

Redwood County All Hazard Mitigation Plan

August 2019



Alexander Ramsey Park, Redwood Falls, Source: JC Shepard ©

This multi-jurisdictional hazard mitigation plan includes County and the Cities of Belview, Clements, Delhi, Lambertton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, and Wanda. This project was supported by Grant Award awarded by the Federal Emergency Management Agency (FEMA).

Prepared by Southwest Regional
Development Commission and
Redwood County Emergency
Management

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REDWOOD COUNTY

ALL HAZARD MITIGATION PLAN

August 2019

Executive Summary

The purpose of the Redwood County All Hazard Mitigation Plan (AHMP) is to determine how to reduce property damage and loss of life resulting from natural and manmade hazards. The Redwood County AHMP includes resources and information to assist county residents, public and private sector organizations, and others interested in participating in planning for both natural and manmade hazards. This mitigation plan identifies hazards that pose a threat to Redwood County, as well as what is currently being done to mitigate their impacts. The plan also provides a list of actions and programs that may enable Redwood County to further reduce negative impacts caused by disasters. The implementation strategies address both natural and manmade hazards that include but are not limited to flooding, drought, severe summer and winter storms, fires, and tornadoes.

“The overall benefit-cost ratio for FEMA mitigation grants is about 4:1, though the ratio varies from 1.5 for earthquake mitigation to 5.1 for flood mitigation.”¹

The Redwood County AHMP Planning Team identified the following natural hazards as the highest rank hazards for Redwood County:

- Tornado
- Winter Storm
- Flash Flood
- Windstorm

This planning process has been conducted by the Southwest Regional Development Commission (SRDC) and Redwood County Emergency Management in accordance with current guidance provided by the State of Minnesota Department of Homeland Security and Emergency Management (HSEM) and the US Federal Emergency Management Agency (FEMA). This hazard mitigation plan documents the multi-jurisdictional, multi-hazard mitigation planning process in Redwood County, Minnesota, which is intended to meet the requirements of the Federal Emergency Management Agency (FEMA) Regulation 44 CFR 201.6 Local Mitigation Plans.

All participating jurisdictions in Redwood County have agreed to a joint administration and operation of the AHMP to help mitigate the effects of natural and manmade hazards. The project was undertaken so

¹ FEMA. Benefits-Cost Analysis of FEMA Hazard Mitigation Grants. Accessed: 3/4/16. Available: <http://earthmind.org/files/risk/Nat-Haz-Review-2007-CBA-of-FEMA-Grants.pdf>

that all local units of government in Redwood County, that wished to participate, could participate and remain eligible for FEMA funding.

The previous Redwood County AHMP was adopted in 2012. The current update reviewed and updated the original plan. The update utilized a great deal of data from many different sources and also relied on input and expertise from the Redwood County AHMP Planning Team. The plan resides with the Office of Emergency Management in Redwood County, who is responsible for maintenance and updates.

Redwood County's All Hazard Mitigation Mission:

“The Redwood County All-Hazard Mitigation Plan is intended to identify effective mitigation efforts through education and proper planning.”

Participation in Plan Development

The Redwood County All Hazard Mitigation Plan is a multiparty effort among Redwood County, Redwood County Emergency Management, Redwood County citizens, local public agencies, people in the private sector, and many people in regional and state organizations. Public participation plays a key role in the planning process. We also rely on the experience of elected and appointed volunteers. The Redwood County AHMP Planning Team (here after referred to as planning team) members comprised a broad representation of the county and their feedback was immensely useful in the development of the plan update.

Redwood County AHMP Planning Team:

- James Sandgren – Redwood County: Emergency Management Director
- Bill Pfarr – Lamberton Township
- Tim Ohoore – City of Vesta
- Lon Walling – Redwood County
- Tim Birkemeyer – City of Lamberton
- Merna Malmberg – Springdale Township
- Gerald Senger – Sheridan Township
- Mary Smith – City of Wabasso
- Keith Berndt – Redwood County Engineer
- Dennis Groebner – Redwood County Commissioner
- Dave Forkrud – Redwood County Commissioner
- Vicki Knobloch – Redwood County Administrator
- Kathy Hillmer – Redwood County
- Scott Larsen – Redwood County
- Jim Salfer – Redwood County Commissioner
- Jim Doering – City of Redwood Falls
- Betsy Snyder – City of Milroy
- Carol Atkins – City of Wabasso, Mayor
- Pam Sheeran – City of Seaforth
- Kerry Netzke – Area II MN River Basin
- Bob Van Hee – Redwood County Commissioner
- Lori Ryer – City of Belview
- Dianne Donner – City of Belview

- Tom Groebner – City of Clements, Mayor
- Scott Wold – Redwood County
- Jacob Kolander – City of Vesta
- Briana Mumme – Redwood County EDA
- Justin Thram – City of Lambertton
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Minnesota Division of Homeland Security and Emergency Management



FEMA

Federal Emergency Management Agency

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Section 1 – Introduction

1.1 Mitigation Planning

Natural and manmade hazards present risks throughout Minnesota. Redwood County has to be ready at all times to respond to a number of natural and manmade disasters. Local units of government, first responders, and emergency managers have worked together to create the Redwood County All Hazard Mitigation Plan (AHMP). This plan helps Redwood County protect its population and infrastructure by planning for natural and manmade hazards before the disaster strikes.

What is Hazard Mitigation Planning? According to the U.S. Federal Emergency Management Agency (FEMA) State and Local Mitigation Planning Fact Sheet:

Hazard mitigation planning is the process State, local, and tribal governments use to identify risks and vulnerabilities associated with natural disasters, and develop long-term strategies for protecting people, resources, and property in future hazard events. This planning process involves Tribal members and other affected stakeholders, and results in a mitigation plan with a strategy for breaking the cycle of disaster damage, reconstruction, and repeated damage. The mitigation plan also identifies mitigation actions and projects to implement the mitigation strategy. Under the Disaster Mitigation Act of 2000 (Public Law 106-390), State, local and tribal governments are required to develop a hazard mitigation plan as a condition for receiving certain types of non-emergency disaster assistance and FEMA grants to implement mitigation projects.

A simpler description comes from James Schwab:

“Hazard mitigation essentially is the art and science of reducing risks of future losses.”²

²Planning Magazine. James Schwab. Accessed: 5/29/13. Available: <http://allhazards.wordpress.com/2010/03/02/mitigation-planning/>

1.2 Purpose

Save lives, reduce injuries, sustain public health

Identify properties that are in obvious need of protection and establish policies and practical actions that fortify these properties from the effects of natural and human caused hazards.

Reduce both economic and physical losses from repetitive damages caused from constant hazard events. Encourage county communities to participate in the National Flood Insurance Program (NFIP).

Improve hazard assessment information to make recommendations for discouraging new development and encouraging preventative measures for existing development in areas vulnerable to natural hazards.

Minimize social dislocation and stress

Where appropriate, develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards and the potential danger for human caused hazards.

Provide assistance in locating tools, partnership opportunities, and funding resources to assist in implementing mitigation activities.

Minimize agricultural losses

Balance land use planning and natural resource management with hazard mitigation in order to protect life, property, and natural environment.

Preserve, rehabilitate, and enhance the county's natural infrastructure systems to serve hazard mitigation functions.

Protect critical infrastructure from damage

Establish policy through the planning process to ensure mitigation projects for critical facilities and services.

Strengthen emergency operations by increasing collaboration and coordination among public agencies, non-profit organizations, businesses, and industries.

Coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures.

1.3 Justification & Legal Authority

The rising costs of natural and human-caused disasters at the end of the 20th century led many leaders to consider how to better protect people and their communities. Congress passed the Disaster Mitigation Act of 2000 (DMA2K) (PL 106-390) to establish a unified national hazard mitigation program. DMA2K amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 (Stafford Act), which in turn had amended the Disaster Relief Act of 1974. DMA2K placed new emphasis on hazard mitigation planning in state and local units of government, requiring adoption of mitigation plans as a prerequisite for certain assistance programs.

A multi-hazard or “All-Hazards” approaches to mitigation planning encompasses both natural and manmade hazards. Following the 2001 attacks on New York City and Washington, DC, and the subsequent reorganization of FEMA and the nation’s homeland security structure, many mitigation planning efforts explicitly incorporated technological hazards arising from human activities in the hazard mitigation plans. While local hazard mitigation plans are only required to address natural hazards, the All-Hazards approach considers a comprehensive array of both risks and potential mitigation actions.

FEMA has implemented hazard mitigation planning requirements through federal regulations (44 CFR 201.6). In Minnesota, the Homeland Security and Emergency Management (HSEM) division of the Department of Public Safety (DPS) works with FEMA to implement disaster mitigation efforts. The Minnesota Department of Natural Resources (DNR) is also involved with mitigation as the agency responsible for implementation of FEMA’s National Flood Insurance Program (NFIP) and floodplain management in the state.

Minnesota Governor’s Executive Order 07 – 14 assigns responsibility for the creation and maintenance of the Minnesota Emergency Operation Plan, the State All Hazard Mitigation Plan and such other duties as may be requested by the HSEM.³ The order also directs other state agencies to assist with the planning process.

Under 44 CFR 201.6, local governments must have a FEMA-approved Local Hazard Mitigation Plan to be eligible for and receive project grants under the following hazard mitigation assistance programs: Hazard Mitigation Grant program (HMGP), Pre-Disaster Mitigation (PDM), Flood Mitigation Assistance (FMA), and Severe Repetitive Loss (SRL).

1.4 Mitigation Funding Programs

FEMA administers several different programs that provide hazard mitigation funding. Typically grants allow a cost-share of 75 to 90 percent federal funding for eligible projects. FEMA offers four hazard mitigation assistance programs which are described in detail at www.fema.gov/hazard-mitigation-assistance. Any projects funded by these programs must demonstrate a positive benefit-cost ratio. The four hazard mitigation assistance programs include: the Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM), Flood Mitigation Assistance (FMA), and Repetitive Flood Claims (RFC).

³ State of Minnesota Executive Order 07-14. Accessed 5/29/13. Available: <http://www.leg.mn/archive/execorders/07-14.pdf>

1.4.1 Hazard Mitigation Grant Program (HMGP)

HMGP provides funds in accordance with priorities identified in hazard mitigation plans to implement mitigation measures during disaster recovery. State and local governments, certain private non-profit organizations, and tribes are eligible sub-applicants through HSEM. Examples of eligible 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
- Constructing safe rooms inside schools or other buildings in tornado-prone areas
- Hazard mitigation planning

1.4.2 Pre-Disaster Mitigation (PDM)

PDM provides funds for hazard mitigation planning and implementation prior to a disaster event. State-level agencies, tribes, local government, and public colleges are eligible sub-applicants through HSEM. Examples of eligible projects include:

- Voluntary acquisition of real property for open space
- Elevation of existing public or private structures
- Retrofitting existing structures to meet building codes
- Construction of safe rooms for public or private structures that meet certain FEMA requirements
- Hydrologic and hydraulic studies/analyses, engineering and drainage studies for project design and feasibility
- Vegetation management
- Protective measures for utilities, water, sewer, roads and bridges
- Storm water management to reduce/eliminate long-term flood risk

1.4.3 Flood Mitigation Assistance (FMA)

FMA implements cost-effective measures to reduce or eliminate long-term risk of flood damage to NFIP structures. State-level agencies, tribes, and local government are eligible sub-applicants through HSEM. Eligible projects include:

- Acquisition, structure demolition, or structure relocation with the property deed restricted for open space uses in perpetuity
- Elevation of structures
- Dry flood proofing of non-residential structures
- Minor structural flood control activities

1.4.4 Other Federal Disaster-related Funding Programs

FEMA is probably more well-known for providing response and recovery assistance. Other programs such as FEMA's Public Assistance (PA) Grant Program provide assistance to State, Tribal and local governments, and certain Private-Nonprofit organizations, so that communities can quickly respond to and recover from major disasters or emergencies. Through the PA Program, FEMA provides supplemental Federal disaster grant assistance for debris removal, emergency protective measures, and the repair, replacement, or restoration of disaster-damaged, publicly owned facilities and the facilities of certain Private Non-Profit (PNP) organizations. The PA Program also encourages protection of these damaged facilities from future events by providing assistance for hazard mitigation measures during the recovery process.

1.5 FEMA Guidance

FEMA has created the *Local Multi-Hazard Mitigation Planning Guidance* (the “Blue Book”) to provide guidance to local governments to meet the requirements of 44 CFR §201.6 *Local Mitigation Plans*. There are three main objectives of the Blue Book. First, the Blue Book is intended to help local jurisdictions develop new mitigation plans or update existing plans in accordance with the requirements of the regulations. Second, the Blue Book is designed to help Federal and State Reviewers evaluate mitigation plans from local jurisdictions in a fair and consistent manner. Third, the Blue Book is designed to help jurisdictions conduct comprehensive reviews and prepare updates to their plans to meet the requirements of 44 CFR Part 201.6.

The Redwood County All Hazard Mitigation Plan is going to follow the planning process outlined in the Blue Book. The Redwood County plan will also use the Local Mitigation Plan Review Tool to specify where in the plan and how the specific regulation requirements were met.

FEMA requires that ALL participating jurisdictions meet the requirements for mitigation planning in 44CFR§201.6. The Blue Book specifically requires that each participating jurisdiction address:

- Risks, where they differ from the county
- Mitigation actions (actions must be identified for each jurisdiction)
- Participation in the planning process (attending meetings, contributing research, data, or other information, commenting on drafts of the plan); and
- Adoption (each jurisdiction must formally adopt the plan).

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Section 2 – Public Planning Process

2.1 Description of the Planning Process

2.1.1 Preplanning

Since the previous County AHMP was approved and adopted in 2012, the Redwood County Emergency Manager and the Southwest Regional Development Commission (SRDC) have collected information on hazards that occurred in Redwood County. This information gathering helped in updating the risk assessment section of the plan. It also helped to initiate conversations during the planning process regarding strategies to mitigate the effects caused from hazards over the five year update cycle.

In the summer of 2017, the planning process began for the update of the Redwood County AHMP. Every five years the Redwood County AHMP has a planned update. “A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within five years in order to continue to be eligible for mitigation project grant funding.”⁴ The Redwood County Emergency Manager initiated the planning process by applying for a planning grant from FEMA and contacting the Southwest Regional Development Commission (SRDC) to assist with the grant and update to the plan.

The Redwood County AHMP Planning Team was reformed to assist with the update. The planning team consisted of a number of elected officials, county staff, city staff, and emergency personnel.

Redwood County AHMP Planning Team:

- James Sandgren – Redwood County: Emergency Management Director
- Bill Pfarr – Lamberton Township
- Tim Ohoore – City of Vesta
- Lon Walling – Redwood County
- Tim Birkemeyer – City of Lamberton
- Merna Malmberg – Springdale Township
- Gerald Senger – Sheridan Township
- Mary Smith – City of Wabasso
- Keith Berndt – Redwood County Engineer
- Dennis Groebner – Redwood County Commissioner
- Dave Forkrud – Redwood County Commissioner
- Vicki Knobloch – Redwood County Administrator
- Kathy Hillmer – Redwood County
- Scott Larsen – Redwood County
- Jim Salfer – Redwood County Commissioner
- Jim Doering – City of Redwood Falls
- Betsy Snyder – City of Milroy
- Carol Atkins – City of Wabasso, Mayor

⁴ FEMA. 44 CFR 201.6 - Local Mitigation Plans. Accessed: 9/25/15. Available: <http://www.law.cornell.edu/cfr/text/44/201.6>

- Pam Sheeran – City of Seaforth
- Kerry Netzke – Area II MN River Basin
- Bob Van Hee – Redwood County Commissioner
- Lori Ryer – City of Belview
- Dianne Donner – City of Belview
- Tom Groebner – City of Clements, Mayor
- Scott Wold – Redwood County
- Jacob Kolander – City of Vesta
- Briana Mumme – Redwood County EDA
- Justin Thram – City of Lamberton
- Madonna Peterson – City of Lamberton
- Lauren Mellenthin – Southwest Health and Human Services: Public Health Emergency Preparedness Coordinator

Southwest Regional Development Commission:

- Maxwell Kaufman, Development Planner
- Judy Elling Przybilla, Development Planner

The SRDC contacted all of the cities within Redwood County that the update to the Redwood County AHMP was taking place. This original outreach also asked the cities to participate in the planning process to update the plan. Outreach was also done to the townships in Redwood County and multiple planning team members also represent townships in Redwood County.

2.1.2 Planning Meeting

The first All Hazard Mitigation Plan Meeting was held on October 18, 2018. This meeting was an introduction to the Redwood County AHMP Planning Team. The SRDC presented on the AHMP planning process, the purpose of the plan, the benefits of having a plan, and the participation in the development of the plan. Agendas for the meetings immediately follow this section, and copies of all of the meeting sign-in sheets are located after the copies of the resolutions of participation.

The planning process started with a review of the timeline and the information that needed to be gathered as part of the update and included in the plan. There were a total of two planning meetings, including the first meeting, to gather information, analyze the natural and manmade hazards that pose a risk in Redwood County, and outline mitigation strategies to mitigate the risk of the hazards that were identified.

In lieu of subcommittee meetings (and due to the length of the plan, the entire planning team was invited to review the plan in detail online. This was done to further refine the plan and gather additional information, analyze potential hazards, and identify mitigation measures.

The CPRI was also discussed during the presentation regarding the planning process. The CPRI worksheet was distributed to the planning team via email so they could complete it prior to meeting in order to expedite the process and gain input from others in their jurisdiction. The CPRI is an important part of the planning process and helps the planning team rank and quantify the natural and other hazards in Redwood County. Vulnerability is the critical component to the planning meetings. The planning team and city

involvement is needed to help identify hazards and provide feedback in regard to potential frequency, spatial extent, potential severity, warning time, risk level, and hazard rank.

The CPRI outlined the natural and other hazards that were included in the original Redwood County AHMP. SRDC staff presented other hazards that are typical to Minnesota and were included in the Minnesota AHMP and other county AHMPs. After thoroughly discussing each statewide hazard, the planning team updated the list of hazards that will be included in the plan. The planning team identified the following hazards (not in a specific order): Natural Hazards affecting the jurisdiction include:

- Blizzards, Winter Storms, and Extreme Cold Events
- Drought
- Flooding & Dam Failure
- Fire—Wildfire
- Severe Summer Storms, Lightning and Hail, and Extreme Heat Events
- Tornadoes and Straight-line Winds
- Sinkholes and Land Subsidence
- Erosion & Landslides

Manmade hazards affecting the jurisdiction include:

- Public Health Emergencies
- Transportation Infrastructure
- Hazardous Materials
- Civil Disturbance
- Water Supply Contamination
- Utility Failure

Certain statewide hazards were eliminated from the discussion since the planning team thought the risk of the hazard was minimal or non-existent in Redwood County. These hazards included:

- Coastal Erosion—Redwood County's lakes and lakeshore are typically stable, so FEMA has not identified any significant 100-year floodplain areas around any of the county's major lakes.
- Earthquake – Given the sparse history of earthquakes in Minnesota, the team did not find this an applicable issue.
- Sea Level Rise, Storm Surge, Tsunami – These hazards concern coastal ocean areas, which Redwood County is not.
- Nuclear Generating Plants—none are located in or near Redwood County.

Public participation is a critical component in the development of the Redwood County AHMP. The planning team is critical in helping to engage the public and to garner feedback in regards to the plan. The planning team recognizes the importance of public involvement during the planning process. Participation in the development of the Redwood County AHMP came from county staff, township and city representatives, and the general public. Efforts were made to actively include these groups in the

update of the Redwood County AHMP, including posting notices as well as draft copies of the plan on the Redwood County Emergency Management website.

Planning Meeting #2

The second All Hazard Mitigation Plan Meeting was held on October 25, 2018. The second meeting was centered on creating a updating the list of mitigation strategies to address the hazards identified at the previous meeting. This helped to outline existing plans and programs, gaps and deficiencies, and existing mitigation measures. The profile also included: locations affected by the hazard, extent of the hazard, previous occurrences of the hazard, and the probability of future events of this hazard.

The risk assessment meeting helped to educate the planning team, local government representatives, and other meeting attendees. Profiling the hazards also helped to facilitate conversation regarding the hazards. The conversations helped to fill in gaps in the research related to the hazards. There was also a chance for meeting attendees to discuss gaps that they identified.

SRDC staff outlined the importance of Goals to be specific, measurable, attainable, relevant, and time bound (SMART Goals). The planning team analyzed and updated the Goal Section in a manner to reflect SMART Goals. Draft goals were developed during this meeting.

Mitigation Strategies & STAPLEE Process – Online Review

The team finalized and prioritized the goals, objectives, and strategies through the STAPLEE Process. STAPLEE stands for Social, Technical, Administrative, Political, Legal, Economic, and Environmental. The STAPLEE Process takes all seven criteria into consideration when finalizing and prioritizing the mitigation goals, objectives, and strategies.

A qualitative approach was used by the team in prioritizing the mitigation goals. The qualitative approach judged and prioritized the mitigation goals, objectives, and strategies based on perceived costs and benefits. All of the goals, objectives, and strategies were discussed during this subcommittee meeting. Upon completion, the Subcommittee reviewed the draft of the goals and strategies electronically.

Plan Review Meeting

The finished plan was sent to the Redwood County Emergency Management Director for review at the beginning of April 2019

The Draft Plan was disseminated to all of the Team Members for review in May 2019. The Redwood County AHMP Planning Team reviewed the entirety of the Redwood County AHMP. Modifications were made via email and phone to the SRDC.

The Public Review Meeting was held on [DATE]. The event was intended as an opportunity for local residents as well as neighboring communities, agencies, businesses, academia, nonprofits, and other interested parties to be involved in the planning process. Entities had the opportunity to ask questions and discuss specific goals with Planning Team members and SRDC staff. The Redwood County AHMP was available online on Redwood County's website for three weeks prior to the Public Review Meeting.

Interested entities could prepare feedback and recommendations before the public review meeting. Attendees were also able to come and go at their convenience, review the material sections of the plan, provide feedback, and make recommendations. A press release for the Public Review Meeting was

advertised in the official Redwood County newspaper. A flyer was also provided to local units of government and a press release was distributed to other local media in the region. The open comment period provided a great opportunity for gathering feedback in regards to the Redwood County AHMP.

2.2 Public Involvement

Intergovernmental coordination was essential in the development of the Redwood County AHMP. The SRDC and Redwood County Emergency Manager provided information to all local units of government in the county regarding the Redwood County AHMP planning process and opportunities for participation. Meeting participation was solicited, but smaller local units of government opted for participating via phone, email, and mail. Public Notice of all planning team meetings was posted at various government offices in Redwood County. Email notices were also sent to local units of government, local organizations, and other entities involved in hazard mitigation. Subcommittee Meetings were not publicized.

All local units of government in Redwood County were invited to review and comment on mitigation goals, objectives and strategies. Public and private entities were sent the mitigation strategies that their representing entity was listed in. Feedback and recommendations were requested regarding the mitigation goals, objectives, and strategies. Refer to the Figure #1 for more information regarding jurisdictions, emergency response departments, schools, and organizations that reviewed and approved the goals section of the Redwood County AHMP.

2.3 Other Opportunity for Involvement

Hazard mitigation has been a regional effort in Southwest Minnesota, with many opportunities for involvement provided for neighboring communities, agencies involved in hazard mitigation, and businesses, academia, and other relevant private and non-profit interests. SRDC has worked with the following Minnesota counties on their hazard mitigation plans:

- Cottonwood County (2011, update 2019)
- Jackson County (2008; update 2016)
- Lincoln County (2010, update 2019)
- Lyon County (2010, update 2017)
- Murray County (2012, update 2019)
- Nobles County (2005; update 2011, update 2018)
- Pipestone County (2010, update 2019)
- Redwood County (2005; update 2012, update 2019)
- Rock County (2007; update 2014)

2.4 Existing Plans, Studies, Reports, and Technical Information

Many sources of local, state, federal, and private information were used during the AHMP update. Various plans, programs, and policies were reviewed by SRDC staff. The literature review was a critical step in updating the Redwood County AHMP. The coordinated use and consideration of these diverse data sources provided a sound basis for this plan and implementation activities. The following references were specifically consulted during the planning process.

- Redwood County Emergency Operations Plan
- Redwood County Comprehensive Plan
- The Redwood County Water Management Plan
- Redwood County Land Use Map
- Redwood County Zoning Ordinances
- Local Water Plans
- Minnesota Department of Health (MDH) regulations regarding water systems and routine inspection of public water systems
- The Minnesota Pollution Control Agency (MPCA) regulations regarding wastewater systems
- NOAA Weather Radio All Hazards (NWR) weather broadcasts system
- The National Flood Insurance Program
- FIRM maps identifying flood hazard areas
- Fire District and Ambulance District Maps
- Mutual Aid Agreements between police forces, fire districts and ambulance districts
- Response Plans: HAZMAT
- MNDOT's Towards Zero Deaths (TZD) Program
- Traffic safety publications
- The Minnesota DNR dam safety program
- The Minnesota DNR drafts Emergency Action Plan
- City of Redwood Falls Comprehensive Plan
- FEMA Planning Aids and Tools
- County All Hazard Mitigation Plans

All of the above documents are incorporated into this planning document by reference. The maps selected and included in this plan have been created by Redwood County and the SRDC utilizing data from Redwood County GIS and the State of Minnesota's Land Management Information Center (LMIC).

The University of Minnesota Duluth Geospatial Analysis Center (GAC) performed a hazard risk assessment for 100-year floods using the Hazus-MH GIS tool. In recognition of the importance of planning in mitigation activities, FEMA created **Hazards USA Multi-Hazard** (Hazus-MH), a powerful geographic information system (GIS)-based disaster risk assessment tool. This tool enables communities of all sizes to predict estimated losses from floods, hurricanes, earthquakes, and other related phenomena and to measure the impact of various mitigation practices that might help reduce those losses. The Minnesota Homeland Security and Emergency Management office has determined that Hazus-MH should play a critical role in

Minnesota's risk assessments, and therefore the 100-year flood event hazard analysis is introduced in this plan.

The list of final mitigation actions was divided into jurisdiction-specific mitigation action charts so that each could see and address those actions that applied specifically to their cities (see *Appendix G: Mitigation Actions by Jurisdiction*).

Public input was sought through meetings and direct conversations (see *Appendix E: Public Meeting Notices and Meeting Notes*).

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SECTION 3: PREREQUISITES

This Chapter covers prerequisites for eligibility to adopt this multi-hazard mitigation plan in multiple jurisdictions. Section II describes the plan adoption process. Section III describes participation provisions post-approval of the hazard mitigation plan by HSEM and FEMA.

3.1 Jurisdictions Represented in this Plan

For the purpose of hazard mitigation, FEMA considers a Local Government having jurisdiction as “any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments..., regional or interstate government entity, or agency or instrumentality of a local government.” (44CFR§201.2) Special considerations are given by FEMA for school districts, private nonprofit organizations, and multi-jurisdictional private nonprofit utilities (such as rural electric cooperatives).

County has the land use authority over the townships, so Redwood County will represent the townships in the All Hazard Mitigation Plan (AHMP). The Redwood County AHMP will cover all the townships in the county. Land use authority within city limits is controlled by the local jurisdiction. Representatives from the townships were asked to participate in the planning process. Redwood County and all of its cities previously passed resolutions of intent to participate in the hazard mitigation process and to be covered by the Redwood County All Hazard Mitigation plan. The Resolutions will be added after FEMA approval from the townships and the cities which can be found in Appendix C at the end of this plan.

Redwood County is a rural county. A number of resources and responsibilities are shared throughout the county. The Redwood County Sheriff’s Office provides law enforcement throughout the county. The Cities of Lamberton, Morgan, Redwood Falls, and Walnut Grove also have separate police departments. Additional resources and responsibilities are shared regionally. Redwood County is part of the Southwest Health and Human Services (SWHHS) service area, which includes the following counties: Lincoln, Lyon, Murray, Pipestone, Redwood, and Rock – a representative from SWHHS was a member of the planning team. This ensured a regional prospective was taken when analyzing hazards.

Invitations were sent via email to representatives of all of the local jurisdictions to participate in the development of the plan either through filling out the worksheets, attendance at the meetings or participating in the plan review process. As in most rural areas, many of the participants wore multiple hats during the development process. For example, Jim Sandgren, Redwood Count EMD, is also a member of the Redwood Falls City Council.

The table below shows the jurisdictions that participated in the risk assessment and mitigation action reviews.

**Figure #1
Participating Jurisdictions**

Local Unit of Government
County of Redwood
City of Belview
City of Clements
City of Delhi
City of Lamberton
City of Lucan
City of Milroy
City of Morgan
City of Redwood Falls
City of Revere
City of Sanborn
City of Seaforth
City of Vesta
City of Wabasso
City of Walnut Grove
City of Wanda

3.2 Adoption Procedure

Each jurisdiction participating in the plan must formally adopt the plan after FEMA provisionally approves the document (Section 1.B.1). This plan must be adopted within one year of provisional FEMA approval, or else be updated and re-submitted to FEMA again. Minnesota Statutes §375.51 Subd.1 requires that a “public hearing shall be held before the enactment of any ordinance adopting or amending a comprehensive plan or official control...”

Once the planning team finalized the draft All Hazard Mitigation Plan (AHMP), copies were made available to the public, local governments, and county departments for comment. The feedback period for the plan was 31 days. The planning team reviewed comments, modifications were made, and the draft was sent to Redwood County Board of Commission for their review.

As part of the planning team’s review, a public hearing was held to obtain any additional comments that the public or others wished to make. **This final public review was conducted on [DATE]. [##] members of the public attended.** When satisfied with the plan, the planning team recommended the Redwood County Board of Commissioners forward the plan the State of Minnesota Division of Homeland Security & Emergency Management (HSEM) for review. Federal rules require that this plan be submitted to HSEM for initial review and coordination, with the State then forwarding the plan to FEMA’s Regional Office in Chicago for formal review and approval. Upon approval by FEMA, the Redwood County Board of

Commissioners will consider a Resolution of Adoption. After County approval, staff will work with each participating local unit of government to facilitate the local adoption of the plan.

Local jurisdictions with Comprehensive Plans and Land Use Plans are encouraged to incorporate applicable strategies, goals, and policies from the Redwood County AHMP into their local plans upon next adoption. Local jurisdictions should utilize applicable zoning, subdivision control, and other ordinances to enforce the policies described in this plan. The Redwood County Emergency Management Department will work with local jurisdiction to help incorporate the applicable strategies, goals, and policies from the Redwood County AHMP into their local plans. The SRDC sent all entities the goals, objectives, and strategies that their entity was named in. These entities had the opportunity to provide feedback and acknowledged the goals, objectives, and strategies that they were named in. Documentation of responses from those that responded can be found at the end of this plan.

3.3 Participation Provisions Post-Approval

FEMA guidance explains a process that jurisdictions can follow to become part of the planning process, or “join” the mitigation plan, after FEMA approval. Any jurisdiction wishing to join the plan at a later date should contact Redwood County Emergency Management.

3.4 Planning Committee Worksheets

All planning meeting agendas, notes, and attendance (sign in sheets) can be found in Appendix E for the meetings stated in Figure #2 below.

**Figure #2
Planning Team and Public Meetings**

Meeting Type	Date	Location
1 st Planning Team Meeting	October 18, 2018	Wabasso, MN
2 nd Planning Team Meeting	October 25, 2018	Wabasso, MN
Plan & Strategy Review	May-June 2019	Online
Public Hearing		

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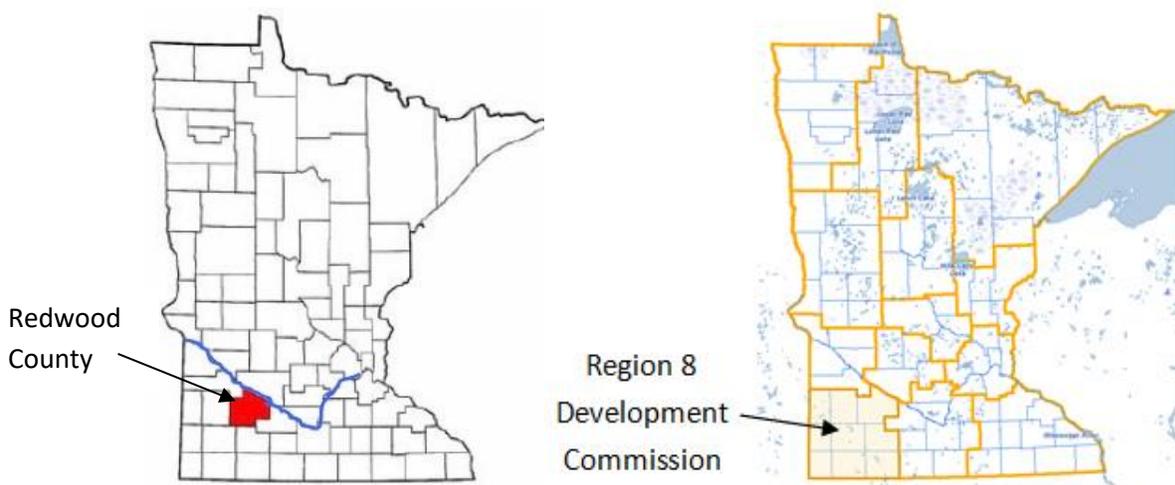
Section 4 – Redwood County Profile

This section offers a general overview of Redwood County to provide a basic understanding of the characteristics of the community, such as the physical environment, population, and the location and distribution of services.

4.1 Location and Area

Cottonwood County is located in southwest Minnesota and has a land area of 879 square miles. The county is bordered on the northeast by Yellow Medicine County, on the northwest by Renville County, on the southwest by Murray County, on the south by Cottonwood County, on the east by Brown County. Cities within Cottonwood County include Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, and Wanda.

Figure #3
Minnesota Counties & Region 8 Development Commission



The City of Redwood Falls is the largest city in Redwood County and serves as the Redwood County seat. The city is along U.S. Highway 71, Minnesota State Highway 19 and 67. U.S Highway 14, 71, State Highway 67, 19, and 68 provide thoroughfares into and out of the county from the north and south and east and west respectively US Highway 71 runs north-south through Redwood Falls, connecting Willmar at TH 23 and Jackson at I-90. US 14 and MN Trunk Highways (TH) 19, 67 and 68 run east-west across the county. U.S. Highway 14 crosses the county from west to east, at Florence, Balaton and Tracy, running parallel to Rapid City, Pierre and Eastern (RCPE) railroad. The Canadian Pacific (CP) railroad starts from east of Tracy, paralleling U.S. Highway 14, running thru Redwood County. MN TH 19 runs east-west through the county, with TH 68 diverting from TH 19 from Marshall towards the northwest. US 71, TH 19 and TH 67 all meet in the city of Redwood Falls.

Figure #4: Transportation – Redwood County

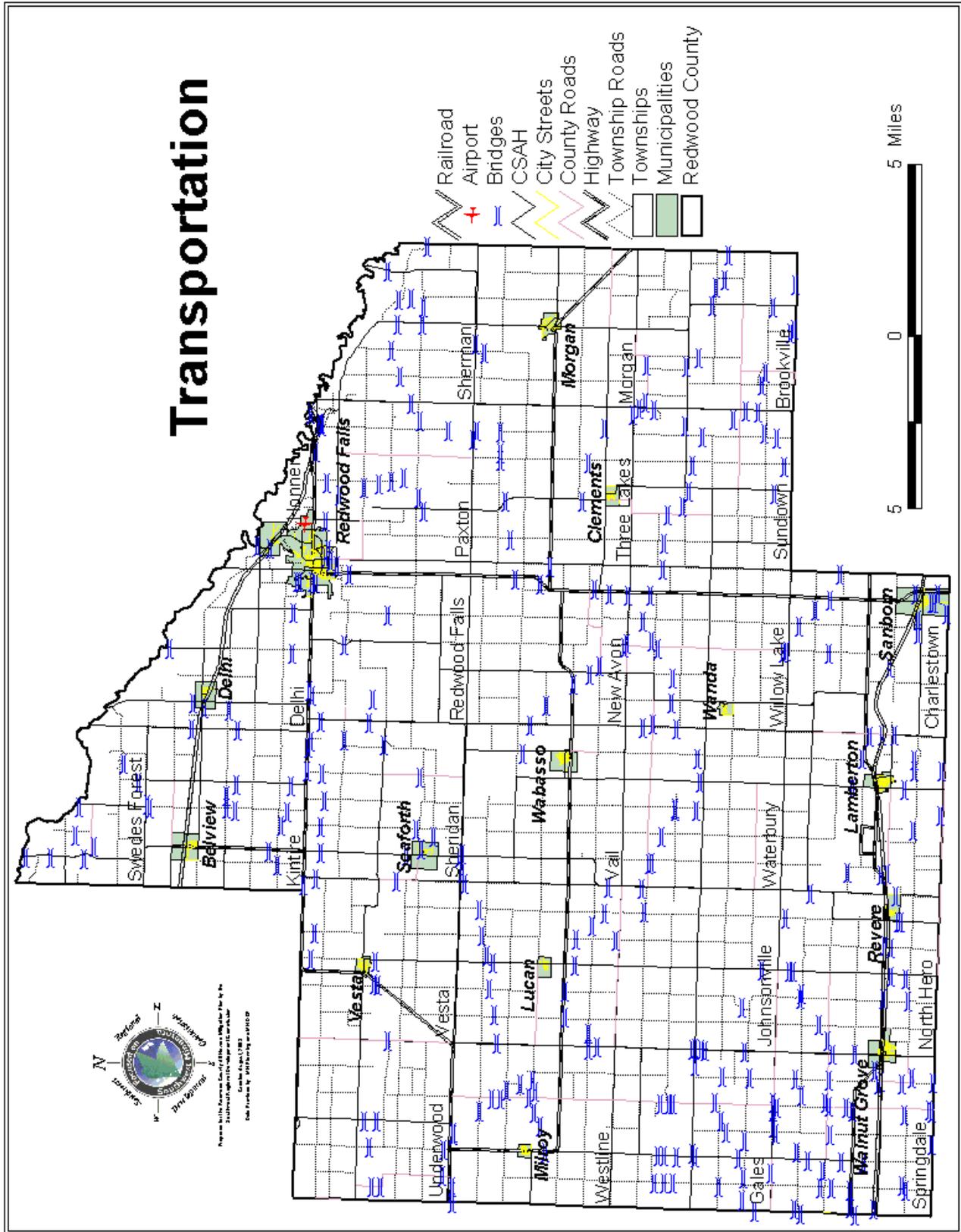
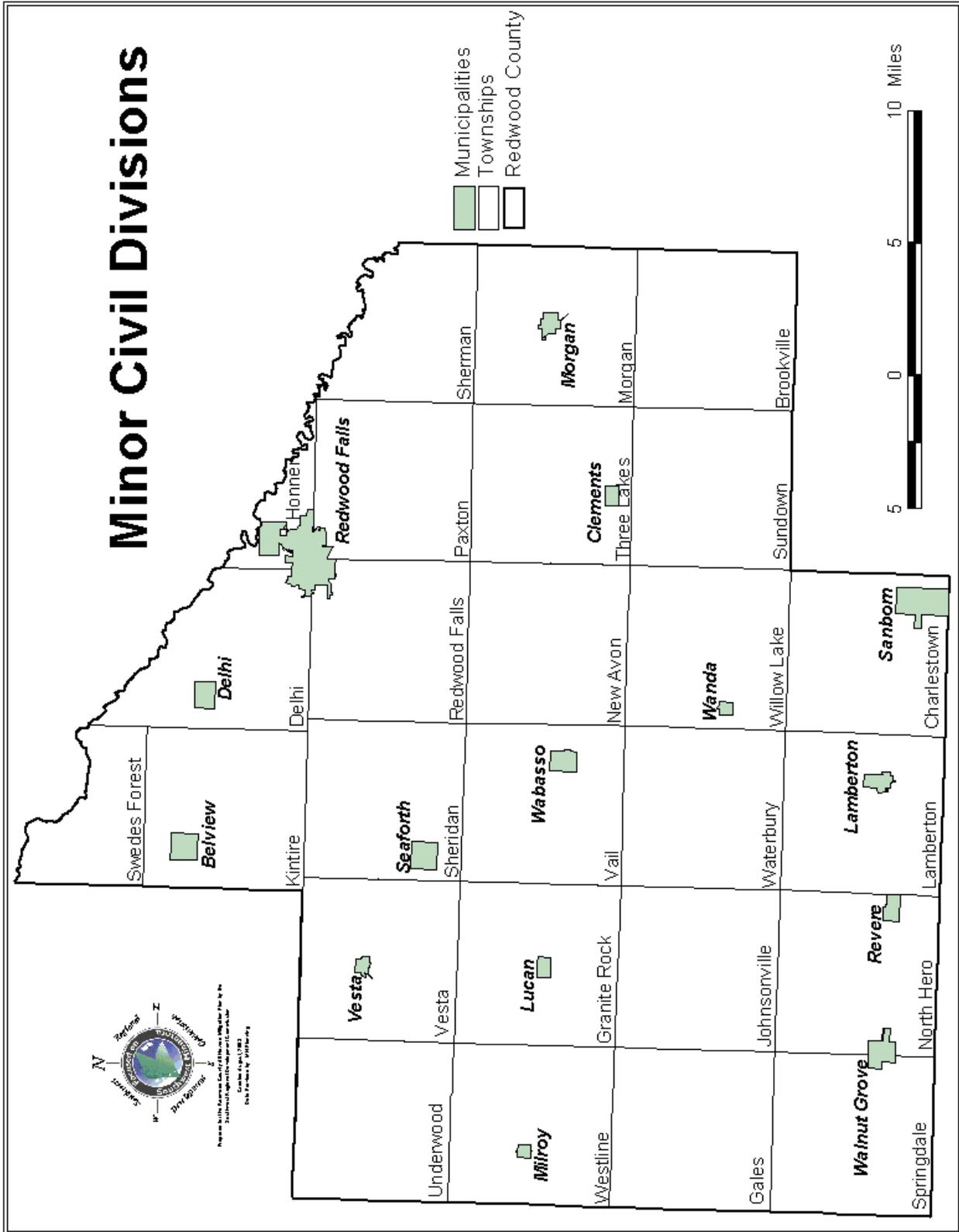


Figure #5: Minor Civil Divisions – Redwood County



4.2 History

Redwood County is located in the southwest region of Minnesota. It was created on February 6, 1862 by the passage of a bill within the Minnesota State Legislature – this bill gave the County the borders it still has today. The County is one of the largest counties in southern Minnesota with 26 townships. Population count taken through the Federal Census of 1870 showed that 1,829 people called Redwood County home. The population in 1900 was 18,000 and during this period children in Redwood County attended 116 different school districts.

Steamboat travel started up the Minnesota River in 1850, and reached Redwood County in 1853, bringing in supplies and people and carrying out wheat from what was originally called Riverside, then North Redwood, and now Redwood Falls.

Communities within Redwood County that developed based on railroad decisions were laid out in patterns that are still recognizable today. The relationships between railroad track, passenger depot, freight house, grain elevator, and commercial streets are readily identifiable within southwestern Minnesota towns and are usually familiar to most people who have traveled in Midwestern America.

The railroads came into the southern part of the county in 1873 and to Redwood Falls in 1878. The northern part of the county was served in 1884. In 1899, the railroad extended from Sanborn to Vesta, through Wabasso, and on to Marshall by 1901. Currently, there are two railroads operating within Redwood County. These include the Minnesota Valley Regional Railroad Authority (MVRRA) with operations by Minnesota Prairie Line, which runs in the northern portion of the county, and the Dakota Minnesota and Eastern (DM&E) Railroad, which runs in the southern portion of the county. The MVRRA enters the county just west of the City of Belview, then passes through Delhi and the northern portion of Redwood Falls and leaves the county just east of Highway 71. The DM&E railroad enters the county one mile south of U.S. Highway 14 adjacent to County State Aid Highway (CSAH) 20 then follows CSAH 20 through Walnut Grove and continues through Revere, Lamberton and Sanborn.

As of the 2000 Census, the population was 16,815. There are 15 cities in the county with Redwood Falls as the county seat. The Lower Sioux Mdewakanton Indian Reservation is entirely within the county. According to the US Census Bureau, the county has a total area of 874 square miles with 873 square miles of land and one square mile of water. The Redwood River, the Cottonwood River, and the Minnesota River are the principal waterways in Redwood County.

4.3 Physical Features

The most prominent example of the natural environment in Redwood County is the Minnesota River Valley. As nearly all of the remaining land within the county has been altered to create agricultural fields and cities, only pockets of remnant natural environments exist elsewhere along river and stream corridors or woodlots. For the most part these other areas are so limited in scale that they lack potential for establishing future benefits based on recreation or tourism. Evidence presented in the plan shows the intensity of non-natural land uses within the county; the largest of which would be areas drained for agricultural use.

The land surface of Redwood County can be divided into seven morphological regions.⁵ The highest and oldest surficial feature forms the "sloped" morphological region, in the southwest corner of the county. This region is cut by numerous stream channels that flow to the northeast, and is a small portion of the edge of the Coteau des Prairies, a large, triangular-shaped highland composed of thick glacial sediments that was produced by erosion; by the James lobe on the west and by the Des Moines lobe on the east.

The "moraine" morphological unit is characterized by the presence of transverse ridges that are generally perpendicular to the inferred direction of ice flow. The ridges may represent small recessional moraines formed during the last advance and retreat of the Des Moines lobe as it deposited the Heiberg Member.

The "ridged" morphological unit is marked by small, closely spaced, parallel ridges that occur along the flank of the Coteau des Prairies and are interpreted to be the result of sediment deposited in parallel crevasses in the glacial ice surface and subsequently dropped in place on the underlying subglacial till surface as the ice melted. They are locally present in large numbers and closely spaced to one another. The orientation of the crevasses can be modified by large objects beneath the glacier. An example of this can be seen in Figure 5B southwest of Sanborn, where the ridges are curved rather than straight. It is conjectured that this was caused as ice flowed around the hard Sioux Quartzite bedrock knob, which is located 1.5 miles (2.4 kilometers) southwest of Redwood County.

Other types of discrete ridges are also found in Redwood County. Rectilinear shaped ridges were produced in areas where the ice was extensively crevassed in perpendicular directions. Another type of ridge, called an eske, has an irregular or branching shape. It formed as meltwater deposited sediment in some of the crevasses.

Hummocky areas have a highly irregular topography marked by numerous closed depressions where glacial meltwater was able to pond and form lakes. This type of topography formed as a result of gradual melting of glacial ice with an uneven distribution of supraglacial and/or englacial sediment. In some areas the hummocky deposits are present together with crevasse fill ridges, resulting in the morphological unit referred to as "mixed".

As the ice melted, meltwater occupied relatively narrow, discrete stream channels and temporarily occupied broader drainage ways, leaving behind smoothed areas where the water washed away finer-

⁵ C-36, Geologic Atlas of Redwood County, Minnesota; Plate 3 - Surficial Geology of Redwood County; Accessed 7/11/17; <https://conservancy.umn.edu/handle/11299/182069>

grained sediment, which resulted in a coarser-grained lag ("washed" morphological unit). Meltwater also locally became ponded in low areas of the landscape.

The "unmodified" morphological region is characterized by an absence of any dominant geomorphic features created by glacial processes. It may locally have features from the regions described above, such as eskers, ridges, or hummocks. Unaltered, natural areas are limited in Redwood County. The vast majority of land in the county has been drained to accommodate agriculture. Practically all that remains of the natural environment is the Minnesota River Valley and other water-related environments along other rivers, streams, and creeks. These well-hydrated areas provide environments where trees and forests can thrive and wildlife can be sustained.

Figure #6
Steep Slopes – Redwood County



4.3.1 Open Water Sources

According to the U.S. Census Bureau, Redwood County has a total area of about 874 square miles, of which a small percentage is water. There are approximately 3.2 square miles (0.4%) of open water in Cottonwood County. The open water is characterized in three categories: lakes, marshes, and rivers and streams.

Lakes

Redwood County does not have a large number of lakes. Nearly all the natural occurring lakes within Redwood County have been drained. There are six lakes in Redwood County and the primary lakes remaining include Lake Redwood and Lake Laura, which are the results of impoundments on the Redwood River and a tributary of Plum Creek.

Laura Lake (20.7 acres / 8.6' deep) is located in the southwest corner of Redwood County.⁶ Lake Redwood is the largest lake (64 acres), located western edge of Redwood Falls. Most of the lakes provide the opportunity to catch game fish and are generally shallow.

Rivers

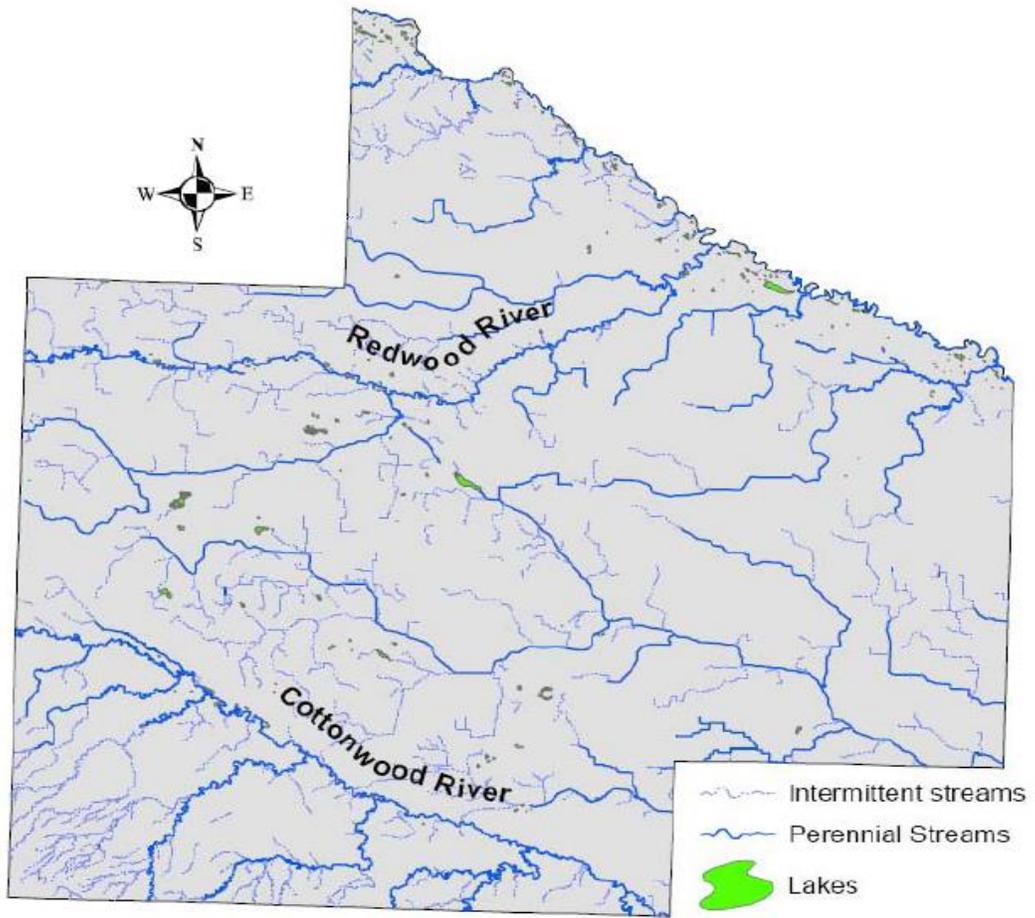
Rivers in Redwood County include the Minnesota, Redwood, and Cottonwood Rivers. The watersheds of the Redwood and Cottonwood Rivers eventually drain into the Minnesota River. Redwood County Rivers, Creeks and Streams

Drainage Ditches

Redwood County has constructed and maintains approximately 520 miles of open drainage ditches and 1,105 miles of county and judicial drainage tile.

⁶ Department of Natural Resources. Accessed 7/11/17. Available: <http://www.dnr.state.mn.us/lakefind/index.html>

Figure #7
Shoreland, Lakes & Streams – Redwood County



Watersheds

Three major watersheds exist in the county. They include the Minnesota River (Granite Falls and Mankato), the Redwood River, and the Cottonwood River. The largest watershed in Redwood County is the Cottonwood River Watershed, which contains approximately 460.8 square miles or 53 percent of the surface area of Redwood County. Eventually the Cottonwood and Redwood Rivers drain into the Minnesota River.

Wetlands

In and around these watersheds are wetlands. Wetlands refer to the low depressions in the landscape that is saturated with water either permanently or seasonally. Originally, wetlands were located throughout nearly the entire county. With the advent of intensive agriculture practices and the application of land drainage techniques, many of the wetlands located on lands that were flat and suited to agricultural use have been drained. Because of this, there are now relatively few wetlands in the flat till plain areas of the county.

The exact amount of wetlands drained throughout Redwood County since the days of early European settlement is unknown, but it is estimated that about 90 percent of the county's original wetlands have been drained and those lands are now used for agricultural purposes.⁷ Most of the county's remaining wetlands are identified in the National Wetlands Inventory. This inventory classifies all wetlands into eight different wetland types. Wetlands are differentiated by depth of water and vegetation

Wetlands in Redwood County not only serve as a water drainage system, they also provide immediate benefits to ecosystems that surround them. Wetlands store runoff and allow for a natural filtration of the water before it enters the ground water. The benefits of a healthy wetland vary from improved water quality to economic development generated from increased hunting, fishing, and recreation spending.

Overall, wetlands provide many benefits to humans including the reduction of flooding by means of storage during high flows, filtration of pollutants and sediment, groundwater and aquifer recharge, wildlife habitat and aesthetic appeal.

In addition, the wetlands in Redwood County provide the following benefits:

- Floodwater Storage and Detention
- Nutrient Assimilation
- Sediment Entrapment
- Groundwater Recharge and Discharge
- Low-Flow Augmentation
- Aesthetics and Recreation
- Shoreland Anchoring and Erosion Control
- Wildlife Habitat
- Fisheries Habitat

⁷ Redwood County All Hazard Mitigation Plan, 2004

Figure #8
Watersheds Map - Redwood County

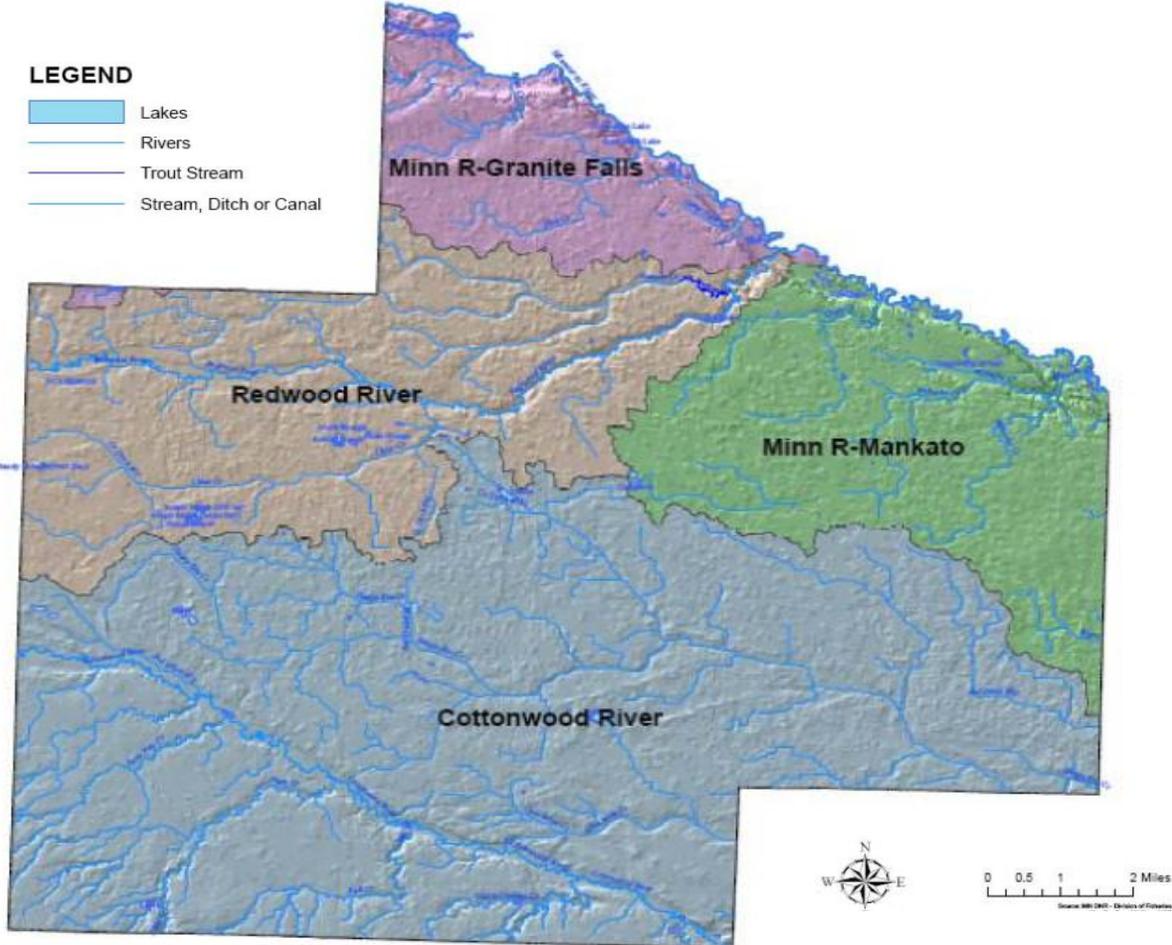
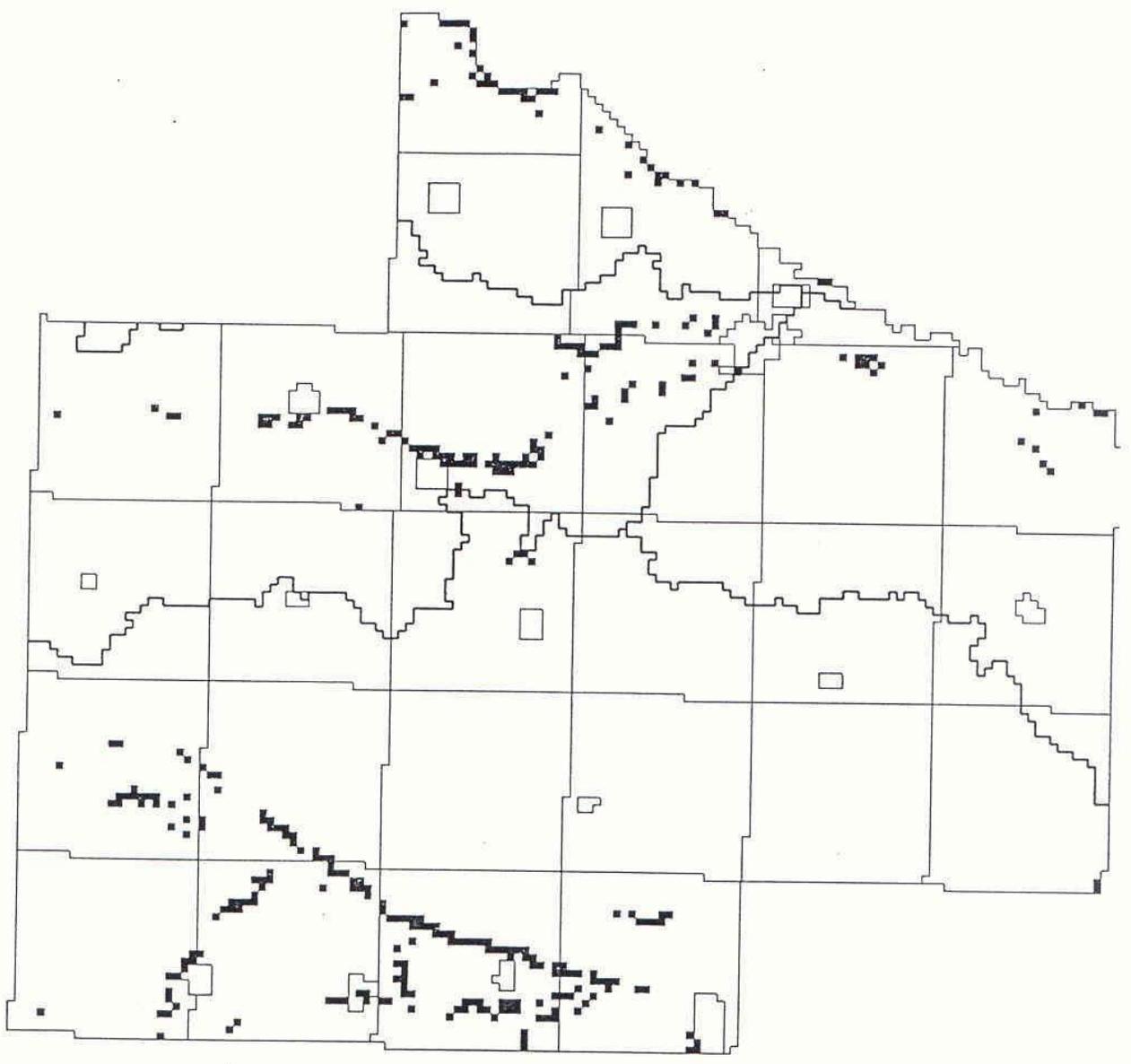
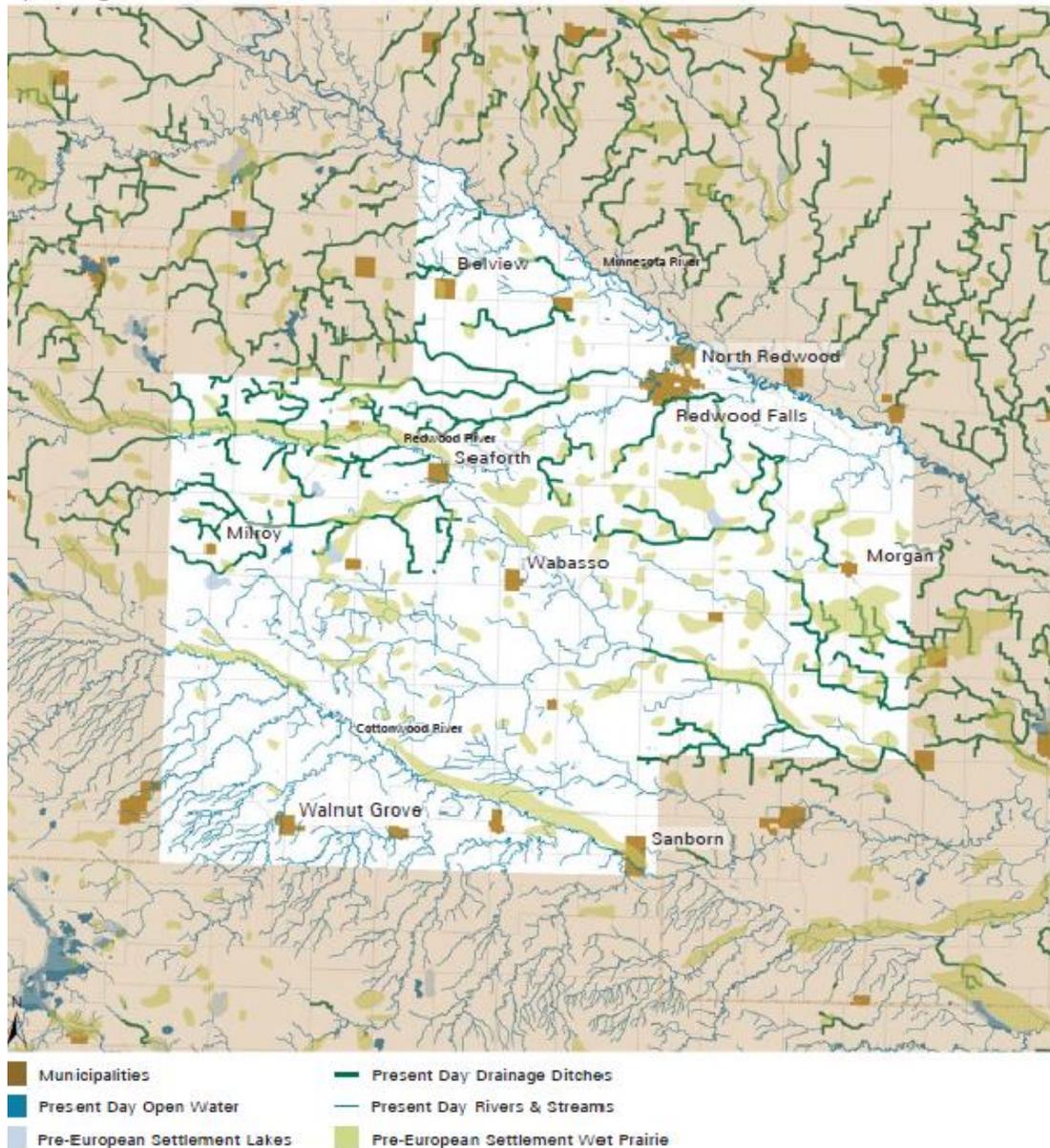


Figure #9
Sedimentation Areas – Redwood County



This map displays critical sedimentation areas in the county. The solid areas represent sedimentation areas, in particular shoreland with estimated soil loss greater than or equal to 3 T/Acre/Year.

Figure #10
Hydrologic Alterations Redwood County



The University of Minnesota Remote Sensing and Geospatial Analysis Laboratory analysis indicates that 86% of land in Redwood County was in agricultural use in the year 2000. This accounts for over 482,000 of the 564,000 acres in the county. About 5% of land is in grass/shrub/wetland, while 5% is classified “urban”. The same analysis found that less than 1% (4,600 acres) of the county is considered “impervious” or developed such that water will run off rather than soak into the ground.

As the landscape in Redwood County has changed over the years due to increased agricultural activities, the wetlands have also changed. Changes in the wetlands are due in part to tiling, changes in vegetation, and impervious surfaces. The exact amount of wetlands drained in Redwood County since increased agricultural activities is unknown. The majority of the remaining wetlands in Redwood County have been

identified in the National Wetlands Inventory. The inventory classifies all wetlands into eight different wetland types based on the depth of water and type of vegetation. Identifying and classifying wetlands along with regulations protecting wetlands help to preserve our wetlands into the future.

Land use and management practices that have occurred in Redwood County have caused water quality degradation in the lakes. Due to the increase of nutrients, the county's lakes have seen an increase in algae blooms and other suspended sediments. With this decrease in water clarity, sunlight is not able to reach all areas of the lakes and this restricts many different kinds of plant growth. This not only eliminates a food supply for many game fish, but it also favors the growth of less desirable species like carp and black bullhead. Those fish then cause greater destruction to the lakes by uprooting other vegetation types and sending more debris into the water column.

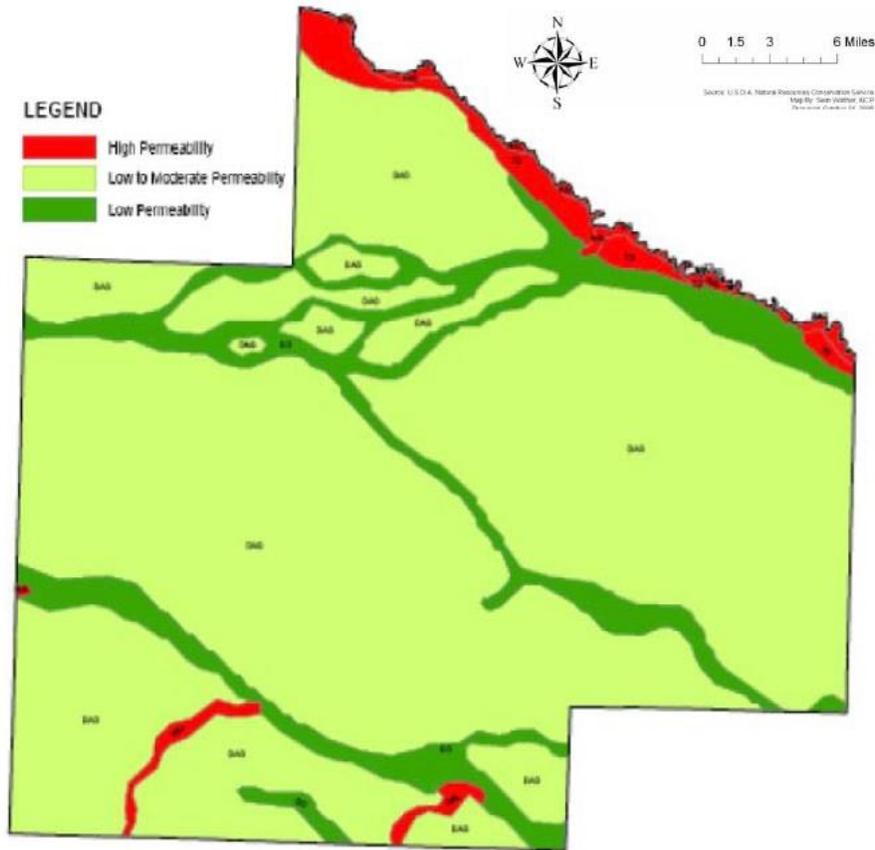
4.3.2 Surficial Geology

According to the Redwood County Comprehensive Water Plan, a thick mantle of glacial drift covers almost all of Redwood County. Along the Minnesota River Valley in the northeast portion of the county, glacial drift is absent and Precambrian rock formations are exposed. The thickness of the drift is highly variable ranging in depth from less than 100 feet in the west central portions of the county to more than 150 to 250 feet in the rest of the county. The drift has sand and gravel lenses, which serve as local aquifers.

Redwood County is primarily a glacial till lowland with an average elevation of 1,100 feet above sea level. A predominant feature of the extreme southwestern portion of the county is the Coteau des Prairies, which ascends to an elevation of approximately 1,450 feet. Many tributaries of the Cottonwood River originate in this region, which is characterized by steep slopes and deep ravines. The rapid decrease in elevation from the Coteau to the lowland areas of the Cottonwood River leads to serious annual flooding during times of snow melt and heavy rainfall. North of the Cottonwood River the terrain is nearly level.

Rapidly moving glacial melt-water removed fine textured particles from the glacial till and deposited the coarse textured material in areas where the current slowed. Sand and gravel deposits are along the present day streams and rivers. The former glacial streams and beaches contain sand and gravel deposits.

Figure #11
Surficial Geology Permeability – Redwood County



4.3.3 Bedrock Geology

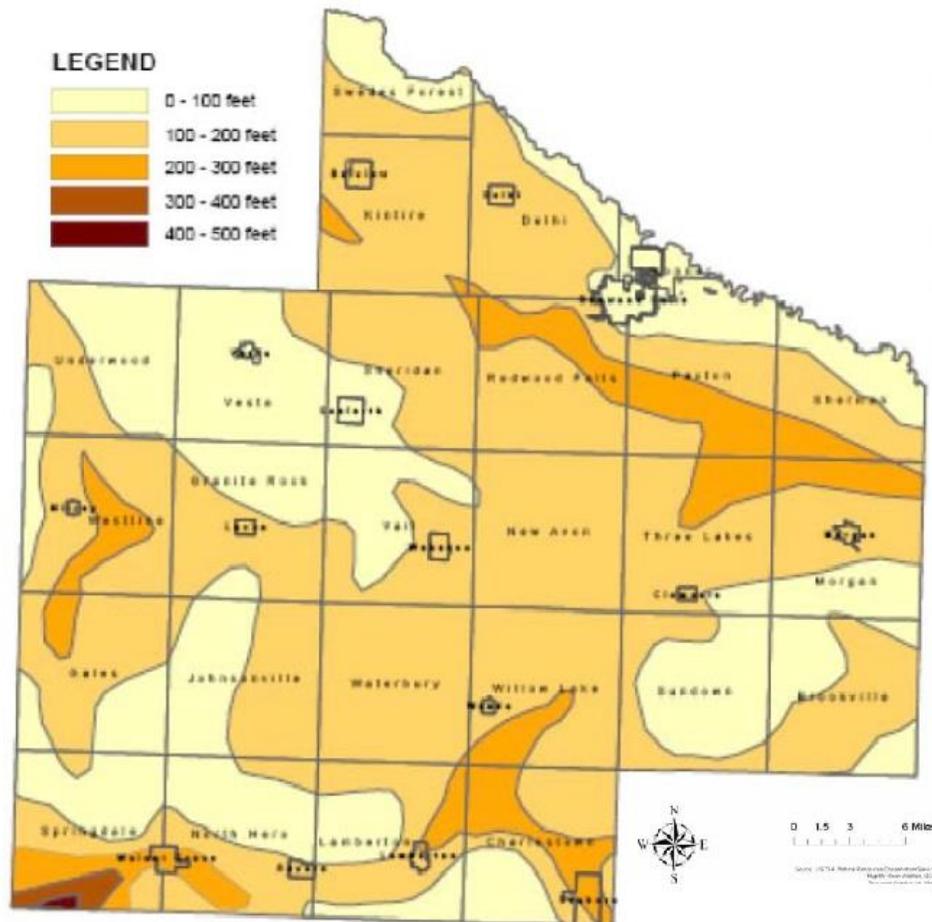
The bedrock ranges in age from Paleoproterozoic (approximately 3,600 to 3,200 Ma, or million years old) to Late Cretaceous (approximately 90 Ma), and records a complex history involving multiple igneous, sedimentary, metamorphic, and tectonic events, as well as significant episodes of weathering and erosion. The geologic interpretation of Precambrian bedrock (rocks older than approximately 540 Ma) in most areas of the county is based on geophysical maps that show diffuse bands of varied geophysical expression. Where these geophysical patterns are intersected by drill holes, or cross areas of exposed bedrock in the Minnesota River valley and its tributaries, the outcrops typically show a complex mixture of rock types.⁸

Cretaceous bedrock and sandstone lie beneath the glacial drift throughout much of the county. In the southwest part of the county, the Cretaceous formation is 10 to 400 feet thick; it thins out to the east and

⁸C-36, Geologic Atlas of Redwood County, Minnesota; Plate 2 - Bedrock Geology of Redwood County; accessed 7/11/17; <https://conservancy.umn.edu/handle/11299/182069>

west and is absent in the areas along the Redwood River from Seaforth to the western border of the county. There is little to no exposed bedrock in the county.⁹

Figure #12
Depth to Bedrock – Redwood County



4.3.4 Soils

There are eight generalized soil areas within Redwood County. The Canisteo and Ves Associations make up the largest percentage (36 percent) of the county's soils. The Okoboji Association makes up the second largest percentage (20 percent) within the county. The smallest generalized soil area is the Wadena Variant-Rock outcrop-Copaston Association, which makes up only about 1 percent of the county and is found in permanent pasture or woodland. Each association is comprised of several major soils and two or more minor soils. These associations define a unique natural landscape with distinctive patterns, relief and drainage.

Aggregate Deposits

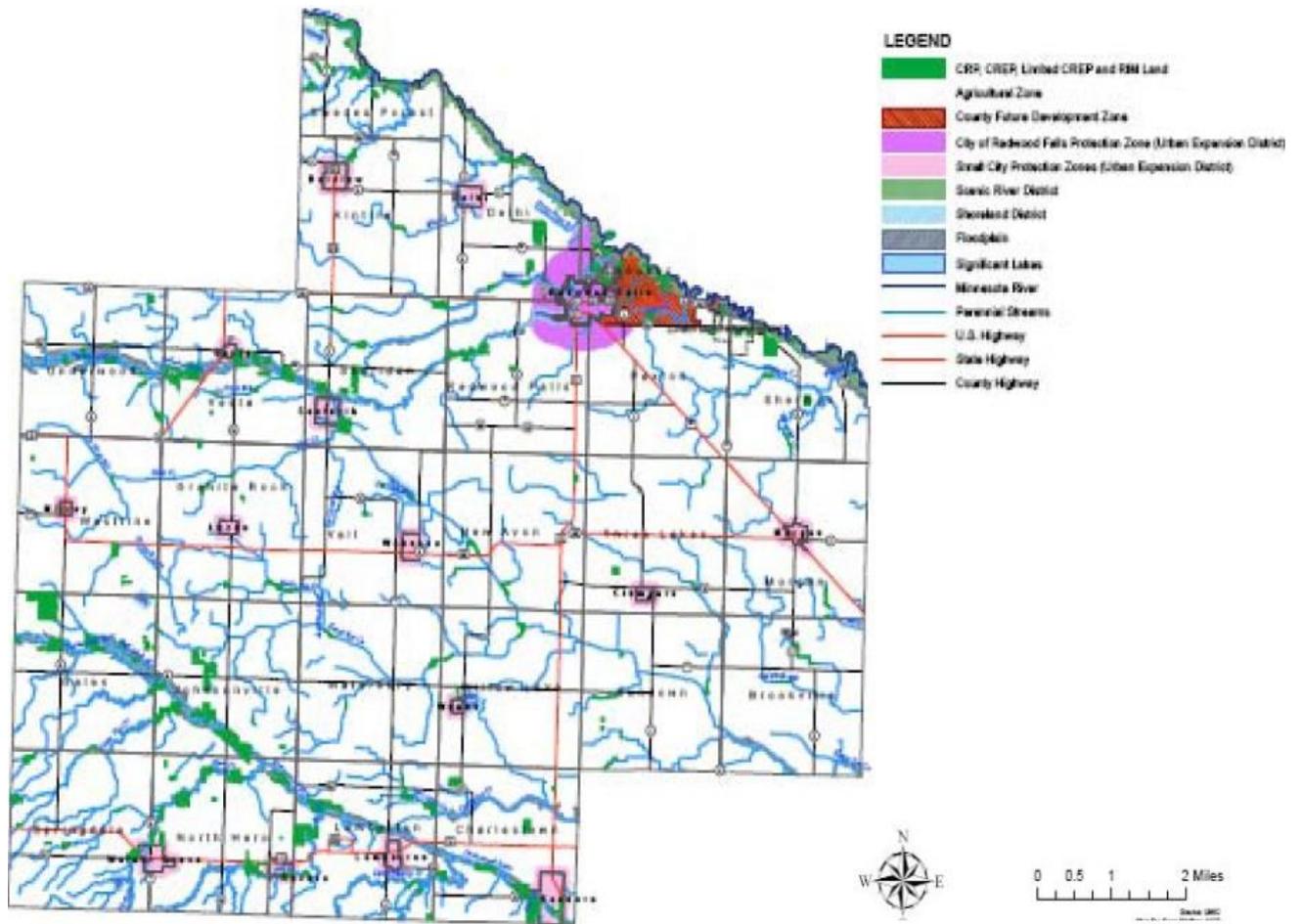
⁹ The Earth. Redwood County Comprehensive Plan 2007.

Gravel Pits: Existing gravel pits and untapped gravel deposits are present in the county. It is important to consider future deposits when contemplating future development patterns, both from the perspective of the value of extracted gravel and the value of other land uses.

Hard Rock Mining: Hard rock (granite) is present in Redwood County, and the most accessible outcroppings are within the Minnesota River Valley. Geologists report that these granite outcroppings are among the oldest in North America and the world.

Aggregate Resource Protection in Minnesota: During 1984, Minnesota Statute 84.94 was enacted to protect aggregate resources; to promote orderly and environmentally sound development; to spread the burden of development; and to introduce aggregate resource protection into local comprehensive planning and land use controls. The legislation initiated county-level identification and characterization of aggregate resources and directed county planning authorities to use the information to consider the protection of identified aggregate resources in their planning decisions.

Figure #14
Landscape and Land Use Zones and Conservation Land Areas – Redwood County



4.4 Climate

Southwest Minnesota has a humid, mid-continental climate. Winters are characterized by cold, dry continental polar air. Summers are characterized by hot, dry tropical air masses from the Southwest meeting warm, moist maritime air masses from the Gulf of Mexico in the summer.

The weather is extremely variable during the year. During the winter months, precipitation is in the form of snowstorms, some which may be severe. During the summer months, precipitation is in the form of showers (occasionally heavy) when warm moist air leaves the Gulf region and meets cooler air over Redwood County. Weather patterns circulate counter-clockwise and generally enter Redwood County from the west to southwest and sometimes from the south.

4.4.1 Precipitation

Redwood County has an average annual precipitation of 20 - 33 inches (Minnesota's state-wide average is 27.01 inches). Average precipitation in Redwood County from 1981 to 2016 was 26.47 inches. Average precipitation can vary from 15 inches (1976) to over 37 inches (1979). In 2016, the average precipitation total was approximately 32.29 inches within Redwood County.¹⁰

From 1981 to 2010, the average seasonal snow fall in the City of Redwood Falls, which is the county seat of Cottonwood County, was 35.8 inches. 1981 - 2010 the average precipitation for City of Redwood Falls was 28.72 inches. Over that same time period, the average precipitation near the City of Vesta, which is in the northwest edge of Redwood County, was 46.1 inches; and the average precipitation near the City of Morgan, which is in the northcentral area on the eastern edge of Redwood County, was 29.96 inches. The average precipitation near the City of Lamberton, which is in the southeast edge of Redwood County, was 27.94 inches

Figure #15
Precipitation: Averages since 1981

Month	1981-2016		Average Precipitation - 1981 - 2010			
	Precipitation in Inches – Redwood County	Precipitation in Inches – Redwood Falls	Snowfall in Inches – Redwood Falls	Precipitation in Inches – Vesta	Precipitation in Inches – Morgan	Precipitation in Inches – Lamberton
January	0.52	0.64	6.1	8.1	0.73	0.57
February	0.51	0.92	7.7	5.6	0.78	0.51
March	1.35	1.61	8.8	10.1	1.78	1.62
April	2.66	2.79	1.5	4.2	3.09	2.97
May	3.54	3.40	0.0	0.0	3.51	3.25
June	4.42	4.46	0.0	0.0	4.46	4.16
July	3.22	3.64	0.0	0.0	3.80	3.74
August	3.50	3.66	0.0	0.0	3.77	3.67
September	2.87	3.16	0.0	0.0	3.22	3.32
October	1.99	2.24	0.1	0.8	2.20	2.06
November	1.30	1.43	4.5	7.6	1.57	1.33

¹⁰ State DNR Climatology Office: http://www.dnr.state.mn.us/climate/historical/acis_stn_meta.html

December	0.53	0.77	8.1	9.7	1.05	0.74
Annual Average	26.47	28.72	35.8	46.1	29.96	27.94

Source: National Climatic Data Center (<http://ggweather.com/normals/>)

4.4.2 Temperature

Average temperature in Redwood County from 1981 to 2016 was 45.7 degrees Fahrenheit. The hottest month on average in Redwood County is July with an annual average temperature of 73.3°F. The coolest month on average is January with an annual average temperature of 15°F. Temperatures were taken in the City of Redwood Falls.

Figure #16

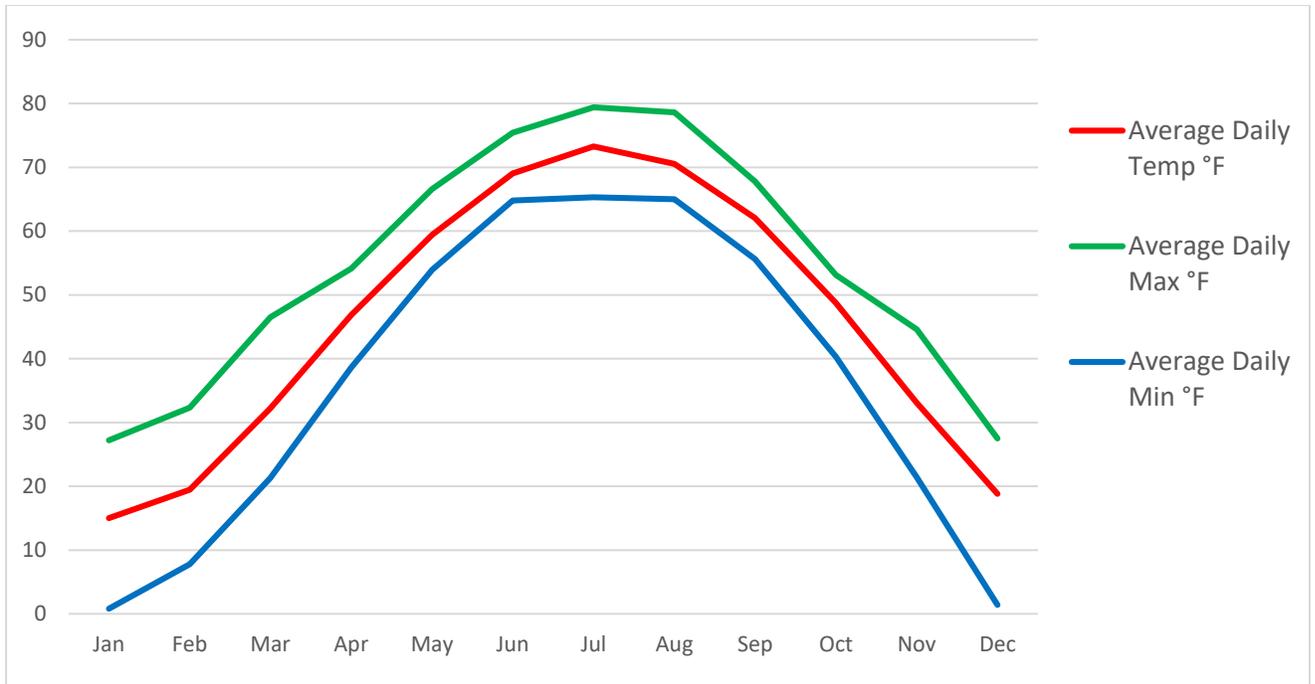
Average Temperature: 1981 – 2016 – Redwood Falls

Month	Average Daily Temp. °F	Average Daily Max °F	Average Daily Min °F
January	15.0	27.2	0.8
February	19.4	32.3	7.8
March	32.2	46.5	21.3
April	46.9	54.1	38.6
May	59.4	66.6	53.9
June	69.1	75.4	64.8
July	73.3	79.4	65.3
August	70.5	78.6	65.0
September	62.0	67.8	55.6
October	48.7	53.1	40.3
November	33.1	44.6	21.4
December	18.8	27.5	1.4
Annual Average	45.7	49.6	41.8

Source: <http://www.dnr.state.mn.us/climate/historical/>

Figure #17

Average Temperature: 1981 – 2016 – Redwood Falls



4.5 Population

Redwood County is the 55th most populous county in the State of Minnesota (out of 87).¹¹ Population growth trends have an effect on the needs and demands of services such as transportation, law enforcement, and emergency response personnel. It is important to analyze past population trends to attempt to make valid projections. However, it should be recognized that population projections are dependent upon a number of factors, a number of which are beyond county control.

4.5.1 Population Trends

The 2010 Census shows that Redwood County has a population of 16,059 and the MN State Demographer’s Office estimated its population to be 15,275 in 2016. The two largest communities are Redwood Falls with a population of 5,254 in 2010 and Morgan with a population of 896 in 2010. The MN State Demographer’s Office estimated Redwood Falls’ population to be 5,211 in 2016 and Morgan’s to be 871 in 2016. From 2000 to 2010, Redwood Falls’ population decreased by (-3.8) percent and Morgan’s population decreased by (-0.8) percent. However, Walnut Grove’s population increased by 45.4% percent, increasing its population count from 313 in 2000 to 871 in 2010. As a whole, Redwood County experienced a decrease in population of (-4.5) percent from 2000 to 2010. Redwood County shares many of the opportunities and challenges common in rural Minnesota and the Midwest overall. The population in Southwest Minnesota has been generally declining for several decades and Redwood County is similar maintaining a relatively consistent population decline since 1950.

Figure #18
Population Trends – Region 8

County	1970	1980	1990	2000	2010	2016 Estimates*
Cottonwood	14,887	14,854	12,694	12,167	11,687	11,465
Jackson	14,352	13,690	11,677	11,268	10,266	9,978
Lincoln	8,143	8,207	6,890	6,429	5,896	5,766
Lyon	24,273	25,207	24,789	25,425	25,857	25,684
Murray	12,508	11,507	9,660	9,165	8,725	8,332
Nobles	23,208	21,840	20,098	20,832	21,378	21,825
Pipestone	12,791	11,690	10,491	9,895	9,596	9,211
Redwood	20,024	19,341	17,254	16,815	16,059	15,275
Rock	11,346	10,703	9,806	9,721	9,687	9,484
Region 8	141,532	137,039	123,359	121,717	119,151	117,020

Source: U.S. Census 1970, 1980, 1990, 2000, 2010, MN State Demographers Office 2016*

Figure #19
Distribution of Population – Redwood County

	1980	1990	2000	2010	2016 Estimates*
Cities	11,224	10,348	10,724	10,514	10,261
Townships	8,117	6,906	6,091	5,545	5,014

¹¹ Department of Employment and Economic Development. Accessed: 7/14/17. Available: <http://www.positivelyminnesota.com/apps/lmi/rws/default.aspx>

Redwood County	19,341	17,254	16,815	16,059	15,275
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Source: U.S. Census 1980, 1990, 2000, 2010, MN State Demographers Office 2016*

While 72.3 percent of the county’s population lived in the rural areas in 1980, only 34.5 percent lived in townships in 2010. The loss in population numbers from the rural areas and increasing urban population is not unique to Redwood County, which is seen in the decline of the number of farmers. Populations in rural farming communities, like Redwood County, are interconnected to the agricultural economy.

The agricultural economy is a competitive industry and is often used in economics as an example of a perfectly competitive market. Competition in the agriculture industry has lead agricultural businesses to specialize and exploit economies of scale to stay competitive in the market place. Innovation, specialization, and economies of scale have resulted in an agriculture industry that has been able to supply agriculture demand with fewer workers. In addition, the migration of young people from the rural areas to more urban areas, and the elderly persons moving to warming states have contributed to the decline of the rural population and the growth of urban centers.

Population by County Subdivision

The overwhelming majority of county subdivision saw a decline in population from 2000 to 2010. The eight county subdivisions that did not see a population decline from 2000 to 2010 was the City of Delhi (1.4%), the City of Seaforth (11.7%), Sherman township (22.9%), Springdale township (0.9%), Swedes Forest township (0.0%), Three lakes township (4.9%), the City of Wabasso (2.1%), and the largest growth was seen in the City of Walnut Grove (45.5%). The two largest population declines were in Redwood Falls township with a (-29.3) percent decrease and Sundown township with a (-23.6) percent decrease.

Figure #20: Distribution of Population by County Subdivision – Redwood County

County Subdivision	2000	2010	Percent Change 2000 - 2010	2016
Belview city	412	384	-6.8%	364
Brookville township	258	224	-13.2%	206
Charlestown township	217	208	-4.1%	175
Clements city	191	153	-19.9%	140
Delhi city	69	70	1.4%	64
Delhi township	298	293	-1.7%	285
Gales township	144	137	-4.9%	119
Granite Rock township	241	225	-6.6%	216
Honner township	86	79	-8.1%	77
Johnsonville township	166	152	-8.4%	136
Kintire township	214	182	-15.0%	185
Lamberton city	859	824	-4.1%	799
Lamberton township	235	193	-17.9%	176
Lucan city	226	191	-15.5%	184
Milroy city	271	252	-7.0%	248
Morgan city	903	896	-0.8%	871
Morgan township	305	257	-15.7%	230
New Avon township	242	191	-21.1%	170
North Hero township	172	161	-6.4%	148
Paxton township	577	555	-3.8%	528
Redwood Falls city	5,459	5,254	-3.8%	5,211
Redwood Falls township	256	181	-29.3%	143
Revere city	100	95	-5.0%	92
Sanborn city	434	339	-21.9%	315
Seaforth city	77	86	11.7%	79
Sheridan township	253	197	-22.1%	165
Sherman township	301	370	22.9%	351
Springdale township	215	217	0.9%	183
Sundown township	242	185	-23.6%	157
Swedes Forest township	121	121	0.0%	107
Three lakes township	185	194	4.9%	171
Underwood township	215	206	-4.2%	172
Vail township	271	229	-15.5%	219
Vesta city	339	319	-5.9%	301
Vesta township	206	192	-6.8%	179
Wabasso city	682	696	2.1%	686
Walnut Grove city	599	871	45.4%	825
Wanda city	103	84	-18.4%	82
Waterbury township	221	196	-11.3%	171
Westline township	203	178	-12.3%	150
Willow Lake township	247	222	-10.1%	195
Total	16,815	16,059	-4.5%	15,275

Source: U.S. Census 2000, 2010, MN State Demographers Office 2016

Population by Age Cohort

Population by age cohort can help planners identify trends and make predictions based on these trends. Changes in age cohorts can also help government plan for changes in demand for services. If the childbearing cohorts decline, government can make predictions that student enrollments may decline in the near future. The largest gain in population by age cohort was the age group 55 to 64 with 24.9 percent. The largest loss in population by age cohort was 35 to 44 with (-26.1) percent.

Figure #21
Population by Age Cohort – Redwood County

Age Group	2000	Percent of Total	2010	Percent of Total	Percent Change 2000 - 2010
0-9	2,192	13.6%	2,168	12.9%	1.1%
10-19	2,170	13.5%	2,686	15.9%	-19.2%
20-24	725	4.5%	723	4.3%	0.3%
25-34	1,625	10.1%	1,771	10.5%	-8.2%
35-44	1,777	11.1%	2,404	14.3%	-26.1%
45-54	2,347	11.9%	2,162	12.9%	8.6%
55-64	2,059	14.6%	1,648	9.8%	24.9%
65-74	1,473	9.1%	1,412	8.4%	4.3%
75-84	1,052	6.5%	1,250	7.4%	-15.8%
85+	639	4.0%	591	3.5%	8.1%

Source: U.S. Census 2000, 2010

Median Age

Cities in Redwood County had a small change in median age from 2000 to 2010, which was an average 3.3 percent increase. The largest two increases in the median age were in the City of Delhi with 39.5 percent, and in the City of Clements with 26.2 percent. The largest decrease in the median age was in the City of Seaforth, and the decrease was (-21.5) percent. The City of Lambertton had the smallest change in median age, which was a (-0.6) percent decrease.

Figure #22
Median Age by City – Redwood County

City	2000	2010	Percent Change 2000- 2010
Belview	44.2	48.6	10.0%
Clements	33.6	42.4	26.2%
Delhi	34.4	48.0	39.5%
Lamberton	50.6	50.3	-0.6%
Lucan	40.0	40.4	1.0%
Milroy	39.9	37.0	-7.3%
Morgan	42.9	38.2	-11.0%
Redwood Falls	39.6	42.1	6.3%
Revere	42.5	41.3	-2.8%
Sanborn	39.8	47.7	19.8%
Seaforth	46.5	36.5	-21.5%
Vesta	34.8	33.5	-3.7%

Wabasso	38.1	43.7	14.7%
Walnut Grove	46.1	36.8	-20.2%
Wanda	43.8	50.5	15.3%

Source: U.S. Census 2000, 2010

In townships in Redwood County the median age increased by an average of 13.5 percent from 2000 to 2010. The largest increase in the median age was in Sheridan Township, and the increase was 41.3 percent. The three decreases in the median age were in Sherman Township with (-3.5) percent, Springdale Township with (-7.2) percent, and Three lakes with (-12.8) percent.

Figure #23
Median Age by Township – Redwood County

Township	2000	2010	Percent Change 2000 - 2010
Brookville	41.7	41.7	0.0%
Charlestown	43.8	47.0	7.3%
Delhi	38.9	47.1	21.1%
Gales	32.8	41.5	26.5%
Granite Rock	32.6	36.5	12.0%
Honner	41.8	42.5	1.7%
Johnsonville	34.0	36.5	7.4%
Kintire	40.0	43.3	8.3%
Lamberton	38.6	46.6	20.7%
Morgan	34.6	40.9	18.2%
New Avon	38.0	46.7	22.9%
North Hero	43.6	48.8	11.9%
Paxton	36.2	42.7	18.0%
Redwood Falls	37.4	47.8	27.8%
Sheridan	34.9	49.3	41.3%
Sherman	31.1	30.0	-3.5%
Springdale	41.5	38.5	-7.2%
Sundown	37.7	47.1	24.9%
Swedes Forest	39.3	43.5	10.7%
Three lakes	41.5	36.2	-12.8%
Underwood	32.1	38.0	18.4%
Vail	39.0	40.8	4.6%
Vesta	36.6	44.0	20.2%
Waterbury	40.4	49.0	21.3%
Westline	39.1	49.5	26.6%
Willow Lake	35.8	39.8	11.2%

Source: U.S. Census 2000, 2010

In Redwood County the median age had a small increase from 39.5 to 42.6 from 2000 to 2010. In 2010, the median age in Redwood County is 2.1 years higher than Region 8 and is 5.2 years higher than the State of Minnesota, while Region 8 has a median age that is 3.1 years higher than the State of Minnesota.

Figure #24
Median Age by County/Region/State

	2000	2010	Percent Change 2000 - 2010
<i>Redwood County</i>	39.5	42.6	7.8%
<i>Region 8</i>	38.7	40.5	4.6%
<i>Minnesota</i>	35.4	37.4	5.6%

Source: U.S. Census 2000, 2010

Population by Race

From 1990's, the Caucasian population of Redwood County continued to decline while each minority group increased by significant percentages. From 2000 to 2010, white had a (-5.9) decrease in percentage while a (-10.4) percent decrease in number. There has been a slight shift towards a more diverse population. The number of population for majority of the non-white race in 2010 has more than doubled the number in 2000, and this growth led to the (-1.1) percent decrease in total population for one race.

In 2010, Redwood County Black or African American population increased by 240.9%, Asian population increased by 856.6%, while Native Hawaiian and other Pacific Islanders decline by (-81.8)% and some other race also decline by (-19.2)%. Also during this time, Redwood County saw an increase in two or more races population of 120.3% and the county has 335 residents who identify as Hispanic/Latino (2.1% of the population). In 2000 the Hispanic/Latino population in the county was 192 or 1.1%; this increase of 74.5 percent is consistent with population trends in the region which indicate the Hispanic/Latino population in the county will continue to increase over the next few decades.

Figure #25
Population by Race Redwood County

	2000 Number	Percent	2010 Number	Percent	Percent Change 2000 - 2010
White	15,969	95.0	14,305	89.1	-10.4%
Black or African American	22	0.1	75	0.5	240.9%
American Indian and Alaska Native	544	3.2	796	5.0	46.3%
Asian	53	0.3	507	3.2	856.6%
Native Hawaiian /other Pacific Islander	11	0.1	2	0.0	-81.8%
Some Other Race	73	0.4	59	0.4	-19.2%
Two or More Races	143	0.9	315	2.0	120.3%
Total Population	16,815	100.0	16,059	100.2	4.5%

Source: U.S. Census 2000, 2010

Diversity in Redwood County influences the number of spoken languages. Roughly 95.1 percent of residents in Redwood County only speak English. There are a number of other languages that are spoken in Redwood County, that include but are not limited to: Spanish, other Indo-European, and Asian languages.

Figure #26
Language Spoken At Home – Redwood County

Subject	Percent	Margin of Error
Speak only English	95.1	+/- .5
Speak a language other than English	4.9	+/- .5
Spanish	1.2	+/- .5
Other Indo-European	0.6	+/- .3
Asian and Pacific Island Languages	2.8	+/- .2
Other Language	0.2	+/- .1

Source: 2015 American Community Survey 5-Year Estimates

4.5.2 Population Projections

Population projections from the MN Department of Administration show that the population in Redwood County is projected to decrease by (-24.6) percent from 2015 to 2050. The projections show a marginal increase in the age cohorts 80+ from 2015 to 2050. The population for all other the age cohorts are projected to decrease by percentages ranging from (-0.6) to (-57.3). The population cohorts 50-79 is expected to have the largest decreases followed by the 0-19 age cohort. Redwood County communities will undoubtedly be impacted by the changing age structure of their communities. The county must ensure that services and needs are met as the population gradually becomes older and the demands for public services change. In the next three decades of years, local governments throughout the State will find themselves dealing with an aging population and attempting to improve the safety and welfare of an older and a more diverse community.

Figure #27: Population Projections Redwood County

Age Group	2015		2020		2025		2030		2035	
	Male	Female								
0 to 4	463	465	356	358	361	416	395	362	414	397
5 to 9	516	512	438	434	335	374	340	333	377	338
10 to 14	576	502	515	449	437	300	336	381	344	293
15 to 19	527	469	571	507	512	307	439	455	346	391
20 to 24	437	421	533	514	569	432	515	548	449	496
25 to 29	382	343	354	318	451	400	492	406	446	442
30 to 34	433	382	356	315	330	412	424	291	466	375
35 to 39	424	370	421	367	348	362	323	304	415	283
40 to 44	371	412	345	384	343	295	284	381	266	316
45 to 49	476	402	397	336	369	260	368	313	307	312
50 to 54	538	554	381	393	316	306	295	325	297	304
55 to 59	586	527	537	483	381	268	316	342	297	285
60 to 64	520	513	523	515	480	282	341	473	285	337
65 to 69	402	458	449	512	452	340	416	515	297	474
70 to 74	355	372	388	407	434	425	437	455	406	459
75 to 79	276	311	313	352	342	439	384	386	390	432
80 to 84	204	240	220	259	249	364	274	294	309	322
85+	186	413	142	315	132	341	141	294	154	312
Gender totals	7,672	7,666	7,239	7,218	6,841	6,858	6,520	6,568	6,265	6,323
Total Population	15,338		14,457		13,699		13,088		12,588	

Age Group	2040		2045		2050		Percent Change 2015- 2050
	Male	Female	Male	Female	Male	Female	
0 to 4	399	400	360	362	328	329	-29.2%
5 to 9	400	397	391	389	356	353	-31.0%
10 to 14	386	336	415	362	410	357	-28.8%
15 to 19	356	316	401	356	432	384	-18.1%
20 to 24	366	352	379	365	424	408	-3.0%
25 to 29	389	349	314	282	331	298	-13.2%
30 to 34	427	378	378	335	307	271	-29.1%
35 to 39	460	402	429	375	384	335	-9.4%
40 to 44	347	386	392	436	369	409	-0.6%
45 to 49	291	247	386	327	440	372	-7.5%
50 to 54	249	256	239	247	326	336	-39.4%
55 to 59	304	273	258	232	250	225	-57.3%
60 to 64	272	268	282	278	242	238	-53.5%
65 to 69	252	288	244	278	255	291	-36.5%
70 to 74	294	309	253	266	247	259	-30.4%
75 to 79	366	413	270	304	234	264	-15.2%
80 to 84	318	375	303	357	225	265	10.4%
85+	174	387	188	416	188	418	1.2%
Gender totals	6,050	6,132	5,882	5,967	5,748	5,812	
Total Population	12,182		11,849		11,560		-24.6%

Source: Minnesota Department of Administration

4.6 Housing

Household characteristics have a direct impact on land use, demand for housing, government services, and public education. Changes in demographics are part of the driving forces that contribute to changes in housing characteristics and demand for housing. Planning and consideration needs to take place at the local levels to ensure the supply of housing is adequate to meet the demand.

