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Section 1: Introduction

Every day, unforeseen circumstances threaten Marshall County. Possibilities ranging from loss of life, to loss of property, or jobs can be experienced from natural, technological, and human-made hazards.

Hazard mitigation in Marshall County has become an increased priority due to an emphasis placed on preventing disasters and reducing damage prior to an actual event occurring. The stimulus of this is the Disaster Mitigation Act of 2000. The Disaster Mitigation Act of 2000 requires that units of local government (cities, townships, and counties) must have an approved mitigation plan in order to receive mitigation grant funding from disasters occurring after November 1, 2004. The purposes of the Disaster Mitigation Act were fourfold:

1. Revise sections of the Robert T. Stafford Disaster Relief and Emergency Assistance Act.
2. Govern costs of federal disaster assistance.
3. Organize a national program for pre-disaster mitigation.
4. Streamline dispensation of disaster relief.

Hazard mitigation planning is a collaborative process that jurisdictions take to develop a plan that outlines how they will protect themselves from hazards. FEMA requires that this planning process occurs in all counties in states across the nation. Failure to comply with these requirements will result in that county or local government unit not being eligible for certain aspects of federal mitigation funding.

Mitigation actions implemented today will reduce the disaster recovery dollars needed for tomorrow. Hazard mitigation breaks the recurring damage/loss cycle. Mitigation is currently accomplished in several ways: construction, prevention, planning and education. It is through these mitigation methods that a balance between the constructed and natural environments is achieved.

The overall goals of the hazard mitigation plan for Marshall County are to get people, property, jobs, and natural resources out of harm's way. The plan is organized in five related, but distinct areas that the planners believe will provide Marshall County and participating jurisdictions the most flexibility to achieve the noted goals. The following sections are included:

1. **County Profile** – This chapter contains information on the County's history, demographics, physical features, infrastructure, and emergency response
2. **Hazards Profile** – This chapter identifies and profiles the various hazards addressed in the plan
3. **Risk Assessment** – This chapter provides a risk assessment for each local governmental unit covered in the plan

HAZARD MITIGATION

“Hazard mitigation refers to any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazardous conditions. Making the best long-term decisions requires analytical steps that are best summarized as planning” (FEMA, 2002).

4. **Goals, Objectives, and Mitigation Strategies** – This chapter identifies the specific mitigation steps the participating jurisdictions have committed to achieving the goals of the plan
5. **Plan Administration** – This chapter outlines how the plan will be administered, including implementation tables for chapter four.

The plan provides guidelines for dealing with present and future hazards. More specific steps are outlined in the county emergency response plans, watershed plans, county water plans and zoning ordinances. The written plan does not replace existing operational mitigation plans currently in use, but supplements them, helping to reinforce and/or improve present and future mitigation. The finished plan depicts a unified and continuous effort and commitment by many dedicated people in Marshall County, all participating jurisdictions, as well as Minnesota Homeland Security Emergency Management, and FEMA.

1.1 Plan Goals and Authority

The goals of the Marshall County Multi-Jurisdictional Hazard Mitigation Plan are to:

- Increase community understanding of emergency management and build support for hazard mitigation
- Develop, promote, integrate and track mitigation strategies
- Continue to improve and enhance the county's emergency management program
- Increase the economic stability, core values, and quality of services of the county
- Increase mitigation resources to eliminate or minimize harm done to people, property, jobs, and natural resources in Marshall County by natural and manmade hazards

The Marshall County Hazard Mitigation Plan has been developed in accordance with requirements set forth in the Disaster Mitigation Act of 2000. The Disaster Mitigation Act of 2000 establishes the framework for pre-disaster hazard mitigation planning and provides the legal basis for state, local and tribal mitigation planning requirements. The newly introduced plan highlights the importance of coordinating hazard mitigation efforts among state, tribal, and local jurisdictions. Under 44 CFR §201.6 local governments must have a FEMA approved hazard mitigation plan in order to apply for and/or receive mitigation funding through existing hazard mitigation assistance programs:


1.2 Hazard Mitigation Grant Program (HMGP)

The Hazard Mitigation Grant Program (HMGP) provides grants to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. Authorized under Section 404 of the Stafford Act and administered by FEMA, HMGP was created to reduce the loss of life and property due to natural disasters.

The program enables mitigation measures to be implemented during the immediate recovery from a disaster. These mitigation measures include:

- Acquisition of real property from willing sellers, and demolition or relocation of buildings to convert the property to open space use
- Retrofitting structures and facilities to minimize damages from high winds, flood, or other natural hazards

- Safe room construction.
- Elevation of flood prone structures
- Development and initial implementation of vegetative management or invasive species programs
- Minor flood reduction projects that do not duplicate the flood prevention activities of other Federal agencies
- Localized flood control projects, such as certain ring levees and floodwall systems, designed specifically to protect critical facilities
- Post-disaster evaluations of potential building codes modifications
- Hazard mitigation planning



*It is estimated that for every dollar spent
on mitigation activities, four dollars
are saved in disaster caused damages.*

Congressional Budget Office (2007)

To offset the cost of mitigation activities, jurisdictions can collaborate with federal organizations and programs. The following are just two examples of programs that can help fund mitigation activities.

1.3 Pre-Disaster Mitigation (PDM)

The Pre-Disaster Mitigation (PDM) program provides funds to states, territories, Indian tribal governments, communities, and universities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. These activities include:

- Voluntary acquisition of real property in flood plains and or property repeatedly damaged by flooding
- Elevation of existing public or private structures
- Construction of safe rooms for public or private structures that meet FEMA requirements
- Hydrologic and hydraulic studies/analyses
- Engineering and drainage studies for project design and feasibility
- Protective measures for utilities, water, sewer, roads and bridges, and storm water management to reduce/eliminate long-term flood risk

1.4 Flood Mitigation Assistance (FMA)

FMA implements cost-effective measures to reduce or eliminate long-term risk of flood damage to National Flood Insurance Program (NFIP) structures. State-level agencies, tribes, and local governments 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
- Repetitive flood claims
- Severe Repetitive Loss

1.5 Participation

Effective mitigation planning does not occur in a vacuum. It requires the entire community to be involved in the mitigation planning process. Thus, the planning process and its ability to identify, engage, and include the entire community is just as important as the plan itself. Throughout the mitigation planning process, Marshall County invited all of the jurisdictions to attend mitigation planning meetings, participate in workshops, and provide input and feedback in the development of the mitigation plan. The following jurisdictions were represented in updating the Marshall County All-Hazard Mitigation Plan Update:

- Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, Warren and Marshall County.

In addition to the noted jurisdictions, efforts were made to invite the public to participate in the planning process.

Section 2: Mitigation Plan Update

Effective planning efforts result in high quality and useful plans; however, written plans are only one element in the process. The planning process is as important as the plan itself. A successful planning process forges partnerships and brings together a cross-section of government agencies, the public, and other stakeholders to reach consensus on how to achieve a desired outcome or resolve a community issue.

Applying an inclusive and transparent process adds validity to the plan. The result is a common set of community values and widespread support for directing financial, technical, and human resources to an agreed upon action. The planning process was an integral part of the Marshall County's Hazard Mitigation Plan. This section describes Marshall County's planning process and how the hazard mitigation plan evolved.

FEMA Requirements Addressed in this Section:

Requirement

§201.6(b) An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:

§201.6(b)(1) (1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;

§201.6(b)(2) (2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and

§201.6(b)(3) (3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

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

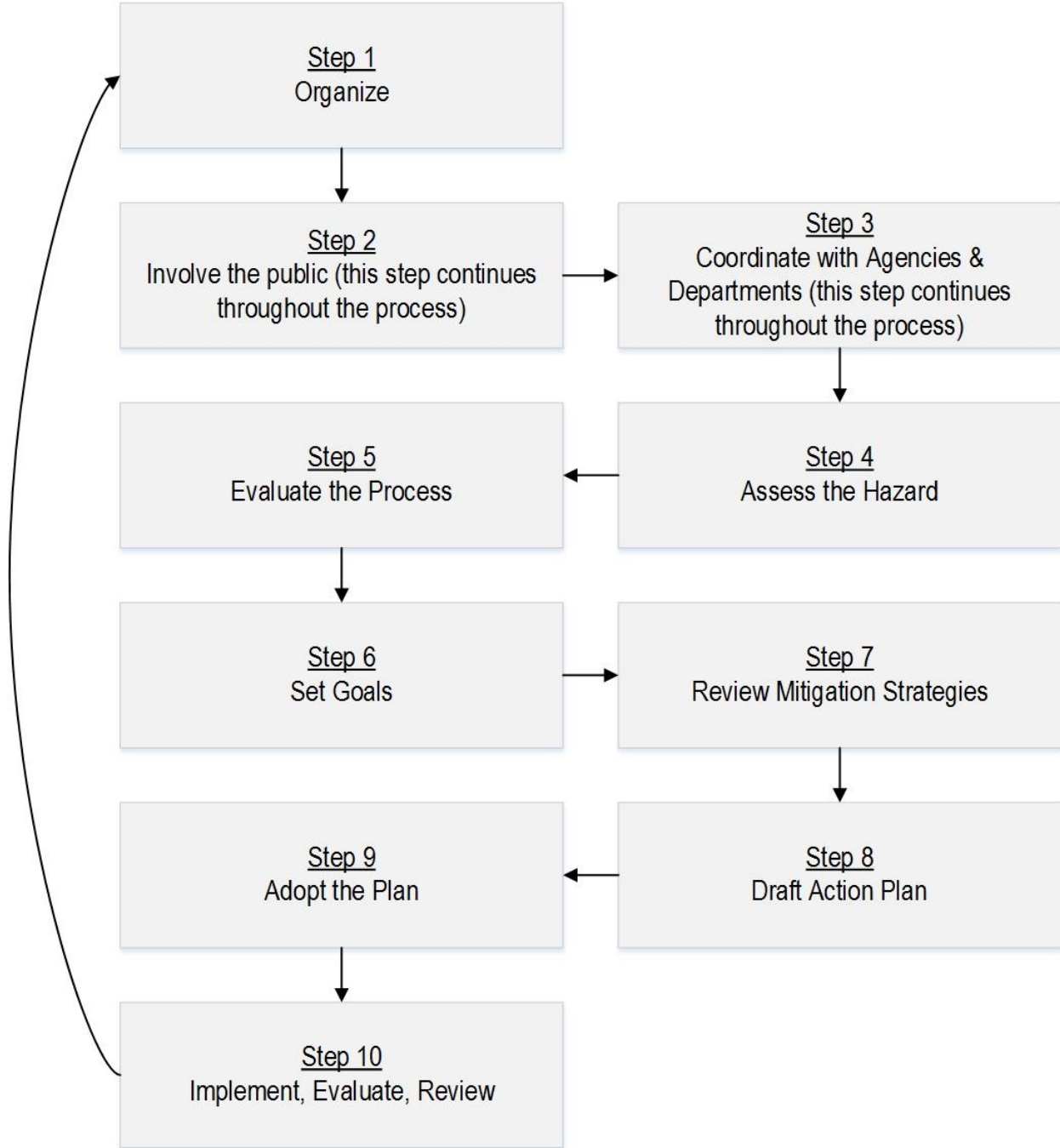
§201.6(c)(4)(i) [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

§201.6(c)(4)(iii) [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.

2.1 Planning Process

To help guide the mitigation update, The Marshall County Steering Committee, and by extension, the Hazard Mitigation Planning Team followed the 10-step process listed below. The planning process is based on the FEMA guidance for mitigation planning. The following graph is a visual representation of the planning process used throughout the plan update cycle.

Figure 1: Planning Process



In addition to the listed process, it is important to note that several key stakeholders reviewed the hazards and their effects on people and property, identified ways to reduce and prevent damage, and recommended the most appropriate and feasible measures for implementation. The Hazard Mitigation Planning Team organized the current plan and updated procedures, reviewed existing plans and programs, and coordinated with stakeholders and the public. The Hazard Mitigation Steering Committee coordinated with key agencies and other organizations to provide insight and discussion throughout the planning process.

2.1.1 Plan Administrators

Because mitigation planning is an all-inclusive process, the involvement of the Marshall County Emergency Manager, Hazard Mitigation Steering Committee, Hazard Mitigation Planning Team and participating jurisdictions was crucial. To accommodate this requirement, these key groups were assigned various duties and responsibilities. These responsibilities were created to ensure the mitigation plan was comprehensive, reflected the goals of Marshall County, and fulfilled the requirements of the mitigation planning process. The aforementioned groups worked closely with several key stakeholders who, in turn, helped to shape the plan.

2.1.2 Emergency Manager Role and Responsibilities

Josh Johnson, the Marshall County Emergency Manager, was ultimately responsible for completing the hazard mitigation plan update, ensuring that all identified mitigation activities were incorporated into comprehensive strategies that protect the county and its participating jurisdictions. The Marshall County Emergency Manager orchestrated the update process, led the Hazard Mitigation Steering Committee and Hazard Mitigation Planning Team, as well as consolidated and solidified stakeholders across the county. The following includes a summary of the duties and responsibilities of the Emergency Manager:

- Oversee the planning process
- Ensure the Plan met the needs of the county, citizens, and complied with the code of federal regulations
- Selection of the Hazard Mitigation Steering Committee members
- Chair the Hazard Mitigation Steering Committee
- Lead the Hazard Mitigation Planning Team
- Take attendance and documenting all meetings
- Point of contact for the plan and planning process
- Ensure the plan was up to date and maintained; i.e., as outlined in the “*Maintain and Maintenance*” section of this plan
- Work within and between the participating jurisdictions and other key stakeholders to ensure the plan represented the entire county
- Ensure that participating jurisdictions were included in the planning update.
- Invite the public to participate and post all updated milestones for review and comment.

2.1.3 The Mitigation Steering Committee

A vital component of the Marshall County 5-year mitigation update effort was to identify the Hazard Mitigation Steering Committee. Identification of this core group was important in ensuring implementation and support of the mitigation planning process. Hazard Mitigation Steering Committee members were chosen for their knowledge of the county, cities, and community services.

Table 1: Hazard Mitigation Steering Committee Members

Marshall County Steering Committee		
Name	Organization	Title
Josh Johnston	Marshall County	County EM Director
Scott Jorgenson	Marshall County	County EM Deputy Director
Scott Peters	Marshall County	Auditor Treasurer
Jason Boman	Marshall County	Sheriff
Lone Aune	Marshall County	County Engineer
Gail Larson	NVHC	Public Health Director
Mark Jones	NVHC	Safety Director
Leroy Vonasek	Marshall County	County Commissioner
Leroy Nelson	Fork Township	Township Officer
Heather Lee	Tri Valley EMS	EMT
Chris Kujava	Marshall County	Social Services Director
Jennifer Olson	NWRDC	Regional Planner
Bob Thompson	Grygla	Grygla Fire Chief

Note: The Marshall County Emergency Manager provided this list of Hazard Mitigation Steering Committee Members.

With regard to the mitigation planning cycle of 2016, the Hazard Mitigation Steering Committee was responsible for ensuring the following:

- Oversee the plan and ensure its relevance to the changing situation of the county
- Monitor and evaluate the mitigation strategies
- Ensure documents reflect current hazard/risk analysis, development trends, code changes and risk perceptions of the county
- Ensure the plan was up to date and maintained as outlined within the plan
- Provided guidance to the Hazard Mitigation Planning Team
- Approve the plan update and processes used to complete the plan

2.1.4 Hazard Mitigation Planning Team

The Hazard Mitigation Planning Team (See the Hazard Mitigation Planning Team Table) provided technical guidance, documented the planning process, and wrote the mitigation plan update. The Marshall County Emergency Manager served as the coordinating entity of the Hazard Mitigation Planning Team.

The Hazard Mitigation Planning Team facilitated the overall plan development to ensure the Hazard Mitigation Plan and Marshall County met the requirements of DMA 2000. Beyond administration, content organization, and text development, the following duties summarize the Hazard Mitigation Planning Team's responsibilities.

- Organize and guide all meetings
- Review all documents provided by the EM and participating jurisdictions
- Provide technical assistance
- Guide the plan development to adhere to DMA 2000 requirements
- Modeled disasters

- Conduct a capability assessment
- Conduct a risk assessment
- Create a hazard and community profile
- Attend and facilitate all the Hazard Mitigation Steering Committee meetings

Table 2: Hazard Mitigation Planning Team Table

Marshall County Planning Team		
5-year Update		
Member	Organization	Title
Josh Johnston	Marshall County	Emergency Manager
Michael Kemp	Integrated Solutions Consulting	Project Manager
Kimberly Pleva-Berka	Integrated Solutions Consulting	Planner

2.1.5 Participating Jurisdictions

Another important aspect of the planning administration process was the inclusion and involvement of the participating jurisdictions. With regard to the 2016 planning cycle, the following participating jurisdictions participated in the planning efforts of the Marshall County Multi-jurisdictional Hazard Mitigation Plan (see Participating jurisdiction call out the box).

Table 3: Participating Jurisdictions

Participating Jurisdictions
Marshall County, Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren

The participating jurisdictions participated in the plan by providing information, attending meetings and giving substantive feedback regarding their jurisdiction and the overall mitigation plan update process. As such, the participating jurisdictions were key participants in the general planning process, hazard identification, risk assessments and the mitigation strategy update process.

The participating jurisdictions were responsible for the following:

- Ensure their participation in mitigating process
- Provide relevant information pertinent to their jurisdictions
- Ensure that within their own jurisdictions, the mitigation plan would be integrated into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate
- Work with the Marshall County Emergency Manager and mitigation planning committee as part of the iterative planning process
- Providing information concerning past mitigation actions and creating new mitigation actions
- Providing comment and review of the plan's community profile, hazard profile, risk assessment, capability assessment, mitigation goals, and maintenance and management section

Each jurisdiction participating in the plan update acted as an official conduit between their respective cities and their citizens. The insight offered by, and provided to the Hazard Mitigation Planning Team by the jurisdictions was invaluable in ensuring the plan represented the entire county.

2.1.6 Meetings and Participation

To kick off the planning process, a series of conference calls were held between Marshall County personnel and the mitigation planner. These meetings helped organize the planning process. During these meetings, goals of the planning update were created, priorities were set, responsibilities delegated, key stakeholders and public participants were identified.

While the kickoff meeting discussed several issues, some of the key outcomes included the following important planning details:

- Due to concerns with time commitments and available county resources, it was communicated to the Hazard Mitigation Planning Team that correspondence would be in electronic format as much as possible (webpages, conference calls, electronic document management systems and email)
- It was communicated that the Marshall County Emergency Manager would be responsible for the development of the plan
- To ensure the involvement of the county stakeholders, the planning process would be iterative
- It was understood that the county would be responsible for ensuring participation and providing requested documents and resources needed to complete the planning process
- It was decided that the county would be responsible for initiating all communication between the Hazard Mitigation Planning Team and stakeholders
- The planner noted that it would be the Marshall County's responsibility to take and keep all records, notes and attendance of all meetings. In addition, it was noted the Marshall County Emergency Manager would provide a matrix of the noted meetings to be included in the written plan update
- The Hazard Mitigation Planning Team would complete a community profile, hazard profile, risk assessment, capability assessment, and update mitigation actions as per their contract with Marshall County

At the request of the Marshall County Emergency Manager, meetings were to serve as both planning and steering meetings. Furthermore, it was requested that the planner starts each meeting with a tutorial concerning general mitigation and concepts. While those attending are experts of their community and areas of reasonability, it was a concern that those attending the meetings had limited experience and knowledge of the hazard mitigation process. The agenda for the rest of the meetings included an overview of the actual planning process, updates of the planning process and comment and approval of various sections of the plan.

To ensure open communication and input, all of the noted meetings were open to the public. Furthermore, invitations for the outlined meetings included announcements via the county and city websites, postings in the paper of record, mass emails, and direct invites. The following is an outline of the agreed upon "five" set meetings.

Table 4: Five-Set Meetings Table

Set Meetings Meeting Number	1	2	3	4	5
Date	October 22, 2013	March 11, 2014	December 18, 2014	February 17, 2016	XXX 2016
Location	Warren MN	Warren MN	Warren MN	Warren MN	Warren MN
Meeting Focus	Kickoff Meeting	Community Profile	Risk Assessment	Mitigation Actions	Plan Approval

Meeting One (October 22, 2013): The focus of the meeting was to set the stage of the planning process, set expectations, and to ensure the plan would accurately represent the makeup of the county and participating jurisdictions. An invitation to this meeting was provided to all of the participating jurisdictions and city and county organizations. The Marshall County Emergency Manager sent the invitations and city information using existing county contacts.

The meeting was well attended and input from those in attendance proved invaluable. The Hazard Mitigation Planning Team provided an introduction of the planning process, a general understanding of mitigation, and introduced the concept of the community profile.

The Hazard Mitigation Planning Team also provided an overview of the planning process and suggested and a timeline for completion. The Hazard Mitigation Planning Team reviewed the mitigation crosswalk and noted that the required elements of the plan. Finally, the Hazard Mitigation Planning Team discussed the iterative process, placing an emphasis on the importance of feedback, input and communication.

Outcomes: The major outcome of the meeting was the understanding that the Hazard Mitigation Planning Team would provide drafts of the community profile for review. It was noted the Hazard Mitigation Planning Team and stakeholders would create the community profile (and subsequent sections of the plan) using an iterative process. The Hazard Mitigation Planning Team provided the community profile in draft form and the stakeholders provided comments and added additional county-owned information to provide additional context and accurately portray the local perspective.

Other outcomes of the meeting concerned the issue of notification and participation. It was understood that several methods would be used to inform the public of the mitigation process with the primary source of public information being outreach by the emergency manager. The Hazard Mitigation Planning Team suggested that each jurisdiction places an announcement on their respective webpages informing the public that the mitigation update process had begun, how and where to participate, points of contact, and meeting dates. The Hazard Mitigation Planning Team further advised each jurisdiction to request that the mitigation planning process and noted information be added as an item in their respective city council meetings as an official agenda item (NOTE: Council agenda items are typically reported and listed in the Marshall County's paper of record). Finally, it was suggested for those jurisdictions that have a regular newsletter to include information about the mitigation planning projects. To ensure everyone's efforts were coordinated and recorded, it was requested that all the actions used to encourage participation to be reported to the emergency manager.

Meeting Two (March 11, 2014): The purpose of the second meeting was to present the findings of the community profile, present the preliminary data of the hazard profile, discuss the relationship of hazards and disasters, finalize the hazards to be completed in the Marshall County Mitigation Plan and present the methods and instruments used to conduct both a capability assessment and a risk assessment. Outcomes of the meeting included accepting the community profile and approval of the various assessment data

collection methods and processes.

Note: This meeting was open to the public with the public being invited via the County Paper of Record.

Outcomes: Outcomes of the meeting included feedback regarding the community profile, deciding on which hazards should be included in the Marshall County Hazard Mitigation Plan, how hazards should be arranged in the Marshall County Hazard Mitigation Plan, how risk should be calculated, presented and determine what hazards should be expounded upon. Also decided up was the capability assessment survey. Finally, it was agreed that the Emergency Manager would ensure all participating jurisdiction were aware of the update process and complied with the planning teams request to participate.

Meeting Three (December 18, 2014): The meetings included a progress update on the mitigation planning process, an overview of the risk and capability assessment results, and the introduction and initial assessment of mitigation actions.

Beyond approving the results of the assessments, this meeting allowed discussion concerning mitigation actions. Specifically discussed was how the mitigation plan assists jurisdictions (qualifying for funding, etc.) documentation of past mitigation actions, areas of improvement, and which mitigation actions should be included in the plan. To facilitate the creation of mitigation actions, the Hazard Mitigation Planning Team conducted a brief training on mitigation strategies. The overview included the following topics:

- How to understand the risk assessment
- The connection of risk hazard and the community profile
- Creating strategy goals

Note: In researching Marshall County's history, the Hazard Mitigation Planning Team discovered that over the past 10 years, their Hazard Mitigation program had not actively recorded mitigation activities for inclusion in future updates of the plan. The Hazard Mitigation Planning Team identified a lack of institutional knowledge or existing records with regard to past mitigation actions and regular mitigation planning meetings. While everyone agreed Marshall County, and its cities, did have a history of conducting/using mitigation planning, the issue was the lack of information concerning past projects and no single agency was responsible for collecting the data. As such, the Hazard Mitigation Planning Team conducted the process of collecting past information actions to the best of their abilities and ensured that the plan will be updated to include a management strategy. (The Hazard Mitigation Planning Team implemented both changes with results reflected in the plan updates, mitigation strategy, and maintenance and management sections.)

Outcomes: It was noted that the jurisdictions would communicate with the Marshall County Emergency Manager and provide feedback concerning the completed risk and capability assessments. In addition, new mitigation goals were created. Finally, participants were instructed to work within their jurisdictions to identify new mitigation actions to be included in this iteration of the mitigation plan.

Meeting Four (February 17, 2015): While the primary purpose of the meeting was an extension of the past meetings, all of the participating jurisdictions were requested to send a representative to the meeting. The call for representation was made to ensure all participating jurisdictions understood the planning process, their commitment, and update them on what had been accomplished to date. This meeting also provided

them with the tools and knowledge to assist in finalizing mitigation projects and completing the plan.

Outcomes: The final mitigation projects were identified and the mitigation plan less the planning section was approved for a final edit. It was noted the emergency manager would place the final mitigation plan in the paper of record for public input. Upon the public input phase, the planning team would ready the plan for final approval.

Meeting Five (XXXXX): The final meeting was conducted via phone conferences and email exchanges per the Marshall County Emergency Manager, the planning team and the participating jurisdictions. The Hazard Mitigation Steering Committee received several plan iterations. Thus, the plan approval process lasted for approximately one month (April 2016 to the May 2016), with the Marshall County Emergency Manager deeming the plan approved and sending it on for state approval.

Final plan approval also consisted of a public comment and questions process. The process was advertised in the county paper of record and was available on the county and cities websites. A copy of the updated plan was available via the county website. A hard copy of the plan update was made available upon request. The review process lasted approximately 15 days.

2.1.7 Additional Meetings and Participation

As well as the aforementioned five meetings, additional meetings were held with the Marshall County Emergency Manager as required and or requested. These additional meetings provided the Hazard Mitigation Planning Team with additional information and insights that were vital to the plan update. Participants included officials from all of the county's jurisdictions, key stakeholders from various organizations, subject matter experts, regional and state officials, and the public.

What follows is a comprehensive list of all the meeting that occurred over the entire planning process. The dates, as well as a general synopsis of what occurred at the meetings, who participated and general notes are provided in the following table. Meetings occurred in both traditional formats and conference calls.

Table 5: Date and Purpose of Meetings

Meetings with Key Stakeholders, the Community and Other Interested Parties			
Date	Purpose	Forum	Participants
October 22, 2013	Marshall County Hazard Mitigation Plan Update Kick-Off Meeting, Community profile	Plenary	Mitigation Planning Committee, Mitigation Steering Committee, Participating Jurisdictions and the Public
December 16, 2013	Water Resource Advisory Committee	Plenary	Mitigation Planning Committee and the Water Resource Advisory Board
March 11, 2014	Marshall County Hazard Mitigation Plan Community/Hazard Profile and Risk Assessment	Plenary	Mitigation Planning Committee, Mitigation Steering Committee, Participating Jurisdictions and the Public
March 15, 2014	Marshall County Township Association	Plenary	Mitigation Planning Team and the Representatives from each of the County's Townships
December 18, 2014	Marshall County Hazard Mitigation Plan Update and Mitigation Strategies	Plenary	Mitigation Planning Committee, Mitigation Steering Committee,

Meetings with Key Stakeholders, the Community and Other Interested Parties			
Date	Purpose	Forum	Participants
			Participating Jurisdictions and the Public
January 12, 2015	City of Grygla	development and informal discussions	Mitigation Planning Committee and city officials
February 17, 2016	EM Committee	Plenary	Mitigation Planning Committee, Mitigation Steering Committee, and Participating Jurisdictions
XXXXXXXX	Mitigation Plan approval	Plan approval	Mitigation Planning Committee, Mitigation Steering Committee, Participating Jurisdictions and the Public
NOTE: Each of these meetings was proceeded by extensive follow-up via electronic and other means. The meetings were advertised in the county paper of record meeting as a result of an open invitation to participate in the plan via the county outreach efforts. Marshall County EM was responsible for creating this table and/or any notes and signup sheets resulting from the meetings.			

In addition to traditional methods of involvement, surveys were also offered to participants. These surveys proved to be a valuable instrument to gather data, garner local support, and ensure community participation.

2.1.8 Partners and Stakeholders

Involving partners and stakeholders in the mitigation planning process will assist in obtaining a thorough and comprehensive understanding of the county's diverse programs, facilities, operations, community vulnerabilities, hazard risks, existing and planned developments and projects, and opportunities to implement mitigation strategies. To facilitate involvement in the mitigation update, the Hazard Mitigation Steering Committee and project team met with, and/or used resources provided by a variety of local, regional, state, and federal authorities. Where appropriate, contacts were also made with regional, state and federal agencies and other external organizations to determine how their programs could support the mitigation efforts. The following is a list of those organizations that were used as resources and/or are actively supporting Marshall County's mitigation efforts.

Table 6: Organizations

<ul style="list-style-type: none"> • U.S. Geological Survey • U.S. Army Corps of Engineers • U.S. Department of the Interior • National Weather Service • Federal Emergency Management Agency 	<ul style="list-style-type: none"> • Marshall County Sheriff's Office • Marshall County Hwy Department • Marshall County Townships Association • Marshall County Social Services • North Valley Health Center 	<ul style="list-style-type: none"> • Marshall County Central School District • Stephen-Argyle School District • Tri County School District • Grygla School District • Goodridge School District • Greenbush Middle River School District 	<ul style="list-style-type: none"> • Warren, Alvarado, , Oslo School Districts • Middle-Snake Tamarac River Watershed District • Red Lake Watershed district • Two Rivers Watershed District • US Bureau of Reclamation
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<ul style="list-style-type: none"> • Houston Engineering • Marshall County Emergency Management 	Public Health <ul style="list-style-type: none"> • P.K.M Electric Cooperative • Roseau Electric Cooperative • Red Lake Electric Cooperative • Marshall County Board of Commissioners 		<ul style="list-style-type: none"> • Minnesota Pipeline CAER Association
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2.1.9 Review and Incorporation of Existing Plans and Studies

To ensure the plan was completed using best practices and included accurate information, the Hazard Mitigation Planning Team members reviewed various public domain documents to include plans, studies, and guides to begin developing the hazard mitigation plan update. These plans included, but were not limited to, mitigation plans from surrounding jurisdictions, FEMA guidance documents, emergency-services documents, contingency plans, community plans, federal, local, state regulations/ordinances, and other similar public domain documents. As such, no protection is claimed in original US government works for this document or any of the resources used in this report.

The following table is a list of the public domain plans and other documents the Hazard Mitigation Planning Team used to guide the hazard mitigation plan update. Sources are also listed and cited within the document.

