities

Relevant facilities include medical facilities, schools, long-term care facilities, day care centers, and government structures. These facilities represent resources for care and shelter as well as populations requiring a higher level of care and installations critical to community services.

Table 2.10-1

Critical Facilities

Agency	Address	Phone
Bates County Memorial Hospital	615 W. Nursery, Butler, MO 64730	(660) 200-7000
Bates County Health Center	501 N. Orange, Butler, MO 64730	(660) 679-6108
Bates County Memorial Hospital Home Care	615 W. Nursery, Butler, MO 64730	(660) 200-7000
Quality Home Care	1300 N. Orange, Butler, MO 64730	(660) 679-6733
Adrian Clinic	57 E. Main, Adrian, MO 64720	(816) 297-8700
Associates in Family Care, LLC	102 E. Main, Adrian, MO 64720	(816) 297-2640
Associates in Family Care, LLC	200 W. Chestnut, Butler, MO 64730	(660) 679-3149
Bates County Medical Clinic	706 S. High, Butler, MO 64730	(660) 679-3118

Nursery Street Family Care Clinic	617 W. Nursery, Butler, MO 64730	(660) 200-2004
Rich Hill Medical Clinic	320 N. 14th, Rich Hill, MO 64779	(417) 395-2150
Allied Mental Health	101 A S. Main, Butler, MO 64730	(660) 679-6700
Counseling Associates	7 W. Dakota, Butler, MO 64730	(660) 679-0881
John Keough, MA	501 N. Orange, Butler, MO 64730	(660) 679-4421
Pathways Community Behavioral Healthcare, Inc.	205 E. Dakota, Butler, MO 64730	(660) 679-4636

Source: Bates County Health Department

Table 2.10-2 Public Library

Agency	Address	Phone
Adrian Community Library	116 E. Main, Adrian, MO 64720	(816) 297-2105
Butler Public Library	100 W. Atkinson, Butler, MO 64730	(660) 679-4321
Rich Hill Memorial Library	514 E. Walnut, Rich Hill, MO 64779	(417) 395-2291

Source: Bates County Health Department

Table 2.10-3: Residential Care

Agency	Address	Phone
Crystal Manor of Adrian	409 W. 1st, Adrian, MO 64720	(816) 297-8832
Bristol Manor	411 S. Delaware, Butler, MO 64730	(660) 679-3661
Silver Oaks	300 S. Delaware, Butler, MO 64730	(660) 679-0866

Table 2.10-4

Agency	Address	Phone
Adrian Senior Center	125 S. Houston, Adrian, MO 64720	(816) 297-4203
Butler Senior Center	611 W. Mill, Butler, MO 64730	(660) 679-5830
Kern Senior Center	613 E. Park, Rich Hill, MO 64779	(417) 395-2225

Source: Bates County Health Department

Table 2.10-5: Schools

School	Address	Enrollment
Adrian Sr. High	601 N. Houston, Adrian, MO 64720	355
Adrian Elementary	601 N. Houston, Adrian, MO 64720	403
Ballard High	Rte 1, Butler, MO 64730	64
Ballard Elementary	Rte 1, Butler, MO 64730	69
Butler High	420 S. Fulton St.	456
Butler Elementary	4 N. High St.	568
Hudson Elementary	Rte 3, Appleton City, MO 64724	65
Hume High	RR 1, Hume, MO 64752	79
Hume Elementary	2nd and Maple, Hume, MO 64752	86
Miami High	Rte 1, Amoret, MO 64722	96
Miami Elementary	Rte 1, Amoret, MO 64722	107
Rich Hill High	703 N. Third, Rich Hill, MO 64779	225
Rich Hill Elementary	320 E. Poplar St., Rich Hill, MO 64779	178

Source: MO DESE

Table 2.10-6: Nursing Homes

Agency	Address	Phone
Adrian Manor Nursing Home	402 W. 1st, Adrian, MO 64720	(816) 697-2107
Heartland-Willow Lane Nursing Center	416 S. High, Butler, MO 64730	(660) 679-6157
Medic lodge of Butler	Nursery and Main, Butler, MO 64730	(660) 679-3179

Source: Bates County Health Department

Infrastructure

Roadways

There are 3 highways that run through various parts of Bates County. MO Highway 52 runs in an east-west direction through the central part of the county. MO Highway 18 runs in an east-west direction through the northern parts of the county. U.S. highway 71 runs in a north-south direction through the central part of the county and connecting the county with Kansas City.

Railroads

Currently, there are 2 active railroads in Bates County. One is classified as a Class 1 railroad and one is classified as a regional railroad. A Class 1 railroad is defined as having annual carrier operating revenues of $250 million or more. Regional railroad is defined as a railroad company that is not Class I, but still has a substantial amount of traffic, with around $40 million in annual revenue. There is no passenger rail in Bates County. A freight rail map of Missouri can be found in Appendix E

Airports

There is one public airport located in Bates County

Table 2.10-7

Airport	Address	Phone
Butler Memorial Airport	101 N Lyon, Butler, MO 64730	(816) 679-4182

There is one private airport located in Bates County

Airport	Address	Phone
Angle Bar M Airport	Rr 1, Adrian, MO 64720	(816) 297-2934

There is one heliport located in Bates County

Heliport	Address	Phone
Bates County Hospital Heliport	615 W. Nursery, Butler, MO 64730	(816) 679-4182

Public Transportation

There is currently no public transportation in Bates County.

Telecommunications

Bates County is served by 4 telephone companies: Sprint, ATT&T, Centurytel, and Embarq

Sewer and Water Facilities

Water and sewer service are provided by Bates County Water Districts 1-7, the City of Adrian, the City of Butler, or the City of Rich Hill.

Electricity and Natural Gas

There are currently 4 providers of electricity that serve Bates County: Kansas City Power and Light, The City of Butler, The City of Rich Hill, and Osage Valley Electric Cooperative. Natural gas is provided by Atmos Energy or Greely Gas Co.

Solid Waste Disposal

No Solid Waste Disposal Facilities in Bates County, but several haulers deal with trash disposal.

Table 2.10-8: Law Enforcement:

Agency	Location	Contact Information
Bates County Sheriff's Department	6 West Fort Scott Butler, MO 64730	636-227-9636 636-207-2340 fax
Adrian Police Department	P. O. Box 246 16 E 5th St. Adrian, MO 64720	816-297-2106 816-297-2888 fax
Butler Police Department	309 N Fulton Butler, MO 64730	660-679-7495 660-679-6133 fax
Drexel Police Department	P.O. Box 710 Drexel, MO 64742	816-619-4444 816-619-4443 fax
Rich Hill Police Department	120 N 7 Th. Rich Hill, MO 64779	417-395-2223 417-395-4555 fax
Missouri State Highway Patrol	P. O. Box 568 Jefferson City, MO 65102	573-751-3313 573-526-6383 fax
Missouri State Water Patrol District 1	P.O. Box 568 1510 East Elm St Jefferson City, MO 65102	573-751-3313 573-522-1287 fax

Emergency Medical Services

Ambulance service for Bates County is provided through the Bates County Ambulance Service. The Bates County Ambulance is dispatched through the Bates County Memorial Hospital.

Fire Protection

The Bates County, Missouri fire department directory contains 6 fire departments. Below is a map of their locations and a list of cities that have fire departments.

Figure 2.10-1 Bates County Fire Departments

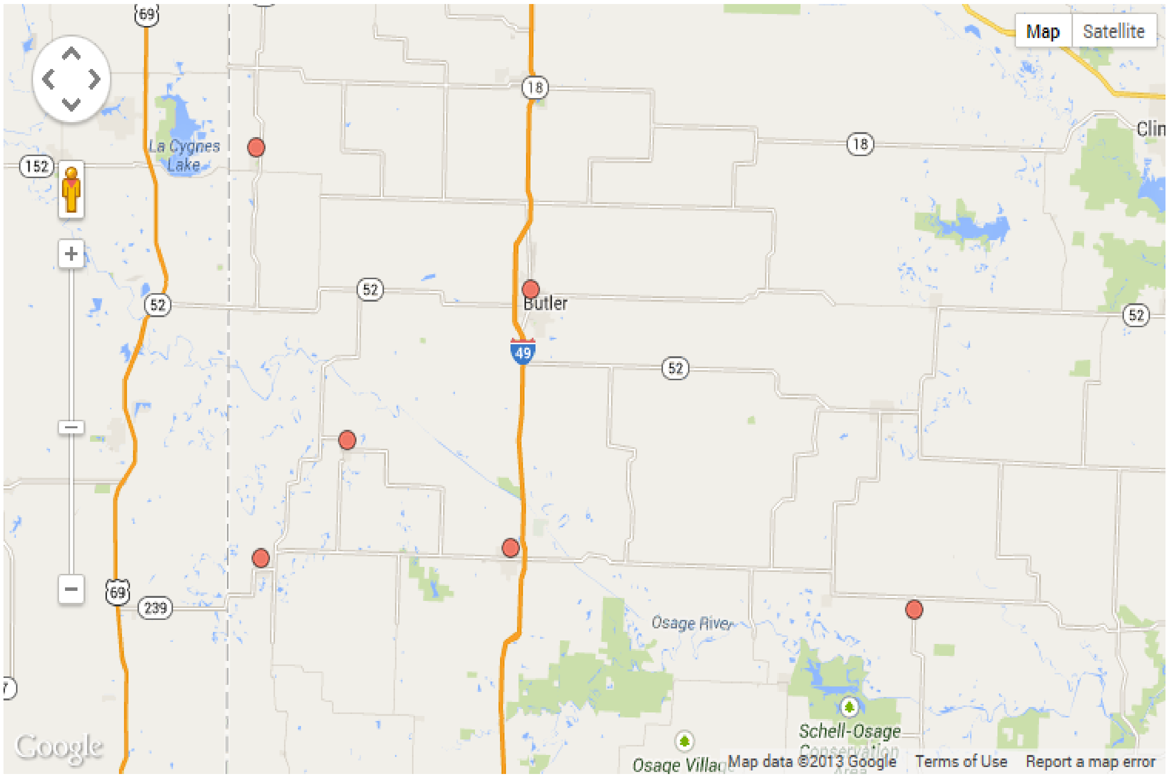


Table 2.10-9

Department	Location and Contact Information
Amsterdam Fire Department	**Physical Address** Amsterdam Volunteer Fire Department 201 Main Amsterdam, MO 64723 **Mailing Address** Amsterdam Volunteer Fire Department 201 Main Amsterdam, MO 64723 Phone: (660) 267-3306 Fax: 6602673119 **Dial 911 for Emergencies**
Butler Fire Department	**Physical Address** Butler Fire Department 701 Roberta RD Butler, MO 64730 **Mailing Address** Butler Fire Department 701 Roberta RD Butler, MO 64730 Phone: (660) 679-6323 Fax: 6606796319 http://www.butler-fire.150m.com **Dial 911 for Emergencies**
Foster Fire Department	**Physical Address** Foster Volunteer Fire Department PO Box 4 Foster, MO 64745 **Mailing Address** Foster Volunteer Fire Department PO Box 4 Foster, MO 64745 Phone: (660) 832-4442 Fax: 6608324440 **Dial 911 for Emergencies**
City of Hume Fire Department	**Physical Address** City of Hume Volunteer Fire Department 201 MAIN Hume, MO 64752 **Mailing Address** City of Hume Volunteer Fire Department 201 MAIN Hume, MO 64752 Phone: (660) 643-7806 Fax: 6606437176 **Dial 911 for Emergencies**

Rich Hill Fire Department	**Physical Address** Rich Hill Fire Department 120 N Seventh Rich Hill, MO 64779 **Mailing Address** Rich Hill Fire Department 120 N Seventh Rich Hill, MO 64779 Phone: (417) 395-2223 Fax: 4173954555 **Dial 911 for Emergencies!**
Rockville Fire Department	Osage Ave & 4th Street Rockville 64780 **Dial 911 for Emergencies**
Taberville Fire Department	**Physical Address** Taberville Volunteer Fire Department 01185 SW HWY H Rockville, MO 64780 **Mailing Address** Taberville Volunteer Fire Department 01185 SW HWY H Rockville, MO 64780 Phone: (660) 598-2832 **Dial 911 for Emergencies**

Emergency Management

The primary EOC for Bates County and the City of Butler is located at the Bates County Emergency Management Agency, 1 North Delaware, and Butler, MO 64730. Communications are available at this location as well as an emergency generator.

Bates County Law enforcement Center is the alternate EOC facility for the County. City of Butler has not identified an alternate EOC facility. Should conditions warrant a relocation of local government, the alternate EOC site will be located at the nearest safe area available?

The Butler Fire Department has a mobile communications van available for on-site direction and control if necessary, and it could also serve as an alternate EOC.

Bates County Housing

The following tables relate information about housing in Bates County.

Table 2.10-3. Housing Occupancy

	Bates County	%	Missouri	U.S.
Total Housing Units	7,842, see rank	100%	2,712,729	131,704,730
Occupied Housing Units	6,744	86.00%, see rank	87.57%	88.62%
Owner Occupied	4,996	63.71%, see rank	60.22%	57.69%
Renter Occupied	1,748	22.29%, see rank	27.35%	30.93%
Vacant Housing Units	1,098	14.00%, see rank	12.43%	11.38%
For Rent	279	3.56%, see rank	3.43%	3.14%
For Sale Only	154	1.96%, see rank	1.63%	1.44%
Rented or Sold, Not Occupied	73	0.93%, see rank	0.57%	0.48%
For Seasonal, Recreational, or Occasional Use	128	1.63%, see rank	2.96%	3.53%
For Migrant Workers	1	0.01%, see rank	0.01%	0.02%
Other Vacant	463	5.90%, see rank	3.83%	2.77%

*Based on 2010 data. View historical housing occupancy data. Source: http://www.usa.com/bates-county-mo-housing.htm#Housing-Occupancy

Figure 2.10-1

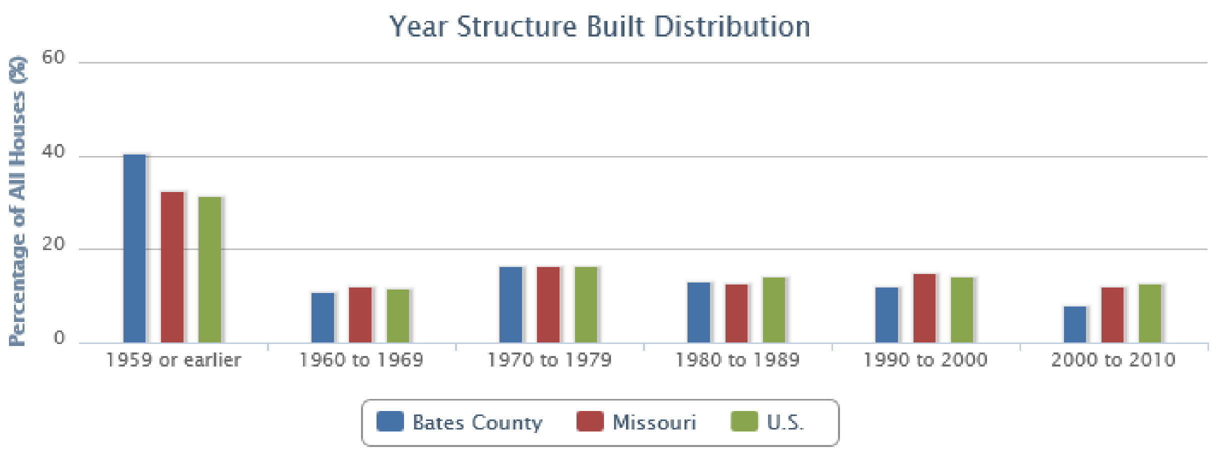


Table 2.10-4 Monthly Owner Costs for Housing Units with a Mortgage

Median Owner Costs,

Bates County 1,061 USD
Missouri 1,192 USD
U.S. 1,524 USD

Owner Costs Distribution

Monthly Owner Costs	Bates County	%	Missouri	U.S.
$299 or Less	7	0.26%, see rank	0.40%	0.22%
$300 to $499	162	6.05%, see rank	3.44%	1.85%
$500 to $699	367	13.71%, see rank	9.42%	5.39%
$700 to $999	621	23.21%, see rank	22.21%	14.41%
$1,000 to $1,499	1,082	40.43%, see rank	34.16%	27.08%
$1,500 to $1,999	259	9.68%, see rank	17.10%	19.94%
$2,000 to $2,999	165	6.17%, see rank	9.89%	19.39%
$3,000 or More	13	0.49%, see rank	3.39%	11.73%

Table 2.10-5 Units in Structure

	Bates County	%	Missouri	U.S.
Total Housing Units	7,799	100%	2,687,610	130,038,080
1-unit, Detached	6,262	80.29%, see rank	70.09%	61.62%
1-unit, Attached	42	0.54%, see rank	3.36%	5.74%
2 Units	149	1.91%, see rank	3.61%	3.88%
3 or 4 Units	345	4.42%, see rank	4.65%	4.47%
5 to 9 Units	43	0.55%, see rank	3.83%	4.84%
10 or More Units	60	0.77%, see rank	7.49%	12.68%
Mobile Home, Boat, RV, Van, etc.	898	11.51%, see rank	6.97%	6.76%

*Based on 2006-2010 data. View historical units in structure data.

Table 2.12-8 House Heating Fuel

	Bates County	%	Missouri	U.S.
Total Housing Units	6,605	100%	2,349,955	114,235,996
Utility Gas	2,306	34.91%, see rank	54.10%	49.91%
Bottled, Tank, or LP Gas	1,789	27.09%, see rank	10.88%	5.38%
Electricity	1,807	27.36%, see rank	30.38%	34.20%
Fuel Oil, Kerosene, etc.	11	0.17%, see rank	0.35%	7.07%
Coal or Coke	16	0.24%, see rank	0.01%	0.12%
Wood	662	10.02%, see rank	3.81%	1.97%
Solar Energy	0	0.00%, see rank	0.02%	0.03%
Other Fuel	11	0.17%, see rank	0.28%	0.42%
No Fuel Used	3	0.05%, see rank	0.18%	0.90%

*Based on 2006-2010 data. View historical house heating fuel data.

2.11 Staff/Organizational and Community Profiles

Each jurisdiction in the Planning Area has an administrative body composed of elected and/or paid staff. These public offices are directly involved with decision making in those jurisdictions and are integral to hazard mitigation planning. Jurisdictions and their administrative offices are listed in this section.

NOTE: Water, Sewer, and Road Districts are not participating jurisdictions in this plan.

Bates County Commission

The Commissioners, in accordance with the State of Missouri's Constitution, will consist of three elected officials who will manage the county business as prescribed by law and keep an accurate record of its proceedings. Responsibilities of the Commission includes, but are not limited to:

Managing County owned property - including the courthouse and law enforcement center.
Overseeing the maintenance of the County's bridges and culverts.
Preparation of the Annual Budget.
Expenditure Approval.
Appointment of board members and trustees of special services.
Applies for and approves State and Federal grants for Bates County.
Maintaining an active role in many State and Federal programs and committees.

Bates County has the following staff positions:

- County Assessor
- County Court Circuit Clerk
- County Clerk
- Coroner
- Emergency Management Director
- Juvenile Court Judge
- Public Administrator
- Prosecutor
- Recorder of Deeds
- Sheriff
- Surveyor

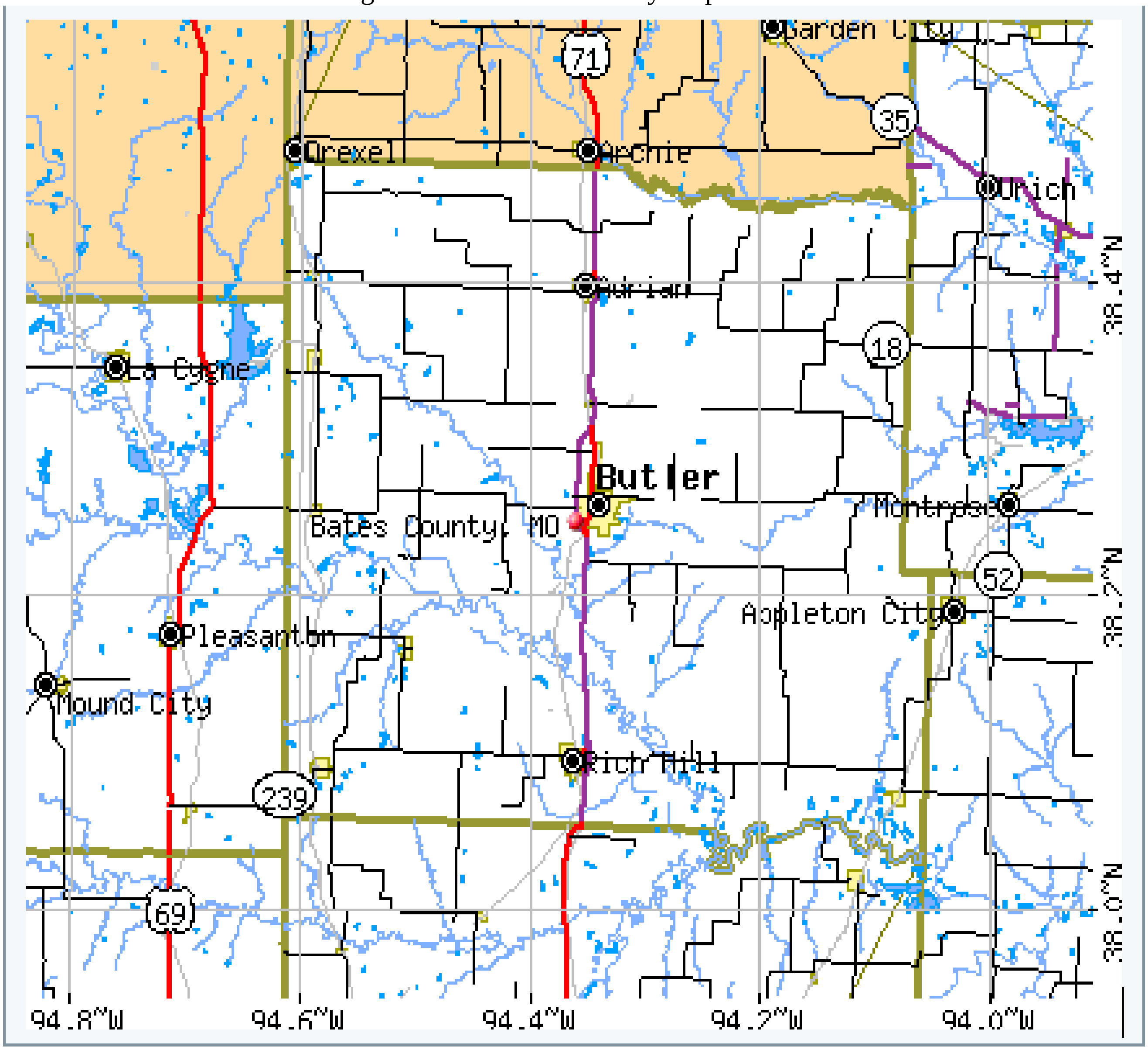
Source: http://www.batescounty.net/

Bates County	
Classification	3 class
Population	17,049
Median Household Income	$36,620
Median Owner-Occupied Housing Value	$103,555
Total Housing Units	7,842
Water Service	PWSD
Electric Service	Osage Valley
Ambulance Service	Bates County Emergency Services
Sewer Service	Septic Tanks
Fire Departments	7 Fire Departments in County
Master Plan	Yes
Emergency Operations Plan	Yes
Building Regulations	No
Zoning Regulations	No
Subdivision Regulations	No
Storm Water Regulations	No
NFIP Participation	Yes
Floodplain Regulations	Yes
Flash Flooding Issues	Yes

Source: Bates Count Clerk, http://www.city-data.com/county/Bates_County-MO.html

Map of Bates County on next page.

Figure 2.11-1 Bates County Map



Source: http://www.city-data.com/county/Bates_County-MO.html

Adrian

The Mayor and Board of Aldermen are the policy making bodies in the city government. Adrian also has the following staff positions:

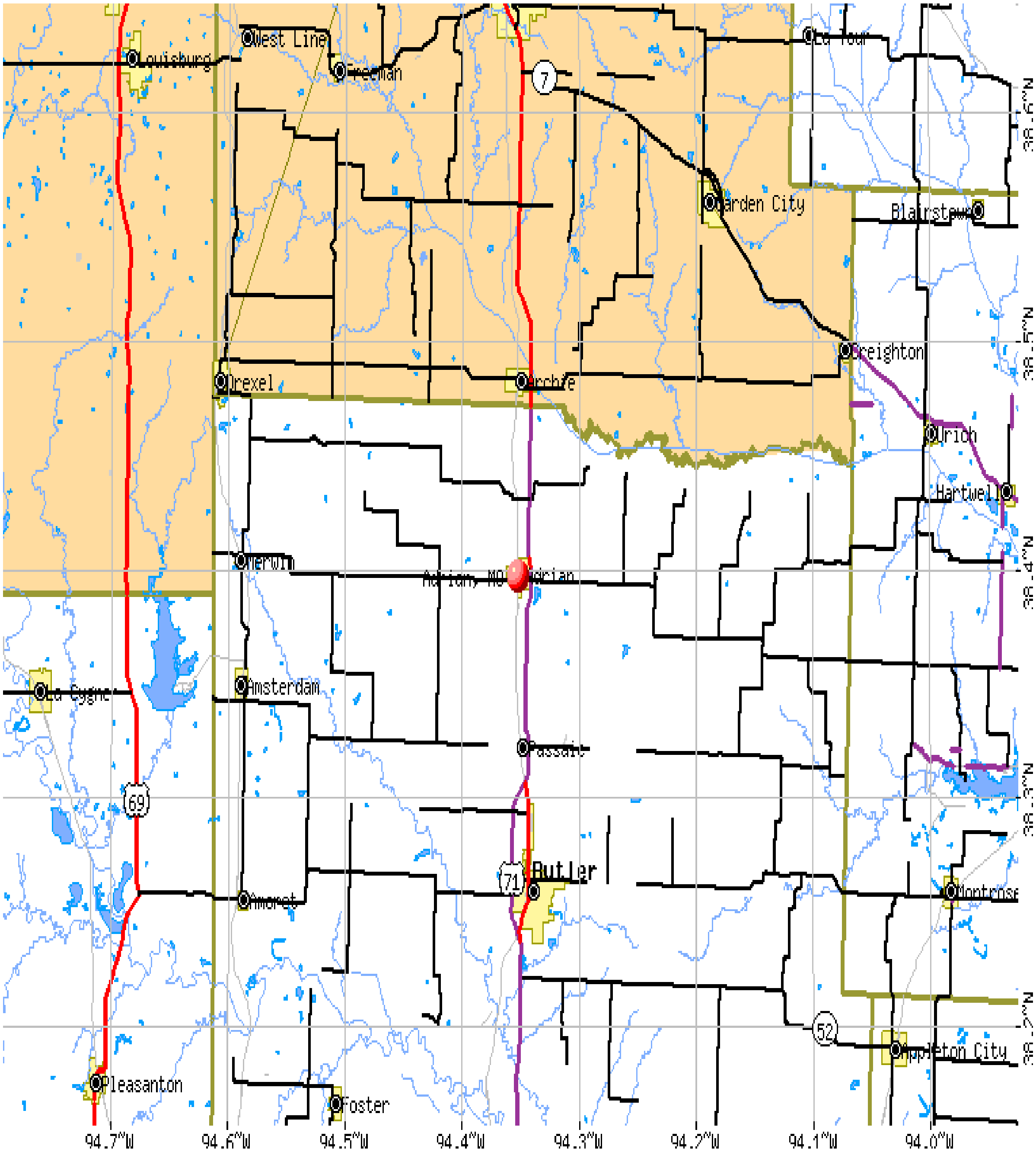
- Mayor
- 3 Alderman
- City Administrator
- City Attorney
- City Clerk
- Street Superintendent
- Treasurer
- Municipal Judge
- Water Superintendent
- Emergency Management Director

Adrian	
Total population	1,644
Classification	4th Class
Median household income	$35,397
Total housing units	737
Median gross rent	$552
Median owner-occupied housing value	$88,507
Master plan	NONE
Emergency Operations Plan	Yes / 2001
Zoning regulations	Minimal
Building regulations	NONE
Subdivision regulations	NONE
Storm water regulations	NONE
Floodplain Regulations	County
Water service	City / $27.90 per 1st 1,000 / $16.45 each additional 1,000 gal.
Sewer service	City / $4.00 per 1st 1,000 / $4.00 each additional
Electric service	KCPL
Fire service	City
Ambulance service	Bates County Emergency Services
NFIP Participation	Yes
Floodplain Regulations	Yes
Flash Flooding Issues?	Some flash flooding / no issues

Source: Adrian City Hall / http://www.city-data.com/city/Adrian-Missouri.html

Map of Adrian on next page.

Figure 2.11-2 Map of Adrian



Source: http://www.city-data.com/city/Adrian-Missouri.html

Amoret

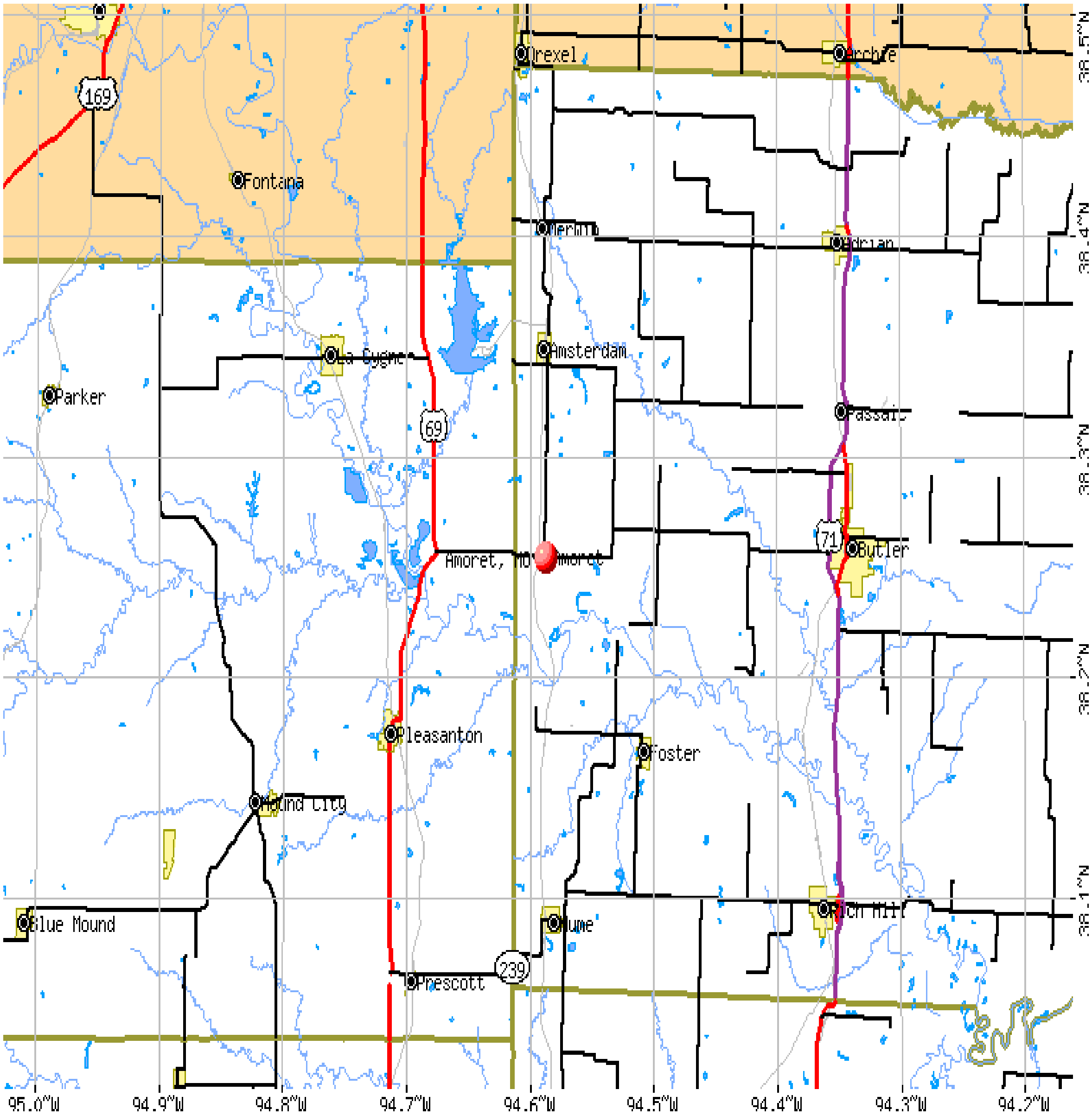
The Mayor and Board of Aldermen are the policy making bodies in the city government. Amoret also has the following staff positions:

- City Clerk
- Fire Chief
- Sewer Superintendent
- Water Superintendent

Amoret	
Total population	186
Classification	4th
Median household income	$20,370
Total housing units	94
Median gross rent	$292.
Median owner-occupied housing value	$27,991
Master plan	NONE
Emergency Operations Plan	County Emergency Operations Plan
Zoning regulations	Minimal
Building regulations	NONE
Subdivision regulations	NONE
Storm water regulations	NONE
Floodplain Regulations	County
Water service	Yes
Sewer service	Yes
Electric Service	Yes
Fire service	Yes
Ambulance service	Yes

Mape of Amoret on next page.

Figure 2.10-2 – Map of Amoret



Souece: http://www.city-data.com/city/Amoret-Missouri.html

Amsterdam

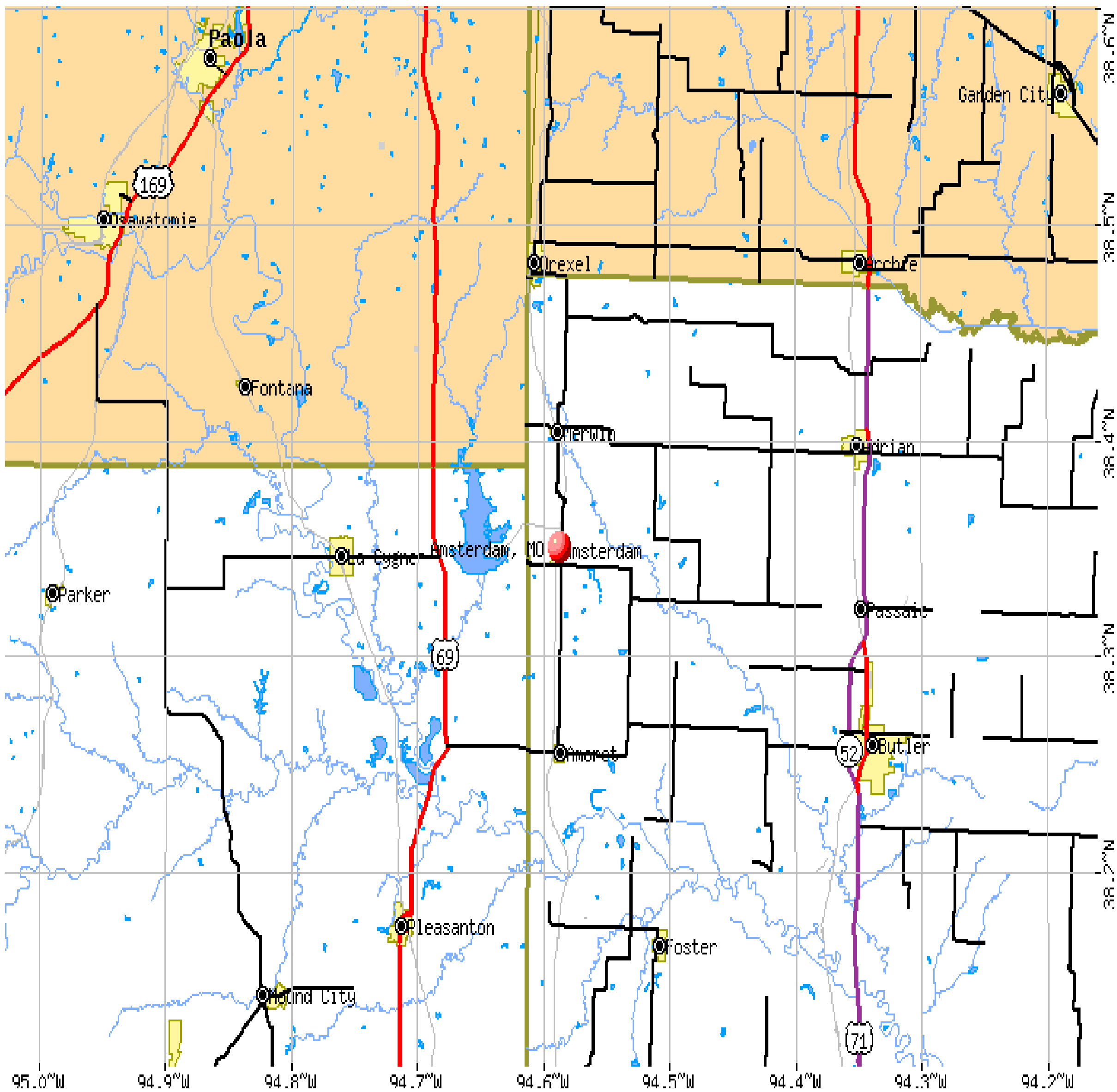
The Mayor and Board of Aldermen are the policy making bodies in the village government. Amsterdam also has the following staff positions:

- Village Clerk
- Park and Recreation Director
- Fire Chief

Amsterdam	
Total population	242
Classification	Village
Median household income	$43,855
Total housing units	106
Median gross rent	$650.
Median owner-occupied housing value	$80,918
Master plan	NONE
Emergency Operations Plan	County Emergency Operations Plan
Zoning regulations	None
Building regulations	None
Subdivision regulations	None
Storm water regulations	None
Floodplain regulations	None
Water service	Bates County PWSD
Sewer service	None
Electric Service	Yes
Fire service	Area Volunteer Departments
Ambulance service	Bates County Emergency Services

Map of Amsterdam on next page.

<u>Figure 2.13-3 –</u> Village of Amsterdam



Source: http://www.city-data.com/city/Amsterdam-Missouri.html

Butler

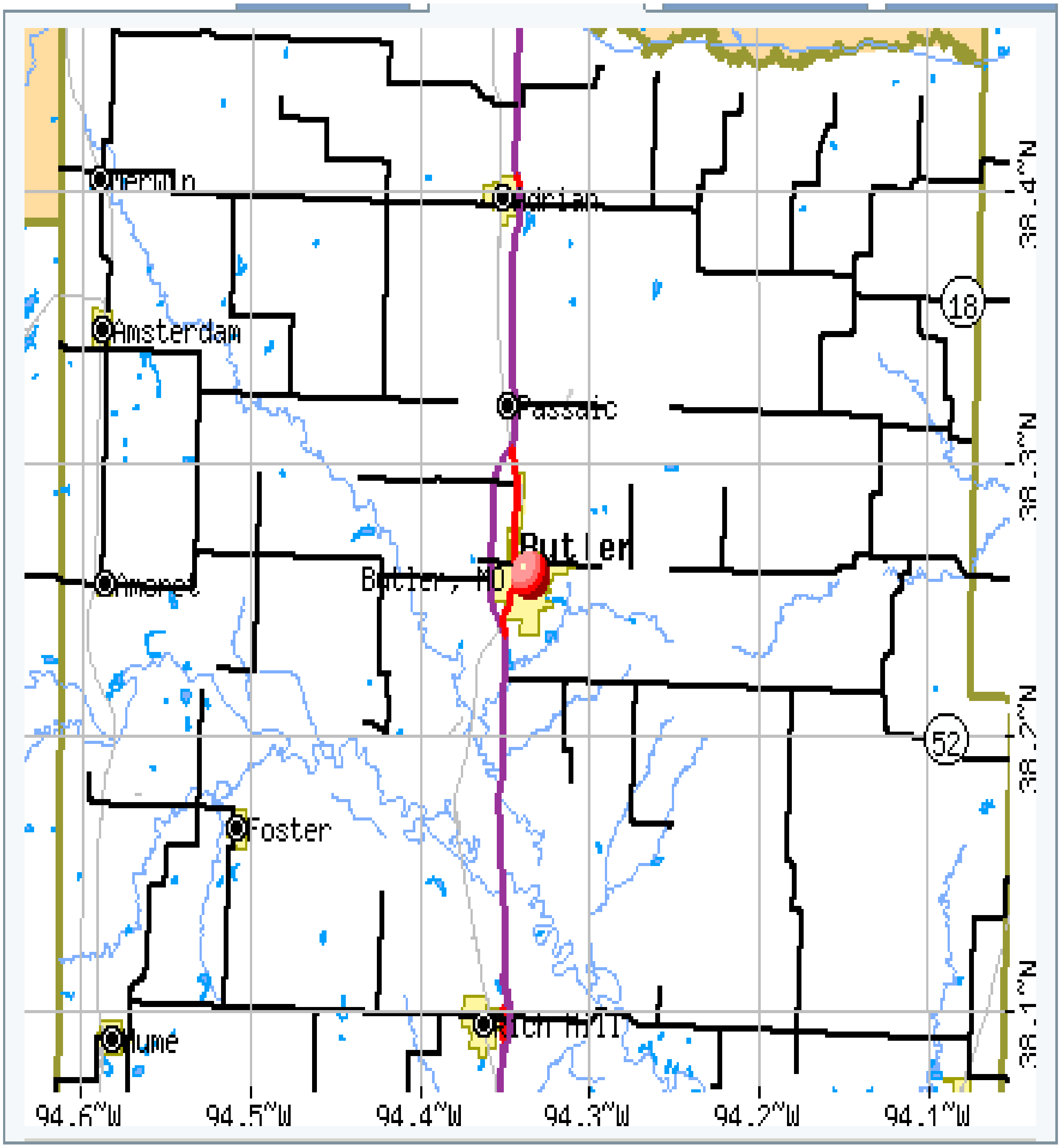
The Mayor and City Council are the policy making bodies in this city government. Butler also has the following staff positions:

- Animal Control Officer
- Assistant Court Clerk
- City Administrator
- City Attorney
- City Clerk
- Deputy Clerk
- Code Enforcement Officer
- Court Administrator
- Municipal Judge
- Office Manager
- Park & Recreation Director
- Public Works Director
- Emergency Management Director
- Fire Chief
- Deputy Fire Chief
- Floodplain Administrator
- Police Chief

Butler	
Total population	4,219
Classification	3rd Class
Median household income	$25,531
Total housing units	2047
Median gross rent	$426
Median owner-occupied housing value	$57,300
Master plan	Yes
Emergency Operations Plan	County Emergency Operations Plan
Zoning regulations	Yes
Building regulations	NONE
Subdivision regulations	NONE
Storm water regulations	NONE
Floodplain regulations	County
NFIP Participation	Yes
Floodplain Regulations	Yes
Flash Flooding Issues	Few areas
Water service	City / $10.00 1st 1,000 - $4.65 each additional 1,000 gal.
Sewer service	City / $5.30 1,000 gal. + $11.40 base
Electric Service	City
Fire Department	City
Ambulance service	Bates County Emergency Services

Source: Butler city hall / http://www.city-data.com/city/Butler-Missouri.html

Figure 2.10-4



Source: http://www.city-data.com/city/Butler-Missouri.html

Foster

The Chairman of the Board and Board Members are the policy making bodies in this city government. Foster also has the following staff positions:

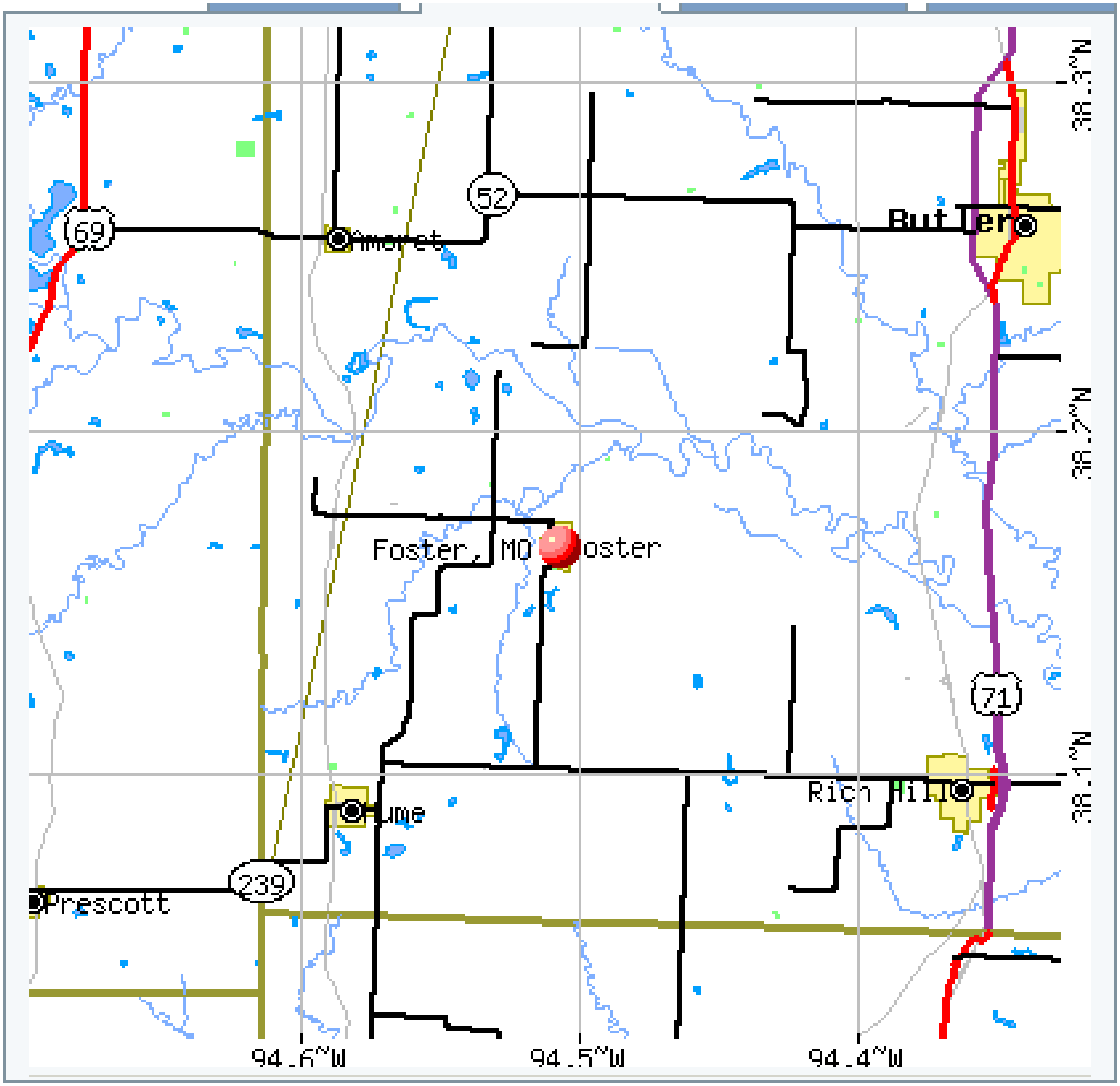
- Collector
- Clerk
- Fire Chief
- Treasurer

Foster	
Classification	Village
Population	117
Median Household Income	$34,749
Median owner-occupied Housing Value	$27,104
Total Housing Units	68
Water Service	Bates PWSD #4
Electric Service	KCPL
Sewer Service	Septic Tanks
Ambulance Service	Bates County Emergency Services
Fire Service	Area Volunteer Fire Departments
Master Plan	No
Emergency Operations Plan	County EOP
Building Regulations	None
Zoning Regulations	None
Subdivision Regulations	None
Storm Water Regulations	None
NFIP Participation	No
Floodplain Regulations	No
Flash Flooding Issues?	Slight

Sources: Village Clerk / http://www.city-data.com/city/Foster-Missouri.html

Map of Foster on next page.

Figure 2.13-5



Source: http://www.city-data.com/city/Foster-Missouri.html

Hume

The Mayor and four City Aldermen are the policy making bodies in this city government. Hume also has the following staff positions:

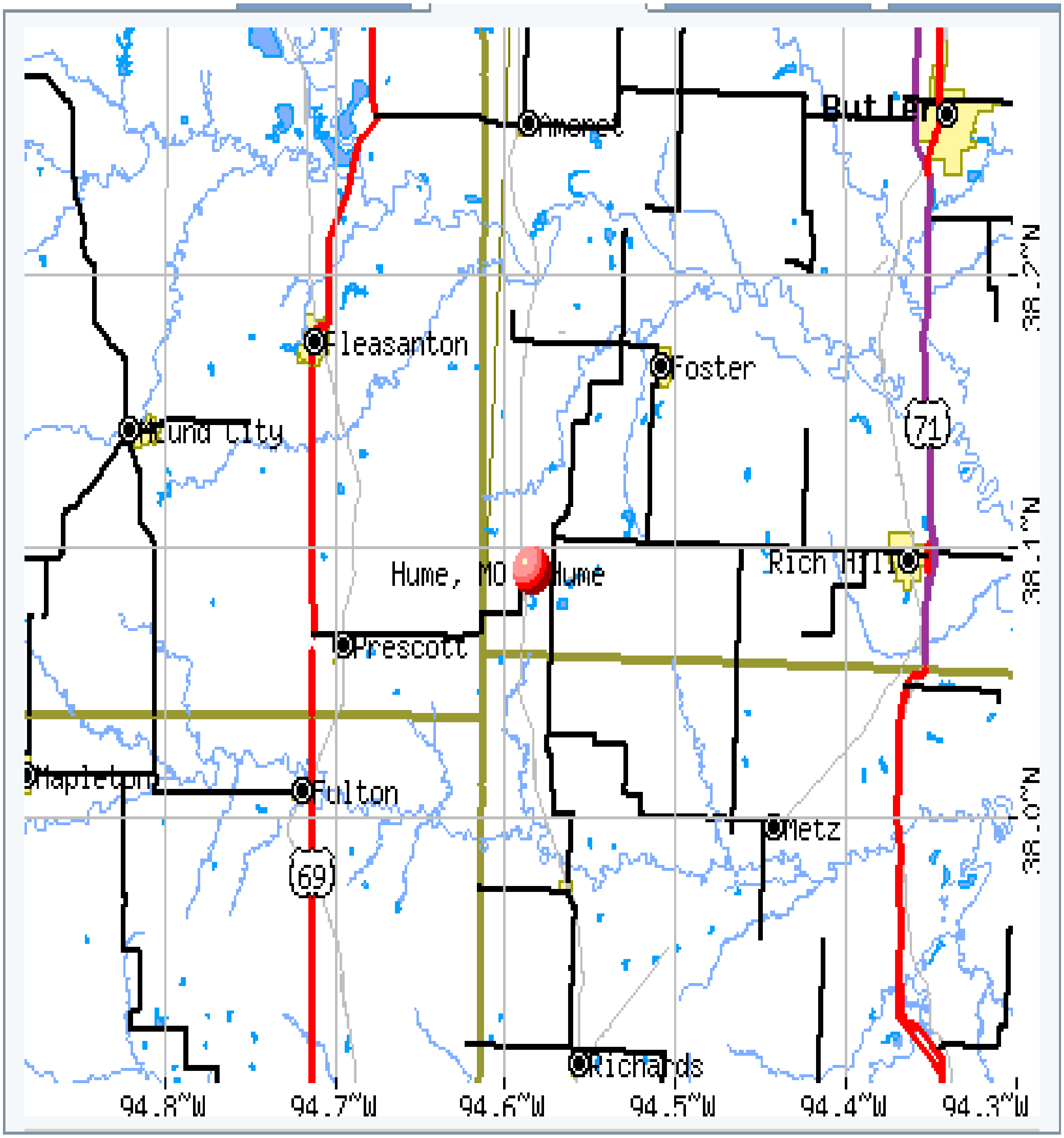
- City Clerk
- Fire Chief
- Street/Sewer/Water Superintendent
- Treasurer

Hume	
Classification	4th Class City
Population	336
Median Household Income	$43,027
Median owner-occupied Housing Value	$65,740
Total Housing Units	141
Water Service	Bates County PWSD # 13
Electric Service	KCPL
Sewer Service	City
Ambulance Service	Bates County Emergency Services
Fire Service	Neighboring Volunteer Department
Master Plan	No
Emergency Operations Plan	County EOP
Building Regulations	None
Zoning Regulations	None
Subdivision Regulations	None
Storm Water Regulations	None
NFIP Participation	No
Floodplain Regulations	None
Flash Flooding Issues?	No

Source: Hume city clerk / *http://www.city-data.com/city/Hume-Missouri.html*

Map of Hume on next page.

Figure 2.13-6



Souece: http://www.city-data.com/city/Hume-Missouri.html

Merwin

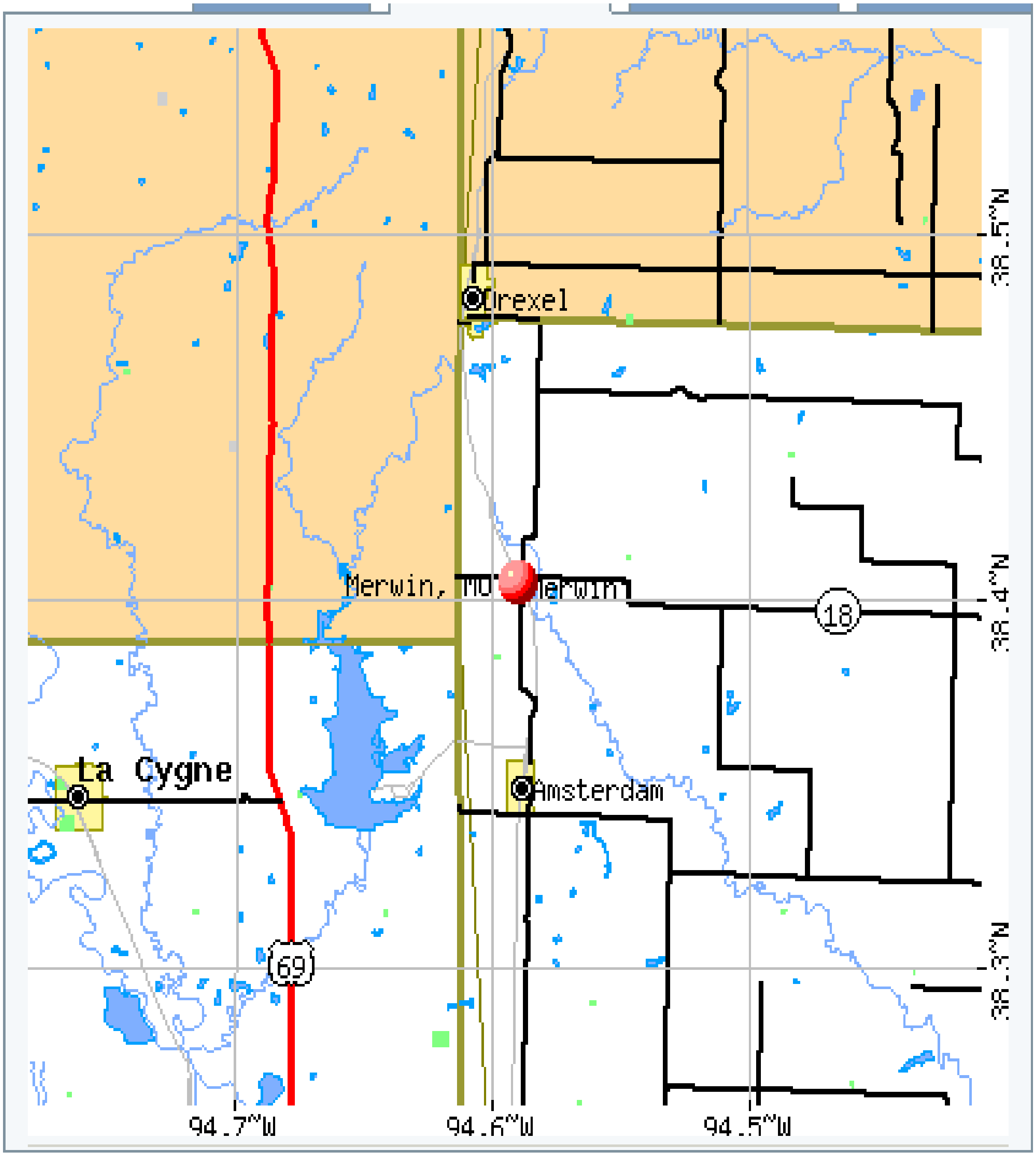
The Chairman of the Board and the village Trustees are the policy making bodies in this village government. Merwin has no additional staff positions:

Merwin	
Classification	Village
Population	58
Median Household Income	$30,555
Median owner-occupied Housing Value	$54,208
Total Housing Units	31
Water Service	unknown
Electric Service	unknown
Sewer Service	Septic Tanks
Ambulance Service	Bates County Emergency Services
Fire Service	Area Volunteer Fire Departments
Master Plan	None
Emergency Operations Plan	None
Building Regulations	None
Zoning Regulations	None
Subdivision Regulations	None
Storm Water Regulations	None
NFIP Participation	No
Floodplain Regulations	None
Flash Flooding Issues?	No

Sources: Village of Merwin / http://www.city-data.com/city/Merwin-Missouri.html

Map of Merwin on next page.

Figure 2.13-7



Source: http://www.city-data.com/city/Merwin-Missouri.html

Passaic

The Chairman of the Board and the three Village Trustees are the policy making bodies in this city government. Passaic also has the following staff positions:

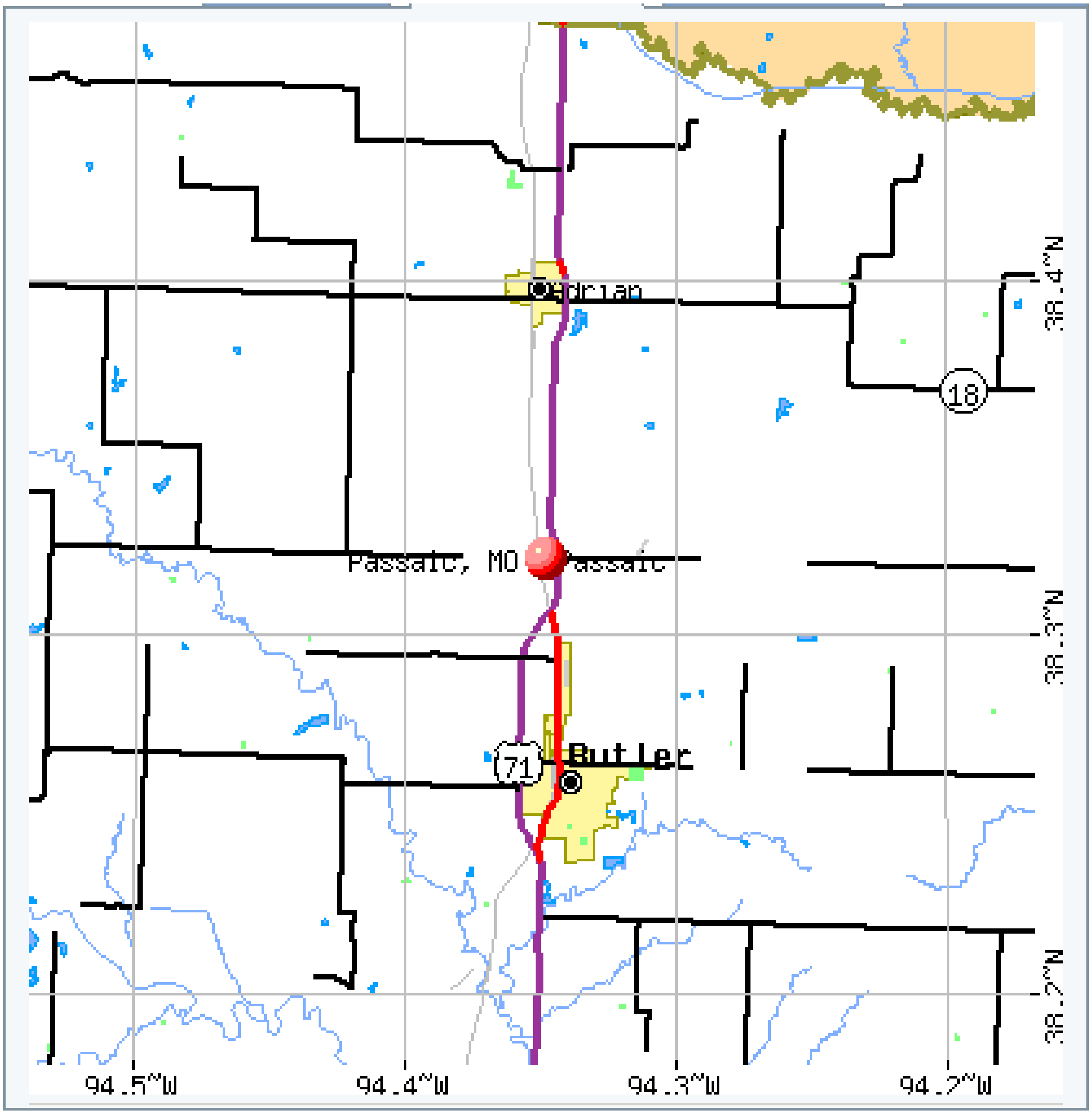
- Fire Chief

Passaic	
Classification	Village
Population	34
Median Household Income	$26,960
Median owner-occupied Housing Value	$9,855
Total Housing Units	14
Water Service	Bates County PWSD
Electric Service	KCPL
Sewer Service	Septic Tanks
Ambulance Service	Bates County Emergency Services
Fire Service	Neighboring Volunteer Departments
Master Plan	None
Emergency Operations Plan	County EOP
Building Regulations	None
Zoning Regulations	None
Subdivision Regulations	None
Storm Water Regulations	None
NFIP Participation	None
Floodplain Regulations	None
Flash Flooding Issues?	Minor

Sources: Village of Passaic / http://www.city-data.com/city/Passaic-Missouri.html

Map of Passaic on next page.

Table 2.13-8



Source: http://www.city-data.com/city/Passaic-Missouri.html

Rich Hill

The Mayor and the four Aldermen are the policy making bodies in this city government. Passaic also has the following staff positions:

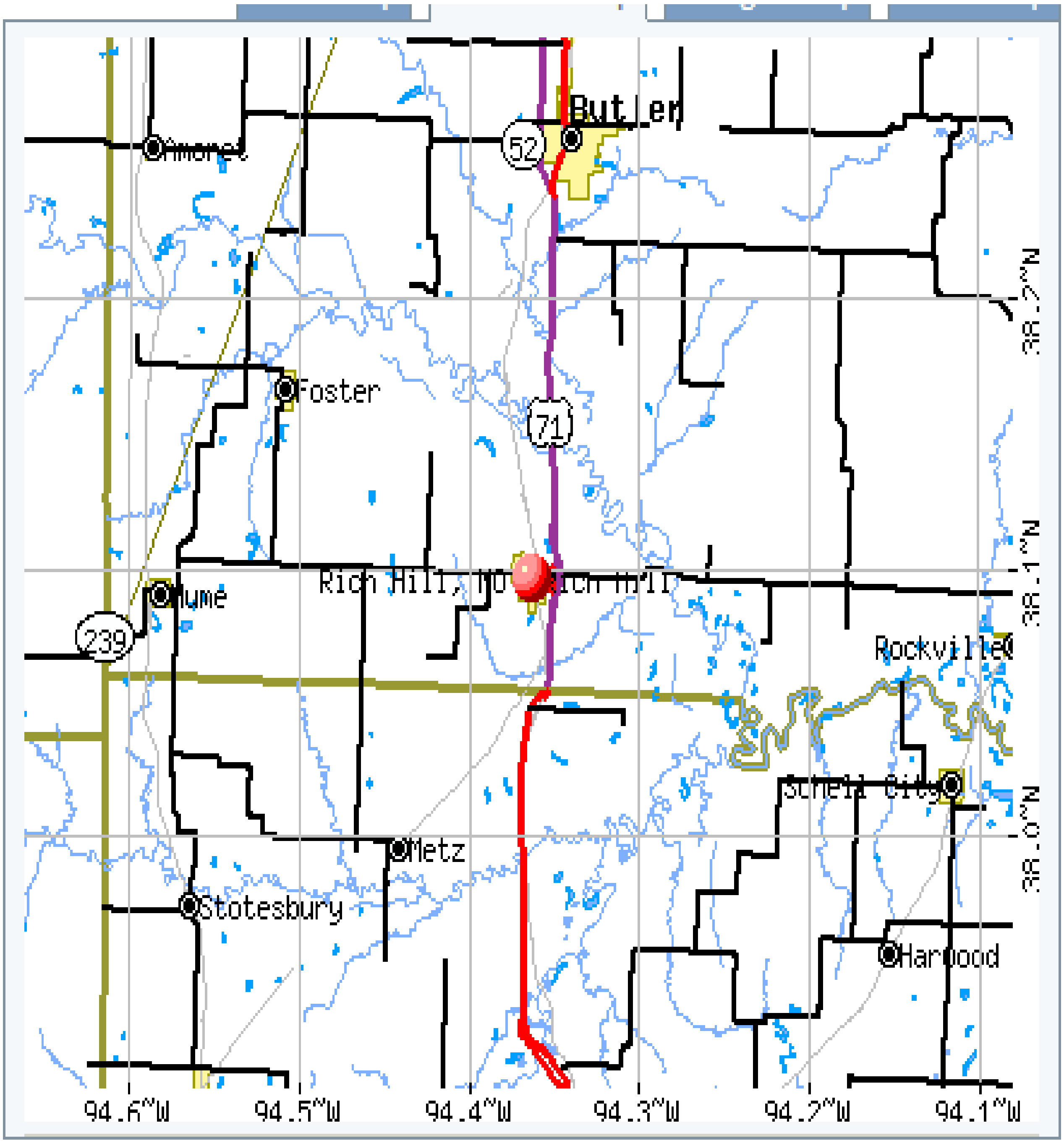
- City Superintendent
- City Attorney
- City Clerk
- City Marshal
- Street Superintendent
- Sewer Superintendent
- Water Superintendent
- Fire Chief
- Emergency Management Director

Rich Hill	
Classification	4th Class
Population	1396
Median Household Income	$30,480
Median owner-occupied Housing Value	$46,915
Total Housing Units	701
Water Service	City/$6.80 per. 1,000 + #13.00 base
Electric Service	City
Sewer Service	City/$5.80/1,000 + $15.00 base
Ambulance Service	Bates County Emergency Services
Fire Service	City Fire Department
Master Plan	Yes
Emergency Operations Plan	Yes
Building Regulations	None
Zoning Regulations	None
Subdivision Regulations	None
Storm Water Regulations	None
NFIP Participation	No
Floodplain Regulations	No
Flash Flooding Issues?	No

Sources: City Clerk /

Map of Rich Hill on next page.