The age cohorts that include 60 through 85+ are projected to decrease by (-24.6) percent from 2015 to 2045 in Redwood County. This aging population change requires different housing needs than younger cohorts. Assisted living facilities and nursing homes are two types of facilities that will help to accommodate this population change. The 60 plus age cohorts also have to be considered in emergency planning, since a number of persons in this cohort may have trouble evacuating a building and performing other safety protocol. This cohort and youth cohorts have to have special considerations when it comes to emergency planning.

There are a number of other considerations that have to be made when it comes to emergency planning. The age of a structure is one variable that impacts how well a structure will withstand a disaster. The age of a structure is also one variable that impacts the ability to repair a structure after a disaster. The building materials used to construct the structure and the maintenance of the structure are two other variables in whether a structure can withstand a disaster. There are a number of other variables that impact the ability of a structure to withstand the stresses of a disaster.

4.6 Housing

4.6.1 Housing Units

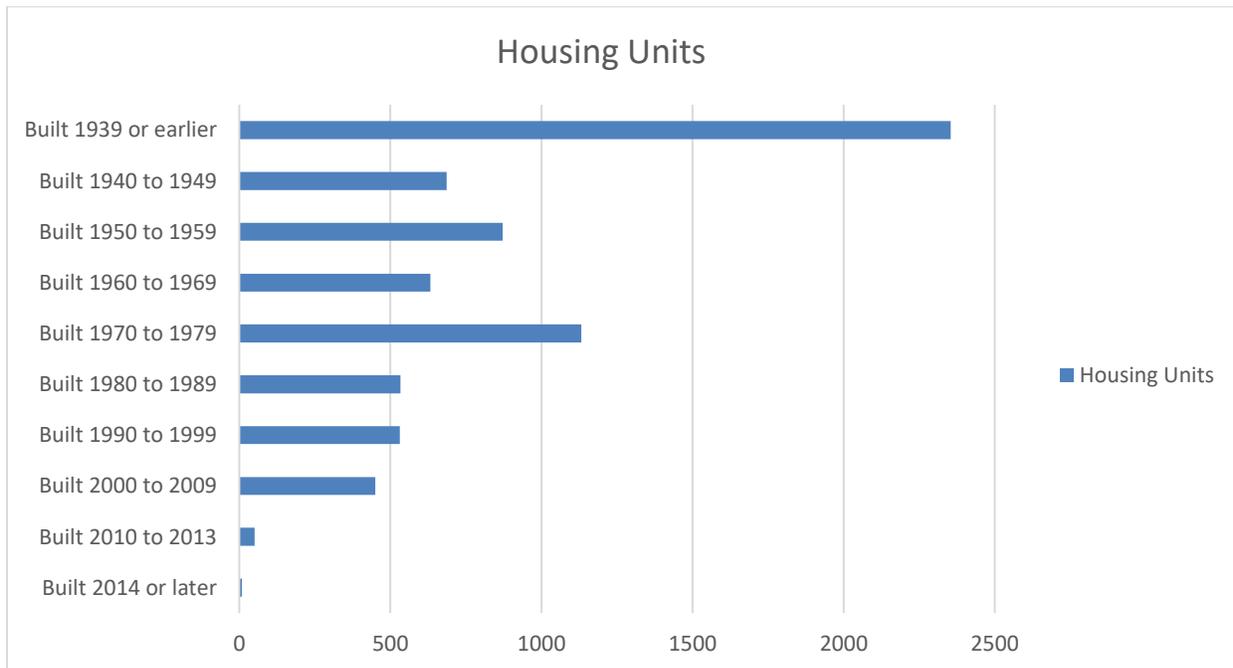
In Redwood County 32.5 percent of housing units were built in 1939 or earlier. More than half of the housing units in Redwood County were built in 1970 to 2010 or later, while 46.0 percent of housing units were built before 1950. Redwood County still has an older housing stock which impacts the county's ability to with stand a disaster.

Figure #28: Build Year of Housing Units – Redwood County

<i>Year Built</i>	<i>Housing Units</i>	<i>Percent</i>
Built 2014 to 2015	8	0.1%
Built 2010 to 2013	51	0.7%
Built 2000 to 2009	450	6.2%
Built 1990 to 1999	531	7.3%
Built 1980 to 1989	533	7.4%
Built 1970 to 1979	1,132	15.6%
Built 1960 to 1969	632	8.7%
Built 1950 to 1959	872	12.0%
Built 1940 to 1949	686	9.5%
Built 1939 or earlier	2,354	32.5%
Total Housing Units	7,249	100%

Source: U.S. Census Bureau, 2015 5-year ACS

Figure #29: Building Year of Housing Units – Redwood County



There were a total of 46,762 housing units in Region 8 in 1970. Region 8 experienced a 12.98 percent increase in housing units from 1970 to 1980. From 1970 to 2000, there was a 12.13 percent increase in housing units for Region 8. From 2000 to 2010, there was a 1.73 percent increasing in housing units for Region 8. In total, there was a 14.9 percent increase in housing units from 1970 through 2010.

For Redwood County, the total number of housing units remained steady from 1970 to 2010, with a 9.1 percent (670 actual units) increase from 1970 to 1980, a (-3.4) percent (-244 actual units) decrease from 1980 to 1990, a 1.2 percent (86 actual units) increase from 1990 to 2000, and a 0.6 percent (42 actual units) increase from 2000 to 2010. Redwood County saw median housing units' growth among Region 8 counties, with a 8.2 percent (554 actual units) increase from 1970 to 2010 overall.

Figure #30
Housing Unit Trends – Region 8

County	1970	1980	1990	2000	2010	Percent Change 1970 - 2010
Cottonwood	5,130	5,804	5,495	5,376	5,419	5.6%
Jackson	4,918	5,525	5,121	5,092	4,990	1.5%
Lincoln	2,882	3,298	3,050	3,043	3,108	7.8%
Lyon	7,526	9,196	9,675	10,298	11,098	47.5%
Murray	4,236	4,679	4,611	4,357	4,556	7.6%
Nobles	7,386	8,212	8,094	8,465	8,535	15.6%
Pipestone	4,286	4,636	4,387	4,434	4,483	4.6%
Redwood	6,718	7,388	7,144	7,230	7,272	8.2%
Rock	3,680	4,095	3,963	4,137	4,262	15.8%
Region 8	46,762	52,833	51,540	52,432	53,723	14.9%

Source: U.S. Census 1970, 1980, 1990, 2000, 2010

Population by Household

The U.S. Census defines households as the total number of occupied housing units, and household units as the total number of livable dwellings that are available. Redwood County's households remained steady but did decline, with a slight increase of 0.4 percent from 1990 to 2010. The number increased in the 2000 census but saw a decline in the 2010 Census. As the result of the increasing households, the persons per household decreased from 2.44 in 2000 to 2.38 in 2010. From 1990 to 2010, there was a slight increase of 9.7% percent in persons per household. This is partially due to the number of elderly living alone, which poses a number of concerns in regards to emergency preparedness.

The Housing Summary Table shows the number of householders living alone and the number of householders 65 years and over living alone. In 2010, there are 2,305 householders living alone and 986 householders were 65 years and over living alone.

Figure #31
Population by Household – Redwood County

	1990	2000	2010	Percent Change 1990 - 2010	2016 Estimates*
<i>Households</i>	6,554	6,674	6,580	0.4%	6,416
<i>Housing Units</i>	7,144	7,230	7,272	1.8%	NA
<i>Average household Size</i>	2.17	2.44	2.38	9.7%	2.32

Source: U.S. Census 1990, 2000, 2010, MN State Demographers Office 2016*

In Redwood County 78.0 percent of occupied housing units are owner-occupied. In Region 8, 74.9 percent of occupied housing units are owner-occupied. Redwood County has seen steady fluctuations in the number of owner-occupied housing units over the past four decades. From 1970 to 2010, Redwood County has seen a 11.9 percent increase in owner-occupied housing units, which is the fourth greatest increase in Region 8. During that same time period, Region 8 saw a 4.6 percent decrease in owner-occupied housing units.

Figure #32
Housing Occupancy – Region 8

	Total Occupied	Owner -Occupied
County	2010	2010 (%)
Cottonwood	4,912	79.6%
Jackson	4,429	78.3%
Lincoln	2,574	80.2%
Lyon	10,227	66.5%
Murray	3,717	82.6%
Nobles	7,946	72.8%
Pipestone	4,054	74.9%
Redwood	6,580	78.0%
Rock	3,918	77.4%
Region 8	48,357	74.9%

Source: U.S. Census 2010

Figure #33
Owner- Occupied Housing Occupancy – Region 8

County	1970	1980	1990	2000	2010	Percent Change 1970 – 2010
Cottonwood	3,760	4,243	3,925	3,955	3,757	-0.1%
Jackson	3,356	3,781	3,477	3,601	3,466	3.3%
Lincoln	2,131	2,323	2,161	2,130	2,063	-3.2%
Lyon	5,107	6,203	6,207	6,643	6,799	33.1%
Murray	2,821	3,181	2,982	3,135	3,070	8.8%
Nobles	5,161	5,928	5,791	5,955	5,783	12.1%
Pipestone	3,066	3,358	3,129	3,173	3,035	-1.0%
Redwood	4,587	5,252	5,055	5,328	5,135	11.9%

Rock	2,519	2,868	2,826	2,994	3,031	20.3%
Region 8	32,508	37,137	35,553	36,914	31,009	-4.6%

Source: U.S. Census 1970, 1980, 1990, 2000, 2010

The trend of renter-occupied units in Redwood County was similar with the owner-occupied units, which has seen steady fluctuations over the past four decades. From 1970 to 2010, the percentage change in renter-occupied housing units decreased by (-8.5) percent (155 actual units). The demand for renter-occupied housing units may increase as the population ages and moves from owner-occupied housing units to assisted living facilities and other rental facilities in Redwood County.

Figure #34
Renter – Occupied Housing Occupancy – Region 8

County	1970	1980	1990	2000	2010	Percent Change 1970 - 2010
Cottonwood	1,053	1,233	1,134	962	1,003	-4.7%
Jackson	1,193	1,207	1,083	955	963	-19.3%
Lincoln	448	605	543	523	511	14.1%
Lyon	1,930	2,476	2,866	3,072	3,428	77.6%
Murray	897	855	776	587	647	-27.9%
Nobles	1,864	1,886	1,892	1,984	2,163	16.0%
Pipestone	996	999	949	896	1,019	2.3%
Redwood	1,579	1,600	1,499	1,346	1,445	-8.5%
Rock	975	987	928	849	887	-9.0%
Region 8	10,935	11,848	11,670	11,174	10,622	-2.9%

Source: U.S. Census 1970, 1980, 1990, 2000, 2010

4.6.2 Vacant Housing Units

The 1970 U.S. Census reported that Redwood County had 520 vacant housing units. This number increased by 3, to 523 units from 1970 to 1980. The number of vacant housing units increased again from 1980 to 1990 by 67 units to 590. The number of vacant housing units stabilized and dropped by 34 units between 1990 and 2000. Between 2000 and 2010, the number rose dramatically to 692 units.

In 1990, the Census Bureau began to separate owner and renter vacant housing units. The combined percentages of the new data are higher than the actual vacant units year round. The numbers include unoccupied units for sale and housing used for seasonal, recreational, or occasional use. The rise of vacant housing units from 1970 to 1990 is mainly contributed to the decrease in rural population in Redwood County and other rural counties.

Figure #35
Vacant Housing – Region 8

County	1970	1980	1990	2000	2010	Percent Change 1970 - 2010
Cottonwood	317	318	435	459	507	59.9%

Jackson	322	379	561	536	561	74.2%
Lincoln	280	324	346	390	534	90.7%
Lyon	484	512	602	583	871	80.0%
Murray	463	445	853	635	839	81.2%
Nobles	350	383	411	526	589	68.3%
Pipestone	224	278	309	365	429	91.5%
Redwood	520	523	590	556	692	33.1%
Rock	182	239	209	294	344	89.0%
Region 8	3,142	3,401	4,316	4,344	5,366	70.8%

Source: U.S. Census 1970, 1980, 1990, 2000, 2010

In 2010, 9.5 percent of the housing units in Redwood County were vacant, which was below the 9.7 percent in Region 8. The percentage of a county's housing units being vacant adversely affects preparing for and cleaning up after a disaster.

Figure #36
Percent Vacant – Region 8

County	1970	1980	1990	2000	2010
Cottonwood	6.6%	5.8%	8.6%	8.5%	9.4%
Jackson	7.1%	7.6%	12.3%	10.5%	11.2%
Lincoln	10.9%	11.1%	12.8%	12.8%	17.2%
Lyon	6.9%	5.9%	6.6%	5.7%	7.8%
Murray	12.5%	11.0%	22.7%	14.6%	18.4%
Nobles	5.0%	4.9%	5.3%	6.2%	6.9%
Pipestone	5.5%	6.4%	7.6%	8.2%	9.6%
Redwood	8.4%	7.6%	9.0%	7.7%	9.5%
Rock	5.2%	6.2%	5.6%	7.1%	8.1%
Region 8	7.1%	6.8%	8.9%	8.1%	9.7%

Source: U.S. Census 1970, 1980, 1990, 2000, 2010

Housing Unit Value

Redwood County has the sixth highest median housing unit value in Region 8 and higher median rent than the Region 8 average. The median rent is 19 dollars more than the Region 8 average. The cost of a disaster in Redwood County is possibly average when compared to Region 8 averages.

Figure #37
Median Housing Unit Value – Region 8

County	Median Housing Unit Value	Median Rent
Cottonwood	\$81,800	\$454
Jackson	\$100,300	\$543
Lincoln	\$76,300	\$477

Lyon	\$136,300	\$543
Murray	\$90,000	\$521
Nobles	\$97,200	\$554
Pipestone	\$85,100	\$576
Redwood	\$88,300	\$557
Rock	\$99,200	\$567
Region 8	\$100,904	\$538

Source: U.S. Census 2010

Figure #38: Housing Summary: 2010 – Redwood County

Subject	Number	Percent
Total Population		
In Households	6,580	100%
In Group Quarters		%
Total Households		
Family Households	5,323	65.0
Non Family Households	2,305	35.0
Householder Living Alone	2,064	31.4
Households 65 years and over living Alone	986	15.0
Households with Individuals under 18	1,882	28.6
Households with Individuals 65 and over	2,124	32.3
Average Household Size	2.38	(X)
Units in Structure		
1 unit, detached	5,323	84.4%
1 unit, attached	95	1.5%
2 units	63	1.0%
3 or 4 units	95	1.5%
5 to 9 units	126	2.0%
10 or more units	372	5.9%
Mobile Home	227	3.6%
Vehicles Available		
None	334	5.3%
1 Vehicle	1,943	30.8%
2 Vehicles	2,384	37.8%
3 or more	1,646	26.1%
House Heating Fuel		
Utility Gas	2,397	38.0%
Bottled, tank, or LP gas	1,861	29.5%
Electricity	1,255	19.9%
Fuel oil, kerosene, etc.	523	8.3%
Coal or coke	0	0.0%
All other fuel	252	4.0%
No fuel used	25	0.4%
Selected Characteristics		
Lacking complete plumbing facilities	19	0.3%
Lacking complete kitchen facilities	44	0.7%
No telephone service	132	2.1%

Source: U.S. Census 2010 and 2015 ACS

4.7 Employment

Redwood County had an estimated employment of 6,614 persons in 2016, including 4,620 employments by private ownership and 1,994 employments by government ownership. The two largest employers by industry were the Trade, Transportation and Utilities Industry and Education and Health Services Industry, followed by the Manufacturing Industry. The industry cohort Natural Resources and Mining including Agricultural, Forestry, Fishing, Hunting and Mining, is estimated to be higher, but self-employed farms workers are not reported in Department of Employment and Economic Development figures.

Figure #39
Employment by Industry – Redwood County

Industry	2000	2010	2016
Natural Resources and Mining	57	54	128
Construction	372	315	300
Manufacturing	1185	812	1,070
Trade, Transportation and Utilities	1,546	1,341	1,438
Information	88	53	54
Financial Activities	243	256	320
Professional and Business Services	310	337	151
Education and Health Services	1,541	1,614	1,417
Leisure and Hospitality	1,299	1,112	1,025
Other Services	161	111	148
Public Administration	381	477	561
All Industries	7,184	6,484	6,614

Source: Department of Employment and Economic Development

Agriculture is a significant driving force in Redwood County. The USDA 2007 Census of Agriculture showed that there were 1,163 farms in Redwood County in 2012, 4.3 percent less than in 2007. In 2012, the average farm size was 448 acres, a 1.8 percent decline from 2007. The average farm reported sales of \$445,711, a 32.8 percent increase from 2007. There were 553,855 acres of farm land in production in Redwood County, a 6.2 percent decline from 2007.¹² In 2012, the market value of agricultural products sold in Redwood County was \$518,362,000, sharp 29.8 percent increase from 2007. Since 2007, the prices for agricultural products have been favorable, and it is expected that the upcoming USDA Census of Agriculture will show a marked increase in the market value of agricultural products sold in Redwood County as compared to 2012.

¹² USDA Census 2012, 2007. Accessed: 7/18/17. Available: <https://www.agcensus.usda.gov/Publications/>

4.7.1 Unemployment Trends

The unemployment rate in Redwood County was 4.1 percent in 2016, while the State of Minnesota had an unemployment rate of 3.9 percent. From 2012 through 2016, the average unemployment rate was 4.7 percent for Redwood County, 4.2 percent for Region 8, 4.5 percent for Minnesota, and 6.4 percent for the United States. The average unemployment rate for Redwood County was on average higher than Region 8, varied over the years compared to the State, and but remained lower than the national rates.

During the economic recession (2008-2012), the average unemployment rate was 6.1 percent for Redwood County, 5.3 percent for Region 8, 6.5 percent for the State of Minnesota, and 8.3 percent for the United States. Redwood County fared significantly better during the economic recession than the State of Minnesota, and the United States, but was higher than Region 8.

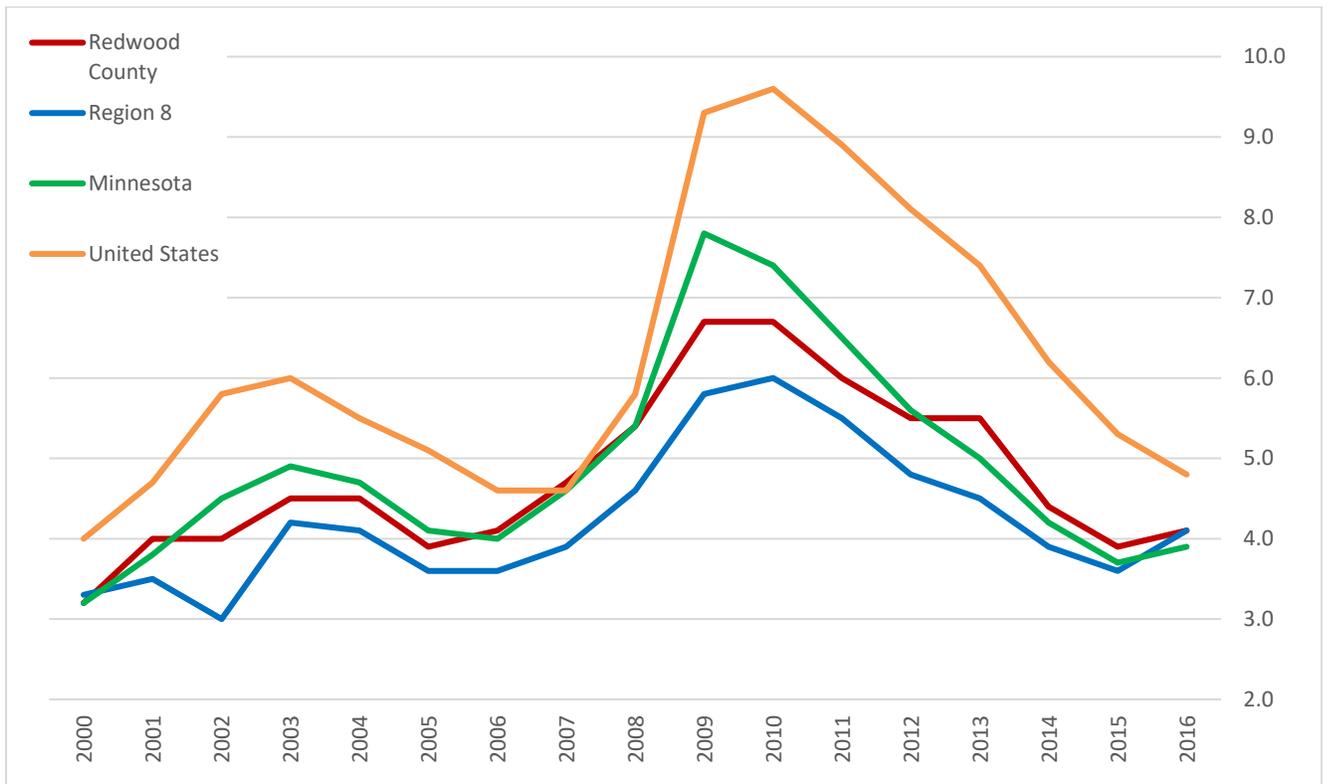
One explanation for Redwood County seeing significantly lower unemployment rates was the agriculture industry. Redwood County is part of a strong agricultural region in Southwest Minnesota. 68.5 percent of farmers list farming as their primary occupation. Redwood County has a significant amount of livestock, including turkeys, hogs and pigs, cattle, sheep, and chickens. Moreover, there is a large employer in the county, Farmers Union Industries a global manufacturing and sales company headquartered in the city of Redwood Falls, and other considerable scale employers such as Schulthomes, Jonti-Craft, Jackpot Junction Casino, Northstar Systembuilt, Walmart Supercenter, Daktronics, MN West Community and Technical College, APMC, Avera, Redwood Falls Area Hospital, Redwood County, Redwood Falls Area Public Schools, A&W Furniture, and others.

Figure #40
Unemployment Trends

Year	Redwood County	Region 8	Minnesota	United States
2016	4.1	4.1	3.9	4.8
2015	3.9	3.6	3.7	5.3
2014	4.4	3.9	4.2	6.2
2013	5.5	4.5	5.0	7.4
2012	5.5	4.8	5.6	8.1
2011	6.0	5.5	6.5	8.9
2010	6.7	6.0	7.4	9.6
2009	6.7	5.8	7.8	9.3
2008	5.4	4.6	5.4	5.8
2007	4.7	3.9	4.6	4.6
2006	4.1	3.6	4.0	4.6
2005	3.9	3.6	4.1	5.1
2004	4.5	4.1	4.7	5.5
2003	4.5	4.2	4.9	6.0
2002	4.0	3.0	4.5	5.8
2001	4.0	3.5	3.8	4.7
2000	3.2	3.3	3.2	4.0

Department of Employment and Economic Development & Bureau of Labor Statistics

Figure #41
Unemployment Trends



4.7.2 Household Income Levels

Changes in income are an indicator of the county’s economic condition. Per Capita income is the mean income computed for every person in a specified geographic area. For household income, the median is based on the distribution of the total number of housing units, including those occupants with no income. According to the 2010 Census information, the median household income for Redwood County was \$44,181, while the Region 8 average was \$44,361. Per capita income in Redwood County was \$23,548, while Region 8 was \$23,192. The median family income was \$55,829, while Region 8 was \$57,072. In two of the income examples, Redwood County ranked lower than the Region 8 average, but was higher in per capita income.

Figure #42
Comparative County Income Levels – Region 8

County	2000 Median Household Income	2010 Median Household Income	2000 Per Capita Income	2010 Per Capita Income	2000 Median Family Income	2010 Median Family Income
Cottonwood	31,943	40,292	16,647	23,162	40,237	51,705
Jackson	36,746	46,869	17,499	25,144	43,426	59,238
Lincoln	31,607	44,672	16,009	24,922	38,605	58,953
Lyon	38,996	46,872	18,013	23,755	48,512	63,793
Murray	34,966	45,657	17,936	24,045	40,893	54,647
Nobles	35,684	43,040	16,987	20,953	43,076	52,356
Pipestone	31,909	40,589	16,450	22,289	40,133	55,609
Redwood	37,352	44,181	18,903	23,548	46,250	55,829
Rock	38,102	45,411	17,411	23,079	44,296	58,147
Region 8	35,998	44,361	17,493	23,192	43,923	57,072

Source: U.S. Census 2000, 2010

4.8 EMERGENCY RESPONSE PROFILE

4.8.1 Introduction

A county's ability to respond to an emergency situation is based on service areas, facilities, equipment, and staff. An understanding of response times and abilities is critical for providing protection to Redwood County residents. The existing facilities, equipment, and staff in Redwood County are here to respond to local hazard events and provide regional support. These investments are critical in mitigating the effects of natural and manmade hazards and protecting lives, property, and other assets. Redwood County is considered a mutual aid county because they provide and receive support from neighboring counties. The following summary and description serves as an inventory of the response facilities for Redwood County. This Chapter profiles the emergency response capabilities of Redwood County. Facilities included in the profile include:

- Law Enforcement
- Public Health
- Ambulance Service
- Fire Department
- Medical Facilities
- Red Cross Shelter
- Sirens and other Emergency Notification Devices

4.8.2 Redwood County Emergency Management

The Redwood County Emergency Management Director administers the county-wide emergency management program in Redwood County. The Director coordinates the emergency management functions of county and city governmental units assigned to various emergency management responsibilities. The Director's duties also include the following:

- Coordinates response to actual disasters/emergencies.
- Maintains the Redwood County Emergency Operation Plan (EOP).
- Maintains an inventory and utilization record of county equipment secured through emergency management sources.
- Maintains liaison with county and state regional offices.
- Prepares informational materials for dissemination to the public and meets with interested groups to explain emergency management programs.

4.9 Profiling Emergency Response Capabilities

Emergency Operations Center

The Redwood County Emergency Management Office and the Emergency Operations Center (EOC) are located in the Sheriff's Office at the Law Enforcement Center in Redwood Falls.

4.9.1 Law Enforcement

In Redwood County, the Cities of Redwood Falls, Morgan, Lamberton, Walnut Grove, and the Lower Sioux Indian Community have an independent police department. The rest of the county is served by the Redwood County Sheriff's Office. The Sheriff's deputies patrol approximately 882 square miles, and contract police services to the cities of Belview, Clements, Delhi, Milroy, Lucan, Revere, Sanborn, Seaforth, Vesta, Wabasso, and Wanda. Redwood County Sheriff Deputies are affiliated with the Brown, Lyon, and Redwood Drug Task Force as Emergency Response Unit and Liaison members.

Redwood County Law Enforcement Center (LEC) is home to the Redwood County Sheriff's Office and also the Redwood County Jail/Dispatch Center, the Redwood County Emergency Manager, and the Minnesota State Patrol. The Redwood County Sheriff's Office currently has 13 sworn personnel serving the county. The patrol deputies provide law enforcement and other sheriff's services to the citizens of Redwood County.

Redwood County Sheriff's Office also operates a county jail system. The Redwood County jail is located in Redwood Falls, and is connected to the Redwood County Law Enforcement Center and adjacent to the Redwood County Courthouse. The jail operates 24 hours a day and 7 days a week. The designed maximum capacity for the facility is 21 beds. The Redwood County 911 Emergency Dispatch and Communications Center is comprised of 7 dispatchers who work 7 days a week, 24 hours a day, on a variety of shifts and are responsible for the dispatching of Law Enforcement, Fire, and EMS countywide. The Redwood County jail provides for the safe, secure, and humane detention of offenders in Redwood County.

Redwood Falls Police Department

The Redwood Falls Police Department's Mission is the protection of human life and property through vigorous prevention, investigation of criminal activity, and to maintain the highest quality of life for the community. Members of the Redwood Falls Police Department are committed to achieving this goal by executing their duties with honor, professionalism, and efficiency. The Redwood Falls Police Department is comprised of a Chief of Police, Assistant Chief of Police, 2 Patrol Sergeants, one School Resource Officer, 6 Patrol Officers and two administrative assistants. The Redwood Falls Police Department is housed in the Redwood County Law Enforcement Center (LEC). Emergency management for Redwood Falls is managed and controlled by the Police Chief of this department. The Chief works closely with the County Emergency Manager and is part of the Redwood County Emergency Management System.

Lamberton Police Department

The mission of the Lamberton Police Department is to protect and serve the community following the direction of the City Council. The Lamberton Police Department is comprised of one full-time officer. The Lamberton Police Department is assisted by the Redwood County Sheriff's Office as needed.

Morgan Police Department

The Mission of the Morgan Police Department is to protect and serve the community. The Morgan Police Department is comprised of two officers. The Morgan Police Department is assisted by the Redwood County Sheriff's Office as needed.

Walnut Grove Police Department

The mission of the Walnut Grove Police Department is to protect and serve the community. The Walnut Grove Police Department is comprised one officer. The Walnut Grove Police Department is assisted by the Redwood County Sheriff's Office as needed.

Lower Sioux Tribal Law Enforcement

The mission of the Lower Sioux Tribal Law Enforcement is to protect life & property and preserve the peace through proactive initiatives and methods that best serve the community. The adoption & implementation of the community oriented policing concept and initiatives to promote, encourage, partnerships with individuals, organizations, and entities to address and solve problems that contribute to the social ills that plague our communities. In the spirit of partnership, we will strive to provide the best professional service by maintaining the highest standards in the field of law enforcement to reflect the integrity of our community. The Lower Sioux Tribal Law Enforcement is comprised of a Chief of Police and seven officers. The Lower Sioux Police Department is assisted by the Redwood County Sheriff's Office as needed.

Law enforcement agencies in Redwood County are also supported by state and federal law enforcement agencies. Law enforcement can contact the MN Bureau of Criminal Apprehension (BCA) for felony crimes that have occurred in the county or for internal investigations. There are a number of other specialized law enforcement agencies that can provide assistance to Redwood County.

4.9.2 Public Health

Redwood County is part of the Southwest Health and Human Services (SWHHS) group. SWHHS provides services across six counties, serving Lincoln, Lyon, Murray, Pipestone, Redwood, and Rock Counties. Southwest Health and Human Services is a multi-county agency that is committed to strengthening individuals, families and communities by providing quality services in a respectful, caring and cost effective manner. SWHHS provides a number of services in regards to public health and welfare that include: social services, child support, financial assistance, and public health services.

- Social Services include: special needs adoption, adult and children's mental health, adult and child protection, chemical health, developmental disabilities, foster care, child care assistance, individuals with disabilities/chronic illness, licensing of foster and child care providers, family services, and senior services.
- Child support assisting in establishing parentage, establishing court orders for child support, enforcing those orders, providing medical, dental and child care support, collecting and processing payments.

- Financial assistance services that determine eligibility for services ranging from cash assistance, food support, health care and emergency assistance.
- Public Health Services that assure a strong public health system, promote healthy families and communities, prevent the spread of infectious disease, make environments safe and healthy, prepare for disasters and emergencies, and help all people get quality health services.

4.9.3 Medical Facilities

Medical facilities inventoried in Redwood County consist of one hospital, five medical clinics, six nursing homes, six assisted living facilities, and 7 chiropractic clinics.

Hospitals

The hospitals in Redwood County are the Carris Health/RedwoodHospital. Carris Health/RedwoodHospital is a privately owned, Level IV trauma center with 25- inpatient beds. The nearest Level III trauma center is located in Marshall; the nearest Level I hospitals are in Minneapolis-St. Paul.

Patients Redwood County are also transferred to hospitals in the region. Other hospitals in the region include: Sanford Tracy Medical Center, Renville County Hospital, Avera Marshall Regional Medical Center, New Ulm Medical Center, Avera McKennan Hospital, and Sanford USD Medical Center. The Sanford Tracy Medical Center is located in the City of Tracy, which is located in Lyon County, just west of Walnut Grove. The Renville County Hospital is level IV trauma center located Olivia (Renville County). The Avera Marshall Regional Medical Center is a Level III Trauma Center and is part of the Avera Health Network located in Marshall (Lyon County). The New Ulm Medical Center is located in New Ulm and is a Level IV Trauma Center. The Rice Memorial Hospital is located in Willmar and is a Level III Trauma Center. The Avera McKennan Hospital and Sanford USD Medical Center are located in Sioux Falls. Both of these hospitals are Level II Trauma Centers.

Clinics

There are five health clinics within Redwood County. The health clinics in Redwood County include: Sanford Tracy Walnut Grove Clinic in Walnut Grove, Mayo Clinic Health System in Lamberton, Avera Medical Group – Redwood Falls, Carris Health Redwood Falls, and Morgan Medical Clinic. In Redwood County only the Sanford Tracy Walnut Grove Clinic is classified as Medicare Certified Rural Health Clinics.¹³

Nursing Homes

There are six nursing homes in Redwood County. The nursing homes in Redwood County include: Gilmore Manor of Morgan, Good Samaritan – Redwood Falls, Parkview Home in Belview, Valley View Manor in Lamberton, Wabasso Rehab & HCC, and Wood Dale Home in Redwood Falls.

- Gilmore Manor is a 35 bed dual Medicare/Medicaid certified 24-hour skilled nursing home facility offering a wide range of services.

¹³ MN Department of health, Health Regulation – Facilities and Professions. Accessed 7/25/17. Available: <http://www.health.state.mn.us/divs/fpc/directory/showprovideroutput.cfm>

- Good Samaritan – Redwood Falls is a 43 bed rehabilitation and skilled care center that offers many services to the community. They are a dual Medicare/Medicaid non-profit skilled health care facility that provides 24-hour nursing care and 7 days per week rehabilitative services.
- Parkview Home is a city owned 30 bed dual Medicare/Medicaid certified 24-hour skilled nursing home facility offering a wide range of services.
- Valley View Manor is a 50 bed dual Medicare/Medicaid certified 24-hour skilled nursing home facility offering a wide range of services.
- Wabasso Rehab & HCC is a 44 bed dual Medicare/Medicaid certified 24-hour skilled nursing home facility offering a wide range of services.
- Wood Dale Home is a 40 bed dual Medicare/Medicaid certified 24-hour skilled nursing home facility offering a wide range of services.

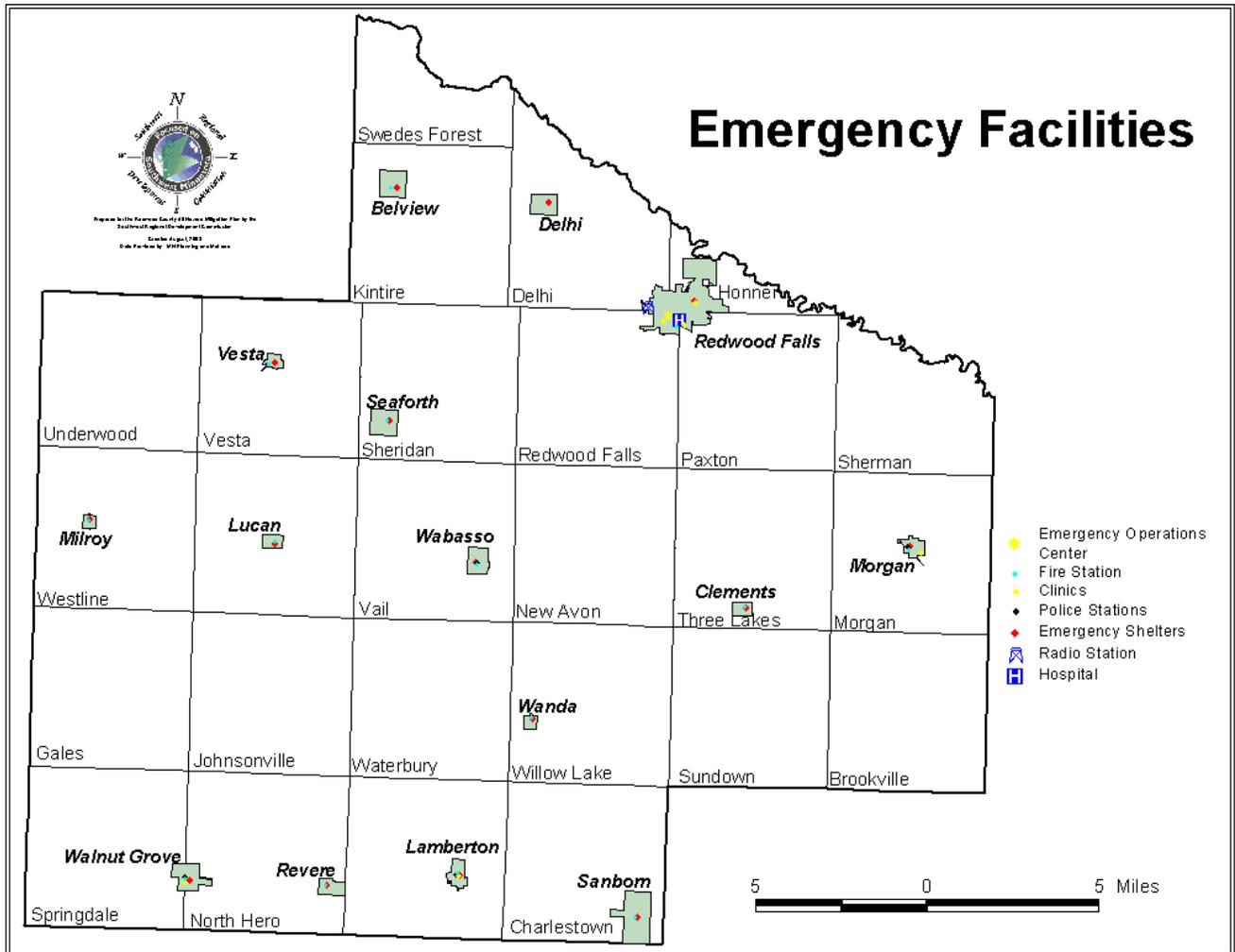
Assisted Living Facilities

There are six assisted living facilities in Redwood County. The assisted living facilities in Redwood County include: Country View Senior Community in Walnut Grove, Gil-Mor Haven in Morgan, Johnson Park Place, Seasons, Garnette Gardens in Redwood Falls, and Parkwood Apartments in Belview.

Chiropractic Clinics

There are 7 chiropractic clinics in Redwood County with most in Redwood Falls. The chiropractic clinics in Redwood County include: Red Rock Chiropractic Center in Lamberton, Fixen Chiropractic and Prairie Chiropractic in Wabasso, In-LINE Chiropractic in Morgan and Active Life Chiropractic, Chiro-Plus, and Redwood Chiropractic in Redwood Falls, There may be other Chiropractic Clinics, but they were not searchable online.

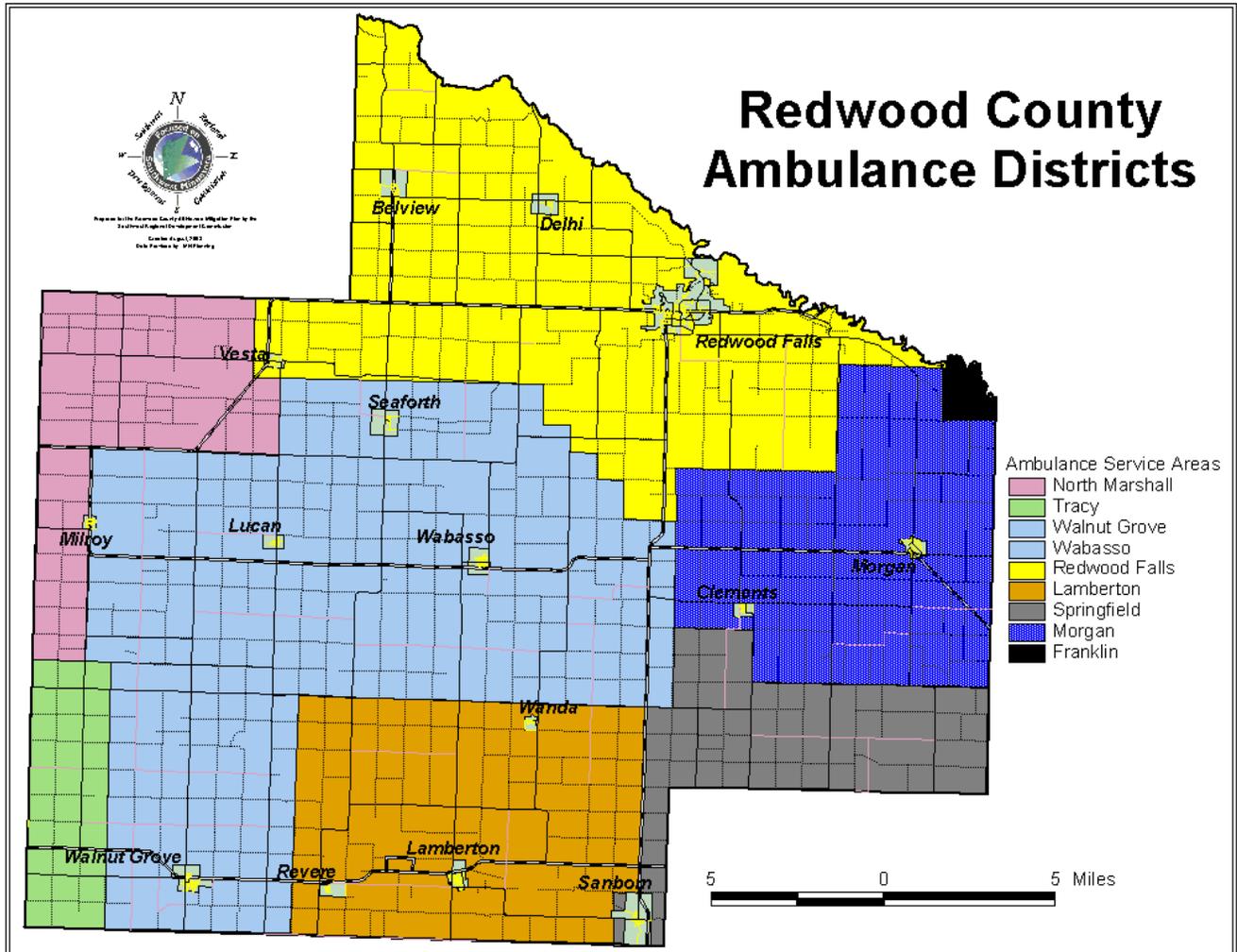
Figure #43
Emergency Facilities Redwood County



4.9.4 Ambulance Service

There are five primary Ambulance Districts in Redwood County. The primary Ambulance Districts include: Wabasso Ambulance District, Walnut Grove Ambulance District, Redwood Falls Ambulance District, Lambertson Ambulance District, and Morgan Ambulance District. Additional ambulances can be called from neighboring counties. Secondary Ambulance Districts include: Tracy Ambulance District, Springfield Ambulance District, Olivia Ambulance District, and Marshall Ambulance.

Figure #44
Ambulance Districts in Redwood County



North Memorial Ambulance Service (Redwood Falls – Marshall Region EMS)

The North Memorial Ambulance Service covers the Cities of Redwood Falls, Delhi, Vesta, and Belview as well as within a 25 mile radius to rural areas in Redwood County. North Memorial Ambulance Service is composed of 9 full-time and 11 part-time staff working 24 hours a day, seven days a week. The North Memorial Ambulance District went on approximately 2,030 calls in 2018. The North Memorial Ambulance Service does have mutual aid agreements with these neighboring ambulance services. The North Memorial Ambulance Service has 4 operational ambulances in Redwood Falls and is an Air Care location for helicopter patient transport.

Wabasso Ambulance Service (Wabasso EMS)

The Wabasso Ambulance Service covers the City of Wabasso, Seaforth, Lucan, Milroy, and Walnut Grove as well as surrounding rural areas. The Wabasso Ambulance Service is composed of 12 Emergency Medical Technicians (EMT). The Wabasso Ambulance Service went on 153 calls in 2013 and 164 calls in

2014. The Wabasso Ambulance Service does have mutual aid agreements with these neighboring ambulance services. The Wabasso Ambulance Service has one operational ambulance.

Walnut Grove Ambulance Service (Walnut Grove EMS)

The Walnut Grove Ambulance Service covers the City of Walnut Grove as well as surrounding rural areas in Lyon, Cottonwood, and Murray Counties. The Walnut Grove Ambulance Service is comprised of 11 Emergency Medical Technicians (EMT). The Walnut Grove Ambulance Service averages roughly 220 calls per year. The Walnut Grove Ambulance Service does have mutual aid agreements with these neighboring ambulance services. The Walnut Grove Ambulance Service has one operational ambulance.

Lamberton Ambulance Service (Lamberton EMS)

The Lamberton Ambulance Service covers the Cities of Lamberton, Revere, Wanda, as well as surrounding rural areas. The Lamberton Ambulance Service is comprised of eight Emergency Medical Technicians-B (EMT-B) and eight first responders (EMR). The Lamberton Ambulance Service averages roughly 135 calls per year. The Lamberton Ambulance Service does have mutual aid agreements with these neighboring ambulance services. The Lamberton Ambulance Service has one operational ambulance.

Morgan Ambulance Service (Morgan EMS)

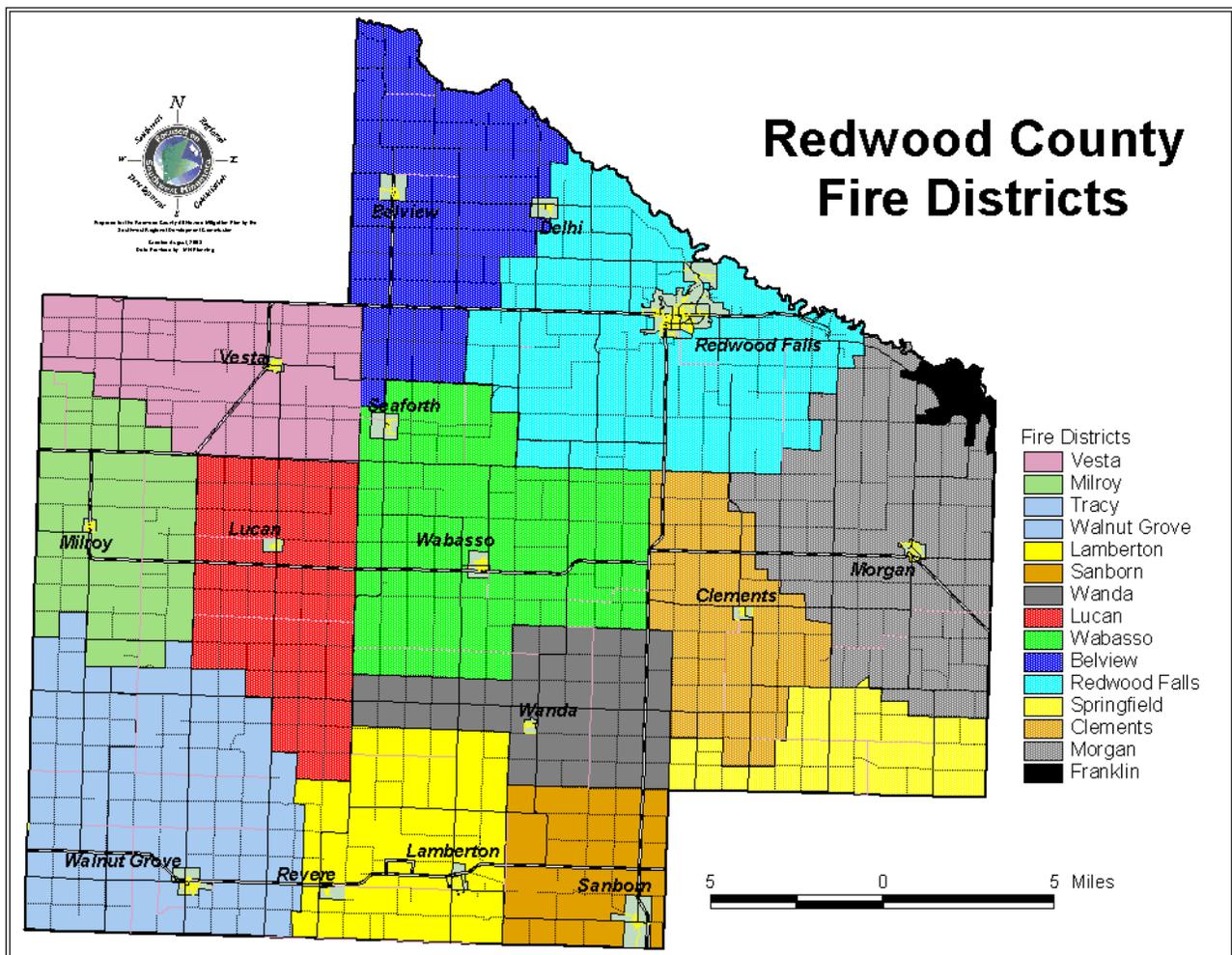
The Morgan Ambulance Service covers the Cities of Morgan and Clements, as well as surrounding rural areas. The Morgan Ambulance Service is comprised of 18 EMTs and six First Responders. The Morgan Ambulance Service went on 150 calls in 2013 and 150 calls in 2014. The Morgan Ambulance Service does have mutual aid agreements with these neighboring ambulance services. The Morgan Ambulance Service has 2 operational ambulances.

4.9.5 Fire/ Emergency Services

There are 14 primary fire districts in Redwood County. The primary fire districts include: Belview Fire District, Redwood Falls Fire District, Morgan Fire District, Clements Fire District, Wanda Fire District, Lambertson Fire District, Milroy Fire District, Lucan Fire District, Wabasso Fire District, Franklin Fire District, Walnut Grove Fire District, Seaforth Fire District, Sanborn Fire District, and Vesta Fire District. Secondary fire districts include: Springfield, Tracy, Morton, and all other neighboring fire districts.

There are no full time fire departments within Redwood County. All fire departments are volunteer based with responsibilities being divided between the fire districts. The ten districts allow for response times to be reduced, but since Redwood County is a rural county some areas are better served than other.

Figure #45
Fire Districts in Redwood County



4.9.6 Primary Fire Districts

Redwood Falls Fire Department (Redwood Falls Fire District)

The Redwood Falls Fire Department covers the City of Redwood Falls, and surrounding townships including Sheridan, Delhi, Redwood Falls, Paxton, and Honner. The Redwood Falls Fire Department consists of 30 volunteer fire fighters. The Redwood Falls Fire Department went on 40 calls in 2018. The Redwood Falls Fire Department does have mutual aid agreements with all the fire departments in Redwood County.

Morgan Fire Department (Morgan Fire District)

The Morgan Fire Department service covers the City of Morgan and surrounding townships including Sherman, Paxton, Morton, Three Lakes, Sundown, and Brookville. The Morgan Fire Department consists of 24 volunteer fire fighters. The Morgan Fire Department went out on 22 calls in 2018. The Morgan Fire Department does have mutual aid agreements with all the fire departments in Redwood County.

Lamberton Fire Department (Lamberton Fire District)

The Lamberton Fire Department covers the Cities of Lamberton and Revere, and surrounding townships including Lamberton, Charlestown, North Hero, Johnsonville, Waterbury, Willow Lake, and Vail. The Lamberton FD consists of 20 volunteer fire fighters, having had approximately 18 calls in 2018. The Lamberton Fire Department has mutual aid agreements with all the fire departments in Redwood County.

Belview Fire Department (Belview Fire District)

The Belview Fire Department covers the Cities of Belview and Delhi as well as Swedes Forest, Kintire, Delhi, Sheridan, and Vesta Townships. The Belview Fire Department consists of 18 volunteer fire fighters. The Belview Fire Department went on 15 calls in 2018. The Belview Fire Department does have mutual aid agreements with every fire department in the county.

Wanda Fire Department (Wanda Fire District)

The Wanda Fire Department covers the City of Wanda and surrounding townships including Willow Lake, Waterbury, Vail, and New Avon. The Wanda Fire Department consists of 18 volunteer fire fighters. The Wanda Fire Department went on 5 calls in 2018. The Wanda Fire Department has mutual aid agreements with all the fire departments in Redwood County.

Wabasso Fire Department (Wabasso Fire District)

The Wabasso Fire Department covers the City of Wabasso and New Avon, Vail, Sheridan, and Waterbury Townships. The Wabasso Fire Department consists of 22 volunteer fire fighters. The Wabasso Fire Department went on approximately 15 calls in 2018. The Wabasso Fire Department has mutual aid agreements with all fire departments in Redwood County.

Seaforth Fire Department (Seaforth Fire District)

The Seaforth Fire Department covers the city of Seaforth. The Seaforth Fire Department consists of 13 volunteer fire fighters. The Seaforth Fire Department went on 2 calls in 2018. The Seaforth Fire Department has mutual aid agreements with neighboring fire departments, including all Redwood County Fire Departments.

Sanborn Fire Department (Sanborn Fire District)

The Sanborn Fire Department covers the city of Sanborn, part of the Charlestown Township, Willow Lake, Sundown in Redwood County. The Sanborn Fire Department consists of 20 volunteer fire fighters. The Sanborn Fire Department went on 15 calls in 2018. The Sanborn Fire Department does have written mutual aid agreements with all fire departments in Redwood County

Clements Fire Department (Clements Fire District)

The Clements Fire Department covers the City of Clements and surrounding townships including Three Lakes, Sundown, New Avon, and Willow Lake. The Clements Fire Department consists of 20 volunteer fire fighters. The Clements Fire Department went on approximately 8 calls in 2018, The Clements Fire Department does have mutual aid agreements with all fire departments in Redwood County.

Walnut Grove Fire Department (Walnut Grove Fire District)

The Walnut Grove Fire Department covers the City of Walnut Grove and North Hero, Springdale, Gales, and Johnsonville Townships. The Walnut Grove Fire Department consists of 25 volunteer fire fighters. The Walnut Grove Fire Department went on approximately 21 calls in 2018, The Walnut Grove Fire Department has mutual aid agreements with all Redwood County Fire Departments.

Milroy Fire Department (Milroy Fire District)

The Milroy Fire Department covers the westerly part redwood County which includes the city of Milroy and townships of Underwood and Gales, Westline and Granite Rock. The Milroy Fire Department consists of 21 volunteer fire fighters. The Milroy Fire Department went on 8 calls in 2018. The Milroy Fire Department does not have written mutual aid agreements with all fire departments in Redwood County

Lucan Fire Department (Lucan Fire District)

The Lucan Fire Department covers the City of Lucan as well as Granite Rock, Vail, and Johnsonville Townships. The Lucan Fire Department consists of 24 volunteer fire fighters. The Lucan Fire Department went on approximately 7 calls in 2018. The Lucan Fire Department has mutual aid agreements with all Redwood County Fire Departments.

Vesta Fire Department (Vesta Fire District)

The Vesta Fire Department covers the City of Vesta and Vesta and Sheridan Townships. The Vesta Fire Department consists of 18 volunteer fire fighters. The Vesta Fire Department went on approximately 8 calls in 2018. The Vesta Fire Department has mutual aid agreements with all Redwood County Fire Departments.

4.9.7 Secondary Fire Districts

Tracy Fire Department (Tracy Fire District)

The Tracy Fire Department covers the City of Tracy and the surrounding townships in Redwood County including: Springdale. The Tracy Fire Department consists of 26 volunteer fire fighters. The Tracy Fire Department went on approximately 167 calls in 2013 and 2014. The Tracy Fire Department does have mutual aid agreements with neighboring fire departments, including: all fire departments in Redwood County

Springfield Fire Department (Springfield Fire District)

The Springfield Fire Department covers the City of Springfield and Brookfield and Sundown Townships in the Redwood County. The Springfield Fire Department consists of 17 volunteer fire fighters. The Springfield Fire Department went on 20 calls in 2018. The Springfield Fire Department does have written mutual aid agreements with neighboring fire departments

Morton Fire Department (Morton Fire District)

The Morton Fire Department covers the City of Morton and Paxton Township in Redwood County. The Morton Fire Department consists of 17 volunteer fire fighters. The Morton Fire Department went on 11 calls in 2018. The Morton Fire Department does have written mutual aid agreements with neighboring fire departments.

4.9.10 Red Cross Shelters

American Red Cross Southwest Minnesota Chapter serves communities across Yellow Medicine, Lincoln, Lyon, Redwood, Renville, McLeod, Sibley, Nicollet, Blue Earth, Watonwan, Brown, Cottonwood, Murray, Pipestone, Rock, Nobles, Lyon, Martin and Faribault counties, covering the nine counties in Southwest Minnesota. There are four shelter trailers; one is in Redwood Falls, one is in Marshall, one is in Worthington and one is in Pipestone. The American Red Cross Southwest Minnesota Chapter is an Emergency Support Function (ESF) #6 and #15.

ESF #6 is responsible for Mass Care, Emergency Assistance, Housing, and Human Services. ESF #6 coordinates the delivery of federal mass care, emergency assistance, housing, and human services when local, tribal, and state response and recovery needs exceed their capabilities.¹⁴

- *Mass Care* - Includes sheltering, feeding operations, emergency first aid, bulk distribution of emergency items, and collecting and providing information on victims to family members.
- *Emergency Assistance*: Assistance required by individuals, families, and their communities to ensure that immediate needs beyond the scope of the traditional “mass care” services provided at the local level are addressed. These services include: support to evacuations (including registration and tracking of evacuees); reunification of families; provision of aid and services to special needs populations; evacuation, sheltering, and other emergency services for household pets and service animals; support to specialized shelters; support to medical shelters; nonconventional shelter management; coordination of donated goods and services; and coordination of voluntary agency assistance.
- *Housing* - Includes housing options such as rental assistance, repair, loan assistance, replacement, factory-built housing, semi-permanent and permanent construction, referrals, identification and provision of accessible housing, and access to other sources of housing assistance. This assistance is guided by the National Disaster Housing Strategy.
- *Human Services* - Includes the implementation of disaster assistance programs to help disaster victims recover their non-housing losses, including programs to replace destroyed personal property, and help to obtain disaster loans, food stamps, crisis counseling, disaster unemployment, disaster legal services, support and services for special needs populations, and other Federal and State benefits.

¹⁴ FEMA. Accessed: 4/16/14. Available: <http://www.fema.gov/pdf/emergency/nrf/nrf-esf-06.pdf>

Emergency Support Function (ESF) #15 ensures that sufficient federal assets are deployed to the field during incidents requiring a coordinated federal response to provide accurate, coordinated, timely, and accessible information to affected audiences, including governments, media, the private sector, and the local populace, including the special needs population. ESF #15 provides the resource support and mechanisms to implement the National Response Framework (NRF) Incident Communications Emergency Policy and Procedures (ICEPP) described in the Public Affairs Support Annex.¹⁵

¹⁵ FEMA. Accessed: 4/16/14. Available: <https://www.hSDL.org/?view&did=483049>

4.9.11 Sirens and other Emergency Notification Devices

Outdoor warning sirens provide coverage in cities and other more densely populated areas within Redwood County. The emergency sirens can be activated by the Redwood County Dispatchers or city officials to warn residents in the event of severe weather. Redwood County is a rural county, so large portions of the county are outside the range of severe weather warning sirens. Refer to Figure #87 for outdoor warning siren coverage and needs in Redwood County.

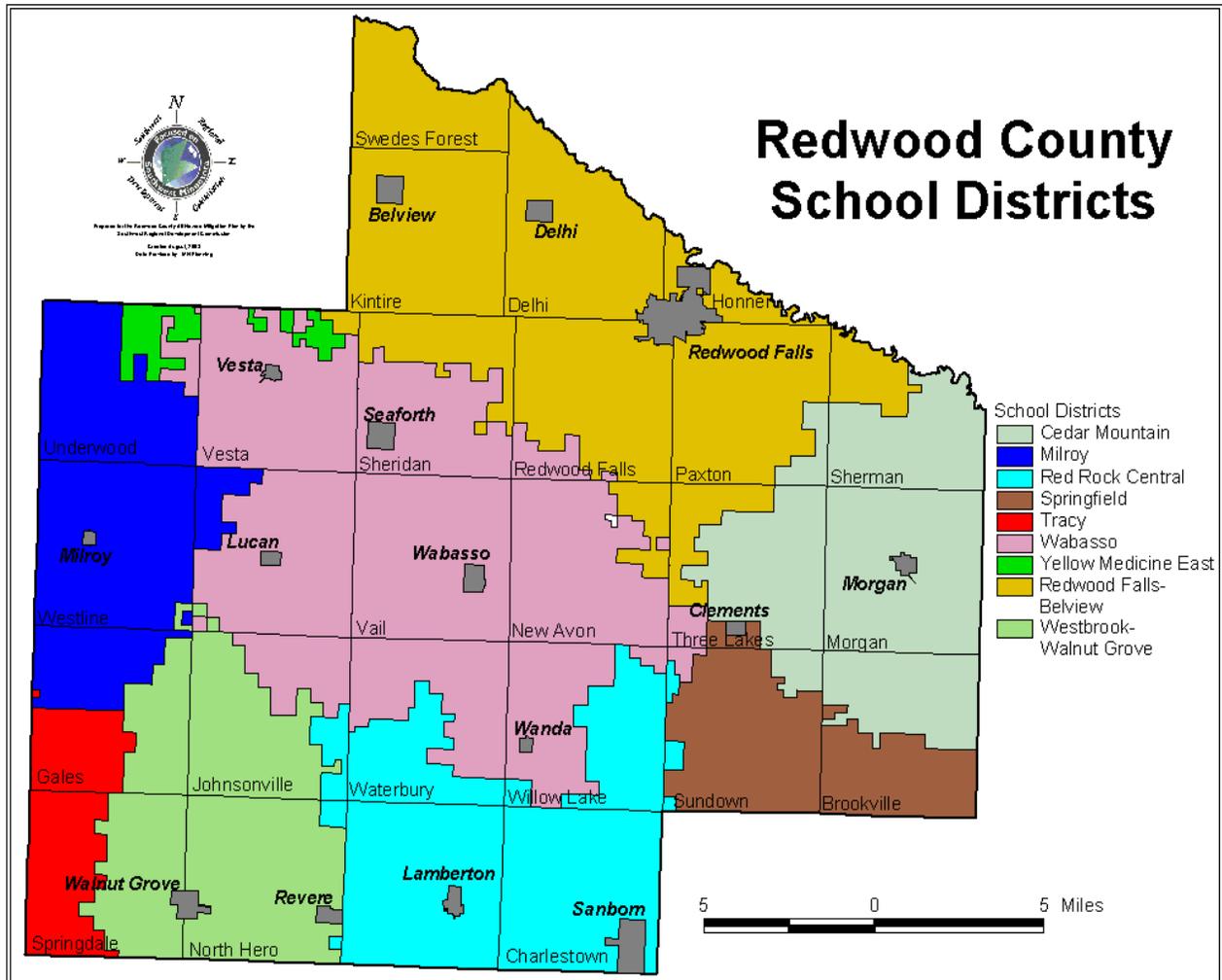
Since Redwood County is a rural county, additional measures are in place to expand the notification system. Emergency warnings over the radio are still an effective medium to reach wide audiences. NOAA Weather Radio All Hazards (NWR) is a nationwide network of radio stations broadcasting continuous weather information directly from the nearest National Weather Service office. NWR broadcasts official Weather Service warnings, watches, forecasts and other hazard information 24 hours a day, 7 days a week. Working with the Federal Communication Commission's (FCC) Emergency Alert System, NWR is an "All Hazards" radio network, making it the single source for comprehensive weather and emergency information. Redwood County is covered by Sioux Falls Weather Service by KXI50 Russell at 162.500 (1000 watts) and KXI31 Jeffers at 162.45 MHz (1000 watts), and by Twin Cities Chanhassen by KX139 New Ulm at 162.525 (1000 watts) and WNG711 Olivia at 162.400 (300 watts). Redwood County's Specific Alert Message Encoding (SAME) code is 027127.

FEMA is working to develop the Integrated Public Alert and Warning System (IPAWS) as the next-generation alert and warning network. IPAWS will expand on the Emergency Alert System (EAS) by adding new technologies to traditional audio-only radio and television alerts, including cell phone, residential phone, Internet and the capability to broadcast one message over more media to more people before, during and after a disaster.

Redwood County selected CodeRed Community Notification System as their emergency response system. CodeRED is an emergency notification service that allows emergency officials to notify residents and businesses by telephone, cell phone, text message, email and social media regarding time-sensitive general and emergency notifications.

Nine public school districts serve Redwood County, five of which have facilities inside the county—Cedar Mountain (Morgan), Redwood Area, Red Rock Central (Lamberton), Westbrook-Walnut Grove, and Wabasso. There is a public charter school at Milroy, and private elementary/middle schools at Morgan, Redwood Falls and Wabasso. The South West / West Central Service Cooperative hosts special education services for students K-12 at the Belview Learning Center.

Figure #46
School Districts in Redwood County



The Red Rock Central and Redwood Area Public Schools have a mass notification system covering a wide variety of devices including text messages and emails, currently closings and other weather related announcements are done through local radio and news stations. Cedar Mountain, Wabasso, and Westbrook-Walnut Grove Public Schools' have a mass instant alert system which includes text, email and voice mail.

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Section 5 – Risk Assessment

The goal of mitigation is to reduce the future impacts of a hazard including loss of life, property damage, disruption to local and regional economies, and the expenditure of public and private funds for recovery. Sound mitigation practices must be based on sound risk assessment. A risk assessment involves quantifying the potential loss resulting from a disaster by assessing the vulnerability of buildings, infrastructure, and people.

Basing risk assessments on the best information available is important in developing effective mitigation actions that benefit communities. Geographic Information System (GIS) tools are not only helpful in producing maps, but they also show structures at risk and may determine damage estimates for potential hazard scenarios. MN Homeland Security and Emergency Management (HSEM) mitigation staff encourages the use of GIS tools in risk assessments because they produce good information to be used in the risk assessment process. In recognition of the importance of planning in mitigation activities, FEMA created **Hazards USA Multi-Hazard (Hazus-MH)**, a powerful GIS-based disaster risk assessment tool. This tool enables communities to predict estimated losses from floods, hurricanes and other related phenomena and to measure the impact of various mitigation practices that might help reduce those losses. Hazus-MH was used by University of Minnesota Duluth Geospatial Analysis Center staff in the flood hazard risk assessment.

This assessment identifies the characteristics and potential consequences of a disaster, how much of the community could be affected by a disaster, and the impact on community assets. A risk assessment consists of 3 components — hazard identification, risk profile, and vulnerability profile. The last step is the risk ranking for each jurisdiction.

5.1 Hazard Identification/Profile

5.1.1 Hazard Identification

The cornerstone of the risk assessment is identification of the hazards that affect jurisdictions. To facilitate the planning process, several sources were employed to ensure that the natural hazards are identified prior to assessment.

The County maintenance of the plan includes continual updates of the hazards identified in the initial plan. The mitigation planning team decided to compare the hazards in the initial plan to the current publications to determine if new hazards should be considered or if some should be deleted.

Natural hazards are identified in the FEMA publication “Multi-Hazard Identification and Risk Assessment – A Cornerstone of the National Mitigation Strategy” also known as MHIRA. FEMA Region V developed a list based on state mitigation plans in the region. The list was divided into natural (Figure #47) and other hazards (Figure #48) as was done in the 2014 Minnesota State Hazard Mitigation Plan.

Figure #47

FEMA MHIRA Natural Hazards in the 2014 Minnesota State Hazard Mitigation Plan

Flooding	Hail	Drought
Dam/Levee Failure	Lightning	Extreme Heat
Wildfire*	Winter Storms	Extreme Cold
Windstorms	Erosion	Earthquakes
Tornadoes	Land Subsidence (Sinkholes & Karst)	

**Addressed in the State Mitigation Plan because Minnesota is a heavily forested state compared to other states in Region V.*

For the purpose of this plan, FEMA defines other hazards or “man-made hazards” as technological hazards and terrorism. These are distinct from natural hazards primarily in that they originate from human activity. In contrast, while the risks presented by natural hazards may be increased or decreased as a result of human activity, they are not inherently human-induced. The term “technological hazards” refers to the origins of incidents that can arise from human activities such as the manufacture, transportation, storage, and use of hazardous materials. For the sake of simplicity, this guide assumes that technological emergencies are accidental and that their consequences are unintended. The term “terrorism” refers to intentional, criminal, and malicious acts. There is no single, universally accepted definition of terrorism, and it can be interpreted in many ways. For the purposes of this plan, FEMA refers to “terrorism” as the use of Weapons of Mass Destruction (WMD), including biological, chemical, nuclear, and radiological weapons; arson, incendiary, explosive, and armed attacks; industrial sabotage and intentional hazardous materials releases; and “cyber terrorism.”

Figure #48
FEMA MHIRA Other Hazards in the 2014 Minnesota State Hazard Mitigation Plan

Terrorism	Nuclear Generating Plant Incidents	Ground and Surface Water Supply Contamination*
Infectious Disease Outbreak	Hazardous Materials Incidents	Transportation Incidents
Fires (Structures and Vehicles)		

**Addressed in the State Hazard Mitigation Plan because Minnesota has made a high investment in its prized resource, water.*

5.1.2 Vulnerability Assessment by Jurisdiction

The planning team met multiple times to review and update the hazards faced by residents of Redwood County, update the existing mitigation actions published in the 2012 All Hazard Mitigation Plan, and propose new mitigation actions.

To engage in this process the planning team drew on a number of data sources. First, the planning team examined the hazards identified in the 2012 Redwood County All Hazard Mitigation Plan (Figure #48). The existing mitigation actions were discussed and adjusted to reflect the definitions of natural hazards used in the State of Minnesota 2014 Multi-Hazard Identification and Risk Assessment list of natural hazards. This was done in order to assure that the risks faced by Redwood County were categorized the same way as the priority hazards established by the State of Minnesota.

Figure #48
Hazards identified in the 2012 Redwood County All Hazard Mitigation Plan

Natural Hazards		Technological Hazards
Blizzards & Winter Storms	Lightening	Public Health & Infectious Disease
Floods	Hail	Dam Failure
Drought	Tornado & Straight Line Winds	Structure and Vehicle Fires
Wildfires	Extreme Heat	Hazardous Materials
Land Subsidence (landslide)	Earthquake	Transportation Accidents
Agricultural Disease	Water Supply Contamination	Civil Unrest & Terrorism

While the AHMP mainly deals with natural hazards, this planning took place with the understanding that many non-natural hazards could occur as a result of natural disasters (i.e. disruption in electrical service due to freezing rain causing problems for both utility corporations and vulnerable populations dependent on electricity for heat).

This plan draws on a variety of data sources including the State of Minnesota and Homeland Security Emergency Management Critical Infrastructure Strategy for the State of Minnesota (2010), FEMA’s Local Mitigation Planning How-to Guide Integrating Manmade Hazards into Mitigation Planning (2003), and the State of Minnesota All Hazards Identification Risk Assessment.

Based on the planning team’s comparison of these two sets of hazards, the planning team developed a list of hazards faced by Redwood County to address in the 2019 plan update (Figure #49).

Figure #49
Hazards Included in the 2019 Redwood County All Hazard Mitigation Plan

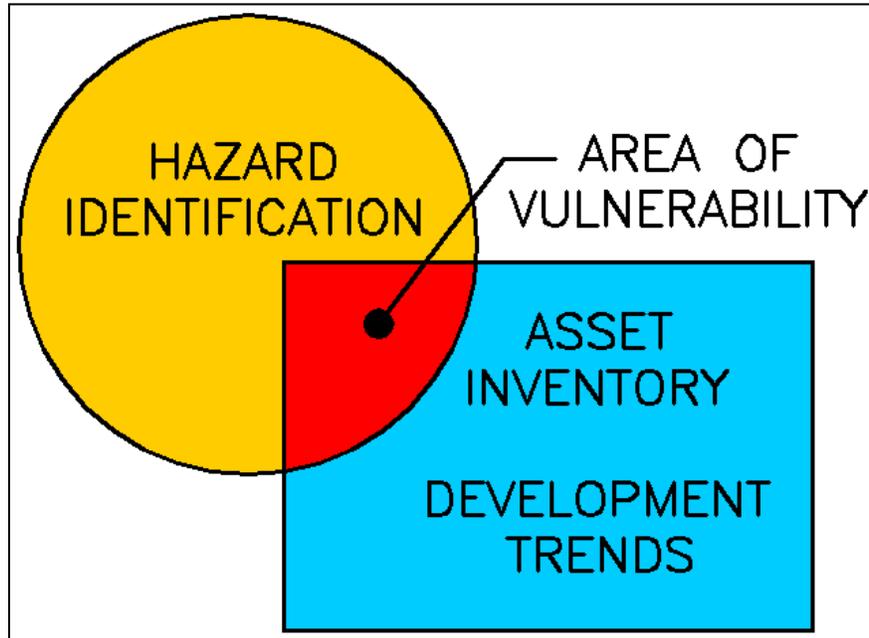
Natural Hazards		
Flooding	Severe Summer Storms (Tornadoes, Windstorms, and Hail)	Severe Winter Storms
Wildfire	Extreme Heat	Extreme Cold
Drought	Subsidence / Landslide	
Other Hazards		
Transportation Infrastructure	Public Health Emergencies	Dam Failure
Civil Disturbance	Hazardous Materials	Utility Failure
Water Supply Contamination		

The committee drew on the 2018 Redwood County Calculated Priority Risk Index, or CPRI, rankings to prioritize each hazard for inclusion in the plan. The methodology of the CPRI is outlined below.

5.1.3 Calculated Priority Risk Index

The vulnerability assessment builds upon the previously developed hazard information by identifying the community assets and development trends and intersecting them with the hazard profiles to assess the potential amount of damage that could be caused by each hazard event. This concept is generally illustrated in Figure #50. A summary of Calculated Priority Risk Index (CPRI) Categories and Risk Levels is shown in Figure #51.

Figure #50
Conceptual Depiction of a Vulnerability Analysis



Definitions of CPRI Categories in Figure #51

Probability – a guide to predict how often a random event will occur. Annual probabilities are expressed between 0.001 or less (low) up to 1 (high). An annual probability of 1 predicts that a natural hazard will occur at least once per year.

Magnitude/Severity – indicates the impact to a community through potential fatalities, injuries, property losses, and/or losses of services. The vulnerability assessment gives information that is helpful in making this determination for each community.

Warning Time – plays a factor in the ability to prepare for a potential disaster and to warn the public. The assumption is that more warning time allows for more emergency preparations and public information.

Duration – relates to the span of time local, state, and/or federal assistance will be necessary to prepare, respond, and recover from a potential disaster event.

Figure #51: Summary of Calculated Priority Risk Index (CPRI) Categories and Risk Levels

CPRI Category	DEGREE OF RISK			Assigned Weighting Factor
	Level ID	Description	Index Value	
Probability	Unlikely	Extremely rare with no documented history of occurrences or events. Annual probability of less than 0.001	1	45%
	Possible	Rare occurrences with at least one documented or anecdotal historic event. Annual probability that is between 0.01 and 0.001.	2	
	Likely	Occasional occurrences with at least two or more documented historic events. Annual probability that is between 0.1 and 0.01.	3	
	Highly Likely	Frequent events with a well-documented history of occurrence. Annual probability that is greater than 0.1.	4	
Magnitude/ Severity	Negligible	Negligible property damages (less than 5% of critical and non-critical facilities and infrastructure). Injuries or illnesses are treatable with first aid and there are no deaths. Negligible quality of life lost. Shutdown of critical facilities for less than 24 hours.	1	30%
	Limited	Slight property damages (greater than 5% and less than 25% of critical and non-critical facilities and infrastructure). Injuries or illnesses do not result in permanent disability and there are no deaths. Moderate quality of life lost. Shut down of critical facilities for more than 1 day and less than 1 week.	2	
	Critical	Moderate property damages (greater than 25% and less than 50% of critical and non-critical facilities and infrastructure). Injuries or illnesses result in permanent disability and at least one death. Shut down of critical facilities for more than 1 week and less than 1 month.	3	
	Catastrophic	Severe property damages (greater than 50% of critical and non-critical facilities and infrastructure). Injuries or illnesses result in permanent disability and multiple deaths. Shut down of critical facilities for 1+ months.	4	
Warning Time	Less than 6 hours	Self-explanatory.	4	15%
	6 to 12 hours	Self-explanatory.	3	
	12 to 24 hours	Self-explanatory.	2	
	More than 24 hours	Self-explanatory.	1	
Duration	Less than 6 hours	Self-explanatory.	1	10%
	Less than 24 hours	Self-explanatory.	2	
	Less than one week	Self-explanatory.	3	
	More than one week	Self-explanatory	4	

The prioritized list of hazards is presented in Figure #52 and is based on the ranking of hazards in the 2018 Redwood County CPRI.

Figure #52
Priorities of Risks Faced by Redwood County

Hazard	Probability	Magnitude/ Severity	Warning Time	Duration	Risk Index	Risk Severity
Tornado	2.50	2.81	3.62	2.85	2.79	Medium
Winter Storm	3.38	2.12	2.50	2.60	2.79	Medium
Flash Flood	2.92	2.04	3.04	2.54	2.64	Medium
Windstorm	2.92	2.19	2.81	2.40	2.63	Medium
Hail	3.00	1.65	3.12	1.85	2.50	Medium
Lightning	2.73	1.38	3.08	1.83	2.29	Medium
Flood (Riverine)	2.48	1.67	2.41	2.73	2.25	Medium
Extreme Cold	2.73	1.81	1.42	2.35	2.22	Medium
Extreme Heat	2.38	1.69	1.35	2.31	2.01	Medium
Erosion	2.12	1.62	1.96	2.20	1.95	Low
Drought	2.04	1.62	1.62	3.00	1.94	Low
Landslide/Mudslide	1.38	1.50	2.36	1.84	1.61	Low
Wildfire	1.35	1.46	2.19	1.92	1.57	Low
Subsidence	1.42	1.32	2.13	1.88	1.54	Low
Dam Failure	1.19	1.42	1.80	1.92	1.43	Low
Earthquake	0.85	1.46	2.23	1.52	1.31	Low

Hazard Profiling Concept of Planning

The risk assessments identify the characteristics and potential consequences of a disaster, how much of the community could be affected by a disaster, and the impact on community assets. A risk assessment consists of 3 components—hazard identification, risk profile, and vulnerability profile. The last step is the risk ranking for each jurisdiction.

5.1.4 GIS and Hazus-MH

The risk analysis step in this assessment quantifies the risk to the population, infrastructure, and economy of the community. Hazards that can be geographically identified (wildland fires, windstorms, tornadoes, hail, floods) were mapped.

Hazus-MH was used to estimate the damages incurred for a 100-year flood event and for general asset assessment. Hazus-MH also generates a combination of site-specific and aggregated loss estimates for the entire county due to a 100-year flood event. Aggregate inventory loss estimates, which include building stock analyses, are based upon the assumption that building stock is evenly distributed across each census block. Therefore, it is possible that overestimates of damage will occur in some parts of areas while underestimates will occur in other areas. With this in mind, total loss estimates tend to be more reliable over larger geographic areas (groups of many blocks) than for individual census blocks. It is important to note that Hazus-MH is not intended to be a substitute for detailed engineering studies. Rather, it is intended to serve as a planning aid for communities interested in assessing their risk to flood-, earthquake-, and hurricane-related hazards. This documentation does not provide full details on the processes and procedures completed in the development of this project. It is only intended to highlight the major steps that were followed during the project.

Site-specific analysis is based upon loss estimations for individual structures. For flooding, analysis of site-specific structures takes into account the depth of water in relation to the structure. Hazus-MH also takes into account the actual dollar exposure to the structure for the costs of building reconstruction, content, and inventory. However, damages are based upon the assumption that each structure will fall into a structural class, and structures in each class will respond in a similar fashion to a specific depth of flooding. Site-specific analysis is also based upon a point location rather than a polygon, therefore the model does not account for the percentage of a building that is inundated. These assumptions suggest that the loss estimates for site-specific structures as well as for aggregate structural losses need to be viewed as approximations of losses that are subject to considerable variability rather than as exact engineering estimates of losses to individual structures.

5.1.5 National Climatic Data Center (NCDC) Records (NOAA)

Historical storm event data was compiled from the National Climatic Data Center (NCDC). NCDC records are estimates of damage reported to the National Weather Service (NWS) from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to given weather events.

The NCDC data included 309 reported days with events in Redwood County between 1956 and July of 2017.¹⁶ However, some weather event categories only had available data going back as recent as 1996. No records before 1956 were available. A summary table of events related to each hazard type is included in the hazard profile sections that follow. A full table listing all events, including additional details, is included in Appendix B. NCDC hazard categories used in this plan are listed in Figure #53.

Figure #53
National Climatic Data Center Historical Hazards

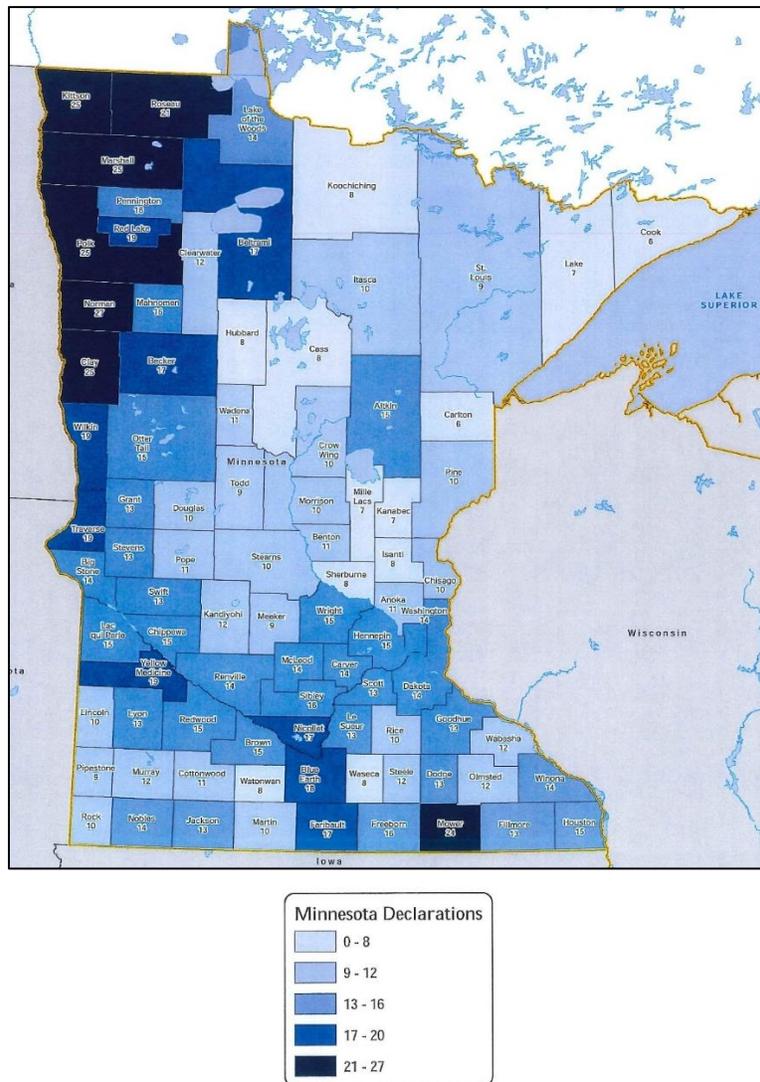
Hazards	
Tornado	Hail Storm
Thunderstorm Wind	Flood/Flash Flood
Severe Snow Events	Ice Storms
Extreme Cold/Wind Chill	Excessive Heat
Wildfire	Drought

¹⁶ NOAA, Storms Events Database. Accessed 7/26/17 Available:
https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=ALL&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=06&endDate_dd=30&endDate_yyyy=2017&county=REDWOOD%3A127&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=27%2CMINNESOTA

5.1.6 FEMA Declared Disasters

There are many natural and other hazards that put Minnesota at risk. A “major disaster” is an event which the President of the United States determines warrants federal aid to supplement state and local recovery efforts. According to FEMA, the state of Minnesota was included in Presidential Disaster Declarations 60 times between 1953 and 2016, of which 25 involved flooding.¹⁷

Figure #54
FEMA-Declared Disasters in Minnesota (1953-2016)



In Redwood County, twelve FEMA disaster declarations have been made between 1965 and 2014. Figure #55 and Figure #56 show the details of the disasters including payments for Public Assistance (PA) and Individual Assistance (IA), listed under the flooding and severe storms profiles. No declarations were

¹⁷ FEMA Data Visualization: Disaster Declarations for States and Counties. Accessed 7/27/17. Available: <https://www.fema.gov/data-visualization-disaster-declarations-states-and-counties>

made for the other storms listed in the NCDL database. Reviewing the federal payments for damages from the declared disasters is a way of correlating the impact from the NCDL report.

Figure #55: FEMA-Declared Major Disasters in Redwood County (1965-2016)

Incident	Declaration Date and Disaster Number	Incident Period	Total PA Obligated by FEMA for Disaster in Minnesota	Total PA Obligated by FEMA for Disaster in Redwood County	Individual Assistance in Minnesota	Individual Assistance in Redwood County
Severe Storms, Straight-Line Winds, Flooding, Landslides, And Mudslides	DR-4182 7/21/2014	6/11/2014- 7/11/2014	\$41,013,710	\$519,946	No	No
Severe Storms, Flooding, And Tornadoes	DR-4009 7/28/2011	7/1/2011- 7/11/2011	\$11,519,032	\$490,706.62	No	No
Severe Storms, Flooding	DR-1982 5/10/2011	3/16/2011- 5/25/2011	\$20,790,850	\$293,907	No	No
Severe Storms And Flooding	DR-1941 10/13/2010	9/22/2010- 10/14/2010	\$25,963,422	\$214,600	No	No
Flooding	DR-1900 4/19/2010	3/1/2010- 4/26/2010	\$12,721,045	\$191,634	No	No
Flooding, Severe Winter Storms, Flooding, And Tornadoes	DR-1370 5/16/2001	3/23/2001- 7/3/2001	\$34,907,042	\$332,791	\$3,650,492	Unknown
Flooding, Severe Flooding, High Winds, Severe Storms	DR-1175 4/8/1997	3/21/1997- 5/24/1997	\$230,488,750	Unknown	Unknown	Unknown
Severe Winter Storms	DR-1158 1/16/1997	1/3/1997 – 2/3/1997	Unknown	Unknown	No	No
Severe Storms, Tornadoes & Flooding	DR-993 6/11/1993	5/6/1933 – 8/25/1993	Unknown	Unknown	Yes \$ Unknown	Unknown
Severe Storms, Tornadoes & Flooding	DR-946 6/26/1992	6/16/1992- 6/20/1992	Unknown	Unknown	Yes \$ Unknown	Unknown
Flooding	DR-255 4/18/1969	4/18/1969	Unknown	Yes \$ Unknown	Unknown	Yes \$ Unknown
Flooding	DR-188 4/11/1965	4/11/1965	Unknown	Yes \$ Unknown	Unknown	Yes \$ Unknown

Data provided by FEMA: <https://www.fema.gov/media-library/assets/documents/28318> accessed on July 26, 2017. Values are estimates collected at the time of the disaster.

Figure #56: FEMA-Declared Emergencies in Redwood County (1976-2016)

Incident	Declaration Date and Disaster Number	Incident Period	Individual Assistance in Minnesota	Public Assistance (all affected areas)
Flooding	EM-3310 3/19/2010	3/1/2010- 4/26/2010	No	Yes \$ Unknown
Hurricane Katrina Evacuation	09/13/2005 EM-3242	08/29/2005 to 10/1/2005	No	\$2,391,613
Drought	06/17/1976 EM-3013	06/17/1976	No	Yes \$ Unknown

Note the Public Assistance totals are estimates collected at the time of the disaster. Data provided by FEMA: <https://www.fema.gov/media-library/assets/documents/28318> and <https://www.fema.gov/media-library/assets/documents/28344> Accessed on July 26, 2017.

Figure #57 depicts the historical projects in Redwood County resulting from hazard mitigation funding.

Figure #57: Historical Hazard Mitigation Funding in Redwood County

Year	Project Description	Sub-Grantee	Federal Share
1997	Living Snow fence: Planting of trees and grasses. These will intercept blowing snow.	Redwood soil and Water Conservation District	\$9,101
1997	Living Snow fence: Planting of trees and grasses. These will intercept blowing snow.	Minnesota Department of Transportation-District-7	\$247,952
2002	Redwood Electric Cooperative - Line Replacement	Redwood Electric Cooperative	\$648,244
2007	Redwood County All Hazard Mitigation Plan Update	Southwest Regional Development Commission	\$18,740
2007	Balsa Avenue, 0.25 miles north of Junction with 305th Street in Underwood Township. Recondition and place aggregate base and bituminous pavement on roadway (approximately 400 feet). Please riprap on roadway slopes adjacent to pavement to effectively create a spillway for over topping flood water. Purpose of the Project - This section of roadway overtops due to excess water from the Redwood River. It is a natural spillway for the Redwood and provides relief for the bridge immediately north of the site. It is prone to overtopping and washout each spring and after large rain events to the west.	Underwood (Township of)	\$46,500

Year	Project Description	Sub-Grantee	Federal Share
2013	City of Redwood Falls, MN acquisition and demolition of properties eminently threatened by landslide. A total of 6 parcels: Blossom Town: parcel # 88-036-4210 / Tamara Brown Insurance Agency: Parcel #'s 88-865-0180, 88-131-3300, & 88-865-0200 / Charles & Marlene Heins: Parcel #'s 88-865-0160 & 88-131-3290-NLODAHL-	City of Redwood Falls	\$435,939

Source: FEMA Hazard Mitigation Program Summary - Open Government Dataset 4/10/2017. Accessed 7/27/17.
 Available: <https://www.fema.gov/media-library/assets/documents/28323>

5.2 Vulnerability Assessment

5.2.1 Asset Inventory

The Hazus-MH defaults, critical facilities, and essential facilities have been updated based on the most recent available data sources. The essential facility updates (schools, medical care facilities, fire stations, and police stations) were integrated into the Hazus-MH input database. Other critical facilities identified by the county were geocoded and overlaid with the Hazus-MH flood model output. Critical facilities are defined by the Department of Homeland Security in the Automated Critical Asset Management System (ACAMS).

The University of Minnesota Duluth Geospatial Analysis Center (GAC) performed the hazard risk assessment for 100-year floods using the Hazus-MH GIS tool. In recognition of the importance of planning in mitigation activities, FEMA created Hazards USA Multi-Hazard (Hazus-MH), a powerful geographic information system (GIS)-based disaster risk assessment tool. This tool enables communities of all sizes to predict estimated losses from floods, hurricanes, earthquakes, and other related phenomena and to measure the impact of various mitigation practices that might help reduce those losses. The Minnesota Homeland Security and Emergency Management (HSEM) office has determined that Hazus-MH should play a critical role in Minnesota's risk assessments.

FEMA's Hazus 4.2 in ArcGIS 10.5.1 was used to estimate the potential losses incurred for a 100-year flood event in Redwood County using a Digital Flood Insurance Rate Map (DFIRM). A 10-meter DEM (digital elevation model) to create a flood depth grid. The resulting HAZUS-MH 100-yr floodplain output is shown in Figure 1.

Redwood County specific building data was sourced from the parcel tax and spatial databases to include building valuations, occupancy class, square footage, year built, and number of stories. A shapefile named RedwoodCO_ParcelData.shp was obtained from Redwood County as well as and LiDAR building data to locate buildings within the county. Additionally, an attribute file named Book1.xlsx (structure value and occupancy class), was used and supplemented with regional averages where values were missing. The resulting spatial dataset included 14184 unique parcel numbers, 7857 of these records were identified as having building values and were used in the analyses.

In cases where building value, year built, or number of stories values were missing, values were assigned based on best practices from values in the other variables and from the region. Square footage was not available for any building records, so building polygons derived from LiDAR (Minnesota GeoCommons) were intersected with the parcel outlines to total building square footage. Average values/sq foot by occupancy class from a neighboring county were then used to estimate square footage. The data were assigned to one parcel centroid or building location, which served as a surrogate for the each parcel's buildings to aggregate to the associated census block for use in the Hazus model.

5.2.2 Facility Replacement Costs

According to the Redwood County general building stock (derived from the county's parcel data and imported to the Hazus model), the Hazus model estimates there are 7,857 parcels with buildings in the region that total replacement value (excluding contents) of \$982 million (2010 dollars). Approximately

67.76% of the buildings (and 42.05% of the building value) are associated with residential housing. The Hazus model estimated 6 parcel's buildings will be at least moderately damaged (>10% damage) in the 100-yr flood scenario. Zero buildings are estimated to be completely destroyed.

Facility replacement costs and total building exposure are identified in Figure #58, which also includes the estimated number of buildings within each occupancy class as calculated by Hazus general building stock.

Figure #58
Redwood County Total Economic Loss, 100-Year Flood

General Occupancy	Estimated Total Buildings	Total Damaged Buildings	Total Building Exposure	Total Economic Loss	Building Loss
Agricultural	1,423	1	\$201,652,000	\$5,019,000	\$532,000
Commercial	673	1	\$86,099,000	\$10,712,000	\$205,000
Education	30	0	\$67,200,000	\$36,522,000	\$61,000
Government	204	0	\$129,974,000	\$48,458,000	\$178,000
Industrial	99	0	\$52,191,000	\$288,000	\$54,000
Religious /Non-Profit	104	0	\$31,941,000	\$4,040,000	\$52,000
Residential	5,324	7	\$ 412,903,000	\$9,733,000	\$1,683,000
Total	7,857	9	\$981,960,000	\$114,772,000	\$2,765,000

Census blocks of concern should be reviewed in more detail to determine the actual location and proximity of facilities with respect to the flood hazard areas. The aggregate losses reported in this study may be overstated due to the fact that values are distributed evenly across a census block. The 3 census blocks with the greatest estimated loss values, which contain parcels with buildings located within the floodplain, are shown in Figure #59. These potentially high loss census blocks, used for the loss estimation, and the Hazus-MH output floodplain are shown in Figure 6, Figure 7, and Figure 8. In some cases, the assets of value may not fall in the floodplain in the same proportion that the floodplain covers the entire census block. For this reason, some potential losses may be overstated.

Figure #59
Redwood County Census Blocks with the Greatest Estimated Losses in the 100-Year Floodplain

Census Block Number	Total Estimated Loss	Location
271277503001030	\$368,000	Redwood Falls
271277503001040	\$293,000	Redwood Falls
271277502001046	\$183,000	2 miles NE of Redwood Falls

An additional analysis was performed to identify the 10 parcels with the highest loss (building + contents) that contain a building which intersects the 100-year floodplain. Some of the parcels are located in one of the 3 census blocks with the greatest estimated loss; these parcels are labeled accordingly. The results of this analysis (and total building values) are shown in Figure #60

Figure #60
Redwood County Properties with Highest Building/Contents Value Intersecting 100-Year Floodplain

Parcel ID	Parcel Building + Contents Total Value	Class Description	Building Area (ft ²)
88-036-4290	\$2,450,800	Government – General Services	18,207
88-036-1040	\$512,200	Government – General Services	9,637
58-030-1020	\$456,000	Agriculture	1,708
53-021-2020	\$381,000	Agriculture	6,796
64-027-1060	\$329,550	Single Family Dwelling	11,886
52-130-1020	\$294,200	Agriculture	3,211
88-810-0200	\$195,600	Single Family Dwelling	5,397
53-010-4060	\$193,400	Agriculture	3,300
51-035-2040	\$166,500	Single Family Dwelling	5,611
88-001-2070	\$158,250	Single Family Dwelling	3,440
Total	\$5,137,500		

5.3 Future Development

Because Redwood County is vulnerable to a variety of natural and other hazards, the county government—in partnership with state government—must make a commitment to prepare for the management of these types of events. Redwood County is committed to ensuring that county elected and appointed officials become informed leaders regarding community hazards so that they are better prepared to set and direct policies for emergency management and county response.

During the past 5 years, some housing development has occurred along SE Redwood Falls, but all development has abided by the rules and regulations of the zoning committee. New houses must be a certain distance from the water and a certain elevation above the water.

The Redwood County Emergency Management Director will work to keep the jurisdictions covered by the AHMP engaged and informed during the plan's 5-year planning cycle. By keeping jurisdictional leaders actively involved in the monitoring, evaluation and update of the AHMP, they will keep their local governments aware of the hazards that face their communities and how to mitigate those hazards through planning and project implementation. Each jurisdiction has identified mitigation strategies that they will seek to implement in their communities (see *Appendix G: Mitigation Actions by Jurisdiction*). Jurisdictions will include considerations for hazard mitigation in relation to future development when updating local comprehensive plans or other plans that may influence such development.

5.4 Hazard Profiles

Hazards were ranked by the planning team as stated in Section 5.1.3 Calculated Priority Risk Index and are listed in this section from high to low priority (see Figure #61).

Figure #61
Ranking of Hazards in Redwood County 2019 AHMP Update

Hazard	Risk Severity
Tornado	Medium
Winter Storm	Medium
Flash Flood	Medium
Windstorm	Medium
Hail	Medium
Lightning	Medium
Flood (Riverine)	Medium
Extreme Cold	Medium
Extreme Heat	Medium
Erosion	Low
Drought	Low
Landslide/Mudslide	Low
Wildfire	Low
Subsidence	Low
Dam Failure	Low
Earthquake	Low

Natural Hazards

Drought
 Extreme Cold
 Extreme Heat
 Flooding
 Severe Summer Storms (Tornado, Windstorm, Hail, Lightning)
 Severe Winter Storms
 Subsidence / Landslide / Erosion
 Wildfire

Other Hazards

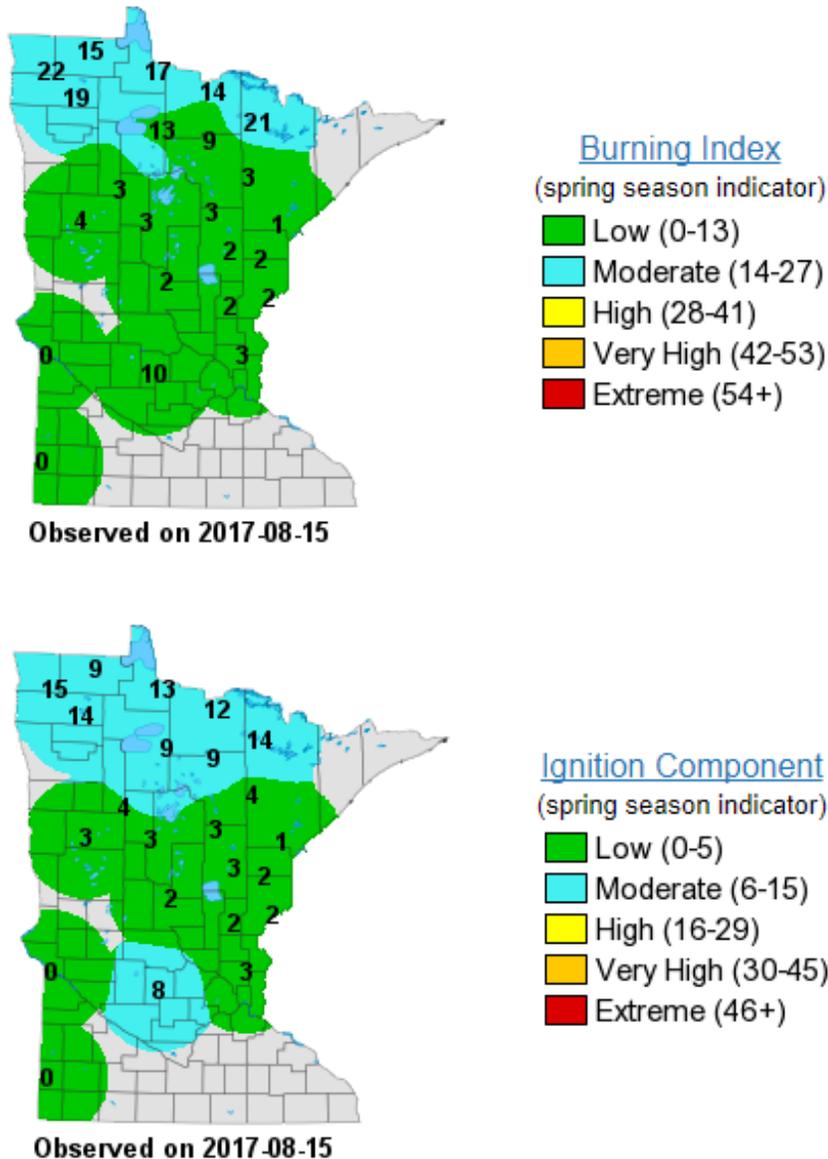
Civil Disturbance
 Dam Failure
 Hazardous Materials
 Public Health Emergencies

Transportation Infrastructure
Utility Failure
Water Supply Contamination

5.4.1 Wildfires

Wildfires can occur anytime the ground is not completely snow-covered and can pose a year-round threat. All locations in Redwood County are at risk to be exposed to this hazard. Incidents of wildfire tend to be localized in southwest Minnesota due to the low burning index in this area. "Burning Index relates the potential amount of effort needed to contain a single fire in a particular fuel type."¹⁸ Wildfires can start in grasslands or in crops if the conditions are dry.