Table 7: Existing Plans and Studies Utilized in the Update

Existing Plans and Studies Utilized in the Update	
Plans/Studies/Guides	Author
2010	US Census Bureau
Potential Cost Savings from the Pre-Disaster Mitigation Program	Congressional Budget Office (2007)
How-to-Guide (Series 386-1, 2, 3, 4, & 5)	FEMA
NFIP Community Rating System	FEMA
National Flood Insurance Program	FEMA
State Hazard Mitigation Plan	MNHSEM
Marshall County, Minnesota, Resilience Report	FEMA
Marshall County Flood Insurance Study	FEMA
Marshall County Hazard Mitigation Plan	Marshall County
Texas Tech University	Wind Science & Engineering Research Center
Marshall County Soil Survey	USDA
Marshall County Local Emergency Operations Plan	Marshall County Emergency Management
Marshall County Land Use/Zoning Ordinance	Marshall County
Two River, Snake and Middle river Watershed Plans	Marshall County

2.1.10 Participation and Data Request

The success of the plan update is heavily dependent on the cooperation of the Hazard Mitigation Steering Committee, participating jurisdictions and Hazard Mitigation Planning Team. The Hazard Mitigation Planning Team created a timeline for the plan update and a timeline of plan completion. The Hazard Mitigation Planning Team also created plan phases and provided direction on what would be needed to complete each phase. Plan instructions included noting who should participate, what documents should be provided to the Hazard Mitigation Planning Team for review, how to review documents, and the overall planning process. This information was shared with the Hazard Mitigation Steering Committee, participating jurisdictions, and the Hazard Mitigation Planning Team. The information was regularly maintained and updated throughout the planning process.

The planning process used to complete the Marshall County plan update was an iterative process; iterative, meaning as sections of the plan was prepared, the emergency manager, the Hazard Mitigation Steering Committee and participating jurisdictions reviewed the draft and provided comments and/or suggestions for improvement. The input and feedback provided were then incorporated into the draft and finalized. The following table is a representation of the planning phases used in this iterative planning process of the Marshall County Mitigation Plan update.

Table 8: Participation Table (Data request)

	Information/Editing Requested by Planning Team					Information Noted as Being Validated by Jurisdictions			
	October 2013 (Community Profile)	March 2014 (Capability & Risk Assessment)	December 2014 (Risk & Strategies)	February 2016 (Strategies & Review)	April 2016 (Review and Final Acceptance)	March 1, 2014 (Community Profile)	December 2014 (Risk Assessment)	February 2016 (Strategies)	May 2016 (Plan Approval)
This spreadsheet is a documentation of the involvement of participating Jurisdictions									
Grygla	X	X	X	X	X	X	X	X	X
Holt	X	X	X	X	X	X	X	X	X
Middle River	X	X	X	X	X	X	X	X	X
Newfolden	X	X	X	X	X	X	X	X	X
Oslo	X	X	X	X	X	X	X	X	X
Stephen	X	X	X	X	X	X	X	X	X
Strandquist	X	X	X	X	X	X	X	X	X
Viking	X	X	X	X	X	X	X	X	X
Warren	X	X	X	X	X	X	X	X	X
Marshall County	X	X	X	X	X	X	X	X	X

(Note: The above table does not represent actual meetings, but rather the iterative planning process. Thus, the table shows timeframes of when the Hazard Mitigation Planning Team requested data and/or feedback, when data was verified by the jurisdictions and which jurisdictions participated in the process.)

2.1.11 Summary of the Planning Process & Significant Plan Updates

The following section provides a bulleted overview of the previously described planning process and the major changes that occurred to this plan during the update. The planning update as conducted in the following phases:

- Community profile creation
- Hazard profile
 - Hazard selection
- Risk assessment conducted
 - Impact (assumptions and magnitudes)
 - Risk
 - Disaster modeling
- Mitigation strategy creation
 - Update of existing strategies
 - Creation of new strategies
 - Prioritizing strategies
- Final plan approval
 - Plan overview created
 - Plan monitoring created
 - Plan maintenance created
 - The mitigation plan was reconciled with the most current language used in planning/information/codes etc. used by the participating jurisdictions

2.2 Changes Made During this Plan Update

The update of the mitigation plan used an iterative planning process for making several changes and enhancements to the previous version of the mitigation plan. The following section provides an overview of the significant updates reflected within this plan.

- The overview of community profile sections changed to reflect the recent census data and changes within the county
- Several variables were included in the community profile that did not previously exist (See the community profile)
- The mitigation goals were recreated and prioritized
- The hazard risk assessment was completed and updated to account for the disasters and changes within the community that occurred in the past five years
- The overview of mitigation goals, objectives and strategies were updated to reflect new goals, new objectives, and new strategies
- Processes were created to ensure governance and accountability of the plan
- A monitor and maintain section was created to ensure the plan remains updated

The following sections constitute the actual mitigation update and are a culmination of all the participants' effort. The information in each section plays an integral role in the mitigation planning process and is interdependent upon the entirety of the planning process. For assistance in using this document and/or

becoming involved in future mitigating planning processes, please contact Marshall County's Emergency Manager.

Section 3: Community Profile

In many jurisdictions, including Marshall County, a detailed and in-depth community profile is developed as a key element of the County Hazard Mitigation Plan; however, its utility goes far beyond this plan alone. The Community Profile is an overview of the political governance, economy, geography, climate, population, community assets, future development and trends, and commercial and industrial make-up of Marshall County. The Community Profile provides the county with a solid foundation for developing a common operational picture for the mitigation, but can also be referenced for other activities, such as THIRA, emergency training, exercises and actual incidents.

To complete the community profile, the Emergency Manager and his representatives contacted numerous agencies, conducted research and examined several technical reports and records (see the corresponding community profile section of this Plan for full details). Marshall County utilized a community effort for planning to design an effective mitigation plan. The input from a variety of stakeholders that will be part of the disaster recovery was involved in the process, these include elected officials, first responders, emergency management, health care providers, public works, road departments, businesses, and the public.

The following pages provide a broad range of information that will serve to provide a context for the subsequent sections in this plan. This information is divided into five broad categories:

1. General Historical Overview
2. Physical characteristics of the County
3. Population and Demographics
4. Community Conditions
5. Critical Infrastructure

This information was used in a subsequent assessment section to determine the type and magnitude of the County's risks.

The county and community profile is an important aspect of the hazard mitigation process. This profile serves to recognize and familiarize the reader with the targets of a dangerous hazard, specifically: people, property, jobs, natural resources, and crops. Through this informational process a general picture of the make-up of Marshall County can be identified.

Several documents were essential in the writing of this plan. The excerpts written below recap these resources for the purpose of providing an idea of the general environment of Marshall County. Information presented in this chapter was derived from several

Your Quality of Life, Your County

You don't really think about it because you don't have to. After a snowstorm the roads are cleared so you can get your kids to school safely, if there is an accident you call 911 to summons help quickly, you don't think about it because it's your county, Marshall County, doing it for you. Every day in our community, county government is hard at work providing the quality of life services that makes our county an outstanding place to live and raise a family. Whether operating services or programs that keep communities safe or providing emergency services during a disaster or protecting children at risk of abuse, counties are at the foundation of what makes our state great. Take a closer look at you county and you'll find that 24/7 they are there working for you.

sources, including the following documents that have been prepared by the County:

- **Marshall County Local Water Management Plan 2007-2015** – The Plan contains the goals, - objectives, policy guidelines, and actions that guide the County in land use management on a day-to-day basis.
- **Marshall County Multi-Hazard Mitigation Plan**– The purpose of the Plan represents a coordinated effort and ongoing commitment to mitigate potential losses and damages caused by the hazards that can be experienced in Marshall County. This Plan establishes the county mitigation planning system, which is related to the county disaster, emergency preparedness, and operational planning mission. The Plan consists of Basic Multi-Hazard Mitigation Planning, Pre-Disaster Mitigation Planning for each identified hazard, and Post-Disaster Mitigation Planning. County agencies with an emergency assignment in the County Emergency Operations Plan have specific responsibility for mitigation planning and implementation.
- **Demographics Affecting Health-Marshall County Profile**-This report was prepared through Stratis Health's Culture Care Connection Minnesota County Profiles, so that health care organizations can better understand their geographic service areas by examining the characteristics of individual counties, surrounding regions, greater Minnesota, and the nation with respect to demographic, socioeconomic, and health status data. The quantitative and qualitative data in this profile can broaden understanding and help organizations consider actions for responding to the area's most pressing needs.
- **Minnesota Population Projections**-The Minnesota Populations Projections Report was prepared by Minnesota Planning State Demographic Center. The report is to be used for jurisdictional planning purposes.
- **Local Water Management Plan 2007-2015**-The purpose of the third generation LWMP is to identify existing and potential problems and opportunities for protection, management and development of water resources and related land resources in Marshall County. Through the direction of the Minnesota Board of Water and Soil Resources, specific priority concerns are to be identified and assessed in addition to concerns for ongoing goals and actions of the water management plan.

The coordinated implementation of these documents forms a sound basis for all hazard mitigation projects, plans, and activities. These documents should be consulted for further details on the information presented herein.

A correctly written hazard mitigation plan will secure the life, wellness, and security of its residents, avert repetitive damages due to various hazards, and furnish a faster recovery process when a disaster does occur. In addition, there is an increased sense of cooperation and communication among the public as well as an increased possibility for funding recovery and reconstruction projects.

3.1 General Overview

Marshall County covers 1,675 square miles and is situated in the northwestern part of Minnesota bordering on the Red River of the North. The County was named in honor of William Rainey Marshall, one of Minnesota's esteemed governors (more on William R. Marshall can be found at www.mnhs.org/people/governors/gov/gov_07.htm). The county seat is Warren.

The county is bounded on the north by Kittson and Roseau counties, on the east by Beltrami County, on the south by Polk and Pennington counties, and on the west by the Red River which separates it from North Dakota.

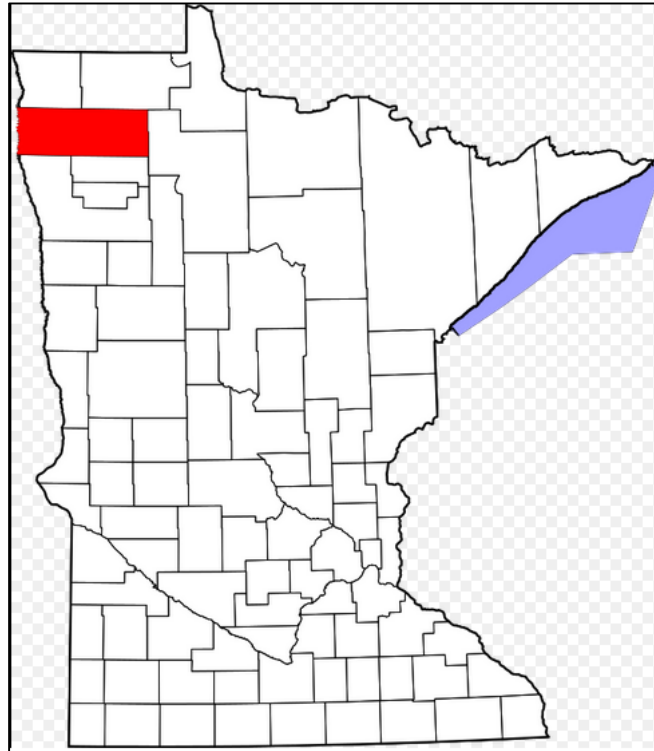
Table 9: Incorporated Cities and Towns in Marshall County and Population

City	Description
Alvarado	Alvarado is a city situated along the Snake River in Marshall County in the U.S. state of Minnesota. The population was 363 at the 2010 census. Minnesota Highway 1 and Minnesota Highway 220 are two of the main arterial routes in the community.
Argyle	Argyle is a city in Marshall County, Minnesota, United States, along the Middle River. The population was 639 at the 2010 census. Old Mill State Park is nearby.
Grygla	Grygla (/ˈɡrɪɡlə/ GRIG-lə) is a city in Valley Township of Marshall County, Minnesota, United States. The population was 221 at the 2010 census.
Holt	Holt is a city in Marshall County, Minnesota, United States. The population was 88 at the 2010 census.
Middle River	Middle River is a city in Marshall County, Minnesota, along the Middle River. The population was 303 at the 2010 census.
Newfolden	Newfolden is a city in Marshall County, Minnesota, along the Middle River. The population was 368 at the 2010 census. Old Mill State Park is nearby.
Oslo	Oslo is a city in Marshall County, Minnesota, United States. The population was 330 at the 2010 census. Minnesota Highway 1 and Minnesota Highway 220 are two of the main arterial routes in the community. Interstate 29 is nearby.
Stephen	Stephen is a city in Marshall County, Minnesota, United States. The population was 658 at the 2010 census.
Strandquist	Strandquist is a city in Lincoln Township of Marshall County, Minnesota, United States. The population was 69 at the 2010 census.

Viking	Viking is a city in Marshall County, Minnesota, United States. The population was 104 at the 2010 census.
Warren	Warren is a city in and the county seat of Marshall County, Minnesota, United States. The population was 1,563 at the 2010 census.

Source: US Census Bureau

Figure 2: Map of Marshall County



3.1.1 Historical Setting:

Marshall County lies in the Red River Valley, the great wheat raising a section of the country. It is a part of the old bed of glacial Lake Agassiz, and the glacial drift left a thick coating of rich soil extending over several miles of nearly level prairie land. Herds of buffalo roamed over these prairies, and Indians hunted them for food and clothing. Elk, deer, and prairie chickens were plentiful and occasionally, a bear was caught. The Indians were not aware, however, of the richness of the soil. The squaws raised a few vegetables and a little corn, and as hunting declined, this became a more important item in their livelihood, but the agricultural value of the land was not developed until the white men settled on it.

As early as 1812, Lord Selkirk opened settlements from Winnipeg to Pembina, and in 1821, many Swiss people were induced to settle there to promote agriculture. Storms, floods, poor harvests, grasshoppers, and famine discouraged the people so many soon left, passing through what is now Marshall County on their way to Fort Snelling and points farther south.

Marshall County was in a direct line from the Selkirk Red River Settlement to the Mississippi River and one

of the early trails passed through the county. Over the trail, furs were carried beginning in the early 1800's. In 1823, Major Stephen H. Long led an expedition to explore the region of the Red River Valley. The expedition went down the east side of the Red River to Pembina, passing through the area that became Marshall County. With Major Long on this expedition was Giacomo Constantino Beltrami. The Red River became a highway of travel in the late 1850's when steamboats began running down the river to Fort Garry, Canada. The first steamboat was built in 1858 at a little town site called La Fayette, opposite the mouth of the Sheyenne River.

There were very few white settlements in this area before the railroads were built in 1872 and 1873. The railroads brought a wave of immigration and within about 10 years, nearly all the land was taken by homestead and preemption claims.

In the eighteen forties and fifties a missionary, Rev. Sela G. Wright, was stationed on a mission farm on Red Lake. He wrote as early as 1848 of a farm that could produce 3,000 bushels of corn and 2,000 bushels of potatoes besides other vegetables, when all the rest of the northern and western Minnesota was a wilderness. Wright told of a trip to the Red River Settlement in December 1843 to purchase oxen and cows.

The government had encouraged settlement by granting land as subsidies to railroad companies on condition that they extend their lines, and by selling land to actual settlers, who, under certain circumstances, could obtain as much as 480 acres. Long processions of emigrant regions, called "prairie schooners," passed along the trails to settle in the Red River Valley. Many settlers came from the south and the east, and others came directly from Europe, especially from Norway and Sweden; others were Germans, Britons, Scots, and Irish.

The first settler to remain on his homestead was Michael McCullough, a hunter and trader, and an outstanding character, who arrived about 1872. He did not file on his homestead near Stephen until May 6, 1879. Others had filed on claims before him, but had abandoned them later. He became a close friend of Charles Wentzel, a sturdy German blacksmith, who came from Prussia and arrived in 1874, settling near the present site of Warren. Mr. Wentzel lived in a log shanty for a few years, later building a log house, and in 1880, a frame house. Others who came in 1878 and settled near Wentzel were Frank Smith, W.A. Wallace, A. P. McIntyre, James B. Titus, Emmet W. Rossman, J. W. Slee, Ed Slee, A. E. Flint, A. B. Nelson, J. McCann, and G. O. Gross.

Early in 1879, Nels Malm, while on a business trip from Willmar to Crookston, met Peter Jarvis, a settler from Argyle, (then Lousia) who told her that the "cream of the valley was around Lousia" and persuaded him to make a trip up there to look over the land with a prospect of settling. The railroad had just completed its line to St. Vincent in 1878 but there was no scheduled train service. Mr. Malm says he passed only two buildings between Crookston and Argyle and one of these was at Warren in Marshall County. It was March and there was very little snow on the prairie. Much impressed by the prospects of the land, he returned to Willmar relating his experience to others. That fall he, with several families, left Willmar in eight covered wagons traveling over land to Argyle. Mr. Malm and one of the men walked, driving a herd of 62 cows. It took them 24 days and they arrived in Argyle on Election Day, November 4, 1879.

On December 15, 1879, Charles A. Bergland, an agent for the Cunard Steamship Line, traveled directly from Gothenburg, Sweden, in the interest of the Swedish Emigrant Association, made a call at Warren. He was so well pleased with the country and its prospects that he expected to send 100 families to settle near Warren.

With the coming of these settlers, the need of a trading point was necessary, and a post office was established, named, "Farley," and A. T. Minor appointed postmaster. Later the name was changed to Warren in honor of the general superintendent of the railroad. In 1878, the railroad was extended to St. Vincent, and a station was built on the site of Warren through the efforts of Mr. McIntyre. This brought many more settlers in 1879 and 1880.

Although this land had been pictured as a land of "milk and honey," the early settlers found much to discourage them. They had barely established themselves when a terrible prairie fire occurred in 1879, destroying much grain and hay and burning some of the settlers. The winters brought blizzards, which were just as discouraging. These hardy pioneers were however not overcome by discouragement. They could acquire land for very little and the richness of the soil would enable them to make a good and honest living for themselves and their families.

It was not long before capitalists saw the profitable prospects of these grain fields, and they bought land from the railroads and the settlers, and established what were called "bonanza farms," some of which contained as many as 40,000 acres. Before 1870, the farmers of the Red River Valley found that this region was more adapted to the raising of spring wheat than to winter wheat. The methods in the milling spring wheat generally in use at the time however, produced a dark flour which did not sell as readily as white. This difficulty was overcome by the introduction of the middlings purifier and steel mill rollers at Minneapolis, beginning in 1870. The subsequent tremendous demand for Minnesota flour made from spring wheat by the perfected process placed a premium on that grain, and created a heavy demand for it. The result was that immigration into the valley increased rapidly.

Marshall County was created from Kittson County by an act of the legislature in 1879. The boundaries were again defined by acts of the legislatures of 1883 and 1885.

The act to establish the county in 1879 directed the governor to appoint three qualified electors to serve as a board of county commissioners which was given authority to appoint all county officers, except the clerk of the district court, who was to be appointed by the judge of that court. These appointed officers were to hold office until their successors were elected and qualified. The county was attached to Polk County for judicial purposes.

In accordance with this act, the governor appointed H. Craig, William A. Wallace, and Edwin S. Radcliff as county commissioners. The county commissioners appointed Henry B. Lane, auditor; A. P. McIntyre, assessor; James P. Nelson, attorney; Wm. H. Gilbert, sheriff; Thomas R. Craig, register of deeds; and Frank Smith, treasurer. The first general election was held on November 4, 1879, and the following officers were elected: commissioners H. M. Craig, Chris Anderson, and Alfred Diamond; sheriff, Willis T. Lackey; treasurer, William A. Wallace; register of deeds, Thomas R. Craig; attorney, A. E. Flint; auditor, O. Taylor; judge of probate, John Slee; court commissioner, the court appointed James P. Nelson, clerk of the district court and the board appointed M. Bauchman on June 1 1880, to complete the term. On March 17, 1880, Mr. Wallace resigned as treasurer and the board appointed James C. McCrea in his stead. At the same meeting, the board appointed W. Carrese as coroner.

Although the office of assessor is not a county office, assessors were appointed by the county commissioners at various times to act for the unorganized parts of the county. They, however, were termed "county assessors." In April 1879, the board appointed A. P. McIntyre as county assessor. In January 1880,

three commissioner districts were to serve also as road districts, and the board appointed A. P. McIntyre, George Foresythe, and John Hughes each as assessor and roadmaster for districts one, two, and three respectively. Other county assessors were appointed in following years for the unorganized parts of the county as late as 1909.

There are 49 townships in Marshall County. The first townships organized were: Middle River, township 156, range 48; Tamarack, 157-48; and Wallace, 155-48, on October 7, 1879. On March 13, 1880, the township of Wallace was joined with 155-47 and called Warrenton. On July 27, 1880, the following townships were organized: Viking, 155-45; Comstock, 155-46; Oak Park, 155-49; Vega, 155-50; Big Woods, 156-50; and Fork, 157-50. The last township organized was Mud Lake, 156-41, on March 12, 1912.

The first school district was organized at Stephen in Tamarack Township, on December 23, 1879. Today there are 9 school districts in the county.

When Marshall County was established the boundary lines were as follows: commencing at the intersection of the middle line of the main channel of the Red River of the North with the line between the townships 154 and 155; then east to the southeast corner of township 155; then north on a line between ranges 38 and 39 to the intersection with the townships line between 158 and 159; then west to the center of the main channel of the Red River, and up the main channel of the river to the place of beginning. Legislative acts of 1883 and 1865 provided for a change of the county lines of Marshall and Polk counties.

Like other counties, Marshall had its contest over the county seat. Although the county commissioners had not definitely designated the county seat, the town of Warren was considered as such. The town of Argyle, a few miles north of Warren, made efforts to have the county seat placed there. On February 8, 1881, the board of county commissioners passed a resolution that the safe be placed in charge of the sheriff and moved to Argyle, and that the county business be transacted there. The commissioners met at Argyle a few times and on February 27, 1882, passed another resolution authorizing the chairman to hire men and teams to haul the safe and other county property from Argyle to Warren and place it in the county building. In 1881, the legislature passed an act to legalize the location of the county seat at Warren, and later in the same year, definitely established it there.

The Methodist Episcopal Church was organized at Warren in the fall of 1879, the first sermon being preached by Reverend Samuel Kerfoot in November of that year. There being no public buildings this first service was held in the barroom of the Commercial Hotel. The next service was in the law office of J. P. Nelson. The erecting of a church was begun in the spring of 1882 and it was completed and dedicated on November 25, 1888. The Reverend Frank Doran preached the dedicatory sermon.

The first brick manufactured in the county was in 1880, by August Lundgren in the southwest quarter of section 36, Warrenton township, range 48. The first brick building erected was the bank at Warren in 1883. Brick making has become a profitable industry.

In March 1935, the following resolution was adopted: "Whereas, the so-called "Old Mill Site" in Marshall County, Minnesota, is a natural amphitheater and playground, used by the people of Northwestern Minnesota for years as a picnic ground, pageant site, and meeting place, and whereas said site has a historical background with an old mill and millstones, with a stream and natural woods and a hillside providing adequate seating capacity for an outdoor amphitheater, which site is centrally located and better adapted for such purposes than any other in this part of the state, and its establishments as a state park is

being promoted by the Marshall County Historical Society, the Warren Commercial Club, and other civic organizations, and a plat and maps thereof are being prepared by such organizations to show the location. Adaptability and extent thereof: Therefore be it resolved, that the Board of County Commissioners of Marshall County, Minnesota goes on record in favor of the establishment of a State Park at the Old Mill Site above described."

Early travel was by way of rivers and trails. These trails were not real roads, but merely well-worn paths. One important trail through Marshall County was the East Plains Trail over which the early ox carts carried furs from Fort Garry and Pembina to near St. Paul, returning with merchandise and other supplies. Better transportation became a necessity as settlements grew, and as soon as counties were established, the county boards made provisions for roads. In Marshall County, the first consideration in 1879 was for bridges.

Road districts were established in January 1880. At a special meeting on August 21, 1880, bids were received for building bridges. A contract was let to E. C. Davis for bridges across Snake, Middle, and Tamarack rivers. An appropriation was also made for the work. Other early considerations for roads and bridges were made in 1881.

In 1871, railroads were completed to Breckenridge and Fargo, but none reached Marshall County until 1878. Today, the Minneapolis, St. Paul, and Sault Ste. Marie crosses the central part of the county from south to north, and a branch of this road crosses the southern border from Thief River to the Dakota line. The Great Northern railroad crosses the western part of the county from south to north, and also crosses the central part of the county.

In 1880, one-third of the farms in the county averaged over 1,000 acres. By 1910, 49.6 percent of the land area were farms and by 1935, it had increased to 76.2 percent. However, diversified farming has become popular since single crop farming develops weed pests, plant diseases, insects, etc., which lower the fertility of the soil. Therefore, the raising of cattle, sheep, and hogs has become important. Many factories for cheese and butter making have been established in the area.

Statistics of the fifteenth census of the United States in 1930 show that there were 3,256 foreign-born in the county. Of these, 1,292 are from Norway; 1,148 from Sweden; 224 from Canada; 147 from Poland; 59 from Denmark; 56 from Finland; 41 from Czechoslovakia; 23 from Scotland; 25 from England; 14 from Ireland; 13 from France; 12 from Austria; 11 from Russia; and 36 from other countries. The population, which began about 1878 with only a few families, increased to 992 in 1880 and to 17,003 in 1930.

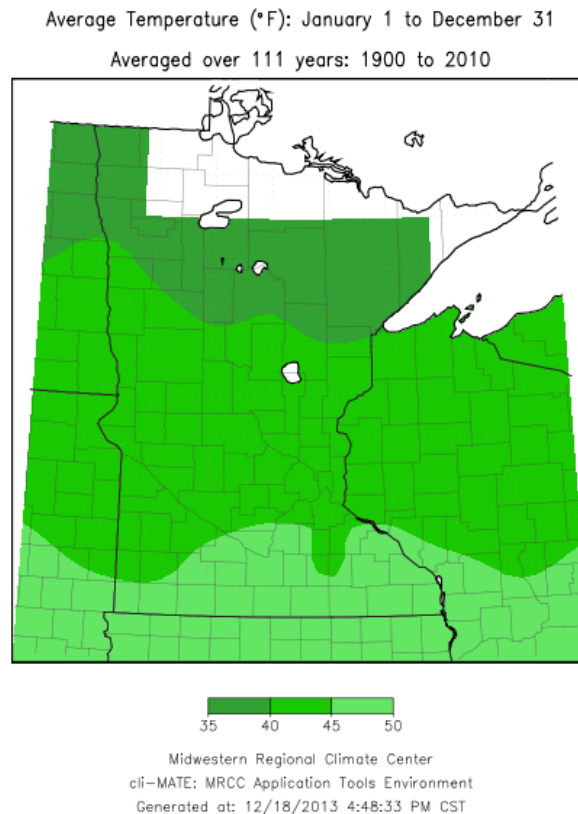
3.2 Climate and Precipitation

According to the 2000 census, the county has a total area of 1,775.07 square miles (4597.4 km²). The next section analyzes Climate, Precipitation, Geology, Hydrology, and Topography of Marshall County.

3.2.1 Climate

Marshall County has a sub-humid, continental climate characterized by wide variations in temperature from summer to winter. The winters are quite long; soils are commonly frozen to a depth from 3 to 5 feet for approximately 6 months of the year. The growing season averages 110 days. The climate is essentially uniform throughout Marshall County. The map to the below was provided by Midwestern Regional Climate Center. Figure 2 illustrates the average temperature for Marshall County. The temperature was averaged over 111 years, January 01, 1900 to December 31, 2010. The average temperature in Marshall County is approximately between 35 degrees to 40 degrees Fahrenheit.

Figure 3: Average Temperature



The average temperature gives a snapshot glance of Marshall County temperature but because of Marshall County's sub-humid continental climate, Marshall County is subject to seasonal extremes. In the winter months' temperatures are known to drop to -10 and July can bring on temperature highs into the 80's.

The winters in Marshall County can last for up to six months. Figure 4 below was provided by the Midwestern Regional Climate Center. The map represents the average minimum temperature in Marshall County during the winter season for 110 years, December 01, 1900 to March 31, 2009. The average minimum temperature during the winter in the Northeastern part of the county is -5.

Figure 4: Average Minimum Temperature

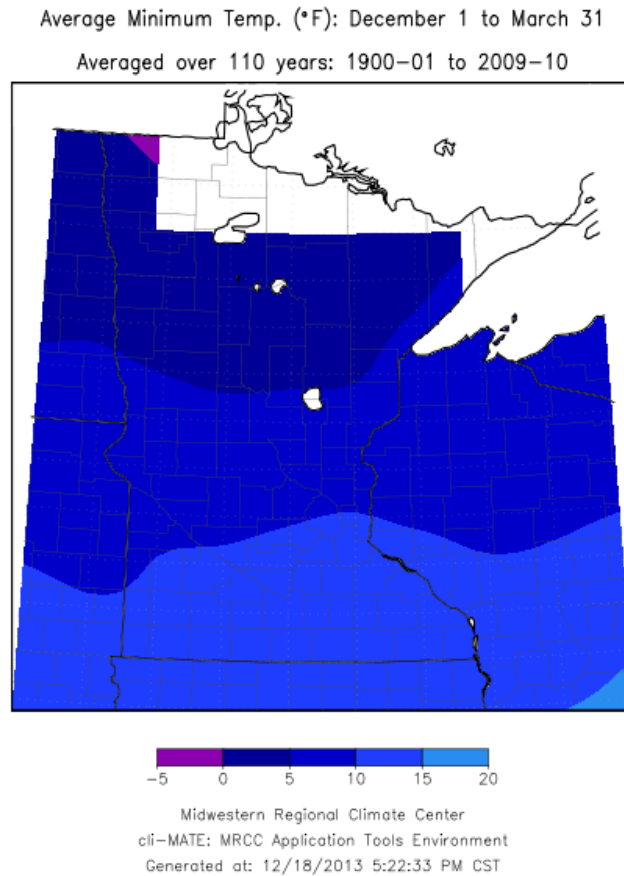
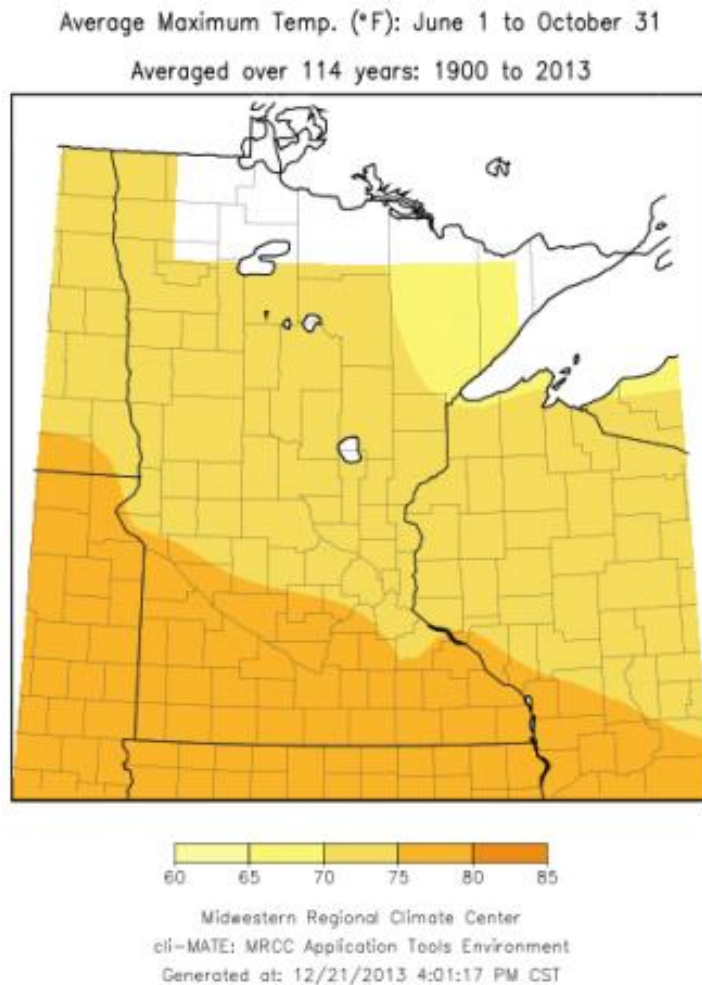


Figure 5 shows the average maximum temperature for Marshall County. During the summer month in Marshall County temperatures can reach 85 degrees. The average high temperature is approximately 70 degrees. The map was provided by Midwestern Regional Climate Center. It illustrates the average maximum temperatures in Marshall County and Minnesota for 114 years. Marshall County historically is cooler than the southern half of the state.