Figure 2.13-9



Source: http://www.city-data.com/city/Rich-Hill-Missouri.html

Rockville

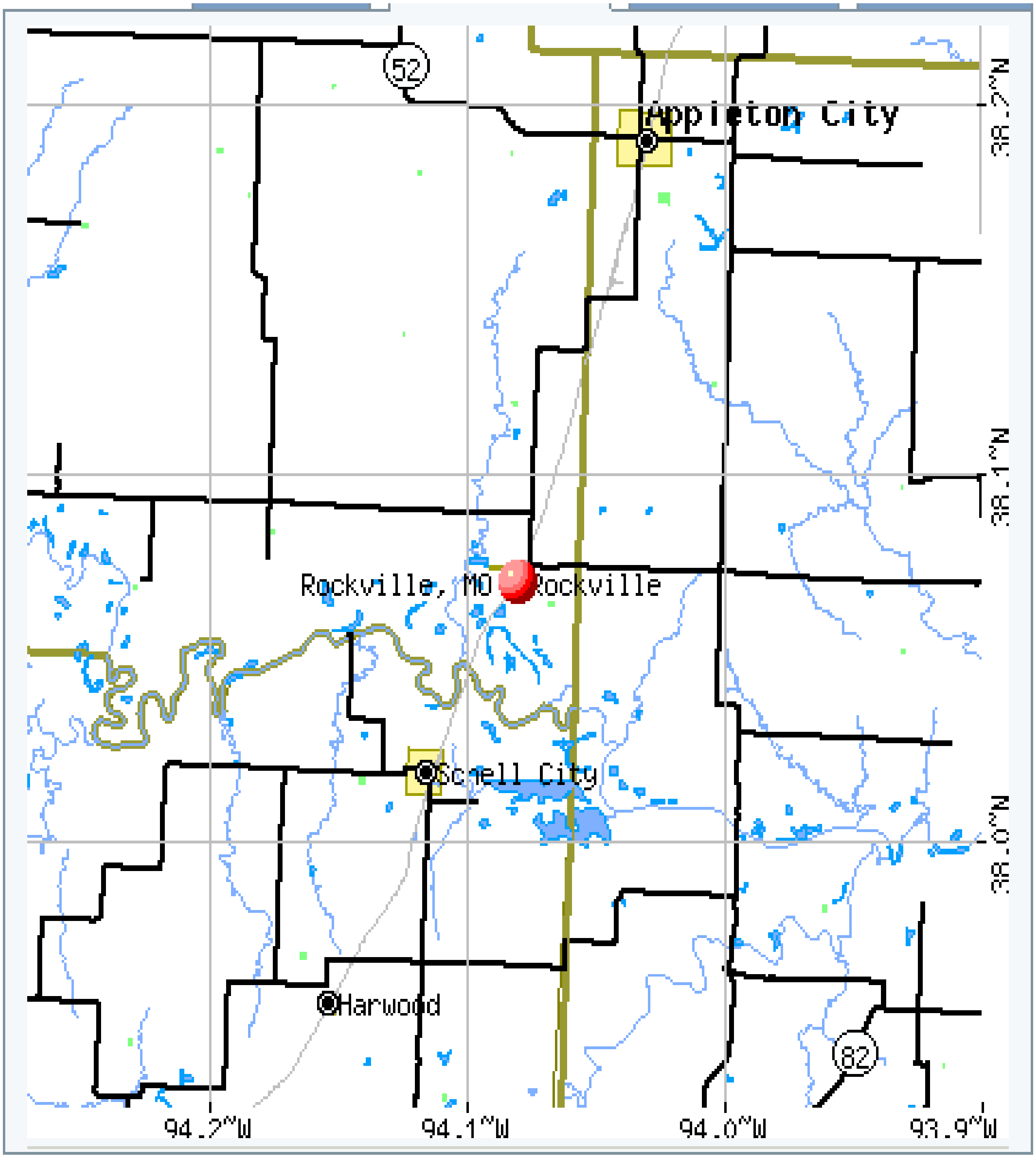
The Mayor and three Aldermen are the policy making bodies in this city government. Rockville also has the following staff positions:

- City Clerk
- City Collector
- Fire Chief
- Treasurer

Rockville	
Classification	4th Class
Population	163
Median Household Income	$18,213
Median owner-occupied Housing Value	$35,777
Total Housing Units	103
Water Service	PWSD#2 Truman $7.50 1st 1,000 / $6.00 each additional 1,000 gal.
Electric Service	KCPL
Sewer Service	City $5.00 1st 1,000 / $4.00 each additional 1,000 gal
Ambulance Service	Ellet Memorial Hospital, Appleton City
Fire Service	City Fire Department
Master Plan	No
Emergency Operations Plan	County EOP/developing own plan.
Building Regulations	None
Zoning Regulations	None
Subdivision Regulations	None
Storm Water Regulations	None
NFIP Participation	No
Floodplain Regulations	None
Flash Flooding Issues?	No

Map of Rockville on next page.

Table 2.13-10



Source: http://www.city-data.com/city/Rockville-Missouri.html

The following table represents the average median owner-occupied housing value of Hickory County.

Table 2.13.1-1

Average Median Owner-Occupied Housing Values		
Jurisdiction	**Median Value**	**Totals**
Adrian	$88,507	$88,507
Amoret	$27,991	$116,498
Amsterdam	$80,918	$197,416
Butler	$57,300	$254,716
Foster	$27,104	$281,820
Hume	$65,740	$347,560
Merwin	$54,208	$401,768
Passaic	$26,960	$482,728
Rich Hill	$46,915	$475,643
Rockville	$35,777	$511,420
Total Average Median owner-occupied housing Value = $511,420 / 10 jurisdictions =$51,142		$

Section 3: Jurisdiction Hazards

3.1: Identified Hazards

Requirement

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

Natural hazard identification process

Natural hazards in western Missouri vary dramatically with regard to intensity, frequency, and the scope of impact. Some hazards, like earthquakes, happen without warning and do not provide any opportunity to warn the general public. Other hazards, such as tornadoes, flooding, or severe winter storms, provide a period of warning which allows for public preparation prior to their occurrence. The following natural hazards have been identified as potential threats for Bates County:

- Tornadoes
- Severe Thunderstorms
- High Winds
- Hail
- Lightning
- Flood
- Severe Winter Weather
- Drought
- Heat Wave
- Earthquakes
- Dam Failure
- Wildfire

Several resources were investigated for the accumulated data relating to natural hazards. The primary sources utilized by the Kaysinger Basin Regional Planning Commission to compile this data include the Federal Emergency Management Agency (FEMA), the Missouri State Emergency Management Agency (SEMA), National Climatic Data Center (NCDC) and National Oceanic and Atmospheric Administration (NOAA) websites and databases. United States Geological Survey (USGS) and the Center for Earthquake Research and Information (CERI) were the primary sources for earthquake information. Other sources included county officials, existing county, regional and state plans, reports on the floods, and information from local officials and residents. This plan utilizes compiled data through January 2011.

Requirement

§201.6(c) (2) (i): [The risk assessment shall include a] description of the…location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

As noted, Bates County is located in western Missouri. This location precludes many natural hazards from occurring or having a significant impact. The natural hazards not included in this hazard mitigation plan include landslides and severe land subsidence. According to the USGS, this is not a serious threat in that the soil types and elevations do not lend themselves to such activity.

Other risks that are not included in this plan are coastal storms, tsunamis, hurricanes, avalanche, volcanic activity, and tropical storms. These do not occur in the area due to soil substructure, location, climate, and geological structure. Though these natural hazards do not affect bates County, the region has potential susceptibility to other natural hazards – namely tornadoes and severe thunderstorms, floods, severe winter weather, drought, heat wave, earthquake, dam failure, and wildfire. The previously identified natural disaster list was not altered. All disasters can precipitate cascading hazards, those secondary hazards caused as a result of a primary natural disaster. Cascading hazards could include interruption of power supply, water supply, business, and transportation. Natural disasters can also cause civil unrest, computer failure, and environmental health hazards. Any of these, in combination, could possibly impact emergency response activities. Table 3.2.1 shows the relationships between Bates County's natural disasters and categories of possible cascading disasters. Examples of specific disasters include nuclear power plant damage, hazardous materials release, mass transportation accidents, and disease outbreak due to unsanitary conditions.

(Land Subsidence is included in the excluded hazards list because subsidence is caused by the removal of ground water or other resources from the ground. The difference between subsidence and sinkholes is that subsidence is a manmade hazard, while sinkholes are natural hazards caused by erosion underground. The United States Geological Survey explains that sinkholes are a characteristic of karst topography, which results from dissolution and collapse of carbonate rocks, such as limestone and dolomite, and is characterized by closed depressions or sinkholes, caves, and underground drainage. While Bates County can be assessed for sinkholes, land subsidence does not occur in the county and in fact is a man-made hazard which this plan does not address.)

3.2 Profiling Hazards

Requirement

§ 201.6(c)(ii) (A) The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area

Each of the natural hazards being profiled in this plan has been studied, analyzed, and assessed for its potential impact on the Planning Area. Each hazard profile is organized in the following manner:

- General description
- Geographic location
- Previous occurrences
- Measures of Probability and Severity
- Existing mitigation strategies

Measures of Probability and Severity

The assessments of probability and severity included in each profile were based on the following definitions from the Missouri State Hazard Mitigation Plan (2013):
Measure of Probability – The likelihood that the hazard will occur.

- Low: The hazard has little or no chance of happening (less than 1 percent chance of occurrence in any given year)
- Moderate: The hazard has a reasonable probability of occurring (between 1 and 10 percent chance of occurrence in any given year).
- High: The probability is considered sufficiently high to assume that the event will occur (between 10 and 100 percent chance of occurrence in any given year).

Measure of Severity – The deaths, injuries, or damage (property or environmental) that could result from the hazard.

- Low: Few or minor damage or injuries are likely.
- Moderate: Injuries to personnel and damage to property and the environment is expected.
- High: Deaths and major injuries and damage will likely occur.

Existing Mitigation Strategies

There are few mitigation strategies already in place in the Planning Area. Most have been in place for several years prior to 2005.

Some of the current mitigation strategies are aimed at mitigating the effects of a specific hazard and are described under the specific hazard profile. The following mitigation strategies are applicable to many or all hazards:

- Health care facilities in the county as well as the county jail have backup generators.
- Agreements are in place with local "shelters" in the county.
- General evacuation procedures are included in the county's Emergency Operation Plan.
- Alternative routes in case of severe weather are in place in all school districts in the county.
- Buses in all school districts have cell phones or two way radios on board.
- Some businesses and municipalities have a weather radio in place.
- The county is continuously maintaining tree limb lines.
- Publicize county or city-wide drills.

3.2.1 Tornados

Although tornadoes may occur in many parts of the world, they are most common in the United States. An area covering portions of Texas, Oklahoma, Arkansas, Missouri, and Kansas is known as "Tornado Alley", where the annual average number of tornadoes is highest in the United States. In an average year in the United States, almost 800 tornadoes are reported. These result in an average of almost 90 deaths, over 1,500 injuries, and over $436 million in damage.

Tornadoes are cyclical windstorms often associated with the mid-western areas of the United States. Weather conditions, which are conducive to tornadoes often, produce a wide range of other dangerous storm activities, including severe thunderstorms, downbursts, straight line winds, lightning, hail, and heavy rains. Essentially, tornadoes are a vortex storm with two components of winds. The first is the rotational winds that can measure up to 500 miles an 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 fifty states, most of them occur in the central United States. The unique geography of the central United States allows for the development of the thunderstorms that spawn tornadoes. The jet stream, which is a high velocity stream of air, determines which are of the central United States will be prone to tornado development. The jet stream normally separates the cold of the north from the warm of the south. During the winter, the jet stream flows west to east over Texas to the Carolina coast. As the sun "moves" north, so does the jet stream, which at summer solstice moves from Canada across Lake Superior to Maine. During its move north in the spring and its recession south during the fall, it crosses Missouri causing the large thunderstorms that breed tornadoes.

Tornadoes spawn from the supercell thunderstorms. These cumulonimbus clouds can reach heights of up to 55,000 feet above ground level, and are commonly formed when solar heating warms gulf air. The dry cool air provided by the jet stream overrides the moist warm air. This cold air presses down on the warm air preventing it from rising, but only temporarily. Soon, the warm air forces its way through the cool air and the cool air moves downward past the rising warm air. Adding to all this is the deflection of the earth's surface, and the air masses will start rotating. This rotational movement around the location of the breakthrough forms a vortex, or funnel. If the newly created funnel stays in the sky it is referred to as a funnel cloud. However, if it touches the ground, the funnel officially becomes a tornado.

A typical tornado can be described as a funnel shaped cloud that is "anchored" to a cloud, usually a cumulonimbus, which is also in contact with the earth's surface. This contact is, on the average, for 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 wide. 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 was 2.27 miles and the mean path area was 0.14 square miles.

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 between 3 and 9 in the afternoon and evening, but have been known to occur at all hours of the day or night.

Tornadoes are classified according to the Enhanced F-Scale (developed by Dr. Theodore Fujita, a renowned severe storm researcher). The EF-Scale attempts to rank tornadoes according to wind speed based on the damage caused.

Dr. T. Theodore Fujita developed the Fujita Tornado Damage Scale (F-Scale) to provide estimates of tornado strength based on damage surveys. Since it's practically impossible to make direct measurements of tornado winds, an estimate of the winds based on damage is the best way to classify a tornado. The new Enhanced Fujita Scale (EF-Scale) Table 3.2.1-1 addresses some of the limitations identified by meteorologists and engineers since the introduction of the Fujita Scale in 1971. The new scale identifies 28 different free standing structures most affected by tornadoes taking into account construction quality and maintenance. The range of tornado intensities remains as before, zero to five, with 'EF-0' being the weakest, associated with very little damage and 'EF-5' representing complete destruction, which was the case in Greensburg, Kansas on May 4th, 2007, the first tornado classified as 'EF-5'. The EF scale was adopted on February 1, 2007.

Table 3.2.1-1

EF-Scale:	Old F-Scale:	Typical Damage:
EF-0 (65-85 mph)	F0 (65-73 mph)	**Light damage.** Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
EF-1 (86-110 mph)	F1 (73-112 mph)	**Moderate damage.** Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF-2(111-135 mph)	F2 (113-157 mph)	**Considerable damage.** Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.

EF-3 (136-165 mph)	F3 (158-206 mph)	**Severe damage.** Entire stories 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.
EF-4 (166-200 mph)	F4 (207-260 mph)	**Devastating damage.** Whole frame houses Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.
EF-5 (>200 mph)	F5 (261-318 mph)	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m (109 yd.); high-rise buildings have significant structural deformation; incredible phenomena will occur.
EF No rating	F6-F12 (319 mph to speed of sound)	**Inconceivable damage**. Should a tornado with the maximum wind speed in excess of EF-5 occur, the extent and types of damage may not be conceived. A number of missiles such as iceboxes, water heaters, storage tanks, automobiles, etc. Will create serious secondary damage on structures.

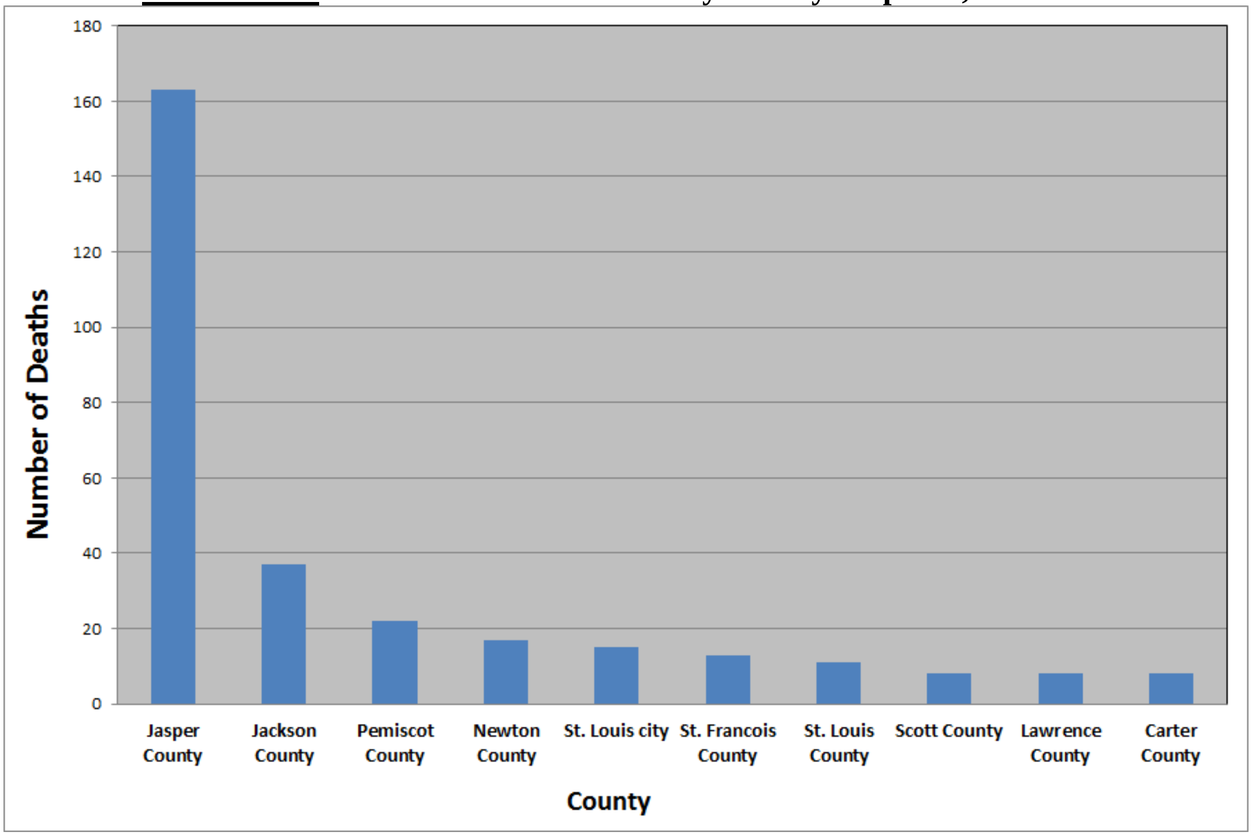
Table 3.2.1-2 EF scale damage indicators

NUMBER	DAMAGE INDICATOR	ABBREVIATION
1	Small barns, farm outbuildings	SBO
2	One- or two-family residences	FR12
3	Single-wide mobile home (MHSW)	MHSW
4	Double-wide mobile home	MHDW
5	Apt, condo, townhouse (3 stories or less)	ACT
6	Motel	M
7	Masonry apt. or motel	MAM
8	Small retail bldg. (fast food)	SRB
9	Small professional (doctor office, branch bank)	SPB
10	Strip mall	SM
11	Large shopping mall	LSM
12	Large, isolated ("big box") retail bldg.	LIRB
13	Automobile showroom	ASR
14	Automotive service building	ASB
15	School - 1-story elementary (interior or exterior halls)	ES
16	School - jr. or sr. high school	JHSH
17	Low-rise (1-4 story) bldg.	LRB
18	Mid-rise (5-20 story) bldg.	MRB
19	High-rise (over 20 stories)	HRB
20	Institutional bldg. (hospital, govt. or university)	IB
21	Metal building system	MBS
22	Service station canopy	SSC
23	Warehouse (tilt-up walls or heavy timber)	WHB
24	Transmission line tower	TLT
25	Free-standing tower	FST
26	Free standing pole (light, flag, luminary)	FSP
27	Tree - hardwood	TH
28	Tree - softwood	TS

Source: www.spc.noaa.gov/faq/tornado/ef-scale.html

As shown in table 3.3.1-3 from the 2013 Missouri State Hazard Mitigation Plan, there have been no recorded deaths attributed to tornados in Bates County since at least 1950.

<u>Table 3.2.1-3</u> Missouri Tornado Deaths by County: Top Ten, 1950–2012



The National Weather Service (NWS) Severe Storms Forecast Center in Kansas City, MO, provides information on tornadoes and severe thunderstorms to emergency managers, news media, law enforcement personnel, and the general public. The Center uses the latest Doppler radar (NEXRAD), wind profilers, and networks of automated surface observing systems (ASOS) across the United States to assist in the prediction and identification process for severe thunderstorm and tornado watches and warnings.

When a tornado watch (favorable conditions for tornado) or warning (tornado is imminent or occurring) is issued, local tornado spotters, emergency response organizations, and ham radio operators are placed on alert to assist in identifying and locating possible tornadoes. When a tornado is detected, emergency operations personnel and law enforcement agencies are alerted immediately. Warnings are broadcast to the public on NOAA weather radio, television stations, cable television, and alarm systems. Emergency managers and local law enforcement officials sound sirens to notify those who have not already received information by other means.

Compared with other States, Missouri ranks number 8 for frequency of Tornadoes, 12 for number of deaths, 15 for injuries and 9 for cost of damages. When we compare these statistics to other States by the frequency per square mile, Missouri ranks number 13 for the frequency of tornadoes, number 14 for fatalities, number 19 for injuries per area and number 15 for costs per area. Based on data from 1950 - 1995.

Missouri, in 2000, had a population of 5,987,580 and between 1950 and 2009 had 2,119 tornadoes. Missouri had 225 fatalities between 1950 and 2009. This averages to around 36 tornados and 4 deaths per year.

As per NOAA 7 tornado event(s) were reported between 01/01/1996 and 07/31/2013 (6422 days). Out of these 7 tornadoes there have been no deaths, and have caused a total damage of almost $500K dollars in damages (See table 3.2.1)

Tornadoes may occur in any part of Missouri, the entire population, as well as buildings and infrastructure, are subject to its effects.
Those parts of the state with large populations, high property value, and high tornado frequency have the greatest exposure to tornado damage, injury, and loss of life.

Tornadoes and other extreme wind events can cause several kinds of damage to buildings. Tornadoes have been known to lift and move objects weighing more than 300 tons a distance of 30 ft., toss homes more than 300 ft. from their foundations, and siphon millions of tons of water from water bodies. However, the less spectacular damage is much more common. Houses and other obstructions in the path of the wind cause the wind to change direction. This change in wind direction increases pressure on parts of the building. Rapid changes in wind speeds are also known to be common during tornadoes. The combination of increased pressures and fluctuating wind speeds creates stress on the building that frequently causes connections between building components (e.g., roof, siding, windows, etc.) to fail. The common misconception that windows should be open during an extreme wind event to "equalize pressure" is a myth that will actually increase the risk of building failure.

Tornadoes also generate a tremendous amount of flying debris or "missiles", which often becomes 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. For example, a 15 pound 2" x 4" wood stud carried by a 250 mph (F4) wind will penetrate most common building materials used today, including reinforced masonry walls.

Historical Statistics

Since 1996, according to the NCDC, tornadoes in Bates County have:

- occurred between March and May;
- caused no reported deaths and no injuries;
- created unknown employment impacts; and
- damaged property valued in excess of $480,000.

The historical data since 1996 is shown in the following table.

Table 3.2-4: Bates County Tornadoes 1996-2013

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								0	0	480.50K	0.00K
PAPINSVILLE	BATES CO.	MO	05/26/2004	20:50	CST	Tornado	F0	0	0	0.00K	0.00K
AMSTERDAM	BATES CO.	MO	03/12/2006	14:24	CST	Tornado	F0	0	0	400.00K	0.00K
BUTLER	BATES CO.	MO	03/12/2006	19:52	CST	Tornado	F2	0	0	5.00K	0.00K
AMSTERDAM	BATES CO.	MO	02/28/2007	20:27	CST-6	Tornado	EF1	0	0	50.00K	0.00K
HUME	BATES CO.	MO	04/27/2007	17:20	CST-6	Tornado	EF0	0	0	0.00K	0.00K
FOSTER	BATES CO.	MO	06/05/2008	22:15	CST-6	Tornado	EF0	0	0	25.00K	0.00K
PAPINSVILLE	BATES CO.	MO	05/11/2011	19:21	CST-6	Tornado	EF0	0	0	0.50K	0.00K
Totals:								0	0	480.50K	0.00K

Statement of Future Probable Severity

The level of tornado impact is generally predictable in regard to EF-scale and distance from the path of the storm. Based on the 7 previous tornado events, the future probable severity is shown below.

Future Probable Severity By F-Scale:

EF0 negligible
EF1 limited
EF2 limited
EF3 critical
EF4 catastrophic
EF5 catastrophic

Statement of Probable Risk

Generally, the risk of tornadoes is relatively minimal in Bates County. Of 114 Missouri counties, Bates County experienced only 7 tornadoes between 1996 and 2013. The probable risk is calculated by dividing the number of events by the number of years, multiplying by 100 to create a risk percentage. (7/17=0.411x100=41.17%) Bates county has a 41.17 % chance of a tornado occurrence in any given year.

Statement of Next Disaster's Likely Adverse Impact on the Community

The enormous power and destructive ability of tornadoes are beyond humankind's capabilities to control. Severity, risk of death, injuries, and property damages will continue to be high. However, technological advances will facilitate earlier warnings than previously available. This, combined with a vigorous public education program and improved construction techniques, provides the potential for significant reductions in the number of deaths and injuries, as well as a reduction in property damage. Based on the 17-year history, the likely adverse impact of future Bates County tornado and thunderstorm events is shown below.

Without mitigation measures:

Life:	limited
Property:	critical
Emotional:	catastrophic
Financial:	critical
Comments:	none

With mitigation measures:

Life:	negligible
Property:	limited
Emotional:	limited
Financial:	limited

Comments: An effective mitigation program could reduce the adverse impact on life and emotional stress from critical to limited or better.

Statement of Next Disaster's Likely Adverse Impact by Jurisdiction

All jurisdictions within the county are equally susceptible to damage stemming from tornadic activity. Vulnerable structures, including critical facilities and mobile homes, exist in each jurisdiction. Particular communities such as Amoret, Foster, Hume Passaic, Merwin and Rockville all have housing stock that was built before or around 1950. Amoret, Hume, Merwin and Passaic all have 20% or more of their housing stock classified as mobile homes. These housing conditions place those six communities in Bates County in high vulnerability scenarios in the event of a tornado. In the event of a tornado, 50-100% of any given jurisdiction may be at risk for damage. Since the passage of the original plan in 2004, no significant changes concerning building development or population shifts have taken place.

Recommendation

- Continue to encourage acquisition of the infrastructure to mitigate possible damage and help reduce the loss of life caused by tornadoes
- Continues to provide emergency preparedness information and resources related to all natural disasters to the public through active education and outreach programs.
- NOAA weather radio (NWR) transmitters should be added in those parts of Bates County that are not presently covered such that NWR can reach the entire population of the county. Partnerships between the NWS, private industry and state and local governments should be explored to fund this expansion
- New home builders and builders of public facilities should be provided with information concerning safe-room construction and cost and should be encouraged to build new structures with safe room. Safe-rooms would likely be desirable features for new-home buyers in high tornado risk areas.
- All communities should be encouraged to develop and adopt building codes with wind load design for new construction and substantial improvements.
- Tornado warning sirens should be implemented where they are not present within Bates County.

3.2.2 Severe Thunderstorms

Severe Thunderstorms

As defined by the National Weather Service, a severe thunderstorm is a storm with hail equal to or greater than ¾ of an inch in diameter or convective wind gusts greater than or equal to 58 miles per hour. Thunderstorms develop when moisture, a rising unstable air mass, and updraft combine. Four types of thunderstorms may impact Bates County:

- **Single cell storm:** The single cell storm lasts approximately 20-30 minutes and is not usually considered to be severe.

- **Multi-cell cluster:** Multi-cell clusters are the most common type of thunderstorms. They consist of a group of storm cells which move as a single unit. Multi-cell storms may produce moderate size hail, flash flooding, and relatively weak tornadoes.

- **Multi-cell line**: Also known as a squall line, the multi-cell line storm is comprised of a long line of storms with a well-developed updraft at its leading edge. These storms may produce golf-ball sized hail, heavy rainfall, and tornadoes, but most often cause significant damage from associated winds.

- **Supercell:** Rare but highly organized, supercells pose a significant risk to life and property in Bates County. With a strong rotating updraft reaching speeds of 150-175 miles per hour, the supercell is capable of producing hail more than two inches in diameter, strong downbursts of more than 80 miles per hour, torrential rain, and strong tornadoes.

Lightning may be produced by any of the four storm types, but is most prevalent multi-cell and super-cell storms. Lightning can cause significant injury and death as well as property damage from cascading effects such as fire.

Thunderstorms and their associated hazards occur, for the most part, on a regional basis. Therefore all jurisdictions within Bates County are equally susceptible.

3.2.3: High winds

Damaging wind from thunderstorms is much more common than damage from tornadoes. In fact, many confuse damage produced by "straight-line" winds and often erroneously attribute it to tornadoes.

The source for damaging winds is well understood and it begins with the **downdraft**. As air rises, it will cool to the point of condensation where water vapor forms tiny water droplets, comprising the cumulus cloud we see. As the air continues to rise further condensation occurs and the cloud grows. Near the center of the updraft, the particle begin to collide and coalescence forming larger droplets. This continues until the rising air can no longer support the ever increasing size of water drops.

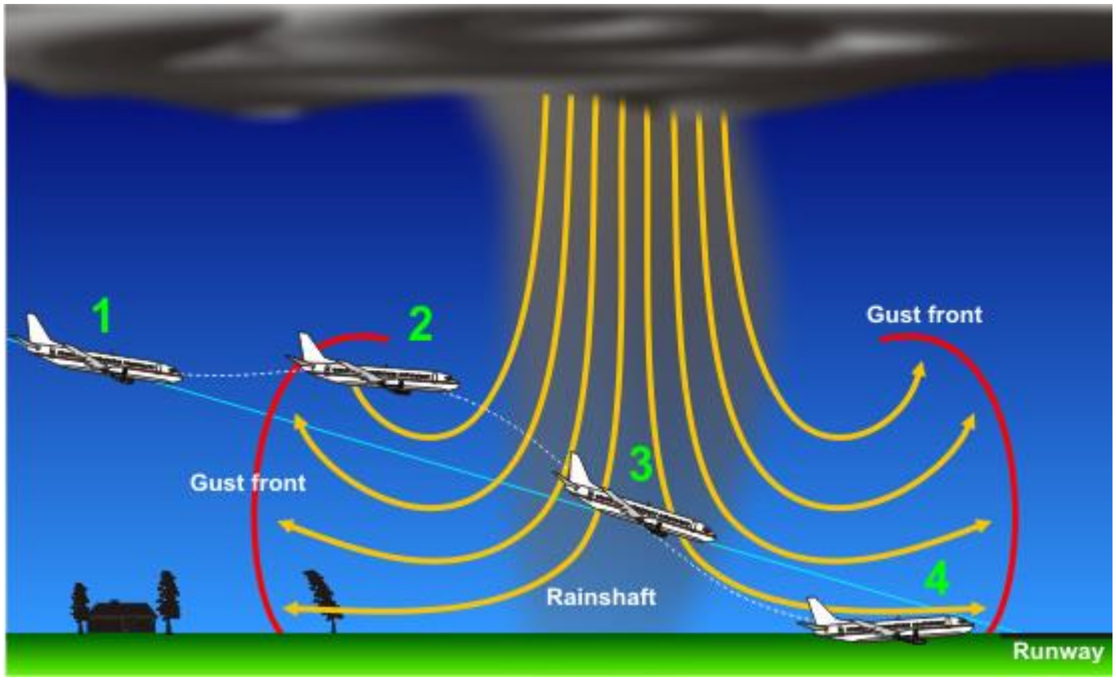
Once the rain drops begin to fall friction causes the rising air to begin to fall towards the surface itself. Also, some of the falling rain will evaporate. Through evaporation heat energy is removed from the atmosphere cooling the air associated with the precipitation.

As a result the cooling, the density of the air increases causing it to sink toward the earth. The downdraft also signifies the end of the convection with the thunderstorm and it subsequent decrease.

When this dense rained-cooled air reaches the surface it spreads out horizontally with the leading edged of the cool air forming a gust front. The gust front marks the boundary of a sharp temperature decrease and increase in wind speed. The gust front can act as a point of lift for the development of new thunderstorm cells or cut off the supply of moist unstable air for older cells.

Downbursts are defined as strong winds produced by a downdraft over a horizontal area up to 6 miles (10 kilometers). Downbursts are further subdivided into **microbursts** and **macro bursts**.

<u>Figure 3.2.3-1</u> Microbursts and Macro bursts



Source: http://www.srh.noaa.gov/jetstream/tstorms/wind.htm

A microburst is a small downburst with an outflow less than 2½ miles (4 kilometers) in horizontal diameter and last for only 2-5 minutes. Despite their small size, microbursts can produce destructive winds up to 168 mph (270 km/h). Also, they create hazardous conditions for pilots and have been responsible for several disasters. For example...

1. As aircraft descend (right) into the airport they follow an imagery line called the "glide slope" (solid light blue line) to the runway.

2. Upon entering the microburst, the plane encounters a "headwind", an increase in wind speed over the aircraft. The stronger wind creates additional lift causing the plane to rise above the glide slope.

   To return the plane to the proper position, the pilot lowers the throttle to decrease the plane's speed thereby causing the plane to descend.

3. As the plane flies through to the other side of the microburst, the wind direction shifts and is now a "tailwind" as it is from behind the aircraft. This decreases the wind over the wing reducing lift. The plane sinks below the glide slope.

4. However, the "tailwind" remains strong and even with the pilot applying full throttle trying to increase lift again; there may be little, if any, room to recover from the rapid descent causing the plane to crash short of the runway.

Since the discovery of this effect in the early to mid 1980's, pilots are now trained to recognize this event and take appropriate actions to prevent accidents. Also, many airports are now equipped with equipment to detect microbursts and warn aircraft of their occurrences.

A **macro bursts** is larger than a microburst with a horizontal extent more than 2½ miles (4 km) in diameter. While also not quite a strong as microbursts they can produce winds as high as 130 mph (210 km/h). Damaging winds generally last longer, from 5 to 20 minutes, and produce tornado-like damage up to an EF-3 scale.

Figure 3.2.3-2 – Macro Burst

Wall of dust approaching the NWS Forecast Office in Phoenix July 5, 2011
Source:* *http://www.srh.noaa.gov/jetstream/tstorms/wind.htm

In wet, humid environments, macro bursts and microbursts will be accompanied by intense rainfall at the ground. If the storm forms in a relatively dry environment, however, the rain may evaporate before it reaches the ground and these downbursts will be without precipitation, known as **dry microbursts**.

In the desert southwest, dust storms are a rather frequent occurrence due to downbursts. The city of Phoenix, AZ typically has 1-3 dust storms each summer due to the cooler dense air spreading out from thunderstorms.

On July 5, 2011, a massive dust storm resulted in widespread areas of zero or near zero visibility in Phoenix. The wind that produced this storm was generated by downbursts from thunderstorms with winds up to 70 mph (110 kip/h).

Heat Bursts

Dry heatbursts are responsible for a rare weather event called "Heat Bursts". Heat bursts usually occur at night, are associated with decaying thunderstorms, and are marked by gusty, sometimes damaging, winds, a sharp increase in temperature and a sharp decrease in dew point.

While not fully understood, it is thought that the process of creating a dry microburst begins higher in the atmosphere for heat bursts. A pocket of cool air aloft forms during the evaporation process since heat energy is required. In heat bursts, all the precipitation has evaporated and this cooled air, being more dense than the surrounding environment, begins to sink due to gravity.

As the air sinks it compresses and with no more water to evaporate the result is the air rapidly warms. In fact, it can become quite hot and very dry. Temperatures generally rise 10 to 20 degrees in a few minutes and have been known to rise to over 120°F (49°C) and remain in place for several hours before returning to normal.

Table 3.2.3-1 Severe Thunderstorm Winds

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								0	0	42.30 K	0.00 K
FOSTER	BATES CO.	MO	07/22/ 1996	16:1 0	CS T	Thundersto rm Wind	69 kts.	0	0	0.00K	0.00 K
MERWIN	BATES CO.	MO	05/17/ 1997	20:3 5	CS T	Thundersto rm Wind	60 kts.	0	0	0.00K	0.00 K
BUTLER	BATES CO.	MO	05/17/ 1997	21:2 0	CS T	Thundersto rm Wind	75 kts.	0	0	0.00K	0.00 K
AMSTERDA M	BATES CO.	MO	05/25/ 1997	23:1 3	CS T	Thundersto rm Wind	70 kts.	0	0	0.00K	0.00 K
ADRIAN	BATES CO.	MO	06/18/ 1998	15:1 8	CS T	Thundersto rm Wind	65 kts.	0	0	0.00K	0.00 K
FOSTER	BATES CO.	MO	06/19/ 1998	22:1 0	CS T	Thundersto rm Wind	60 kts.	0	0	0.00K	0.00 K
BUTLER	BATES CO.	MO	06/29/ 1998	20:5 0	CS T	Thundersto rm Wind	60 kts.	0	0	0.00K	0.00 K

BUTLER	BATES CO.	MO	05/04/ 1999	22:1 4	CS T	Thundersto rm Wind	52 kts.	0	0	0.00K	0.00 K
BUTLER	BATES CO.	MO	06/28/ 1999	00:3 0	CS T	Thundersto rm Wind	65 kts.	0	0	0.00K	0.00 K
FOSTER	BATES CO.	MO	06/28/ 1999	00:3 0	CS T	Thundersto rm Wind	60 kts.	0	0	0.00K	0.00 K
BUTLER	BATES CO.	MO	07/26/ 2000	22:3 5	CS T	Thundersto rm Wind	60 kts. E	0	0	0.00K	0.00 K
RICH HILL	BATES CO.	MO	08/24/ 2000	16:3 0	CS T	Thundersto rm Wind	57 kts. E	0	0	0.00K	0.00 K
FOSTER	BATES CO.	MO	08/26/ 2000	17:2 0	CS T	Thundersto rm Wind	57 kts. E	0	0	0.00K	0.00 K
ADRIAN	BATES CO.	MO	09/07/ 2001	19:2 7	CS T	Thundersto rm Wind	60 kts. E	0	0	0.00K	0.00 K
RICH HILL	BATES CO.	MO	07/09/ 2003	21:2 5	CS T	Thundersto rm Wind	52 kts. EG	0	0	0.00K	0.00 K
ADRIAN	BATES CO.	MO	07/09/ 2003	21:4 5	CS T	Thundersto rm Wind	52 kts. EG	0	0	0.00K	0.00 K
ROCKVILLE	BATES CO.	MO	08/21/ 2003	22:3 0	CS T	Thundersto rm Wind	61 kts. EG	0	0	2.00K	0.00 K
BUTLER	BATES CO.	MO	06/12/ 2004	22:0 5	CS T	Thundersto rm Wind	61 kts. EG	0	0	0.00K	0.00 K
BUTLER	BATES CO.	MO	07/05/ 2004	05:1 5	CS T	Thundersto rm Wind	61 kts. EG	0	0	10.00 K	0.00 K

PASSAIC	BATES CO.	MO	06/04/2005	04:30	CST	Thunderstorm Wind	52 kts. EG	0	0	0.00K	0.00K
HUME	BATES CO.	MO	09/13/2005	17:45	CST	Thunderstorm Wind	52 kts. EG	0	0	0.00K	0.00K
RICH HILL	BATES CO.	MO	09/13/2005	18:47	CST	Thunderstorm Wind	52 kts. EG	0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	10/17/2007	14:10	CST-6	Thunderstorm Wind	52 kts. EG	0	0	0.00K	0.00K
AMSTERDAM	BATES CO.	MO	01/07/2008	17:40	CST-6	Thunderstorm Wind	52 kts. EG	0	0	0.00K	0.00K
AMSTERDAM	BATES CO.	MO	06/02/2008	12:00	CST-6	Thunderstorm Wind	61 kts. EG	0	0	0.00K	0.00K
AMSTERDAM	BATES CO.	MO	06/02/2008	12:10	CST-6	Thunderstorm Wind	52 kts. EG	0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	06/02/2008	12:25	CST-6	Thunderstorm Wind	61 kts. EG	0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	06/02/2008	12:30	CST-6	Thunderstorm Wind	70 kts. EG	0	0	0.00K	0.00K
RICH HILL	BATES CO.	MO	03/08/2009	05:45	CST-6	Thunderstorm Wind	61 kts. EG	0	0	25.00K	0.00K
BUTLER MEM ARPT	BATES CO.	MO	06/09/2009	19:50	CST-6	Thunderstorm Wind	60 kts. EG	0	0	0.00K	0.00K

RICH HILL	BATES CO.	MO	06/15/2009	21:57	CST-6	Thunderstorm Wind	61 kts. EG	0	0	0.00K	0.00K
MERWIN	BATES CO.	MO	06/15/2009	22:00	CST-6	Thunderstorm Wind	78 kts. EG	0	0	3.00K	0.00K
BUTLER	BATES CO.	MO	07/11/2009	02:10	CST-6	Thunderstorm Wind	61 kts. EG	0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	07/11/2009	02:12	CST-6	Thunderstorm Wind	52 kts. EG	0	0	0.00K	0.00K
AMORET	BATES CO.	MO	08/10/2009	13:52	CST-6	Thunderstorm Wind	52 kts. EG	0	0	0.00K	0.00K
RICH HILL	BATES CO.	MO	08/10/2009	14:20	CST-6	Thunderstorm Wind	61 kts. EG	0	0	1.00K	0.00K
ROCKVILLE	BATES CO.	MO	08/10/2009	14:35	CST-6	Thunderstorm Wind	56 kts. EG	0	0	1.00K	0.00K
MERWIN	BATES CO.	MO	08/19/2011	00:20	CST-6	Thunderstorm Wind	52 kts. EG	0	0	0.30K	0.00K
BUTLER	BATES CO.	MO	08/19/2011	00:38	CST-6	Thunderstorm Wind	52 kts. EG	0	0	0.00K	0.00K
ADRIAN	BATES CO.	MO	05/19/2013	21:24	CST-6	Thunderstorm Wind	52 kts. EG	0	0	0.00K	0.00

											K
BUTLER	BATES CO.	MO	05/19/ 2013	21:3 5	CS T-6	Thundersto rm Wind	52 kts. EG	0	0	0.00K	0.00 K
Totals:								0	0	42.30 K	0.00 K

Column Definitions:
'Mag': Magnitude, 'Dth': Deaths, 'Inj': Injuries, 'PrD': Property Damage, 'CrD': Crop Damage
Source:
ttp://www.ncdc.noaa.gov/stormevents/listevents.jsp?beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1996&endDate_mm=07&endDate_dd=31&endDate_yyyy=2013&eventType=%28C%29+Hail&county=BATES&zone=ALL&submitbutton=Search&statefips=29%2CMISSOURI

2.2.4: Hail

Any thunderstorm which produces hail that reaches the ground is known as a hailstorm. Hail has a diameter of 5 millimeters (0.20 in) or more. Hailstones can grow to 15 centimeters (6 in) and weigh more than 0.5 kilograms (1.1 lb.).

Unlike ice pellets, hailstones are layered and can be irregular and clumped together. Hail is composed of transparent ice or alternating layers of transparent and translucent ice at least 1 millimeter (0.039 in) thick, which are deposited upon the hailstone as it travels through the cloud, suspended aloft by air with strong upward motion until its weight overcomes the updraft and falls to the ground. Although the diameter of hail is varied, in the United States, the average observation of damaging hail is between 2.5 cm (1 in) and golf ball-sized (1.75 in).

Stones larger than 2 cm (0.80 in) are usually considered large enough to cause damage. The Meteorological Service of Canada will issue severe thunderstorm warnings when hail that size or above is expected.[6] The US National Weather Service has a 2.5 cm (1 in) or greater in diameter threshold, effective January 2010, an increase over the previous threshold of ¾-inch hail. Other countries will have different thresholds according local sensitivity to hail; for instance grape growing areas could be adversely impacted by smaller hailstones. Hailstones can be very large or very small, depending on how strong the updraft is: weaker hailstorms produce smaller hailstones than stronger hailstorms (such as supercells).

Formation

Hail forms in strong thunderstorm clouds, particularly those with intense updrafts, high liquid water content, great vertical extent, large water droplets, and where a good portion of the cloud layer is below freezing 0 °C (32 °F). These types of strong updrafts can also indicate the presence of a tornado. The growth rate is maximized where air is near a temperature of −13 °C (9 °F)

Figure 3.2.4-1

Hail shaft

Figure 3.2.4-2

Severe thunderstorms containing hail can exhibit a characteristic green coloration

Like other precipitation in cumulonimbus clouds hail begins as water droplets. As the droplets rise and the temperature goes below freezing, they become super cooled water and will freeze on contact with condensation nuclei. A cross-section through a large hailstone shows an onion-like structure. This means the hailstone is made of thick and translucent layers, alternating with layers that are thin, white and opaque. Former theory suggested that hailstones were subjected to multiple descents and ascents, falling into a zone of humidity and refreezing as they were uplifted. This up and down motion was thought to be responsible for the successive layers of the hailstone. New research, based on theory as well as field study, has shown this is not necessarily true.

The storm's updraft, with upwardly directed wind speeds as high as 110 miles per hour (180 km/h) blow the forming hailstones up the cloud. As the hailstone ascends it passes into areas of the cloud where the concentration of humidity and super cooled water droplets varies. The hailstone's growth rate changes depending on the variation in humidity and super cooled water droplets that it encounters. The accretion rate of these water droplets is another factor in the hailstone's growth. When the hailstone moves into an area with a high concentration of water droplets, it captures the latter and acquires a translucent layer. Should the hailstone move into an area where mostly water vapor is available, it acquires a layer of opaque white ice.

Furthermore, the hailstone's speed depends on its position in the cloud's updraft and its mass. This determines the varying thicknesses of the layers of the hailstone. The accretion rate of super cooled water droplets onto the hailstone depends on the relative velocities between these water droplets and the hailstone itself. This means that generally the larger hailstones will form some distance from the stronger updraft where they can pass more time growing. As the hailstone grows it releases latent heat, which keeps its exterior in a liquid phase. Because it undergoes 'wet growth', the outer layer is *sticky*, or more adhesive, so a single hailstone may grow by collision with other smaller hailstones, forming a larger entity with an irregular shape.

The hailstone will keep rising in the thunderstorm until its mass can no longer be supported by the updraft. This may take at least 30 minutes based on the force of the updrafts in the hail-producing thunderstorm, whose top is usually greater than 10 km high. It then falls toward the ground while continuing to grow, based on the same processes, until it leaves the cloud. It will later begin to melt as it passes into air above freezing temperature.

Thus, a unique trajectory in the thunderstorm is sufficient to explain the layer-like structure of the hailstone. The only case in which multiple trajectories can be discussed is in a multicellular thunderstorm where the hailstone may be ejected from the top of the "mother" cell and captured in the updraft of a more intense "daughter cell". This however is an exceptional case.

Factors favoring hail

Hail is most common within continental interiors of the mid-latitudes, as hail formation is considerably more likely when the freezing level is below the altitude of 11,000 feet (3,400 m). Movement of dry air into strong thunderstorms over continents can increase the frequency of hail by promoting evaporational cooling which lowers the freezing level of thunderstorm clouds giving hail a larger volume to grow in. Accordingly, hail is less common in the tropics despite a much higher frequency of thunderstorms than in the mid-latitudes because the atmosphere over the tropics tends to be warmer over a much greater altitude. Hail in the tropics occurs mainly at higher elevations.[15]

Hail growth becomes vanishingly small when air temperatures fall below −30 °C (−22 °F) as super cooled water droplets become rare at these temperatures. Around thunderstorms, hail is most likely within the cloud at elevations above 20,000 feet (6,100 m). Between 10,000 feet (3,000 m) and 20,000 feet (6,100 m), 60 percent of hail is still within the thunderstorm, though 40 percent now lies within the clear air under the anvil. Below 10,000 feet (3,000 m), hail is equally distributed in and around a thunderstorm to a distance of 2 nautical miles (3.7 km).

Climatology

Hail occurs most frequently within continental interiors at mid-latitudes and is less common in the tropics, despite a much higher frequency of thunderstorms than in the mid altitudes. Hail is also much more common along mountain ranges because mountains force horizontal winds upwards (known as orographic lifting), thereby intensifying the updrafts within thunderstorms and making hail more likely. The higher elevations also result in there being less time available for hail to melt before reaching the ground.

The largest recorded hailstone in the United States by diameter 8 inches (20 cm) and weight 1.93 pounds (0.88 kg). The hailstone fell in Vivian, South Dakota on July 23, 2010.

Terminal velocity of hail, or the speed at which hail is falling when it strikes the ground, varies by the diameter of the hailstones. A hailstone of 1 centimeter (0.39 in) in diameter falls at a rate of 9 meters per second (20 mph), while stones the size of 8 centimeters (3.1 in) in diameter fall at a rate of 48 meters per second (110 mph).

Hailstone velocity is dependent on the size of the stone, friction with air it is falling through, the motion of wind it is falling through, collisions with raindrops or other hailstones, and melting as the stones fall through a warmer atmosphere

Hazards

Hail can cause serious damage, notably to automobiles, aircraft, skylights, glass-roofed structures, livestock, and most commonly, farmers' crops. Hail damage to roofs often goes unnoticed until further structural damage is seen, such as leaks or cracks. It is hardest to recognize hail damage on shingled roofs and flat roofs, but all roofs have their own hail damage detection problems. Metal roofs are fairly resistant to hail damage, but may accumulate cosmetic damage in the form of dents and damaged coatings.

Hail is one of the most significant thunderstorm hazards to aircraft. When hailstones exceed 0.5 inches (13 mm) in diameter, planes can be seriously damaged within seconds. The hailstones accumulating on the ground can also be hazardous to landing aircraft. Hail is also a common nuisance to drivers of automobiles, severely denting the vehicle and cracking or even shattering windshields and windows. Wheat, corn, soybeans, and tobacco are the most sensitive crops to hail damage. Hail is one of Canada's most expensive hazards. Rarely, massive hailstones have been known to cause concussions or fatal head trauma.

The largest hailstone in terms of diameter and weight ever recorded in the United States fell on July 23, 2010 in Vivian, South Dakota; it measured 8 inches (20 cm) in diameter and 18.62 inches (47.3 cm) in circumference, weighing in at 1.93 pounds (0.88 kg).[42] This broke the previous record for diameter set by a hailstone 7 inches diameter and 18.75 inches circumference (still the greatest *circumference* hailstone) which fell in Aurora, Nebraska in the United States on June 22, 2003, as well as the record for weight, set by a hailstone of 1.67 pounds (0.76 kg) that fell in Coffeyville, Kansas in 1970.

As demonstrated below by table 3.2.4-1 from the NOAA Natal Climatic Center there have been 110 event(s) were reported between 01/01/1996 and 07/31/2013 (6422 days) that caused almost 7 million dollars in property damage.

Table 3.2.4-1: Bates County Hail Occurrences: -01/01/1996 and 07/31/2013

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								0	0	6.892M	0.00K
AMSTERDAM	BATES CO.	MO	05/24/1996	15:02	CST	Hail	0.75 in.	0	0	0.00K	0.00K
HUME	BATES CO.	MO	06/02/1996	15:40	CST	Hail	1.25 in.	0	0	0.00K	0.00K
RICH HILL	BATES CO.	MO	04/20/1997	15:45	CST	Hail	1.00 in.	0	0	0.00K	0.00K

ADRIAN	BATES CO.	MO	05/25/1997	21:28	CST	Hail	1.75 in.	0	0	0.00K	0.00K
WORLAND	BATES CO.	MO	04/14/1998	20:25	CST	Hail	1.00 in.	0	0	0.00K	0.00K
MERWIN	BATES CO.	MO	04/14/1998	22:30	CST	Hail	1.75 in.	0	0	0.00K	0.00K
ADRIAN	BATES CO.	MO	06/18/1998	15:18	CST	Hail	0.75 in.	0	0	0.00K	0.00K
RICH HILL	BATES CO.	MO	06/19/1998	23:22	CST	Hail	1.00 in.	0	0	0.00K	0.00K
AMORET	BATES CO.	MO	06/07/1999	18:48	CST	Hail	1.75 in.	0	0	0.00K	0.00K
AMSTERDAM	BATES CO.	MO	06/07/1999	19:00	CST	Hail	1.00 in.	0	0	0.00K	0.00K
RICH HILL	BATES CO.	MO	02/17/2000	21:25	CST	Hail	0.75 in.	0	0	0.00K	0.00K
ROCKVILLE	BATES CO.	MO	02/17/2000	21:50	CST	Hail	0.75 in.	0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	05/08/2000	16:31	CST	Hail	1.75 in.	0	0	0.00K	0.00K
LACYVILLE	BATES CO.	MO	05/08/2000	19:35	CST	Hail	0.75 in.	0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	05/08/2000	20:40	CST	Hail	1.75 in.	0	0	0.00K	0.00K
ADRIAN	BATES CO.	MO	05/21/2000	15:50	CST	Hail	0.75 in.	0	0	0.00K	0.00K
RICH HILL	BATES CO.	MO	05/21/2000	17:07	CST	Hail	0.88 in.	0	0	0.00K	0.00K
PASSAIC	BATES CO.	MO	05/23/2000	20:45	CST	Hail	1.75 in.	0	0	0.00K	0.00K
MERWIN	BATES CO.	MO	05/26/2000	23:12	CST	Hail	0.88 in.	0	0	0.00K	0.00K

RICH HILL	BATES CO.	MO	08/24/2000	16:30	CST	Hail	0.75 in.	0	0	0.00K	0.00K
VIRGINIA	BATES CO.	MO	08/26/2000	16:57	CST	Hail	0.75 in.	0	0	0.00K	0.00K
FOSTER	BATES CO.	MO	10/04/2000	23:00	CST	Hail	1.00 in.	0	0	0.00K	0.00K
FOSTER	BATES CO.	MO	04/09/2001	20:07	CST	Hail	0.75 in.	0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	04/09/2001	20:27	CST	Hail	0.75 in.	0	0	0.00K	0.00K
MERWIN	BATES CO.	MO	04/09/2001	21:07	CST	Hail	0.88 in.	0	0	0.00K	0.00K
ADRIAN	BATES CO.	MO	04/14/2001	21:21	CST	Hail	0.75 in.	0	0	0.00K	0.00K
MERWIN	BATES CO.	MO	10/04/2001	16:25	CST	Hail	1.00 in.	0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	10/04/2001	17:50	CST	Hail	0.75 in.	0	0	0.00K	0.00K
ADRIAN	BATES CO.	MO	05/08/2002	20:20	CST	Hail	0.88 in.	0	0	0.00K	0.00K
ADRIAN	BATES CO.	MO	03/12/2003	21:10	CST	Hail	0.75 in.	0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	03/12/2003	21:16	CST	Hail	1.75 in.	0	0	0.00K	0.00K
ADRIAN	BATES CO.	MO	03/12/2003	21:17	CST	Hail	1.75 in.	0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	03/12/2003	21:25	CST	Hail	0.88 in.	0	0	0.00K	0.00K
ADRIAN	BATES CO.	MO	03/12/2003	21:30	CST	Hail	1.75 in.	0	0	0.00K	0.00K
PASSAIC	BATES CO.	MO	04/19/2003	19:08	CST	Hail	0.75 in.	0	0	0.00K	0.00K
RICH HILL	BATES CO.	MO	04/30/2003	22:25	CST	Hail	0.75 in.	0	0	0.00K	0.00K

BUTLER	BATES CO.	MO	05/04/2003	03:05	CST	Hail	0.88 in.	0	0	0.00K	0.00K
MERWIN	BATES CO.	MO	05/04/2003	16:30	CST	Hail	1.00 in.	0	0	0.00K	0.00K
ADRIAN	BATES CO.	MO	05/04/2003	20:45	CST	Hail	0.88 in.	0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	05/04/2003	21:15	CST	Hail	0.88 in.	0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	05/06/2003	14:22	CST	Hail	1.00 in.	0	0	0.00K	0.00K
ROCKVILLE	BATES CO.	MO	05/06/2003	14:30	CST	Hail	1.75 in.	0	0	0.00K	0.00K
ADRIAN	BATES CO.	MO	05/08/2003	19:50	CST	Hail	1.75 in.	0	0	0.00K	0.00K
ADRIAN	BATES CO.	MO	05/08/2003	19:57	CST	Hail	4.00 in.	0	0	6.750M	0.00K
ADRIAN	BATES CO.	MO	05/08/2003	19:58	CST	Hail	1.75 in.	0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	05/08/2003	20:00	CST	Hail	2.50 in.	0	0	5.00K	0.00K
ADRIAN	BATES CO.	MO	05/08/2003	20:00	CST	Hail	2.50 in.	0	0	25.00K	0.00K
ADRIAN	BATES CO.	MO	05/08/2003	20:00	CST	Hail	1.75 in.	0	0	0.00K	0.00K
PASSAIC	BATES CO.	MO	07/11/2003	19:35	CST	Hail	1.25 in.	0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	07/11/2003	19:37	CST	Hail	1.00 in.	0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	07/11/2003	19:38	CST	Hail	1.00 in.	0	0	0.00K	0.00K
PASSAIC	BATES CO.	MO	07/11/2003	19:38	CST	Hail	0.75 in.	0	0	0.00K	0.00K
PLEASANT RIDGE	BATES CO.	MO	07/11/2003	19:55	CST	Hail	1.00 in.	0	0	0.00K	0.00K
ADRIAN	BATES CO.	MO	08/01/2003	23:55	CST	Hail	0.75 in.	0	0	0.00K	0.00K

ADRIAN	BATES CO.	MO	05/19/2004	00:24	CST	Hail	0.75 in.	0	0	0.00K	0.00K
ADRIAN	BATES CO.	MO	05/24/2004	22:15	CST	Hail	0.75 in.	0	0	0.00K	0.00K
AMSTERDAM	BATES CO.	MO	03/03/2005	17:35	CST	Hail	1.00 in.	0	0	0.00K	0.00K
AMSTERDAM	BATES CO.	MO	03/03/2005	17:40	CST	Hail	0.75 in.	0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	03/03/2005	18:23	CST	Hail	1.75 in.	0	0	0.00K	0.00K
AMORET	BATES CO.	MO	04/11/2005	17:00	CST	Hail	1.00 in.	0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	04/11/2005	17:20	CST	Hail	1.75 in.	0	0	0.00K	0.00K
BALLARD	BATES CO.	MO	04/21/2005	15:45	CST	Hail	2.75 in.	0	0	0.00K	0.00K
BALLARD	BATES CO.	MO	04/21/2005	16:09	CST	Hail	2.75 in.	0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	06/30/2005	17:40	CST	Hail	1.00 in.	0	0	0.00K	0.00K
RICH HILL	BATES CO.	MO	09/13/2005	18:47	CST	Hail	0.75 in.	0	0	0.00K	0.00K
HUME	BATES CO.	MO	03/12/2006	14:43	CST	Hail	1.00 in.	0	0	0.00K	0.00K
FOSTER	BATES CO.	MO	03/12/2006	14:49	CST	Hail	1.00 in.	0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	03/12/2006	19:20	CST	Hail	2.75 in.	0	0	25.00K	0.00K
VIRGINIA	BATES CO.	MO	03/12/2006	19:20	CST	Hail	3.00 in.	0	0	75.00K	0.00K
ADRIAN	BATES CO.	MO	03/12/2006	19:28	CST	Hail	1.75 in.	0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	03/12/2006	19:29	CST	Hail	1.75 in.	0	0	0.00K	0.00K
ALTONA	BATES CO.	MO	03/12/2006	19:40	CST	Hail	1.00 in.	0	0	0.00K	0.00K

BUTLER	BATES CO.	MO	03/12/2006	20:10	CST	Hail	1.75 in.	0	0	0.00K	0.00K
RICH HILL	BATES CO.	MO	06/05/2006	21:05	CST	Hail	0.88 in.	0	0	0.00K	0.00K
ADRIAN	BATES CO.	MO	02/28/2007	19:15	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
AMSTERDAM	BATES CO.	MO	02/28/2007	20:15	CST-6	Hail	2.75 in.	0	0	12.00K	0.00K
ADRIAN	BATES CO.	MO	02/28/2007	20:25	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
HUME	BATES CO.	MO	04/27/2007	17:15	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
HUME	BATES CO.	MO	04/27/2007	17:20	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
HUME	BATES CO.	MO	06/02/2008	11:20	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
FOSTER	BATES CO.	MO	06/02/2008	11:25	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
RICH HILL	BATES CO.	MO	06/02/2008	11:40	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
AMSTERDAM	BATES CO.	MO	06/02/2008	12:10	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
AMSTERDAM	BATES CO.	MO	06/02/2008	12:10	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
FOSTER	BATES CO.	MO	06/02/2008	12:20	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
NYHART	BATES CO.	MO	06/02/2008	12:28	CST-6	Hail	0.88 in.	0	0	0.00K	0.00K
RICH HILL	BATES CO.	MO	06/02/2008	12:34	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
RICH HILL	BATES CO.	MO	06/02/2008	12:35	CST-6	Hail	2.75 in.	0	0	0.00K	0.00K
BUTLER MEM ARPT	BATES CO.	MO	06/28/2008	00:13	CST-6	Hail	0.75 in.	0	0	0.00K	0.00K
RICH HILL	BATES CO.	MO	06/28/2008	00:34	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K

ADRIAN	BATES CO.	MO	03/08/2009	05:28	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
PLEASANT RIDGE	BATES CO.	MO	03/24/2009	07:12	CST-6	Hail	2.75 in.	0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	06/09/2009	09:30	CST-6	Hail	0.88 in.	0	0	0.00K	0.00K
PLEASANT GAP	BATES CO.	MO	06/09/2009	09:35	CST-6	Hail	0.88 in.	0	0	0.00K	0.00K
AMSTERDAM	BATES CO.	MO	04/02/2010	18:40	CST-6	Hail	0.75 in.	0	0	0.00K	0.00K
PASSAIC	BATES CO.	MO	07/11/2010	14:14	CST-6	Hail	0.88 in.	0	0	0.00K	0.00K
ADRIAN	BATES CO.	MO	05/22/2011	15:28	CST-6	Hail	0.88 in.	0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	05/25/2011	02:43	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
PAPINSVILLE	BATES CO.	MO	06/18/2011	05:00	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
MERWIN	BATES CO.	MO	08/08/2012	19:00	CST-6	Hail	0.75 in.	0	0	0.00K	0.00K
HUME	BATES CO.	MO	09/25/2012	16:30	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
RICH HILL	BATES CO.	MO	09/25/2012	16:39	CST-6	Hail	0.75 in.	0	0	0.00K	0.00K
RICH HILL	BATES CO.	MO	09/25/2012	16:45	CST-6	Hail	0.88 in.	0	0	0.00K	0.00K
FOSTER	BATES CO.	MO	09/25/2012	16:55	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
NEW HOME	BATES CO.	MO	09/25/2012	16:56	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
RICH HILL	BATES CO.	MO	09/25/2012	16:56	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
RICH HILL	BATES CO.	MO	05/19/2013	17:45	CST-6	Hail	0.88 in.	0	0	0.00K	0.00K
RICH HILL	BATES CO.	MO	05/19/2013	17:45	CST-6	Hail	0.88 in.	0	0	0.00K	0.00K

ELKHART	BATES CO.	MO	05/20/2013	07:36	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
ADRIAN	BATES CO.	MO	05/31/2013	15:25	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
Totals:								0	0	6.892M	0.00K

Column Definitions:
'Mag': Magnitude, 'Dth': Deaths, 'Inj': Injuries, 'PrD': Property Damage, 'CrD': Crop Damage
Source: NOAA National Climatic Data Center

3.2.5: Lightning

While large scale natural disasters such as hurricanes, earthquakes and tornadoes grab most of the headlines, the most dangerous and also one of the most common is lightning. In the United States alone there were more than 13 million lightning strikes in 1989, resulting in 67 deaths, 322 injuries and causing over 100 million dollars in property damage.

The Lightning Bolt

There are several types of lightning strikes; cloud-to-cloud, cloud-to-air, and cloud-to-ground. By far the most dangerous is the cloud-to-ground (this is assuming that you are not in an airplane. Cloud-to-plane-to-ground lightning is common, because of the charge differentials caused by planes. These bolts scare the heck out of the paying customers, but only cause a moderate sweat for the crew, unless the navigation is knocked out).

Lightning is created when a separation of the positive and negative charges within a cloud becomes so great that the insulating power of air is exceeded and great amounts of electricity are then released.

Exactly how such a charge separation is created in a cloud is not entirely understood, but several necessary ingredients to the process have been identified. The main two are ice pellets and rising air. Both of these are found in cumulonimbus clouds, most common in the late-spring and summer. The ice pellets pick up net charges through collisions, and are sorted out by the updrafts, leaving an abundance of the larger negatively charged pellets at the bottom of the clouds and the smaller, positively charged ones near the cloud tops. As the negative charge grows, it begins to draw a positive charge on the surface of the earth under the cloud, since opposite charges attract. When the negative charge is great enough it leaves the cloud and heads towards the surface as the first stage of a lightning bolt.

This first surge of electrons is called a stepped leader. The leader moves towards the ground in a succession of 50m steps, creating a pathway of electrical flow. As the stepped leader nears the ground, a strong positive charge is induced beneath it. Eventually, the electrical attraction is so strong, that the positive charge rises up out of the ground or out from objects protruding from the ground (houses, people, especially people on roofs of houses fixing television antennae), in an attempt to meet the stepped leader.

This rising positive charge is called a streamer. When the streamer and the stepped leader meet, the electrical circuit between the cloud and the ground is complete. At that instant, the negative charges in the leader explosively flow to the ground. The negative charges closest to the surface flow out first, followed by the charges progressively high up the leader.

This is called the return stroke. The violent surge of electrons within the return stroke heats the air to temperature in excess of 50,000 F (that's about 5 times the temperature of the surface of the sun!) and causes it to brightly glow. This is the brilliant flash that we recognize as lightning. It actually propagates upward! And so do the souls of TV. Antenna repairmen or State Climatologists connected to the roof if they've been good and virtuous! Generally, however, this entire process happens so fast that the human eye cannot separate its components, and we see only a complete flash.

After the initial return stoke, the channel through the air remains very conductive, and thus provides an easy pathway from the cloud to the ground. Oftentimes, several subsequent strokes will follow this same channel, with each stroke draining the negative charge from higher up in the cloud. These strokes follow within milliseconds of each other and produce the flickering effect that is sometimes observed.

Thunder is produced when the air heated by the return stroke rapidly expands into the air around it. This rapid expansion produces a sound wave, which propagates away from the strike at about 1100 feet per second (a fifth of a mile per second). Since the return stroke begins at the ground, thunder begins at the ground. The rumbling of thunder is caused as the sound from the different sections of the lightning bolt reach the observer at different times. The distance to the lighting strike can be estimated by counting the number of seconds it takes from the time you see a flash until the time you hear the thunder. Dividing this number of seconds by five will give a good estimate of the number of miles between you and the strike.

Lightning Protection

Since the power contained in a flash of lightning is tremendous (several hundred millions of volts, and several tens of thousands of amps), it is best to take precautions which lessen the chance of you and your property being struck.

The proper installation of lightning rods on buildings and trees can save immeasurable amounts of monetary as well as sentimental value by re-channeling the energy of a direct stroke. The idea behind a lightning rod is that it serves as the highest object around and so it intercepts the stepped leader on its way to the ground.

A sharp tip on the rod facilitates the rise of a streamer from the rod and increases its effectiveness. Lightning rods will generally protect an area within a 45 cone beneath the rod. For large structures, several rods may be needed to insure complete protection, or perhaps an overhead ground wire. For further and more complete information on protecting your home from lightning strikes check with an expert in lightning protection (often found in your local telephone directory).

There are also precautions that should be taken to protect yourself from bodily harm. A list of these from the National Weather Service is provided here. The main thing to remember is to make sure you are not in the vicinity of the highest thing around (get off the roof), and also not in contact with, or near electrical appliances such as the telephone. The electricity of a strike to a phone line, power line or even a tree, can travel long distances and still provide a jolt strong enough to kill.

Lightning Research

Since cloud-to-ground lightning strikes cause so much destruction they have been the object of much study. Recently, technology has been introduced which allows very precise determination of lightning strike location and energy. A national network of 114 lightning ground stroke detectors has recently been put in place by the Electric Power Research Institute (EPRI), a private organization, that serves the needs of power companies and other subscribers interested in lightning across the country. These detectors sense the characteristic electromagnetic impulses of cloud-to-ground lightning strikes that occur up to several hundred kilometers away. Then, by using triangulation techniques, the network is able to describe the location of every ground stroke that it detects in the continental U.S.

As such it provides invaluable information for scientific studies, power and telephone company storm response, and even corporate and individual insurance claims. The illustration below uses data from this network to show the lightning strike density in the state of Virginia for the year 1989. The maximum is located over southeastern Virginia where they average 5 to 6 ground strikes per year per square kilometer (250 acres). Summertime temperatures are the highest in the state and moisture is abundant, which are necessary ingredients for the formation of lightning producing storms.

Lightning information source: http://climate.virginia.edu/lightning/lightning.general.html

Table 3.2.5-4: Bates County Lightning Occurrences: 1996 - 2013

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								0	0	2.00K	0.00K
BUTLER	BATES CO.	MO	06/16/2009	01:36	CST-6	Lightning		0	0	2.00K	0.00K
Totals:								0	0	2.00K	0.00K

Source: http://www.ncdc.noaa.gov/stormevents/listevents.jsp?beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1996&endDate_mm=07&endDate_dd=31&endDate_yyyy=2013&eventType=%28C%29+Lightning&county=BATES&zone=ALL&submitbutton=Search&statefips=29%2CMISSOURI

As demonstrated in the table above indicates that the National Weather Service only has one report of lightning damage in Bates County causing $2,000 in damage. There are probably many more such strikes that go unreported because of the rural nature of Bates County.

Statement of Future Probable Severity

Severe wind and hail and lightning events are a common occurrence in Bates County. According to the NOAA, severe criteria for wind events constitutes winds over 58 mph and hail larger than ¾ inches in diameter. Non-severe criteria constitutes heavy rainfall, which may cause flash flooding, and lightning occurrences. With most residents having knowledge and experience in thunderstorm and hail occurrences the severity to population remains fairly low. Using NOAA standards, most hail occurrences in the county are classified as severe and almost all thunderstorm events are classified as not severe. Future high wind and hail events will likely have a critical impact on the county

Statement of Probable Risk

Thunderstorms, severe winds, hail and lightning are a fairly regular occurrence in Bates County. Severity of these storms varies greatly. Of 41 thunderstorms and high wind events from 1996-2013, 7 storms caused $420,300 in property damage, $0 in crop damage, and no injuries. 7 of 110 hail events were responsible for over $6,897,000 in property damage and $0 in crop damage. These statistics suggest a significant probable risk for Bates County.