Figure #62: Burning Index & Ignition Component Map – Minnesota



¹⁸ MN Department of Natural Resources. Accessed: 7/31/17. Available: http://www.dnr.state.mn.us/forestry/fire/maps/fdi_grass.html

Wildfire occurs when an uncontrolled fire spreads through vegetation, posing danger and destruction of property. Wildfires often begin unnoticed, spread quickly, and can be highly unpredictable. Prairie fires are less common than forest fires in the rugged Northern or Western forested area, but prairie fires can pose a serious threat. The State hazard plan categorizes wildfires into three types:

- Wild land fires in grasslands, brush and forests;
- Interface fires where natural landscapes meet urbanized areas; or
- Prescribed burns, intentionally set or natural fires that are allowed to burn for beneficial purposes.

Factors such as topography, fuel and weather affect wildfire behavior. Fire intensity tends to increase during daytime heating. Large parcels of land left fallow in conservation and natural areas may be susceptible to grass fire even when properly managed. Gusty winds and low relative humidity create conditions for wildfire to spread rapidly in dry grasses and crops. Farm fields with row crops, ditches, and rights-of-way along railroad tracks are also vulnerable, in particular to the errant spark or carelessly discarded cigarette. Prolonged periods of high temperatures and/or high winds increase the risk of wildfires. The potential severity of a wildfire is minor according to the planning team.

Relationship to Other Hazards—Cascading Effects

- Flooding and erosion. Major wildfires can completely destroy ground cover, which causes heavy erosion and vegetation loss. If heavy rains follow a major fire, flash floods, landslides, and mudflows might occur since vegetation is essential in deterring flooding during heavy rainfalls or spring runoff.
- Public Health - Air quality is adversely affected by wildfires

Wildfire History in Redwood County

Approximately 1,300 wildfires occur in Minnesota each year.¹⁹ However, according to data from the National Centers for Environmental Information, Minnesota experienced fourteen reportable wildfires between 2003 and 2017. Wildfires occur throughout the spring, summer and fall; however, most wildfires in Minnesota take place in March, April, and May. During this period, much of the existing vegetation has been killed due to winter temperatures and is dead, brown and combustible. Also, there is little green vegetation to serve as a barrier for a moving wildfire.

Wildfires in western Minnesota most often occur in grasslands. Grasslands typically include lands in conservation programs such as Reinvest In Minnesota (RIM), Conservation Reserve Program (CRP), Wetland Reserve Program (WRP) and Conservation Reserve Enhancement Program (CREP); “rough ground” that has been hayed, pastured or left wild; and public lands (such as wildlife management areas (WMAs), state parks, waterfowl production areas (WPAs), etc.). Fire danger grows when cedar trees encroach into grasslands. These trees can add a considerable amount of fuel load.

There were zero wildfires in Redwood County from January 2000 through July 2014.²⁰ The National Weather Service issues Grassland Fire Danger statements from April 1st to November 15th each year. The

¹⁹ Minnesota DNR website. Accessed 7/31/17. Available: <http://www.dnr.state.mn.us/forestry/anniversary/beginning-now.html>

²⁰ NOAA. Storm Events Database. Accessed 7/31/17. Available: <http://www.ncdc.noaa.gov/stormevents/>

DNR is the lead state agency for wildfire response and prevention across the state, and offers training and other resources for local fire departments. DNR conducts controlled burns annually to help manage grasslands.

Wildfire and Climate Change

Temperatures are predicted to rise in the state, which could lead to more extreme heat events and associated wildfire risks. As Minnesota's climate changes, weather fluctuations between drought and extreme rain events and increasing temperatures will result in changes to forest composition and/or distribution. These fluctuations can lead to dry conditions that may cause increased fire risk in both grassland and forest environments.

Vulnerability

Wildfires in Redwood County are rare, but they can occur under the right conditions.

Plans and Programs

- Local fire departments – Local fire departments within the districts extinguish structure fires. Each department is responsible for fires within their boundaries. However, they often work together on larger fires through mutual aid agreements.
- State training – Local firefighters participate in mandatory firefighting training classes offered by the state. Firefighters are also offered the opportunity to participate in wildfire training classes offered by the Minnesota Department of Natural Resources-Forestry Department.
- Burning Bans – Currently, in times of extreme heat and drought, the county will enact burning bans. Residents are alerted through the media when a burning ban is enacted.
- Burn Permits – Redwood County Sheriff's Office issues burn permits for a \$10.00 fee. Burning permits are good for one year and law enforcement will be checking and calling if they see smoke. Emergency responders respond to reported fires, so you should alert the authorities when you are going to burn.
- Burn barrels – "In Minnesota, open burning of household garbage is banned, with the exception of farms where regularly scheduled pick up of waste is not "reasonably available to the resident" (Minn. Stat. §§ 17.135 and 88.171). However, 32 of Minnesota's 87 counties have adopted no-burn/bury resolutions to close this exemption."²¹ It is illegal to burn garbage in Redwood County.
- Property management – Many properties that are owned by Redwood County are used for recreation or conservation. Management plans providing maintenance of these properties (including cutting tall grass, thinning trees, prescribed burning, and removal of low-hanging branches around structures) are in place.
- Prescribed burns – The DNR conducts prescribed (or controlled) burns annually in Redwood County. Controlled burns help to reduce fuel load, while also benefiting native prairie restoration. Controlled burns have to be conducted in the right locations and in the right weather conditions. Coordination between the DNR and local fire departments is done to ensure the controlled burns are contained.
- Burning permits – Local residents are required to acquire burning permits to conduct burns.

²¹ Minnesota Pollution Control Agency. Accessed: 7/31/17. Available: <https://www.pca.state.mn.us/waste/laws-prohibiting-backyard-burning-garbage>

- Ditch maintenance – Road ditches are maintained to help decrease the chance of a wildfire spreading. MN Stat. 160.232 states: “To provide enhanced roadside habitat for nesting birds and other small wildlife, road authorities may not mow or till the right-of-way of a highway... Exception is from July 31 to August 31, where the entire right of way may be mowed. Statute also states “When feasible, road authorities are encouraged to utilize low maintenance, native vegetation that reduces the need to mow, provides wildlife habitat, and maintains public safety.”
- Water source capacity – Water storage is also analyzed by fire departments in Redwood County to understand water source capacity to fight fires.
- Road closures – Fire departments in Redwood County keep up to date on road closures so efficient routes can be used to reduce response times.
- Mutual Aid Agreements – Mutual Aid Agreements are in place between police forces, fire districts and ambulance districts to ensure adequate emergency services in Redwood County. Mutual Aid Agreements create agreement among emergency responders to lend assistance across jurisdictional boundaries. Mutual Aid Agreements are updated every five years in Redwood County, and they are currently in the process of updating them.
- Quarterly Fire Protection Meeting – Redwood County holds quarterly fire chief meetings.
- Right-of-way maintenance – Road Authorities maintain the right-of-way of roadways in Redwood County. This helps to limit tree growth and farm fields from approaching onto public right-of-way of roadways.

Gaps and Deficiencies

- Lack of fire breaks – Redwood County needs a program that places fire breaks in between the continuous CRP (Conservation Reserve Program) tracts of land or other state wildlife areas during times of severe drought.
- Wildfire risk assessment – Redwood County does not undertake a systematic assessment of wildfire risk and associated prevention measures.
- Countywide fire department – With a number of smaller fire departments, Redwood County could benefit from creating a countywide fire department. A countywide department could help with coordination, fire inspections, education, and regulations regarding compliance. A countywide department would also help with sharing of resources and decreasing operating costs.
- Fire department/EMS equipment – Regulations, compliance, and training issues are costing rural fire departments more and more. This is causing deficiencies in equipment availability. Not having proper equipment is a safety concern. Older equipment is better than no equipment.
- Evacuation plans – All cities in Redwood County should have evacuation plans detailing the routes residents should take in the event of a large fire.
- Property maintenance – An increasing number of properties are used for recreation or conservation. These properties may not be monitored frequently, which can result in overgrowth and an increased fire risk. Managing properties effectively can reduce the risk of wildfires. Effective property maintenance can include cutting tall grass, thinning trees, prescribed burning, and removal of low-hanging branches around structures as needed.
- Emergency response staffing levels – Keeping local fire departments staffed is becoming an issue. Local fire departments are getting older, and there are less young residents volunteering for the

departments. Availability is also a concern for the local fire departments. A number of Redwood County residents work outside the county, so availability is an issue.

- Burn barrel compliance – Compliance with burn barrel regulation is an issue. An educational campaign may be necessary to increase compliance.
- Water availability – Redwood County is a rural county, so water availability during a rural fire can be an issue. Barn fires require between 5 and 15 tankers of water, each 2,000 gallons. This requires firefighters to pull water from multiple locations depending on the location of the fire. Pulling water from multiple sources affects response times and the ability to contain the fire.
- Dry hydrants – There is only one dry hydrant in Redwood County (in Johnsonville Township). More dry hydrants spread throughout Redwood County would help to ensure timely refill capabilities of tanker trucks. Maintenance is an issue regarding dry hydrants. The dry hydrant has to be blown out once a year.
- Transformer and meter fires – corn dryers and other heavy equipment can overload and overheat a transformer or meter. This is a concern in the fall during harvest.

5.4.2 Severe Winter Storms – Blizzards, Ice Storms

Minnesota experiences winter weather from mid-autumn through the winter season into spring. Heavy snowfall can immobilize large regions at the same time. All types of winter storms can also be accompanied by extreme cold—both absolute temperatures and wind chill.

Between the years of 1975 and 1991, there were 49 deaths associated with blizzards statewide, or an average of 3 deaths per year. Deaths attributable to blizzards have dropped in recent years (seven since 1992), primarily due to increased weather awareness and warning capabilities across the state. The economic costs of winter storms since 1992 has resulted in property damage of over \$26,000,000.

Ice storms are described as occasions when damaging accumulations of ice occur due to freezing rain. The terms freezing rain and freezing drizzle warn the public that a coating of ice is expected on the ground and on other exposed surfaces. Heavy accumulations of ice can bring down trees, electrical wires, telephone poles and lines, and communication towers.

All locations in Redwood County are equally likely to be exposed to this hazard. Rural areas are more likely to be severely impacted by the hazard. Rural homes and farms face the threat of isolation and utility failure during winter storms. Roads throughout the county are at risk from ice or blowing and drifting snow. Roads closed due to hazardous winter weather also make it difficult for emergency responders to access individuals located in remote rural areas. Given the rural nature of Redwood County, residents of smaller communities may face similar isolation issues as rural residents. City residents are also at risk. Attempting to travel between communities would expose city dwellers to higher levels of risk corresponding with their rural counterparts.

There are several types of winter storm events that are typical for this area including: heavy snow events, ice storms, and blizzards. Heavy snow events in Minnesota are considered to be 6 or more inches of snow in a 12-hour period, or 8 or more inches in a 24-hour period. Snow is considered heavy when visibilities drop below one-quarter mile regardless of wind speed. Heavy snows can lead to building collapse as well as creating a hazard to residents and travelers.

Ice storms include freezing rain, freezing drizzle and sleet (see Section 5.4.4 Severe Summer Storms below for information on hail storms, which more typically occur in the spring and summer seasons). Freezing rain, probably the most serious of the ice storms, occurs during a precipitation event when warm air aloft exceeds 32 degrees Fahrenheit while the surface remains below the freezing point. When precipitation originating as rain or drizzle contacts physical structures on the surface, ice forms on all surfaces creating problems for traffic, utility lines, and tree limbs.

Sleet forms when precipitation originating as rain falls through a rather large layer of the atmosphere with below freezing temperatures allowing the raindrops to freeze before reaching the ground. Sleet is also referred to as ice pellets. Freezing rain freezes when it hits the ground, creating a coating of ice on roads, trees and power lines. Sleet storms are usually of shorter duration than freezing rain and generally create fewer problems.

Ice storms combined with high winds often threaten the electrical power grid. Typical power outages are due to localized storm events and utility crews can respond and restore power within hours. A complete power outage, however, has the potential to be a catastrophic event, due to the extensive systems that rely on remote power generation. Water and sewer service rely on electrical pumping stations. Individual home furnaces may be able to run on natural gas or propane, but usually need electricity to circulate warm air or hot water throughout a building.

Blizzards are the most violent type of winter storm. A blizzard occurs with sustained or frequent gusts to 35 miles per hour or greater and considerable amounts of falling and/or blowing snow (reducing visibility to less than a quarter mile) for three hours or longer. While blizzards in Redwood County can occur from October through April, they are most likely from November through the end of March. Temperature is not taken into consideration when the National Weather Service issues a Blizzard Warning; however, the nature of these storms typically leads to extreme cold.

Relationship to Other Hazards—Cascading Effects

- *Flooding.* Heavy snows and rapid snow melt are primary contributors to seasonal spring flooding. Areas along rivers and stream Redwood County can be impacted by spring flooding.
- *Transportation Crashes.* Winter storms often lead to hazardous conditions for transportation infrastructure. Icy roads can make travel difficult and poorly designed roads can result in large drifts that make travel impossible. Poor driving conditions and poorly designed transportation infrastructure can contribute to motor vehicle crashes.
- *Utility Failure.* Winter storms can impact the power grid. Utility interruption can be severe in Redwood County due to the rural nature of the county. A winter storm can isolate rural residents and can leave them without power for extended periods of time. These residents are at risk of hypothermia or even death.
- *Wildland or Structural Fire* - Heavy storms that result in large amounts of downed timber can result in an increase of dead or dying trees left standing, thus providing an increased fuel load for a wildfire. There is an additional risk of increased frequency of structural fires during heavy snow events, primarily due to utility disruptions and the use of alternative heating methods by residents.
- *Public Safety* - Drivers stranded in snowstorms may make uninformed decisions that can put them at risk; residents who are unprepared or vulnerable may not be able to obtain goods or reach their destinations. EMS providers may be slowed by road conditions while responding to emergencies. Ice storms may result in power outages due to downed power lines, putting people at risk for cold temperature exposure and reducing the ability to spread emergency messages to the public via television, radio or computer.

History of Severe Winter Storms in Redwood County

From January 2000 through April 2017, there have been 41 documented winter storms in Redwood County. These winter storms are often not confined to Redwood County but affect all of southwest Minnesota. In the table below are 15 winter storm occurrences that occurred from January 2011 through April 2017.

Figure #63
Winter Storms – Redwood County

Date	Location	Event Narrative
1/30/2011	14 counties (including Redwood)	A period of light snowfall continued for an 18 to 24 hour time span and produced locally 7 to 11 inches. Travel was made difficult at times, and some schools and businesses closed.
2/20/2011	41 counties (including Redwood)	Snowfall amounts averaged between eight and twelve inches. Thunder-snow also occurred during the morning in far southern Minnesota. The winter precipitation made travel very difficult, resulting in schools and businesses being forced to close.
3/23/2011	28 counties (including Redwood)	A period of sleet and snow fell on the onset of the precipitation, with some heavy snowfall rates. Locally 11 inches fell and travel was made difficult at times, and some schools and businesses closed.
12/8/2012	35 counties (including Redwood)	Snow developed across the western part of the county during the early evening of Saturday, December 8 th and became heavier during the morning hours with totals ranging from 10 to 16 inches by the afternoon of December 9 th . The heaviest amounts were in the northern one-half of the county.
2/10/2013	25 counties (including Redwood)	Initially, some sleet and snow fell across the county however, the bulk of the snowfall occurred during the morning hours of Sunday, February 10 th . The snowfall tapered off during the early afternoon, but occasional light snow along with increasing wind developed by evening. 3 to 6 inches of snow fell, with the heaviest in the northwest part of the county.
4/9/2013	42 counties (including Redwood)	Snowfall amounts ranged from 10 to 13 inches across the county. The first bands of snow, sleet and rain developed across southwest Minnesota. Some areas received over 3 inches of snow southwest of Redwood Falls. A second wave of snow, sleet and rain, including some thunderstorms, moved across southern Minnesota during the evening of Tuesday, April 9 th .
4/18/2013	29 counties (including Redwood)	As the storm intensified Thursday afternoon, the snow became heavy at times with the sleet and snow, transitioning into all snow by the late afternoon. Snowfall rates during the late afternoon, and evening hours of Thursday, April 18 th , were one to two inches per hour, with isolated three inch per hour rates. Snowfall amounts quickly increased during the evening, with several areas already receiving 6 or more inches before 9 pm. Snowfall amounts ranged from 6 to 8 inches across the far eastern part of the county.
11/5/2013	Redwood, Renville	A fast moving winter storm system moved across southwest Minnesota during the afternoon and evening of Tuesday, November 5 th . Tuesday morning, a band of snow led to localized 6 to 11 inches of snow near Milroy, Redwood Falls, and Bird Island. Local observers in Redwood County received between 6 to locally 11 inches of snowfall in a 6 to 12 hour period. The heaviest occurred in the western part of Redwood County where a local observer reported 10.5 inches of snowfall near Milroy.

Date	Location	Event Narrative
12/4/2013	23 counties (including Redwood)	Although some precipitation fell Monday and Tuesday in the form of snow, sleet and rain, the bulk of the heavier snow fell early Wednesday morning, through Wednesday afternoon. This storm produced locally 5 to 7 inches of snow across the county.
4/3/2014	23 counties (including Redwood)	A winter storm developed Thursday morning, April 3rd. By the late afternoon, the area of precipitation across southwest, and south central Minnesota quickly expanded. Several observations, and trained spotters reported locally 6 to 9 inches of snowfall across the far eastern part of Redwood County.
11/30/2015	7 counties (including Redwood)	Several waves of snow moved across southern Minnesota Monday, November 30th. A quick 3 to 5 inches of snow fell across the Minnesota River Valley from west of Mankato, to Redwood Falls, and Madison by 4 pm Monday afternoon. Another band of snow developed Monday evening and moved northward across southwest and west central Minnesota through 2 am. Trained weather observers and local officials indicated that 7 to 9 inches fell across Redwood County. Locally, the town of Redwood Falls measured 8.6 inches of snow.
12/25/2015	Redwood, Renville, Yellow Medicine	Snow developed across southern Minnesota toward midnight, and moved northward, producing a swath of 6 to locally 8 inches in southwest and portions of west central Minnesota before tapering off Friday morning. A few reports of 6 to 8 inches of snow fell near Redwood Falls. The snow tapered off by late morning, but the bulk of the heavier snowfall occurred between 10 pm to 6 am LST.
2/2/2016	25 counties (including Redwood)	Light to moderate snow fell across the county, along with sustained winds of 20 to 30 mph. This created very hazardous driving conditions. Locally, 6 inches of snow fell in the county by the evening. In addition, areas of blowing snow reduced visibility below 2 miles through midnight. There were major impacts with this storm including numerous county roads and highways in southwest Minnesota closed. Travel was not recommended or closed including I-90 west of Albert Lea by 2 PM CST Tuesday due to car accidents and whiteout conditions. Other impacts included the Minneapolis-St. Paul International Airport, which had 175 flights canceled or delayed by as much as five hours.
12/10/2016	14 counties (including Redwood)	A storm system developed Saturday morning, by the late afternoon and early evening, a band of heavier snowfall developed. This band generated snowfall rates of 1/2 to 1 inch per hour and caused a small area of snowfall amounts between 6 to 10 inches from west central, to southeast Minnesota. The heaviest occurred near Redwood Falls and Granite Falls. The snow tapered off from west to east Sunday morning after 9 am. Totals of 8 to 10 inches fell in a 24 hour period across the rest of southern Minnesota as a few inches occurred Saturday, with the bulk of the snowfall between 9 pm and 9 am. The heaviest snowfall from this storm included Redwood Falls 12.1 inches.
3/12/2017	16 counties (including Redwood)	A winter storm dropped 9 to 11 inches of snow across Redwood county Sunday morning, through early Monday morning. Redwood County measured 2.5 of snow in one hour during the height of the storm Sunday afternoon. The heaviest snow tapered off Sunday evening with mostly light snow, and flurries between midnight and 6 am. Almost all of the snow ended shortly after sunrise Monday in south central Minnesota. The heavier totals included 11 inches in Wabasso.

National Climatic Data Center (NCDC/NOAA) Storm Events database

From January 2000 through April 2017, there have been 17 documented Blizzards in Redwood County. In the table below are blizzard occurrences that occurred from December 2013 through April 2017.

Figure #64
Blizzards – Redwood County

Date	Location	Event Narrative
12/9/2013	10 counties (including Redwood)	During the morning through the day of Sunday, December 9 th surface winds increased to over 25 mph, with gusts over 40 to 45 mph by the late morning. The combination of sustained winds of 25 to 35 mph, with frequent gusts over 40 mph, caused white-out conditions. Local observations, and individuals in the county reported near zero visibilities at times. The winds began to subside during the evening, with much better conditions by 9 pm.
2/11/2013	10 counties (including Redwood)	A large storm system dumped 6 to 12 inches of snow across west central and southwest Minnesota on Sunday, February 10 th . Wind speeds increased to over 25 mph by the evening, with gusts in open areas between 40 and 50 mph during the overnight hours. These wind speeds, combined with the newly fallen snow, created blizzard conditions across most of west central and portions of southwest Minnesota. The Minnesota Department of Transportation called in all of the snow plows in this area due to significant blowing and drifting snow across the highways.
2/18/2013	13 counties (including Redwood)	Although initially temperatures warmed into the 30s and created a crust on the top layer of snow, winds intensified, and along with some light snow that developed, caused the top layer to blow off and create blizzard conditions for several hours during the afternoon, and evening hours of Monday, February 18 th . Several highways and county roads were closed due to the blowing snow, surface visibilities dropped to less than a few hundred feet at times as winds gusted up to 50 mph. Winds slowly subsided late in the evening, but considerable drifting snow continued along with some areas of blowing snow. Wind speeds increased to over 30 mph, with gusts in excess of 45 mph at times during the afternoon and evening. Surface visibilities based on the Minnesota Department of Transportation, and surface observations at Redwood Falls indicated near zero visibilities at times, with road closures on Highway 71, and 67 during the height of the storm.
1/16/2014	21 counties (including Redwood)	A strong cold front moved across Minnesota during the early morning hours of Thursday, January 16 th . Light snow fell during the morning, but wind speeds increased to 25 to 35 mph, with gusts over 45 mph across west-central Minnesota shortly after sunrise Thursday morning. These stronger winds, and even higher wind gusts, moved southward across western Minnesota. Blowing snow became prevalent once the wind speeds increased, with whiteout conditions by mid to late morning in west central Minnesota, and by the early to midafternoon hours across south central Minnesota. Blizzard conditions continued for several hours from early afternoon through the early evening of Thursday, January 16 th . A peak wind gust of 50 mph occurred during the height of the storm. The Minnesota Department of Transportation reported numerous roadways as nearly impassable or had no travel advised during the height of the storm.

Date	Location	Event Narrative
1/22/2014	17 counties (including Redwood)	A strong arctic front surged southward early Wednesday morning January 22nd. Prior to this front, light snow fell across the Upper Midwest, setting the stage for blowing snow once stronger winds developed. Wind speeds increased to over 30 mph, with gusts over 40 mph, along the Minnesota River Valley. Blowing snow developed quickly and caused whiteout conditions in west central, southwest and south central Minnesota. Surface visibility improved by sunset. The Minnesota Department of Transportation advised no travel in southwest Minnesota by late morning due to the blizzard conditions.
1/26/2014	26 counties (including Redwood)	A blanket of light snow fell across central and southern Minnesota, as well as west central Wisconsin the evening of Saturday, January 26th. Locally 2 to 5 inches of snow fell during a 6 to 12 hour period before ending early Sunday morning. The snow was light and easily blown due to the high snowfall ratio.
2/20/2014	39 counties (including Redwood)	A very powerful low pressure system trekked from southeast Kansas to northeast Wisconsin on February 20th. A rain/snow mix began across much of the area during the morning of the 20th as temperatures hovered in the middle 30s, but precipitation quickly transitioned to heavy snow by early afternoon. The snow continued through the early morning hours of the 21st before tapering off. Northwest winds increased to between 20 and 30 mph, with gusts to between 40 and 50 mph. Blizzard conditions developed overnight across the vast open terrain of southern Minnesota. Visibility dropped to near zero at times with winds producing snow drifts up to three feet deep. These drifts and winds combined with snow that created whiteout conditions for several hours and causing numerous roads, including state highways to close due to impassable roads.
2/26/2014	17 counties (including Redwood)	Initially southwest winds gusted above 35 mph for several hours leading to blizzard conditions across portions of south central, central and west central Minnesota. There was a brief period where winds decreased in the mid to late afternoon hours before the main arctic front moved through. By the early evening, winds increased and created blizzard conditions. Although no roads closed during the period, county officials advised no travel as snow drifts made it very hazardous to drive, and with some roads ice covered due to the past winter storm, many accidents occurred.
1/8/2015	22 counties (including Redwood)	During the morning of Thursday, January 8th, snow fell across a wide area of Minnesota. Previous snowfall that occurred Monday plus a light dusting that occurred Thursday morning combined with increasing northwest winds to produce blizzard conditions across a large area of western and southern Minnesota. By the early afternoon, winds started to gust over 50 mph in west central Minnesota. By 2 pm, several highways from west central Minnesota, southwest along the Minnesota River Valley, and along the Minnesota/Iowa border, closed. Roads became hazardous with several roads closed during the height of the blizzard. Conditions started to improve during the evening, but roads remained very hazardous until after 9 pm as winds lessened.

Date	Location	Event Narrative
2/7/2016	19 counties (including Redwood)	A recent winter storm produced 2 to 4 inches of snow in west central Minnesota, with amounts of 6 to 10 inches farther to the southeast across southwest and south central Minnesota. Wind speeds increased significantly Sunday evening and deteriorating conditions after midnight, by Monday morning, wind speeds had averaged 30 to 40 mph, with frequent gusts of 40 to 50 mph. Blizzard warning was also extended through the afternoon for Redwood, Brown, Watonwan and Martin Counties due to continued strong winds, whiteout conditions, and closed county roads and highways. One of the highest wind gusts across the region was recorded at the Redwood Falls Airport, 49 mph. The Minnesota Department of Transportation closed several roads, including I-90 west of Fairmont for several hours Monday morning. Several county roads were snow covered and were not advised to travel on based on Minnesota Department of Transportation. The worst conditions occurred in the southwestern part of the county where wind gusts were higher.
11/18/2016	17 counties (including Redwood)	The bulk of the heavy snowfall occurred Friday morning through Friday afternoon, when locally 6 to 12 inches of snow fell across west central Minnesota. In addition to the heavy snowfall, strong winds developed, creating blizzard conditions in west central Minnesota by Friday morning as the system intensified. Blizzard conditions continued for several hours across the county. Winds were gusting over 40 mph which created whiteout conditions along with around 6 inches of snowfall. Roads become impassable in western Redwood county during the afternoon due to the winds and snowfall combined and no travel was recommended by the Minnesota Department of Transportation.

National Climatic Data Center (NCDC/NOAA) Storm Events database

Severe Winter Storms and Climate Change

Historically, winter storms have had a large impact on public safety in Minnesota. This will continue, with a possible increase in snowstorm frequency and annual total snowfall. Winter weather is often a cause of power outages. Pressures on energy use, reduced reliability of services, potential outages and potential rise in household costs for energy are major climate change risks to public health.

The number of heavy snowfall years for the Midwest has fluctuated throughout the 1900-2006 time period. The periods of 1900-1920 and 1960-1985 had numerous years with snowfall totals over the 90th percentile. In the recent 3 decades, the number of heavy seasonal snowfall totals has been much lower. Despite these generally lower seasonal snowfall totals, some areas of the Midwest have still experienced significant snow totals in the most recent decade. The 100-year linear trends based on decadal values show that the upper Midwest had statistically significant (1% level) upward linear trends in snowstorm frequency from 1901 to 2000.²²

Vulnerability

Winter storms are highly likely in the area, and they occur annually and have major impacts on local communities. The risk level assigned to blizzards and winter storms events by the planning team is high. The effects of a winter storm can include: closures, need to clear snow and ice from public streets, recover

²² Kunkel, et al., Regional Climate Trends and Scenarios for the U.S. National Climate Assessment., 2013

from utility failure, possibly provide emergency shelters for travelers and dislocated residents, and potential injuries and death. Winter storms can also cause lost productivity and disruptions in the local workforce, with public and private employees unable to work regular hours.

A number of facilities in Redwood County do have emergency generators that help keep emergency services available during a winter storm.

Figure #65
Locations with Emergency Generators & Needs, Redwood County

City	Location / Description	Needs
Redwood Falls	Sheriff's Office	
Redwood Falls	Carris Health/Redwood Hospital	
Redwood Falls	Wooddale Home	
Redwood Falls	Sunwood Home	
Redwood Falls	Redwood Co EM Portable	
Redwood Falls	4 generators PUC	
Belview	Parkview Home	
Morgan	Gil Mor Manor	

Information request to city and county representatives

The accumulated effects of winter storms and blizzard conditions also pose a risk to structures from snow load on roofs. Vulnerable structures can easily collapse under the weight of heavy snow and/or high winds. The Minnesota building code has requirements for snow loads.

Analysis of specific infrastructure and structure dollar-cost vulnerability is not possible since winter storms can (and do) impact large portions of the study area. Based on current available data, modeling future losses would only be possible for total losses with excessive margins of error. Future storm events could be tracked specifically as they occur and could be used to model local vulnerability to winter storms in future updates.

Plans and Programs

- Real-time weather monitoring – The City of Redwood Falls has a real-time weather monitoring station at the Redwood Falls Municipal Airport that provides current temperatures, dew point, wind speed, wind direction, and barometric pressure.

- Travel Assistance – “511 is a public service of the Minnesota Department of Transportation (MnDOT) to help traveler’s access information about road conditions, traffic incidents, commercial vehicle restrictions, and weather information via the phone or the Web, 24 hours a day, seven days a week.”²³
- Regional Forecasts – Redwood County is in the Sioux Falls broadcasting region. Weather forecasts in the Sioux Falls region tend to be a good predictor of weather in Redwood County. Redwood County uses this information in regards to school closures and other weather related announcements.
- School closings – Redwood County’s school districts have a policy of closing schools when wind chills exceed certain thresholds, low visibilities create unsafe driving conditions, or when heavy snow has fallen making travel difficult. Local radio stations partner with the school districts to make sure the announcements are out by 6:00 am or earlier if possible.
- Snow Fences – Redwood County has in the past promoted natural and manmade snow fences to protect highways against drifting snow.
- Road closures – Redwood County Public Works and local cities are working closely with MnDOT to improve transportation safety in all weather conditions. Road closures are enacted when conditions become too hazardous. MnDOT uses the 511MN.org, or 511 for mobile phones. This system does not send out alerts, but posts weather related road information online for public access.
- Emergency generators – Emergency generators help keep emergency services available during winter storms. Refer to Figure #65 for public entities with emergency generators in Redwood County.
- Lambertson wind break - This twin-row planting of honeysuckle protects a 400 foot section of Highway 14 west of Lambertson, Minn. in Redwood County. The snow fence is located on the property of the University of Minnesota's Southwest Research and Outreach Center.
- City Policies – Cities have snow removal and winter parking policies in place to ensure access throughout the city.
- Minnesota Building Code – The City of Redwood Falls and Paxton Township have adopted the Minnesota Building Code. The Minnesota Building Code helps to ensure buildings are built with minimum snow load requirements and other requirements to ensure the building is safe and will be safe for years to come. Cities that have not adopted a building code include Belview, Vesta, Milroy, Seaforth, Lucan, Wabasso, Walnut Grove, Lambertson, Sanborn, Wanda, Clements, Morgan, and Revere. Redwood County has adopted the Minnesota Building Code.

²³ MnDOT. 511. Accessed: 8/7/17. Available: <http://hb.511mn.org/About.html>

Gaps and Deficiencies

- Automated weather stations at schools – Automated weather stations at schools throughout Redwood County would provide more current information and quicker response to dangerous and changing weather conditions.
- 511 System – The 511 system does not incorporate local knowledge as well as it could. County staff has little involvement in providing updates to the 511 system. Including snowplow drivers and other county staff could help to improve the accuracy of the system. County staff has local knowledge regarding the road network and can provide accurate information into the system.
- Road Closures Coordination – MnDOT closes state highways and does not talk to local emergency managers. There needs to be a direct line of communications between MnDOT and local emergency managers. This is an issue for emergency response and mass sheltering.
- Snow removal ordinance – Snow removal along sidewalks and at intersections can be an issue in Redwood County. Most cities in Redwood County have an ordinance regarding snow removal. Snow should be removed from sidewalks within 24 hours of a snow event, but this policy is often not enforced. City ordinances and enforcement should be used to prohibit snow piles from interfering with pedestrian traffic and visibility, especially around schools.
- Warning systems – The effective range of warning systems is limited. Travelers may be unaware of an upcoming storm. Local radio stations issue severe weather warnings, but satellite radio is becoming more widely used. Severe weather warnings issued on the radio may not be as effective as in the past. Weather radios should be promoted and more widely used, so residents and travelers can plan accordingly.
- Snow loads and building codes – Some residents are resistant to building codes that could help assure higher standards for new construction. The accumulated effects of winter storms and blizzard conditions also pose a risk to structures from snow load on roofs. Vulnerable structures can easily collapse under the weight of heavy snow and/or high winds. The City of Redwood Falls and Paxton Township have adopted the Minnesota Building Code.
- Building Codes – Certified inspectors increase the cost of building. This increase in costs could result in less development. Cities in Redwood County have thought it is the responsibility of the property owner to ensure the building meets standards outlined in the Minnesota Building Code.
- Commuting time – Commuting times have increased. In Redwood County a number of residents commute long distances to work, which increases their exposure to winter weather hazards. Population in Redwood Falls doubles during the work day.
- Backup generators – It is expensive to install back-up generators. Due to limited funding sources, redundant electrical supply back-up may not be available in all essential locations in Redwood County. Figure #65 identifies locations that need back-up generators. Some critical public facilities have emergency electrical generation on-site. A number of private residents also have backup generators.
- Lack of rental ordinances – Cities in Redwood County do not have a rental ordinance.
- Lack of snow fences – As prices for farm land and crops have went up, a number of trees and wind breaks have been taken out.

- Coordination with rural electric cooperatives – When power outages occur, it can be difficult for rural electric trucks to get into areas with drifting snow. Increased coordination is needed with county and township staff to open routes to the source of a power outage.
- Language barriers – Language barriers can be an issue regarding severe weather warnings. There are a number of nationalities and languages spoken in Redwood County. This makes it difficult to send out emergency broadcast. Having to translate emergency broadcasts into multiple languages takes time and money.
- Generator connectivity – The Redwood County Government Center is not equipped with a quick connect system for a transportable generator. All critical government infrastructure should be built with a quick connect generator system.
- Hardening of the electrical grid – Much work has already been completed to harden electric utilities against winter storms. Redundancies in utility systems can further reduce outages resulting from storms.
- Hardening of the electrical grid – As of today approximately 294 miles of older overhead single lines remain in Redwood County. The cost of replacing this conductor is estimated to cost approximately \$10.9 million. Redwood Electric Cooperative (REC) suffers from storm damage and interruptions mainly from ice, wind, and severe weather on its overhead lines. In order to lower the effects from extreme weather on overhead lines, REC builds and maintains its distribution system to specifications that try to limit damage during extreme weather conditions. REC works with its engineering company to determine areas where overhead facilities should be replaced with underground facilities, to locate tie lines and to loop feeds to pick up member electrical load if one substation fails. If/when available, REC would use FEMA mitigation dollars for site specific projects to harden its distribution system and would pursue additional non-site specific projects if additional FEMA dollars become available. Looping/tying substation feeds together so if one substation fails, the load can be picked up by other substations.
- Putting ties between substations underground.
- Replacing overhead lines with underground lines for key member loads. These loads would include rural water pumping stations and other emergency loads that rely on electricity to maintain service. REC's pole testing program is on a 10 year rotation; therefore approximately 1,500 poles are tested each year. Based on the results of the program over the past 5 years, an average of approximately 5% of poles tested are due for replacement. The cost to replace one pole on a single phase overhead distribution line is estimated to be \$900 per pole. This does not include the cost of the wire and other hardware.
- Tree Maintenance – Cities help to increase the reliability of the utility grid by cutting down and maintaining trees that are close to power lines and in the public right-of-way.
- Road design – Transportation engineers use road design to substantially reduce hazards from blowing and drifting snow. Living snow fences have been used to mitigate the effects of blowing and drifting snow, which affect road conditions. Living snow fences are designed plantings of trees and/or shrubs and native grasses located along roads or around buildings, which create a vegetative trap to control blowing and drifting snow.

5.4.3 Flooding & Subsidence

Flooding is one of the most common hazards across the United States and “floods are among the most frequent and costly natural disasters.”²⁴ Flooding can occur anytime, anywhere. Seemingly benign streams can overflow their banks from a sudden rainstorm, quick snowmelt, or blockage of a channel. Lakes or reservoirs can retain water and quietly creep up the shorelines. City sewers can back up and pour into private basements and onto public streets. Dams can break causing flooding down river.

The National Flood Insurance Program (NFIP) was created by Congress to help property owners to protect themselves financially. NFIP offers flood insurance in communities that agree to adopt and enforce ordinances to reduce the risk of flooding. In Minnesota, the DNR administers floodplain management programs.²⁵

There are 5 flood insurance policies in Redwood County.²⁶ Each policy covers a single building, but all single family home policies include detached garages. The table below outlines that number of policies in the county.

Figure #66
Flood Insurance Policies – Redwood County (as of 4/30/2017)

County / City	Number of NFIP Policies in Force	Insurance in Force – Whole Dollars
Redwood County (unincorporated areas of county only)	5	41,228,500
State of MN	9,541	\$2,230,873,300

FEMA Region V NFIP Policy Information by State. Accessed: 8/7/2017. Available: <https://bsa.nfipstat.fema.gov/reports/1011.htm>

The Federal Emergency Management Agency (FEMA) has mapped the probability of flood waters inundating floodplains. FEMA works with local communities to map the Special Flood Hazard Area (SFHA), commonly known as the 100-year floodplain (one percent floodplain), where they calculate a one percent chance of a flood event any given year. Within the SFHA lie the floodway, in which water can be expected at any time, and the flood fringe which is vulnerable to flood events.

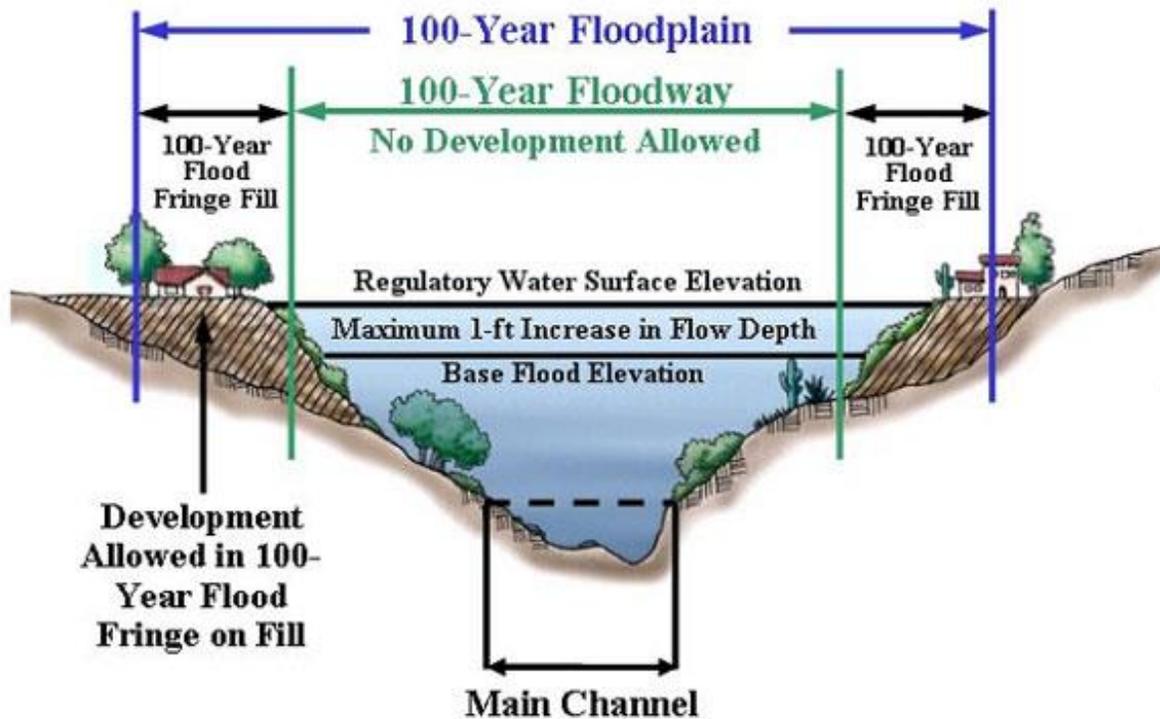
FEMA has developed Flood Insurance Rate Maps (FIRMs) for many communities across the United States. FEMA now posts these online, along with “FIRMettes” — a “a full-scale portion of a FEMA Flood Insurance Rate Map (FIRM) that you create yourself online by selecting the desired area from an image of a Flood Insurance Rate Map.”

²⁴ American Red Cross. Accessed: 8/8/17. Available: <http://www.redcross.org/prepare/disaster/flood>

²⁵ Flood Smart. Accessed 8/7/17. Available: http://www.floodsmart.gov/floodsmart/pages/about/nfip_overview.jsp

²⁶ FEMA Region V NFIP Policy Information by State. Accessed: 8/7/2017. Available: <https://bsa.nfipstat.fema.gov/reports/1011.htm>

Figure #67
100-Year Floodplain (1 percent Floodplain)



Obsolete FIRMs, many not updated since their initial production in the 1970s, make flood management decision-making difficult. Redwood County has been working with DNR and FEMA to engineer, review and adopt digital floodplain maps, or dFIRMs.

Locations Affected by the Hazard

Flooding can occur anytime, anywhere. The majority of Redwood County is classified as Zone X, which is defined as an area of minimal flood risk. The areas of minimal flooding include most of the intermittent streams throughout the county. These streams contain surface water runoff at various times throughout the year and high water levels may extend beyond the established drainage channel and onto adjacent lands. Flash flooding events tend to be localized, not countywide, but the risk is countywide. Flash flooding can occur rapidly and cause substantial damage. Flash flooding can cause a rapid rise in the water level of a stream or creek above a predetermined flood level.

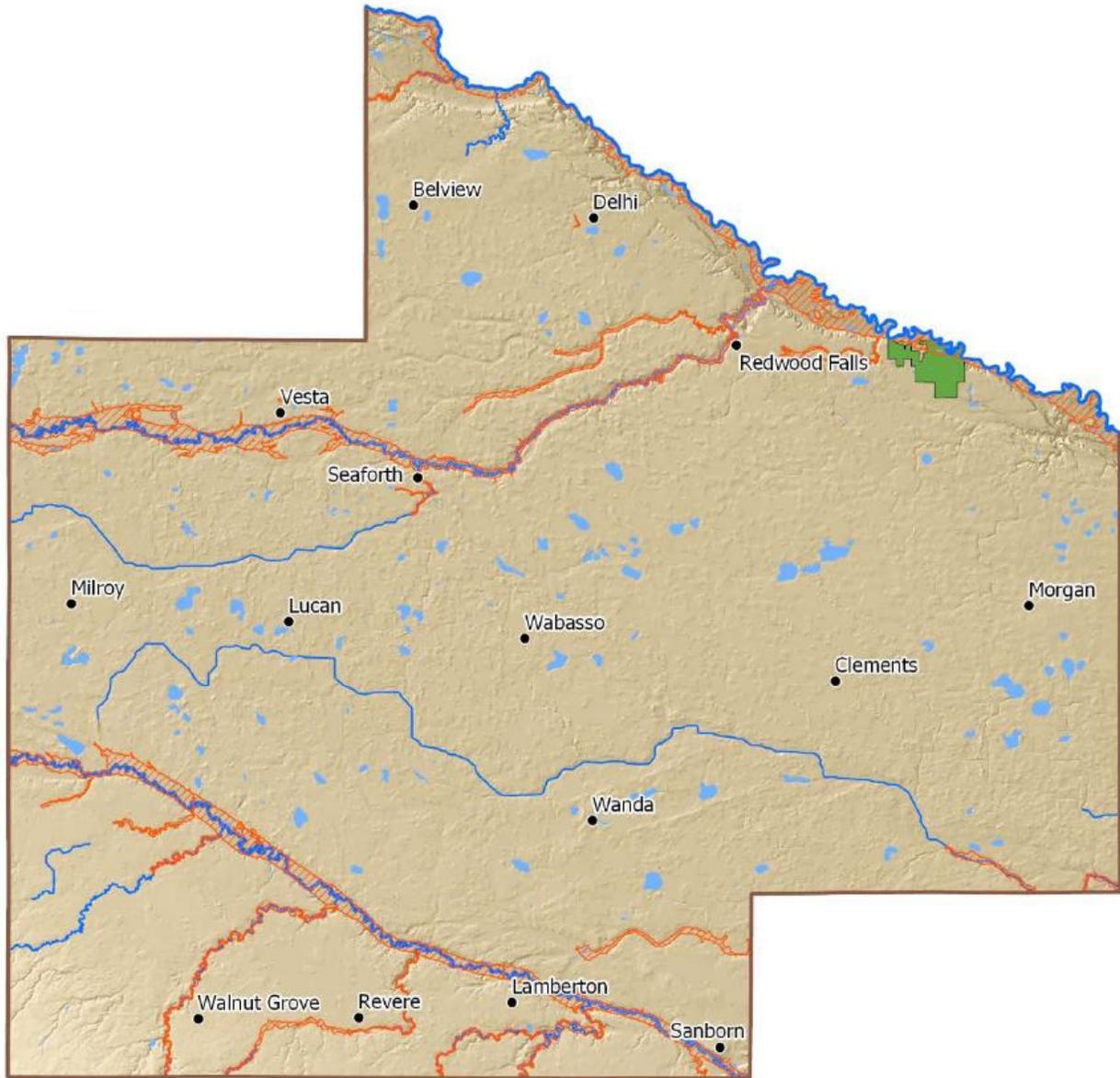
One percent floodplain areas do exist in Redwood County. These flood plain areas are along the Minnesota River, Redwood River, Cottonwood River, and multiple streams and creeks. Additionally, the floodplain extends into or directly adjacent to the Cities of Lambertton, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, and Walnut Grove as well as the Lower Sioux Community.²⁷

²⁷ Tribal Nations do not participate in county-level Hazard Mitigation planning and partake in their own planning through FEMA.

About two-thirds of local townships include mapped floodplains. Many of these areas are narrow, following streams and creeks. The Minnesota River, however, has a broad floodplain along the boundary between Renville and Redwood counties that includes Swedes Forest, Delhi, Honner, Paxton, and Sherman Township, as well as old North Redwood Falls. The Redwood River enters from Lyon County and crosses four townships—Underwood, Vesta, Sheridan, and Redwood Falls Township—and corners of the city of Seaforth on its way to the county seat and the Minnesota River. The Cottonwood River also enters from Lyon County in Gales Township and crosses Johnsonville, North Hero, Lamberton and Charleston townships, before touching its namesake county and exiting into Brown County.

A Flood Insurance Rate Map (FIRMs) is available for the City of Redwood Falls. The following communities have mapped flood hazard areas (mainly very small areas) but do not participate: Revere, Vesta, Walnut Grove. The following do not have mapped flood hazard areas or participate: Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Wabasso, Wanda. The Flood Insurance Rate Maps (FIRM) for these public entities can be found by contacting the Redwood County Emergency Manager.

Figure #68
HAZUS Analysis, Redwood County 100-Year Floodplain



-  100-Year Floodplain
-  Lower Sioux Indian Community

Data Sources: FEMA DFIRM, and Hazus-MH

Please note that the Cities of Belview, Clements, Lamberton, Lucan, Milroy, Morgan, Wabasso, and Wanda have no mapped special flood hazard areas.

City of Delhi

While floodplain was mapped for the City of Delhi in 1974 and 2013, the small flood hazard area along Rice Creek is in a farmed area outside the developed part of the town site. One farm site is close to the floodplain. This area was not mapped in the draft dFIRM. The City of Delhi does not participate in NFIP.

City of Redwood Falls

The Minnesota River Valley is deep and wide, but is largely undeveloped except at the old city of North Redwood, which merged with Redwood Falls in the 1990s. The Redwood River's course through the city is largely confined to Lake Redwood and Alexander Ramsey Park, the largest municipal park in Minnesota. Ramsey Park is also home to the 183' long historic stone Swayback Bridge, built in 1938 by the federal Works Progress Administration (WPA). The initial AHMP estimated the floodplain area in the city encompassed about 0.6 square miles or 12% of the community.

City of Revere

A flood hazard area was mapped along Pell Creek in the undeveloped portion of the City of Revere; however, the incorporated area is smaller today than when mapped in 1979. The City of Revere does not participate in NFIP; no structures are at risk.

City of Sanborn

The Cottonwood River's floodplain is about ¼ -mile wide as it leaves the county outside Sanborn. This is one area in which the dFIRM maps have identified a more extensive floodplain than the existing maps; a wider floodway designated will affect development of the City Park.

City of Seaforth

The floodplain was mapped for the City of Seaforth in 1974 and 2013. Small creeks run through the southern and eastern portions of Seaforth, tributary to the Redwood River which flows across the northern city limits. The dFIRM maps one non-residential building near the floodplain along the Redwood River. The City of Seaforth joined the NFIP in 2011.

City of Vesta

The Redwood River flows south of the City of Vesta, outside the current city limits. The current Flood Hazard Boundary Map show more extensive corporate limits than today, so the city is listed as sanctioned in the Community Status Book. The 2013 dFIRM floodplain is more extensive in this area, including a wide floodway, and a small portion of dFIRM floodplain appears to cross the current city limits on the southeast corner of the city. The City of Vesta does not participate in NFIP; no structures appear to be at risk, although a lagoon may be located in the dFIRM floodplain.

City of Walnut Grove

The floodplain was mapped for the City of Walnut Grove in 1978 and 2013. A flood hazard area follows Plum Creek in the undeveloped northeast portion of the City of Walnut Grove. The City of Walnut Grove does not participate in NFIP; no structures are at risk.

Although all of these cities have mapped floodplains—many without structures. Any of these could break at any time, with the potential to cause water damage throughout the county. Some cities also have lakes, wetlands and other sources of high groundwater that can be a hazard to public and private property.

Figure #69: 100-Year Floodplain and Losses – Lambertton

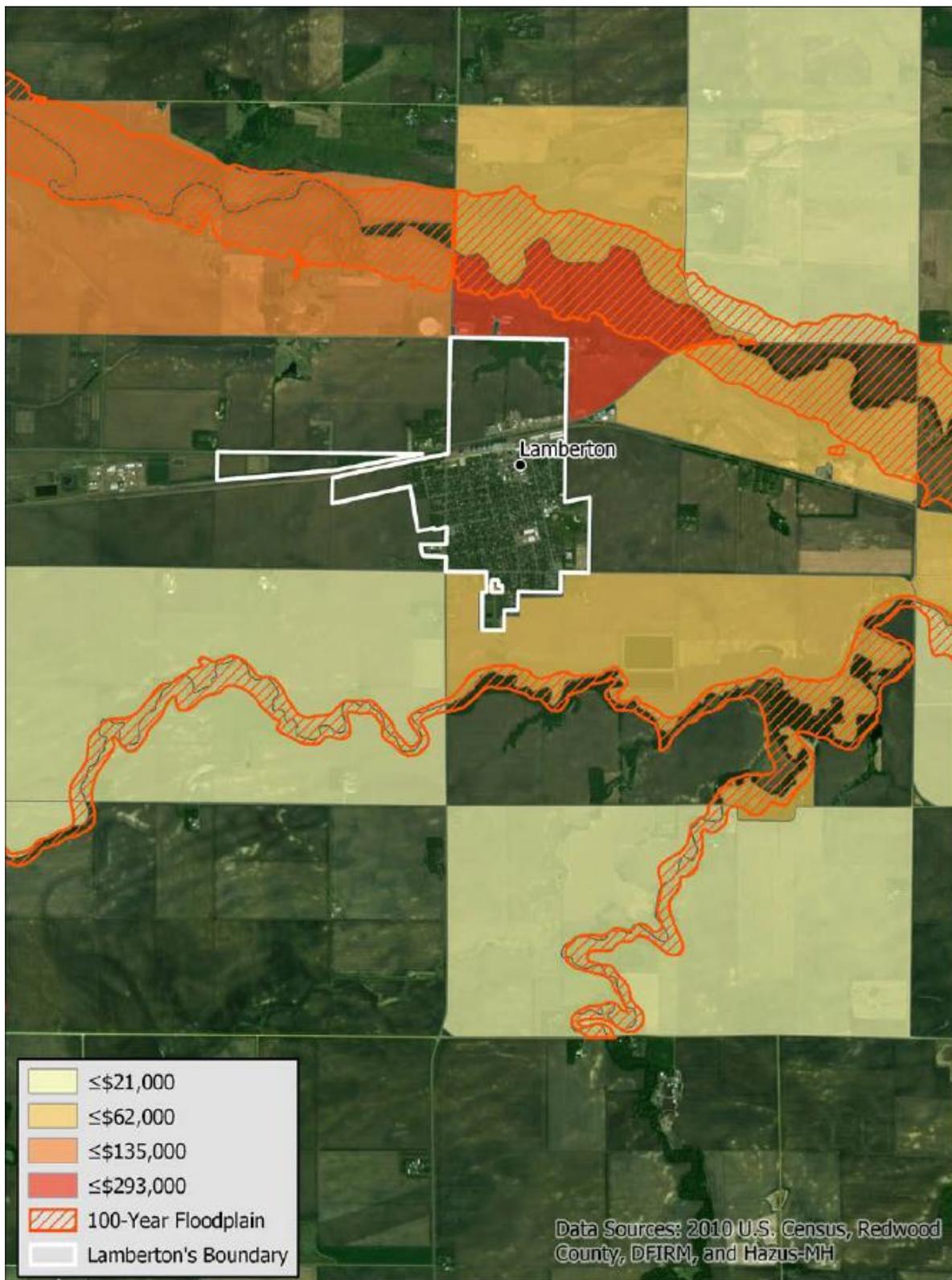


Figure 4. 100-Year Building-Related Flood Loss Estimates in Lambertton

Figure #70: 100-Year Floodplain and Losses – Redwood Falls

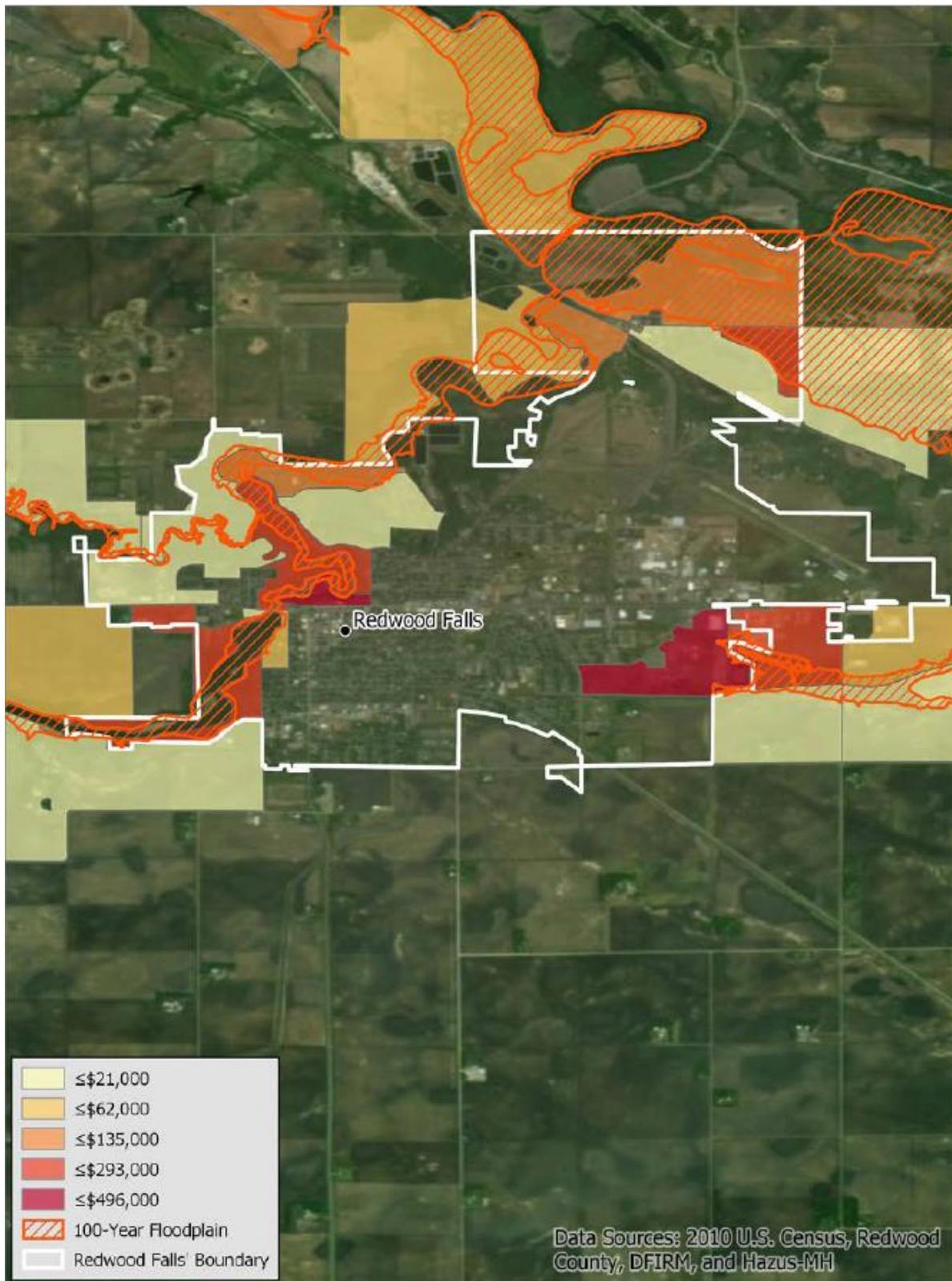


Figure 3. 100-Year Flood Building-Related Loss Estimates in Redwood Falls

Figure #71: 100-Year Floodplain and Losses – Walnut Grove

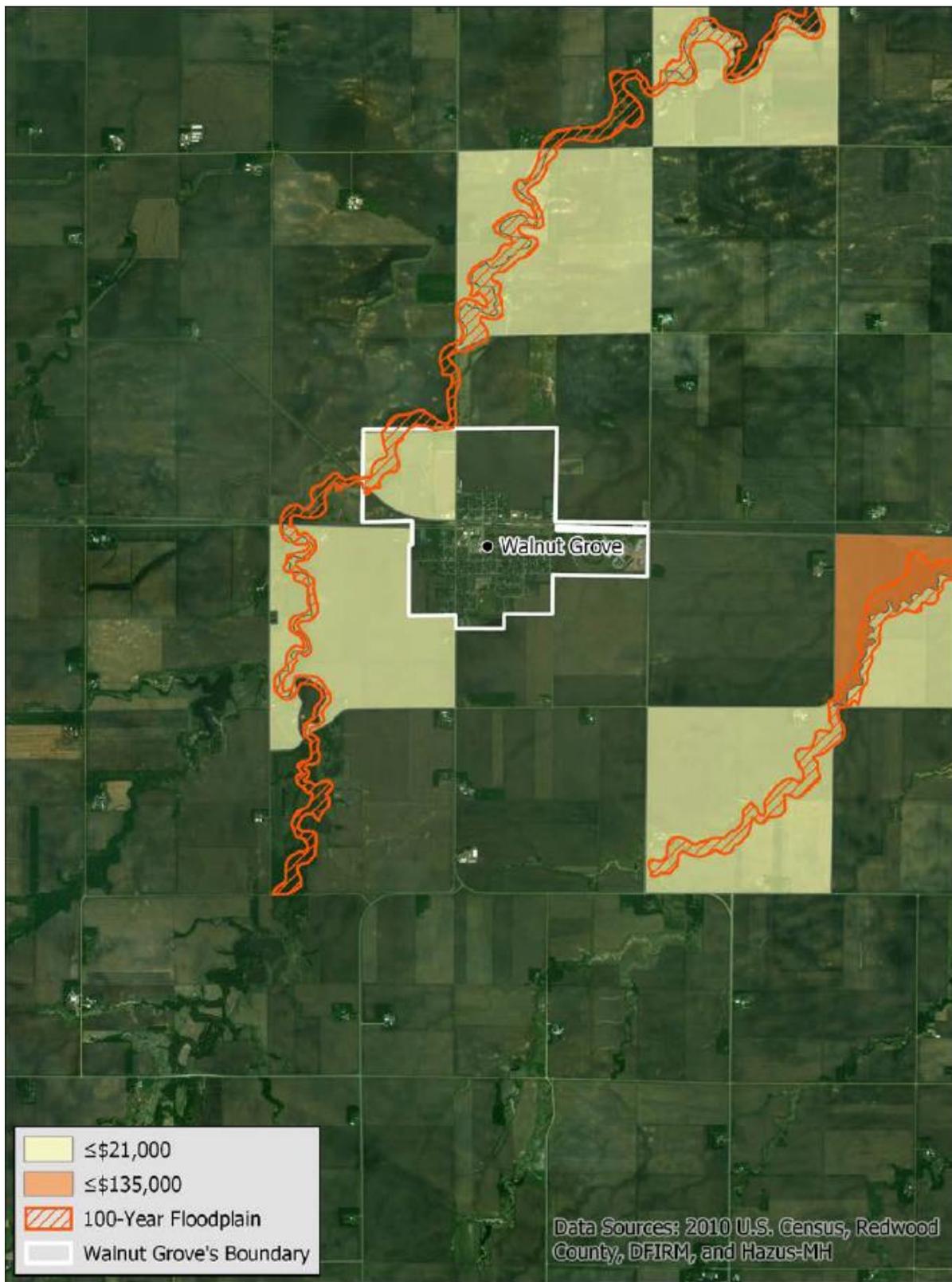
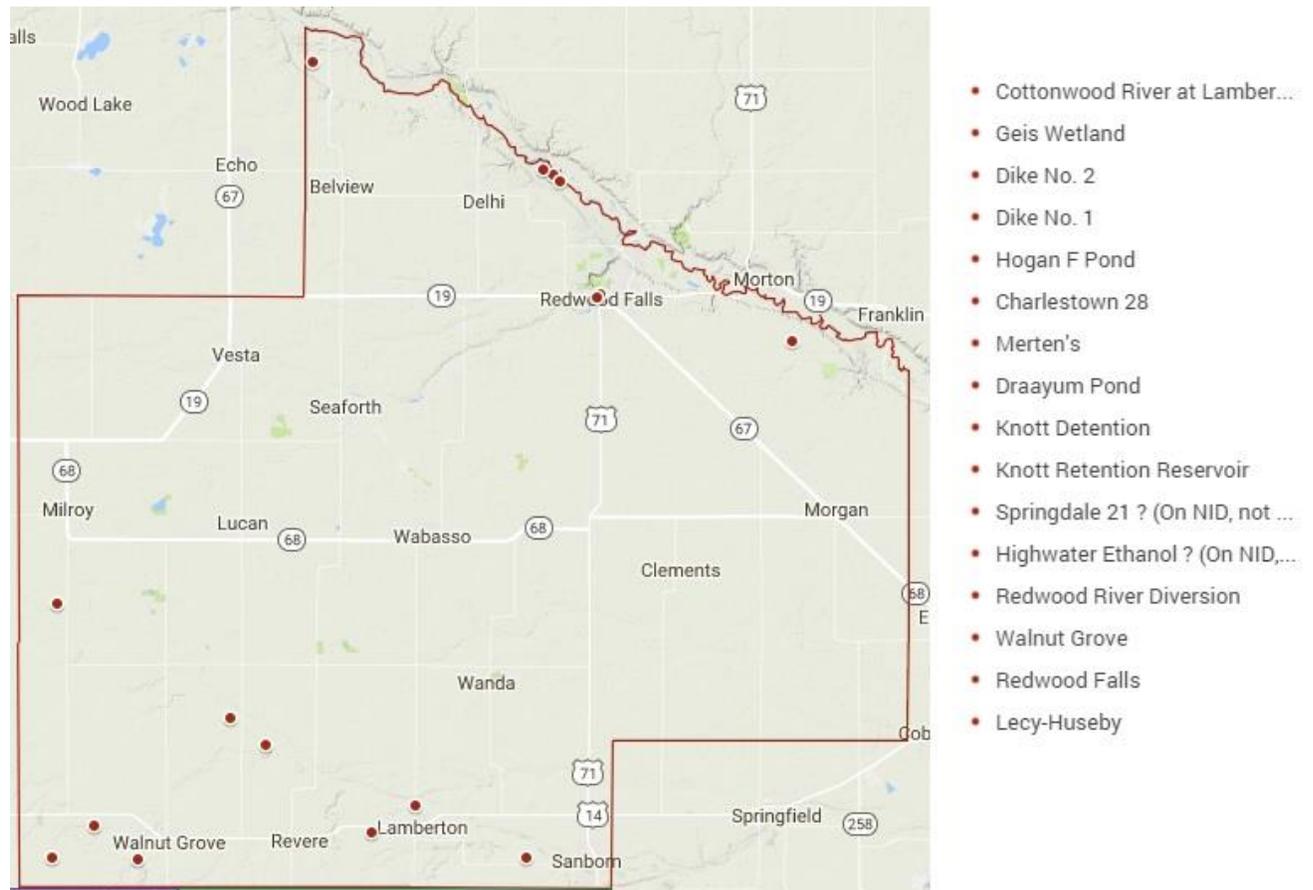


Figure 5. 100-Year Flood Building-Related Loss Estimates in Walnut Grove

Dams

An Emergency Action Plan (EAP) is required for all High Hazard dams, implemented in the County Emergency Operations Plan (EOP). Currently the City of Redwood Falls' Redwood Falls Dam, originally used for hydroelectric generation, has a High Hazard rating. Redwood County's Walnut Grove dam on Plum Creek is rated at Significant Hazard. There are an additional 13 low-rated dams monitored by MN DNR.

Figure #72
Dams – Redwood County

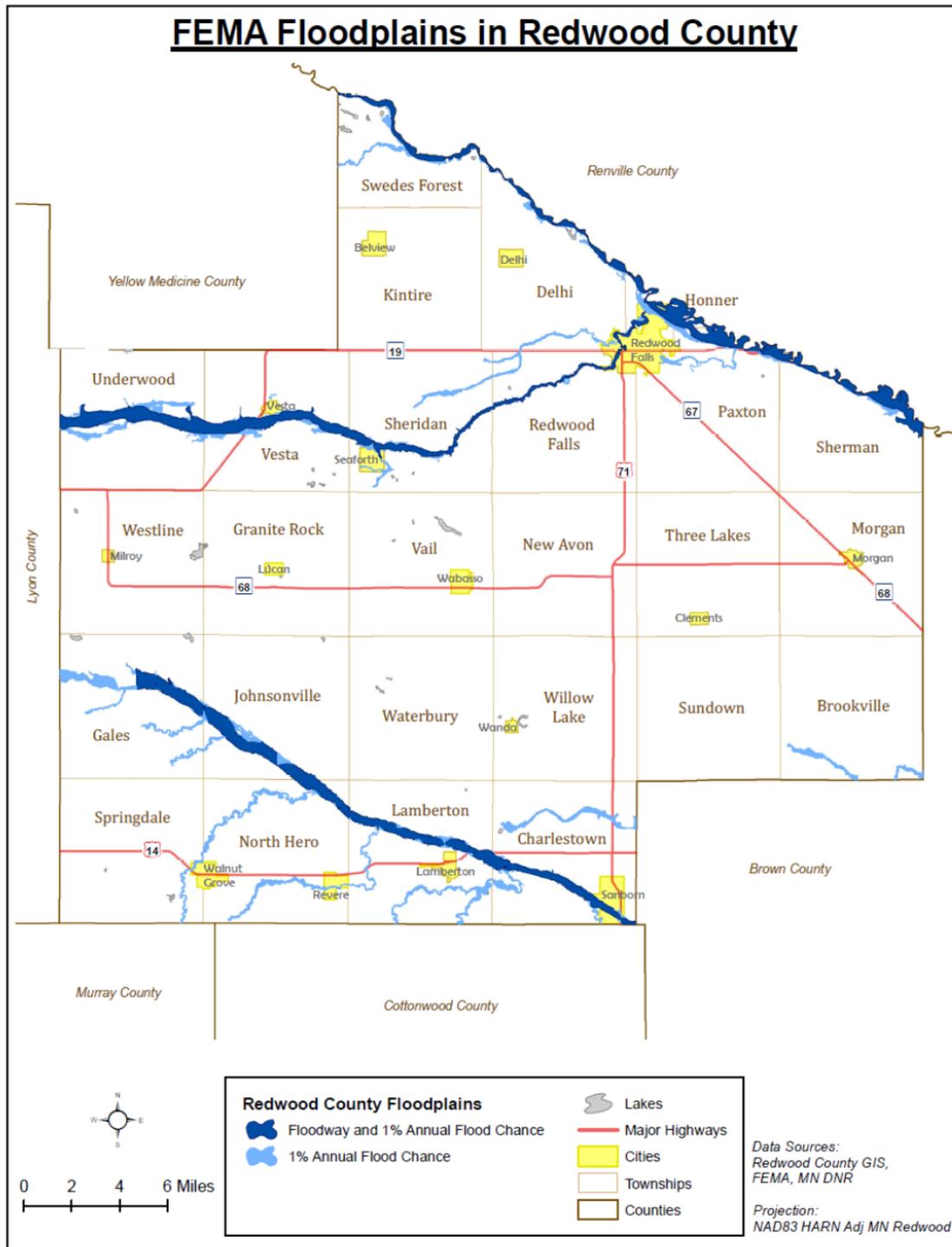


Land Subsidence

Unstable stream banks and steep bluffs can be prone to landslides and subsidence, especially during heavy precipitation or a flood event. This has been a problem along the Minnesota River valley, for example, along road cuts—in April 2011, 7,000 cubic yards of soil slid onto TH 19/71 blocking the highway between Redwood Falls and Morton for several days. The County Highway Engineer has also expressed concern with sloughing at the County Shop site and near bridges on county roads crossing the Minnesota River outside Franklin (Renville County) and Delhi.

The Redwood County Soil Survey notes severe limitations due to caving in several soil types.²⁸ Geologic maps show Redwood County to be located outside areas prone to subsidence due to Karst soil sinkholes.

Figure #73: Flood Plain Map – Redwood County



²⁸ USDA (1981)

Highly erodible soils can result in landslides and sinkholes. Both of these phenomena can occur in Redwood County but are rare as the county's soil loss rates are only 5 T/ac.²⁹ The Erodibility Index (EI) is a numerical expression of the potential of a soil to erode, considering climatic factors and the physical and chemical properties of the soil – the higher the index, the greater is the investment needed to maintain the sustainability of the soil resource base if intensively cropped. Highly Erodible Land (HEL) in Southwest Minnesota is defined to have an EI of at least 5.³⁰ The soil loss tolerance rate (T) is the maximum rate of annual soil loss that will permit crop productivity to be sustained economically and indefinitely on a given soil. Erosion is considered to be greater than T if either the water (sheet & rill) erosion or the wind erosion rate exceeds the soil loss tolerance rate.

Critical Facilities

There are no essential facilities (care, fire, police, schools) in Redwood County that are within the one percent floodplain according to the HAZUS analysis.

Effect on Housing

The majority of Redwood County's population lives safe from flooding, although some housing units have been identified within the one percent floodplain and flooding can occur anywhere. County staff has identified residential and commercial structures within the floodplain using GIS, FIRM Maps, and the State of Minnesota DOQ flyovers.

Development has occurred along and near waterways in Redwood County due to the aesthetics they create. The median housing unit value in Redwood County was \$88,300 in 2010 and \$92,600 in 2015.³¹ The total economic loss estimate for residential structures is \$9,733,000 while the estimated building loss is \$1,683,000. This is just the value of the residential structures. Since flooding could occur in any of the communities within Redwood County and in the rural areas, the potential damage of a flood could be relatively high.

Commercial Structures

There is one commercial structure currently located within the one percent floodplain in Redwood County. Future construction of commercial buildings in the floodplain has been prohibited under Redwood County's zoning regulations.

Public Infrastructure

Within Redwood County there are some roads that are prone to flooding or washing out during a hazard event. Those most noted are roads in low-lying areas. River crossings along the Redwood River are the most vulnerable to intermittent flooding from spring thaws or large rain falls.

²⁹ National Resources Conservation Service, Worthington MN Office. Data Request 1/8/18. Received: 1/9/18.

³⁰ National Resources Conservation Service, Worthington MN Office. Data Request 1/8/18. Received: 1/9/18.

³¹ Census 2010, 2015 ACS. Accessed: 8/8/17. Available:

https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml

Along with flooding or washing out of roads, the County has had a problem with debris being left on roads as a result of water running over the roadway. Debris removal is often limited, but cleanup is a cost that is incurred.

There are 328 bridges on county, municipal, and township roadways within Redwood County.³² Most are made of steel or steel reinforced concrete, which can withstand annual spring flooding. To date, none of the bridges within Redwood County have been destroyed as a result of flooding.

The majority of damages from flooding occur on township roads and county roads. Many other locations can experience damage from flooding depending on the location, amount, and duration of the rainfall event. A one percent flood event would result in a number of roadways sustaining damage and wider spread road closures.

Roads, bridges, and culverts are susceptible to damage from flooding. This may be the result of an undersized culvert, poor drainage, inadequate holding basin, or other issues. For more information regarding specific locations identified in the figure below, please contact the Redwood County Public Works Office.

There are no communities in Redwood County that have wastewater treatment plants close to the one percent floodplain. To date, extensive damage to wastewater treatment ponds within the county due to flooding has not occurred.

Relationship to Other Hazards—Cascading Effects

Numerous. Flooding can have a number of secondary effects that can create additional hazards related to fire, public health, utility failure, insect and pest infestation, and infrastructure damage. Flooding can interfere with emergency response to fires, as seen in Grand Forks, North Dakota, during the Red River Flood of 1997. The after effects of a flood can be a contaminated water supply and mold which affect public health. It can take up to a week or two to get the power back on after a flood. Not having reliable power makes day to day life more difficult. Insect and pest infestation can take place after the flood has receded. Damage to infrastructure can take weeks to repair. This can cause increase emergency response times and put residents at risk.

Flood History in Redwood Hazard

Flood events are an almost annual occurrence in Redwood County, but damage has tended to be limited to roads and bridges. There is a stream gauge on the Redwood River above the City of Redwood Falls, and on the Minnesota River at the US 71 / TH19 Highway Bridge near Morton. Moderate flood stage at the Redwood gauge is 15', which has been exceeded four times.

From January 1993 through June 2017, there have been 14 documented floods and 8 documented flash floods in Redwood County. The tables below documents flooding occurrences since 2000. NOAA defines a flood as “an overflow of water onto normally dry land. The inundation of a normally dry area caused by rising water in an existing waterway, such as a river, stream, or drainage ditch. Ponding of water at or

³² MnDOT. MN Bridges Report 2016. Accessed: 8/18/17. Available: <http://www.dot.state.mn.us/bridge/pdf/minnesota-bridges-2016-report.pdf>

near the point where the rain fell. Flooding is a longer term event than flash flooding: it may last days or weeks.”³³

NOAA defines a flash flood as “a flood caused by heavy or excessive rainfall in a short period of time, generally less than 6 hours. Flash floods are usually characterized by raging torrents after heavy rains that rip through river beds, urban streets, or mountain canyons sweeping everything before them. They can occur within minutes or a few hours of excessive rainfall. They can also occur even if no rain has fallen, for instance after a levee or dam has failed, or after a sudden release of water by a debris or ice jam.”³⁴

Figure #74
Floods – Redwood County

Date	Location	Event Narrative
4/1/2001	Redwood County and 41 other counties	Heavy snowfall during winter remained on the ground through the end of March and then rapidly melted, resulting in river stages close to record levels. Water began to gush through drainage ditches, streams and into the mainstem rivers during midday April 1. Heavy rain April 7-8 over much of central Minnesota prolonged the high water and also added one or two feet to many crests during mid-April. Another period of heavy rain April 22-23 caused rivers to crest again; in some cases the crest was higher than the first. Many rivers remained well above flood stage into mid-May. The crest on the Minnesota River at Henderson came within one half foot of its record level that was set in 1965. Numerous roads and bridges were closed, millions of sandbags used, approximately 200 homes and businesses were partially submerged with flood waters, and about 100 homes and businesses were damaged beyond repair across the 42 counties. Three fatalities were attributed to the flooding: i) two boys in Renville County were playing on top of melting snow along a deep drainage ditch. They died when the snow collapsed into the drainage ditch with its torrential flow, and ii) two men drove around a barricade on Highway 101 at Shakopee (Scott County) and drove into the Minnesota River
5/1/2001	Redwood County and 19 other counties	Snowmelt flooding that began April 1 continued into early May on the major rivers: the Minnesota, St. Croix, Crow River, South Fork of the Crow River, and the Mississippi River below its confluence with the Minnesota River. See April Storm Data for details, including damage amounts. The last of the river levels finally went below warning criteria on May 8.

³³ NOAA. Accessed: 8/8/17. Available: <http://www.srh.noaa.gov/mrx/hydro/flooddef.php>

³⁴ NOAA. Accessed: 8/8/17. Available: <http://www.srh.noaa.gov/mrx/hydro/flooddef.php>

Date	Location	Event Narrative
5/30/2004	Redwood, Renville, McLeod Counties	Heavy rain that fell between 10 PM CDT on the 29th and 3 AM on the 30th caused widespread flooding of roads, fields, and waterways across Redwood and southern Renville counties. In Redwood County, significant flooding was reported in Redwood Falls, Wabasso, and Morgan. Eight county roads had to be closed after water flowed over them. In Redwood Falls the Minnesota River crested 2 feet above flood stage. The Redwood River, the Cottonwood River, and Ramsey Creek also ran high. Ramsey Park and the sway back bridge were closed by high water in addition to nearby County Road 31. Numerous basements were flooded across the city. In Morgan, many city residents reported flooded basements and nearby gravel roads were washed out. Farmers outside of town had to replant beans and corn after their fields flooded. The highest rainfall totals included 8 inches in New Avon Township, 7 inches in Wabasso, and 5 inches in Redwood Falls. Several roads, fields, and waterways, including the Redwood and Minnesota rivers, remained flooded through the evening of the 31st.
3/13/2007	Redwood Falls, Springfield, Rush River, Dawson	Snow melt and rapid warming brought flooding to portions of central and southern Minnesota. Water flooded Ramsey Park, covering a road.
3/19/2010	Vesta and 49 other cities	The winter had very little melting on the snow cover and therefore, once temperatures in March started to rise and melt the snow cover, there was nearly three to six inches of liquid water ready to be release onto the surface. Numerous counties roads were flooded from snow melt and associated runoff along several tributaries of the Minnesota River, and the Redwood River in Redwood County. Monetary costs were based on FEMA, State, and Local assistance which includes the following categories; emergency protective measures, and road systems and bridges.
3/25/2011	Delhi and 8 other cities	Due to a very wet fall, and a deep snow pack by mid March, when temperatures began to rise and melt the snow, area streams, creeks and eventually rivers rose to minor, moderate, and major stage levels. Several county roads and U.S. Highways became impassable due to Spring snow melt and the associated runoff that continued through the end of the month. The worst areas were along the Redwood and Cottonwood Rivers, and their tributaries.
6/18/2014	Redwood Falls ARPT and 16 other cities/ARPT	Several rounds of thunderstorms began during the week of June 14th, and continued through most of the week with areas of flash flooding. The flash flooding evolved into areal flooding, and then main-stem river flooding which continued through the end of the month. Parts of Minnesota received 10-12 inches of rain from June 14th through the 23rd, which is 400-600% above normal. The cities of Belview, Vesta, and Redwood Falls all had sewer backups due to flooding related problems.

National Climatic Data Center (NCDC / NOAA) Storm Events database

Figure #75
Flash Floods – Redwood County

Date	Location	Event Narrative
4/22/2001	Redwood County and 8 other counties	Two to four inches rain fell on saturated ground. County officials reported roads closed in portions of Benton, Meeker, Redwood, Renville and Stearns Counties, with some roads washed out.
5/29/2004	Redwood, Renville, McLeod Counties	Heavy rain that fell between 10 PM CDT on the 29th and 3 AM on the 30th caused widespread flooding of roads, fields, and waterways across Redwood and southern Renville counties. In Redwood County, significant flooding was reported in Redwood Falls, Wabasso, and Morgan. Eight county roads had to be closed after water flowed over them. In Redwood Falls the Minnesota River crested 2 feet above flood stage. The Redwood River, the Cottonwood River, and Ramsey Creek also ran high. Ramsey Park and the sway back bridge were closed by high water in addition to nearby County Road 31. Numerous basements were flooded across the city. In Morgan, many city residents reported flooded basements and nearby gravel roads were washed out. Farmers outside of town had to replant beans and corn after their fields flooded. The highest rainfall totals included 8 inches in New Avon Township, 7 inches in Wabasso, and 5 inches in Redwood Falls.
9/12/2005	Redwood County and 7 other counties	Local law enforcement officials reported flooded roadways in Redwood Falls. A total of 3.62 inches of rain was recorded in Morgan.
8/19/2007	Redwood Falls and 10 other cities	A slow moving cold front provided the lift mechanism needed for strong thunderstorms, heavy rain and flooding. Water flooded the intersection of Highway 67 and 68 in the city of Morgan. Water flowed out of ditches along Highway 71 near Redwood Falls.
10/05/2007	Redwood Falls	A warm frontal boundary near extreme South Central Minnesota produced some sporadic flooding. Law enforcement reported significant street flooding in the city.
9/22/2010	Walnut Grove ARPT and 11 other cities	Strong thunderstorms developed during the late afternoon, and early evening across the county, and dropped one to two inches of rainfall, along with some hail stones. By 730 pm, another band of thunderstorms developed across the county and began to train over the same areas. County Road 10, south of Highway 14, was flooded due to the excessive rainfall and closed for a portion of the night. In addition to the smaller tributaries, the larger Minnesota and Mississippi Rivers had flooding from Redwood Falls, to the Twin Cities, then southeast to Red Wing, Minnesota for about two to three weeks, as the runoff was extensive.

Date	Location	Event Narrative
6/18/2014	Belview and 9 other cities	There were three rounds of thunderstorms that occurred from south central to east central Minnesota from midnight, through 9 am Thursday morning. Each round of thunderstorms produced one to two inches of rainfall, and by the time the third round moved across the same areas, nearly 4 to 6 inches fell, and produced widespread areas of flooding, with some flash flooding. As the thunderstorms developed near Granite Falls prior to midnight, and west of Redwood Falls. Due to excessive rainfall in a short period of time, flood waters caused the basement walls of homes in Belview to collapse.

National Climatic Data Center (NCDC) Storm Events database

Vulnerability

Flooding is highly likely to occur each year and forecasting technology and models can help predict yearly spring flooding. Even with weather forecasting technology floods can occur rapidly and poses a risk throughout the county. Flooding can occur anytime anywhere, so the potential damage of a flood could be higher than the total value of residential structures within the floodplain. The value of residential structures does not take into consideration outbuildings, machine sheds, and agricultural production. The potential damage of a flood could be relatively high. Flash flooding could result in sewer systems being overloaded and flooding to occur in basements. Basement flooding could be isolated to low lying areas, or could be citywide in an event of an extreme rain event.

Plans and Programs

Improvements have been made along the flood plain. Pumps have been purchased by cities to assist with bypassing the sewer system during an extreme rain event. Additional plans and programs include:

- Zoning – The floodplain section of the Redwood County Development Code addresses the placement of structures within the floodplain. Redwood County’s zoning regulations prohibits any further development within the floodplains. Existing structures may continue to exist as “grandfathered” structures, but the county anticipates the number of these structures will be reduced over time.
- The Redwood Soil & Water Conservation District (RSWCD) ten-year strategic plan includes goals to reduce flooding and documenting the effectiveness of flood reduction measures, as well as working on water quality issues. The Redwood-Cottonwood Rivers Control Area, a non-regulatory, joint-powers organization that includes eight counties in the Redwood and Cottonwood river basins, focuses mostly on water quality but also works to keep water on the landscape longer, reducing potential flood impacts.
- Area II River Basin – The Area II River Basin works to alleviate recurrent flood problems in southwest Minnesota. Member counties include: Brown, Cottonwood, Lac qui Parle, Lincoln, Lyon, Murray, Pipestone, Redwood, and Yellow Medicine.
- Dams – Area II River Basin have worked with Redwood County to sponsor and complete dam projects in the county and surrounding counties.
- County flood area maps – Redwood County has FIRM maps identifying the 100-year. The county zoning ordinance controls permitted land uses in these areas, what can be built, and how.

- City flood area maps – A few cities in Redwood County have official FIRM maps identifying the 100-year flooding plain. All cities addressed flood risks in their planning and zoning documents.
- Redwood County Emergency Operations Plan – A response plan to a flood emergency has been developed and local resources and personnel have been committed to it:
- Response Plan – A response plan to a flood emergency has been developed and local resources and personnel have been committed to it. Part of the response plan is an evacuation plan that is in the EOP.
- National Flood Insurance Program (NFIP) – Redwood County and the following cities participate in the NFIP: Redwood Falls, Sanborn, and Seaforth.³⁵ The NFIP has three basic aspects that include: floodplain identification and mapping, floodplain management, and flood insurance.
- Zoning restrictions – The City of Redwood Falls and Redwood County have zoning restrictions that limit new structures and land uses within the Floodway, Flood Fringe, and General Flood Plain District.
- Water level monitoring – Water levels in the Redwood River are monitored, so the water levels downstream are predictable. The closest gauge is by County Road 17.
- Wastewater treatment plants are required to test discharges after major rains events to determine whether or not discharges meet PCA guidelines for acceptable levels of waste.
- Local Water Management Plan – The water plan identifies priorities regarding drainage, which includes flooding.
- Emergency response planning – Road closures are taken into account in planning and training. Local fire departments, emergency medical services, and other emergency responders plan for having to use alternative routes in case of flooding.
- Ditch system / drainage – Redwood County continues to make improvements to the ditch system. With increased tiling, it is important to reevaluate the ditch system and drainage.
- Sediment ponds – The Redwood County Highway Departments works with the DNR and other organizations to increase the number of sedimentation ponds along roadways in Redwood County. Sedimentation ponds hold back water, which helps to control flooding. Redwood County Zoning references erosion control and drainage in our subdivision ordinance, but the county does not distinctly call out requirements for sedimentation ponds or their required size. Redwood County follows state recommendations on storm water management for bare land development and other applicable projects.
- In 2010, in response to DR-1900, FEMA’s Environmental Planning and Historic Preservation program worked with the Redwood County Highway Engineer and Minnesota Historical Society to stabilize the historic Ramsey Park Swayback Bridge (Section VI.A.5.a). FEMA and the historical society posted a locally-produced video of the project on YouTube.³⁶ While funds were committed for rehabilitation, unfortunately two more flood-related disasters (DR-1941, DR-1982) caused further damage and delays in restoration of the structure. The County and the City of Redwood Falls have been working with the State Historic Preservation Officer (SHPO) and developing an application for Minnesota Legacy funding.

³⁵ MN DNR. National Flood Insurance Program Participation. Data Request. Accessed: 7/11/2017.

³⁶ <http://www.youtube.com/watch?v=tqD557QiLec> accessed most recently 20 October 2011

- The City of Redwood Falls is also working with FEMA and DNR in response to these disasters to purchase a flood-prone building in Old North Redwood from a willing seller. The project cost is estimated at approximately \$54,000 and will make room for future flood-preparation efforts.
- Road mitigation projects – Road retention projects were pursued to reduce the impact of flooding along roadways. These projects included: analyzing runoff and the capacity of county ditches, the installation of smaller culverts, and adding water retention ponds. Downsizing culverts is a reversal in the trend of replacing culverts with larger sized culverts, which only transfer additional water downstream. Redwood County has been proactive in culvert replacement.

Gaps and Deficiencies

- Models for 500-year and 1000-year floods don't exist, but these types of floods happen (summer 2018, specifically).
- Wastewater treatment vulnerability to flooding – Wastewater treatment plants are vulnerable to flooding. Pumps may not be capable to keep up with flood events. This would result in sewer water being combined with clean water and entering the various watersheds. Pond systems are the most vulnerable.
- Grandfathered in structures in the floodplain – At-risk uses and structures remain in identified 100-year floodplains, because they are “grandfathered” in.
- Severe flooding – Local resources are not adequate for a severe and prolonged flood. State and federal resources are required when responding to severe flooding. There may be a time delay to receive assistance.
- Development in the floodplain – Some residents are resistant to leaving their property, even if it is located in a designated floodplain. The area may be seen as scenic, so the resident may want to continue living in the floodplain.
- Many local residents are resistant to zoning and building codes that could assure higher standards for new construction.
- Local assistance – Local match for mitigation projects (such as acquisition of property) is often difficult to acquire, due to limited local budgets and will likely become even more difficult to fund as local government assistance is further cut back.
- Local resources – Local resources are not adequate for a severe or prolonged flood. Additional assistance would be needed.
- Limitations of models – Models are increasingly being used by engineers and scientists in flood management. Models are only as accurate as the data that is used in the analysis. Outdated maps and not including all the impacting variables can cause forecasting errors to occur. Ground saturation is one variable that is not included in the models for estimating yearly flood levels. Ground saturation affects the amount of moisture that can be soaked in during a precipitation event. Forecasters are working on ways to include ground saturation into their flood models.
- Floodplain - Existing land use plans do not necessarily address flood plain protection.
- Pumps – There are always a number of requests for pumps and generators when there are flood events. The MN Warn System helps to coordinate the supply of pumps, generators, and other equipment to affected communities. Through the MN Warn System communities can share local and regional assets.

- Aging drainage systems – Public drainage systems are aging and maintenance costs are increasing. Culverts are rusting out and replacement costs are substantial. Townships and local units of government need outside funding to help update public drainage systems. Not updating the system will lead to culvert failures, roads washing out, and erosion.

5.4.4 Severe Summer Storms (Severe Thunderstorms, Lightning, and Hail)

During the spring, summer and autumn, severe thunderstorms, lightning, and hail can occur. (Windstorm and tornado events are addressed in the next section.) All locations in Redwood County are at risk to be affected by this hazard. Severe summer storm events will be more widespread. These weather events can generate lightning and hail that tend to be more isolated.

Thunderstorms, which occur most frequently from mid-May through mid-July, are the most common type of severe summer storm. Thunderstorms are usually localized, produced by cumulonimbus clouds, accompanied by lightning, and have strong wind gusts, heavy rains, and sometimes hail or tornadoes. Thunderstorms are produced by air masses that become unstable and that overturn violently. Unstable air masses are usually the result of warm humid air at lower elevations and colder air at higher elevations.

Lightning is often associated with thunderstorms and can be deadly. Lightning occurs to balance the difference between positive and negative discharges within a cloud, between two clouds, and between the cloud and ground. For example, a negative charge at the base of the cloud is attracted to a positive charge on the ground. A lightning bolt happens when the difference between the charges is great enough. The charge is usually strongest on tall buildings, trees, and other objects protruding from the surface. Consequently, these objects are more likely to be struck than lower objects.

While cloud-to-ground lightning poses the greatest threat to people and objects on the ground, it accounts for only 20 percent of all lightning strikes. The remaining lightning occurs within the cloud, from cloud to cloud, or from the ground to the cloud. The most common type of lightning is lightning occurring within a cloud.

Hail is an ice product produced in severe thunderstorms. It is formed when strong updrafts within the cumulonimbus cloud carry water droplets above the freezing level or when ice pellets in the cloud collide with water droplets. The water droplets freeze or attach themselves to the ice pellets and begin to freeze as strong updraft winds toss the pellets and droplets back up into colder regions of the cloud. Both gravity and downdrafts in the cloud pull the pellets down, where they encounter more droplets that attach and freeze and are tossed once again to higher levels in the cloud. This process continues until the hail becomes too heavy to be supported by the updrafts and falls to the ground.

Figure #76
Estimating Hail Size

Description	Diameter (inches)
Pea	0.25
Plain M&M	0.5
Penny	0.75
Nickel	0.88
Quarter	1
Half Dollar	1.25
Walnut or Ping Pong Ball	1.5
Golf ball	1.75
Hen's Egg or Lime	2
Tennis Ball	2.5
Baseball	2.75
Tea Cup	3
Grapefruit	4
Softball	4.5
CD-DVD	4.75 – 5

National Weather Service (NWS)

In Minnesota, most hail ranges in size from pea-size (1/4 inch) to golf-ball size (1-3/4 inch). Larger hailstones have been reported, but occur less frequently. Strong updrafts are necessary within the cloud to form hail, and are usually associated with severe thunderstorms. Coverage areas for individual hailstorms are highly variable and spotty due to the changing nature of the cumulonimbus cloud.

Given the rural agricultural nature of the county, the likelihood is greatest that crops would experience the most damage from a hail event; however, hail can also do a great amount of damage to vehicles and roofs of individual structures. The chance of significant building damage is likely to be higher within the cities as there are simply more buildings clustered in a small area to be potentially damaged.

Relationship to Other Hazards—Cascading Effects

- *Utility Failure.* Extreme heat can lead to the power grid being overloaded and can in turn cause blackouts.
- *Transportation Infrastructure.* Heavy rain can cause flash flood events, and may threaten transportation infrastructure.
- *Fire.* Lightning can cause both structure fires and wildfires.
- *Agricultural Disease.* Extreme Heat can have a major effect on the county’s crops and livestock. During prolonged heat events, crops grow weak and are more susceptible to plant pests and diseases. In times of extreme heat, it is important that confinement buildings are properly ventilated and outside livestock are provided with places to get into the shade. Heat stroke can pose a serious threat to livestock.

Severe Summer Storms History in Redwood County

Thunderstorms are not documented by the NOAA as a separate event. There is one documented lightning event in Redwood County from January 2000 through July 2017.³⁷ There were most likely a number of other lightning events, but they went unreported. “Tall objects such as trees and skyscrapers are commonly struck by lightning... Lightning can strike the ground in an open field even if the tree line is close by.”³⁸

Figure #77: Lightning Events – Redwood County

Date	Location	Event Narrative
6/21/2002	Vesta	Lightning struck a machine shop in which a man was working. Some electricity traveled through a hoist and hydraulic hose that the man was holding, entered his body through one arm and exited out the other. Although struck, the injury was not serious.

National Climatic Data Center (NCDC) Storm Events database

The lightning activity level (LAL) is a common parameter that is part of fire weather forecasts nationwide. LAL is a measure of the amount of lightning activity using values 1 to 6 where:

Figure #78: Lightning Activity Level

LAL	Cloud & Storm Development	Lightning Strikes / 15 min
1	No thunderstorms.	-
2	Cumulus clouds are common but only a few reach the towering cumulus stage. A single thunderstorm must be confirmed in the observation area. The clouds produce mainly virga, but light rain will occasionally reach the ground. Lightning is very infrequent.	1-8
3	Towering cumulus covers less than two-tenths of the sky. Thunderstorms are few, but two to three must occur within the observation area. Light to moderate rain will reach the ground, and lightning is infrequent.	9-15
4	Towering cumulus covers two to three-tenths of the sky. Thunderstorms are scattered and more than three must occur within the observation area. Moderate rain is common and lightning is frequent.	16-25
5	Towering cumulus and thunderstorms are numerous. They cover more than three-tenths and occasionally obscure the sky. Rain is moderate to heavy and lightning is frequent and intense.	>25
6	Similar to LAL 3 except thunderstorms are dry.	

³⁷ NOAA. Accessed: 8/7/17. Available: <http://www.ncdc.noaa.gov/stormevents/>

³⁸ NOAA. Accessed: 8/7/17. Available: <http://www.nssl.noaa.gov/education/svrwx101/lightning/>

Figure #79: Lightning Detector Needs – Redwood County Schools

Location	Lightning Detectors	Need for Lightning Detectors
Redwood Area Schools	[None]	Would only need two since all fields are in the same complex.
Westbrook-Walnut Grove Elementary	[2 – generally kept with our athletic trainers at our outdoor events]	Add 2 additional devices to our supply, since often have multiple events at multiple sites taking place concurrently.
Milroy Elementary	None	
Red Rock Central Schools	None	

Figure #80: Lightning Detector Needs – Cities (Public Facilities)

Location	Lightning Detectors	Need for Lightning Detectors
Redwood Falls	1	Legion Park – softball and baseball fields

Hail events are separate events recorded by NOAA. Hail is often part of a thunderstorm and is not always reported due to the varying size and the rural nature of Redwood County. From January 2000 through July 2017, there have been 80 documented hail events in Redwood County. Some of these hail events are only minutes apart, but a hail event is a separate event if the storm stops hailing and starts hailing a few minutes later.

Figure #81: Hail Events, Redwood County (2010 – 2017)

Date	Location	Size	Event Narrative
6/26/2010	Milroy, Morristown, Burr	1.0"	Several reports of quarter size hail occurred from Milroy to Lucan, Minnesota.
9/15/2010	Morgan and 5 other cities	0.88"	Several waves of thunderstorms moved across central and southern Minnesota during the early morning hours of Wednesday September 15th, and continued to regenerate across South Dakota, and into portions of central and southern Minnesota, during the afternoon and evening hours as an area of low pressure developed. A few severe thunderstorms developed around Mankato, and Owatonna, Minnesota, where hail up to ping pong size was reported.
4/6/2011	Walnut Grove, Glenville	0.75"	A series of thunderstorms moved across northern Iowa, and into far southern Minnesota during the early morning hours of Sunday, April 10th. Most of the thunderstorms produced heavy rainfall and pea to dime size hail. One thunderstorm moved from northern Worth County in Iowa, into far southern Freeborn County between Albert Lea and the Iowa border. The storm intensified and produced half dollar size hail in the town of Glenville, Minnesota. Earlier Saturday, several non-severe thunderstorms produced dime size hail near Redwood Falls.

Date	Location	Size	Event Narrative
7/1/2011	Redwood Falls and numerous other cities	0.75" - 1.25"	Several of the storms developed tornadoes near Redwood Falls. In addition to the tornadoes, severe straight line winds occurred. Plus, the development of the rear inflow notch, allowed for the strong winds to continue beyond the main bow echo across many areas of southern Minnesota. Widespread reports of hail with each storm, along with a few reports of baseball and softball size hail. 1.25" and 0.75" hail reported in Redwood Falls.
5/1/2012	Walnut Grove, Lamberton, and numerous other cities	0.88" - 1.0"	A frontal boundary that lied across central Minnesota, was the focus for showers and thunderstorms that developed near Alexandria, and moved to the east-southeast during the afternoon, and evening hours. Other thunderstorms developed across southern Minnesota during the afternoon, and early evening and produced mainly large hail.
5/26/2012	Walnut Grove	0.75"	A large thunderstorm complex that developed across southern Minnesota during the afternoon of Saturday, May 26th, quickly became severe in portions of east central Minnesota.
6/19/2012	Redwood Falls, Morgan, Gilfillan	0.75" - 0.88"	A complex of thunderstorms that developed early Tuesday morning across South Dakota, moved quickly eastward across southern Minnesota, with numerous reports of large hail, severe wind gusts, and torrential rainfall. Farmers across southern Minnesota, from Redwood Falls to New Prague, were hit by large hail and high winds. The combination of the hail and high winds caused a large swath of crop damage, up to 15 miles wide in some areas to corn and soy beans. Some farmers had a total loss as the hail shredded corn and soy bean fields.
8/1/2012	Wabasso, St. Leo, Springfield, Northfield, and Zumbrota	0.75"	Wednesday afternoon, August 1st, thunderstorms developed near Canby, Minnesota, and moved to the east-southeast and intensified. Large hail was the first to develop early in the storms history, then it began to bow out and move to the east-southeast across portions of west-central and southwest Minnesota, where several wind gusts over 60 mph occurred. The highest wind gust occurred at 551 PM CST at the Redwood Falls regional airport where a measured 79 mph wind gust occurred.
8/23/2013	Milroy and 13 other cities	1.0"	During the early afternoon of Thursday, August 23rd, thunderstorms begun to develop in west-central Minnesota near Morris, and moved northeast. A few large hail stones were reported south and southwest of Hancock. Later that afternoon, thunderstorms developed near Marshall, and to the northeast near Glencoe and Watertown. Some of the storms produced large hail.