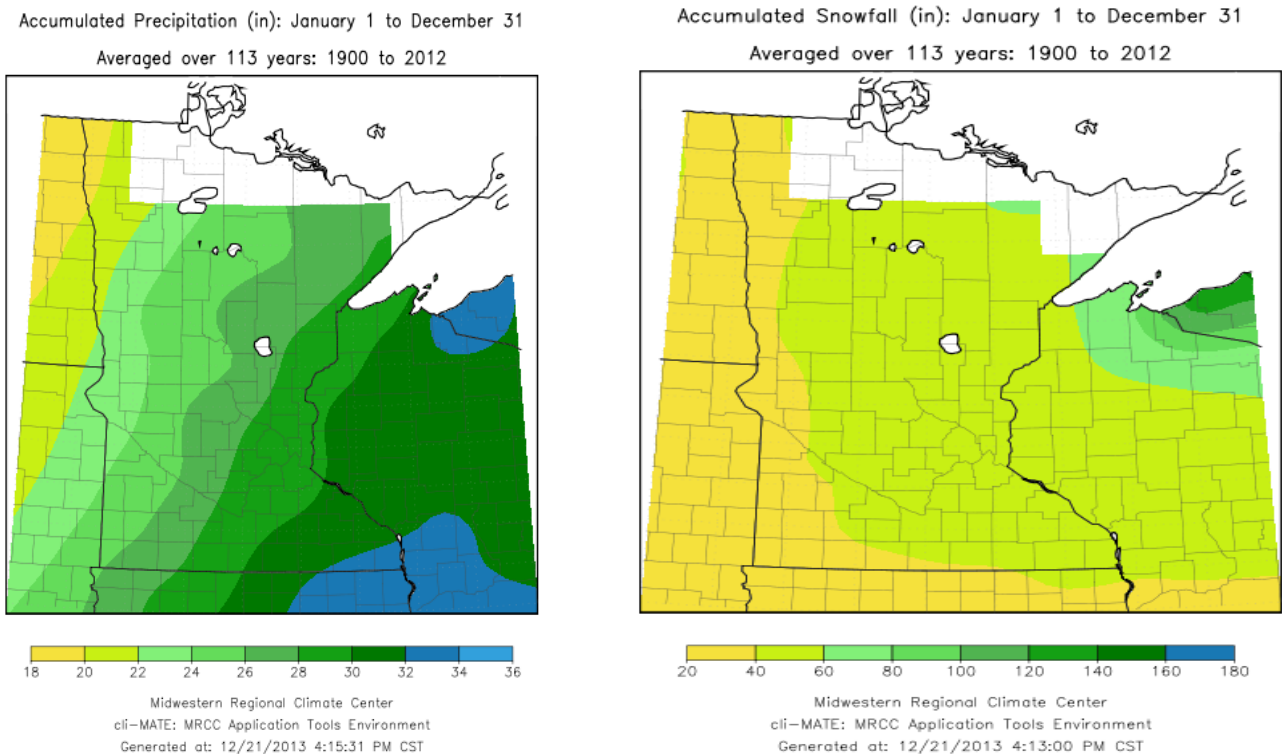
Figure 5: Average Maximum Temperature



3.2.2 Precipitation

Marshall County has an average annual precipitation of between 18 to 22 inches. It receives a little less than average precipitation compared to the state of Minnesota. The maps below were both provided by the Midwestern Regional Climate Center. The map illustrates the monthly average precipitation between the years 1900 to 2012. Marshall County receives between 20 and 40 inches of snowfall a year. The other map illustrates snowfall accumulation for 113 years in Minnesota.

Figures 6 and 7: Accumulated Precipitation and Snowfall



3.2.3 Geology

Contemporary Minnesota is much quieter geologically than in the past. Outcroppings of lava flows and magma intrusions are the only remaining traces of the volcanism that ended over 1,100 million years ago. Landlocked within the continent, the state is a long distance from the seas that once covered it, and the continental glacier has receded entirely from North America. Minnesota's landscape is a relatively flat peneplain; its highest and lowest points are separated by only 518 meters (1,699 ft.) of elevation.

While the state no longer has true mountain ranges or oceans, there is a fair amount of regional diversity in landforms and geological history, which in turn has affected Minnesota's settlement patterns, human history, and economic development. These diverse geological regions can be classified several ways. The classification used below principally derives from Sansome's *Minnesota Underfoot - A Field Guide to Minnesota's Geology*, but is also influenced by *Minnesota's Geology* by Ojakangas and Matsch. These authorities generally agree on areal borders, but the regions as defined by Ojakangas and Matsch are more geographical in their approximations of areas of similar geology, while Sansome's divisions are more

irregular in shape in order to include all areas within a region of similar geology, with particular emphasis on the effects of recent glaciation. As glaciation and its residue have largely dictated regional surface geology and topography, Sansome's divisions are often coextensive with ecological provinces, sections, and subsections.

Marshall County is located in Northwestern Minnesota. Northwestern Minnesota is a vast plain in the bed of Glacial Lake Agassiz. This plain extends north and northwest from the Big Stone Moraine, beyond Minnesota's borders into Canada and North Dakota. In the northeast, the Glacial Lake Agassiz plain transitions into the forests of the Arrowhead. The region includes the lowland portions of the Red River watershed and the western half of the Rainy River watershed within the state, at approximately the level of Lake Agassiz' Herman Beach. In ecological terms, it includes the Northern Minnesota Peatlands of the Laurentian Mixed Forest, the Tallgrass Aspen Parklands, and the Red River Valley Section of the Prairie Parklands.

Bedrock in this region is mainly Archean, with small areas of Lower Paleozoic and Upper Mesozoic sedimentary rocks along the western border. By late Wisconsinan times this bedrock had been covered by clayey glacial drift scoured and transported from sedimentary rocks of Manitoba. The bottomland is undissected and essentially flat, but imperceptibly declines from about 400 meters at the southern beaches of Lake Agassiz to 335 meters along the Rainy River. There is almost no relief, except for benches or beaches where Glacial Lake Agassiz stabilized for a time before it receded to a lower level. In contrast to the lakebed, these beaches *rise* from the south to the north and east at a gradient of approximately 1:5000; this rise resulted from the isostatic rebound of the land after the recession of the last ice sheet. In the western part of the region in the Red River Valley, fine-grained glacial lake deposits and decayed organic materials up to 50 meters in depth form rich, well-textured, and moisture-retentive, yet well-drained soils (mollisols), which are ideal for agriculture. To the north and east, much of the land is poorly drained peat, often organized in rare and distinctive patterns known as *patterned peatland*. At marginally higher elevations within these wetlands are areas of black spruce, tamarack, and other water-tolerant species. The United States Geological Survey provided the geological units for Marshall County:

Geologic units in Marshall County, Minnesota

Oahe Formation- River Sediment (Phanerozoic | Cenozoic | Quaternary | Holocene) *at surface, covers 0.1 % of this area*

Dark, obscurely bedded clay and silt (overbank sediment); generally overlying cross-bedded sand (channel sediment); as thick as ten meters (30 feet); on flood plains of modern streams.

Lithology: clay or mud; silt; sand

Cretaceous rocks, undivided (Cretaceous) *at surface, covers 12 % of this area*

Cretaceous rocks, undivided - Dakota, Graneros, Greenhorn, Carlie, Niobara, and Pierre formations and their nonmarine equivalents in northwestern, southwestern, and southeastern Minnesota

Lithology: shale; sandstone; limestone

Mixed metavolcanic rocks (Late Archean) *at surface, covers 19 % of this area*

Mixed metavolcanic rocks - Mafic to felsic volcanic sequences that have variable amounts of felsic volcanogenic and volcanoclastic rocks and lean iron-formation. Includes parts of the Ely Greenstone and the Soudan Iron-formation in northeastern Minnesota.

Lithology: mafic metavolcanic rock; felsic metavolcanic rock; iron formation

Middle and Upper Ordovician rocks, undivided (Middle and Late Ordovician) *at surface, covers 13 % of this area*

Middle and Upper Ordovician rocks, undivided - Sandstone and shaly sandstone of the Winnipeg Formation and limestone and dolomitic limestone of the Red River Formation along the east edge of the Williston Basin in northwestern Minnesota

Lithology: sandstone; limestone

Syntectonic to pre-tectonic granitoid rocks (Late Archean) *at surface, covers 21 % of this area*

Syntectonic to pre-tectonic granitoid rocks - Granite and granodiorite of the Vermilion Granitic Complex, the Giants Range and Bemidji batholiths, as well as smaller intrusions of tonalite and monzonite of the Algonian orogen in northern Minnesota. Also includes the Odessa, Sacred Heart, and Fort Ridgely Granites exposed along the Minnesota River Valley in southwestern Minnesota.

Lithology: granite; granodiorite; tonalite; monzonite

Post-tectonic mafic intrusions (Late Archean) *at surface, covers 2 % of this area*

Post-tectonic mafic intrusions - Gabbro, peridotite, pyroxenite, and their metamorphic equivalents. **The unit** also includes small intrusive complexes of anorthosite, gabbroic anorthosite, and anorthositic gabbro. Generally characterized by pronounced magnetic signatures.

Lithology: gabbro; peridotite; pyroxenite; anorthosite

Multiphase intrusions of hornblende-pyroxene-bearing and biotite-bearing monzonite, monzodiorite, diorite, syenite, and granodiorite (Late Archean) *at surface, covers 15 % of this area*

Multiphase intrusions of hornblende-pyroxene-bearing and biotite-bearing monzonite, monzodiorite, diorite, syenite, and granodiorite - Typically postdates regional metamorphism and deformation associated with the Algonian orogen.

Lithology: monzonite; monzodiorite; diorite; syenite; granodiorite

Mafic metavolcanic rocks (Late Archean) *at surface, covers 18 % of this area*

Mafic metavolcanic rocks - Dominantly basalt that contains thin sedimentary units, including iron-formation. Includes parts of the Ely Greenstone and the Newton Lake Formation in northeastern Minnesota. Also includes metabasalt exposed in the Minnesota River Valley.

Lithology: basalt; sedimentary rock; iron formation; meta-basalt

Jurassic rocks, undivided (Jurassic) *at surface, covers 0.8 % of this area*

Jurassic rocks, undivided - Unnamed units of green, gray, brown, and red shale, white to tan micritic limestone and dolostone, and white, fine- to coarse-grained sandstone and siltstone; unit contains nodules of chert and gypsum

Lithology: shale; limestone; dolostone (dolomite); sandstone; siltstone; chert; gypsum

3.2.4 Hydrology

All ground water of economic importance is derived from precipitation. After the precipitation falls on the earth's surface, part is returned to the atmosphere by evaporation, some of it runs into streams, and the remainder percolates into the ground. Much of the water that sinks into the ground is held temporarily in the soil and is returned to the atmosphere either by evaporation or by transpiration. The remainder infiltrates downward to the zone of saturation and becomes ground water. Ground water moves under the influence of gravity from areas of recharge to areas of discharge. The movement of ground water is generally very slow and may be only a few feet per year. The rate of movement is governed by the permeability of the deposits through which the water moves and by the hydraulic gradient. Gravel and well-sorted medium to coarse sand are very permeable. Fine-grained materials such as silt, clay, and shale have low permeability. These act as confining barriers that restrict the free movement of ground water into or out of more permeable rocks.

The water level in a well fluctuates in response to recharge to and discharge from the aquifer. Land surface loadings and atmospheric pressure changes cause minor water level fluctuations in confined aquifers. Pumping a well causes its water level to be lowered. The water level surface surrounding the well resembles a cone and is referred to as the cone of depression. Water level drawdown is the difference between static and pumping levels. The degree of drawdown is controlled by the hydraulic properties of the aquifer, the physical characteristics of the well, and the rate and duration of pumping. Continuous withdrawal of water from an aquifer by pumping will cause a decrease in the rate of natural discharge, an increase in the rate of recharge, and a reduction in the volume of water in storage.

3.2.5 Aquifers

Marshall County citizens, businesses and government are dependent on ground water for their drinking supply. Water is obtained from private wells, public wells and through the Marshall-Polk or Kittson-Marshall Rural Water Systems. It is important for the local government and citizens to understand the quality of groundwater in Marshall County.

Ground water is found in the surficial and buried aquifers present within glacial deposits in the County. These sand and gravel soils make up the surficial unconfined, shallow, intermediate, deep and basal confined aquifers. The surficial aquifer is basically saturated sand and gravel beach deposits formed by Lake Agassiz. This area of beach ridges runs from the north-central part of the county by Strandquist and south through Newfolden and Viking. It is a shallow aquifer and is the first aquifer susceptible to contamination from surface activity. Surficial sands and gravel are susceptible to contamination since their recharge areas are extensive and the aquifer materials are highly permeable. These unconfined aquifers could be significant areas of recharge for the underlying confined aquifers.

Table 10: Aquifer Withdrawal Rates

County	Glacial/Surficial Aquifer	Other Aquifers
Becker	6.52	0.71
Kittson	0.6	0.56
Marshall	0.31	0.28
Norman	0.22	0.18
Pennington	0.06	0.02
Polk	0.67	0.48
Red Lake	0.87	0.15
Roseau	0.66	0.25

Figures are MG/D (million gallons per day)

Source: United States Geological Survey

3.2.6 Watersheds

Marshall County has approximately eight sub-watersheds located within four organized watershed districts. These sub-watersheds are: Thief River, Snake River, Middle River, Melgard-Swift Coulee, Tamarac River, Angus-Oslo a.k.a. Grand Marais, Roseau, and Two Rivers. The streams of these watersheds are normally slow flowing and meandering, except during spring thaw and/or where they have been channelized.

The four watershed districts are: the Two Rivers Watershed District with an office in Hallock, MN , the Middle-Snake-Tamarac Rivers Watershed District which has an office in Warren, MN, the Roseau River Watershed District which has an office in Roseau, MN, and the Red Lake Watershed District which has an office in Thief River Falls, MN.

- **Thief River Watershed (Red Lake Watershed District)**

This watershed that is approximately 1090 square miles in size lies in the Eastern third of Marshall County and into the northern portion of Beltrami County. The Moose River in the northern portion of the watershed flows west from Beltrami County into Thief Lake. The Mud River in the south central portion of the watershed flows west from Beltrami County into Agassiz Pool (formerly known as Mud Lake). Both Thief Lake and Agassiz Pool outlet into the Thief River which flows south and meets the Red Lake tributary of the Red Lake River Watershed). The Thief River is classified as an Agricultural River while the Mud and Moose Rivers are classified as Tributaries under the Protected Waters Inventory. The majority of the County wetlands reside in this watershed with DNR classified Natural Environment Lakes named Kuriko, Agassiz Pool, Farmes Pool (formerly known as Elm Lake) and Thief Lake. The Thief Lake Wildlife Management Area and the Agassiz National Wildlife Refuge are both located in this watershed. Land use consists of recreation land for hunting, wildlife management, agricultural production of crops and the majority of the county livestock producers.

- **Snake River Watershed** (Middle-Snake-Tamarac Rivers Watershed District)

The Snake River Watershed lies in the southwestern two-thirds of Marshall County with a small portion in Polk County. The Snake River consists of approximately 750 square miles (250 square miles in MC) and originates about 6 miles west of the City of Newfolden. It flows in a southwesterly direction and intersects with the South Branch Snake River, then continues in a westerly direction through the City of Warren, thence in a southwesterly direction where it enters into Polk County and north again into Marshall County, through Alvarado and connects with the Middle River in Big Fork Township. It then travels a few miles before it outlets into the Red River of the North. The Snake River is classified as an Agricultural River. Horseshoe Lake, classified as a Natural Environment Lake under the Protected Waters Inventory, is located in Section 29 of Fork Township. Few wetlands remain in the western side of this watershed as a large portion of the land has been drained for agricultural crop production. The eastern side of the watershed has been drained less, therefore, more wetlands are found in this area. Beach ridges are located in the central portion of the watershed.

- **Middle River Watershed** (Middle-Snake-Tamarac Rivers Watershed District)

The Middle River is a tributary of the Snake River that originates east of the City of Middle River. The river flows generally in a westerly direction taking in approximately 295 square miles. The major reaches of the Middle River are classified as Agricultural under the Protected Waters Inventory while a section of the Middle River from the City of Middle River to the City of Newfolden is classified as Forested. Few wetlands remain in the western side of this watershed as a large portion of the land has been drained for agricultural crop production. More wetlands are found on the eastern side of the watershed. Beach ridges are located in the central portion of the watershed.

- **Melgard-Swift Coulee Watershed** (Middle-Snake-Tamarac Rivers Watershed District)

The Melgard-Swift Coulee drains an area of approximately 137 square miles in the west central part of the District. Few wetlands remain in the western side of this watershed. Beach ridges are located in the eastern portion of the watershed.

- **Tamarac River Watershed** (Middle-Snake-Tamarac Rivers Watershed District)

Tamarac Watershed lies in the northwestern two-thirds of Marshall County and into southern Kittson County. The watershed consists of approximately 446 square miles (with about 333 square miles in MC). Drainage originates about 7 miles east and 8 miles north of the City of Middle River. It starts as part of Judicial Ditch (JD) #19 and flows west until it enters the Tamarac River, continues west through the City of Stephen, northwest and then west to the Red River of the North. The major reaches, of the Tamarac River, are classified as Agricultural. Florian Reservoir that is located on the Tamarac River, has been classified as a Recreational Development Lake under the Protected Waters Inventory. Land in the western portion of this watershed has been extensively drained for intensive farming of crops and therefore, few wetlands remain. Beach ridges are found in the central part of the watershed. Wetlands are found in the eastern part of the watershed as well as the East Park Wildlife Management Area. Land use consists of recreation use for hunting and crop production.

- **Angus-Oslo Watershed** (Middle-Snake-Tamarac Rivers Watershed District)

Angus-Oslo Watershed empties into the Red River on the western boundary of the County. The small area of the watershed in Marshall County lies in the Agassiz Lake Plain. Few wetlands remain in this watershed.

- **Roseau Watershed** (Roseau Watershed District)

A small portion of the Roseau Watershed lies in the northeast corner of Marshall County and is under the jurisdiction of the Roseau Watershed District. Organic deposits of peat and muck in wetland areas make up this part of the watershed.

- **Two Rivers Watershed** (Two Rivers Watershed District)

The Two Rivers Watershed crosses the northern central border of Marshall County. It lies within the jurisdiction of the Two Rivers Watershed District.

3.2.7 Wetlands

Wetlands are commonly found in the glacial moraine region of the watershed. There are eight types of wetlands found in Minnesota.

Type 1 (seasonally flooded basin) wetlands are often found in upland depressions or forests that are found in the floodplain. Looks can be deceiving as this swamp only floods during certain seasonal periods, leaving it well drained other times of the year. Vegetation varies greatly depending on the continuity and time of the flood from herbaceous plants to hardwood trees.

Type 2 (wet meadow) wetlands are often found in shallow basins or sloughs. The soil is waterlogged a few inches below the surface. Grasses, rushes, sedges, and various broadleaf plants inhabit this type of wetland.

Type 3 (shallow marsh) wetlands are found in shallow lake basins or sloughs. The soil is waterlogged and is covered by six inches of water or more. Grass, rushes, cattails, arrowheads, smartweed, and pickerelweed is often found populating this wetland.

Type 4 (deep marsh) wetlands are found in depressions like shallow lake basins, potholes, and sloughs. Six inches to three feet of water often covers the soil. Cattails, rushes, reeds, and wild rice are found here, as well as pondweeds, nalads, coontail, watermilfoils, waterweeds, duckweeds, and water lilies.

Type 5 (shallow open water) wetlands are found in shallow lake basins. Water less than ten feet deep covers the surface of the soil. The vegetation is similar to the vegetation in Type 4 wetlands.

Type 6 (shrub swamp) wetlands are located along slow streams, drainage depressions, and flood plains. Water up to six inches covers the ground. This is because the water table is located at or near the surface. Vegetation residing here include alders, willows, dogwoods, buttonbrush, and swamp privet.

Type 7 (wooded swamp) wetlands are found in ancient shallow lake basins, oxbows, slow streams, and on flat uplands. Up to one foot of water covers the ground. This is because the water table is located at or near the surface. Hardwood and coniferous vegetation such as black spruce, tamarack, balsam, red maple, and black ash are found residing in these swamps, as well as deciduous duckweed and smartweed.

Type 8 (bog) wetlands are found in shallow glacial lake basins and depressions, flat uplands, and slow streams. The soil is usually waterlogged because the water table is at or near the surface. Woody and herbaceous varieties of vegetation grows here, as well as moss.

3.2.8 Lakes

There are 14 lakes in Marshall County. The biggest of these are Mud Lake and Thief Lakes.

3.2.9 Topography

Marshall County was once part of glacial Lake Agassiz. Evidence of this prehistoric lake can still be seen in the topography of the county today. Remnants of "McCauleyville Beach" of Lake Agassiz, can be found on the eastern portion of the county, which is an area of sandy soil and sand ridges. Additional evidence of the glacier and Lake Agassiz includes the approximately 140 feet drop in elevation from the eastern portion of the county to the western sections of the county near the Red River. The western section of the county near the Red River contain black, rich soil that the Red River Valley is famous for.

3.3 Population and Demographics

Demographics are the quantifiable statistics of a given population. Demographics are also used to identify the study of quantifiable subsets within a given population which characterize that population at a specific point in time. In this section we examine Population Trends, Population of Marshall County Cities and Townships, Comparable Growth of Surrounding Areas, Population of Age Groups, Households, Population Projections, Special Populations and Economics.

3.3.1 Historic Population Trends

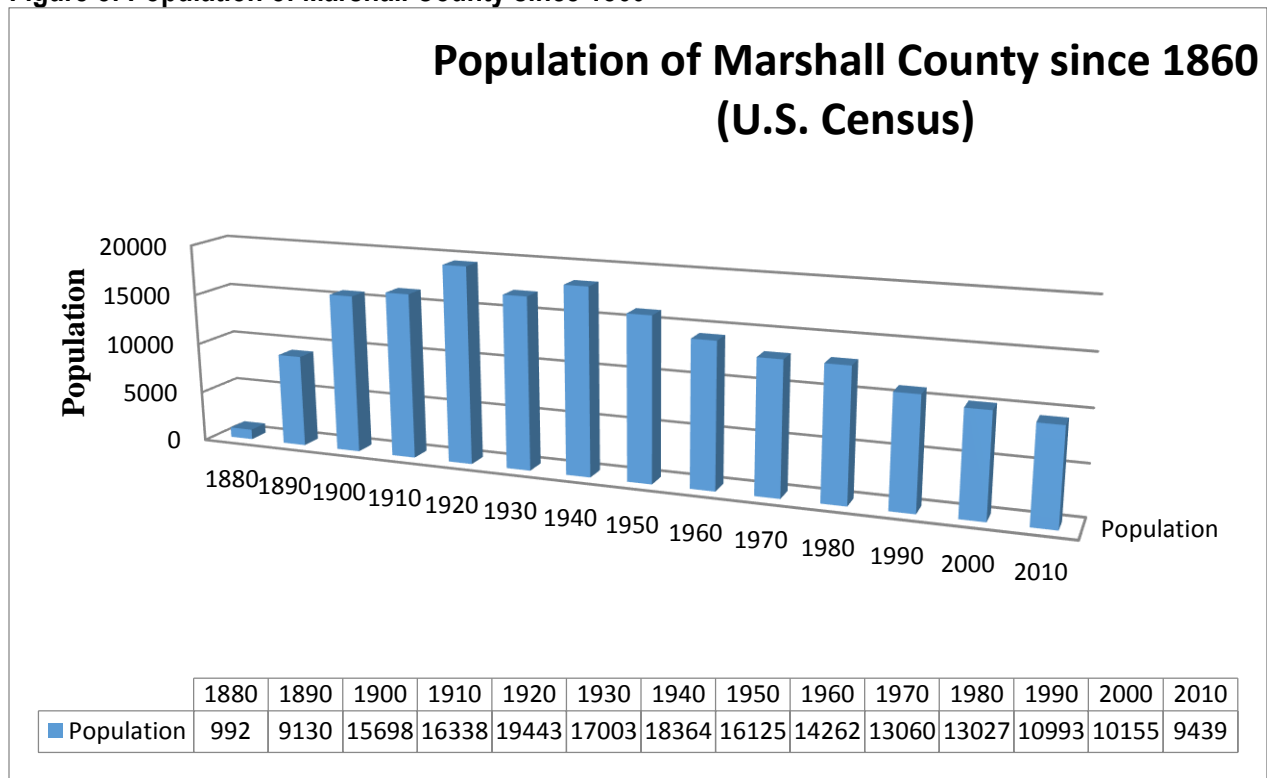
Population trends or population growth is the change in a population over time and can be quantified as the change in the number of individuals in an area. Four factors determine population growth or decline for a geographical area-births, deaths, immigration rate, and emigration rate. Growth can be both positive and negative. A positive growth ratio indicates that the population is increasing while a negative growth ratio indicates the population is decreasing. The effects of population changes are varied and vast. Population growth can be devastating to an area when the population exceeds the resources to sustain it. In areas of quick positive growth housing may become an issue and put a strain on infrastructure, while also increasing waste in the area. In areas that have a negative growth the existing population may not be able to support an economic system.

Marshall County's population trends are economically influenced. Marshall County was officially formed in 1879 in 1880 the population was 905. During the 1880's homesteaders inundated the land and population swelled to 5,387 in 1890. The growth trend continued to be positive into the 1920's. There was a slight decline during the 1930's and the population peaked in 1940. The growth of Marshall County in the early 1900's can be correlated with the arrival of the railroad.

Table 11: Population of Marshall County since 1880 (U.S. Census)

Census Year	Population	Percent Change
1880	992	-
1890	9,130	820.4%
1900	15,698	71.9%
1910	16,338	4.1%
1920	19,443	19.0%
1930	17,003	-12.5%
1940	18,364	8.0%
1950	16,125	-12.2
1960	14,262	-11.6%
1970	13,060	-8.4%
1980	13,027	-0.3%
1990	10,993	-15.6%
2000	10,155	-7.6%
2010	9,439	-7.1%
Est. 2013	9,425	-0.1%

Source: US Census

Figure 8: Population of Marshall County since 1860

3.3.2 Cities and Township Populations 1970-2010

Another way to examine population trends or growth is to analyze individual cities within the area. Marshall County houses eleven cities, Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, and Warren. Warren is the only city in the county with a population over a thousand people. The population of Warren has been steadily decreasing since 1970 with the biggest decrease between 1980 and 1990 where the town lost approximately 15% of its population. Between 1980 and 1990 the county as a whole lost approximately 25% of its population. It's interesting to note that in Marshall County more people live in rural areas instead of towns.

Table 12: Population of Marshall County's Cities Since 1970 (U.S. Census)

Cities	Years				
	1970	1980	1990	2000	2010
Alvarado	302	385	356	371	363
Argyle	739	741	636	656	639
Grygla	211	216	220	228	221
Holt	97	119	88	89	88
Middle River	369	349	285	319	303
Newfolden	390	384	345	362	368
Oslo	417	379	362	347	330
Stephen	904	898	707	708	658
Strandquist	138	136	98	88	69
Viking	118	129	103	92	104
Warren	1999	2105	1813	1678	1563
Townships	7376	7533	5980	5217	4733
Marshall County	13060	13027	10993	10155	9439

3.3.3 Comparable Growth

We can also analyze growth trends by analyzing adjacent counties to Marshall County. Marshall County is surrounded by Pembina, Kittson, Roseau, Beltrami, Polk, Pennington, Grand Forks, and Walsh Counties. The following information was provided by Minnesota Populations of 2005 to 2030.

- The state's population is more centered than ever in the Twin Cities area. Almost six of every 10 Minnesotans now live in the 11 counties clustered around Minneapolis and St. Paul, while western, northwestern and northeastern Minnesota are losing residents as young people leave never to return.

Marshall and adjacent counties are following this negative growth trend. Pembina, Walsh and Grand Forks County are all in the State of North Dakota, they are also the adjacent counties to Marshall County that have the largest populations. Beltrami County located in Minnesota is the adjacent county with the largest population in Minnesota.

Table 13: Adjacent County Area Population Change since 1970

County	Year				
	1970	1980	1990	2000	2010
Pembina	10,728	10,399	9,238	85,85	7,413
Walsh	16,251	15,371	13,840	12,389	11,119
Grand Forks	61,102	66,100	70,683	66,109	66,861
Pennington	13,266	15,258	13,306	13,584	13,930
Beltrami	26,373	30,982	34,382	39,650	44,442
Roseau	11,569	12,574	15,026	16,338	15,629
Kittson	6,853	6,672	5,767	5,285	4,552

Source: State Demographic Center

3.3.4 Population by Age Groups

The following information was provided by Stratis Health, Demographics Affecting Health-Marshall County Profile-According to the 2010 Census, the number of Minnesotans age 65 and older increased 15% while the number of those over 85 increased almost 25% since the 2000 census. The median age in Marshall County was 44.1 years compared with 37.4 for the state. The overall age composition of the state has become much older in the past ten years. Gender is evenly distributed across age groups, with a notable exception in older age groups which have larger proportions of females.