The probable risk is calculated by dividing the number of events by the number of years, multiplying by 100 to create a risk percentage. 41 thunderstorm high wind events occurred in Bates County between 1996 and 2013, (41/17=2.411x100=241.176%) resulting in a probable risk percentage of 241%. 122 hail events occurred between 1996 and 2013, (122/17=7.176x100=717.64%) yielding a 717% probable risk percentage of one hail event in any given year.

According to the NOAA National Climatic Data Center, there has only been one recorded lightning event causing damage in Bates County. There are quite certainly many un-reported lighting strikes that occur in the count but since they have not been reported they can not be used in the following risk calculation.

Between 1996 and 2013 there has been $2000.00 in property damage with no loss of life reported. Therefor the documented risk for lighting strikes in Bates county is (1/17=.0588x100=5.88%) therefore there is a less that 6% risk of a damaging lighting strike in the county.

Statement of Next Disaster's Likely Adverse Impact on the Community

Thunderstorms, high winds and hail may cause significant property damage, crop damage, injury, and even death. Improvements in meteorological forecasting and warning systems for such storms have increased the potential for advance public preparation. These improvements, however, may or may not provide sufficient warning time depending upon the speed of storm development. The use of advanced forecasting, warning systems, vigorous public education, and improved construction techniques may reduce property damage as well as the number of deaths and injuries. Based on the 17-year history, the likely adverse impact of future Bates County thunderstorm, damaging wind, hail and lighting events is shown below.

Without mitigation measures:

Life:	critical
Property:	critical
Emotional:	critical
Financial:	critical
Comments:	none

With mitigation measures*:*

Life:	negligible
Property:	limited
Emotional:	negligible
Financial:	limited
Comments:	An effective mitigation program could reduce the adverse impact on life and emotional stress from critical to limited or better.

Statement of Next Disaster's Likely Adverse Impact by Jurisdiction

All jurisdictions within the county are equally susceptible to damage stemming from Thunderstorm, High Wind events, hail and lighting. Vulnerable structures, including critical facilities and mobile homes, exist in each jurisdiction. Particular communities such as Amoret, Foster, Hume Passaic, Merwin and Rockville all have housing stock that was built before or around 1950. Amoret, Hume, Merwin and Passaic all have 20% or more of their housing stock classified as mobile homes. These housing conditions place those six communities in Bates County in high vulnerability scenarios in the event of a tornado. In the event of a tornado, 50-100% of any given jurisdiction may be at risk for damage. Since the passage of the original plan in 2004, no significant changes concerning building development or population shifts have taken place.

Recommendation

Recommend that county officials continue to provide emergency preparedness information and resources related to all natural disasters to the public through active education and outreach programs.

3.2.6 Flood

A flood is a 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.

Flash flooding is characterized by rapid accumulation or runoff of surface waters from any source. This type of flooding can occur within six hours of a rain event, after a dam or levee failure, or following a sudden release of water held by an ice or debris jam. Flash floods can catch people unprepared. Because flash floods can develop in just a matter of hours, most flood related deaths result from this type of flooding event.

Several factors contribute to flooding. Two key elements are rainfall intensity and duration. Intensity is the rate of rainfall and duration is how long the precipitation lasts. Topography, soil conditions, and ground cover also play important roles. Most flash flooding is caused by slow-moving thunderstorms or heavy rains. Widespread floods, on the other hand, can be fast-rising, but generally develop over a period of hours or days.

Urbanization further aggravates the flooding potential by increasing runoff two to six times over what would occur on natural terrain. As land is converted from fields or woodlands to buildings and pavement, it loses its ability to efficiently absorb rainfall. During periods of urban flooding, streets can become swift moving rivers, while basements and viaducts can fill with water, creating potentially dangerous situations.

The areas adjacent to rivers and stream banks that serve to carry excess floodwater during rapid runoff are called floodplains. A floodplain is defined as the lowlands and relatively flat areas adjoining rivers and streams. The term “base flood,” or 100-year flood, is the area in the floodplain that is subject to a one percent or greater chance of flooding in any given year, based upon historical records.

Floodplains are a vital part of a larger entity called a basin, or watershed. A basin is defined as all the land drained by a river and its branches. In some cases, flooding may not necessarily be directly attributable to a river, stream or lake. Rather, it may be the combination of excessive rainfall/snowmelt, saturated ground, and inadequate drainage within a given basin.

Historical Statistics

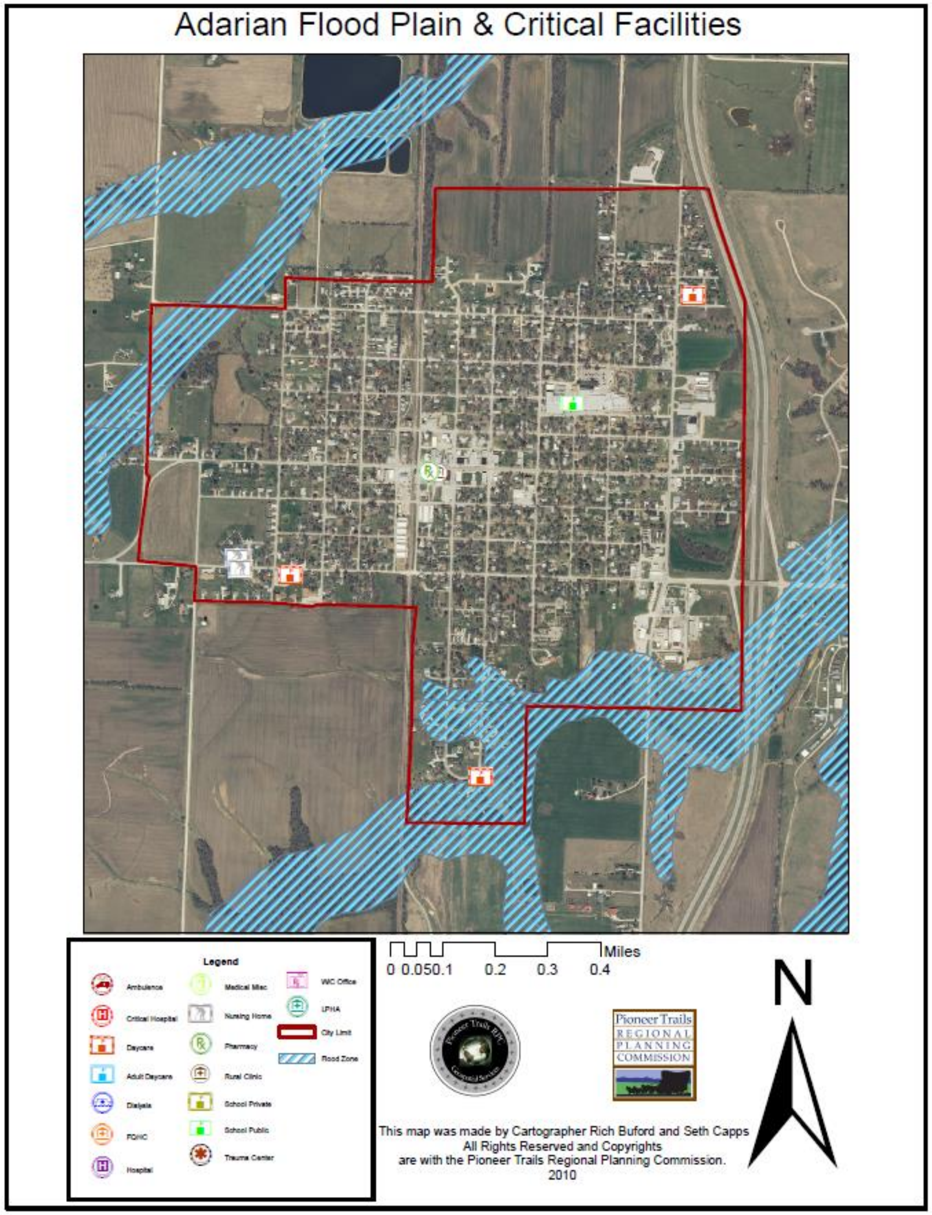
The following table from the NOAA National Climatic Data Center indicates that in the last 17 years there have been 13 flash flood events in Bates county with no reported loss of life and no reported property or crop damage.

Table 3.2.6-1 Bates County Flash Flood History 1996-2013

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								0	0	0.00K	0.00K
ADRIAN	BATES CO.	MO	*05/19/2004*	02:09	CST	Flash Flood		0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	*01/12/2005*	17:40	CST	Flash Flood		0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	*06/06/2005*	11:10	CST	Flash Flood		0	0	0.00K	0.00K
ADRIAN	BATES CO.	MO	*06/01/2006*	18:15	CST	Flash Flood		0	0	0.00K	0.00K
BALLARD	BATES CO.	MO	*05/02/2007*	11:32	CST-6	Flash Flood		0	0	0.00K	0.00K
AMSTERDAM	BATES CO.	MO	*05/06/2007*	11:08	CST-6	Flash Flood		0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	*05/06/2007*	14:15	CST-6	Flash Flood		0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	*06/28/2007*	12:55	CST-6	Flash Flood		0	0	0.00K	0.00K
ADRIAN	BATES CO.	MO	*06/29/2007*	07:30	CST-6	Flash Flood		0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	*06/30/2007*	10:52	CST-6	Flash Flood		0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	*06/30/2007*	14:00	CST-6	Flash Flood		0	0	0.00K	0.00K
BUTLER	BATES CO.	MO	*06/30/2007*	16:00	CST-6	Flash Flood		0	0	0.00K	0.00K
SPRUCE	BATES CO.	MO	*06/16/2009*	06:51	CST-6	Flash Flood		0	0	0.00K	0.00K
Totals:								0	0	0.00K	0.00K

Source: NOAA National Climatic Data Center

County and Jurisdiction floodplain maps are on the following pages.


Adarian Flood Plain & Critical Facilities
Legend
Ambulance
Critical Hospital
Daycare
Adult Daycare
Dialysis
FQHC
Hospital
Medical Misc
Nursing Home
Pharmacy
Rural Clinic
School Private
School Public
Trauma Center
WIC Office
LPHA
City Limit
Flood Zone
0 0.050.1 0.2 0.3 0.4
Miles
N
This map was made by Cartographer Rich Buford and Seth Capps
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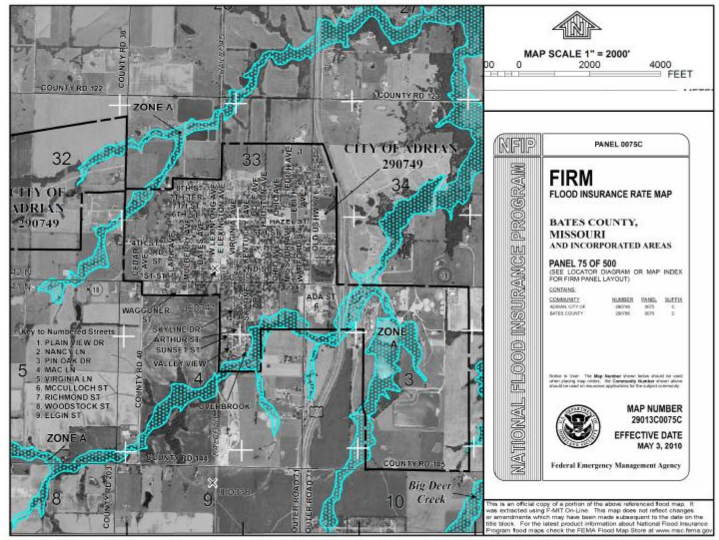
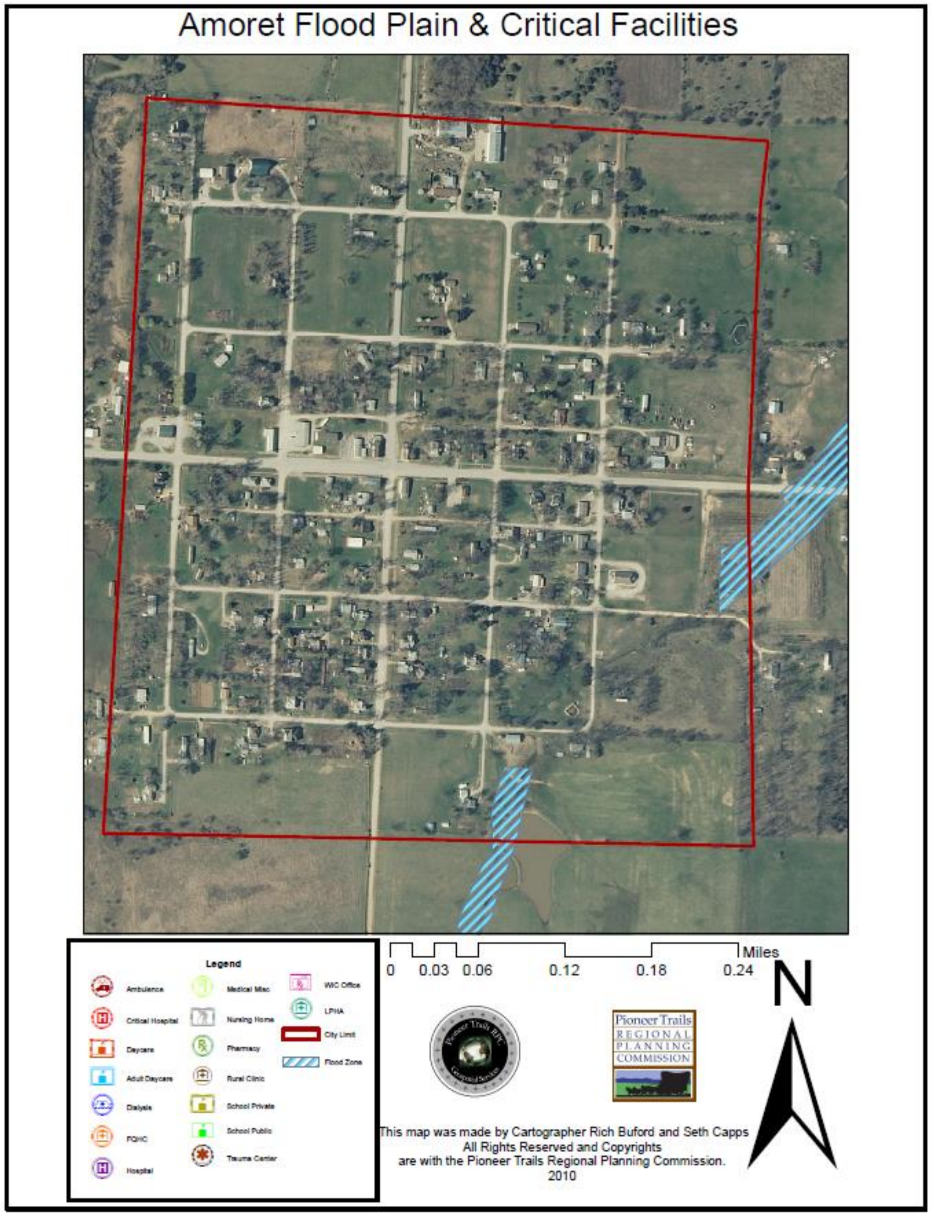
are with the Pioneer Trails Regional Planning Commission.
2010
Pioneer Trails
REGIONAL
PLANNING
COMMISSION


MAP SCALE 1" = 2000'
2000
4000
FEET
NFIP
PANEL 0075C
FIRM
FLOOD INSURANCE RATE MAP
BATES COUNTY,
MISSOURI
AND INCORPORATED AREAS
PANEL 75 OF 500
NATIONAL FLOOD INSURANCE PROGRAM
MAP NUMBER
29013C0075C
EFFECTIVE DATE
MAY 3, 2010
Federal Emergency Management Agency
CITY OF ADRIAN
290749
ZONE A
COUNTY RD 122
Key to Numbered Streets
1. PLAIN VIEW DR
2. NANCY LN
3. PIN OAK DR
4. MAC LN
5. VIRGINIA LN
6. MCCULLOCH ST
7. RICHMOND ST
8. WOODSTOCK ST
9. ELGIN ST
Big Deer Creek



Amoret Flood Plain & Critical Facilities
Legend
Ambulence
Critical Hospital
Daycare
Adult Daycare
Dialysis
FQHC
Hospital
Medical Misc
Nursing Home
Pharmacy
Rural Clinic
School Private
School Public
Trauma Center
WIC Office
LPHA
City Limit
Flood Zone
0 0.03 0.06 0.12 0.18 0.24 Miles
N
Pioneer Trails Regional Planning Commission
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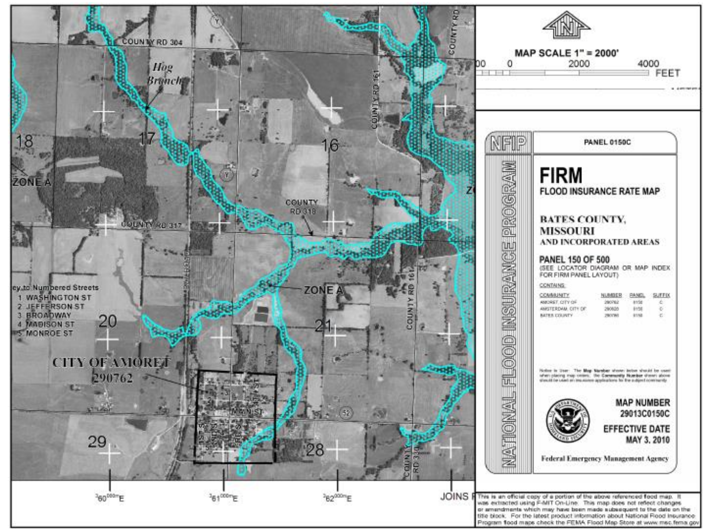
2010



COUNTY RD 304
Hog Branch
ZONE A
COUNTY RD 317
COUNTY RD 318
ZONE A
CITY OF AMORET
290762
18
17
16
20
21
29
28
JOINS
MAP SCALE 1" = 2000'
0 2000 4000 FEET
NFIP
NATIONAL FLOOD INSURANCE PROGRAM
PANEL 0150C
FIRM
FLOOD INSURANCE RATE MAP
BATES COUNTY, MISSOURI
AND INCORPORATED AREAS
PANEL 150 OF 500
(SEE LOCATOR DIAGRAM OR MAP INDEX FOR FIRM PANEL LAYOUT)
MAP NUMBER
29013C0150C
EFFECTIVE DATE
MAY 3, 2010
Federal Emergency Management Agency
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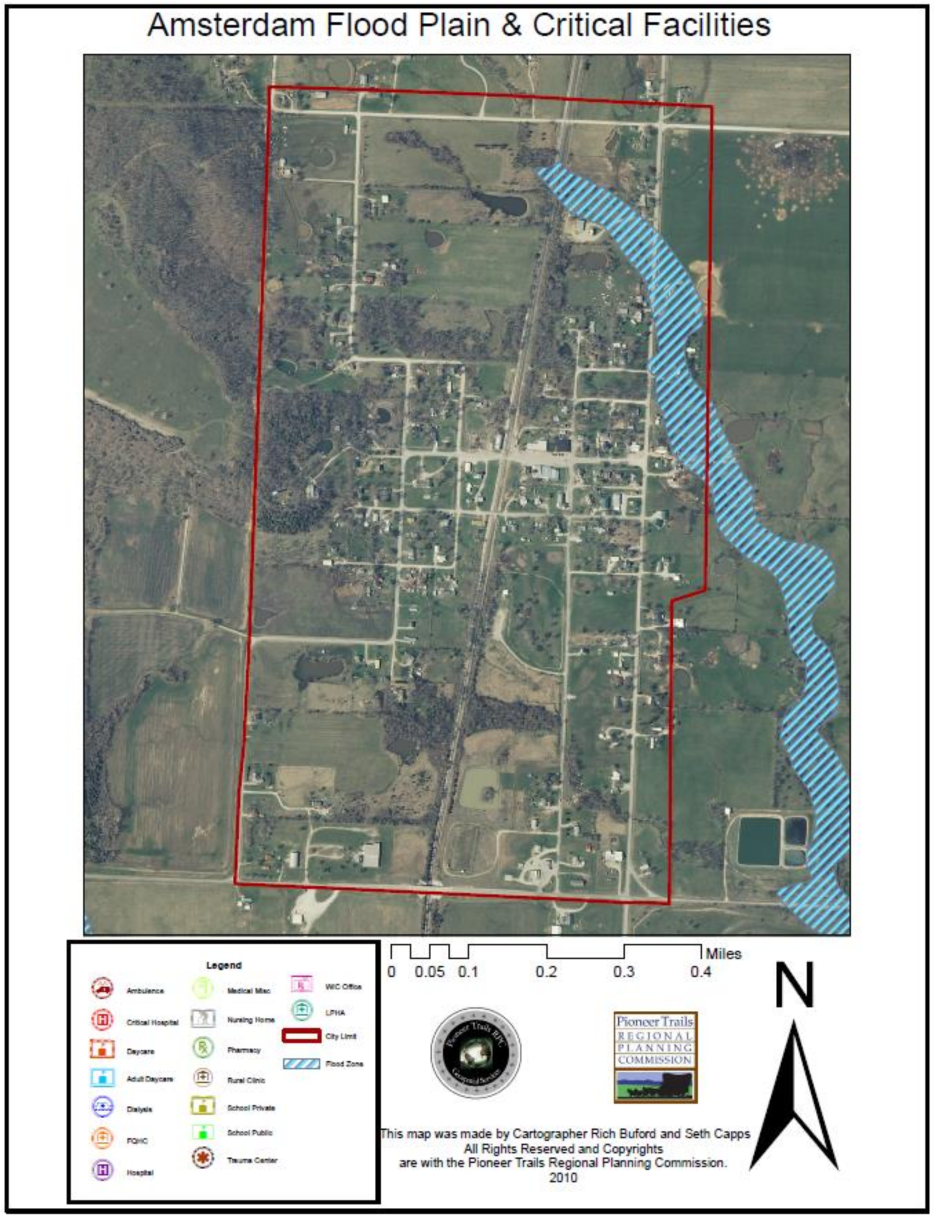
Amsterdam Flood Plain & Critical Facilities
Legend
Ambulance
Critical Hospital
Daycare
Adult Daycare
Dialysis
FQHC
Hospital
Medical Misc
Nursing Home
Pharmacy
Rural Clinic
School Private
School Public
Trauma Center
WIC Office
LPHA
City Limit
Flood Zone
0 0.05 0.1 0.2 0.3 0.4 Miles
Pioneer Trails Regional Planning Commission
N
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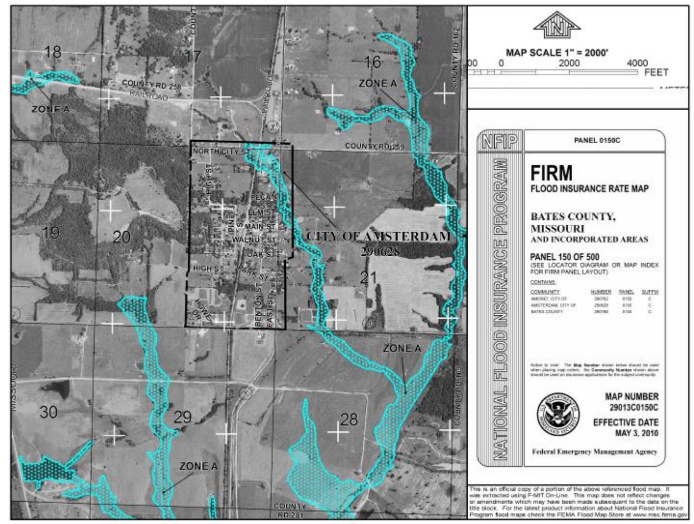
2010


MAP SCALE 1" = 2000'
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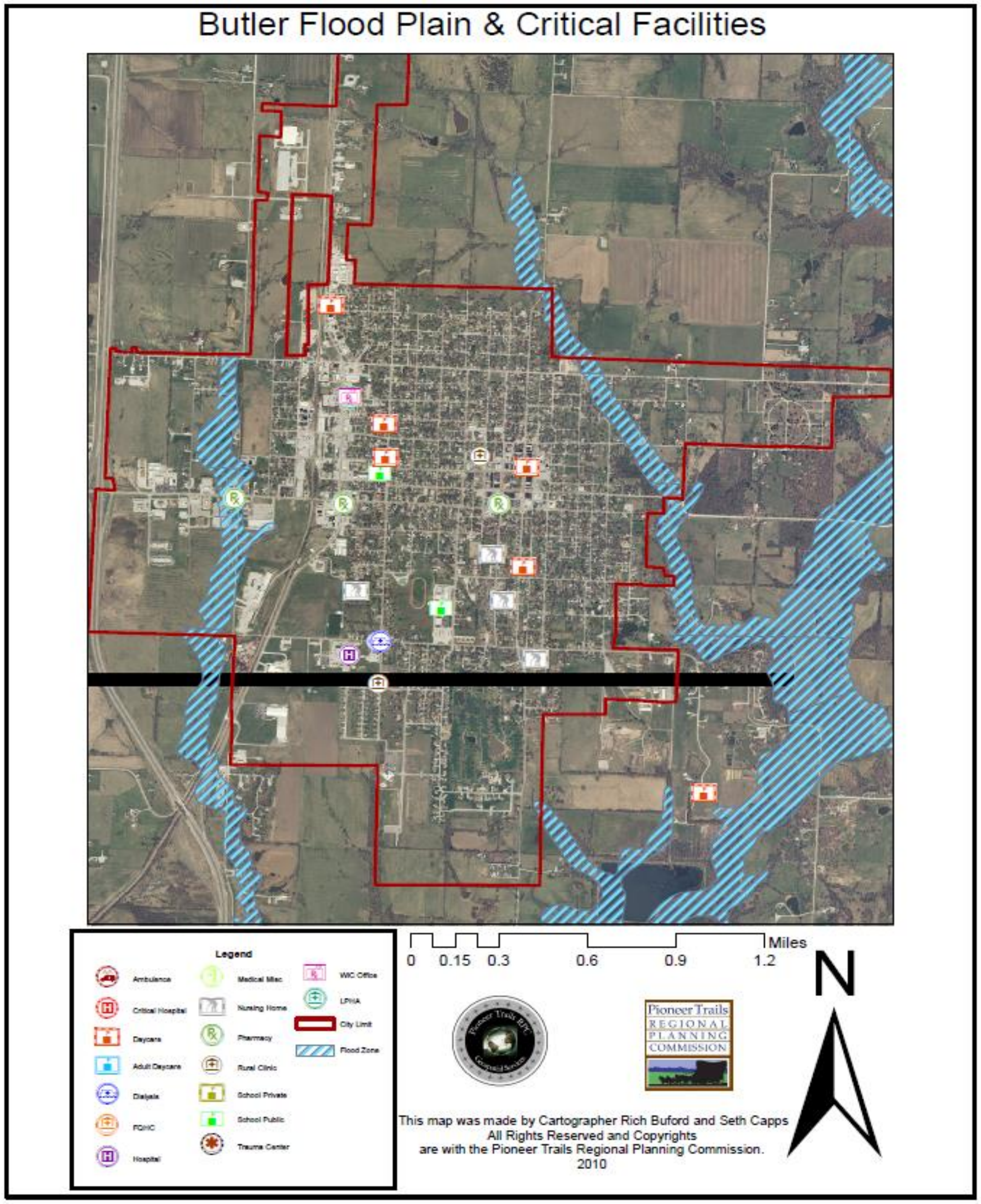
FEET
ZONE A
CITY OF AMSTERDAM
NFIP
NATIONAL FLOOD INSURANCE PROGRAM
PANEL 0150C
FIRM
FLOOD INSURANCE RATE MAP
BATES COUNTY, MISSOURI
AND INCORPORATED AREAS
PANEL 150 OF 500
MAP NUMBER
29013C0150C
EFFECTIVE DATE
MAY 3, 2010
Federal Emergency Management Agency


Butler Flood Plain & Critical Facilities
Legend
Ambulance
Critical Hospital
Daycare
Adult Daycare
Dialysis
FQHC
Hospital
Medical Misc
Nursing Home
Pharmacy
Rural Clinic
School Private
School Public
Trauma Center
WIC Office
LPHA
City Limit
Flood Zone
0 0.15 0.3 0.6 0.9 1.2 Miles
N
Pioneer Trails Regional Planning Commission
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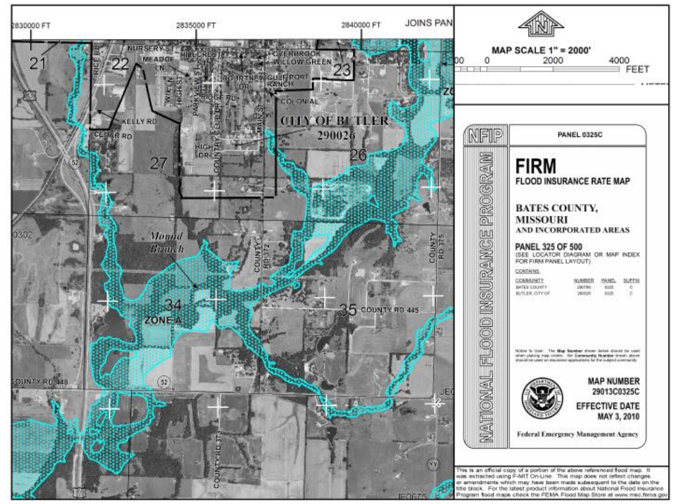
2010


2830000 FT
2835000 FT
2840000 FT
JOINS PAN
CITY OF BUTLER
290026
ZONE A
MAP SCALE 1" = 2000'
0 2000 4000
FEET
NFIP
NATIONAL FLOOD INSURANCE PROGRAM
PANEL 0325C
FIRM
FLOOD INSURANCE RATE MAP
BATES COUNTY, MISSOURI
AND INCORPORATED AREAS
PANEL 325 OF 500
(SEE LOCATOR DIAGRAM OR MAP INDEX FOR FIRM PANEL LAYOUT)
MAP NUMBER
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EFFECTIVE DATE
MAY 3, 2010
Federal Emergency Management Agency
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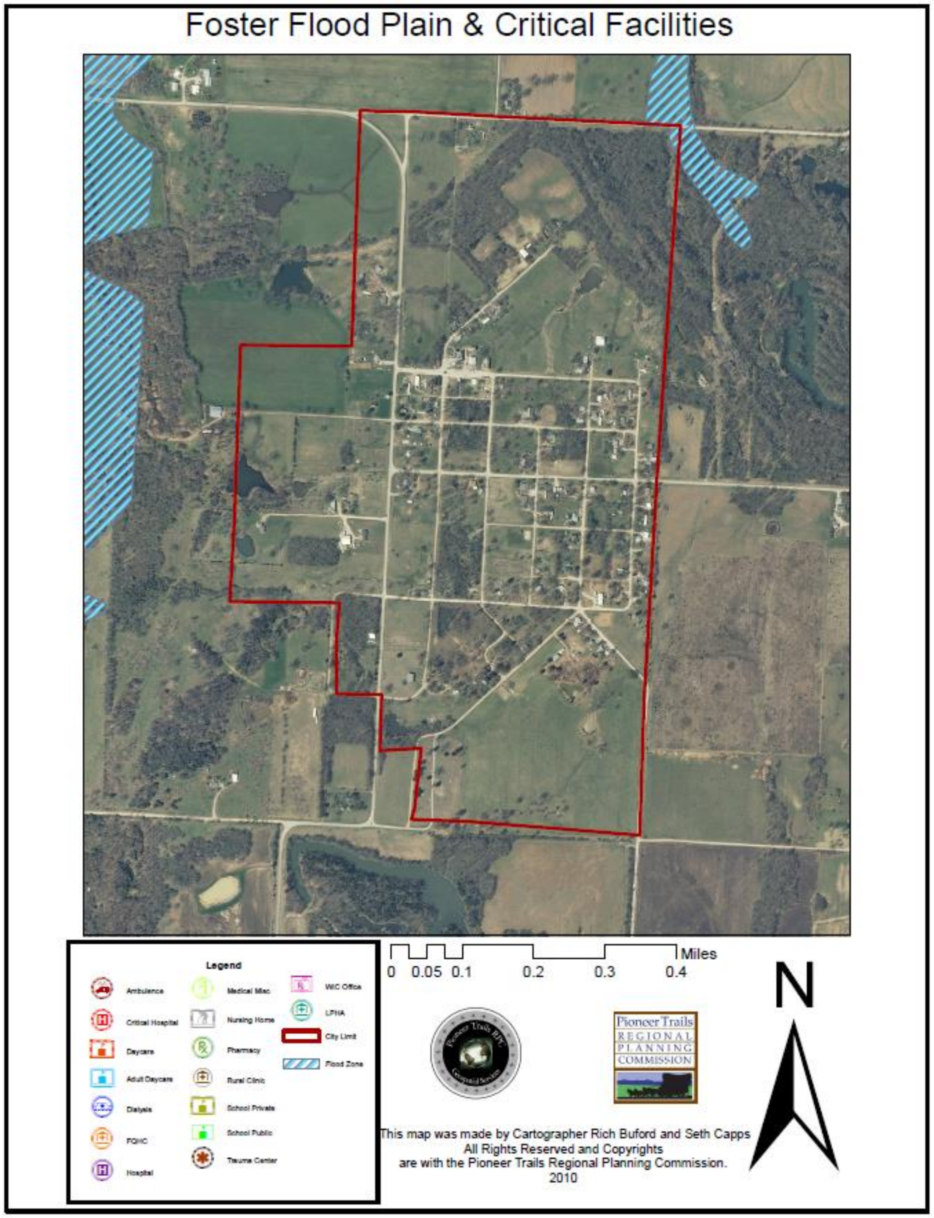
Foster Flood Plain & Critical Facilities
Legend
Ambulance
Critical Hospital
Daycare
Adult Daycare
Dialysis
FQHC
Hospital
Medical Misc
Nursing Home
Pharmacy
Rural Clinic
School Private
School Public
Trauma Center
WIC Office
LPHA
City Limit
Flood Zone
0 0.05 0.1 0.2 0.3 0.4 Miles
N
Pioneer Trails Regional Planning Commission
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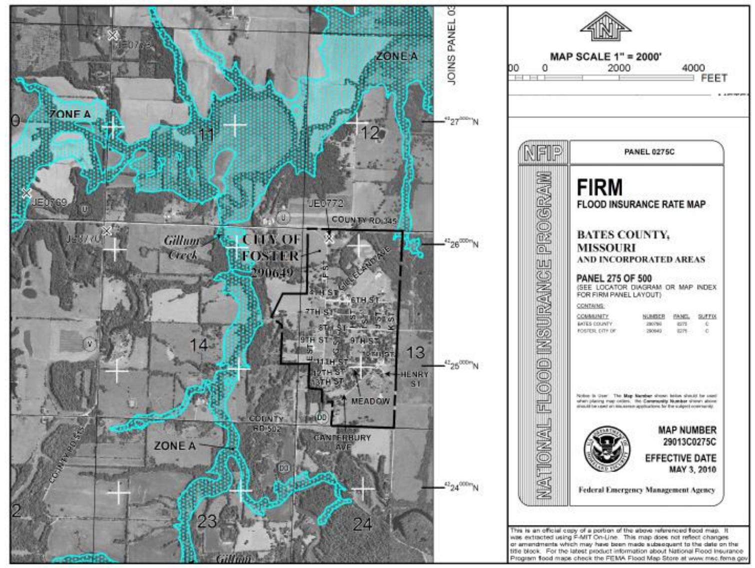
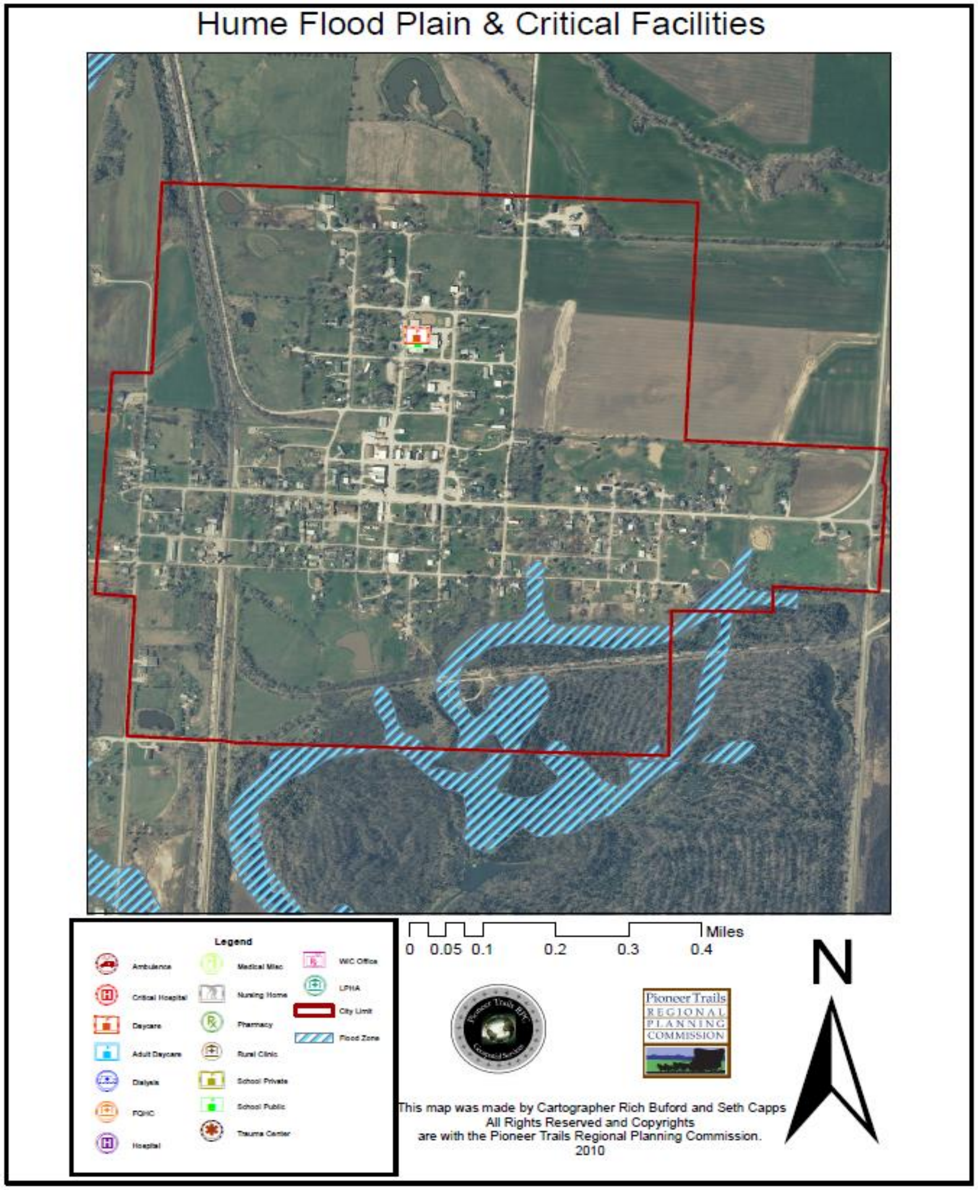
2010


ZONE A
CITY OF FOSTER
290649
Gillum Creek
MAP SCALE 1" = 2000'
FEET
NFIP
PANEL 0275C
FIRM
FLOOD INSURANCE RATE MAP
BATES COUNTY, MISSOURI
AND INCORPORATED AREAS
PANEL 275 OF 500
NATIONAL FLOOD INSURANCE PROGRAM
MAP NUMBER
29013C0275C
EFFECTIVE DATE
MAY 3, 2010
Federal Emergency Management Agency


Hume Flood Plain & Critical Facilities
Legend
Ambulance
Critical Hospital
Daycare
Adult Daycare
Dialysis
FQHC
Hospital
Medical Misc
Nursing Home
Pharmacy
Rural Clinic
School Private
School Public
Trauma Center
WIC Office
LPHA
City Limit
Flood Zone
0 0.05 0.1 0.2 0.3 0.4
Miles
N
Pioneer Trails
REGIONAL
PLANNING
COMMISSION
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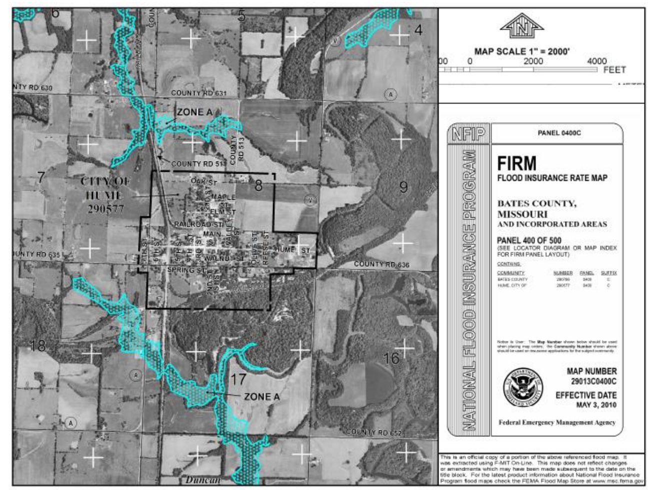
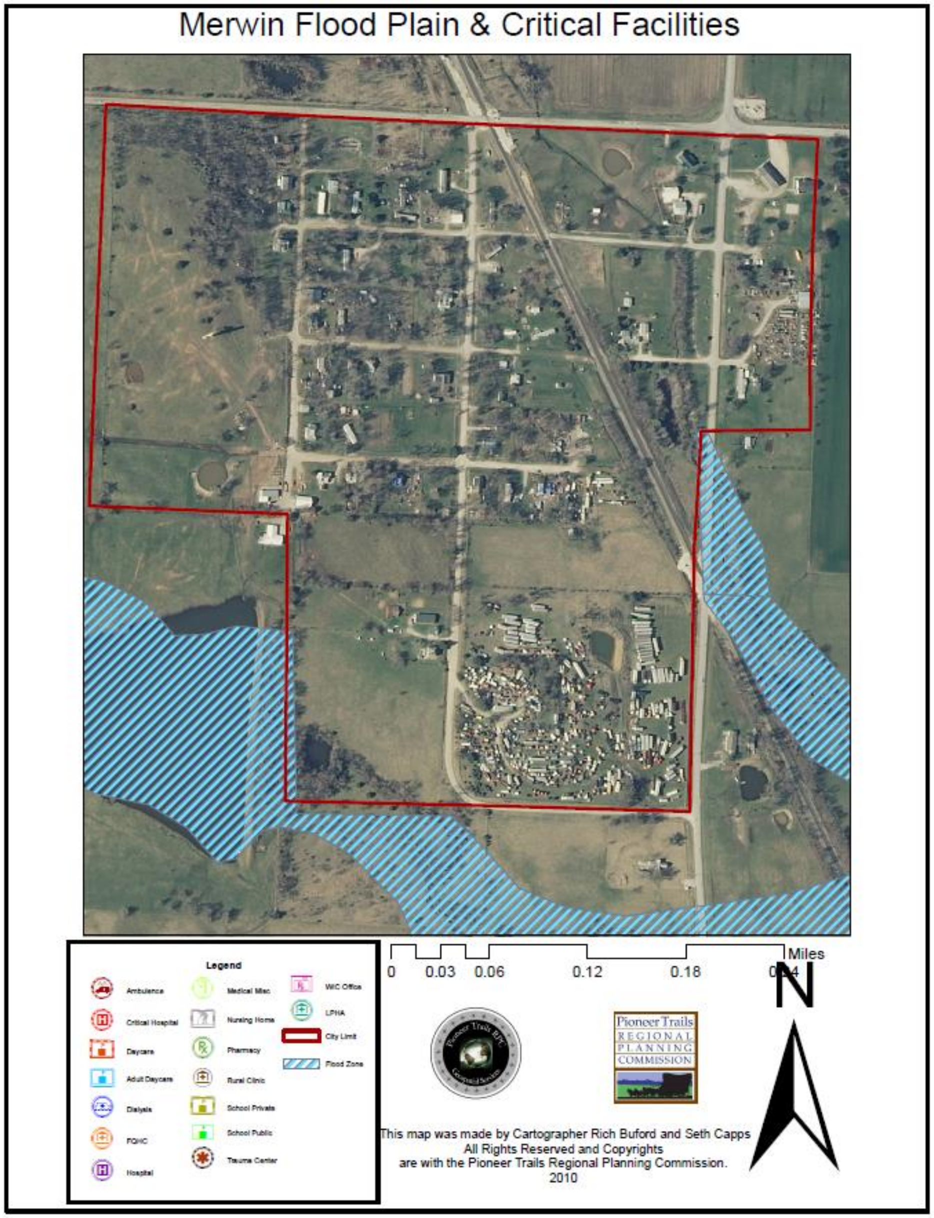
2010


MAP SCALE 1" = 2000'
ZONE A
CITY OF HUME
290577
COUNTY RD 636
ZONE A
NFIP
PANEL 0400C
FIRM
FLOOD INSURANCE RATE MAP
BATES COUNTY, MISSOURI
AND INCORPORATED AREAS
PANEL 400 OF 500
NATIONAL FLOOD INSURANCE PROGRAM
MAP NUMBER 29013C0400C
EFFECTIVE DATE MAY 3, 2010
Federal Emergency Management Agency


Merwin Flood Plain & Critical Facilities
Legend
Ambulance
Critical Hospital
Daycare
Adult Daycare
Dialysis
FQHC
Hospital
Medical Misc
Nursing Home
Pharmacy
Rural Clinic
School Private
School Public
Trauma Center
WIC Office
LPHA
City Limit
Flood Zone
0 0.03 0.06 0.12 0.18 0.24 Miles
N
Pioneer Trails Regional Planning Commission
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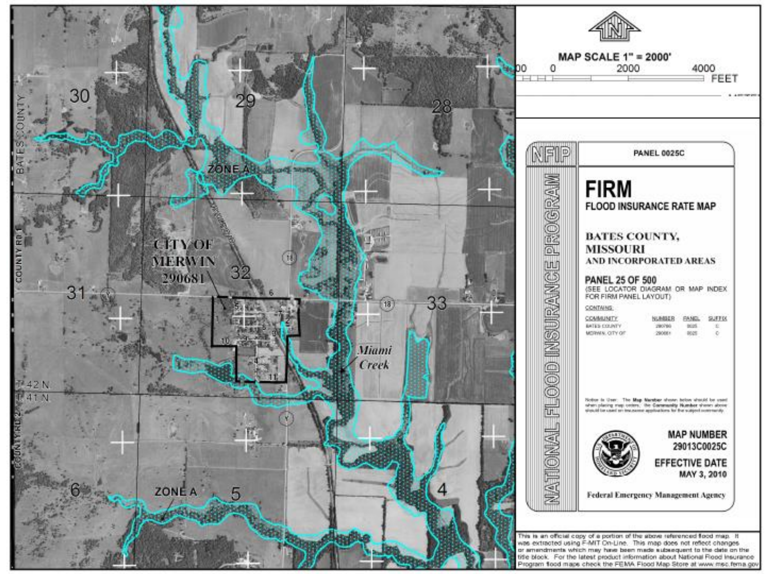
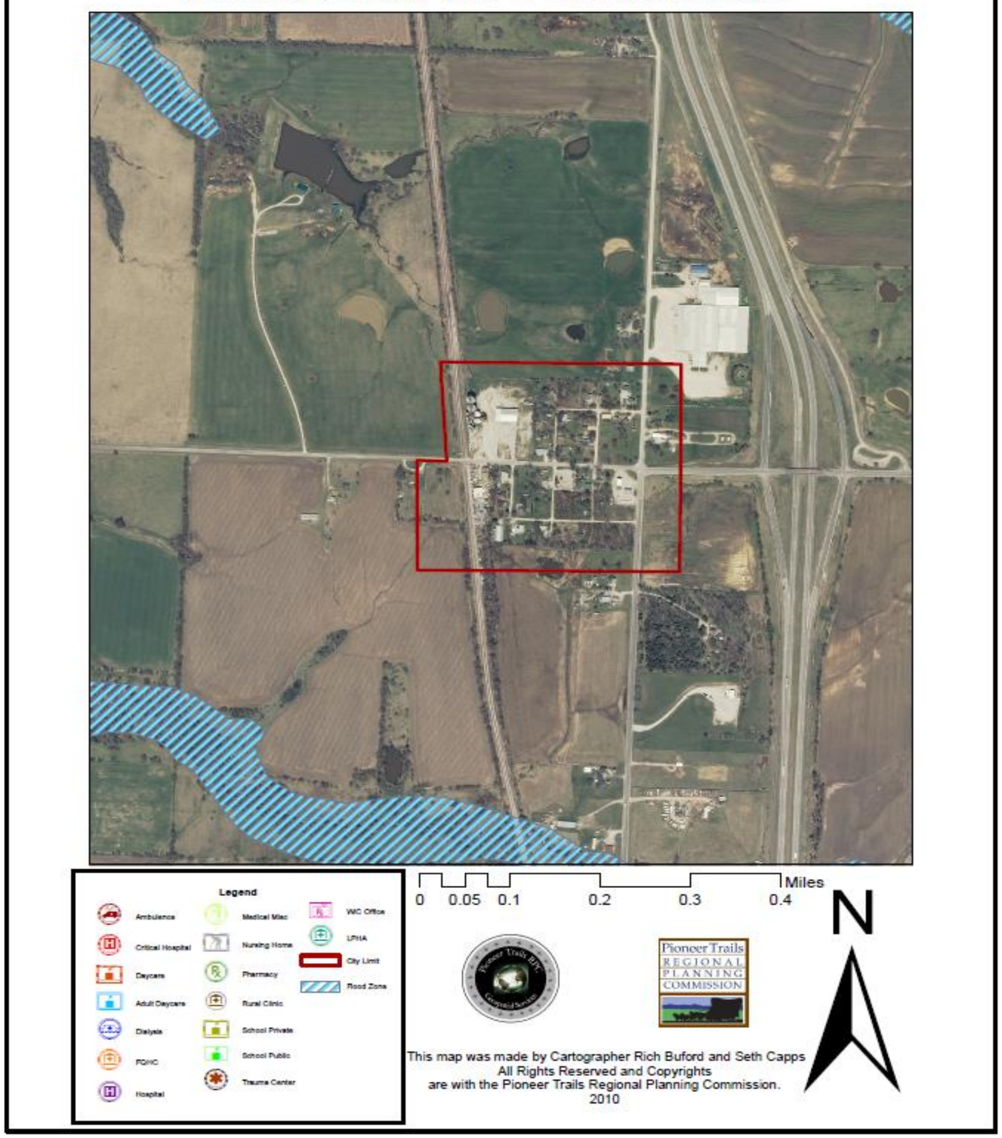
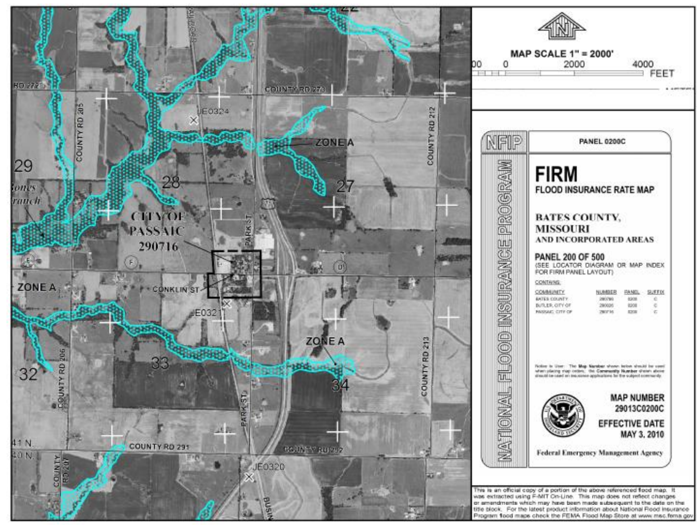
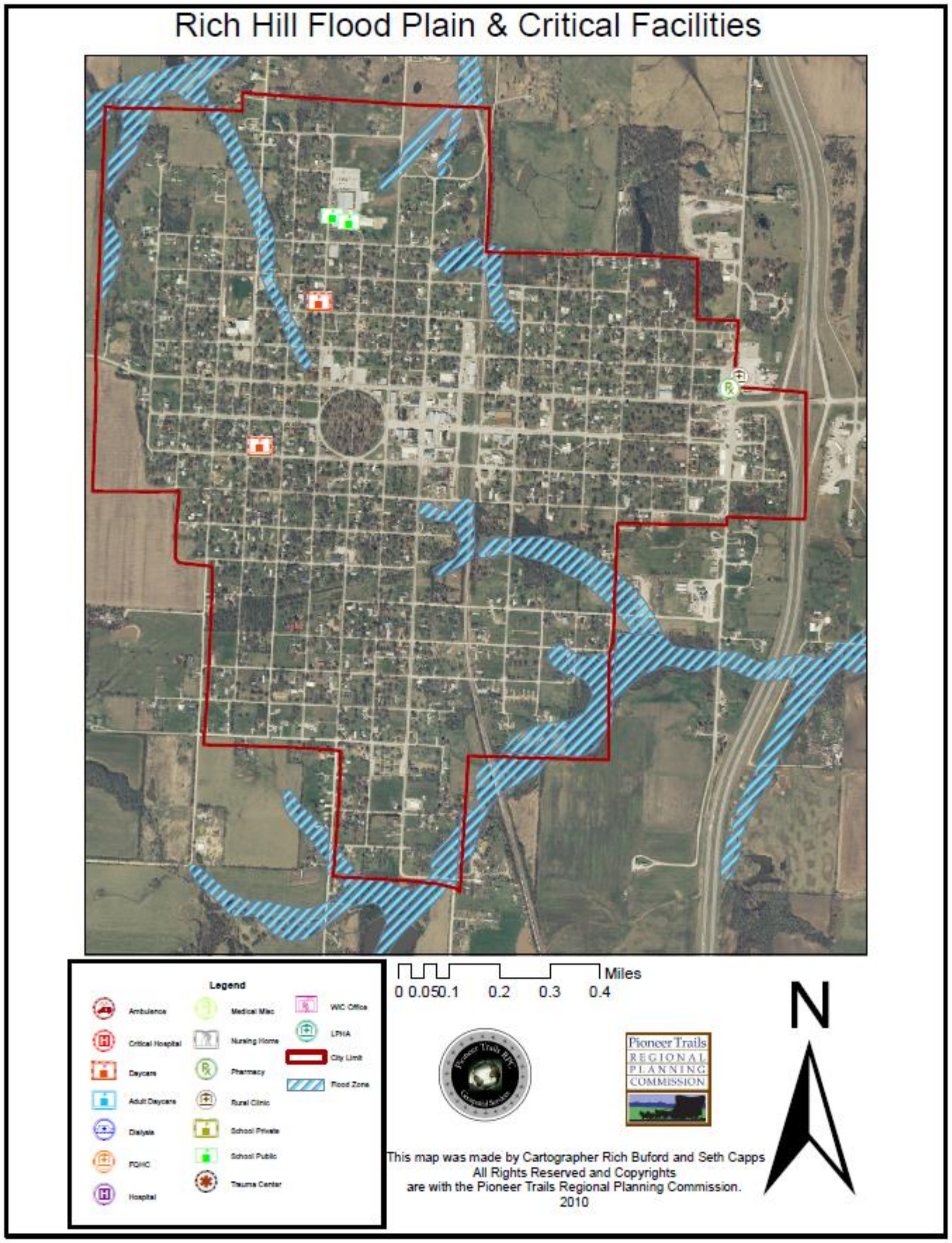

30
29
28
ZONE A
CITY OF MERWIN 290681
32
31
33
Miami Creek
6
ZONE A
5
4
MAP SCALE 1" = 2000'
FEET
NFIP
PANEL 0025C
FIRM
FLOOD INSURANCE RATE MAP
BATES COUNTY, MISSOURI
AND INCORPORATED AREAS
PANEL 25 OF 500
NATIONAL FLOOD INSURANCE PROGRAM
MAP NUMBER 29013C0025C
EFFECTIVE DATE MAY 3, 2010
Federal Emergency Management Agency

Passaic Flood Plain & Critical Facilities






Rich Hill Flood Plain & Critical Facilities
Legend
Ambulance
Critical Hospital
Daycare
Adult Daycare
Dialysis
FQHC
Hospital
Medical Misc
Nursing Home
Pharmacy
Rural Clinic
School Private
School Public
Trauma Center
WIC Office
LPHA
City Limit
Flood Zone
Miles
0 0.050.1 0.2 0.3 0.4
Pioneer Trails Regional Planning Commission
N
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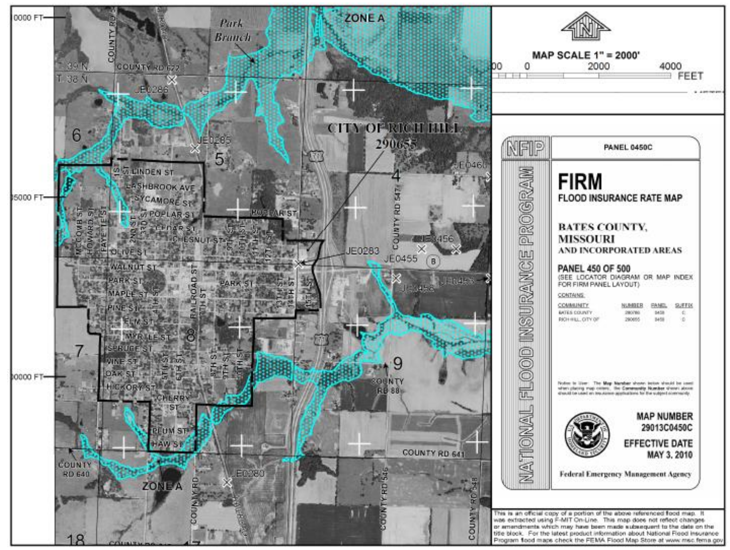
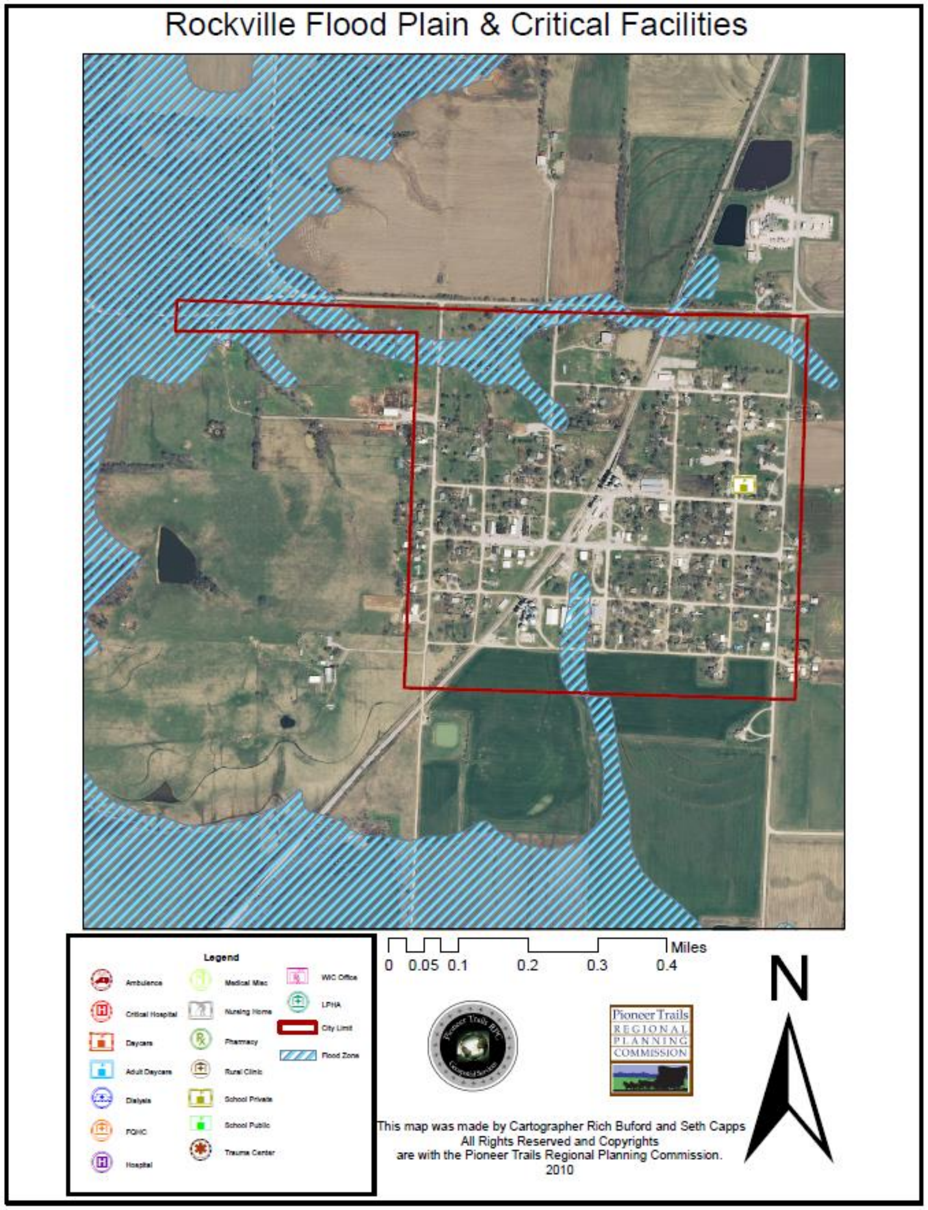
2010


ZONE A
Park Branch
CITY OF RICH HILL
290655
ZONE A
MAP SCALE 1" = 2000'
0 2000 4000
FEET
NATIONAL FLOOD INSURANCE PROGRAM
NFIP
PANEL 0450C
FIRM
FLOOD INSURANCE RATE MAP
BATES COUNTY, MISSOURI
AND INCORPORATED AREAS
PANEL 450 OF 500
MAP NUMBER
29013C0450C
EFFECTIVE DATE
MAY 3, 2010
Federal Emergency Management Agency


Rockville Flood Plain & Critical Facilities
Legend
Ambulance
Critical Hospital
Daycare
Adult Daycare
Dialysis
FQHC
Hospital
Medical Misc
Nursing Home
Pharmacy
Rural Clinic
School Private
School Public
Trauma Center
WIC Office
LPHA
City Limit
Flood Zone
Miles
0 0.05 0.1 0.2 0.3 0.4
N
Pioneer Trails REGIONAL PLANNING COMMISSION
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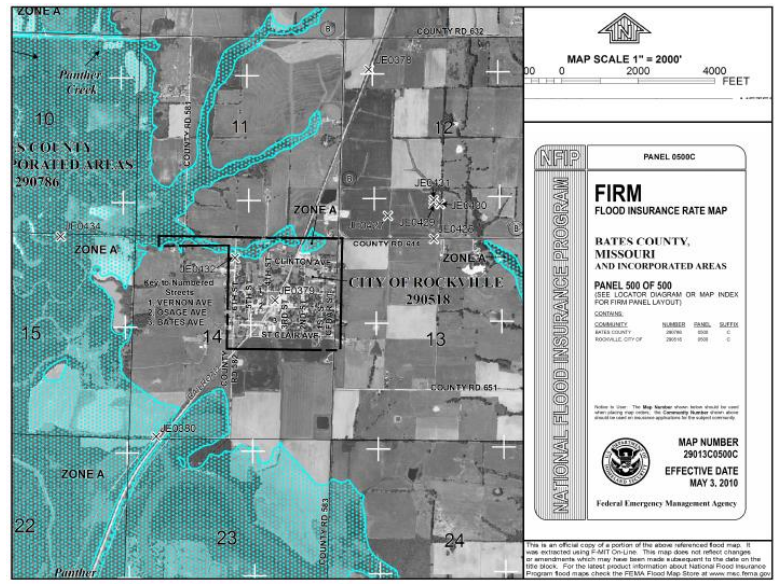
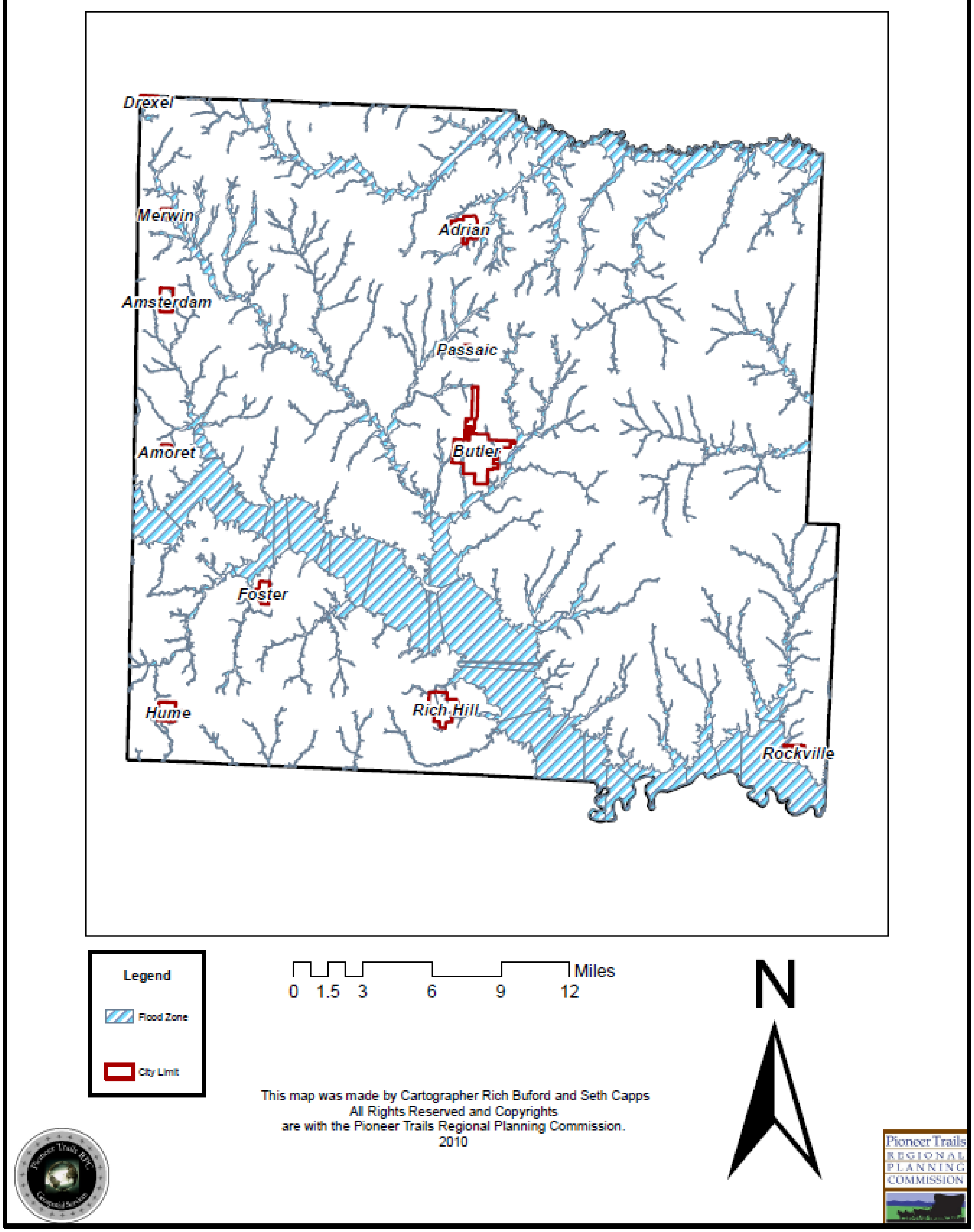
2010


ZONE A
Panther Creek
COUNTY RD 632
COUNTY RD 644
COUNTY RD 651
ZONE A
CITY OF ROCKVILLE
290518
CLINTON AVE
ST CLAIR AVE
Key to Numbered Streets
1 VERNON AVE
2 OSAGE AVE
3 BATES AVE
MAP SCALE 1" = 2000'
2000 4000
FEET
NFIP
PANEL 0500C
FIRM
FLOOD INSURANCE RATE MAP
BATES COUNTY, MISSOURI
AND INCORPORATED AREAS
PANEL 500 OF 500
MAP NUMBER
29013C0500C
EFFECTIVE DATE
MAY 3, 2010
Federal Emergency Management Agency
NATIONAL FLOOD INSURANCE PROGRAM

Bates County Flood Plain Map



Bates County has a total of 2 repetitive loss properties with a total of 4 losses within the County. No repetitive loss properties have been mitigated.