Date	Location	Size	Event Narrative
6/18/2013	Wabasso, Wanda, Granite Falls, and Springfield	1.75"	A small scale disturbance moved southeast across the Dakotas and into southwest Minnesota, producing an area of very large hail early on the 18th. The colder temperatures aloft combined with ample wind shear to generate severe thunderstorms, some of which produced up to 2.5 inch size hail near Wabasso, Wanda, and Springfield. Crop damage was reported near Springfield due to the large hail stones.
6/21/2013	Milroy, Vesta, and 15 other cities	1.5"	Two rounds of severe thunderstorms occurred across portions of southern and central Minnesota, between Friday afternoon, June 21st and early Saturday morning, June 22nd. These storms developed across central South Dakota and moved into west central Minnesota after 4 pm, causing large hail, damaging winds and torrential rainfall. Another area of severe thunderstorms developed across southwest and west central Minnesota and moved east-southeast across south central Minnesota during the overnight hours. Due to the severity of this event, 18 Minnesota counties hit by flash flooding and severe storms were declared national disaster by the president of the United States, and were allowed FEMA assisted funds. A preliminary estimate pegs the cost of damage to public infrastructure at \$17.8 million.
6/22/2013	Seaforth, Myrtle	1.0"	Isolated severe storms near Redwood Falls and Albert Lea moved northeast across east central and southeast Minnesota during the early morning hours of Sunday, June 23rd. After 2 am, a line of severe storms developed across southwest Minnesota and raced eastward rapidly and produced occasional large hail and damaging wind gusts across southern Minnesota. Significant damage to crops was noted in the area due to the combination of strong winds and large hail.
8/31/2013	Wabasso and 8 other cities	1.75"	During the afternoon of Saturday, August, 31st, a complex of thunderstorms developed across southeast North Dakota, and moved into west central Minnesota during the late afternoon hours. These storms moved southeast across mainly western and southern Minnesota and produced large hail and damaging winds. Most of the severe storms were concentrated along the Minnesota River Valley during the early evening hours as a bow echo moved southeast.
5/8/2014	Morgan and 11 other cities	0.75"	Several rounds of thunderstorms occurred Thursday afternoon and evening as warm air surged northward across the Plains, and into the Upper Midwest. A warm front extended across far southern Minnesota. Several reports of damaging winds occurred with this bow type thunderstorm complex Thursday afternoon.

Date	Location	Size	Event Narrative
6/8/2016	Belview, Redwood Falls, Morgan	0.75" - 0.88"	Scattered thunderstorms developed along the leading edge of a very warm and humid air mass across southern Minnesota. These storms developed in the afternoon of Wednesday, June 8th in west central and southwest Minnesota, and moved southeast. A few storms produced up to nickel size hail around Redwood Falls.
6/17/2016	Redwood Falls and 20 other cities	0.75"	A large complex of thunderstorms developed during the early morning of Friday, June 17th. These storms moved eastward across eastern North Dakota and produced a large area of severe winds and hail. During the afternoon, a broken line of storms continued to form south and west across southern Minnesota. The storms in the afternoon become more multicellular as they expanded further to the south and east toward the Minnesota/Iowa border by early evening. Due to the multicellular nature of the storms, downburst winds and large hail were localized. In central Minnesota, the main damage was associated with large hail, up to golf ball size at times.
8/18/2016	Sanborn	1.0"	A complex of thunderstorms that developed from morning convection across west central Minnesota, moved southeast across southwest and into south central Minnesota during the afternoon. The storms intensified north of Springfield, Minnesota and raced east-southeast across south central Minnesota. Several reports of measured high winds, trees blown down, and power outages.
3/6/2017	Redwood Falls, Wabasso	1.0"	A powerful storm system that developed across the northern plains Monday, March 6th, produced a swath of large hail and some damaging wind gusts from central Minnesota, southward into the central plains. Once thunderstorms developed, strong to severe storms developed quickly and produced large hail near Redwood Falls.

National Climatic Data Center (NCDC / NOAA) Storm Events database

Hail and Climate Change

According to the Federal Advisory Committee Draft National Climate Assessment (NCA), winter storms have increased slightly in frequency and intensity, and their tracks have shifted northward over the U.S. Other trends in severe storms, including the numbers of hurricanes and the intensity and frequency of tornadoes, hail, and damaging thunderstorm winds are uncertain. Since the impact of more frequent or intense storms can be larger than the impact of average temperature, climate scientists are actively researching the connections between climate change and severe storms (National Climate Assessment Development Advisory Committee, 2013).

The occurrence of very heavy precipitation has increased in Minnesota in recent decades and future projections also indicate this will continue (International Climate Adaptation Team, 2013). While it is unknown if this precipitation will occur during severe storms that produce hail, the possibility has not been ruled out.

Vulnerability

Severe summer storms are highly likely to take place every year, including lightning, and hail. People do not always recognize their limitations. Summer storms can pose a serious risk to all populations, especially the young and elderly population. Informing the public about summer storms is important in preventing accidents.

Plans and Programs

- Emergency alert system – Redwood County has the CodeRED emergency notification system. CodeRED allows emergency officials to notify residents and businesses by telephone, cell phone, text message, email and social media regarding time-sensitive general and emergency notifications.
- Lightning detectors – “Lightning hazards can be mitigated by advanced planning. One part of this safety program should include an early detection and warning alarm package. Lightning detectors can give notice to shut down dangerous operations before the arrival of lightning. (Note: there is no defense from a "first strike" situation.) Detectors also may signal ‘all clear’ conditions after the lightning threat has passed.”³⁹ Lightning detectors would improve safety at outdoor sporting events. Refer to Figure #79 for an inventory and need for lightning detectors for schools in Redwood County.
- Storm Ready Community – StormReady is a community preparedness program that encourages government entities and commercial gathering sites to prepare for severe storms. Storm Ready Communities are about building resilient communities in the face of increasing vulnerabilities to extreme weather events. Redwood County, and the City of Redwood Falls
- Weather Ready Nation Ambassador – “The Weather-Ready Nation Ambassador™ initiative is the National Oceanic and Atmospheric Administration’s (NOAA) effort to formally recognize NOAA partners who are improving the nation’s readiness, responsiveness, and overall resilience against extreme weather, water, and climate events. As a WRN Ambassador, partners commit to working with NOAA and other Ambassadors to strengthen national resilience against extreme weather.”⁴⁰ Redwood County is a Weather Ready Nation Ambassador.
- Severe Weather Awareness – Each spring, Redwood County Emergency Management personnel will educate local schools, nursing homes, hospitals, etc. on the importance of doing a “Severe Weather Awareness Week” workshop for their staff. This workshop identifies evacuation routes and emergency shelters, along with other important information. Entities that participate include: Redwood Area Public Schools, Red Rock Central Public Schools, Westbrook-Walnut Grove Public Schools, Redwood Falls Area Hospital, and Redwood County Government Center. There are also a number of businesses, assisted living and long term care facilities, and day cares that participate.
- Local media – Severe weather warnings are broadcasted via local media. Public service announcements are one of the ways to warn the public of severe weather.
- Severe weather spotter training – an annual training is provided in Redwood County. The National Weather Service conducts the training.

³⁹ National Lightning Safety Institute. Overview of Lightning Detection Equipment. Accessed: 2/24/16. Available: http://lightningsafety.com/nlsi_lhm/detectors.html

⁴⁰ NOAA. Weather Ready Nation Ambassadors. Accessed: 3/24/16. Available: <http://www.nws.noaa.gov/com/weatherreadynation/ambassadors.html>

Gaps and Deficiencies

- Public education – The public may not be aware of the real risks associated with heat exhaustion, extreme heat events, and other severe summer storms.
- Lightning detectors – Lightning detectors detect lightning produced by thunderstorms. Lightning detectors would improve safety at outdoor sporting events by providing better information when delaying or cancelling a sporting event. Not all outdoor sporting events have a lightning detector. Currently, the National Federation of State High School Associations (NFHS) “30-30 Rule” is used. The 30-30 Rule states that when you see lightning, count the time until you hear thunder. If this time is 30 seconds or less, go immediately to a safer place. Some smart phones are able to download a lightning detector app. Refer to Figure #79 for an inventory and need for lightning detectors for schools in Redwood County.

5.4.5 Tornado & Straight-line Wind Events

Tornadoes are the most violent of all storm types experienced in Minnesota.⁴¹ A tornado is a rapidly rotating column of air that is spawned from a cumulonimbus cloud. When it drops to the ground, it can create significant property damage and loss of life.

Straight-line winds are also damaging but not to the extent of more powerful tornadoes. Straight-line winds can and do produce substantial damage over wider areas at one time. NOAA documents straight-line wind events as thunderstorm wind events and defines them as winds equal to or greater than 40 mph (35 knots). All of Redwood County is at risk of a tornado. FEMA places Southern Minnesota in Wind Zone IV, subject to winds of up to 250 mph.⁴²

Minnesota lies along the north edge of the region of maximum tornado occurrence in the United States, known as tornado alley. Tornado Alley encompasses part of the central United States that extends across parts of Texas, Oklahoma, Kansas, Missouri, East Nebraska, and West Iowa. Tornadoes have been reported in Minnesota in every month from March through November.⁴³

The severity of tornado damage is measured by the Fujita Tornado Scale, with a sliding scale from F0 to F5 depending on wind speed. A tornado's path typically ranges from 250 feet to a quarter of a mile in width. The speed a tornado travels varies but commonly is between 20 mph and 30 mph. Most tornadoes stay on the ground for less than five minutes. Tornadoes frequently move from southwest to northeast but this also varies and cannot be counted on in all instances.⁴⁴

Tornado damage can vary from limited damage to trees and building to complete destruction of a community. Along with monetary damages, loss of life is a real concern. However, due to the rural nature of Redwood County, many funnel clouds have only caused damages to crops and unpopulated area.

⁴¹ MN State Hazard Mitigation Plan 2014. Accessed: 8/8/17. Available: <https://dps.mn.gov/divisions/hsem/hazard-mitigation/Documents/State%20Plan%20Final%202014.pdf>

⁴² FEMA. Accessed: 8/8/17. Available: https://www.fema.gov/media-library-data/1418837471752-920f09bb8187ee15436712a3e82ce709/FEMA_P-320_2014_508.pdf

⁴³ MN State Hazard Mitigation Plan 2014. Accessed: 8/8/17. Available: <https://dps.mn.gov/divisions/hsem/hazard-mitigation/Documents/State%20Plan%20Final%202014.pdf>

⁴⁴ MN State Hazard Mitigation Plan 2014. Accessed: 8/8/17. Available: <https://dps.mn.gov/divisions/hsem/hazard-mitigation/Documents/State%20Plan%20Final%202014.pdf>

Figure #82: Enhanced F-Scale for Tornado Damage

Scale	Wind Estimate	Typical Damage
EF0	65-85 mph	Light damage. Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged.
EF1	86-109 mph	Moderate damage. Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
EF2	110-137 mph	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	138-167 mph	Severe damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
EF4	168-199 mph	Devastating damage. Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.
EF5	200-234 mph	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yards); trees debarked; incredible phenomena will occur.

National Climatic Data Center (NCDC/NOAA) Storm Events database

Figure #83: Straight-line Wind Damage Estimates

Wind Speed	Effects
25 – 31 mph	Large branches in motion, whistling in telephone wires
32 – 38 mph	Whole trees in motion
39 – 54 mph	Twigs break off of trees, wind impedes walking
55 – 72 mph	Damage to chimneys and TV antennas, pushes over shallow rooted trees
73 – 112 mph	Peels surface off roofs, windows broken, trailer houses overturned
113+ mph	Roofs torn off houses, weak buildings and trailer houses destroyed, large trees uprooted

The National Weather Service

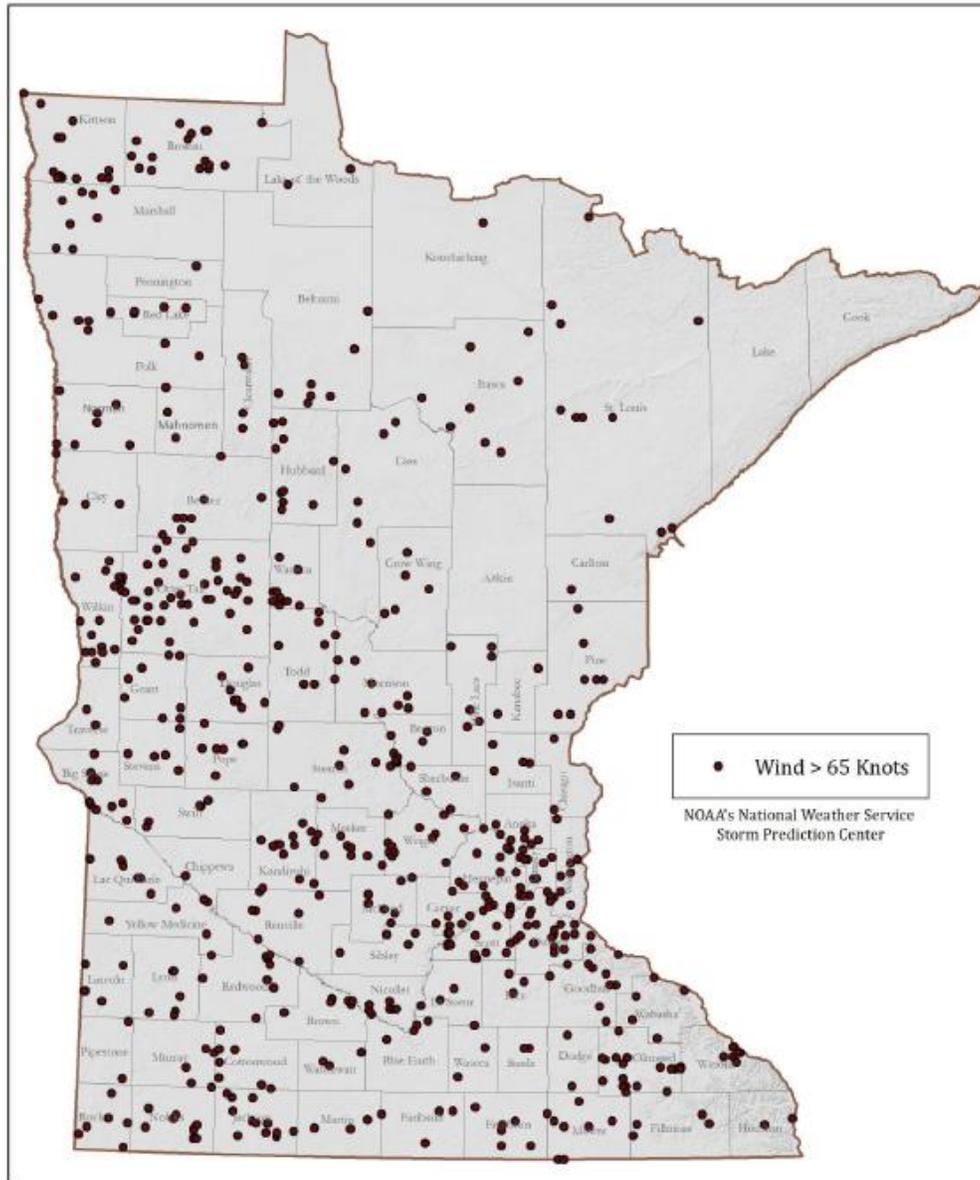
The most severe windstorms usually occur (and do the most damage) during severe thunderstorms in the spring and summer months. These include tornadoes, downbursts, or straight line winds. Straight-line winds have similar effects to tornadoes without the rotational damage pattern.

Downbursts are created by a column of sinking air, capable of producing straight-line winds in excess of 150 mph. Winds of greater than 60 mph are also associated with intense spring and fall low-pressure systems. These winds can inflict damage to buildings and overturn high profile vehicles.

The Minnesota AHMP calculated an annual probability of 1.4 of a windstorm (thunderstorm wind) event with \$1,013,164,000 in building exposure. The Minnesota AHMP places Redwood County as a medium level risk (a moderate vulnerability based less than two wind events per year and compared to building exposure).⁴⁵ According to the National Climatic Data Center, there have been 8,961 high wind events in Minnesota between 1/1/1955 to 8/31/2013. This number is misleading because the same storm data may have been reported at multiple locations. However, due to these events there were 10 deaths and approximately \$881 million dollars in property damages.

⁴⁵ MN State Hazard Mitigation Plan 2014. Accessed: 8/8/17. Available: <https://dps.mn.gov/divisions/hsem/hazard-mitigation/Documents/State%20Plan%20Final%202014.pdf>

Figure #84
Reported sustained winds or wind gusts 65+ knots, 1955-2012⁴⁶



Relationship to Other Hazards—Cascading Effects

- *Numerous.* A tornado or straight-line wind storm, can lead to total destruction of buildings and wide-scale casualties. There can be fires, disruptions to transportation infrastructure and other infrastructure, and potential public health emergencies. Catastrophic events such as these may also create the potential for civil unrest.

⁴⁶ MN State Hazard Mitigation Plan 2014. Accessed: 8/8/17. Available: <https://dps.mn.gov/divisions/hsem/hazard-mitigation/Documents/State%20Plan%20Final%202014.pdf>

- *Emergency Response.* Emergency response times can also be affected by infrastructure being damaged. Cell phone towers and telephone lines can be downed delaying calls for help.

Tornado & Straight-line Wind Events History in Redwood County

There were 7 documented tornadoes in Redwood County from January 2000 through July 2017. There were 54 thunderstorm wind events documented during this same time period. Straight-line winds are classified by NOAA as thunderstorm wind events.

Figure #85
Tornadoes – Redwood County

Date	Location	Scale	Event Narrative
4/18/2004	Revere	F-0	A tornado was recorded on video by law enforcement as it crossed Highway 14 east of Revere. The tornado downed trees on either side of the road. The remainder of the tornado's path included open fields where little if any damage occurred.
4/18/2004	Lamberton	F-1	The tornado traveled across mainly rural areas where little if any damage occurred. However, one farm 4 miles north of Sanborn sustained significant damage when the tornado struck a large shop made of clay blocks. The building was destroyed and many of the tools inside the building were damaged. Debris from the building was scattered across nearby fields. A metal corn crib was also damaged on the farm.
6/25/2010	Revere	EF-1	A tornado moved southeast across mostly open fields, causing only minor damage at a couple of farmsteads. About 1/2 mile southeast of Highway 14 and Garden Avenue, however, it struck a farmstead, demolishing two sheds, and peeling away a portion of a barn roof. The house sustained minor damage, and the tornado uprooted or broke several dozen trees. The tornado then turned south-southeast and hit one more farmstead, knocking down more trees and causing minor damage to a house. The tornado was recorded on video by storm chasers.
7/1/2011	Vesta	EF-1	An EF-1 tornado touched down just east of the Lyon, Redwood County border, and moved northeast to approximately 8 miles north of Milroy. Path length was approximately 2.6 miles, with a maximum width of 300 yards. Numerous trees were uprooted with a grain bin heavily damaged.
7/1/2011	Vesta	EF-1	An EF-1 tornado touched down in Redwood County, approximately 6 miles west of Vesta, and moved into the far southeast corner of Yellow Medicine County, near 100th Avenue and 600th Street. Numerous trees were uprooted along with a few homes damaged along the path across northwestern Redwood County.

Date	Location	Scale	Event Narrative
7/1/2011	Belview	EF-1	An EF-1 tornado continued along a path across northwest Redwood County, northeast to the Minnesota River, or approximately 3.5 miles north of Delhi where it crossed the Minnesota River into Renville County. The most concentrated area of tornadic damage with hundreds of trees uprooted or blown down was in the town of Belview. In addition, a few homes were damaged along the tornado path.
4/21/2012	Lucan		Several witnesses and storm spotters observed a tornado touchdown south of Lucan, Minnesota. The tornado tracked to the southeast and damaged a farmhouse, which included several outbuildings, a greenhouse, pole barn, and shed. Based on damage the tornado was rated an EF0 with top winds of 80 mph. The tornado lifted one quarter of a mile southeast of the farmhouse where debris was thrown one half mile.

National Climatic Data Center (NCDC / NOAA) Storm Events database

Figure #86
Thunderstorm Wind Event (60+ knots) – Redwood County

Date	Location	Wind Speed	Event Narrative
9/13/2004	Lamberton	62 kts MG	A 71 MPH wind gust was recorded by an automated weather sensor at a school.
6/26/2010	Wabasso	61 kts EG	Numerous trees were uprooted between Wabasso and Wanda, Minnesota. A large grain bin was also blown down near Wabasso, Minnesota.
7/1/2011	Milroy	87 kts EG	A long-lived and complex storm moved into western Redwood County around 3:22 PM CST, and moved northeast across mainly the northern 1/3 of the county before moving into portions of far southeast Yellow Medicine County and western Renville County. Several hundred trees were either snapped or uprooted along with damage to several outbuildings and large grain storage bins. There were also reported areas of crops destroyed but either the wind or hail. Based on the damage reports and radar imagery, wind speeds were likely sustained above 70 to 90 mph, (isolated 100 mph wind gusts) for 10 to 15 minutes in any given location as the storm traversed the county.

Date	Location	Wind Speed	Event Narrative
7/1/2011	Redwood Falls	68 kts MG	Several of the storms developed tornadoes near Redwood Falls, and again around St. Cloud, Minnesota. In addition to the tornadoes, severe straight line winds occurred. Plus, the development of the rear inflow notch, allowed for the strong winds to continue beyond the main bow echo across many areas of southern Minnesota. Widespread damage occurred with this system along with hundreds of large trees blown down and structural damage to homes and barns. Widespread reports of hail with each storm, along with a few reports of baseball and softball size hail. The wind was measured on a car's anemometer.
8/1/2011	Redwood Falls	61 kts MG and 69 kts MG	Wind speeds measured at 17:45 and 17:51 respectively in Redwood Falls. Wednesday afternoon, August 1st, thunderstorms developed near Canby, Minnesota, and moved to the east-southeast and intensified. Large hail was the first to develop early in the storms history, then it began to bow out and move to the east-southeast across portions of west-central and southwest Minnesota, where several wind gusts over 60 mph occurred. The highest wind gust occurred at 551 PM CST at the Redwood Falls regional airport where a measured 79 mph wind gust occurred.

National Climatic Data Center (NCDC / NOAA) Storm Events database

Straight-line winds can also cause property damage, but there is less risk of loss of life associated with straight-line winds. Tornadoes and straight-line winds can be most devastating to those living in mobile homes, boats, or RV's. The 2015 American Community Survey conducted by the US Census identified 291 mobile home units (4.0% of the 7,249 available housing units) in Redwood County.⁴⁷

Windstorms and Climate Change

Lack of high-quality long-term data sets make assessment of changes in wind speeds very difficult (Kunkel, et al., Regional Climate Trends and Scenarios for the U.S. National Climate Assessment, 2013). One analysis generally found no evidence of significant changes in wind speed distribution. Other trends in severe storms, including the numbers of hurricanes and the intensity and frequency of tornadoes, hail, and damaging thunderstorm winds are uncertain. Since the impact of more frequent or intense storms can be larger than the impact of average temperature, climate scientists are actively researching the connections between climate change and severe storms (National Climate Assessment Development Advisory Committee, 2013).

Tornadoes and Climate Change

Tornadoes and other severe thunderstorm phenomena frequently cause as much annual property damage in the U.S. as do hurricanes, and often cause more deaths. Although recent research has yielded

⁴⁷ FactFinder. Accessed 8/8/17. Available: <http://factfinder2.census.gov>

insights into the connections between global warming and the factors that cause tornados and severe thunderstorms, such as atmospheric instability and increases in wind speed with altitude (Del Genio, Yao, & Jonas, 2007), these relationships remain mostly unexplored, largely because of the challenges in observing thunderstorms and tornadoes and simulating them with computer models (National Climate Assessment Development Advisory Committee, 2013).

According to Harold Brooks of NOAA's National Severe Weather Laboratory, there is increasing variability in the "start" of tornado season. The number of days with more than 30 EF1 or greater tornadoes is increasing, while the number of days with at least 1 EF1 or greater tornadoes is decreasing. Thus, tornadoes are occurring on fewer days, but *more* are occurring on outbreak days.

Tornadoes have not been recorded in Minnesota in the winter months of December, January and February (MN DNR, 2014). However, the state of Wisconsin has recorded 3 tornadoes in January and 6 in December during the period of 1844-2013 (National Weather Service Weather Forecast Office, 2014) including a recent January tornado in 2008.

Vulnerability

Tornado and Straight-line Wind events are likely to take place in any year. Tornadoes are less common than straight-line wind events, but communities need to be prepared since loss of life is a risk associated with these two hazards. Severe wind events can cause minor damage to structural failure and full-scale devastation. Residents and travelers must be warned of impending danger immediately before and during a tornado or severe straight-line wind event.

Plans and Programs

- Severe Weather Spotter Network – The severe storm spotter network, sponsored by the National Weather Services (NWS), enlists the help of trained volunteers to spot severe storm conditions and report this information to the NWS. No tornado warnings are given unless the storm has been spotted by someone or is confirmed by NWS radar reports. Redwood County bi-annually trains 80 to 100 severe weather spotters who report directly to the NWS when severe weather is observed.
- Severe Weather Shelters – The Minnesota State Zoning Ordinance regarding severe weather shelters has been adopted by Redwood County. This ordinance requires on-site shelter for mobile home park residents or provides information on evacuation routes to safe shelters elsewhere. There are three mobile home parks in Redwood Falls.
- NOAA Weather Radio – NWR broadcasts official warnings, watches, forecasts, and other hazard information 24 hours a day, seven days a week. The nationwide network of radio stations broadcast continuous weather information from the nearest National Weather Service office. The NWR is your primary source of comprehensive weather and emergency information regarding all hazards.
- Outdoor warning sirens – Most of the county's cities have emergency sirens that can be activated to warn residents in the event of a tornado. Outdoor warning sirens offer last minute warnings to take shelter. The primary purpose of the outdoor warning siren is to alert people who are outside to severe weather, chemical hazard, or other emergency. If you hear an outdoor warning siren you should seek shelter immediately. Most of the cities in Redwood County have good coverage by emergency sirens

that can be activated to warn residents in the event of a severe weather event or other emergency. All of the sirens in Redwood County have been converted to narrow band frequency.

- County Emergency Management Plan – The county Emergency Management Plan designates where to go in case of an emergency, who the main contacts are, and who is in charge of response and clean up.
- Text Alert – All Redwood County Public Schools has a text alert system for emergencies and school closings.
- Warning sirens – No warning sirens in Redwood County have voice capabilities.
- Emergency shelters – Local units of government in Redwood County provide emergency shelters.
- Severe Weather Awareness – Each spring, Redwood County Emergency Management personnel will educate local schools, nursing homes, hospitals, etc. on the importance of doing a “Severe Weather Awareness Week” workshop for their staff. This workshop identifies evacuation routes and emergency shelters, along with other important information. Entities that participate include all private and public schools, Carris Health/Redwood Regional Medical Center, and Redwood County Government Center. There are also a number of businesses, assisted living and long term care facilities, and day cares that participate.
- Local media – Severe weather warnings are broadcasted via local media. Public service announcements are one of the ways to warn the public of severe weather.
- Severe weather spotter training – an annual training is provided in Redwood County. The National Weather Service conducts the training.
- Tornado drills – Redwood Area Public Schools, Westbrook-Walnut Grove Public Schools, and Red Rock Central Public Schools participate in severe weather awareness week. The schools have a plan in place for tornadoes and other severe weather events.

Figure #87

Outdoor Warning Sirens – Redwood County

Cities	Sirens Adequate	Have backup battery
Belview	Yes	No
Lamberton	Yes	No
Lucan	Yes	No
Milroy	Yes	No
Morgan	Yes	No
Redwood Falls	Yes	No
Revere	Yes	No
Sanborn	Yes	No
Seaforth	Yes	No
Vesta	Yes	No
Wabasso	Yes	No
Walnut Grove	Yes	No
Wanda	Yes	No
County Park	Yes	No

Gaps and Deficiencies

- Emergency shelters in nursing homes and assisted living facilities – A number of nursing homes and assisted living facilities in Redwood County do not have basement shelters or other suitable shelters for the residents. In the event of a violent storm residents are moved into an interior hallway away from windows. This policy is in place because the majority of the residents are elderly and don't move well.
- Emergency shelters in mobile home parks – Mobile homes typically do not provide adequate emergency shelter for residents. The cities of Redwood Falls has mobile home parks and were identified as needing additional emergency shelters.
- Warning siren range – The effective range of warning sirens is limited. Rural areas are outside the range of the severe weather warning system areas. Weather radios should be more widely used. Local radio stations provide warnings, but increasingly feature non-local satellite programming.
- Local radio and television warnings – Local radio and television stations do provide warnings, but they are effective only if tuned to the local channel. Satellite and internet based mediums are widely used, so local emergency broadcasts are limited. Language barriers can also be an issue regarding severe weather warnings.
- Tornado preparedness training – Training should be given to educate residents as to where to go in their own homes during a tornado.
- Emergency shelter and safe rooms – Not all parks in Redwood County have emergency shelters. There are no safe rooms in Redwood County. Funding is an obstacle for the construction of safe rooms.
- Warning sirens in county parks – Laura Ingalls Wilder County Park in Redwood County has a warning siren.
- Warning siren backup batteries – No sirens are equipped with a backup battery. If the power goes off as a result of the storm, the siren is useless if it does not have a backup generator. See Figure #87 for warning sirens in Redwood County that do and do not have backup batteries (backup power generation).
- Diversity and language barriers – There are a number of nationalities and languages spoken in Redwood County. This makes it difficult to send out emergency broadcast. Having to translate emergency broadcasts into multiple languages takes time and money.

5.4.6 Extreme Cold

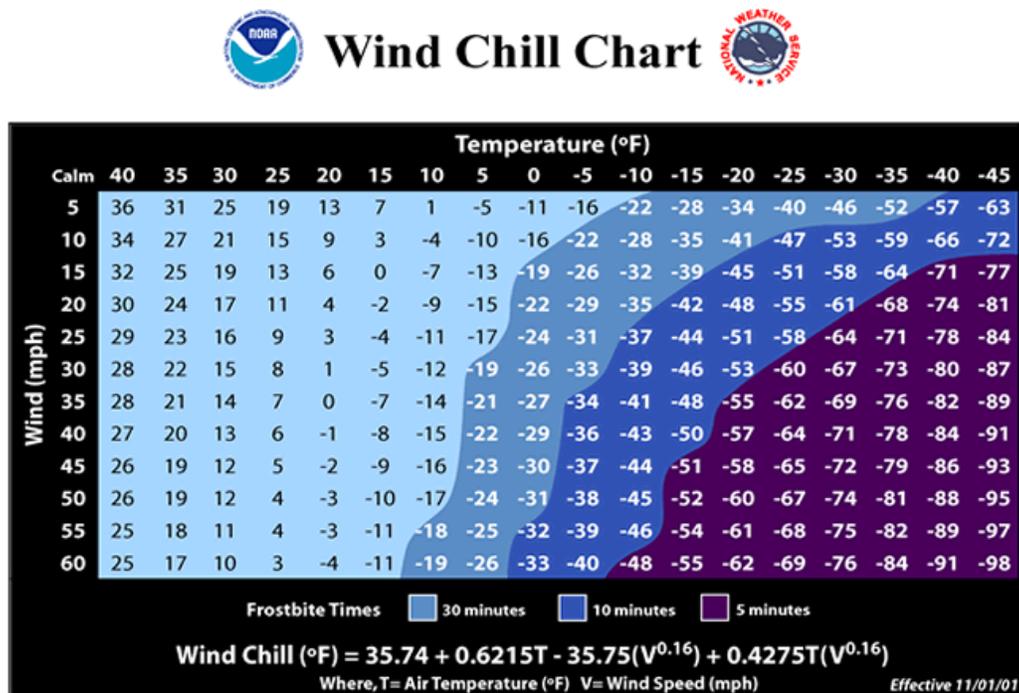
Minnesota experiences winter weather from mid-autumn through the winter season into spring. Extreme cold can immobilize large regions at the same time. All types of winter storms can be accompanied by extreme cold—both absolute temperatures and wind chill. All locations in Redwood County are equally likely to be exposed to this hazard. Rural areas are more likely to be severely impacted by the hazard. Rural homes and farms face the threat of isolation and utility failure during winter storms.

Given the rural nature of Redwood County, residents of smaller communities may face similar isolation issues as rural residents. City residents are also at risk. Attempting to travel between communities would expose city dwellers to higher levels of risk corresponding with their rural counterparts.

Extreme cold events are when temperatures lead to direct dangers to people and animals. Infants and the elderly are most susceptible to prolonged exposure to the cold. Wind and cold weather can combine to cause wind chill temperatures as low as 70 degrees below zero.⁴⁸ Prolonged exposure can cause frostbite or hypothermia and can be life-threatening.

Below freezing temperatures can also damage vegetation and cause pipes to freeze and burst inside homes. More deaths are attributed to winter storms than to extreme cold weather events, but some populations are at more risk than others. The best advice is to stay inside. Over half of winter-weather deaths occurred in a vehicle, and 30 percent occurred outdoors.

Figure #88: Wind Chill Table



⁴⁸ National Oceanic and Atmospheric Administration. Accessed 8/9/17. Available: http://www.nws.noaa.gov/om/cold/wind_chill.shtml

Relationship to Other Hazards—Cascading Effects

- *Transportation Crashes.* Winter storms often lead to hazardous conditions for transportation infrastructure. Icy roads can make travel difficult. Poor driving conditions and poorly designed transportation infrastructure can contribute to motor vehicle crashes.
- *Wildfire.* Extreme cold directly impacts firefighting, making fire suppression more difficult and increasing the likelihood of equipment damage.
- *Public Health.* Frozen septic systems can lead to the release of increased levels of untreated wastewater into the environment.
- *Public Safety.* Anyone exposed to extremely cold temperatures can develop frostbite and hypothermia. The elderly, children and those who engage in outdoor work or recreation may be most susceptible to the danger of extremely cold temperatures.

Extreme Cold History in Redwood County

From January 2000 through April 2017, there have been 11 documented extreme cold events in Redwood County. In the table below are extreme cold events that occurred in that timeframe.

Figure #89: Extreme Cold Events – Redwood County

Date	Location(s)	Event Narrative
12/15/2008	Redwood and 23 counties	Strong northwest winds combined with temperatures in the teens below zero, caused wind chill values to fall below 30 below for several hours Sunday morning.
1/7/2010	Redwood and 15 counties	Strong winds combined with low temperatures to produce several hours of wind chill values of 25 to 35 degrees below zero. The Redwood Falls airport recorded a low wind chill value of 31 below at 7 pm.
2/1/2011	Redwood and 11 counties	The combination of very low temperatures, and wind speeds averaging around 10 mph, created wind chill values between 35 and 45 below zero across west central and portions of southwest and south central Minnesota. Several reporting stations had wind chill values averaging between 35 and 40 below zero.
12/23/2013	Redwood and 16 counties	As temperatures fell below -10, and wind speeds averaged around 10 to 15 mph, wind chill values fell to around 35 to 40 below zero. Some of the gusts produced wind chill values as low as -45 Monday morning.
12/29/2013	Redwood and 16 counties	Temperatures fell into the teens below zero early Sunday morning, December 29th. As winds continued to be gusty and average around 20 to 35 mph, wind chill values held near 35 to 40 below zero.
1/5/2014	Redwood and 41 counties	Several sources from local observations indicated that a prolonged period of wind chill values below -35F occurred in the county, with locally -50F or lower during the height of the cold conditions.
1/22/2014	Redwood and 41 counties	After blizzard conditions subsided during the afternoon, skies cleared and temperatures dropped into the teens below zero. As winds continued around 10 to 15 mph, wind chill values dropped to -35F through Thursday morning,

Date	Location(s)	Event Narrative
		January 23rd. Wind chill values dropped to 35 below zero for several hours across the county.
1/27/2014	Redwood and 41 counties	Although there was a period where wind chill values rose above 35 below zero during the day of Monday, January, 27th, these values once again dropped to dangerous readings of 35 below zero by the evening. Wind chill values dropped below -35 degrees across the county and last for numerous hours. Schools were closed once again across the state, with many businesses and recreational activities cancelled. Due to the prolonged cold period, propane supplies in the North Central and Great Lakes States dropped to very low levels. The sustained subzero temperatures had sped up the consumption of this energy and on hand stocks were dangerously low. Governor Mark Dayton issued Emergency Executive Order on January 27, declaring a Peacetime State of Emergency in Minnesota in response to a severe shortage of propane and other home heating fuel supplies statewide.
3/2/2014	Redwood and 28 counties	The first two days of March remained extremely cold, with wind chill values dropping to -35F or colder for several hours during the evening of March 1st, to the morning hours of March 2nd. Several sources of surface observations indicated that temperatures and wind speeds were cold enough to produce wind chill values of -35F or colder.
1/17/2014	Redwood and 39 counties	Actual air temperatures fell into the teens, and to near 20 degrees below zero Sunday morning. As wind speeds averaged between 5 to 10 mph, with occasional gusts over 15 mph, this combined to create wind chill values of -35F or colder for several hours during the morning of Sunday, January 17th. Several sources of weather observations in the county indicated that wind chill values dropped to around -35F for a few hours.
12/17/2014	Redwood and 42 counties	Several sources of observations in the county, including airport and public weather stations indicated wind chill values dropping before -35F for several hours. The coldest wind chill values were around sunrise which a few locations reached -45F in open areas.

National Climatic Data Center (NCDC / NOAA) Storm Events database

Extreme Cold and Climate Change

There is not yet any observable trend related to extreme cold events and climate change in Minnesota. Cold temperatures have always been a part of Minnesota's climate and extreme cold events will continue. However, an increase in extreme precipitation or storm events such as ice storms as the climate changes could lead to a higher risk of residents being exposed to cold temperatures during power outages or other storm-related hazards during extreme cold.

Vulnerability

Extreme cold temperatures affect the county nearly every year. The amount of snow and ice, number of blizzard conditions, and days of sub-zero temperatures each year are unpredictable.

Within Redwood County the risk of extreme cold does not vary geographically. Citizens living in climates such as these must always be prepared for situations that put their lives or property at risk. It is not always

the depth of the cold, but an unprepared individual with a vehicle breakdown or unmaintained garage that are at risk. Rural citizens not connected to city gas lines are more vulnerable to issues with extreme cold. The vulnerability of each jurisdiction to extreme cold has not changed due to any development in the last five years.

Plans and Programs

- Real-time weather monitoring – The City of Redwood Falls has a real-time weather monitoring station at the Redwood Falls Municipal Airport that provides current temperatures, dew point, wind speed, wind direction, and barometric pressure.
- Travel Assistance – “511 is a public service of the Minnesota Department of Transportation (MnDOT) to help traveler’s access information about road conditions, traffic incidents, commercial vehicle restrictions, and weather information via the phone or the Web, 24 hours a day, seven days a week.”⁴⁹
- Regional Forecasts – Redwood County is in the Sioux Falls broadcasting region. Weather forecasts in the Sioux Falls region tend to be a good predictor of weather in Redwood County. Redwood County uses this information in regards to school closures and other weather related announcements.
- School closings – Redwood County’s school districts have a policy of closing schools when wind chills exceed certain thresholds, low visibilities create unsafe driving conditions, or when heavy snow has fallen making travel difficult. Local radio stations partner with the school districts to make sure the announcements are out by 6:00 am or earlier if possible.
- Wind chill warnings – The local radio and television media partner with the National Weather Service to issue a wind chill warning when temperatures are -30 degrees Fahrenheit or lower. Severe wind chill warnings are provided when conditions warrant and when safety is a factor. Wind chills of -40 degrees Fahrenheit or lower frequently prompt the closing of schools to protect children, particularly in rural areas.
- Emergency generators – Emergency generators help keep emergency services available during winter storms. Refer to Figure #65 for public entities with emergency generators in Redwood County.

Gaps and Deficiencies

- Automated weather stations at schools – Automated weather stations at schools throughout Redwood County would provide more current information and quicker response to dangerous and changing weather conditions.
- 511 System – The 511 system does not incorporate local knowledge as well as it could. County staff has little involvement in providing updates to the 511 system. Including snowplow drivers and other county staff could help to improve the accuracy of the system. County staff has local knowledge regarding the road network and can provide accurate information into the system.
- Road Closures Coordination – MnDOT closes state highways and does not talk to local emergency managers. There needs to be a direct line of communications between MnDOT and local emergency managers. This is an issue for emergency response and mass sheltering.
- Language barriers – Language barriers can be an issue regarding severe weather warnings. There are a number of nationalities and languages spoken in Redwood County. This makes it difficult to send out

⁴⁹ MnDOT. 511. Accessed: 8/10/17. Available: <http://hb.511mn.org/About.html>

emergency broadcast. Having to translate emergency broadcasts into multiple languages takes time and money.

5.4.7 Extreme Heat

During the spring, summer and autumn excessive heat can occur. Extreme heat events were assigned a hazard rank of moderate by the planning team. Excessive heat temperatures and temperature change is one of the variables that impact summer storms. All locations in Redwood County are at risk to be affected by this hazard. Extreme heat events will be more widespread.

Extreme heat helps to contribute to the magnitude of a thunderstorm and often accompanies severe summer storms. The combination of high temperatures and exceptionally humid conditions can lead to overheating, heat stress, and a severe strain on the system. Heat stress can lead to heat cramps, heat exhaustion, heatstroke, and even death. According to the Centers for Disease Control and Prevention (CDC), more than 300 Americans die annually from excessive heat exposure from 1979-2003. Extreme heat events, or heat waves, are a leading cause of extreme weather-related deaths in the United States. The number of heat-related deaths is rising.⁵⁰

Relationship to other Hazards

- *Drought and Wildfire.* Dry, hot conditions can reduce the protective moisture of woodlands and increase the risk of wildfire.
- *Public Safety.* Anyone exposed to extreme heat can develop heat exhaustion and heat stroke. The elderly, children and those who engage in outdoor work or recreation may be most susceptible to the danger of extreme heat.

Extreme Heat History in Redwood County

Extreme heat events are documented as a separate event by NOAA. There were three documented extreme heat events in Redwood County from January 2000 through April 2017. Excessive heat occurs from a combination of high temperatures and high humidity index. From 1979 to 2003, more people in the U.S. died from extreme heat than from hurricanes, lightning, tornadoes, floods, and earthquakes combined.⁵¹

Figure #90
NOAA Heat Definitions

Excessive Heat Outlook	A combination of temperature and humidity over a certain number of days are designed to provide an indication of areas of the country where people and animals may need to take precautions against the heat during the months of May through November.
Excessive Heat Warning	Issued within 12 hours of the onset of the following criteria: heat index of at least 105°F for more than 3 hours per day for 2 consecutive days, or heat index more than 115°F for any period of time.

⁵⁰ Centers for Disease Control and Prevention (CDC). Accessed 8/10/17. Available: <https://ephtracking.cdc.gov/showClimateChangeExtremeHeat.action>

⁵¹ Minnesota Department of Health. Accessed: 8/10/17. Available: http://www.health.state.mn.us/divs/climatechange/docs/toolkit_chapter1.pdf

Excessive Heat Watch

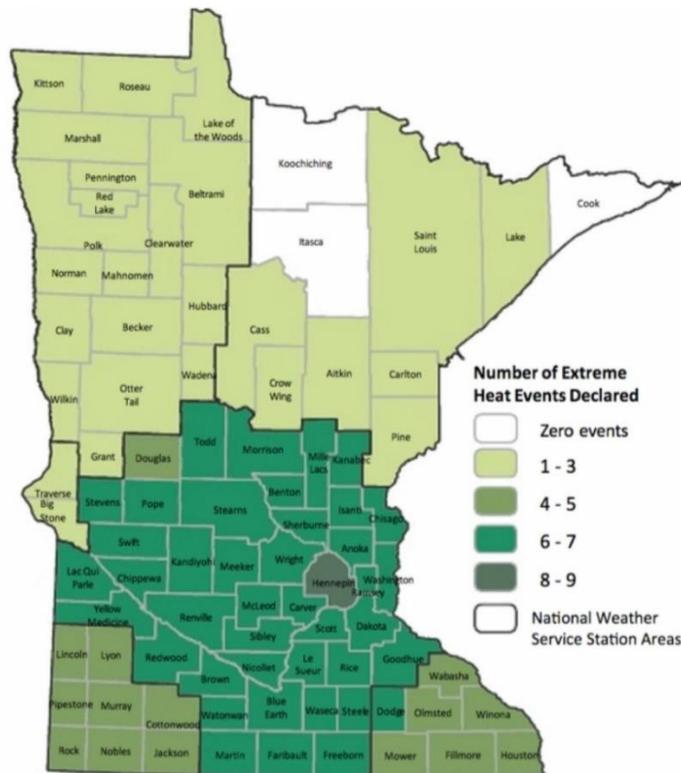
Issued by the National Weather Service when heat indices are in excess of 105°F (41°C) during the day combined with nighttime low temperatures of 80°F (27°C) or higher are forecast to occur for two consecutive days.

Figure #91**Excessive Heat – Redwood County**

Date	Location	Event Narrative
7/18/2011	Redwood and 41 other Counties	Local observations around the county indicated heat index values rose above 105 degrees Monday, July 18th, and continued through Wednesday July 20th. Overnight heat index values averaged around 80 degrees with the highest heat index of 119 degrees Monday afternoon, July 18th. In addition, the heat affected turkeys in southwest Minnesota, where 50,000 turkeys died due to heat related causes in Redwood Falls alone.
8/5/2013	Redwood and 29 other Counties	Temperatures across the area rose above 90 degrees during the afternoon of Sunday, August 25th. As dew point rose into the 70s, the heat indices surpassed 100 degrees for several hours during the afternoon, topping out around 105 degrees. During the evening, heat indices held above 80 degrees. The heat and humidity continued through Tuesday afternoon before temperatures fell into the 70s.
7/20/2016	Redwood and 41 other Counties	Several surface observations across Redwood County measured heat indices over 105 degrees for several hours during the afternoon of Wednesday, July 20th, and again Thursday afternoon July 21st. Temperatures only managed to fall into the mid to upper 70s during the morning of July 21st, and rebounded into the 80s and 90s once again by the afternoon. The highest heat index value was 115 degrees.

National Climatic Data Center (NCDC / NOAA) Storm Events database

Figure #92
Number of Extreme Heat Events by County 1995 - 2012



Source: <https://statesummaries.ncics.org/mn>

Extreme Heat and Climate Change

Minnesota’s average temperature has increased more than 1.5°F since recordkeeping began in 1895, with increased warming happening in recent decades (International Climate Adaptation Team, 2013). Annual temperatures in the Midwest have generally been well above the 1901-1960 average since the late 1990s, with the decade of the 2000s being the warmest on record.⁵² Seven of Minnesota’s ten warmest years occurred in the last 15 years. Projected increases are 2°F to 6°F more by 2050 and 5°F to 10°F by 2100 (MN Environmental Quality Board, 2014). The Midwest has experienced major heat waves and their frequency has increased over the last 6 decades (Perera, et al., 2012). For the U.S., mortality increases 4% during heat waves compared with non-heat wave days (Anderson & Bell, 2011). During July 2011, 132 million people across the U.S. were under a heat alert – and on July 20 the majority of the Midwest experienced temperatures in excess of 100°F. Heat stress is projected to increase as a result of climbing summer temperatures and humidity (Schoof, 2012). On July 19, 2011, Moorhead Minnesota set a new state record for the hottest heat index ever, at 134°F. That same day, Moorhead also recorded a new state record for the highest dew point at 88. It was the hottest, most humid spot on the planet that day (Douglas, 2011).

⁵² Kunkel, et al., Regional Climate Trends and Scenarios for the U.S. National Climate Assessment, 2013.

Increasing temperatures impacts Minnesota's agricultural industry. Agriculture is highly dependent on specific climate conditions. As a result of increasing temperature, crop production areas may shift to new regions of the state where the temperature range for growth and yield of those crops is optimal. According to the National Climate Assessment, the Midwest growing season has lengthened by almost 2 weeks since 1950 due in large part to earlier timing of the last spring freeze. This trend is expected to continue. While a longer growing season may increase total crop production, other climate changes, such as increased crop losses and soil erosion from more frequent and intense storms, and increases in pests and invasive species, could outweigh this benefit. There may also be higher livestock losses during periods of extreme heat and humidity. Losses of livestock from extreme heat lead to a challenge in disposal of animal carcasses. Currently there are only 2 rendering facilities in Minnesota available for livestock disposal. If a rendering facility is not available, lost livestock must be composted on an impervious surface. If losses are high, finding an impervious surface large enough is a challenge. In an attempt to adapt to increased temperatures, livestock areas in Minnesota may shift farther north. As a result of new livestock areas and the resulting manure production, farmers may transition to manure-based fertilizer applications in areas where traditionally only commercial fertilizers have been used, with accompanying environmental advantages and disadvantages.⁵³

Vulnerability

Extreme heat is highly likely to take place every year. People do not always recognize their limitations. Summer heat can pose a serious risk to all populations, especially the young and elderly population. Informing the public about extreme heat events and other summer storms is important in preventing accidents.

Plans and Programs

- Heat advisories – The local radio and television media are in contact with the National Weather Service to issue a heat advisory when the combination of temperature and humidity create risks for people and animals. A heat index of 105 to 114 warrants a heat advisory. This occurs when air temperature reaches 95 degrees and the relative humidity is 50 percent. An excessive heat warning is issued when the heat index reaches 115. This occurs with an air temperature of 95 degrees and relative humidity of 60 percent. A heat index of 115 or higher puts both humans and animals at risk.
- Emergency alert system – Redwood County has the CodeRED emergency notification system. CodeRED allows emergency officials to notify residents and businesses by telephone, cell phone, text message, email and social media regarding time-sensitive general and emergency notifications.
- Weather Ready Nation Ambassador – Redwood County is a Weather Ready Nation Ambassador. “The Weather-Ready Nation Ambassador™ initiative is the National Oceanic and Atmospheric Administration’s (NOAA) effort to formally recognize NOAA partners who are improving the nation’s readiness, responsiveness, and overall resilience against extreme weather, water, and climate events. As a WRN Ambassador, partners commit to working with NOAA and other Ambassadors to strengthen national resilience against extreme weather.”⁵⁴

⁵³ Adapting to Climate Change in Minnesota: 2013 Report of the Interagency Climate Adaptation Team, 2013

⁵⁴ NOAA. Weather Ready Nation Ambassadors. Accessed: 3/24/16. Available: <http://www.nws.noaa.gov/com/weatherreadynation/ambassadors.html>

- Local media – Severe weather warnings are broadcasted via local media. Public service announcements are one of the ways to warn the public of severe weather.
- Severe weather spotter training – an annual training is provided in Redwood County. The National Weather Service conducts the training.

Gaps and Deficiencies

- Public education – The public may not be aware of the real risks associated with heat exhaustion, extreme heat events, and other severe summer storms.
- The effective range of warning systems is limited. Weather radios should be more widely used. Local radio stations provide warnings, but increasingly feature non-local satellite programming.

5.4.8 Drought

Drought is defined as a prolonged period of dry weather with very little or no precipitation. There are four types of drought: meteorological drought (departure from average), hydrological drought (shortfall of stream flows or groundwater), agricultural drought (soil moisture deficiencies), and socioeconomic or water management drought. Droughts can have lasting effects and can cause a serious depletion of surface and ground waters.

The entire county is equally at risk for drought; however, areas within the county may react differently to drought conditions. Areas with well-drained soils may be more likely to experience adverse impacts to crops. Areas that rely on individual wells for drinking water supplies are more likely to experience shortages than areas with access to municipal and rural water suppliers. Different areas in Redwood County may be impacted differently by a drought, but the small size of the county and interdependence of the residents will result in any drought event having a significant impact on the entire county.

All cities in the county except Delhi and Seaforth have central water distribution centers. Red Rock Rural Water System (RRRW) provides potable water service to rural southwest Redwood County. RRRW currently does not provide any emergency backup to cities in Redwood County that have their own water system. Lincoln-Pipestone Rural Water (LPRW) provides potable water service to rural northwest Redwood County to the Cities of Milroy Seaforth, and Vesta. LPRW currently does not provide any emergency backup to cities in Redwood County that have their own water system.

Figure #93: Lincoln-Pipestone Rural Water Distribution Map

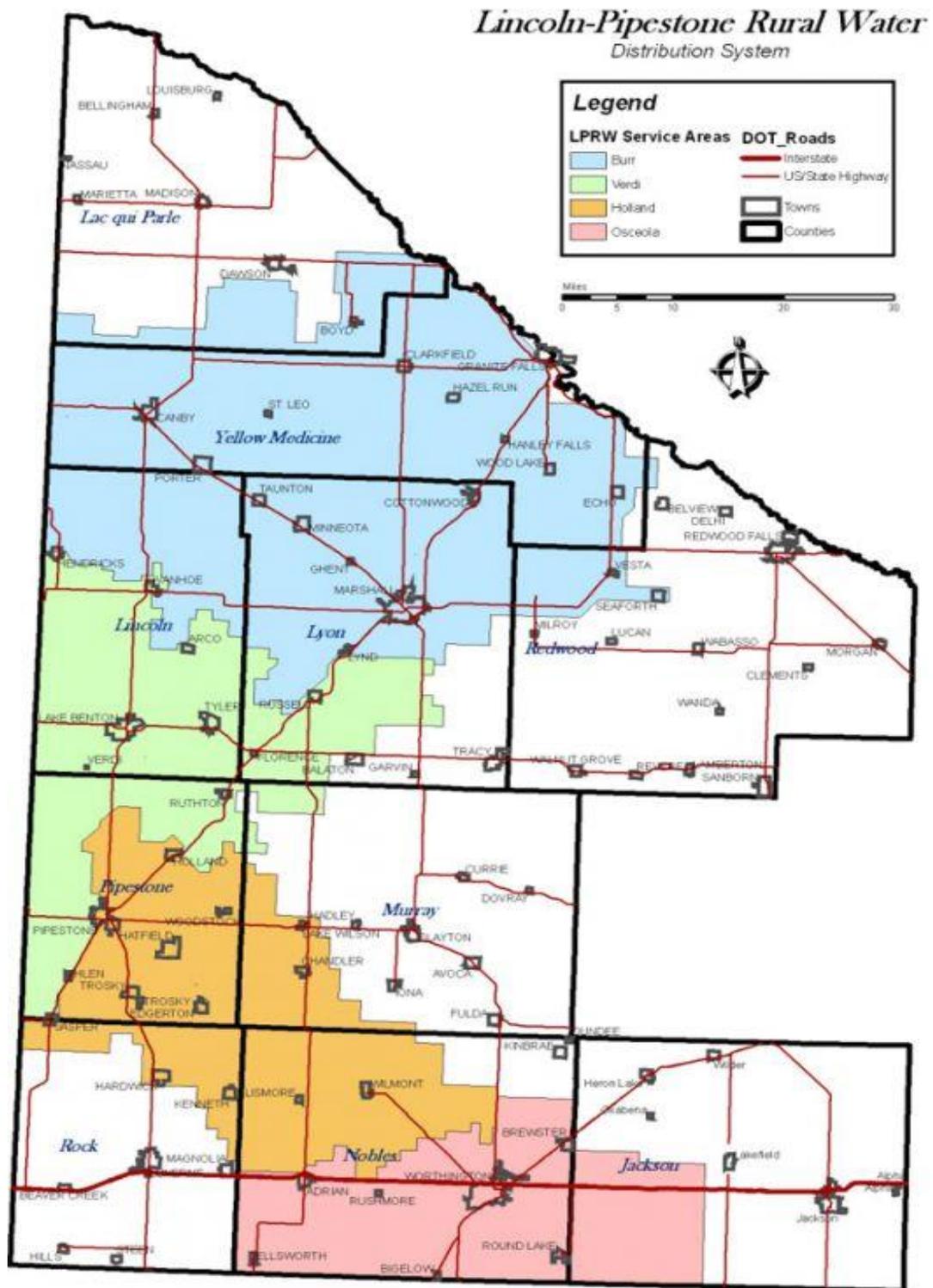
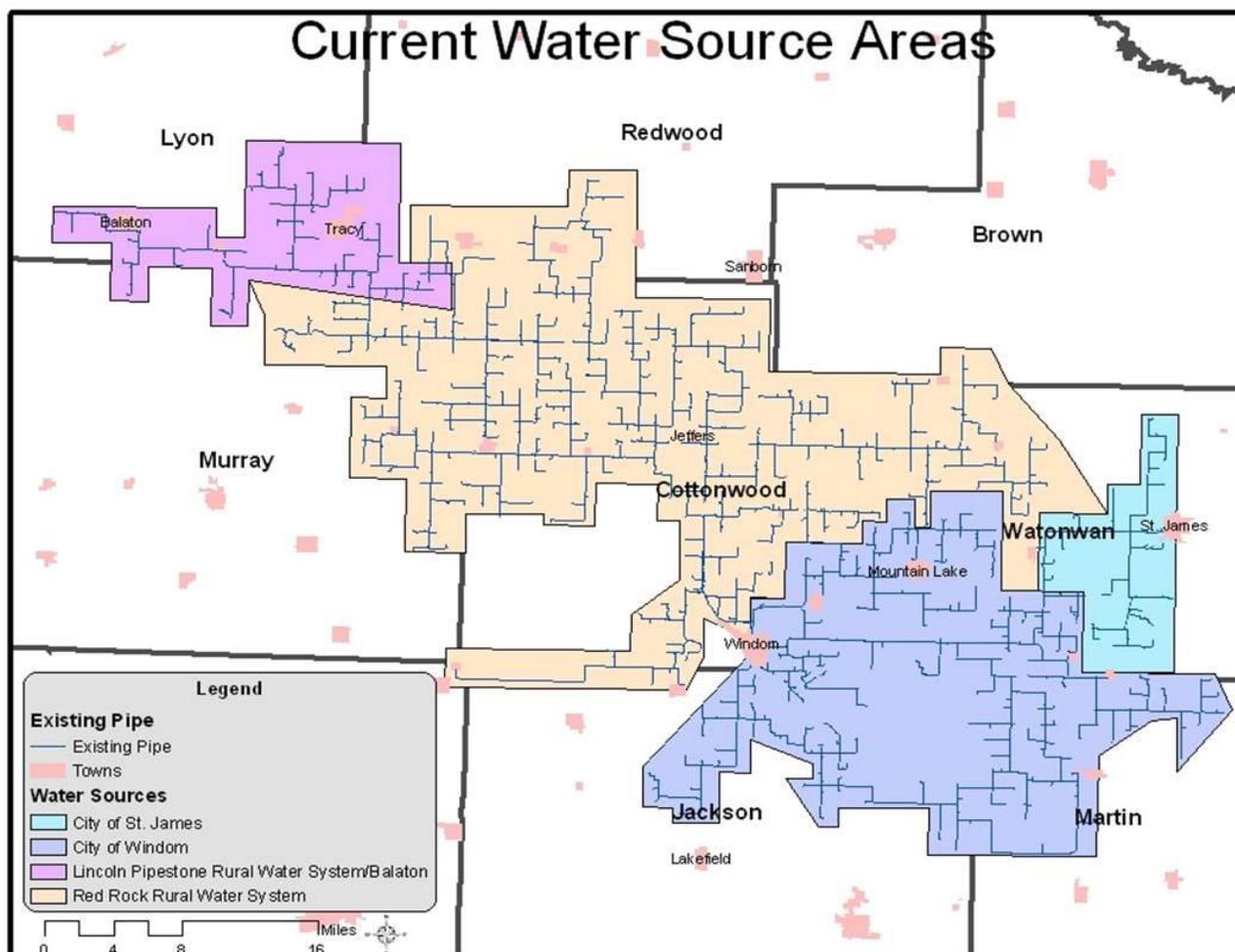


Figure #94: Red Rock Rural Water Distribution Map



Redwood County’s economy is base heavily on agriculture. A severe drought could cause economic hardship within the county. Corn and soybeans yields can be dramatically decreased by drought conditions. Livestock operations are affected by loss of feedstock, pasture and general forage, as well as drinking water. Reduced yields due to a drought event will not only have an economic impact on individual farmers, but on secondary suppliers who buy and sell crops and livestock, agricultural retailers, and local governments that rely on sales taxes. Drought insurance for crops does help compensate for losses, but there can still be economic hardship as the result of a drought.

A drought will not only produce a hardship for the farmers growing the crops, but overall supply can decrease causing food prices to rise. The U.S. Department of Agriculture estimates that the drought during the summer of 2012 will push retail food prices up by between 3% and 4% in 2013.⁵⁵

Relationship to Other Hazards—Cascading Effects

Drought can increase the risk of a number of natural and manmade hazards.

⁵⁵ Time. The Cost and Consequences of the U.S. Drought. Oct. 26 2012. Access: 8/10/17. Available: <http://business.time.com/2012/10/26/the-cost-and-consequences-of-the-u-s-drought/#ixzz2Tqswe7kB>

- *Wildfires.* Drought stressing woods, brush land, and non-cultivated fields significantly increases the risk of wildfires and lightning strikes onto dry fields have the potential to cause wildfires as well. In addition, moving equipment within Redwood County like trains or combines during fall harvest have the potential to cause wildfires.
- *Insect Infestation.* An increase in the amount of insects and other pests are often caused or impacted by severe drought conditions.
- *Tree Loss.* Due to the lack of moisture, tree loss or decline can be experienced resulting in several problems including: loss of shade for homes requires increased power consumption, and loss of windbreaks provided by trees allows for an increase in soil erosion.
- *Wells/Aquifers.* The absence of rain for a long period of time is insufficient to recharge aquifers and eventually, the loss of water in underground wells results.
- *Business interruption.* A drought can result in watering bans. Businesses that are heavier water users will be impacted. Golf courses, processing facilities, car washes, and a number other businesses will be impacted.
- *Utility/Infrastructure.* Redwood County's limited groundwater resources, provided by surficial aquifers, can be easily negatively impacted by drought.
- *Dust Storms.* As surface soils dry out and the winds blow, an increased amount of soil erosion occurs.

Drought History in Redwood County

The NCDC/NOAA database does not document periods of drought events for Redwood County.

Dry weather beginning in August 1999 through spring 2000 affected eight of the nine counties in the Southwest Regional Development Commission service area. The initial Redwood County AHMP documented extremely dry conditions during the 2001 growing season. The area experienced one of the driest fall (September through November) periods on record. Unusually warm weather during the month contributed to the drying. One noticeable manifestation of the dry conditions was a number of grass fires. While damage was mainly limited to the grasslands, considerable manpower and expense was needed to fight the fires. Burning had to be restricted, causing some economic impact. Although most of the fires did not start naturally, the extremely dry conditions and in some cases strong winds exacerbated the fires. Similar conditions re-occurred in the Fall of 2011. In 2012, the National Weather Service, southwest Minnesota, including the Redwood area, has been categorized as being in severe drought. Records shown five months seen only one to two inches of precipitation (U of M Extension climatologist) and typically precipitation is 10 inches or more. In January 201 the county was approximately eight inches on average behind normal. This led to significantly dry conditions in southwest and south central portions of the state.⁵⁶ August 2017 the Swift County Monitor reported that Redwood counties is classified as abnormally dry heading into the month of August.

⁵⁶ The Redwood Falls gazette. 1/3/2012. Accessed: 8/10/17. Available: <http://www.redwoodfallsgazette.com/article/20120103/NEWS/301039966>

Figure #95: US Drought Monitor – August 2017

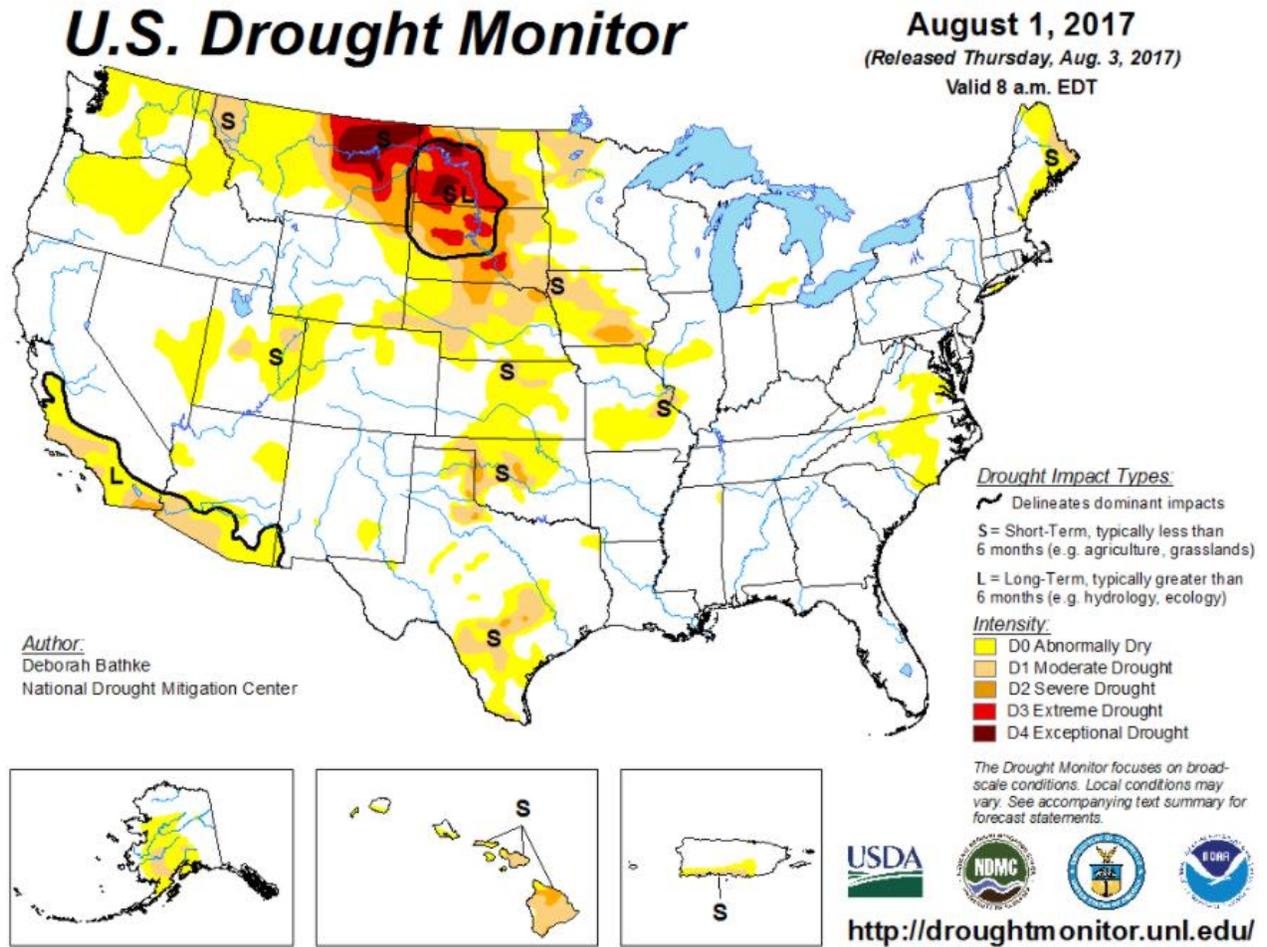
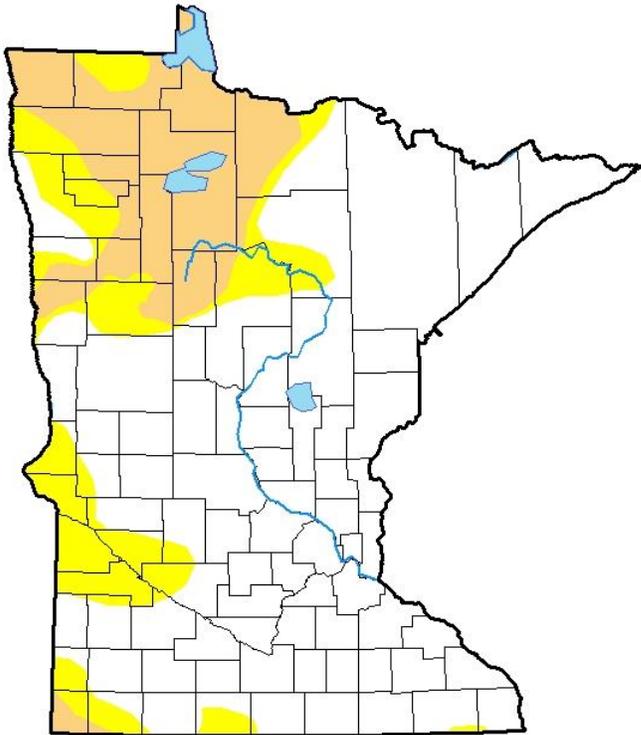


Figure #96: US Drought Monitor, Minnesota – August 2017

**U.S. Drought Monitor
Minnesota**

August 1, 2017
(Released Thursday, Aug. 3, 2017)
Valid 8 a.m. EDT



Drought Conditions (Percent Area)

	None	D0	D1	D2	D3	D4
Current	68.22	14.37	17.41	0.00	0.00	0.00
Last Week 07-25-2017	67.95	24.02	8.02	0.00	0.00	0.00
3 Months Ago 05-02-2017	100.00	0.00	0.00	0.00	0.00	0.00
Start of Calendar Year 01-03-2017	100.00	0.00	0.00	0.00	0.00	0.00
Start of Water Year 09-27-2016	100.00	0.00	0.00	0.00	0.00	0.00
One Year Ago 08-02-2016	98.54	1.44	0.02	0.00	0.00	0.00

Intensity:

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

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

Author:

Deborah Bathke
National Drought Mitigation Center



<http://droughtmonitor.unl.edu/>

Drought and Climate Change

Droughts have been happening throughout Minnesota’s history and it is not yet clear how climate change may impact this (International Climate Adaptation Team, 2013). While there was no apparent change in drought duration in the Midwest over the past century (Dai, 2011), the average number of days without precipitation is projected to increase in the future (National Climate Assessment Development Advisory Committee, 2013).

Even in areas where precipitation does not decrease, projected higher air temperatures will cause increased surface evaporation and plant water loss, leading to drier soils. As soil dries out, a larger proportion of the incoming heat from the sun goes into heating the soil and adjacent air rather than evaporating its moisture, resulting in hotter summers under drier climatic conditions (Mueller & Seneviratne, 2012). Temperature has risen in Minnesota about 2°F since the early 20th century. Under a higher emissions pathway, historically unprecedented warming is projected by the end of the 21st century. While warmer temperatures will reduce the heating energy demand and lengthen the growing season, it will also increase the intensity of naturally occurring droughts.⁵⁷ In 2007, 24

⁵⁷ NCICS State Summaries. Accessed: 8/10/17. Available: <https://statesummaries.ncics.org/mn>

Minnesota counties received drought designation, while 7 counties were declared flood disasters. In 2012, 55 Minnesota counties received federal drought designation at the same time 11 counties declared flood emergencies (MN Environmental Quality Board, 2014).

Vulnerability

Droughts can occur throughout Redwood County.

Plans and Programs

- Watering Ban Ordinance – Redwood County and the City of Redwood Falls have developed ordinances on water usage within their communities and can place restrictions on this usage in times of drought. The watering bans decrease the demand for water. This is done to curve demand for nonessential watering. Residents are alerted through the media when a watering ban is enacted. Cities in Redwood County have not issued a watering ban in recent memory.
- Burning ban – Redwood County can issue a burning ban during a drought event.
- Redwood County Water Management Plan – The Redwood County Comprehensive Water Management Plan serves as the five year ‘Work Plan’ for the Redwood Soil and Water Conservation District (SWCD). Yearly Plans are developed to achieve the goals and objectives of the Water Plan. The Water Plan identifies and maps the major and minor aquifers serving the county. The Redwood County Comprehensive Water Management Plan can be found on the Redwood SWCD website.⁵⁸ The next update is planned for 2020.
- Recharge rates – The Redwood County Comprehensive Water Management Plan documents the number of gallons of water used per year by municipalities and large water users within the county. Regionally, recharge rates are tracked regional by Minnesota Board of Soil and Water Conservation.
- Shoreline zoning – Redwood County has adopted the Department of Natural Resources (DNR) statutory shoreline zoning classifications and minimum standards. Zoning along the river is also regulated by the river conservancy district, which is overseen by the Minnesota Board of Soil and Water Conservation.
- Aquifer inventories – Recharge rates and capacities of the county’s aquifers are recorded and inventoried by United States Geological Survey (USGS). These studies help to determine the capacities and recharge rates of the county’s aquifers in order to better assess use restrictions and provisions during times of drought.
- Usage rates – The Department of Natural Resources (DNR) regulates withdrawal and usage rates. There has to be a draw down study before irrigation permits can be issued.
- Public outreach – Educational campaigns regarding water conservation by the Redwood Soil and Water Conservation District and rural water systems. This helps to ensure Redwood County’s ground water supplies are sufficient to meet demands.

Gaps and Deficiencies

- Water conservation outreach – Water conservation programs need to be established to educate residents on the need and ways to conserve water usage.

⁵⁸ RedwoodCounty Soil and Water Conservation District. Accessed: 8/10/2017. Available: http://www.redwoodswcd.org/Water%20Mangement%20Plan/RedwoodCounty_WaterPlan%202016%20Amen d.pdf

- Lack of watering ban ordinance – Redwood County and the City of Redwood Falls have developed ordinances on water usage within their communities and can place restrictions on this usage in time of drought. The rest of the cities in Redwood County do not have watering ban ordinances. Cities with populations over 1,000 have a Water Supply Plan with the DNR, which has triggers for water reduction measures.
- Water supply – A number of communities are dependent on or rely on rural water as a backup. Water supply could be an issue in Redwood County.
- Lack of Fire Breaks – The County needs a program that places fire breaks in between the continuous CRP tracts of land or other state wildlife areas during times of severe drought.
- Rural Water – The water sources that serve residents in Redwood County are not located within the County.
- Large water users –The City of Redwood Falls is a large water user, since one of the city's main industries is Farmers Union Industries. An adequate water supply is critical to the food processing industry in Redwood Falls and Redwood County.
- Annual recharge rates – Redwood County does not have estimated annual recharge rates, but there is a robust mounting of heavy water users and wells.

5.4.9 Landslides & Erosion

Erosion is the wearing away of land, such as the loss of a riverbank, beach, shoreline, or dune material. It is measured as the rate of change in the position or displacement of a riverbank or shoreline over a period of time. Short-term erosion typically results from periodic natural events, such as flooding, hurricanes, storm surges, and windstorms, but may be intensified by human activities. Long-term erosion is a result of multi-year impacts such as repetitive flooding, wave action, sea level rise, sediment loss, subsidence, and climate change. Death and injury are not typically associated with erosion; however, it can destroy buildings and infrastructure (FEMA, 2013).

The movement of a mass of rock, debris, or earth down a slope by the force of gravity is considered a landslide. They occur when the slope or soil stability changes from stable to unstable, which may be caused by earthquakes, storms, volcanic eruptions, erosion, fire, or additional human-induced activities. Slopes greater than 10 degrees are more likely to slide, as are slopes where the height from the top of the slope to its toe is greater than 40 feet. Slopes are also more likely to fail if vegetative cover is low and/or soil water content is high. Potential impacts include environmental disturbance, property and infrastructure damage, and injuries or fatalities (FEMA, 2013).

Relationship to Other Hazards—Cascading Effects

Numerous.

Soil Erosion/Landslides History in Redwood County

Some areas of Redwood Falls have had issues with soil erosion and landslides, though they were not major. However, there is increasing concern about the hazard in the county, particularly with the higher levels of rain they have been receiving.

Soil Erosion/Landslides and Climate Change

The increased magnitude and frequency of flooding events and storm activity that may result from climate change may in turn increase the risk of soil erosion and landslides. According to University of Washington geologist Dave Montgomery, “If the climate changes in a way that we get a lot more rainfall you would expect to see a lot more landslides” (Phillips, 2014).

In Minnesota, the wettest days are getting wetter. This can contribute to increased erosion in many locations due to flooding and saturation of soils. Reduced ice cover on lakes and shorelines (due to warmer temperatures) could potentially expose shorelines to increased erosion or damage during weather events when they previously may have been covered with ice (National Climate Assessment Development Advisory Committee, 2013).

According to the 2014 National Climate Assessment, “Increased precipitation intensity also increases erosion, damaging ecosystems and increasing delivery of sediment and subsequent loss of reservoir storage capacity” (Pryor, et al., 2014).

Vulnerability

The vulnerability of each jurisdiction to soil erosion and landslides has not changed due to any development in the last 5 years.

Plans and Programs in Place

Public Information and Warning – Rochester Alert is the IPAWS system used by Redwood County to send out notifications to the public during emergencies in a timely manner. This can be area-specific if needed. Redwood County Emergency Management has an official Facebook page as well as a Twitter page. The Redwood County Sheriff’s Office also has a Facebook page, which is used to send out information to the public. Redwood County has a good relationship with the media and NWS (National Weather Service), both of which assist in reaching the public with critical information.

Emergency Operations Plan (EOP) – Redwood County has an EOP, which includes all of the county departments as well as city officials and emergency organizations. The plan is organized to assist with the responsibilities and assignments during any type of emergency.

SWCD 2017 Operational Plan – the 2017 plan includes an operational objective for Protection of Natural Resources, which has a specific focus on erosion control education and mitigation measures. Example actions include:

- “Control erosion by promoting upland practices where they apply and assist in their implementation through state and federal cost share programs and providing landowners with technical assistance.”
- “Serve as a cooperative technical agency to City and County Townships in conducting plat reviews for all proposed developments with emphasis on controlling runoff, erosion and protecting wetlands.”
- “Administer and implement elements of the County Soil Erosion ordinance for suburban development and rural activities.”

Gaps and Deficiencies

- None identified.

5.5 Other Hazards

5.5.1 Dam Failure

Dams and impoundments maintain lake levels and help control flooding and the destructive power of water. Dams and impoundments are a critical part in minimizing erosion. “There are more than 1,250 dams in Minnesota; 800 are public dams, and the state owns over 430 of the public dams. Most of the public dams are more than 50 years old and require ongoing emergency repairs and reconstruction to maintain their structural integrity.”⁵⁹

Dam failure is defined as a collapse or failure of an impoundment resulting in downstream flooding. Failure may occur for one or a combination of the following reasons:

- Prolonged periods of rainfall and flooding;
- Inadequate spillway capacity, resulting in excess overtopping flows;
- Internal erosion caused by embankment or foundation leakage or piping;
- Improper maintenance, including failure to remove trees, repair internal seepage problems, replace lost material from the cross section of the dam and abutments, or maintain gates, valves, and other operational components;
- Improper design, including the use of improper construction materials and construction practices;
- Improper operation, including the failure to remove or open gates or valves during high flow periods;
- Failure of upstream dams on the same waterway that release water to a downstream dam;
- Earthquakes, which typically cause longitudinal cracks at the tops of the embankments that can weaken entire structures

The Department of Natural Resources (DNR) has a dam safety program that inspects the structural integrity of dams and impoundments. The DNR classifies dam structures in three categories:

- Class 1; High Hazard: any loss of life or serious hazard to public;
- Class 2; Significant Hazard: possible health hazard or probable loss of high-value property;
- Class 3; Low Hazard: property loss restricted to rural outbuildings and local roads.

There are 16 dams in Redwood County. The majority of dams are a Class 3, which is the lowest risk. There is one Class 2 dam located in Walnut Grove and one Class 1 dam located in Redwood Falls. Below is a dam inventory table for Redwood County.

⁵⁹ Minnesota Department of Natural Resources. Accessed: 8/10/17. Available: http://www.dnr.state.mn.us/waters/surfacewater_section/damsafety/index.html

Figure #97: Dam Inventory – Redwood County

Dam Name	ID	Next Inspection Year	Last Inspection Date	Dam Class	City	Distance
Cottonwood River at Lamberton (Kuhar County Park)	MN01514	2018	4/13/2010	3	Sanborn	7
Geis Wetland (Dike A)	MN01357	2016	10/30/2008	3	Sanborn	25
Dike No. 2	MN00681	2017	12/11/2009	3	Redwood Falls	3
Dike No. 1	MN00682	2017	12/11/2009	3	Redwood Falls	3
Hogan F Pond	MN00849	2016	6/10/2008	3	Franklin	-
Charlestown 28	MN01669	-	-	3	Sanborn	3
Merten's	MN00683	2017	12/11/2009	3	Redwood Falls	3
Draayum Pond	MN00847	2016	10/30/2008	3	Lamberton	-
Knott Detention	MN00729	2016	10/30/2008	3	Sanborn	-
Knott Retention Reservoir	MN00848	2016	10/30/2008	3	Lamberton	-
Springdale 21	MN01642	-	-	3	Lamberton	45
Highwater Ethanol	MN01680	-	-	3	Lamberton	6.5
Redwood River Diversion	MN00890	2018	4/15/2010	3	Redwood Falls	0
Walnut Grove (Plum Creek lake)	MN00728	2019	3/12/2015	2	Walnut Grove	-
Redwood Falls	MN00511	2016	3/12/2015	1	Redwood Falls	1
Lecy-Huseby	MN00140	2018	4/23/2010	3	Redwood Falls	-

DNR Dam Safety Engineer

Select areas along other streams and water ways in Redwood County where impoundments were constructed to hold back water are also susceptible to flooding from impoundments washing out or dam failure upriver.

Dam failure, although the risk is minimal, has the potential to be devastating to the areas within the floodplain and around the streams directly below impoundments and dams. Dam failure may result in flash flooding, extensive property damage, erosion, destruction of infrastructure including road and culvert, and loss of life. It is more likely to have an impoundment or culvert fail. A failure of an impoundment or culvert has a potential of devastating downstream property damage, erosion, and destruction of infrastructure, including roads and other culverts.

Relationship to Other Hazards—Cascading Effects

- *Flash Flooding.* Dam failure has the potential to cause damage to the areas directly below the dam. Dam failure would cause immediate flash flooding, destruction of property, erosion of crops, infrastructure damage, and possibility of lives being lost. Damage to public infrastructure could also occur in areas of heavy water movement.

Dam Failure History in Redwood County

There have been no recorded dam failure events in Redwood County.

Dam Failure and Climate Change

Dams are designed based on assumptions about a river's annual flow behavior that will determine the volume of water behind the dam and flowing through the dam at any one time. Changes in weather patterns due to climate change may alter the expected flow pattern. It is conceivable that bigger rainfalls at earlier times in the year could threaten a dam's designed margin of safety, causing dam operators to release greater volumes of water earlier in a storm cycle in order to maintain the required margins of safety. Such early releases of increased volumes can increase flood potential downstream.

While climate change will not increase the probability of catastrophic dam failure, it may increase the probability of design failures. Minnesota had a dam failure due to a large storm event in June 2012. The Forebay canal had operated as designed for nearly 100 years. The intensity of the 2012 rain event caused a failure of the canal wall which caused significant damage.

Climate change is adding a new level of uncertainty that needs to be considered with respect to assumptions made during dam construction.

Vulnerability

Free flowing water has tremendous power. It can move boulders, carve out rock, and erode an impoundment or dam. It is important to slow the runoff of water, so groundwater supplies can be replenished and the volume of free flowing water in streams and rivers is reduced. Reducing the free flowing water in streams and rivers will help to preserve impoundments and dams, but over time impoundments and dams will require maintenance and replacement.

There are a 16 dams in Redwood County. One dam is classified as Class 1 (in Redwood Falls), one is classified as Class 2 (Walnut Grove), and the remaining 14 dams are classified a Class 3 (which is the lowest risk classification). Erosion would be the biggest risk if a dam failed in Redwood County.

Plans and Programs

- Minnesota Dam Safety Program – The Minnesota Department of Natural Resources (DNR) regulates nearly 900 dams in the State of Minnesota. The DNR and U.S. Army Corps of Engineers regularly inspect dam and reservoir capabilities for flooding and dam failure. The Minnesota DNR dam safety program inspects the structural integrity of dams and impoundments in Redwood County. The classification of the dam depends on how often the dam is inspected. A dam classified as High Hazard is inspected annually. High hazard dams (Class 1) have Emergency Action Plans which need to be reviewed and revised as necessary on a periodic basis. A dam classified as Significant Hazard (Class 2) is inspected every three to four years. A dam classified as Low Hazard (Class 3) is inspected every eight years.
- Dam Emergency Action Plan – The Minnesota DNR drafts an Emergency Action Plan (EAP) for all High Hazard dams and strongly recommends that Significant Hazard dams be included as well. An EAP is a formal document that identifies potential emergency conditions at a dam and specifies preplanned actions to be followed in order to minimize property damage and loss of life in the event of a dam failure.

- Emergency Operations Plan – Explains the standard operating guidelines for countywide notification in the event of an emergency and the procedures of evacuation during an emergency.
- Impoundment dams and other water control systems.
- U.S. Army Corps of Engineers - The U.S. Army Corps of Engineers has plans in place for terroristic acts against the dams and flood control projects in the county.

Gaps and Deficiencies

- Registry of dams – Not all dams and impoundments are identified by the DNR. If the dam is not on the registry, the dam does not get inspected by the DNR. Non-identified dams could be at risk of failing, since they are not inspected.
- Infrequency of dam inspection – Dams in Redwood County that are all classified by the Minnesota DNR as Low Hazard dams and therefore only get inspected every eight years. The infrequency of inspection may result in maintenance being deferred for a number of years or structural deficiencies not being identified. Inadequate maintenance could result in dam failure.

5.5.2 Public Health Emergencies

As technology developed people started to demand sewer systems, running water, and waste disposal. This helped to prevent the spread of disease and helped to maintain a healthier public. As building technology also developed people started to demand safe and well-built buildings. This made it safer for people to live and work. Local government saw these demands and has tried to create uniformity through regulation. Through this government regulation the public health service evolved.

Public health services today face new challenges to counter ever-evolving disease. The Minnesota Department of Health (MDH) works with Department of Public Safety (DPS) and other agencies to prepare for large-scale emergencies of many types. Infectious diseases can present wide threats to many people, or very narrow threats to highly susceptible populations.

- An “epidemic” is a disease that occurs suddenly in numbers clearly in excess of normally expected rates.
- A “pandemic” is an epidemic that spreads across a large region.

People throughout Redwood County are equally affected by this hazard. “Infectious diseases have the potential to affect any form of life.”⁶⁰ Some infectious diseases that were thought to have been eradicated have re-emerged and new strains present threats to the populations and require monitoring. Different strains of the influenza virus emerge seasonally and require modifications to antibiotics and vaccinations.

Infectious diseases in livestock also pose a significant risk. Food supplies could be affected and the livelihood of the owners of livestock will be impacted. Certain infectious diseases are considered more likely to present a public health emergency hazard in rural Minnesota.

Many infectious diseases are preventable and controllable. Measles, Rubella, Polio, and Pertussis are all vaccine preventable diseases. These diseases are no longer common, but a single case can cause a public health emergency. Doctors are often not looking for these diseases, so they may be overlooked which can cause the disease to spread. Also, more parents are electing not to vaccinate which puts the entire population at greater risk.

Arboviral Encephalitis commonly known as West Nile Virus is a mosquito transmitted disease that can cause encephalitis in people and horses. This virus was usually found in mosquitos and birds in Africa and Europe. However, West Nile encephalitis was reported in New York City in 1999.⁶¹ In 2012, there was one death in Minnesota associated with West Nile Virus. In Redwood County there no cases recorded in 2014 (most recent year reported) and there have been 17 cases of West Nile Virus recorded since 2002.⁶²

⁶⁰ MN State Hazard Mitigation Plan 2014. Accessed: 8/14/17. Available: <https://dps.mn.gov/divisions/hsem/hazard-mitigation/Documents/State%20Plan%20Final%202014.pdf>

⁶¹ Minnesota Department of health. Accessed: 8/14/17. Available: <http://www.health.state.mn.us/divs/idepc/diseases/westnile/>

⁶² Minnesota Department of health. Accessed: 8/17/17. Available: <http://www.health.state.mn.us/divs/idepc/diseases/westnile/statistics.html>

In 2009, the Centers for Disease Control and Prevention (CDC) started taking larger steps to combat H1N1 (sometimes called “swine flu”). H1N1 was first detected in people in the United States in April 2009. This virus has the potential to spread fast and can cause severe illness in people. The virus can spread person to person, much in the same way the seasonal influenza is spread.⁶³

Smallpox has not been an issue in the United States for more than 50 years. Due to the threat of terrorism, this disease has been thrust to the forefront of public concern and fear. Smallpox is a serious, contagious, and sometimes fatal infectious disease. There is no specific treatment for smallpox. The only prevention for small pox is vaccination.

“Ebola is a rare and deadly disease caused by infection with a strain of Ebola virus. The 2014 Ebola epidemic is the largest in history, affecting multiple countries in West Africa. The risk of an Ebola outbreak affecting multiple people in the U.S. is very low.”⁶⁴

Relationship to Other Hazards—Cascading Effects

- *Emergency Response.* A public health emergency will affect the ability to respond and recover from any other natural or manmade hazard. If an epidemic event were to occur, deaths could be in the many hundreds of thousands across the nation.
- *Civil Disturbance.* If the health of the general public is perceived to be threatened on a large scale, riots or states of lawlessness are a possibility.

Public Health Emergencies History in Redwood County

Standard procedures involve collection of accurate assessment data, outbreak detection and investigation, and development of appropriate control strategies based on specific epidemiological data. These activities require close collaboration between health care providers, clinical laboratories, state and local health departments, and federal agencies.

Aside from the 2009 H1N1 influenza outbreak, there have been no other major public health emergencies in Redwood County in recent years. During the summer of 2017, the Southwest Health and Human Services building in Redwood County had a power outage and due to that power outage, public health staff had to transport vaccines to the Redwood Area Hospital due to dropping refrigerator temperatures.⁶⁵

Influenza is a common seasonal occurrence in Redwood County, but no major outbreak has occurred. Seasonal influenza is planned for every year. The annual seasonal influenza usually peaks in February. There are stands of influenza that can be more devastating. Influenza Type A virus has caused three pandemics in the past century worldwide with significant loss of life. Pandemics are caused by the unstable nature of Influenza Type A, and new subtypes that appear through genetic drifts or shifting.

⁶³ Center for Disease Control and Prevention. Accessed: 8/14/17. Available: <http://www.cdc.gov/h1n1flu/qa.htm>

⁶⁴ Center for Disease Control and Prevention. Accessed 11/5/14. Available: <http://www.cdc.gov/vhf/ebola/outbreaks/2014-west-africa/index.html>

⁶⁵ Southwest Health and Human Services Data Request. Received: 01/26/2018

Figure #98: Cases of Selected Communicable Diseases Reported to the Minnesota Department of Health by District of Residence, 2015

Disease	District (population per U.S. Census 2014 estimates)								Unknown Residence	Total (5,372,030)
	Metropolitan (2,919,177)	Northwestern (157,393)	Northeastern (326,026)	Central (732,492)	West Central (235,563)	South Central (290,521)	Southeastern (498,011)	Southwestern (212,847)		
Anaplasmosis	145	104	96	186	49	5	23	5	0	613
Arboviral disease										
La Crosse	0	0	0	0	0	1	0	0	0	1
West Nile	5	0	0	2	1	0	0	1	0	9
Babesiosis	9	14	3	12	5	1	1	0	0	45
Blastomycosis	16	3	5	7	1	0	2	0	0	34
Botulism (Infant)	0	0	0	0	0	0	1	0	0	1
Brucellosis	3	0	0	0	0	0	1	0	0	4
Campylobacteriosis	469	15	29	152	42	47	91	79	0	924
Cryptosporidiosis	72	7	8	58	44	30	60	37	0	316
Escherichia coli O157 infection	49	2	1	22	4	6	11	20	0	115
Hemolytic uremic syndrome	2	0	0	4	1	1	2	1	0	11
Giardiasis	316	15	42	105	23	25	49	45	0	620
Haemophilus influenzae disease	37	6	8	17	3	9	10	14	0	104
HIV (non-AIDS)	200	1	3	7	3	2	6	2	4	228
AIDS (diagnosed in 2015)	93	3	3	6	4	3	7	2	20	141
Legionellosis	31	0	5	6	1	2	6	0	0	51
Listeriosis	1	0	0	1	0	0	1	0	0	3
Lyme disease	555	44	120	288	49	18	92	10	0	1176
Measles (rubeola)	2	0	0	0	0	0	0	0	0	2
Meningococcal disease	2	0	1	2	0	0	2	0	0	7
Mumps	6	0	0	0	0	0	0	0	0	6
Pertussis	343	23	30	88	13	6	75	14	2	594
Q Fever (acute)	0	0	1	1	0	0	0	0	0	2
Salmonellosis	578	18	36	135	31	48	70	59	0	975
Sexually transmitted diseases										
Chlamydia trachomatis - genital infections	13534	461	992	1901	576	823	1470	370	1111	2123
Gonorrhea	3166	50	130	263	87	54	185	23	139	4097
Syphilis, total	569	3	13	29	1	10	19	10	0	654
Primary/secondary	220	0	2	10	2	4	5	4	0	246

Disease	District (population per U.S. Census 2014 estimates)									
	Metropolitan (2,919,177)	Northwestern (157,393)	Northeastern (326,026)	Central (732,492)	West Central (235,563)	South Central (290,521)	Southeastern (498,011)	Southwestern (212,847)	Unknown Residence	Total (5,372,030)
Early latent*	162	3	1	10	0	3	4	2	0	185
Late latent**	184	0	10	9	1	3	9	4	0	220
Congenital	3	0	0	0	0	0	0	0	0	3
Other***	0	0	0	0	0	0	0	0	0	0
Shigellosis	244	1	6	12	8	8	8	5	0	292
Streptococcal invasive disease - Group A	124	10	27	32	8	8	20	7	0	236
Streptococcal invasive disease - Group B	275	13	39	76	15	30	62	17	0	527
Streptococcus pneumoniae disease	238	16	50	81	32	44	51	22	0	534
Toxic shock syndrome (Staphylococcal)	10	0	0	1	0	0	0	0	0	11
Tuberculosis	111	1	0	9	3	4	18	4	0	150
Varicella	167	4	10	75	9	35	33	28	0	361
Viral hepatitis, type A	15	0	2	0	1	2	1	0	0	21
Viral hepatitis, type B (acute infections only, not perinatal)	15	0	0	2	0	0	2	0	0	19
Viral hepatitis, type C (acute infections only)	13	2	10	4	4	1	2	1	0	37

* Duration ≤1 year

** Duration >1 year

*** Includes unstaged neurosyphilis, latent syphilis of unknown duration, and latent syphilis with clinical manifestations

County Distribution within Districts

Metropolitan - Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, Washington

Northwestern - Beltrami, Clearwater, Hubbard, Kittson, Lake of the Woods, Marshall, Pennington, Polk, Red Lake, Roseau

Northeastern - Aitkin, Carlton, Cook, Itasca, Koochiching, Lake, St. Louis

Central - Benton, Cass, Chisago, Crow Wing, Isanti, Kanabec, Mille Lacs, Morrison, Pine, Sherburne, Stearns, Todd, Wadena, Wright

West Central - Becker, Clay, Douglas, Grant, Mahnomen, Norman, Otter Tail, Pope, Stevens, Traverse, Wilkin

South Central - Blue Earth, Brown, Faribault, LeSueur, McLeod, Martin, Meeker, Nicollet, Sibley, Waseca, Watonwan

Southeastern - Dodge, Fillmore, Freeborn, Goodhue, Houston, Mower, Olmsted, Rice, Steele, Wabasha, Winona

Southwestern - Big Stone, Chippewa, Cottonwood, Jackson, Kandiyohi, Lac Qui Parle, Lincoln, Lyon, Murray, Nobles, Pipestone, **Redwood**, Renville, Rock, Swift, Yellow Medicine

Source: <http://www.health.state.mn.us/divs/idepc/newsletters/dcn/sum15/2015dcn.pdf>

Vulnerability

People contract seasonal influenza every year and other diseases occur regularly. If an outbreak occurs that is contagious it is critical to quarantine the population affected by the disease. This is often difficult since the outbreak may go unnoticed for a period of time. Certain mutations of a disease are also becoming more resistant to antibiotics. This is particularly true regarding Influenza Type A. Younger and older population cohorts are at a higher risk for acquiring a disease.

Plans and Programs

- Emergency Operations Plan – County Emergency Management is working closely with Public Health and local healthcare facilities to mitigate and effectively respond to potential Public Health Emergencies. The Redwood County Emergency Operations Plan outlines procedures for county and local governments for contacting appropriate state and federal agencies and provides guidelines and strategies for dealing with infectious diseases. A command structure between local public health and the Emergency Manager is also outlined in the Emergency Operations Plan.
- Southwest Health and Human Services (SWHHS) – SWHHS works with the Minnesota Department of Health (MDH) to address infectious diseases that are listed in MN Rule #4605.7040 (such as Encephalitis, Hepatitis, Influenza, Lyme’s Disease, Tuberculosis, and Syphilis). If any of these or other listed diseases should appear in Redwood County, SWHHS works with MDH and local medical providers to limit the spread of the disease. SWHHS routinely receives information from MDH via Health Alert Network (HAN) for outbreaks occurring in Minnesota or outbreaks that could impact the state and issues appropriate information based on the most current alerts. SWHHS provides information to public and private employers, schools and hospitals about potential infectious disease threats and prevention measures.
- Area Strategic Stockpile Plan – SWHHS has a Strategic National Stockpile (SNS) plan in place. SWHHS and working with the Minnesota Department of Health and other regional and local partners for the mass distribution of needed medicines and supplies for a Public Health Emergency. SWHHS will continue to coordinate with regional partners for mass distribution of needed medical supplies for a public health emergency.
- Response capabilities (facilities) – SWHHS have designated buildings for the Strategic National Stockpile and Medical Countermeasure Dispensing Sites.
- Medical Countermeasure Dispensing Plan – SWHHS has a Medical Countermeasure Dispensing Plan in place. The plan covers mass dispensing of medicines and supplies/Medical Countermeasure Dispensing (MDS). In the event of a naturally occurring outbreak, bioterrorism incident or mass vaccination, dispensing of medication may be needed within a short period of time to prevent morbidity and mortality due to the incident. SWHHS has four designated medical countermeasure dispensing sites (MDS) which are utilized as an emergency, temporary, public health clinic to provide immunizations or medications to a large number of residents. SWHHS follows guidance from the Minnesota Department of Health (MDH) and works with other local, state, federal, and non-governmental agencies, as necessary.
- Isolation/Quarantine (I/Q) Plan – SWHHS has developed an Isolation & Quarantine plan to prevent the spread of diseases. The I/Q will be event specific. The plan will address measures to protect the public and prevent spread of disease. Isolation measures are directed towards people already ill, who are

usually within a health care facility or off site care. Quarantine is a tool used to hold & limit contact between persons who have been exposed to a disease in their own home. Both measures are effective tools in preventing spread of disease. SWHHS does not monitor individuals once they are placed in I/Q. This monitoring will come down from MDH.

- Media outreach – County Emergency Management works with SWHHS and other local media throughout the county in the event of an infectious disease outbreak.
- Vaccination program – SWHHS conducts outreach programs to educate residents on the benefits of routine vaccinations. Part of this outreach is to assure that children and adults have access to recommended vaccines. Targeted groups include children, people with high deductibles, or people with no insurance. People in these groups can receive immunizations through the agency. Flu immunizations are also targeted to some adults within the county. Immunizations are designed to assist families of need in protecting their children and themselves from infectious diseases. SWHHS also participates in the South Central/Southwest Minnesota Immunization Information Connection (MIIC), which is a confidential, computerized network of shared immunizations records. It provides clinics, schools, and parents/adults with accurate, complete, and up-to-date immunization records. This system can assist in alerting participating families if there is any disease outbreak that may put them at risk in their area.
- Environmental health regulations and policies – SWHHS in cooperation with MDH has worked to develop environmental health regulations, a policy guide, and procedures to address infectious disease and food borne illness. Redwood County relies on the State for inspections.
- Outbreaks – Carris Health/Redwood Hospital has written plans for Investigation of Suspected Outbreaks, Significant Epidemiologic Occurrence or Sentinel Events, Pandemic Influenza, Flu Center, and Reporting of Communicable Diseases.
- Southwest Healthcare Preparedness Coalition Team – The coalition represents 23 hospitals, 43 primary care clinics, 50 Nursing Homes, 103 EMS groups and two tribal governments in our 16-county region in southwest Minnesota. Additional coalition members include: State and local representatives from Public Health, Homeland Security and Emergency Management, the Minnesota Department of Health, and the Emergency Medical Services Regulatory Board. The coalition is working together toward enhancing our response to local, regional, statewide, and national emergencies.⁶⁶
- MDH FluSafe Program – Carris Health/Redwood Hospital has performed staff vaccination and tracked percentage vaccinated each year participating in the MDH FluSafe Program with vaccination efforts of greater than 90% for several years.
- Public education – Southwest Health and Human Services, the agency responsible for the delivery of public health and social services in Redwood County, has various campaigns to educate the public on the importance of active living and healthy eating, vaccinations, tobacco, and other public health issues.
- Senior LinkAge Line® – The Senior LinkAge Line® is the Minnesota Board on Aging's free statewide information and assistance service. This service helps to connect Minnesotans to local services.

⁶⁶ Southwest Regional Emergency Preparedness Team. Accessed: 8/14/17. Available: <http://www.mnswept.com/>

- ACT on Alzheimer’s Marshall – A group dedicated to helping build awareness about dementia. Programs and activities regarding Alzheimer’s began as early as 1980. For more information visit: <http://www.actonalz.org/marshall>.

Gaps and Deficiencies

- Strategic National Stockpile vulnerable to power outages – Southwest Health and Human Services (SWHHS) and the Minnesota Department of Health maintain a Strategic National Stockpile (SNS) of needed medicines and supplies for Public Health Emergencies. The medication/vaccinations are vulnerable to power outages. A power outage could result in medicines and supplies not being kept cold and spoiling.
- Response capabilities (facilities) – SWHHS needs to work with Emergency Management, various units of government, and health care facilities to clarify and determine the use of buildings needed to respond to a public health emergency or respond to a hazard.
- Aging population – An aging population puts the county at greater risk of Public Health Emergencies. The population cohort 85 plus has increased by 22.4 percent from 2000 to 2010.⁶⁷ As more of the population is dependent on the younger population cohorts to help them, it puts a greater need on the rest of the population to stay healthy. The older population is dependent and requires services the rest of the population provides. If healthcare staff becomes sick that will put a strain on the care capacity of assisted living facilities, other elderly care facilities, and general care facilities.
- Cultural diversity & vaccination disparities – Due to the diversity of Redwood County, it is difficult to conduct public outreach in regards to immunizations. People from other countries do not have the same immunization plans as is custom in the United States. The overwhelming majority of school age children are vaccinated, but adults from other counties may not be vaccinated.
- Lack of Alzheimer’s treatment – There is a lack of treatment facilities for Alzheimer’s in southwest Minnesota.
- Lack of mental health treatment – There is a lack of treatment facilities for mental health issues in southwest Minnesota. Mental health issues go undiagnosed and too many people are not getting treatment. Jail space is being used to house people with mental health issues.