Table 14: Population by Age Group

Gender Distribution-Marshall County		
Age Range	Male	Female
Under 15	49.5%	50.5%
15 to 24	53.8%	46.2%
25 to 44	53%	47%
45 to 64	52.2%	47.8%
65 and older	45.1%	54.9%

Source: U.S. Census 2010

3.3.5 Households

A household consists of one or more people who live in the same dwelling and also share meals or other living accommodation, and may consist of a single family or some other grouping of people. It does not include people who live in group quarters (dormitories, prisons, military barracks, prisons, etc.). According to the 2010 Census, there were 10,155 people, 4,101 households and 2,837 families residing in the county. There were 4,101 households of which 30.20% had children under the age of 18 living with them, 60.20% were married couples living together, 5.40% had a female householder with no husband present, and 30.80% were non-families. 28.70% of all households were made up of individuals and 15.10% had someone living alone who was 65 years of age or older. The average household size was 2.45 and the average family size was 3.01. The median household income was \$34,804, and the median family income was \$41,908.

Table 15: Households, and Average Household Size of Marshall County

HOUSEHOLDS BY TYPE	Number	Percent
Total households	3,981	100.0
Family households (families)	2,686	67.5
With own children under 18 years	1,056	26.5
Husband-wife family	2,249	56.5
With own children under 18 years	791	19.9
Male householder, no wife present	186	4.7
With own children under 18 years	106	2.7
Female householder, no husband present	251	6.3
With own children under 18 years	159	4.0
Nonfamily households	1,295	32.5
Householder living alone	1,145	28.8
Male	606	15.2
65 years and over	163	4.1
Female	539	13.5
65 years and over	380	9.5

Source: U.S. Census 2010

3.3.6 Population Projections

The Minnesota Demographics Center has published population projections for Marshall County in five-year increments. These projections are presented in Table 1E. However, population projections should only be viewed as educated estimates based on historical data. There are a number of variables that directly and indirectly influence population levels including in-migration, out-migration, net births/deaths, and economic conditions. For this reason, the population projections should only be used for general planning purposes.

Table 16: Marshall County Population Projections 2005-2020

Age	2015	2020	2025	2030
0-4	490	460	470	450
5-9	580	590	580	560
10-14	620	630	630	630
15-19	620	560	570	570
20-24	380	370	350	250
25-29	440	410	390	380
30-34	570	530	500	480
35-39	530	580	550	540
40-44	540	540	590	560
45-49	580	570	540	600
50-54	730	550	530	530
55-59	690	670	510	500
60-64	690	670	660	520
65-69	330	660	630	610
70-74	410	470	570	570
75-79	340	270	430	510
80-84	260	280	300	350
85 plus	330	310	330	350

Source: US Census

3.3.7 Special Populations

Special population is a term used to express a disadvantaged group for example populations with disabilities, minors, and the elderly. Special populations often require accommodations for physical, mental or emotional differences. Special populations must be carefully considered by emergency service providers. The tables below illustrate the special population in Marshall County the statistics were provided by the Census Bureau. Below are tables of special populations identified in Marshall County. Children, Elderly and Females all represent special populations within the county. The table below illustrates the population of children within the county. The children population in the county has decreased from 2000 to 2010.

Table 17: Children

Children Marshall Census Data 2000-2012		
Years	2000	2012
Child and Youth Population	2538	2173
Marshall County Population	10155	9449

Source: U.S. Census 2010

The population 65 and over is considered economically dependent and need special planning when considering mitigation. Marshall County has a higher number of elderly people when compared to the state. The projections that were provided by Minnesota Demographic Agency predict that the elderly population in Marshall County will increase.

Table 18: Elderly Population

Marshall County Population by Age Calendar Year	Total County Population	65+ County Population	County Percent 65+	State Percent 65+	85+ County Population	County Percent 85+	State Percent 85+
2000	10,155	1,881	18.52	12.08	229	2.26	1.74
2010	9,439	1,816	19.24	12.88	286	3.03	2.01
2020	9,990	2,120	21.22	15.94	230	2.30	2.11
2030	10,020	2,560	25.55	20.63	270	2.69	2.68

The total population of females in Marshall County is 4,690. The majority of the female population is 18 years and under or over 65 years of age. That means the majority of the female population in Marshall County is economically dependent.

Table 19: Female Population

Subject	Female 2010 Census Data (US Census Bureau)
Female Population	4690
Under 18	1120
Over 65	1330

Population with a Disability

As you can see from the table below, there is a significant number of individuals in Marshall County with a disability, with 12.5% reported as having a disability. It is of significance to point out that 37.2% of the population who is 65 and older have a disability. This can have an impact on mitigation planning for the county.

Table 20: Disability Population Statistics for Marshall County

DISABILITY STATUS OF THE CIVILIAN NONINSTITUTIONALIZED POPULATION	Number	Percent
Total Civilian Noninstitutionalized Population	9,359	9,359
With a disability	1,170	12.5%
Under 18 years	2,181	2,181
With a disability	77	3.5%
18 to 64 years	5,408	5,408
With a disability	435	8.0%
65 years and over	1,770	1,770
With a disability	658	37.2%

Poverty

The population in Marshall County identified as living in poverty was approximately 10.4% of the overall population. Poverty in Marshall County is higher than overall state averages and overall national averages.

Table 21: Residents with income below the poverty level in 2009

Area	Percent Below Poverty Level
Marshall County	9.8%
Minnesota	7.9%

Table 22: Residents with income below 50% of the poverty level in 2009

Area	Percent
Marshall County	3.6%
Minnesota	3.2%

3.4 Cultural Conditions

The state of Minnesota has a rich cultural history dating back over 5,000 years ago with inhabitation of the region following the last Ice Age. The state's first inhabitants being Native Americans with the dominate tribes being the Dakota and Ojibwa (also called Chippewa or Anishinabe) Indians with cave drawings called petroglyphs found in several state parks throughout the region, such as in Jeffers Petroglyphs near Comfrey. Ancient burial mounds can also be found throughout the state.

The first European explorers came to the Minnesota region in the early 1600's by Etienne Brule, in 1623 or 1624. Groseilliers and Radisson, however, in 1654 to 1660, are generally regarded as the first explorers of the region. These first explorations ultimately resulted in French sovereignty over Lake Superior. Fort Snelling was the first permanent European settlement in Minnesota in 1825. The earliest settlers were primarily from the East Coast with most immigration from Germans and Scandinavians by the late 1860's.

Minnesota became the 32nd state in the union in 1858. On October 27, 1849 nine large Minnesota counties were created. Among them were Benton, Dahkotoh, Itasca, Ramsey, Mahkahta, Pembina, Wabasha, Washington, and Wahnata. Of those Benton, Dakota, Itasca, Ramsey, Wabasha, and Washington hold their original name. With the creation of Kittson County on March 9, 1878, Pembina County no longer existed. When Minnesota was organized as a state, 57 of the present 87 counties were established. The last county to be established was Lake of the Woods County in 1923.

3.4.1 Race and Ethnicity

The vast majority of Marshall County is White, with the percentage being 96.6 percent. The next largest category is Hispanic or Latino with 3.6%. Knowing the main ethnic background of the community can have a significant impact on mitigation planning.

Table 23: Population of Marshall County by Race and Ethnicity

RACE	Number	Percent
Total population	9,439	100.0
One Race	9,358	99.1
White	9,119	96.6
Black or African American	26	0.3
American Indian and Alaska Native	43	0.5
Asian	19	0.2
Native Hawaiian and Other Pacific Islander	3	0.0
Some Other Race	148	1.6
Two or More Races	81	0.9
White; American Indian and Alaska Native	43	0.5
White; Asian	7	0.1
White; Black or African American	12	0.1
White; Some Other Race	9	0.1
Hispanic or Latino (of any race)	337	3.6

Source: U.S. Census 2010

The following table illustrates that there is a distinct majority regarding the language spoken in the homes of residents of Marshall County. With 93.8% of residents speaking only English at home and 3.6 % of residents speaking Spanish.

Table 24: Language Spoken at Home in Marshall County

LANGUAGE SPOKEN AT HOME	Number	Percent
Population 5 years and over	8,912	8,912
English only	8,360	93.8%
Language other than English	552	6.2%
Speak English less than "very well"	101	1.1%
Spanish	323	3.6%
Speak English less than "very well"	73	0.8%
Other Indo-European languages	202	2.3%
Speak English less than "very well"	25	0.3%
Asian and Pacific Islander languages	6	0.1%
Speak English less than "very well"	0	0.0%
Other languages	21	0.2%
Speak English less than "very well"	3	0.0%

Source: U.S. Census 2010

3.4.2 Level of Education

The next table indicates the level of education of the residents of Marshall County. This indicates that of the population in Marshall County 25 and over, the majority of the county has graduated from high school and attended some college.

Table 25: Level of Education for Marshall County

EDUCATIONAL ATTAINMENT	Number	Percent
Population 25 years and over	6,676	6,676
Less than 9th grade	388	5.8%
9th to 12th grade, no diploma	423	6.3%
High school graduate (includes equivalency)	2,551	38.2%
Some college, no degree	1,398	20.9%
Associate's degree	749	11.2%
Bachelor's degree	911	13.6%
Graduate or professional degree	256	3.8%
Percent high school graduate or higher	(X)	87.9%
Percent bachelor's degree or higher	(X)	17.5%

Source: U.S. Census 2010

3.4.3 Socioeconomic Conditions: Income

The income per household in Marshall County can tell a lot about the County as a whole. There are a total of 4,080 households in the county. The income range with the highest number of households is the \$50,000-\$74,999 range, with the second largest income range being \$75,000-\$99,999. These statistics indicate that almost half the households in the county have income ranges within the lower class to middle class.

Table 26: Income and Benefits per Household in Marshall County

INCOME AND BENEFITS (IN 2013 INFLATION-ADJUSTED DOLLARS)	Number	Percent
Total households	4,080	4,080
Less than \$10,000	204	5.0%
\$10,000 to \$14,999	217	5.3%
\$15,000 to \$24,999	415	10.2%
\$25,000 to \$34,999	527	12.9%
\$35,000 to \$49,999	597	14.6%
\$50,000 to \$74,999	929	22.8%
\$75,000 to \$99,999	637	15.6%
\$100,000 to \$149,999	387	9.5%
\$150,000 to \$199,999	88	2.2%
\$200,000 or more	79	1.9%
Median household income (dollars)	52,198	(X)
Mean household income (dollars)	62,246	(X)

3.4.5 Employment Status

The following table indicates that the unemployment rate in Marshall County is less than the national average. The national average unemployment rate is 6.9% and the actual unemployment in Marshall County in 2010 was 5.9%.

Table 27: Employment Status in Marshall County

EMPLOYMENT STATUS	Number	Percent
Population 16 years and over	7,542	7,542
In labor force	5,062	67.1%
Civilian labor force	5,058	67.1%
Employed	4,761	63.1%
Unemployed	297	3.9%
Armed Forces	4	0.1%
Not in labor force	2,480	32.9%
Civilian labor force	5,058	5,058
Percent Unemployed	(X)	5.9%

Source: U.S. Census Bureau

Occupation

The following table shows that the majority of occupations by people in Marshall County are either in Management, business, science and arts occupations, or sales and office occupations. These 2 occupation type categories make up more than half of the occupations in the County.

Table 28: Occupations in Marshall County

OCCUPATION	Number	Percent
Civilian employed population 16 years and over	4,761	4,761
Management, business, science, and arts occupations	1,591	33.4%
Service occupations	655	13.8%
Sales and office occupations	1,004	21.1%
Natural resources, construction, and maintenance occupations	679	14.3%
Production, transportation, and material moving occupations	832	17.5%

Source: US Census

3.4.6 Economic Conditions

The major sources of income in Marshall County are Educational and Health Care services, Agriculture and Manufacturing. Table 21 shows the most common industries in the county and displays percentages each industry.

Table 29: Most Common Industries in Marshall County

INDUSTRY	Number	Percent
Civilian employed population 16 years and over	4,761	4,761
Agriculture, forestry, fishing and hunting, and mining	623	13.1%
Construction	382	8.0%
Manufacturing	695	14.6%
Wholesale trade	300	6.3%
Retail trade	447	9.4%
Transportation and warehousing, and utilities	279	5.9%
Information	56	1.2%
Finance and insurance, and real estate and rental and leasing	175	3.7%
Professional, scientific, and management, and administrative and waste management services	157	3.3%
Educational services, and health care and social assistance	1,056	22.2%
Arts, entertainment, and recreation, and accommodation and food services	220	4.6%
Other services, except public administration	188	3.9%
Public administration	183	3.8%

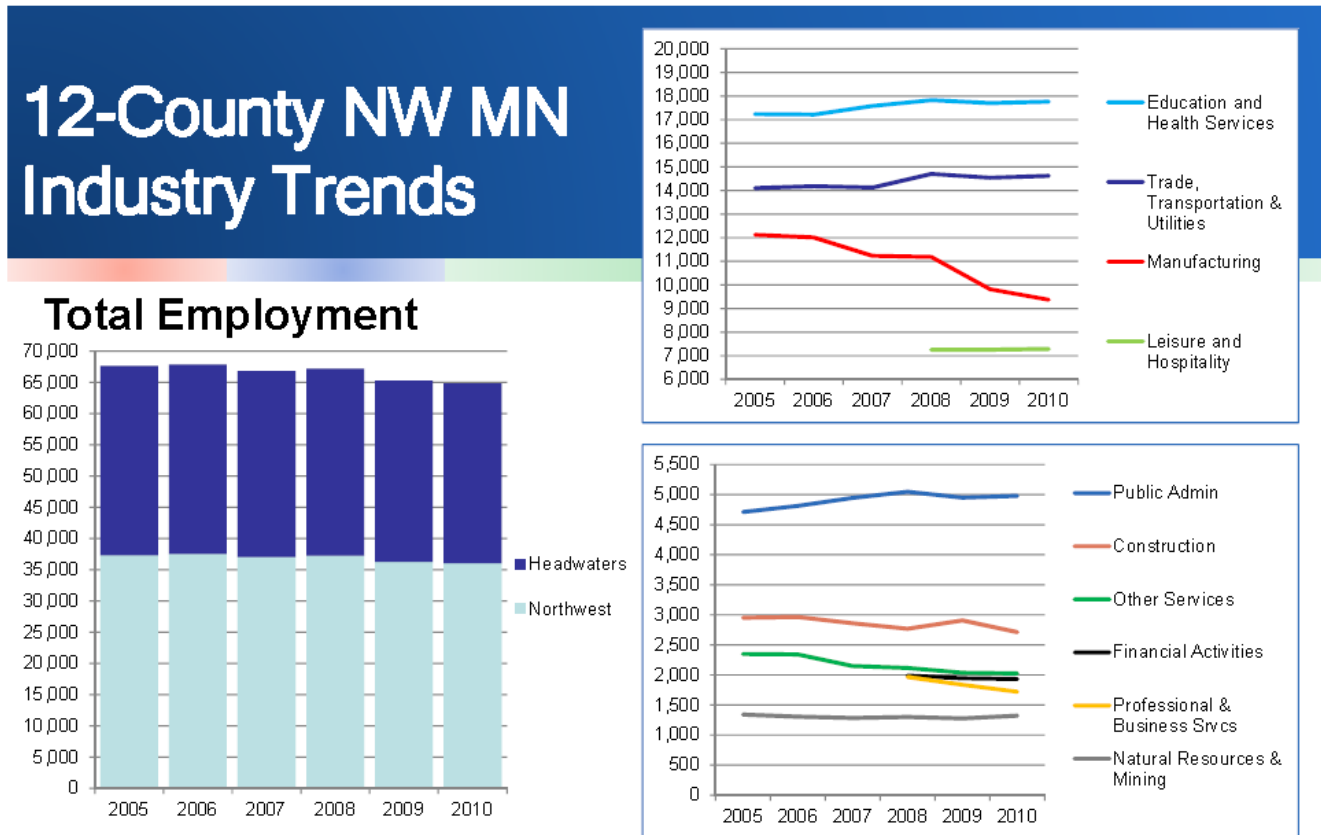
3.4.7 Economics

In Marshall County Northwest Minnesota Foundation invests resources, facilitates collaboration, and promotes philanthropy to make the region a better place to live and work. The Northwest Foundation serves twelve counties including Marshall County. It provides development for the following activities in the counties.

- Natural Assets - outdoor recreation, clean air and water, lakes and forests
- Structural assets - housing, health care, education
- Social assets - leadership effective organizations, community character
- Economic assets - jobs, family incomes, business opportunities

The following economic information was provided by the Northwest Foundation.

Figure 9: Industry Trends



- * **5,115 firms** paid **\$2.1 billion in payroll** (12-county MN region).
- * Self Employment accounts for **1,729 jobs** and **\$384 million sales**.

3.4.8 Agriculture

Table 22 outlines the profile for Marshall County with regards to farms. Among all the Minnesota counties, Marshall County ranks 29th in the total value of agricultural products sold. The table outlines the percent change seen from 2007 to 2012. As you can see, the acreage of land used for farms and the number of farms have decreased in the time period indicated. The average size of the farms within the county, has however, increased. This is critical information, because agriculture is a big industry in the County.

Table 30: Marshall County Farm Profile

	2012	2007	Percent Change
Number of Farms	1,148	1,405	-18
Land in Farms	820,112	910,687	-10
Average Size of Farm	714	648	+10

Source: U.S. Census of Agriculture

3.4.9 Future Development

Current economic trends for the region are as follows:

1. Aspects of agriculture have plummeted in recent years. Counties in the region with the most population loss often are agriculturally dependent. Population loss is an important issue in many counties.
2. Employment in the region has increased since 1990, but it is not an even growth. The gain is not enough to prevent population loss. Large losses are seen in agriculture and self-employment.
3. Some recent growth in the service and retail portions of the workforce is related to outside visitors coming to the region and surrounding areas for recreational purposes.
4. Agricultural lands and natural areas are a majority of the landscape in the region. The ensuing environment befits the preferences of a rural population.

3.4.10 Faith-Based Organizations

More than half of all congregations and many other faith-based organizations provide some form of human services to their communities. These resources are very valuable resources for mitigating and responding to community adversity. Below is a list of faith-based organizations in Marshall County.

Table 31: Faith-Based Organizations in Marshall County

Church Name	Location	Denomination
Alvarado Baptist Church	Alvarado	Baptist
Community Bible Church	Grygla	Bible
Assumption Church	Strandquist	Catholic
St. Joseph's Catholic Church	Middle River	Catholic
St. Joseph's Catholic Church	Oslo	Catholic
St. Peter and Paul Catholic Church	Warren	Catholic
St Rose Church	Argyle	Catholic
St. Stephens Catholic Church	Stephen	Catholic
Evangelical Covenant Church	Warren	Evangelical Covenant
Viking Covenant Church	Viking	Evangelical Covenant
Evangelical Free Church	Newfolden	Evangelical Free
Kongsvinger Lutheran Church	Oslo	Lutheran AALC
New Hope Lutheran Church	Newfolden	Lutheran AALC

Alma Free Lutheran Church	Argyle	Lutheran AFLC
Our Saviors Free Lutheran Church	Argyle	Lutheran AFLC
Westaker Free Lutheran Church	Newfolden	Lutheran AFLC
Bethlehem Lutheran Church	Newfolden	Lutheran ELCA
Bigwood Lutheran Church	Oslo	Lutheran ELCA
First Lutheran Church	Middle River	Lutheran ELCA
First Lutheran Church	Stephen	Lutheran ELCA
First Lutheran Church	Warren	Lutheran ELCA
Nazareth Lutheran Church	Newfolden	Lutheran ELCA
New Hope Lutheran Church	Alvarado	Lutheran ELCA
Our Saviors Free Lutheran Church	Warren	Lutheran ELCA
Our Saviors Free Lutheran Church	Middle River	Lutheran ELCA
Zion Lutheran Church	Oslo	Lutheran ELCA
Zion Lutheran Church	Viking	Lutheran ELCA
Zion Evangelical Lutheran Church	Warren	Lutheran Missouri Synod
Grace United Methodist Church	Warren	Methodist United
Harvest Community Church	Warren	Non-Denominational

3.5 Critical Infrastructure

The term built environment refers to the human-made surroundings that provide the setting for human activity, ranging in scale from personal shelter and buildings to neighborhoods and cities that can often include their supporting critical infrastructure (bridges, water treatment, highways, etc.) and key resource (schools, museums, etc.) assets. The built environment is a material, a spatial, and cultural product of human labor that combines physical elements and energy in forms necessary for living, working and playing. In urban planning, the phrase connotes the idea that a large percentage of the human environment is man-made, and these artificial surroundings are so extensive and cohesive that they function as organisms in the consumption of resources, disposal of wastes, and facilitation of productive enterprise within its bounds.

The County's infrastructure and facilities are important for its normal functioning and the health, safety, and general welfare of its residents. This section identifies Marshall County's important critical infrastructure and facilities, including subsections on transportation, schools, medical facilities, waste facilities, and historic sites.

3.5.1 Railroads

Two major freight railways run through Marshall County. Burlington Northern Santa Fe railroad and the Canadian Pacific (Soo Line) both run through the county. The BNSF Railway is the second-largest freight railroad network in North America, second to the Union Pacific Railroad (its primary competitor for Western U.S. freight), and is one of seven North American Class I railroads. The Burlington Northern Santa Fe (BNSF) line in Marshall County runs alongside highway 75 and goes through the cities of Stephen, Argyle and Warren.

The Soo Line Railroad (reporting mark SOO) is the primary United States railroad subsidiary of the Canadian Pacific Railway (CP), controlled through the Soo Line Corporation, and one of seven U.S. Class I railroads. This railway runs through the cities of Strandquist and Newfolden in Marshall County. It runs alongside highway 59 in Marshall County.

There is also a Class III private railway line which runs through the county. This is the Minnesota Northern line and it runs through the cities of Middle River and Holt and runs alongside state highway 32 in Marshall County.

Table 32: FRA Railroad Track Classification

Class	Freight Speed (mph)	Passenger Speed (mph)
One	10	15
Two	25	30
Three	40	60
Four	60	80

The efficiency of a railroad is affected by the physical condition of the rail lines. The Federal Railroad Administration (FRA) track classification is based upon the physical characteristics of the roadbed, track geometry, and track structure. There are four different track classifications with maximum freight and passenger speed. Characteristics related to the roadbed include drainage and vegetation. Track geometry includes gauge, alignment, elevation, and surface. Track structure involves ballast, ties, rail, spikes, joints, and switches. These characteristics determine the allowable operating speeds for each rail line.

3.5.2 Pipelines

Two companies in Marshall County have petroleum gas lines that go through the County, the Great Lakes Transmission and Enbridge Energy Partners. The petroleum pipelines are identified in blue below. The red pipeline is identified as a hazardous liquid pipeline. The map was provided by the National Pipeline Mapping System. The county also houses a natural gas pipeline, known as the Viking Gas Transmission. The pipeline takes gas from the TransCanada pipeline in Minnesota and brings it to Wisconsin. The pipeline is owned by ONEOK Partners.

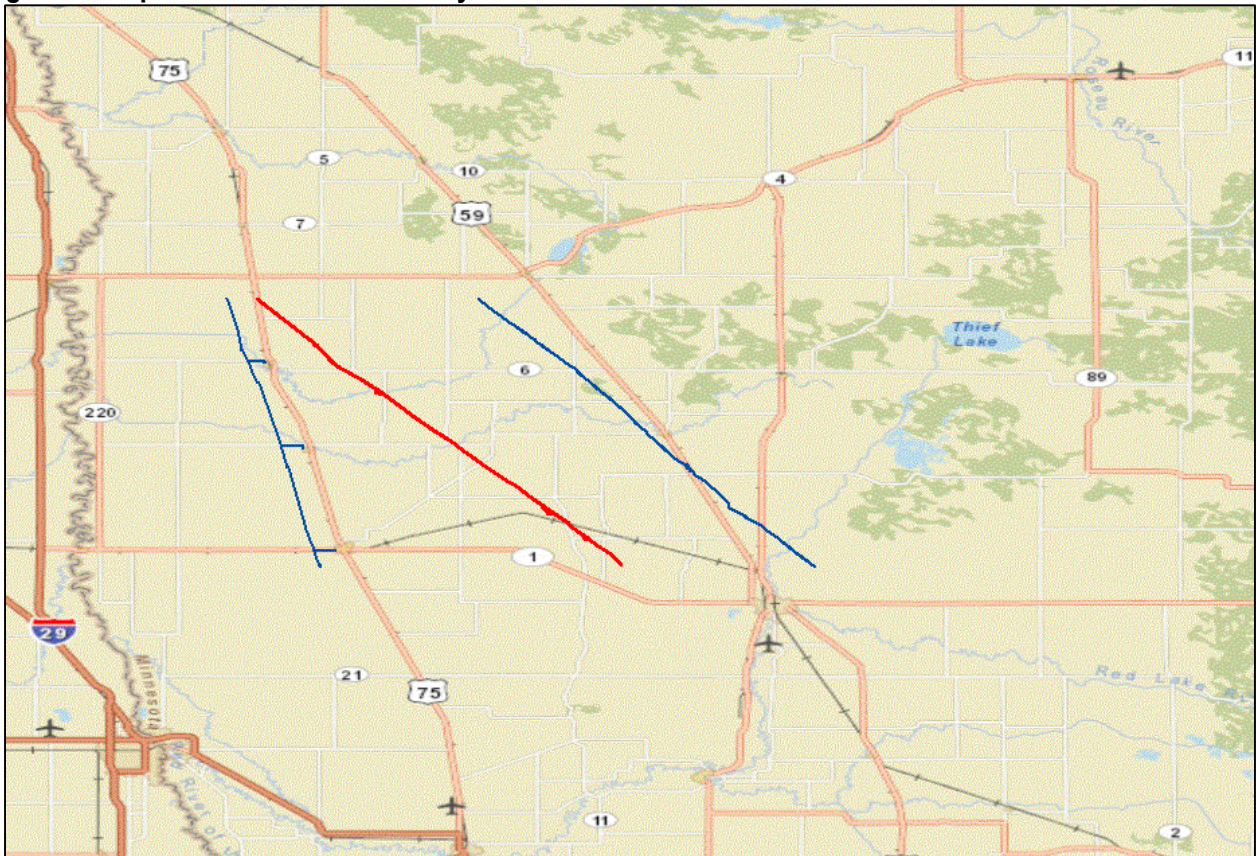
The energy transportation network of the United States consists of over 2.5 million miles of pipelines. That's enough to circle the earth about 100 times. These pipelines are operated by approximately 3,000 companies, large and small. Based on data generated from annual reports to PHMSA from pipeline operators, the network includes approximately:

- 175,000 miles of onshore and offshore Hazardous Liquid pipeline;
- 321,000 miles of onshore and offshore Gas Transmission and Gathering pipelines;
- 2,066,000 miles of Gas Distribution mains and service pipelines;
- 114 active LNG Plants connected to our gas transmission and distribution systems; and
- Propane Distribution System pipelines.

Although pipelines exist in all fifty states, most of us are unaware that this vast network even exists. This is due to the strong safety record of pipelines and the fact that most of them are located underground. Installing pipelines underground protects them from damage and helps protect our communities as well.

Most hazardous liquid and gas *transmission* pipelines are located underground in rights-of-way (ROW). A ROW consists of consecutive property easements acquired by, or granted to, the pipeline company. The ROW provides sufficient space to perform pipeline maintenance and inspections, as well as a clear zone where encroachments can be monitored and prevented.

Figure 10: Pipelines in Marshall County



Pipelines depicted on this map represent gas transmission and hazardous liquid lines only. Gas gathering and gas distribution systems are not represented. This map should never be used as a substitute for contacting a one-call center prior to excavation activities. Please call 811 before any digging occurs. Questions regarding this map or its contents can be directed to npms-nr@mbakercorp.com.

Projection: Geographic Datum: NAD83

Map produced by the NPMS Public Viewer at www.npms.phmsa.dot.gov

Pipeline operators are required to post brightly-colored markers along their ROW to indicate the presence of – but not necessarily the *exact* location of – their underground pipelines. Markers come in a variety of

shapes and sizes. They contain information about the nearby pipeline as well as emergency contact information for the company that operates it.

Gas distribution systems consist of distribution main lines and service lines. Distribution main lines are generally installed in underground utility easements alongside streets and highways. Distribution service lines run from the distribution main line into homes or businesses. Distribution main and service lines are not generally indicated by above-ground markers.

Pipelines play a vital role in our daily lives. Cooking and cleaning, the daily commute, air travel and the heating of homes and businesses are all made possible by the readily available fuels delivered through pipelines.

These routine activities really add up, in terms of energy use. Natural gas provides for fully 24% of our country's *total energy consumption*, and petroleum provides for another 39%.

Because such huge volumes of hazardous liquids and gas must be transported, the only feasible way to do so is through pipelines. Pipelines do not crowd our highways and waterways as trucks and barges would, nor do they contribute to traffic congestion or highway accidents. (U.S. Department of Transportation

3.5.3 Transit

Tri-Valley Transportation also known as T.H.E. Bus (Tri-Valley Heartland Express) is a division of Tri-Valley Opportunity Council, Inc. (TVOC). TVOC is a community action agency serving citizens since 1965 and an Affirmative Action / Americans with Disabilities / Equal Opportunity Corporation.

T.H.E. Bus is a curb to curb service and provides public transportation services to the general public in seven Minnesota counties, Polk, Red Lake, Norman, Marshall, Kittson, Pennington and Clearwater. Buses run through these counties on various days with various destinations. The public transit buses are available with no age limits or income guidelines. Buses have seating available for up to 45 passengers. Each bus is handicap accessible with two accessible entrances. If passengers are unable to use the door he/she may request the use of the lift. Each driver has been trained to properly use the lift and secure mobility devices within the buses.

3.5.4 Highways

The major highways which run through Marshall County are U.S. highway 59 and U.S. Highway 75. U.S. Route 59 is a north–south United States highway (though it is signed east–west in parts of Texas). A latecomer to the U.S. numbered route system, U.S. 59 is now a border-to-border route, part of NAFTA Corridor Highway System. It parallels U.S. Route 75 for nearly its entire route, never much more than 100 miles (160 km) away, until it veers southwest in Houston, Texas. Its number is out of place since U.S. 59 is either concurrent with or entirely west of U.S. Route 71. The highway's northern terminus is nine miles (14 km) north of Lancaster, Minnesota, at the Canadian border, where it continues as Manitoba Highway 59. Its southern terminus is at the Mexican border in Laredo, Texas, where it continues as Mexican Federal Highway 85D.