Bates County Repetitive Loss Properties:

Table 3.2.6-2&3

County Name	Community	Occupancy	Losses	Data Type	As of Date
Bates County	Butler	Single	2	Non-Mitigated	8/31/2009
Bates County	Butler	Single	3	Non-Mitigated	9/1/2009

Total Summary:

County Name	Community	Losses	Properties s	Data Type	As of Date
Bates County	Butler	4	2	Non-Mitigated	8/31/2009

Statement of Future Probable Severity

According to SEMA's Severity Ratings Table, the 1993 floods would qualify as critical. During the 1995 floods, some facilities were closed for 24 hours. Most other flood events had minimal impact on quality of life, no critical facilities or services were shut down for more than 24 hours, and property damage was less than 10%. Therefore, the probable severity of future floods could range from critical to negligible in the floodplain areas.

Statement of Future Probable Risk

Flooding causes widespread destruction disrupts businesses, and forces evacuation of 300,000 people in the United States annually. Direct flood losses are usually expressed in damage and death in a defined region. Indirect flood damage can include downtime for flooded industry and businesses, loss of production capability and income, disaster assistance and administration costs, costs due to lost power and communications, evacuation costs, and less tangible costs of psychological effects on flood victims.

The National Weather Service (NWS) is responsible for keeping records of major floods that have caused loss of life, major property damage, and major agricultural loss. Interpretation of flood-loss data is difficult, and estimates are not necessarily comparable due to differences in reporting in reporting flood losses, estimating personal vs. governmental outlays, and in adjusting dollar amounts. Because of these and other difficulties, flood damage data for most years is incomplete. However, the NWS reported $23,600,000 in property damage and $7,200,000 in crop damage caused by 47 floods in the state between 1994 and 2009. Equivalent damage information is frequently not available for loss incurred from the multitude of smaller flood events that do not prompt federal response. Damage caused by flood events is therefore much more costly than NWS statistics indicate.

Many deaths caused by flooding are attributed to motorists who attempt to cross-swollen stream courses in automobile and are swept away by floodwaters.

Low water bridges are particularly dangerous during flood events and periods of high water. Studies by FEMA show that 60 percent of flood fatalities occur in urban areas, 75% occur at night, and 49 % occur in cars. Motorists who underestimate the depth and velocity of floodwaters cause a high percentage of these. There have been no deaths in Bates County Due to flooding between the years of 1994 and 2009.

Statement of Next Disaster's Likely Adverse Impact on the Community

Unless the next flood to hit the county is of greater magnitude than the floods of 1993, 1995, or 2002, the likely impact will be limited.

Without mitigations measures:

Life:	Limited
Property:	Critical
Emotional:	Catastrophic
Financial:	Critical
Comments:	The above values assume conditions at the time of the 1993 floods.

With mitigation measures:

Life:	Negligible
Property:	Limited
Emotional:	Critical
Financial:	Limited
Comments:	Further mitigation measures should be directed at improving land use practices and elevating or redesigning vulnerable highways.

Statement of Next Disaster's Likely Adverse Impact by Jurisdiction

Nearly all of the jurisdictions in Bates County lie in the 100 year floodplain with the exception of Foster, Merwin and Passaic. Jurisdictions in the floodplain are most susceptible to the potential damage from a flooding event. Since the passage of the original plan in 2004, no significant changes concerning building development or population shifts have taken place. Additionally, there have been no buyouts through NFIP.

Recommendation:

- Analyze each repetitive flood property within Bats County and identify feasible mitigation options
- Recommend revisions to requirements for development within the floodplain, where appropriate and institute planning and zoning requirements
- Develop a better flood warning system.
- Enhance GIS floodplain data for Bates County
- Create storm water regulations
- Implement a Community Rating System
- Develop educational materials for community residents and officials regarding flood dangers in specific communities.

National Flood Insurance Program

The most important program aimed at identifying and reducing exposure to floods is the National Flood Insurance Program (NFIP). The NFIP was created in 1968 by the National Flood Insurance Act. The objectives of this act were to provide communities with the means to identify floodplain areas that have special flood hazards and to establish flood-risk zones in all such areas. To facilitate these goals in a timely fashion, Flood Hazard Boundary Maps (FHBM) were created using available data and approximate methods to identify areas within communities subject to inundation by the 100-year flood. If a community is interested in joining the program, or if it has been notified by FEMA that it has more than one Special Flood Hazard Area (SFHA), then it is classified in the Emergency Phase of the program, and a FHBM will be created.

Most communities join the Regular Phase of the Program, and a Flood Insurance Study (FIS) is preformed. The FIS is a detailed engineering study using hydrologic and hydraulic analyses to develop Base Flood Elevation (BFE) models. NFIP Flood Insurance Rate Maps (FIRM) is based on these models.

The NFIP makes federally subsidized flood insurance available to property owners located in communities participating in the flood program. Communities wanting to participate in the NFIP must establish and enforce minimum floodplain-management regulations in their special flood hazard areas. The National Flood Insurance Reform Act (NFIRA) of 1994 strengthened NFIP by providing mitigation insurance and establishing the Flood Mitigation Assistance grant program for State and community flood mitigation planning and mitigation projects.

FEMA rewards mitigation efforts by voluntary participation in the Community Rating System (CRS), which provides discounts ranging from 5 percent to 45 percent on flood insurance rates in local communities that comply with minimum standards for floodplain management. The discounts provide incentive for new flood protection activities that can help save lives and property in case of a flood. To participate in the CRS, a community must undertake some or all of 18 different activities to gain credit through a point system administered by the CRS. These activities are divided into categories of Public Information, Mapping and Regulations, Flood Damage Reduction, and Flood Preparedness. Specific activities are listed in the CRS Coordinators Manual. A community can earn extra credit points if the activities are coordinated through a comprehensive floodplain-management plan.

Population trends in Bates County indicate that the population is steadily increasing after sharp declines over the early half of the 20th century. Future exposure to flood hazards is likely to increase moderately over the next few decades. All communities, except Foster, Merwin and Hume have the floodplain lie within their boundaries affecting housing and commercial structures. There are three jurisdictions that participate in the National Flood Insurance Program:

Communities in NFIP Program

CID	Community Name	County	Initial NFIP Map Date	Initial FIRM Date	Most Recent Firm Panel Date
290749	Adrian	Bates	1/24/1975	8/19/1985	5/3/2010
290026	Butler	Bates	4/5/1974	9/4/1985	5/3/2010
290786	Bates County		4/19/1983	3/1/2001	5/3/2010

NFIP Policies in Bates County as of 3/10/13

Community	Policies In-Force	Insurance In-Force Whole	Written Premium In-Force
Bates County	15	$ 1,557,300	$ 8,961
Adrian	1	$ 28,000	$ 119
Butler	2	$ 440,000	$ 3,523

3.2.7 Levee Failure

Description

A levee is defined by the National Flood Insurance Program as “a man-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding.” The Bates County planning committee researched the National Levee Database maintained by the U.S. Army Corps of Engineers, the Missouri DNR, the Web, and local records to find information about levees existing in the planning area. The research revealed no records of levees in the planning area. While it is likely that levees exist, such as low-head agricultural levees, no records indicate that the breach or overtopping of these levees would impact property other than that of the levee owner. Damage to residential structure is unlikely. nonetheless, the planning committee determined that it was in the best interest of Bates County to include levees in the plan as a hazard that could cause damage.

Levee failure, according to FEMA, can occur by the following means:

Overtopping - When a large flood occurs, water can flow over a levee. The stress exerted by the flowing water can cause rapid erosion.

Piping - Levees are often built over old stream beds. Flood waters will follow these sub grade channels causing a levee to erode internally thereby allowing flood waters to rupture the levee structure.

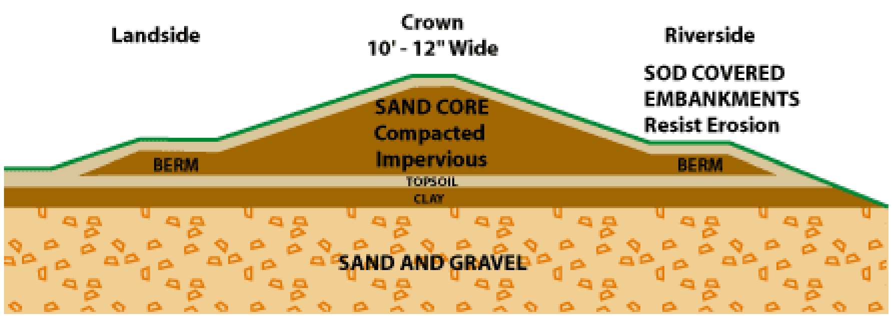
Seepage and Saturation - If flood waters sit up against a levee for a long period, the levee may become saturated and eventually collapse.

Erosion - Most levees are constructed of sand or soil which erodes easily under high velocity flood waters.

Structural Failures - Lack of regular maintenance is a key reason levees fail at gates, walls or closure sites.

Levees are generally built with three distinctive parts known as a landside, a crown, and a riverside. See figure below.

Figure 3.2.7-1



There is no single agency with responsibility for levee oversight. The US Army Corps of Engineers has specific and limited responsibilities for approximately 2,000 levees nationwide. Fortunately, Stockton Lake levee is the only levee and is Army Corps owned. "Construction of Stockton Dam began in October 1963, and the project was placed in operation in December 1969. The dam consists of an earth/rock embankment, concrete spillway, and the hydroelectric power plant. Water released through the power plant produces electric energy which is marketed by the Southwest Power Administration www.swpa.gov/generation.htm. Four large spillway gates can be used during flood release operations to supplement discharges made through the power plant. The design of the gated spillway prevents overtopping the dam and permits the controlled release of excess flood water." -U.S. Army Corps of Engineers (USACE)-
There are no Cedar County levees that are shown on the US Army Corps of Engineers National Levee Database interactive levee data map. Neither Kaysinger staff nor County staff has the capabilities of finding the small private or agricultural levees without some major extensive work and manpower. This is something that will need to be addressed in the next plan. There are no levee districts within the County either according to the County Clerk.
Souce:*http://nld.usace.army.mil/egis/f?p=471:32:4063545953670137:LOAD_SEARCH:NO:32*

Levees are usually engineered to withstand a flood with a computed risk of occurrence. Many levees in Missouri were largely constructed to protect agricultural land and are not built to design standards established to protect people and property.

Their presence can, in some cases, generate a false sense of security. If a larger flood occurs, then that structure will likely be overtopped. If during the overtopping the levee fails or is washed out, the water behind it can be released as a flash flood. Failed levees can create floods that are catastrophic to life and property in part because of the tremendous energy of the released water according to the State Hazard Mitigation Plan, 2010. **Federally authorized levees** are typically designed and built by the Corps in cooperation with a local sponsor then turned over to a local sponsor to operate and maintain. **Non-federal levees** are designed, built, and managed by a non-federal entity.

Measures of Probability and Severity

The planning committee determined that based on the lack of existing data on levees in Bates County that probability and severity of levee breach could not be determined. The planning committee will try to obtain additional information on levees for a more informed risk analysis for the next plan update.

3.2.8 Severe Winter Weather (Snow, Ice and Extreme Cold)

Like thunderstorms, severe winter weather events tend to occur over wide geographic areas, encompassing an entire county or a large group of counties. According to SEMA, severe winter weather events such as snow, ice storms and extreme cold can cause injuries, deaths and property damage in a variety of ways. Winter storms are considered deceptive killers because most deaths are not directly related to the storm. Causes of death range from traffic accidents during adverse driving conditions to heart attacks caused by overexertion while shoveling snow. Hypothermia or frostbite may be considered the most direct cause of death and injuries attributed to winter storms and/or severe cold. Economic costs are difficult to measure.

Heavy accumulations of ice can bring down trees, electric power lines and poles, telephone lines, and communications towers. Such power outages also create an increased risk of fire as residents seek use of alternative fuel sources (wood or kerosene for heat, fuel burning lanterns or candles for emergency lighting). Crops, trees, and livestock can be killed or injured due to deep snow, ice, or severe cold. Buildings and automobiles may be damaged from falling tree limbs, power lines, and poles. Local governments, homeowners, business owners, and power companies can be faced with spending millions of dollars for restoration of services, debris removal, and landfill hauling.

Historical Statistics

Since 1996, according to the NCDC, severe winter storms in Bates County have:

- occurred primarily between October through March;
- caused 0 deaths and 0 injuries;
- damaged property valued at $0 and damaged no crops

Table 3.2.8-1: Bates County Winter Storm events 1996-2013

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	12/11/2000	00:00	CST	Winter Storm		0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	01/28/2001	02:00	CST	Winter Storm		0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	02/09/2001	02:00	CST	Winter Storm		0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	01/02/2003	00:20	CST	Winter Storm		0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	02/23/2003	19:30	CST	Winter Storm		0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	12/10/2003	04:00	CST	Winter Storm		0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	01/25/2004	08:00	CST	Winter Storm		0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	01/12/2007	06:00	CST-6	Winter Storm		0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	03/20/2010	04:00	CST-6	Winter Storm		0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	01/19/2011	13:00	CST-6	Winter Storm		0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	02/21/2013	05:00	CST-6	Winter Storm		0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	02/25/2013	16:30	CST-6	Winter Storm		0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	03/23/2013	15:00	CST-6	Winter Storm		0	0	0.00K	0.00K
Totals:								0	0	0.00K	0.00K

Source: NOAA National Climatic Data Center

Since 1996, according to the NCDC, severe winter weather in Bates County has:

- occurred primarily between January through February;
- caused 0 deaths and 0 injuries;
- damaged property valued at $0 and damaged no crops

Table 3.5.8-2: Bates County Winter Weather Events 1996-2013

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	01/10/2006	06:00	CST	Winter Weather		0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	02/07/2010	12:00	CST-6	Winter Weather		0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	01/10/2011	00:00	CST-6	Winter Weather		0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	02/13/2012	02:00	CST-6	Winter Weather		0	0	0.00K	0.00K
Totals:								0	0	0.00K	0.00K

Source: NOAA National Climatic Data Center

Statement of Future Probably Severity

No deaths occurred in Bates County due to cold and ice storms. In 1997, a glaze/ice storm resulted in $582,000 in property damage. Two years later, in 1999, another ice storm caused $2,800,000 in additional damage. In 2007, Bates County was subjected to a subsequent ice storm which devastated surrounding areas, resulting in $200,000 in property damages. Of 21 regional events, only eleven directly impacted the county. However, those eleven (extreme cold, ice, and heavy snow) warrant ratings of critical for future probably severity.

Table 3.2.8-3: Bates County Ice Storm Events 1996-2013

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								0	0	582.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	12/21/1997	05:00	CST	Ice Storm		0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	11/08/2000	12:00	CST	Ice Storm		0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	01/30/2002	04:00	CST	Ice Storm		0	0	580.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	12/09/2007	01:00	CST-6	Ice Storm		0	0	2.00K	0.00K
Totals:								0	0	582.00K	0.00K

Excessive winter weather can prove devastating. Primary concerns include the potential loss of heat, power, telephone service, and a shortage of supplies if storm conditions continue for more then one day. Further, employees may be unable to get to work due to icy conditions, unplowed roadways, or facility damage.

Winter weather warnings are organized by stages of severity by the National Weather Service. These stages are shown below:

WINTER WEATHER ADVISORY:
Winter weather conditions are expected to cause significant inconveniences and may be hazardous. If caution is exercised, these situations should not become life-threatening.
The greatest hazard is often to motorists.

WINTER STORM WATCH:
Severe winter conditions, such as heavy snow and/or ice, are possible within the next day or two.

WINTER STORM WARNING:
Severe winter conditions have begun or are about to begin in your area.

BLIZZARD WARNING:
Snow and strong winds will combine to produce a blinding snow (near zero visibility), deep drifts, and life-threatening wind chill. Seek refuge immediately.

FROST/FREEZE WARNING:

Below freezing temperatures are expected and may cause significant damage to plants, crops, or fruit trees. In areas unaccustomed to freezing temperatures, people who have homes without heat need to take added precautions.

In addition to snow, the effects of temperature and wind chill increase the severity of a winter storm. Wind blowing across exposed skin drives down the skin temperature and eventually the internal body temperature. The faster the wind blows, the faster the heat is carried away, the greater the heat loss and the colder it feels. Exposure to low wind chills can be life threatening to humans and animals.

A new Wind Chill Temperature Index took effect on November 1, 2001, replacing the original wind chill index that was devised in 1945. To determine the Wind Chill Temperature Index from the table below, locate the air temperature along the top of the table and the wind speed along the left side. The point where the two intersect is the wind chill temperature.

Figure 3.2.8-1

Wind Chill Chart

Temperature (°F)

Wind (mph) \ Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes | 10 minutes | 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph) *Effective 11/01/01*

Based upon the county's event history and the risk indicators discussed above, extreme cold events are likely the most dangerous for Bates County. The future probable severity for each category of winter event is shown below.

Winter event:	**Probable severity:**
Heavy snow:	limited
Ice event:	limited
Extreme cold:	critical
Blizzard:	critical

Statement of Probable Risk

Overall, there is a highly likely risk of impacts due to winter weather, based upon the county's history, snowfall summary and number of events by month of occurrence. These events are most likely to affect all jurisdictions which exist within the county due to their regional nature. History shows that snow events of at least three inches are highly likely. Ice events are likely. Periods of extremely cold temperature are also possible. Therefore, the risks for each type of severe winter weather are shown below.

The probable risk for combined winter weather events is calculated by dividing the number of events by the number of years, multiplying by 100 to crate a risk percentage. 22 winter weather events occurred in Bates County between 1996 and 2013, resulting in a probable risk percentage of 123.5% of a winter storm event in any given year. (22/17=1.294x100=129.4%)

Winter event:	**Probable risk:**
Heavy snow	likely
Ice event	highly likely
Extreme Cold	highly likely
Blizzard	possible

Statement of Next Disaster's Likely Adverse Impact on the Community

Based on recent history, the probably severity of future Bates County winter storm events is shown below:

Without mitigation measures:

Life:	catastrophic
Property:	critical
Emotional:	critical
Financial:	limited
Comments:	none

With mitigation measure:

Life:	negligible
Property:	limited
Emotional:	limited
Financial:	limited
Comments:	A public awareness campaign regarding winter safety tips could help decrease the impact of winter storm events.

Statement of Next Disaster's Likely Adverse Impact by Jurisdiction

All jurisdictions within the county are equally susceptible to damage stemming from severe winter weather, particularly snow and ice events. In the event of a severe winter storm, 50-100% of any given jurisdiction may be at risk for damage.

Since the passage of the original plan in 2004, no significant changes concerning building development or population shifts have taken place. In the case of extreme cold temperatures, special consideration must be given to the potential impact upon the young and the elderly populations.

Recommendation:

- Work with MoDOT to monitor pavement and weather conditions so that they can be synchronized with snow removal machinery for more accurate, efficient, and timely snow removal.
- Maintain and expand distribution methods of severe weather alerts to the general public as the county's needs change and new technology becomes available.
- Continue to provide emergency preparedness information and resources related to severe winter weather to the public through active education and outreach programs.

3.2.9 Drought

The impacts of drought are not limited to agriculture, but can extend to encompass the whole economy. Impacts can adversely affect a small town's water supply, the corner grocery store, commodity markets and a big city's tourism. According to the National Drought Mitigation Center, drought costs the U.S. economy an average of $7-9 billion a year. Losses from the Great Drought of 1988-89 were assessed at $39 billion. More recently, the University of Missouri estimated the drought losses of 2002 and 2003 farm production years. Economic impact to the Missouri economy due to agricultural losses was estimated at $461 million for 2002 and $575 million in 2003.

Drought's impact on society results from the interplay between a natural event (less precipitation than expected resulting from natural climatic variability) and the demand development places on groundwater reservoirs. A drought situation often is exacerbated by development practices that decrease the percolation of surface water into groundwater reservoirs. Recent droughts in both developing and developed countries and the resulting economic and environmental impacts have underscored society's vulnerability to this "natural" hazard. Like thunderstorms and severe winter weather, drought events tend to be regional in nature, encompassing all jurisdictions within the county.

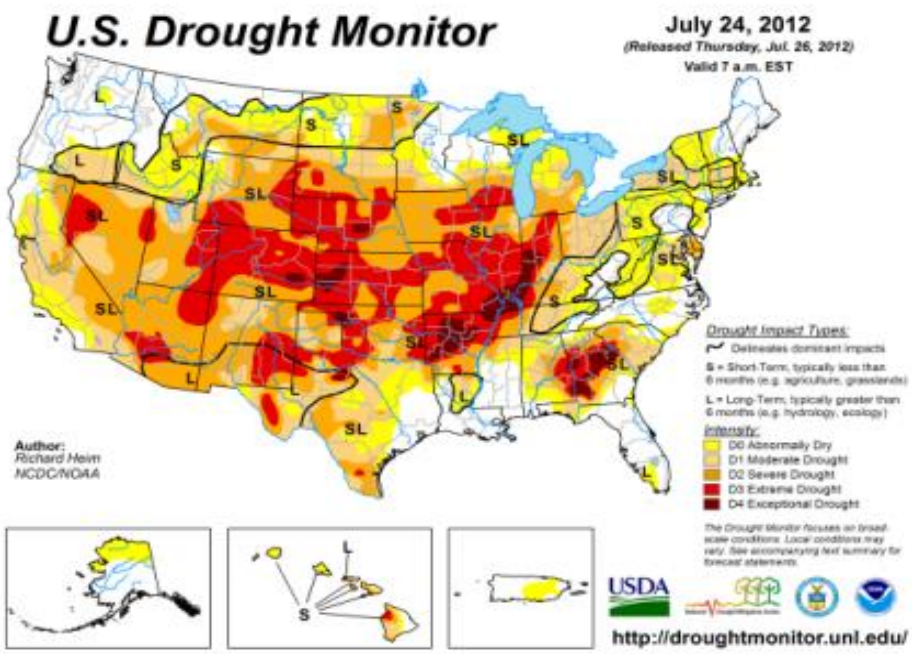
The dictionary definition of drought is a period of prolonged dryness. The Missouri Drought Response Plan commonly distinguishes between five categories of drought:

- ***Agricultural Drought*:** defined by soil moisture deficiencies;
- ***Hydrological Drought*:** defined by declining surface water and groundwater supplies;
- ***Meteorological Drought*:** defined by precipitation deficiencies.
- ***Hydrological Drought and Land Use:*** defined as a meteorological drought in one area that has hydrological impacts in another area; and
- ***Socioeconomic Drought:*** defined as droughts that impact supply and demand of some economic commodity.

Agricultural and meteorological droughts are the most likely to wreak economic losses in Bates County.

The most commonly used indicator of drought and drought severity is the Palmer Drought Severity Index (PDSI) published jointly by NOAA and the United States Department of Agriculture. The PDSI measures the departure of water supply (in terms of precipitation and stored soil moisture) from demand (the amount of water required to recharge soil and keep rivers, lakes, and reservoirs at normal levels). The result is a scale from +4 to -4, ranging from an extremely moist spell to extreme drought. By relating the PDSI number to a regional index, one can compile data that reflects long-term wet or dry tendencies. Regional indicators such as the PSDI are limited in that they respond slowly to deteriorating conditions. On the other hand, observing surface conditions and groundwater measurements may provide only a snapshot of a very small area. Therefore, the use of a variety of drought indicators is essential for effective assessment of drought conditions, with the PSDI being the primary drought severity indicator. The PDSI regions and severity scale are shown in the figure below.

Figure 3.2.9-1



Historical Statistics

The counties of west-central Missouri have been subject to severe droughts over the past 10 years. In Missouri, the 1999-2000 droughts began in July of 1999 and developed rapidly into a widespread drought just three months later. The entire state was placed under a Phase I Drought Advisory level by DNR and the Governor declared an Agricultural Emergency.

In October, the U.S. Agriculture Secretary declared a federal disaster, making low-interest loans available to farmers in Missouri and neighboring states and altering the status of northern Missouri to Phase II Drought Advisory level. By May of 2000, twenty-seven northern Missouri counties were upgraded to Phase III Drought Advisory level (Conservation). Increased precipitation allowed for a return to near-normal conditions by July 2000 for northwest Missouri.

In Missouri, the 1999-2000 droughts began in July of 1999 and developed rapidly into a widespread drought just three months later. The entire state was placed under a Phase 1 Drought Advisory level by DNR and the Governor declared an Agricultural Emergency. In October the U.S. Agriculture Secretary declared a federal disaster, making low-interest loans available to farmers in Missouri and neighboring states. By June of 2000, the entire state was under a Phase 2 Alert for drought conditions. Drought conditions put Bates County within the state's Phase 2 Alert area for June, July, and August of 2000. Currently, according to the PSDI map, county conditions indicate moderate to severe drought conditions as of March of 2013.

Figure 3.2.9-2

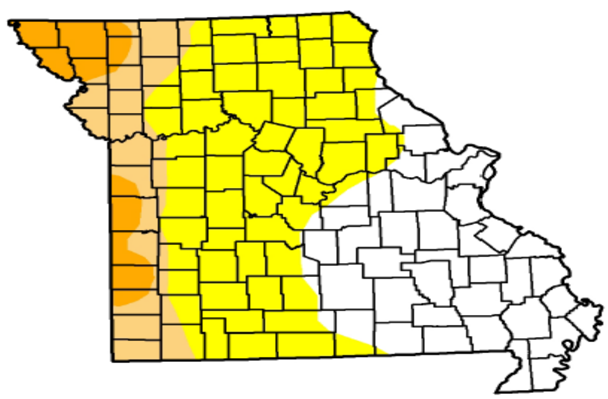
U.S. Drought Monitor

March 19, 2013
Valid 7 a.m. EST

Missouri

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	34.67	65.33	19.61	6.85	0.00	0.00
Last Week (03/12/2013 map)	34.67	65.33	19.58	6.85	0.00	0.00
3 Months Ago (12/18/2012 map)	0.00	100.00	94.68	29.09	0.00	0.00
Start of Calendar Year (01/01/2013 map)	0.00	100.00	94.68	40.42	0.00	0.00
Start of Water Year (09/25/2012 map)	0.00	100.00	100.00	84.50	16.90	0.00
One Year Ago (03/13/2012 map)	95.13	4.87	0.00	0.00	0.00	0.00



Intensity:
- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://droughtmonitor.unl.edu

USDA

Released Thursday, March 21, 2013
National Drought Mitigation Center,

According to the NOAA National Climatic Data Center Bates County has experienced 8 drought events reported between 01/01/1996 and 07/31/2013 (6422 days)

Table 3.2.9-1: Bates County Drought Occurrences: 1996 – 2013

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	04/01/2000	00:00	CST	Drought		0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	07/01/2012	00:00	CST-6	Drought		0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	08/01/2012	00:00	CST-6	Drought		0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	09/01/2012	00:00	CST-6	Drought		0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	11/01/2012	00:00	CST-6	Drought		0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	01/01/2013	00:00	CST-6	Drought		0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	02/01/2013	00:00	CST-6	Drought		0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	03/01/2013	00:00	CST-6	Drought		0	0	0.00K	0.00K
Totals:								0	0	0.00K	0.00K

Source: NOAA National Climatic Data Center

Statement of Future Probable Severity

Crops are the first to show the impact of drought in Bates County. As drought increases, livestock water supplies become scarce and, finally, deep wells begin to fail. When good water becomes a scarce commodity and people must compete for the available supply, the importance of drought severity and duration increases dramatically.

According to the Climate Prediction Center, the average annual precipitation for the St. Louis regional area is 39 inches and the state rates Bates County for moderate drought susceptibility. Precipitation related impacts on time scales ranging from a few days to a few months can include effects on wildfire danger, non-irrigated agriculture, topsoil moisture, pasture conditions, and unregulated stream flows. Lack of precipitation over a period of several months or years adversely affects reservoir stores, irrigated agriculture, groundwater levels, and well water depth. Groundwater resources in the county are adequate to meet domestic and municipal water needs, but due to required well depths, irrigation wells are very expensive.

The DNR's drought response system has four phases. Phase 1 begins when water monitoring analysis indicates anticipated drought consequences. The situation moves into Phase 2 when the PDSI reads -1.0 to -2.0. At the same time, stream flow, reservoir levels and groundwater levels are below normal over a period of several months. Phase 3 is based on a PDSI between -2.0 to -4.0 and various other factors. Phase 4, or activation of drought emergency procedures, generally begins when the PSDI exceeds -4. Therefore, using the DNR's drought response system, the probable severity levels of a future drought could be:

Phase:	**Probable Severity:**
Phase 1, Advisory:	negligible
Phase 2, Alert:	limited
Phase 3, Conservation:	critical
Phase 4, Emergency:	critical

Statement of Probable Risk

Overall, it is possible for Bates County to experience drought in any given year. Therefore, the risk of experiencing various levels of drought is shown below.

Phase:	**Probable Risk:**
Phase 1, Advisory:	likely
Phase 2, Alert:	likely
Phase 3, Conservation:	possible
Phase 4, Emergency:	possible

Statement of Next Disaster's Likely Adverse Impact on the Community

The probable risk is calculated by dividing the number of events by the number of years, multiplying by 100 to create a risk percentage. 8 events occurred in Bates County between 1996 and 2013, resulting in a probable risk percentage of 47% of a drought event occurring in any single year. (8/17=0.470x100=47%)

The likely adverse impact of future Bates County drought events is shown below.

Without mitigation measures*:*

Life:	negligible
Property:	limited (crop damage)
Emotional:	critical
Financial:	critical
Comments:	none.

With mitigation measures*:*

Life:	negligible
Property:	negligible (crop damage)
Emotional:	limited
Financial:	limited

Comments: Educating farmers on the latest techniques for soil moisture maintenance, for example, could help stem the emotional impacts by reducing drought-related financial losses. Increased consolidation of small water structures also should be investigated.

Statement of Next Disaster's Likely Adverse Impact by Jurisdiction

All jurisdictions within the county are equally susceptible to damage stemming from drought, particularly in phases 3 and 4. In the event of a severe drought, 100% of any given jurisdiction may be at risk for damage, which would most likely occur in crop damages. Since the passage of the original plan in 2004, local agricultural producers have been encouraged to research and implement steps which reduce water usage in the event of a drought.

Recommendation:

- To discern and promote a set of best practices for drought-resistant farming;
- Seek a cooperative effort with the home owners and contractors to promote best practices in storm water runoff and permeable surfaces.
- Initiate a cooperative effort to reduce the number of small water structures

3.2.10 Extreme Heat

The dangers associated with extreme temperatures are often overlooked by the general public. According to NOAA, heat is the number two killer among natural hazards. Only the cold temperatures of winter take a greater toll. In contrast to the visible, destructive, and violent nature of floods, hurricanes, and tornadoes, a heat wave is a silent killer.

Heat kills by overloading the human body's capacity to cool itself. In the disastrous heat wave of 1980, more than 1,250 people died nationwide. In a normal year, about 175 Americans succumb to the bodily stresses of summer heat. As with previously identified hazards, heat waves tend to be regional in nature, placing all jurisdictions within the county at equal risk.

Air temperature is not the only factor to consider when assessing the likely effects of a heat wave. High humidity, which often accompanies heat in Missouri, can increase the harmful effects. Relative humidity must also be considered, along with exposure, wind, and activity. The Heat Index devised by the NWS combines air temperature and relative humidity. Also known as the apparent temperature, the Heat Index is a measure of how hot it really feels. For example, if the air temperature is 102 degrees and the relative humidity is 55% then it feels like 130 degrees; 28 degrees hotter than the actual ambient temperature. To find the Heat Index from Figure 2.10, find the air temperature along the left side of the table and the relative humidity along the top. Where the two intersect is the Heat Index for any given time of day.

Table 3.2.10-1

Relative Humidity (%)	Air Temperature (°F)										
	70	75	80	85	90	95	100	105	110	115	120
	Apparent Temperature										
0	64	69	73	78	83	87	91	95	99	103	107
10	65	70	75	80	85	90	95	100	105	111	116
20	66	72	77	82	87	93	99	105	112	120	130
30	67	73	78	84	90	96	104	113	123	135	148
40	68	74	79	86	93	101	110	123	137	151	
50	69	75	81	88	96	107	120	135	150		
60	70	76	82	90	100	114	132	149			
70	70	77	85	93	106	124	144				
80	71	78	86	97	113	136	157				
90	71	79	88	102	122	150	170				
100	72	80	91	108	133	166					

Apparent Temp. (°F)	Danger Category	Injury Threat
Below 80	None	Little or no danger under normal circumstances
80–90	Caution	Fatigue possible if exposure is prolonged and there is physical activity
91–105	Extreme Caution	Heat cramps and heat exhaustion possible if exposure is prolonged and there is physical activity
106–130	Danger	Heat cramps or exhaustion likely, heat stroke possible if exposure is prolonged and there is physical activity
Above 130	Extreme Danger	Heat stroke imminent!

Note: Add 10°F when protective clothing is worn and add 10°F when in direct sunlight.
Source: U.S. Fire Administration, FA-114, *Emergency Incident Rehabilitation*, July 1992.

In addition, the National Weather Service (NWS) recently has devised a method to warn of advancing heat waves up to seven days in advance. The new Mean Heat Index is a measure of how hot the temperatures actually feel to a person over the course of a full 24 hours. It differs from the traditional Heat Index in that it is an average of the Heat Index from the hottest and coldest times of each day.

Historical Statistics

Fourteen heat events have directly impacted Bates County between 1994 and 2010. The most significant heat waves occurred in 1994 and 1999. These heat waves resulted in the following impacts:

- 49 deaths;

- 55 injuries; and
- crop damage valued at $50,000

Heat events affecting Bates County from 1996 to 2013 are noted in the table below.

Table 3.2.10-2: Bates County Heat Events: 1996-2013

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	08/06/2007	12:00	CST-6	Excessive Heat		0	0	0.00K	0.00K
BATES (ZONE)	BATES (ZONE)	MO	07/18/2012	11:00	CST-6	Excessive Heat		0	0	0.00K	0.00K
Totals:								0	0	0.00K	0.00K

Source: NOAA National Climatic Data Center

Statement of Future Probable Severity

The levels of severity, by Heat Index apparent temperature, are:

• **Extreme Danger** (heat stroke or sunstroke highly likely at 130ºF or higher);

• **Danger** (sunstroke, muscle cramps, and/or heat exhaustion likely at 105ºF to 129ºF);

• **Extreme Caution** (sunstroke, muscle cramps, and/or heat exhaustion possible at 90ºF to 104ºF); and

• **Caution** (fatigue possible at less than 90ºF).

The NWS uses these levels in their weather warning messages to alert the public to the dangers of exposure to extended periods of heat, especially when high humidity acts along with the high temperatures to reduce the body's ability to cool itself.

Although most heat-related deaths occur in cities, residents of rural areas are at risk due to factors that can include age, outdoor activities, or lack of air conditioning. While heat-related illness and death can occur due to exposure to intense heat in just one afternoon, heat stress on the body has a cumulative effect. The persistence of a heat wave increases the danger.
Excessive heat can lead to illnesses and other stresses on people with prolonged exposure to these conditions.

In addition to the human toll, the Midwestern Climate Center notes other possible impacts such as electrical infrastructure damage and failure, highway damage, crop damage, water shortages, livestock deaths, fish kills, and lost productivity among outdoor-oriented businesses. The future probable severity for Bates County is shown below according to severity levels.

Index: Probable Severity:

Heat Index of 130ºF or higher:	catastrophic
Heat Index of 105ºF to 129ºF:	critical
Heat Index of 90ºF to 104ºF:	limited
Heat Index of less than 90ºF:	negligible

Statement of Probable Risk:

In Bates County, days with temperatures of 90 degrees and above generally occur during the month of July. A review of the data for 1996-2013 shows the county could experience a brief heat wave every year. However, on average, only three instances could qualify as heat waves, dependent upon the relative humidity during those times. Based on NWS historical records, an actual extended heat wave may occur only once or twice per decade. The county's risk of experiencing heat waves is shown below according to Heat Index severity levels.

Index: Probable Severity:

Extreme Danger:	unlikely
Danger:	possible
Extreme Caution:	likely
Caution:	highly likely

Statement of Next Disaster's Likely Adverse Impact on the Community

The adverse impacts of future heat waves affecting Bates County at the "Extreme Caution" level are shown below.

***Without mitigation measures**:*

Life:	limited
Property:	limited
Emotional:	limited
Financial:	limited
Comments:	None.

With mitigation measures:

Life:	negligible
Property:	negligible
Emotional:	negligible
Financial:	limited
Comments:	None

Statement of Next Disaster's Likely Adverse Impact by Jurisdiction

All jurisdictions within the county are equally susceptible to damage stemming from a heat wave as these types of events tend to be regional in nature. In the event of a heat wave, 25% of any given jurisdiction may be at risk for damage. Since the passage of the original plan in 2004, no significant changes concerning building development or population shifts have taken place which may impact a heat wave. Bates County does include mitigation strategies which include the opening of cooling centers in case of a severe heat event. As with extreme cold temperatures, special consideration must be given to the potential impact upon the young and the elderly populations.

Recommendation

- That the County initiates a mitigation activity to provide cooling centers or portable fans for the elderly and those populations without air conditioning during sustained high temperatures.
- Initiate an education program to teach outdoor workers, students and the general public on the dangers of extended exposure to high temperatures and simple measures to avoid harmful consequences.

3.2.11 Earthquakes

According to the widely accepted plate tectonic theory, the earth's outermost layer, the lithosphere, is a solid and brittle material. This layer consists of several large and fairly stable slabs of rigid rock called plates. These plates are in almost continuous motion relative to each other. This motion causes stresses to accumulate within the rocks resulting in deformation. When the amount of stress exceeds the strength of the rocks, these rocks rupture and relative motion takes place along both sides of the rupture zone. This rupture zone is called a fault. If the motion or slippage along the fault zone happens abruptly, an earthquake will be generated. Thus earthquakes result from a sudden release of stress accumulated within the rocks over some period of time. The rupture and slippage processes generate seismic waves that radiate from the fault surface in all directions. If the energy of the seismic waves is high enough, people and structures along the earth surface will be affected.

The focus or hypocenter of an earthquake is the point within the earth where the initial rupture of the rock occurs and where the seismic waves from this point are first released.

The majority of earthquakes in the central United States have shallow focal depths, generally 15 kilometers or less. Most of these earthquakes occur within the New Madrid Seismic Zone (NMSZ) (see next section). Almost all earthquake activity of the NMSZ occurs along ancient faults that are buried below the surface (from 0 to about 2 km) by thick alluvial sediments of the Mississippi and other rivers in the area. The epicenter of an earthquake is the point on the ground surface directly above the focus.

Most earthquakes such as those occurring in areas such as San Andreas Fault, Alaska, Japan, and Andes occur along the plate boundaries. In some cases, earthquake zones develop within the plate itself resulting in intraplate seismicity. The plate tectonics theory does not as easily explain this type of seismicity (Bolt, 1993). Such intraplate earthquakes must arise from a more localized system of forces perhaps associated with structural complexities from very ancient geological conditions or from variation of strength of the lithosphere. The New Madrid Seismic Zone is by far the most important example of intraplate seismicity in North America.

The New Madrid Fault System (NMFS) extends 120 miles southward from the area if Charleston, Missouri, and Cairo, Illinois, through New Madrid and Caruthersville, following Interstate 55 to Blytheville and on down to Marked Tree, Arkansas. It crosses five state lines and cuts across the Mississippi River in three places and the Ohio River in two places.

The fault is active, averaging more than 200 measured events per year (1.0 or more on the Richter scale), about 20 per month. Tremors large enough to be felt (2.5 – 3.0 on the Richter scale) are noted annually. Every 18 months the fault releases a shock of 4.0 or more, capable of local minor damage. Magnitudes of 5.0 or greater, occurring about once per decade, can do significant damage and be felt in several states.

The highest earthquake risk in the United States, outside the west coast, is along the NMFS. Damaging tremblers are not as frequent as in California, but when they do occur, the destruction covers over more than 20 times the area because of underlying geology.

A damaging earthquake in this area, 6.0, reoccurs about every 80 years (the last one in 1895). In 2002, the U.S.G.S. released new earthquake probabilities for the NMSZ. For a magnitude 6.0 – 7.5 or greater earthquake, there now is estimated to be a 25 – 40% chance in 50 years. The results would be serious damage to schools and masonry buildings from Memphis to St. Louis.

The earthquake risk to Bates County is dominated by its proximity to the New Madrid Fault system. This fault system generates an annual rate of about 200 earthquakes per year. Even though Bates County is a considerable distance from the epicenters of the quakes on this fault system, there is a high probability that residents of the county would feel the effects of a major magnitude earthquake even from so far away.

The Nemaha Ridge also represents a significant earthquake threat to Bates County as well.

Located around 100 miles from the County border, the Nemaha uplift is a buried mountain range that trends northeast and extends from Omaha, NE to Oklahoma City, OK. Formed around 300 million years ago, the structure separates the Salina and Sedgwick basins from the Forest City and Cherokee basins of eastern Kansas The ridge is a high-angle, reverse fault. A reverse fault is where the hanging wall is pushed up relative to the foot wall.

The Nemaha Ridge is bounded by several active fault zones. The largest of these faults is the Humboldt fault zone. This fault is a strike-slip fault that forms the eastern boundary of the Nemaha Ridge, closest to Bates County, lying east of Manhattan, KS and west of Wamego, KS. The probability of an earthquake at the Humboldt Fault below a magnitude of 6.0 is once every 1,800 years and above 6.0 once every 10,000 years. The last rupture in the area occurred in Kansas City, KS in 1999 with a 3.0 magnitude earthquake.

Figure 3.2.11-1

During the process of fault rupture, energy radiates from the source area in the form of seismic waves. These waves travel in all directions and as they do, they cause the ground to vibrate or shake. In general, the amount of energy in these waves increases with an increase of the energy of the earthquake. Thus the severity of the ground motion is a function of the amount of energy in the seismic waves. Due to the fact that earth material is not perfectly elastic, energy in the seismic waves is absorbed (attenuated) as it travels through the earth. This explains the decrease in the amount of ground motion as the distance between the observation point and the causative fault or epicenter increases. Depending on the epicenter distance, faulting process and the type of material the waves travel through, the ground vibrates at a wide spectrum of frequencies. In general, the seismic waves range in frequency from less than 0.01 Hz to more than 50 Hz.

Earthquake motion and damage is the result of three basic types of elastic waves. Two of these waves propagate within the body of the earth, and are called body waves. The first of these body waves are called the primary or P waves. P waves, also called compressional or longitudinal waves, have a motion similar to that of sound wave in that, as they spread out, they alternately push (compress) and pull (dilate) the earth material. These waves are able to travel through both solid rock and liquid material. The second of the body waves are the shear waves, also called secondary or S waves. As S waves propagate, they shear the rock sideways at right angles to the direction of travel. S waves cannot propagate in the liquid parts of the earth, such as ocean or outer core.

The actual speed of P and S waves depends on the density and elastic properties of the rocks and soil through which they pass. In most earthquakes, the P waves are felt first. The effect is similar to a sonic boom that bumps and rattles windows (Bolt, 1993). The S waves arrive some seconds later, moving the ground up and down and side-to-side. The vertical and horizontal shaking of the ground by the S waves is the primary cause of structural damage.

The third general type of seismic waves is called surface waves. As their name indicates, these waves have their motion restricted to near the surface of the earth. Earthquakes usually generate two types of surface waves. The first type is called Love waves. The motion of Love waves is essentially the same as that of S waves that have no vertical displacement; they move the ground from side to side in a horizontal plane but at right angles to the direction of propagation. The horizontal shaking of Love wave is particularly damaging to the foundations of structures. The second type of surface waves is known as the Raleigh waves. These waves cause the ground to move in both vertically and horizontally in a vertical plane parallel to the direction in which the wave is traveling. Surface waves travel more slowly than body waves and therefore arrive at a later time. Of the two surface waves, Love waves generally travel faster than Raleigh waves.

Ground Failure and Liquefaction

In areas where ground failure might occur, seismic intensity values may increase by one or two levels. Areas of likely ground failure, such as liquefaction and slope instability, are common in Bates County. Liquefaction occurs primarily in saturated, loose, and fine to medium-grained unconsolidated sediments in areas where the ground water table is 50 feet or less below the ground surface.

When these sediments are shaken, such as during an earthquake, a sudden increase in pore water pressure causes the soils to lose strength and behave as a liquid. Sand boils, sand blows or "sand volcanoes" are a common result. Liquefaction-related effects include loss of bearing strength, ground oscillations, lateral spreading, and flow-failures or slumping. Ground failure caused by liquefaction is expected to cause major earthquake damage throughout the embayment region. Recent research conducted by the USGS and other institutions indicates that the 1811-1812 New Madrid earthquake series caused widespread ground failure and liquefaction throughout the region. Evidence of old liquefaction features indicates that several such events had taken place in the past.

A secondary hazard of earthquakes in cities is fire, which may be more devastating than the ground movement. Disruption of electric power lines and broken gas lines can start fires that are difficult to control because firefighting equipment may be damaged.

At the same time, water lines also are broken, leaving no means to fight the fire effectively. Blocked and damaged roads often hamper access to fires. Terrible fires have accompanied earthquakes in Japan and the United States. In the great 1906 San Francisco earthquake, sometimes referred to as the "San Francisco fire," about 80 percent of the damage was due to fire rather than simple building failure. Installing numerous valves in all water and fuel pipeline systems helps to combat these problems.

Historical Statistics

The New Madrid Seismic Zone, located in the northern part of the Mississippi Embayment, is one of the most seismically active regions of eastern North America. The 1811 - 1812 series of earthquakes, commonly known as the New Madrid earthquakes, produced damaging intensities over areas far greater than any historical earthquake in the conterminous United States. These and other historical earthquakes, as well as recent seismic activity, indicate that the New Madrid seismic zone has high potential for generating damaging earthquakes. Considering the isoseismic map for the 1811 - 1812 earthquake sequence, a conclusion is easily drawn that with the current distribution of population and infrastructure within the region, a repetition of the sequence similar to that in 1811-1812 would likely cause widespread destruction of property and loss of life.

Earthquake activity in the New Madrid seismic zone is considered to be a "high-risk, low-probability" phenomenon. The high risk in this region is associated with three main phenomena: (1) the potential for a future, large-magnitude earthquake, (2) the efficient transmission of seismic energy in the frequency range that is associated with structural damage, and (3) the population and infrastructure presently exist in the anticipated damage area. During the winter of 1811-12, a sequence of the three largest earthquakes in the history of this region occurred. The three main shocks, which occurred on December 16, 1811, January 23, 1812, and February 7, 1812, had epicenter Modified Mercalli intensities of XI, X-XI and XI-XII and estimated body-wave magnitudes (m_b) of 7.2, 7.1, and 7.4 and estimated surface-wave magnitudes (M_s) of 8.5, 8.4, and 8.8, respectively.

Since 1812, only two large earthquakes of surface-wave magnitude greater than 6.0 have occurred in the central United States, both in the New Madrid Seismic Zone.
The first earthquake, which struck on January 4, 1843, was centered in Arkansas at the extreme southern end of the Arkansas branch (near Marked Tree). It had a surface-wave magnitude of 6.3, and an area of Modified Mercalli intensity of VI or greater that encompassed about 60,000 square miles. The earthquake caused structural damage in Memphis, southwest Tennessee, northeast Arkansas, and the extreme northwest corner of Mississippi. The second large historic earthquake occurred near Charleston, Missouri, at the northern end of the New Madrid Seismic Zone in 1812. This earthquake had a surface-wave magnitude of 6.7 (Nuttli, 1990). Arkansas, Illinois, Missouri, and Tennessee are the most historically active states east of the Rocky Mountains.

The active portion of the New Madrid Seismic Zone is part of a larger complex of faults, the greater number of which extend in a northeasterly direction from the active zone and are exposed to the north of the Mississippi Embayment.
Others extend in a northwest-southeast direction across southern Missouri and Illinois. Major faults of this system extend to the southwest from Caruthersville to Marked Tree, Arkansas. Some of these faults appear to be completely inactive, while others are sites of minor activity. The most widely accepted hypothesis for the generation of earthquakes in the New Madrid region is that they are responses to plate tectonic forces acting upon previously existing zones of weakness, which are favorably oriented with respect to the regional stress field.

Statement of Future Probable Severity

The possibility of a great earthquake occurring soon in the New Madrid seismic zone is small. Scientists believe that catastrophic events like those of the 1811-12 happen in the New Madrid region every 550-1200 years. This means there is roughly a 0.3-1.0% probability of an event greater than magnitude 8.0 within the next 15 years, and a 2.7-4.0% probability within 50 years. Even though the probabilities are small, there is no reason to be complacent, for there have been other damaging earthquakes in the region since 1811 and 1812.

A major earthquake, magnitude 7.0 or greater, occurs every 254-500 years and has a probability of five to nine percent within the next fifteen years, and a nineteen to twenty nine percent within the next fifty years. An earthquake of this size would be felt throughout much of the central and eastern United States. Damage could amount to several billion dollars.

A damaging earthquake in this area, magnitude 6.0 or greater, happens every seventy to ninety years and has a probability of 40- 63% within the next fifteen years, and 86-97% within the next fifty years. An earthquake of this size would cause damage to older structures, especially those of masonry construction and mobile homes.

Earthquakes of 5.0 or less are also possible in many other parts of the central and eastern U.S., including Missouri. The following table lists the recurrence interval for different magnitude earthquakes in the NMSZ.

Recently the USGS published the following findings:

Scientists from the U.S. Geological Survey (USGS) scientists and the Center for Earthquake Research and Information at the University of Memphis have updated their expectations for earthquakes in the New Madrid Seismic Zone. The new forecasts estimate a 7 to 10 percent chance, in the next 50 years, of a repeat of a major earthquake like those that occurred in 1811-1812, which likely had magnitudes of between 7.5 and 8.0.

There is a 25 to 40 percent chance, in a 50-year time span, of a magnitude 6.0 and greater earthquake.

The earthquake probabilities have changed considerably since the most commonly cited forecast published in 1985. The new probabilities show an increased chance of larger (7.5-8.0 magnitude) earthquakes and a lesser chance of magnitude 6.0 and greater earthquakes. Meanwhile, estimates of the hazard, or potential for damage caused by shaking, have changed much less. A fact sheet with the new information is available on the web at: http://pubs.usgs.gov/fs/fs-131-02/.
"More than fifteen years of research has given us the information to allow us to update our forecasts. But even though the chances of a mid-sized earthquake are reduced, the chances of a devastating earthquake in the region have risen," said USGS scientist Eugene Schweig. "Given this new information, people should absolutely not drop their guard. The threat of an earthquake to Mid-America is still very real."

The New Madrid seismic zone is an area of frequent small earthquakes that stretches along the lower Mississippi Valley from just west of Memphis, Tennessee into southern Illinois. It also was the location of a sequence of three or four major earthquakes in 1811 and 1812.

Major earthquakes in the range of magnitude 7.5 to 8.0 are capable of causing widespread damage over a large region. Magnitude 6.0 earthquakes can cause serious damage in areas close to the earthquake's location because the hazard (chance of damage in a given area) depends not only on earthquake probabilities, but also on where the earthquakes occur and local soil conditions.

In Memphis and throughout the Mid-America region, the USGS is improving its earthquake monitoring and reporting capabilities through the Advanced National Seismic System (ANSS), a nation-wide network of modern strong motion seismometers that will provide emergency-response personnel with real-time "shaking" information within minutes of an earthquake.

ANSS stations will assist emergency responders within minutes of an event showing not only the magnitude and epicenter, but where damage is most likely to have occurred.

Ten new ANSS instruments were recently installed in the Memphis area, 20 have been installed across the mid-America region, and more than 175 have been installed in other vulnerable urban areas outside the central U.S. to provide real-time information on how the ground responds when a strong earthquake happens.

"The ultimate goal of ANSS is to save lives and ensure public safety," said Dr. John Filson, U. S. Geological Survey (USGS) Earthquake Program Coordinator. "This information, already available in Southern California, is generated by data from seismic instruments installed in urban areas and has revolutionized the response time of emergency managers to an earthquake, but its success depends on further deployment of instruments in other vulnerable cities."

In 1997, during the reauthorization of the National Earthquake Hazards Reduction Program, Congress asked for an assessment of the status and needs of earthquake monitoring. The result was the authorization of ANSS to be implemented by the USGS. The system, when implemented, would integrate all regional and national networks with 7,000 new seismic instruments, including 6,000 new strong-motion sensors in 26 at-risk urban areas. To date, approximately 350 instruments have been installed.

New USGS National Seismic Hazard Maps depict these hazard or likelihood of ground shaking. The USGS and its partners in universities and state geological surveys are preparing more detailed hazard maps for Memphis and other areas that include the effects of local soil conditions. For more information see http://geohazards.cr.usgs.gov/eq/.

The goal of USGS earthquake monitoring is to mitigate risk - using better instruments to understand the damage shaking causes and to provide information to help engineers create stronger and sounder structures that ensure vital infrastructures, utility, water, and communication networks keep operating safely and efficiently.

Table 3.2.11-2
Earthquake frequencies in the New Madrid Seismic Zone

MAGNITUDE	RECURRENCE INTERVAL
4.0	14 months
5.0	10-12 years
6.0	70-90 years
7.0	254-500 years
8.0	550-1200 years

The most important direct earthquake hazard is ground shaking. Ground shaking affects structures close to the earthquake epicenter but can also affect those at great distances. NMSZ and possibly other faults in the region have the potential of generating earthquakes that will cause strong ground motion throughout Missouri. Ground motion at any given site can be characterized by three different parameters.

These parameters are ground displacement, velocity, and acceleration. Each has its own usage and application. For engineering applications, ground acceleration, rather than velocity or displacement, is the primary consideration in design criteria. This is because acceleration is directly related to the dynamic forces that earthquakes induce on structures. Ground acceleration may be presented as a peak value or spectral value. Peak value represents the maximum predicted ground acceleration regardless of the frequency of the seismic waves. Spectral value, on the other hand, represents the maximum ground acceleration at a particular frequency (e.g., 1.0 Hz).

Seismologists and engineers are currently using computer-modeling schemes to predict ground acceleration. Input to this modeling process includes the maximum magnitude of an earthquake expected in the source areas, seismic wave attenuation equations, and site information. Even with fairly reliable models, it is still difficult to anticipate the damage sustained by different types of structures during an earthquake. This is because the response of structures to ground shaking depends on many parameters, including the amplitude and frequency content of the seismic waves, and the duration of shaking.

The frequency content of the ground motion, in turn, depends on the rupture mechanism of the earthquake, the properties of the materials that attenuate the seismic energy, and the regional and local site conditions that may amplify, focus, or defocus the seismic waves arriving at the site of interest. In addition, different structures, because of differences in their natural frequencies and modes of vibration, respond differently to a given ground motion. For planning of critical facilities, therefore, it is often best to study the effects of the worst-case scenario, using as standard the maximum credible earthquake of the fault nearest to the site.
Earthquakes may occur at anytime and anywhere in the central United States including Missouri. However, it is most likely they will occur along the 120-mile New Madrid Seismic Zone. Different from most other hazards, earthquakes are known to cause wide spread damage and

human casualties (e.g. 1906 San Francisco earthquake, 1994 Northridge earthquake, 1995 Kobe, Japan, earthquake).

A repetition of the 1811-1812 events or even magnitude 7.6 earthquake in the New Madrid Seismic Zone is expected to cause severe effects not just in Missouri, but throughout the central United States including, Arkansas, Illinois, Tennessee, Kentucky, and possibly Indiana and Mississippi. An earthquake of magnitude 6+ (similar to the 6.3 Marked Tree earthquakes of 1843) is expected to affect area of more than 60,000 square miles.

Bates County Earthquake activity

Bates County-area historical earthquake activity is significantly below Missouri state average. It is 97% smaller than the overall U.S. average.

On 5/18/2005 at 19:59:42, a magnitude 3.3 (3.3 LG, Depth: 3.1 mi, Class: Light, Intensity: II - III) earthquake occurred 26.0 miles away from the county center

On 7/31/2005 at 07:07:07, a magnitude 3.3 (3.3 LG, Depth: 3.1 mi) earthquake occurred 94.5 miles away from the county center

On 3/30/2001 at 17:13:55, a magnitude 3.1 (3.1 LG, Depth: 3.1 mi) earthquake occurred 60.3 miles away from the county center

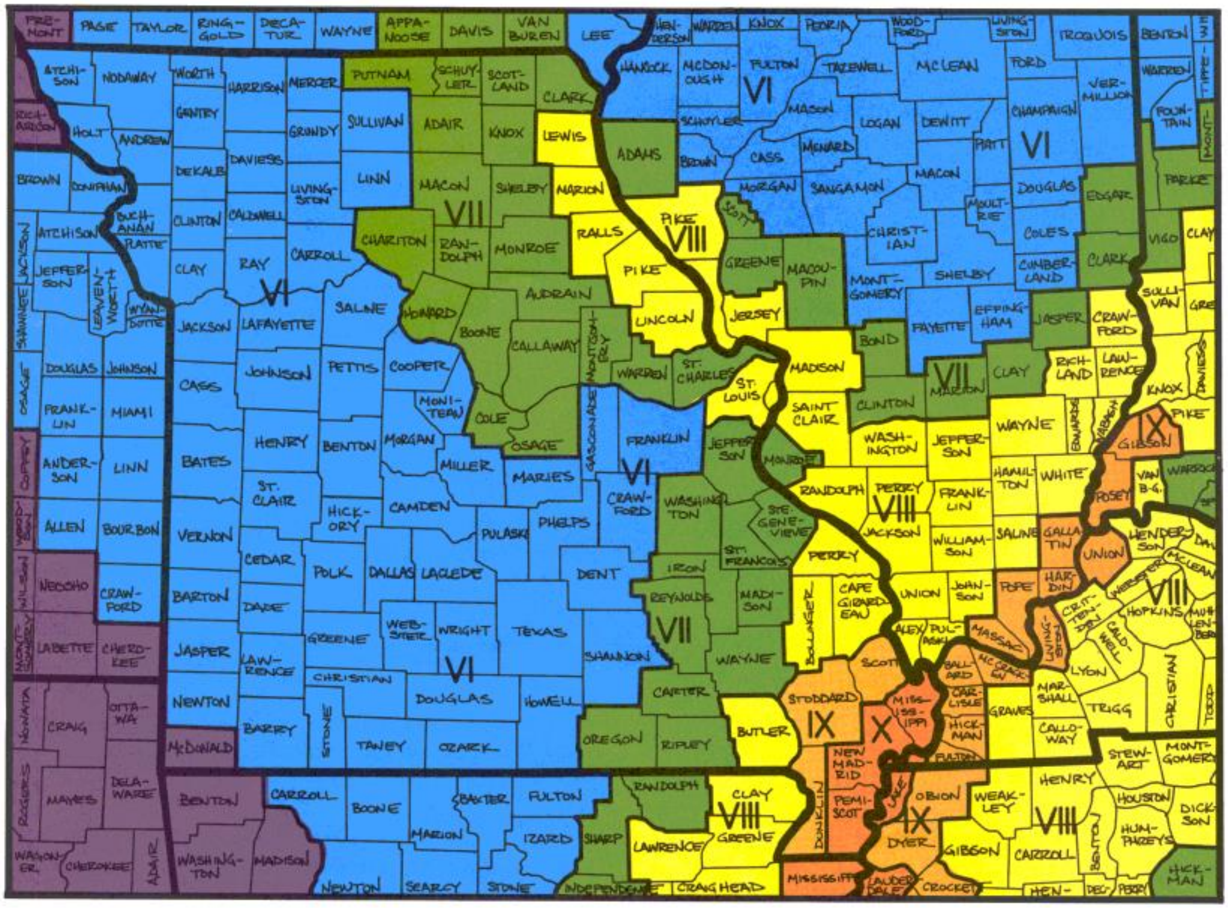
On 5/13/1999 at 14:18:22, a magnitude 3.0 (3.0 LG, Depth: 3.1 mi) earthquake occurred 61.9 miles away from Bates County center

On 1/21/1992 at 11:36:21, a magnitude 3.1 (2.3 LG, 3.1 MD, Depth: 3.1 mi) earthquake occurred 93.6 miles away from the county center

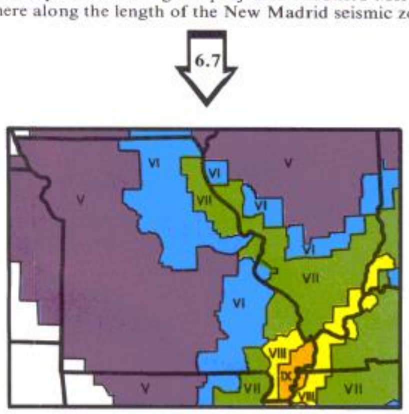
On 3/23/2007 at 08:15:49, a magnitude 3.1 (3.1 LG, Depth: 3.1 mi) earthquake occurred 99.4 miles away from the county center
Magnitude types: regional Lg-wave magnitude (LG), duration magnitude (MD)
Source:* *http://www.city-data.com/county/Bates_County-MO.html#ixzz2j26SetvN

Figure 3.2.11-2

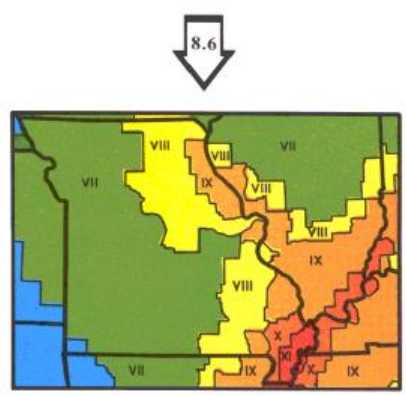
PROJECTED EARTHQUAKE INTENSITIES



his map shows the highest projected Modified Mercalli intensities by county from a potential magnitude – 7.6 earthquake whose epicenter could be any-here 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.

Figure 3.2.11-3

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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Statement of Probable Risk

Historic and recent earthquake activity in central United States, discussed in the Hazard Identification Section of this chapter, indicate that throughout this century, the region has not experienced a major earthquake that caused widespread damage or injuries. According to the magnitude-recurrence relation, the rate of earthquake activity for any particular seismic source usually remains stable for long periods of time (possibly thousands of years). Application of such a relation in the New Madrid Seismic Zone indicates that an earthquake of magnitude 6+ in the region is overdue.

The recurrence interval for a magnitude 6 earthquake is about 100 years. Many Midwestern communities are located near the New Madrid fault, an area with high seismic risk. Estimates of the recurrence intervals of the large 1811-1812 earthquakes are about 500 to 1000 years. Most residents are not aware of this risk because the last significant earthquake occurred in the early 19th century. However, small quakes along this fault continue to occur in Missouri about every 8 days.

Based on the history previous Bates County earthquake events, Bates County 28.57% chance of experiencing an earthquake of magnitude of between 3.0 to 3.3. 6 events in 21 years = (6/21=0.285x100=28.57%) Since Bates County lies a good distance from the New Madrid Fault, small earthquakes usually are not noticeable. The more severe threat stems from an earthquake producing Modified Mercalli impact levels of VII-XIII.

Probable Risk of Modified Mercalli Levels:

I – V:	unlikely
VI:	likely (40-63% chance through year 2015)
VII:	possible
VII – XIII:	possible

Statement of Next Disaster's Likely Adverse Impact on the Community

The impact on the general public, small to medium size businesses, life-line services, and the infrastructure may be radically lessened if precautions are undertaken at multiple levels. Increased education, concern and subsequent action can reduce the potential effects of earthquakes, and this can be done in conjunction with preparations for other natural hazards. A program that recognizes the risk of flooding, landslides and other dangers and which incorporates earthquake issues will be the most beneficial to Bates County citizens.

Individuals and all levels of government have roles in reducing earthquake hazards. Individuals can reduce their own vulnerability by taking some simple and inexpensive actions within their own households. Local government can take action to lower the threat through the proper regulation of poor sites, assuring that vital or important structures (police, fire, and school buildings) resist hazards, and developing infrastructure in a way that decreases risk. State agencies and the legislature can assist the other levels of action and provide incentives for minimizing hazards.

Based on the Projected Earthquake Intensities map, Bates County is most at risk for Modified Mercalli Level VI as likely adverse impacts. The possible effects at Level VI are shown below.

Without Mitigation Measures:

Life:	limited
Property:	limited
Emotional:	limited
Financial:	limited

With Mitigation Measures:

Life:	negligible
Property:	limited
Emotional:	negligible
Financial:	negligible
Comments:	Education, building regulation enhancements, and infrastructure enhancements will help minimize building damage and injuries.

Statement of Next Disaster's Likely Adverse Impact by Jurisdiction

All jurisdictions within the county are equally susceptible to damage stemming from an earthquake. In the event of an earthquake, 50% of any given jurisdiction may be at risk for damage. Since the passage of the original plan in 2004, no significant changes concerning building development have taken place. Bates County's third-class status prevents mitigation actions based on zoning and building construction.

Recommendation

- Initiates mitigation activities to encourage developers and building owners to institute appropriate earthquake safeguards to protect the lives of those using their buildings; and
- Create a coordinated initiative to educate residents about precautions required by all the natural hazards in the county.

3.2.12 Dam Failure

Dam failure may also result in a flood event. A dam impounds water in the upstream area, referred to as the reservoir. The amount of water impounded is measured in acre-feet. An acre-foot of water is the volume that covers an acre of land to a depth of one foot. As a function of upstream topography, even a very small dam may impound or detain many acre-feet of water. Dam failures are not routine, but the results can be devastating. Two factors influence the potential severity of full or partial dam failure: the amount of water impounded, and the density, type, and value of development downstream.

A number of outside forces can cause Dam failures. Included in these are prolonged periods of rain or flooding, landslides into reservoirs, failure of dams upstream, and earthquakes. The most common cause of dam failure is prolonged rainfall that produces flooding. Failure due to events such as earthquakes or landslides, however, is significant because there is little to no advance warning. It is important to note that dam failures can result from natural events, human-induced events, or a combination. Improper design and maintenance, inadequate spillway capacity, or internal erosion or piping within a dam may also cause failure. People, property, and infrastructure downstream of dams are subject to devastating damage in the event of failure.

The National Dam Safety Program (NDSP) was established in 1996 with the Director of FEMA as coordinator. The purpose of the program is to reduce the risks to life and property from dam failure in the United States by bringing together the expertise and resources of the Federal and non-Federal communities in achieving national dam safety hazard reduction. The NDSP establishes a grant assistance program to the States to improve their dam safety programs; provides funds for research and training; creates a National Dam Safety Review Board to monitor the State assistance program; and funds the National Inventory of Dams (NID) under the United States Army Corps of Engineers.

Bates County Dam Failure Flood Hazard

According to the Missouri Department of Natural Resources, there are 26 dams in Bates County. Each dam listed is assigned a hazard classification (high, significant, or low hazard class) based on potential of loss to life and property (exposure) should the dam fail. The hazard classification is not an indicator of the adequacy of the dam or its physical integrity. Hazard classification is updated continually based on development and changing demographics upstream and downstream. Three of the 26 dams within Bates County are classified as a high hazard dam because of the significant development downstream from it. The hazard rating is based on the contents of the downstream environment zone (permanent dwellings, public buildings, campgrounds, industrial buildings, etc.). Dam failure can result in flood inundation areas significantly larger than the 100-year regulatory floodplain indicated on Federal Insurance Rate Maps (FIRM's).

All federal agencies were recently required to develop Flood Emergency Plans for dams under their control. As part of these plans, flood inundation maps were prepared based upon selected emergency conditions. Preparation of these maps does not reflect on the safety, physical condition, or integrity of the dam. Conditions considered for the dams include: 1) occurrence of the spillway design flood without failure (the flood for which the emergency spillway was designed), 2) failure of the dam (by piping, for example) concurrent with the spillway design flood, and 3) earthquake-induced failure (instantaneous, full-depth breach) of the dam at normal high pool. The possibility is extremely remote that any of these conditions will occur.

Frequency of flooding from dam failure is not maintained as a separate statistic. Dams or levees may fail during flood events that are documented by the National Weather Service as part of the damage assigned to flood events. Dam failures are often cited as secondary effects of natural disasters and are not named as the primary hazard that caused the disaster declaration. Although the frequency of dam failure is difficult to assess, dam failures have occurred in the United States, some failures with major loss of life. The frequency of dam failure will likely increase in the future, as more than 85% of the dams in the United States will be more than 50 years old (the design life of a dam) by the year 2020.

A dam is defined by the National Dam Safety Act as an artificial barrier which impounds or diverts water and (1) is at least 6 feet high and stores at least 50 acre-feet of water or (2) is at least 25 feet high and stores at least 15 acre-feet. Of the 80,000-plus dams in the United States, less than 5%are under the control of the federal government.