⁶⁷ U.S. Census 2000, 2010. Accessed: 8/14/17. Available: <http://factfinder2.census.gov>

5.5.3 Transportation Infrastructure

Minnesotans move goods and people on a variety of transportation networks. Infrastructure is a critical need for the operation and competitiveness of a city, county, or region. Infrastructure is the skeleton and nervous system of a community. Infrastructure includes roads and bridges, rail, air and transit.

Roads, bridges, rails, landing strips, and other transportation infrastructure wear out. Transportation infrastructure is characterized by long-term, capital-intensive investments that are interdependent and vulnerable to both natural and manmade hazards. Transportation infrastructure continually needs to be inspected and upgraded. Numerous locations in Redwood County have the potential to be affected by transportation infrastructure hazards.

Redwood County's transportation network is comprised of highways, railways, airports and trails. The system is designed to serve local residents, agriculture and industry, as well as travelers and regional commerce. The Minnesota Department of Transportation (MnDOT) works with the county engineer and municipal authorities to construct, maintain, and regulate a comprehensive system of roads, rail and airports for public and private use.

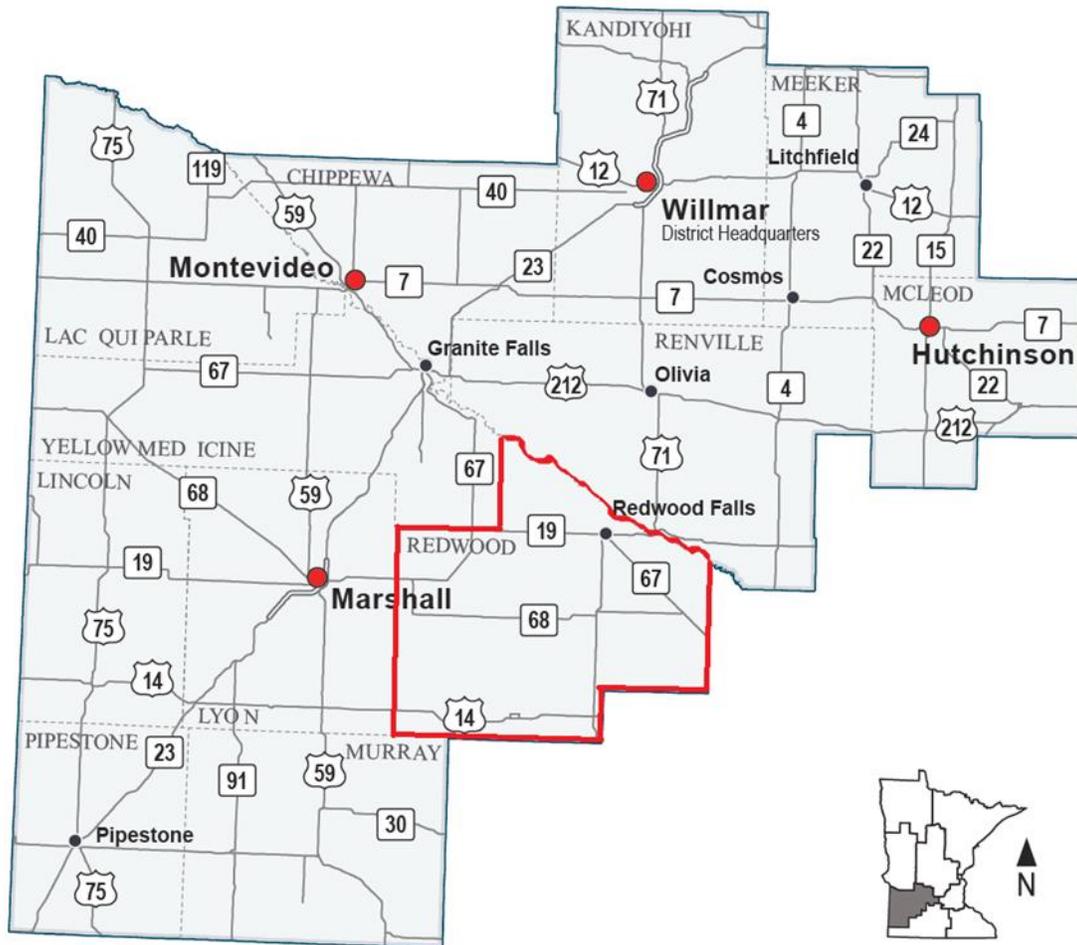
Roads

There are hundreds of miles of roadway to be monitored and maintained in Redwood County. There are city highways, county roads, township roads, and city streets traversing Redwood County that all require different monitoring and upkeep. It is critical to keep the system in a good state of repair, so people and goods can travel safely.

Redwood County has roads and bridges in state, county, and local jurisdictions with each entity having primary responsibility for construction and maintenance over their segments. The road network is designated by jurisdiction:

- **Trunk Highway System.** Statewide routes originally established under a 1920 constitutional amendment. The routes are the responsibility of MnDOT. Redwood County is located in MnDOT's District 8, which has its primary office in Willmar. U.S. Highways 14, 71, and State Highways 19, 67, and 68 are Trunk Highways (TH routes).
- **County State Aid Highways (CSAH).** Roads or streets established and designated under county jurisdiction in accordance with Minnesota Statutes Chapter 162. The State provides funding assistance to maintain the CSAH system.
- **County Roads (CR).** Roads established and maintained by the county under the sole authority of the county board.
- **Township Roads.** Roads established and maintained by township boards or reverted back to township jurisdiction by the county board.
- **City Streets.** Any street/road in a municipality not otherwise designated.

Figure #99: MnDOT Area Transportation District 8 – Redwood County



One issue that affects road conditions is winter weather. Ice and snow can build up on the road and can cause hazardous driving conditions. Due to the prevailing wind patterns in the area, east-west roads are more susceptible to ice and snow affecting the road surface. Road crews are responsible for maintaining the roadway, clearing snow, and salting for ice. It is also the responsibility of the driver to take the road conditions into consideration and drive appropriately. Winter weather is just one variable that impacts road conditions. There are a number of other variables that impact road conditions.

Traffic crashes are the primary hazard to people and property related to transportation infrastructure. The Minnesota Department of Transportation (MnDOT) and Minnesota Department of Public Safety (DPS) developed the Strategic Highway Safety Plan covering years 2014-2019. The plan was intended to examine the underlying causes of traffic deaths and serious injuries, determine strategies to mitigate those causes, and implement the most promising strategies in the “Toward Zero Deaths” program. The Toward Zero Death program continues today.

The Minnesota Strategic Highway Safety Plan (SHSP) study for the entire state of Minnesota found the most frequent crash types and contributing factors included:⁶⁸

- Lane Departure
- Intersection
- Unbelted Occupants
- Impaired Roadway Users
- Younger Drivers
- Inattentive Drivers
- Speed
- Motorcyclists

These variables along with transportation infrastructure conditions and design can impact the severity of crash or incident.

Bridges

There are approximately 328 bridges on county, municipal, and township roadways within Redwood County. MnDOT lists 199 bridges in Redwood County on their inventory of bridges over 20 feet.⁶⁹ Some bridges intersect with the mapped floodplain. These bridges are inspected and a grade of the bridge is given. This helps to ensure the safety of crossing using a bridge. There are 61 bridges in Redwood County that have been identified as structurally deficient (≤ 80 sufficiency rating), January 1, 2016.⁷⁰ In Minnesota, 9.1 percent of bridges are structurally deficient in 2012.⁷¹

Bridges are classified as “structurally deficient” if they have a general (poor) condition rating for the deck, superstructure, substructure, or culvert or if the road approaches regularly overtop due to flooding. The fact that a bridge is structurally deficient does not imply that it is unsafe. The condition can be a variable that is assumed to be safe, as in the 35W bridge collapse. If a bridge has been identified as unsafe during a physical inspection, the structure will be closed.

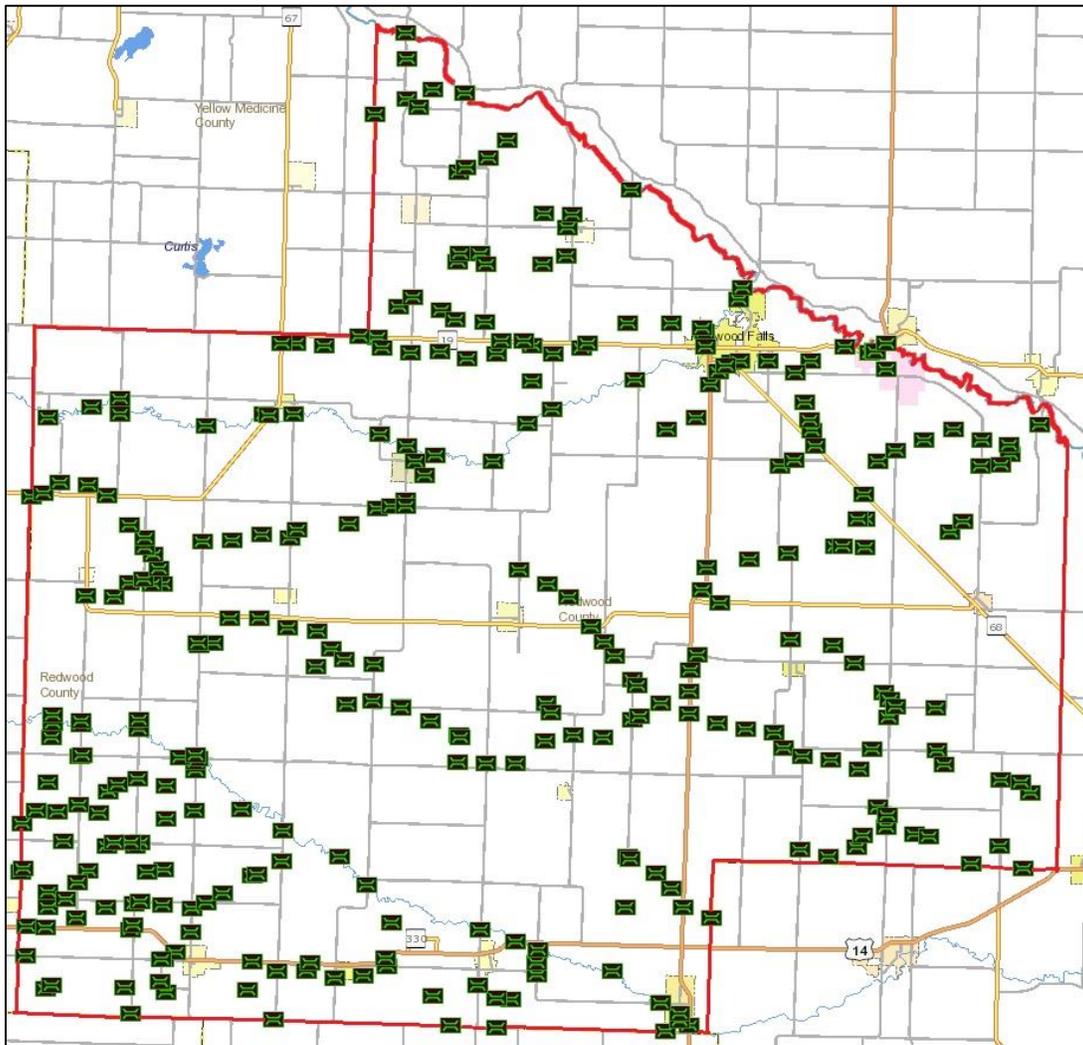
⁶⁸ MnDOT. Accessed: 5/29/17. Available: <http://www.dot.state.mn.us/trafficeng/safety/shsp/>

⁶⁹ MnDOT Minnesota Bridges October 2016. Accessed: 8/14/17. Available: <http://www.dot.state.mn.us/bridge/pdf/minnesota-bridges-2016-report.pdf>

⁷⁰ MnDOT. Minnesota Bridges, October 2016. Accessed: 8/15/17. Available: <http://www.dot.state.mn.us/bridge/pdf/minnesota-bridges-2016-report.pdf>

⁷¹ Governing. Local Bridges in Bad Shape. Accessed: 8/15/17 Available: <http://www.governing.com/topics/transportation-infrastructure/gov-local-state-government-owned-bridge-condition-disparity.html>

Figure #100: Road & Bridge Map – Redwood County

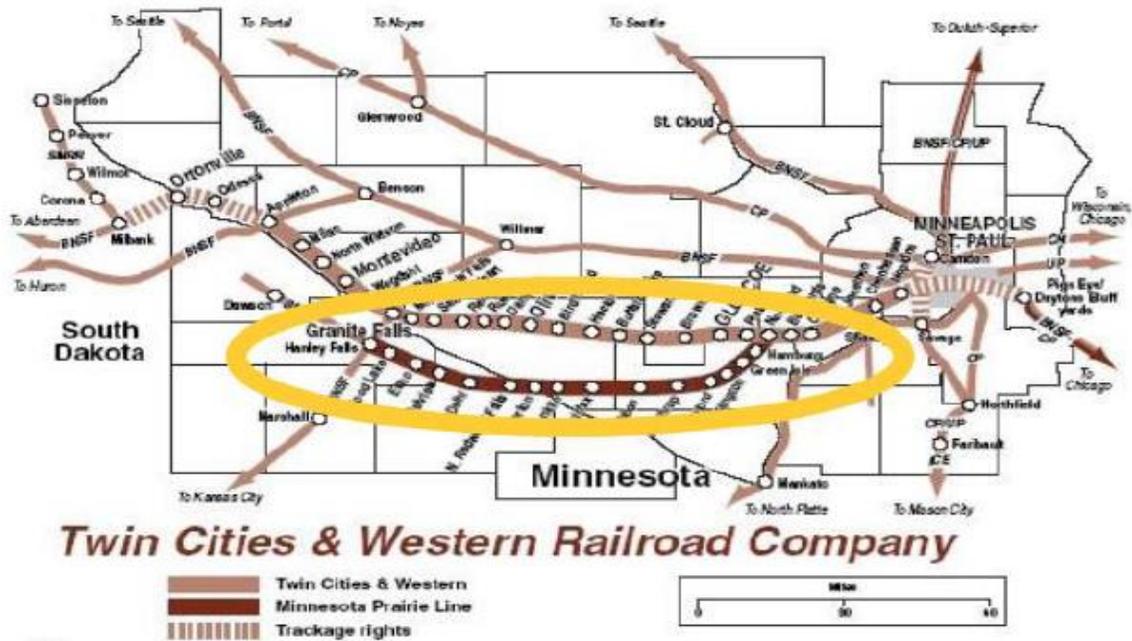


Railroads

There are two railroads serving Redwood County, the Canadian Pacific (SP) SOO Line and the Minnesota Prairie Line (MPLI) – MVRRA. The Canadian Pacific is a Class I railroad and the Minnesota Prairie Line – MVRRA is a Class III railroad. Class I railroads have operating revenues of 433.2 million or more. Class III railroads are often called a “short line railroad” and have operating revenues of \$36.6 million or less. These railroads are a critical element in Redwood County’s transportation system.

The MPLI railroad cross Redwood County operates in the northern part of the county on track that is owned by the Minnesota Valley Regional Railroad Authority (MVRRA). MPLI has 94 miles of between Norwood Young America and Hanley Falls, MN. Commodities shipped in the region include: corn, soybeans, distillers dry grain (DDG’s), fertilizers, ethanol, butter, lumber and other forest products, canned vegetables, biodiesel, tallow, salt (commercial & industrial), and aggregates. The MVRRA Rail Line has a 10-mile per hour speed limit. When transporting ethanol that limit decreases to 7-miles per hour.

Figure #101: Minnesota Prairie Line (MPLI) Railroad



The CP crosses Redwood County operates in the southern part of the county, owns its track and right-of way, and operates a 14,700-mile rail network linking the principal cities of Canada from Montreal to Vancouver, and the U.S. Midwest and Northeast.⁷² Forty-four percent of Canadian Pacific Railroad Limited shipments include grain, coal, sulfur, and fertilizer. The RCPE primarily ships grain, bentonite clay, ethanol, fertilizer, cement and other products.⁷³ There are numerous rail crossings close to US Highway 14 along the Canadian Pacific (Soo Line) Railroad (passing through Walnut Grove, Revere, Lambertson, and Sanborn) and in the northern part of the county along the Minnesota Prairie Line Railroad (passing through Belview, Delhi, and Redwood Falls).

Railroad crossing pose a serious risk for motor vehicles passing over the tracks. Railroad crossings are marked and a number have crossing arms, but according to MnDOT, the chance of death or serious injury from a vehicle and train crash is 11 times greater than other traffic collisions.⁷⁴ Since there is an increased risk of crossing, additional measures should be taken to ensure the safety of the crossing.

⁷² Canadian Pacific Railroad Limited. Accessed: 9/14/15. Available: <http://www.cpr.ca/en>

⁷³ Rapid City, Pierre & Eastern Railroad. Accessed: 2/19/16. Available: https://www.gwrr.com/operations/railroads/north_america/rapid-city-pierre--eastern-railroad

⁷⁴ MNDOT. Accessed: 8/15/17. Available: <http://www.dot.state.mn.us/ofrw/railroad/safety.html>

Figure #102: Canadian Pacific Railroad



Figure #103: Canadian Pacific Freight Overview

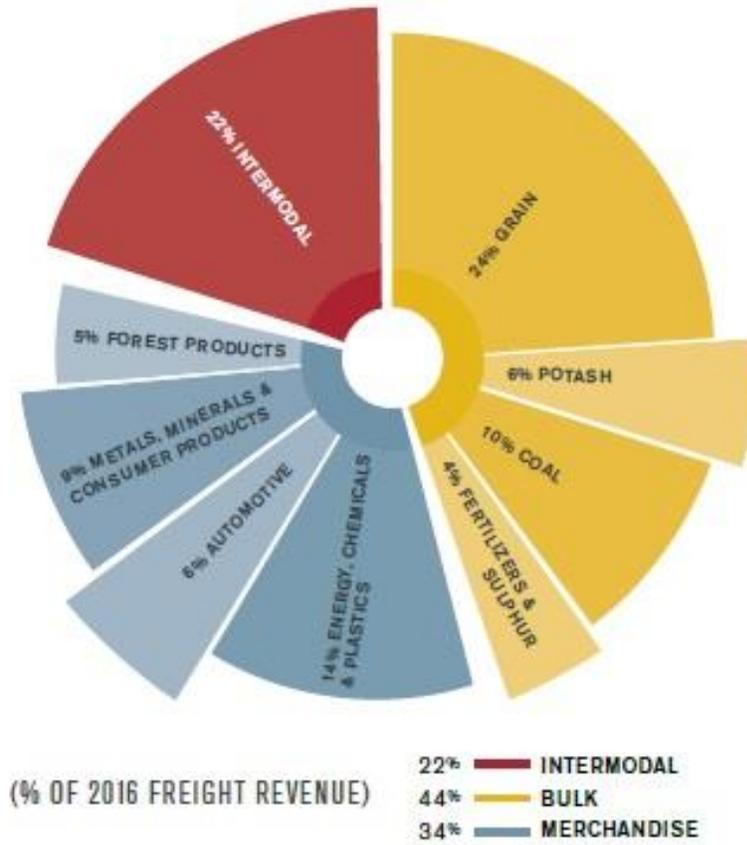
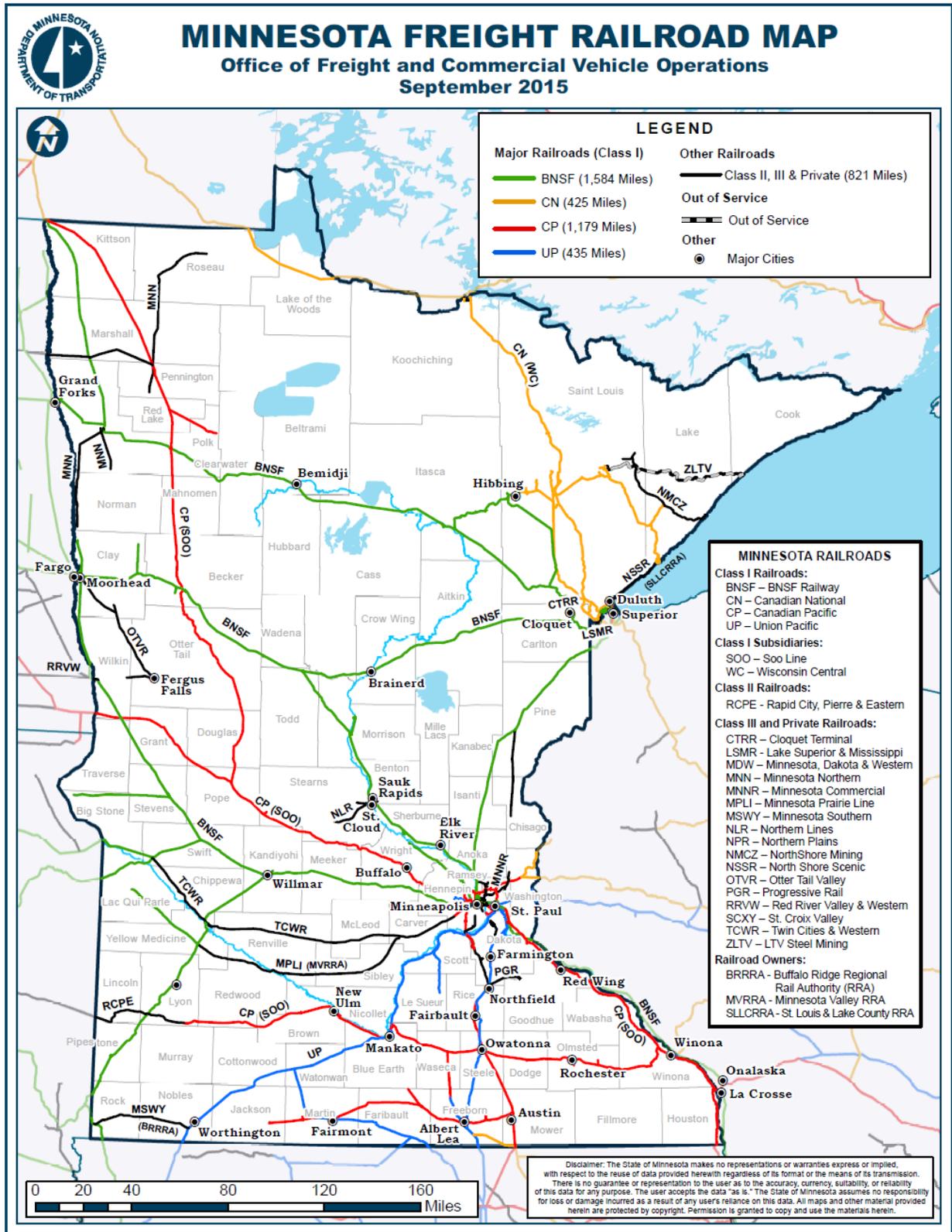


Figure #104: Railroads – Minnesota



Air Transportation

There is one municipal airport in Redwood County, the Redwood Falls Municipal Airport. The Redwood Falls Municipal Airport features two active runways and is categorized as a general aviation airport. Runway (12/30) is a paved runway aligned east/west and features a 4,001' by 100' runway. Runway (15/23) is a grass runway aligned northwest/southeast and features a 2,081' by 200' runway and is closed during the winter months. The airport offers terminal building, maintenance hangar, 22 hangar rentals, pilot flying classes, and fuel dispensing facilities.⁷⁵ North Memorial Ambulance operates Air Care III out of the Redwood Falls Municipal Airport.

The City of Redwood Falls has adopted Airport Zoning regulations to protect adjacent land use from conflicts with airport traffic. MnDOT also reviews applications within a certain distance of an airport to reduce the chance of future use conflicts.

Figure #104
Redwood Falls Municipal Airport



Relationship to Other Hazards—Cascading Effects

- Emergency Response. Dangerous roadways can make emergency response difficult.

⁷⁵ Redwood Falls Municipal Airport. Accessed: 8/15/17. Available: <http://www.ci.redwood-falls.mn.us/city-services/airport/>

Transportation Infrastructure Emergencies History in Redwood County

Rails, landing strips, and other transportation infrastructure are monitored, inspected, and maintained to ensure people and goods are transported safely. There are a number of variables that impact safety that vary from current weather condition and design to age and upkeep. Driving and planning for the conditions are important to ensure safety. Infrastructure failure, like a bridge collapsing, can also cause transportation crashes, but are less common. Listed below are the historical accidents/incidents for transportation infrastructure in Redwood County.

Aviation

Since 2010, there have been 2 aviation accidents / incidents in Redwood County.⁷⁶

- June 21, 2012 Redwood Falls, when the airplane encountered a wind gust on takeoff roll, which lifted the right wing and caused the airplane to roll left. The airplane then lifted off the ground about 2-3 feet, and the pilot aborted the takeoff.
- November 11, 2012 in Revere, the pilot experienced total loss of engine power during cruise flight due to fuel contamination and the inadequate design of the fuel system. Before departure, the pilot added about 3 gallons of fuel to the existing fuel on board the airplane. The pilot did not find contamination when he drained fuel from the main fuel tank sump drain. About 20 minutes after departure, during cruise flight, the airplane experienced a total loss of engine power that led the pilot to conduct a forced landing on a road. The airplane nosed over during the landing.

Bridges

There have been no recent bridge related incidents in Redwood County.

Railroads

There was one recent major train derailment in Redwood County. On Tuesday, January 11, 2011, there was a 15 car train derailment by the City of Walnut Grove spilling their loads of wheat. No one was hurt. Other transport trails do pose a serious risk, if a derailment occurs.

There have been multiple accidents in Redwood County since 2010 that involve trains. There have been two fatalities in Redwood County since 2010. One fatal rail incident near Lamberton October 3, 2012. A local farmer crossing the railroad tracks at the Harvest Avenue railroad crossing-south of US highway 14, driving a John Deer Tractor with an attached wagon was struck by a Canadian Pacific train Engine out of Waseca.⁷⁷ As a result of the crash, the farmer was pronounced dead on the scene. Another fatality happened July 16, 2013, a semi-truck driver was crossing the tracks northeast of Sanborn when his semi was struck by a Canadian Pacific train. He was airlifted to a Twin Cities hospital and later pronounced dead.⁷⁸

⁷⁶ NTSB Aviation Accident Database & Synopses. Accessed: 8/15/17. Available:

https://www.nts.gov/_layouts/nts.aviation/Results.aspx?queryId=be5f147f-735a-41e7-a6d8-97e31800d845

⁷⁷ KDUZ. Accessed 8/15/17. Available: <http://www.kduz.com/2012/10/04/fatal-traintractor-collision/>

⁷⁸ Pierce County Herald. Accessed: 8/15/17. Available:

<http://www.piercecountyherald.com/news/accidents/1423987-minnesota-news-briefs-truck-driver-killed-train-accident-redwood-county>

Figure #105
Walnut Grove Train Derailment - 2011



Source: FELA Lawyer News Blog

Vulnerability

Transportation infrastructure is a basic component of government. Funding for transportation infrastructure should be maintained in every budget cycle, but funding previously allocated for transportation infrastructure has been used for other programs, like subsidizing ethanol and other programs in the general fund. This has resulted in less funding to maintain our transportation infrastructure. This decrease in funding makes maintaining and improving our transportation infrastructure more difficult.

Plans and Programs

- Emergency Operations Plan – The Redwood County Emergency Operations Plan explains the procedures of evacuation during an emergency evacuation.
- Road authorities – The Redwood County High Department works closely with MnDOT to improve local transportation infrastructure. MnDOT encourages discussions to identify and improve locations where higher risk areas of conflict may exist and is interested in suggestions to improve safety. Public Roadways and other transportation infrastructure are inspected, monitored, and maintained to ensure safety.
- Snow management – According to MnDOT, “Drift-free roads are achievable through two mitigation strategies, proper road design and/or the use of snow fences. A suitably designed roadway will promote snow deposition in ditches rather than on the roadway and blowing snow that does reach the road will move across without drifting. Snow fences can also help maintain clear roadways by capturing blowing snow upwind of a problem area and storing that snow over the winter season.”⁷⁹
- Living snow fences – Redwood County has received hazard mitigation funding in the past for living snow fences. The sub-grantees for this were Redwood SWCD and MnDOT District 7.
- National Bridge Inventory System – Bridges or culverts that carry vehicular traffic and are longer than 20 feet are part of the National Bridge Inventory System. In Minnesota, bridges 10 feet or longer are inspected and inventoried. The general condition rating ranges from 0 (failed condition) to 9 (excellent) based on the physical condition of the deck (riding surface), the superstructure (load

⁷⁹ MNDOT. Accessed: 8/15/17. Available: <http://www.dot.state.mn.us/environment/livingsnowfence/design.html>

carrying members such as beams or trusses that support the driving surface), and substructures (abutments and piers).

- Comprehensive Plan – the City of Redwood Falls has a Comprehensive Plan contains a chapter on transportation. Transportation goals are outlined in the plan to mitigate transportation related issues.
- There are a number of regional assets that are shared throughout southwest Minnesota in Emergency Management Region Five. Primary among these shared assets is the Minnesota Emergency Response and Industrial Training (MERIT) Center located in Marshall. The MERIT Center provides training opportunities for local and regional emergency responders for a wide variety of situations, including hazardous materials spills, tanker spills and renewable energy related disasters.

Gaps and Deficiencies

- Transportation Funding – As funding has declined the condition of the transportation infrastructure has also declined
- High commuting numbers – Many people in Redwood County commute to work, which increases exposure to transportation hazards. The population of Redwood Falls increases during the work day.
- Train derailment – Train derailments have occurred in Redwood County. As the number of trains increase the likelihood of a derailment causing injury, death, and property damage goes up.
- Hazard materials transport – Hazard materials are being shipped on CP and MPLI trains roughly daily through Redwood County. This includes hazard materials as well as Bakken Oil.
- Redwood Falls Municipal Airport – There has been limited training with the Redwood Falls Fire Department regarding emergency response at the Redwood Falls Municipal Airport.

5.5.4 Utility Failure

Utility failure consists of power outages, water treatment system failure, and waste water treatment system failure. Citizens have come to expect these services on a 24/7 basis. When these services fail there can be a social, economic, and public health impact. Utility failure was assigned a hazard rank of moderate by the planning team.

The electric utility industry is comprised of municipal utilities, cooperatives and investor-owned utilities. Municipal utilities are governed by the city council or appointed utility commission. Municipals are non-profit. Capital is raised through operating revenues or sale of tax-exempt bonds. There are 125 municipal electric utilities in the state. Cooperatives are governed by an elected board of directors. Those cooperative customers whose name appears on a bill are eligible to vote for these directors. Cooperatives are non-profit entities but make a 'margin' on sales. Cooperatives often access funds through the federal Rural Utilities Service, or the National Rural Utilities Cooperative Finance Corporation (CFC), a privately owned, non-governmental organization. Traditionally, cooperative boards set their own rates. Investor-owned utilities, also known as IOUs, are governed by a board of directors elected by stockholders. IOUs are a state-regulated monopoly. They exist to make a profit for their stockholders while serving the public. Capital is raised through stock sales, taxable bonds and through operating revenues. Five IOUs operate in Minnesota.

Locations Affected by the Hazard

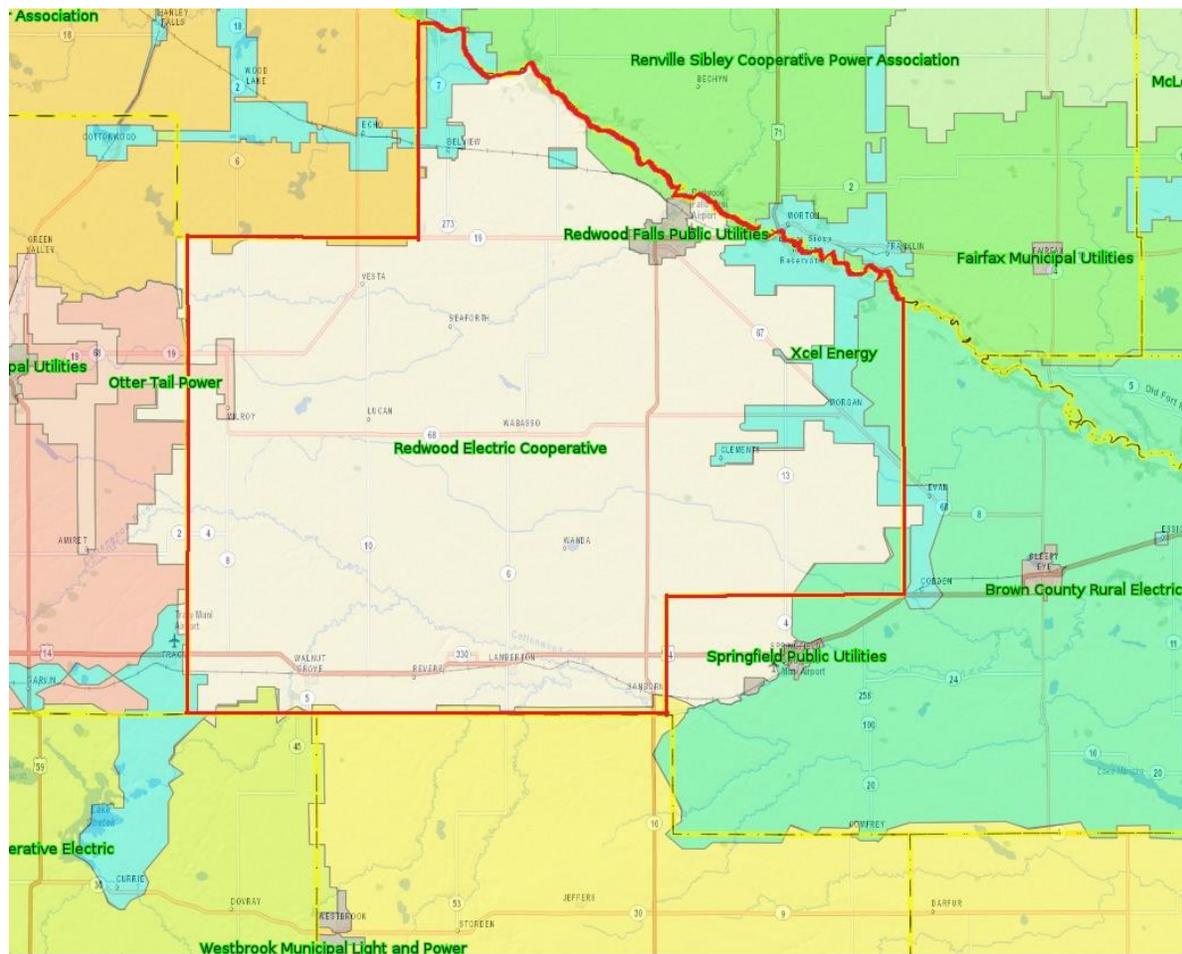
The majority of Redwood County residents is connected to and relies on one or more of these systems: power grid, water treatment system, and waste water treatment system. A small percentage of residents have personal backup generator, personal wells, and septic tanks. In the event of a major utility failure, the majority of Redwood County residents will be affected by the event.

There are nine main electric utilities in Redwood County. The main electric utilities include: Redwood Electric Cooperative, Redwood Falls Public Utilities, Xcel, Otter Tail Power, Renville Sibley Cooperative Association, Minnesota Valley Cooperative Light and Power, South Central Electric Association, Brown County Rural Electric Association, and Nobles Cooperative Electric. Refer to Figure #106 for electric utility service area map.

Xcel Energy provides electrical service to the cities of Belview, Clements, Delhi, Morgan, and the Lower Sioux reservation. Otter Tail Power provides electrical service to the city of Milroy. These two investor-owned utilities also serve some residents along distribution lines between cities.

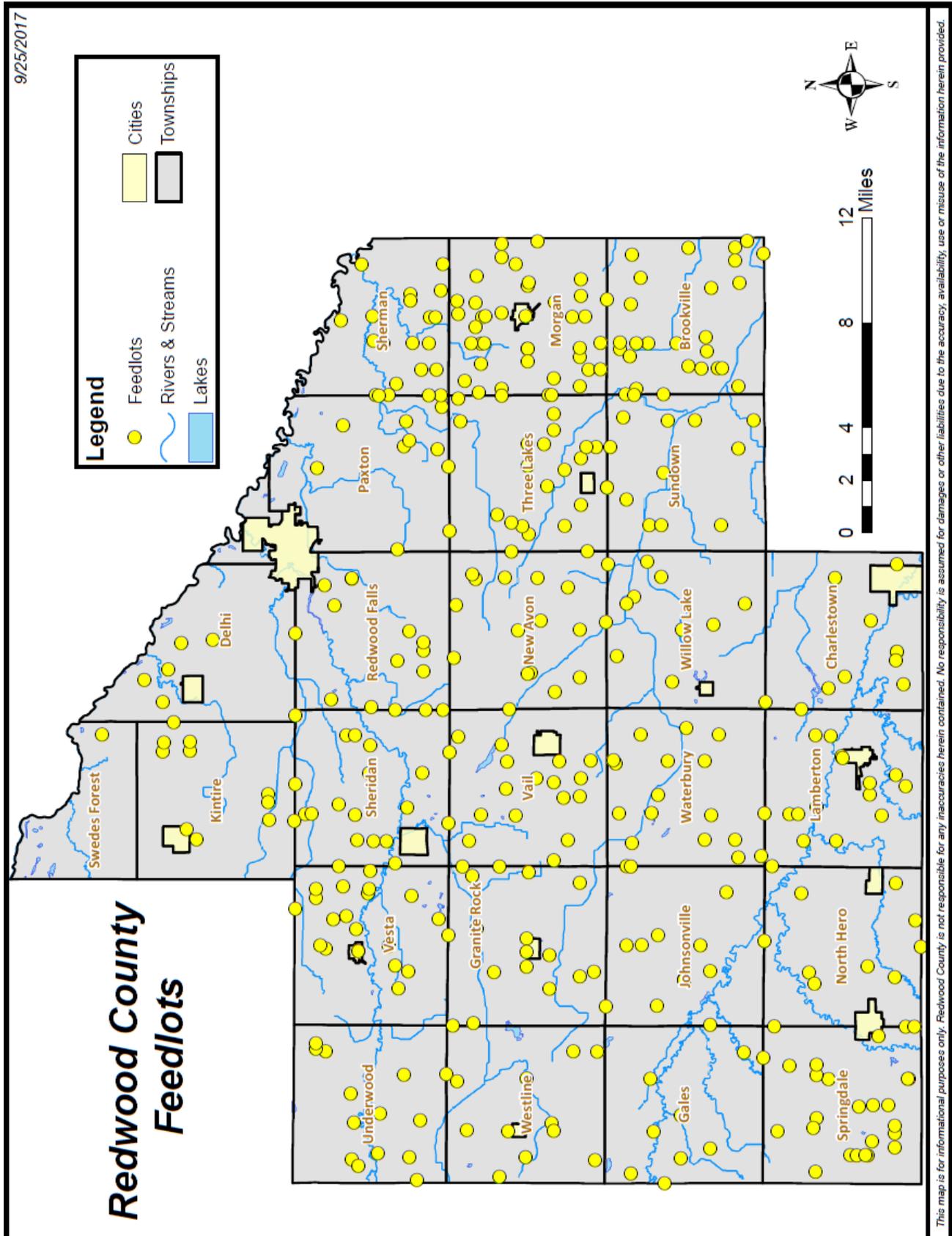
Redwood Falls Public Utilities Commission provides electrical service within the city of Redwood Falls. Minnesota Valley Co-Op Light & Power serves a very small section of the northern and northeastern border townships in the county. Renville Sibley Cooperative Power Association provides rural electric service to a small section in Northeastern edge of the county along the Minnesota River. Redwood Electric Cooperative serves most of the county, as well as the cities of Vesta, Seaforth, Lucan, Wabasso, Wanda, Sanborn, Lamberton, Revere, and Walnut Grove. There are a few service lines from neighboring rural electric co-ops (Nobles Cooperative Electric and South Central Electric Association) along the county lines.

Figure #106
Electric Utilities – Redwood County



Utility failure can cause hardship and economic loss. The loss of power can have a cascading effect. A loss of power can result in water supply pumps not being able to replenish the water supply for a city or rural water system and water treatment facilities not being able to process waste water. Power interruption can also result in food spoiling, adequate drinking water supplies being diminished, and extreme cold and warm temperatures causing hardship and can be potentially life threatening for both people and livestock. The majority of all feedlots operating within the county rely on electricity for their livestock's water. In terms of animal production, a loss of power could result in large livestock losses. Routine daily activities can also become difficult and overwhelming at times.

Figure #107: Feedlots – Redwood County



Relationship to Other Hazards—Cascading Effects

- Public Health Emergency. The failure of septic treatment facilities and systems can have immediate adverse impacts on human health due to communicable diseases and epidemics. A water treatment failure could also result in contamination of the water supply.
- Fire. Utility failures caused by downed power lines can cause wildfires and structure fires. Fighting a fire would be more challenging since electric pumps are not able to replenish the water supply and refueling may have to take place a number of miles from the fire. These variables will affect the response time, and will make it more difficult to stay ahead of the fire.

Utility Failure History in Redwood County

Redwood County has seldom experienced a countywide power loss. Typically, when the power is down it is confined to certain localities and crews can respond immediately and have power restored within hours. However, a severe daylong blizzard can keep crews from getting to the problem. The initial storm and piled up snow left behind can cause the power outage to last for multiple days.

Power outages caused by winter storms, high winds, and tornadoes can have significant economic impacts. These events may force the closure of businesses, schools and government offices. Homeowners may see food spoiled, move to a temporary shelter, experience flooding inside of their homes, or have their pipes burst all due to the lack of power. From 1999-2011 FEMA provided approximately \$31 million dollars to private non-profits in Minnesota for disaster recovery efforts. Of the \$31 million dollars, approximately \$24 million was provided to electric cooperatives (15 cooperatives) to repair utility lines, clean-up debris or for protective measures.⁸⁰

During the time period of July 1 -11 2011 severe storms, flooding, and tornadoes hit the region. The region was declared a major disaster by President Obama July 28, 2011 (FEMA-4009-DR). The primary impact was damage to utilities: Redwood County per capita impact of \$86.06.

In the spring of 2013, an ice storm hit the region that caused hundreds of electric poles to snap in half. The ice storm caused miles of downed power lines that took weeks to fully repair. For close to a week some regional residents were without power.

Vulnerability

Natural hazards will continue to cause power outages. Hardening of the utility grid will help to prevent large outages, but the costs of redundancy and hardening of the utility grid will limit the extent of the project.

There are miles of power lines in Redwood County that are above ground on poles. This makes them vulnerable to winter storms, ice buildup, tornadoes and straight line winds, and other natural disasters. The risk level assigned to utility failure by the planning team is average.

Plans and Programs

⁸⁰ MN State Hazard Mitigation Plan 2014. Rural Electric Cooperative Annex. Access: 8/15/17. Available: <https://dps.mn.gov/divisions/hsem/hazard-mitigation/Documents/Rural%20Electrical%20Cooperative%20Annex%202014.pdf>

- Tree maintenance – Electric utility providers identify and clean up areas of Redwood County that are most likely to experience damage to power lines from falling tree limbs. Redwood County works with each of its communities to ensure that these activities are conducted regularly.
- Limiting electrical power – In times of extreme heat, the county will enact rolling power blackouts. Rolling blackouts decrease the demand for electricity and conserves energy during peak demand. A rolling blackout is having certain portions of the community scheduled to lose power. This is done to keep the system from overloading. Residents are alerted through the media when their portion of town will be without power.
- Utility grid upgrades – The utility grid is constantly being upgraded with new poles and technology to make the system more reliable.
- Utility grid hardening – Local electrical cooperatives are hardening the electrical grid through various building techniques. Rural electrics suffer from storm damage and interruptions mainly from ice, wind, and severe weather on its overhead lines, so additional mitigation funding could advance utility hardening projects at a faster rate.
- Water storage – There are planning recommendations to help mitigate the impact of utility failure. To help ensure adequate water storage capacity, cities consider two basic recommendations when analyzing water storage needs. First, Minimum storage should be at least 40 gallons/capita. Second, municipal water supply should have a minimum water storage capacity equal to the average daily water usage. During a power outage the water stored in water holding facilities can act as a reserve water supply until power can be regained.
- Emergency primary care facility – The Carris Health/Redwood Hospital is designated as an emergency primary care facility.
- Underground gas lines – Most gas mains within the county have been placed underground. This makes the lines less susceptible to damage to the system.
- Water availability –
- Mutual Aid Agreement – Federated Rural Electric Association has mutual aid agreements with neighboring electric utilities to provide support in case of a large scale outage.
- MnWARN – “MnWARN is a formal emergency response program in Minnesota. MnWARN is a mutual aid agreement to provide a program whereby water, wastewater, and storm water utilities sustaining physical damage from natural or other disasters in the state of Minnesota can obtain emergency assistance, in the form of personnel, equipment, and materials and other associated services necessary to protect the health and welfare of the utilities' customers.” The following cities are members of MnWARN: Redwood Falls, Belview, Wabasso, Sanborn, Lamberton, and Walnut Grove.

Gaps and Deficiencies

- Above ground power lines – Many power lines in the county are above ground and subject to damage from ice storms, wind, and falling tree limbs.
- Backup generators – Not all communities have backup electrical generators to guarantee the operation of essential services in the event of a county wide utility failure. Water supplies could be diminished quickly, medical supplies that need to be cold may spoil, large amounts of food may spoil, and waste water could become an issue.
- Essential operating systems – Facilities in the region that have backup generators learned, in the spring ice storm of 2013, that all essential operating systems were not hooked up to the generator. There are

also key facilities that do not have backup generators. Refer to Figure #65 for a list of facilities that need new or additional backup generators.

- Cell phone coverage – Cell phone reception in rural areas in Redwood County is not reliable. In the case of an emergency, landline and satellite phones are needed to call for help.
- Public education – Public awareness should be increased for alerting the public of potential damage to gas mains and lines as these could be disrupted at many locations within the county.
- Natural gas lines and township road maintenance – there is a risk associated with snagging natural gas lines along township roads when work is being done. County roads require getting a permit. A permit should also be required along township roads.
- Hardening of the electrical grid – It is important to increase redundancy between the different electrical utilities in Redwood County. There is redundancy within individual systems, but there should also be redundancy between systems and suppliers. This would increase the reliability of the grid within Redwood County.
- Funding for hardening of the electrical grid – Local cooperatives will be able to harden the grid at a faster rate if rural electric funding could be supplemented with mitigation funding from FEMA and other sources.

5.5.5 Civil Disturbance

Civil disturbance is violence that includes actions meant to undermine law and order. This can include riots, generalized violence, unlawful obstructions, and others.⁸¹

U.S. Code 18 U.S.C. § 2331 defines Domestic Terrorism activities as acts that:

- Involve acts dangerous to human life that violate federal or state law;
- Appear intended
 - i. to intimidate or coerce a civilian population;
 - ii. to influence the policy of a government by intimidation or coercion; or
 - iii. to affect the conduct of a government by mass destruction, assassination, or kidnapping;
- Occur primarily within the territorial jurisdiction of the U.S

Locations Affected by the Hazard

Public buildings and facilities, such as the Courthouse, schools and utilities, are potential targets for civil disturbance. Agricultural chemical depots may also be targets for terrorism. Isolated rural farmsteads may also be inviting staging grounds for violent groups or individuals, away from watchful eye of law enforcement.

Relationship to Other Hazards—Cascading Effects

The nature of civil disturbance is inherently unpredictable. Cascading effects depend on the specifics of the event. For example, release of anthrax or other biological agents could lead to animal and crop disaster, destruction of a dam could lead to flooding, destruction of an industrial or farm chemical site could lead to a hazardous material crisis, or destruction of any structure could likely lead to fires.

Previous Occurrences of the Hazard

There have been no events of this type in Redwood County. An active shooter or an intentional effort to contaminate food or water sources may be the most significant localized threats to be considered.

Vulnerability

Given the unpredictable nature of civil disturbance, the vulnerability of Redwood County to this threat is difficult to determine. .

Plans and Programs

- Redwood Area Community Center has a security camera system.

Gaps and Deficiencies

- Manpower – Law enforcement in Redwood County would not have the manpower required for a large-scale civil disturbance.
- Training –Training for a civil disturbance would require mutual aid response with National Guard units to better understand and work with military personnel.
- Equipment - Protective gear for crowd control as well as higher level response gear (Class A HazMat suits for possible chemical incidents; crowd control devices - gas launchers, etc.) for terrorism or a civil disturbance.

⁸¹ 2014 Minnesota State Hazard Mitigation Plan pg. 182, retrieved 2/3/2016
(<https://dps.mn.gov/divisions/hsem/hazardmitigation/Documents/State%20Plan%20Final%202014.pdf>)

- There is no response plan for a large-scale crisis.

5.5.6 Water Supply Contamination & Availability

Water supply contamination is the introduction of point and non-point source pollutants into public ground water and/or surface water supplies.⁸² Water supply contamination can be the result of mismanaged landfills and dumps, negative externalities of industrial activity, and agricultural run-off. The availability of water is always a concern, with water sources being consumed at high rates across the United States. Coupled with the risk for drought, water supply availability continues to be a concern for the planning team.

Surficial aquifers yield “young water”, with 10-12 year recharge cycles from precipitation. This makes them more susceptible to drought and contamination from both point and non-point sources. The highest quality water comes from these shallow aquifers. The deeper the aquifers the more iron and manganese there is in the water. The more shallow aquifers are preferred since they have better quality water, but are more susceptible to contamination.

Microbiological and chemical contaminants can enter the ground water through leaking underground storage tanks, feedlots, and waste disposal sites. Human wastes and pesticides can also be carried to lakes and streams during heavy rains or snow melt. Areas in Redwood County have different risk factors in regards to certain contaminants, but there is equal risk throughout the county for water contamination.

Figure #108
Public Water Supplies – Redwood County

Public Water Supplier	ID
Belview	1640001
Walnut Grove	1640014
Clements	1640002
Lucan	1640004
Milroy	1640005
Wanda	1640015
Morgan	1640006
Lamberton	1640003
Redwood Falls	1640008
Revere	1640010
Sanborn	1640011
Seaforth	1640018
Vesta	1640012
Wabasso	1640013

⁸² EPA. Accessed 6/3/13. Available: <http://www.epa.gov/agriculture/tsur.html>

Extent of the Hazard

A major contamination could cause massive disruption to Redwood County's economy and the health of surrounding communities. Removing contaminants from a water supply or relocating a well is an expensive process. Treating water for both human and animal consumption may result in people and farming operations relocating to new locations. This would leave areas of Redwood County unused until contaminants are removed from the water supply.

Relationship to Other Hazards—Cascading Effects

- **Public Health Emergency.** Since Redwood County has a shallower well system, the county is more susceptible to water supply contamination. Polluted water sources can cause illness and epidemics in both humans and animals.
- **Civil Disturbance.** A water supply shortage could also lead to public unrest and civil disturbances. When the supply of a necessity becomes drastically low distress can take over and cause civil unrest. Scarce resources could cause the public to loot and cause civil disorder.

Previous Occurrences of the Hazard

Redwood County has not had a major groundwater contamination problem.

Vulnerability

Redwood County has some risk of water supply contamination since the county is tapped into aquifers, but no major groundwater contamination has occurred. Water recharge in shallow wells can occur in a matter of hours, so wells that are drilled into the shallow aquifer are more vulnerable to pollutants infiltrating the water supply. A number of regulations and monitoring procedures are in place to help maintain a quality water supply. Refer to the Plans and Programs section under Vulnerability for more measures to keep ground water supplies safe.

Plans and Programs

- **Redwood County Local Water Management Plan** – The Redwood County Local Water Management Plan (which was recently updated) encourages water retention practices and identifies the importance of wetland restoration which would help with aquifer recharge. The plan identifies that efforts to protect groundwater should focus on Drinking Water Supply Management Areas (DWSMAs) and surficial aquifers, and it outlines Redwood County's enforcement of the state code for septic systems and floodplain ordinances. The county also does private well water testing through the well water testing program and conducts a free well water nitrate testing clinic at the Redwood County Fair.
- **Wellhead Protection Program** – Several municipalities in Redwood County have set up a wellhead protection program, as promoted by the Minnesota Department of Health. All incorporated communities in Redwood County will eventually be developing wellhead protection plans. Since 1974, all water wells constructed in Minnesota must meet the location and construction requirements of the Minnesota Well Code. These requirements pertain to private wells, also. Refer to Appendix A for a handout regarding wellhead protection.
- **Abandoned Well Sealing Program** – Redwood County through the Soil and Water board has a cost share program for sealing abandoned wells. This program is part of the Local Water Management Plan.
- **Feedlot pollution prevention** – Redwood County actively works to protect water sources from feedlot runoff. County ordinances require that all feedlots within the county participate in the state's feedlot

program. Also, county and county extension services promote best management practices to minimize runoff from feedlots. County zoning ordinances also limit feedlot locations.

- Subsurface Sewage Treatment Systems (SSTS) – SSTS are commonly known as septic systems and are regulated by Minnesota Statutes 115.55 and 115.56. Minnesota Pollution Control Agency (MPCA) enforces the statutes and Redwood County continually works with MPCA towards updating failing septic systems.
- Septic System Code – Redwood County enforces the state code for septic systems and floodplain ordinances.
- Household Hazardous Waste Program (HHW) – The Redwood County’s HHW program, helps residents with the disposal of toxic household products and provides an exchange program for usable leftover products.
- Wastewater water monitoring – The MPCA requires routine inspection of all public wastewater systems. State staff, in the Water-Quality Point-Source Program, issue permits and monitors compliance through data review and inspections, and enforces permit conditions. Employees at the wastewater facilities are certified operators under state requirements. These operators are required to take state training to maintain their certified operator status.
- Public water system monitoring – The MDH requires routine inspection of all public water systems. State staff issues permits and monitors compliance through data review and inspections, and enforces permit conditions. Employees at the water facilities are certified operators under state requirements. These operators are required to take state training to maintain their certified operator status.
- Drinking water standards – The U.S. Environmental Protection Agency (EPA), as required by the Safe Drinking Water Act of 1974, sets uniform nationwide minimum standards for drinking water. State public health and environmental agencies have the primary responsibility for ensuring that each public water supplier meets the federal drinking water standards or more stringent ones established by the state. The EPA requires an ongoing water quality monitoring program to ensure public water systems are working properly. Local officials work together with the MDH and EPA to ensure that all public water supplies are safe. Also, the EPA requires all local suppliers to promptly inform the public should the supply become contaminated.
- Shoreline zoning – Redwood County has adopted the state’s statutory shoreline riparian zoning classifications and minimum standards via ordinance.
- Clean Water, Land and Legacy Amendment – The Clean Water, Land and Legacy Amendment of 2008 increased the sales and use tax rate by three-eighths of one percent on taxable sales, starting July 1, 2009, continuing through 2034. Approximately 33 percent of this revenue is dedicated to the Clean Water Fund to protect, enhance, and restore water quality in lakes, rivers, streams, and groundwater.
- County zoning – Several steps are being taken to protect ground water sources from feedlot runoff. County ordinances require that all feedlots within Redwood County participate in the State’s feedlot programs. Also, county extension services promote best management practices to minimize runoff from feedlots. County zoning ordinances also limit feedlot locations.
- Inflow & Infiltration – All cities in Redwood County work to reduce inflow and infiltration in their sanitary sewer systems.
- Sedimentation pond – Sedimentation ponds are being integrated into highway projects to help slow the flow of water and allow for a more natural water filtration process.

Gaps and Deficiencies

- Backup drinking water sources – The Redwood County Emergency Management Plan should identify alternate sources of drinking water, including locations for acquiring adequate amounts of bottled water, in the event of well contamination.
- Public outreach for wellhead protection – Efforts to educate private well owners on the importance of wellhead protection plans are not well planned and coordinated with state and federal efforts.
- Septic system inspection – Redwood County does not have an ordinance requiring periodic inspections of individual septic systems. The initial installation must meet MPCA requirements, and it has to be installed by a licensed contractor.
- Security around public water sources – Wells, water towers, groundwater storage tanks and water treatment plants should have additional security. This may include fencing around sites, alarm systems for break-ins and the addition of surveillance cameras. Rural water supplies may be more vulnerable, since security is less.
- Backup electrical generators – Not all communities have backup electrical generators to guarantee the operation of their water supply and/or wastewater treatment facilities.
- Sump pump public education – The general public may be unaware that sump pumps cannot drain into the city wastewater system.
- Wellhead protection plans - All cities do not have Wellhead Protection Plans. The City of Redwood Falls have wellhead protection plans. The rest of the cities in Redwood County do not have wellhead protection plans, but are encouraged to have one developed by the Minnesota Department of Health within the next five years.
- Rural Water Systems Wellhead protection plans – Lincoln Pipestone Rural Water has a water source (well) located outside the county.
- Wellhead protection plan funding – The Minnesota Department of Health lacks resources to work with every community to complete wellhead protection plans quickly.
- Nitrates – Aquifers in the region are often shallow and have a high potential of contamination from nitrate leaching. Deeper aquifers may not be suitable for water supplies due to naturally occurring contaminants, such as sulfur, or because of slow well recharge. Nitrates have found to be a specific problem in the region.
- Aging infrastructure – The water supply infrastructure in the majority of cities in southwest Minnesota is past its useful life. The water supply infrastructure is old, in need of repair, and is extremely costly to replace. Repairs and replacement is occurring, but this process could be accelerated with state and federal funding. Accelerated funding would help to decrease costs, so cities could make larger updates. There are economies of scale in larger projects and having work done in multiple adjacent cities.
- Towns without wellhead protection plans are a gap.

5.5.7 Hazardous Materials

Hazardous materials are found everywhere, from farm to home. A hazardous material is any item which has the potential to cause harm to humans, animals, or the environment, by itself or through interaction with other factors. Spilled material can be costly to clean up and may render the area of the spill unusable for an extended period of time. Water supplies may become contaminated by the introduction of point and non-point source pollutants into public ground water and/or surface water supplies.

Locations Affected by the Hazard

Redwood County there are a number of manufacturers who use and or produce a number of potentially hazardous materials. US 71, 67, 68 and 14 run through the county and these major transportation corridors have a high volume of semi-truck traffic. The loads coming to the county and through the county varies, but some of these loads could pose a serious chemical hazard if a crash would take place. Oil tankers are one example.

Many chemicals are also used daily in agriculture, putting farms and rural communities at risk. Anhydrous ammonia is one dangerous chemical used in agriculture that if not handled properly can be very dangerous.

Extent of the Hazard

Federal law defines certain hazardous chemicals, and requirements for emergency planning for facilities at which hazardous substances are present. According to the Minnesota AHMP, approximately 6,000 facilities across the state report their storage of hazardous chemicals to the Minnesota Department of Public Safety's Emergency Planning and Community Right-To-Know Act (EPCRA) Program, US Environmental Protection Agency (EPA), and their local fire department. Within Redwood County there are 5 facilities that report hazardous material storage to state and local authorities.⁸³ These types of facilities are known as 302 facilities after EPCRA Section 302(c) that require state and local authorities to develop chemical emergency preparedness and response capabilities through better coordination and planning with local businesses.

Chemicals

Land use activities and farming practices can have significant impacts on vulnerable aquifers. Aquifers in the region are often shallow and have a high potential of contamination from nitrate leaching. Deeper aquifers may not be suitable for water supplies due to naturally occurring contaminants, such as sulfur, or because of slow well recharge. Nitrates have been identified as a specific problem in the region.

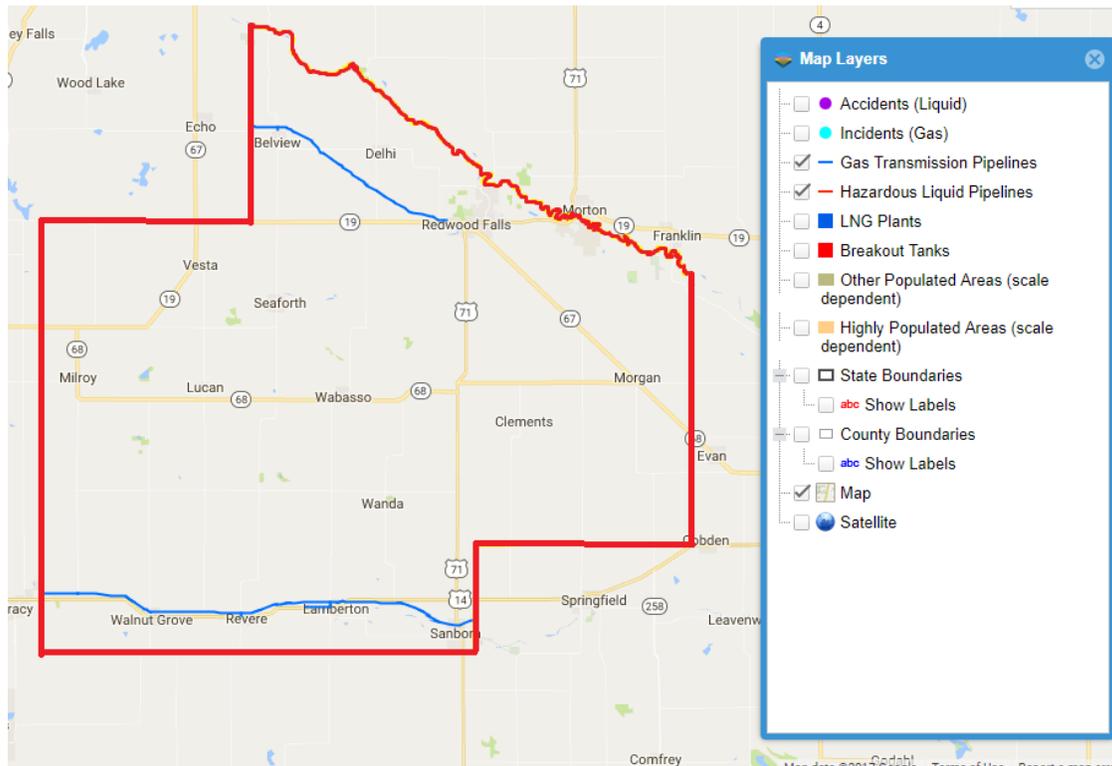
Pipelines

The State Fire Marshal's Pipeline Safety Team (SFMPST) oversees pipeline operations in Minnesota. The National Pipeline Mapping System identifies no hazardous liquid pipelines traversing Redwood County. There are two gas transmission pipelines in Redwood County that travel across the northern portion and southern stretch of the county. These pipelines are in blue on the map below. Pipelines are pressurized and monitored, so pipelines can be quickly shut off in case of an accident. Pipelines are a safer way to transport hazardous liquids than by trucks or rail. "The evidence is clear: transporting oil and natural gas

⁸³ Toxic Release Inventory Program. 2016 Preliminary Dataset. Accessed 8/14/17. Available: <https://www.epa.gov/toxics-release-inventory-tri-program/2016-preliminary-dataset-basic-data-files>

by pipeline is safe. Furthermore, pipeline transportation is safer than transportation by road, rail, or barge, as measured by incidents, injuries, and fatalities—even though more road and rail incidents go unreported.”⁸⁴

Figure #109
Hazardous Liquid and Gas Transmission Pipelines – Redwood County

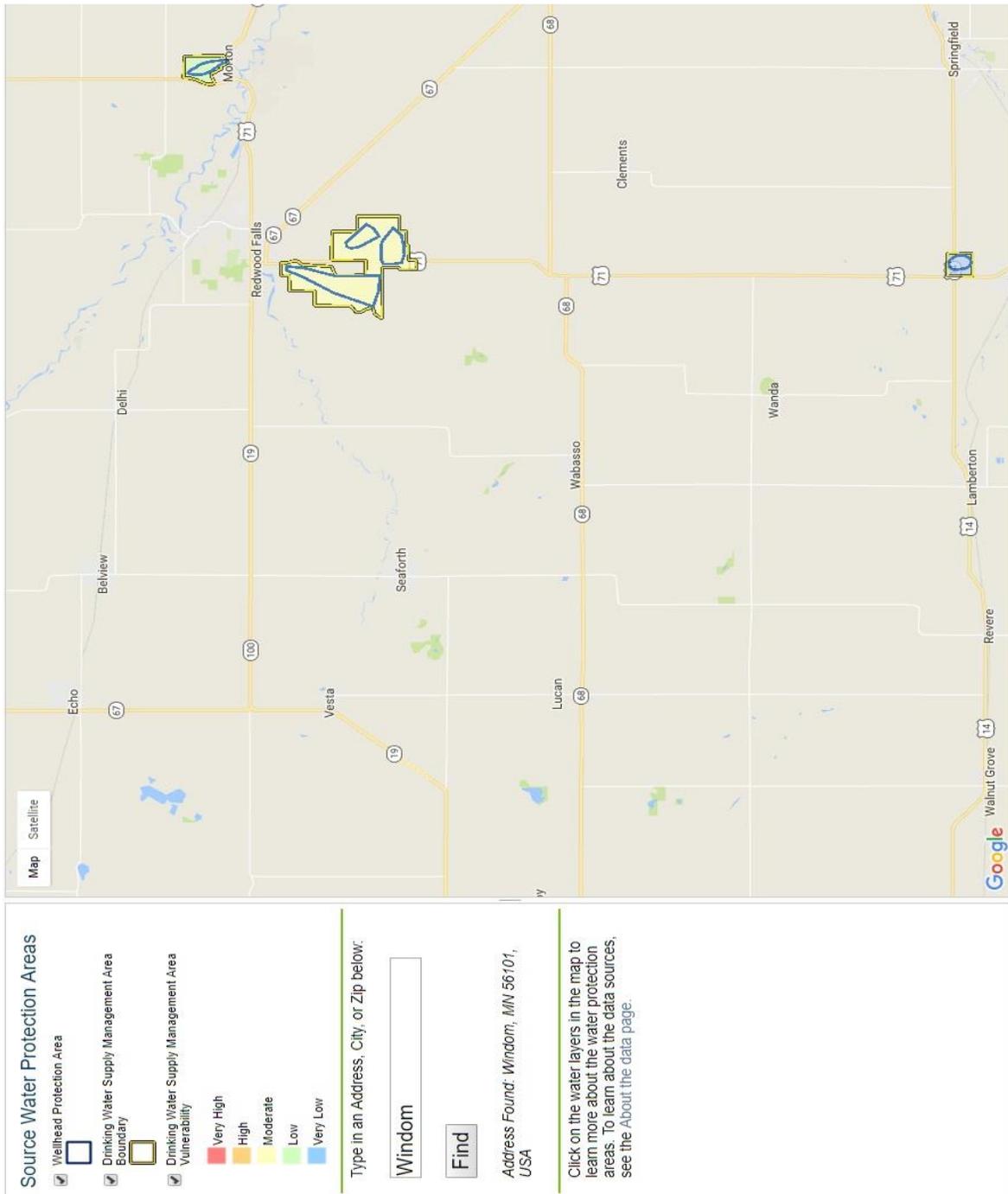


Source: National Pipeline Mapping System - <https://www.npms.phmsa.dot.gov/PublicViewer/>

⁸⁴ Manhattan Institute for Policy Research. Issue Brief – Pipelines are Safer for Transportation of Oil and Gas. Accessed: 7/23/15. Available: http://www.manhattan-institute.org/html/ib_23.htm#.VbFOi6_bK70

Figure #110

Water Source Protection Areas – Redwood County



Meth

Meth is a powerful stimulant drug that is similar to a family of drugs called amphetamines. During the production process there are a number of dangerous chemicals that are mixed that can cause dangerous fires and explosions. According to the Rand Drug Policy Research Center, amphetamines are the most widely used illicit drug worldwide, after marijuana.⁸⁵ Information in regional data systems and feedback

⁸⁵ Rand. Accessed: 5/29/13. Available: http://www.rand.org/pubs/research_briefs/RB9438/index1.html

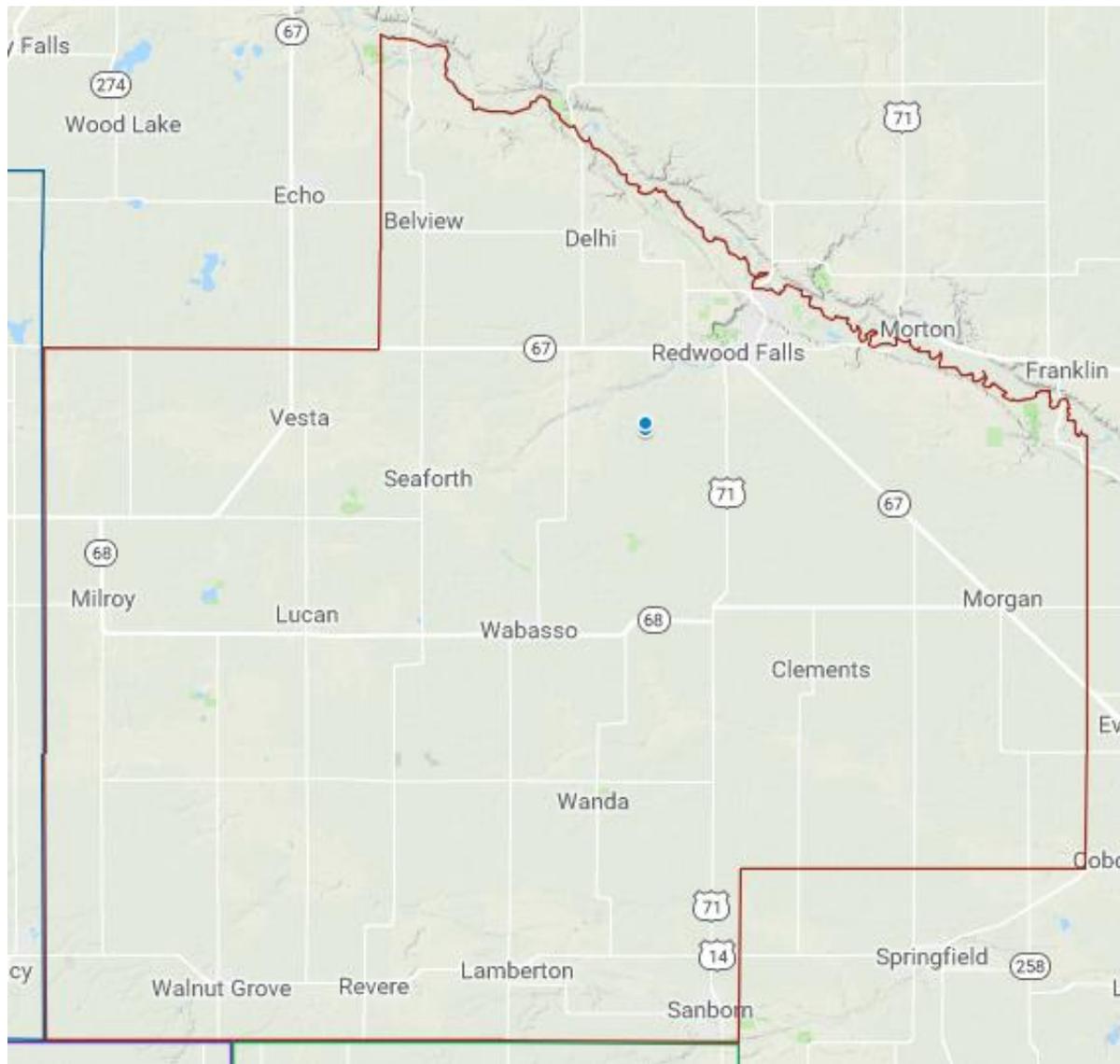
from law-enforcement agencies and elected officials indicate that meth is still a problem facing the populations they serve, though its production is generally no longer taking place locally.

Meth labs are a concern in the region and an incident at a lab could result in a major hazard material incident. A number of hazardous chemicals are used in the production process. An explosion and fire could result in a number of chemicals being emitted into the air and the ground water. There is also chemical byproduct from cooking meth that is often discarded. This chemical byproduct could infiltrate the ground water and cause ground water contamination.

Decommissioning of Wind Towers

There are a few wind towers in Redwood County and more may be built in the future. Current towers are located southwest of Redwood Falls. In counties with more extensive wind turbine systems, there is a concern of wind towers being abandoned and property owners left with removal and cleanup – this is something for Redwood County to consider moving forward. There are removal and cleanup guarantees in the majority of the contracts with the wind farms, but if the wind farm files bankruptcy or closes all together, there may not be funding for removal and cleanup. There would be a substantial cost associated with decommissioning wind towers.

Figure #111
Wind Towers in Redwood County⁸⁶



Relationship to Other Hazards—Cascading Effects

- Fire. Hazardous materials incidents may cause or occur in conjunction with a fire. This could result in the fire spreading at a fast rate and can make containing and fighting the fire more difficult. Specialized equipment may be required to combat the fire caused or in conjunction with a hazardous material.
- Water Supply Contamination. An incident involving hazardous materials on the roads, rail, or in the air can lead to a water contamination issue. Wellhead Protection Plans discuss the infiltration of chemicals leaking into ground water aquifers. The issue of infiltration could be multiplied by a load of hazardous materials being transported on any of the main highways being in a crash and causing contamination to the ground water.
- Terrorist activity. Most hazardous materials in transit are marked, but there is an unknown volume of government materials being shipped that are not marked due to security reasons. Since MN HWY 14,

⁸⁶ Source: USGS. Accessed 8/23/2017. Available: <https://eerscmap.usgs.gov/windfarm/>

67, 68 and 71 pass through Redwood County, there is an increased risk of illicit activity along the corridor.

- Public Health Emergency. Hazardous materials being proceeded in or shipped through Redwood County could be involved in a crash. The exposure of radiological substances by unprotected humans might result in the negative effects caused by such an exposure. It can be life threatening depending upon how much exposure and the length of the exposure time.

Previous Occurrences of the Hazard

Hazardous material incidents can occur in different locations:

- Fixed site facilities
- Highway and rail transportation
- Air transportation
- Pipeline transportation

There have been 19 hazardous materials incidents reported in Redwood County since 2000.⁸⁷ Hazardous material incidents also include the discovery of underground storage tanks and other minor incidents. Removal of underground storage tanks is required procedure by EPA, but in the past barrels and other materials were buried and discarded. It is unknown how many hazardous materials are buried in Redwood County.

Figure #112
Hazardous Materials Incidents since 2000 – Redwood County

Date	Nearest City	Type	Cause	Description / Report
3/22/2015	Redwood Falls	Mobile	Other	Discharge of diesel fuel (100-200 gallons) from the saddle tank on a semi-truck due to a vehicle accident.
4/3/2015	Brookville Township	Mobile	Equipment Failure	Release of anhydrous ammonia into the atmosphere from a nurse tank due to an equipment failure on the tool bar.
6/10/2015	Redwood Falls	Continuous	Other	Continuous release of ammonia into the atmosphere from a waste water pond at a feed manufacturing facility due to normal operations. This is the yearly report.
7/15/2013	Sanborn	Railroad	Other	A train made contact with a tractor trailer truck while crossing county road 153 at Tracy subdivision mm 200.8 which released an unknown amount of diesel onto the ground.

⁸⁷ USCG National Response Center – EPA Hazardous Incidents Reports. Accessed 8/14/17. Available: <http://nrc.uscg.mil/>

Date	Nearest City	Type	Cause	Description / Report
10/3/2012	Lamberton	Railroad	Unknown	An accident at a grade crossing involving a freight train and a farm tractor. There was a spill of diesel fuel from the farm tractor. The driver of the tractor was a fatality.
1/12/2011	Walnut Grove	Railroad	Derailment	A 15 car freight train derailment which resulted in a spill of wheat/grain. The amount of wheat/grain is unknown at this time.
9/16/2009	Vesta	Storage Tank	Equipment Failure	A storage tank was being filled with diesel fuel and it overflowed because of a bad gauge.
1/22/2007	Redwood Falls	Storage Tank	Equipment Failure	A release of materials into a dike area from a storage tank due to equipment failure.
3/31/2006	Lamberton	Railroad Non-Release	Derailment	A grain train was pulling out of an elevator track when 5 cars derailed due to unknown causes.
7/19/2006	Revere	Storage Tank	Operator Error	Overfill of above ground storage tank. Product released was mixture of soy oil and #2 fuel oil. Amount released was approximately 50 gallons. Release contained in containment dike. Product being recovered by west central environmental company.
5/10/2005	Redwood Falls	Continuous	Other	This is an initial of a continuous release report. Planned incident.
6/16/2005	Redwood Falls	Continuous	Other	A release of materials due to biological causes.
11/8/2005	Milroy	Storage Tank	Equipment Failure	Material released from a nurse tank due to broken hose.
11/11/2005	Sheridan	Storage Tank	Equipment Failure	A pin broke in the hitch of the trailer. The coupler that was supposed to release did not release which caused a valve on the tank to break loose.
4/19/2004	Sanborn	Railroad Non-Release	Unknown	A unit train derailed 6 cars (4 on their side and 2 upright) due to unknown causes. All cars were carrying corn. There were no hazmat releases.
8/31/2004	Wabasso	Storage Tank	Equipment Failure	Material released from a storage tank due to equipment failure.
12/7/2004	Lamberton	Railroad Non-Release	Derailment	A freight train derailed 11 cars.
11/5/2003	Wabasso	Storage Tank	Equipment Failure	Due to equipment failure, a valve broke on a nurse tank causing material to release into the air.

Date	Nearest City	Type	Cause	Description / Report
11/12/2001	Redwood Falls	Fixed	Equipment Failure	The material released out of the ammonia chiller due to a leak within the filter.

Probability of Future Events of this Hazard

The potential frequency of hazard events involving hazardous materials is likely according to the planning team. With US 71, 14, MN 19, 67, and 68 passing through the county, one Class I railroads (the Canadian Pacific SOO Line), and one Class III railroad (Minnesota Prairie Line – MVRRA) there is a high probability that there will be a crash involving hazardous materials. Refer to Figure #104 for the Minnesota Railroad Map in the Transportation Infrastructure subsection.

Vulnerability

With US 71, 14, MN 19, 67, and 68 passing through the county, one Class I railroads (the Canadian Pacific SOO Line), and one Class III railroad (Minnesota Prairie Line – MVRRA) crossing Redwood County, hazardous materials may be traveling through the area at any time. This volume of hazard materials traversing Redwood County poses a serious risk of a hazardous material incident occurring. Precautionary measures are in place to prevent an incident from occurring, but a crash on US HWY 14, 71, or MN 67 involving a tanker of hazardous materials could result in a major hazardous material incident. A major incident could have large cascading effects since almost all water for public consumption in Southwest Minnesota is sourced from underground aquifers, rather than surface waters.

Plans and Programs

- State agency cooperation – Redwood County works directly with the appropriate state agencies to address needs for responding to and mitigating the impacts of a hazardous materials event.
- Emergency Operations Plan – The EOP discusses Radiological/Hazardous Materials and outlines procedures for dealing with hazardous material accidents, spills, and releases. EOP identifies the 302/312 facilities within Redwood County that maintain a supply of hazardous chemicals.
- Environmental health regulations – Redwood County has worked to develop environmental health regulations. These documents are cross-departmental plans that deal with hazardous material, infectious disease, and food-borne illnesses. They serve to provide guidelines to protect the citizens of the county.
- Training of emergency personnel – All emergency personnel are trained to at least the minimum Hazardous Materials Awareness level and all first responder groups conduct the required Occupational Health and Safety Administration training on a yearly basis.
- Ordinance – Redwood County has a meth lab ordinance describing the policies and procedures for cleaning up such a site. The cost of the cleanup is billed to the property owner.
- Redwood County Solid Waste Plan – In 2014, Redwood County updated its 10 year Solid Waste Plan. The plan identifies the policies and programs regarding Hazardous Waste Management for the county. The plan also identifies the large waste generators within the county.
- Hazardous chemicals collection – Redwood County’s Emergency Manager works with the Department of Public Safety, Emergency Response Commission to assist in the statewide collection of hazardous

chemicals existing at facilities throughout Redwood County so that local emergency officials can prepare for incidents.

- Household Hazardous Waste Facility –The facility takes any hazardous waste that comes from a household such as paint, cleaners, fluorescent lights, etc.
- Regional hazardous waste facility. [COUNTY] County works with the regional office in Marshall, MN, in providing a way for Very Small Quantity Generators (VSQG) to dispose of their hazardous waste.
- Hazardous Materials Response Team – Redwood County does not have a HAZMAT Team. Redwood County coordinates with the HAZMAT Team out of Mankato and Marshall. Sioux Falls could potentially be added as a HAZMAT Team, but state lines can make coordination more difficult.
- Monitoring program – A number of store owners currently report to the sheriff’s office when products are sold that are used in making meth.
- Regional Deacon Trailer – Mass decontamination can be performed using this asset. This asset is portable and available to the HSEM Region Five.
- Carris Health/Redwood Hospital has a portable decontamination shower. The facility has access to other decontamination assets, personal protective equipment (PPE), and other resources through the System and Regional partners which can be deployed with a phone call (through SWEPT).
- MnDOT – MnDOT has several departments to address hazardous materials, freight, emergency management and disaster preparedness. The District State Aid Engineer is a good contact for access to those resources.
- Water plan – Redwood County’s water plan recognizes that the county’s ground water is impacted by both agricultural and residential fertilizer and pesticide applications.
- Regional and State assistance – Plans are in place specifying hazardous material cleanup and protocol for who should be contacted for regional and state assistance.

Gaps and Deficiencies

- Specialized equipment – Redwood County fire departments are in need of specialized equipment to deal with hazardous materials. This equipment is often a single use item and is a high cost item. Maintaining this equipment is expensive, so this equipment is often not purchased, available, or dies on the shelf.
- Public education regarding drug ingredients – Public outreach to business owners needs to occur more frequently regarding substances used in making meth and other controlled substances.
- Hazard material / Meth lab cleanup -The sheriff’s office and local fire departments are trained to handle a number of hazardous materials, but for meth labs and other hazard materials a HAZMAT certified cleanup team is required. The Redwood County sheriff’s office does not have a HAZMAT Team. Meth lab clean up can be very costly. If a fire fighter goes into a fire and sees that it is a meth lab, the equipment the fire fighter is wearing is no longer good. The chemicals in the fire contaminate the suit, so there are other costs that can be associated with a meth lab fire and clean up.
- Hazardous material training for first responders – First responders are trained to recognize hazardous materials and establish a perimeter. Hazardous material training only happens every three years for emergency responders. A refresher course would be helpful for emergency responders.
- 302 Facilities portable database – It may be time consuming to look up what hazardous materials a 302 facility is storing. A more usable database could assist with emergency response and increasing the safety of emergency responders.

- Proper hazardous waste disposal – Although the Redwood County Household Hazardous Waste Facility is open, there is still a need to educate the public and businesses on how to dispose of their waste properly.
- Drug Drop Box outreach and marketing – There is a prescription and over the counter medication disposal drop box in the Redwood County Law Enforcement Center. The Redwood County sheriff's office in conjunction with the Redwood Falls police department helped to setup the drug drop box. Additional outreach and marketing to the public is needed to increase use of the drug drop box.

5.6 Hazard Identification Worksheet

5.6.1 Methodology

The Hazard Identification Worksheet is a tool to help profile the identified hazards. In Section II above the results of Planning Team’s Hazard Identification Worksheet were included in the profile of the identified natural and manmade hazards. The profile and the hazard identification worksheet helped the planning team assign priority to hazard mitigation strategies.

The Hazard Identification Worksheet was developed by the former Minnesota Planning Agency and expanding by the Southwest Regional Development Commission.

The sorting criteria for categories in the Hazard Identification Worksheet are as follows:

Figure #113: CPRI Sorting Criteria

Probability:	Unlikely if <1% chance in the next 100 years, Occasional = 1% and 10% chance in next year, Likely = between 10% and 100% chance in next year, Highly Likely = greater than 10% chance in next year.
Magnitude/Severity:	Limited =<10% area affected destroyed, Minor = 10% to 25% area affected, Major = 25% to 50% area affected, Substantial = >50% area affected.
Warning Time:	Minimal, 6 – 12 hours, 12– 24 hours, 24+ hours
Duration:	Prolonged, Extended, Intermediate, or Brief
Risk Level:	Combined ranking based on previous categories
Hazard Rank:	Subjective ranking by Planning Team based on previous categories

**Figure #114
CPRI Worksheet Rankings**

Hazard	Probability	Magnitude/Severity	Warning Time	Duration	Risk Index	Risk Severity
Tornado	2.50	2.81	3.62	2.85	2.79	Medium
Winter Storm	3.38	2.12	2.50	2.60	2.79	Medium
Flash Flood	2.92	2.04	3.04	2.54	2.64	Medium
Windstorm	2.92	2.19	2.81	2.40	2.63	Medium
Hail	3.00	1.65	3.12	1.85	2.50	Medium
Lightning	2.73	1.38	3.08	1.83	2.29	Medium
Flood (Riverine)	2.48	1.67	2.41	2.73	2.25	Medium
Extreme Cold	2.73	1.81	1.42	2.35	2.22	Medium
Extreme Heat	2.38	1.69	1.35	2.31	2.01	Medium
Erosion	2.12	1.62	1.96	2.20	1.95	Low
Drought	2.04	1.62	1.62	3.00	1.94	Low
Landslide/Mudslide	1.38	1.50	2.36	1.84	1.61	Low
Wildfire	1.35	1.46	2.19	1.92	1.57	Low

Subsidence	1.42	1.32	2.13	1.88	1.54	Low
Dam Failure	1.19	1.42	1.80	1.92	1.43	Low
Earthquake	0.85	1.46	2.23	1.52	1.31	Low

5.6.2 Repetitive Flood Claim Properties and Severe Repetitive Loss Properties

Repetitive loss properties are defined by FEMA as having two or more losses of at least \$1,000 each paid under the National Flood Insurance Program (NFIP) within any 10-year period since 1978. A Severe Repetitive Loss (SRL) property is defined by FEMA as a residential property covered under NFIP that has at least four NFIP claim payments over \$5,000 each and the cumulative amount of such claims exceeds \$20,000. An SRL property may also be one for which at least two separate NFIP payments have been made with the cumulative amount of the building portion of these claims exceeding the market value of the building.

Repetitive Loss Properties

FEMA has a nonpublic database of all of the repetitive loss structures within the State. These structures are those which have sustained damages on two separate occasions within a ten-year time span for which the cost of repairs at the time of the flood meets or exceeds 25 percent of the market value of the structure before the damage occurred.

Based on this database, Redwood County does not have any repetitive loss structures identified. From January 1, 1978, through November 30, 2017, zero total losses were reported in rural Redwood County.⁸⁸

Figure #115
Loss Statistics Flooding – Redwood County, January 1, 1978 – June 30, 2017

Community Name	Total Losses	Closed Losses	Open Losses	Closed Without Payment Losses	Total Payments
City of North Redwood Falls	1	1	0	0	\$88,998.60
Redwood County	2	2	0	0	\$54,453.53
Totals	3	3	0	0	\$143,452.13

FEMA: Loss Statistics

Severe Repetitive Loss Properties

As of November 2017, there were no Severe Repetitive Loss properties in in Redwood County.⁸⁹

⁸⁸ 2017 Flood Mitigation Assistance RL and SRL county lists. Accessed 12-7-2017.

⁸⁹ 2017 Flood Mitigation Assistance RL and SRL county lists. Accessed 12-7-2017.

5.6.3 Analyzing Development Trends

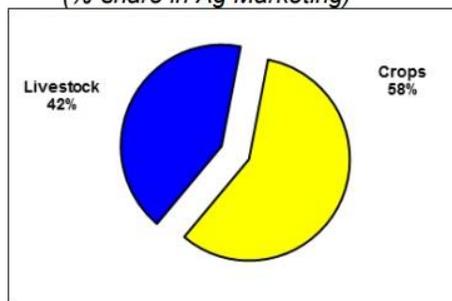
Land Use and Development Trends

Redwood County is a rural county with urban growth in the City of Redwood Falls. There are 521,453 acres in farm production in Redwood County.⁹⁰ Agriculture and manufacturing are two primary business categories in Redwood County.

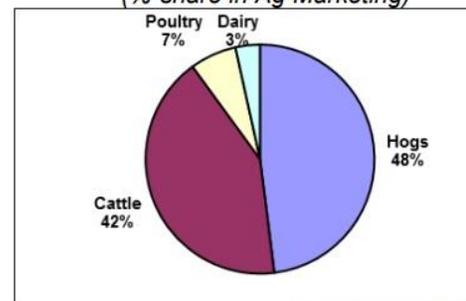
A large percentage of tillable land in Redwood County is farmed. There are also lands in conservation programs, parks, and other more natural settings. Not having all of the tillable ground in production helps to maintain ground water quality, wetlands, and plants and wildlife.

Figure #116
Redwood County Farm Land Use

Redwood County Crop & Livestock Production
(%-share in Ag Marketing)



Redwood County Livestock Sectors
(%-share in Ag Marketing)



Source: USDA/NASS

Prohibiting development in floodplains also helps to mitigate the negative effects of flooding and runoff. Grasslands, shrubs, and other vegetation help to negate the negative effects that flooding and runoff can have. It is important to incorporate land conservation practices into local and county land use policy and development plans. One percent floodplain areas do exist in Redwood County. These flood plain areas are along the Redwood River, Cottonwood River, Minnesota River, and multiple streams and creeks. Compatible development has occurred along the Minnesota River in the City of Redwood Falls. Refer to the subsection under Flooding, Location Affected by the Hazard, on page ## for more information regarding the one percent floodplain.

In southwest Minnesota there have also been a growing number of wind farms, solar farms, ethanol plants, and other biofuel plants. This development trend poses some unique challenges. In regards to roads and bridges, there is an increase of oversized loads, which can wear out the infrastructure faster and pose safety concerns to other motorists.

Firefighting also may be challenging. Specialized equipment is required to reach the top of the turbines, so firefighters have been instructed to sit back and let the wind turbine burn. Firefighters will monitor the fire to make sure the fire does not spread.

⁹⁰ USDA Census 2012. Accessed: 9/8/17. Available:

http://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_2_County_Level/Minnesota/st27_2_001_001.pdf

Ethanol plants and other biofuel plants have the potential to generate large and very hot fires. Plans are in place to address these new developments, but there is not extensive experience in mitigating hazards related to these development trends. Refer to 5.4.1 Wildfires for more information related to wind turbines ethanol plants, and biofuel fires.

A combination of conservation and planning has helped Redwood County maintain safe and efficient development. Redwood County is a rural county, so emergency response is impacted by distance and time and the availability of equipment and resources. Regional efforts help to mitigate the effects of natural and manmade hazards in Redwood County.

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Section 6 – Mitigation Strategy

The goal of mitigation is to protect lives and reduce the future impacts of hazards including property damage, disruption to local and regional economies, the amount of public and private funds spent to assist with recovery, and to build disaster-resistant communities. Mitigation actions and projects should be based on well-constructed risk assessments, provided in Section 5 of this plan. Mitigation should be an ongoing process adapting over time to accommodate a community's needs.

6.1 Community Capability Assessment

The capability assessment identifies current activities used to mitigate hazards. The capability assessment identifies the policies, regulations, procedures, programs, and projects that contribute to the lessening of disaster damages. The assessment also provides an evaluation of these capabilities to determine whether the activities can be improved in order to more effectively reduce the impact of future hazards. The following sections identify existing plans and mitigation capabilities within all of the communities.

6.1.1 National Flood Insurance Program (NFIP)

The NFIP is a federal program created by Congress to mitigate future flood losses nationwide through sound, community-enforced building and zoning ordinances and to provide access to affordable, federally-backed flood insurance protection for property owners. The NFIP is designed to provide an insurance alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by floods. Participation in the NFIP is based on an agreement between local communities and the federal government that states that if a community will adopt and enforce a floodplain management ordinance to reduce future flood risks to new construction in Special Flood Hazard Areas (SFHAs), the federal government will make flood insurance available within the community as a financial protection against flood losses.

There are 5 flood insurance policies in Redwood County.⁹¹ Each policy covers a single building, but all single family home policies include detached garages. Figure #117 below shows which jurisdictions in Redwood County participate in the National Flood Insurance Program (NFIP).

Figure #117
NFIP Participation in Redwood County

Jurisdiction Name	NFIP	Mapped High-Risk Areas
Redwood County	Yes	5/19/2017
Belview	Yes	5/19/2017
Clements	No – determined not to have an A Zone	
Delhi	No – determined not to have an A Zone	
Lamberton	No – determined not to have an A Zone	
Lucan	No – Has an A Zone but chooses not to participate	5/19/2017
Milroy	Sanction Date: 5/19/2014	
Morgan	No – determined not to have an A Zone	
Redwood Falls	Yes	
Revere	No – determined not to have an A Zone	
Sanborn	No – determined not to have an A Zone	
Seaforth	No – determined not to have an A Zone	
Vesta	Yes	5/19/2017
Wabasso	NFIP	Mapped High-Risk Areas
Walnut Grove	Yes	5/19/2017
Wanda	Yes	5/19/2017

Source: FEMA NFIP Community Status Book

There are no repetitive loss properties in the county.

6.1.2 Plans and Ordinances

Redwood County and its incorporated communities have a number of plans and ordinances in place to ensure the safety of residents and the effective operation of communities, including a Zoning Ordinance,

⁹¹ FEMA Region V. Information request. Received: 9/8/17.

Floodplain Ordinance, Wellhead Protection Plan, Local Water Plan, Transportation Plan, Economic Development Plan, and Emergency Operations Plan.

In Section 5.4 of this plan (*Hazard Profiles*) a review of the plans and programs in place was included as related to each of the hazards addressed in the plan.

For a full listing of plans and programs in place in Redwood County, see *Appendix H: Redwood County Plans & Programs in Place*.

6.2 Mitigation Goals

In Section 5.0 of this plan, the risk assessment identified Redwood County as prone to a number of natural and technological hazards. Planning team members understand that although hazards cannot be eliminated altogether, Redwood County can work toward building disaster-resistant communities.

Hazard mitigation is intended to protect our communities by reducing or eliminating long-term risk to people and property before a disaster strikes. Emergency management involves a cycle through which communities prepare, respond, and recover from emergencies and disasters. The planning team formulated goals, objectives, and strategies to mitigate the effects of natural and manmade hazards.

Goals are general guidelines that explain what Redwood County wants to achieve. Objectives narrow the general guidelines and define in more detail what Redwood County wants to achieve. Strategies are the actual steps to be taken to achieve the goals.

A qualitative approach was used by the planning team to judge and prioritize the mitigation strategies based on perceived costs and benefits. The process used to judge and prioritize the mitigation strategies was the STAPLEE Process.

Figure #118
STAPLEE+E Planning Factors

S – Social	Mitigation actions are acceptable to the community if they do not adversely affect a particular segment of the population, do not cause relocation of lower income people, and if they are compatible with the community’s social and cultural values.
T – Technical	Mitigation actions are technically most effective if they provide a long-term reduction of losses and have minimal secondary adverse impacts.
A – Administrative	Mitigation actions are easier to implement if the jurisdiction has the necessary staffing and funding.
P – Political	Mitigation actions can truly be successful if all stakeholders have been offered an opportunity to participate in the planning process and if there is public support for the action.
L – Legal	It is critical that the jurisdiction or implementing agency have the legal authority to implement and enforce a mitigation action.
E – Economic	Budget constraints can significantly deter the implementation of mitigation actions. Hence, it is important to evaluate whether an action is cost-effective, as determined by a cost benefit review, and possible to fund.
E – Environmental	Sustainable mitigation actions that do not have an adverse effect on the environment, comply with federal, state, and local environmental regulations, and are consistent with the community’s environmental goals, have mitigation benefits while being environmentally sound.

Refer to the Planning Process Chapter for more information relating to the STAPLEE Process and the planning process.

It should be noted that not every hazard identified within the risk assessment has a goal outlined below. Goals were combined for certain hazards with similar mitigation measures. For example, severe summer storms and tornadoes both require similar awareness, prevention and structural measures. The main benefit of the actions listed is the improved health, safety and welfare of the community and residents. The highest ranking hazards are listed first, followed by moderate rank hazards and finally low rank hazards. An acronym list of entities listed in the strategies below can be found in Section 6.3.

6.2.1 Hazard Mitigation Actions

Redwood County and its included municipalities share a common All Hazard Mitigation plan and worked closely to develop it. These people work together with their city councils and the Redwood County Emergency Management Director to assure that the hazards and mitigation actions included in this plan are accurate and addressed in their jurisdictions. The jurisdictions responsible for each action are Redwood County and each of the 15 incorporated cities.

Figure #119 lists all mitigation actions for Redwood County and its jurisdictions. Appendix G contains separate mitigation action tables for each jurisdiction. Each of these mitigation action charts detail the hazard, the mitigation action to address it, the priority ranking for implementation (1 = High Priority; 2 = Moderate Priority; 3 = Low Priority), its current stage of implementation, the timeframe for implementation going forward, the jurisdictions who have identified they will work to implement the action, the responsible parties to carry through with implementation, and comments on how the plan will be implemented through existing planning mechanisms and funding to make implementation happen.

In addition to ranking the hazard mitigation actions using STAPLE+E, the planning team also reports on the status of the mitigation action. Completed and deleted mitigation actions are denoted in Appendix F.

Status

Ongoing mitigation actions from the initial review were incorporated into annual reviews by the mitigation team. The status designations for the mitigation action chart are below. The status designations are broken into new and existing.

New Mitigation Strategy

- New – new action added to the AHMP

Existing Mitigation Strategy

- Ongoing – actions require continuing application
- In Progress – actions are currently being acted upon
- Complete – the action is complete
- Deferred – no progress has been made

Timeframe

The timeframe for implementing a mitigation strategy is divided into three categories:

- Short Term – 1 to 5 years
- Long Term – 5 + years
- Continuous

6.2.2 Strategy Implementation & Administration

Prioritization does not mean that all strategies with a priority ranking of five have to be accomplished before strategies with a four and so on can be implemented. The purpose of the prioritization is to show that the planning team talked about possible options and with unlimited resources, this is what they chose to accomplish first. Due to scarce resources, it may be necessary to start with a goal that has less upfront costs and is relatively easier to implement. The goals, objectives, and strategies being outlined in the Redwood County AHMP are recommendations from the planning team, so during implementation modifications can take place.

Redwood County Emergency Management is the primary agency responsible for implementation and administration of this plan. The County will implement mitigation strategies within the next five years, and will seek appropriate funding to do so.

Local jurisdictions with comprehensive plans and land use controls will be strongly encouraged to incorporate applicable goals, objectives, and strategies into their local plans upon their next update. Transmittal of the final plan will include a letter from the County Emergency Manager requesting that each participating jurisdiction 1) adopt this Hazard Mitigation Plan as a primary policy document, and 2) review and incorporate all applicable policies of this document into the community's existing plans by inclusion or by reference.