U.S. Route 75 is a north–south U.S. Highway. The highway's northern terminus is in Kittson County, Minnesota, at the Canadian border, where it once continued as Manitoba Highway 75 on the other side of the now-closed border crossing. Its southern terminus is at Interstate 30 and Interstate 45 in Dallas, where it is known as North Central Expressway. U.S. 75 was a border-to-border route, from Canada to the Gulf of Mexico at Galveston, Texas. However, the entire segment south of Dallas has been decommissioned in

favor of Interstate 45, a cutoff section of town-to-town surface road having become State Highway 75.

There are also Minnesota State Highways 1, 32, 89, 219, 220 and 317 which run through the county.

3.5.5 Airports

Below is Minnesota's complete list of airfields in Marshall County. List of airfields and airports are split into two classifications, Public Airports and Private Airports. Private airports may allow access if scheduled ahead of time or if heading to a hanger attached to that field. Listed below are Marshall County Airports.

- Johnson Airport-Private
- Arthur Field Airport-Private
- Hagens Private Airport-Private
- Klamar Field Airport-Private
- Paul Field Airport-Private
- Grygla Muni-Mel Wilkens Field Airport-Public
- Chanlin Field Airport-Private
- Stephen Muni Airport-Public
- Warren Muni Airport-Public

3.5.6 Water Control Structures

The Department of Natural Resources maintains the Minnesota State Dam Program. Minnesota's Dam Safety Program was created in 1978 in response to the federal Dam Safety Act. A series of major dam failures killed scores of people in the 1970's and prompted Congress to pass the act to improve dam safety nationally. Minnesota's program includes enabling legislation, agency rules for construction and operation, the creation of a dam database, permitting requirements, regular inspections, repair of state-owned dams, and cost-share grants for dam repairs by local units of government.

The Dam Safety Program regulates the repair, operation, design, construction, and removal of dams. Both privately and publicly owned dams are regulated. The program sets minimum standards for dams regarding safety, design, construction, and operation. These standards are implemented through inspections, permitting, and correcting deficiencies.

Enabling Legislation. Minnesota Statutes, Section 103G.515 authorizes the DNR commissioner to inspect dams and issue orders directing dam owners to make necessary repairs. The same section directs the commissioner to adopt rules governing dam safety.

Agency Rules. Minnesota Rules, parts 6115.0300 through 6115.0520 govern the state Dam Safety Program. The rules define which dams are subject to state jurisdiction, and establishes three dam hazard classes.

State dam safety regulations apply only to structures that pose a potential threat to public safety or property. The potential for damage downstream if a dam fails increases as the height of the dam and the volume of impounded water increases. State dam safety rules do not apply to dams that are so low or retain so little water as to not pose a threat to public safety or property.

Dams 6 feet high or less, regardless of the quantity of water they impound, and dams that impound 15 acre-feet of water or less, regardless of their height, are exempt from state dam safety rules. Dams that are

less than 25 feet high and impound less than 50 acre-feet are also exempt from state dam safety rules unless there is a potential for loss of life due to failure or misoperation.

Inspections. Dams designated as High Hazard are inspected annually and lower hazard dams are inspected less frequently by DNR dam safety engineers.

Some inspections are also performed by professional engineers working for the U.S. Army Corps of Engineers, the Natural Resources Conservation Service, the Federal Energy Regulatory Commission, and private dam owners. Dams being built or having major repair also require state inspection. High hazard dams have emergency action plans, which need to be monitored and revised as necessary on a periodic basis. Some dams have instrumentation to warn of internal changes that may indicate a deterioration of their structural integrity, and these dams need to be checked on a regular basis.

The DNR repairs and maintains state-owned dams. Minnesota Statutes, Section 103G.511 authorizes a state dam safety cost-share program. The DNR commissioner may make grants to local units of government for dam repair, reconstruction, or removal. Funding for repair or removal is provided by the legislature through state bonding appropriations.

Some older dams no longer provide sufficient benefits to compensate for their environmental damages, public safety hazards, and repair/maintenance costs. In these cases, the state provides grants only for their removal.

Construction and operation of dams can have varied impacts upstream, downstream, and to surrounding lands. Losses suffered by other parties can become liabilities to a dam owner. These impacts could include:

- raising or lowering of ground water levels that affect wells or crops,
- increased downstream flooding caused by improper operation,
- drowning of anglers or swimmers because of improper operation,
- damage to a fishery because of improper operation,
- erosion problems (upstream or downstream) because of improper operation,
- channel degradation because of interruption of sediment transport, and
- water quality degradation because of reservoir siltation and stagnant water conditions.

Marshall County currently houses no high hazard dams. The table below lists the dams in Marshall County.

Table 33: Dams in Marshall County

Dam Name	DNR-Dam Number	Dam Ownership	Dam Name	DNR-Dam Number	Dam Ownership
EAST PARK WMA POND	MN00368	Dam Safety	POOL NO. 22	MN00626	Federal
ECKVOLL WMA	MN00923	Dam Safety	POOL NO. 23	MN00627	Federal
ELM LAKE	MN00412	Dam Safety	POOL NO. 24	MN00628	Federal
LOST RIVER POOL	MN00924	Dam Safety	POOL NO. 25	MN00629	Federal
MCCREA 12	MN01448	Dam Safety	POOL NO. 27	MN00630	Federal
MIDDLE RIVER	MN00552	Exempt	POOL NO. 3	MN00640	Federal
MOOSE RIVER	MN01179	Exempt	POOL NO. 7	MN00639	Federal
OLD MILL STATE PARK	MN00228	Exempt	POOL NO. 8	MN00378	Federal
POOL NO. 1	MN00641	Federal	STEPHEN CITY	MN00352	Dam Safety
POOL NO. 10	MN00638	Federal	TAMARAC RIVER R1	MN00889	Dam Safety
POOL NO. 11	MN00637	Federal	THIEF LAKE	MN00218	Dam Safety
POOL NO. 14	MN00636	Federal	WARREN DIVERSION	MN01351	Dam Safety
POOL NO. 15	MN00635	Federal	WARREN STORAGE	MN01350	Dam Safety
POOL NO. 17	MN00634	Federal	POOL NO. 22	MN00626	Federal
POOL NO. 18	MN00633	Federal	POOL NO. 23	MN00627	Federal
POOL NO. 19	MN00632	Federal	POOL NO. 24	MN00628	Federal

3.5.7 Solid Waste Disposal

The Minnesota Pollution Control Agency provides information on Minnesota's solid waste facilities and regulation for hazardous waste, solid waste and tanks. The agency identified the Mar-Kit Sanitary Landfill near Hallock as a solid waste facility owned and operated by Marshall and Kittson Counties. The landfill is operated as a regional collection facility. The landfill generally services Marshall and Kittson Counties. However, waste is also received from the Minnesota counties of Koochiching, Lake of the Woods, Pennington, Red Lake, and Roseau, the Red Lake Indian Reservation, and the northeast counties of North Dakota, including parts of Cavalier, Pembina, Ramsey, and Walsh Counties.

The landfill currently includes active and closed municipal solid waste (MSW) disposal areas, a demolition debris landfill, site access and service roads, an office building, a materials recycling facility (MRF), a balefill facility, and an equipment storage facility. The current disposal area, Area C, has been divided into cells to reflect the closure sequence of filling to maximize airspace as the landfill development has proceeded. Former disposal Area B was filled in sequence and finally covered. Former disposal Area A was filled in a sequential pattern as cells were trenched into the existing ground. Areas A and B are not lined, as this was not required at the time they were filled. They have, however, been closed by capping with impermeable materials. Area C consists entirely of lined cells.

Marshall County operates the Marshall County Demolition Landfill, near Warren. The landfill currently includes active and demolition debris disposal areas and an equipment storage facility. The current disposal area has been divided into cells to reflect the closure sequence of filling to maximize airspace as the landfill development has proceeded. The demolition landfill is not lined.

3.5.8 Key Resources Emergency Services

Marshall County Emergency Management is the local government office responsible for developing and maintaining the comprehensive emergency management program which intended to reduce vulnerability to hazards, and enable the community to cope with significant emergencies and disasters. The comprehensive emergency management program includes many partners whose collective efforts include the mitigation of, preparedness for, response to, and the recovery from threats to public safety and protection of property. Potential hazards include natural, manmade, and/or nuclear incidents. The table below illustrates Law Enforcement, EMS and Fire Agencies that serve Marshall County and the communities within the county.

Table 34: Emergency Services in Marshall County

Jurisdiction	Law Enforcement	EMS	Fire
Alvarado	Marshall County Sheriff Office	Warren Volunteer Ambulance Services	Alvarado Fire Department
Grygla	Marshall County Sheriff Office	Thief River Falls Ambulance	Grygla Fire Department
Argyle	Marshall County Sheriff Office	Warren Volunteer Ambulance Services	Argyle Fire Department
Holt	Marshall County Sheriff Office	Thief River Falls Ambulance	Middle River Fire Department
Middle River	Marshall County Sheriff Office	Tri County EMS E-5	Middle River Fire Department
Newfolden	Marshall County Sheriff Office	Tri County EMS E-5	Newfolden Fire Department
Oslo	Marshall County Sheriff Office	Warren Volunteer Ambulance Services	Oslo Fire Department
Stephen	Marshall County Sheriff Office	Stephen Volunteer Ambulance Service	Stephen Fire Department
Strandquist	Marshall County Sheriff Office	Tri County EMS E-1	Karlstad Fire Department
Viking	Marshall County Sheriff Office	Thief River Falls Ambulance	Viking Fire Department
Warren	Warren Police Department	Warren Volunteer Ambulance Services	Warren Fire Department
Marshall County	Marshall County Sheriff Office		

Healthcare

Marshall County is served by one hospital located in Warren. The North Valley Health Center (NVHC) is a 501(c)3 non-profit corporation located in Warren, MN and is the only primary care medical facility located in northwest Minnesota's Marshall County. The hospital provides ambulance service, clinic services, diagnostic imaging, hospital services, specialty services, therapies and laboratory services.

Nursing Homes and Long Term Care Facilities

Marshall County Community Health programs provide assistance to the elderly and disabled which includes:

1. Long-Term Care Consultation (LTCC) – helps residents make decisions about care. The goal of the consultation is to help residents and their families choose services that reflect their needs

and preferences.

2. Independent Community Living Services. The goal of Independent Community Living Services is to promote health and home safety in a community setting. Independent community living with the aid of support services begins with a Long-Term Care Consultation. The Long-Term Care Consultation (LTCC) is conducted by a team who helps Marshall County residents and their families determine if independent community living is the appropriate choice to meet their needs.
3. Information about nursing homes. A decision to stay in a nursing home is based more on health care needs than housing needs. Depending on the severity and the expected duration of an illness, a nursing home stay might be the best choice for senior health care. The advantage of a nursing home is that the senior will receive 24-hour, 7 day-a-week specialized care.

Nursing home services may be covered in part or in full by private pay, long-term care insurance or health care insurance. When skilled nursing becomes necessary, seniors with low income and insufficient, or no insurance, may apply to the county for help. Hospital social workers can help with the application process. Seniors and those concerned with their care can talk with a Marshall County Public Health Nurse. There is one long-term care facility located in the county. The Good Samaritan Center, located in Warren, meet the needs of Marshall County residents.

Public Health

Quin Community Health Services in partnership with the Minnesota Department of Health and Local Public Health departments in Kittson, Marshall, Pennington, Red Lake and Roseau counties provides public health services that promote, protect and support the health of community residents in Marshall County.

Quin CHS was established by a joint powers agreement in 1978. At that time it was known as the K-M-PRL Community Health Services Agency and included the counties of Kittson, Marshall, Pennington and Red Lake.

In 1979 Roseau County joined the CHS and it became known as Quin Community Health Services.

- Quin CHS provides financial oversight, grant management and administrative support for state and federal public health funds.
- Quin CHS provides WIC (Women, Infants and Children) services to participants at satellite clinics in Kittson, Marshall, Pennington, Red Lake and Roseau counties.

Local Public Health Agencies in each county provide programs and services based on:

Essential Local Public Health Activities

1. Assure an adequate local public health infrastructure
2. Promote healthy communities and healthy behaviors
3. Prevent the spread of infectious disease
4. Protect against environmental health hazards
5. Prepare for and respond to disasters and assist communities in recovery
6. Assure the quality and accessibility of health services

Schools

Marshall County has four school districts that serve grades Kindergarten to High School, Grygla Public School District, Marshall County Central School District, Stephen/Argyle School District, and Warren/Alvarado/Oslo School District. The districts provide the county with the following programs, Vocational Education, Arts, Music, Special Education, and Advanced Placement testing.

Table 35: Marshall County School Enrollment

SCHOOL ENROLLMENT	Number	Percent
Population 3 years and over enrolled in school	2,018	2,018
Nursery school, preschool	116	5.7%
Kindergarten	130	6.4%
Elementary school (grades 1-8)	950	47.1%
High school (grades 9-12)	539	26.7%
College or graduate school	283	14.0%

Section 4: Risk Assessment

A risk assessment is critical to mitigation and comprehensive emergency management because it allows communities to measure and better understand the potential impact of hazards on their communities. Conducting a risk analysis is a multi-step process. The risk assessment process includes identifying hazards, profiling hazard events, determining how frequent hazards occur, and determining both the type and magnitude of hazard impact. A risk assessment provides the means for emergency managers and community leaders to develop mitigation actions, to prioritize resources needed to address operational activities, and to ultimately help a community become more resilient (Schwab, Eschelbach, and Brower, 2007).

FEMA Requirements Addressed in this Section:

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

§201.6(c)(2)(ii): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. All plans approved after October 1, 2008 must also address NFIP insured structures that have been repetitively damaged by floods. The plan should describe vulnerability in terms of:

§201.6(c)(2)(ii)(A): (A) The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.

§201.6(c)(2)(ii)(B): (B) An estimate of the potential dollar losses to vulnerable structures identified in ... this section and a description of the methodology used to prepare the estimate.

§201.6(c)(2)(ii)(C): (C) Providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

§201.6(c)(2)(iii): For multi-jurisdictional plans, the risk assessment section must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

4.1 Hazard Profile

The first step in conducting risk analyses is to identify which hazards are the most probable to impact one's community. With regard to Marshall County's mitigation plan update, an all-inclusive list of hazards was considered for inclusion in the plan update. The Hazard Mitigation Planning Team reviewed several sources to include Marshall County's previous hazard mitigation plan, hazards identified by FEMA (Multi-Hazard Identification and Risk Assessment), the Region's Threat Hazard Risk Analysis (THIRA), the Minnesota State Multi-Hazard Mitigation Plan, and mitigation plans of other neighboring counties. In addition to reviewing the region's mitigation plans, the Hazard Mitigation Planning Team analyzed past declared disasters, and spoke to local experts and residents. To elicit input from both officials and citizens, a survey was created and distributed to all of the participating jurisdictions.

While this iteration of the plan evaluated a wide variety of hazards, after careful analyses, receiving feedback from the public and approval of the steering committee, it was decided that this update would essentially remain the same as the previous plan less three exceptions. As suggested by the Hazard Mitigation Planning Team and approved by

the Hazard Mitigation Steering Committee and upon receiving feedback from the citizens of Marshall County and the MN HSEM, the following changes were made:

1. The risk assessment process would be updated to better align with the current standards.
2. Flashfloods was incorporated into the hazard of general flooding
3. Flood control structures were reclassified as Dam/Levee failure
4. The hazards of terrorism were eliminated from the plan. Marshall County has other plans in place (such as the THIRA) which serve as the primary planning documents to address non-natural and political hazards.
5. Issues of blizzard, extreme precipitation blizzard, snow storms and ice storms were incorporated into severe winter storms
6. Thunderstorms were eliminated as issues of wind and lightning (both included hazards) accounted for this hazard
7. Earthquake was not profiled as it was decided the frequency and impact of an event on Marshall County and the participating jurisdictions are negligible
8. The hazard of Fires (Structures and Vehicles) was added to the plan.
9. The hazard of Invasive Species was added to the plan.

Table 36: provides a summary of the final hazards identified in the hazard risk assessment:

Natural Hazards	Natural Hazards	Technological Hazards
Flooding (riverine and flash flood)	Erosion	Hazardous Material Release
Dam / Levee Failure	Land Subsidence	Invasive Species
Wildfire	Drought	Infectious Diseases
Windstorms	Extreme Heat	Fires (Structures and Vehicles)
Tornadoes		Transportation Incidents
Hail		Ground and Surface Water Supply Contamination
Lightning		
Winter Storms		

4.1.1 Risk Assessment Process

At the most fundamental level, both DHS and FEMA recognize that risk is equal to frequency X consequence ($R = FC$) of a hazard. More specifically, risk is based on the premise that in order to have a certain level of risk there must be a probability or likelihood for a hazardous event to occur. Likewise, if the event does occur, it must have an impact or consequence. The following section outlines the methodology used to determine Marshall County's risk.

To assess hazards and determine risk, the planning team proposed that a methodology based on probability and impact be utilized.

First, each hazard was researched, documented, and assessed for frequency and impact. Then, the hazard frequency and impacts were compiled for all of the individual hazard assessments. Once this data was compiled, the frequency and impact calculations were tabulated to obtain a matrix of risk scores. The risk methodology as highlighted above was presented to the steering committee during the December 10, 2014 steering/planning meeting.

4.1.2 Probability of Future Occurrences

The probability of future occurrences is commonly determined by using the frequency of past events to gauge the likelihood of future occurrences. In the case of Marshall

County, the hazard analyses and update was based on the County's historical data, the written record and information provided by citizens of Marshall County, and input from participating jurisdictions. When possible, a 50-year period was used to determine probability (note not all hazards report 50 years of data). The data used for all the hazard probabilities can be found in Appendix B.

The method used in the Marshall County's plan for standardizing the scale of probability values was based on the probability as shown below. The metrics for these classifications have been modified to reflect the 50-year reoccurrence interval used for this risk assessment and properly reflect the scale for the probabilities that was analyzed.

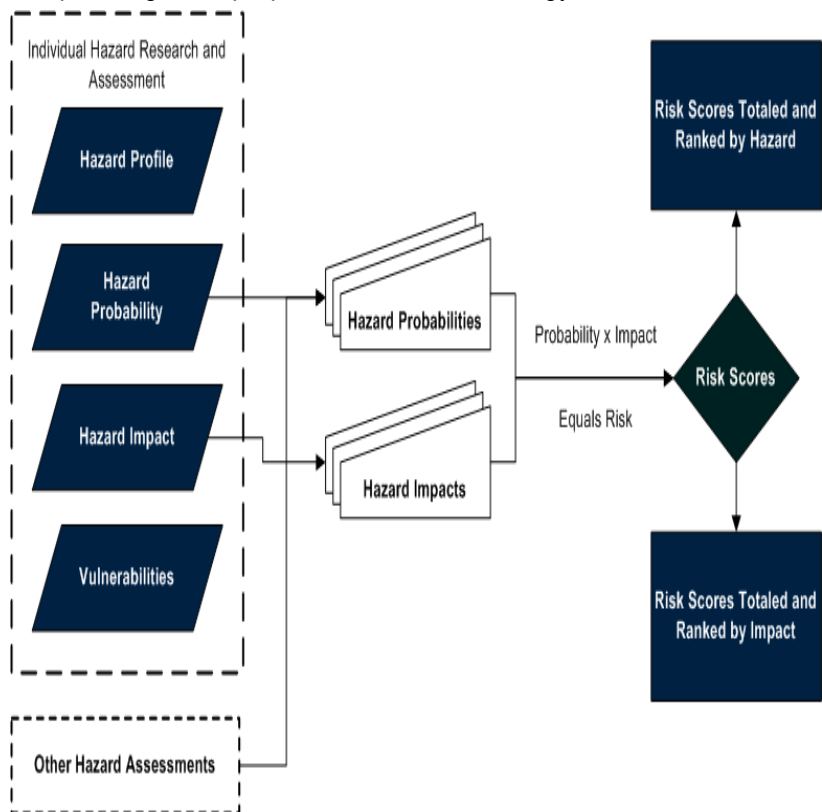


Table 37: Frequency/Probability

Frequency/Probability		
Level ID	Description Index Value	Index Value
Unlikely	Rare with no documented history of occurrences or events. Annual probability of less than 0.001	.5
Possible	Rare occurrences with at least one documented or anecdotal historic event. Annual probability that is between 0.01 and 0.001	1
Likely	Likely occurrences with at least two or more documented historic events. Annual probability that is between 0.1 and 0.01	2
Highly Likely	Highly Likely Frequent events with a well-documented history of occurrence. Annual probability that is greater than 0.1.	3

One issue to note is that hazard data is often reported regionally versus being isolated to a single community. When determining risk, regional reporting can present a challenge in that multiple communities are noted as being impacted versus individual cities or counties. For example, NOAA might report that a severe storm affecting the Southcentral part of Marshall County while not directly indicating the city of Viking as being affected. As such, to ensure each jurisdiction (or in the example--- Viking) is accounted for a quadrant system was used.

The quadrant used in the Risk Analyses simply arranged Marshall County and its cities into the regional reporting categories (Central Marshall, Southcentral Marshall, Northcentral Marshall, Northwestern Marshall, Southwestern Marshall, Northeastern Marshall, and Southeastern Marshall). For tabulating hazards frequency, the following Regional Classification Table demonstrates which cities are associated with each jurisdiction.

Table 38: Regional Classification

Regional Classification	
Central	Holt, Newfolden, Unincorporated Marshall County
Southcentral	Viking, Unincorporated Marshall County
Northcentral	Middle River, Strandquist, Unincorporated Marshall County
East central	Grygla, Unincorporated Marshall County
West central	Argyle, Unincorporated Marshall County
Northwestern	Stephen, Unincorporated Marshall County
Southwestern	Alvarado, Oslo, Warren, Unincorporated Marshall County
Northeastern	Unincorporated Marshall County
Southeastern	Unincorporated Marshall County

Note: The quadrant system was only used when the Hazard data used regional indications and did not directly indicate a community.

4.1.3 Hazard Impact

When conducting a risk analysis, creating a probability of a hazard occurrence is just one of several steps one must take to determine risk. To determine risk one must also take in account both impact assumption and impact magnitudes.

Impact assumptions describe how hazards impact the County and or its cities. The specific set of impact

assumptions listed below were selected for Marshall County's hazard risk analyses. The listed impact assumptions were chosen as they 1) can be caused by several different hazard events; 2) are mostly independent of each other; 3) each can be (to certain degrees) mitigated; 4) are often cited in the disaster literature (Center Comprehensive Emergency Management Research. 2015). And 5) are commonly used in disaster planning.

Table 39: Impact Assumptions

Impact Assumptions	
Casualties/Trauma	Non-Critical injuries that require medical attention.
Communication, Lack thereof	Disruption of communication including mobile and wired phone, radio, television, and satellite.
Continuity of Government	Disruption of county government normal operations.
Debris	Dry, wet, hazardous, organic or inorganic materials that need to be cleared and properly disposed.
Emergency Services Disrupted/Limited	Fire, Rescue, and Medical services are either overwhelmed or unable to respond normally.
Evacuation Needs	Hazardous conditions require the evacuation from either a specific site or larger area within the county.
Fatalities	Death due to the hazard.
Hazardous Material Release	Hazard event causes a hazard material release as a secondary hazard.
Overwhelm of First Responders	First responders are overwhelmed or unable to respond.
Mass Care Needs	Hazard event requires emergency sheltering of citizens.
Physical Damage / Asset Destruction	Loss or damage to the built environment.
Power, Disruption/Outages	Inability to supply power to end users or lack of enough power.
Transportation, Disruption/Failure	County roads, sidewalks, and public transit are obstructed or unable to function normally.
Economic Loss	Hazard causes loss or disruption to economic assets.

4.1.4 Impact Magnitudes

Disaster is loosely determined by when a jurisdiction's capacity is exceeded or when the jurisdiction no longer has the capacity to cope with the hazard. To quantify impact assumptions, it is necessary to determine the magnitude that hazard might have on a jurisdiction. The metric for impact magnitude consisted of a number of descriptors that are normally associated with a jurisdiction's capability and capacity to respond to, mitigate, and or recover from hazed events. A full list of these magnitude ratings is presented in the Impact Magnitude Rating table below.

Table 40: Impact Magnitude Ratings Descriptors

Impact Magnitude Ratings	
Rating	Descriptors
0	Hazard has no foreseeable effect specific to the impact assumption (rare).
1	Impact is present, but is extremely light having relatively no notable adverse effect on the jurisdiction.
2	Impact has an effect on the Jurisdiction, but does not always require next level government intervention.
3	Impact necessitates a county response or deployment of resources, impact disrupts normal/planned community functions.
4	Impact requires EOC operations or other coordinated response efforts.
5	Cost of impact exceeds a threshold of being unusually detrimental or disruptive to the Jurisdiction.
6	Impact is taxing on county's resources and has a widespread effect on the greater community.
7	Impact has an extended response / short-term recovery duration exceeding 36 hours and some long-term recovery needs.
8	Impact exceeds county and municipal response capabilities/capacities.
9	Long-term recovery planning needed, State or Federal resources needed to aid response and recovery from the impact.
10	Impact is so great it disrupts basic county function for an extended period of time and causes secondary hazards.

The final steps in calculating consequence (impact score) is to provide a magnitude for each impact. Once each impact is assigned a magnitude rating, the sums of each impact are added together and divided by 14 (the number of impact assumptions). The maximum impact score for each event could be 10 while the minimal score could be 0.

As noted by the steering committee during the March 11, 2013 meeting, the challenge with using this model is to quantify hazard impacts so that they use similar scales and are easily interpreted without inserting bias.

To account for bias, it was decided that once the data was calculated, it would be placed on a dedicated webpage for open review and comment by the steering committee, participating jurisdictions, and public. The emergency manager was responsible for informing the public, steering committee and participating jurisdictions that the information was available for review and to provide comment. The hazard risk assessment was reviewed over 90 times, with input occurring from each of the participating jurisdictions. In instances where the findings provided by the jurisdictions were inconsistent with the written record, the average of the two data sets was used to determine the County's hazard frequencies.

Table 41: Impact Descriptors

Impact		
Level ID	Description Index Value	Index Value
No Impact	No action required.	0
Low (Less than 3.33)	Minimal action required.	1
Moderate (3.34-7.45)	Action required with present resources.	2
High (7.5-10)	County resources are overloaded and additional help is required.	3

4.2 Risk

This section is a summary of risks and the factors that contributed to the overall risk score for each hazard. Data was derived from Marshall County's past mitigation plan, readily available data (internet searches, disaster database), and records provided by Marshall County and the participating jurisdictions. The individual hazard profiles were the basis that informed the hazard risk analysis process. The probability, impact and risk hazard event data was analyzed for each of the listed hazards and for each of the participating jurisdictions in the county.

Risk Scoring Key	
0 – 3.23	Little To No Risk
3.24 - 5.49	Low Risk
5.5 - 7.74	Moderate Risk
7.75 - 9	High Risk

To satisfy the risk equation proved earlier (i.e. Risk = Frequency X Consequence), a final risk score for each jurisdiction was generated. Risk was determined by multiplying the probability index number by the hazards consequence index number (i.e. Consequence = Impact Assumption X Impact Magnitude / 14). Risk scores range from 0-9 and are categorized as Little to No Risk (score of 0 to 3.23), Low Risk (score of 3.24 to 5.49), Moderate Risk (score of 5.5 to 7.74) and High Risk (score of 7.5 or higher). The table to the right summarizes the risk-scoring key.

To assist the reader in understanding how risk was determined an example is provided.

EXAMPLE: Over the past 50 years, hazard X occurred 40 times. From this information, it can be determined that this hazard is highly likely to reoccur and is recorded with a probability index score is equal to 3. Additionally, the hazard impact assessment suggests the hazard will have a moderate impact on the jurisdiction ($70/14=5$) and as such the hazard's impact index score is equivalent to 2. The hazard risk score is calculated based on the probability (3) multiplied by the impact (2), to give an overall risk score of 6 or Moderate Risk.

It should be noted that because some select hazards were grouped, there might be inflation with regard to probability and impact. For example, severe summer storms include instances of hail, thunderstorms, and severe winds. Thus, the number of events and impact will rise causing the risk to also rise.

Another consideration is this model uses both the written record and record as reported by Marshall County citizens. Therefore, there may be ambiguity with regard to occurrence and impacts provided in written record. Additionally, while some hazard events technically occur outside of the legal boundaries of a jurisdiction, the effect of these hazards are still felt by those living in the jurisdiction. Thus, it is common for participants to note hazards such as wildfire and or invasive species as having an impact on their respective jurisdictions regardless of that hazard technically occurring outside the boundaries of their legal jurisdiction. Finally, one must also consider the influence of perception when assessing a hazard's magnitude. For example, one might say an event was worse or less severe than officially reported. Such as the perception that a severe storm generated an actual tornado; however, in reality the event generated severe, straight-line winds.

It should be noted that considerations such as these occur in all data analyses. However, such incommodes do not influence the overall purpose of mitigation or diminish the analyses. Matter of fact, It can be argued that including both qualitative and quantitative data has made the model more accurate as it accommodates for risk perceptions and expertise of those living in Marshall County.

4.3 Risk Findings

The hazard risk assessment requires information about what hazards have historically impacted the communities, past mitigation actions, current vulnerability, climate change, the relationship to other hazards and what hazards may present risks in the future. Identifying historical and potential future hazards was primarily accomplished in two phases. The first phase entailed interviewing local government officials and staff, local emergency planning and response staff, and the public. The second phase entailed researching government records and news publications for records of previous hazard events. The results of the initial hazard evaluation were used to further focus the risk assessment on hazards that historically caused the most problems and those judged to be of most future concern.

Using the aforementioned frequency X consequence ($R = FC$) formula, each jurisdiction has its own unique risk score based on the aforementioned 28 points of data. Furthermore, an overall score was provided as a means to show the overall risk to the participating jurisdictions as a whole. Note, while the level of detail for each hazard correlates to the relative risk of each hazard, risk is limited by the amount of data available. As such as additional information is discovered and or new hazards are identified, this plan can be easily adjusted and updated.

Note, the hazards and corresponding jurisdictional risk are listed in order of risk. Each of the identified hazards presented below includes a description of the hazard, the risk of the hazard affecting the jurisdictions within Marshall County, the vulnerability of the jurisdictions within Marshall County, mitigation actions that have taken place in the past five years, and the relationship of the hazard to climate change and other hazards.

In November 2014, the final risk scores were posted on the project webpage for review and comment. The Marshall County Emergency Manager was responsible for ensuring that the Hazard Mitigation Steering Committee, jurisdictions, and the community at large were aware that the data was available for review. The results were reviewed over 45 times.

4.4 Flood

Flood was identified in the prior hazard mitigation plan from January 2008 for Marshall County and was also identified as one of the hazards to be included in this 2015 plan update. The following detail and analysis also concluded that flooding is still the number one hazard with the highest risk potential compared to the other hazards. Additionally, analyses are included in this 2015 plan update to include a more in-depth look at what flooding is, the history of it within Marshall County and the potential it has to impact the county residents. A definition of flooding is provided prior to taking a closer look at the effect flooding has on Marshall County in order to provide the reader with a knowledge of the hazard.