Missouri's DNR regulates the design, construction and maintenance of 4,100 non-federal, non-agricultural dams that are at least 35 feet high. Dam owners have primary responsibility for the safe design, operation and maintenance of their dams.

Missouri DNR classifies dams by 3 hazard classes:

Class 1: The area downstream from the dam that would be affected by inundation contains ten (10) or more permanent dwellings or any public building. Inspection of these dams must occur every two years.

Class 2: The area downstream from the dam that would be affected by inundation contains one to nine permanent dwelling, or one or more campgrounds with permanent water, sewer and electrical services or one or more industrial buildings. Inspection of these dams must occur once every three years.

Class 3: 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. Inspection of these dams must occur once every five years.

They are responsible for providing early warning of problems at the dam, for developing an effective emergency action plan, and for coordinating that plan with local officials. The state has ultimate responsibility for public safety and many states regulate construction, modification, maintenance, and operation of dams.

Oversight is extremely valuable to the owners as well as those people living downstream of the dam that could be flooded in the event the dam should fail. Dams can fail for many reasons. The most common are:

- Piping: internal erosion caused by embankment leakage, foundation leakage and deterioration of pertinent structures appended to the dam.
- Erosion: inadequate spillway capacity causing overtopping of the dam, flow erosion and inadequate slope protection.
- Structure Failure: caused by an earthquake, slope instability or faulty construction.

These failure types often are interrelated. For example, erosion, either on the surface or internal, may weaken the dam or lead to structural failure. Additionally, a structural failure may shorten the seepage path and lead to a piping failure.

Table 3.2.12-1

Missouri Department of Natural Resources

Missouri Dam Report by County

Regulated
Agriculture Exempt

BATES

ID Number	Location	Year Complete	Height (ft)	Length (ft)	Drainage Area (acre)	Lake Area (acre)	Hazard Class	Permit Number
ADRIAN RESEVOIR DAM								
MO20005	S03 T41N R31W	1963	27.00	Unknown	550.00	38.00	2	
APPLETON CITY LAKE DAM								
MO20047	S12 T39N R29W	1936	30.00	Unknown	2,840.00	36.00	2	
BEISLEY LAKE DAM-NORTH								
MO20263	S24 T38N R31W	1953	30.00	Unknown	490.00	33.00	3	
BEISLEY LAKE DAM-SOUTH								
MO20214	S24 T38N R31W	1962	25.00	Unknown	170.00	10.00	3	
BOONE LAKE DAM								
MO20386	S07 T42N R33W	1965	15.00	Unknown	225.00	10.00	3	
BUTLER CITY DAM								
MO20015	S14 T40N R32W	1930	30.00	Unknown	2,150.00	55.00	3	
COLLINS LAKE DAM								
MO20558	S08 T41N R30W	1965	15.00	Unknown	330.00	30.00	3	
DREXEL CITY RESERVOIR DAM SOUTH								
MO20213	S07 T42N R33W	1968	29.00	Unknown	550.00	50.00	3	
DREXEL LAKE DAM								
MO20046	S06 T42N R33W	1953	22.00	Unknown	2,920.00	26.00	1	
EASTLAND LAKE DAM								
MO20444	S17 T38N R31W	1960	16.00	Unknown	160.00	10.00	1	
G.W. MORRIS								
MO50858		1998	15.00	96.00	0.00	23.00		
HARMONY MISSION DAM								
MO20767	S15 T38N R32W	1985	42.00	1,781.00	1,520.00	96.00	1	S-009
HODGES LAKE DAM								
MO20211	S10 T42N R33W	1966	30.00	Unknown	1,070.00	15.00	2	
KCS BRIDGE A-65								
MO20209	S32 T41N R33W	1974	25.00	Unknown	1,500.00	7.00	3	
KENT POWELL IRRIGATION LAKE DAM								
MO50030		1975	20.00	2,090.00	1.00	1.00		
MARTENS LAKE DAM								
MO20559	S35 T42N R31W	1960	25.00	Unknown	155.00	6.00	3	
MILLER LAKE DAM								
MO20091	S14 T38N R31W	1960	25.00	Unknown	110.00	7.00	3	
NELSON LAKE DAM								
MO20727	S02 T40N R33W	1800	15.00	Unknown	650.00	21.00	3	
POWELL LAKE DAM								
MO20384	S04 T40N R30W	1800	15.00	Unknown	510.00	25.00	3	
ROBERTS LAKE DAM								
MO20596	S35 T39N R29W	1975	25.00	Unknown	55.00	2.00	3	
ROCKING CHAIR RANCH LAKE DAM								
MO20212	S32 T42N R33W	1960	20.00	Unknown	250.00	12.00	3	
SHANNON CIRCLE S RANCH LAKE DAM								
MO20450	S33 T42N R33W	1976	25.00	Unknown	155.00	25.00	2	
WARD LAKE DAM-SEC 13								
MO50026		1972	20.00	600.00	1.00	1.00		
WARD LAKE DAM-SEC 29								
MO20453	S29 T41N R32W	1972	15.00	Unknown	80.00	11.00	3	
WARD LAKE DAM-SECT. 7								
MO50027	S07 T41N R32W	1971	19.00	630.00	100.00	19.00	2	

Missouri Department of Natural Resources

Missouri Dam Report by County

Regulated
Agriculture Exempt

BATES

ID Number	Location	Year Complete	Height (ft)	Length (ft)	Drainage Area (acre)	Lake Area (acre)	Hazard Class	Permit Number
WELLIVER LAKE DAM								
MO20452	S20 T41N R32W	1970	20.00	Unknown	120.00	23.00	2	

SUMMARY

Regulated Dams: **1**	Total:		**16,662.00**	**592.00**
Total Dams: **26**	Average:	**22.88**	**640.85**	**22.77**

Source: Missouri Department of Natural Resources

Thousands of people have been injured, many killed, and billions of dollars in property damaged by dam failures in the United States. The problem of unsafe dams in Missouri was underscored by dam failures at Lawrenceton in 1968, Washington County in 1975, Fredericktown in 1977, and a near failure in Franklin County in 1978. No records were found to indicate any dam failures in Bates County.

According to Missouri DNR's Dam Safety Division in Rolla, Bates County now has 26. Only the Harmony Mission Dam is regulated by the State.

All Bates County dams are earthen construction. The mean dam height is 23 feet. The mean maximum storage capacity is 640 acre-feet. (An acre-foot is one acre of water that is one foot deep. For example, a 10-acre lake that is 10 feet deep would have a maximum storage capacity of 100 acre- feet.). All but the Harmony Mission Dam are less than 35 feet high and therefore not regulated by Missouri DNR. People living downstream of these smaller unregulated dams are virtually at the mercy of the dam owner's construction and maintenance practices.

Statement of Future Probable Severity

Missouri DNR has defined three levels of hazard potential –high, significant, and low -as accepted by the Interagency Committee on Dam Safety. The definitions are:

- ***High***: Failure or improper operation will probably cause loss of human life.
- ***Significant***: Failure or improper operation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.
- ***Low***: Failure or improper operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

The future probable severity of a dam failure in Bates County is shown below according to DNR's hazard potential levels.

Hazard Level	**Future Probable Severity**
High	catastrophic
Significant	critical
Low	negligible

Statement of Probable Risk

Of the total 26 dams, 3 are rated by Missouri DNR as “high” risk. 4 are rated as “significant”, and 14 are considered “low.” There are four dams in Bates County that are not rated. The “high” risk category is based on the following conditions.

- More than 30 years old;
- High ratio of maximum storage to dam height; and/or,
- High population density downstream.

These “high” risk dams represent the greatest risk of dam failure. The county’s risk of experiencing a dam failure is shown below according to DNR’s hazard levels.

Hazard Level	**Probable Risk**
High	highly likely
Significant	possible
Low	not likely

Statement of Next Disaster’s Likely Adverse Impact on the Community

In the event of dam failure inundation in Bates County, estimated impacted areas are shown in the following maps:

Dam breach inundation map legend.

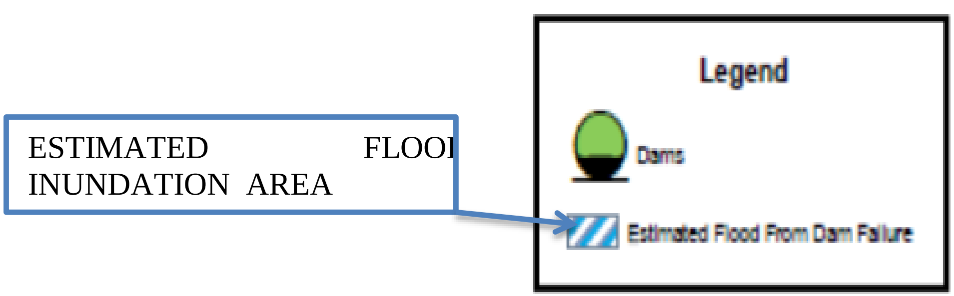
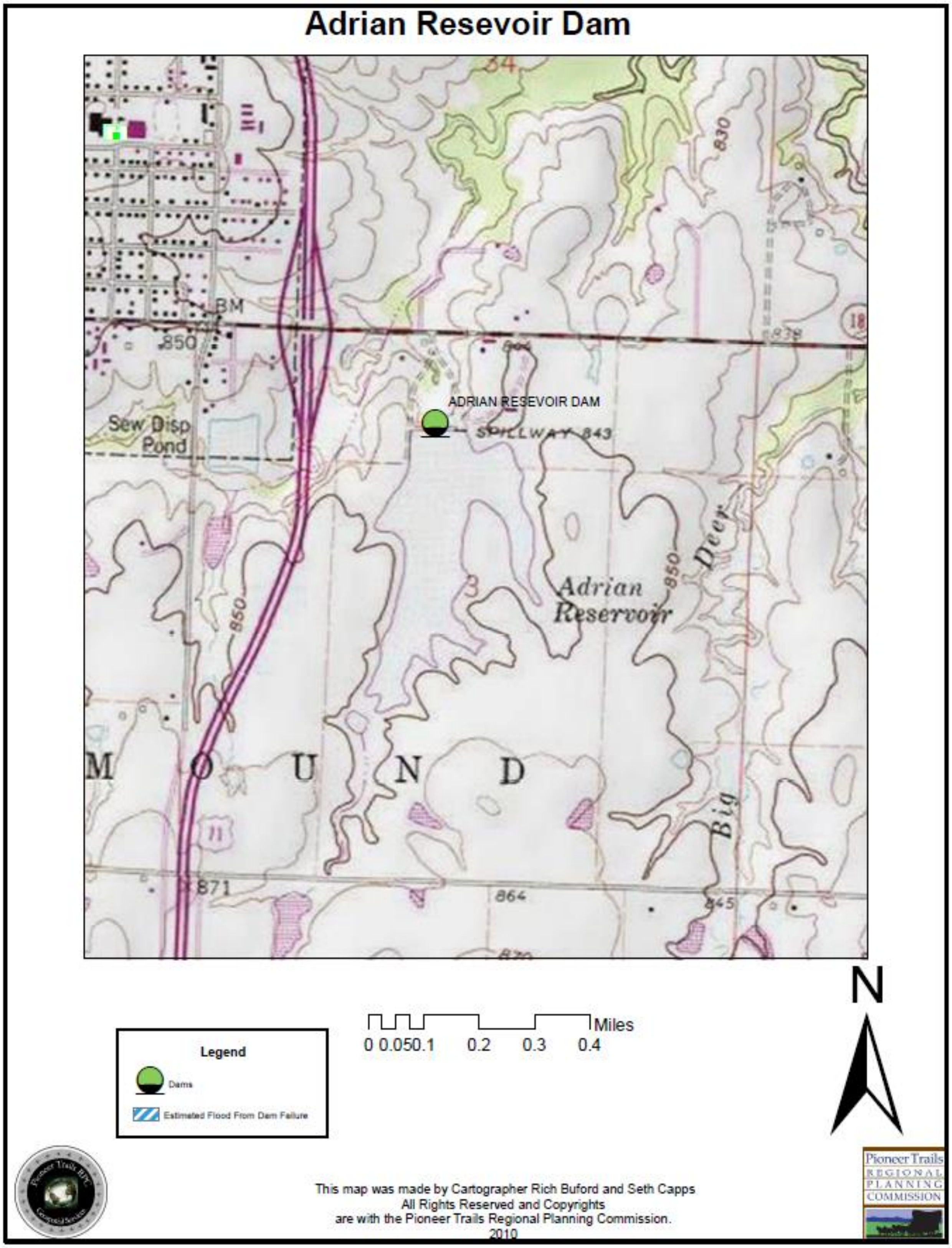


Figure 3.2.12-1



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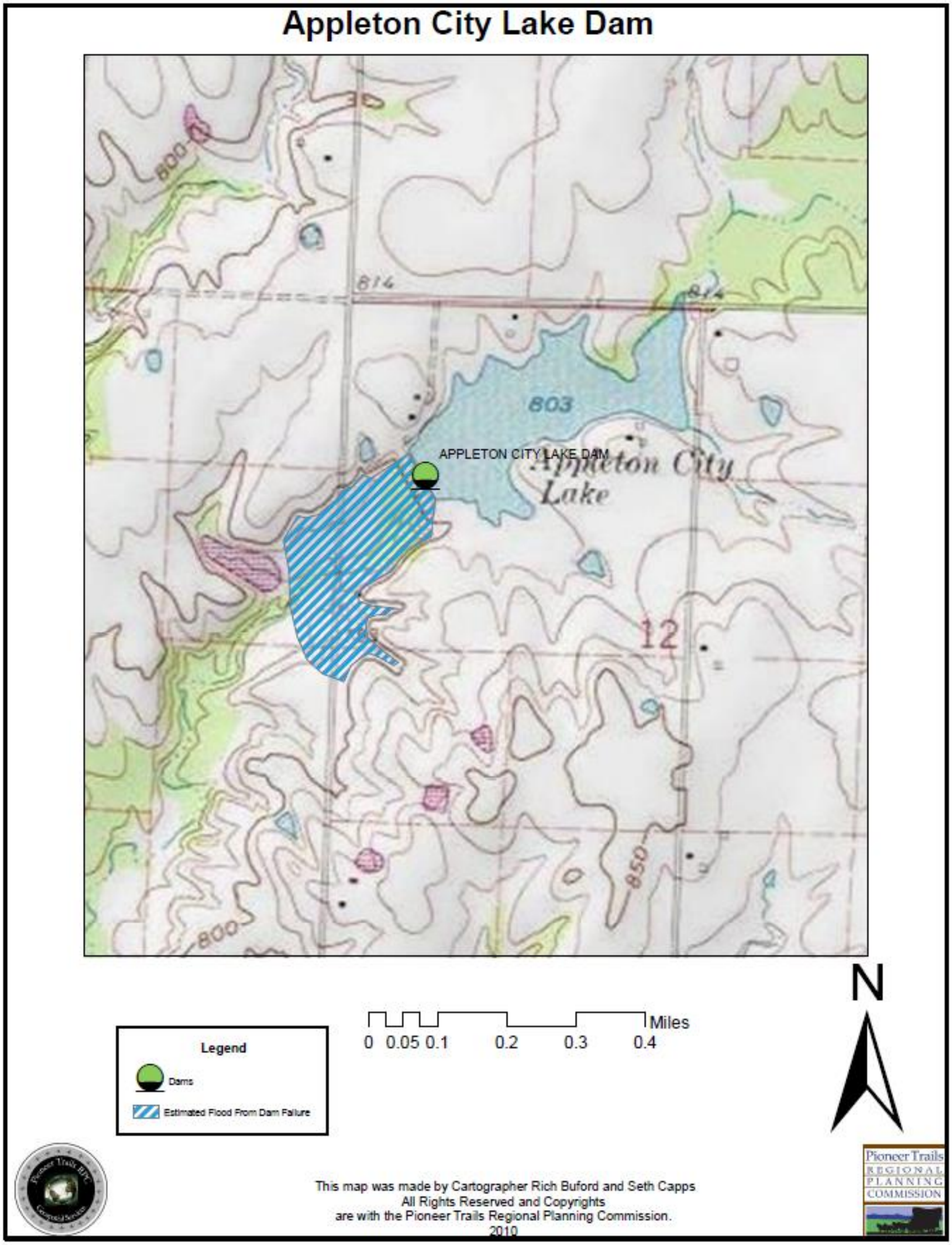

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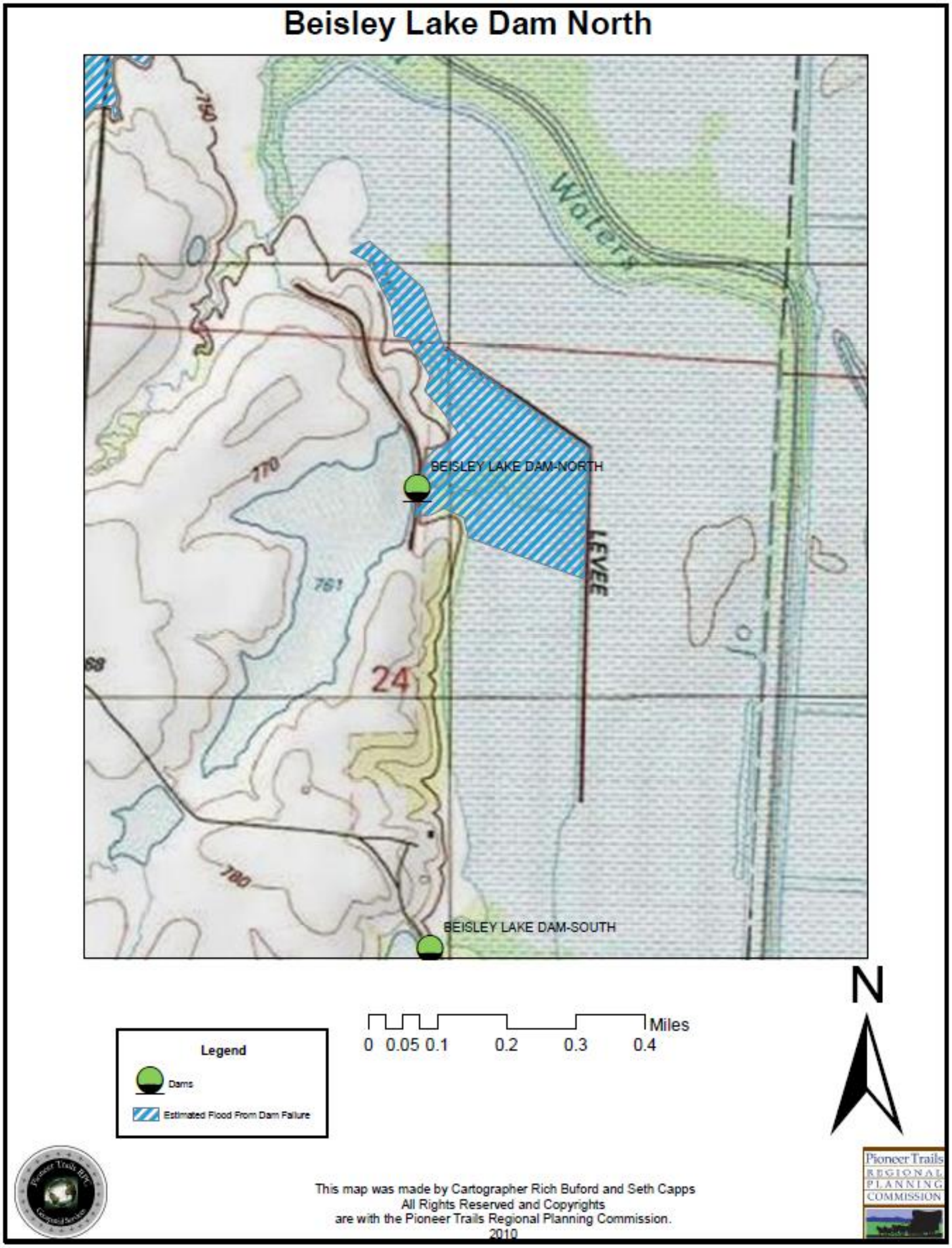

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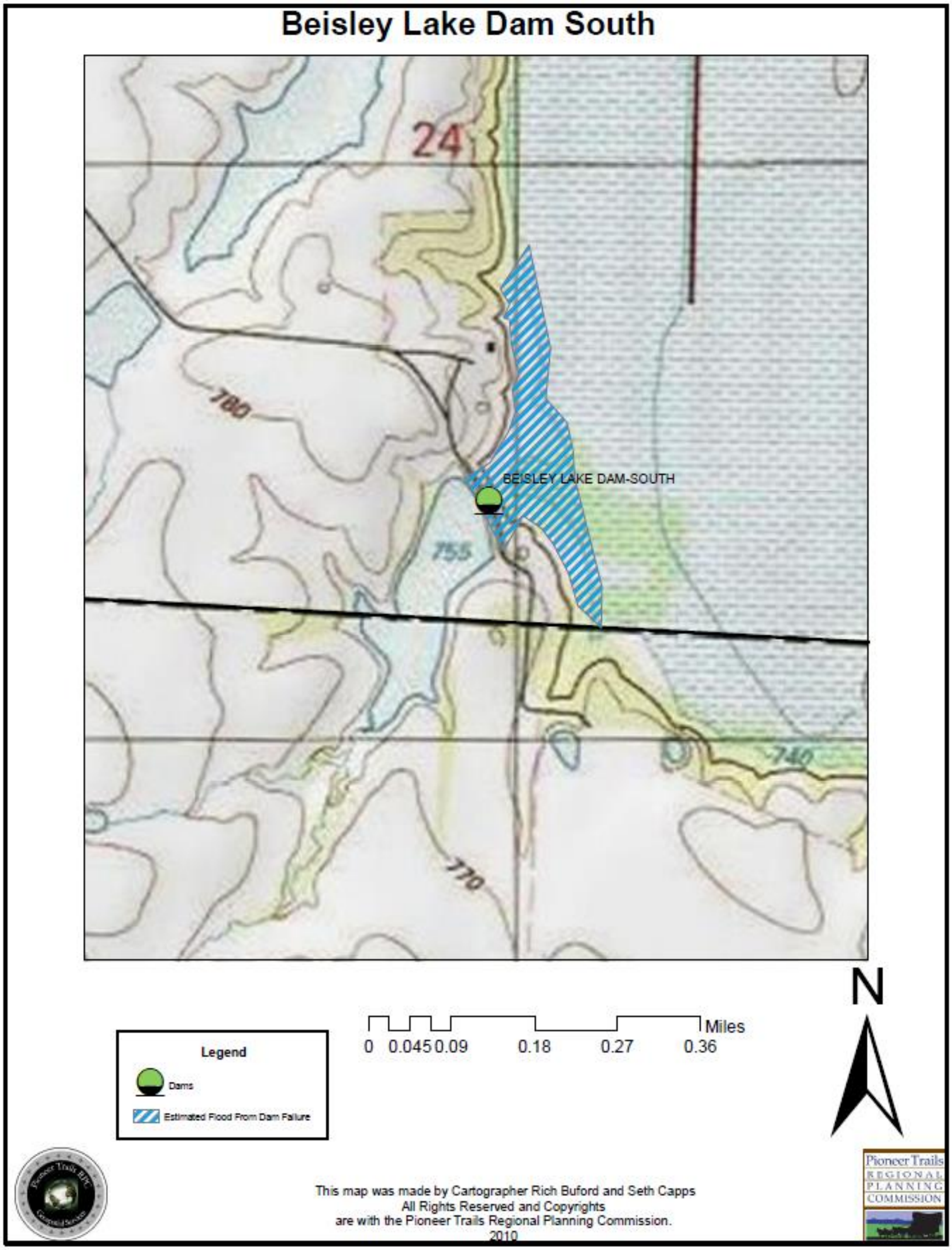

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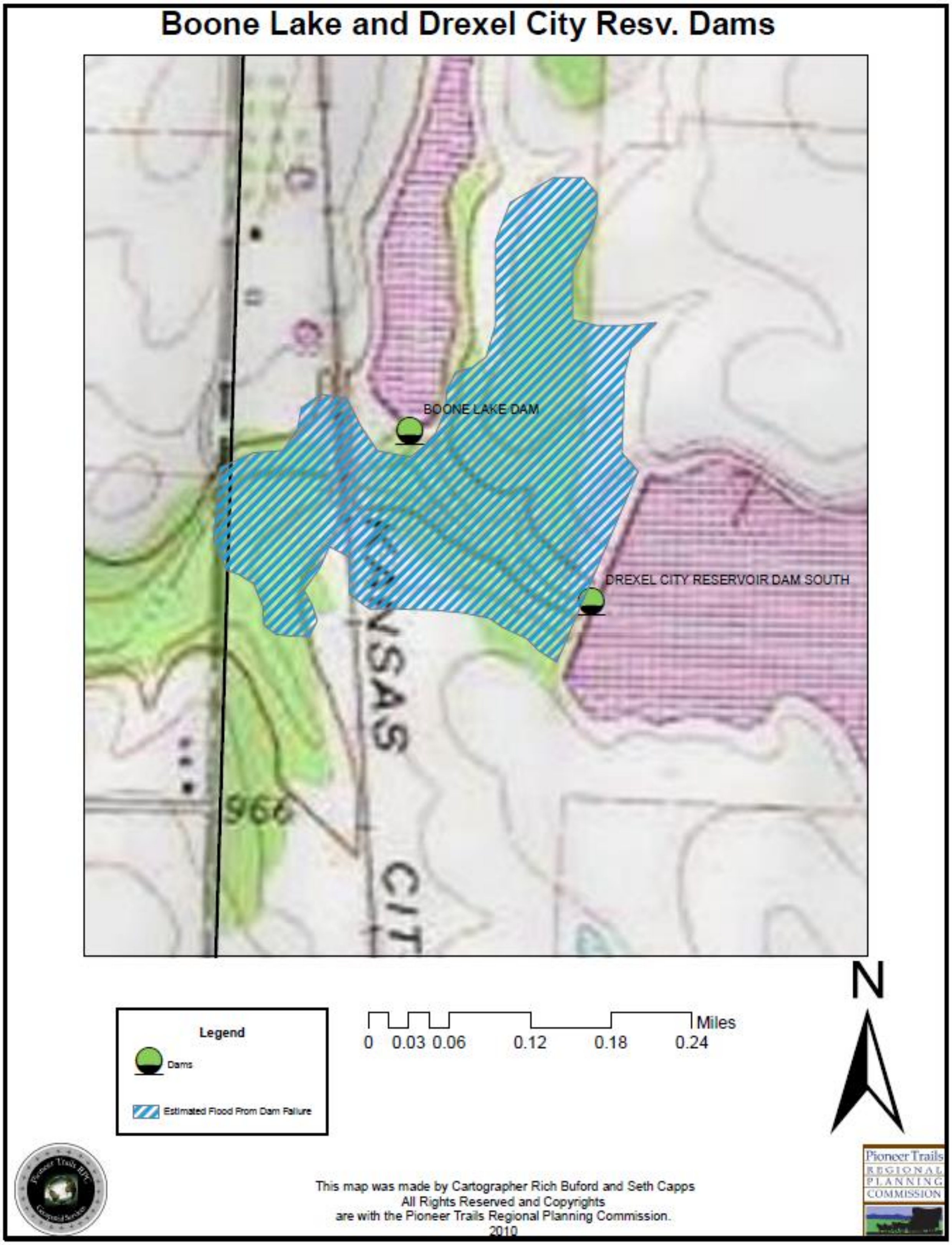

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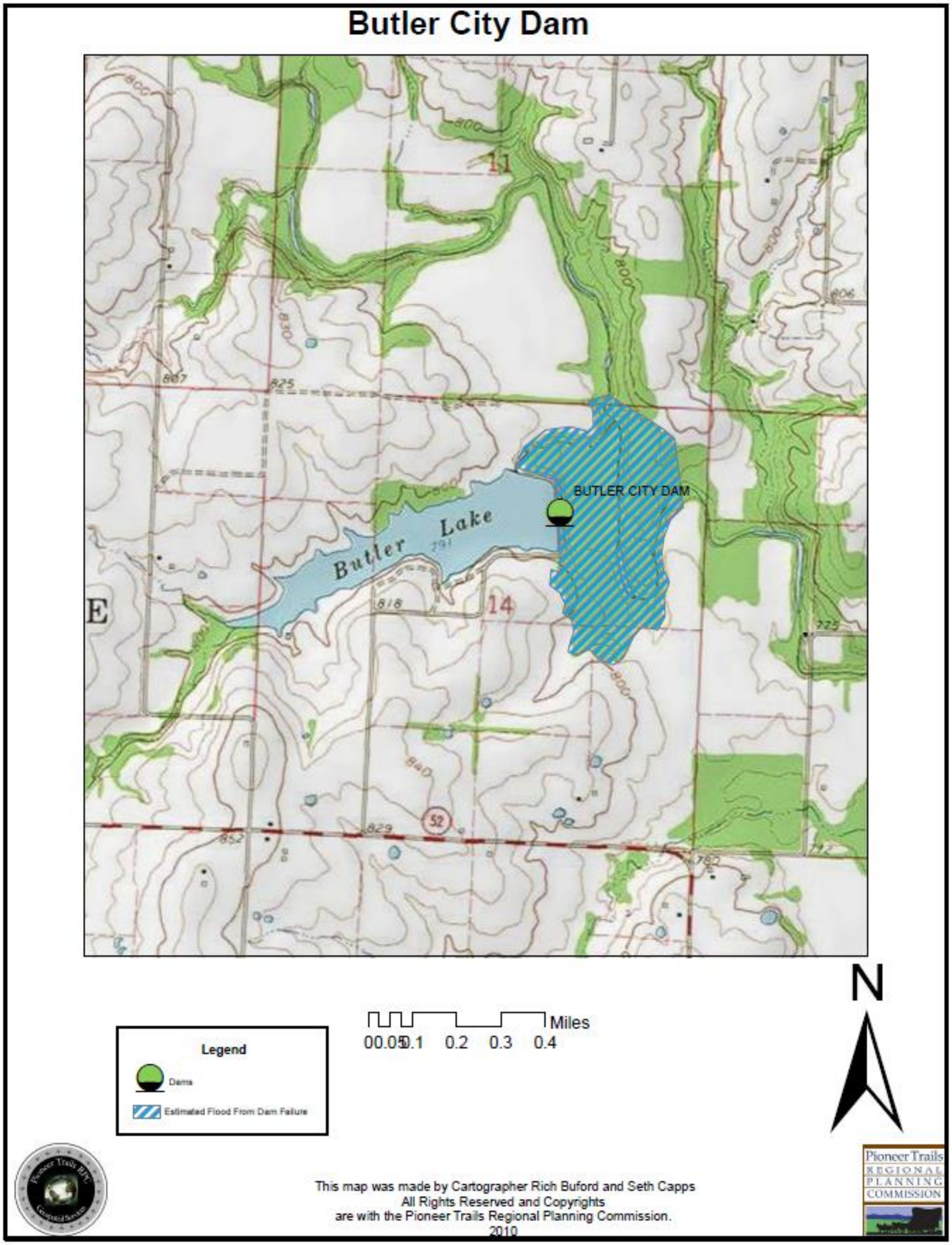

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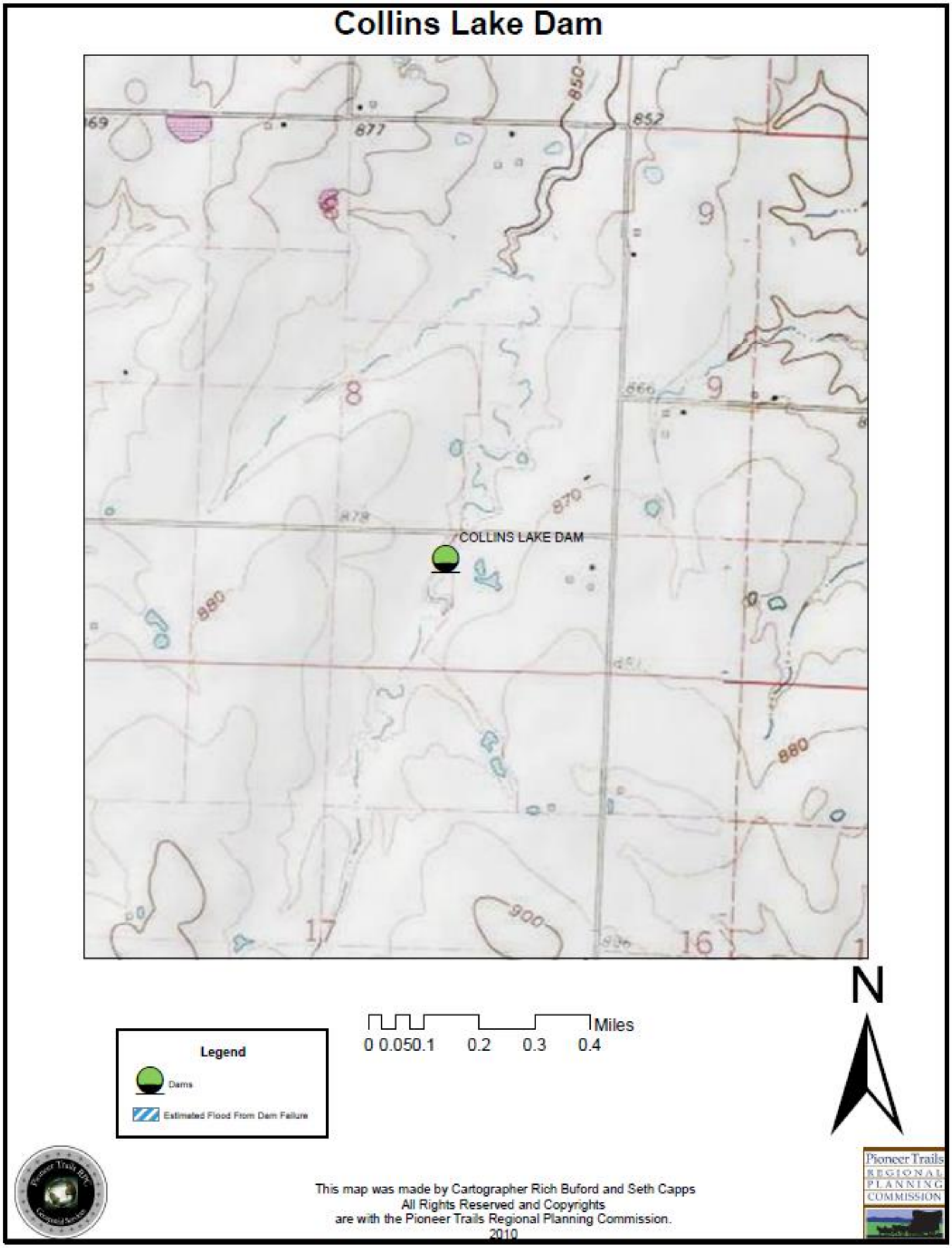

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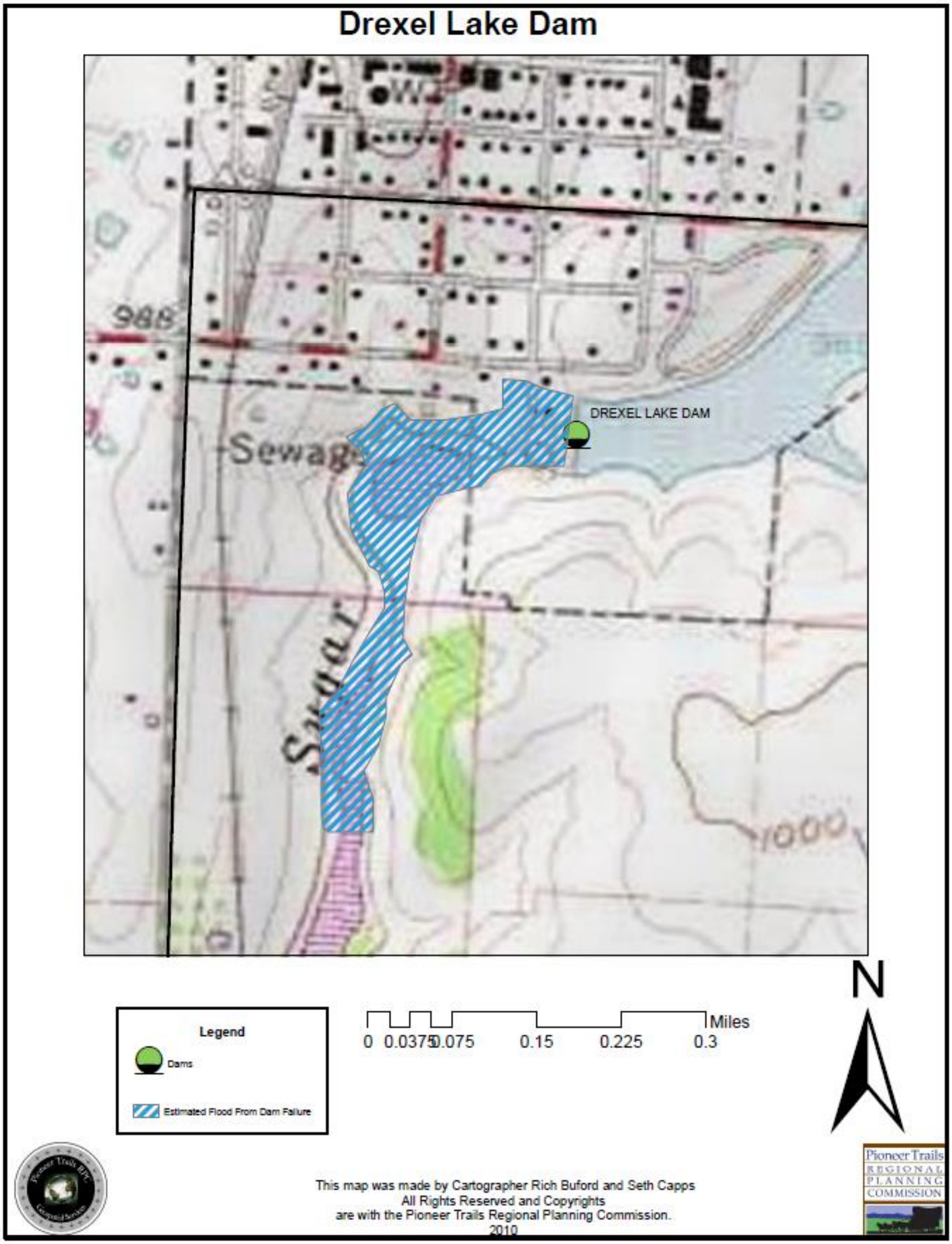

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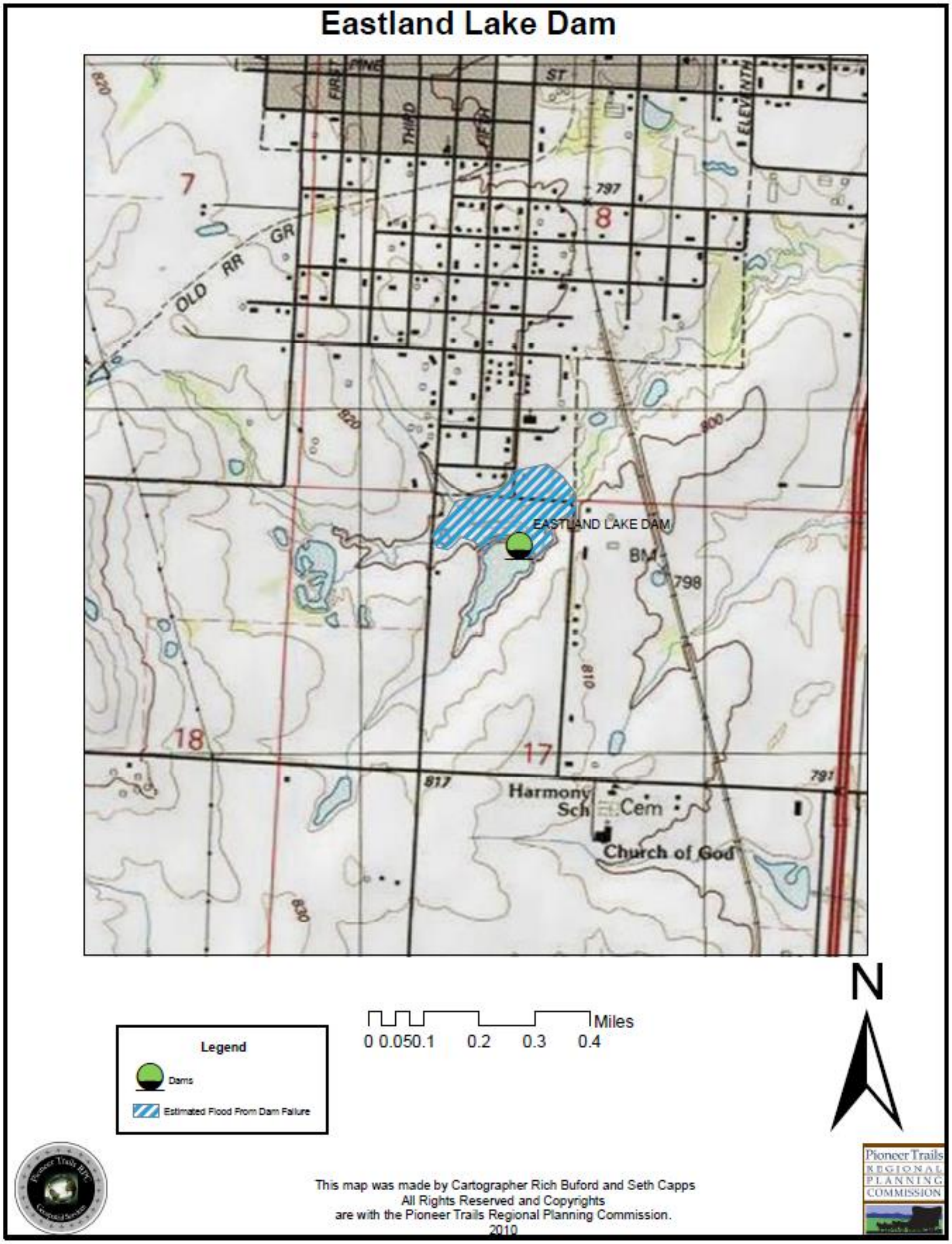

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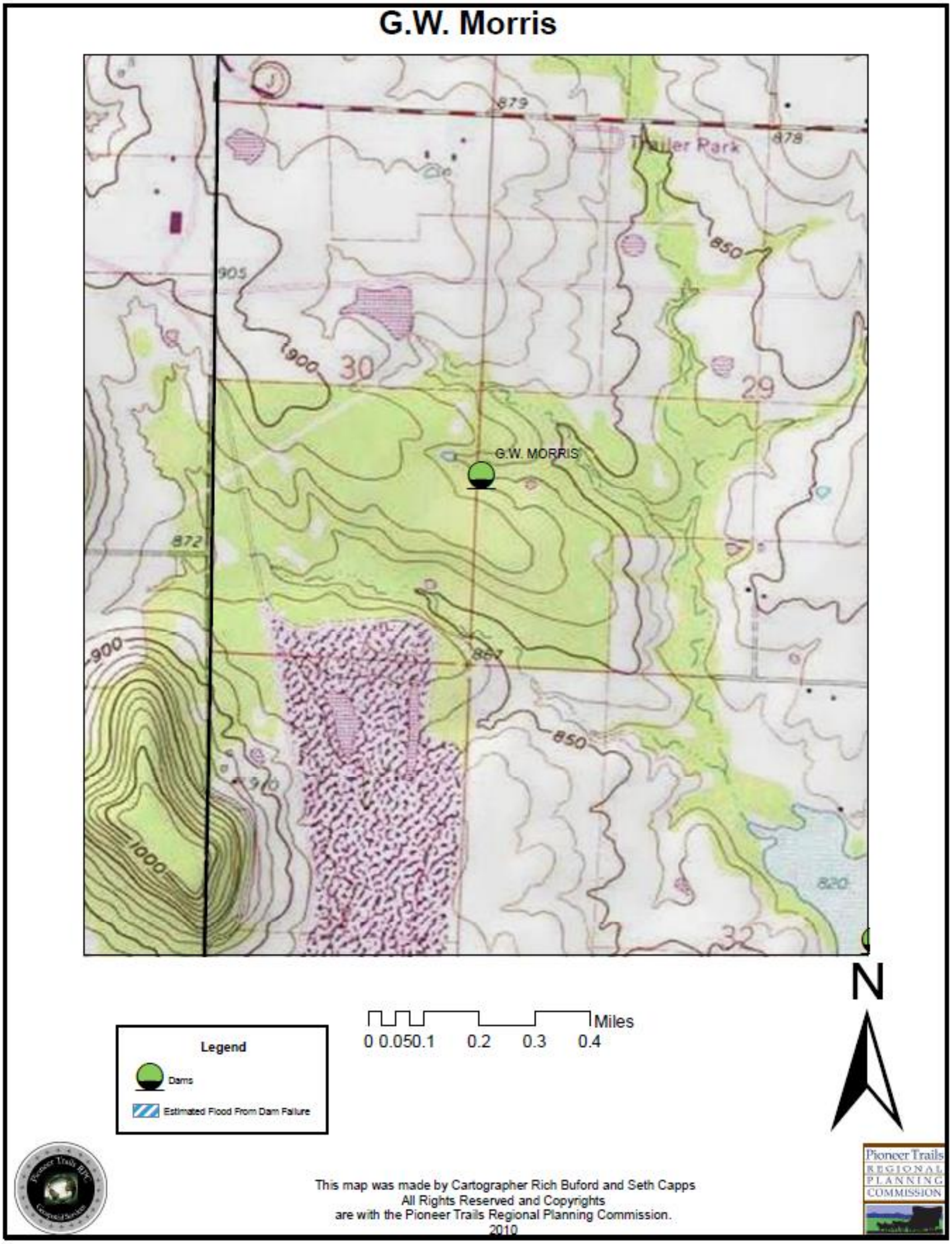

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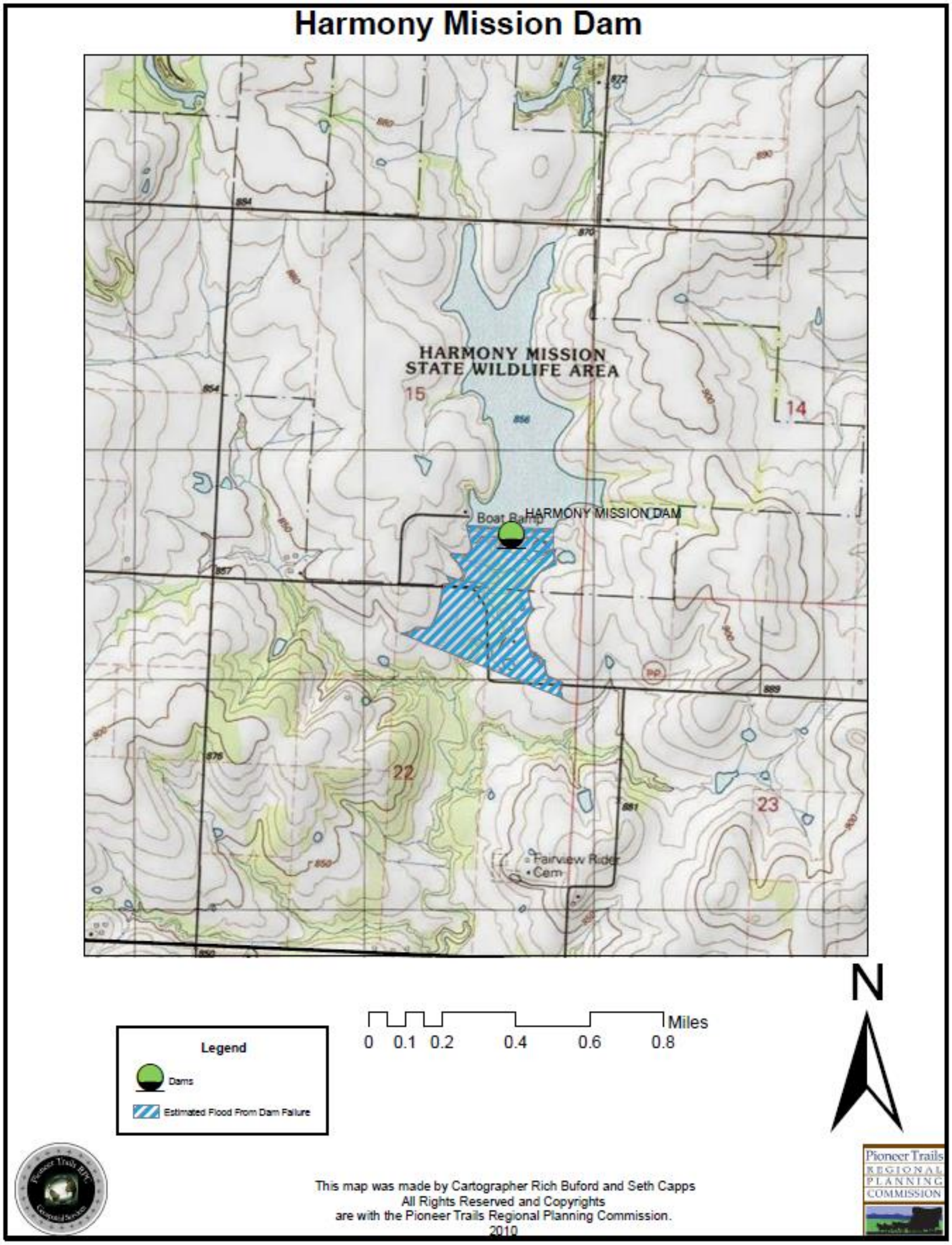

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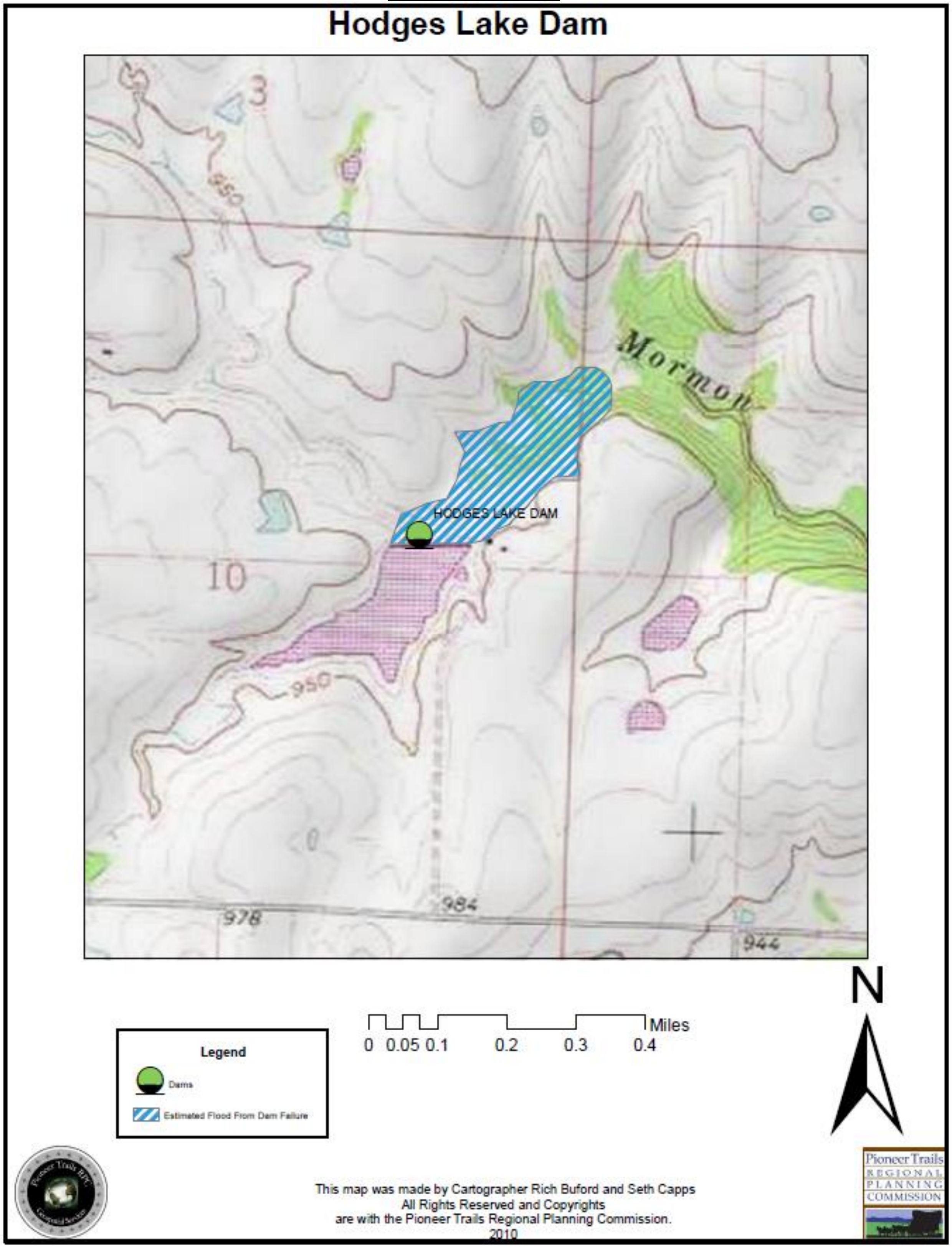

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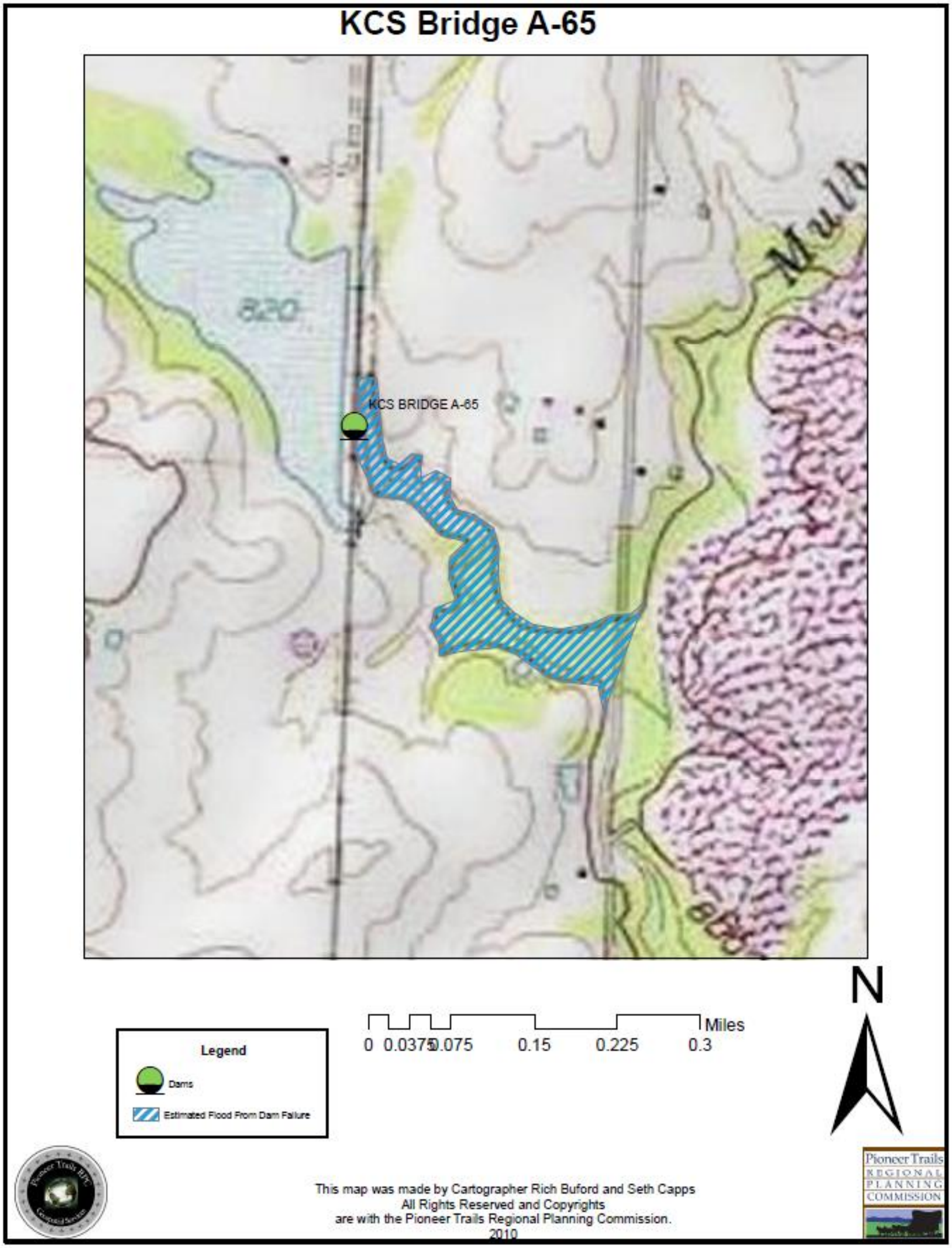

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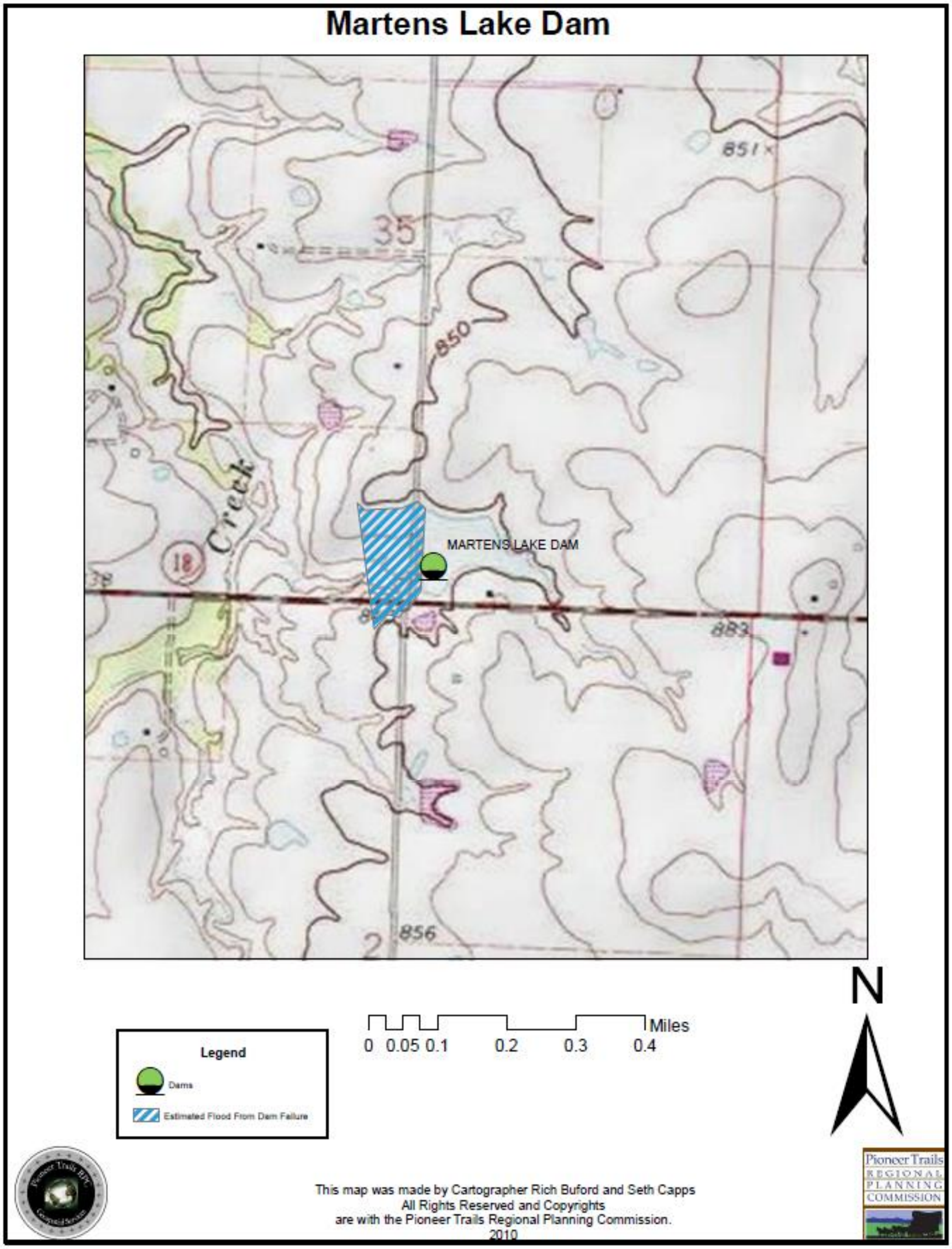

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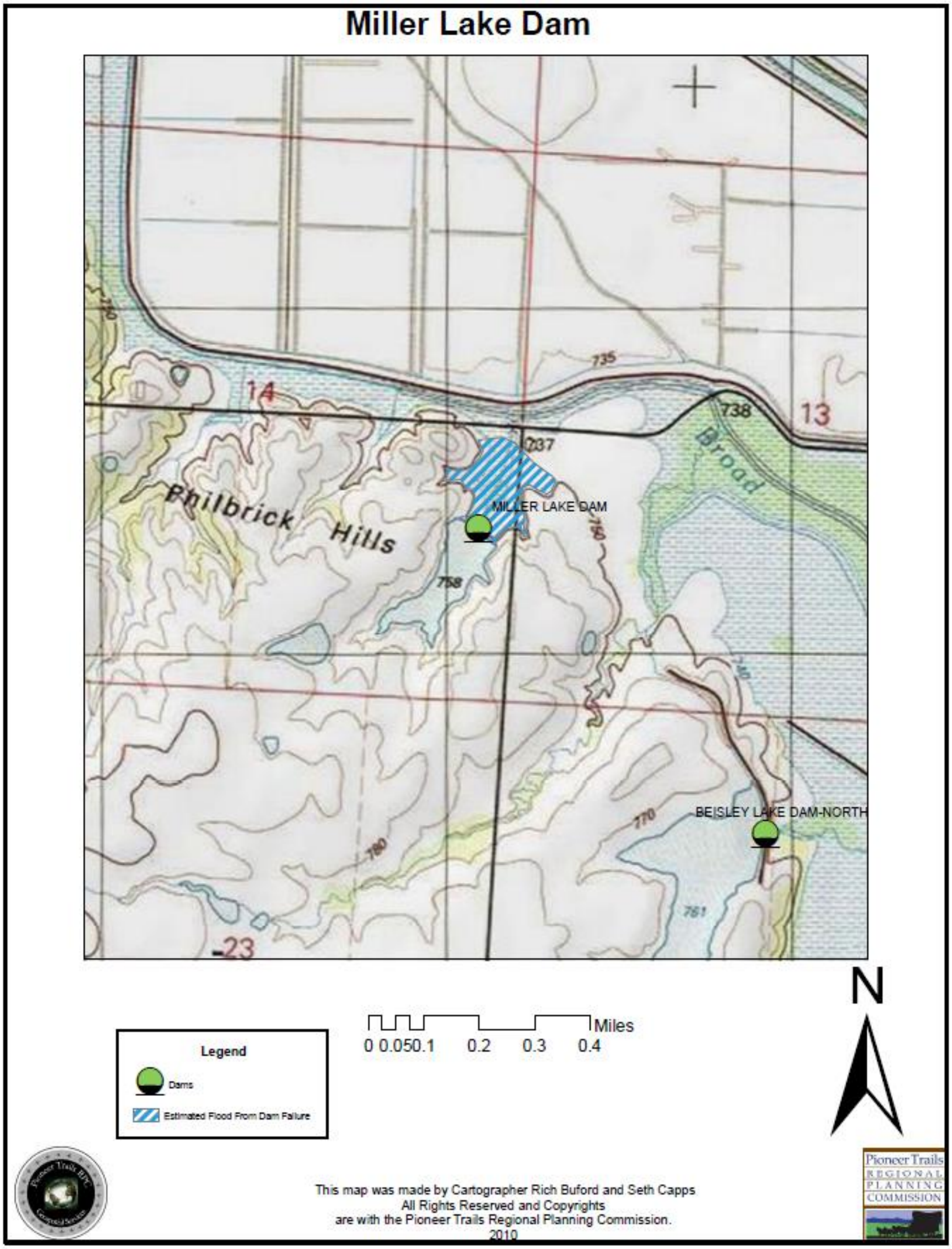

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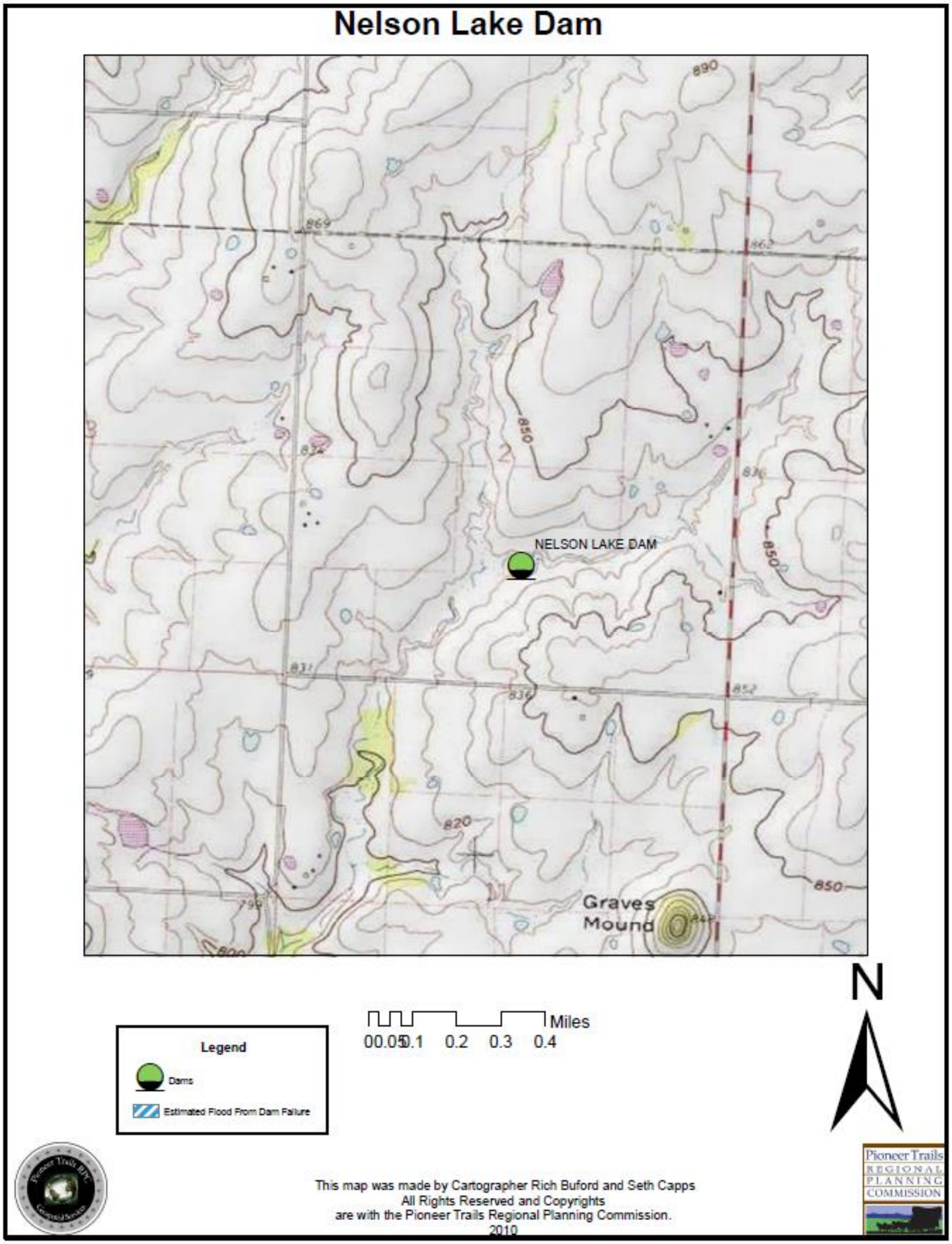