6.3 Mitigation Strategies Acronym List

Cities

CiB	City of Belview	CiR	City of Revere
CiC	City of Clements	CiSa	City of Sanborn
CiD	City of Delhi	CiSe	City of Seaforth
CiLa	City of Lambertton	CiV	City of Vesta
CiLu	City of Lucan	CiW	City Wabasso
CiMi	City of Milroy	CiWG	City of Walnut Grove
CiMo	City of Morgan	CiWa	City of Wanda
CiRF	City of Redwood Falls		

Townships

Twp	All Townships
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Local Organizations

RCA	Redwood County Administration
RCPW	Redwood County Public Works
RCHwy	Redwood County Highway Department
RRRSWA	Redwood/Renville Regional Solid Waste Authority
EM	Redwood County Emergency Management
RMO	Redwood County Land Management Office
HAZ	HAZMAT Team
SWHHS	Southwest Health and Human Services
SWCD	Soil and Water Conservation District

Other Entities and Organizations

EMS	Medical Response Personnel (EMS)
Fire	Fire Districts
Hosp	Hospitals & Clinics
LAW	Law Enforcement
Sch	Local School districts
PU	Public Utilities
RWS	Rural Water Systems
BWSR	Minnesota Board of Water and Soil Resources
MDA	Minnesota Dept. of Agriculture
MDH	Minnesota Dept. of Health
MnDOT	Minnesota Dept. of Transportation
BAH	Minnesota Board of Animal Health
Ext	University of Minnesota Extension
MPCA	Minnesota Pollution Control Agency
DNR	Department of Natural Resources
DPS	Department of Public Safety
RC	American Red Cross
Rail	Local Railroads
Air	Local Airports (Redwood Falls)
FEMA	U.S. Federal Emergency Management Administration
USDA	U.S. Department of Agriculture

ALL	All jurisdictions and entities
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6.4 Mitigation Strategies

Figure #119: All Mitigation Actions for Redwood County

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
1	Ag Disease – Awareness	Provide information on ag disease and prevention to producers and residents.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, Ext, FSA, MDA, MDH, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd		Low
2	Ag Disease – Prevention	Monitor invasive insect species, such as emerald ash borer.		Revised	Ongoing	Redwood County	RCEM, SWCD, MDA, DNR, Ext, RCEO		Low, \$10,000
3	Severe Storms – Structural	Conduct a study to determine what places in the county and each city are deficient in safe rooms; Construct at least one new safe room or improve warning system in one community each year.		Revised	2019-2023	Redwood County, all Cities	RCEM, RCEO, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd	Currently no safe rooms in Redwood County	Medium, \$45,000
4	Severe Storms – Awareness	Educate local schools, nursing homes, assisted living, hospitals, etc on importance of doing a “Severe Weather Awareness Week” workshop for their staff, including identifying evacuation routes and safe rooms.		Carried Over	Ongoing	Redwood County, Redwood Falls, Morgan, Wabasso, Milroy, Lamberton, Walnut Grove	RCEM, Hosp, Sch, CiRF, CiMo, CiW, CiMi, CiL, CiWG		Low
5	Severe Storms – Awareness	Make nursing home staff aware of the need/importance of providing shelter locations and evacuation routes for residents in case of severe weather.		Carried Over	Ongoing	Redwood County	RCEM		Low

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
6	Severe Storms – Prevention	Ensure manufactured home parks have updated emergency management plans; work with park managers to improve communication during severe storms; ensure residents are familiar with emergency plans, evacuation routes, safe rooms.		Carried Over	2019-2020	Redwood County, Redwood Falls	RCEM, CiRF	This should be included in building codes.	Medium
7	Severe Storms – Prevention	Encourage all residents and public building to have NOAA Public Alert Radios with SAME technology and to sign up for CodeRED alerts, especially in rural areas away from community sirens.		Revised	Ongoing	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiMo, CiRF, CiR, CiSA, CiSe, CiV, CiWb, CiWG, CiWd		Low
8	Severe Storms – Protection	Ensure that critical facilities have access to backup power generators. Examine needs and costs for providing backup power generation where none currently exists.		Revised	2019-2022	Redwood County, Clements, Lamberton, Lucan, Redwood Falls, Seaforth, Wabasso, Walnut Grove	RCEM, CiC, CiLa, CiLu, CiRF, CiSe, CiWb, CiWG Hosp	No backup at Countryview Assisted Living in Walnut Grove	Medium, \$300,000
9	Severe Storms – Protection	Harden utilities, replace overhead w/ underground power lines.		Revised	Ongoing	Redwood County, Redwood Falls	RCEM, RCEO, CiRF, Utilities	City of Lucan is done.	High, Millions
10	Severe Storms – Protection	Use road design and living snow fences to control snow.		Carried Over	Ongoing	Redwood County	RCHwy, SWCD, MnDOT		Medium
11	Severe Storms – Protection	Scope at least one infrastructure retrofit project in one community each year.		Carried Over	Annually	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiCo, MiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Medium, \$10,000

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
12	Drought – Prevention	Work with the MN Department of Health to develop & implement Wellhead Protection Plans and educate the public on the importance of wellhead protection and water conservation.		Revised	Ongoing	Redwood County, Belview, Clements, Redwood Falls, Sanborn	RCEO, SWCD, CiB, CiC, CiRF, CiSa, MDH	City of Clements in currently in progress.	Medium
13	Wildfire – Prevention	Conduct wildfire risk assessments periodically.		Carried Over	Ongoing	Redwood County, Lamberton, Redwood Falls	RCEO, RCSO, CiLa, CiRF, Fire, DNR		Low
14	Wildfire – Awareness	Participate in the “Firewise” education program.		Carried Over	Ongoing	Redwood County	RCEM, Fire		Low
15	Wildfire – Emergency Services	Develop management plans that outline the scheduled maintenance of conservation properties.		Carried Over	Deferred	Redwood County	FSA, DNR, SWCD		Medium
16	Wildfire – Emergency Services	Encourage development of evacuation plans, which clearly delineate routes residents should take in the event of a large-scale wildfire.		Carried Over	Deferred	Redwood County	RCEM, RCEO, RCSO, RCHwy, Twp, DNR		Medium
17	Wildfire – Protection	Encourage township road authorities to cut back road ditches and bale where appropriate, which will limit potential for the spreading of wildfire.		Carried Over	Ongoing	Redwood County	RCHwy, Twp		Low
18	Wildfire – Awareness	Develop a program to educate property owners on the need for firebreaks before they enroll land in CRP or CREP.		Carried Over	Ongoing	Redwood County	RCEM, SWCD, DNR, FSA, Ext		Low, \$10,000

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
19	Hazardous Materials – Awareness	Continue awareness of the county household hazardous waste facility, its importance, and how to utilize services.		Revised	Ongoing	Redwood County	RRRSWA		Low
20	Hazardous Materials – Prevention	Develop Geographic Information Systems capability to map locations of fixed facilities using hazardous materials and associated transportation corridors.		Revised	Deferred	Redwood County, Redwood Falls	RCEM, RCEO, RRRSWA, CiRF, MDA, MDH, MPCA		Low, \$20,000
21	Hazardous Materials – Prevention	Review the water plan for potential groundwater contaminants within the county.		Revised	Deferred	Redwood County	RCEO, SWCD	Watershed-based plans cross more than one county and are about 2-3 years out.	Low, \$10,000
22	Hazardous Materials – Prevention	County, townships, and cities with airports/flightpath review airport improvement plans and zoning.		Carried Over	2019-2020	Redwood County, Redwood Falls	RCEO, CiRF, Twp, MnDOT		Medium, \$30,000
23	Civil Disturbance – Emergency Services	Complete and maintain thorough community risk and threat assessments.		Carried Over	Ongoing	Redwood County	RCSO, LE, RCEM		Low
24	Civil Disturbance – Prevention	Consider zoning code changes and updates that reflect building measures to withstand terrorist attack.		Carried Over	Deferred	Redwood County, Redwood Falls	RCEO, CiRF, Sch		Low
25	Civil Disturbance – Prevention	Increase security at critical facilities, add fencing, alarm systems, and surveillance cameras as appropriate.		Carried Over	Ongoing	Redwood County	RCSO, LE, RCEM	Surveillance exists on public buildings in Redwood Falls.	High, \$300,000

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
26	Civil Disturbance – Prevention	Limit public access in high profile critical facilities in times of increased potential for terrorist activity. These times could follow the federal government (Dept. of Homeland Security) warning system.		Revised	Ongoing	Redwood County	RCEM, RCSO, FSA, LE		Medium, \$20,000
27	Structure Fires – Prevention	Ensure that snow removal ordinances are followed and encourage building construction to include fire/smoke alarms and sprinkler systems.		Carried Over	Ongoing	Redwood County	RCEM, RCEO, RCSO, Fire	This is in Redwood Falls' building code.	Low
28	Structure Fires – Awareness	Work with community fire chiefs to educate and encourage residents on the need for having fire alarms and chimney inspections.		Carried Over	Ongoing	Redwood County	RCEM, Fire		Low
29	Public Health – Awareness	Improve coordination and communication with local media.		Carried Over	Ongoing	Redwood County	RCEM, SWHHS		Low
30	Public Health – Emergency Services	Work with Public Health Service and MDH on the mass distribution of needed medicines and supplies for public health emergencies.		Carried Over	Ongoing	Redwood County	RCEM, SWHHS		Low
31	Public Health – Emergency Services	Update Redwood County Emergency Operations Plan Public Health annex.		Revised	2019	Redwood County	RCEM, SWHHS		Medium, \$35,000

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
32	Flooding/Dam Failure – Emergency Services	Work with communities to develop their own EOP.		Revised	Ongoing	Redwood County, Redwood Falls	RCEM, RCHwy, SWCD, CiRF	Redwood Falls is developing their and will release a draft template that other cities can use.	Medium, \$75,000
33	Flooding/Dam Failure – Prevention	Discourage future development within floodplains; consider minor localized flood reduction projects, especially to reduce overland flooding.		Revised	Ongoing	Redwood County, all Cities	ALL	In the floodplain ordinance.	Low
34	Flooding/Dam Failure – Protection	Encourage sound construction practices and agricultural Best Management Practices (BMPs) in flood fringe areas.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, BWSE, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd, Twp		Low
35	Flooding/Dam Failure – Prevention	Implement dFIRM floodplain maps.		Carried Over	Ongoing	Redwood County, Redwood Falls, Sanborn, Seaforth	RCEO, CiRF, CiSa, CiSe, DNR, FEMA	Redwood Falls and Seaforth are in the process.	Medium
36	Flooding/Dam Failure – Prevention	Jurisdictions not currently participating in the National Flood Insurance Program (NFIP) will review their flood hazard areas and consider participation.		Carried Over	2019-2020	Delhi, Revere, Vesta, Walnut Grove, Wanda	DNR, CiD, CiR, CiV, CiWG, CiWd		Medium
37	Flooding/Dam Failure – Prevention	Encourage all property owners in flood hazard areas to purchase flood insurance.		Carried Over	Ongoing	Redwood County, Redwood Falls, Sanborn, Seaforth, Wanda	RCEO, CiRF, CiSa, CiSe, CiWd		Low

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
38	Flooding/Dam Failure – Protection	Develop a program to voluntarily acquire, relocate, or elevate at-risk structures in floodplains.		Carried Over	2019-2021	Redwood County, Redwood Falls, Sanborn	RCEM, RCEO, CiRF, CiSa, DNR, HSEM		Medium, \$50,000
39	Flooding/Dam Failure – Protection	Retrofit infrastructure to reduce impacts of flooding; stabilize/replace at-risk bridges and slopes prone to sloughing.		Revised	Ongoing	Redwood County, Belview, Redwood Falls, Sanborn, Seaforth	RCHwy, RCEO, CiB, CiRF, CiSa, CiSe		High, \$5,000,000
40	Flooding/Dam Failure – Protection	Reinforce natural spillways and grade existing spillways.		New	2019-2024	Redwood County	RCEO, RCEM, SWCD	Specific need foreseen in Underwood and Johnsonville Townships	High, \$1,000,000
41	Flooding/Dam Failure – Prevention	Encourage sump pump ordinances and strengthen existing ordinances with inspection.		New	Ongoing	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd		Low
42	Flooding/Dam Failure – Structural	Harden water retention areas. Raise existing water retention ponds and create new ones where appropriate.		New	2019-2024	Redwood County, Belview, Clements, Vesta	RCEO, RCEM, SWCD, CiB, CiC, CiV		High, \$10 million
43	Landslide/Subsidence – Prevention	Inventory potential sinkhole hazards from sources such as failed tile lines, septic systems, and cisterns.		New	2019-2024	Redwood County, Vesta	RCEO, RCEM, Twp, CiV	Failed tile lines in Vesta pose a risk for sinkholes.	Low
44	Utility Failure – Structural	Implement water retention on underground tile liens to relieve pressure on the drainage system.		New	2019-2024	Redwood County	RCEO, RCEM, SWCD, Twp		High, \$5,000,000

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
45	Utility Failure – Prevention	Review elevation of ground facilities to see if they need hardening or raising.		New	2019-2024	Redwood County	RCEO, RCEM, Utility		Low
46	Utility Failure – Structural/ Protection	Retrofit, flood-proof, and/or harden sanitary sewer lines to prevent infiltration.		New	2019-2024	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, Utility, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd,		High, \$100,000
47	Utility Failure – Protection	Harden HAM radio networks in the event of a communications utility failure.		New	2019-2024	Redwood County	RCEM		Low, \$15,000
48	Water Supply Contamination – Awareness	Notify those at high-risk for water contamination.		New	2019-2024	Redwood County	RCEM, RCEO, SWCD, Twp	Specific concerns in the Townships of Swede Forest, Kintire, and Lamberton due to soil types.	Low
49	Transportation Infrastructure – Prevention	Work with the local Toward Zero Deaths coalition to identify areas where transportation infrastructure can be improved to lower fatal crash rates.		New	2019-2024	Redwood County	RCEM, RCHwy		Low

6.4.1 Mitigation Actions by Community

Action items for Participating Jurisdictions

Redwood County is a rural county with one full-time paid staff in the area of emergency management. Jurisdictions in Redwood County rely on Redwood County Emergency Management for services regarding emergency management and hazard mitigation. Redwood County Emergency Management maintains regular communication with all local units of government in the county to facilitate intergovernmental cooperation.

Combining strategies between jurisdictions is due to the rural nature of the county, and that a number of jurisdictions are similar in regards to the natural or manmade hazard the strategy is trying to mitigate. A number of strategies in the Redwood County AHMP have “All Cities” listed as who will be working to implement the strategy. Some strategies specifically outline a specific city or multiple specific cities to work together on implementing the strategy. The listed entities under each strategy have had the opportunity to provide input and recommendations in regards to the strategy and will work together to implement the strategy.

Implementation by Local Jurisdictions

Each local jurisdiction will implement and integrate the strategies identified in the hazard mitigation plan as they update their own comprehensive plans, zoning ordinances, and other plans that the community may from time to time need to update. When “All Cities” are identified within the strategies, it means that all jurisdictions mentioned in a strategy will take the strategy into consideration when updating planning processes and undergoing construction or development projects. For example, planning for new construction at the Redwood County Government Center in recent years took into consideration those strategies such as redundant power supplies when planning and constructing the new addition. In many of the smaller jurisdictions these strategies will be implemented as changes are made, but changes in the smaller jurisdictions do not occur as frequently as in the larger jurisdictions.

Mitigation actions by jurisdiction for the above cities are separated out in Appendix G.

Section 7 – Plan Maintenance

7.1 Monitoring, Evaluation, and Updating the Plan

The Redwood County All Hazard Mitigation Plan (AHMP) should be considered a living document. The plan should be reviewed at a minimum of every 5 years. The guidance in this section will function as the primary tool when reviewing progress on the implementation of the Redwood County AHMP.

Plan Monitoring

It is the intent of the plan to serve as a guide for mitigating current and future hazards. Redwood County Emergency Management Department maintains regular contact with all jurisdictions in Redwood County. This will allow the Redwood County Emergency Management Director and Department to monitor and implement strategies outlined in the AHMP. The Redwood County Emergency Management Director will evaluate the goals that have been implemented by Redwood County and jurisdictions within the county. The Redwood County Emergency Management Director will also evaluate the Redwood County AHMP on the number of strategies that have been implemented and the number of goals that were reached.

Public participation is critical in implementing strategies outlined in the plan. Local residents and representatives have a thorough understanding of local issues. Local residents and representatives can assist in gathering support and technical information to help ensure the project is successful. Maintaining regular contact with the jurisdictions in Redwood County will help to ensure that the Redwood County Emergency Management Director and Department are able to effectively implement the strategies outlined in the plan.

Evaluating the Plan

It is recommended that the County Emergency Management Director review and formally evaluate the plan within eighteen months of adoption, as well as after every disaster event, to adequately prepare for the plan update. When implementing strategies from the existing plan it is important to consider improvements that can be made to the planning process, implementation, and evaluation of the plan. AHMP are evolving documents that need to stay up to date. Information gathering and evaluation should be taking place throughout the five year cycle of updating the plan. This will help to insure existing risk assessments are accurate and that mitigation efforts are effective.

Updating the Plan

FEMA requires that plans be reviewed, updated and re-approved every five years or sooner. The planning process timeline for reviewing, updating, and approving an AHMP at Minnesota Homeland Security and Emergency Management (HSEM) and Federal Emergency Management Agency (FEMA) is around 15 months. Within three years of adoption, the Emergency Management Director will formulate a work plan and seek input from Redwood County AHMP Planning Team members, local units of government, and local residents to start the process to update the Redwood County AHMP. The Emergency Management Director will also extend an invitation to non-participating jurisdictions to join the planning process for the update.

7.2 Implementation

Redwood County and its included municipalities share a common AI Hazard Mitigation Plan and work together closely to develop, revise, and implement it. This AHMP provides a comprehensive chart of mitigation actions for Redwood County and its jurisdictions (*Section 6.4*). Jurisdictions participated in the AHMP planning process and identified the specific mitigation strategies that they would seek to implement in their communities during the 5-year planning cycle. These mitigation actions are also provided in Appendix G: *Mitigation Actions by Jurisdiction*.

A number of implementation tools are available to address hazards. Many of these tools are below, however, in some cases additional discussion is needed in order to identify what strategies are most appropriate to use. This will be part of an ongoing discussion as Redwood County looks for opportunities for plan implementation. The following tools should be considered:

Education: In many cases education of residents has been identified as one of the most effective mitigation strategies.

Capital Investments: Capital investments such as fire and ambulance equipment, sprinkler systems and dry hydrants are tools that can limit risks and impacts of natural and other hazards.

Data Collection and Needs Assessments: Data collection and needs assessments can aid in gaining a better understanding of threats and allow planning for mitigation strategies accordingly. As resources are limited for this part of the planning process, additional data collection is likely to be an ongoing activity as resources become available.

Coordination: Responsibilities for mitigation strategies run across various county departments, local fire and ambulance departments, city and township governments, and a host of state and federal agencies. Ongoing coordination is an important tool to ensure resources are used efficiently. Coordination can also avoid duplication of efforts or prevent gaps that are created because of unclear roles and responsibilities. The mitigation plan review process can function as a tool to have an ongoing discussion of roles, responsibilities, and opportunities for coordination.

Regional Cooperation: Counties and public safety services providers throughout the Northeastern Region of Minnesota often share similar challenges and concerns. In some cases a regional approach may be warranted as a mitigation strategy in order to save resources. Mutual aid agreements are a tool already in use for a number of services. Needs assessments for fire and ambulance services and development of assistance for volunteer recruiting, training, and retention could benefit from a regional approach. Cooperation among counties could also help in lobbying for certain funding priorities that address concerns relating to challenges in service delivery in rural areas. Organizations such as FEMA Region V and the MN Department of HSEM through the Regional Program Coordinator can offer tools and resources to assist in these cooperative efforts.

Regulation: Regulation is an important mitigation tool for Redwood County. Regulation plays a particularly important role for land use, access to structures and the protection of water resources and public health.

7.3 Continued Public Involvement

Continued public involvement is critical to the successful implementation of the All Hazard Mitigation Plan (AHMP). The County and its participating jurisdictions should continue to engage new public stakeholders in planning discussions and project implementation during the 5-year cycle of this plan.

Redwood County maintains a website that includes a page for Emergency Management. The SRDC also maintains a website that includes a page for hazard mitigation. Both of these websites will be the main point of access for the public regarding information about the Redwood County AHMP. A PDF copy of the approved plan will be available on these pages along with other information related to the update and hazard mitigation. The public will have access to the plan and be able to provide input regarding progress on the mitigation strategies.

<https://redwoodcounty-mn.us/>

<http://www.swrdc.org/planning/hazard-mitigation/>

Other Opportunities for Involvement

Hazard mitigation has been a regional effort in Southwest Minnesota with services overlapping between counties. All Hazard Mitigation Plan (AHMP) development starts with reviewing the counties existing mitigation plan and comparing the plan with the neighboring counties. There are many opportunities during the development of a plan for involvement provided from neighboring communities, agencies involved in hazard mitigation, businesses, academia, and other relevant private and non-profit interests. SRDC has helped to develop mitigation plans for the following counties in southwest Minnesota:

- Cottonwood County
- Jackson County
- Lincoln County
- Lyon County
- Murray County
- Nobles County
- Pipestone County
- Redwood County
- Rock County

During the 5-year period before the plan is updated, planning team members will be responsible to keep their city councils, city departments, schools, and community members updated and engaged in the implementation of their respective mitigation action charts (see *Appendix G: Mitigation Actions by Jurisdiction*). Each respective jurisdiction will report their progress in this area to the Redwood County Emergency Management Director. Jurisdictions will use numerous means of public outreach to engage new public stakeholders in providing input on mitigation efforts or concerns on hazards by sharing information at city council meetings, sharing information at special events, working with local schools and partner organizations, and posting information on relevant local or social media that their communities use to inform and engage the public. As local mitigation projects are implemented, jurisdictions will work to keep the public updated and engaged in those local efforts.

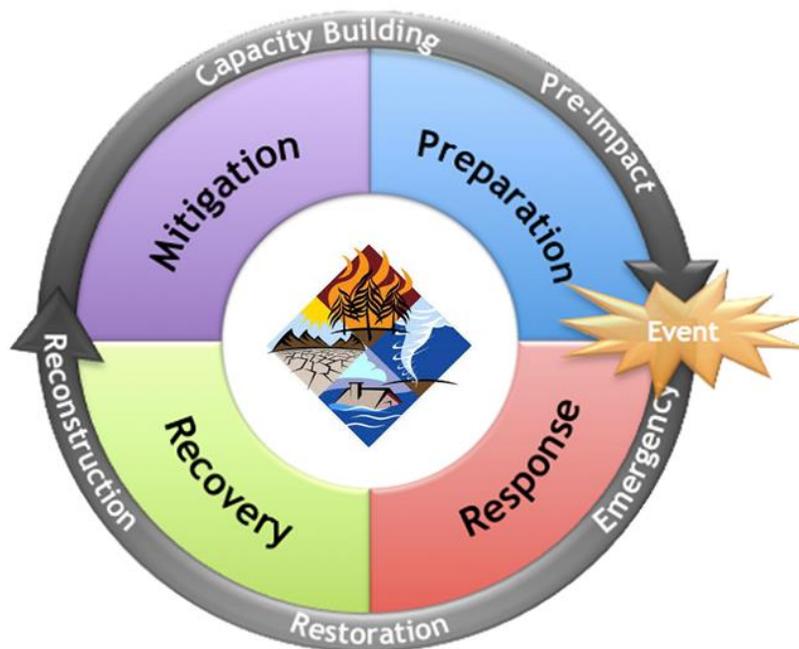
Conclusion

Hazards can occur with little or no warning. The relatively unpredictable nature of some hazards makes mitigating the effects of an event more difficult, but history and probability says that natural and manmade hazards are going to occur. Since hazardous events are going to take place, hazard mitigation is here to minimize the damages to property and loss of life.

When planning mitigation projects and investing in the future, it is critical to consider all the costs, not just the construction costs. There are costs associated with the potential loss of life, public and private property damages, interruption to the economy, decreased connectivity, health outcomes, and loss of community. Decision makers need to consider health and include health related outcomes in the benefits and costs of a project.

Health benefits of a project could be related to increasing livability, connectivity, and creating an environment where people want to live. When people are there, people invest and create demand. Hazard mitigation can be the link between livability, economic vitality, and public safety.

Figure #120
Disaster Management Cycle



APPENDICES

REDWOOD COUNTY ALL HAZARD MITIGATION PLAN, 2019

Appendix A – Redwood County Maps

Appendix B – Redwood County Hazard Events

Appendix C – Resolutions after FEMA Review

Appendix D – Planning Team Meetings

Appendix E – Public Meeting Notices and Meeting Notes

Appendix F – Completed and Deleted Actions from the 2008 Plan

Appendix G – Mitigation Actions by Jurisdiction

Appendix H – Redwood County Plans & Programs in Place

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Appendix A - Redwood County Maps & Hazus Analysis

Figure A-1: Public Facilities Map – Redwood Falls

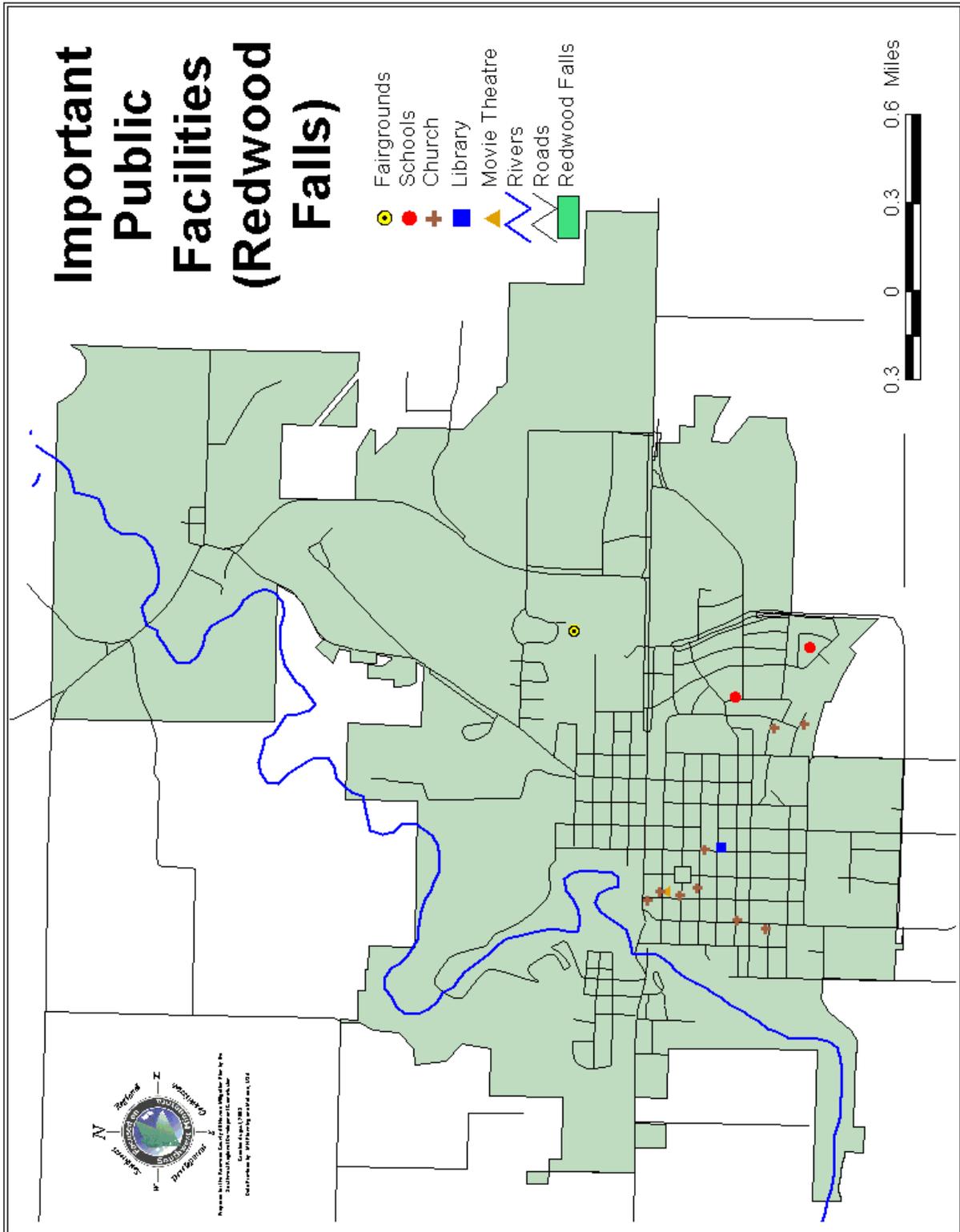


Figure #6
Steep Slopes – Redwood County



Figure #7
Shoreland, Lakes & Streams – Redwood County

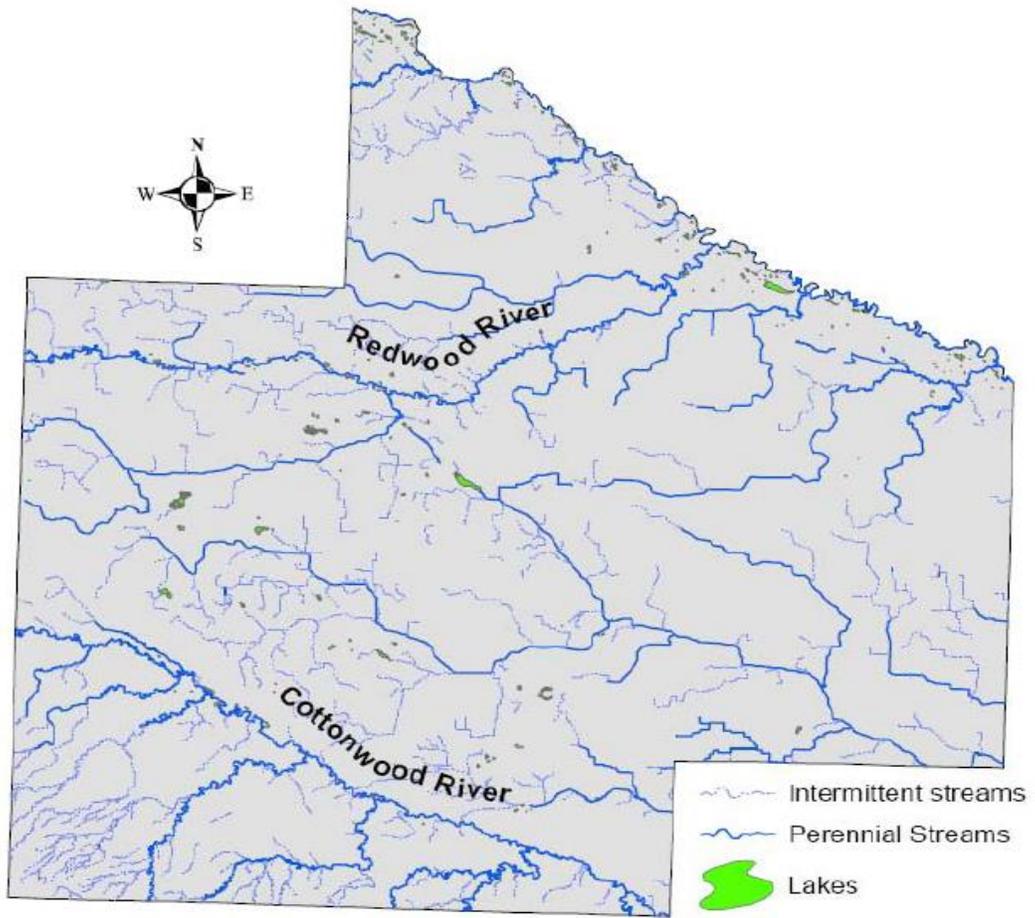


Figure #8
Watersheds Map - Redwood County

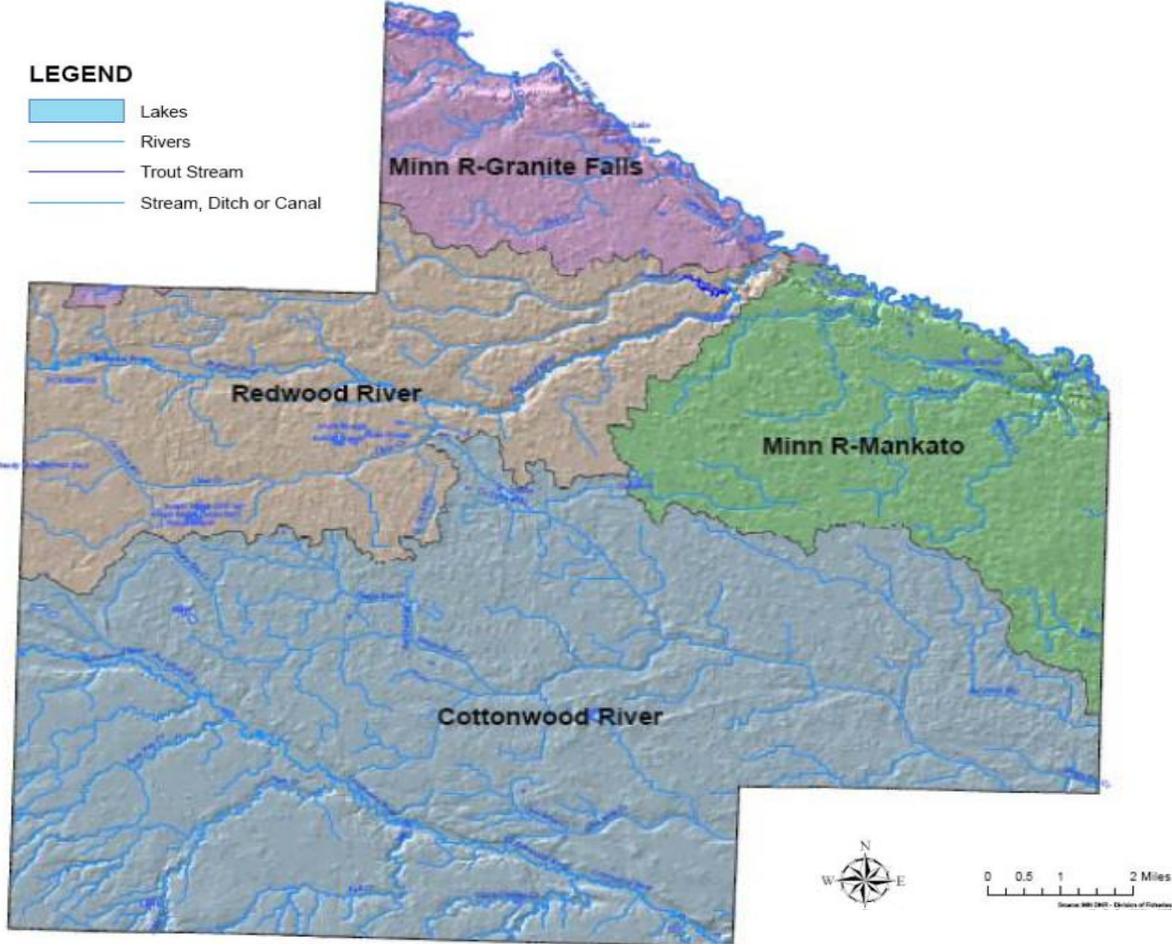


Figure #9
Sedimentation Areas – Redwood County

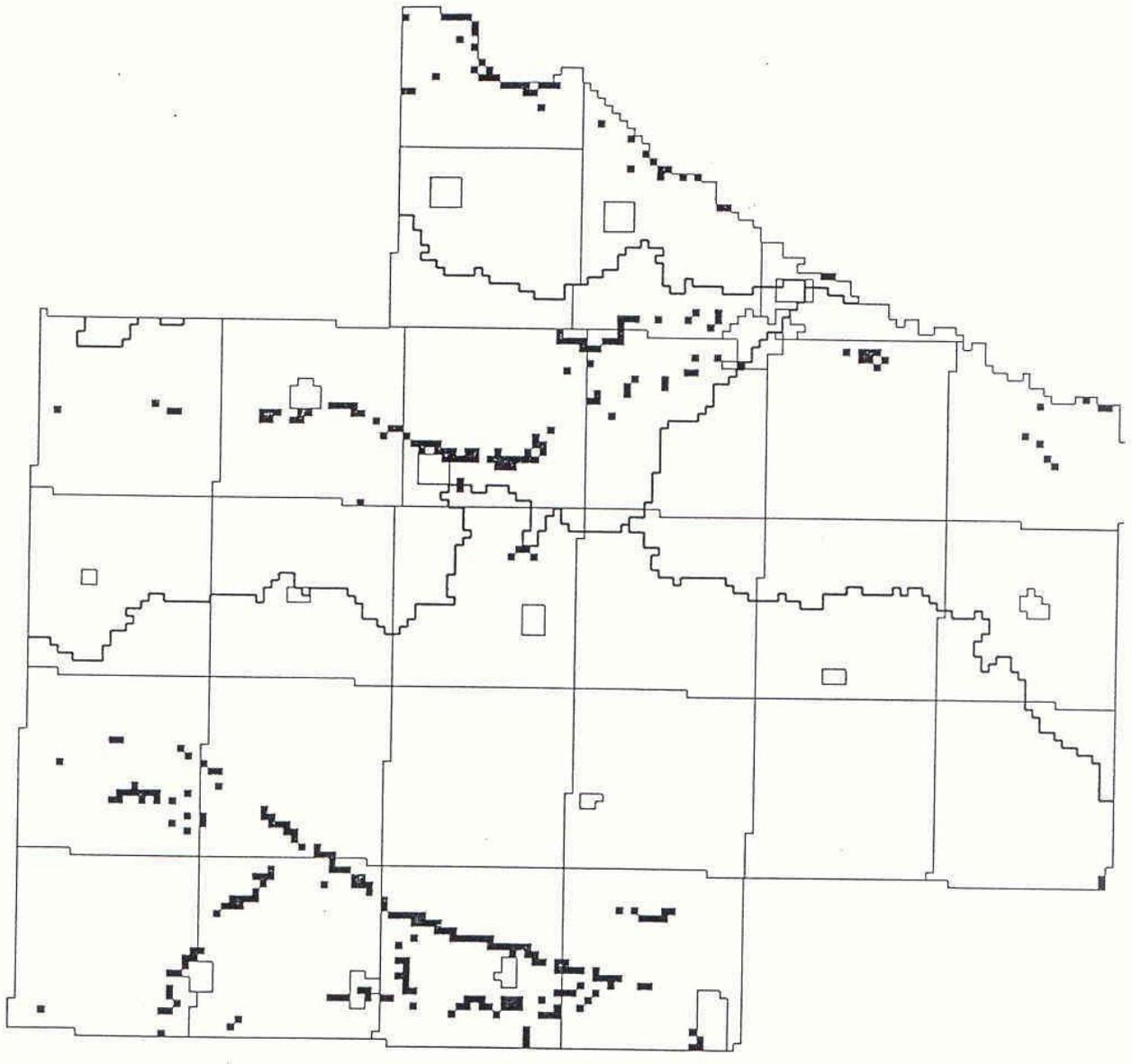


Figure #10
Hydrologic Alterations Redwood County

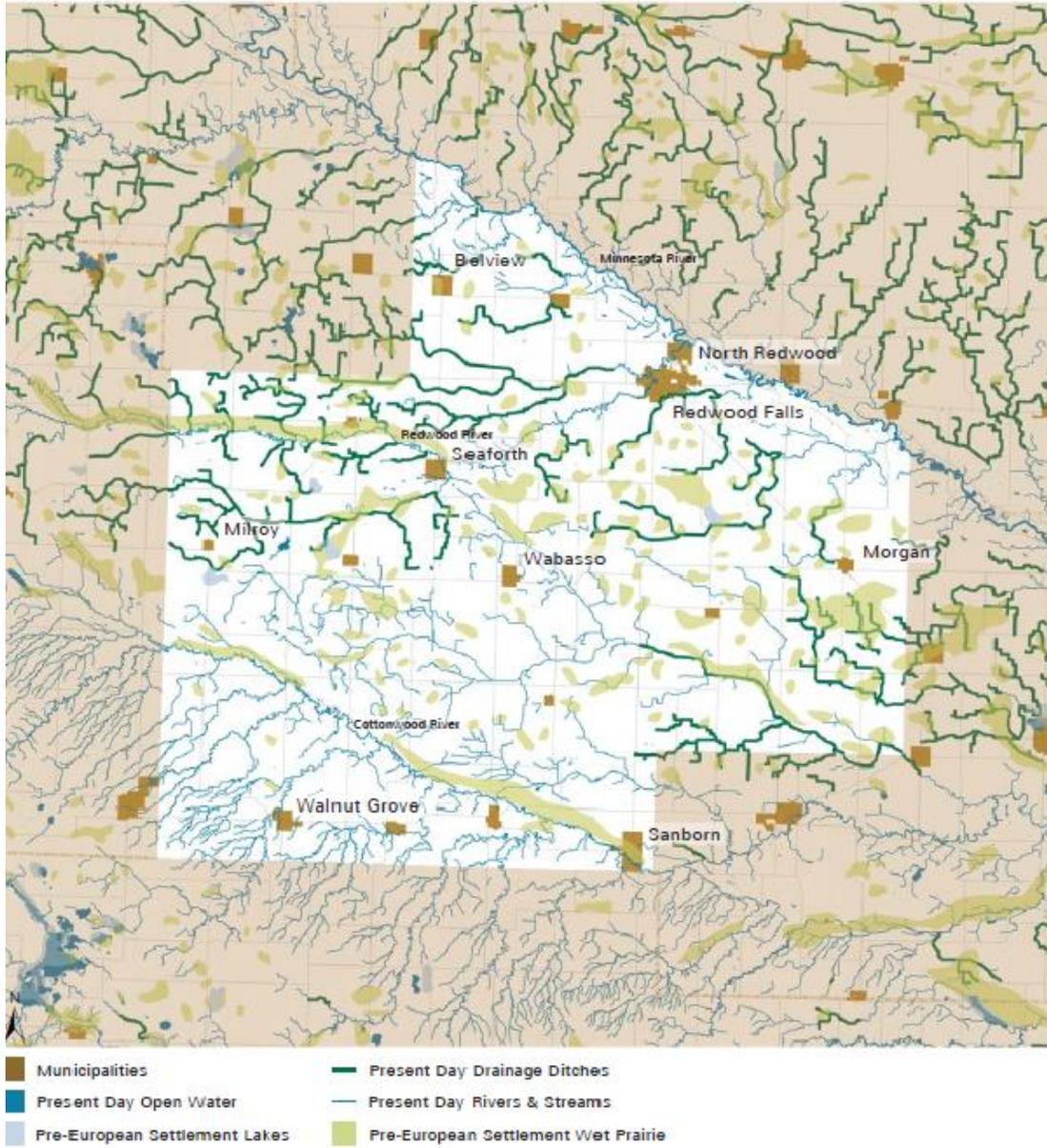


Figure #11
Surficial Geology Permeability – Redwood County

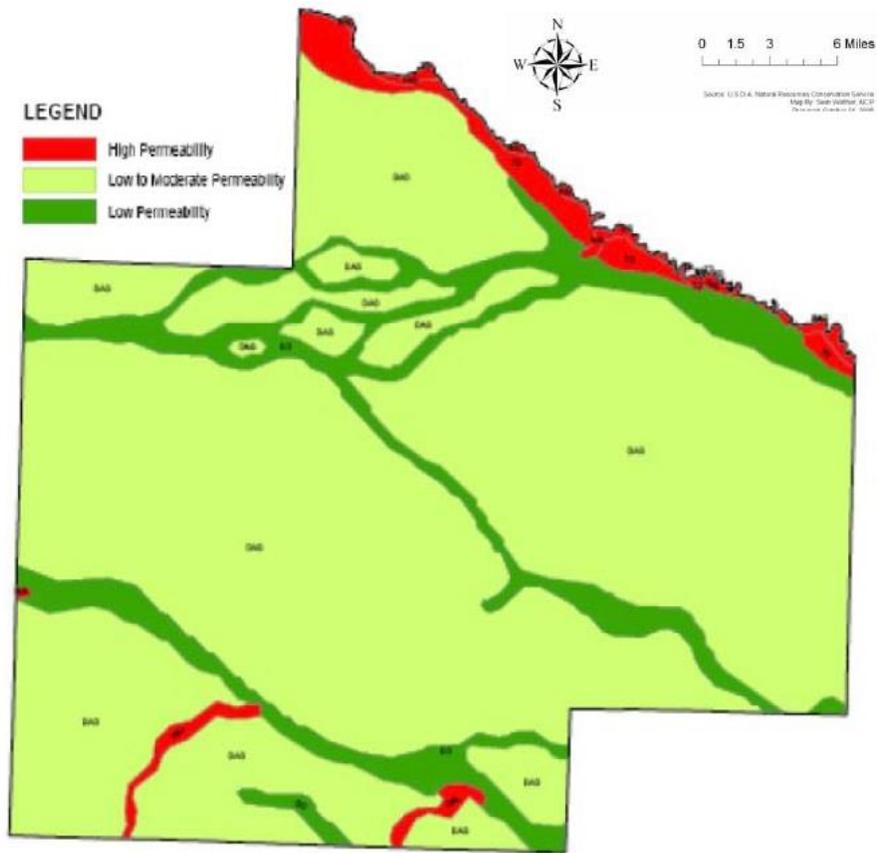


Figure #12
Depth to Bedrock – Redwood County

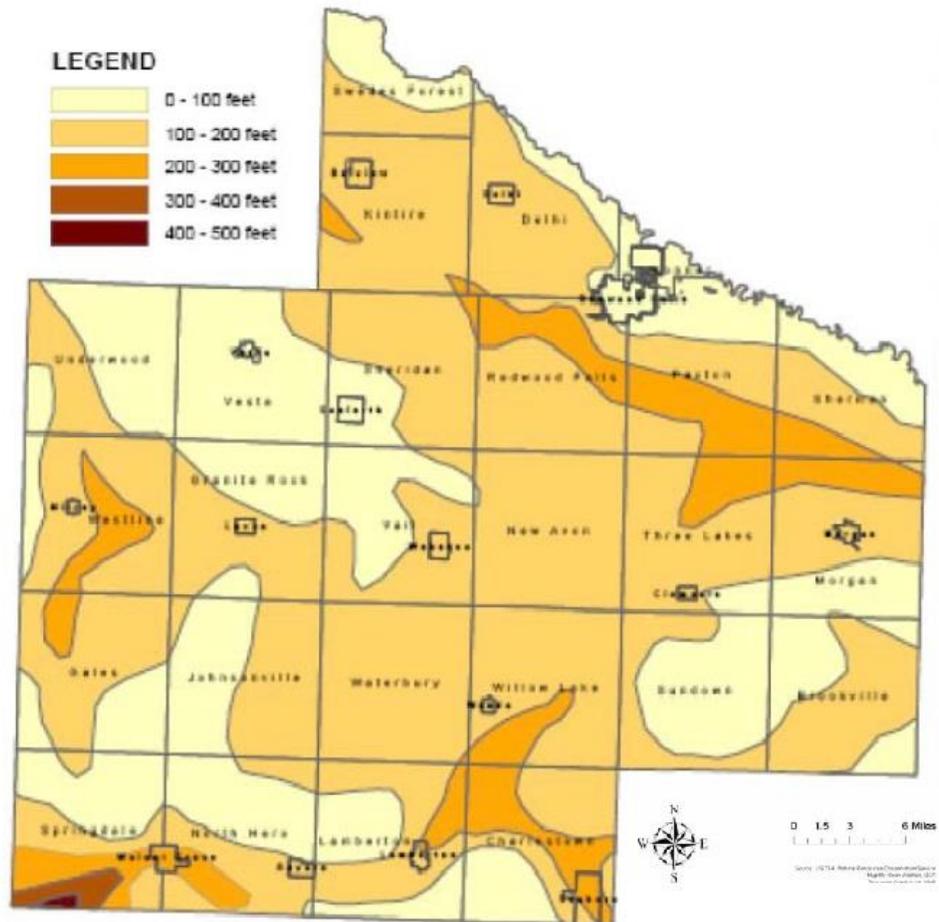


Figure #13
General Soils Map – Redwood County

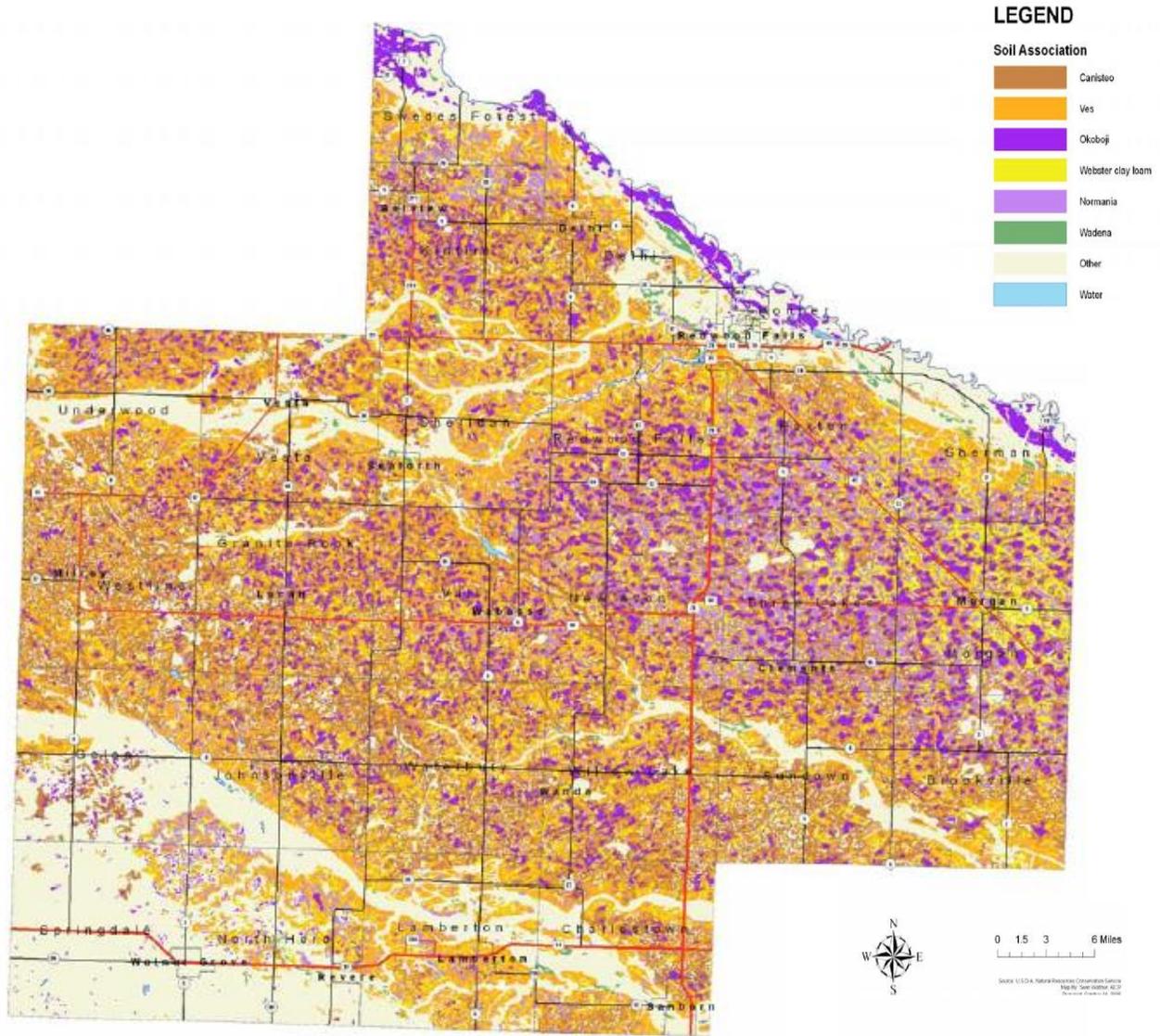


Figure #14
Landscape and Land Use Zones and Conservation Land Areas – Redwood County

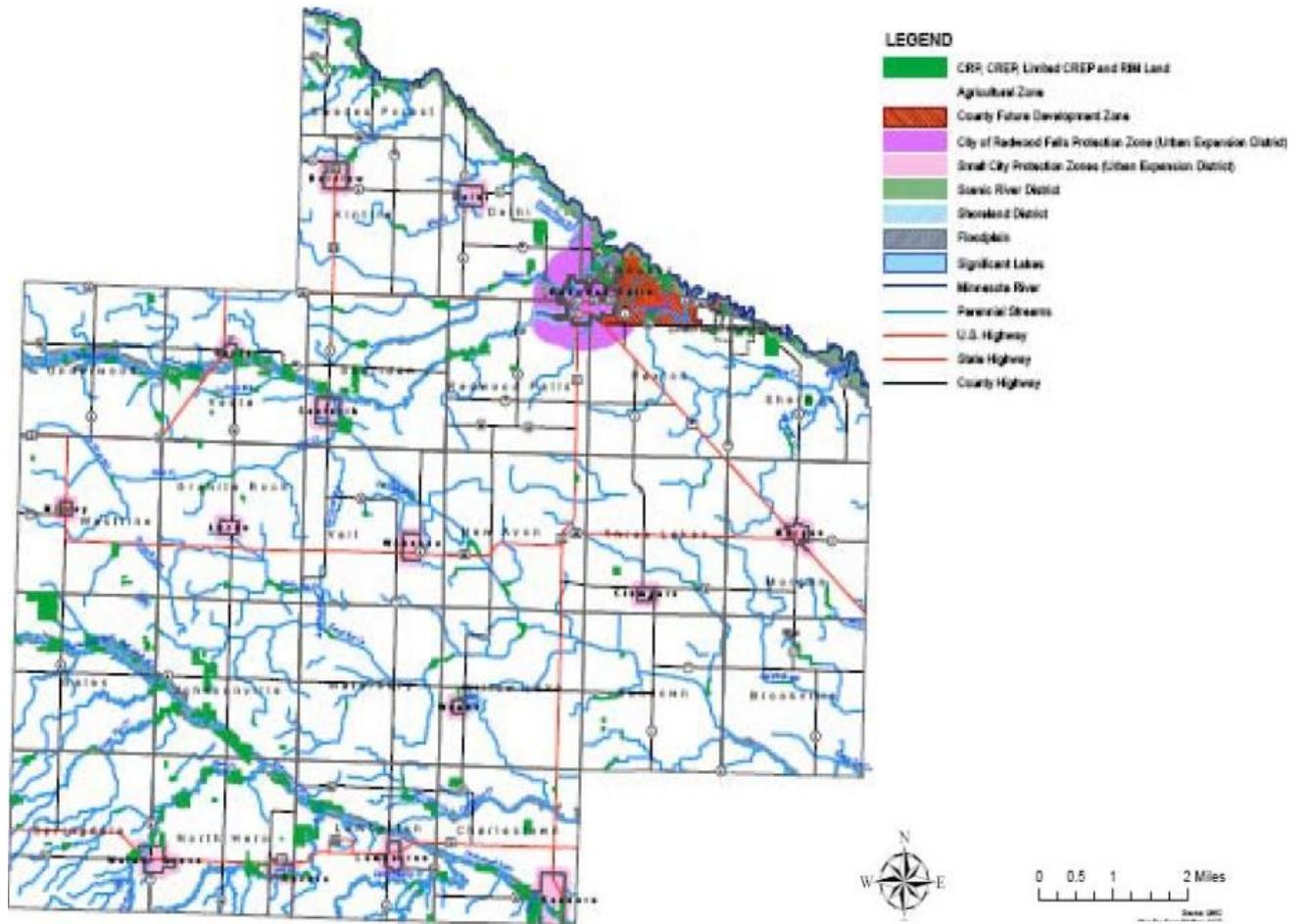


Figure #43
Emergency Facilities Redwood County

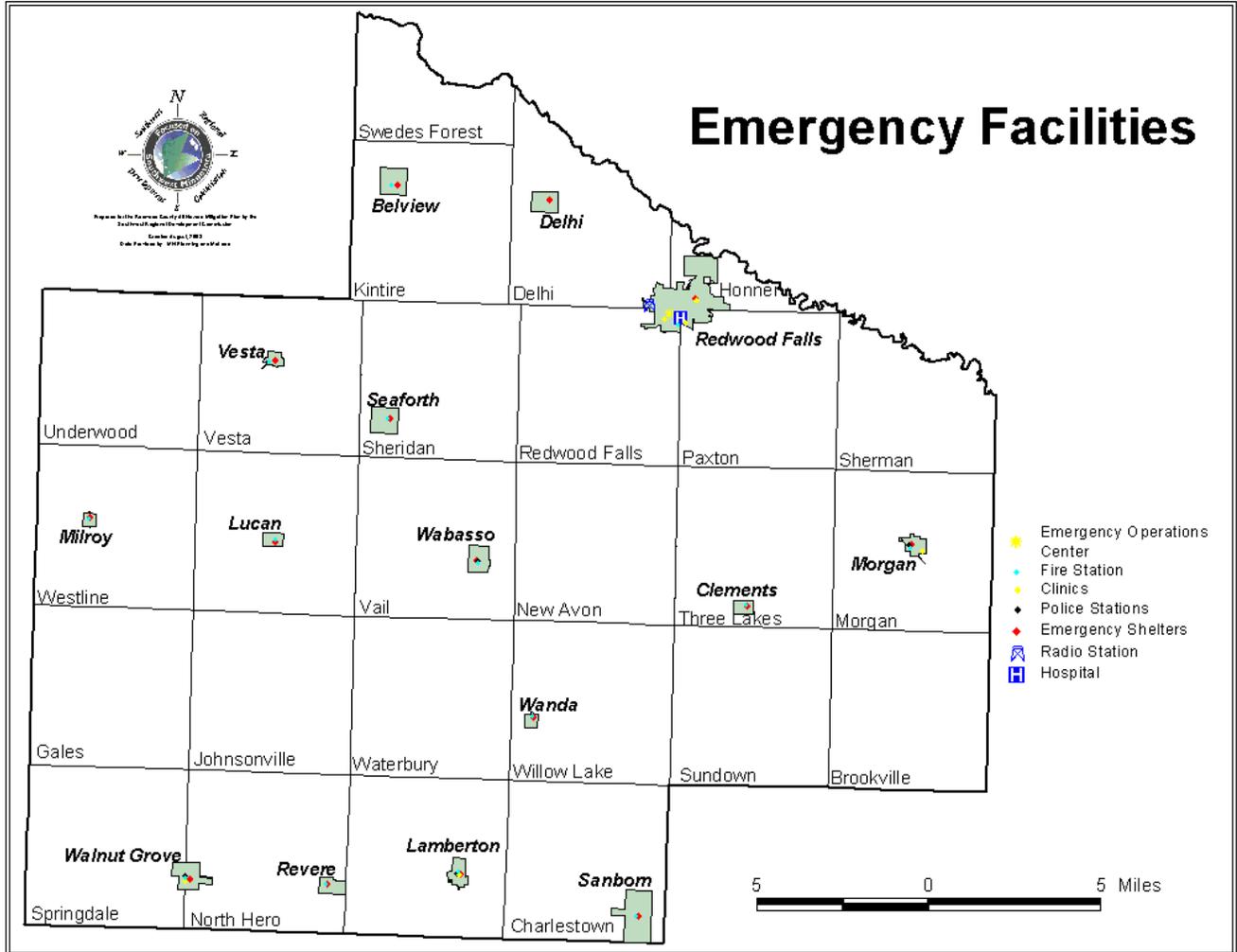


Figure #44
Ambulance Districts in Redwood County

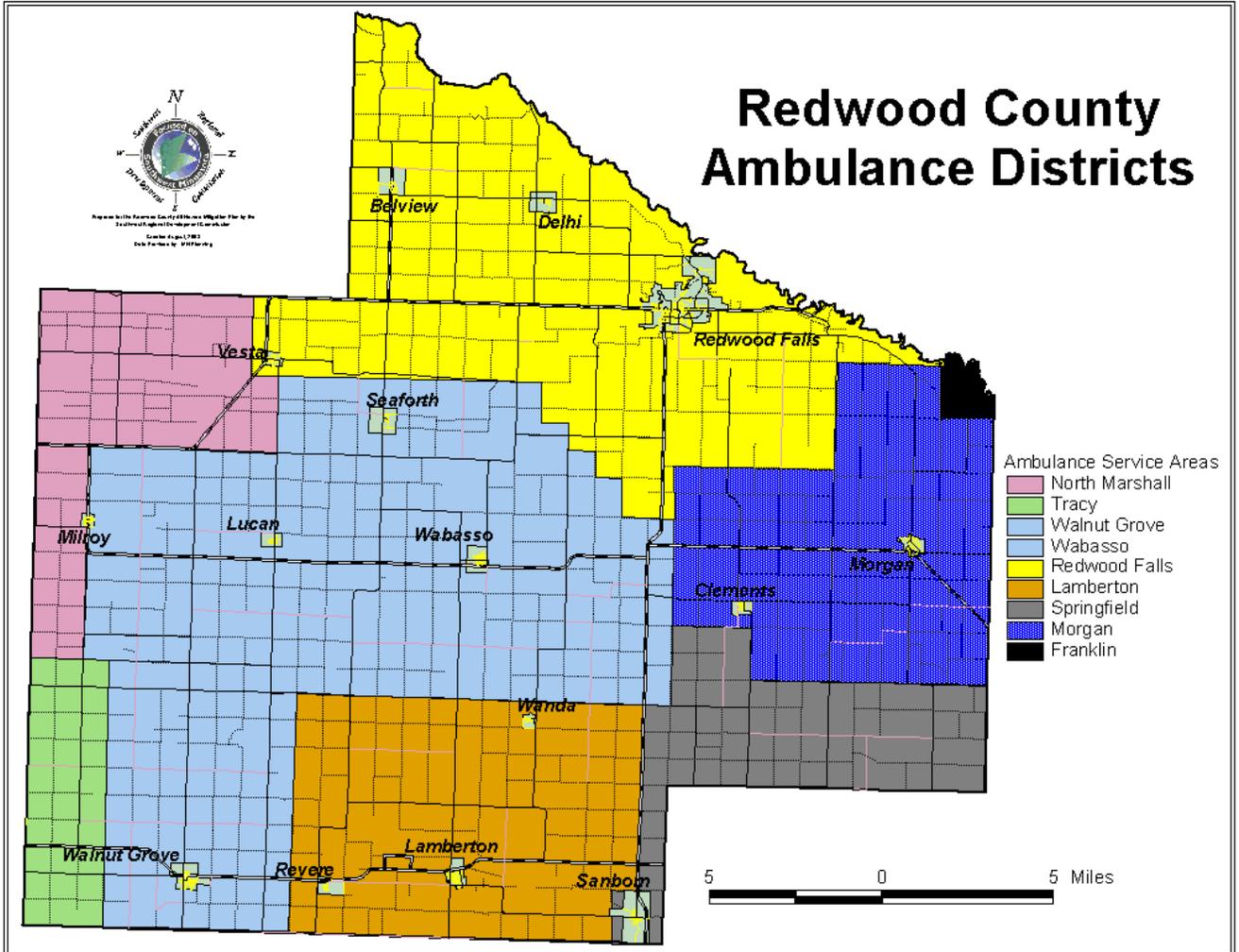


Figure #45
Fire Districts in Redwood County

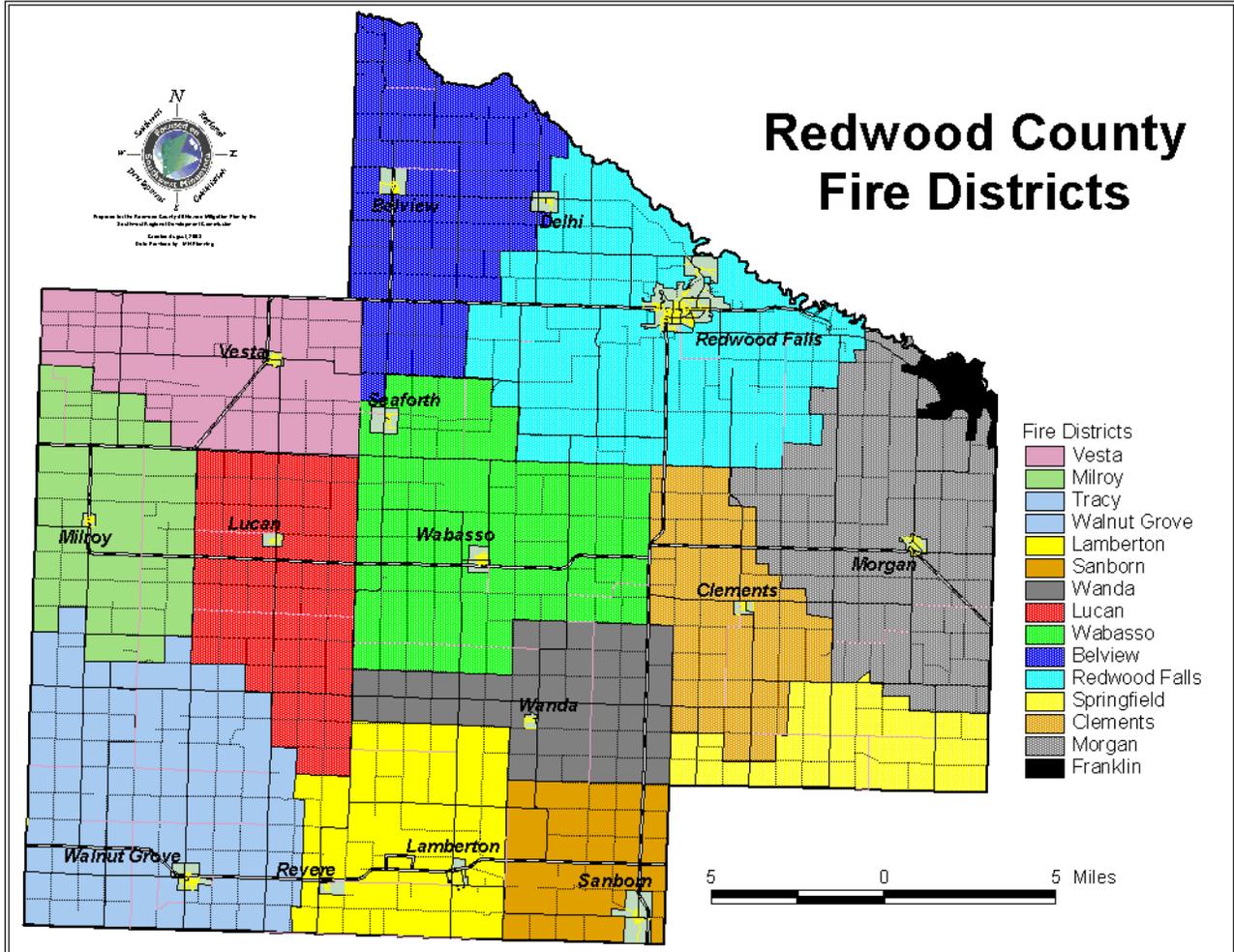


Figure #46
 School Districts in Redwood County

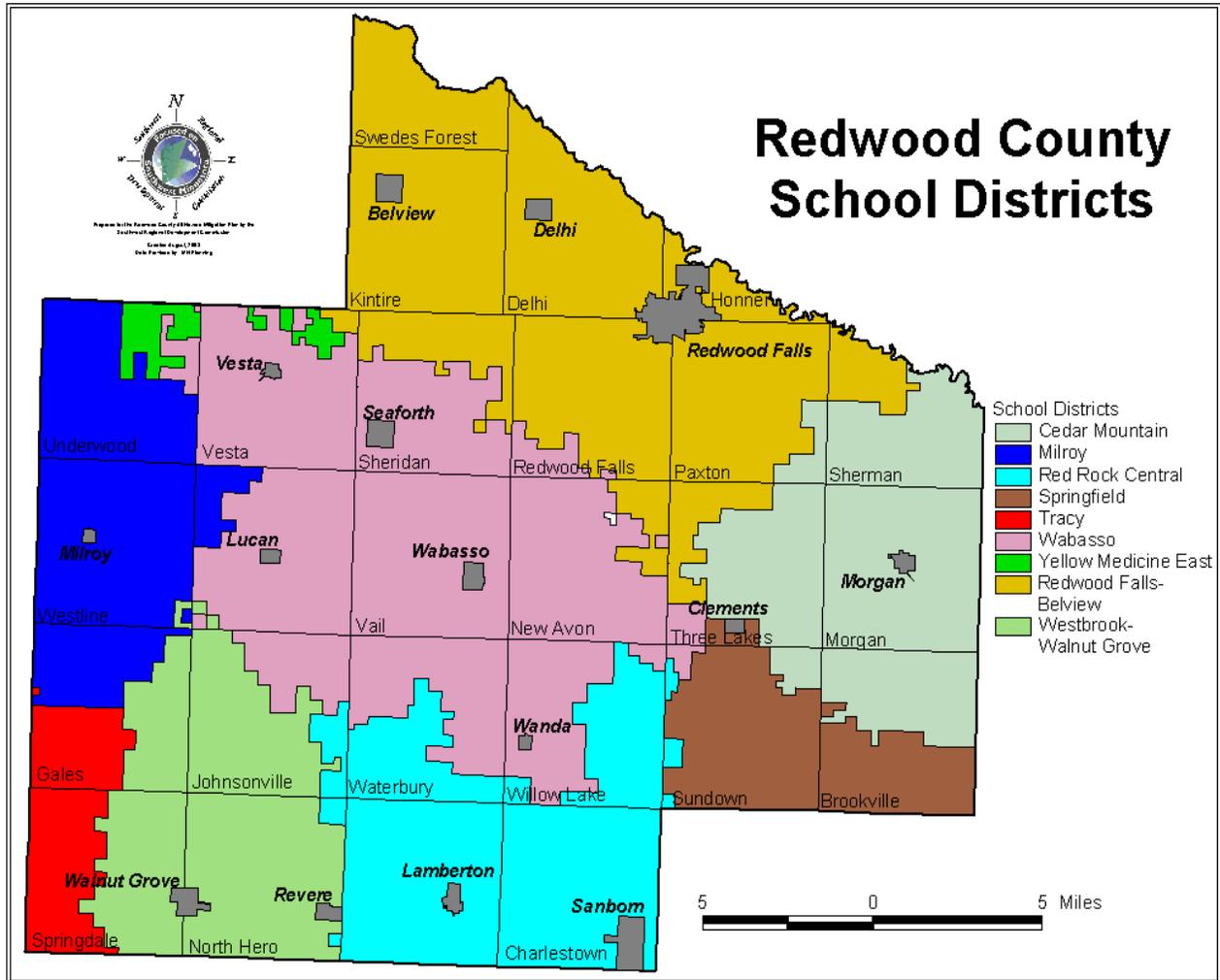
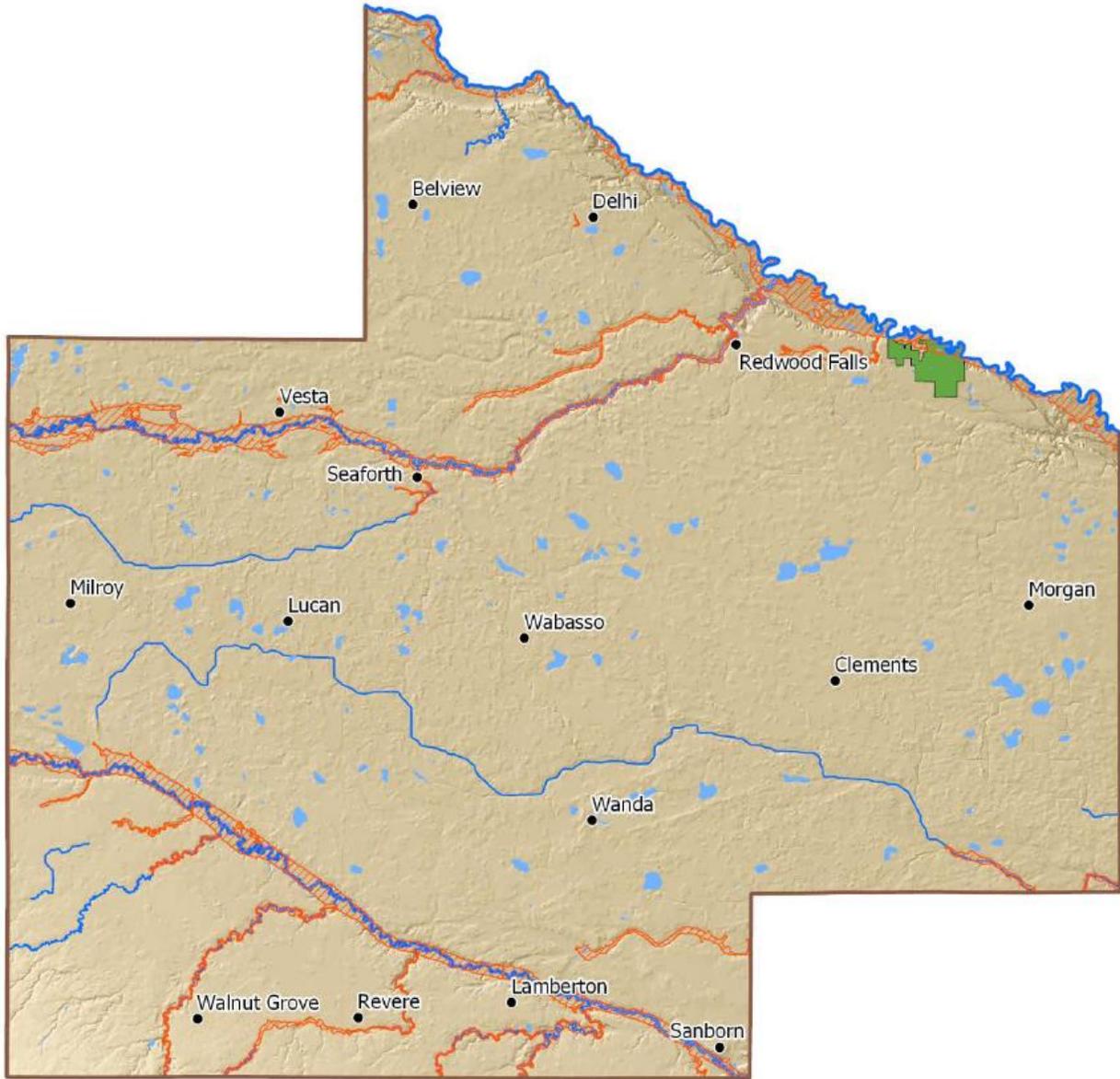


Figure #68
HAZUS Analysis, Redwood County 100-Year Floodplain



-  100-Year Floodplain
-  Lower Sioux Indian Community

Data Sources: FEMA DFIRM, and Hazus-MH

Figure #69: 100-Year Floodplain and Losses – Lambertton

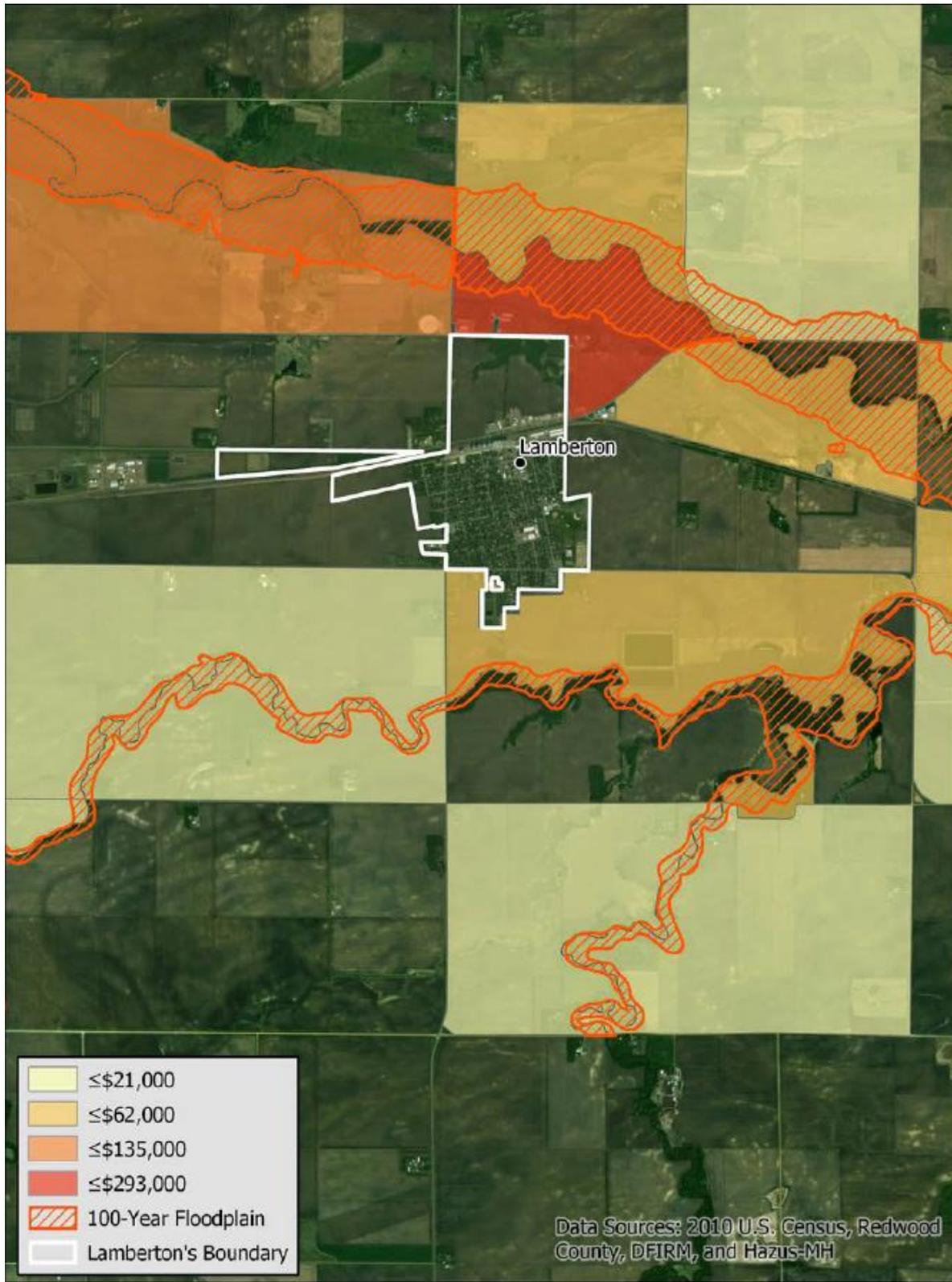


Figure 4. 100-Year Building-Related Flood Loss Estimates in Lambertton

Figure #70: 100-Year Floodplain and Losses – Redwood Falls

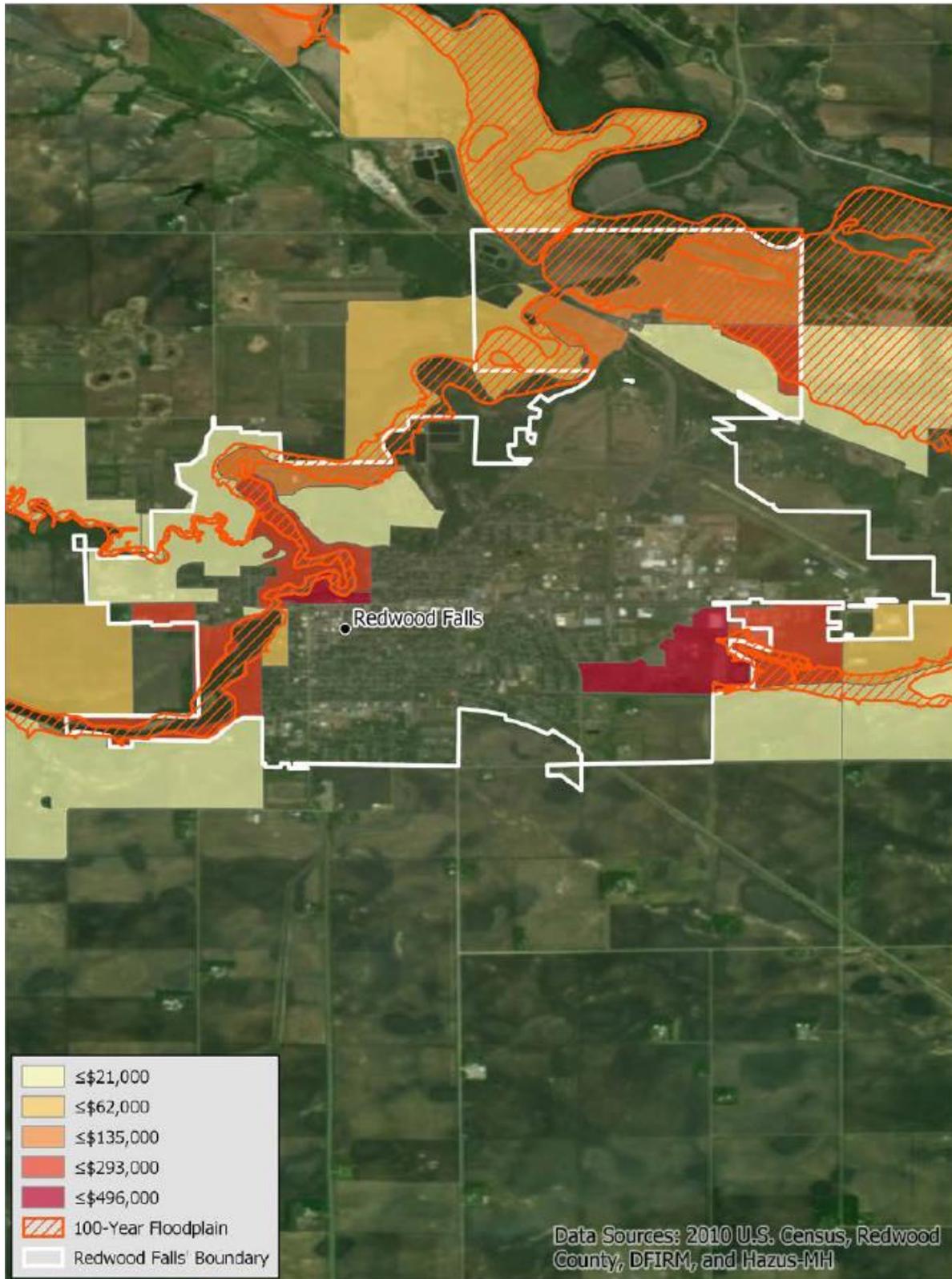


Figure 3. 100-Year Flood Building-Related Loss Estimates in Redwood Falls

Figure #71: 100-Year Floodplain and Losses – Walnut Grove

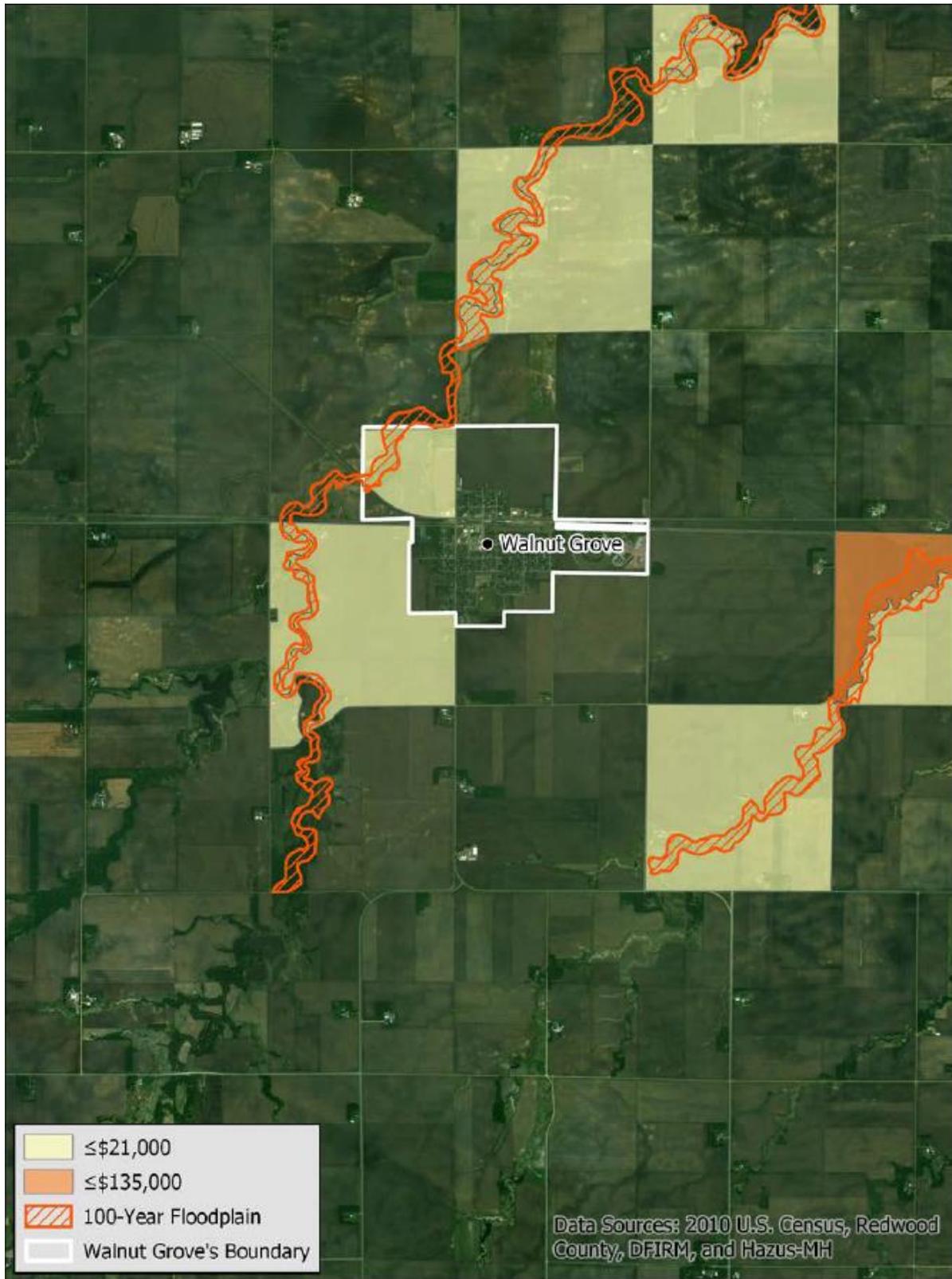
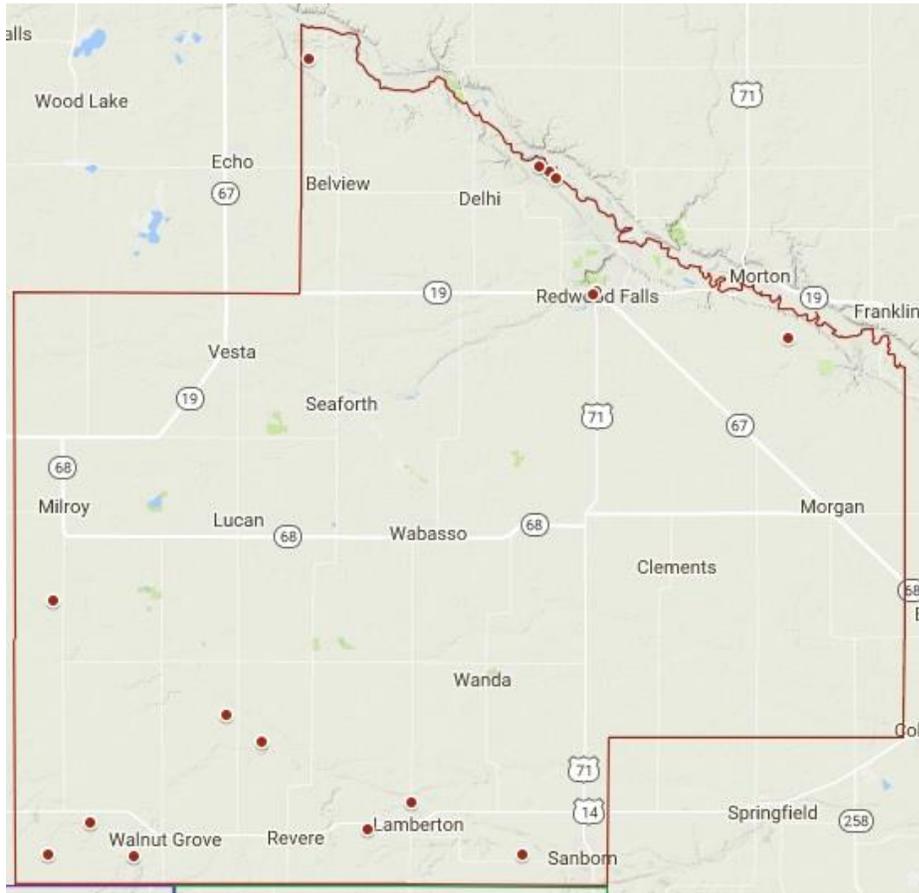


Figure 5. 100-Year Flood Building-Related Loss Estimates in Walnut Grove

Figure #72
Dams – Redwood County



- Cottonwood River at Lamber...
- Geis Wetland
- Dike No. 2
- Dike No. 1
- Hogan F Pond
- Charlestown 28
- Merten's
- Draayum Pond
- Knott Detention
- Knott Retention Reservoir
- Springdale 21 ? (On NID, not ...
- Highwater Ethanol ? (On NID,...
- Redwood River Diversion
- Walnut Grove
- Redwood Falls
- Lecy-Huseby