Flooding is the accumulation of water within a water body (e.g., stream, river, lake, or reservoir) and the overflow of excess water onto adjacent floodplains. Floodplains are lowlands, adjacent to water bodies that are subject to recurring floods. Floods are natural events that are considered hazards only when people and property are affected. Nationwide, hundreds of floods occur each year, making it one of the most common hazards in all 50 states and U.S. territories (FEMA, 1997). There are a number of categories of floods in the U.S., including the following:

- Riverine flooding, including overflow from a river channel

- Flash Floods
- Fluctuating lake levels
- Coastal flooding on the North Shore of Lake Superior
- Debris flow

While there is no sharp distinction between riverine floods, flash floods, ice jam floods, and dam-break floods, these types of floods are widely recognized and may be helpful in considering the range of flood risk and appropriate responses. The most common type of flooding event is riverine flooding, also known as overbank flooding. Riverine floodplains range from narrow, confined channels in the steep valleys of mountainous and hilly regions, to wide, flat areas in plains and coastal regions. The amount of water in the floodplain is a function of the size and topography of the contributing watershed, the regional and local climate, and land use characteristics. In steep valleys, flooding is usually rapid and deep, but of short duration, while flooding in flat areas is typically slow, relatively shallow, and may last for long periods of time. The cause of flooding in large rivers is typically prolonged periods of rainfall from weather systems covering large areas. These systems may saturate the ground and overload the rivers and reservoirs in numerous smaller basins that drain into larger rivers. Localized weather systems (i.e., thunderstorms) may cause intense rainfall over smaller areas, leading to flooding in smaller rivers and streams. Annual spring floods, due to the melting of snowpack, may affect both large and small rivers and areas.

A flash flood is defined as a rapid and extreme flow of high water into a normally dry area, or a rapid water level rise in a stream or creek above a predetermined flood level, beginning within six hours of the causative event (e.g., intense rainfall, dam failure, ice jam). However, the actual time threshold may vary in different parts of the country. Ongoing flooding can intensify to flash flooding in cases where intense rainfall results in a rapid surge of rising flood waters. (National Weather Service, 2012).

The definition of a flash flood per the Minnesota Climatology Working Group is “the occurrence of six inches or more rainfall within a 24-hour period.” The size of a flash flood is measured via area in square miles over which a four-inch or more rainfall occurs. The rationale for using these criteria is that a rainfall of six inches in a 24-hour period will produce a river flow in equivalent to that of a 100-year return period in Minnesota and that four-inch and greater rainfall generally leads to reports of increased erosion or other economic damages. Ice jam floods usually occur in the spring and are most likely to occur where the channel slope naturally decreases, when culverts freeze solid, in reservoir headwaters, near natural channel constructions (e.g., bends and bridges), and along shallows.

4.4.1 Flood Risk for Marshall County:

The overall probability that flooding will occur each year in Marshall County is Highly Likely and its relative impact is High, and thus the overall risk for Marshall County is High. The risk for flooding for each of the cities is different and was determined based upon the specific data collected and outlined in the history section of this hazard profile. In assessing flood data for the 2015 update, data from 2009 to 2014 was used to determine the risk for each of the cities and the county as a whole. Most notable are the cities of Alvarado, Argyle, Grygla, Middle River, Stephen and the unincorporated areas of Marshall County, because they are at a high risk of flooding due to an extensive history of problematic flooding. The table provided below provides the name of each of the cities in the County, the probability that flooding will have an impact on that jurisdiction, the impact potential, as well as the overall risk calculated by the determine probability and impact ratings.

Table 42: Flood Hazard Risk Assessment

Flood			
City	Probability	Impact	Risk
Alvarado	Highly Likely	Moderate	Moderate
Argyle	Highly Likely	Moderate	Moderate
Grygla	Highly Likely	Moderate	Moderate
Holt	Possible	Low	Little to No
Middle River	Highly Likely	Moderate	Moderate
Newfolden	Possible	Low	Little to No
Oslo	Possible	Low	Little to No
Stephen	Highly Likely	Moderate	Moderate
Strandquist	Possible	Low	Little to No
Viking	Possible	Low	Little to No
Warren	Possible	Low	Little to No
Marshall County	Highly Likely	Moderate	Moderate
Total	Highly Likely	High	High

*The probability is based upon data available from 2006-2014

The 2015 update utilized the frequency X consequence ($R = FC$) formula and each jurisdiction has its own unique risk score based on the 28 points of data analyzed. The risk determined for the 2015 update represents little change from the previous plan, as the overall risk was High for the 2015 update. Similarly, the last plan update was done in January 2008 and indicated that flood had the potential to have a substantial impact on Marshall County and a significant threat is posed. This meant that the hazard was found to occur once every 5 years and could have a substantial impact on large areas of Marshall County.

4.4.2 Flood History in Marshall County:

The following information was provided by the September 2011 Flood Insurance Study for Marshall County, MN from the FEMA website. The Flood Insurance Study for Marshall County outlined the principal flood problems within the county. Principal Flood Problems Flooding in Marshall County occurs primarily along the Red River of the North, the Middle River, the Snake River, the Snake River Diversion Channel, the Tamarac River, and the Mud River. The principal flood season in Marshall County is in the spring as a result of rapid snowmelt accompanied by spring rains. The region is also susceptible to flooding as a result of intense regional storms. The Red River of the North flows north, which compounds the flooding problem; the downstream reaches of the river are still frozen while the upstream reaches are beginning to flow from spring snowmelt. Runoff from tributary streams is generally synchronized with mainstream flows, increasing the resulting flood peak. A major flood event occurred on the Red River of the North in 2009. Major flooding on the Red River of the North occurred in May 1950, April of 1966, 1969, 1978, 1979, 1996, 1997, 2006 and 2009.

City of Alvarado:

Low-lying areas of the City of Alvarado as well as the City of Warren are subject to periodic overflow from the Snake River. The most severe flooding occurs in early spring because of heavy rain and snowmelt. Major flooding events on the Snake River have occurred in 1950, 1965, 1966, 1969, 1975 and 1979.

City of Argyle:

The most severe flooding in the City of Argyle occurs due to flooding on the Middle River with the most recent flooding on the Middle River in April 2006.

City of Grygla:

The most severe flooding in the City of Grygla occurs due to flooding on the Mud River. Past flooding problems have occurred due to water backing up to the east of the State Highway 89 Bridge. A major flood occurred in July 1919 following 19 inches of rain. The most recent flooding of the Mud River was in April 2006.

City of Stephen:

The most severe flooding in the City of Stephen occurs due to flooding on the Tamarac River. The flood of record occurred on April 18, 1979, following heavy snows and a late spring thaw. No record of discharges exists for this or subsequent floods.

The unincorporated areas of Marshall County were included as part of this Flood Insurance Study, however there were no details regarding the flood history in the unincorporated areas. The Flood Insurance Study did indicate land use in the unincorporated areas of Marshall County is primarily agricultural in nature. Industry in the county is generally agricultural in nature. Floodplain development consists mainly of farmsteads and farm outbuildings.

Information from the 2014 Minnesota All Hazard Mitigation Plan provided information regarding repetitive loss properties in Marshall County. Acquisition of Repetitive Loss Properties Federal, state, and local funding has resulted in the acquisition of a significant number of repetitive loss structures. The NFIP Repetitive Loss Mitigated indicates 224 properties have been acquired. The total for these properties for building payments was over \$7.2 million, contents payments were over \$1.2 million for a total of \$8.7 million in losses.

Marshall is one of the top five counties in the number of Repetitive Loss Properties acquired in the state of Minnesota. The definition of a repetitive loss property for Flood Mitigation Assistance (FMA) structures covered by a contract for flood insurance made available under the NFIP that: (a) Has incurred flood-related damage on 2 occasions, in which the cost of the repair, on the average, equaled or exceeded 25 percent of the market value of the structure at the time of each such flood event; and (b) At the time of the second incidence of flood-related damage, the contract for flood insurance contains increased cost of compliance coverage.

Previous Problems

Heavy Rainstorms

It was stated in the January 2008 mitigation plan that intense rainstorms are a problem for Marshall County. It is hard to mitigate the effects of a large rain (six inches or higher) when it comes all at once. Storm sewers often cannot handle the immense flow of water and flooding occurs for both rural and urban residents. Overland flooding might also occur, this has threatened the entire county.

- The main road going into Grygla floods during an extreme precipitation event. This is a hazard to traffic entering/leaving the city. Other structures in the area like the school are also in danger of flooding.

- Heavy rains in Stephen can overwhelm storm sewers. This leaves areas to be in danger of flooding.
- Two parks in Argyle get partially flooded.
- Portions of Strandquist flood after large precipitation events.
- Some land currently in CRP near the river in Moose Township gets flooded when the lake is high.
- Fork Township gets totally flooded during a bad year (high precipitation, fast melt, ground saturation, ice/log jams, etc...). A normal year sees only partial flooding.
- Overland flooding is a problem for the Thief River Subwatershed of the Red Lake Watershed. A noted high-level severity is seen downstream of impoundments. There are concerns about impoundment operations including the drainage levels.
- Flooding adjacent to Agassiz, as the floodplain is altered by berms.
- Some of the county has inadequate outlets.

Flooding Isolation

The January 2008 mitigation plan for Marshall County indicated that during a flood, certain areas of Marshall County get completely isolated and roadways see massive amounts of damage. Some roadways in Marshall County need to be reconstructed so that the damages faced during the next flooding episode diminish. Roads are very costly to fix and residents need the roads to be able to travel freely within the county. All incoming and outgoing roads in Big Woods Township are completely submerged during serious floods. Great damage could be done to the area, since the main means of transportation for emergency vehicles are cut. Area flooding can be up to twenty-three miles wide because of a major water intersection (the Snake River meets the Red River). Township residents need to travel ten miles by boat to reach land. Additionally, Fork Township stated that some roads in Marshall County are currently in poor condition and need maintenance. The township has also noticed an increased amount of neglect in passing years to some roadways. Road flooding is also a problem listed in the Thief River Subwatershed in the Red Lake Watershed. Additionally, the City of Oslo gets isolated when highway 1 is submerged.

Cropland Flooding

Cropland flooding was included as a problem from the January 2008 mitigation plan. Depreciated land affects the tax base of the county, and fewer farmers results in less income for the region. If land cannot be farmed, it cannot be lived upon and each flood that has occurred means that tax dollars have been lost. Flooding has made agriculture very hard for all farmers in Marshall County. Cropland flooding is especially a problem for the Thief River Subwatershed in the Red Lake Watershed District. The district views it as a high ranking problem that is quite extensive. There is also a high severity problem when a three inch plus rain occurs adjacent to Agassiz, sections 7, 8 and 9 in Whiteford Township. CRP downstream of Elm Lake floods frequently and the whole length of Ditch 200 flood as well.

4.4.3 Major Declared Disasters for Flood in Marshall County:

Of the aforementioned floods, there have been 22 flood events in the last 50 years in Marshall County which have been declared a disaster by FEMA. All but one of these disasters were major declared disasters, which is when the President believes an event has caused damage of such severity that it is beyond the combined capabilities of state and local governments to respond. 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. The beginning and ending date of the incident are included for these declared disasters, as well as information on the type of assistance program that was provided.

Table 43: Declared Disasters for Flood in Marshall County

IH Program Declared	IA Program Declared	PA Program Declared	HM Program Declared	Declaration Date	Disaster Type	Incident Type	Title	Incident Begin Date	Incident End Date	Disaster Close Out Date
No	No	Yes	Yes	7/21/2014	DR	Flood	SEVERE STORMS, STRAIGHT-LINE WINDS, FLOODING, LANDSLIDES, AND MUDSLIDES	6/11/2014	7/11/2014	
No	No	Yes	Yes	5/10/2011	DR	Flood	SEVERE STORMS AND FLOODING	3/16/2011	5/25/2011	
No	No	Yes	Yes	4/19/2010	DR	Flood	FLOODING	3/1/2010	4/26/2010	
No	No	Yes	No	3/19/2010	EM	Flood	FLOODING	3/1/2010	4/26/2010	3/22/2012
Yes	No	Yes	Yes	4/9/2009	DR	Severe Storm(s)	SEVERE STORMS AND FLOODING	3/16/2009	5/22/2009	
No	No	Yes	No	3/26/2009	EM	Severe Storm(s)	SEVERE STORMS AND FLOODING	3/16/2009	5/22/2009	3/6/2012
No	No	Yes	Yes	6/5/2006	DR	Flood	FLOODING	3/30/2006	5/3/2006	3/6/2014
No	Yes	Yes	Yes	6/14/2002	DR	Severe Storm(s)	SEVERE STORMS, FLOODING AND TORNADOES	6/9/2002	6/28/2002	4/25/2012
No	Yes	Yes	Yes	5/16/2001	DR	Flood	SEVERE WINTER STORMS, FLOODING, AND TORNADOES	3/23/2001	7/3/2001	11/6/2013
No	No	Yes	Yes	8/26/1999	DR	Severe Ice Storm	SEVERE ICE STORM AND FLOODING	3/1/1999	5/30/1999	4/29/2014
No	Yes	Yes	Yes	4/8/1997	DR	Flood	SEVERE FLOODING, HIGH WINDS, SEVERE STORMS	3/21/1997	5/24/1997	6/7/2010
No	No	Yes	Yes	6/1/1996	DR	Flood	FLOODING AND SEVERE STORMS	3/14/1996	6/17/1996	3/9/2005
No	Yes	Yes	Yes	6/11/1993	DR	Severe Storm(s)	SEVERE STORMS, TORNADOES & FLOODING	5/6/1993	8/25/1993	3/11/2009
No	Yes	Yes	Yes	5/8/1989	DR	Flood	FLOODING	3/29/1989	5/8/1989	3/1/1999
No	Yes	Yes	Yes	4/30/1979	DR	Flood	SEVERE STORMS & FLOODING	4/30/1979	4/30/1979	7/6/1984
No	Yes	Yes	Yes	4/22/1978	DR	Flood	STORMS, ICE JAMS, SNOWMELT & FLOODING	4/22/1978	4/22/1978	7/6/1984
No	Yes	Yes	Yes	7/17/1975	DR	Severe Storm(s)	SEVERE STORMS, TORNADOES & FLOODING	7/17/1975	7/17/1975	11/6/1981
No	Yes	Yes	Yes	6/10/1974	DR	Flood	HEAVY RAINS & FLOODING	6/10/1974	6/10/1974	4/18/1977
No	Yes	Yes	Yes	7/22/1970	DR	Flood	HEAVY RAINS & FLOODING	7/22/1970	7/22/1970	5/15/1973
No	Yes	Yes	Yes	4/18/1969	DR	Flood	FLOODING	4/18/1969	4/18/1969	4/15/1974
No	Yes	Yes	Yes	3/22/1966	DR	Flood	FLOODING	3/22/1966	3/22/1966	6/5/1969
No	Yes	Yes	Yes	4/11/1965	DR	Flood	FLOODING	4/11/1965	4/11/1965	1/29/1970

4.4.4 Mitigation (Past 5 Years):

Mitigation actions for flooding from Marshall County's January 2008 All Hazard Mitigation Plan stated the mitigation actions for flooding were to reduce repetitive damage to roads by protecting roads from flooding and heavy rain and eliminating isolation due to flooding. Additional actions were to prevent agricultural flooding damage by diminishing crop damage from standing water. The county also indicated they would address flooding damage by identifying at-risk structures, investigating local sewer systems and decreasing flooding in the 100-year floodplain.

Current flooding mitigation strategies that were also listed in the January 2008 plan are detailed below:

Current strategies for heavy rainfall were listed as:

- Grygla currently pumps water from a certain manhole to fix this problem, however monitoring is necessary to know when to start. A lift station at this location would cure this problem.
 - -Grygla's city council has discussed the problem and placed importance upon seeing it completed.
- Stephen requires additional portable pumps for the town. They are gas operated and would pump excess water back into the river.
 - -Stephen has also placed a high priority on acquiring a couple pumps. The location of additional funding would aid the speed of the solution.
- Argyle makes use of ring dikes to protect the areas.
- Strandquist cleaned out ditches and installed bigger culverts, which has helped the problem.
- Warren and the Middle/Snake/Tamarac Watershed are currently constructing a diversion to help rid the city of flooding problems from the Snake River, although those nearby worry about a possible increase of overland flooding from the structure. The project includes a flood water storage site that stores excess water and later releases it to a floodway around Warren. Warren as well as downstream townships should see a reduction in river overflowing due to the project. The Emergency Manager indicated that this project has been completed.
- The Thief River Subwatershed has the most control structures (impoundments) than any other in the Red Lake Watershed District.

Agriculture is important to Marshall County. Many flood projects that were current as of the January 2008 mitigation plan included the following methods that had been utilized to reduce flooding to farmland.

- Drainage problems need to be corrected. The initial melt needs to be drained quickly. Water coming a short time later can be held until the rivers are able to handle the oncoming water load.
- There are programs for affected farmers to deal with agricultural flooding damage.
- Tiling the land is also a flood control practice used mostly on flat cropland or any area with no slope that is threatened by flooding. A porous pipe is placed underneath the ground. The pores in the pipe may vary from wide to narrow depending on factors such as soil structure and clay content. Water percolates through the ground and into the tube. The water can then be moved to a ditch or river. Once water logged cropland can now become tillable. Land with low permeability may not benefit from tiling, as this factor is one of the main components.
- Landowners have improved private drainage systems and participated in efforts to implement larger scale flood protection systems.
- Townships have used roadway ditches and other means to increase the effectiveness of drainage systems.
- The county manages road and drainage systems to lessen the impacts of flood events.

Warren was also working on a flood control project. Warren was using a combination of a five-mile diversion to speed the Snake River around the south edge of the city and off-stream storage to protect against a hundred-year flood. Low flows would be allowed to continue through Warren, but high flows would be diverted into the floodway. The impoundment is located eleven miles northeast of Warren. The diked area of 540 acres can handle up to 6,800 acre/feet and partially controls the flow of fifty-seven square miles of the 175 square mile area that drains toward Warren. It could hold water for up to twenty-six days, but it is estimated that ninety percent would be released in ten days or less.

- Phase I - Lower mile of the floodway and outlet chute. Completed in August, 2002.
- Phase II - Off Channel Floodwater Storage Reservoir.
- Phase III - Snake River Diversion Structure and upper three miles of the floodway. Also included are three highway and two railroad crossings.
- Phase IV - Construction of wetlands and tree planting.

Ninety percent of the city was in the floodplain before the project. Instead of flood insurance that may extend into the thousands, an annual assessment fee of \$35 will be charged in order to pay for Warren's share of the project.

- One NRCS official said that this was the fastest project ever built in the United States.
- The diversion contains over 400,000 pounds of steel and 1,237 yards of concrete.

Flood Insurance Study:

The following information was provided by the Flood Insurance Study for Marshall County, MN from September 2011 from the FEMA website. The Flood Insurance Study for Marshall County outlined the Flood Protection Measures within Marshall County. Levees that provide some degree of protection against flooding exist in the study area. However, it has been ascertained that some of these levees may not protect the community from rare events such as the 1-percent-annual-chance flood. The criteria used to evaluate protection against the 1-percent-annual-chance flood are 1) adequate design, including freeboard, 2) structural stability, and 3) proper operation and maintenance. Levees that do not protect against the 1-percent-annual-chance flood are not considered in the hydraulic analysis of the 1-percent-annual-chance floodplain.

The City of Argyle is serviced by the Middle River Flood Control Project. Built by the USACE, St. Paul District, and completed in March 1993, the project consists of intermittent sections of levees, road raises, and drainage facilities consisting of interceptor ditches, pipes, and ponding areas with gated outlet structures.

In the late 1960s, approximately 7,700 feet of an emergency levee was constructed by the City of Alvarado, with technical assistance from the USACE. The levee was built to withstand an event similar to the 1969 flood. Much of the work on the levee was undertaken without foundation investigation, and no design control was maintained over the selection of foundation materials or placement; therefore, the existing levee could not be regarded as reliable against a one-percent-annual chance flood. However, the USACE has constructed the Alvarado Snake River Flood Control Project to replace this levee. The flood control project consists of an earthen levee, two reaches of pre-cast concrete floodwall, closure areas, and interior drainage facilities. The two separate reaches of pre-cast concrete floodwall, located near the city's western corporate limits, are approximately 600 feet long. State Highway one, located near the city's northern corporate limits, serves as the northern flood barrier. A sandbag or earthen fill closure ranging from 0.0 to 1.5 feet is required along State Highway 1 to ensure standard project flood protection to the top of the

barrier. Sandbag closures are also required where the railroad crosses the levee on the east and west of the city, and at State Highway 220 near the southern portion of the city. Interior drainage facilities for the project consist of six gravity outlets, four ponding areas, an interceptor, and a pump station.

A Federal flood control project exists in the City of Oslo and the surrounding unincorporated areas of Marshall County. This flood control project consists of a ring levee around the City of Oslo.

The City of Warren is serviced by the Soil Conservation Service (SCS), now the Natural Resources Conservation Service, and Snake River Watershed Project. The project consists of a flood storage reservoir located upstream of the city, and a diversion structure, which, during a significant flood event, will divert high flows around the city and into the SCS Snake River Diversion Channel (SCS, 2010).

Many temporary dikes and levees were constructed in Marshall County in advance of the 1978 and 1979 floods. Many of them are still in place and offer some protection against flooding. They are, however, temporary in nature and have not been considered effective for this FIS.

National Flood Insurance Program (NFIP):

While several of the mitigation strategies include elements of the NFIP, the county and participating jurisdictions' participation in the program is considered an action in and of itself. Thus, the following narrative describes the county's participating jurisdictions' involvement and future commitment to the program.

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. 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.

In 1968, Congress created the National Flood Insurance Program (NFIP) in response to the rising cost of taxpayer funded disaster relief for flood victims and the increasing amount of damage caused by floods. The Federal Emergency Management Agency (FEMA) manages the NFIP, and oversees the floodplain management and mapping components of the Program. Nearly 20,000 communities across the United States and its territories participate in the NFIP by adopting and enforcing floodplain management ordinances to reduce future flood damage. In exchange, the NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in these communities.

The communities in Marshall County which participate in the National Flood Insurance Program (NFIP) are the cities of Alvarado, Argyle, Grygla, Middle River, Newfolden, Oslo, Stephen and Warren. Marshall County as a whole is also listed as a participant in the NFIP. This information was provided by the FEMA Minnesota Community Status Book Report. Additionally, the 2014 Minnesota All Hazard Mitigation Plan included information on the top ten total payments of repetitive loss properties of non-mitigated repetitive

losses. Marshall County was included in the top ten for the state due to repetitive loss and flooding in the city of Warren. There have been a total of \$1,104,079.35 with 196 losses for 74 properties.

Table 43.5 NFIP Mitigated and Non Mitigated Repetitive Loss

Marshall County: Non Mitigated						
Community Name	Occupancy	Total Building Payment	Total Contents Payment	Losses	Total Paid	Average Pay
MARSHALL COUNTY*	SINGLE FMLY	17,708.91	0.00	3	17,708.91	5,902.97
MARSHALL COUNTY*	NON RESIDENT	1,750.00	3,777.08	2	5,527.08	2,763.54
MARSHALL COUNTY*	SINGLE FMLY	24,152.90	1,567.50	2	25,720.40	12,860.20
MARSHALL COUNTY*	ASSMD CONDO	49,936.82	140.00	2	50,076.82	25,038.41
MARSHALL COUNTY*	SINGLE FMLY	69,158.52	7,169.80	2	76,328.32	38,164.16
MARSHALL COUNTY*	SINGLE FMLY	20,172.39	0.00	2	20,172.39	10,086.20
MARSHALL COUNTY*	SINGLE FMLY	7,005.18	0.00	2	7,005.18	3,502.59
MARSHALL COUNTY*	SINGLE FMLY	44,716.51	2,122.00	2	46,838.51	23,419.26
MARSHALL COUNTY*	SINGLE FMLY	51,453.04	3,470.97	4	54,924.01	13,731.00
MARSHALL COUNTY*	SINGLE FMLY	47,414.94	1,598.90	2	49,013.84	24,506.92
MARSHALL COUNTY*	SINGLE FMLY	6,900.00	0.00	2	6,900.00	3,450.00
MARSHALL COUNTY*	ASSMD CONDO	74,788.78	114,768.06	4	189,556.84	47,389.21
MARSHALL COUNTY*	SINGLE FMLY	2,782.64	0.00	2	2,782.64	1,391.32
MARSHALL COUNTY*	SINGLE FMLY	8,981.07	0.00	3	8,981.07	2,993.69
OSLO, CITY OF	SINGLE FMLY	12,305.38	0.00	2	12,305.38	6,152.69
OSLO, CITY OF	ASSMD CONDO	106,063.06	75,709.46	2	181,772.52	90,886.26
WARREN, CITY OF	SINGLE FMLY	17,842.93	0.00	3	17,842.93	5,947.64
WARREN, CITY OF	SINGLE FMLY	41,482.10	0.00	2	41,482.10	20,741.05
WARREN, CITY OF	SINGLE FMLY	11,681.53	0.00	2	11,681.53	5,840.77
WARREN, CITY OF	SINGLE FMLY	10,683.81	0.00	3	10,683.81	3,561.27
WARREN, CITY OF	SINGLE FMLY	9,509.27	0.00	3	9,509.27	3,169.76
WARREN, CITY OF	SINGLE FMLY	24,840.69	0.00	3	24,840.69	8,280.23
WARREN, CITY OF	SINGLE FMLY	8,311.14	0.00	2	8,311.14	4,155.57
WARREN, CITY OF	SINGLE FMLY	17,459.74	0.00	2	17,459.74	8,729.87
WARREN, CITY OF	NON RESIDENT	26,372.00	0.00	2	26,372.00	13,186.00
WARREN, CITY OF	2-4 FAMILY	19,981.38	0.00	4	19,981.38	4,995.35
WARREN, CITY OF	SINGLE FMLY	2,575.77	0.00	2	2,575.77	1,287.89
WARREN, CITY OF	SINGLE FMLY	8,130.28	0.00	3	8,130.28	2,710.09
WARREN, CITY OF	SINGLE FMLY	10,893.36	0.00	3	10,893.36	3,631.12
WARREN, CITY OF	2-4 FAMILY	20,289.35	0.00	3	20,289.35	6,763.12
WARREN, CITY OF	SINGLE FMLY	22,222.68	2,400.00	4	24,622.68	6,155.67
WARREN, CITY OF	SINGLE FMLY	6,049.74	0.00	3	6,049.74	2,016.58
WARREN, CITY OF	SINGLE FMLY	6,229.40	0.00	2	6,229.40	3,114.70
WARREN, CITY OF	SINGLE FMLY	23,053.27	0.00	4	23,053.27	5,763.32
WARREN, CITY OF	SINGLE FMLY	22,099.87	0.00	2	22,099.87	11,049.94
WARREN, CITY OF	SINGLE FMLY	14,243.35	0.00	3	14,243.35	4,747.78

Marshall County: Non Mitigated						
Community Name	Occupancy	Total Building Payment	Total Contents Payment	Losses	Total Paid	Average Pay
WARREN, CITY OF	SINGLE FMLY	23,153.46	0.00	2	23,153.46	11,576.73
WARREN, CITY OF	SINGLE FMLY	12,731.69	159.99	3	12,891.68	4,297.23
WARREN, CITY OF	NON RESIDENT	0.00	5,970.99	2	5,970.99	2,985.50
WARREN, CITY OF	NON RESIDENT	27,672.88	0.00	3	27,672.88	9,224.29
WARREN, CITY OF	SINGLE FMLY	4,166.81	0.00	3	4,166.81	1,388.94
WARREN, CITY OF	2-4 FAMILY	16,128.29	0.00	2	16,128.29	8,064.15
WARREN, CITY OF	SINGLE FMLY	9,752.15	0.00	2	9,752.15	4,876.08
WARREN, CITY OF	SINGLE FMLY	9,674.87	0.00	2	9,674.87	4,837.44
WARREN, CITY OF	SINGLE FMLY	12,427.30	0.00	5	12,427.30	2,485.46
WARREN, CITY OF	SINGLE FMLY	12,425.07	0.00	2	12,425.07	6,212.54
WARREN, CITY OF	NON RESIDENT	13,918.68	4,651.49	2	18,570.17	9,285.09
WARREN, CITY OF	SINGLE FMLY	7,598.45	0.00	2	7,598.45	3,799.23
WARREN, CITY OF	SINGLE FMLY	45,133.76	1,036.68	4	46,170.44	11,542.61
WARREN, CITY OF	SINGLE FMLY	16,213.07	0.00	3	16,213.07	5,404.36
WARREN, CITY OF	SINGLE FMLY	11,872.91	0.00	2	11,872.91	5,936.46
WARREN, CITY OF	SINGLE FMLY	9,266.54	815.70	3	10,082.24	3,360.75
WARREN, CITY OF	SINGLE FMLY	18,114.17	0.00	3	18,114.17	6,038.06
WARREN, CITY OF	SINGLE FMLY	31,832.48	4,559.21	3	36,391.69	12,130.56
WARREN, CITY OF	SINGLE FMLY	8,925.37	0.00	2	8,925.37	4,462.69
WARREN, CITY OF	SINGLE FMLY	21,278.75	1,247.94	2	22,526.69	11,263.35
WARREN, CITY OF	SINGLE FMLY	10,494.04	0.00	3	10,494.04	3,498.01
WARREN, CITY OF	SINGLE FMLY	12,995.61	2,650.00	3	15,645.61	5,215.20
WARREN, CITY OF	SINGLE FMLY	3,009.16	0.00	2	3,009.16	1,504.58
WARREN, CITY OF	SINGLE FMLY	13,047.92	0.00	2	13,047.92	6,523.96
WARREN, CITY OF	SINGLE FMLY	6,183.16	0.00	2	6,183.16	3,091.58
WARREN, CITY OF	SINGLE FMLY	7,897.10	0.00	2	7,897.10	3,948.55
WARREN, CITY OF	SINGLE FMLY	7,636.46	0.00	3	7,636.46	2,545.49
WARREN, CITY OF	SINGLE FMLY	15,843.10	0.00	3	15,843.10	5,281.03
WARREN, CITY OF	SINGLE FMLY	17,420.52	0.00	3	17,420.52	5,806.84
WARREN, CITY OF	SINGLE FMLY	2,239.00	0.00	2	2,239.00	1,119.50
WARREN, CITY OF	SINGLE FMLY	17,293.83	0.00	2	17,293.83	8,646.92
WARREN, CITY OF	NON RESIDENT	38,708.21	0.00	2	38,708.21	19,354.11
WARREN, CITY OF	SINGLE FMLY	13,403.62	0.00	3	13,403.62	4,467.87
WARREN, CITY OF	SINGLE FMLY	16,811.61	1,165.58	3	17,977.19	5,992.40
WARREN, CITY OF	SINGLE FMLY	5,908.17	0.00	2	5,908.17	2,954.09
WARREN, CITY OF	SINGLE FMLY	34,684.83	0.00	3	34,684.83	11,561.61
WARREN, CITY OF	SINGLE FMLY	9,655.47	0.00	3	9,655.47	3,218.49
WARREN, CITY OF	SINGLE FMLY	8,205.01	0.00	2	8,205.01	4,102.51
WARREN, CITY OF	SINGLE FMLY	11,437.76	0.00	3	11,437.76	3,812.59