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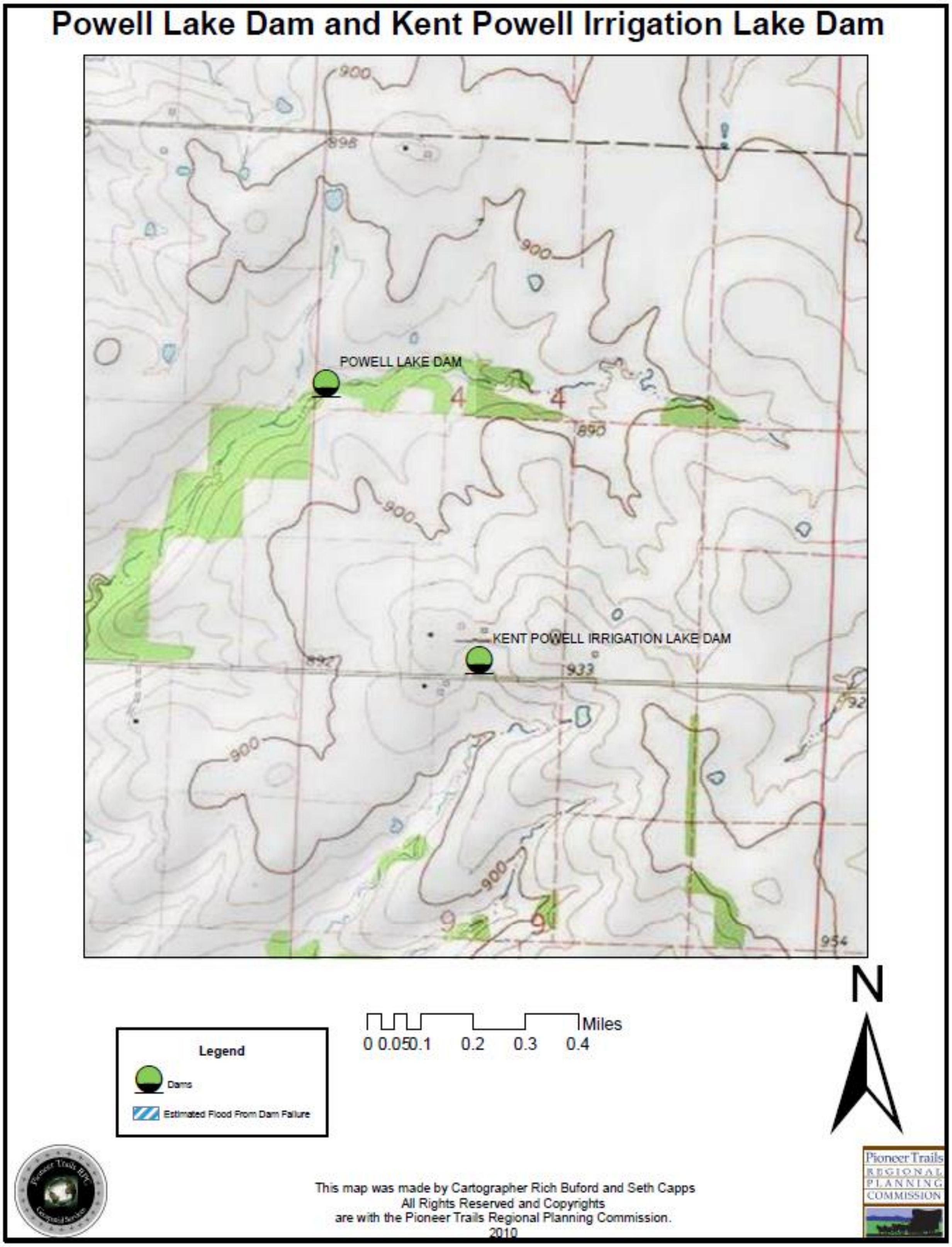

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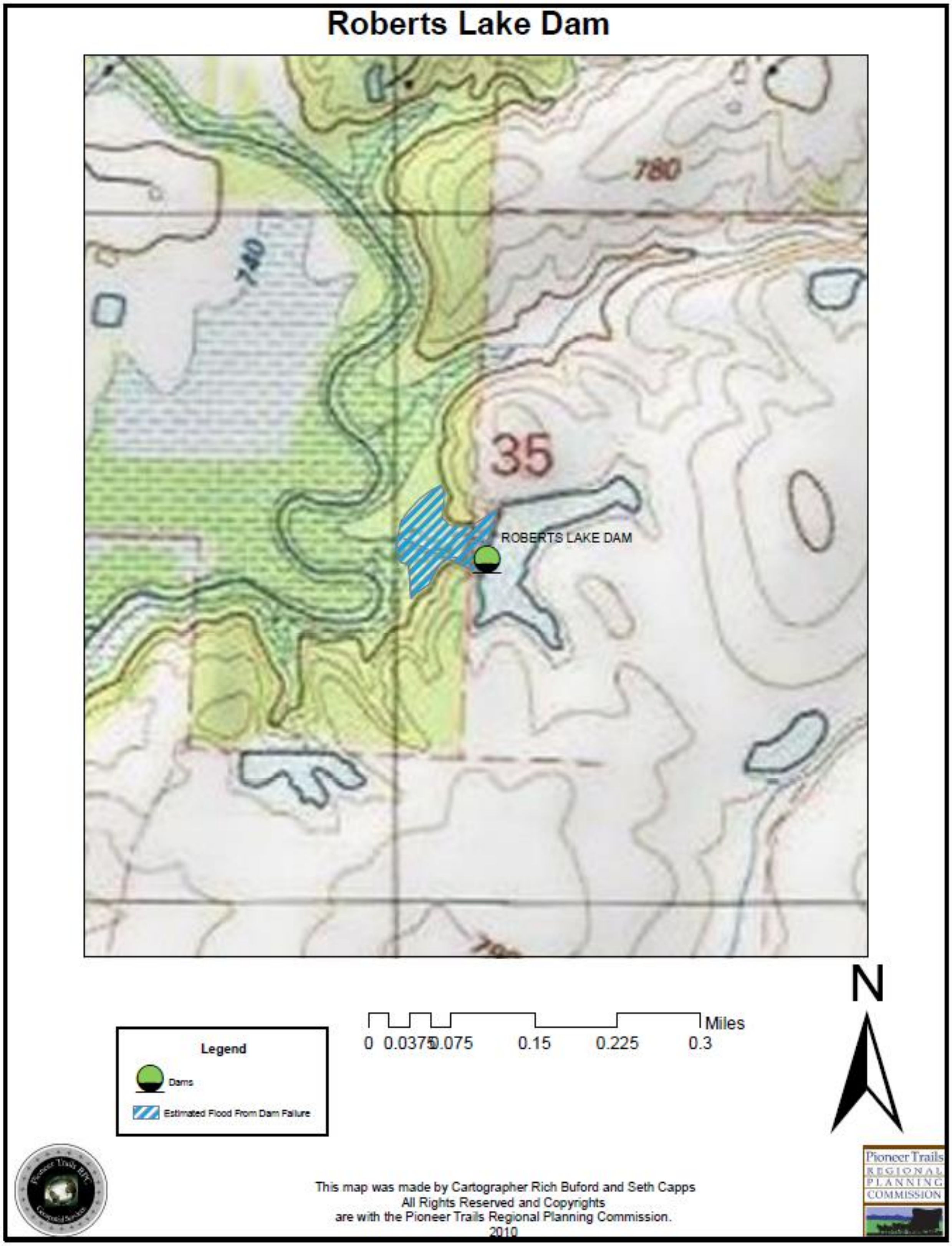

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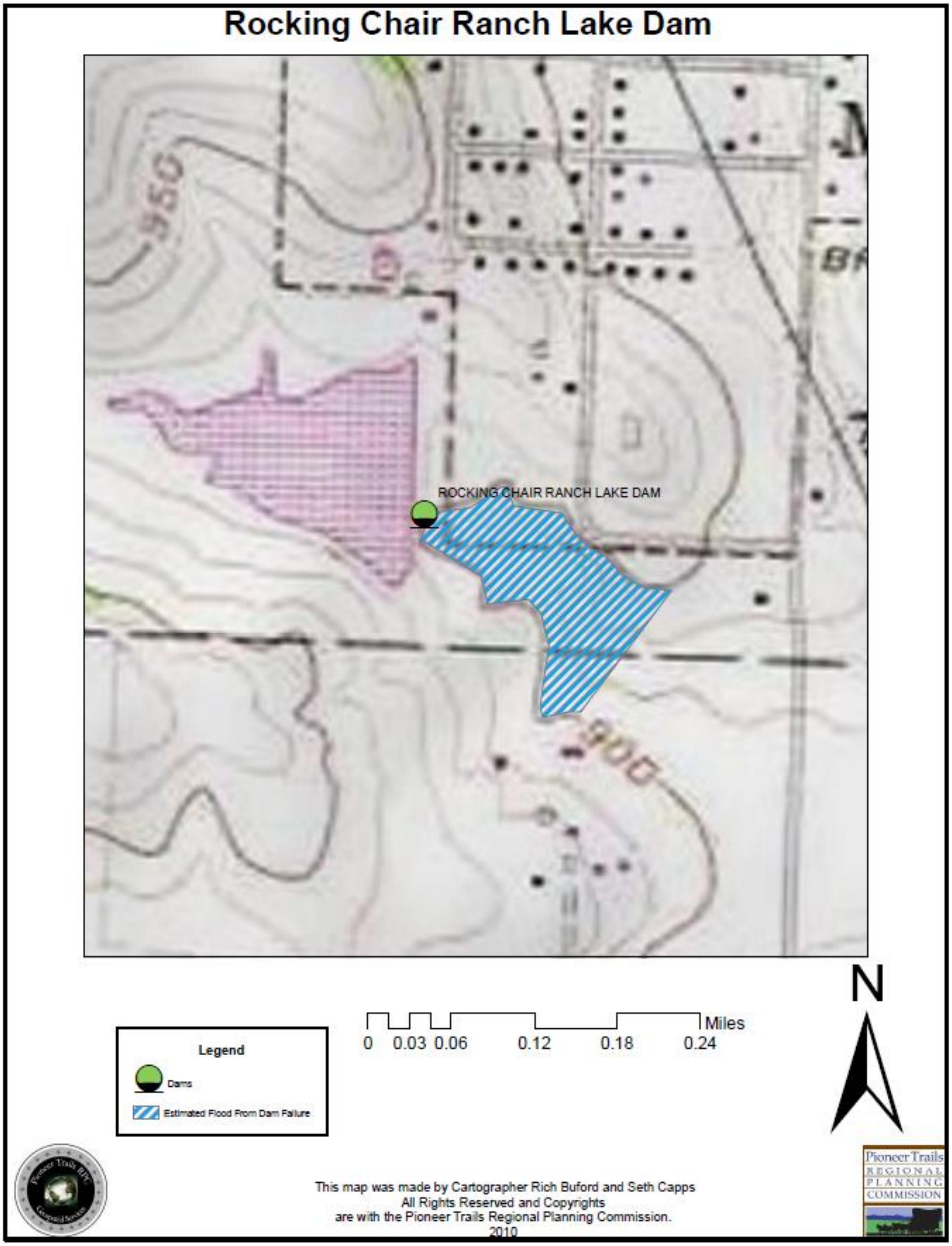

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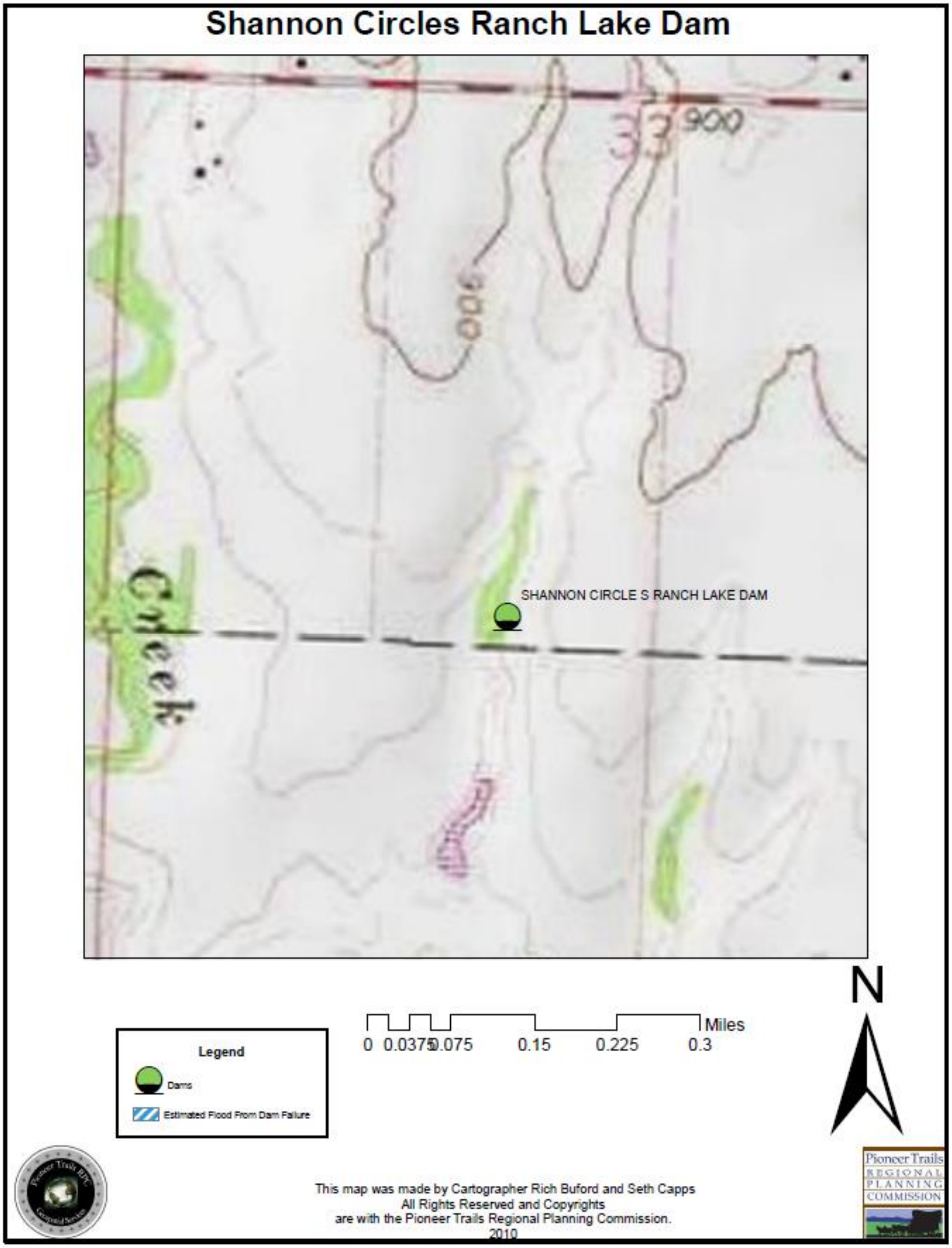

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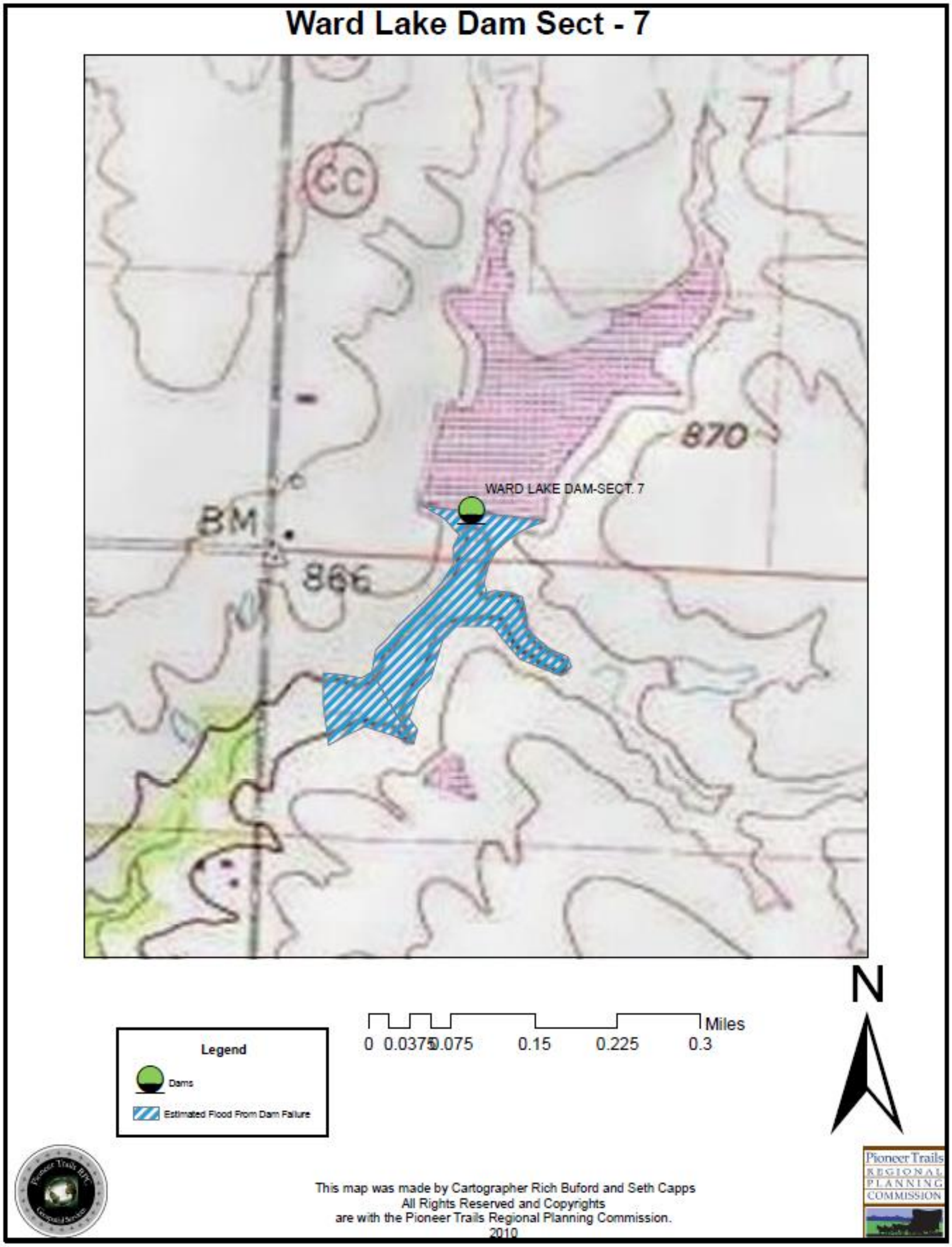


Figure 3.2.12-22

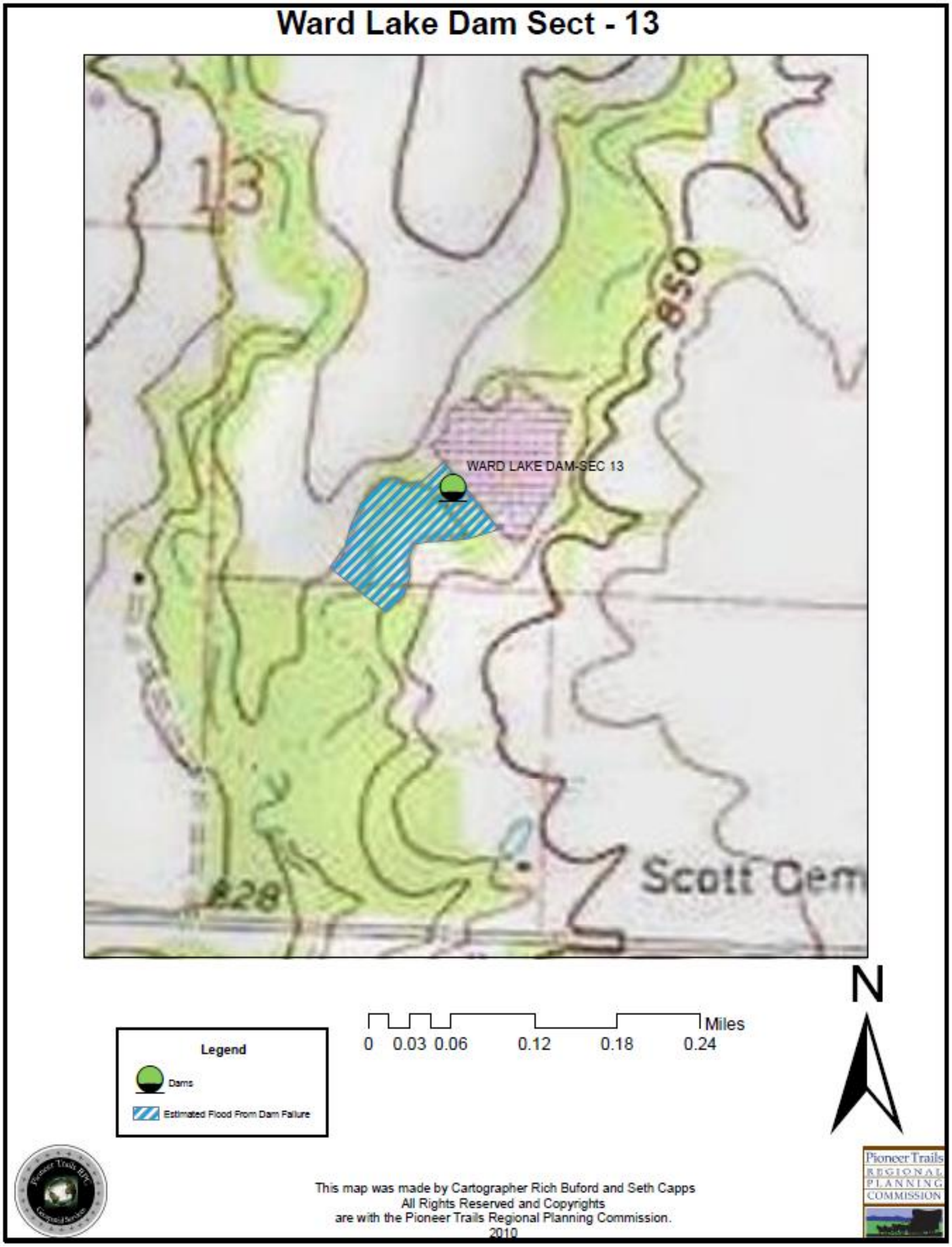
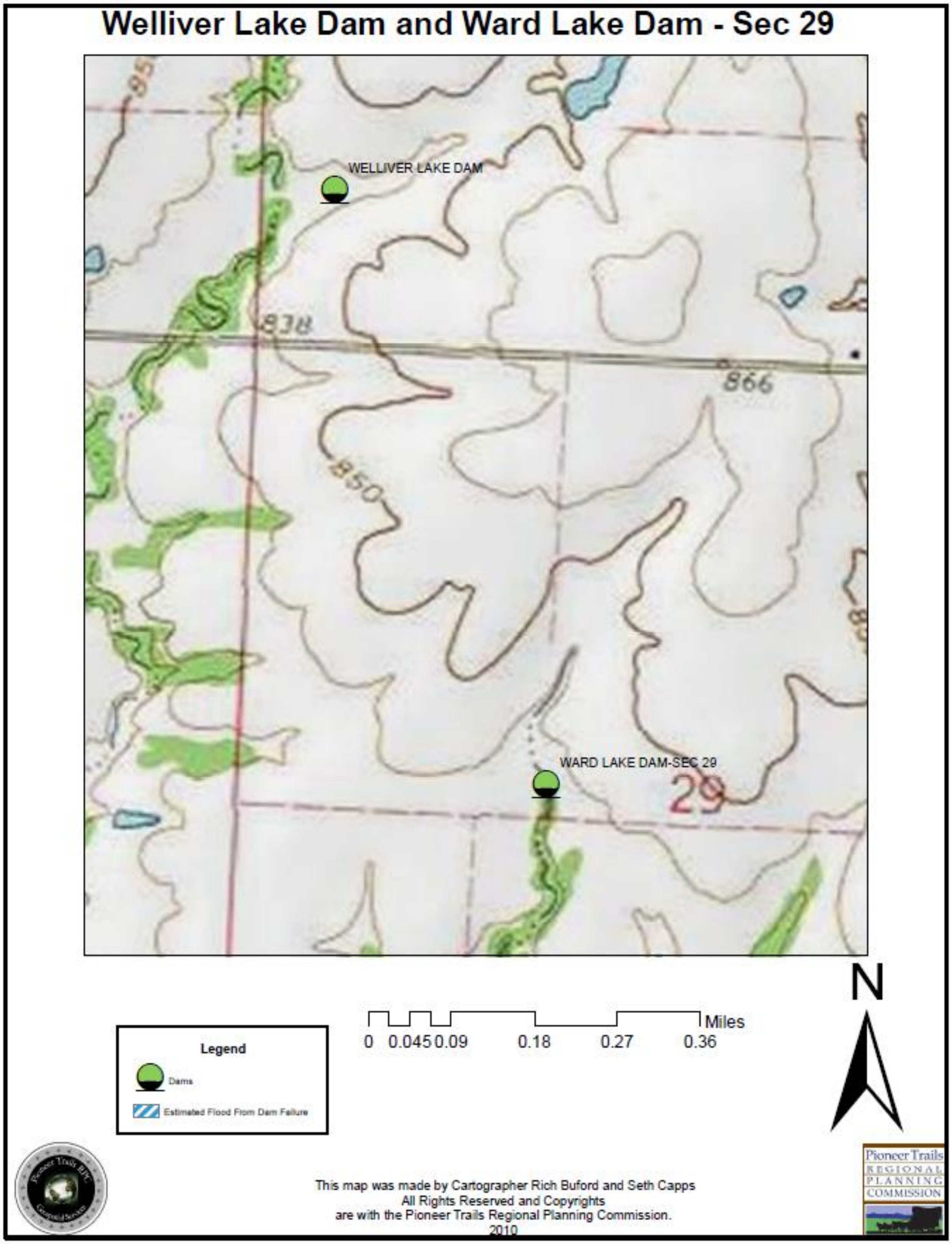


Figure 3.2.12-23



Without mitigation measures:

Life:	catastrophic
Property:	catastrophic
Emotional:	catastrophic
Financial:	catastrophic
Comments:	Without mitigation, 23 dams in Bates County pose dangerous threats to downstream communities

With mitigation measures:

Life:	negligible
Property:	negligible
Emotional:	negligible
Financial:	negligible
Comments:	If a mechanism for county inspections was instituted and deficiencies corrected, the risk of dam failure would be negligible.

Statement of Next Disaster's Likely Adverse Impact by Jurisdiction

The planning committee based the analysis of probability and severity of flooding on recorded previous events as reflected in the NCDC database. Based on this data, the assessment of a dam failure impact upon Bates County and its jurisdictions is a fairly moderate estimate. With 26 dams total in the county only 2 cities, Merwin and Rich Hill are at risk for flood damage from a dam failure. The Harmony Mission Dam, as well as the other dams with a Class 1 Hazard Ranking are in areas that would not have a detrimental effect on individual jurisdictions in the event of a dam failure.

Recommendation

That the county work with the DNR Dam Safety Program to identify appropriate mitigation measures and develop a comprehensive map of possible areas of inundation during a dam failure.

3.2.13 Wildfire

Each year, about 3,700 wildfires burn more than 55,000 acres of forest and grassland in our state. Unlike the Western states that have a summer fire season, Missouri's period of highest vulnerability to wildfires comes in the spring and fall. Dead vegetation, combined with the low humidity and high winds typical of these seasons, makes the risk of wildfire greater at these times.

The majority of wildfires in the world are thought to be started by people. However, the greatest cause of wild land fires is lightning. Eight million lightning strikes occur worldwide each day. One percent of these strikes result in wild land fires. In fact, dry lightning is responsible for 80 percent of all fires in wild land areas.

Dry lightning occurs during thunderstorms when the humidity levels are so low that rain evaporates before it reaches the ground. Even though the rain does not reach the ground, the lightning does.

Forest and grassland fires can and have occurred on any day throughout the year. The majority of the fires, however, and the greatest acreage loss will occur during the spring fire season which is normally between February 15 and May 10. The length and severity of this burning period depends on weather conditions. Spring is Missouri is noted for its low humidity and high winds. In addition, spring is the time of the year when rural residents normally burn their garden spots, brush piles, etc. Many landowners also still believe it is necessary to burn the woods in the spring of the year in order to get more grass, kill ticks, and get rid of the brush. These conditions, together with below normal precipitation and high temperatures, result in extremely high fire danger. Depending on weather conditions, a sizable number of fires also can occur between mid-October and late November.

According to SEMA's 2000 Hazard analysis, wildfires are most common in the southern districts of the state. However, it is possible for wildfires to occur in Bates County due to drought, debris burning and incendiary fires. According to the MDC, humans cause at least 88% of Missouri fires. Debris burning is consistently the number one cause of wildfires. Incendiary fires, willfully set on another person's property, continue to rank second in the number of wildfires each year. Fires caused by natural ignition, like lightning, are rare despite 50 to 70 thunderstorm days per year.

Table 3.2.13-1

2009 Missouri Wildfire Statistics

Item	Number of Fires	% of Total
Lightning	9	0%
Campfire	40	1%
Smoking	47	1%
Debris	1,804	48%
Arson	304	8%
Equipment	106	3%
Railroads	12	0%
Children	15	0%
Miscellaneous	1,442	38%
Total	**3,779**	**100%**

Figure 3.2.13-2: Fire Danger Categories

Low Fire Danger	Open burning is usually safe with proper containers and precautions under low fire danger conditions. However, residents should always check on local ordinances that prohibit open burning under any conditions. Escaped fires are easy to extinguish. No fire crew staffing is planned for low fire danger conditions.	**Burning index <20.**
Moderate Fire Danger	Open burning is usually safe with the proper precautions under moderate fire danger conditions. Burning should be done in the early morning and late evening to avoid windier conditions at midday. Escaped fires can be contained with proper fire-fighting equipment. Partial fire crew staffing is planned for moderate fire danger.	**Burning index = 21-30.**
High Fire Danger	Any open burning is discouraged during high fire danger. Windy conditions, low humidity and dry fuels contribute to high fire danger. Fires escape control easily and containment is difficult, endangering human safety and property. Partial or full fire staffing is planned, depending on local burning conditions.	**Burning index = 31-45.**
Extreme Fire Danger	Open burning should not be attempted during extreme fire danger. Local authorities may impose burning bans. High winds and extended dry periods lead to extreme burning conditions. Open fires can quickly escape and are very difficult to control. Spot fires occur ahead of the main fire, and erratic burning conditions make fires difficult to control even for experienced fire fighters. Full fire crew staffing is planned for extreme burning conditions.	**Burning index >45.**

In the United States, about 2.5 million acres (1 acre = 1 football field, approximately) of developed lands and wild lands will burn every year. Often the carelessness of people leads to fires in wild lands, in which planned burns by farmers is the leading contributor. Campers who neglect to properly extinguish campfires cause some wild land fires, while others are the result of lit cigarettes tossed onto the dry ground. Arsonists can contribute to other occurrences.

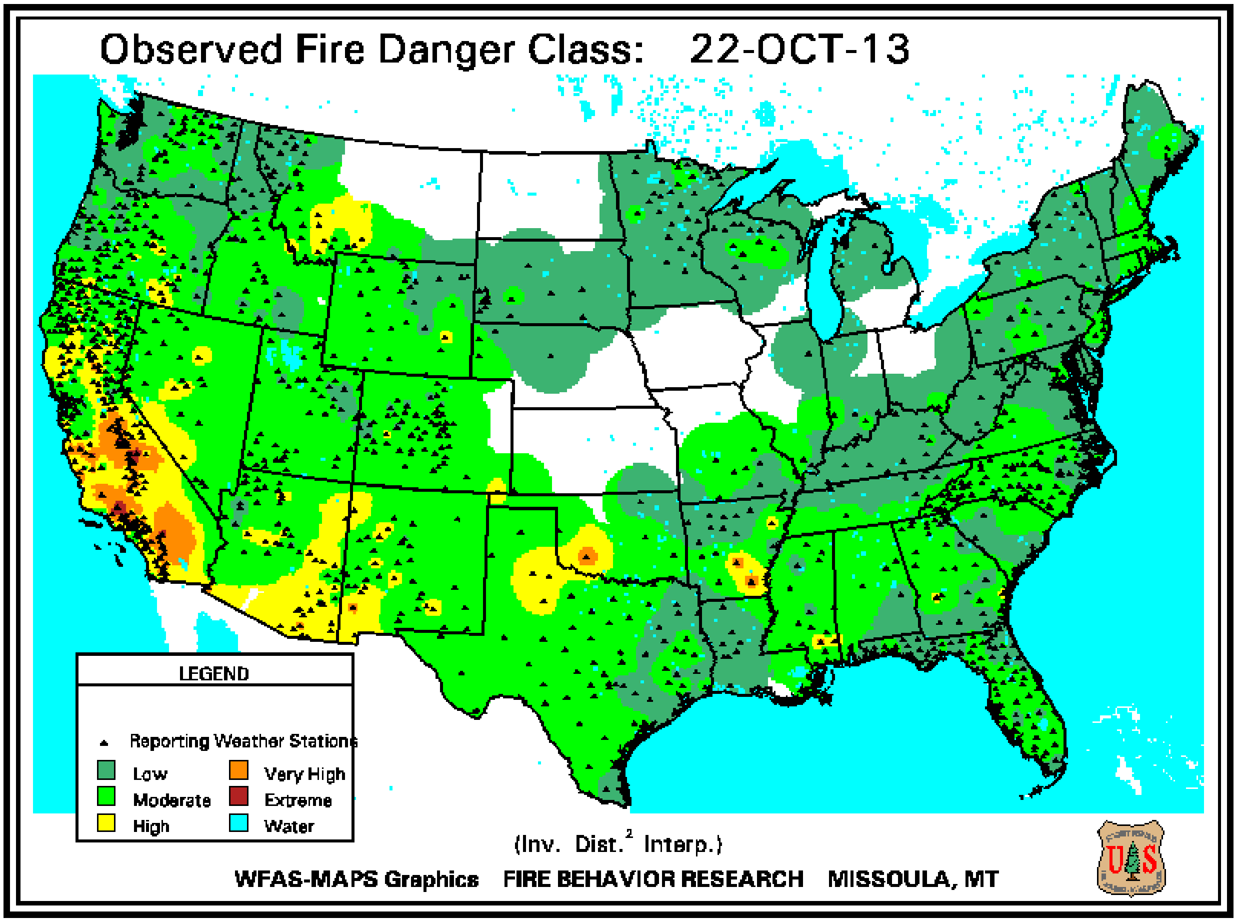
In most instances, grass, brush, and forest fires are natural events that have occurred periodically throughout history. There are three major classes of wild land fires: ground fires, surface fires, and crown fires. Ground fires spread across the grass and low-lying vegetation. Surface fires burn the trunks of trees as well as the grass and low-lying vegetation. During crown fires, the flames move across the ground, up the trees, and across the tops of the trees. Crown fires are the most dangerous and destructive class of wild land fires.

Fire danger is based upon the burning index (BI). The burning index takes into account the fuel moisture, relative humidity, wind speed, temperature and recent precipitation. The burning index is the basis for fire suppression crew staffing levels. The Missouri Department of Conservation relies upon the local news media to help warn citizens of high fire danger. A set of standardized fire danger adjectives has been developed for fire warnings. These adjectives include a brief description of burning conditions, open burning suggestions for homeowners and fire crew staffing levels. Residents should always check with their local fire department or conservationist for local burning conditions.

Historical Statistics

No Missouri fires are listed among the significant wildfires in the U.S. since 1825. Fires covering more than 300 acres are considered large in Missouri. Missouri averages 3,500 fires a year with 45,000 acres burned, or an average fire size of 12 acres. The following map shows the distribution of forest and grassland across the county. Bates County has experienced no wildfires in the past 60 years.

Figure 3.2.13-2



Statement of Future Probable Severity

In Bates County, according to local MDC agents, fires tend to be fairly frequent but small due to early detection and quick response. However, wildfires can flare out of control, often with catastrophic results. Grass grows back quickly with little damage, but fires in forests and croplands are costly. Grass and shrubs take one to five years to grow back. Trees, however, can take 20 to 100 years to return.

Additional losses occur in the buffer area between undeveloped and developed land. Even when they can respond immediately, fighters in rural areas may not be able to prevent large fires from destroying remote homes and property. The FEMA website points out that as residential areas expand into previously undeveloped areas; people living in these communities are increasingly threatened by forest fires. Protecting structures from fire in these buffer areas poses special problems, and can stretch firefighting resources to the limit. Propane tanks located near trees and vegetation can increase the risk of destruction in the event of fire. Fatalities occasionally can result from wildfires, usually due to overexertion or heart attack. The MDC diagram below illustrates the possible severity of a fire's progression.

Figure 3.2.13-3

Wildfire fuel includes combustible material in the form of vegetation such as grass, leaves, ground litter, plants, shrubs and trees. The forested areas, combined with dry weather conditions and/or human error, represent the potential for a disastrous wildfire within the county. Based on the county's ample supply of wildfire fuel and continuing new development near forest and grasslands, the future probable severity is shown below.

Buffer Areas:	critical
Forests:	critical
Croplands:	critical

The following maps provide an overview of wildfire exposure for jurisdictions in Bates County:

Table 3.2.13-3: Map Keys

Wildfire Category	Housing Density (Housing Units/Mile)	Vegetation
Low Density Interface	4 - 31	Below 50% of an area within 1.5 mi. of an area with 75% vegetation
Medium Density Interface	31 - 461	Below 50% of an area within 1.5 mi. of an area with 75% vegetation
High Density Interface	Greater than 461	Below 50% of an area within 1.5 mi. of an area with 75% vegetation
Low Density Intermix	4 - 31	Area with greater than 50% vegetation
Medium Density Intermix	31 - 461	Area with greater than 50% vegetation
High Density with No Vegetation	Greater than 461	Area with less than 50% vegetation

Wildfire Urban Interface Definitions (Source: University of Wisconsin)

Expanded legend for wildfire maps below.

Figure 3.2.13-4

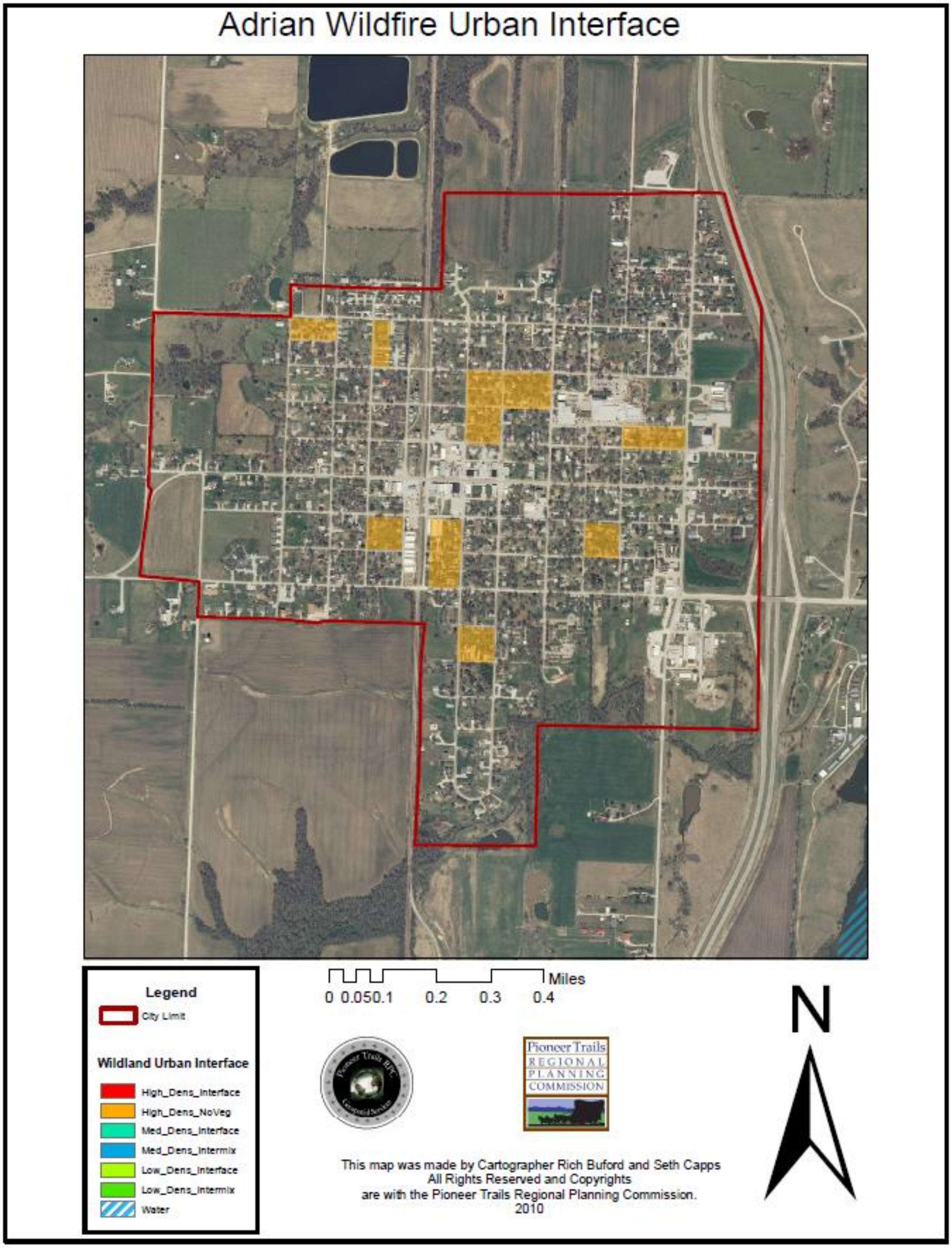


Figure 3.2.13-5

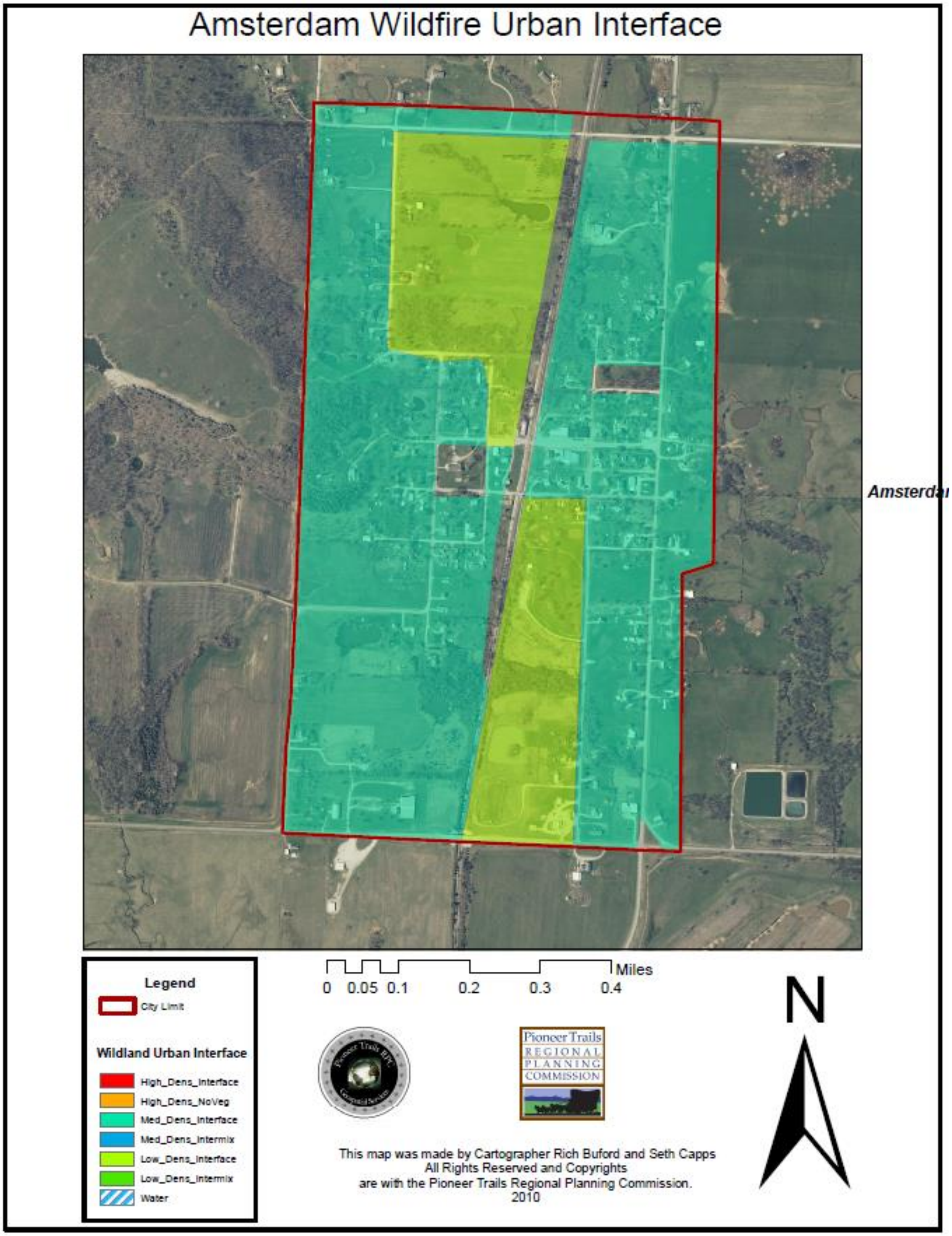


Figure 3.2.13-6

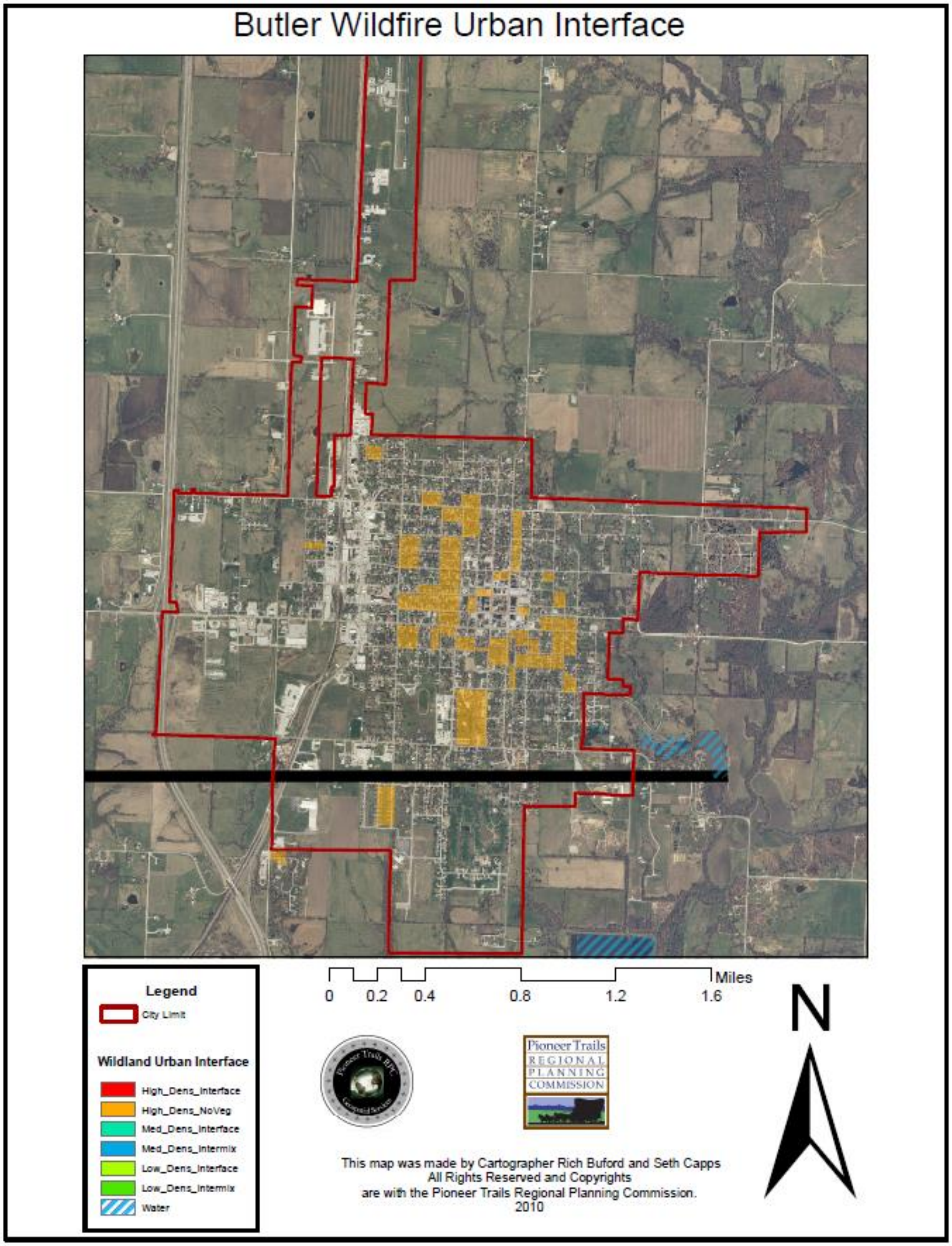


Figure 3.2.13-7

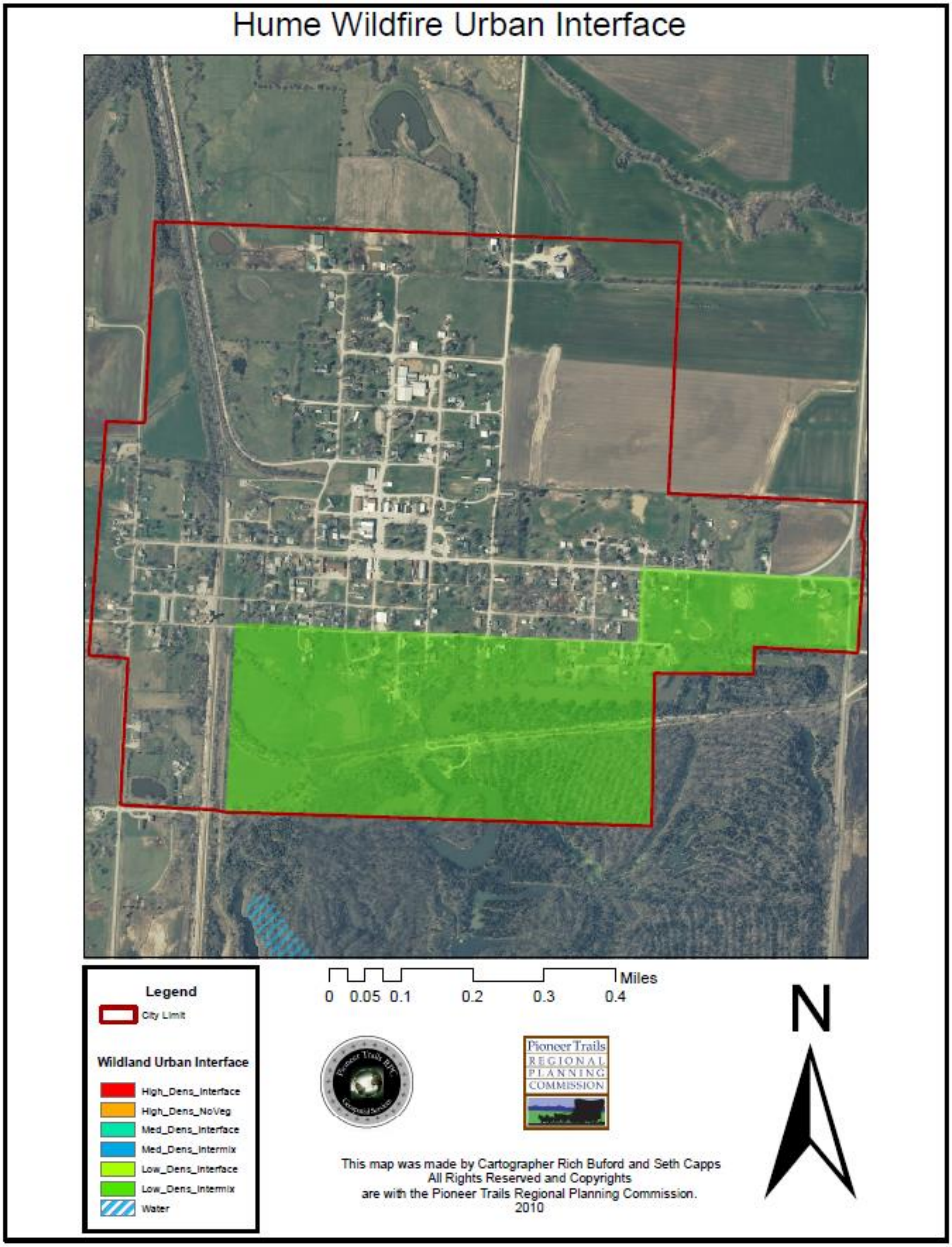


Figure 3.2.13-8

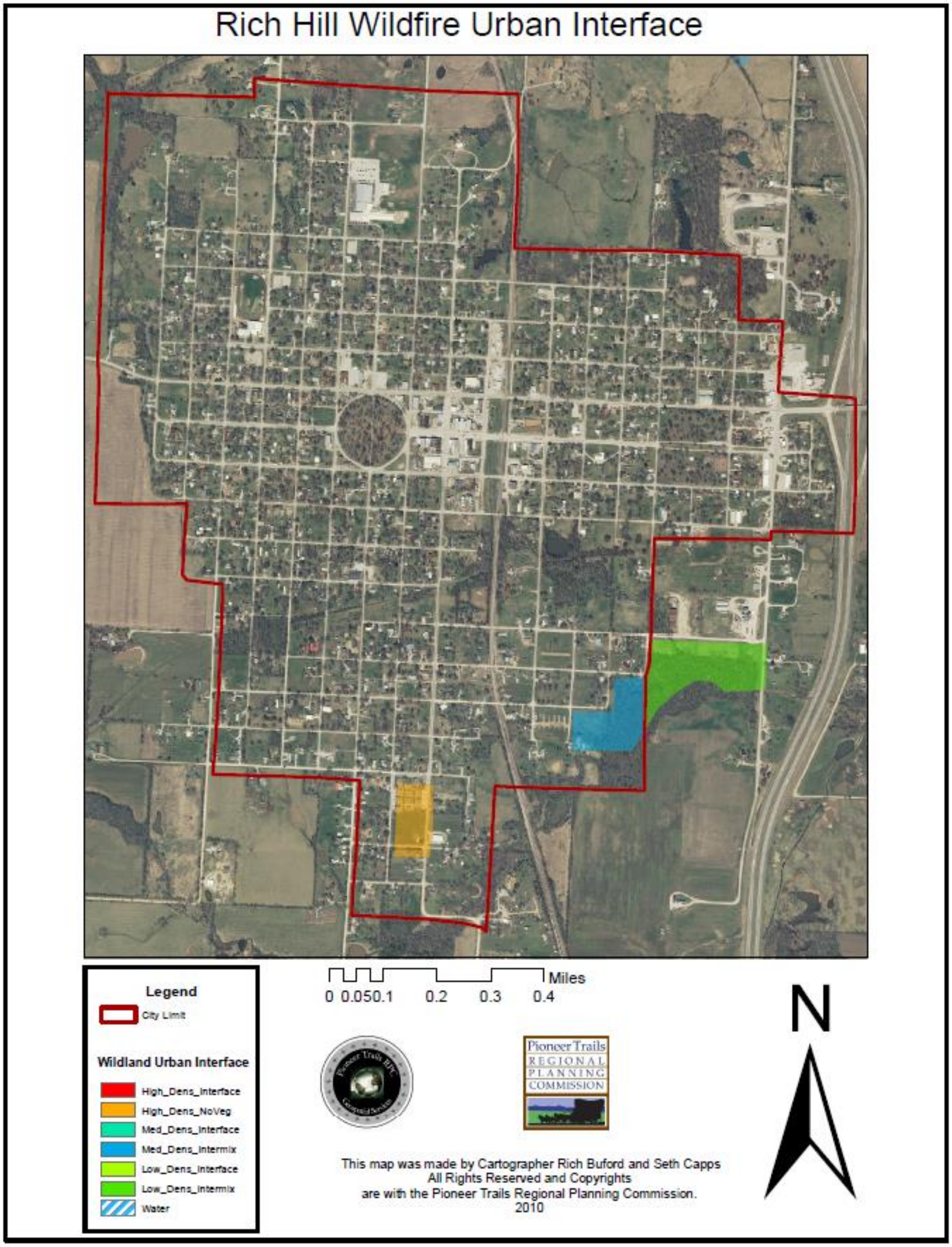
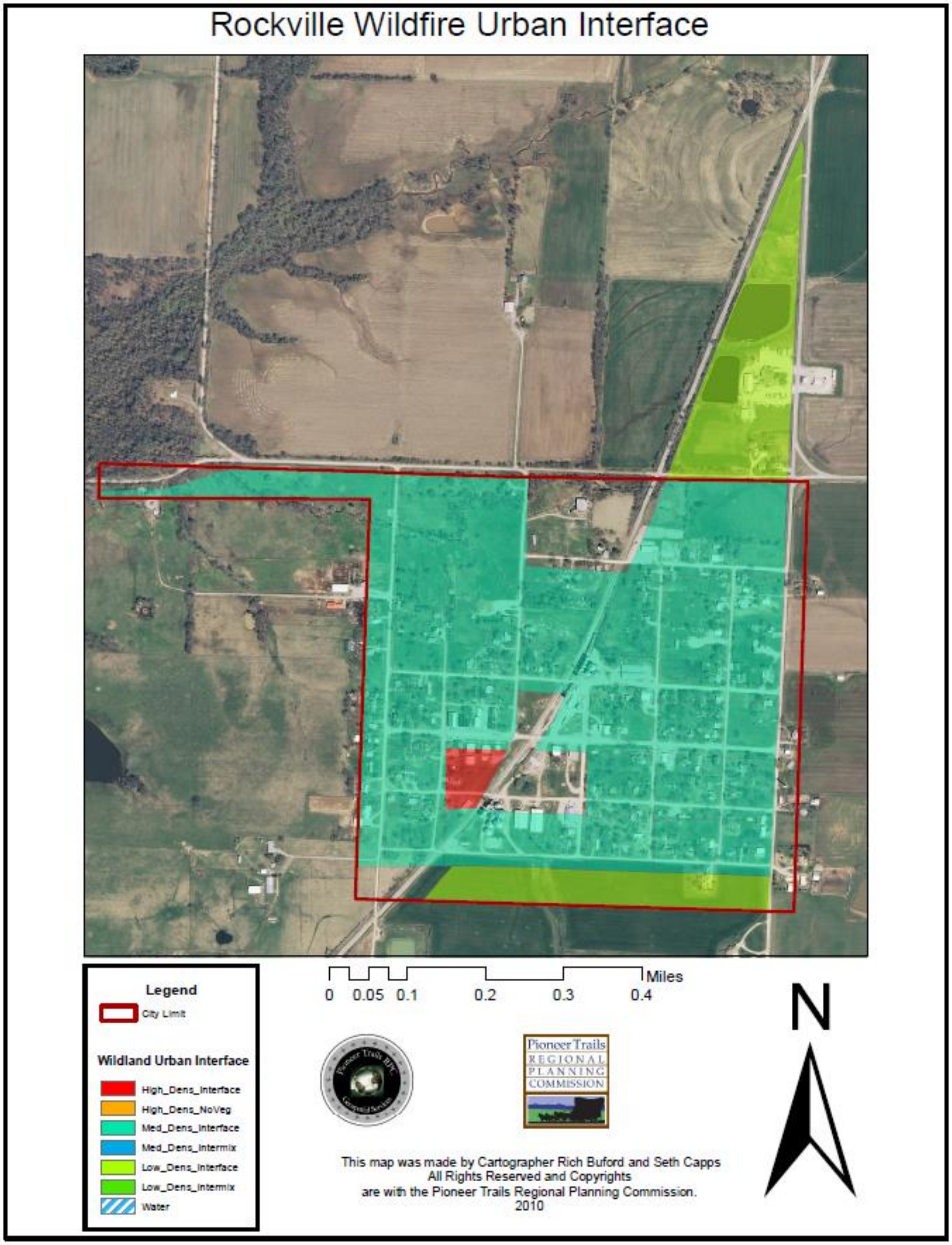


Figure 3.2.13-9



Statement of Probable Risk

Judging from the county's lack of wildfires, a disastrous wildfire is not likely. Conversely, the absence of previous fires has contributed to an increasing supply of wildfire fuel within the county's forested areas. The following fire danger index is used by MDC. The likeliness of a future occurrence, at each of the fire danger index levels is shown below.

Low Fire Danger:	highly likely
Moderate Fire Danger:	highly likely
High Fire Danger:	likely
Extreme Fire Danger:	possible

Statement of Next Disaster's Likely Adverse Impact on the Community

A major wildfire could affect expensive homes built within the buffer area. In addition, timber harvesters would suffer great economic hardship. The likely adverse impact of a disastrous Bates County wildfire is shown below.

Without Mitigation Measures:

Life:	limited
Property:	critical
Emotional:	critical
Financial:	critical

With Mitigation Measures:

Life:	negligible
Property:	limited
Emotional:	limited
Financial:	limited
Comments:	The practice of prescribed burning mimics nature's way of reducing the accumulation of underbrush that provides quick fuel for a wildfire.

Statement of Next Disaster's Likely Adverse Impact by Jurisdiction

Most jurisdictions within the county are equally susceptible to damage stemming from wildfire. Amsterdam and Rockville both have greater potential wildfire hazard damage within their city limits. Rich Hill, Hume, Butler and Adrian all have an exposure to wildfires that could cause damage within the community. The villages of Amoret, Foster, Merwin and Passaic are not exposed to the threat of wildfires. The possibility for increased impact is further compounded with possible complications concerning drought.

Recommendation

- Continue to pursue mitigation activities to encourage citizens to keep vegetation clear from structures.
- Institutes an education initiative to reduce the risk of wild fires.

Section 4: Multijurisdictional Risk Assessment

All municipalities and government subunits within Bates County participated in the creation of this hazard mitigation plan, and unless otherwise noted, the actions prescribed within pertain to all jurisdictions without bias. Bates County hazards strongly tend to be either geographically random or regional in scope, with exceptions in flood, wildfire and dam failure. Using historical events and data compiled from the National Weather Service and United States Geological Survey (USGS), Hazard Profile Worksheets for each identified natural hazard affecting Bates County are included in the following pages. The county and most of the incorporated areas have experienced limited damage from winter storms, tornadoes, thunderstorms, heat waves, drought, dam failure, and wildfires. All location-specific vulnerabilities are noted in the following Hazard Profile Worksheets as well as the preceding pages.

The scaling system for potential severity in the Hazard Profile Worksheets is as follows:

Catastrophic	-	More than 50% of area will be affected by hazard
Critical	-	25% to 50 % of area will be affected by hazard
Limited	-	10% to 25% of area will be affected by hazard
Negligible	-	Less than 10%

Vulnerability Assessment worksheets are included at the end of each hazard vulnerability assessment. These worksheets detail loss estimates for each hazard affecting the county. Loss estimates were calculated using a combination of information from the community profiles, historical loss data in the hazard profiles, and general knowledge of the jurisdiction as well as HAZUS data provided through the HAZUS-MH program provided by FEMA. Rough economic estimates were not included.

- The number of buildings was estimated by analysis shapefiles and attribute tables using GIS and HAZUS-MH
- The number of people was derived from population statistics in the 2000 US Census

4.1 Vulnerability Assessment

The following vulnerability assessment for Bates County and all of the jurisdictions was done using past hazard data (frequency and damage) as well as public input and assessment. The vulnerability was based on two key factors:

- Frequency of Hazard
- Severity of Hazard's Affect on an Area

These two factors were assigned a number value based on probability and severity:

Frequency of Hazard Scale:

Unlikely (Less than 1% probability in the next 100 years) - 1
Possible (1 – 10% probability in the next year) - 2
Likely (10 – 100% probability in the next year) - 3
Highly Likely (Near 100% probability in the next year - 4

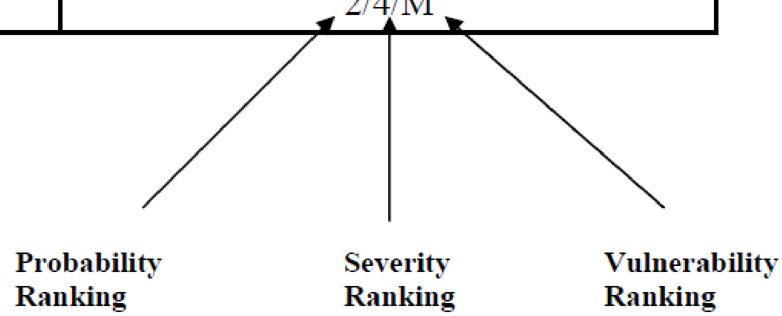
Severity of Hazard Scale:

Negligible (Less than 10% of hazard area affected) - 1
Limited (10 – 25% of hazard area affected) - 2
Critical (25 – 50% of hazard area affected) - 3
Catastrophic (50% or higher of hazard area affected) - 4

Hazards were assigned the two values by jurisdiction. The values of probability and severity were added together to determine the overall vulnerability of a hazard by each jurisdiction (Probability + Severity = Overall Vulnerability). For instance:

Figure 4.2-1

Hazard	County XYZ
Tornado	2/4/M



Overall Vulnerability (Probability + Severity) Scale:

Low - 1-3
Medium - 4-6
High - 7-8

Vulnerability data and building damage counts were calculated using HAZUS-MH from the Federal Emergency Management Agency (FEMA) data for Bates County. With current data availability, the building counts derived from HAZUS-MH are the only anticipated damages reported in the plan.

4.2.1 Tornado Vulnerability Assessment

All jurisdictions in Bates County have the same exposure to a tornado hazard. With the majority of tornados occurring in the County listed as EF-0 to EF-2, vulnerability is minimal. Significant Damage could occur, however, should an EF-3 or higher tornado occur within the limits of any jurisdiction. This is due to no design regulations in the county which would reinforce structures, almost a third of which were built before 1950. Hume, Passaic and Rockville have a significantly older housing stock than the rest of the county with the majority of their homes built before 1950. A large number of Bates County residents also reside in mobile homes. These structures are not suited to withstand high winds and the effects of a tornado leading to extensive damage. 15 percent of the housing stock is mobile homes with the majority being in the unincorporated areas, Passaic, Merwin, Hume and Amoret.

Table 4.2.1-1: Bates County Tornado Loss Estimate

County	Population Impacted	Total Buildings	Buildings Impacted	Approximate Value Affected	Flood Loss Ratio (based on exposure)	Comments
Bates	4,173	8273	1,641	$35,084,313	0.198356098	0.140312

Source: 2013 Missouri State Hazard Mitigation Plan

Figure 4.2.1-1

TORNADO HAZARD PROFILE WORKSHEET

POTENTIAL SEVERITY BY TORNADO TYPE:

EF0 - Negligible	**EF3 - Critical**
EF1 - Limited	**EF4 - Catastrophic**
EF2 - Limited	**EF5 - Catastrophic**

FREQUENCY OF OCCURRENCE:

- [ ] **Highly Likely**: Near 100% probability in next year.
- [x] **Likely**: Between 10 and 100% probability in next year, or at least one chance in 10 years.
- [ ] **Possible**: Between 1 and 10% probability in next year, or at least one chance in next 100 years.
- [ ] **Unlikely**: Less than 1% probability in next 100 years.

SEASONAL PATTERN:

Most Bates County tornadoes have occurred between April and July, but have known to stretch from February to November.

AREAS LIKELY TO BE AFFECTED MOST (BY SECTOR):

Any location in Bates County could be susceptible to a tornado.

PROBABLE DURATION:

Bates County's tornadoes have ranged from F0 to F3. At these levels, most are usually on the ground for a few minutes.

POTENTIAL SPEED OF ONSET

(Probable amount of warning time):

- [x] Minimal (or no) warning.
- [ ] 6 to 12 hours warning.
- [ ] 12 to 24 hours warning.
- [ ] More than 24 hours warning.

EXISTING WARNING SYSTEMS:

Bates County has several tornado sirens in the incorporated communities, but the growth of each of the cities requires additional sirens to be installed.

SPECIAL VULNERABILITIES BY JURISDICTION

Hume, Passaic and Rockville all have a significantly older housing stock than the rest of the county. Passaic, Merwin, Hume, Amoret and the unincorporated area all have a large portion of their housing stock categorized as mobile homes. Old structures and mobile homes, coupled with no building or design regulations increase vulnerability of these jurisdictions to tornado and high wind events.

4.2.2 Severe Thunderstorms Vulnerability Assessment

All jurisdictions in Bates County have the same exposure to a thunderstorm and high wind hazard. Vulnerability is critical with a severe thunderstorm highly likely to occur and cause damage. Damage is likely to occur due to no design regulations in the county which would reinforce structures, almost a third of which were built before 1950. Hume, Passaic and Rockville have a significantly older housing stock than the rest of the county with the majority of their homes built before 1950. A large number of Bates County residents also reside in mobile homes. These structures are not suited to withstand high winds and the effects of a tornado leading to extensive damage. 15 percent of the housing stock is mobile homes with the majority being in the unincorporated areas, Passaic, Merwin, Hume and Amoret.