Figure #73: Flood Plain Map – Redwood County

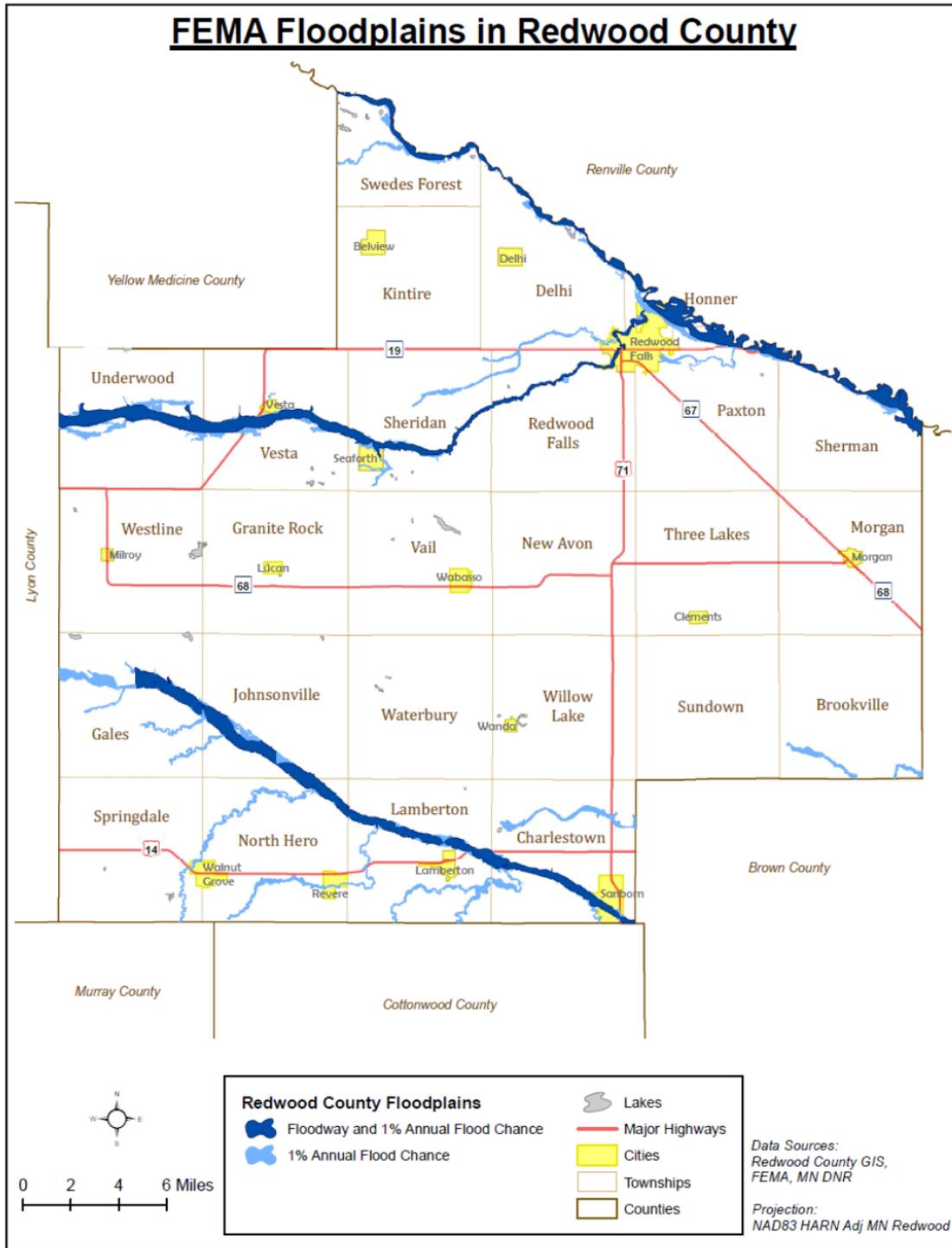


Figure #93: Lincoln-Pipestone Rural Water Distribution Map

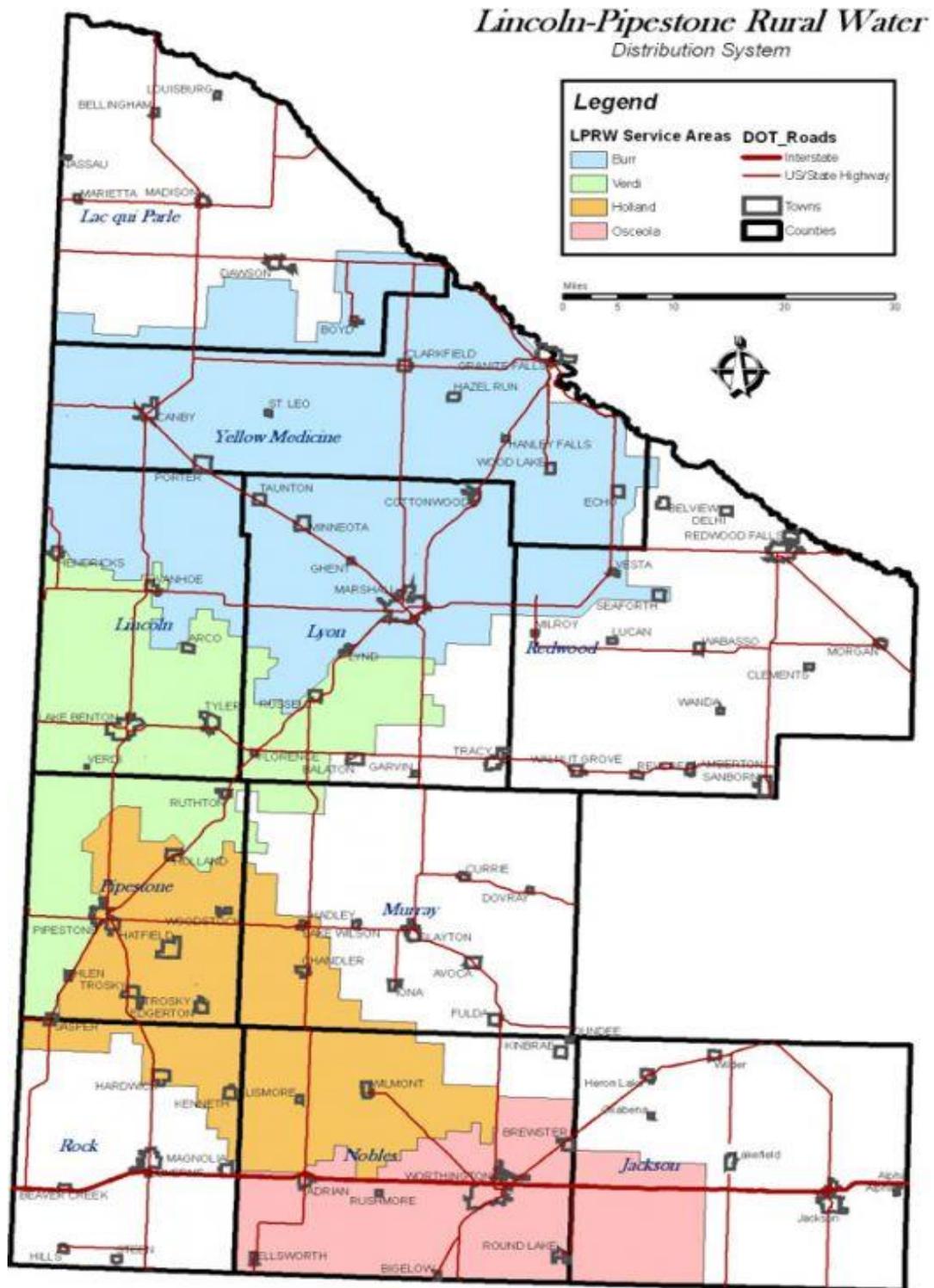


Figure #94: Red Rock Rural Water Distribution Map

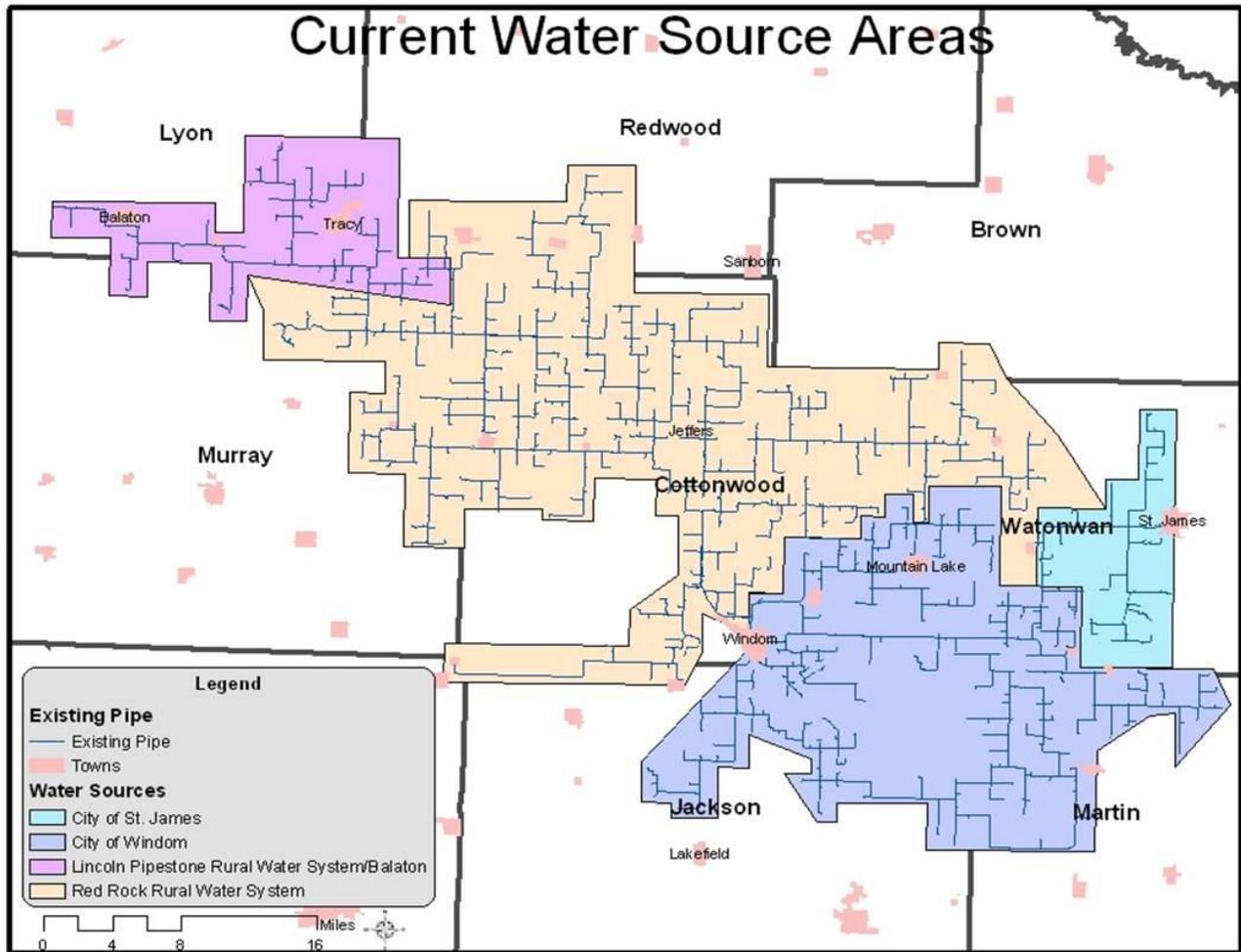


Figure #100: Road & Bridge Map – Redwood County

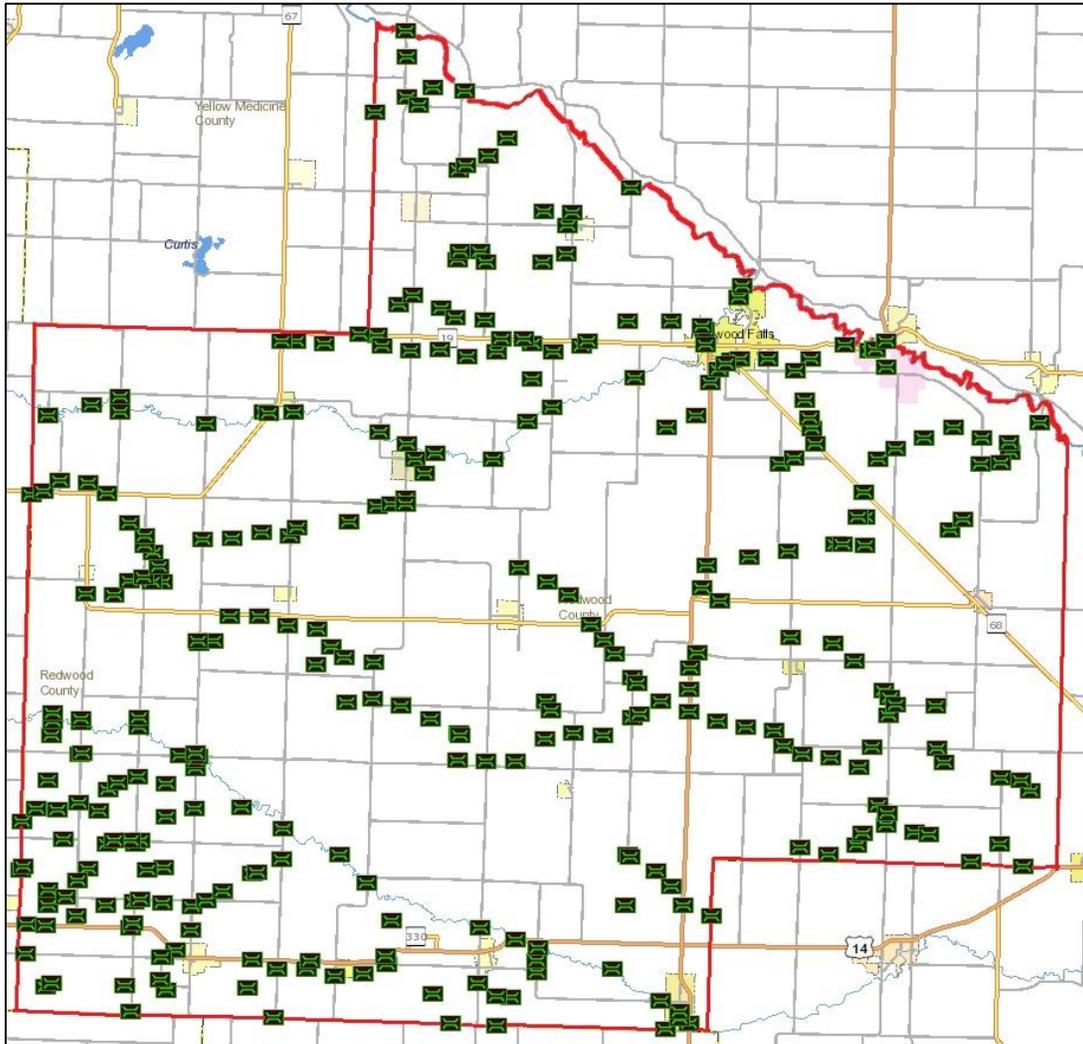


Figure #104
Redwood Falls Municipal Airport

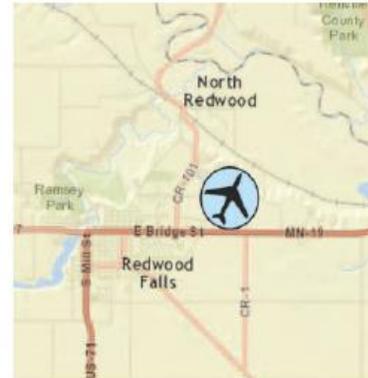


Figure #106
Electric Utilities – Redwood County

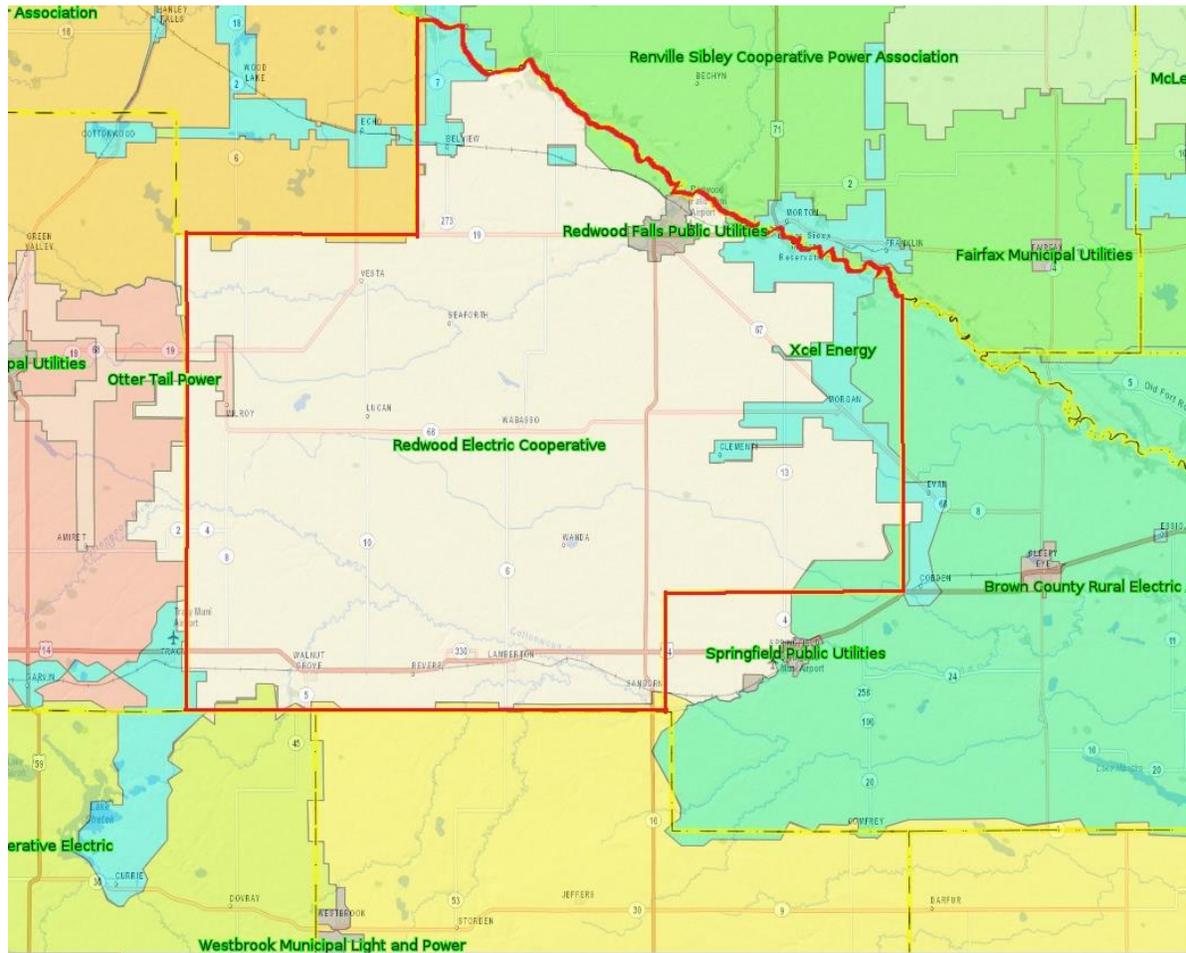


Figure #107: Feedlots – Redwood County

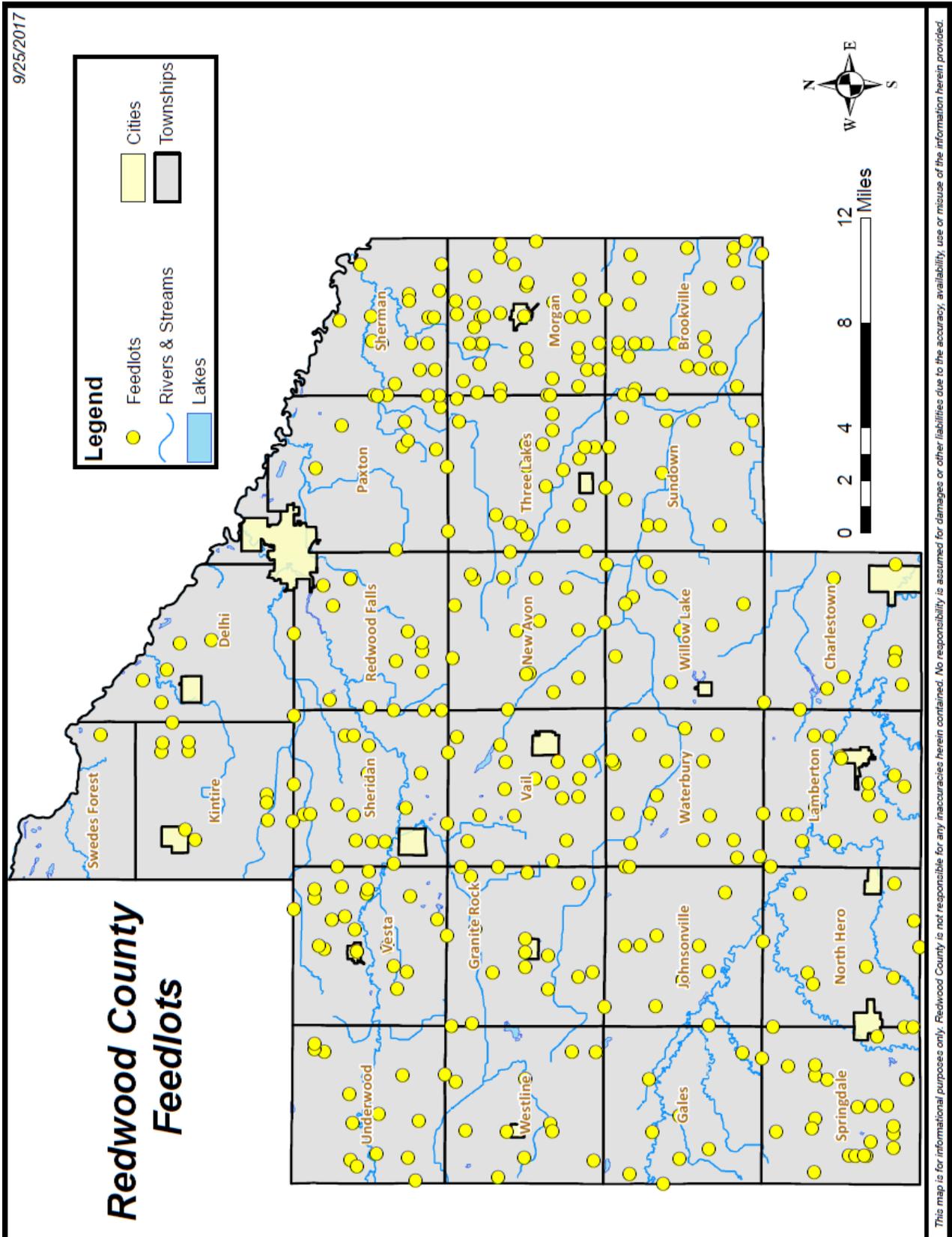


Figure #109
Hazardous Liquid and Gas Transmission Pipelines – Redwood County

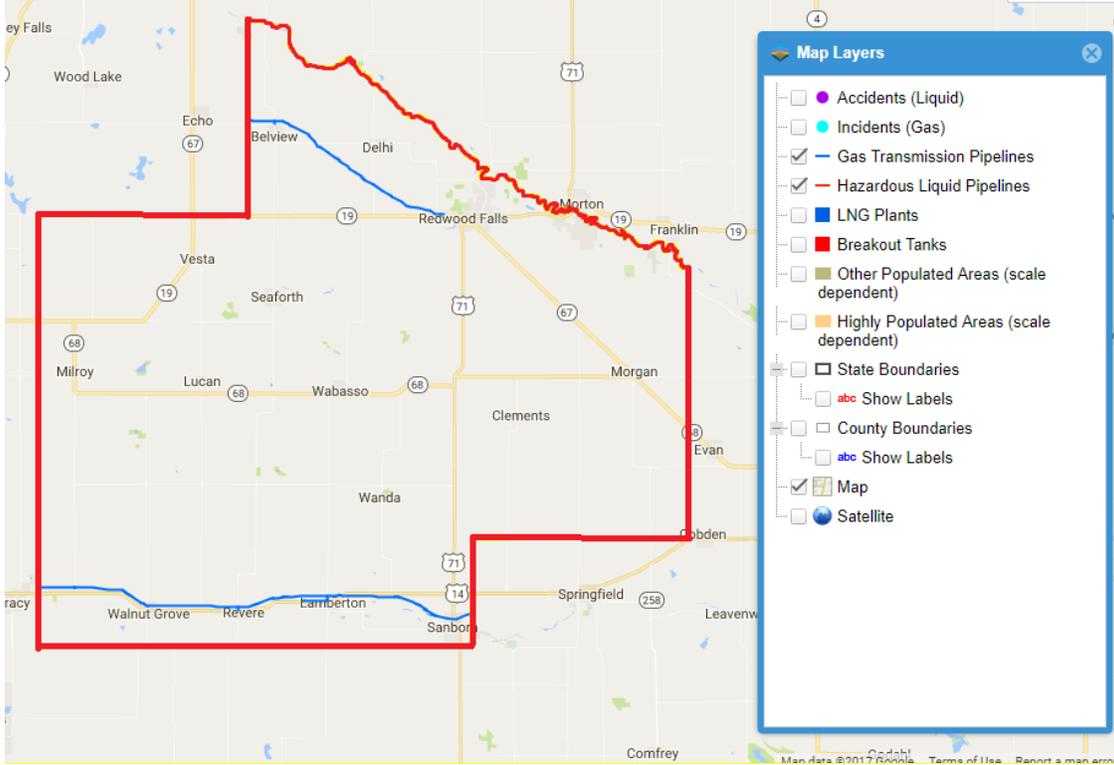
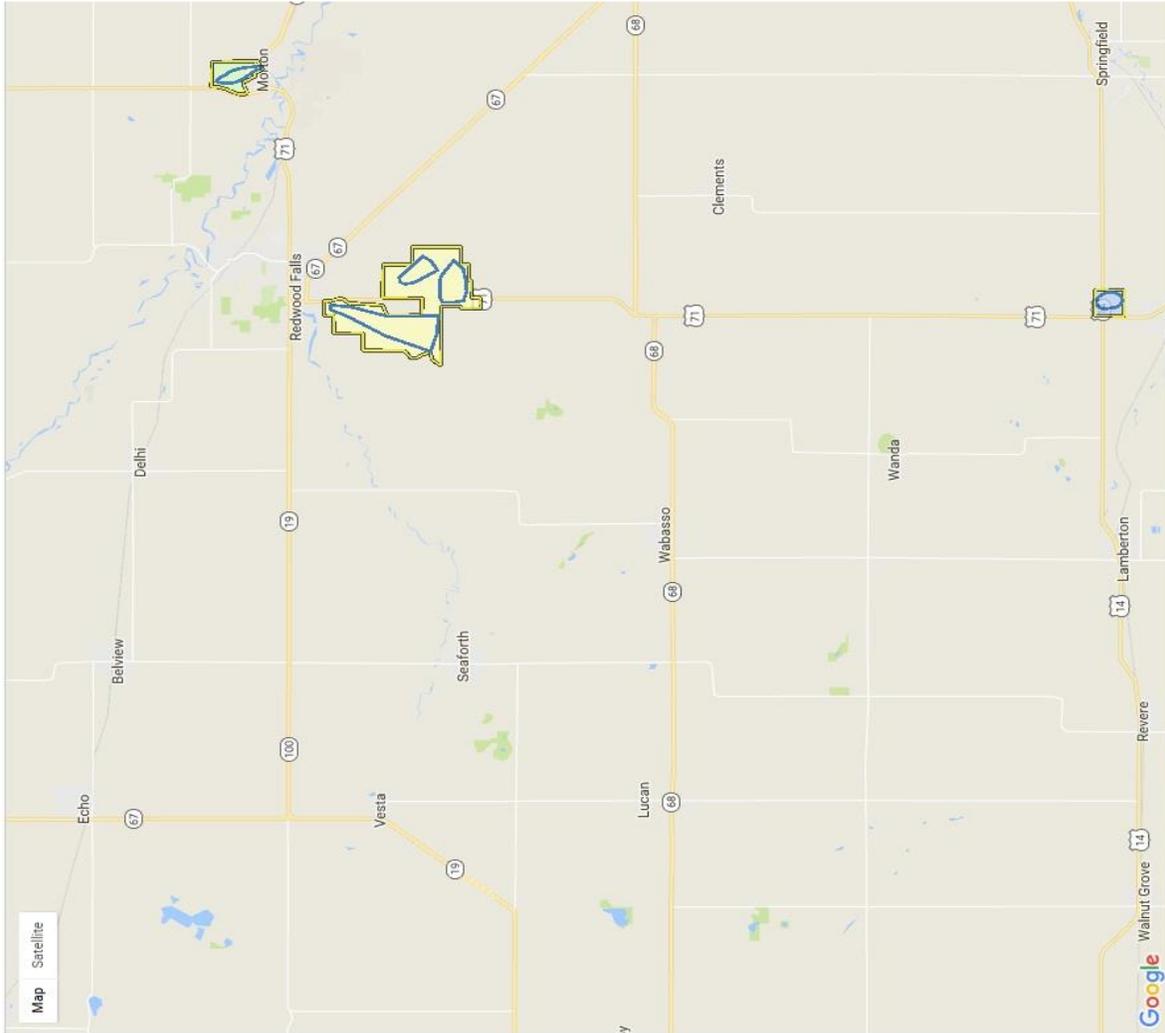


Figure #110
Water Source Protection Areas – Redwood County



Source Water Protection Areas

- Wellhead Protection Area
- Drinking Water Supply Management Area Boundary
- Drinking Water Supply Management Area Vulnerability

- Very High
- High
- Moderate
- Low
- Very Low

Type in an Address, City, or Zip below:

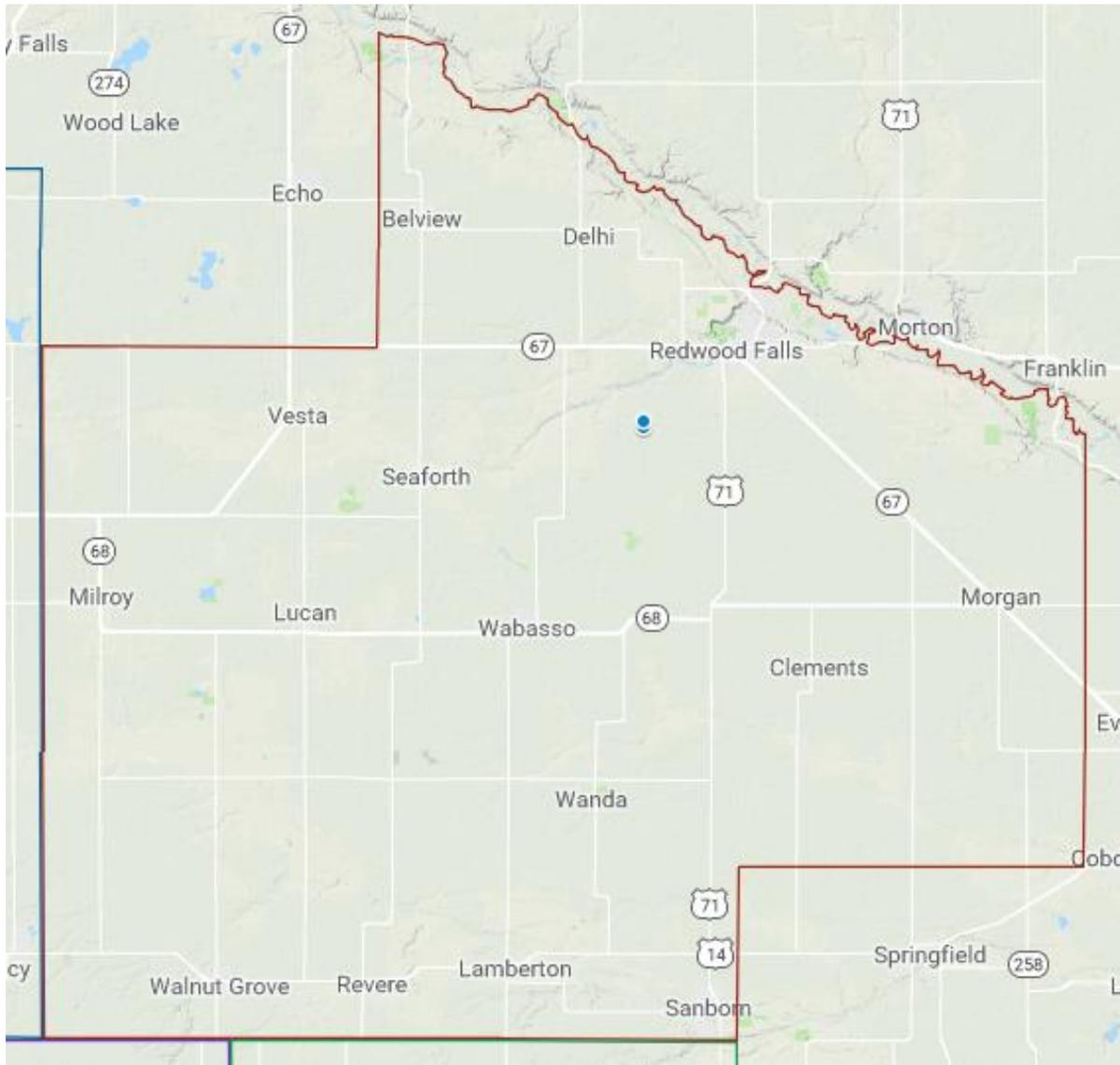
Window

Find

Address Found: Window, MN 56101, USA

Click on the water layers in the map to learn more about the water protection areas. To learn about the data sources, see the About the data page.

Figure #111
Wind Towers in Redwood County⁹²



⁹² Source: USGS. Accessed 8/23/2017. Available: <https://eerscmap.usgs.gov/windfarm/>

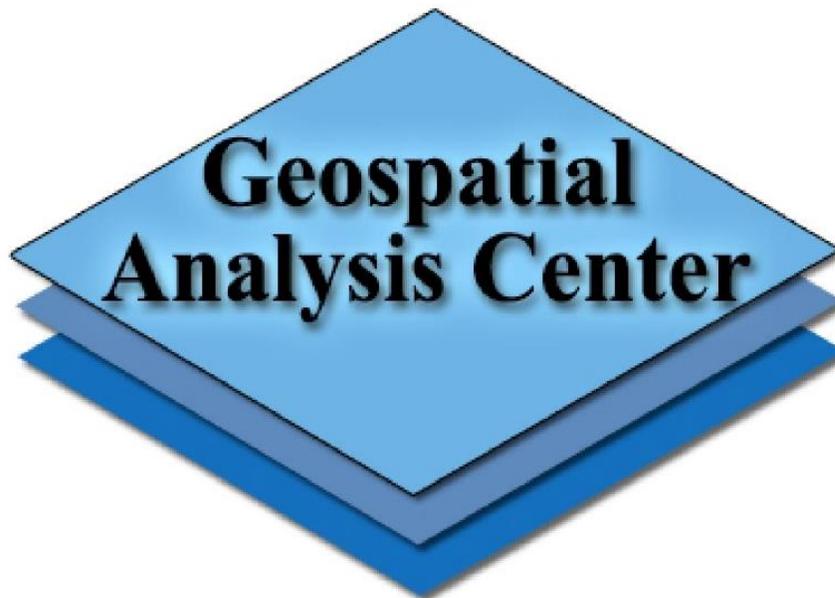
Flood Hazard Analysis for Redwood County

*Prepared for Southwest Regional Development Commission
Level II Flood Hazard Analysis performed using FEMA'S Hazus-MH*

May 2018

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Redwood County Hazus-MH Hazard Analysis

The University of Minnesota Duluth Geospatial Analysis Center (GAC) performed the hazard risk assessment for 100-year floods using the Hazus-MH GIS tool. In recognition of the importance of planning in mitigation activities, FEMA created **Hazards USA Multi-Hazard** (Hazus-MH), a powerful geographic information system (GIS)-based disaster risk assessment tool. This tool enables communities of all sizes to predict estimated losses from floods, hurricanes, earthquakes, and other related phenomena and to measure the impact of various mitigation practices that might help reduce those losses. The Minnesota Homeland Security and Emergency Management (HSEM) office has determined that Hazus-MH should play a critical role in Minnesota's risk assessments.

FEMA's Hazus 4.2 in ArcGIS 10.5.1 was used to estimate the potential losses incurred for a 100-year flood event in Redwood County using a Digital Flood Insurance Rate Map (DFIRM). A 10-meter DEM (digital elevation model) to create a flood depth grid. The resulting HAZUS-MH 100-yr floodplain output is shown in Figure 1.

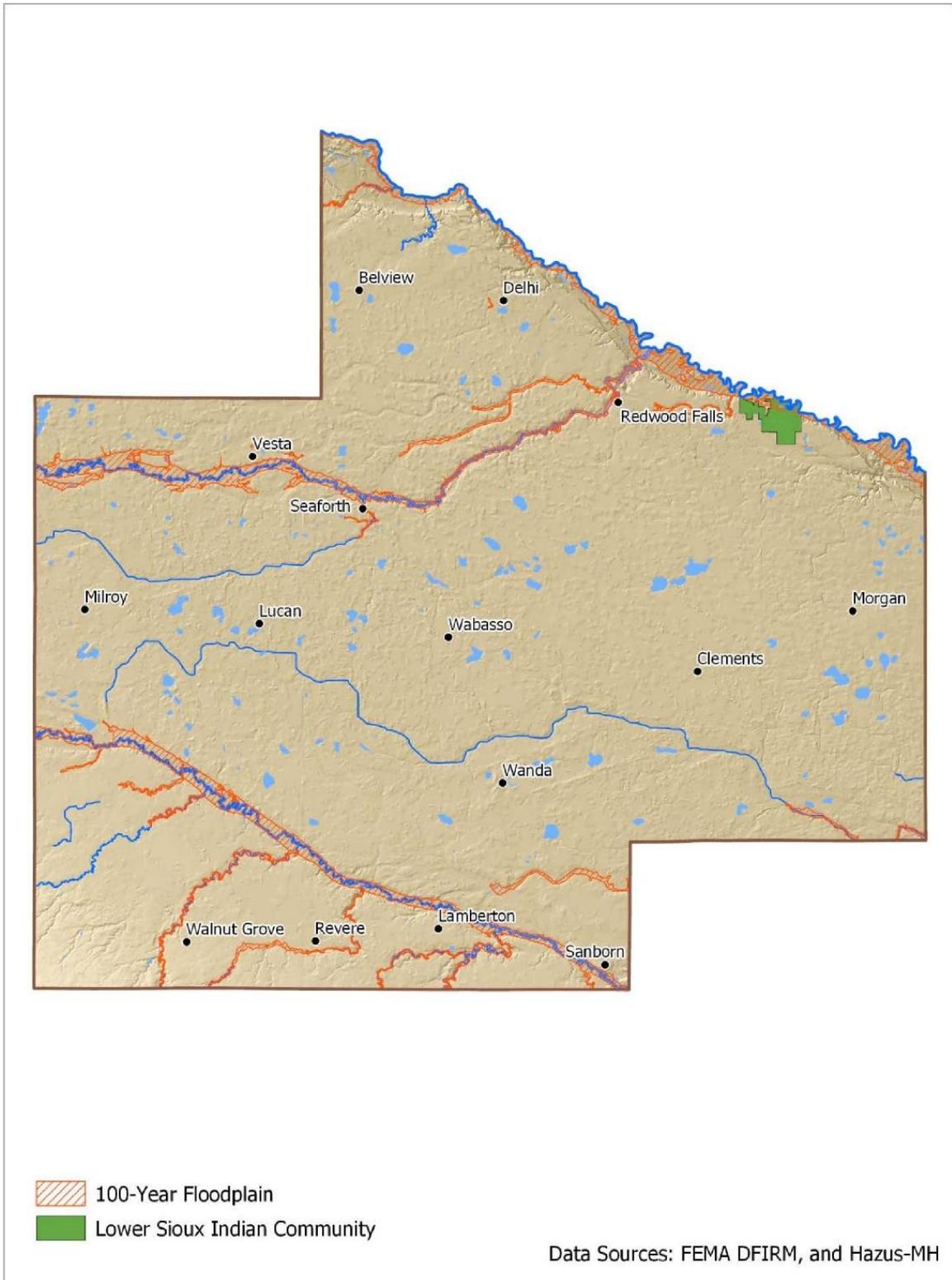


Figure 1. 100-Year Floodplain in Redwood County

Redwood County specific building data was sourced from the parcel tax and spatial databases to include building valuations, occupancy class, square footage, year built, and number of stories. A shapefile named RedwoodCO_ParcelData.shp was obtained from Redwood County as well as and LiDAR building data to locate buildings within the county. Additionally, an attribute file named Book1.xlsx (structure value and occupancy class), was used and supplemented with regional averages where values were missing. The resulting spatial dataset included 14184 unique parcel numbers, 7857 of these records were identified as having building values and were used in the analyses.

In cases where building value, year built, or number of stories values were missing, values were assigned based on best practices from values in the other variables and from the region. Square footage was not available for any building records, so building polygons derived from LiDAR (Minnesota GeoCommons) were intersected with the parcel outlines to total building square footage. Average values/sq foot by occupancy class from a neighboring county were then used to estimate square footage. The data were assigned to one parcel centroid or building location, which served as a surrogate for the each parcel's buildings to aggregate to the associated census block for use in the Hazus model.

According to the Redwood County general building stock (derived from the county's parcel data and imported to the Hazus model), the Hazus model estimates there are 7,857 parcels with buildings in the region that total replacement value (excluding contents) of \$982 million (2010 dollars). Approximately 67.76% of the buildings (and 42.05% of the building value) are associated with residential housing. The Hazus model estimated 6 parcel's buildings will be at least moderately damaged (>10% damage) in the 100-yr flood scenario. Zero buildings are estimated to be completely destroyed.

The total economic loss estimated for the flood is \$114.77 million, which represents 64.7% of the total replacement value of the buildings exposed because the census block in which they reside in is in the 100-year floodplain. Economic losses are broken into 2 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 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 \$8.16 million. 93% of the estimated losses were related to the business interruption of the region. Residential occupancies made up 8.48% of the total loss.

The reported building counts should be interpreted as degrees of loss rather than an exact number of buildings exposed to flooding. These numbers were derived from aggregate building inventories which are assumed to be dispersed evenly across census blocks. Hazus requires that a predetermined amount of square footage of a typical building sustain damage in order to produce a damaged building count. If only a minimal amount of damage to buildings is predicted, it is possible to see zero damaged building counts while also seeing economic losses.

The total estimated number of damaged buildings (parcels as a surrogate), total building losses, and estimated total economic losses for the countywide 100-year flood are shown in Table 1. The distribution of economic losses for Redwood County is depicted in Figure 2.

General Occupancy	Estimated Total Buildings	Total Damaged Buildings	Total Building Exposure	Total Economic Loss	Building Loss
Agricultural	1423	1	\$201,652,000	\$5,019,000	\$532,000
Commercial	673	1	\$86,099,000	\$10,712,000	\$205,000
Education	30	0	\$67,200,000	\$36,522,000	\$61,000
Government	204	0	\$129,974,000	\$48,458,000	\$178,000
Industrial	99	0	\$52,191,000	\$288,000	\$54,000
Religious/Non-Profit	104	0	\$31,941,000	\$4,040,000	\$52,000
Residential	5,324	7	\$412,903,000	\$9,733,000	\$1,683,000
Total	7,857	9	\$981,960,000	\$114,772,000	\$2,765,000

Table 1. Redwood County Total Economic Loss from 100-Year Flood

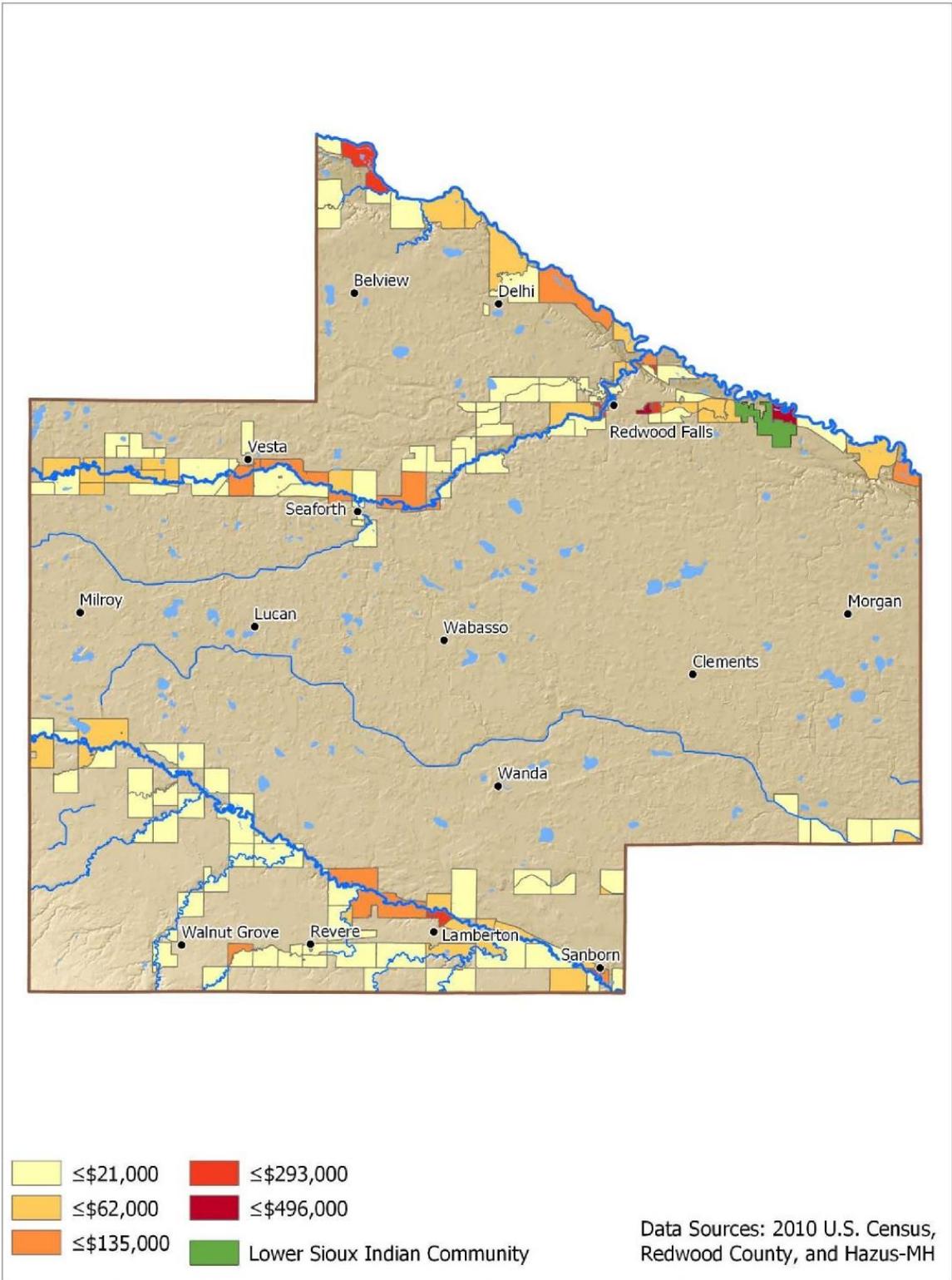


Figure 2. Estimated Building-Related Loss by Census Block within the 100-Year Floodplain

The three most populated cities with a potential economic loss are displayed in Figure 3, Figure 4, and Figure 5.

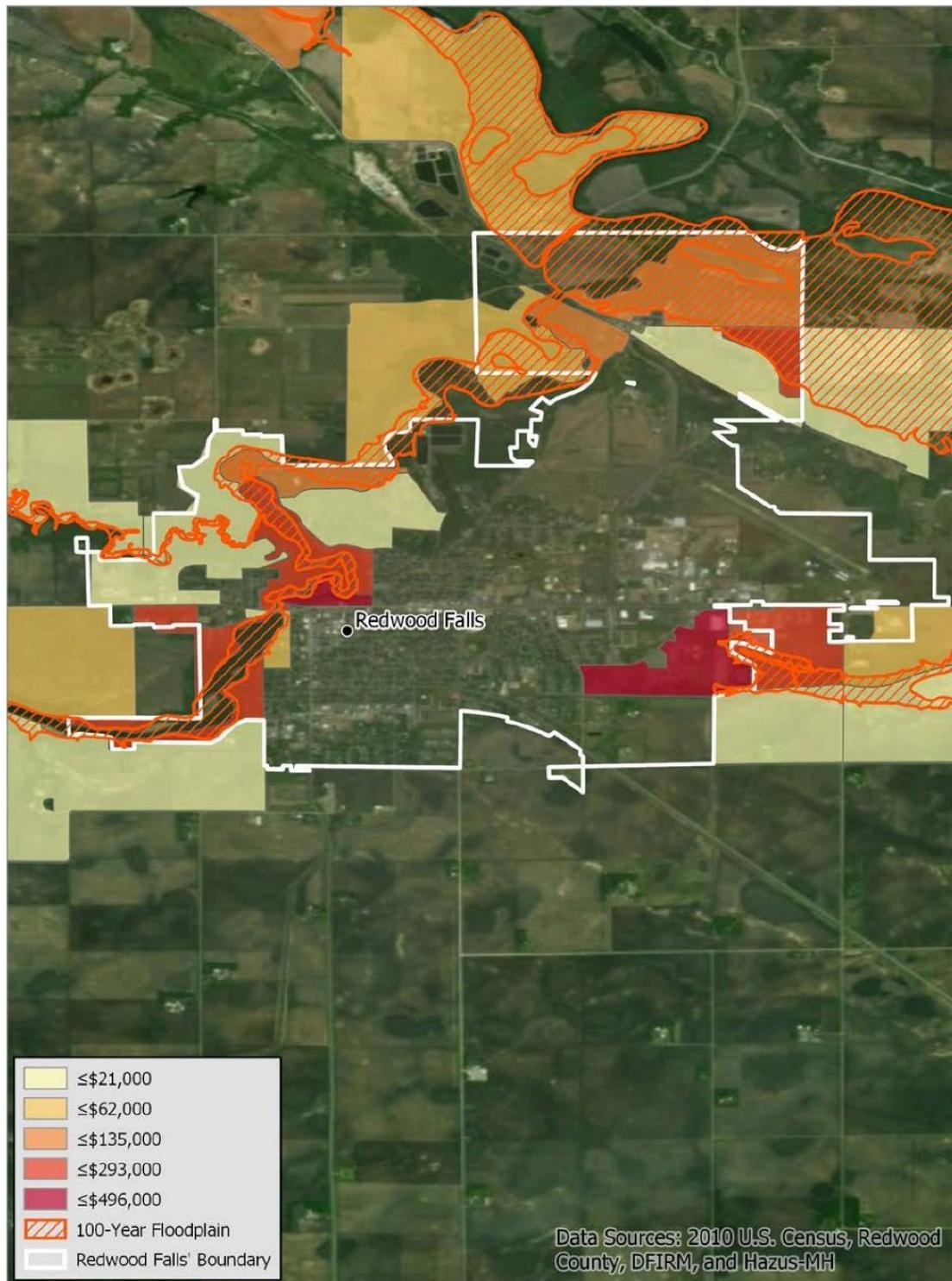


Figure 3. 100-Year Flood Building-Related Loss Estimates in Redwood Falls

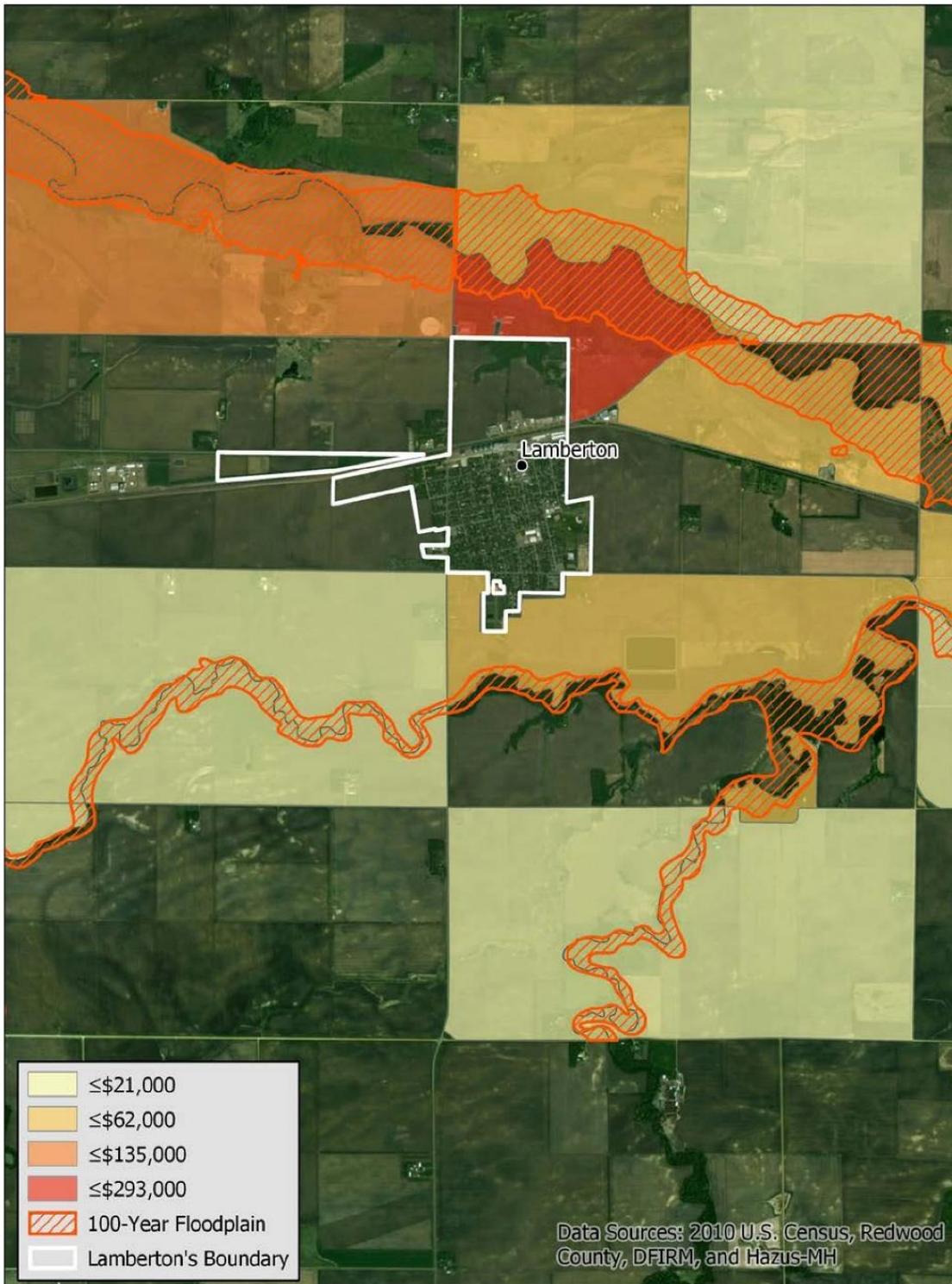


Figure 4. 100-Year Building-Related Flood Loss Estimates in Lambertton

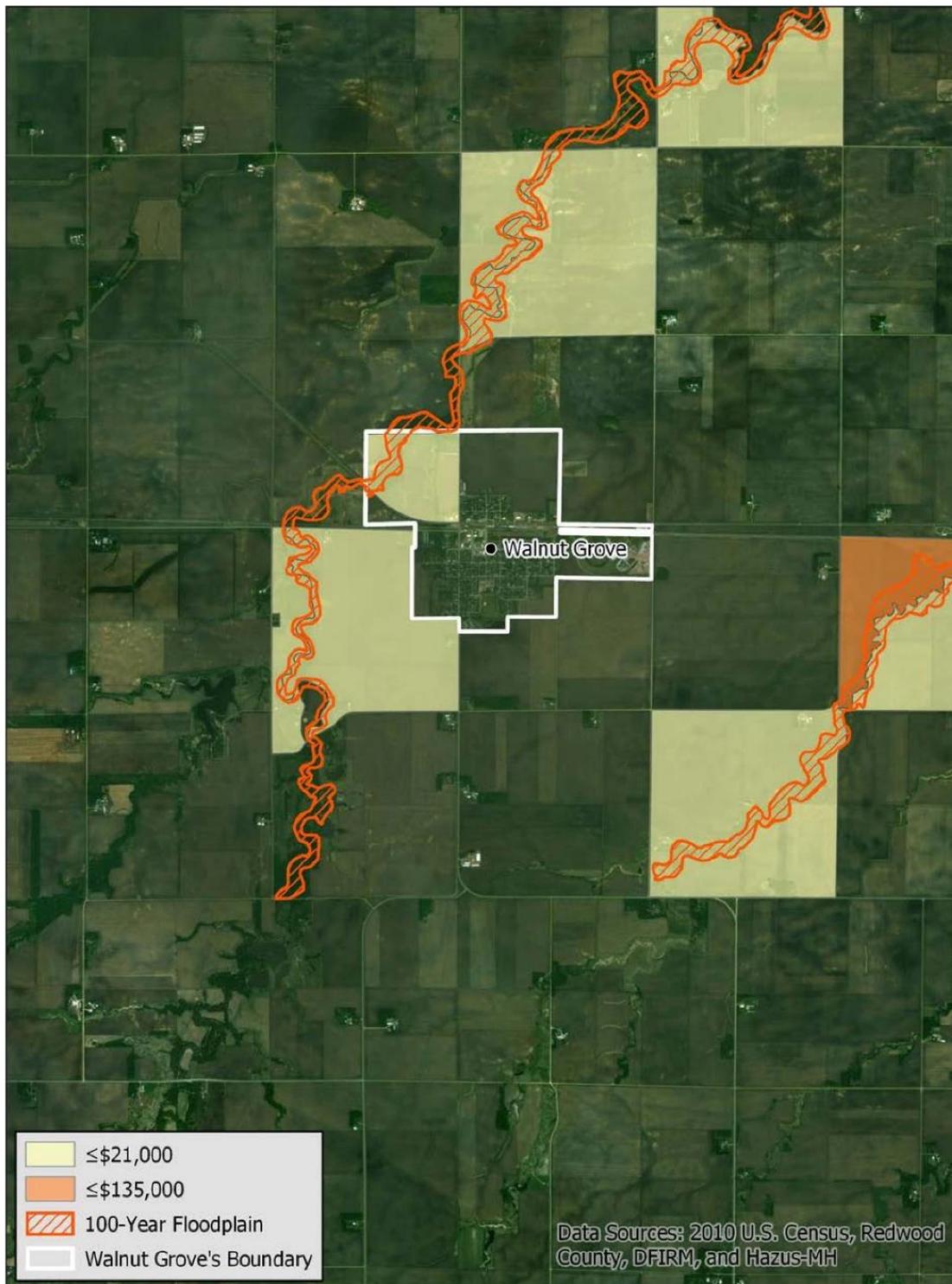


Figure 5. 100-Year Flood Building-Related Loss Estimates in Walnut Grove

Census blocks of concern should be reviewed in more detail to determine the actual location and proximity of facilities with respect to the flood hazard areas. The aggregate losses reported in this study may be overstated due to the fact that values are distributed evenly across a census block. The 3 census blocks with the greatest estimated loss values, which contain parcels with buildings located within the floodplain, are shown in Table 2. These potentially high loss census blocks, used for the loss estimation, and the Hazus-MH output floodplain are shown in Figure 6, Figure 7, and Figure 8. In some cases, the assets of value may not fall in the floodplain in the same proportion that the floodplain covers the entire census block. For this reason, some potential losses may be overstated.

Census Block Number	Total Estimated Loss (Building Value & Building's Contents)	Location
271277503001030	\$368,000	Redwood Falls
271277503001040	\$293,000	Redwood Falls
271277502001046	\$183,000	2 miles northeast of Redwood Falls

Table 2. Census Blocks with the greatest estimated losses in the 100-Year Floodplain

An additional analysis was performed to identify the 10 parcels with the highest loss (building + contents) that contain a building which intersects the 100-year floodplain. Some of the parcels are located in one of the 3 census blocks with the greatest estimated loss; these parcels are labeled accordingly. The results of this analysis (and total building values) are shown in Table 3.

Parcel ID	Total Value of Building(s) & Building's Contents on Parcel	Class Description	Building Area (ft ²)
88-036-4290	\$2,450,800	Government – General Services	18,207
88-036-1040	\$512,200	Government – General Services	9,637
58-030-1020	\$456,000	Agriculture	1,708
53-021-2020	\$381,000	Agriculture	6,796
64-027-1060	\$329,550	Single Family Dwelling	11,886
52-130-1020	\$294,200	Agriculture	3,211
88-810-0200	\$195,600	Single Family Dwelling	5,397
53-010-4060	\$193,400	Agriculture	3,300
51-035-2040	\$166,500	Single Family Dwelling	5,611
88-001-2070	\$158,250	Single Family Dwelling	3,440
Total	\$5,137,500		

Table 3. Redwood County Properties with Highest Building/Contents Value with Potential Building Flood Damage

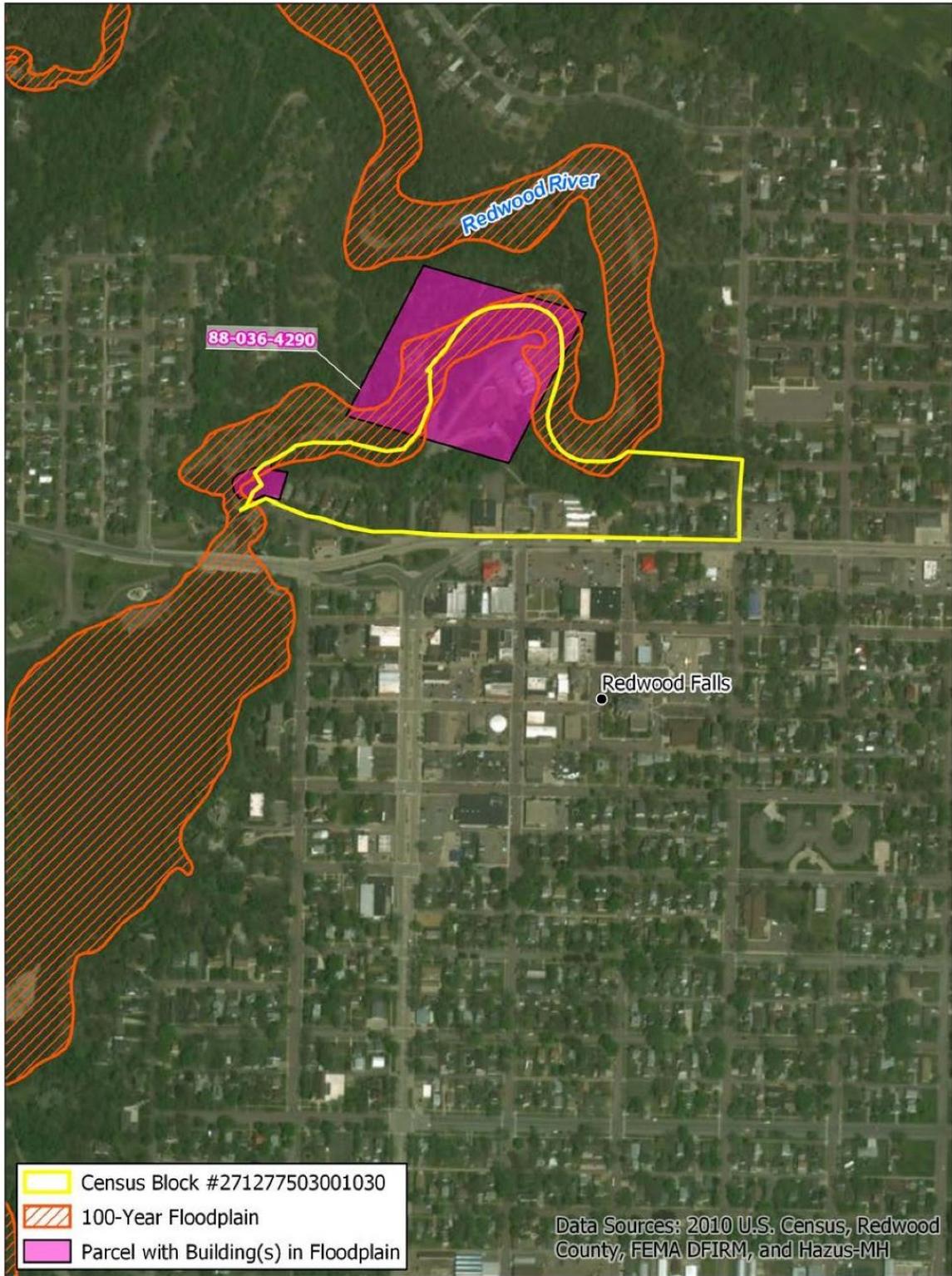


Figure 6. Census Block #271277503001030 and 100-Year Floodplain, Redwood Falls

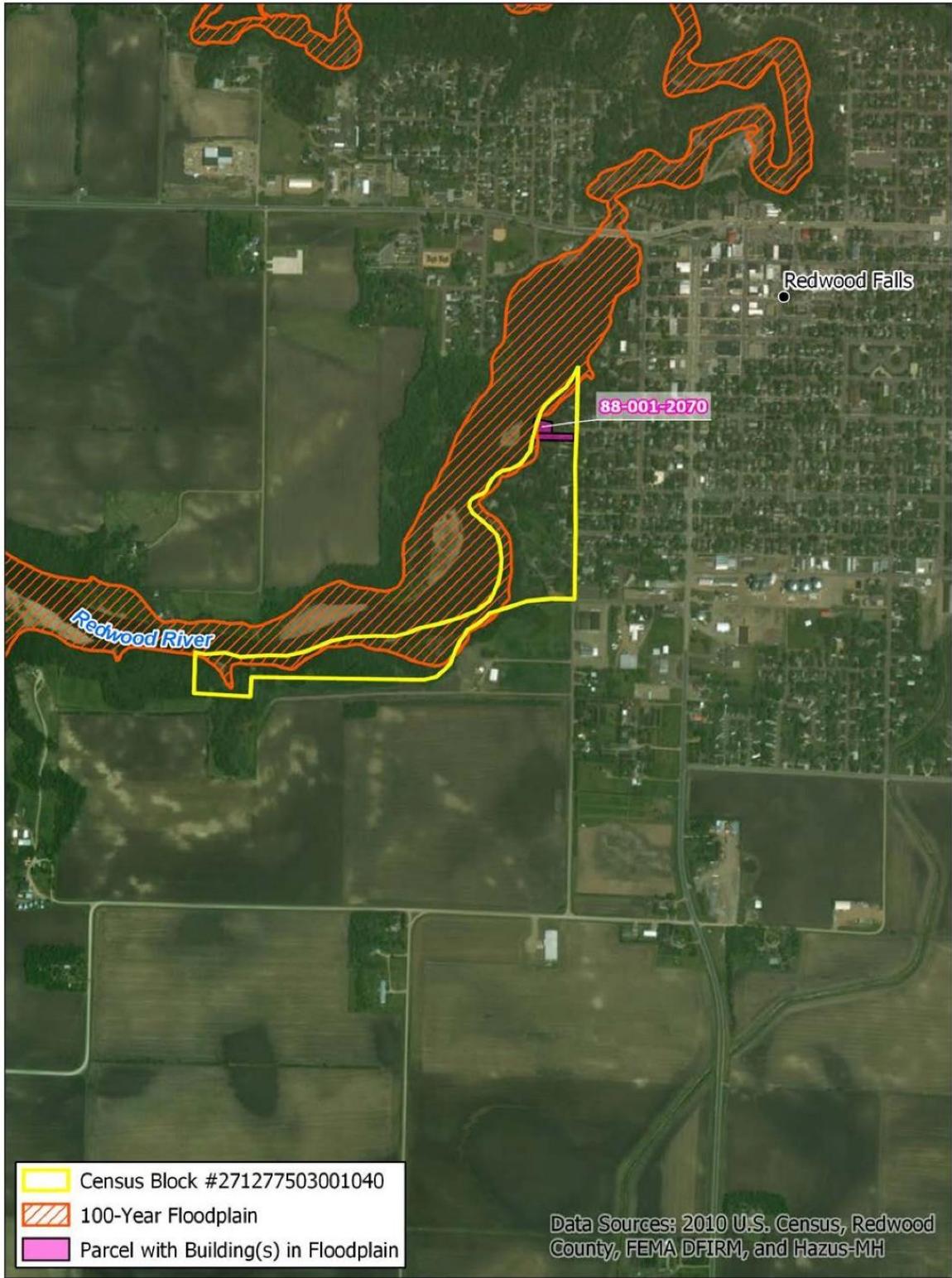


Figure 7. Census Block #271277503001040 and 100-Year Floodplain, Redwood Falls

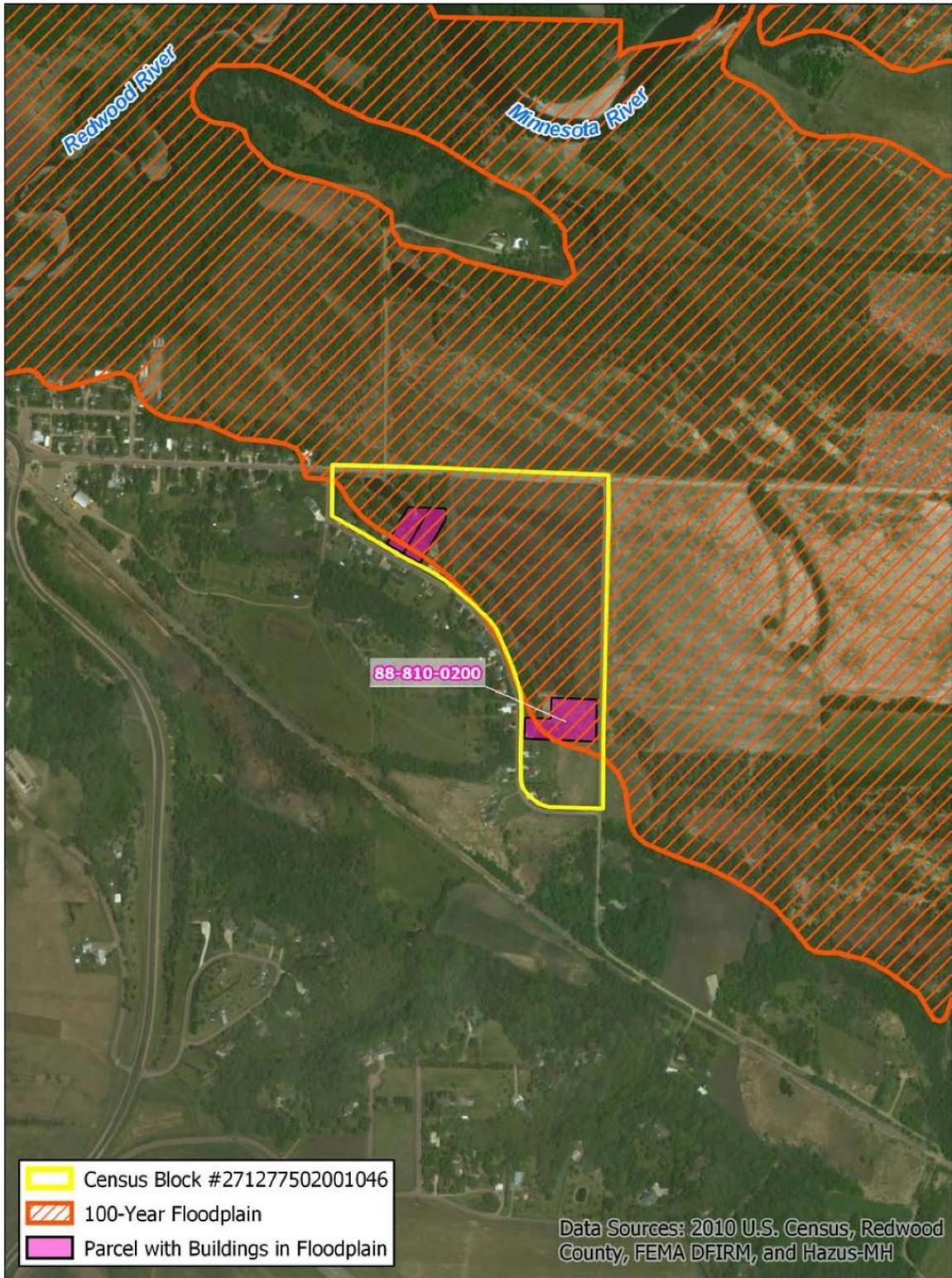


Figure 8. Census Block #271277502001046 and 100-Year Floodplain, 2 miles northeast of Redwood Falls

Hazus-MH Essential Facility Loss Analysis

Essential facilities encounter the same impacts as other buildings within the flood boundary: structural failure, extensive water damage to the facility, and loss of facility functionality (i.e. a damaged police station will no longer be able to serve the community). However, none of Redwood County's essential facilities (care facilities, fire stations, police stations, and schools) included in the Hazus-MH analysis fall within the flood boundary.

Hazus-MH Shelter Requirement Analysis

Hazus-MH estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus-MH also estimates those displaced people that may require accommodations in temporary public shelters. The countywide 100-year flood model estimates 88 households may be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, the model estimates 2 people (out of 16,059) may seek temporary shelter in public shelters.

Hazus-MH Debris Generation Analysis

Hazus estimates the amount of debris that may be generated by the flood. The countywide 100-year flood model breaks debris into 3 general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). 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 5,618 tons of debris may be generated. Of the total amount, Finishes comprises 39% of the total, Structure comprises 35% of the total, and Foundation comprises 27%. If the debris tonnage is converted into an estimated number of truckloads, it will require 225 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Appendix B – Redwood County Hazard Events

The National Climatic Data Center Database (NOAA) was queried for all notable events through June, 2017. However, some categories of events do not have records prior to 1996.

Figure B - 1. All severe tornado events recorded by NCDC (NOAA), 1956 through June 2017

Location or County	Date	Magnitude	Deaths	Injuries	Property Damage
Redwood Co.	06/19/1958	F0	0	0	0.03K
Redwood Co.	08/04/1958	F1	1	2	0.25K
Redwood Co.	05/04/1959	F0	0	0	0.25K
Redwood Co.	06/07/1967	F0	0	0	0.00K
Redwood Co.	06/13/1968	F5	0	0	2.500M
Redwood Co.	06/28/1979	F1	0	1	25.00K
Redwood Co.	06/21/1981	F2	0	0	250.00K
Redwood Co.	06/21/1981	F0	0	0	0.00K
Redwood Co.	06/21/1981	F2	0	0	250.00K
Redwood Co.	06/23/1981	F2	0	0	2.500M
Redwood Co.	04/21/1985	F1	0	0	250.00K
Redwood Co.	04/21/1985	F1	0	0	250.00K
Redwood Co.	06/16/1992	F3	0	0	0.00K
Redwood Co.	06/16/1992	F1	0	0	0.00K
Redwood Co.	06/16/1992	F3	0	0	0.00K
Redwood Co.	06/16/1992	F2	0	0	0.00K
Redwood Co.	06/16/1992	F2	0	0	0.00K
Redwood Co.	06/16/1992	F1	0	0	0.00K
Redwood Co.	06/16/1992	F2	0	0	0.00K
Clements	06/18/1998	F1	0	0	0.00K
Redwood Falls	06/18/1998	F0	0	0	0.00K
Revere	04/18/2004	F0	0	0	0.00K
Lamberton	04/18/2004	F1	0	0	0.00K
Revere	06/25/2010	EF1	0	0	0.00K
Vesta	07/01/2011	EF1	0	0	250.00K
Vesta	07/01/2011	EF1	0	0	500.00K
Belview	07/01/2011	EF1	0	0	200.00K
Lucan	04/21/2012	EF0	0	0	250.00K
Highest Value Property Damage:			1	3	7.226M

Figure B – 2. All severe hail storm events recorded by NCDC (NOAA), 1955 through June 2017

Location Or County	Date	Hail Size (inches)	Deaths	Injuries	Property Damage	Crop Damage
Redwood Co.	08/04/1958	0.75 in.	0	0	0.00K	0.00K
Redwood Co.	08/04/1958	1.75 in.	0	0	0.00K	0.00K
Redwood Co.	08/10/1959	1.75 in.	0	0	0.00K	0.00K
Redwood Co.	08/03/1961	1.50 in.	0	0	0.00K	0.00K
Redwood Co.	05/04/1964	1.25 in.	0	0	0.00K	0.00K
Redwood Co.	06/09/1965	1.75 in.	0	0	0.00K	0.00K
Redwood Co.	07/06/1968	0.75 in.	0	0	0.00K	0.00K
Redwood Co.	06/15/1973	1.75 in.	0	0	0.00K	0.00K
Redwood Co.	06/16/1973	1.75 in.	0	0	0.00K	0.00K
Redwood Co.	09/10/1975	1.00 in.	0	0	0.00K	0.00K
Redwood Co.	06/15/1979	0.75 in.	0	0	0.00K	0.00K
Redwood Co.	06/28/1979	1.50 in.	0	0	0.00K	0.00K
Redwood Co.	07/11/1979	1.00 in.	0	0	0.00K	0.00K
Redwood Co.	07/26/1979	1.75 in.	0	0	0.00K	0.00K
Redwood Co.	08/31/1979	1.00 in.	0	0	0.00K	0.00K
Redwood Co.	05/26/1980	0.75 in.	0	0	0.00K	0.00K
Redwood Co.	06/23/1981	1.75 in.	0	0	0.00K	0.00K
Redwood Co.	04/02/1982	0.75 in.	0	0	0.00K	0.00K
Redwood Co.	04/02/1982	1.75 in.	0	0	0.00K	0.00K
Redwood Co.	07/02/1982	2.50 in.	0	0	0.00K	0.00K
Redwood Co.	07/02/1982	2.75 in.	0	0	0.00K	0.00K
Redwood Co.	04/20/1985	1.00 in.	0	0	0.00K	0.00K
Redwood Co.	04/20/1985	1.75 in.	0	0	0.00K	0.00K
Redwood Co.	05/11/1985	0.75 in.	0	0	0.00K	0.00K
Redwood Co.	05/11/1985	1.00 in.	0	0	0.00K	0.00K
Redwood Co.	05/11/1985	1.00 in.	0	0	0.00K	0.00K
Redwood Co.	05/29/1986	1.75 in.	0	0	0.00K	0.00K
Redwood Co.	07/11/1987	1.00 in.	0	0	0.00K	0.00K
Redwood Co.	05/28/1991	1.75 in.	0	0	0.00K	0.00K
Redwood Co.	05/28/1991	1.75 in.	0	0	0.00K	0.00K
Redwood Co.	05/28/1991	4.50 in.	0	0	0.00K	0.00K
Redwood Co.	05/28/1991	2.75 in.	0	0	0.00K	0.00K

Location Or County	Date	Hail Size (inches)	Deaths	Injuries	Property Damage	Crop Damage
Vesta	05/07/1993	0.88 in.	0	0	0.00K	0.00K
Wanda	04/25/1994	1.75 in.	0	0	0.00K	0.00K
Redwood Co.	05/23/1994	0.88 in.	0	0	0.00K	0.00K
Redwood Co.	08/07/1994	0.75 in.	0	0	0.00K	0.00K
Wabasso	08/07/1994	0.75 in.	0	0	0.00K	0.00K
Redwood Co.	08/07/1994	0.75 in.	0	0	0.00K	0.00K
Walnut Grove	07/19/1995	1.75 in.	0	0	0.00K	0.00K
Seaforth	09/05/1995	0.75 in.	0	0	0.00K	0.00K
Redwood Falls	06/05/1996	0.75 in.	0	0	0.00K	0.00K
Sanborn	07/27/1996	1.50 in.	0	0	0.00K	0.00K
Lamberton	07/13/1997	4.00 in.	0	0	200.00K	1.200M
Morgan	07/13/1997	3.00 in.	0	0	0.00K	0.00K
Wabasso	06/11/1998	0.75 in.	0	0	0.00K	0.00K
Belview	06/26/1998	0.75 in.	0	0	0.00K	0.00K
Milroy	07/20/1998	1.75 in.	0	0	0.00K	0.00K
Lamberton	07/20/1998	0.75 in.	0	0	0.00K	0.00K
Sanborn	06/09/1999	0.75 in.	0	0	0.00K	0.00K
Sanborn	06/09/1999	0.88 in.	0	0	0.00K	0.00K
Walnut Grove	07/13/1999	0.88 in.	0	0	0.00K	0.00K
Walnut Grove	05/17/2000	0.88 in.	0	0	0.00K	0.00K
Sanborn	05/17/2000	0.75 in.	0	0	0.00K	0.00K
Revere	04/24/2001	0.75 in.	0	0	0.00K	0.00K
Lamberton	04/24/2001	0.75 in.	0	0	0.00K	0.00K
Belview	08/17/2001	2.75 in.	0	0	25.00K	0.00K
Vesta	05/05/2002	1.75 in.	0	0	0.00K	0.00K
Redwood Falls	05/05/2002	1.75 in.	0	0	0.00K	0.00K
Redwood Falls	05/05/2002	0.75 in.	0	0	0.00K	0.00K
Milroy	05/05/2002	1.25 in.	0	0	0.00K	0.00K
Lucan	05/05/2002	1.00 in.	0	0	0.00K	0.00K
Milroy	05/05/2002	0.88 in.	0	0	0.00K	0.00K
Seaforth	06/21/2002	1.00 in.	0	0	0.00K	0.00K
Walnut Grove	07/28/2002	1.00 in.	0	0	0.00K	0.00K
Milroy	08/16/2002	0.75 in.	0	0	0.00K	0.00K

Location Or County	Date	Hail Size (inches)	Deaths	Injuries	Property Damage	Crop Damage
Redwood Falls	08/16/2002	1.75 in.	0	0	0.00K	0.00K
Walnut Grove	06/23/2003	0.88 in.	0	0	0.00K	0.00K
Morgan	04/18/2004	0.88 in.	0	0	0.00K	0.00K
Vesta	06/11/2004	0.88 in.	0	0	0.00K	0.00K
Redwood Falls	06/11/2004	0.75 in.	0	0	0.00K	0.00K
Walnut Grove	06/15/2004	1.00 in.	0	0	0.00K	0.00K
Lucan	06/23/2004	0.88 in.	0	0	0.00K	0.00K
Lamberton	07/20/2004	0.75 in.	0	0	0.00K	0.00K
Milroy	07/31/2004	0.75 in.	0	0	0.00K	0.00K
Lucan	08/23/2004	0.88 in.	0	0	0.00K	0.00K
Walnut Grove	05/08/2005	1.00 in.	0	0	0.00K	0.00K
Redwood Falls	06/13/2005	0.75 in.	0	0	0.00K	0.00K
Morgan	06/13/2005	0.75 in.	0	0	0.00K	0.00K
Milroy	08/03/2005	2.00 in.	0	0	0.00K	0.00K
Milroy	08/03/2005	0.88 in.	0	0	0.00K	0.00K
Wabasso	08/03/2005	1.00 in.	0	0	0.00K	0.00K
Milroy	09/05/2005	1.25 in.	0	0	0.00K	0.00K
Belview	09/16/2006	0.88 in.	0	0	0.00K	0.00K
Redwood Falls	06/10/2007	1.00 in.	0	0	0.00K	0.00K
Morgan	05/01/2008	0.75 in.	0	0	0.00K	0.00K
Milroy	05/06/2008	0.75 in.	0	0	0.00K	0.00K
Milroy	05/06/2008	0.75 in.	0	0	0.00K	0.00K
Walnut Grove	05/06/2008	0.75 in.	0	0	0.00K	0.00K
Lucan	05/30/2008	1.00 in.	0	0	0.00K	0.00K
Wabasso	05/30/2008	1.00 in.	0	0	0.00K	0.00K
Morgan	06/05/2008	0.88 in.	0	0	0.00K	0.00K
Delhi	06/27/2008	0.88 in.	0	0	0.00K	0.00K
Wanda	08/14/2008	0.75 in.	0	0	0.00K	0.00K
Wanda	08/14/2008	0.75 in.	0	0	0.00K	0.00K
Vesta	08/14/2008	0.75 in.	0	0	0.00K	0.00K
Vesta	08/14/2008	1.00 in.	0	0	0.00K	0.00K
Seaforth	08/02/2009	0.88 in.	0	0	0.00K	0.00K
Lucan	08/02/2009	1.00 in.	0	0	0.00K	0.00K

Location Or County	Date	Hail Size (inches)	Deaths	Injuries	Property Damage	Crop Damage
Rowena	08/02/2009	2.00 in.	0	0	0.00K	0.00K
Clements	08/02/2009	0.88 in.	0	0	0.00K	0.00K
Walnut Grove	08/08/2009	1.00 in.	0	0	0.00K	0.00K
Milroy	06/26/2010	1.00 in.	0	0	0.00K	0.00K
Morgan	09/15/2010	0.88 in.	0	0	0.00K	0.00K
Walnut Grove	04/09/2011	0.75 in.	0	0	0.00K	0.00K
Redwood Falls	07/01/2011	0.75 in.	0	0	0.00K	0.00K
Redwood Falls	07/01/2011	1.25 in.	0	0	0.00K	0.00K
Walnut Grove	05/01/2012	1.00 in.	0	0	0.00K	0.00K
Lamberton	05/01/2012	0.88 in.	0	0	0.00K	0.00K
Walnut Grove	05/26/2012	0.75 in.	0	0	0.00K	0.00K
Redwood Falls	06/19/2012	0.75 in.	0	0	0.00K	0.00K
Morgan	06/19/2012	0.75 in.	0	0	0.00K	0.00K
Gilfillan	06/19/2012	0.88 in.	0	0	0.00K	0.00K
Wabasso	08/01/2012	0.75 in.	0	0	0.00K	0.00K
Milroy	08/23/2012	1.00 in.	0	0	0.00K	0.00K
Wabasso	06/18/2013	1.75 in.	0	0	0.00K	0.00K
Wanda	06/18/2013	2.50 in.	0	0	0.00K	0.00K
Milroy	06/21/2013	1.50 in.	0	0	0.00K	0.00K
Vesta	06/21/2013	1.00 in.	0	0	0.00K	0.00K
Seaforth	06/22/2013	1.00 in.	0	0	0.00K	100.00K
Wabasso	08/31/2013	1.75 in.	0	0	0.00K	0.00K
Morgan	05/08/2014	0.75 in.	0	0	0.00K	0.00K
Belview	06/08/2016	0.88 in.	0	0	0.00K	0.00K
Redwood Falls	06/08/2016	0.75 in.	0	0	0.00K	0.00K
Morgan	06/08/2016	0.88 in.	0	0	0.00K	0.00K
Morgan	06/08/2016	0.75 in.	0	0	0.00K	0.00K
Morgan	06/08/2016	0.75 in.	0	0	0.00K	0.00K
Redwood Falls	06/17/2016	0.75 in.	0	0	0.00K	0.00K
Sanborn	08/18/2016	1.00 in.	0	0	0.00K	0.00K
Wabasso	03/06/2017	0.75 in.	0	0	0.00K	0.00K
Redwood Falls	03/06/2017	1.00 in.	0	0	0.00K	0.00K
Redwood Falls	03/06/2017	2.00 in.	0	0	25.00K	0.00K

Location Or County	Date	Hail Size (inches)	Deaths	Injuries	Property Damage	Crop Damage
Highest Value Property Damage:			0	0	250.00K	1.300M

Figure B - 3. All severe thunderstorm wind events recorded by NCDL (NOAA), 1955 through June 2017

Location Or County	Date	Wind Speed in Knots	Deaths	Injuries	Property Damage	Crop Damage
Redwood Co.	08/28/1956	62 kts.	0	0	0.00K	0.00K
Redwood Co.	05/04/1959	70 kts.	0	0	0.00K	0.00K
Redwood Co.	06/21/1961	53 kts.	0	0	0.00K	0.00K
Redwood Co.	05/29/1962	58 kts.	0	0	0.00K	0.00K
Redwood Co.	05/17/1963	50 kts.	0	0	0.00K	0.00K
Redwood Co.	07/16/1963	60 kts.	0	0	0.00K	0.00K
Redwood Co.	05/05/1964	64 kts.	0	0	0.00K	0.00K
Redwood Co.	05/05/1964	51 kts.	0	0	0.00K	0.00K
Redwood Co.	05/05/1964	63 kts.	0	0	0.00K	0.00K
Redwood Co.	06/08/1964	63 kts.	0	0	0.00K	0.00K
Redwood Co.	07/12/1965	52 kts.	0	0	0.00K	0.00K
Redwood Co.	06/09/1968	0 kts.	0	0	0.00K	0.00K
Redwood Co.	06/21/1968	55 kts.	0	0	0.00K	0.00K
Redwood Co.	06/25/1969	0 kts.	0	0	0.00K	0.00K
Redwood Co.	04/19/1973	0 kts.	0	0	0.00K	0.00K
Redwood Co.	04/19/1973	0 kts.	0	0	0.00K	0.00K
Redwood Co.	07/02/1974	50 kts.	0	0	0.00K	0.00K
Redwood Co.	07/09/1974	52 kts.	0	0	0.00K	0.00K
Redwood Co.	07/13/1976	50 kts.	0	0	0.00K	0.00K
Redwood Co.	08/10/1976	61 kts.	0	0	0.00K	0.00K
Redwood Co.	08/10/1976	61 kts.	0	0	0.00K	0.00K
Redwood Co.	08/10/1976	55 kts.	0	0	0.00K	0.00K
Redwood Co.	06/16/1979	0 kts.	0	0	0.00K	0.00K
Redwood Co.	06/19/1979	0 kts.	0	0	0.00K	0.00K
Redwood Co.	06/19/1979	0 kts.	0	0	0.00K	0.00K
Redwood Co.	06/19/1979	0 kts.	0	0	0.00K	0.00K
Redwood Co.	07/20/1979	52 kts.	0	0	0.00K	0.00K

Location Or County	Date	Wind Speed in Knots	Deaths	Injuries	Property Damage	Crop Damage
Redwood Co.	07/26/1979	50 kts.	0	0	0.00K	0.00K
Redwood Co.	05/26/1980	0 kts.	0	0	0.00K	0.00K
Redwood Co.	05/29/1980	65 kts.	0	0	0.00K	0.00K
Redwood Co.	07/15/1980	70 kts.	0	0	0.00K	0.00K
Redwood Co.	08/04/1980	0 kts.	0	0	0.00K	0.00K
Redwood Co.	10/16/1980	0 kts.	0	0	0.00K	0.00K
Redwood Co.	06/13/1981	0 kts.	0	0	0.00K	0.00K
Redwood Co.	08/03/1981	0 kts.	0	0	0.00K	0.00K
Redwood Co.	04/26/1984	0 kts.	0	0	0.00K	0.00K
Redwood Co.	04/27/1984	0 kts.	0	0	0.00K	0.00K
Redwood Co.	06/22/1984	52 kts.	0	0	0.00K	0.00K
Redwood Co.	04/19/1985	52 kts.	0	0	0.00K	0.00K
Redwood Co.	04/19/1985	52 kts.	0	0	0.00K	0.00K
Redwood Co.	04/20/1985	0 kts.	0	0	0.00K	0.00K
Redwood Co.	04/21/1985	50 kts.	0	0	0.00K	0.00K
Redwood Co.	05/11/1985	0 kts.	0	0	0.00K	0.00K
Redwood Co.	06/07/1985	0 kts.	0	0	0.00K	0.00K
Redwood Co.	06/12/1990	0 kts.	0	0	0.00K	0.00K
Redwood Co.	07/08/1990	0 kts.	0	0	0.00K	0.00K
Redwood Co.	06/03/1991	0 kts.	0	0	0.00K	0.00K
Redwood Co.	06/20/1991	0 kts.	0	0	0.00K	0.00K
Redwood Co.	05/10/1992	51 kts.	0	0	0.00K	0.00K
Redwood Co.	06/16/1992	0 kts.	0	0	0.00K	0.00K
Redwood Co.	06/16/1992	0 kts.	0	0	0.00K	0.00K
Redwood Co.	06/16/1992	0 kts.	0	0	0.00K	0.00K
Redwood Co.	06/16/1992	0 kts.	0	0	0.00K	0.00K
Redwood Co.	06/16/1992	0 kts.	0	0	0.00K	0.00K
Redwood Co.	06/16/1992	0 kts.	0	0	0.00K	0.00K
Redwood Co.	06/16/1992	0 kts.	0	0	0.00K	0.00K
Walnut Grove	06/20/1994	0 kts.	0	0	0.00K	0.00K
Redwood Falls	06/22/1995	51 kts.	0	0	0.00K	0.00K
Janesville	07/14/1995	61 kts.	0	0	0.00K	0.00K
Revere	07/27/1995	0 kts.	0	0	150.00K	0.00K
Wabasso	05/18/1996	61 kts.	0	0	0.00K	0.00K

Location Or County	Date	Wind Speed in Knots	Deaths	Injuries	Property Damage	Crop Damage
Redwood Falls	08/06/1996	52 kts.	0	0	0.00K	0.00K
Wabasso	08/06/1996	52 kts.	0	0	0.00K	0.00K
Milroy	10/29/1996	50 kts.	0	0	0.00K	0.00K
Walnut Grove	06/22/1997	50 kts.	0	0	0.00K	0.00K
Lamberton	07/13/1997	50 kts.	0	0	0.00K	0.00K
Milroy	07/25/1997	50 kts.	0	0	0.00K	0.00K
Morgan	05/18/1998	56 kts.	0	0	0.00K	0.00K
Morgan	05/18/1998	56 kts.	0	0	0.00K	0.00K
Belview	05/30/1998	55 kts.	0	0	0.00K	0.00K
Walnut Grove	06/24/1998	61 kts.	0	0	0.00K	0.00K
Vesta	06/24/1998	50 kts.	0	0	0.00K	0.00K
Redwood Falls	06/24/1998	55 kts.	0	0	0.00K	0.00K
Lamberton	06/24/1998	61 kts.	0	0	0.00K	0.00K
Wabasso	07/18/1998	52 kts.	0	0	0.00K	0.00K
Walnut Grove	07/18/1998	52 kts.	0	0	0.00K	0.00K
Sanborn	07/20/1998	52 kts.	0	0	0.00K	0.00K
Clements	07/20/1998	65 kts.	0	0	0.00K	0.00K
Clements	07/20/1998	65 kts.	0	0	0.00K	0.00K
Lamberton	07/03/1999	55 kts.	0	0	0.00K	0.00K
Sanborn	07/03/1999	65 kts.	0	0	0.00K	0.00K
Walnut Grove	08/07/2000	55 kts. E	0	0	0.00K	0.00K
Morgan	08/07/2000	55 kts. E	0	0	0.00K	0.00K
Lamberton	08/07/2000	55 kts. E	0	0	0.00K	0.00K
Vesta	06/10/2001	55 kts. E	0	0	0.00K	0.00K
Walnut Grove	07/21/2001	52 kts. E	0	0	0.00K	0.00K
Sanborn	07/21/2001	50 kts. E	0	0	0.00K	0.00K
Clements	04/16/2002	50 kts. E	0	0	0.00K	0.00K
North Redwood	05/29/2002	55 kts. E	0	0	0.00K	0.00K
Walnut Grove	07/28/2002	52 kts. E	0	0	0.00K	0.00K
Revere	07/28/2002	55 kts. E	0	0	0.00K	0.00K
Milroy	08/16/2002	52 kts. E	0	0	0.00K	0.00K
Lucan	08/16/2002	55 kts. E	0	0	40.00K	0.00K
Wabasso	08/16/2002	52 kts. E	0	0	0.00K	0.00K

Location Or County	Date	Wind Speed in Knots	Deaths	Injuries	Property Damage	Crop Damage
Redwood Falls	08/16/2002	52 kts. E	0	0	0.00K	0.00K
Redwood Falls	07/04/2003	55 kts. EG	0	0	0.00K	0.00K
Morgan	03/27/2004	56 kts. EG	0	0	0.00K	0.00K
Walnut Grove	05/16/2004	50 kts. EG	0	0	0.00K	0.00K
Lucan	08/23/2004	52 kts. EG	0	0	0.00K	0.00K
Lamberton	09/13/2004	62 kts. MG	0	0	0.00K	0.00K
Morgan	06/08/2005	52 kts. EG	0	0	0.00K	0.00K
Vesta	06/08/2005	50 kts. EG	0	0	0.00K	0.00K
Morgan	08/03/2005	50 kts. EG	0	0	0.00K	0.00K
Sanborn	06/16/2006	55 kts. EG	0	0	0.00K	0.00K
Wanda	06/16/2006	50 kts. EG	0	0	0.00K	0.00K
Clements	06/16/2006	55 kts. EG	0	0	0.00K	0.00K
Redwood Falls	06/16/2006	55 kts. EG	0	0	0.00K	0.00K
Redwood Falls	09/16/2006	51 kts. MG	0	0	0.00K	0.00K
Clements	06/16/2007	50 kts. EG	0	0	0.00K	0.00K
Redwood Falls	08/28/2007	54 kts. MG	0	0	0.00K	0.00K
Morgan	07/31/2008	58 kts. EG	0	0	0.00K	0.00K
Milroy	06/26/2010	56 kts. EG	0	0	0.00K	0.00K
Wabasso	06/26/2010	61 kts. EG	0	0	50.00K	0.00K
Clements	08/10/2010	52 kts. EG	0	0	10.00K	0.00K
Delhi	08/12/2010	56 kts. EG	0	0	15.00K	0.00K
Milroy	07/01/2011	87 kts. EG	0	0	1.500M	1.500M
Redwood Falls	07/01/2011	51 kts. MG	0	0	0.00K	0.00K
Redwood Falls	07/01/2011	54 kts. MG	0	0	0.00K	0.00K
Redwood Falls	07/01/2011	68 kts. MG	0	0	0.00K	0.00K
Redwood Falls	07/01/2011	55 kts. MG	0	0	0.00K	0.00K
Redwood Falls A	05/05/2012	50 kts. MG	0	0	0.00K	0.00K
Wabasso	05/27/2012	56 kts. EG	0	0	25.00K	0.00K
Redwood Falls	05/27/2012	56 kts. EG	0	0	25.00K	0.00K
Redwood Falls A	05/27/2012	56 kts. MG	0	0	0.00K	0.00K
Redwood Falls	08/01/2012	58 kts. MG	0	0	0.00K	0.00K
Redwood Falls	08/01/2012	57 kts. MG	0	0	0.00K	0.00K
Redwood Falls	08/01/2012	61 kts. MG	0	0	0.00K	0.00K

Location Or County	Date	Wind Speed in Knots	Deaths	Injuries	Property Damage	Crop Damage
Redwood Falls	08/01/2012	69 kts. MG	0	0	0.00K	0.00K
Redwood Falls	07/09/2013	50 kts. MG	0	0	0.00K	0.00K
Redwood Falls	08/31/2013	51 kts. MG	0	0	0.00K	0.00K
Vesta	08/06/2015	56 kts. EG	0	0	10.00K	0.00K
Delhi	06/12/2016	52 kts. EG	0	0	0.00K	0.00K
Morgan	06/17/2016	52 kts. EG	0	0	0.00K	0.00K
Clements	06/17/2016	56 kts. EG	0	0	0.00K	0.00K
Clements	08/18/2016	56 kts. EG	0	0	10.00K	50.00K
Highest Value Property Damage:			0	0	1.835M	1.550M

Figure B - 4. All extreme flood events recorded by NCDC (NOAA), 1997 through June 2017

Location or County	Date	Deaths	Injuries	Property Damage	Crop Damage
REDWOOD (ZONE)	03/15/1997	0	0	0.00K	0.00K
REDWOOD (ZONE)	03/23/1997	0	0	0.00K	0.00K
REDWOOD (ZONE)	03/27/1997	0	0	0.00K	0.00K
REDWOOD (ZONE)	04/01/1997	0	0	0.00K	0.00K
REDWOOD (ZONE)	04/01/1997	0	0	0.00K	0.00K
REDWOOD (ZONE)	04/01/1997	0	0	0.00K	0.00K
REDWOOD (ZONE)	05/01/1997	0	0	0.00K	0.00K
REDWOOD (ZONE)	04/01/2001	0	0	0.00K	0.00K
REDWOOD (ZONE)	05/01/2001	0	0	0.00K	0.00K
REDWOOD (ZONE)	05/30/2004	0	0	0.00K	0.00K
REDWOOD FALLS	03/13/2007	0	0	0.00K	0.00K
VESTA	03/19/2010	0	0	255.00K	0.00K
DELHI	03/25/2011	0	0	0.00K	0.00K
REDWOOD FALLS	06/18/2014	0	0	0.00K	0.00K
Highest Value Property Damage:		0		255.00K	0.00K

Figure B - 5. All severe snow events recorded by NCD (NOAA), 1996 through June 2017

Location or County	Date	Type	Deaths	Injuries	Property Damage
REDWOOD (ZONE)	01/17/1996	Blizzard	0	0	0.00K
REDWOOD (ZONE)	01/28/1996	Blizzard	0	0	0.00K
REDWOOD (ZONE)	03/23/1996	Heavy Snow	0	0	0.00K
REDWOOD (ZONE)	03/24/1996	Blizzard	0	0	0.00K
REDWOOD (ZONE)	11/22/1996	Heavy Snow	0	0	0.00K
REDWOOD (ZONE)	12/14/1996	Heavy Snow	0	0	0.00K
REDWOOD (ZONE)	12/17/1996	Blizzard	0	0	0.00K
REDWOOD (ZONE)	12/23/1996	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	01/09/1997	Blizzard	0	0	0.00K
REDWOOD (ZONE)	01/15/1997	Blizzard	0	0	0.00K
REDWOOD (ZONE)	01/22/1997	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	01/01/1999	Heavy Snow	0	0	0.00K
REDWOOD (ZONE)	01/17/1999	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	03/08/1999	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	01/19/2000	Heavy Snow	0	0	0.00K
REDWOOD (ZONE)	01/29/2001	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	02/07/2001	Heavy Snow	0	0	0.00K
REDWOOD (ZONE)	02/24/2001	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	11/26/2001	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	02/09/2002	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	03/08/2002	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	03/14/2002	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	02/02/2003	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	02/11/2003	Blizzard	0	0	0.00K
REDWOOD (ZONE)	11/22/2003	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	12/09/2003	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	12/15/2003	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	01/24/2004	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	02/01/2004	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	01/01/2005	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	01/21/2005	Blizzard	0	0	0.00K
REDWOOD (ZONE)	03/18/2005	Winter Storm	0	0	0.00K

Location or County	Date	Type	Deaths	Injuries	Property Damage
REDWOOD (ZONE)	12/29/2005	Heavy Snow	0	0	0.00K
REDWOOD (ZONE)	03/12/2006	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	02/24/2007	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	03/01/2007	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	12/01/2007	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	12/20/2008	Blizzard	0	0	0.00K
REDWOOD (ZONE)	01/12/2009	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	02/26/2009	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	12/08/2009	Blizzard	0	0	0.00K
REDWOOD (ZONE)	12/23/2009	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	01/06/2010	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	01/25/2010	Blizzard	0	0	0.00K
REDWOOD (ZONE)	02/07/2010	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	11/28/2010	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	12/03/2010	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	12/10/2010	Blizzard	0	0	0.00K
REDWOOD (ZONE)	12/20/2010	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	01/30/2011	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	02/20/2011	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	03/23/2011	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	12/08/2012	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	12/09/2012	Blizzard	0	0	0.00K
REDWOOD (ZONE)	02/10/2013	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	02/11/2013	Blizzard	0	0	0.00K
REDWOOD (ZONE)	02/18/2013	Blizzard	0	0	0.00K
REDWOOD (ZONE)	04/09/2013	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	04/18/2013	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	11/05/2013	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	12/04/2013	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	01/16/2014	Blizzard	0	0	0.00K
REDWOOD (ZONE)	01/22/2014	Blizzard	0	0	0.00K
REDWOOD (ZONE)	01/26/2014	Blizzard	0	0	0.00K
REDWOOD (ZONE)	02/20/2014	Blizzard	0	0	0.00K

Location or County	Date	Type	Deaths	Injuries	Property Damage
REDWOOD (ZONE)	02/26/2014	Blizzard	0	0	0.00K
REDWOOD (ZONE)	03/04/2014	Heavy Snow	0	0	0.00K
REDWOOD (ZONE)	04/03/2014	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	01/08/2015	Blizzard	0	0	0.00K
REDWOOD (ZONE)	11/30/2015	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	12/25/2015	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	02/02/2016	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	02/07/2016	Blizzard	0	0	0.00K
REDWOOD (ZONE)	11/18/2016	Blizzard	0	0	0.00K
REDWOOD (ZONE)	12/10/2016	Winter Storm	0	0	0.00K
REDWOOD (ZONE)	03/12/2017	Winter Storm	0	0	0.00K
Highest Value Property Damage:			0	0	0.00K

Figure B - 6. All severe ice storm events recorded by the NCDL (NOAA), 1996 through June 2017

Location or County	Date	Type	Deaths	Injuries	Property Damage
Redwood County	11/14/1996	Ice Storm	0	0	0
Highest Value Property Damage:			0	0	0

Figure B - 7. All extreme cold/wind chill events recorded by NCDL (NOAA), 1996 through June 2017

Location or County	Date	Type	Deaths	Injuries	Property Damage
REDWOOD (ZONE)	01/18/1996	Cold/wind Chill	0	0	0.00K
REDWOOD (ZONE)	01/31/1996	Cold/wind Chill	0	0	0.00K
REDWOOD (ZONE)	02/01/1996	Cold/wind Chill	0	0	0.00K
REDWOOD (ZONE)	12/24/1996	Cold/wind Chill	0	0	0.00K
REDWOOD (ZONE)	01/15/1997	Cold/wind Chill	0	0	0.00K
REDWOOD (ZONE)	02/10/2008	Cold/wind Chill	0	0	0.00K
REDWOOD (ZONE)	02/19/2008	Cold/wind Chill	0	0	0.00K
REDWOOD (ZONE)	12/15/2008	Extreme Cold/wind Chill	0	0	0.00K
REDWOOD (ZONE)	01/14/2009	Cold/wind Chill	0	0	0.00K
REDWOOD (ZONE)	01/07/2010	Extreme Cold/wind Chill	0	0	0.00K
REDWOOD (ZONE)	02/01/2011	Extreme Cold/wind Chill	0	0	0.00K

Location or County	Date	Type	Deaths	Injuries	Property Damage
REDWOOD (ZONE)	12/23/2013	Extreme Cold/wind Chill	0	0	0.00K
REDWOOD (ZONE)	12/29/2013	Extreme Cold/wind Chill	0	0	0.00K
REDWOOD (ZONE)	01/05/2014	Extreme Cold/wind Chill	0	0	0.00K
REDWOOD (ZONE)	01/22/2014	Extreme Cold/wind Chill	0	0	0.00K
REDWOOD (ZONE)	01/27/2014	Extreme Cold/wind Chill	0	0	0.00K
REDWOOD (ZONE)	03/02/2014	Extreme Cold/wind Chill	0	0	0.00K
REDWOOD (ZONE)	01/17/2016	Extreme Cold/wind Chill	0	0	0.00K
REDWOOD (ZONE)	12/17/2016	Extreme Cold/wind Chill	0	0	0.00K
Highest Value Property Damage:			0	0	0

Figure B - 8. All extreme heat events recorded by NCDC (NOAA), 1996 through June 2017

Location or County	Date	Type	Deaths	Injuries	Property Damage
REDWOOD (ZONE)	07/23/1999	Heat	0	0	0.00K
REDWOOD (ZONE)	07/29/1999	Heat	0	0	0.00K
REDWOOD (ZONE)	07/30/2001	Heat	0	0	0.00K
REDWOOD (ZONE)	08/01/2001	Heat	0	0	0.00K
REDWOOD (ZONE)	08/04/2001	Heat	0	0	0.00K
REDWOOD (ZONE)	07/30/2006	Heat	0	0	0.00K
REDWOOD (ZONE)	07/18/2011	Excessive Heat	0	0	1.000M
REDWOOD (ZONE)	08/25/2013	Excessive Heat	0	0	0.00K
REDWOOD (ZONE)	07/20/2016	Excessive Heat	0	0	0.00K
Highest Value Property Damage:			0	0	1.000M

Appendix C – Resolutions after FEMA Review

Appendix D - Planning Team Meetings



May 6, 2019

Hello,

Redwood County has initiated the All-Hazard Mitigation Plan (AHMP) *update* process and invites you to attend the two planning meetings. You were identified as a potential planning team member based on your previous participation in Redwood County's AHMP planning in 2012 and/or your representation as a key stakeholder. This process is focused on identifying the natural and man-made hazards that pose a risk to Redwood County, its cities, and its townships.

The meetings will be:

1. Thursday, **October 18**, 2018 from **1:00 PM-2:30 PM**
2. Thursday, **October 25**, 2018 from **1:00 PM-2:30 PM**

Both meetings will be held at the **Wabasso Community Center** (1429 Front Street, Wabasso, MN 56293).

Please note the meetings are on separate topics. At the first meeting we will be going over the basics of hazard mitigation, ranking the hazards, and looking over the strategies from the previous plan. At the second meeting we will be looking at the flood hazard analysis maps and discussing new strategies to place in the updated hazard mitigation plan. See the attached agendas for more details. Please plan to attend both meetings if possible.

All incorporated cities must participate to be eligible for FEMA Hazard Mitigation Assistance whereas townships are covered under the county, but are invited to participate also. If you know of other Redwood County officials or residents who would have a vested interest in this plan update, please forward this information to them. It is important to get as much input as possible when updating this plan.

Feel free to contact myself or Maxwell Kaufman at the Southwest Regional Development Commission (507-836-1633) with any questions and I look forward to starting this process with you!

Regards,

Jim Sandgren
Redwood County Emergency Management Director

507-637-4035 | jim_s@co.redwood.mn.us

Redwood County All-Hazard Mitigation Plan Update
Meeting #1 – Planning Process

Date: Thursday, October 18, 2017
Time: 1:00 PM – 2:30 PM
Location: Wabasso Community Center,
1429 Front Street, Wabasso, MN 56293

Agenda

- 1:00 PM Introductions
- 1:05 PM Presentation – Maxwell Kaufman, Southwest Regional Development Commission
Intro to Hazard Mitigation Planning & Benefits
- Planning Process/Timeline
 - Meeting #2
 - Public Hearing
 - Types of Mitigation Assistance
- 1:35 PM Hazards identified in initial plan
- Hazards from 2012 plan will be reviewed and updated per their current status. Historical data since the initial plan will be discussed to determine if a hazard/mitigation strategy is still applicable or should be deleted.
 - Hazards not addressed in the initial plan may also be added. All participating jurisdictions should be involved with hazard validation.
- 2:20 PM CPRI Worksheet Handout & Explanation
- 2:25 PM Questions, Comments, Observations
- 2:30 PM Adjourn

Meeting #1 Deliverables

- Better understanding of planning process
- Better understanding of research and data gathering responsibilities
- Updated list of hazards
- Completed CPRI's

Redwood County Hazard Mitigation Meeting #1
Wabasso Community Center
Thursday, October 18, 2018 | 1:00 PM-2:30 PM

Notes

Hazards were reviewed and mitigation strategies updated as follows:

Hazard - Strategy	Mitigation Action	Status	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation
Ag Disease – Awareness	Provide information on ag disease and prevention to producers and residents.	Revised	Redwood County, all Cities	RCEO, SWCD, Ext, FSA, MDA, MDH	
Ag Disease – Prevention	Monitor invasive insect species, such as emerald ash borer.	Revised	Redwood County	RCEM, SWCD, MDA, DNR, Ext, RCEO	
Severe Storms – Structural	Conduct a study to determine what places in the county and each city are deficient in safe rooms; Construct at least one new safe room or improve warning system in one community each year.	Revised	Redwood County, all Cities	RCEM, RCEO, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd	Currently no safe rooms in Redwood County
Severe Storms – Awareness	Educate local schools, nursing homes, assisted living, hospitals, etc on importance of doing a “Severe Weather Awareness Week” workshop for their staff, including identifying evacuation routes and safe rooms.	Carried Over	Redwood County, Redwood Falls, Morgan, Wabasso, Milroy, Lamberton, Walnut Grove	RCEM, Hosp, Sch	
Severe Storms – Awareness	Make nursing home staff aware of the need/importance of providing shelter locations and evacuation routes for residents in case of severe weather.	Carried Over	Redwood County	RCEM	
Severe Storms – Prevention	Ensure manufactured home parks have updated emergency management plans; work with park managers to improve communication during severe storms; ensure residents are familiar with emergency plans, evacuation routes, safe rooms.	Carried Over	Redwood County, Redwood Falls	RCEM, CiRF	This should be included in building codes.