Marshall County: Non Mitigated						
Community Name	Occupancy	Total Building Payment	Total Contents Payment	Losses	Total Paid	Average Pay
WARREN, CITY OF	SINGLE FMLY	20,400.54	2,000.00	3	22,400.54	7,466.85
WARREN, CITY OF	SINGLE FMLY	16,322.39	0.00	3	16,322.39	5,440.80
WARREN, CITY OF	SINGLE FMLY	5,261.79	0.00	3	5,261.79	1,753.93
WARREN, CITY OF	SINGLE FMLY	16,979.01	0.00	2	16,979.01	8,489.51
WARREN, CITY OF	SINGLE FMLY	8,535.22	0.00	3	8,535.22	2,845.07
WARREN, CITY OF	SINGLE FMLY	7,038.31	0.00	2	7,038.31	3,519.16
WARREN, CITY OF	SINGLE FMLY	10,130.67	0.00	3	10,130.67	3,376.89
WARREN, CITY OF	SINGLE FMLY	12,572.54	0.00	3	12,572.54	4,190.85
WARREN, CITY OF	SINGLE FMLY	9,853.64	0.00	2	9,853.64	4,926.82
WARREN, CITY OF	SINGLE FMLY	5,940.00	0.00	3	5,940.00	1,980.00
WARREN, CITY OF	SINGLE FMLY	6,370.40	0.00	2	6,370.40	3,185.20
WARREN, CITY OF	SINGLE FMLY	15,500.00	3,020.67	3	18,520.67	6,173.56
WARREN, CITY OF	SINGLE FMLY	7,652.86	0.00	3	7,652.86	2,550.95
WARREN, CITY OF	SINGLE FMLY	28,817.79	0.00	3	28,817.79	9,605.93
WARREN, CITY OF	SINGLE FMLY	12,931.95	981.05	3	13,913.00	4,637.67
MARSHALL COUNTY*	SINGLE FMLY	18,893.48	1,653.00	3	20,546.48	6,848.83
Marshall County Mitigated						
Community Name	Occupancy	Total Building Payment	Total Contents Payment	Losses	Total Paid	Average Pay
MARSHALL COUNTY*	SINGLE FMLY	11,630.12	665.00	2	12,295.12	6,147.56
MARSHALL COUNTY*	SINGLE FMLY	9,211.00	100.00	2	9,311.00	4,655.50
MARSHALL COUNTY*	ASSMD CONDO	45,119.21	9,598.50	2	54,717.71	27,358.86
MARSHALL COUNTY*	SINGLE FMLY	59,369.55	15,767.84	2	75,137.39	37,568.70
MARSHALL COUNTY*	SINGLE FMLY	118,193.77	10,762.50	2	128,956.27	64,478.14
MARSHALL COUNTY*	ASSMD CONDO	74,277.25	906.49	2	75,183.74	37,591.87
MARSHALL COUNTY*	ASSMD CONDO	48,363.12	5,212.82	2	53,575.94	26,787.97
MARSHALL COUNTY*	SINGLE FMLY	7,988.51	0.00	3	7,988.51	2,662.84
MARSHALL COUNTY*	NON RESIDNT	11,365.62	3,345.40	4	14,711.02	3,677.76
STEPHEN, CITY OF	SINGLE FMLY	87,416.19	74,992.25	2	162,408.44	81,204.22
WARREN, CITY OF	SINGLE FMLY	10,000.00	0.00	2	10,000.00	5,000.00
WARREN, CITY OF	SINGLE FMLY	11,978.59	0.00	2	11,978.59	5,989.30
WARREN, CITY OF	SINGLE FMLY	23,027.63	0.00	3	23,027.63	7,675.88
WARREN, CITY OF	SINGLE FMLY	32,969.31	9,917.54	3	42,886.85	14,295.62
WARREN, CITY OF	SINGLE FMLY	12,931.30	379.32	4	13,310.62	3,327.66
WARREN, CITY OF	SINGLE FMLY	13,351.79	0.00	3	13,351.79	4,450.60
WARREN, CITY OF	SINGLE FMLY	13,243.58	0.00	2	13,243.58	6,621.79
WARREN, CITY OF	SINGLE FMLY	4,497.15	0.00	2	4,497.15	2,248.58

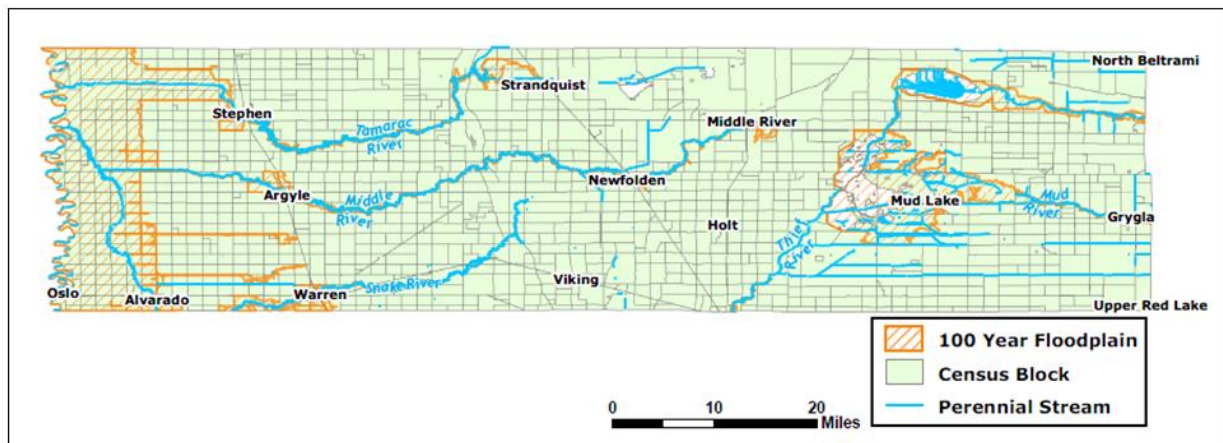
4.4.5 Vulnerability:

Concerning flood hazards, there is much vulnerability that exists in Marshall County. A large portion of Marshall County lies within the floodplain, which creates an increased risk of damage or property loss to the structures and populations that inhabit those areas. Anyone living near a waterway, such as the Snake River and Red River, is also at an increased risk especially in the springtime when there is the potential for heavy rain, ice jams and sudden snowmelt. Any properties with improperly maintained flood control structures or property located in low elevations are also at an increased risk.

HAZUS-MH was used to estimate the damages incurred for a hypothetical 100-year flood event in Marshall County. Based on this model, not an actual event, an estimated 34 buildings will be damaged totaling \$11.8 million in building losses and \$38.3 million in total economic losses.

The following map is the Marshall County HAZUS-MH Analysis 100-year Flood Boundary Map based upon the model. This map was created by the Polis Center as part of the Flood Analysis for Marshall County as part of the Minnesota Pre-Disaster Mitigation Plan. The flood analysis for Marshall County was released in 2009 and HAZUS-MH was used to generate the flood depth grid for a 100-year return period.

Figure 11: Marshall County HAZUS-MH Analysis (100-Year Flood) Map



The following information is provided from the Minnesota All Hazard Mitigation Plan from 2014 and outlines the vulnerabilities to Marshall County from flooding.

The Minnesota All Hazard Mitigation Plan from 2014 identified the flood vulnerability of schools, hospitals, fire stations and police stations. The updated state data was used in the 2013 100-yr HAZUS flood analysis. A total of 6,089 structures were in the database with 180 of these structures to be found in the in the 100-year floodplain. Approximately three percent of the profiled structures were found to be in the floodplain. This may or may not be an overestimation since the analysis did not take into account elevation and data errors. Marshall County data was included and is provided below. The total facilities in Marshall County for schools, hospitals, fire stations and police stations were 31.

Table 44: Flood Vulnerability for Government Facilities in Marshall County (2009 Est.)

County	Total Facilities	Facilities in 100-year Floodplain	Total Exposure of Facilities
Marshall	31	3	\$58,272,000

Source: FEMA HAZUS-MH 2009

The Minnesota All Hazard Mitigation Plan from 2014 also outlined the county flood vulnerability of structures by building class. The estimated building loss for all counties is aggregated by occupancy class. These losses are calculated from the General Building Stock inventory. The General Building Stock inventory provided with the HAZUS-MH tool did not change from 2010 to 2013 when the analysis was run. In summary, 10,678 structures or 0.5 of the total building stock in the state were found to be a potentially damaged because of the new analysis. The estimated total building loss is estimated to be \$3,360,275,000 or 0.8% of the total building value in the state. The following outlines the estimated total damaged buildings, exposure, economic and building loss for Marshall County. The Minnesota All Hazard Mitigation Plan analyzed the data and ranked the highest counties vulnerable to floods based on building loss.

Table 45: Building Loss and Exposure in Marshall County

County	Estimated Total Buildings	Total Damaged Buildings	Total Building Exposure X \$1000	Total Economic Loss X \$1000	Building Loss X\$1000
Marshall	7976	34	\$583,449	\$22,059	\$7,501

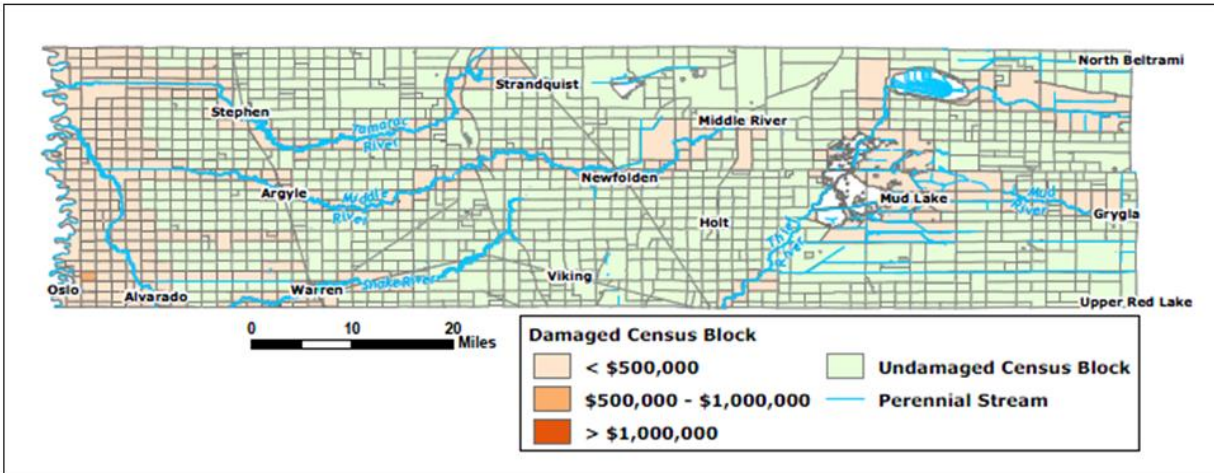
Source: FEMA HAZUS-MH 2009

Crop flood indemnity claims from 2000-2013 was also reported in the Minnesota All Hazard Mitigation Plan from 2014. According to this, Marshall County had a total of \$1,964,648 in claims for crop flooding.

Flood Analysis for Marshall County:

Included from the report by the Polis Center as part of the Flood Analysis for Marshall County from the Minnesota Pre-Disaster Mitigation Plan was a 100-year flood map including the Marshall County Total Economic Loss. This map shows the census blocks and the total economic loss. HAZUS-MH estimates eight census blocks with losses exceeding one million dollars.

Figure 12: Marshall County HAZUS-MH Total Economic Loss Map



A HAZUS-MH Shelter Requirement Analysis was part of the Flood Analysis for Marshall County from the Minnesota Pre-Disaster Mitigation Plan. This Shelter Requirement Analysis 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 model estimates 741 households may be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 1,229 people (out of a total population of 10,155) may seek temporary shelter in public shelters. There are eight facilities in Marshall County that have been determined to be at risk of flooding based upon the HAZUS-MH analysis and these facilities could potentially experience damages. The following buildings are at potential for damage from a flood event:

Table 46: Marshall County Essential Facilities at Risk of Flooding

Facility Name
North Valley Health Center
Warren Fire Department
Grygla Fire Department
Marshall County Sheriff's Department
WAO High School
WAO Elementary School

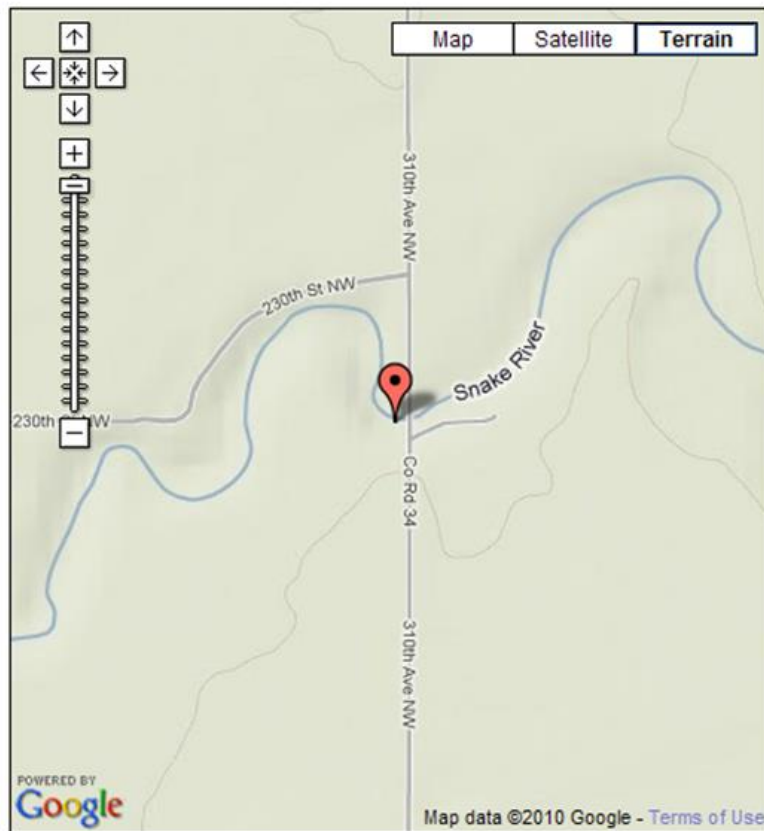
The National Oceanic and Atmospheric Administration (NOAA) Advanced Hydrologic Prediction Service provides information from gauge locations at points along various rivers across the United States. For Marshall County, data are provided for three points: Red River of the North at Oslo, Snake River at Alvarado, and Snake River above Warren Diversion.

Figure 13: Stream Gauge Location for Red River of the North at Oslo



Figure 14: Stream Gauge Location for Snake River at Alvarado



Figure 15: Stream Gauge Location for Snake River above Warren Diversion

4.4.6 Flood and Climate Change in Marshall County:

The Minnesota All Hazard Mitigation plan stated that as Minnesota's climate changes, the quantity and character of precipitation is changing. Average precipitation has increased in the Midwest since 1900, with more increases in recent years. According to the Draft National Climate Assessment (NCA), the Midwest has seen a 45% increase in very heavy precipitation (defined as the heaviest 1% of all daily events) from 1958 to 2011. This precipitation change has led to increased magnitude of flooding.

4.4.7 Relationship to other Hazards in Marshall County:

Flooding is related to various other hazards such as severe storms, because severe and/or slow moving thunderstorms and spring snow melt can contribute to flooding and under the right conditions can cause flash flooding. Flooding can also be related to dam failure because flood events have the potential to compromise the structural integrity of dams, which could lead to more severe flood events. As stated in section 3.5.10 Water Control Structures in the Community Profile section, there are 16 water control structures that have been classified as dams by the DNR, most of which have been assigned a hazard potential. None of the dams in Marshall County are listed as being High hazard.

Flooding can be related to infectious disease because wastewater spills are a possible consequence of flooding. Public health can be affected because the incidence of infectious diseases can increase with wastewater spills. The potential risk impact of all residents within the county is the same having a low risk overall, but a highly likely probability of occurring. Infectious diseases also have an increased impact on the

elderly, who make up 19.2 percent of the population in Marshall County and as stated in the Community Profile section, the elderly population is expected to experience steady growth over the next 20 years.

4.5 Winter Storms

Winter storms were identified in the prior hazard mitigation plan from January 2008 for Marshall County and was also identified as one of the hazards to be included in this 2015 plan update. Additionally, analyses are included in this 2015 plan update to include a more in-depth look at what winter storms are, the history of them within Marshall County and the potential they have to impact the county residents. A definition of winter storms from is provided prior to taking a closer look at the effect winter storms have on Marshall County in order to provide the reader with knowledge of the hazard.

Severe winter storms vary in size and strength and include heavy snowstorms, blizzards, freezing rain, sleet, ice storms, and blowing and drifting snow conditions. Extremely cold temperatures accompanied by strong winds can result in wind chills that cause bodily injuries such as frostbite and death. In the Midwest, Canadian and Arctic cold fronts that push snow and ice deep into the interior region of the United States cause severe winter storms. Severe winter storms can shut down highways, down power lines, take down trees and tree limbs, create hazardous driving conditions, hypothermia, fires from personal heating units such as heated blankets, flooding, and deaths to the young and elderly who can be exposed to the severe weather for prolonged periods of time. Blizzards are the most severe form of winter storms and are associated with large amounts of falling or blowing snow with wind gusts in excess of 35 mph. When these types of conditions exist the National Weather Service may issue a “Blizzard Warning”, or if such storm is expected, they may issue a “Winter Storm Watch”.

Severe winter storm occurrences tend to be very disruptive to transportation and commerce. Trees, cars, roads, and other surfaces develop a coating or glaze of ice, making even small accumulations of ice extremely hazardous to motorists, bicyclists, and pedestrians. The most prevalent impacts of heavy accumulations of ice are slippery roads and walkways that lead to vehicle and pedestrian accidents; collapsed roofs from fallen trees and limbs and heavy ice and snow loads; and felled trees, telephone poles and lines, electrical wires, and communication towers. Severe storms can cause the disruption of telecommunications and power for days. Heavy snow or accumulated ice can also isolate people from assistance or services. The National Weather Service issues a Wind Chill Advisory for Minnesota when widespread wind chills of -40°F or lower with winds of at least ten miles per hour (mph) expected. In some parts of southern Minnesota, the threshold may be -35°F. A Wind Chill Warning is issued when widespread wind chills of -40°F in northern Minnesota and -35°F in southern with winds greater than ten mph are expected.

The National Weather Service can be credited with providing at least 48 hours forewarning of a severe winter storm. This can give time for residents and governments to prepare for the storm such as stockpiling resources, prepping snow-moving equipment, and making plans. The NWS Warning Terminology Table breaks down the different types of advisories, watches, and warnings and when they are used.

Table 47: NWS Warning Terminology Table

National Weather Service Warning Terminology	
Winter Weather Advisory	Alert for ice, cold weather, or snow that can range from 2 - 6 inches.
Winter Storm Watch	Alert for severe winter weather with a high possibility in the next few days resulting in high accumulations of snow or ice.
Winter Storm Warning	Severe weather (ice, snow, cold) are about to begin or have already started.
Blizzard Warning	Snow condition resulting in high winds, snowdrifts, lack of visibility, and threatening conditions when traveling and to those exposed to the weather.
Ice Storm Warning	High accumulations of ice that will cause dangerous travel and problems to power infrastructure.
Heavy Storm Warning	Snow accumulation of 6 or more inches.

The wind chill temperature is how cold people and animals feel when outside. Wind chill is based on the rate of heat loss from exposed skin caused by wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature and eventually the internal body temperature. Therefore, the wind makes it feel much colder. If the temperature is 00 F and the wind is blowing at 15 mph, the wind chill is -19 F. At this wind chill temperature, exposed skin can freeze in 30 minutes. The National Weather Service issues a Wind Chill Advisory for Minnesota when widespread wind chills of -40 F or lower with winds at least 10 miles per hour (mph) are expected.

4.5.1 Winter Storms Risk in Marshall County:

The overall probability that severe winter storms will occur each year in Marshall County is Highly Likely and its relative impact is Moderate and thus the overall risk for Marshall County is Moderate. The risk for severe winter storms for each of the cities is the same because data was not available by individual city. In assessing severe winter storm data for the 2015 update, data from 2009 to 2014 was used to determine the risk for each of the cities and the county as a whole. The data provided for winter storms in Marshall County was divided into East Marshall County and West Marshall County. The incidences for both the East Marshall County and West Marshall County were similar with 50 plus incidences for West and 40 plus incidences for East in the past 5 years. Based upon this data, the overall county probability, impact and risk are the same because of the high number of incidences and the impact potential for Marshall County. The table provided below provides the name of each of the cities in the County, the probability that winter storms will have an impact on that jurisdiction, the impact potential, as well as the overall risk calculated by the determine probability and impact ratings

Table 48: Severe Winter Storms Risk by City in Marshall County

Severe Winter Storms			
City	Probability	Impact	Risk
Alvarado	Highly Likely	Moderate	Moderate
Argyle	Highly Likely	Moderate	Moderate
Grygla	Highly Likely	Moderate	Moderate
Holt	Highly Likely	Moderate	Moderate
Middle River	Highly Likely	Moderate	Moderate
Newfolden	Highly Likely	Moderate	Moderate
Oslo	Highly Likely	Moderate	Moderate
Stephen	Highly Likely	Moderate	Moderate
Strandquist	Highly Likely	Moderate	Moderate
Viking	Highly Likely	Moderate	Moderate
Warren	Highly Likely	Moderate	Moderate
Marshall County	Highly Likely	Moderate	Moderate
Total	Highly Likely	Moderate	Moderate

The 2015 update utilized the frequency X consequence ($R = FC$) formula and each jurisdiction has its own unique risk score based on the 28 points of data analyzed. The risk determined for the 2015 update represents a change from the previous plan. The 2015 update indicated winter storms have a Moderate impact and Moderate risk potential for Marshall County. Whereas, the previous plan update completed in January 2008 indicated that winter storms had the potential to have a limited impact on Marshall County and posed a significant threat. This meant that the hazard was found to occur every year and could have limited impact on the overall county of Marshall.

4.5.2 Severe Winter Storms History in Marshall County:

Severe winter storms occur each season in Marshall County. The types of severe winter storm events that occur in Marshall County include blizzard, severe cold, ice storms and severe snowfall. Reports provided by the National Oceanic Atmospheric Administration (NOAA) indicate some of the most notable severe winter storms in Marshall County occurred in 2014. As an example of how harsh winters can be in Marshall County in 2014 alone, there were 11 blizzards and 11 instances of extreme cold/wind chill reported.

NOAA provided the history of severe winter storm events in Marshall County. From 2009 to 2014, there have been numerous recorded events of severe winter storms in Marshall County. A comprehensive list of the last 50 years of data can be found in Appendix B.

Previous Problems

A concern for residents in Marshall County during the winter months is whiteout conditions. Whiteout conditions in Marshall County have historically caused emergency service personnel to not be able to do

their jobs efficiently. The rescue of stranded travelers often puts others at risk, as well as those in charge of road maintenance.

Disaster Declarations

There have been two severe winter storms in the last 50 years in Marshall County that have been declared disasters by FEMA. The two severe winter storms, which have been declared disasters by FEMA, were both major declared disasters, which is when the President believes an event has caused damage of such severity that it is beyond the combined capabilities of state and local governments to respond. 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.

Table 49: Major Declared Disasters for Severe Winter Storms

Individuals and Households Program Declared	Individual Assistant Program Declared	Public Assistance Program Declared	Hazard Mitigation Program Declared	Declaration Date	Incident Type	Incident Begin Date	Incident End Date	Disaster Close Out Date	Declared Location
No	Yes	Yes	Yes	5/16/2001	Severe Winter Storm, Flooding and Tornadoes	3/23/2001	7/3/2001	11/6/2013	Marshall County
No	No	Yes	Yes	1/16/1997	Severe Winter Storm	1/3/1997	2/3/1997	3/21/2000	Marshall County

4.5.3 Mitigation Actions During the Past Five Years in Marshall County:

Mitigation actions for winter storms from Marshall County's January 2008 All Hazard Mitigation Plan stated the mitigation action for winter storms was to deter long-term electrical disruptions by assessing the infrastructure power concerns, working with local power companies, co-ops and utilities and reducing the east/west power line vulnerability.

4.5.4 Vulnerability:

According to the 2014 Minnesota All Hazard Mitigation Plan, the topography, land-use characteristics, and winter climate of western Minnesota cause this area to be particularly vulnerable to blowing and drifting snow. For an average winter season, taxpayers in Minnesota spend approximately \$100 million in snow removal costs, with Minnesota Department of Transportation expending \$41 million. In the event of a winter season with anomalously high snowfall and exceedingly strong winds, as was the case for much of the state during the winter of 1996-97, the cost of snow removal can soar to \$215 million.

Transportation systems, electrical distribution systems, and structures are vulnerable to severe winter storms throughout the entire state. These vulnerabilities impact human safety, disrupt distribution of government services, cause economic disruptions and damage structures.

Transportation systems in Marshall County that have the potential to be impacted by severe weather are airports, and roadways. The public and private airports in Marshall County could potentially be impacted and prevent flights from coming in or going out in the event of a severe winter storm. Roadways can be treacherous or impassable during severe winter storms making it difficult for individuals to get essential items such as food and medical care. It can also make it difficult for emergency vehicles to get to those people who are experiencing some type of emergency during a severe storm.

Severe ice or snowstorms can disrupt telecommunications and power for days. Such storms can also cause exceptionally heavy snowfall that persists for days, resulting in heavy flooding. The most prevalent impacts of heavy accumulations of ice or snow are slippery roads and walkways that lead to vehicle and pedestrian accidents. In addition heavy snow loads can cause roofs to collapse trees and limbs to break as well as damaged telephone poles and lines, electrical wires, and communication towers. Children and the elderly are also at an increased risk when there is extreme cold. Children who need to walk to school or stand outside at a bus stop are at an increased risk of frostbite due to the potential of additional time outside in the cold. The elderly and those living in poverty may not have the resources to pay higher electricity or natural gas bills in the winter months to keep their homes warm. If power is lost during the winter months, it can also cause dangerously cold temperatures inside and those with limited resources may find themselves with no place warm to go. Slippery roads and walkways also pose a threat to the safety of people, especially the elderly, who are more prone to falls. Individuals who live in rural or isolated areas are also at an increased risk for severe winter storms. Additionally, livestock, which makes up 4% of the Marshall County Crop and Livestock Production, are at an increased risk.

4.5.5 Winter Storms and Climate Change:

Severe winter storms are a yearly occurrence in Marshall County. The current climate change, which is occurring within the Midwest region, has the potential to increase the severe winter storm frequency within the Midwest, including Marshall County. Severe winter storms can have a large impact on public safety in Marshall County. This will continue, with a possible increase in snowstorm frequency and annual total snowfall. Severe winter weather is often a cause of power outages. Pressures on energy use, reduced reliability of services, potential outages and a potential rise in household costs for energy are major climate change risks to public health.

4.5.6 Relationship to other Hazards:

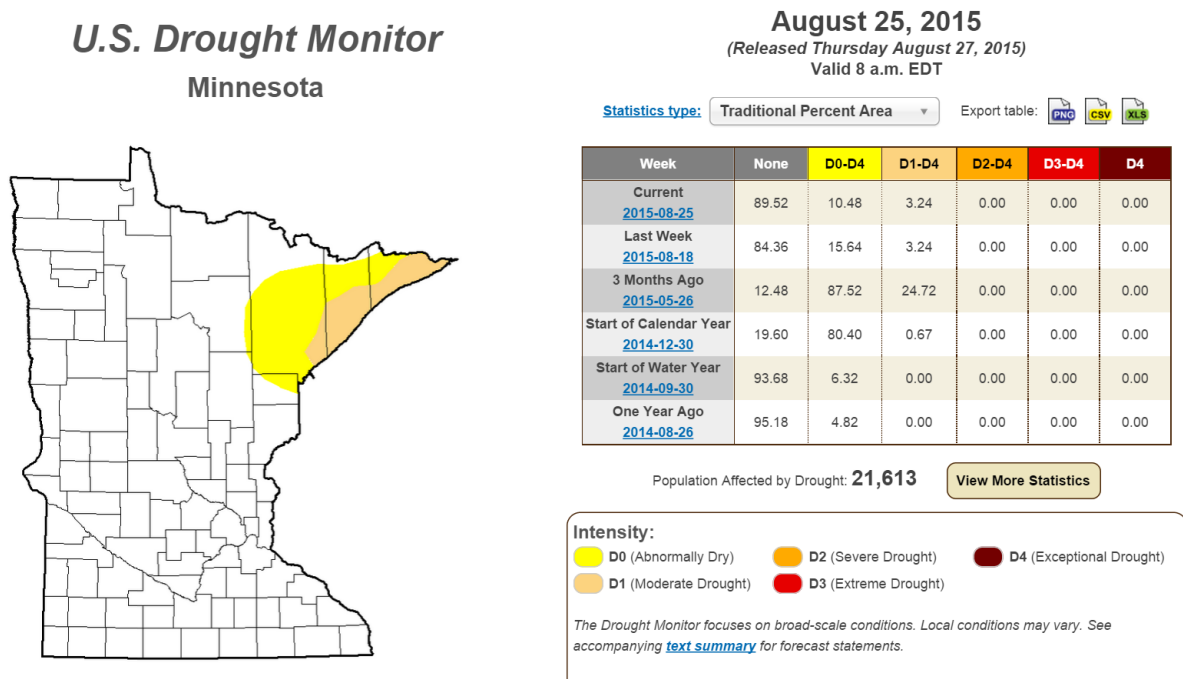
Severe winter storms have relationships to other hazards such as flooding and structural fires. Snowmelt from heavy snows can cause localized flooding which can cause dangerous conditions for residents and motorists. It can also destroy property and infrastructure such as roads. In addition, heavy winter snowstorms can cause power outages that may cause residents to use alternative heating methods, which can increase the risk of structural fires.

4.6 Drought

Drought was identified in the prior hazard mitigation plan from January 2008 for Marshall County and was also identified as one of the hazards to be included in this 2015 plan update. Additionally, analyses are included in this 2015 plan update to include a more in-depth look at what drought is, the history of it within Marshall County and the potential it has to impact the county residents. A definition of drought from the Minnesota Department of Natural Resources (DNR) is provided prior to taking a closer look at the effect drought has on Marshall County in order to provide the reader with a knowledge of the hazard.