Table 4.2.2-1: Bates County Severe Thunderstorm Estimated Losses

County	Total Hail Incidents	Total Hail Property Loss ($)	Total Crop Insurance Paid for Hail Damage ($)	Total Wind Incidents ($)	Total Wind Property Loss ($)	Total Crop Insurance Paid for Wind Damage ($)	Total Lightning Incidents	Total Lightning Property Loss ($)
Bates	104	$6,897,000	$249,653	22	$12,000	$33,63	1	$2,000

Source: 2013 State of Missouri Hazard Mitigation Plan

Figure 4.2.2-2

SEVERE THUNDERSTORM HAZARD PROFILE

WORKSHEET

POTENTIAL SEVERITY:

Critical: 25 to 50%

FREQUENCY OF OCCURRENCE:

- [X] **Highly Likely**: Near 100% probability in next year.
- [ ] **Likely**: Between 10 and 100% probability in next year, or at least one chance in 10 years.
- [ ] **Possible**: Between 1 and 10% probability in next year, or at least one chance in next 100 years.
- [ ] **Unlikely**: Less than 1% probability in next 100 years.

SEASONAL PATTERN:

Severe thunderstorms hail, and high winds may occur at any time during the year, but tend to be most prevalent between March and October.

AREAS LIKELY TO BE AFFECTED MOST (BY SECTOR):

Any location in Bates County could be susceptible to severe storms.

PROBABLE DURATION:

Severe storms vary considerable in duration.

POTENTIAL SPEED OF ONSET

(Probable amount of warning time):

- [ ] Minimal (or no) warning.
- [X] 6 to 12 hours warning.
- [ ] 12 to 24 hours warning.
- [ ] More than 24 hours warning.

EXISTING WARNING SYSTEMS:

Most communities have siren systems and there are weather radio frequencies available for this area.

SPECIAL VULNERABILITIES BY JURISDICTION

Hume, Passaic and Rockville all have a significantly older housing stock than the rest of the county. Passaic, Merwin, Hume, Amoret and the unincorporated area all have a large portion of their housing stock categorized as mobile homes. Old structures and mobile homes, coupled with no building or design regulations increase vulnerability of these jurisdictions to tornado and high wind events.

4.2.3 Flood Vulnerability Assessment

Bates County, Adrian and Butler all participate in the NFIP. While the floodplain encroaches into these three jurisdictions, ordinances and regulations are in place to prevent unauthorized development in floodplain areas. Amoret is not listed as participating communities in the FEMA Community Status Book Report for Missouri as a participating in the National Flood Program.

Amsterdam, Hume, Merwin, Rich Hill and Rockville all have the floodplains in their jurisdiction, but do not participate in the NFIP. The floodplain does not affect any structures in Amsterdam, Hume, Merwin and Rockville; however a few are located in the floodplain in Rich Hill. None of Foster and Passaic are located in the floodplain. Damage in Bates County can also cause damage on roads and infrastructure. Crops are also susceptible to flood damage as well, which is the most vulnerable asset in the county in regards to flooding.

4.2.3A: Hazus Bates County 100 Year Flood Scenario

General Description

This scenario is based on a Hazus study, specific to Bates County, done by the State of Missouri.

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of Hazus is to provide a methodology and software application to develop multi -hazard losses at a regional scale . These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The geographical size of the region is 848 square miles and contains 1,941 census blocks. The region contains over 7 thousand households and has a total population of 16,653 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 9,606 buildings in the region with a total building replacement value (excluding contents) of 948 million dollars (2006 dollars). Approximately 95.24% of the buildings (and 71.16% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 9,606 buildings in the region which have an aggregate total replacement value of 948 million (2006 dollars). Table 4.3.2A-1 and Table 4.3.2A-2 present the relative distribution of the value with respect to the general occupancies by Study Region and Bates County Scenario respectively.

Table 4.2.3A-1: Building Exposure by Occupancy for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	674,307	71.2%
Commercial	135,534	14.3%
Industrial	28,906	3.1%
Agricultural	19,297	2.0%
Religion	21,461	2.3%
Government	19,196	2.0%
Education	48,886	5.2%
Total	**947,587**	**100.00%**

Table 4.2.3A-2: Building Exposure by Occupancy for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	301,710	90.7%
Commercial	20,036	6.0%
Industrial	4,347	1.3%
Agricultural	1,252	0.4%
Religion	3,203	1.0%
Government	79	0.0%
Education	1,955	0.6%
Total	**332,582**	**100.00%**

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 60 beds. There are 15 schools, 9 fire stations, 4 police stations and 1 emergency operation center.

Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	Bates County – 2013 State Hazard Mitigation Plan
Scenario Name:	Bates Flood – 100 year
Return Period Analyzed:	100 year
Analysis Options Analyzed:	No what-ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 21 buildings will be at least moderately damaged. This is over 37% of the total number of buildings in the scenario. There are an estimated 7 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 of the Hazus Flood Technical Manual . Table 4.3.2A-3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4.3.2A-4 summarizes the expected damage by general building type.

Table 4.2.3A-3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		substantially	
Occupancy	**count**	**%**	**count**	**%**	**count**	**%**	**count**	**%**	**count**	**%**	**count**	**%**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	1	4.76	4	19.05	9	42.86	7	33.33
Total					**1**		**4**		**9**		**7**	

Table 4.2.3A-4: Expected Building Damage by Building Type

	1-10		11-20		21-30		31-40		41-50		substantially	
Building Type	count	%	count	%	count	%	count	%	count	%	count	%
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManfHouse	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	100.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	1	100.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	1	5.26	3	15.79	9	47.37	6	31.58
Total					**1**		**4**		**9**		**7**	

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 60 hospital beds available for use. On the day of the scenario flood event, the model estimates that 60 hospital beds are available in the region.

Table 4.2.3A-5: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**At least moderate**	**At least Substantial**	**Loss of use**
Fire Stations	9	0	0	0
Hospitals	1	0	0	0
Police Stations	4	0	0	0
Schools	15	0	0	0

Social Impact

Shelter Requirements

Hazus estimates that number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodation in temporary public shelters. The model estimated 348 households will be displaced due to the flood. Displacement include households evacuated from within or very near to the inundated area. Of these, 130 people (out of a total population of 16,653) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 20.87 million dollars, which represents 6.27 percent of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood.

Business interruption

Losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 20.86 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 73.67% of the total loss. Table 4.3.2A-6 below provides a summary of the losses associated with the building damage.

Table 4.2.3A-6: Building-Related Economic Loss Estimates
(Millions of Dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building loss						
	Building	10.30	0.42	0.78	0.11	11.61
	Content	5.07	1.04	1.97	0.63	8.72
	Inventory	0.00	0.02	0.50	0.03	0.54
	Subtotal	15.37	1.48	3.25	0.76	20.86
Business Interruption						
Income	0.00	0.00	0.00	0.00	0.00	0.01
Relocation	0.00	0.00	0.00	0.00	0.00	0.00
Rental Income	0.00	0.00	0.00	0.00	0.00	0.00
Wage	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.01
All	Total	15.37	1.48	3.25	0.76	20.87

Figure 4.3.3-2

FLOOD HAZARD PROFILE WORKSHEET

POTENTIAL SEVERITY:

Critical: 25 to 50%

FREQUENCY OF OCCURRENCE:

- [ ] **Highly Likely**: Near 100% probability in next year.
- [ ] **Likely**: Between 10 and 100% probability in next year, or at least one chance in 10 years.
- [X] **Possible**: Between 1 and 10% probability in next year, or at least one chance in next 100 years.
- [ ] **Unlikely**: Less than 1% probability in next 100 years.

SEASONAL PATTERN:

Flooding occurs most often in the county during the months of April through June.

AREAS LIKELY TO BE AFFECTED MOST (BY SECTOR):

Any location, where topography allows, in Bates County could be susceptible to flooding.

PROBABLE DURATION:

Flash flooding can occur within minutes. Sustained flooding can last over several days, weeks, or months.

POTENTIAL SPEED OF ONSET

(Probable amount of warning time):

- [X] Minimal (or no) warning.
- [ ] 6 to 12 hours warning.
- [ ] 12 to 24 hours warning.
- [ ] More than 24 hours warning.

EXISTING WARNING SYSTEMS:

National Weather Service Watches and Warnings via TV, Radio, and Weather Radio.

SPECIAL VULNERABILITIES BY JURISDICTION

Amsterdam, Merwin, Hume, Rich Hill, and Rockville all have portions of their jurisdiction in their floodplain. None of these communities participate in the NFIP. With no regulation these jurisdictions are at risk for losses from flood events. 3 communities: Adrian, Butler and the unincorporated area participate in the NFIP and have regulations to deal with floodplain development.

4.2.4 Severe Winter Weather Vulnerability Assessment

Every jurisdiction in Bates County is susceptible to severe winter weather. Direct damage to structures is minimal in the event of a severe winter storm event, but with an aging housing stock the threat of a collapsed roof from heavy snowfall or frozen pipes remains a risk. Loss of life remains a threat as well with access ways for emergency services inaccessible during severe ice and snow events.

Vulnerability Loss Estimation: Vulnerable structures damages in the event of a severe snow and ice event.

<u>Figure 4.2.4-1:</u> Annualized Severe Winter Weather Damages

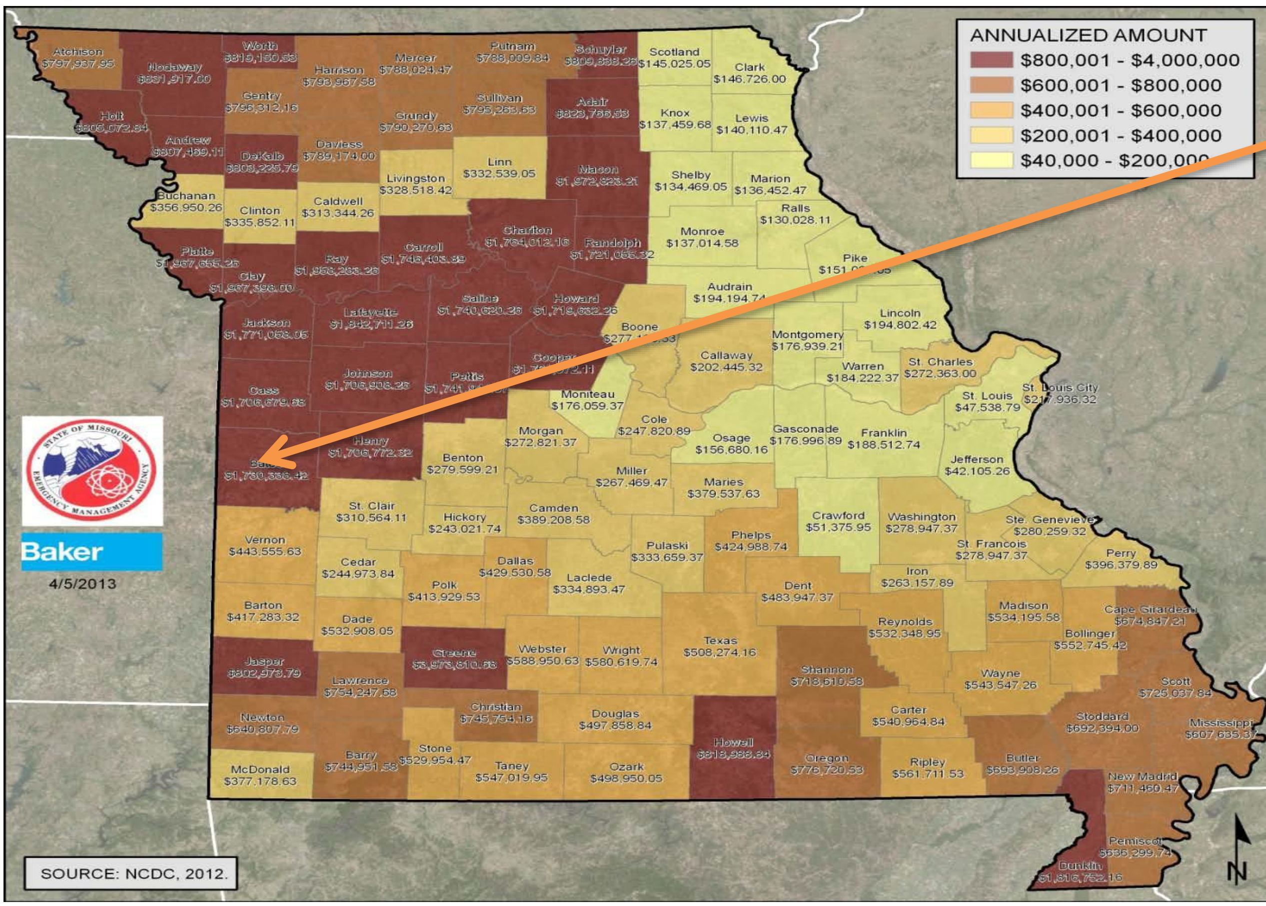


Figure 4.2.4-1 demonstrates that Bates County annualized severe winter weather damages may total between $400.001 and $600.000.

Figure 4.2.4-2

SEVERE WINTER WEATHER HAZARD PROFILE WORKSHEET

POTENTIAL SEVERITY:

Heavy Snow - Limited

Ice Event - Limited

Extreme Cold - Critical

Blizzard - Critical

FREQUENCY OF OCCURRENCE:

- [x] **Highly Likely**: Near 100% probability in next year.
- [ ] **Likely**: Between 10 and 100% probability in next year, or at least one chance in 10 years.
- [ ] **Possible**: Between 1 and 10% probability in next year, or at least one chance in next 100 years.
- [ ] **Unlikely**: Less than 1% probability in next 100 years.

SEASONAL PATTERN:

Severe winter weather in Bates County occurs most often October through March.

AREAS LIKELY TO BE AFFECTED MOST (BY SECTOR):

Severe Winter Weather events tend to occur on a regional scale, thus likely to affect the entire county.

PROBABLE DURATION:

Dangerous conditions can occur within a few hours. Ice and/or snow can last over several days. Cascading effects (utility outages, for example) also can last several days.

POTENTIAL SPEED OF ONSET

(Probable amount of warning time):

- [ ] Minimal (or no) warning.
- [x] 6 to 12 hours warning.
- [ ] 12 to 24 hours warning.
- [ ] More than 24 hours warning.

EXISTING WARNING SYSTEMS:

National Weather Service Watches and Warnings via TV, Radio, and Weather Radio.

SPECIAL VULNERABILITIES BY JURISDICTION

All Jurisdictions represented by this plan are equally vulnerable to severe winter weather.

4.2.5 Drought Vulnerability Assessment

Over the past decade five drought alerts have been declared in Bates, three of which were a Phase 3 (Conservation Phase) Alert. With close to 88% of the county farmland, the major damage from a drought to Bates County is in agricultural losses.

Vulnerability Loss Estimation: In the event a Phase 3 Alert, critical damage to county crops could occur resulting in damage to 50% of farms, crops and livestock:

Table 4.2.5-1: Bates County Vulnerability to Drought

County	Total Crop Insurance Paid for Drought Damage 1998-2012	Crop Claims Ratio Rating	Annualized Crop Insurance Claims/Drought Damage	Crop Exposure (2007 Census of Agriculture)	Annual Crop Claims Ratio	Crop Loss Ratio Rating
Bates	$49,475,429	4	$3,298,362	$49,679,000	6.64%	4

Source: 2013 State of Missouri Hazard Mitigation Plan

Figure 4.2.5-1

DROUGHT HAZARD PROFILE WORKSHEET

POTENTIAL SEVERITY:

Phase 1 - Negligible

Phase 2 - Limited

Phase 3 - Critical

Phase 4 - Critical

FREQUENCY OF OCCURRENCE:

- [ ] **Highly Likely**: Near 100% probability in next year.
- [x] **Likely**: Between 10 and 100% probability in next year, or at least one chance in 10 years.
- [ ] **Possible**: Between 1 and 10% probability in next year, or at least one chance in next 100 years.
- [ ] **Unlikely**: Less than 1% probability in next 100 years.

SEASONAL PATTERN:

Drought alerts usually are issued in the summer months, however, economic impacts can extend year round.

AREAS LIKELY TO BE AFFECTED MOST (BY SECTOR):

Severe droughts tend to occur on a regional scale, thus likely to affect the entire county.

PROBABLE DURATION:

Drought conditions can last several months to several years.

POTENTIAL SPEED OF ONSET

(Probable amount of warning time):

- [ ] Minimal (or no) warning.
- [ ] 6 to 12 hours warning.
- [ ] 12 to 24 hours warning.
- [x] More than 24 hours warning.

EXISTING WARNING SYSTEMS:

MO DNR uses several indices to monitor precipitation and other drought factors. The PSDI is the main indicator.

SPECIAL VULNERABILITIES BY JURISDICTION

All Jurisdictions and crops represented by this plan are equally vulnerable to drought.

4.2.6 Extreme Heat Vulnerability Assessment

Every jurisdiction in Bates County is susceptible to extreme heat conditions. The primary at risk populations to severe heat are senior citizens, defined as those aged sixty-five and older. Bates County currently has a large amount of senior citizens, who comprise almost a fifth of the population at 19%. Loss of life due to excessively high temperatures which could cause, exhaustion, heat stroke and dehydration remains a constant threat to elderly citizens. No cooling centers exist in the county to provide relief for residents creating an even greater threat to loss of life

Vulnerability Loss Estimation: Rural deaths in Missouri as a result of hyperthermia accounted for 39% of heat related deaths as compared with 61% of heat related deaths in the metropolitan areas. From 2000-2009, 84 deaths have been recorded across rural Missouri, which averages to nine deaths a year. Data deficiencies at the time do not allow for estimations based on single county losses.

<u>Figure 4.2.6-1:</u> Bates County Percent of Age 65 and up.

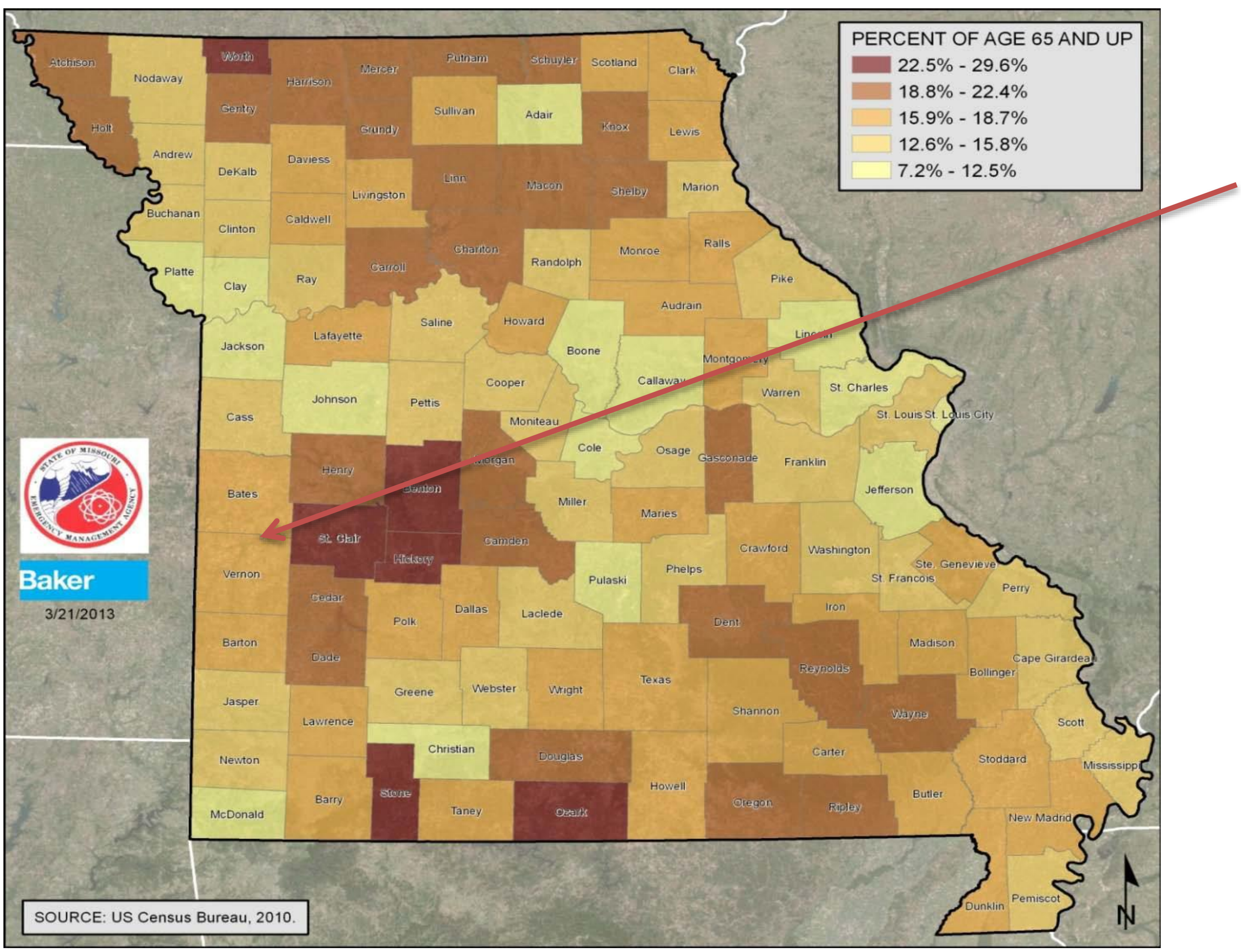


Figure 4.2.6-1 above indicates that Bates County has approximately a 20% population of citizens age 65 and above, which may lead to an increased risk of hyperthermic illness and fatalities during the summer months.

Figure 4.2.3-2 Hyperthermia Morality

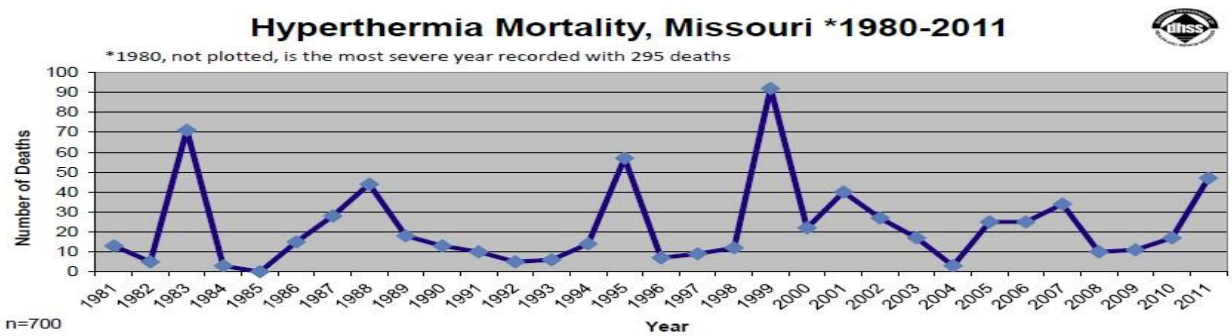


Figure 4.2.6-3

EXTREME HEAT HAZARD PROFILE WORKSHEET

POTENTIAL MAGNITUDE (Percentage of the jurisdiction that can be affected):

Heat Index of 130 Degrees (f) or higher - Catastrophic

Heat Index of 105 to 129 Degrees (f) - Critical

Heat Index of 90 to 104 Degrees (f) - Limited

Heat Index of less than 90 Degrees (f) - Negligible

FREQUENCY OF OCCURRENCE:

- [ ] **Highly Likely**: Near 100% probability in next year.
- [x] **Likely**: Between 10 and 100% probability in next year, or at least one chance in 10 years.
- [ ] **Possible**: Between 1 and 10% probability in next year, or at least one chance in next 100 years.
- [ ] **Unlikely**: Less than 1% probability in next 100 years.

SEASONAL PATTERN:

Heat wave alerts usually are issued in the summer months, however, economic impacts can extend year round.

AREAS LIKELY TO BE AFFECTED MOST (BY SECTOR):

Severe heat and drought tend to occur on a regional scale, thus likely to affect the entire county.

PROBABLE DURATION:

Extreme heat conditions can last several days to weeks.

POTENTIAL SPEED OF ONSET

(Probable amount of warning time):

- [ ] Minimal (or no) warning.
- [ ] 6 to 12 hours warning.
- [ ] 12 to 24 hours warning.
- [x] More than 24 hours warning.

EXISTING WARNING SYSTEMS:

The National Weather Service uses the Heat Index to alert the public via TV, radio, and weather radio.

SPECIAL VULNERABILITIES BY JURISDICTION

All Jurisdictions represented by this plan are equally vulnerable to heat waves. Elderly populations may be more adversely affected than other age cohorts to an extreme heat event.

4.2.7 Earthquake Vulnerability Assessment

Over the past several years, Bates County has experienced several minor tremors with little structural damage occurring. However, with no design regulation and the median year that houses were built in the county is 1970, Bates County is susceptible to critical damage should an earthquake of 5.0 or greater hit from faults on either side of the state.

The loss-ratio column in Table 4.2.7 from the 2013 Missouri State Hazard Mitigation Plan represents the ratio of the average annualized losses of Bates County divided by the entire building inventory by county as calculated by Hazus. The loss ratio is an indication of the economic impacts an earthquake could have, and how difficult it could be for a particular community to recover from an event.

Table 4.2.7-1: Bates County Estimated Earthquake Losses

	Building Loss Total ($)*	Loss Ratio %**	Income Loss Total ($)*	Total Economic Loss to Buildings ($)*	Loss Ratio Rank
Bates	20	0.00	5	25	109

4.2.7A Hazus Bates County Earthquake Scenario

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery. (Information taken from the State of Missouri)

The geographical size of the region is 850.58 square miles and contains 4 census tracts. There are over 6 thousand households in the region which has a total population of 17,049 people (2002 Census Bureau data).

There are an estimated 8 thousand buildings in the region with a total building replacement value (excluding contents) of 1,598 (millions of dollars). Approximately 94.00 % of the buildings (and 82.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 815 and 583 (millions of dollars) , respectively.

Building Inventory

Hazus estimates that there are 8 thousand buildings in the region which have an aggregate total replacement value of 1,598 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 65% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 60 beds. There are 15 schools, 9 fire stations, 4 police stations and 1 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 28 dams identified within the region. Of these, 3 of the dams are classified as 'high hazard'. The inventory also includes 0 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 4.2.7A-1 and 4.2.7A-2.

The total value of the lifeline inventory is over 1,398.00 (millions of dollars). This inventory includes over 108 kilometers of highways, 283 bridges, 5,535 kilometers of pipes.

Table 4.2.7A-1: Bates County Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	283	103.10
	Segments	19	550.90
	Tunnels	0	0.00
		Subtotal	**654.00**
Railways	Bridges	0	0.00
	Facilities	0	0.00
	Segments	68	111.40
	Tunnels	0	0.00
		Subtotal	**111.40**
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Bus	Facilities	1	1.10
		Subtotal	**1.10**
Ferry	Facilities	0	0.00
		Subtotal	**0.00**
Port	Facilities	0	0.00
		Subtotal	**0.00**
Airport	Facilities	1	10.70
	Runways	1	38.00
		Subtotal	**48.60**
		Total	**815.20**

Source: State of Missouri

Table 4.2.7A-2: Bates County Utility System Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	55.40
	Facilities	3	102.90
	Pipelines	0	0.00
		Subtotal	**158.30**
Waste Water	Distribution Lines	NA	33.20
	Facilities	7	480.20
	Pipelines	0	0.00
		Subtotal	**513.40**
Natural Gas	Distribution Lines	NA	22.10
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**22.10**
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**0.00**
Electrical Power	Facilities	0	0.00
		Subtotal	**0.00**
Communication	Facilities	3	0.30
		Subtotal	**0.30**
		Total	**694.10**

Building Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 4.2.7A-3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4.2.7A-4 below summarizes the expected damage by general building type.

Table 4.2.7A-3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	28	0.40	4	0.45	2	0.72	0	1.01	0	0.71
Commercial	231	3.30	34	3.77	17	5.17	3	6.99	0	5.64
Education	12	0.17	2	0.20	1	0.28	0	0.34	0	0.48
Government	24	0.34	3	0.38	2	0.52	0	0.55	0	0.83
Industrial	46	0.66	7	0.75	4	1.13	1	1.54	0	1.08
Other	1,201	17.15	198	21.90	102	31.76	11	25.17	1	13.03
Religion	29	0.42	4	0.46	2	0.63	0	0.86	0	0.86
Single Family	5,430	77.56	651	72.10	191	59.79	28	63.53	3	77.37
Total	**7,001**		**903**		**320**		**45**		**4**	

Table 4.2.7A-4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	4,760	67.99	495	54.78	91	28.45	6	13.16	0	2.51
Steel	105	1.51	16	1.78	11	3.38	2	4.40	0	2.34
Concrete	32	0.46	4	0.45	2	0.58	0	0.41	0	0.20
Precast	29	0.41	3	0.37	3	0.88	1	1.71	0	0.23
RM	18	0.26	1	0.16	1	0.32	0	0.39	0	0.02
URM	1,385	19.78	248	27.50	130	40.54	27	61.11	4	89.04
MH	672	9.59	135	14.95	83	25.85	8	18.83	0	5.66
Total	**7,001**		**903**		**320**		**45**		**4**	

Note: RM= Reinforced Masonry **URM** = Unreinforced Masonry **MH** = Manufactured Housing

Before the earthquake, the region had 60 hospital beds available for use. On the day of the earthquake, the model estimates that only 43 hospital beds (73.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 84.00% of the beds will be back in service. By 30 days, 96.00% will be operational.

Table 4.2.7A-5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	1	0	0	1
Schools	15	0	0	15
EOCs	1	0	0	1
Police Stations	4	0	0	4
Fire Stations	9	0	0	9

Transportation and Utility Lifeline Damage

Table 4.2.7A-6: provides damage estimates for the transportation system.

Table 4.2.7A-6

System	Component		Number of Locations			
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	19	0	0	19	19
	Bridges	283	0	0	283	283
	Tunnels	0	0	0	0	0
Railways	Segments	68	0	0	68	68
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0

	Facilities	0	0	0	0	0
Bus	Facilities	1	0	0	1	1
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
	Facilities	1	0	0	1	1
	Runways	1	0	0	1	1

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Table's 4.2.7A-7 through 9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 4.2.7A-8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

System	# of				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	3	0	0	3	3
Waste Water	7	0	0	7	7
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	3	0	0	3	3

Table 4.2.7A-8: Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kts)	Number of Leaks	Number of Breaks
Potable Water	2,768	92	23
Waste Water	1,661	46	12
Natural Gas	1,107	16	4
Oil	0	0	0

Table 4.2.7A-9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	6,744	0	0	0	0	0
Electric Power		0	0	0	0	0

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris. The model estimates that a total of 0.01 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 72.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 320 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 5 households to be displaced due to the earthquake. Of these, 3 people (out of a total population of 17,049) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 4.2.7A-10 provides a summary of the casualties estimated for this earthquake.

Table 4.2.7A-10:

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	1	0	0	0
	Single Family	4	1	0	0
	Total	**5**	**1**	**0**	**0**
2 PM	Commercial	1	0	0	0
	Commuting	0	0	0	0
	Educational	3	1	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	1	0	0	0
	Total	**6**	**1**	**0**	**0**
5 PM	Commercial	1	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	2	0	0	0
	Total	**4**	**1**	**0**	**0**

Economic Loss

The total economic loss estimated for the earthquake is 29.83 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 19.83 (millions of dollars); 18 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 70 % of the total loss. Table 4.2.7A-11 below provides a summary of the losses associated with the building damage.

Table 4.2.7A-11: Building-Related Economic Loss Estimates
(millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.0	0.0	0.44	0.01	0.16	0.6
	Capital-	0.0	0.0	0.28	0.01	0.02	0.3
	Rental	0.3	0.0	0.21	0.01	0.02	0.6
	Relocation	1.15	0.18	0.40	0.04	0.30	2.07
	Subtotal	**1.46**	**0.29**	**1.33**	**0.06**	**0.50**	**3.65**
Capital Stock Losses							
	Structural	2.2	0.2	0.3	0.08	0.40	3.36
	Nonstructural	6.7	0.8	1.0	0.21	0.88	9.72
	Content	1.7	0.1	0.5	0.14	0.44	3.04
	Inventory	0.0	0.0	0.0	0.02	0.01	0.05
	Subtotal	**10.7**	**1.3**	**1.9**	**0.4**	**1.74**	**16.1**
	Total	**12.17**	**1.62**	**3.28**	**0.51**	**2.24**	**19.83**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Table's 4.2.7A-12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region.

Table 4.2.7A-12 Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	550.92	$0.00	0.00
	Bridges	103.09	$0.43	0.42
	Tunnels	0.00	$0.00	0.00
	Subtotal	**654.00**	**0.40**	
Railways	Segments	111.41	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**111.40**	**0.00**	
Light Rail	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Bus	Facilities	1.12	$0.06	5.34
	Subtotal	**1.10**	**0.10**	
Ferry	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Port	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Airport	Facilities	10.65	$0.57	5.34
	Runways	37.96	$0.00	0.00
	Subtotal	**48.60**	**0.60**	
	Total	**815.20**	**1.10**	

Table 4.2.7A-13: Utility System Economic Losses

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	$0.00	0.00
	Facilities	102.90	$1.46	1.42
	Distribution Lines	55.40	$0.41	0.75
	Subtotal	**158.25**	**$1.87**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	480.20	$6.78	1.41
	Distribution Lines	33.20	$0.21	0.63
	Subtotal	**513.40**	**$6.99**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	22.10	$0.07	0.32
	Subtotal	**22.14**	**$0.07**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Electrical Power	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Communication	Facilities	0.30	$0.00	1.42
	Subtotal	**0.31**	**$0.00**	
	Total	**694.10**	**$8.94**	

Figure 4.2.7-2

EARTHQUAKE HAZARD PROFILE WORKSHEET

POTENTIAL SEVERITY (Based on Mercalli Intensity Index):

MMI I – Negligible	**MMI VI – Limited**	**MMI XI - Catastrophic**
MMI II – Negligible	**MMI VII – Critical**	**MMI XII - Catastrophic**
MMI III – Negligible	**MMI VIII – Critical**	
MMI IV – Limited	**MMI IX - Critical**	
MMI V - Limited	**MMI X - Catastrophic**	

FREQUENCY OF OCCURRENCE:

- [ ] **Highly Likely**: Near 100% probability in next year.
- [ ] **Likely**: Between 10 and 100% probability in next year, or at least one chance in 10 years.
- [x] **Possible**: Between 1 and 10% probability in next year, or at least one chance in next 100 years.
- [ ] **Unlikely**: Less than 1% probability in next 100 years.

SEASONAL PATTERN:

Earthquakes are not affected by climatic conditions.

AREAS LIKELY TO BE AFFECTED MOST (BY SECTOR):

The impacts of an earthquake are felt on a regional scale, thus likely to affect the entire county.

PROBABLE DURATION:

Earthquakes last from a few to several minutes.

POTENTIAL SPEED OF ONSET

(Probable amount of warning time):

- [x] Minimal (or no) warning.
- [ ] 6 to 12 hours warning.
- [ ] 12 to 24 hours warning.
- [ ] More than 24 hours warning.

EXISTING WARNING SYSTEMS:

Earthquake prediction is far from accurate. There are no warning systems in place.

COMPLETE VULNERABILITY ANALYSIS

See vulnerability analysis on page 205

SPECIAL VULNERABILITIES BY JURISDICTION

All Jurisdictions represented by this plan are equally vulnerable to an earthquake.

4.2.8 Dam Failure Vulnerability Assessment

There are three Class 1 Hazard Dams in Bates County and six Class 2 Hazard Dam. 14 dams are classified as a Class 3 Hazard Dam. The majority of the dams are located in remote areas in the county where little damage would be done to crops and structures. Four dams affect jurisdictions in Bates County: Adrian, Rich Hill, Merwin, and Drexel (Cass County). The Adrian Reservoir damn is a small body of water that flows downstream of Adrian. The Eastland Lake Dam would adversely affect the southern end of Rich Hill. The Rocking Chair Ranch Dam would affect the southern end of Merwin.

The damage from a dam failure is almost limited in scope in terms of structural, population or crop loss. Most flooding in the county damages road infrastructure and puts delays on commerce and travel. Data limitations restrict estimating potential dollar values of commercial activities lost to flood related events caused by a dam failure.

The Planning Committee realizes that dam-related information and GIS data sets will continue to improve and evolve in the coming years. As this data becomes available, SEMA intends to leverage it for additional dam failure analysis in future Plan updates.

Table 4.2.8-1 from the 2013 Missouri State Hazard Mitigation Plan provides vulnerability analysis only for state regulated dams in Bates County.

Table 4.2.8-1: Vulnerability Analysis for Failure of State-regulated Dams in Bates County

County	Class 1	Class 2	Class 3	Total	Estimated # of Buildings Vulnerable	Average Exposure Value per Structure ($)	Estimated Total Potential Building Exposure ($)	Estimated Total Population Exposure	Estimated Building Losses ($)
Bates	1	0	0	1	10	73,703	1,685,333	2	842,666

Figure 4.2.8-2

DAM FAILURE HAZARD PROFILE WORKSHEET

POTENTIAL SEVERITY (Based on failure of dam by hazard class):

High - Catastrophic

Significant - Critical

Low - Negligible

FREQUENCY OF OCCURRENCE:

- [ ] **Highly Likely**: Near 100% probability in next year.
- [ ] **Likely**: Between 10 and 100% probability in next year, or at least one chance in 10 years.
- [x] **Possible**: Between 1 and 10% probability in next year, or at least one chance in next 100 years.
- [ ] **Unlikely**: Less than 1% probability in next 100 years.

SEASONAL PATTERN:

Dam failure would most likely be caused by heavy rains. Therefore, the most likely risk might be April to June.

AREAS LIKELY TO BE AFFECTED MOST (BY SECTOR):

Larger, older dams pose significant risk to undeveloped areas of Bates County.

PROBABLE DURATION:

Dam failures usually last several minutes, depending on the severity of the failure and the acre-feet of water.

POTENTIAL SPEED OF ONSET

(Probable amount of warning time):

- [x] Minimal (or no) warning.
- [ ] 6 to 12 hours warning.
- [ ] 12 to 24 hours warning.
- [ ] More than 24 hours warning.

EXISTING WARNING SYSTEMS:

One dam is regulated by MO DNR. All others are not regulated or inspected. Generally a dam could fail without warning.

SPECIAL VULNERABILITIES BY JURISDICTION

Adrian, Merwin, and Rich Hill are the only three communities that would be adversely affected by a dam failure. In all three communities the southern portion of the jurisdiction would be flooded.

4.2.9 Wildfire Vulnerability Assessment

The threat of wildfire can occur throughout most places in Bates County. Amsterdam and Rockville have the largest vulnerabilities due to the vegetation in their jurisdictions. Amoret, Foster, Merwin, and Passaic do not have any vegetation or high density that would create any extensive damage in their jurisdiction. Adrian, Butler, Hume, Rich Hill and the unincorporated area all have portions of their jurisdiction with vegetation and higher densities which could lead to greater damages in the event of a wildfire.

Table 4.2.9-1: Statistical Data and Factor Ratings for Urban/Structure Fire Vulnerability (2004-2008) (US Census, 2010)

County	Housing Units /sq. mi.	Housing Density Rating	Annual # Average	Likelihood Rating	Total Building Exposure ($)	Building Exposure Rating	Average Annual Property Loss ($)	Annual Property Loss Ratio	Property Loss Ratio Rating	Total Deaths/Injuries		Death /Injury Factor	Death/Injury Factor Rating	Death /Injury/# of Fires Factor	Death/Injury/# of Fires Factor Rating	Average of factors	Overall Vulnerability Rating
Bates	9.4	1	65	2	1,598,983,000	3	617,283	0.000386	3	2	19	23	4	0.35	4	3	3

Table 4.2.9-2: Statistical Data and Factor Ratings for Wildfire Vulnerability

County	Wildfires 2004-2012	Average Annual # of Wildfires	Likelihood Rating 1-5	Acres Burned	Average Annual Acres Burned	Average Acres Burned Rating	Total Buildings Damaged	Overall Vulnerability
Bates	187	20.8	1	2832.57	315	3	3	3

Figure 4.2.9-1

WILDFIRE HAZARD PROFILE WORKSHEET

POTENTIAL SEVERITY (By land vegetation type):

Buffer Areas - Critical

Forests - Critical

Croplands - Critical

FREQUENCY OF OCCURRENCE:

- [ ] **Highly Likely**: Near 100% probability in next year.
- [ ] **Likely**: Between 10 and 100% probability in next year, or at least one chance in 10 years.
- [x] **Possible**: Between 1 and 10% probability in next year, or at least one chance in next 100 years.
- [ ] **Unlikely**: Less than 1% probability in next 100 years.

SEASONAL PATTERN:

Wildfires are likely to occur from February to June.

AREAS LIKELY TO BE AFFECTED MOST (BY SECTOR):

Though forested areas along the transition are between urban and rural development and along the various river/lake banks are most likely to be affected, all jurisdictions are equally vulnerable to the possibility of wildfire due to agricultural surroundings.

PROBABLE DURATION:

Wildfires can last a few minutes to several weeks.

POTENTIAL SPEED OF ONSET

(Probable amount of warning time):

- [x] Minimal (or no) warning.
- [ ] 6 to 12 hours warning.
- [ ] 12 to 24 hours warning.
- [ ] More than 24 hours warning.

EXISTING WARNING SYSTEMS:

The Conservation Department relies on fire towers, air surveillance, and 911 call from the general public.

SPECIAL VULNERABILITIES BY JURISDICTION

Amsterdam and Rockville have significant vegetation in their jurisdiction making them more susceptible to wildfires. Adrian, Butler, Hume, Rich Hill and the unincorporated areas all have vegetation within their jurisdictions that make them susceptible to wildfires

Section 5: Mitigation Strategy

5.1 City/County Capability Assessment

Mitigation management policies

The Bates County Emergency Management Director is charged with preparing for disasters. That duty includes advising the County Commission on mitigation measures and implementing those measures deemed appropriate by the Commission. In general, the county's policies encourage cooperation between Bates County agencies as well as cooperation between county agencies and those of neighboring jurisdictions.

Existing plans

There is no county master plan. Only the City of Butler has a comprehensive plan and zoning ordinances. The main goals of the Butler plan is to encourage development in and around already developed areas to provide more efficient access to adequate roadways, utilities, and emergency services.

The county's 2009 Emergency Operation Plan is approved by the County Commission and identifies facilities and resources that require special security during a disaster; promotes the development and maintenance of mutual aid agreements with nearby agencies; requires participation in drills and exercises; identifies vulnerabilities in county-administered road, water, and wastewater facilities; and includes an evacuation plan. The EOP includes all-hazard mitigation measures.

Mitigation programs

Mitigation programs currently enacted in Bates County is participation in the National Flood Insurance Program. Bates County, Adrian and Butler all participate in the NFIP and enact regulations to promote development outside of the floodplains.

Capabilities (organization, staffing, training, etc.)

The capabilities of emergency management, fire protection, law enforcement, emergency medical services are detailed at the end of Section I.

The primary EOC for Bates County and the City of Butler is located at 1 N. Delaware in Butler, MO. Communications are available at this location as well as an emergency generator.

Bates County Law enforcement Center is the alternate EOC facility for the County. The City of Butler has not identified an alternate EOC facility. Should conditions warrant a relocation of local government, the alternate EOC site will be located at the nearest available safe area.

The Butler Fire Department has a mobile communications van available for on-site direction and control if necessary, and it could also serve as an alternate EOC. The EOC will be manned according to the level of emergency.

The EOC has survivable communications from primary and other operating forces, the Emergency Alert System, commercial and public broadcast stations, SEMA, adjacent jurisdictions, and the incorporated areas within the county. The communications and warning equipment are tested on a scheduled basis. The cities and county have substantial communication abilities, both fixed and mobile, to coordinate the scene of an emergency. However, the EMA has only a limited number of mobile telecommunications devices such as cell phones.

Fire equipment and vehicles are available to city and county agencies. Equipment available for police, rescue, mass care, and information/communications is fairly adequate. The County Hospital, Bates County Memorial Hospital provides a range of health services.

The EMA director has received training in professional development, emergency response planning, emergency response operations, exercises, disaster response and recovery, and disaster mitigation within the last five years. Emergency response personnel and EOC staff have received substantial training in the past five years. Appropriate officials have had limited training on hazard mitigation.

Responsibilities and authorities

City and county governments have the following:

- the legal basis for authorization to order an evacuation, redirect funds for emergency use, order a curfew, and commandeer facilities and/or equipment and materials;
- authorized lines of succession for the chief elected officials with power to initiate necessary emergency activities;
- substantially safeguarded vital records, although limited for records needed to reconstitute local government;
- a substantial analysis of the possible impacts of potential disasters;
- a multi-hazard emergency operations plan;
- limited completion of mutual aid agreements with neighboring jurisdictions;
- substantial protection of people with special needs

Intergovernmental and interagency coordination

The Bates County Emergency Management Director serves to maintain coordination among fire, law enforcement, emergency medical, public health officers from the county, incorporated areas, and adjacent jurisdictions.

Commitments to a comprehensive mitigation program

Bates County maintains and regularly updates the Emergency Operation Plan that includes mitigation measures for all hazards, both natural and manmade.

County laws, regulations and policies related to development in hazard-prone areas

Bates County as well as the cities of Adrian and Butler all participate in the National Flood Insurance Program. All three jurisdictions have floodplain regulations that disallow development in areas designated as susceptible to a 100 year flood. These regulations are enforced through floodplain ordinances and development is reviewed by local floodplain managers, emergency management personnel and public officials.

County laws, regulations and policies related to hazard mitigation in general

Other than floodplain regulations, no county laws, regulations and policies related to hazard mitigation exist.

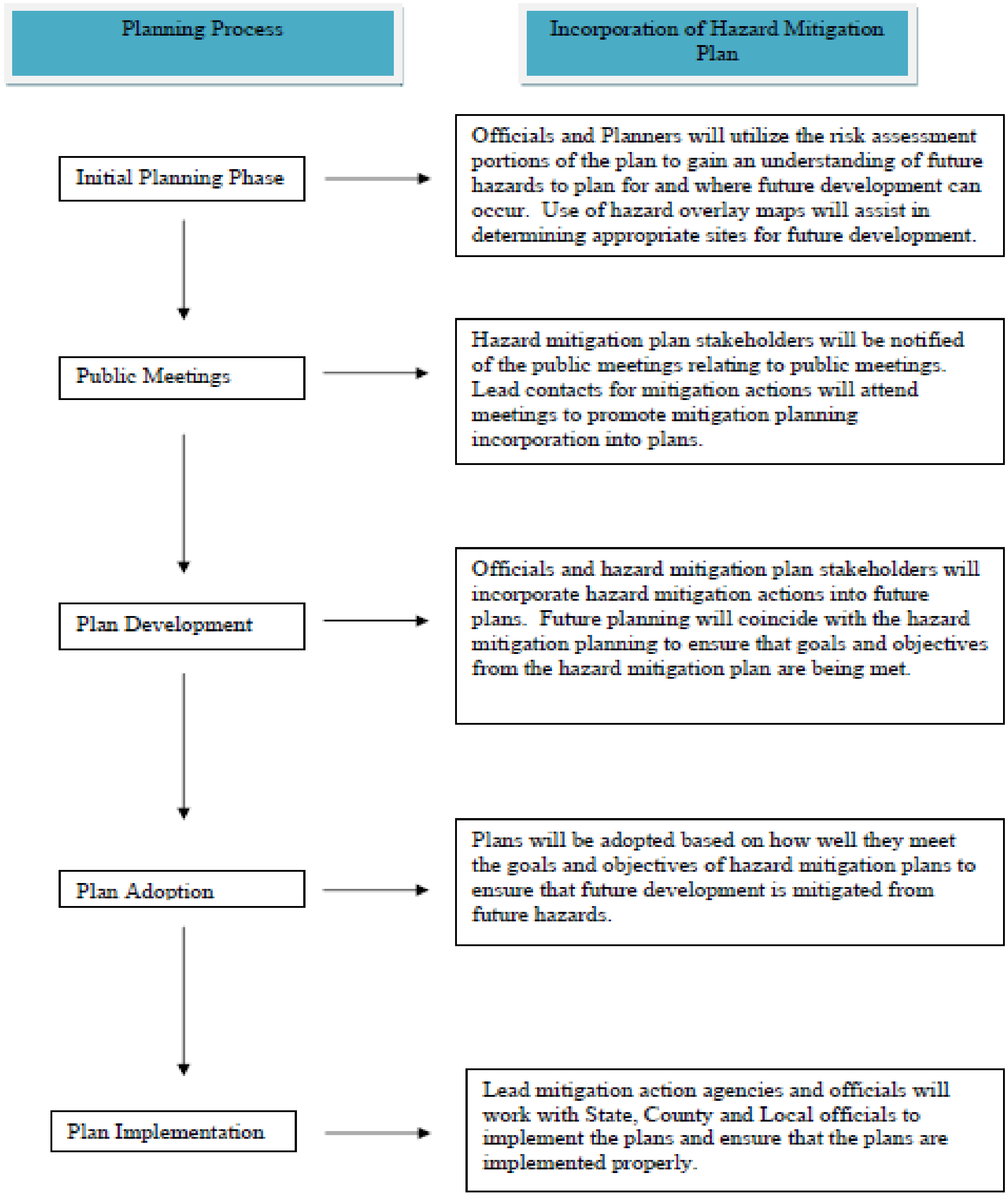
5.2 Risk Assessment Incorporation

Local risk assessments are incorporated and prioritized into local planning on an "as needed" basis. Several initiatives will be implemented in incorporating the hazard mitigation plan into local planning.

- Flood hazard maps and Wildfire Urban Interface maps will be utilized when dealing with the placement of new critical facilities and residential areas.
- Future comprehensive planning and/or zoning implementation will utilize the hazard mitigation plans resources and maps to look at areas within jurisdictions that are suitable for development in regards to hazard vulnerability.
- School districts should utilize the hazard maps provided in the plan in developing evacuation routes and emergency operations plans.
- Businesses will also be encouraged to develop emergency operation plans using the County Hazard Mitigation Plan as a resource for information.
- Future plans relating to health, transportation, and environmental issues will all utilize the hazard boundary maps and information in developing planning documents.
- Goals and objectives will be reviewed during the planning processes to coincide hazard mitigation goals and objectives with those of local plans.

With few plans implemented in Bates County, it becomes imperative to develop a system for creating plans and incorporating the hazard mitigation plan into said plans. In the beginning of local planning processes, officials will hold initial meetings to determine public sentiment on planning issues. Using data obtained from several resources, including the hazard mitigation plan, jurisdictions will be charged with planning future ordinances and development in relation to hazard data and mitigation goals and actions. All future plans will incorporate mitigation actions.

Figure 5.2-1


Planning Process
Incorporation of Hazard Mitigation Plan
Initial Planning Phase
Officials and Planners will utilize the risk assessment portions of the plan to gain an understanding of future hazards to plan for and where future development can occur. Use of hazard overlay maps will assist in determining appropriate sites for future development.
Public Meetings
Hazard mitigation plan stakeholders will be notified of the public meetings relating to public meetings. Lead contacts for mitigation actions will attend meetings to promote mitigation planning incorporation into plans.
Plan Development
Officials and hazard mitigation plan stakeholders will incorporate hazard mitigation actions into future plans. Future planning will coincide with the hazard mitigation planning to ensure that goals and objectives from the hazard mitigation plan are being met.
Plan Adoption
Plans will be adopted based on how well they meet the goals and objectives of hazard mitigation plans to ensure that future development is mitigated from future hazards.
Plan Implementation
Lead mitigation action agencies and officials will work with State, County and Local officials to implement the plans and ensure that the plans are implemented properly.

5.3 Mitigation Funding

Mitigation funding is primarily based upon the combination of expected damage and death/injury impacts. Another facet of the county's mitigation concerns is the intensity of development pressures. The master plan calls for concentrating new land use and economic development in and around higher-density areas to provide greater access to infrastructures and emergency measures.

Integration of hazard mitigation with the city/county department's plans

The county EMD meets with representatives from fire districts, law enforcement, emergency medical and health organizations. The cities rely on the county's EOP. The County Hazard Mitigation Plan will work in conjunction with the County EOP to provide residents and public officials with the proper information and resources to develop future plans. City and County department's will utilize the plans mitigation actions to help develop new programs in hazard mitigation that focus on education, prevention, structural improvements and natural resource protection. Integration of hazard data will also provide useful information to City/County departments in understanding which hazards to help educate the public on and which hazards will need to be addressed in future emergency planning, especially for first responders and law enforcement officials.

How the county determines cost-effectiveness of mitigation programs

Cost-effectiveness is considered on a case-by-case basis, dependent upon the scope of damages, estimated savings in future hazard events, the type of mitigation project, and the probable hazard to human life in future events.

Mitigation funding options including current and potential sources of federal, state, local, private

The county and incorporated areas have historically relied upon federal disaster declarations in cases of heavy widespread damages. Sources have included FEMA, SEMA, the Missouri Department of Natural Resources and Department of Economic Development (DED), and various other grant programs. In addition, investments in infrastructures that have mitigating effects have been funded from sources such as local tax revenues. Other funding options being considered for the future include the grant sources identified in SEMA's 2010 Missouri State Hazard Mitigation Plan, which include:

5.3.1 Pre-Disaster Mitigation Program

Program Summary: The Pre-Disaster Mitigation (PDM) program is a FEMA grant program. In 2009, Congress amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act to reauthorize the pre-disaster mitigation program of FEMA. In addition, there is the Legislative Pre-Disaster Mitigation (L-PDM) program funded through the National Legislative Pre-Disaster Mitigation Fund.

The purpose of PDM and L-PDM programs are to provide funds to states, territories, Indian tribal governments, and communities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations.

Project grants are available for voluntary acquisition of real property (i.e., structures and land, where necessary) for open space conversion; relocation of public or private structures; elevation of existing public or private structures to avoid flooding; structural and nonstructural retrofitting of existing public or private structures to meet/exceed applicable building codes; construction of safe rooms for public and private structures; vegetation management (e.g., for wildfire); protective measures for utilities, water and sanitary sewer systems, and infrastructure; storm water management projects; and localized flood control projects that are designed specifically to protect critical facilities and that do not constitute a section of a larger flood control system. Planning grants are available for new plan development, plan upgrades, and comprehensive plan reviews and updates.

Amount: Congress appropriated $90 million for this program for fiscal year 2009 and $100 million for fiscal year 2010. Each State will receive at least $575,000 or the amount that is equal to one percent of the total funds appropriated to carry out this section for the fiscal year. PDM grants are awarded on a competitive basis. Eligible sub-applications will compete nationally for PDM grant funds.

Eligibility: In Missouri, SEMA serves as the applicant for all PDM and L-PDM grants. State level agencies, including state institutions (e.g., state hospital or university); federally recognized Indian tribal governments; local governments (including state recognized Indian tribes and Missouri State Hazard Mitigation Plan FINAL 4.69 July 2010 authorized Indian tribal organizations); public colleges and universities; and Indian Tribal colleges and universities are eligible to apply to SEMA for assistance as sub-applicants. Private nonprofit organizations and private colleges and universities are not eligible to apply to the State, but an eligible, relevant state agency or local government may apply on their behalf. SEMA reviews and prioritizes sub-applications and submits the grant application with sub-applications to FEMA for review and approval.

All sub-applicants that have been identified through the NFIP as having a Special Flood Hazard Area and that have a Flood Hazard Boundary Map or a Flood Insurance Rate Map must be participating and in good standing in the NFIP. There is no NFIP participation requirement for PDM and HMGP project sub-applications for projects located outside of the SFHA.

Also there are no NFIP participation requirements for PDM and HMGP hazard mitigation planning sub-applications. The latest Hazard Mitigation Assistance Unified Guidance can also provide the latest information.

For project grants, sub-applicants must have a FEMA-approved local mitigation plan. All activities submitted for consideration must be consistent with the local mitigation plan as well as the Missouri State Hazard Mitigation Plan.

Cost-Share Requirements: PDM and L-PDM grants are provided on a 75 percent federal/25 percent nonfederal cost share basis. Small and impoverished communities may be eligible for up to a 90 percent federal cost-share (see Section 5.3.3 Small and Impoverished Communities).

Requirements: Recipients of PDM and L-PDM planning grants must produce FEMA-approved hazard mitigation plans.

5.3.2 Flood Mitigation Assistance Program

Program Summary: The Flood Mitigation Assistance Program (FMA) is a program under FEMA's NFIP. Its purpose is to implement cost-effective measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insured under the NFIP. The FMA provides planning grants for communities to assess their flood risk and identify actions to reduce it. Planning grants may be used to develop a new or update an existing flood mitigation plan (this also applies to the flood hazard portion of multi-hazard mitigation plans).

Project grants are available for acquisition, structure demolition, or structure relocation with the property deed restricted for open space uses in perpetuity; elevation of structures; dry flood proofing of nonresidential structures; and minor structural flood control activities. Planning grants are available for flood mitigation planning activities.

Amount: For fiscal year 2009 (October 1, 2008-September 30, 2009), Congress appropriated $35.7 million for the FMA and Missouri received $540,200 ($498,600 for projects and $41,600 for planning). For fiscal year 2010, Congress has appropriated $40 million.

Eligibility: In Missouri, SEMA serves as the applicant for all FMA grants. State-level agencies, federally recognized Indian tribal governments, and local governments (including state recognized Indian tribes and authorized Indian tribal organizations) are eligible to apply to SEMA for assistance as sub-applicants. Individuals and private nonprofit organizations are not eligible to apply to the State, but a relevant state agency or local community may apply on their behalf. SEMA reviews and prioritizes sub-applications by the applications that include mitigating repetitive loss properties. SEMA then submits the grant application with sub-applications to FEMA for review and approval.

All sub-applicants must be participating and in good standing in the NFIP. Also properties included in a project sub-application must be NFIP-insured at the time of the application submittal. For project grants, sub-applicants must have a FEMA-approved flood mitigation plan or multi-hazard mitigation plan that meets FMA planning requirements. All activities submitted for consideration must be consistent with the local mitigation plan as well as the Missouri State Hazard Mitigation Plan.

Cost-Share Requirements: FMA funds are provided on a 75 percent federal/25 percent nonfederal cost share basis. The recipient must provide the 25 percent match, only half of which may be in-kind contributions.

For severe repetitive loss properties, FEMA will contribute up to 90 percent of the total eligible costs if the State has taken actions to reduce the number of severe repetitive loss properties and has an approved state mitigation plan that specifies how it intends to reduce the number of severe repetitive loss properties. Missouri State Hazard Mitigation Plan FINAL 4.71 July 2010

Requirements: Recipients of FMA planning grants must produce FEMA-approved flood mitigation plans.

5.3.3 Hazard Mitigation Grant Program

Program Summary: The Hazard Mitigation Grant Program (HMGP) is a FEMA program to provide funds to states, territories, Indian tribal governments, and communities to significantly reduce or permanently eliminate future risk to lives and property from natural hazards. HMGP funds projects in accordance with priorities identified in state, tribal, or local hazard mitigation plans, and enables mitigation measures to be implemented during the recovery from a disaster. HMGP funds can be used for projects to protect either public or private property, as long as the project fits within state and local government mitigation strategies to address areas of risk and complies with program guidelines. Examples of projects include acquiring and relocating structures from hazard-prone areas; retrofitting structures to protect them from floods, high winds, earthquakes, or other natural hazards; constructing certain types of minor and localized flood control projects; and constructing safe rooms inside schools or other buildings in tornado prone areas.

The State may set aside up to 7 percent of the HMGP funds received following a presidential disaster declaration to develop FEMA-approved mitigation plans. The State may also set aside up to 5 percent of the HMGP monies to fund the State 5% Initiative Projects (see Section 4.4.1: Actions (Projects) That Will Be Considered by the State of Missouri).

Amount: Federal funding under the HMGP is available following a major disaster declaration if requested by the governor. The amount of an HMGP grant will depend on the costs associated Missouri State Hazard Mitigation Plan FINAL 4.72 July 2010 with each individual disaster. Since the Missouri State Hazard Mitigation Plan is an enhanced plan, the State is eligible for up to 20 percent of the total estimated federal assistance provided after a major disaster declaration. States with standard hazard mitigation plans are eligible for 15 percent for amounts not more than $2 billion, 10 percent for amounts of more than $2 billion and not more than $10 billion, and 7.5 percent on amounts more than $10 billion and not more than $35.3 billion.

Eligibility: HMGP funds are administered by SEMA. Local governments, eligible private nonprofit organizations or institutions, and Indian tribes or authorized tribal organizations are eligible to apply to SEMA for assistance as sub-applicants. Individuals and businesses are not eligible to apply to the State, but eligible local governments or private non-profit organizations may apply on their behalf.

SEMA's administrative plan for eight federal disasters starting with DR-1736 in December 2007, says that the Mitigation Section reviews the submitted HMGP sub-applications documents. Priority is given to flood mitigation, tornado/ severe wind, ice storm and earthquake mitigation projects located in the declared counties.

If all available funds are not expended on these mitigation projects, consideration will be given to other types of mitigation projects in the declared counties prior to requesting proposals statewide. The sub-applications are sent to FEMA for review and approval.

For project grants, sub-applicants must have a FEMA-approved local mitigation plan. All activities submitted for consideration must be consistent with the local mitigation plan as well as the Missouri State Hazard Mitigation Plan.

Cost-Share Requirements: HMGP funds are provided on a 75 percent federal/25 percent nonfederal cost share basis. The nonfederal match does not does not need to be cash; in-kind services and/or materials may be used.

5.3.4 Repetitive Flood Claims Program

Program Summary: The Repetitive Flood Claims (RFC) Program is a FEMA program designed to reduce or eliminate the long-term risk of flood damage to structures insured under the NFIP that have had one or more claim payment(s) for flood damage. Project grants are available for voluntary property acquisition, structure demolition, structure elevation, dry flood proofing of structures, and minor localized flood reduction projects. If the structure is removed, the property is deeded to the community and restricted only to open-space use. The property can never be developed again. Planning grants and non-flood hazard mitigation activities are not available.

Amount: Historically, Congress appropriated $10 million for the RFC program for each fiscal year 2006-2010. RFC grants are awarded nationally without reference to state allocations, quotas, or other formula-based allocation(s) of funds.

Eligibility: RFC funds can only be used mitigate structures that are located within a state or community that cannot meet the requirements of the FMA for either cost share or capacity to manage the activities.

In Missouri, SEMA serves as the applicant for all RFC grants. State-level agencies, federally recognized Indian tribal governments, and local governments (including state-recognized Indian tribes and authorized Indian tribal organizations) are eligible to apply to SEMA for assistance as sub-applicants. Individuals and private nonprofit organizations are not eligible to apply to the State, but a relevant state agency or local community may apply on their behalf. SEMA reviews and prioritizes sub-applications and submits the grant application with sub-applications to FEMA for review and approval. All sub-applicants must be participating and in good standing in the NFIP.

Cost-Share Requirements: All RFC grants are eligible for up to 100 percent federal assistance.

5.3.5 Severe Repetitive Loss Program

Program Summary: The Severe Repetitive Loss (SRL) program is a FEMA program with a purpose to reduce or eliminate the long-term risk of flood damage to severe repetitive loss residential properties and the associated drain on the National Flood Insurance Fund (NFIF) from such properties. FEMA defines SRL properties as residential properties that have at least four NFIP claim payments over $5,000 each, at least two of which occurred within any ten-year period, and the cumulative amount of such claims payments exceeds $20,000; or that have at least two separate claims payments (building payments only) where the total of the payments exceeds the value of the property, when two such claims have occurred within any ten-year period.

Project grants are available for flood mitigation activities such as acquisition, structure demolition, or structure relocation with the property deed restricted for open-space uses in perpetuity; elevation of structures; flood proofing of structures; minor physical localized flood control projects; and mitigation reconstruction. SEMA gives the highest priority to the sub-applicant projects that demonstrate the greatest savings to the NFIF based on a benefit cost ratio.

Planning grants are not available.

Amount: The SRL program was authorized for up to $40 million for fiscal years 2006 and 2007. Then up to $80 million in fiscal years 2008 and 2009 and $70 million in fiscal year 2010. The SRL program is subject to the availability of appropriation funding, as well as any directive or restriction made with respect to such funds.

Eligibility: In Missouri, SEMA serves as the applicant for all SRL grants. State-level agencies, federally recognized Indian tribal governments, and local governments (including state recognized Indian tribes and authorized Indian tribal organizations) are eligible to apply to SEMA for assistance as sub-applicants. Individuals and private nonprofit organizations are not eligible to apply to the State, but a relevant state agency or local community may apply on their behalf. SEMA reviews and prioritizes sub-applications and submits the grant application with sub-applications to FEMA for review and approval.

All sub-applicants must be participating and in good standing in the NFIP and an approved local mitigation plan is required.

Cost-Share Requirements: SRL grants are provided on a 75 percent federal/ 25 percent nonfederal cost share basis. Up to 90 percent federal cost-share funding may be available for projects approved in states, territories, and federally recognized Indian Tribes with FEMA approved standard or enhanced mitigation plans or Indian tribal plans that include a repetitive loss strategy for mitigating existing and future SRL properties.

5.3.6 FEMA's Public Assistance - Mitigation

Program Summary: Section 406 (Public Assistance) of the Stafford Act establishes the program for the repair, restoration, and replacement of facilities damaged as a result of a presidentially declared disaster. These funds can also be used for hazard mitigation measures a state or local government determines to be necessary to meet a need for governmental services and functions in the area affected by the major disaster. Section 406 mitigation funds can only be used in the declared disaster areas (usually counties) and only in conjunction with identified, eligible disaster projects that will strengthen existing infrastructure and facilities to more effectively withstand the next disaster. One example would be replacing a blown out culvert with one designed to convey higher flows, instead of one that will be easily damaged in a flood again.

Eligibility: State-level agencies, federally recognized Indian tribal governments, and local governments (including state-recognized Indian tribes and authorized Indian tribal organizations) are eligible to apply to SEMA for assistance.

Cost-Share Requirements: Public Assistance grants are provided at not less than 75 percent federal/25 percent nonfederal cost share basis for emergency measures and permanent restoration. All projects approved under State disaster assistance grants will be subject to the cost sharing provisions established in the FEMA-State Agreement and the Stafford Act.

Requirements for hazard mitigation funding programs

Recommended improvements include expanded mutual aid agreements among neighboring jurisdictions, improved the capabilities of the EOC, additional warning sirens, adopt and implement the newly written stormwater regulations, educate the public concerning the link between stormwater runoff and flash floods, promote drought-resistant farming techniques and design recommendations to reduce impervious surfaces, work with DNR to promote dam maintenance, and generally increase education for public safety.

In addition, Missouri's Structural Assessment and Visual Evaluation (SAVE) Coalition facilitates the use of volunteer engineers, architects and qualified building inspectors who perform damage assessments of homes following disasters such as earthquake, floods and tornadoes. The SAVE Coalition can provide sound advice to communities and citizens concerning the safety of reentering their homes following a disaster, with the added intent of minimizing the need for sheltering by keeping people in their homes as much as safely feasible. Missouri statute RSMO 44.023 provides immunity from liability for those working in disaster volunteer programs.

The Missouri Seismic Safety Commission (under Missouri statutes RSMO 44.227 44.229, 44.231, 44.233, 44.235, and 44.227) has developed a Strategic Plan for Earthquake Safety in Missouri that contains a number of recommendations for earthquake mitigation. The commission also sponsors Earthquake Awareness activities each year, including exhibitions at the St. Louis Science Center and the State Capitol. The Bates County Hazard Mitigation Committee may want to investigate the possibility of bringing some of these programs to a local venue.

5.4 Policies and Development Trends

The table below shows the cities that have zoning, building regulations, storm water regulations, earthquake regulations, and floodplain regulations.

Table 5.4-1

Jurisdiction	Master Plan	Zoning	Building Codes	Earthquake Design	Subdivision Regulations	Stormwater Regulations	Floodplain Regulations	Emergency Operations Plan
Adrian							X	X
Amoret								
Amsterdam								
Butler	X	X	X	X	X	X	X	X
Foster								
Hume								
Merwin								
Passaic								
Rich Hill								
Rockville								
Unincorporated Area							X	X

Section 6: Goals and Strategies

6.1 Mitigation

Mitigation is defined as "…sustained action that reduces or eliminates long-term risk to people and property from natural hazards and their effects." It describes the ongoing effort at the Federal, State, local, and individual levels to lessen the impact of disasters upon our families, homes, communities and economy.