Hazard - Strategy	Mitigation Action	Status	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation
Severe Storms – Prevention	Encourage all residents and public building to have NOAA Public Alert Radios with SAME technology and to sign up for CodeRED alerts, especially in rural areas away from community sirens.	Revised	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiMo, CiRF, CiR, CiSA, CiSe, CiV, CiWb, CiWG, CiWd	
Severe Storms – Protection	Ensure that critical facilities have access to backup power generators. Examine needs and costs for providing backup power generation where none currently exists.	Revised	Redwood County, Clements, Lamberton, Lucan, Redwood Falls, Seaforth, Wabasso, Walnut Grove	RCEM, CiC, CiLa, CiLu, CiRF, CiSe, CiWb, CiWG Hosp	No backup at Countryview Assisted Living in Walnut Grove
Severe Storms – Protection	Harden utilities, replace overhead w/ underground power lines.	Revised	Redwood County, Redwood Falls	RCEM, RCEO, CiRF, Utilities	City of Lucan is done.
Severe Storms – Protection	Use road design and living snow fences to control snow.	Carried Over	Redwood County	RCHwy, SWCD, MnDOT	
Severe Storms – Protection	Scope at least one infrastructure retrofit project in one community each year.	Carried Over	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiCo, MiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd	
Drought – Prevention	Work with the MN Department of Health to develop & implement Wellhead Protection Plans and educate the public on the importance of wellhead protection and water conservation.	Revised	Redwood County, Belview, Clements, Redwood Falls, Sanborn	RCEO, SWCD, CiB, CiC, CiRF, CiSa, MDH	City of Clements in currently in progress.
Drought – Prevention	Encourage development of ordinances that contain conservation provisions and use restrictions in times of severe drought.	Complete	Redwood County	RCEO, RCEM, BWSR	All cities have DNR water appropriation plans, nder which this is required.
Wildfire – Prevention	Conduct wildfire risk assessments periodically.	Carried Over	Redwood County, Lamberton, Redwood Falls	RCEO, RCSO, CiLa, CiRF, Fire, DNR	
Wildfire – Awareness	Participate in the “Firewise” education program.	Carried Over	Redwood County	RCEM, Fire	
Wildfire – Emergency Services	Develop management plans that outline the scheduled maintenance of conservation properties.	Carried Over	Redwood County	FSA, DNR, SWCD	

Hazard - Strategy	Mitigation Action	Status	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation
Wildfire – Emergency Services	Encourage development of evacuation plans, which clearly delineate routes residents should take in the event of a large-scale wildfire.	Carried Over	Redwood County	RCEM, RCEO, RCSO, RCHwy, Twp, DNR	
Wildfire – Protection	Encourage township road authorities to cut back road ditches and bale where appropriate, which will limit potential for the spreading of wildfire.	Carried Over	Redwood County	RCHwy, Twp	
Wildfire – Awareness	Develop a program to educate property owners on the need for firebreaks before they enroll land in CRP or CREP.	Carried Over	Redwood County	RCEM, SWCD, DNR, FSA, Ext	
Hazardous Materials – Awareness	Continue awareness of the county household hazardous waste facility, its importance, and how to utilize services.	Revised	Redwood County	RRRSWA	
Hazardous Materials – Prevention	Develop Geographic Information Systems capability to map locations of fixed facilities using hazardous materials and associated transportation corridors.	Revised	Redwood County, Redwood Falls	RCEM, RCEO, RRRSWA, CiRF, MDA, MDH, MPCA	
Hazardous Materials – Prevention	Review the water plan for potential groundwater contaminants within the county.	Revised	Redwood County	RCEO, SWCD	Watershed-based plans cross more than one county and are about 2-3 years out.
Hazardous Materials – Prevention	County, townships, and cities with airports/flightpath review airport improvement plans and zoning.	Carried Over	Redwood County, Redwood Falls	RCEO, CiRF, Twp, MnDOT	
Civil Disturbance – Emergency Services	Complete and maintain thorough community risk and threat assessments.	Carried Over	Redwood County	RCSO, LE, RCEM	
Civil Disturbance – Prevention	Consider zoning code changes and updates that reflect building measures to withstand terrorist attack.	Carried Over	Redwood County, Redwood Falls	RCEO, CiRF, Sch	

Hazard - Strategy	Mitigation Action	Status	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation
Civil Disturbance – Prevention	Increase security at critical facilities, add fencing, alarm systems, and surveillance cameras as appropriate.	Carried Over	Redwood County	RCSO, LE, RCEM	Surveillance exists on public buildings in Redwood Falls.
Civil Disturbance – Prevention	Limit public access in high profile critical facilities in times of increased potential for terrorist activity. These times could follow the federal government (Dept. of Homeland Security) warning system.	Revised	Redwood County	RCEM, RCSO, FSA, LE	
Structure Fires – Prevention	Ensure that snow removal ordinances are followed and encourage building construction to include fire/smoke alarms and sprinkler systems.	Carried Over	Redwood County	RCEM, RCEO, RCSO, Fire	This is in Redwood Falls' building code.
Structure Fires – Emergency Services	Ensure each property has road or alley access of sufficient size for modern fire fighting vehicles.	Complete ?	Redwood County	RCEO, Fire	This is mandatory.
Structure Fires – Awareness	Work with community fire chiefs to educate and encourage residents on the need for having fire alarms and chimney inspections.	Carried Over	Redwood County	RCEM, Fire	
Public Health – Awareness	Improve coordination and communication with local media.	Carried Over	Redwood County	RCEM, SWHHS	
Public Health – Emergency Services	Work with Public Health Service and MDH on the mass distribution of needed medicines and supplies for public health emergencies.	Carried Over	Redwood County	RCEM, SWHHS	
Public Health – Emergency Services	Maintain a quarantine plan in coordination with local doctors and other health professionals.	Carried Over	Redwood County	RCEM, RCSO, LE, SWHHS, Hosp	This plan might exist?
Public Health – Emergency Services	Update Redwood County Emergency Operations Plan Public Health annex.	Revised	Redwood County	RCEM, SWHHS	

Hazard - Strategy	Mitigation Action	Status	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation
Flooding/Dam Failure – Emergency Services	Work with communities to develop their own EOP.	Revised	Redwood County, Redwood Falls	RCEM, RCHwy, SWCD, CiRF	Redwood Falls is developing their and will release a draft template that other cities can use.
Flooding/Dam Failure – Prevention	Discourage future development within floodplains; consider minor localized flood reduction projects, especially to reduce overland flooding.	Revised	Redwood County, all Cities	ALL	In the floodplain ordinance.
Flooding/Dam Failure – Protection	Encourage sound construction practices and agricultural Best Management Practices (BMPs) in flood fringe areas.	Revised	Redwood County, all Cities	RCEO, SWCD, BWSE, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd, Twp	
Flooding/Dam Failure – Prevention	Implement dFIRM floodplain maps.	Carried Over	Redwood County, Redwood Falls, Sanborn, Seaforth	RCEO, CiRF, CiSa, CiSe, DNR, FEMA	Redwood Falls and Seaforth are in the process.
Flooding/Dam Failure – Preventions	Jurisdictions not currently participating in the National Flood Insurance Program (NFIP) will review their flood hazard areas and consider participation.	Carried Over	Delhi, Revere, Vesta, Walnut Grove, Wanda	DNR, CiD, CiR, CiV, CiWG, CiWd	
Flooding/Dam Failure – Prevention	Encourage all property owners in flood hazard areas to purchase flood insurance.	Carried Over	Redwood County, Redwood Falls, Sanborn, Seaforth, Wanda	RCEO, CiRF, CiSa, CiSe, CiWd	
Flooding/Dam Failure – Protection	Develop a program to voluntarily acquire, relocate, or elevate at-risk structures in floodplains.	Carried Over	Redwood County, Redwood Falls, Sanborn	RCEM, RCEO, CiRF, CiSa, DNR, HSEM	
Flooding/Dam Failure – Protection	Retrofit infrastructure to reduce impacts of flooding; stabilize/replace at-risk bridges and slopes prone to sloughing.	Revised	Redwood County, Belview, Redwood Falls, Sanborn, Seaforth	RCHwy, RCEO, CiB, CiRF, CiSa, CiSe	

COMPLETED/DELETED ACTIONS

Hazard - Strategy	Mitigation Action	Status	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation
Severe Storms – Protection	Harden utilities, replace overhead with underground power lines.	Complete	Lucan	CiLu	Done for Lucan since 2012.
Severe Storms – Emergency Services	Implement county-wide public alert telephone-text notification system.	Complete	Redwood County	RCEM	CodeRED covers this. Strategy consolidated with strategy 7.
Drought – Prevention	Educate the public of the importance of wellhead protection and water conservation.	Consolidated	Redwood County	RCEO, SWCD, MDH, Ext, RWS	Consolidated with strategy 12.
Hazardous Materials – Prevention	Update the Emergency Response Plan to identify alternate sources of drinking water, including the location of adequate amounts of bottled water.	Complete	Redwood County	RCEM, RWS	This is included in the DNR water appropriation plan.
Public Health – Protection	Ensure that hospitals have access to back up power generators.	Complete	Redwood County, Redwood Falls	RCEM, SWHHS, CiRF, Hosp	Complete.
Plan Maintenance – Prevention	Budget to perform additional data collection and analysis to identify vulnerable structures in specific detail in the next plan update.	Complete	Redwood County	RCEM, HSEM	This has been budgeted for the 2019 and future updates.
Plan Maintenance – Prevention	Budget to perform estimates of potential monetary losses to structures, contents, and functions in specific detail in next plan update.	Complete	Redwood County	RCEM, HSEM	This has been budgeted for the 2019 and future updates.
Flooding/Dam Failure – Prevention	Indicate on zoning forms if property is in flood hazard area.	Complete	Redwood County, Redwood Falls, Vesta	RCEO, CiRF, CiV	Complete.

Redwood County Multi Hazard Mitigation Plan (MHMP)



*Planning Team Kickoff Meeting
October 18, 2018*

**Redwood County Emergency Management
&
Southwest Regional Development Commission**

Agenda

- Welcome & Introductions
 - Jim Sandgren, Redwood County Emergency Management Director
- Presentation: Redwood County All-Hazard Mitigation Plan
 - Maxwell Kaufman, Southwest Regional Development Commission
 - AHMP Overview
 - Hazard Ranking
 - Mitigation Actions
- Feedback
- Next Steps



What is Hazard Mitigation(HM)?

- HM is sustained action to reduce or eliminate long-term risk to people and their property from hazards.
- HM planning is the process local governments use to identify risks and vulnerabilities associated with natural disasters, and develop long-term strategies for protecting people and property from future hazard events.
- HM planning allows communities to strategically plan for and work together to implement activities that are cost-effective, technically feasible and environmentally sound BEFORE a disaster strikes.

IDENTIFY
THE HAZARDS
ASSESS
VULNERABILITIES
REDUCE
THE RISKS

Planning Process Timeline

- Kickoff - *Completed*
 - HSEM, regional EMDs, SRDC
- Meeting 1 - *Today*
 - Overview, Choose & Rank Hazards, Update Strategies
- Meeting 2
 - Discuss HAZUS Assessment, Hazard Rankings, and Existing & Potential Mitigation Projects
- Meeting 3 (Online)
 - Online review as a Mitigation Strategies Subcommittee
 - Confirm updated mitigation strategies
- Plan Review Subcommittee Meeting (review via email)
- Public Hearing



AHMP Planning Team Role

1. Provide input on development of the plan
2. Rank hazards, prioritize mitigation strategies, and identify projects for implementation.
3. Assist with public outreach and participate in public meetings.
4. Review draft plans and provide feedback.
5. Facilitate final adoption of the AHMP by local governments.

About the Plan

- The All Hazard Mitigation Plan (MHMP) is a requirement of the Federal Disaster Mitigation Act of 2000 (DMA 2000). The development of a local government plan is required in order to maintain eligibility for certain federal disaster assistance and hazard mitigation funding programs.
- Content:
 - Redwood County physical and social profile
 - Asset Inventory
 - Hazard Assessment and Vulnerability Analysis
 - Mitigation Actions

Hazard Identification

- This plan is a multi-jurisdictional plan that covers Redwood County, including all 15 incorporated cities, and participating townships.
- Hazard Identification
 - Existing County Plans
 - Hazard Ranking
 - Record of Events (FEMA, NCEM)
 - GIS and HAZUS (Flood only)

While only cities passed resolutions of participation in the plan, any townships can also participate and are encouraged to participate if they have specific hazard mitigation needs.

What hazards can be addressed?

- An All-Hazard Mitigation Plan looks primarily at natural disasters, which can include any of the following (not all required):

Drought	Earthquake	Erosion	Extreme Temperatures
Flood (+Dam/Levees)	Hail	Landslide	Lightning
Sea Level Rise	Severe Wind	Severe Winter Weather	Storm Surge
Subsidence	Tornado	Tsunami	Wildfire

Other Hazards

- Non-natural hazards (other) are not required by the DMA 2000 to be addressed in the AHMP and are not eligible for FEMA mitigation funds, but may be eligible for mitigation funds from other sources.
- Can include, but not limited to:
 - Civil Disturbance/Terrorism
 - Dam, Impoundment, & Culvert Failure
 - Hazardous Materials
 - Public Health Emergencies
 - Transportation Infrastructure
 - Utility Failure
 - Water Supply Contamination

The mitigation plans address natural hazards per the Stafford Act and 44 CFR. The EPA and other agencies regulate hazardous materials that fall under their authorities so they don't become a catastrophe. This program does not fund human and animal health and safety since they fall under the authority of HHS, CDC, and USDA among others.

An example of how this may work is in regards to a wastewater treatment plant vulnerable to flooding. The mitigation actions that could be funded are installation of a floodwall or elevating the electrical and pumps. Commercial facilities can be flood proofed.

This is why it is important to list hazmat or such facilities as secondary hazards since there may be some funding.



Redwood County Historical Hazards Review

Hazard Events (January 2000 – July 2017)

Natural

- Blizzards: 17
- Drought: 0
- Earthquake: 0
- Extreme Cold: 11
- Extreme Heat: 3
- Flash Floods: 7
- Floods: 7
- Hail: 48
- Lightning: 1

- Thunderstorm Wind: 33

- Tornadoes: 4
- Wildfire: 0
- Winter Storms: 41

Other

- Aviation: 2
- Hazardous Materials: 20

Only earthquake in region was in Pipestone county in 1964.

Lightning is much larger, but these are only the events recorded by NOAA.

Hail events are the largest in terms of number, followed by Winter Storms.

Flooding is what FEMA likes to focus on and what will be done by UMD with the HAZUS analysis.

Hazardous - USCG National Response Center – EPA Hazardous Incidents Reports. Accessed 8/14/17. Available: <http://nrc.uscg.mil/>

Aviation - NTSB Aviation Accident Database & Synopses. Accessed: 8/15/17. Available: <https://www.nts.gov/investigations/AccidentReports/Pages/railroad.aspx>

Types of FEMA Declarations

Major Disaster Declarations: The President can declare a major disaster for any natural event, including any hurricane, tornado, storm, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, or drought, or, regardless of cause, fire, flood, or explosion, that the President determines has caused damage of such severity that it is beyond the combined capabilities of state and local governments to respond.

Emergency Declarations: The President can declare an emergency for any occasion or instance when the President determines federal assistance is needed. Emergency declarations supplement State and local or Indian tribal government efforts in providing emergency services, such as the protection of lives, property, public health, and safety, or to lessen or avert the threat of a catastrophe in any part of the United States.

A major disaster declaration provides a wide range of federal assistance programs for individuals and public infrastructure, including funds for both emergency and permanent work.

Emergency Declarations - The total amount of assistance provided for in a single emergency may not exceed \$5 million. The President shall report to Congress if this amount is exceeded.

FEMA-Declared Disasters in Redwood County						
Incident	Declaration Date and Disaster Number	Incident Period	Total PA Obligated by FEMA for Disaster in Minnesota	Total PA Obligated by FEMA for Disaster in Redwood County	Individual Assistance in Minnesota	Individual Assistance in Redwood County
Severe Storms, Straight-Line Winds, Flooding, Landslides, And Mudslides	DR-4182 7/21/2014	6/11/2014- 7/11/2014	\$41,013,710	\$519,946	No	No
Severe Storms, Flooding, And Tornadoes	DR-4009 7/28/2011	7/1/2011- 7/11/2011	\$11,519,032	\$490,706.62	No	No
Severe Storms, Flooding	DR-1982 5/10/2011	3/16/2011- 5/25/2011	\$20,790,850	\$293,907	No	No
Severe Storms And Flooding	DR-1941 10/13/2010	9/22/2010- 10/14/2010	\$25,963,422	\$214,600	No	No
Flooding	DR-1900 4/19/2010	3/1/2010-4/26/2010	\$12,721,045	\$191,634	No	No
Flooding, Severe Winter Storms, Flooding, And Tornadoes	DR-1370 5/16/2001	3/23/2001-7/3/2001	\$34,907,042	\$332,791	\$3,650,492	Unknown
Flooding, Severe Flooding, High Winds, Severe Storms	DR-1175 4/8/1997	3/21/1997- 5/24/1997	\$230,488,750	Unknown	Unknown	Unknown
Severe Winter Storms	DR-1158 1/16/1997	1/3/1997 – 2/3/1997	Unknown	Unknown	No	No
Severe Storms, Tornadoes & Flooding	DR-993 6/11/1993	5/6/1993 – 8/25/1993	Unknown	Unknown	Yes \$ Unknown	Unknown
Severe Storms, Tornadoes & Flooding	DR-946 6/26/1992	6/16/1992- 6/20/1992	Unknown	Unknown	Yes \$ Unknown	Unknown
Flooding	DR-255 4/18/1969	4/18/1969	Unknown	Yes \$ Unknown	Unknown	Yes \$ Unknown
Flooding	DR-188 4/11/1965	4/11/1965	Unknown	Yes \$ Unknown	Unknown	Yes \$ Unknown

- 7 FEMA-Declared Disasters
- 5 included flooding
- 4 included severe storms
- 2 included tornadoes
- 2 included severe ice/winter storms
- 1 included straight-line winds, landslides, and mudslides

FEMA-Declared Emergencies in Redwood County

Incident	Declaration Date and Disaster Number	Incident Period	Individual Assistance in Minnesota	Public Assistance (all affected areas)
Flooding	EM-3310 3/19/2010	3/1/2010- 4/26/2010	No	Yes \$ Unknown
Hurricane Katrina Evacuation	09/13/2005 EM-3242	08/29/2005 to 10/1/2005	No	\$2,391,613
Drought	06/17/1976 EM-3013	06/17/1976	No	Yes \$ Unknown

Discussion: Past Hazards Included for Mitigation

Natural

- Agricultural Disease (animal/crop)
- Blizzard & Winter Storms
- Drought
- Earthquake
- Erosion
- Extreme Temperatures (Heat)
- Flood (+Dam/Levee Failure)
- Hail
- Landslide & Subsidence
- Lightning
- ▲ Sea Level Rise
- ▲ Storm Surge
- Tornado & Straight Line Winds
- ▲ Tsunami
- Fire - Wildfire

Man-Made

- Civil Unrest/Terrorism
- Dam Failure
 - (combined with flooding for analysis)
- Fire – Structure & Vehicle Fires
 - (combined with wildfire for analysis)
- Hazardous Materials
- Public Health & Infectious Disease
- Transportation Infrastructure
- Utility Failure
- Water Supply Contamination
 - (combined with hazardous materials for analysis)

Those in red had mitigation strategies in the 2012 plan.



CPRI – Ranking your County’s Hazards

Hazard Ranking – CPRI Worksheet

Worksheet that allows each jurisdiction to rank the risk that each hazard poses to the jurisdiction.

- Probability
- Magnitude/Severity
- Warning Time
- Duration

0.40 Probability	0.3 Magnitude / Severity	0.10 Warning Time	0.1 Duration
1 - Improbable / Rare <input type="checkbox"/> Event is probable within the calendar year. <input type="checkbox"/> Event has up to 1 in 1000 chance of occurring (1 in 1000). <input type="checkbox"/> Chance of event is greater than 20% likely per year. <input type="checkbox"/> Event is "highly likely" to occur.	1 - Catastrophic <input type="checkbox"/> Local jurisdiction is overwhelmed and unable to effectively respond to the hazard. Local resources are inadequate or non-existent. Complete loss of communications. Masses regional, state, FEMA and federal response is required. Federal disaster declaration. <input type="checkbox"/> Local and regional medical services are unable to manage the volume of injuries and fatalities. Mass evacuation, sheltering, and care of displaced residents, medical patients, high risk and vulnerable populations are required. <input type="checkbox"/> Loss of public utilities, government and essential services for more than 1 month. Widespread destruction of critical infrastructure, public and private property. More than 50% of critical and non-critical facilities and infrastructure damaged or destroyed. Extended emergency response operations lasting more than 1 month may be required.	<input type="checkbox"/> No notice up to 6 hours	<input type="checkbox"/> More Than 1 Week
2 - Likely <input type="checkbox"/> Event is probable within the next three years. <input type="checkbox"/> Event has up to 1 in 3 years chance of occurring (1 in 33%). <input type="checkbox"/> Chance of event is greater than 20% but less than or equal to 33% per year. <input type="checkbox"/> Event is "likely" to occur.	2 - Critical <input type="checkbox"/> Local jurisdiction is unable to effectively respond without District-level mutual aid support and significant state assistance. Local resources have been expended and local agencies have reached the limits of their capabilities. Communications seriously degraded with significant impact on operations. State disaster. <input type="checkbox"/> Local medical services are unable to manage number of injuries and fatalities. Patients require transportation to regional medical facilities outside of the affected areas. Local area evacuations, sheltering, and care of displaced residents, medical patients, high risk and vulnerable populations are required. <input type="checkbox"/> Loss of public utilities, government and essential services for up to 1 month. Significant damage to critical infrastructure, public and private property over a large area. Up to 50% of critical and non-critical facilities and infrastructure damaged. Emergency response operations lasting up to 1 month may be required.	<input type="checkbox"/> 6 to 12 Hours	<input type="checkbox"/> Up to 1 Week
3 - Possible <input type="checkbox"/> Event is probable within the next five years. <input type="checkbox"/> Event has up to 1 in 5 years chance of occurring (1 in 20%). <input type="checkbox"/> Chance of event is greater than 10% but less than or equal to 20% per year. <input type="checkbox"/> Event could "possibly" occur.	3 - Moderate <input type="checkbox"/> Local jurisdiction is able to effectively respond with significant inter-local mutual aid support and limited state assistance. Local and mutual aid resources are adequate to support response. Communications systems operating near capacity. Local medical services are able to manage volume of injuries and fatalities but are near the limits of their capabilities. Only critically injured patients are diverted to facilities outside of the affected areas. Limited evacuations and sheltering required. <input type="checkbox"/> Loss of public utilities, government and essential services for up to 1 week. Significant damage to critical infrastructure, public and private property over a localized area. Up to 20% of critical and non-critical facilities and infrastructure damaged. Response operations lasting up to 1 week may be required.	<input type="checkbox"/> 12-24 Hours	<input type="checkbox"/> Up to 1 Day
4 - Unlikely <input type="checkbox"/> Event is probable within the next 10 years. <input type="checkbox"/> Event has an up to 1 in 10 years chance of occurring (1 in 10%). <input type="checkbox"/> Chance of event occurrence is less than or equal to 10%. <input type="checkbox"/> Event is "unlikely" to occur.	4 - Manageable <input type="checkbox"/> Local jurisdiction is able to manage incident with standard mutual aid and little or no state assistance. Local resources are adequate to support response. Communications system operating normally. Local emergency. <input type="checkbox"/> Local medical services are able to manage number of injuries and fatalities with on-hand personnel and resources. <input type="checkbox"/> Loss of public utilities, government and essential services for up to 24 hours. Damage contained to a single incident scene and immediate area. Up to 5% of critical and non-critical facilities and infrastructure damaged. Response operations lasting up to 72 hours may be required.	<input type="checkbox"/> 24+ Hours	<input type="checkbox"/> Up to 6 Hours



Mitigation Strategies

Mitigation Strategies

- **Prevention (P):** Government, administrative, or regulatory actions.
- **Property Protection (PP):** Removal or modification of existing buildings or structures to protect them from a hazard.
- **Public Education and Awareness (PE):** Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them.
- **Natural Resource Protection (NRP):** Actions that minimize hazard losses and preserve or restore the functions of natural systems.
- **Emergency Services (ES):** Actions that protect people and property during and immediately after a disaster or hazard event. Services include warning systems, emergency response services, and protection of critical facilities.
- **Structural Projects (SP):** Actions that involve the construction of structures to reduce the impact of a hazard, for example: floodwalls, safe rooms.

Historical Hazard Mitigation Funding in Redwood County

Year	Project Description	Sub-Grantee	Federal Share
1997	Living Snow fence: Planting of trees and grasses. These will intercept blowing snow.	Redwood soil and Water Conservation District	\$9,101
1997	Living Snow fence: Planting of trees and grasses. These will intercept blowing snow.	Minnesota Department of Transportation-District-7	\$247,952
2002	Redwood Electric Cooperative - Line Replacement	Redwood Electric Cooperative	\$648,244
2007	Redwood County All Hazard Mitigation Plan Update	Southwest Regional Development Commission	\$18,740
2007	Balsa Avenue, 0.25 miles north of Junction with 305th Street in Underwood Township. Recondition and place aggregate base and bituminous pavement on roadway (approximately 400 feet). Please riprap on roadway slopes adjacent to pavement to effectively create a spillway for over topping flood water. Purpose of the Project - This section of roadway overtops due to excess water from the Redwood River. It is a natural spillway for the Redwood and provides relief for the bridge immediately north of the site. It is prone to overtopping and washout each spring and after large rain events to the west.	Underwood (Township of)	\$46,500
2013	City of Redwood Falls, MN acquisition and demolition of properties eminently threatened by landslide. A total of 6 parcels: Blossom Town: parcel # 88-036-4210 / Tamara Brown Insurance Agency: Parcel #'s 88-865-0180, 88-131-3300, & 88-865-0200 / Charles & Marlene Heins: Parcel #'s 88-865-0160 & 88-131-3290-NLODAHL-	City of Redwood Falls	\$435,939

Implementation of Mitigation Actions

- Happens at every jurisdictional level.
- Happens in partnership with other local, State, and Federal agencies and non-profit organizations.
- Can be inexpensive (“low-hanging fruit”)
- Can be high-cost (some are HMA-eligible)
- Some may be implemented quickly, others may be ongoing, and some may occur over several years.

The impact of hazards on people and property can only be reduced when efforts are made to mitigate against them before they occur.

Not everything will be something that FEMA can cover. Their funds are limited. So sometimes things might have to be written in to a budget at a county or city level.

Mitigation Actions Eligible for HMA

- Retrofit or construction of safe room facilities to protect public during extreme wind events.
- Purchase of generators for backup power to support the operation of essential function in critical facilities in the event of severe storms.
- Burying or strengthening of power lines to reduce the risk of power outages from downed lines during a severe storm.
- Install new warning systems in identified vulnerable locations
- Mitigation measures to reduce the threat of wildfire.
- Infrastructure retrofit for flood prone areas.
- Minor localized flood reduction projects to lessen the frequency of severity of flooding and decrease predicted flood damages.
- Relocate flood-prone properties or acquire and demolish flood prone properties.
- Dry-proof or wet-proof facilities that are flood prone.

- Retrofit or construction of safe room facilities to protect public during extreme wind events.
 - Locations may include schools, mobile home parks, campgrounds, or other areas where there are populations vulnerable to high winds and tornado events.
- Purchase of generators for backup power to support the operation of essential function in critical facilities in the event of severe storms.
 - Critical facilities may include police and fire stations, hospitals, and water and sewer treatment facilities, and other facilities that the county deems critical.
- Burying or strengthening of power lines to reduce the risk of power outages from downed lines during a severe storm.
 - Where it is feasible and cost-effective as part of new construction or retrofit.
- Install new warning systems in identified vulnerable locations
 - Used to alert people in high-risk, vulnerable areas such as campgrounds, parks and rural residents out of reach of other existing warning siren systems to approaching severe weather.
- Mitigation measures to reduce the threat of wildfire.
 - Activities such as creation of defensible space, application of ignition-resistant construction, hazardous fuels reduction, and installation of external wildfire sprinkler systems.
- Infrastructure retrofit for flood prone areas.
 - To make mitigation improvements for structures such as culverts, road, bridges, and government buildings.

- Minor localized flood reduction projects to lessen the frequency of severity of flooding and decrease predicted flood damages.
 - Such as installation or modification of culverts; stormwater management activities, such as creating retention and detention basins, protection of sanitary sewer lift stations in flood-prone areas, installation of flow-rate meters (stream gauges) on rivers and streams that are prone to flooding high-risk, vulnerable properties.
- Relocate flood-prone properties or acquire and demolish flood prone properties.
 - Located in the special flood hazard area and outside of the special flood hazard area.
- Dry-proof or wet-proof facilities that are flood prone.
 - Reduce potential infrastructure flood damages on utilities such as wastewater treatment, pipelines, and power facilities by dry-proofing or wet-proofing facilities that are flood prone.

Homework

- Review past plan's mitigation strategies (handout)
- Determine if they are:
 - Completed
 - Need to be Deleted
 - In Progress
 - Need to be put into updated plan

Next Steps

- 2nd Planning Team meeting
 - Next Thursday, October 25, 2018 at 1:00 PM
 - Wabasso Community Center
- CPRI Worksheet (for anyone not present today)
 - Explanation
 - Will be sent as Excel File (unless paper copy is needed)
- Hazard Mitigation Strategies 2012
 - Update your applicable strategies

Redwood County MHMP Contacts:

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Emergency Management Director – Redwood County

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jim_s@co.redwood.mn.us | 507-637-4035

Maxwell Kaufman

Development Planner – Southwest Regional Development Commission

2401 Broadway Ave, Slayton, MN 56172

maxk@swrdc.org | 507-836-1633

Public Meeting Sign In Sheet

Date: 10/18/18

Time Held: 1:00 PM to 2:30 PM

City/ County Location: Wabasso, Redwood Co. Purpose: Hazard Mitigation Mtg. #1

PRINT NAME	SIGNATURE	COMMUNITY AFFILIATION
Bill Pfarr	<i>[Signature]</i>	Lamberton Township
Jim Sandgren	<i>[Signature]</i>	Redwood Co E.M.
Tim Ochoare	<i>[Signature]</i>	City of Vesta
LON WALLING	<i>[Signature]</i>	REDWOOD CO.
Tim Birkemeyer	<i>[Signature]</i>	City of Lamberton
Lauren Muelenthin	<i>[Signature]</i>	Southwest Health & Human Services
MERNA S. Malmberg	<i>[Signature]</i>	Springdale Twp.
Gerald Senger	<i>[Signature]</i>	Sheridan Twp.
Mary Smith	<i>[Signature]</i>	City of Wabasso
Keith Bernolt	<i>[Signature]</i>	Redwood County
DENNIS GROEBNER	<i>[Signature]</i>	Commissioner
Dave For Knud	<i>[Signature]</i>	"
Vicki Knobloch	<i>[Signature]</i>	Redwood County
Kathy H. Ilmer	<i>[Signature]</i>	Redwood County
Scott Larsen	<i>[Signature]</i>	Redwood County
JIM SAFFER	<i>[Signature]</i>	REDWOOD COUNTY COMMISSIONER
Jim Doering	<i>[Signature]</i>	City of Redwood
Betsy Snyder	<i>[Signature]</i>	City of Milton
Carol Atkins	CAROL ATKINS	Mayor Wabasso
Pam Sheeran	<i>[Signature]</i>	City of Sargents
Tom Metzke	<i>[Signature]</i>	Area 11 MN River Basin
Bobbin Lee	<i>[Signature]</i>	Redwood City Comm.
Jeri Kuel	<i>[Signature]</i>	Belview
Dianna Donner	Dianna Donner	Belview
Tom Groebner	<i>[Signature]</i>	Clements Mayor

Reported by: *[Signature]* Agency: SRDC
 Signature

The value of participation by volunteer members of the public is \$27.40/hour.

The Community Affiliation is if the attendee wish to state a public or private organization they are representing or if they are representing themselves.

Redwood County All-Hazard Mitigation Plan Update

Planning Team Meeting #2

Thursday, October 25, 2018

1:00 PM – 2:30 PM

**Wabasso Community Center,
1429 Front Street, Wabasso, MN 56293**

Agenda

- 1:00 PM HAZUS Flood Assessment Presentation – *Max Kaufman, SRDC*
- 1:15 PM Review completed CPRI Rankings
• *(Compiled from CPRIs completed at first meeting.)*
Prioritize hazards to be in 2018 plan
- 1:30 PM Review Existing Gaps/Deficiencies for Each Hazard
- 1:50 PM Identify new strategies for updated plan
- 2:25 PM Sub-Committee Formation & scheduling of subcommittee meetings (if needed)
• Mitigation Strategies Subcommittee (STAPLE+E)
• Plan Review Subcommittee
- 2:25 PM Questions, Comments, Observations
- 2:30 PM Adjourn

Meeting Deliverables

- Updated list of hazards and prioritized hazards for county as well as plans/programs & gaps/deficiencies.
- Identified carry-over strategies and completed / deleted strategies
- Identify new strategies for insertion into updated plan
- Dedicated team members to review all strategies and the entire plan

Redwood County All-Hazard Mitigation Plan Update

Planning Team Meeting #2

Thursday, October 25, 2018

1:00 PM – 2:30 PM

Wabasso Community Center,
1429 Front Street, Wabasso, MN 56293

Agenda

HAZUS Flood Assessment

- The HAZUS flood analysis includes estimates only for a 100-year flood.
- The flooding during the summer of 2018 was between a 500-year and 1000-year frequency flood (depending on location).

Review Complete CPRI Rankings

- CPRIS needed from: Delhi, Lucan, Morgan, Revere, Sanborn, Walnut Grove, Wanda.

Hazard Review: Gaps/Deficiencies and New Strategies Identification

- Flooding
 - New Strategy: Reinforce natural spillways / grade existing spillways. County-wide. Specifically a foreseen need in Underwood and Johnsonville Townships.
 - Vesta: Highway 19 & Cemetery Road, farmland is sloped toward town. Water backs up and floods homes.
 - New Strategy: Encourage sump pump ordinances and strengthen existing ordinances with inspection.
 - Water retention: Area II works on this. Current policies are to build for a 100-year flood event because it is too expensive to build for a 500-year event.
 - New Strategy: Harden water retention areas. Raise the existing water retention ponds and create new ones where appropriate. (Clements, Belview, Vesta specifically)
 - New Strategy?: Encourage use of a material better than Class 5 gravel. | Previously ran out. Granite holds up better, but is very hard on tires. Potentially not a new strategy.
 - Culverts: Upsizing vulnerable culverts is a possible strategy, though the funds for this come from The Federal Highway Administration (FHWA).
- Landslide/Subsidence
 - Jim Sandgren has the updated language from the amendment to the last plan. We will add this as a carried over strategy in the plan update. This is regarding acquiring and relocating/demolishing at-risk structures along river areas.
 - New Strategy: Inventory potential sinkhole hazards from sources such as failed tile lines, septic systems, and cisterns. | Failed tile lines (Vesta) pose a risk for sinkholes.
- Utility Failure
 - Max Kaufman will check with Nobles County to see what they did after their ice storm/straight line winds this past winter that took down power lines across the county. This can be a new strategy.
 - New Strategy: Water retention on underground tile lines to relieve pressure on drainage system.
 - New Strategy: Review elevation of ground facilities to see if they need hardening/raising.
 - New Strategy: Retrofit/flood-proof/harden sanitary sewer lines to prevent infiltration.
 - New Strategy: Harden HAM radio networks in the event of a communications utility failure.
- Water Supply Contamination
 - New Strategy?: Encourage/educate on wellhead protection plans/programming. | This is already covered.

- New Strategy: Notify those at high-risk for water contamination. | Specifically Swede Forest, Kintire, and Lamberton due to soil types.
- Transportation Infrastructure
 - New Strategy?: Work with the local Toward Zero Deaths coalition to identify areas where transportation infrastructure can be improved to lower fatal crash rates.

Next Steps

- Plan will be finalized and the team will review online.
- Public hearing and public comment phase (30 days)
- Plan then goes to HSEM & FEMA for approval.
- After approval, all participating jurisdictions (Redwood County and all 15 incorporated cities) must adopt the plan by resolution in order to be eligible for Hazard Mitigation Assistance.

Redwood County All-Hazard Mitigation Plan Update



Planning Team Meeting #2
October 25, 2018

Redwood County Emergency Management
+
Southwest Regional Development Commission

Agenda

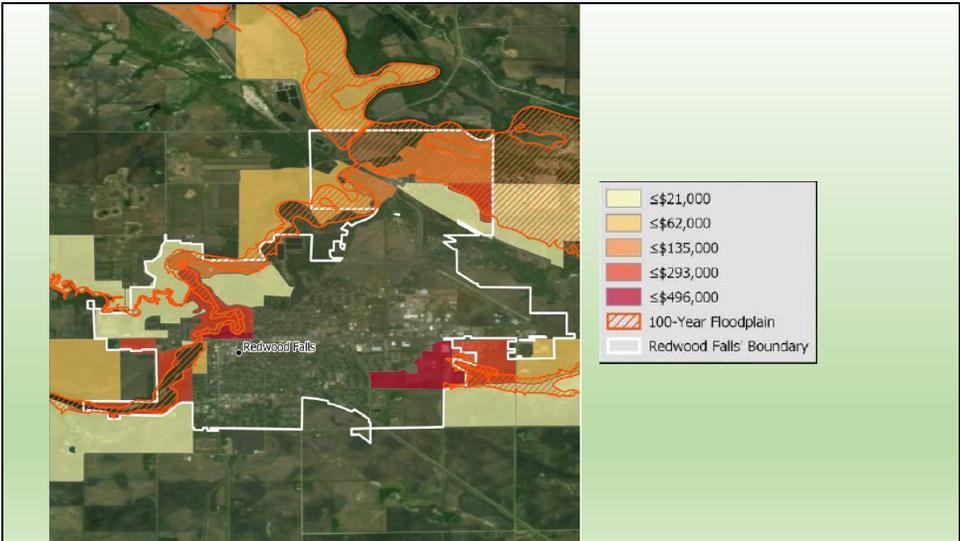
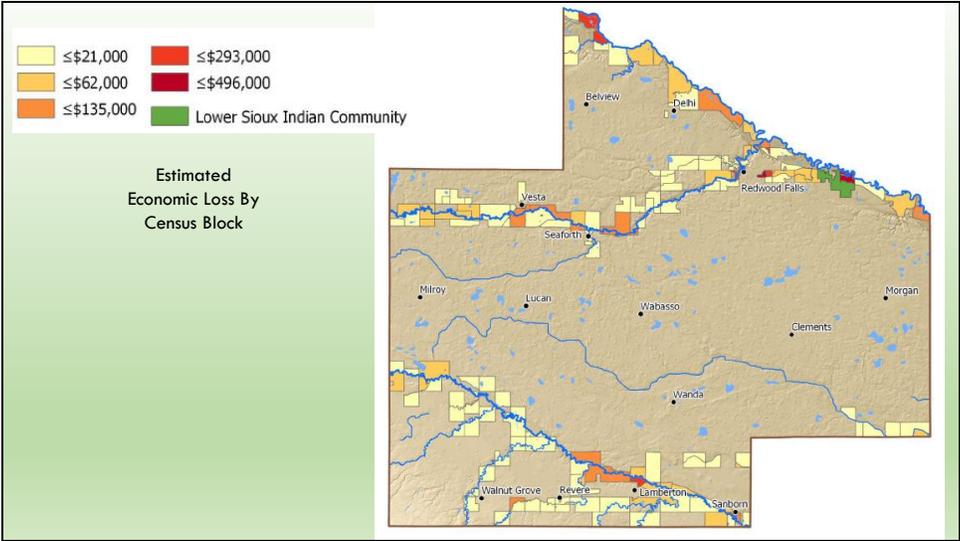
- HAZUS Flood Assessment
- Completed CPRI Rankings
- New Mitigation Strategies
 - What programs are already in place? Where are our current gaps?
- Next Steps

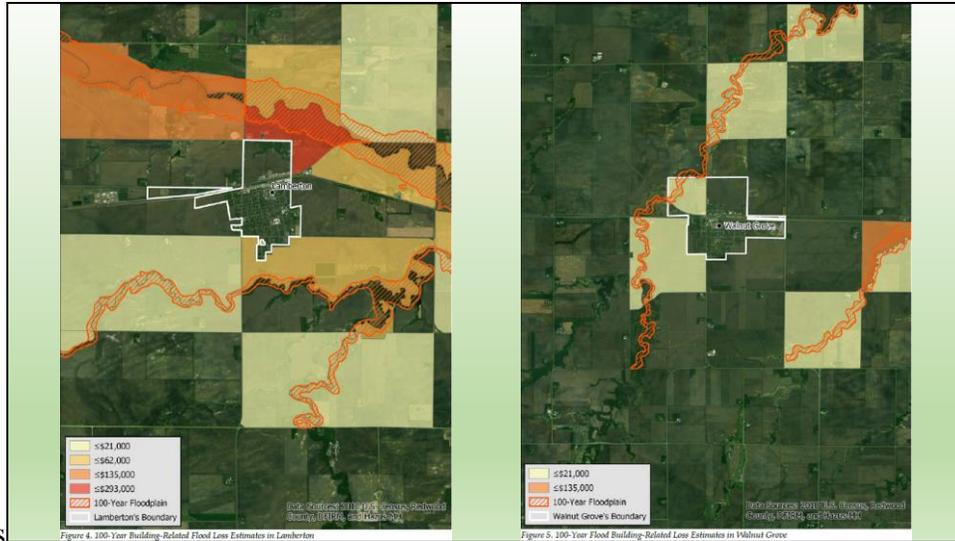
HAZUS Flood Assessment

- 14,182 parcels in Redwood County – 7,857 with buildings on them.
 - 6 parcels' buildings will be at least moderately damaged (>10% damage) in a 100-year flood. Zero are estimated to be completely destroyed.
- Total Economic Loss: \$114.77 million (64.7% of total replacement value of scenario buildings).
 - Total Building-Related Losses: \$8.16 million
 - 93% of estimated losses were related to business interruption.
- Residential occupancies made up 8.48% of total loss.

General Occupancy	Estimated Total Buildings	Total Damaged Buildings	Total Building Exposure	Total Economic Loss	Building Loss
Agricultural	1423	1	\$201,652,000	\$5,019,000	\$532,000
Commercial	673	1	\$86,099,000	\$10,712,000	\$205,000
Education	30	0	\$67,200,000	\$36,522,000	\$61,000
Government	204	0	\$129,974,000	\$48,458,000	\$178,000
Industrial	99	0	\$52,191,000	\$288,000	\$54,000
Religious/Non-Profit	104	0	\$31,941,000	\$4,040,000	\$52,000
Residential	5,324	7	\$412,903,000	\$9,733,000	\$1,683,000
Total	7,857	9	\$981,960,000	\$114,772,000	\$2,765,000

Table 1. Redwood County Total Economic Loss from 100-Year Flood





Census Block Number	Total Estimated Loss (Building Value & Building's Contents)	Location
271277503001030	\$368,000	Redwood Falls
271277503001040	\$293,000	Redwood Falls
271277502001046	\$183,000	2 miles northeast of Redwood Falls

Census Blocks of Concern

Table 2. Census Blocks with the greatest estimated losses in the 100-Year Floodplain

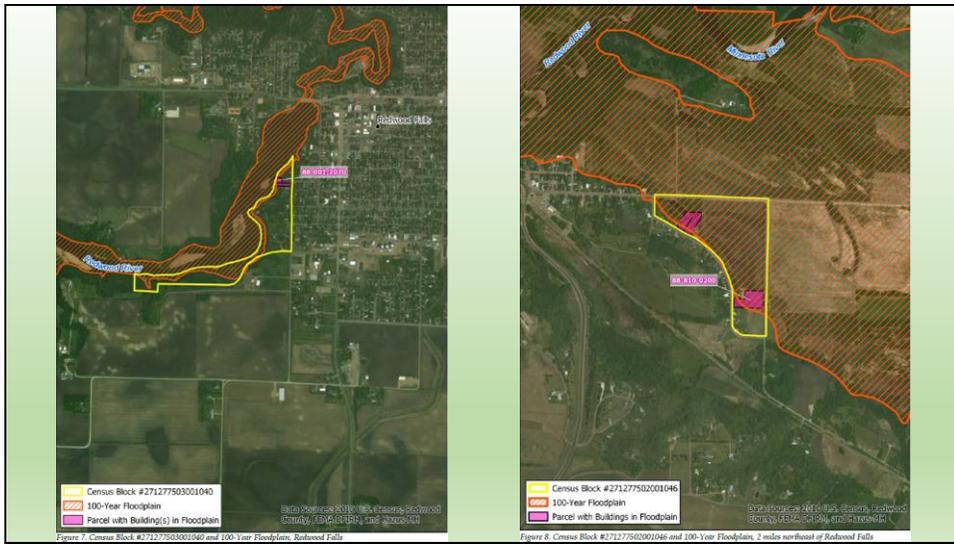
Parcel ID	Total Value of Building(s) & Building's Contents on Parcel	Class Description	Building Area (ft ²)
88-036-4290	\$2,450,800	Government – General Services	18,207
88-036-1040	\$512,200	Government – General Services	9,637
58-030-1020	\$456,000	Agriculture	1,708
53-021-2020	\$381,000	Agriculture	6,796
64-027-1060	\$329,550	Single Family Dwelling	11,886
52-130-1020	\$294,200	Agriculture	3,211
88-810-0200	\$195,600	Single Family Dwelling	5,397
53-010-4060	\$193,400	Agriculture	3,300
51-035-2040	\$166,500	Single Family Dwelling	5,611
88-001-2070	\$158,250	Single Family Dwelling	3,440
Total	\$5,137,500		

Parcels of Concern

Table 3. Redwood County Properties with Highest Building/Contents Value with Potential Building Flood Damage

Table 3:

- Power Plant & Headgate Building | Redwood Falls
- Ramsey Park Shelter House, Animal Cages | Redwood Falls
- Lamberton
- Gales Twp
- Sheridan Twp
- Delhi
- Redwood Falls
- Gales Twp
- Charlestown Twp
- Redwood Falls



Essential Facility Loss

- None of Redwood County's essential facilities (care, fire, police, school) fall within the flood boundary.

Shelter Requirement

- 88 households are estimated to be displaced. 2 people estimated to seek temporary shelter in public shelters.

Debris Generation

- 5,618 tons of debris may be generated by a 100-year flood. It would require 225 truckloads to remove that debris.

Hazard Ranking – CPRI Worksheet

- Worksheet that allows each jurisdiction to rank the risk that each hazard poses to the jurisdiction.
 - Probability
 - Magnitude/Severity
 - Warning Time
 - Duration

6.01 Probability	6.02 Magnitude / Severity	6.03 Warning Time	6.04 Duration
1 - Highly Likely <input type="checkbox"/> Event is probable within the calendar year. <input type="checkbox"/> Event has up to 1 in 1 year chance of occurring (1% = 100%) <input type="checkbox"/> Chance of event is greater than 33% likely per year. <input type="checkbox"/> Event is "highly likely" to occur.	1 - Catastrophic <input type="checkbox"/> Local jurisdiction is overwhelmed and unable to effectively respond to the hazard. Local resources are inadequate or non-existent. Complete loss of communications. Massive regional, state, FEMA and federal response is required. Federal disaster declaration. <input type="checkbox"/> Local and regional medical services are unable to manage the volume of injuries and fatalities. Mass evacuation, sheltering, and care of displaced residents, medical patients, high risk and vulnerable populations are required. <input type="checkbox"/> Loss of public utilities, government and essential services for more than 1 month. Widespread destruction of critical infrastructure, public and private property. More than 50% of critical and non-critical facilities and infrastructure damaged or destroyed. Extended emergency response operations lasting more than 1 month may be required.	<input type="checkbox"/> 6-12 Hours <input type="checkbox"/> No notice up to 6 hours	<input type="checkbox"/> Up to 1 Week <input type="checkbox"/> More Than 1 Week
2 - Likely <input type="checkbox"/> Event is probable within the next three years. <input type="checkbox"/> Event has up to 1 in 3 years chance of occurring (1/3 = 33%) <input type="checkbox"/> Chance of event is greater than 20% but less than or equal to 33% per year. <input type="checkbox"/> Event is "likely" to occur.	2 - Significant <input type="checkbox"/> Local jurisdiction is unable to effectively respond without District level mutual aid support and significant state assistance. Local resources have been expended and local agencies have reached the limits of their capabilities. Communications services degraded with significant impact on operations. State disaster declaration. <input type="checkbox"/> Local medical services are unable to manage number of injuries and fatalities. Patients require transportation to regional medical facilities outside of the affected areas. Local area evacuations, sheltering, and care of displaced residents, medical patients, high risk and vulnerable populations are required. <input type="checkbox"/> Loss of public utilities, government and essential services for up to 1 month. Significant damage to critical infrastructure, public and private property over a large area. Up to 50% of critical and non-critical facilities and infrastructure damaged. Emergency response operations lasting up to 1 month may be required.	<input type="checkbox"/> 6 to 12 Hours <input type="checkbox"/> 6 to 12 Hours	<input type="checkbox"/> Up to 1 Week <input type="checkbox"/> Up to 1 Week
3 - Possible <input type="checkbox"/> Event is probable within the next five years. <input type="checkbox"/> Event has up to 1 in 5 year chance of occurring (1/5 = 20%) <input type="checkbox"/> Chance of event is greater than 10% but less than or equal to 20% per year. <input type="checkbox"/> Event could "possibly" occur.	3 - Moderate <input type="checkbox"/> Local jurisdiction is able to effectively respond with significant inter-local mutual aid support and limited state assistance. Local and mutual aid resources are adequate to support response. Communications systems operating near capacity. Local medical services are able to manage volume of injuries and fatalities but are near the limits of their capabilities. Only critically injured patients are directed to facilities outside of the affected areas. Limited evacuations and sheltering required. <input type="checkbox"/> Loss of public utilities, government and essential services for up to 1 week. Significant damage to critical infrastructure, public and private property over a localized area. Up to 25% of critical and non-critical facilities and infrastructure damaged. Response operations lasting up to 1 week may be required.	<input type="checkbox"/> 12-24 Hours <input type="checkbox"/> 12-24 Hours	<input type="checkbox"/> Up to 1 Day <input type="checkbox"/> Up to 1 Day
4 - Unlikely <input type="checkbox"/> Event is probable within the next 10 years. <input type="checkbox"/> Event has an up to 1 in 10 years chance of occurring (1/10 = 10%) <input type="checkbox"/> Chance of event occurrence is less than or equal to 10%. <input type="checkbox"/> Event is "unlikely" to occur.	4 - Manageable <input type="checkbox"/> Local jurisdiction is able to manage incident with standard mutual aid and little or no state assistance. Local resources are adequate to support response. Communications system operating normally. Local emergency response. <input type="checkbox"/> Local medical services are able to manage number of injuries and fatalities with on hand personnel and resources. <input type="checkbox"/> Loss of public utilities, government and essential services for up to 24 hours. Damage confined to a single incident scene and immediate area. Up to 5% of critical and non-critical facilities and infrastructure damaged. <input type="checkbox"/> Response operations lasting up to 72 hours may be required.	<input type="checkbox"/> 24+ Hours <input type="checkbox"/> 24+ Hours	<input type="checkbox"/> Up to 6 Hours <input type="checkbox"/> Up to 6 Hours

CPRI Risk Index (Preliminary – Still need: Belview, Clements, Delhi, Lucan, Milroy, Morgan, Revere, Sanborn, Walnut Grove, Wanda)		Threat/Hazard/Technological Accident - do not alter order - calculation in next categories are tied to the order of the hazards	Probability				Magnitude/Severity	
			Warning Time	Duration				
Type								
Natural Hazards	Flood (Riverine)	2.79	1.79	2.84	3.17	2.54		
Natural Hazards	Flash Flood	3.00	2.17	3.06	2.61	2.72		
Natural Hazards	Dam Failure	1.50	1.78	2.35	2.47	1.81		
Natural Hazards	Tornado	2.72	2.83	3.44	2.67	2.86		
Natural Hazards	Wildfire	1.50	1.61	2.61	2.29	1.78		
Natural Hazards	Windstorm	3.17	2.17	2.44	2.24	2.67		
Natural Hazards	Winter Storm	3.44	2.33	2.67	2.71	2.92		
Natural Hazards	Lightning	2.72	1.44	3.06	2.13	2.33		
Natural Hazards	Hail	3.17	1.83	2.94	2.11	2.63		
Natural Hazards	Drought	2.28	1.83	1.89	3.06	2.16		
Natural Hazards	Extreme Heat	2.83	2.00	1.50	2.67	2.37		
Natural Hazards	Extreme Cold	3.22	2.17	1.61	2.61	2.60		
Natural Hazards	Erosion	2.50	1.83	2.33	2.29	2.25		
Natural Hazards	Subsidence	1.61	1.41	2.56	2.00	1.73		
Natural Hazards	Landslide/Mudslide	1.56	1.50	2.65	2.06	1.75		
Natural Hazards	Earthquake	1.00	1.67	2.67	1.76	1.53		

Mitigation Strategies (Handout)

- Carryover Strategies
- Deleted/Completed Strategies
- New Strategies Discussion
 - Mitigation Ideas (https://www.fema.gov/media-library-data/20130726-1904-25045-0186/fema_mitigation_ideas_final508.pdf)

Discussion: Hazards to Include for Mitigation

NATURAL

- Drought
- *Earthquake (risk assessment only)*
- *Extreme Temperatures*
- Flood (+ Dam Failure)
- Hail
- *Lightning*
- Severe/Straight-Line Wind
- Severe Winter Weather
- *Subsidence/Landslide*
- Tornado
- Wildfire

MAN-MADE

- Agricultural Disease (animal/crop)
- Civil Disturbance
- Hazardous Materials
- Public Health Emergency
- Structure Fire
- *Transportation Infrastructure*
- *Utility Failure*
- *Water Supply Contamination*

No strategies yet for those in blue.

FOCUS: Those in blue and flooding. Any others they want to touch on.

Mitigation Strategies

- **Prevention:** Government, administrative, or regulatory actions.
- **Property Protection:** Removal or modification of existing buildings or structures to protect them from a hazard.
- **Public Education and Awareness:** Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them.
- **Natural Resource Protection:** Actions that minimize hazard losses and preserve or restore the functions of natural systems.
- **Emergency Services:** Actions that protect people and property during and immediately after a disaster or hazard event. Services include warning systems, emergency response services, and protection of critical facilities.
- **Structural Projects:** Actions that involve the construction of structures to reduce the impact of a hazard, for example: floodwalls, safe rooms.

Mitigation Actions Eligible for HMA

1. Retrofit or construction of safe room facilities to protect public during extreme wind events.
2. Purchase of generators for backup power to support the operation of essential function in critical facilities in the event of severe storms.
3. Burying or strengthening of power lines to reduce the risk of power outages from downed lines during a severe storm.
4. Install new warning systems in identified vulnerable locations
5. Mitigation measures to reduce the threat of wildfire.
6. Infrastructure retrofit for flood prone areas.
7. Minor localized flood reduction projects to lessen the frequency of severity of flooding and decrease predicted flood damages.
8. Relocate flood-prone properties or acquire and demolish flood prone properties.
9. Dry-proof or wet-proof facilities that are flood prone.

Next Steps

- Subcommittees (Online)
 - Mitigation Strategies Subcommittee
 - Plan Review Subcommittee
- Finalize Plan
- Public Hearing & Comment Period (30 Days)
- All participating jurisdictions must adopt the plan by resolution in order to be eligible for Hazard Mitigation Assistance.
 - Once Redwood County has adopted the plan, it will be reviewed by HSEM and FEMA, any changes will be made, and the plan will be finalized.

Redwood County AHMP Contacts:

Jim Sandgren

Emergency Management Director – Redwood County

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Maxwell Kaufman

Development Planner – Southwest Regional Development Commission

2401 Broadway Ave, Slayton, MN 56172

maxk@swrdc.org | 507-836-1633

Public Meeting Sign In Sheet

Date: 10/25/18

Time Held: 1:00 PM to 2:30 PM

City/ County Location: Wabasso, Redwood

Purpose: Haz Mit Mtg. #2

PRINT NAME	SIGNATURE	COMMUNITY AFFILIATION
LOX WALLING	<i>Lox Walling</i>	CO. COMM.
Jacob Kolander	<i>Jacob Kolander</i>	City of Vista
Thomas Groebner	<i>Thomas Groebner</i>	City of Clements
Lori Ryer	<i>Lori Ryer</i>	City of Belview
Dave Forklund	<i>Dave Forklund</i>	C.C.
Mary Smith	<i>Mary Kilmer</i>	City of Wabasso
Jim Sandgren	<i>Jim Sandgren</i>	Redwood Co E.M.
Scott Wild	<i>Scott Wild</i>	Redwood County enviro
Briana Mummie	<i>Briana Mummie</i>	RW County EDA
Merna Malmberg	<i>Merna Malmberg</i>	Springdale Twp.
Kim Sasse	<i>Kim Sasse</i>	Redwood Co Comm
Pam Sheeran	<i>Pam Sheeran</i>	City of Seaforth
Justin Thamm	<i>Justin Thamm</i>	City of Lambert
Carol Atkins	<i>Carol Atkins</i>	WABASSO
Madonna Peterson	<i>Madonna Peterson</i>	Lamberton
Kern Netzke	<i>Kern Netzke</i>	Area II MN River Basin
Betsy Snyder	<i>Betsy Snyder</i>	Milroy
Jim Doering	<i>Jim Doering</i>	City of Redwood Falls

Reported by: *Max K*
Signature

Agency: SW Regional Development Commission

The value of participation by volunteer members of the public is \$27.40/hour.

The Community Affiliation is if the attendee wish to state a public or private organization they are representing or if they are representing themselves.

Appendix E - Public Meeting Notices and Comments

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Appendix F - Completed and Deleted Actions from the 2012 Plan

Hazard - Strategy	Mitigation Action	Status	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
Drought – Prevention	Encourage development of ordinances that contain conservation provisions and use restrictions in times of severe drought.	Complete	Redwood County	RCEO, RCEM, BWSR	All cities have DNR water appropriation plans, under which this is required.	Medium
Structure Fires – Emergency Services	Ensure each property has road or alley access of sufficient size for modern fire fighting vehicles.	Complete	Redwood County	RCEO, Fire	This is mandatory.	Medium
Public Health – Emergency Services	Maintain a quarantine plan in coordination with local doctors and other health professionals.	Complete	Redwood County	RCEM, RCSO, LE, SWHHS, Hosp	This plan exists.	Low
Severe Storms – Protection	Harden utilities, replace overhead with underground power lines.	Complete	Lucan	CiLu	Done for Lucan since 2012.	-
Severe Storms – Emergency Services	Implement county-wide public alert telephone-text notification system.	Complete	Redwood County	RCEM	CodeRED covers this. Strategy consolidated with strategy 7.	-
Drought – Prevention	Educate the public of the importance of wellhead protection and water conservation.	Consolidated	Redwood County	RCEO, SWCD, MDH, Ext, RWS	Consolidated with strategy 12.	-
Hazardous Materials – Prevention	Update the Emergency Response Plan to identify alternate sources of drinking water, including the location of adequate amounts of bottled water.	Complete	Redwood County	RCEM, RWS	This is included in the DNR water appropriation plan.	-
Public Health – Protection	Ensure that hospitals have access to back up power generators.	Complete	Redwood County, Redwood Falls	RCEM, SWHHS, CiRF, Hosp	Complete.	-
Plan Maintenance – Prevention	Budget to perform additional data collection and analysis to identify vulnerable structures in specific detail in the next plan update.	Complete	Redwood County	RCEM, HSEM	This has been budgeted for the 2019 and future updates.	-
Plan Maintenance – Prevention	Budget to perform estimates of potential monetary losses to structures, contents, and functions in specific detail in next plan update.	Complete	Redwood County	RCEM, HSEM	This has been budgeted for the 2019 and future updates.	-
Flooding/Dam Failure – Prevention	Indicate on zoning forms if property is in flood hazard area.	Complete	Redwood County, Redwood Falls, Vesta	RCEO, CiRF, CiV	Complete.	-

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Appendix G - Mitigation Actions by Jurisdiction

Figure G-1: Mitigation Actions for the City of Belview

Figure G-2: Mitigation Actions for the City of Clements

Figure G-3: Mitigation Actions for the City of Delhi

Figure G-4: Mitigation Actions for the City of Lamberton

Figure G-5: Mitigation Actions for the City of Lucan

Figure G-6: Mitigation Actions for the City of Milroy

Figure G-7: Mitigation Actions for the City of Morgan

Figure G-8: Mitigation Actions for the City of Redwood Falls

Figure G-9: Mitigation Actions for the City of Revere

Figure G-10: Mitigation Actions for the City of Sanborn

Figure G-11: Mitigation Actions for the City of Seaforth

Figure G-12: Mitigation Actions for the City of Vesta

Figure G-13: Mitigation Actions for the City of Wabasso

Figure G-14: Mitigation Actions for the City of Walnut Grove

Figure G-15: Mitigation Actions for the City of Wanda

Figure G-1: Mitigation Actions for the City of Belview

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
1	Ag Disease – Awareness	Provide information on ag disease and prevention to producers and residents.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, Ext, FSA, MDA, MDH, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd		Low
3	Severe Storms – Structural	Conduct a study to determine what places in the county and each city are deficient in safe rooms; Construct at least one new safe room or improve warning system in one community each year.		Revised	2019-2023	Redwood County, all Cities	RCEM, RCEO, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd	Currently no safe rooms in Redwood County	Medium, \$45,000
7	Severe Storms – Prevention	Encourage all residents and public building to have NOAA Public Alert Radios with SAME technology and to sign up for CodeRED alerts, especially in rural areas away from community sirens.		Revised	Ongoing	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Low
11	Severe Storms – Protection	Scope at least one infrastructure retrofit project in one community each year.		Carried Over	Annually	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiCo, MiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Medium, \$10,000
12	Drought – Prevention	Work with the MN Department of Health to develop & implement Wellhead Protection Plans and educate the public on the importance of wellhead protection and water conservation.		Revised	Ongoing	Redwood County, Belview, Clements, Redwood Falls, Sanborn	RCEO, SWCD, CiB, CiC, CiRF, CiSa, MDH	City of Clements in currently in progress.	Medium

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
33	Flooding/Dam Failure – Prevention	Discourage future development within floodplains; consider minor localized flood reduction projects, especially to reduce overland flooding.		Revised	Ongoing	Redwood County, all Cities	ALL	In the floodplain ordinance.	Low
34	Flooding/Dam Failure – Protection	Encourage sound construction practices and agricultural Best Management Practices (BMPs) in flood fringe areas.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, BWSE, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd, Twp		Low
39	Flooding/Dam Failure – Protection	Retrofit infrastructure to reduce impacts of flooding; stabilize/replace at-risk bridges and slopes prone to sloughing.		Revised	Ongoing	Redwood County, Belview, Redwood Falls, Sanborn, Seaforth	RCHwy, RCEO, CiB, CiRF, CiSa, CiSe		High, \$5,000,000
41	Flooding/Dam Failure – Prevention	Encourage sump pump ordinances and strengthen existing ordinances with inspection.		New	Ongoing	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd		Low
42	Flooding/Dam Failure – Structural	Harden water retention areas. Raise existing water retention ponds and create new ones where appropriate.		New	2019-2024	Redwood County, Belview, Clements, Vesta	RCEO, RCEM, SWCD, CiB, CiC, CiV		High, \$10 million

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
46	Utility Failure – Structural/ Protection	Retrofit, flood-proof, and/or harden sanitary sewer lines to prevent infiltration.		New	2019-2024	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, Utility, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd,		High, \$100,000

Figure G-2: Mitigation Actions for the City of Clements

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
1	Ag Disease – Awareness	Provide information on ag disease and prevention to producers and residents.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, Ext, FSA, MDA, MDH, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd		Low
3	Severe Storms – Structural	Conduct a study to determine what places in the county and each city are deficient in safe rooms; Construct at least one new safe room or improve warning system in one community each year.		Revised	2019-2023	Redwood County, all Cities	RCEM, RCEO, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd	Currently no safe rooms in Redwood County	Medium, \$45,000
7	Severe Storms – Prevention	Encourage all residents and public building to have NOAA Public Alert Radios with SAME technology and to sign up for CodeRED alerts, especially in rural areas away from community sirens.		Revised	Ongoing	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Low
8	Severe Storms – Protection	Ensure that critical facilities have access to backup power generators. Examine needs and costs for providing backup power generation where none currently exists.		Revised	2019-2022	Redwood County, Clements, Lambertson, Lucan, Redwood Falls, Seaforth, Wabasso, Walnut Grove	RCEM, CiC, CiLa, CiLu, CiRF, CiSe, CiWb, CiWG Hosp	No backup at Countryview Assisted Living in Walnut Grove	Medium, \$300,000
11	Severe Storms – Protection	Scope at least one infrastructure retrofit project in one community each year.		Carried Over	Annually	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiCo, MiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Medium, \$10,000

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
12	Drought – Prevention	Work with the MN Department of Health to develop & implement Wellhead Protection Plans and educate the public on the importance of wellhead protection and water conservation.		Revised	Ongoing	Redwood County, Belview, Clements, Redwood Falls, Sanborn	RCEO, SWCD, CiB, CiC, CiRF, CiSa, MDH	City of Clements in currently in progress.	Medium
33	Flooding/Dam Failure – Prevention	Discourage future development within floodplains; consider minor localized flood reduction projects, especially to reduce overland flooding.		Revised	Ongoing	Redwood County, all Cities	ALL	In the floodplain ordinance.	Low
34	Flooding/Dam Failure – Protection	Encourage sound construction practices and agricultural Best Management Practices (BMPs) in flood fringe areas.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, BWSE, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd, Twp		Low
41	Flooding/Dam Failure – Prevention	Encourage sump pump ordinances and strengthen existing ordinances with inspection.		New	Ongoing	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd		Low
42	Flooding/Dam Failure – Structural	Harden water retention areas. Raise existing water retention ponds and create new ones where appropriate.		New	2019-2024	Redwood County, Belview, Clements, Vesta	RCEO, RCEM, SWCD, CiB, CiC, CiV		High, \$10 million

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
46	Utility Failure – Structural/ Protection	Retrofit, flood-proof, and/or harden sanitary sewer lines to prevent infiltration.		New	2019-2024	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, Utility, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd,		High, \$100,000

Figure G-3: Mitigation Actions for the City of Delhi

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
1	Ag Disease – Awareness	Provide information on ag disease and prevention to producers and residents.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, Ext, FSA, MDA, MDH, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd		Low
3	Severe Storms – Structural	Conduct a study to determine what places in the county and each city are deficient in safe rooms; Construct at least one new safe room or improve warning system in one community each year.		Revised	2019-2023	Redwood County, all Cities	RCEM, RCEO, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd	Currently no safe rooms in Redwood County	Medium, \$45,000
7	Severe Storms – Prevention	Encourage all residents and public building to have NOAA Public Alert Radios with SAME technology and to sign up for CodeRED alerts, especially in rural areas away from community sirens.		Revised	Ongoing	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Low
11	Severe Storms – Protection	Scope at least one infrastructure retrofit project in one community each year.		Carried Over	Annually	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiCo, MiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Medium, \$10,000
33	Flooding/Dam Failure – Prevention	Discourage future development within floodplains; consider minor localized flood reduction projects, especially to reduce overland flooding.		Revised	Ongoing	Redwood County, all Cities	ALL	In the floodplain ordinance.	Low

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
34	Flooding/Dam Failure – Protection	Encourage sound construction practices and agricultural Best Management Practices (BMPs) in flood fringe areas.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, BWSE, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd, Twp		Low
36	Flooding/Dam Failure – Prevention	Jurisdictions not currently participating in the National Flood Insurance Program (NFIP) will review their flood hazard areas and consider participation.		Carried Over	2019-2020	Delhi, Revere, Vesta, Walnut Grove, Wanda	DNR, CiD, CiR, CiV, CiWG, CiWd		Medium
41	Flooding/Dam Failure – Prevention	Encourage sump pump ordinances and strengthen existing ordinances with inspection.		New	Ongoing	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd		Low
46	Utility Failure – Structural/ Protection	Retrofit, flood-proof, and/or harden sanitary sewer lines to prevent infiltration.		New	2019-2024	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, Utility, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd,		High, \$100,000

Figure G-4: Mitigation Actions for the City of Lambertton

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
1	Ag Disease – Awareness	Provide information on ag disease and prevention to producers and residents.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, Ext, FSA, MDA, MDH, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd		Low
3	Severe Storms – Structural	Conduct a study to determine what places in the county and each city are deficient in safe rooms; Construct at least one new safe room or improve warning system in one community each year.		Revised	2019-2023	Redwood County, all Cities	RCEM, RCEO, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd	Currently no safe rooms in Redwood County	Medium, \$45,000
4	Severe Storms – Awareness	Educate local schools, nursing homes, assisted living, hospitals, etc on importance of doing a “Severe Weather Awareness Week” workshop for their staff, including identifying evacuation routes and safe rooms.		Carried Over	Ongoing	Redwood County, Redwood Falls, Morgan, Wabasso, Milroy, Lambertton, Walnut Grove	RCEM, Hosp, Sch, CiRF, CiMo, CiW, CiMi, CiL, CiWG		Low
7	Severe Storms – Prevention	Encourage all residents and public building to have NOAA Public Alert Radios with SAME technology and to sign up for CodeRED alerts, especially in rural areas away from community sirens.		Revised	Ongoing	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Low

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
8	Severe Storms – Protection	Ensure that critical facilities have access to backup power generators. Examine needs and costs for providing backup power generation where none currently exists.		Revised	2019-2022	Redwood County, Clements, Lamberton, Lucan, Redwood Falls, Seaforth, Wabasso, Walnut Grove	RCEM, CiC, CiLa, CiLu, CiRF, CiSe, CiWb, CiWG Hosp	No backup at Countryview Assisted Living in Walnut Grove	Medium, \$300,000
11	Severe Storms – Protection	Scope at least one infrastructure retrofit project in one community each year.		Carried Over	Annually	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiCo, MiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Medium, \$10,000
13	Wildfire – Prevention	Conduct wildfire risk assessments periodically.		Carried Over	Ongoing	Redwood County, Lamberton, Redwood Falls	RCEO, RCSO, CiLa, CiRF, Fire, DNR		Low
33	Flooding/Dam Failure – Prevention	Discourage future development within floodplains; consider minor localized flood reduction projects, especially to reduce overland flooding.		Revised	Ongoing	Redwood County, all Cities	ALL	In the floodplain ordinance.	Low
34	Flooding/Dam Failure – Protection	Encourage sound construction practices and agricultural Best Management Practices (BMPs) in flood fringe areas.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, BWSE, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd, Twp		Low
41	Flooding/Dam Failure – Prevention	Encourage sump pump ordinances and strengthen existing ordinances with inspection.		New	Ongoing	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd		Low

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
46	Utility Failure – Structural/ Protection	Retrofit, flood-proof, and/or harden sanitary sewer lines to prevent infiltration.		New	2019-2024	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, Utility, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd,		High, \$100,000

Figure G-5: Mitigation Actions for the City of Lucan

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
1	Ag Disease – Awareness	Provide information on ag disease and prevention to producers and residents.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, Ext, FSA, MDA, MDH, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd		Low
3	Severe Storms – Structural	Conduct a study to determine what places in the county and each city are deficient in safe rooms; Construct at least one new safe room or improve warning system in one community each year.		Revised	2019-2023	Redwood County, all Cities	RCEM, RCEO, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd	Currently no safe rooms in Redwood County	Medium, \$45,000
7	Severe Storms – Prevention	Encourage all residents and public building to have NOAA Public Alert Radios with SAME technology and to sign up for CodeRED alerts, especially in rural areas away from community sirens.		Revised	Ongoing	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Low
8	Severe Storms – Protection	Ensure that critical facilities have access to backup power generators. Examine needs and costs for providing backup power generation where none currently exists.		Revised	2019-2022	Redwood County, Clements, Lamberton, Lucan, Redwood Falls, Seaforth, Wabasso, Walnut Grove	RCEM, CiC, CiLa, CiLu, CiRF, CiSe, CiWb, CiWG Hosp	No backup at Countryview Assisted Living in Walnut Grove	Medium, \$300,000
11	Severe Storms – Protection	Scope at least one infrastructure retrofit project in one community each year.		Carried Over	Annually	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiCo, MiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Medium, \$10,000

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
33	Flooding/Dam Failure – Prevention	Discourage future development within floodplains; consider minor localized flood reduction projects, especially to reduce overland flooding.		Revised	Ongoing	Redwood County, all Cities	ALL	In the floodplain ordinance.	Low
34	Flooding/Dam Failure – Protection	Encourage sound construction practices and agricultural Best Management Practices (BMPs) in flood fringe areas.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, BWSE, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd, Twp		Low
41	Flooding/Dam Failure – Prevention	Encourage sump pump ordinances and strengthen existing ordinances with inspection.		New	Ongoing	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd		Low
46	Utility Failure – Structural/ Protection	Retrofit, flood-proof, and/or harden sanitary sewer lines to prevent infiltration.		New	2019-2024	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, Utility, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd,		High, \$100,000

Figure G-6: Mitigation Actions for the City of Milroy

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
1	Ag Disease – Awareness	Provide information on ag disease and prevention to producers and residents.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, Ext, FSA, MDA, MDH, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd		Low
3	Severe Storms – Structural	Conduct a study to determine what places in the county and each city are deficient in safe rooms; Construct at least one new safe room or improve warning system in one community each year.		Revised	2019-2023	Redwood County, all Cities	RCEM, RCEO, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd	Currently no safe rooms in Redwood County	Medium, \$45,000
4	Severe Storms – Awareness	Educate local schools, nursing homes, assisted living, hospitals, etc on importance of doing a “Severe Weather Awareness Week” workshop for their staff, including identifying evacuation routes and safe rooms.		Carried Over	Ongoing	Redwood County, Redwood Falls, Morgan, Wabasso, Milroy, Lamberton, Walnut Grove	RCEM, Hosp, Sch, CiRF, CiMo, CiW, CiMi, CiL, CiWG		Low
7	Severe Storms – Prevention	Encourage all residents and public building to have NOAA Public Alert Radios with SAME technology and to sign up for CodeRED alerts, especially in rural areas away from community sirens.		Revised	Ongoing	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Low

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
11	Severe Storms – Protection	Scope at least one infrastructure retrofit project in one community each year.		Carried Over	Annually	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiCo, MiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Medium, \$10,000
33	Flooding/Dam Failure – Prevention	Discourage future development within floodplains; consider minor localized flood reduction projects, especially to reduce overland flooding.		Revised	Ongoing	Redwood County, all Cities	ALL	In the floodplain ordinance.	Low
34	Flooding/Dam Failure – Protection	Encourage sound construction practices and agricultural Best Management Practices (BMPs) in flood fringe areas.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, BWSE, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd, Twp		Low
41	Flooding/Dam Failure – Prevention	Encourage sump pump ordinances and strengthen existing ordinances with inspection.		New	Ongoing	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd		Low
46	Utility Failure – Structural/ Protection	Retrofit, flood-proof, and/or harden sanitary sewer lines to prevent infiltration.		New	2019-2024	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, Utility, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd,		High, \$100,000

Figure G-7: Mitigation Actions for the City of Morgan

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
1	Ag Disease – Awareness	Provide information on ag disease and prevention to producers and residents.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, Ext, FSA, MDA, MDH, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd		Low
3	Severe Storms – Structural	Conduct a study to determine what places in the county and each city are deficient in safe rooms; Construct at least one new safe room or improve warning system in one community each year.		Revised	2019-2023	Redwood County, all Cities	RCEM, RCEO, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd	Currently no safe rooms in Redwood County	Medium, \$45,000
4	Severe Storms – Awareness	Educate local schools, nursing homes, assisted living, hospitals, etc on importance of doing a “Severe Weather Awareness Week” workshop for their staff, including identifying evacuation routes and safe rooms.		Carried Over	Ongoing	Redwood County, Redwood Falls, Morgan, Wabasso, Milroy, Lamberton, Walnut Grove	RCEM, Hosp, Sch, CiRF, CiMo, CiW, CiMi, CiL, CiWG		Low
7	Severe Storms – Prevention	Encourage all residents and public building to have NOAA Public Alert Radios with SAME technology and to sign up for CodeRED alerts, especially in rural areas away from community sirens.		Revised	Ongoing	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Low

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
11	Severe Storms – Protection	Scope at least one infrastructure retrofit project in one community each year.		Carried Over	Annually	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiCo, MiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Medium, \$10,000
33	Flooding/Dam Failure – Prevention	Discourage future development within floodplains; consider minor localized flood reduction projects, especially to reduce overland flooding.		Revised	Ongoing	Redwood County, all Cities	ALL	In the floodplain ordinance.	Low
34	Flooding/Dam Failure – Protection	Encourage sound construction practices and agricultural Best Management Practices (BMPs) in flood fringe areas.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, BWSE, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd, Twp		Low
41	Flooding/Dam Failure – Prevention	Encourage sump pump ordinances and strengthen existing ordinances with inspection.		New	Ongoing	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd		Low
46	Utility Failure – Structural/ Protection	Retrofit, flood-proof, and/or harden sanitary sewer lines to prevent infiltration.		New	2019-2024	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, Utility, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd,		High, \$100,000

Figure G-8: Mitigation Actions for the City of Redwood Falls

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
1	Ag Disease – Awareness	Provide information on ag disease and prevention to producers and residents.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, Ext, FSA, MDA, MDH, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd		Low
3	Severe Storms – Structural	Conduct a study to determine what places in the county and each city are deficient in safe rooms; Construct at least one new safe room or improve warning system in one community each year.		Revised	2019-2023	Redwood County, all Cities	RCEM, RCEO, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd	Currently no safe rooms in Redwood County	Medium, \$45,000
4	Severe Storms – Awareness	Educate local schools, nursing homes, assisted living, hospitals, etc on importance of doing a “Severe Weather Awareness Week” workshop for their staff, including identifying evacuation routes and safe rooms.		Carried Over	Ongoing	Redwood County, Redwood Falls, Morgan, Wabasso, Milroy, Lamberton, Walnut Grove	RCEM, Hosp, Sch, CiRF, CiMo, CiW, CiMi, CiL, CiWG		Low
6	Severe Storms – Prevention	Ensure manufactured home parks have updated emergency management plans; work with park managers to improve communication during severe storms; ensure residents are familiar with emergency plans, evacuation routes, safe rooms.		Carried Over	2019-2020	Redwood County, Redwood Falls	RCEM, CiRF	This should be included in building codes.	Medium

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
7	Severe Storms – Prevention	Encourage all residents and public building to have NOAA Public Alert Radios with SAME technology and to sign up for CodeRED alerts, especially in rural areas away from community sirens.		Revised	Ongoing	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiMo, CiRF, CiR, CiSA, CiSe, CiV, CiWb, CiWG, CiWd		Low
8	Severe Storms – Protection	Ensure that critical facilities have access to backup power generators. Examine needs and costs for providing backup power generation where none currently exists.		Revised	2019-2022	Redwood County, Clements, Lamberton, Lucan, Redwood Falls, Seaforth, Wabasso, Walnut Grove	RCEM, CiC, CiLa, CiLu, CiRF, CiSe, CiWb, CiWG Hosp	No backup at Countryview Assisted Living in Walnut Grove	Medium, \$300,000
9	Severe Storms – Protection	Harden utilities, replace overhead w/ underground power lines.		Revised	Ongoing	Redwood County, Redwood Falls	RCEM, RCEO, CiRF, Utilities	City of Lucan is done.	High, Millions
11	Severe Storms – Protection	Scope at least one infrastructure retrofit project in one community each year.		Carried Over	Annually	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiCo, MiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Medium, \$10,000
12	Drought – Prevention	Work with the MN Department of Health to develop & implement Wellhead Protection Plans and educate the public on the importance of wellhead protection and water conservation.		Revised	Ongoing	Redwood County, Belview, Clements, Redwood Falls, Sanborn	RCEO, SWCD, CiB, CiC, CiRF, CiSa, MDH	City of Clements in currently in progress.	Medium
13	Wildfire – Prevention	Conduct wildfire risk assessments periodically.		Carried Over	Ongoing	Redwood County, Lamberton, Redwood Falls	RCEO, RCSO, CiLa, CiRF, Fire, DNR		Low

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
20	Hazardous Materials – Prevention	Develop Geographic Information Systems capability to map locations of fixed facilities using hazardous materials and associated transportation corridors.		Revised	Deferred	Redwood County, Redwood Falls	RCEM, RCEO, RRRSWA, CiRF, MDA, MDH, MPCA		Low, \$20,000
22	Hazardous Materials – Prevention	County, townships, and cities with airports/flightpath review airport improvement plans and zoning.		Carried Over	2019-2020	Redwood County, Redwood Falls	RCEO, CiRF, Twp, MnDOT		Medium, \$30,000
24	Civil Disturbance – Prevention	Consider zoning code changes and updates that reflect building measures to withstand terrorist attack.		Carried Over	Deferred	Redwood County, Redwood Falls	RCEO, CiRF, Sch		Low
32	Flooding/Dam Failure – Emergency Services	Work with communities to develop their own EOP.		Revised	Ongoing	Redwood County, Redwood Falls	RCEM, RCHwy, SWCD, CiRF	Redwood Falls is developing their and will release a draft template that other cities can use.	Medium, \$75,000
33	Flooding/Dam Failure – Prevention	Discourage future development within floodplains; consider minor localized flood reduction projects, especially to reduce overland flooding.		Revised	Ongoing	Redwood County, all Cities	ALL	In the floodplain ordinance.	Low
34	Flooding/Dam Failure – Protection	Encourage sound construction practices and agricultural Best Management Practices (BMPs) in flood fringe areas.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, BWSE, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd, Twp		Low

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
35	Flooding/Dam Failure – Prevention	Implement dFIRM floodplain maps.		Carried Over	Ongoing	Redwood County, Redwood Falls, Sanborn, Seaforth	RCEO, CiRF, CiSa, CiSe, DNR, FEMA	Redwood Falls and Seaforth are in the process.	Medium
37	Flooding/Dam Failure – Prevention	Encourage all property owners in flood hazard areas to purchase flood insurance.		Carried Over	Ongoing	Redwood County, Redwood Falls, Sanborn, Seaforth, Wanda	RCEO, CiRF, CiSa, CiSe, CiWd		Low
38	Flooding/Dam Failure – Protection	Develop a program to voluntarily acquire, relocate, or elevate at-risk structures in floodplains.		Carried Over	2019-2021	Redwood County, Redwood Falls, Sanborn	RCEM, RCEO, CiRF, CiSa, DNR, HSEM		Medium, \$50,000
39	Flooding/Dam Failure – Protection	Retrofit infrastructure to reduce impacts of flooding; stabilize/replace at-risk bridges and slopes prone to sloughing.		Revised	Ongoing	Redwood County, Belview, Redwood Falls, Sanborn, Seaforth	RCHwy, RCEO, CiB, CiRF, CiSa, CiSe		High, \$5,000,000
41	Flooding/Dam Failure – Prevention	Encourage sump pump ordinances and strengthen existing ordinances with inspection.		New	Ongoing	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd		Low
46	Utility Failure – Structural/ Protection	Retrofit, flood-proof, and/or harden sanitary sewer lines to prevent infiltration.		New	2019-2024	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, Utility, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd,		High, \$100,000

Figure G-9: Mitigation Actions for the City of Revere

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
1	Ag Disease – Awareness	Provide information on ag disease and prevention to producers and residents.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, Ext, FSA, MDA, MDH, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd		Low
3	Severe Storms – Structural	Conduct a study to determine what places in the county and each city are deficient in safe rooms; Construct at least one new safe room or improve warning system in one community each year.		Revised	2019-2023	Redwood County, all Cities	RCEM, RCEO, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd	Currently no safe rooms in Redwood County	Medium, \$45,000
7	Severe Storms – Prevention	Encourage all residents and public building to have NOAA Public Alert Radios with SAME technology and to sign up for CodeRED alerts, especially in rural areas away from community sirens.		Revised	Ongoing	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Low
11	Severe Storms – Protection	Scope at least one infrastructure retrofit project in one community each year.		Carried Over	Annually	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiCo, MiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Medium, \$10,000
33	Flooding/Dam Failure – Prevention	Discourage future development within floodplains; consider minor localized flood reduction projects, especially to reduce overland flooding.		Revised	Ongoing	Redwood County, all Cities	ALL	In the floodplain ordinance.	Low

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
34	Flooding/Dam Failure – Protection	Encourage sound construction practices and agricultural Best Management Practices (BMPs) in flood fringe areas.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, BWSE, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd, Twp		Low
36	Flooding/Dam Failure – Prevention	Jurisdictions not currently participating in the National Flood Insurance Program (NFIP) will review their flood hazard areas and consider participation.		Carried Over	2019-2020	Delhi, Revere, Vesta, Walnut Grove, Wanda	DNR, CiD, CiR, CiV, CiWG, CiWd		Medium
41	Flooding/Dam Failure – Prevention	Encourage sump pump ordinances and strengthen existing ordinances with inspection.		New	Ongoing	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd		Low
46	Utility Failure – Structural/ Protection	Retrofit, flood-proof, and/or harden sanitary sewer lines to prevent infiltration.		New	2019-2024	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, Utility, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd,		High, \$100,000

Figure G-10: Mitigation Actions for the City of Sanborn

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
1	Ag Disease – Awareness	Provide information on ag disease and prevention to producers and residents.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, Ext, FSA, MDA, MDH, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd		Low
3	Severe Storms – Structural	Conduct a study to determine what places in the county and each city are deficient in safe rooms; Construct at least one new safe room or improve warning system in one community each year.		Revised	2019-2023	Redwood County, all Cities	RCEM, RCEO, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd	Currently no safe rooms in Redwood County	Medium, \$45,000
7	Severe Storms – Prevention	Encourage all residents and public building to have NOAA Public Alert Radios with SAME technology and to sign up for CodeRED alerts, especially in rural areas away from community sirens.		Revised	Ongoing	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Low
11	Severe Storms – Protection	Scope at least one infrastructure retrofit project in one community each year.		Carried Over	Annually	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiCo, MiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Medium, \$10,000
12	Drought – Prevention	Work with the MN Department of Health to develop & implement Wellhead Protection Plans and educate the public on the importance of wellhead protection and water conservation.		Revised	Ongoing	Redwood County, Belview, Clements, Redwood Falls, Sanborn	RCEO, SWCD, CiB, CiC, CiRF, CiSa, MDH	City of Clements in currently in progress.	Medium

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
33	Flooding/Dam Failure – Prevention	Discourage future development within floodplains; consider minor localized flood reduction projects, especially to reduce overland flooding.		Revised	Ongoing	Redwood County, all Cities	ALL	In the floodplain ordinance.	Low
34	Flooding/Dam Failure – Protection	Encourage sound construction practices and agricultural Best Management Practices (BMPs) in flood fringe areas.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, BWSE, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd, Twp		Low
35	Flooding/Dam Failure – Prevention	Implement dFIRM floodplain maps.		Carried Over	Ongoing	Redwood County, Redwood Falls, Sanborn, Seaforth	RCEO, CiRF, CiSa, CiSe, DNR, FEMA	Redwood Falls and Seaforth are in the process.	Medium
37	Flooding/Dam Failure – Prevention	Encourage all property owners in flood hazard areas to purchase flood insurance.		Carried Over	Ongoing	Redwood County, Redwood Falls, Sanborn, Seaforth, Wanda	RCEO, CiRF, CiSa, CiSe, CiWd		Low
38	Flooding/Dam Failure – Protection	Develop a program to voluntarily acquire, relocate, or elevate at-risk structures in floodplains.		Carried Over	2019-2021	Redwood County, Redwood Falls, Sanborn	RCEM, RCEO, CiRF, CiSa, DNR, HSEM		Medium, \$50,000
39	Flooding/Dam Failure – Protection	Retrofit infrastructure to reduce impacts of flooding; stabilize/replace at-risk bridges and slopes prone to sloughing.		Revised	Ongoing	Redwood County, Belview, Redwood Falls, Sanborn, Seaforth	RCHwy, RCEO, CiB, CiRF, CiSa, CiSe		High, \$5,000,000

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
41	Flooding/Dam Failure – Prevention	Encourage sump pump ordinances and strengthen existing ordinances with inspection.		New	Ongoing	Redwood County, Belview, Clements, Delhi, Lambertton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd		Low
46	Utility Failure – Structural/ Protection	Retrofit, flood-proof, and/or harden sanitary sewer lines to prevent infiltration.		New	2019-2024	Redwood County, Belview, Clements, Delhi, Lambertton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, Utility, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd,		High, \$100,000

Figure G-11: Mitigation Actions for the City of Seaforth

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
1	Ag Disease – Awareness	Provide information on ag disease and prevention to producers and residents.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, Ext, FSA, MDA, MDH, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd		Low
3	Severe Storms – Structural	Conduct a study to determine what places in the county and each city are deficient in safe rooms; Construct at least one new safe room or improve warning system in one community each year.		Revised	2019-2023	Redwood County, all Cities	RCEM, RCEO, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd	Currently no safe rooms in Redwood County	Medium, \$45,000
7	Severe Storms – Prevention	Encourage all residents and public building to have NOAA Public Alert Radios with SAME technology and to sign up for CodeRED alerts, especially in rural areas away from community sirens.		Revised	Ongoing	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Low
8	Severe Storms – Protection	Ensure that critical facilities have access to backup power generators. Examine needs and costs for providing backup power generation where none currently exists.		Revised	2019-2022	Redwood County, Clements, Lambertson, Lucan, Redwood Falls, Seaforth, Wabasso, Walnut Grove	RCEM, CiC, CiLa, CiLu, CiRF, CiSe, CiWb, CiWG Hosp	No backup at Countryview Assisted Living in Walnut Grove	Medium, \$300,000
11	Severe Storms – Protection	Scope at least one infrastructure retrofit project in one community each year.		Carried Over	Annually	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiCo, MiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Medium, \$10,000

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
33	Flooding/Dam Failure – Prevention	Discourage future development within floodplains; consider minor localized flood reduction projects, especially to reduce overland flooding.		Revised	Ongoing	Redwood County, all Cities	ALL	In the floodplain ordinance.	Low
34	Flooding/Dam Failure – Protection	Encourage sound construction practices and agricultural Best Management Practices (BMPs) in flood fringe areas.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, BWSE, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd, Twp		Low
35	Flooding/Dam Failure – Prevention	Implement dFIRM floodplain maps.		Carried Over	Ongoing	Redwood County, Redwood Falls, Sanborn, Seaforth	RCEO, CiRF, CiSa, CiSe, DNR, FEMA	Redwood Falls and Seaforth are in the process.	Medium
37	Flooding/Dam Failure – Prevention	Encourage all property owners in flood hazard areas to purchase flood insurance.		Carried Over	Ongoing	Redwood County, Redwood Falls, Sanborn, Seaforth, Wanda	RCEO, CiRF, CiSa, CiSe, CiWd		Low
39	Flooding/Dam Failure – Protection	Retrofit infrastructure to reduce impacts of flooding; stabilize/replace at-risk bridges and slopes prone to sloughing.		Revised	Ongoing	Redwood County, Belview, Redwood Falls, Sanborn, Seaforth	RCHwy, RCEO, CiB, CiRF, CiSa, CiSe		High, \$5,000,000
41	Flooding/Dam Failure – Prevention	Encourage sump pump ordinances and strengthen existing ordinances with inspection.		New	Ongoing	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd		Low

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
46	Utility Failure – Structural/ Protection	Retrofit, flood-proof, and/or harden sanitary sewer lines to prevent infiltration.		New	2019-2024	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, Utility, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd,		High, \$100,000

Figure G-12: Mitigation Actions for the City of Vesta

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
1	Ag Disease – Awareness	Provide information on ag disease and prevention to producers and residents.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, Ext, FSA, MDA, MDH, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd		Low
3	Severe Storms – Structural	Conduct a study to determine what places in the county and each city are deficient in safe rooms; Construct at least one new safe room or improve warning system in one community each year.		Revised	2019-2023	Redwood County, all Cities	RCEM, RCEO, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd	Currently no safe rooms in Redwood County	Medium, \$45,000
7	Severe Storms – Prevention	Encourage all residents and public building to have NOAA Public Alert Radios with SAME technology and to sign up for CodeRED alerts, especially in rural areas away from community sirens.		Revised	Ongoing	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Low
11	Severe Storms – Protection	Scope at least one infrastructure retrofit project in one community each year.		Carried Over	Annually	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiCo, MiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Medium, \$10,000
33	Flooding/Dam Failure – Prevention	Discourage future development within floodplains; consider minor localized flood reduction projects, especially to reduce overland flooding.		Revised	Ongoing	Redwood County, all Cities	ALL	In the floodplain ordinance.	Low

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
34	Flooding/Dam Failure – Protection	Encourage sound construction practices and agricultural Best Management Practices (BMPs) in flood fringe areas.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, BWSE, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd, Twp		Low
36	Flooding/Dam Failure – Prevention	Jurisdictions not currently participating in the National Flood Insurance Program (NFIP) will review their flood hazard areas and consider participation.		Carried Over	2019-2020	Delhi, Revere, Vesta, Walnut Grove, Wanda	DNR, CiD, CiR, CiV, CiWG, CiWd		Medium
41	Flooding/Dam Failure – Prevention	Encourage sump pump ordinances and strengthen existing ordinances with inspection.		New	Ongoing	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd		Low
42	Flooding/Dam Failure – Structural	Harden water retention areas. Raise existing water retention ponds and create new ones where appropriate.		New	2019-2024	Redwood County, Belview, Clements, Vesta	RCEO, RCEM, SWCD, CiB, CiC, CiV		High, \$10 million
43	Landslide/Subsidence – Prevention	Inventory potential sinkhole hazards from sources such as failed tile lines, septic systems, and cisterns.		New	2019-2024	Redwood County, Vesta	RCEO, RCEM, Twp, CiV	Failed tile lines in Vesta pose a risk for sinkholes.	Low

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
46	Utility Failure – Structural/ Protection	Retrofit, flood-proof, and/or harden sanitary sewer lines to prevent infiltration.		New	2019-2024	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, Utility, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd,		High, \$100,000

Figure G-13: Mitigation Actions for the City of Wabasso

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
1	Ag Disease – Awareness	Provide information on ag disease and prevention to producers and residents.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, Ext, FSA, MDA, MDH, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd		Low
3	Severe Storms – Structural	Conduct a study to determine what places in the county and each city are deficient in safe rooms; Construct at least one new safe room or improve warning system in one community each year.		Revised	2019-2023	Redwood County, all Cities	RCEM, RCEO, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd	Currently no safe rooms in Redwood County	Medium, \$45,000
4	Severe Storms – Awareness	Educate local schools, nursing homes, assisted living, hospitals, etc on importance of doing a “Severe Weather Awareness Week” workshop for their staff, including identifying evacuation routes and safe rooms.		Carried Over	Ongoing	Redwood County, Redwood Falls, Morgan, Wabasso, Milroy, Lambertson, Walnut Grove	RCEM, Hosp, Sch, CiRF, CiMo, CiW, CiMi, CiL, CiWG		Low
7	Severe Storms – Prevention	Encourage all residents and public building to have NOAA Public Alert Radios with SAME technology and to sign up for CodeRED alerts, especially in rural areas away from community sirens.		Revised	Ongoing	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Low

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
8	Severe Storms – Protection	Ensure that critical facilities have access to backup power generators. Examine needs and costs for providing backup power generation where none currently exists.		Revised	2019-2022	Redwood County, Clements, Lamberton, Lucan, Redwood Falls, Seaforth, Wabasso, Walnut Grove	RCEM, CiC, CiLa, CiLu, CiRF, CiSe, CiWb, CiWG Hosp	No backup at Countryview Assisted Living in Walnut Grove	Medium, \$300,000
11	Severe Storms – Protection	Scope at least one infrastructure retrofit project in one community each year.		Carried Over	Annually	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiCo, MiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Medium, \$10,000
33	Flooding/Dam Failure – Prevention	Discourage future development within floodplains; consider minor localized flood reduction projects, especially to reduce overland flooding.		Revised	Ongoing	Redwood County, all Cities	ALL	In the floodplain ordinance.	Low
34	Flooding/Dam Failure – Protection	Encourage sound construction practices and agricultural Best Management Practices (BMPs) in flood fringe areas.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, BWSE, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd, Twp		Low
41	Flooding/Dam Failure – Prevention	Encourage sump pump ordinances and strengthen existing ordinances with inspection.		New	Ongoing	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd		Low

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
46	Utility Failure – Structural/ Protection	Retrofit, flood-proof, and/or harden sanitary sewer lines to prevent infiltration.		New	2019-2024	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, Utility, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd,		High, \$100,000

Figure G-14: Mitigation Actions for the City of Walnut Grove

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
1	Ag Disease – Awareness	Provide information on ag disease and prevention to producers and residents.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, Ext, FSA, MDA, MDH, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd		Low
3	Severe Storms – Structural	Conduct a study to determine what places in the county and each city are deficient in safe rooms; Construct at least one new safe room or improve warning system in one community each year.		Revised	2019-2023	Redwood County, all Cities	RCEM, RCEO, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd	Currently no safe rooms in Redwood County	Medium, \$45,000
4	Severe Storms – Awareness	Educate local schools, nursing homes, assisted living, hospitals, etc on importance of doing a “Severe Weather Awareness Week” workshop for their staff, including identifying evacuation routes and safe rooms.		Carried Over	Ongoing	Redwood County, Redwood Falls, Morgan, Wabasso, Milroy, Lamberton, Walnut Grove	RCEM, Hosp, Sch, CiRF, CiMo, CiW, CiMi, CiL, CiWG		Low
7	Severe Storms – Prevention	Encourage all residents and public building to have NOAA Public Alert Radios with SAME technology and to sign up for CodeRED alerts, especially in rural areas away from community sirens.		Revised	Ongoing	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Low

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
8	Severe Storms – Protection	Ensure that critical facilities have access to backup power generators. Examine needs and costs for providing backup power generation where none currently exists.		Revised	2019-2022	Redwood County, Clements, Lamberton, Lucan, Redwood Falls, Seaforth, Wabasso, Walnut Grove	RCEM, CiC, CiLa, CiLu, CiRF, CiSe, CiWb, CiWG Hosp	No backup at Countryview Assisted Living in Walnut Grove	Medium, \$300,000
11	Severe Storms – Protection	Scope at least one infrastructure retrofit project in one community each year.		Carried Over	Annually	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiCo, MiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Medium, \$10,000
33	Flooding/Dam Failure – Prevention	Discourage future development within floodplains; consider minor localized flood reduction projects, especially to reduce overland flooding.		Revised	Ongoing	Redwood County, all Cities	ALL	In the floodplain ordinance.	Low
34	Flooding/Dam Failure – Protection	Encourage sound construction practices and agricultural Best Management Practices (BMPs) in flood fringe areas.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, BWSE, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd, Twp		Low
36	Flooding/Dam Failure – Prevention	Jurisdictions not currently participating in the National Flood Insurance Program (NFIP) will review their flood hazard areas and consider participation.		Carried Over	2019-2020	Delhi, Revere, Vesta, Walnut Grove, Wanda	DNR, CiD, CiR, CiV, CiWG, CiWd		Medium

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
41	Flooding/Dam Failure – Prevention	Encourage sump pump ordinances and strengthen existing ordinances with inspection.		New	Ongoing	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd		Low
46	Utility Failure – Structural/ Protection	Retrofit, flood-proof, and/or harden sanitary sewer lines to prevent infiltration.		New	2019-2024	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, Utility, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd,		High, \$100,000

Figure G-15: Mitigation Actions for the City of Wanda

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
1	Ag Disease – Awareness	Provide information on ag disease and prevention to producers and residents.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, Ext, FSA, MDA, MDH, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd		Low
3	Severe Storms – Structural	Conduct a study to determine what places in the county and each city are deficient in safe rooms; Construct at least one new safe room or improve warning system in one community each year.		Revised	2019-2023	Redwood County, all Cities	RCEM, RCEO, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, ViWG, CiWd	Currently no safe rooms in Redwood County	Medium, \$45,000
7	Severe Storms – Prevention	Encourage all residents and public building to have NOAA Public Alert Radios with SAME technology and to sign up for CodeRED alerts, especially in rural areas away from community sirens.		Revised	Ongoing	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Low
11	Severe Storms – Protection	Scope at least one infrastructure retrofit project in one community each year.		Carried Over	Annually	Redwood County, all Cities	RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, MiCo, MiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWG, CiWd		Medium, \$10,000
33	Flooding/Dam Failure – Prevention	Discourage future development within floodplains; consider minor localized flood reduction projects, especially to reduce overland flooding.		Revised	Ongoing	Redwood County, all Cities	ALL	In the floodplain ordinance.	Low

Action Number	Hazard - Strategy	Mitigation Action	Priority	Status	Time-frame	Jurisdictions	Responsibility	Redwood County Comments on Planning Mechanisms for Implementation	Est. Cost/ Source
34	Flooding/Dam Failure – Protection	Encourage sound construction practices and agricultural Best Management Practices (BMPs) in flood fringe areas.		Revised	Ongoing	Redwood County, all Cities	RCEO, SWCD, BWSE, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd, Twp		Low
36	Flooding/Dam Failure – Prevention	Jurisdictions not currently participating in the National Flood Insurance Program (NFIP) will review their flood hazard areas and consider participation.		Carried Over	2019-2020	Delhi, Revere, Vesta, Walnut Grove, Wanda	DNR, CiD, CiR, CiV, CiWG, CiWd		Medium
37	Flooding/Dam Failure – Prevention	Encourage all property owners in flood hazard areas to purchase flood insurance.		Carried Over	Ongoing	Redwood County, Redwood Falls, Sanborn, Seaforth, Wanda	RCEO, CiRF, CiSa, CiSe, CiWd		Low
41	Flooding/Dam Failure – Prevention	Encourage sump pump ordinances and strengthen existing ordinances with inspection.		New	Ongoing	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd		Low
46	Utility Failure – Structural/ Protection	Retrofit, flood-proof, and/or harden sanitary sewer lines to prevent infiltration.		New	2019-2024	Redwood County, Belview, Clements, Delhi, Lamberton, Lucan, Milroy, Morgan, Redwood Falls, Revere, Sanborn, Seaforth, Vesta, Wabasso, Walnut Grove, Wanda	RCEO, RCEM, Utility, CiB, CiC, CiD, CiLa, CiLu, CiMi, CiMo, CiRF, CiR, CiSa, CiSe, CiV, CiWb, CiWB, CiWd,		High, \$100,000

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Appendix H - Redwood County Plans & Programs in Place

Planning & Regulatory

Plans/Programs	Yes / No
Comprehensive/Master Plan	No
Capital Improvements Plan	No
Economic Development Plan	No
Emergency Operations Plan	Yes
Continuity of Operations Plan	No
Transportation Plan	Yes
Storm water Management Plan	Some
Community Wildfire Protection Plan	No
FireWise Program	No
Water Conservation/Emergency Preparedness Plan	No
Wellhead Protection Plan	Some
Database of dry hydrants/well access	Yes
Burning permits/restrictions	Yes
Water Management Plan	Yes
Zoning ordinance	Yes
Subdivision ordinance	Yes/Some
Floodplain ordinance	Yes
Natural hazard specific ordinance (storm water, steep slope, wildfire)	Yes
Flood insurance rate maps	Yes
Acquisition of land for open space and public recreation uses	Yes
School closing policy/communications plan in event of inclement weather/temperatures	Yes
Storm shelters (list all locations)	No
Warning sirens (list all locations)	Yes
SKYWARN Program	Yes
CodeRED Mass Notification System	Yes
Severe Weather Awareness Week	Yes
Winter Weather Awareness Week	Yes
NOAA Weather Radios	Yes

Administrative & Technical

Administration	Yes / No
Planning Commission	Yes
Mitigation Planning Committee	Yes
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Yes
Mutual aid agreements	Yes
Staff	Yes / No
Chief Building Official	Yes
Floodplain Administrator	Yes
Emergency Manager	Yes
Community Planner	No
Civil Engineer	Yes
GIS Coordinator	Yes
Technical	Yes / No
Warning systems/services (Reverse 911, outdoor warning signals)	Yes
Hazard data and information	No
Hazus analysis	Yes

Education & Outreach

Program/Organization	Yes / No
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Yes
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Yes
Natural disaster or safety related school programs	Yes
StormReady certification	No
Firewise Communities certification	No
Public-private partnership initiatives addressing disaster-related issues	Yes