Mitigation includes not only avoiding the development of vulnerable sections of the community, but also making existing development in hazard-prone areas safer. For example, we can identify areas in our community that are susceptible to damage from natural hazards and take steps to make these areas less vulnerable, through flood buyouts for example.

We can also steer growth to less risky areas, through nonstructural measures such as avoiding construction in the most flood-prone areas for example.
Keeping buildings and people out of harm's way is the essence of mitigation. In fact, incorporating mitigation into decisions related to our community's growth can result in a safer, more resilient community, and one that is more attractive to new families and businesses.

Bates County is subject to many types of natural hazards such as floods, tornadoes, winter storms, earthquakes, droughts, and occasionally, wild fires. Some, such as floods, can occur at many times of the year and almost anywhere in the county.
All-hazard mitigation planning is what we call the process associated with devising strategies needed to mitigate the damages associated with this wide variety of potential disasters.

Categories of Mitigation
Mitigation measures may be grouped into five categories.

1. **Prevention**
2. **Property protection**
3. **Natural resource protection**
4. **Public education and awareness**
5. **Structural projects**

1. Prevention Measures are intended to keep a hazard risk problem from getting worse. They insure that the future development does not increase hazard losses.

Communities can achieve significant progress toward hazard resistance through prevention measures. This is particularly true in areas that have not been developed or where capital investment has not been substantial.

Using prevention measures, future development can be guided away from hazards, while maintaining other community goals such as economic development and quality of life.

- Planning and zoning
- Open space preservation
- Land development regulations
- Storm water management

2. Property protection measures are used to modify buildings subject to hazard risk, or their surroundings, rather than to prevent the hazard from occurring. A community may find these to be inexpensive measures because often they are implemented or cost-shared with property owners. These measures directly protect people and property at risk. (Protecting a building does not have to affect the building's appearance and therefore a popular measure for historic and cultural sites.)

Some examples of property protection are:

- Acquisition – public procurement and management of lands that are vulnerable to damage from hazards
- Relocation – permanent evacuation of hazard-prone areas through movement of existing hazard-prone development and population to safer areas
- Rebuilding – modifying structures to reduce damage by future hazard events
- Flood proofing – protecting a flood-prone building using one or more of several different methods

3. Natural resource protection measures are intended to reduce the intensity of hazard effects as well as to improve the quality of the environment and wildlife habitats. Parks, recreation, or conservation agencies or organizations usually implement these activities.

Examples of natural resource protection include:

- Erosion and sediment control
- Wetland protection

4. Public information activities inform and remind people about hazardous areas and the measures necessary to avoid potential damage and injury.

Public information activities for mitigation are directed towards property owners, potential property owners, business owners, and visitors. A few examples of public information activities to achieve mitigation are.

- Providing hazard maps and other hazard information.
- Outreach programs that provide hazard and mitigation information to people when they have not asked for it.

How might outreach programs accomplish this?

- Print media
- Radio/TV. spots and interviews
- Videotape
- Massing mailings
- Notices to residents and property owners in a specific, hazard-prone area
- Displays in widely used facilities such as public buildings and malls
- Property owner handbooks
- Presentations at meeting of neighborhood groups

- Real estate disclosure
- Information in the public library or a library developed specifically for mitigation information
- Available technical assistance
- School age and adult education

5. Structural measures directly protect people and property at risk. They are called "structural "because they involve construction of man-made structures to control hazards.

Structural projects for flood control may include:

- Reservoirs
- Levees, floodwalls, and seawalls
- Diversions
- Channel modifications
- Storm sewers

6.2 County and Jurisdictions Hazard Mitigation Goals

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

Hazard mitigation goals were developed during the planning process for the original Bates County Hazard Mitigation Plan in 2005. For the current update the Hazard Mitigation Technical Steering Committee reviewed the 2005 goals. Language changes were made for clarification while retaining the essential focus of the original goals.

To provide a more concise intent of the Hazard Mitigation Goals, the format of the goal presentation has also been changed.

All goals and objectives from the 2005 plan were reviewed by the Bates County Emergency Management Director, as well as several key County department heads and the public. The goals were also reviewed at public meetings and discussed thoroughly.

6.3 Mitigation Actions Updates

> Requirement
> § 201.6(c) (b) (ii):
> [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive rang of specific mitigation actions and projects being considered to reduce the effects of each hazard with particular emphasis on new and existing buildings and infrastructure.

The 2005 plan contained a comprehensive list of mitigation actions which served as a starting point for the update discussions. The Technical Steering Committee for the update (2011-2013) reviewed and discussed all the mitigation actions from the original plan. The current status of each of the 2005 mitigation actions from the original pan was evaluated. It was determined that while progress had been made on some of the previous plan actions, implementation of many actions had not occurred. This was largely because they were not practical or feasible, and were no supported by the population. The following 2005 actions were eliminated.

Under Objective 1.3
Recommendation: Tree trimming programs and dead tree removal.

Under Objective 2.1
Recommendation: Develop a self-inspection program at critical facilities to assure that the building infrastructure is earthquake and tornado resistant.

Objective 4.2
The County, incorporated cities, and schools should encourage active participation of chief elected officials in mitigation planning and activities.

Under Objective 6.2
Recommendation: Cities and counties will implement cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole.

Another change from the 2005 plan is that under Objective 2.1 is the recommendation to "encourage current NFIP participants to continue to comply with the regulations." The wording of this action was changed and split into tow different actions. The change was to ensure that NFIP participants continued to participate, and non-participants were encouraged to become members.

In addition, some of the actions were combined for efficiency and to avoid duplication. The remainder of the actions in the 2005 plan were carried forward into the 2013 update without substantive change.

In order to ensure that there was a comprehensive mitigation approach to each hazard, there was a discussion of each hazard and the existing actions focused on it mitigation. This approach was useful in developing appropriate new actions, when deemed important.

The actions, along with explanatory information, can be seen in the summaries on the following pages. Note that not all of the new actions originated with the Hazard Mitigation Technical Steering Committee.

The actions in the following table are from the 2005 Plan and have been implemented by the county and/or participating communities. Although implementation has occurred, all the actions have been carried forward into the 2013 Plan Update. This is because the Planning Committee determined that the actions were of an ongoing nature and should be continued into the future.

6.3.1 Prioritization, Implementation, and Administration

Requirement

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

Requirement

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

STAPLEE Review and Prioritization of Mitigation Actions and Objectives.

I accordance with Section 201.6 or the regulations detailed above, the Planning Committee prioritized the actions, crating a timeframe for implementation. In drafting this prioritization process, Kaysinger Basin Regional Planning Commission (KBRPC) and community planning partners worked cooperatively to determine which STAPLEE criteria each action did or was likely to be achieved.

The Hazard Mitigation Technical Steering Committee then looked at each hazard and its associated mitigation actions in order to make a preliminary prioritization of the actions for the Planning Area as a whole. Each action was discussed with a view toward feasibility, jurisdictions to be involved, benefit/cost ration and timeframe.

Each of the actions proposed for the 2012 Update was reviewed using the criteria, and a high, medium or low priority was assigned to each action based on the results of the STAPLEE analysis. The definition of each priority was established as follows.

- High: To be implemented within the next year if possible.
- Medium: To be implemented within the next two to five years, if possible.
- Low: To be implemented after the next five years, if possible.

The STAPLEE criteria are defined on the following table.

Table 6.3.1-1

Definition of the STAPLEE Criteria		
Abbreviation	Criteria	Definition of the Criteria
S	Social	Mitigation actions are acceptable to the community if they do n adversely affect a particular segment of the population, do n cause relocation of lower income people, and if they a compatible with the community's social and cultural values.
T	Technical	Mitigation actions are technically most effective if they provic long-term reduction of losses and have minimal seconda adverse impacts.
A	Administrative	Mitigation actions are easier to implement if the jurisdiction ha the necessary staffing and funding.
P	Political	Mitigation actions can truly be successful if all stakeholders hav been offered an opportunity to participate in the planning proce and if there is public support of the action.
L	Legal	It is crucial that the jurisdiction or implementing agency have th legal authority to implement and enforce a mitigation action.
E	Economical	Budget constraints can significantly deter the implementation mitigation actions. Hence, it is important to evaluate whether a action is cost-effective and possible to fund.
E	Environmental	Sustainable mitigation actions that do not have an adverse effe on the environment, that comply with federal, State, and loc environmental regulations, are consistent with the community environmental goals, have mitigation benefits while bei environmentally sound.

The results of the Planning Committee's STAPLEE analysis of each action are included on the following pages in the discussion of the individual action items.

Prioritization by Participating Jurisdictions

The prioritization of the proposed 2013 mitigation actions by the Hazard mitigation Technical Steering Committee was a preliminary overall prioritization for the entire Planning Area. In the case of the educational institutions, the representatives from the school districts were given the opportunity to develop mitigation actions specific to their institutions, although none of the school districts did do so. This was accomplished through fax and email correspondence between the Planning Committee and the superintendents of the school districts.

All Other Participating Jurisdictions

After the preliminary overall prioritization by the Hazard Mitigation Technical Steering Committee, the mitigation actions suggested for the specific participating jurisdictions were handed over to the representative or governing bodies of those jurisdictions for final prioritization, implementation, and administration decisions.

It was recognized that participating jurisdictions might choose to exclude some suggested mitigation actions based on specific issues. Finally, there was the possibility that participating jurisdictions might choose to make changes to the preliminary prioritization.

An information sheet (Information and Guidelines for Assessing Mitigation Actions for Your Jurisdiction) was given to each participating jurisdiction. This sheet provided the following information:

- Explanation of the scales used for the preliminary prioritization and the cost/benefit assessment.
- Instruction that the preliminary prioritization needed to be reviewed and either accepted or changed.
- Instruction that benefit vs. cost must be taken into consideration in the prioritization process.

A questionnaire regarding the process used in finalizing the mitigation actions for the jurisdiction was included with the information sheet. Follow-up calls and/or emails were made to representatives of the participating jurisdictions by the Plan Author to clarify the process and decisions made regarding the mitigation actions.

6.3.2 Mitigation Goals, Objectives and Actions

A comprehensive list of the goals, objectives, and mitigation actions for the Bates County Hazard Mitigation Plan (2013) follows.

The mitigation actions listed are for the entire Planning Area; participating jurisdictions may differ in the specific actions undertaken in their jurisdictions. In accordance with implementing regulations, after each action is a summary narrative discussion.
The summary includes information on which of the hazards are addressed by the proposed action, the jurisdictions choosing the action, the lead agency and partners for implementation, possible funding sources, estimated costs, discussion of financial considerations, the assigned STAPLEE priority, and the status of the actions carried over from the 2005 plan.

For the goals and objective where no action has been accomplished since the 2005 plan there have been no local champions of the proposed objectives that have come forward to usher in and assure that the local jurisdiction has taken steps to accomplish the stated tasks. This lack of effort will be discussed and an attempt will be made to appoint an individual or planning committee for each jurisdiction to ensure that all proposed task and objectives are not only carried forward, but have had specific actions, towards their completion, completed for the next plan update.

Goal 1: The County, incorporated cities and schools should reduce risks and vulnerabilities of people in hazard prone areas.

Objective 1.1: The County, incorporated cities, and schools should advise the public about health and safety precautions to guard against loss of life from natural hazards.

1.1 The County EMD should provide education programs on personal emergency preparedness.

- **Hazards Addressed:** All hazards.
- **Jurisdictions Choosing This Action:** Bates County.
- **Lead Agency:** County Emergency Management Agency
- **Partners (if any):** State emergency management for possible source materials, as well as the legislative bodies of the participating jurisdictions.
- **Funding Sources:** Included in the salaries of personnel.
- **Estimated Cost:** None.
- **Discussion of Cost vs. Benefits:** Virtually cost-free and provides the significant benefit of increasing public awareness.
- **STAPLEE Priority:** Medium
- **Action Status:** This action was carried over form the 2005 Plan without progress having been made.

1.2 Add earthquake drills as required drills each year.

- **Hazards Addressed:** Earthquakes
- **Jurisdictions Choosing This Action:** Bates County.
- **Lead Agency:** County Emergency Management Agency.
- **Partners (if any):** LEPC
- **Funding Sources:** Local funding.
- **Estimated Cost:** None beyond cost of funding personnel.
- **Discussion of Cost vs. Benefits:** Virtually cost-free and providing high benefit of public preparedness for a serious event that could cause unprecedented damage, but has not occurred in anyone’s memory.
- **STAPLEE Priority:** Medium
- **Action Status:** This is a new action for the 2013 Plan Update.

Objective 1.2 The County, incorporate cities, and schools should use the latest technology, when funds are secured, to provide adequate warning, communications, and mitigation of hazard events.

1.2.1 Assist communities with securing funding for early warning systems, improved communications systems, GIS/GPS, and mitigation projects.

- **Hazards Addressed:** All hazards for GIS/GPS, communications, and mitigation projects. Warning systems would be more likely to address tornadoes and severe thunderstorms.
- **Jurisdictions Choosing This Action:** Bates County, and al participating communities.
- **Lead Agency:** Bates County Emergency Management Agency.
- **Partners (if any):** Potentially the governing bodies of the local jurisdictions.
- **Funding Sources:** Mitigation grants, emergency management grants, and/or local funding.
- **Estimated Cost:** Potentially several hundred thousand dollars, depending on the complexity of the systems to be purchased.
- **Discussion of Cost vs. Benefits:** The GIS systems could be high cost, but providing high benefits of warning the public in the event of tornadoes and other severe storms. The GIS ability would open up a lot of opportunities for more in-depth analysis of hazards and their impact on the planning area. Low possibility of obtaining funds locally for a rural county with declining population.
- **STAPLEE Priority:** Medium.
- **Action Status:** This action was the result of coming two actions from the previously approved plan.

1.2.2 Promote the purchase of NOAA all-hazard radios by local residents to ensure advanced warning about threatening weather or other disasters.

- **Hazards Addressed:** Tornadoes/Severe thunderstorms, severe winter weather.
- **Jurisdictions Choosing This Action:** Bates County and all participating jurisdictions.
- **Lead Agency:** Bates County Emergency Management Agency.
- **Partners (if any):** Local news media, community organizations.
- **Funding Sources:** Local funding.
- **Estimated Cost:** None, unless funds become available to provide free NOAA all-hazards radios.
- **Discussion of Cost vs. Benefits:** Virtually cost-free and providing high benefit of public awareness.
- **STAPLEE Priority:** Medium
- **Action Status:** Although some progress has been made, this action is of a continuing nature. The Planning Committee decided to carry this action over into the future.

1.2.3 Partner with local radio stations to assure that appropriate warning is provided to county residents of impending disasters.

- **Hazards Addressed:** All hazards, with the possible exception of drought.
- **Jurisdictions Choosing This Action:** Bates County.
- **Lead Agency:** Bates County Emergency Management Agency.
- **Partners (if any):** Local and area radio stations, LEPC
- **Funding Sources:** Local funding.
- **Estimated Cost:** None beyond cost of funding personnel.
- **Discussion of Cost vs. Benefits:** Virtually cost-free and providing high benefits of public warning during a disaster.
- **STAPLEE Priority:** High
- **Action Status:** This action was carried over from the 2005 Plan without progress having been made.

Objective 1.3: The County, incorporated cities, and schools should reduce danger to and enhance protection of dangerous areas during hazardous events.

1.3.1 Examine potential road and bridge upgrades that would reduce danger to residents during occurrences of natural disasters, assisting communities/county in securing funding for road and bridge improvements.

- Hazards Addressed: Flooding.
- **Jurisdictions Choosing This Action:** Bates county and participating jurisdictions.
- **Lead Agency:** Local and County public works agencies.
- **Partners (if any):** Local legislative agencies.
- **Funding Sources:** Grants, Hazard Mitigation Funds, local matching funds.
- **Estimated Cost:** Cost could be in the hundreds to thousands of dollars depending on the chosen project.
- **Discussion of Cost vs. Benefits:** Possibly very high cost and providing high benefits of increased transportation safety. Possible low community support.
- **STAPLEE Priority:** Medium
- **Action Status:** This action is a combination of two actions carried over from the 2005 Plan. Limited progress has been made on this action. As a member of the Kaysinger Basin Regional Planning Commission Bates County participate in the Regional Transportation Plan to identify problem roads and bridges.

Goal 2: The County, incorporated cities, and schools should reduce the potential impact of natural disasters on new and existing properties and infrastructure and the local economy.

Objective 2.1: The County, incorporated cities, and schools should implement cost-effective activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to natural hazards.

2.1.1: Encourage businesses to develop emergency plans.

- **Hazards Addressed:** Tornados, Thunderstorms, severe winter weather.
- **Jurisdictions Choosing This Action:** All participating jurisdictions.
- **Lead Agency:** Bates County Emergency Management.
- **Partners (if any):** Local manufacturers.
- **Funding Sources:** Internal funding.
- **Estimated Cost:** None beyond cost of funding personnel.
- **Discussion of Cost vs. Benefits:** Virtually cost-free while providing high benefits.
- **STAPLEE Priority:** High
- **Action Status:** This action has been carried over from the previously approved plan. No progress has been made. Most businesses in the county are small in nature, with less formalized procedures in place. This action will be reviewed in the next plan update to determine if it is appropriate for inclusion in the Bates County Plan.

Objective 2.2: The County, incorporated cities, and schools should discourage new development and encourage preventative measures for existing development in areas vulnerable to natural hazards, thereby reducing losses to the National Flood Insurance Program (NFIP).

2.2.1: Educate residents about the dangers of floodplain development and the benefits of the National Flood Insurance Program.

- **Hazards Addressed:** Flooding.
- **Jurisdictions Choosing This Action:** Bates County, Adrian and Butler
- **Lead Agency:** Legislative bodies of all participating jurisdictions.
- **Partners (if any):** NFIP, FEMA and SEMA
- **Funding Sources:** Additional funding needs not anticipated.
- **Estimated Cost:** None beyond cost of funding personnel.
- **Discussion of Cost vs. Benefits:** Virtually no additional cost involved with increased safety and decreased community losses during flood events.
- **STAPLEE Priority:** High
- **Action Status:** This action was carried over from the 2005 plan with little progress having been made. Discussions have occurred at local legislative body meetings.

2.2.2: Jurisdictions participating in the NFIP will continue to participate in the program.

- **Hazards Addressed:** Flooding
- **Jurisdictions Choosing This Action:** All jurisdictions.
- **Lead Agency:** Legislative bodies of all participating jurisdictions.
- **Partners (if any):** NFIP and FEMA
- **Funding Sources:** None needed.
- **Estimated Cost:** No additional associated cost.
- **Discussion of Cost vs. Benefits:** Very high benefit in avoiding disastrous losses to citizenry in the even of future flooding, with no additional cost.
- **STAPLEE Priority:** High
- **Action Status:** This action is new to the Plan Update.

2.2.3: Jurisdictions not currently participating in the NFIP will be encouraged to become active participants in the program.

- **Hazards Addressed:** Flooding
- **Jurisdictions Choosing This Action:** All jurisdictions.
- **Lead Agency:** Legislative bodies of all participating jurisdictions. (note that school districts are not eligible to participate in the NFIP.
- **Partners (if any):** NFIP and FEMA
- **Funding Sources:** None needed.
- **Estimated Cost:** No additional associated cost.
- **Discussion of Cost vs. Benefits:** No cost, and very high possible benefits in making citizenry eligible to buy flood insurance not available through most individual policies.
- **STAPLEE Priority:** Medium, due to possible lack of political support from participating jurisdictions.
- **Action Status:** This action is new to the plan.

Objective 2.3: The County, incorporated cities and schools should use regulations to ensure that development will not put people in harm's way or increase threats to existing properties.

2.3.1: Encourage minimum building standards for building codes in all cities.

- **Hazards Addressed:** Flooding, tornados/thunderstorms, earthquakes, severe winter weather, and wildfire.
- **Jurisdictions Choosing This Action:** Bates County, all participating jurisdictions.
- **Lead Agency:** Legislative bodies of participating jurisdictions.
- **Partners (if any):** Local businesses.
- **Funding Sources:** None needed
- **Estimated Cost:** None above personnel funding.
- **Discussion of Cost vs. Benefits:** Low cost with possible high benefits.

- **STAPLEE Priority:** Low (The adoption of building codes can be a politically charged activity not popular with all segments of the community).
- **Action Status:** This action was part of the previously approved plan, but no progress has been made in implementation.

2.3.2: Encourage local and county governments to develop and implement regulations for the securing of hazardous materials, tanks and mobile homes.

- **Hazards Addressed:** Flooding, tornadoes/thunderstorms, earthquakes, dam/levee failures, and wildfires.
- **Jurisdictions Choosing This Action:** Encouragement would come from the county EMD for all participating jurisdictions to participate.
- **Lead Agency:** Bates County EMA
- **Partners (if any):** Local legislative bodies and LEPC.
- **Funding Sources:** No additional funding needed
- **Estimated Cost:** No additional cost anticipated.
- **Discussion of Cost vs. Benefits:** Low cost with the high benefit of less property loss.
- **STAPLEE Priority:** Low (The adoption of building codes can be a politically charged activity not popular with all segments of the community).
- **Action Status:** This action has been combined with another action. Both were part of the previously approved plan, but no progress has been made in its implementation.

Goal 3: The County, incorporated cities, and schools should promote education, outreach, research and development programs to improve the knowledge and awareness among citizens and industry about hazards thy may face, their vulnerability to identified hazards, and hazard mitigation alternatives that can reduce their vulnerabilities.

Objective 3.1: The County, incorporated cities, and schools should heighten public awareness of the full range of natural hazards by developing education and outreach programs.

3.1.1: Regular press released from county and city EMD offices concerning hazards, where they strike, frequency and preparation and distribute SEMA brochures at public facilities and events.

- Hazards Addressed: All hazards.
- **Jurisdictions Choosing This Action:** All participating jurisdictions.
- **Lead Agency:** City and County EMD's
- **Partners (if any):** Community agencies, Red Cross, Missouri Department of Health and Senior Services.
- **Funding Sources:** Community awareness press releases are usually provided free of charge.
- **Estimated Cost:** None above normal personnel funding.
- **Discussion of Cost vs. Benefits:** Virtually no cost with the high benefit of increased community awareness.
- **STAPLEE Priority:** High
- **Action Status:** This action is a combination of three like actions from the previously approve plan. This type of activity is continuous and ongoing. Brochures were made available at public facilities like the county office buildings. The Planning Committee determined that is was in everyone's interest to continue these actions and carried them forward into the Plan Update.

Objective 3.2: The County, incorporated cities, and schools should publicize and encourage the adoption of appropriate hazard mitigation measures by county and city governments.

3.2.1: Cities, county should continually re-evaluate their hazard mitigation plan and merge with other community planning, developing press releases concerning completed hazard mitigation projects.

- **Hazards Addressed:** All hazards.
- **Jurisdictions Choosing This Action:** All jurisdictions.
- **Lead Agency:** County and city EMD's
- **Partners (if any):** Community Planning Agencies, Local county and city planning commissions.
- **Funding Sources:** No external funds needed.
- **Estimated Cost:** None
- **Discussion of Cost vs. Benefits:** No cost providing the high benefit of increased community planning.
- **STAPLEE Priority:** High
- **Action Status:** This action combined two actions for the previously approved plan. Re-evaluation of the hazard mitigation plan did not occur between the approval of the previous plan and the plan update process.

3.2.2: Create safe rooms in schools.

- **Hazards Addressed:** Primarily for tornados, but safe rooms could be used as shelter during other hazard events.
- **Jurisdictions Choosing This Action:** School districts.
- **Lead Agency:** School districts.
- **Partners (if any):** Missouri Emergency Management Agency, FEMA
- **Funding Sources:** 75% could be funded through HMGP funding, if available, with a 25% local match requirement.
- **Estimated Cost:** Precise cost estimates would be made at the time that funding is available based on the proposed size of the safe room.
- **Discussion of Cost vs. Benefits:** This would be a very high cost project even for a small safe room, but with significant benefits.
- **STAPLEE Priority:** This project rated very high in the STAPLEE analysis, since it is so strongly supported by almost every sector in the community. However, without outside funding from grants, it is not likely that the project would be feasible.
- **Action Status:** This is a new action in the Plan Update.

3.2.3: Ask SEMA specialist to present information to city councils, county commissions, KBRPC, and Bates County Emergency Planning Committee.

- **Hazards Addressed:** Flooding, tornados/thunderstorms, earthquakes severe winter weather and wildfire.
- **Jurisdictions Choosing This Action:** All jurisdictions.
- **Lead Agency:** Bates County Emergency Management Director.
- **Partners (if any):** SEMA
- **Funding Sources:** None needed

- **Estimated Cost:** No additional cost associated with this action.
- **Discussion of Cost vs. Benefits:** No cost with the medium benefit of increased public awareness.
- **STAPLEE Priority:** Medium.
- **Action Status:** This action was carried over from the previously approved plan but has not been implemented.

Goal 4: The County, incorporated cities, and schools should strengthen communication and coordinate participation between public agencies, citizens, non-profit organizations, business, and industry to create a widespread interest in mitigation.

Objective 4.1: The cunt, incorporated cities, and schools should build and support local partnerships to continuously become less vulnerable to hazards.

4.1.1: Encourage and participate in joint training (and/or drills), partnering activities, and informational meetings between agencies, public and private entities (including schools and businesses).

- **Hazards Addressed:** All hazards.
- **Jurisdictions Choosing This Action:** All jurisdictions.
- **Lead Agency:** County and City Emergency Management Directors.
- **Partners (if any):** SEMA, Red Cross, Missouri Department of Health and Senior services and local emergency services.
- **Funding Sources:** No additional funding needed.
- **Estimated Cost:** No additional cost.
- **Discussion of Cost vs. Benefits:** No cost with the medium benefit of increased community awareness.
- **STAPLEE Priority:** Medium.
- **Action Status:** This action combined three actions from the previously approved plan, all of which were carried over from the previously approved plan. Progress has been made on this action, as numerous meeting and join training secessions have been held.

4.1.2: Pool different agency resources to achieve widespread results.

- **Hazards Addressed:** All hazards.
- **Jurisdictions Choosing This Action:** All jurisdictions.
- **Lead Agency:** County Emergency Management
- **Partners (if any):** All emergency service, SEMA, FEMA and LEPC's
- **Funding Sources:** None needed
- **Estimated Cost:** No additional cost.

- **Discussion of Cost vs. Benefits:** No additional cost and providing high benefits in increased agency corporation.
- **STAPLEE Priority:** Hi
- **Action Status:** This action has been carried over from the previously approved plan with some increased inter-agency cooperation. It was decided to carry this action forward into the new plan update.

Goal 5: The County, incorporated cities, and schools should establish priorities for reducing risks to the people and their property with emphasis on long term and maximum benefits to the public rather than short term benefits of special interest.

Objective 5.1: The County, incorporated cities, and schools should incorporate hazard mitigation into the long range planning and development activities of the county and each jurisdiction.

5.1.1: All communities need to develop stormwater management plans, and include storm water management considerations in all new development.

- **Hazards Addressed:** Flooding.
- **Jurisdictions Choosing This Action:** All jurisdictions.
- **Lead Agency:** Public Works Departments of the participating communities. In those instances where the community does not have a Public Works Department, the legislative body would be the lead agency. The lead agencies for the school districts would be the school boards.
- **Partners (if any):** None
- **Funding Sources:** City and County revenues pay public employee salaries.
- **Estimated Cost:** No additional cost anticipated.
- **Discussion of Cost vs. Benefits:** Strongly benefits the communities at a low cost.
- **STAPLEE Priority:** Formal storm water management plan may not be practical or feasible for smaller communities, and so this action received a lower priority score. In addition, new development is not occurring in many of the participating jurisdictions. Political support could be low.
- **Action Status:** This action is a combination of two actions carried over from the previously approved plan but has not been implemented.

5.1.2: Encourage communities to zone all areas in floodplain as open space, or zone as a conservation zone.

- **Hazards Addressed:** Flooding.
- **Jurisdictions Choosing This Action:** Bates County, Arden and Butler.
- **Lead Agency:** County and City planning and zoning committees.
- **Partners (if any):** None
- **Funding Sources:** No additional funding needed.
- **Estimated Cost:** No additional cost.

- **Discussion of Cost vs. Benefits:** Low cost with a high benefit to communities.
- **STAPLEE Priority:** This action may not be feasible, since not all communities have zoning ordinances or the means to enforce land development regulations.
- **Action Status:** This action is a combination of two actions and has been carried over from the previously approved plan without implementation.

Objective 5.2: The County, incorporated cities, and schools should promote beneficial uses of hazardous areas while expanding open space and recreational opportunities.

5.2.1: Encourage local government to purchase properties in the floodplain as funds become available and convert the land into public/recreational or open space

- **Hazards Addressed:** Flooding
- **Jurisdictions Choosing This Action:** Bates County
- **Lead Agency:** Local planning commissions..
- **Partners (if any):** FEMA
- **Funding Sources:** Grants and public donations.
- **Estimated Cost:** Possible high costs with medium benefits.
- **Discussion of Cost vs. Benefits:** With the potential for high cost and possible lack of public buy in this action received a lower rating.
- **STAPLEE Priority:** Low
- **Action Status:** This action is a combination of two actions from the previously approved plan. This action is to be carried over but has not yet been fully implemented.

Goal 6: The County, incorporated cities and schools should secure resources for investment in hazard mitigation.

Objective 6.1: The County, incorporated cities and schools should research the use of outside sources for funding.

6.1.1: Work with the SEMA area coordinator to learn about new mitigation funding opportunities.

- **Hazards Addressed:** All hazards.
- **Jurisdictions Choosing This Action:** Bates County.
- **Lead Agency:** County Emergency Management Agency.
- **Partners (if any):** None
- **Funding Sources:** None

- **Estimated Cost:** No cost to work with SEMA
- **Discussion of Cost vs. Benefits:** No cost and providing the possibility of future mitigation funds
- **STAPLEE Priority:** High
- **Action Status:** This action is carried over from the previously approved plan but has not been formally implemented. However, some interaction between the county and SEMA has occurred since the 2005 plan was approved.

6.1.2: Work with local/state/federal agencies to include mitigation in all economic and community development projects.

- **Hazards Addressed:** All hazards.
- **Jurisdictions Choosing This Action:** Bates County.
- **Lead Agency:** County Emergency Management Agency.
- **Partners (if any):** Local, State and Federal agencies.
- **Funding Sources:** None
- **Estimated Cost:** No additional cost
- **Discussion of Cost vs. Benefits:** No cost and providing increased public safety and security.
- **STAPLEE Priority:** High
- **Action Status:** This action is carried over from the previously approved plan but has not been implemented.

6.3.3 Monitoring, Evaluating, and Updating the Plan

Bates County has developed a method to ensure regular review and update of the Hazard Mitigation Plan. The county's Hazard Mitigation Planning Committee consists of the County Commissioners, municipal public officials, members of the Bates County Emergency Management Committee (fire, law enforcement, emergency medical, and public health officers), officials responsible for various objectives in the plan, and the County EMA director. Hazard mitigation objectives will be an agenda item, as needed, at yearly meetings of the Bates County Emergency Management Committee meeting. As planning begins the public will be encouraged to participate. The county will publicize the various objectives and the objective at hand by way of media coverage and published reminders.

The County EMA director is responsible for contacting all Hazard Mitigation Planning Committee members and organizing the annual meeting. The meeting will be held in February of each year, and committee members will be responsible for monitoring and evaluating the progress of the mitigation strategies in the plan. The committee will review each goal and objective to determine their relevance to changing situations in the county, as well as changes in State or Federal policy, and to ensure that they are addressing current and expected conditions. The committee also will review the risk assessment portion of the plan to determine if this information should be updated or modified. The parties responsible for the various implementation actions will report on the status of their projects and will include which implementation processes worked well, any difficulties encountered, how coordination efforts were proceeding, and which strategies should be revised.

The County EMA director will then have three months to update and make changes to the plan before submitting it to the committee members and the State Hazard Mitigation Officer. The plan will be posted on the Bates County website (www.batescounty.net) and copies will be made available in the Bates County Office of Emergency Management. If no changes are necessary, the State Hazard Mitigation Officer will be given a justification for this determination. The general public will be encouraged to attend Hazard Mitigation Planning Committee meetings through media coverage, published notices, reminders or announcements at civic meetings, and possibly public speaking engagements. Kaysinger Basin Regional Planning Commission will continue to host any hazard mitigation announcements or information, as well as a copy of the latest plan, on the KBRPC website (www.kaysinger.org).

Appendix A: Formal Adoption Resolutions Sample

RESOLUTION NO. _________

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

WHEREAS, the (Jurisdiction) recognizes that no community is immune from natural hazards whether it be tornado/severe thunderstorm, flood, severe winter weather, drought, heat wave, earthquake, dam failure or wildfire and recognizes the importance 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 (Jurisdiction) may have previously pursued measures such as building codes, fire codes, floodplain management regulations, zoning ordinances, and stormwater management regulations 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 assists 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 Hazard Mitigation program, the (Jurisdiction) will be eligible to apply for post-disaster mitigation funds; and

WHEREAS, the (Jurisdiction) desires to commit to working with government partners and community partners to implement the Natural Hazard Mitigation Plan; and

WHEREAS, the (Jurisdiction) will implement pertinent precepts of the mitigation plan by incorporation into other community plans and mechanisms where appropriate; and

WHEREAS, the (Jurisdiction) 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 (Jurisdiction) as follows:

The (Jurisdiction) hereby adopts the ________ County Multi-Jurisdictional Natural Hazards Mitigation Plan attached hereto for the purpose of building a safer community by reducing natural hazard vulnerability.

ADOPTED this ___________ day of ___________, 2011.

___________________________________ ATTEST: _______________________________

Certifying Official(s) (Name, Title)

RESOLUTION NUMBER: 1301

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

WHEREAS, **The Miami R-I School District, Bates County Missouri,** recognizes that no community is immune from natural hazards whether it be tornado/severe thunderstorm, flood, severe winter weather, drought, heat wave, earthquake, dam failure or wildfire and recognizes the importance 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 Miami R-I School District, Bates County Missouri,** may have previously pursued measures such as building inspections, fire alarm system inspections, school safety plans, and staff training 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 assists 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 Hazard Mitigation program, **The Miami R-I School District, Bates County Missouri,** will be eligible to apply for post-disaster mitigation funds; and

WHEREAS, **The Miami R-I School District, Bates County Missouri,** desires to commit to working with government partners and community partners to implement the Natural Hazard Mitigation Plan; and

WHEREAS, **The Miami R-I School District, Bates County Missouri,** will implement pertinent precepts of the mitigation plan by incorporation into other community plans and mechanisms where appropriate; and

WHEREAS, **The Miami R-I School District, Bates County Missouri,** 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 Miami R-I School District, Bates County Missouri,** as follows:

The Miami R-I School District, hereby adopts the **Bates County** Multi-Jurisdictional Natural Hazards Mitigation Plan attached hereto for the purpose of building a safer school district by reducing natural hazard vulnerability.

ADOPTED this 18th day of November 2013.

[signature]
Superintendent

ATTEST: Marilyn D. Lindsay
(Name, Title) Miami BOE Secretary/Treas

Mary Lempus
President

____

____

____

RESOLUTION NUMBER: _________

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

WHEREAS, **The Rich Hill R-IV School District, Bates County Missouri,** recognizes that no community is immune from natural 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 Rich Hill R-IV School District, Bates County Missouri,** may have previously pursued measures such as building inspections, fire alarm system inspections, school safety plans, and staff training 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 assists 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 Hazard Mitigation program, **The Rich Hill R-IV School District, Bates County Missouri,** will be eligible to apply for post-disaster mitigation funds; and

WHEREAS, **The Rich Hill R-IV School District, Bates County Missouri,** desires to commit to working with government partners and community partners to implement the Natural Hazard Mitigation Plan; and

WHEREAS, **The Rich Hill R-IV School District, Bates County Missouri,** will implement pertinent precepts of the mitigation plan by incorporation into other community plans and mechanisms where appropriate; and

WHEREAS, **The Rich Hill R-IV School District, Bates County Missouri,** 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 Rich Hill R-IV School District, Bates County Missouri,** as follows:

The Rich Hill R-IV School District, hereby adopts the **Bates County** Multi-Jurisdictional Natural Hazards Mitigation Plan attached hereto for the purpose of building a safer school district by reducing natural hazard vulnerability.

ADOPTED this ___11___ day of ___December___ 2013.

[signature]
Superintendent

ATTEST: Jeff Blackford, Superintendent
(Name, Title)

[signature]
President

____

____

____

RESOLUTION NUMBER: _________

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

WHEREAS, **The Hudson R-9 School District, Bates County Missouri,** recognizes that no community is immune from natural 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 Hudson R-9 School District, Bates County Missouri,** may have previously pursued measures such as building inspections, fire alarm system inspections, school safety plans, and staff training 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 assists 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 Hazard Mitigation program, **The Hudson R-9 School District, Bates County Missouri,** will be eligible to apply for post-disaster mitigation funds; and

WHEREAS, **The Hudson R-9 School District, Bates County Missouri,** desires to commit to working with government partners and community partners to implement the Natural Hazard Mitigation Plan; and

WHEREAS, **The Hudson R-9 School District, Bates County Missouri,** will implement pertinent precepts of the mitigation plan by incorporation into other community plans and mechanisms where appropriate; and

WHEREAS, **The Hudson R-9 School District, Bates County Missouri,** 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 Hudson R-9 School District, Bates County Missouri,** as follows:

The Hudson R-9 School District, hereby adopts the **Bates County, Missouri** Multi-Jurisdictional Natural Hazards Mitigation Plan attached hereto for the purpose of building a safer school district by reducing natural hazard vulnerability.

ADOPTED this 9th day of December, 2013.

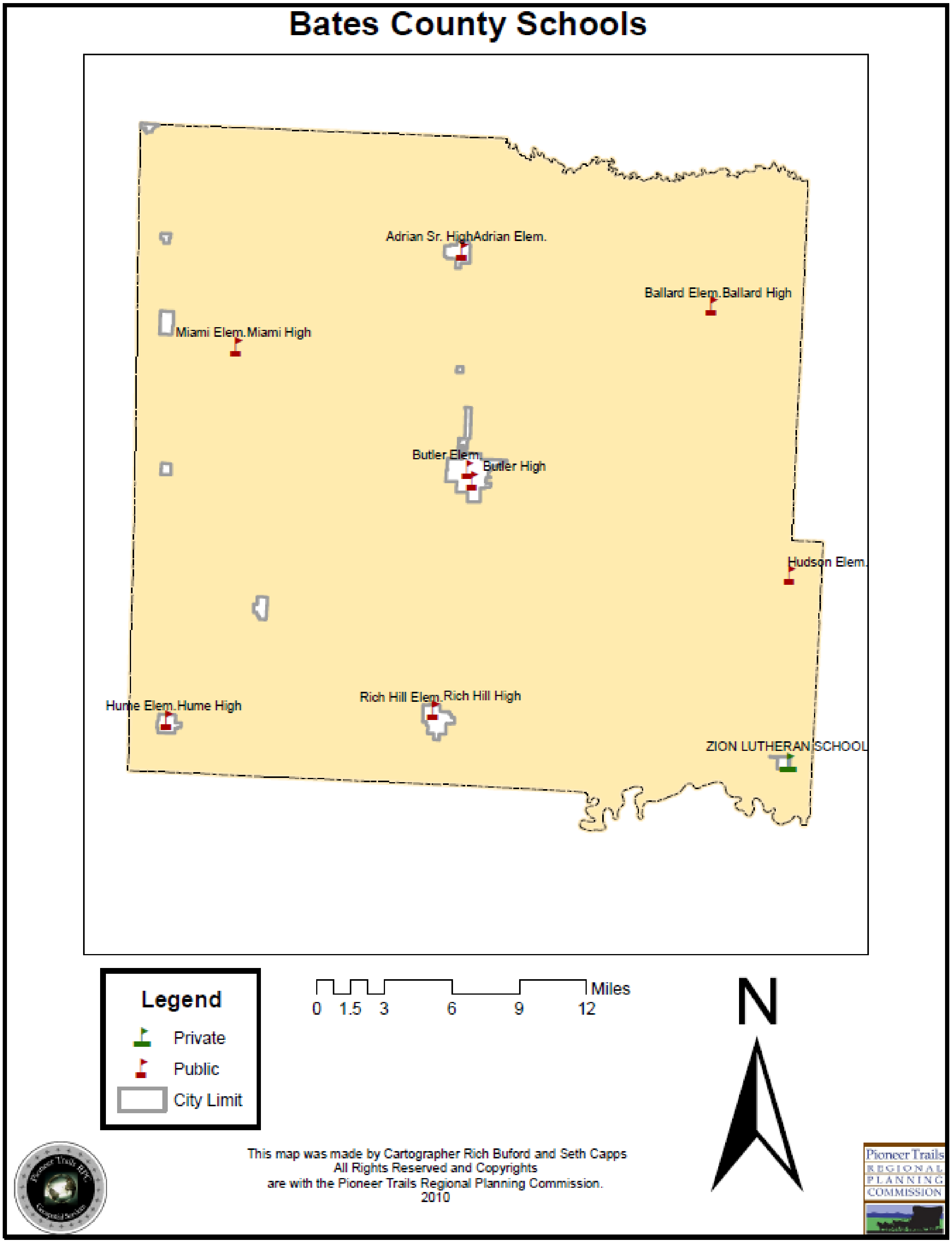
Karen Warmbrodt
Superintendent/Principal

ATTEST: Ladonna Green
(Name, Title) Ladonna Green, Secretary

[signature]
President

Appendix B: Maps

- Bates County Schools
- Bates County Soils
- Bates County Watersheds
- City of Butler – Land Use Map
- MO Freight Rail Map


Bates County Schools
Adrian Sr. High
Adrian Elem.
Ballard Elem.
Ballard High
Miami Elem.
Miami High
Butler Elem.
Butler High
Hudson Elem.
Hume Elem.
Hume High
Rich Hill Elem.
Rich Hill High
ZION LUTHERAN SCHOOL
Legend
Private
Public
City Limit
0 1.5 3 6 9 12
Miles
N
This map was made by Cartographer Rich Buford and Seth Capps
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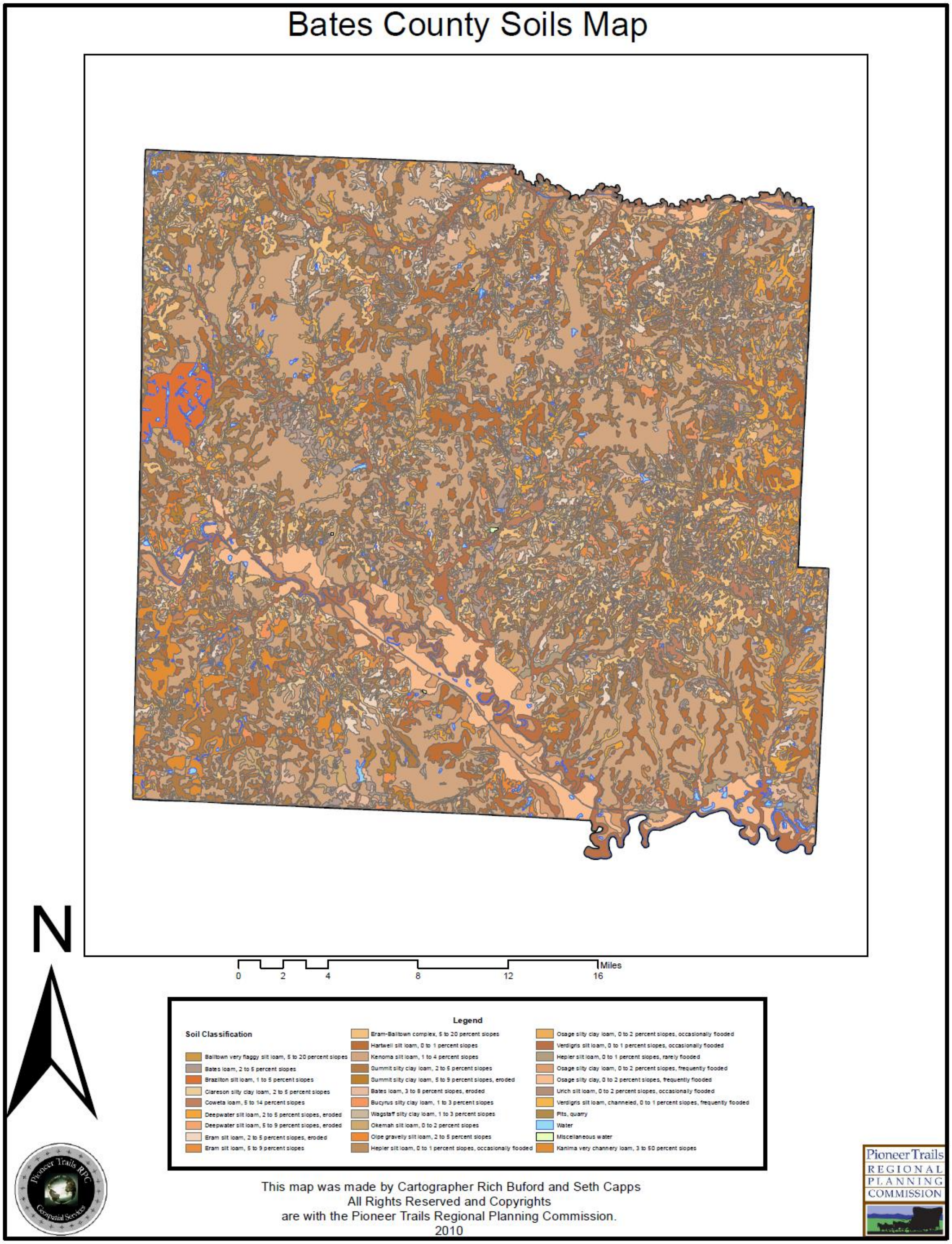
are with the Pioneer Trails Regional Planning Commission.
2010
Pioneer Trails
REGIONAL
PLANNING
COMMISSION


Bates County Soils Map
N
0
2
4
8
12
16
Miles
Legend
Soil Classification
Balltown very flaggy silt loam, 5 to 20 percent slopes
Bates loam, 2 to 5 percent slopes
Brazilton silt loam, 1 to 5 percent slopes
Clareson silty clay loam, 2 to 5 percent slopes
Coweta loam, 5 to 14 percent slopes
Deepwater silt loam, 2 to 5 percent slopes, eroded
Deepwater silt loam, 5 to 9 percent slopes, eroded
Eram silt loam, 2 to 5 percent slopes, eroded
Eram silt loam, 5 to 9 percent slopes
Eram-Balltown complex, 5 to 20 percent slopes
Hartwell silt loam, 0 to 1 percent slopes
Kenoma silt loam, 1 to 4 percent slopes
Summit silty clay loam, 2 to 5 percent slopes
Summit silty clay loam, 5 to 9 percent slopes, eroded
Bates loam, 3 to 8 percent slopes, eroded
Bucyrus silty clay loam, 1 to 3 percent slopes
Wagstaff silty clay loam, 1 to 3 percent slopes
Okemah silt loam, 0 to 2 percent slopes
Olpe gravelly silt loam, 2 to 5 percent slopes
Hepler silt loam, 0 to 1 percent slopes, occasionally flooded
Osage silty clay loam, 0 to 2 percent slopes, occasionally flooded
Verdigris silt loam, 0 to 1 percent slopes, occasionally flooded
Hepler silt loam, 0 to 1 percent slopes, rarely flooded
Osage silty clay loam, 0 to 2 percent slopes, frequently flooded
Osage silty clay, 0 to 2 percent slopes, frequently flooded
Urich silt loam, 0 to 2 percent slopes, occasionally flooded
Verdigris silt loam, channeled, 0 to 1 percent slopes, frequently flooded
Pits, quarry
Water
Miscellaneous water
Kanima very channery loam, 3 to 50 percent slopes
This map was made by Cartographer Rich Buford and Seth Capps
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Pioneer Trails
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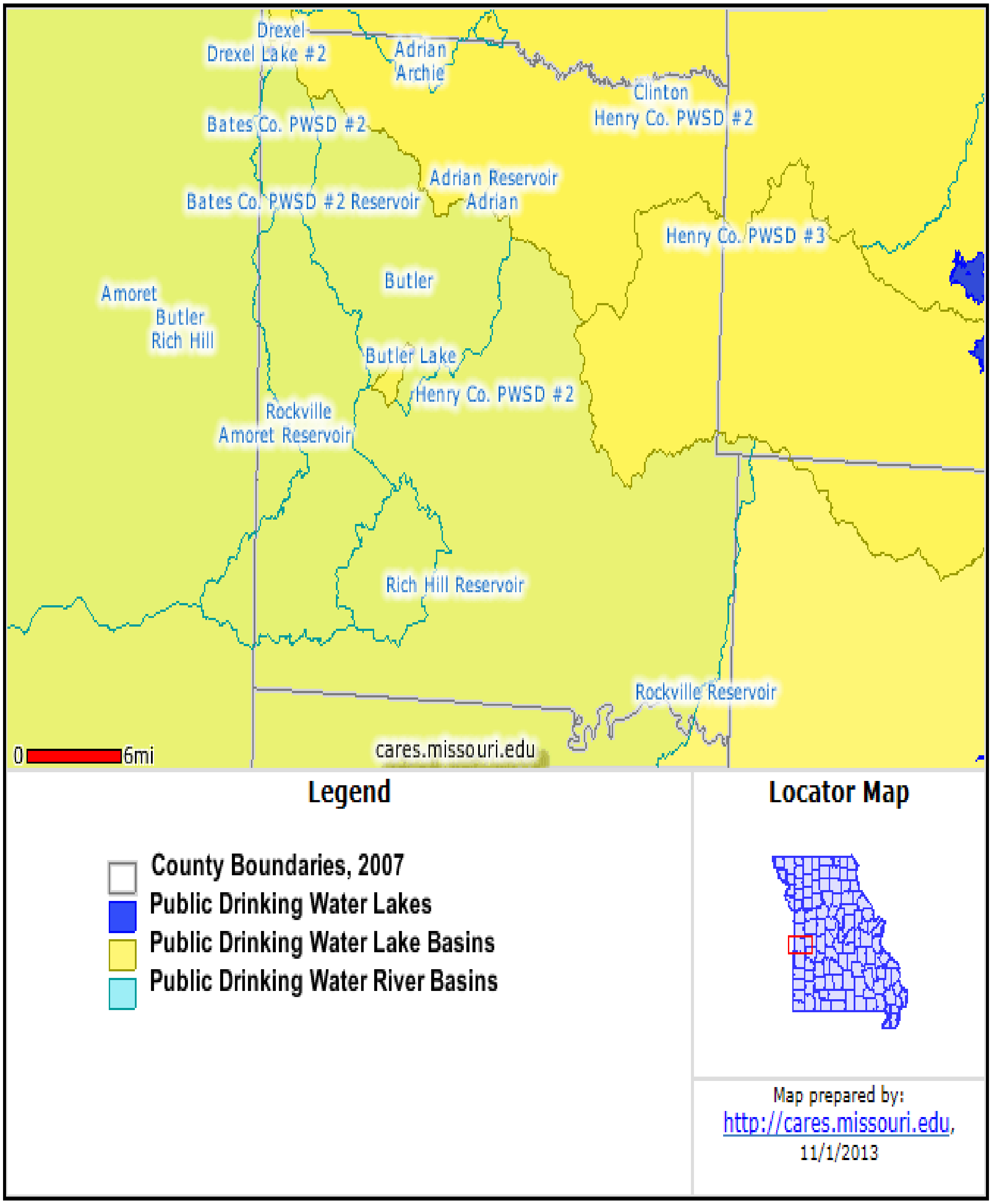
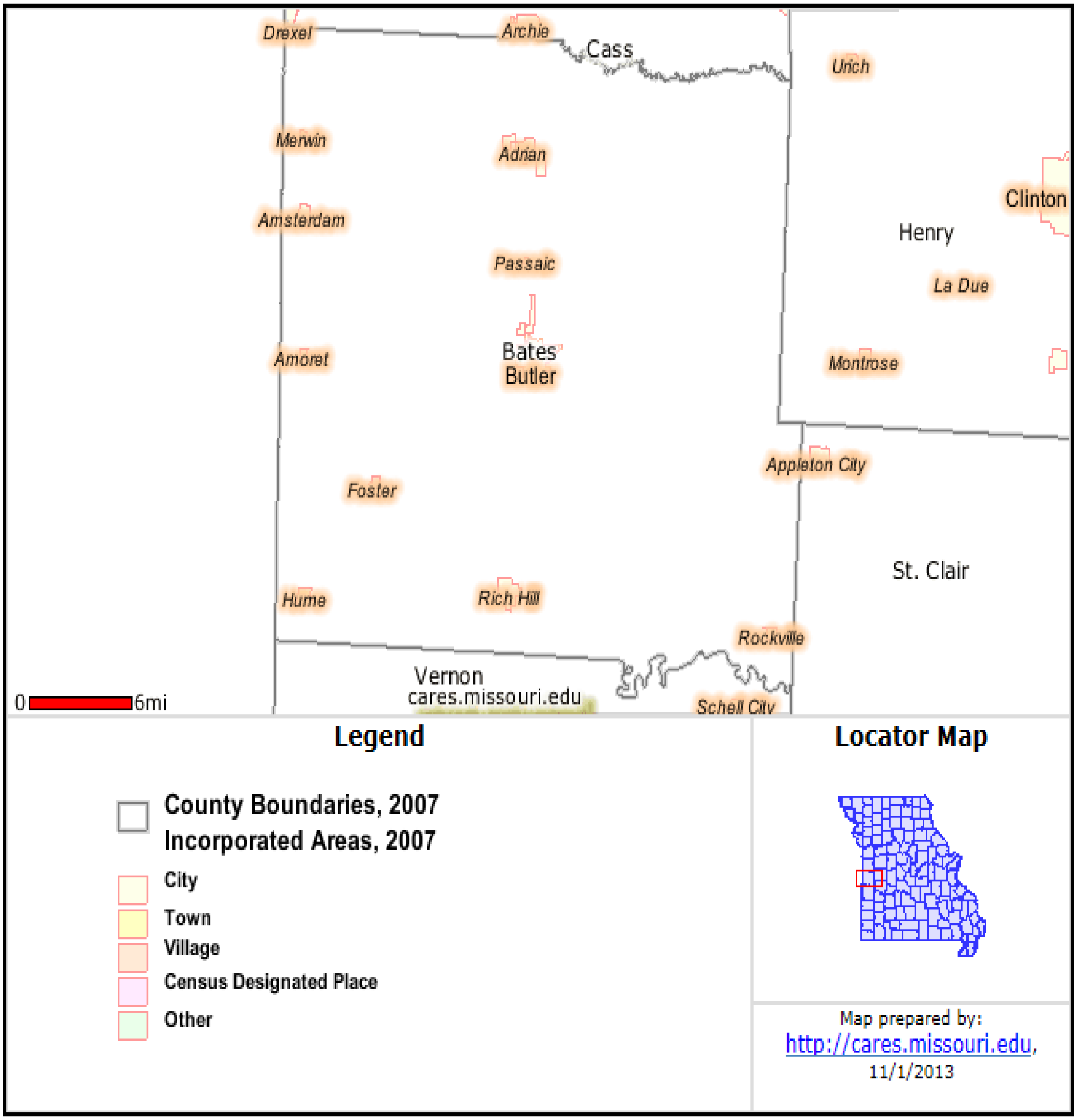
COMMISSION

Bates County Drinking Water Sources



Bates County Map with Cities



Source:
http://ims.missouri.edu/maproom/missouri/viewer.htm?JS=layerparam20524041154&DATA=,ad1a,ad2a,&LEVEL=&APP=

Appendix C: Public Meeting Documents

6 News Xpress, Butler, Mo., Friday, July 16, 2010

Public input sought at Natural Hazard Mitigation hearing July 19

Kaysinger Basin Regional Planning Commission and Pioneer Trails Regional Planning Commission will be conducting an initial public meeting regarding the Natural Hazard Mitigation Plan update. The meeting will consist of an overview of the mitigation planning process as well as a review of past disasters affecting the county and mitigation actions taken in the past five years.

As mandated by the Disaster Mitigation Act of 2000, natural hazard mitigation plans must be updated every five years. The mitigation plans demonstrate how a jurisdiction will lower its risk and exposure to natural disasters. Natural Mitigation Plans are required for communities to remain eligible for pre- and post-disaster mitigation FEMA grants such as: the Pre-Disaster Mitigation Program, Hazard Mitigation Grant Program, Flood Mitigation Assistance; Repetitive Flood Claims and Severe Repetitive Loss.

A copy of the 2004 Bates County Natural Hazard Plan will be made available on the Pioneer Trails Regional Planning Commission Website located at:

www.trailsrpc.org.

Please take a moment to review the document prior to the meeting.

Date: Monday, July 19 - 5:30 p.m. at Bates County Office of Emergency Management, 108 East Fort Scott St., Butler, Mo.

For any questions, call Andrew Weisberg, Community Development Planner, 660-463-7934 or email at Drew@trailsrpc.org.

Appendix D: Meeting Sign In Sheets

BATES COUNTY HAZARD MITIGATION PLAN UPDATE

JULY 19, 2010 AT 5:30 PM - BATES COUNTY EMA OFFICE

NAME	ORGANIZATION REPRESENTING	POSITION	SIGNATURE
James Roberts	Bates Co LEPC / Rockville Fire	Chairman	[illegible]
Brian Bearce	Adrian EMA/Fire	EMD	[illegible]
Ron Nissen	Bates Co EMD		[illegible]
Jim Henry	City of Butler EMD	EMD	[illegible]
Randy W. Pike	Bates County	Commissioner	[illegible]
Danny [illegible] Ross	City of Rich Hill	Laborer	[illegible]

BATES COUNTY HMP UPDATE
PUBLIC MEETING

Date 9/13/10
Time In: 3:30 Time Out:
Place BATES COUNTY EMD OFFICE

[illegible]	[illegible]	[illegible]	[illegible]
Jody Welston	Bates Co Health Center	local public health	welstj@lpha.mopublic.org
Dean Paul	BATES CO HEALTH CENTER	PUBLIC HEALTH	paynes@lpha.mopublic.org
Randy W. Pike	Bates County	County	RandyWPike@Hotmail.com
Ron Nissen	Bates County EMD	County EMA	batesema480@embarqmail.com
Jim Garnett	Butler Police Dept	City of Butler	butlerpolice35@yahoo.com
Jim Henry	City of Butler Fire/EMA	City of Butler	bfd201@earthlink.net
James Roberts	Bates County LEPC Rockville Fire Dept	Bates County Rockville Fire Dept	centerplace@gmail.com

Bates County Hazard Mitigation Plan - Public Information Meeting Butler R5 School Board Meeting: November 13, 2013 7:00 pm		
Name: (please print)	**Position:**	**Organization Represented:**
Debbie Gellhammer	Math Teacher	Butler R-V
Neta Apple	Science Instructor	Butler R-V
Annie Zellmer	1st Grade Teacher	Butler R-V
Jessica McIntyre	Asst. Elem Principal	Butler R-V
Stacey Lawson	Elem Principal	Butler R-V
Jan Meyer	citizen	Harrisonville
Tom Simonin	Citizen	Rural Butler
Carol Tilley	Science Teacher	Butler RV
Beck Zerwald	Secretary	Butler R-V
Diana Vermaas	1st Grade Teacher	Butler R-V
Jo Anne Bohannon	5th Grade Math Teacher	Butler R-V
Steve Hubbard	Principal	Butler R-V
KIRK HANNAH	ASST. PRINCIPAL	BUTLER R-V
MARCI Beckley	Director of Special Services	Butler R-V
Heath Oates	Assistant Superintendent	Butler R-V
Phillis Duda	School Board Member	Butler R-V
Jerret Wheatley	School Board Member	Butler R-V.
LARRY ANDERSON	School Board Member	BUTLER R-V
Darin Carter	Superintendent	Butler-R-V
BRAD DAVIS	School Board Member	Butler R-V
Jim Herrell	School Board Member	Butler RV

Bates County Hazard Mitigation Plan - Public Information Meeting
Miami R-I School District: 18th, 2013 7:00 pm

Name: (please print)	Position:	Organization Represented:
Bob Anderson	Teacher/Coach - ~~[illegible]~~	Miami R-I
Keith Smith	Teacher/Coach	Miami R-I
Angie Wiley	Teacher	Miami R-I
[illegible]	Principal	Miami R-1
Lynda Wiley	School Board Member	Miami R-1
Molly Downs	School Board Member	Miami R-1
[illegible]	Superintendent	Miami R-1
Mary Limpus	School Board Member	Miami R-1
Marilyn Lindsay	School Board Sec./Treas	Miami R-1
Vickie Popplewell	school board member	Miami R-1
Patrick Popplewell	School board Member	Miami R-1
AARON Muller	School BOARD MEMBER	MiAMi R-1

Bates County Hazard Mitigation Plan - Public Information Meeting
Rich Hill R-IV School Board Meeting: December 11, 2013 6:00 pm

Name: (please print)	Position:	Organization Represented:
Landon Swope	Board member	Rich Hill R-IV School
Bill Thompson	Board Member	Rich Hill R-IV School
Shawn Breckenridge	Board Member	"
Jeff Blackford	Superintendent	"
Kenneth Taylor	Board Member	" "
DAVID YARICK	BOARD MEMBER	"
Wade Mumma	Board Member	"
Jani Drake	Principal	"
Brodi Miller	ECSE Teacher	"
Dredra Dueckman	Elementary Teacher	"
Patricia Atteppie	High School Secretary	"
Katy Green	community Member	"
DONNA MORRISON	BOARD Secretary / BookKeeper	"
Belinda Schoppel	Community Member	"

Appendix A

Butler R-V School District
Local Jurisdiction Hazard Mitigation Plan

Section A1: Introduction

The Butler R-V school district main office is located at 420 S. Fulton St. in Butler, Missouri, is to be added as a jurisdiction to the Bates County Multi-Jurisdictional Hazard Mitigation plan. The town of Butler, Missouri is currently a participating jurisdiction in the Bates County Hazard Mitigation plan. The School District serves a total of 1,063 students in the two schools with a total certified staff of 96. See table 1.1. Flood Plan map in this appendix shows that there are no Butler R-V buildings located in any Bates County flood zone.

Table 1.1 **Butler R-V**

	Schools	Cert. Staff	Residents	Non-Res.	Total
Elementary Schools	1	52	627	0	627
Middle Schools	0	0	0	0	**0**
Jr. High Schools	0	0	0	0	**0**
High Schools	1	44	431	5	**436**
Total	**2**	**96**	**1,058**	**5**	**1,063**

Section A2: Planning Process

The Kaysinger Basin Regional Planning Commission developed the Butler R-V School Distircts Local Jurisdiction Hazard Mitigation Plan.

The process of preparing the addition of Butler R-V School District to the Bates County Hazard Mitigation plan include meeting with the Superintendent of the District and the Butler R-V School Board on November 13th and discussing the Bates County Hazard Mitigation Plan. A sign in sheet for that meeting is included in this appendix.

The current Bates County Hazard Mitigation plan assesses the vulnerability of Butler Missouri to the natural hazards including; Tornados, Severe Thunderstorms, High Winds, Hail, Lightning, Flood, Levee Failure, Severe Winter Weather, Drought, Extreme Heat, Earthquakes, Dam Failure and Wildfires. The School District information on student /staff population (table A1-1) buildings, (table A2-1) that might be affected by a hazard either directly or through cascading damages.

<u>Table A2-1</u> Butler R-V

District	Building Count	Building Replacement Cost	Assed Valuation
Butler R-V	**1**	**$4,017,424.00**	
	2	**$857,352,00**	
	3	**$987,908,00**	
	4	**$805,688.00**	
	5	**$5,815,396.00**	
	6	**$65,844.00**	
	7	**$1,108,745.00**	
	8	**$10,195,704.00**	
	9	**$65,844.00**	
	10	**$164,608.00**	
	11	**$167,564.00**	
	Total	**$10,593,720.00**	**$10,593,720.00**

Source: Butler-RV School District

Cascading damages may include; power and communications interruption, water supply interruption, business interruption, transportation interruption, computer failure or loss of records, health or environmental hazards, and civil unrest.

The Butler R-V School Board has signed a resolution adopting the Bates County Hazard Mitigation plan. A copy of that resolution is included in this appendix.

<u>Table A2-2</u> Butler R-V development Trends

District	District Developments (last 5 years)	Date Implemented
Butler R-V	**New track and football complex.**	**2011 and in progress.**
	Interior lighting upgrade, district wide.	**2011**
	Parking lots paved	**2011**
	Roof improvements	**2011**
	Sidewalk and drainage improvements	**2011**
	Replace floor tile at elementary	**2011**

Source: Butler-RV School District

Cascading damages may include; power and communications interruption, water supply interruption, business interruption, transportation interruption, computer failure or loss of records, health or environmental hazards, and civil unrest.

The Butler R-V School Board has signed a resolution adopting the Bates County Hazard Mitigation plan. A copy of that resolution is included in this appendix.

Section A3: Hazard and Risk Assessment

Vulnerability is identified, in this appendix, as the level of exposure of an asset; in this case, the buildings and the contents of those buildings to damage inflicted by natural hazard events. Other factors such as student/staff population are also taken into account to determine an overall estimation of potential risks from a hazard in this school district. Man-maid hazards will not be addressed except as they relate to cascading damages. This hazard assessment combines the probability of occurrence with the probable severity to assign an overall vulnerability rating Table A3-1 shows the overall vulnerability assessment for the Butler R-V School District. Table A3-2 indicates susceptibility to cascading damages resulting form natural disasters. Table A3-3 identifies total replacement values of all school district buildings.

{Overall ratings were calculated by assigning numeric values to the rankings of **Low (1), Medium (2)** and **High (3),** averaging the probability with the severity and dividing that number by two. Probability rankings were determined by historical occurrences and rated as: **Low** = possible, **Moderate** = Likely, **High** = Highly Likely. Severity rankings were determined by the potential magnitude or percentage of the jurisdiction that can be affected; **Low** = Limited **(0% - 25%), Moderate** = Critical **(25% - 50%), High** = Catastrophic **(More than 50%)**}

Hudson R-IX

	Schools	Cert. Staff	Residents	Non-Res.	Total
Elementary Schools	**1**	**15**	**50**	**21**	**71**
Middle Schools	0	0	0	0	**0**
Jr. High Schools	0	0	0	0	**0**
High Schools	0	0	0	0	**0**
Total	**1**	**15**	**50**	**21**	**71**

Miami R-I

	Schools	Cert. Staff	Residents	N o	Total
Elementary Schools	**1**	**16**	**112**		**112**

Middle Schools	0	0	0	**0**
Jr. High Schools	0	0	0	**0**
High Schools	1	15	79	**79**
Total	**2**	**31**	**191**	**191**

District	Building Count	Building Replacement Cost	Assessed Valuation
Miami R-I	**1**	**$7,632,000**	**$13,787,949**
	Total	**$7,632,000**	**$13,787,949**

District	District Developments (last 5 years)	Date Implemented
Miami R-1	Replacement of Gym Bleachers	2011
	Replacement of Gym Floor	2012
	Replacement of District Lighting Fixtures	2013

Rich Hill R-IV

	Schools	Cert. Staff	Residents	No	Total
Elementary Schools	1	25	192		192
Middle Schools	0	0	0		**0**
Jr. High Schools	0	0	0		**0**
High Schools	1	25	227		**227**
Total	**2**	**50**	**419**		**419**

District	Building Count	Building Replacement Cost	Assessed Valuation
Rich Hill R-IV	**Bryant High School**	$3,859,000	$3,859,000
	Elementary School Building	$4,401,000	$4,401,000
	Bus Barn	$34,000	$34,000
	New High School	$3,860,000	$3,860,000
	New Vocational	$574,000	$574,000

	Building		
	Total	**$12,728,000.00**	**$12,728,000.00**

Source: Rich Hill R-IV School District

School District	District Development (last 5 years)	Date Implemented
Rich Hill R-IV	New HVAC units in the high school and updating units in the elementary school.	2013 – in process.
	Tile and flooring in elementary building.	2013 – in process.
	New sewer line in elementary building.	2012
	Upgrading building security with locks, fences, and cameras.	2010 and ongoing.
	Upgrade electrical, cable, internet, and electronics in building.	2009 and ongoing.
	Construction of new learning addition to existing High School.	2011
	Construction of new press box and locker rooms at football field.	2010
	Retrofit lights in gym, agricultural shop and auditorium.	2009
	Paving of asphalt driveway and parking lot.	2008
	Replacement of roof on old high school building and gym.	2008

Source: Rich Hill R-IV School District