According to the Minnesota Department of Natural Resources (DNR), drought is defined as a period of abnormally dry and/or unusually hot weather sufficiently prolonged for the corresponding deficiency of water to cause a *serious hydrologic imbalance*. Drought affects the County in several ways: 1) when a serious hydrologic imbalance occurs, 2) soil moisture reserves, 3) groundwater supplies, 4) lake levels and 5) stream flows are reduced. Water-dependent industries including agriculture, public utilities, forestry, and tourism are often severely impacted. The figure below depicts the drought intensity for Minnesota as of August 25, 2015. The drought intensity status of Marshall County at the time of this drought monitor was none.

Figure 16: U.S. Drought Monitor for Minnesota



4.6.1 Drought Risk for Marshall County:

While the probability for drought is likely, its relative impact is low and thus the overall risk for drought in Marshall County is little to no risk. The risk for drought for each of the cities is the same, because data was not available for each individual city, but rather for the county as a whole. In assessing drought for the 2015 update, data from 2009 to 2014 was used to determine the risk for Marshall County. While the relative risk for a drought is low, drought is still a concern in Marshall County because of the impact a period of drought may have on agriculture, forestry and tourism in the County. Agriculture is an important industry in the county and, as noted in the community profile section of this plan, 69.9 percent of the county land use is agricultural, so a drought could have a significant impact on a large industry in Marshall County. The table provided below provides the name of each of the cities in the County, the probability that drought will have an impact on that jurisdiction, the impact potential, as well as the overall risk calculated by the determine probability and impact ratings. The risk rating for all the jurisdictions is Little to No.

Table 50: Drought Hazard Risk Assessment

Drought			
	Probability	Impact	Risk
Alvarado	Likely	Low	Little to No
Argyle	Likely	Low	Little to No
Grygla	Likely	Low	Little to No
Holt	Likely	Low	Little to No
Middle River	Likely	Low	Little to No
Newfolden	Likely	Low	Little to No
Oslo	Likely	Low	Little to No
Stephen	Likely	Low	Little to No
Strandquist	Likely	Low	Little to No
Viking	Likely	Low	Little to No
Warren	Likely	Low	Little to No
Marshall County	Likely	Low	Little to No
Total	Likely	Low	Little to No

The 2015 update utilized the frequency X consequence ($R = FC$) formula and each jurisdiction has its own unique risk score based on the 28 points of data analyzed. The risk determined for the 2015 update represents a change from the previous plan. This update indicated the overall risk for Marshall County is Little to No. Whereas the last plan update was done in January 2008 indicated that drought had the potential to have a limited substantial impact on Marshall County and no significant threat is posed. This meant that the hazard was found to occur once every 10 years and could have limited substantial major impact on large areas of Marshall County.

4.6.2 Drought History in Marshall County:

The most recent drought events in Marshall County were reported in April 2015. All of Marshall County was reported to be affected by this drought which occurred on April 28, 2015. Prior to that, the most recent drought events took place in 2012.

Drought history in Marshall County National Climatic Data Center records show droughts in Marshall County in the years of 2006, 2007, 2012 and 2015. In 2006 and 2012, the droughts in Marshall County spanned over several months from mid-July to December in 2006, from January to April in 2007 and from July to October in 2012. A comprehensive list of the last 50 years of data can be found in Appendix B.

Previous Problems

Drought occurrences were listed as a previous problem in the mitigation plan from January 2008. Due to the recent wet cycle that had affected Marshall County, drought mitigation had not been in the public eye. It was indicated that drought in the area needs to be currently studied to prevent any dangerous situations in the future. There were particular areas in Marshall County which were included in this problem statement and are as follows:

- Golf courses often have to cease operations during extremely dry periods, causing individual

economic distress.

- Farmers can have irrigation problems during a drought, and ranchers can have water supply problems with their cattle.
- Seeding clouds is sometimes used in the area to bring rain. This must be watched however because if an area is overseeded or the weather conditions are just right, torrential rains can occur, causing more damage to the dry landscape than the drought.

Disaster Declarations

Of the aforementioned droughts, the only drought in the last 50 years in Marshall County which has been declared a disaster by FEMA was in June 1976. This was an emergency declaration, which is more limited in scope and without the long-term federal recovery programs of a Major Disaster Declaration. This drought incident began in June 1976 and the disaster close out was in 1979. Public assistance and hazard mitigation programs were declared for this incident.

Table 51: Emergency Declared Disasters: Drought

IH Progra m Declare d	IA Progra m Declare d	PA Progra m Declare d	HM Progra m Declare d	Declaratio n Date	Disaste r Type	Inciden t Type	Title	Incident Begin Date	Incident End Date	Disaster Close Out Date
No	No	Yes	Yes	6/17/1976	EM	Drought	Drought	6/17/1976	6/17/1976	3/14/1979

4.6.3 Mitigation Actions in the Past Five Years in Marshall County:

Mitigation actions for drought from Marshall County's January 2008 All Hazard Mitigation Plan stated the mitigation action for drought was to educate residents about fire prevention and protect people from drought-related damage.

4.6.4 Vulnerability in Marshall County:

Drought presents vulnerabilities to the residents in Marshall County. Individuals whose livelihoods rely on water, such as farmers who need water to produce crops, can be heavily impacted by drought. As stated in the Community Profile section of this document, 69.9 percent of the land use in Marshall County is agricultural. Financial-related stress due to drought conditions can lead to mental health illness including depression and suicide thoughts. Drought can also have a significant impact on the economy due to the destruction of major crops such as barley, spring wheat, sugar beets and soybeans. The drying effect of drought on vegetation also increases the risk of wildfire and the vulnerability of structures located in wildland interface areas.

Those living in poverty in Marshall County, 9.8 percent of the population, are also at an increased risk due to drought conditions. Individuals living in poverty may not be able to afford increasing prices during drought conditions, making it possible for individuals to suffer health problems because of the lack of healthy food and possible contamination of well water. Children and the elderly, who make up 42 percent of the population within Marshall County, are also at increased risks of illness related to drought conditions. The Centers for Disease Control and Prevention indicated acute respiratory and gastrointestinal illnesses can be more easily spread during drought conditions. E.coli and Salmonella are bacteria that can more readily contaminate food during drought conditions.

4.6.5 Drought and Climate Change in Marshall County:

The 2014 Minnesota All Hazard Mitigation Plan states that Minnesota's climate is changing in ways that will affect the environment, economy and everyday life. Climate change is occurring and has the potential to affect the frequency of drought in Marshall County. According to the 2014 National Climate Assessment from the U.S. Global Change Research Program, for the Midwest region, temperatures above 95°F are expected to increase in frequency by mid-century. Higher temperatures are associated with negative human health impacts and suppressed agricultural yields. In addition, the 2014 National Climate Assessment indicated the frequency of days with very heavy precipitation (the wettest 2% of days) is also projected to increase, raising the risk of floods and nutrient pollution. Direct effects of climate change will include increased heat stress, flooding, drought, and late spring freezes.

The 2014 National Climate Assessment indicated that in the next few decades, longer growing seasons and rising carbon dioxide levels will increase yields of some crops, though those benefits may be offset by extreme weather events. It was determined through this assessment that in the long term, the combined stresses associated with climate change are expected to decrease agricultural productivity. Since agriculture is an important industry in Marshall County, the agricultural productivity is important. The 2014 National Climate Assessment indicated that while there was no apparent change in drought duration in the Midwest region as a whole over the past century, the average number of days without precipitation is projected to increase in the future. This could lead to agricultural drought and suppressed crop yields.

4.6.6 Relationship to other Hazards in Marshall County:

There are three hazards that are related to drought. The first is wildfires, because drought conditions can significantly increase the risks of wildfire. Wildfires can ignite very easily under very dry conditions and can spread quickly. Lightning strikes can be a cause for the start of a wildfire, especially under such dry conditions. Under drought conditions, not enough precipitation falls to relieve the land from drought and wildfires can become out of hand. Burn bans may be put into effect in an effort to stop the wildfires from developing and easily spreading. The second hazard associated with droughts is subsidence because periods of drought can cause shrinkage of soils, which can impact subsidence.

The third hazard associated with droughts is extreme heat, because extreme heat and drought conditions often coexist with each other. The presence of one may cause the other to appear, the main difference is that drought conditions can last for months. There are many health related dangers when it comes to extreme heat. There are also increased loads placed on electrical grids to run air conditioning units, which can cause loss of power to residents in the county. Loss of power can lead to extended periods of time that more vulnerable individuals, such as those living in poverty, the elderly and children, may spend in extreme heat. In addition, extreme heat means more electrical demands on air conditioning units for residents. This can increase electrical bills, which can impact those who are living in poverty.

4.7 Infectious Disease

Infectious Disease was identified in the prior hazard mitigation plan from January 2008 for Marshall County and was also identified as one of the hazards to be included in this 2015 plan update. Additionally, analyses are included in this 2015 plan update to include a more in-depth look at what infectious disease is, the history of it within Marshall County and the potential it has to impact the county residents. A definition of infectious disease is provided prior to taking a closer look at the effect infectious disease has on Marshall County in order to provide the reader with a knowledge of the hazard.

Infectious diseases are disorders caused by organisms, such as bacteria, viruses, fungi or parasites. Many organisms live in and on our bodies. They are normally harmless or even helpful, but under certain conditions, some organisms may cause disease. Some infectious diseases can be passed from person to person. Some are transmitted by bites from insects or animals, and others are acquired by ingesting contaminated food or water or being exposed to organisms in the environment.

Signs and symptoms vary depending on the organism causing the infection, but often include fever and fatigue. Mild complaints may respond to rest and home remedies, while some life-threatening infections may require hospitalization. Many infectious diseases, such as measles and chickenpox, can be prevented by vaccines. Frequent and thorough hand-washing also helps protect you from infectious diseases.

The following hazard analysis includes relevant national, state, and county level (if available) disease outbreak information. It is important to note that Minnesota is divided into eight regions that house local public health agencies in Minnesota.

4.7.1 Definitions of Infectious Diseases included in the table below:

Campylobacteriosis is an infection by the *Campylobacter* bacterium, most commonly *C. jejuni*. It is among the most common bacterial infections of humans, often a foodborne illness. It produces an inflammatory, sometimes bloody, diarrhea or dysentery syndrome, mostly including cramps, fever and pain. Animals farmed for meat are the primary source of campylobacteriosis.

Cryptosporidium is a microscopic parasite that causes the diarrheal disease cryptosporidiosis. Both the parasite and the disease are commonly known as "Crypto." There are many species of *Cryptosporidium* that infect animals, some of which also infect humans. The parasite is protected by an outer shell that allows it to survive outside the body for long periods of time and makes it very tolerant to chlorine disinfection. While this parasite can be spread in several different ways, water (drinking water and recreational water) is the most common way to spread the parasite. *Cryptosporidium* is a leading cause of waterborne disease among humans in the United States.

West Nile virus (WNV) is most commonly transmitted to humans by mosquitoes. You can reduce your risk of being infected with WNV by using insect repellent and wearing protective clothing to prevent mosquito bites. There are no medications to treat or vaccines to prevent WNV infection. Fortunately, most people infected with WNV will have no symptoms. About 1 in 5 people who are infected will develop a fever with other symptoms. Less than 1% of infected people develop a serious, sometimes fatal, neurologic illness.

Giardiasis is a diarrheal disease caused by the microscopic parasite *Giardia*. A parasite is an organism that feeds off of another to survive. Once a person or animal (for example, cats, dogs, cattle, deer, and beavers) has been infected with *Giardia*, the parasite lives in the intestines and is passed in feces (poop). Once outside the body, *Giardia* can sometimes survive for weeks or months. *Giardia* can be found in every region of the U.S. and around the world.

Escherichia coli (abbreviated as *E. coli*) are bacteria found in the environment, foods, and intestines of people and animals. *E. coli* are a large and diverse group of bacteria. Although most strains of *E. coli* are harmless, others can make you sick. Some kinds of *E. coli* can cause

diarrhea, while others cause urinary tract infections, respiratory illness and pneumonia, and other illnesses.

Haemophilus influenzae (including Hib) is a bacterium that can cause a severe infection, occurring mostly in infants and children younger than five years of age. In spite of its name, *Haemophilus influenzae* does not cause influenza (the "flu"). It can cause lifelong disability and be deadly.

There are six identifiable types of *Haemophilus influenzae* bacteria (a through f) and other non-identifiable types (called nontypeable). The one that most people are familiar with is *Haemophilus influenzae* type b, or Hib. There's a vaccine that can prevent disease caused by Hib, but not the other types of *Haemophilus influenzae*.

HIV is a virus spread through body fluids that affects specific cells of the immune system, called CD4 cells, or T cells. Over time, HIV can destroy so many of these cells that the body can't fight off infections and disease. When this happens, HIV infection leads to AIDS.

Lyme disease is caused by the bacterium *Borrelia burgdorferi* and is transmitted to humans through the bite of infected blacklegged ticks. The blacklegged ticks are mostly found in the forested areas of north and east central Minnesota. The blacklegged tick may also be found in forested areas outside of Central Minnesota. The tick while camping or hiking typically bites those infected with Lyme disease. Typical symptoms include fever, headache, fatigue, and a characteristic skin rash called erythema migrans. If left untreated, the infection can spread to joints, the heart, and the nervous system. Lyme disease is diagnosed based on symptoms, physical findings (e.g., rash), and the possibility of exposure to infected ticks. Laboratory testing is helpful if used correctly and performed with validated methods. Most cases of Lyme disease can be treated successfully with a few weeks of antibiotics. Steps to prevent Lyme disease include using insect repellent, removing ticks promptly, applying pesticides, and reducing tick habitat. The ticks that transmit Lyme disease can occasionally transmit other tick-borne diseases as well.

Anaplasmosis is a vector borne bacterial disease caused by a bite from a blacklegged tick. For Anaplasmosis bacteria to transfer to humans, the tick must be attached for 12 to 24 hours. As with Lyme disease, the blacklegged tick is found in forested areas in north central and east central Minnesota. Symptoms of Anaplasmosis include fever (over 102° F), severe headache, muscle aches and chills with shaking. Other symptoms may include nausea, vomiting, abdominal pain, diarrhea and change in mental status. Tetracycline antibiotics are typically prescribed for the infection.

Meningococcal disease can refer to any illness that is caused by the type of bacteria called *Neisseria meningitidis*. Meningococcal disease is a contagious infection spread by close contact with an infected person, such as living together or kissing. Quick medical attention is extremely important if meningococcal disease is suspected.

Pertussis, also known as whooping cough, is a highly contagious respiratory disease. It is caused by the bacterium *Bordetella pertussis*. Pertussis is known for uncontrollable, violent coughing which often makes it hard to breathe. After fits of many coughs, someone with pertussis often needs to take deep breaths which result in a "whooping" sound. Pertussis most commonly affects infants and young children and can be fatal, especially in babies less than 1 year of age. The best way to protect against pertussis is immunization.

Salmonellosis is an infection with bacteria called *Salmonella*. Most persons infected with *Salmonella* develop diarrhea, fever, and abdominal cramps 12 to 72 hours after infection. The illness usually lasts 4 to 7 days, and most persons recover without treatment. However, in some persons, diarrhea may be so severe that the patient needs to be hospitalized. In these patients, the *Salmonella* infection may spread from the intestines to the bloodstream, and then to other body sites and can cause death unless the person is treated promptly with antibiotics. The elderly, infants, and those with impaired immune systems are more likely to have a severe illness.

Chlamydia is a common STD that can infect both men and women. It can cause serious, permanent damage to a woman's reproductive system, making it difficult or impossible for her to get pregnant later on. Chlamydia can also cause a potentially fatal ectopic pregnancy (a pregnancy that occurs outside the womb).

Gonorrhea is a sexually transmitted disease (STD) that can infect both men and women. It can cause infections in the genitals, rectum, and throat. It is a very common infection, especially among young people ages 15-24 years.

Streptococcus pneumoniae bacteria, or pneumococcus, can cause many types of illnesses. Some of these illnesses can be life-threatening. Pneumonia, which is an infection of the lungs, can be caused by many different bacteria, viruses, and even fungi. Pneumococcus is one of the most common causes of severe pneumonia. Besides pneumonia, pneumococcus can cause other types of infections too, such as: ear infections, sinus infections, meningitis and bacteremia. Some of these infections are considered "invasive." Invasive disease means that germs invade parts of the body that are normally free from germs. For example, pneumococcal bacteria can invade the bloodstream, causing bacteremia, and the tissues and fluids surrounding the brain and spinal cord, causing meningitis. When this happens, the disease is usually very severe, causing hospitalization or even death.

Tuberculosis (TB) is caused by a bacterium called *Mycobacterium tuberculosis*. The bacteria usually attack the lungs, but TB bacteria can attack any part of the body such as the kidney, spine, and brain. If not treated properly, TB disease can be fatal. TB is spread through the air from one person to another. The TB bacteria are put into the air when a person with TB disease of the lungs or throat coughs, sneezes, speaks, or sings. People nearby may breathe in these bacteria and become infected.

4.7.2 Infectious Disease Risk in Marshall County:

While the probability for infectious diseases is Highly Likely in Marshall County, its relative impact is Low and thus the overall risk for infectious diseases in Marshall County is Little to No. The risk for infectious diseases for each of the cities is the same because data was not available by individual city. In assessing infectious diseases for the 2015 updated, data from 2013 for the Northwestern Region was used to determine this risk. The Northwestern Region used occurrences from the following counties: Beltrami, Clearwater, Hubbard, Roseau, Lake of the Woods, Marshall, Pennington, Roseau, Red Lake, and Roseau. As such, the reader must take into account that risk is determined on a regional level versus County or city level. The table provided below provides the name of each of the cities in the County, the probability that infectious disease will have an impact on that jurisdiction, the impact potential, as well as the overall risk calculated by the determine probability and impact ratings.

Table 52: Infectious Disease Risk by City in Marshall County

Infectious Disease			
City	Probability	Impact	Risk
Alvarado	Highly Likely	Low	Little to No
Argyle	Highly Likely	Low	Little to No
Grygla	Highly Likely	Low	Little to No
Holt	Highly Likely	Low	Little to No
Middle River	Highly Likely	Low	Little to No
Newfolden	Highly Likely	Low	Little to No
Oslo	Highly Likely	Low	Little to No
Stephen	Highly Likely	Low	Little to No
Strandquist	Highly Likely	Low	Little to No
Viking	Highly Likely	Low	Little to No
Warren	Highly Likely	Low	Little to No
Marshall County	Highly Likely	Low	Little to No
Total	Highly Likely	Low	Little to No

The 2015 update utilized the frequency X consequence ($R = FC$) formula and each jurisdiction has its own unique risk score based on the 28 points of data analyzed. The risk determined for the 2015 update represents a significant change from the previous plan. This update indicated the overall risk for Marshall County is Little to No. Whereas the last plan update done in January 2008 indicated that infectious disease had the potential to have a substantial major impact on Marshall County and no significant threat is posed. This meant that the hazard was found to occur dependent on the type could have a substantial major impact on large areas of Marshall County.

4.7.3 Infectious Disease History in Marshall County:

The following data represents communicable diseases that have been reported to the Minnesota Department of Health in 2013 for the Northwestern Region. The Northwestern Region where occurrences developed is classified as the following counties: Beltrami, Clearwater, Hubbard, Kittson, Lake of the Woods, Marshall, Pennington, Polk, Red Lake, and Roseau.

The infectious disease occurrences which are the highest in the Northwestern Region are Sexually Transmitted Diseases (STD), Chlamydia Trachomatis and Gonorrhea. These STD's made up 480 cases in 2013. The other infectious diseases which have a high number of occurrences are Anaplasmosis and Lyme disease, which are vector borne bacterial diseases caused by a bite from a blacklegged tick. The blacklegged tick is found in forested areas in north central and east central Minnesota. Mosquitoes are also a source of infectious disease in the county and have accounted for 9 cases of West Nile Virus in the Northwestern Region of Minnesota in 2013.

Table 53: Communicable Disease and Number of Occurrences

Communicable Disease	Number of Occurrences
Anaplasmosis	95
Campylobacteriosis	18
Cryptosporidiosis	5
West Nile	9
Escherichai Coli	3
Giardiasis	3
Haemophilus Influenzae invasive disease	7
HIV (non-AIDS)	1
AIDS	2
Lyme disease	54
Meningococcal Disease	0
Pertussis	4
Salmonellosis	12
Chlamydia Trachomatis (STD)	424
Gonorrhea (STD)	56
Streptococcus Pneumoniae invasive disease	14
Streptococcal invasive disease - Group A	6
Streptococcal invasive disease - Group B	12
Tuberculosis	2
Viral Hepatitis, Type A	0
Viral Hepatitis, Type B	0
Viral Hepatitis, Type C	3

Source: Minnesota Department of Health Annual Summary of Communicable Diseases Reported to the Minnesota Department of Health, 2013

Previous Problems

Mosquito eradication was listed as a previous problem from the January 2008 mitigation plan for Marshall County. This plan stated that the mosquito fogger in Argyle needs an increasing amount of maintenance with each passing year. A rise in the West Nile virus could be seen if the city is not able to combat mosquitoes. Strandquist would also like some equipment to spray for mosquitoes on their own, as it is sometimes expensive for smaller cities to rent equipment. Inclement weather makes it hard to schedule spraying also. It is costly to spray, but dangerous if the city does not, so not spraying is not an option.

4.7.4 Presidential Declared Disasters: Infectious Disease

No presidential declared disasters for infectious disease in the past five years.

4.7.5 Mitigation (Past 5 Years):

Mitigation actions for infectious disease from Marshall County's January 2008 All Hazard Mitigation Plan stated the mitigation action for infectious disease was to continue involvement in programs that deal with infectious disease and population health. The Emergency Manager for Marshall County indicated that the mitigation actions that have taken place since the last plan have centered around public education.

4.7.6 Vulnerability in Marshall County:

In Marshall County, there are certain populations of people who are more susceptible to infectious disease. The elderly, which makes up 19.2 percent of the population, as stated in the Community Profile Section of this document, and children are at an increased risk of becoming infected with airborne diseases because of weakened immune systems and spending more time in crowded settings, which more easily spread airborne diseases such as schools and nursing homes. Within Marshall County, there is also increased risk of tick and mosquito transmitted diseases, such as Lyme disease, Anaplasmosis and West Nile Virus because of the rural nature of the county. Individuals who spend any extended time outside (farmers, ranchers, recreationist etc.) are at an increased risk.

4.7.7 Infectious Disease and Climate Change in Marshall County:

According to the World Health Organization, changes in infectious disease transmission patterns are likely major consequence of climate change. There are three categories of research into the linkages between climatic conditions and infectious disease transmission. The first examines evidence from the recent past of associations between climate, variability and infectious disease occurrence. The second looks at early indicators of already-emerging infectious disease impacts of long-term climate change. The third uses the above evidence to create predictive models to estimate the future burden of infectious disease under projected climate change scenarios.

Types of diseases which are impacted by climate change are vector-borne and water-borne diseases. Important determinants of vector borne disease transmission include: vector survival and reproduction, the vector's biting rate, and the pathogen's incubation rate within the vector organism. Vectors, pathogens and hosts each survive and reproduce within a range of optimal climatic conditions: temperature and precipitation are the most important, while sea level elevation, wind, and daylight duration are also important. Human exposure to waterborne infections occurs by contact with contaminated drinking water, recreational water, or food. This may result from human actions, such as improper disposal of sewage wastes, or be due to weather events. Rainfall can influence the transport and dissemination of infectious agents, while temperature affects their growth and survival.

Source: World Health Organization

4.7.8 Relationship to other Hazards:

Flood and drought conditions are associated with infectious disease because food and waterborne disease outbreaks can be sparked by flood and drought conditions. Food and water can become contaminated during flood and drought conditions, which can negatively impact the public's health. Norovirus, Salmonella and E. coli are also associated with waterborne illness outbreaks, which are usually caused by drinking water contaminated by animal or human waste. Additionally, standing water from flooding can cause the mosquito population to increase, making West Nile Virus more prevalent.

4.8 Subsidence

Subsidence was identified in the prior hazard mitigation plan from January 2008 for Marshall County and was also identified as one of the hazards to be included in this 2015 plan update. Additionally, analyses are included in this 2015 plan update to include a more in-depth look at what subsidence is, the history of it within Marshall County and the potential it has to impact the county residents. A definition of subsidence

from the 2014 Minnesota State Hazard Mitigation Plan is provided prior to taking a closer look at the effect subsidence has on Marshall County in order to provide the reader with knowledge of the hazard.

According to the 2014 Minnesota State Hazard Mitigation Plan, there are three types of potential problems associated with the existence or formation of sinkholes: subsidence, flooding, and pollution. Subsidence commonly involves a gradual sinking, but it could also result in an instantaneous or catastrophic collapse. In Marshall County, subsidence can occur in areas of the state where limestone and dolostone are present, such as the Northwestern corner of the state.

The change in the local environment affecting the soil mass causing subsidence and sinkholes collapse is called a triggering mechanism. Water is the main factor affecting the local environment that causes subsidence. Water level decline can happen naturally or be human induced. Factors in water decline are pumping water from wells, localized drainage from construction, dewatering, and drought. Changes in the groundwater flow include an increase in the velocity of groundwater movement, increase in the frequency of water table fluctuations, and increased or reduced recharge. Increased loading causes pressure in the soil leading to failure of underground cavities and spaces. Vibrations caused by an earthquake, vibrating machinery and blasting can cause structural collapse followed by surface settlement.

4.8.1 Subsidence Risk in Marshall County:

The overall probability for subsidence within Marshall County is Unlikely, its relative impact is No Impact, and thus the overall risk for subsidence within Marshall County is Little to No. The risk for subsidence in Marshall County is different for each city and was determined based upon the specific data collected and outlined in the history section of this hazard profile. In assessing subsidence for the 2015 update, data from 2009-2014 was used to determine the risk for Marshall County, including each of the cities and the county as a whole. Most notable are the cities of Grygla and Oslo. These cities both have a Likely probability of subsidence due to a history of subsidence and specific conditions within the city limits. The table provided below provides the name of each of the cities in the County, the probability that subsidence will have an impact on that jurisdiction, the impact potential, as well as the overall risk calculated by the determine probability and impact ratings.

Table 54: Subsidence Risk by City in Marshall County

Subsidence			
City	Probability	Impact	Risk
Alvarado	Unlikely	No Impact	Little to No
Argyle	Unlikely	No Impact	Little to No
Grygla	Likely	Moderate	Low
Holt	Unlikely	No Impact	Little to No
Middle River	Unlikely	No Impact	Little to No
Newfolden	Unlikely	No Impact	Little to No
Oslo	Likely	Moderate	Low
Stephen	Unlikely	No Impact	Little to No
Strandquist	Unlikely	No Impact	Little to No
Viking	Unlikely	No Impact	Little to No
Warren	Unlikely	No Impact	Little to No
Marshall County	Unlikely	No Impact	Little to No
Total	Unlikely	No Impact	Little to No

The 2015 update utilized the frequency X consequence ($R = FC$) formula and each jurisdiction has its own unique risk score based on the 28 points of data analyzed. The risk determined for the 2015 update represents little change from the previous plan. The 2015 update indicate Little to No risk for subsidence in Marshall County. Similarly, the last plan update done in January 2008 indicated that subsidence had the potential to have a limited impact on Marshall County and no significant threat is posed. This meant that the hazard was found to occur dependent upon the location and could have limited impact on single sites in Marshall County.

4.8.2 Subsidence History in Marshall County:

According to the 2008 Marshall County Hazard Mitigation Plan, parts of Marshall County have been affected by subsidence in past years. Both urban and rural areas have been impacted by subsidence. A problem with subsidence in Marshall County is that subsidence has been damaging culverts and agricultural related dikes along the River. The damage is so great that some of these culverts and dikes will not function anymore. Since ownership and responsibility for maintenance are unclear, funding maintenance costs are challenging.

There is a cemetery in Oslo that has the potential to be affected by subsidence. Currently, every river that runs through Marshall County has some areas where subsidence is occurring. Many people are losing their backyards in Warren due to the Snake River.

Previous Problems

Subsidence concerns listed in the January 2008 mitigation plan for Marshall County indicated that a constantly changing river has homes and land near it in danger of subsidence. Marshall County does not want to limit growth in the area, but does want to regulate it to avoid future problems. Some specific areas in the county with subsidence problems are listed below:

- Big Woods Township has a problem with subsidence.
- Portions of the dike in Oslo have to be strengthened every year that flooding endangers the city. The extra soil cannot be kept on the dike permanently or subsidence would threaten it.
- The cemetery might need to be relocated.
- The Snake River has been subsiding in Warren, causing people to lose portions of their backyard.
- The Thief River Subwatershed of the Red Lake Watershed has noted problems with subsidence including river and ditch bank failures, active erosion, culvert and road washouts and sedimentation. Problems have a high severity ranking and are widespread in extent.
- Problems may become worse immediately after the spring thaw or other large events.

4.8.3 Presidential Declared Disasters: Subsidence

There were no declared disasters related to subsidence in Marshall County.

4.8.4 Mitigation Actions During the Past Five Years in Marshall County:

Mitigation actions for subsidence from Marshall County's January 2008 All Hazard Mitigation Plan stated the mitigation action for subsidence was to supply county-wide prevention by controlling new structure and housing placement for future periods of population growth, utilizing resources and information from local groups and agencies and preventing further subsidence of affected areas.

There were numerous current strategies relating to subsidence listed in the previous mitigation plan from January 2008 in reference to the above "*Previous Problems*." The following are the strategies that were listed:

- Cities, watersheds and the county utilize various methods to deal with subsidence. Application of a various method depends on cost and the situation. Stabilizing the river banks, relocating homes, changing the setback requirements with public consensus, doing individual soil consultations (SWCD, NRCS) with parties who want to live near the river so that the risk is recognized, and utilizing local universities, engineers and graduate students were all strategies listed.
- County-wide zoning was not currently available in Marshall County, but rules regarding shores and development were enforced in the form of a shore land ordinance. Restrictions describe set-backs and how close property/homes can be to a body of water. This directly affects subsidence. Other criteria described included the identification of zoning districts with regulations in the shore land and floodplain ordinances of Marshall County. In Marshall County, restrictions list a distance of 300 feet away from a river/stream and 1,000 feet away from an ordinary high water line (OHWL) of a lake, pond or flowage.
- The Marshall County Comprehensive Local Water Plan has an objective that promotes a soil loss limits program. The water plan is currently being updated. Accomplishments listed in the water plan include suspended sediment monitoring on the Thief, Mud, Moose and Red Lake Rivers and starting the development of a potential soil loss limits ordinance (which is not yet completed).
- The following goals and policies are listed in the Ten Year Updated Watershed Management Plan for the Middle-Snake-Tamarac Rivers Watershed District. Written in 1994, it was amended in 2004 and approved by the MN Board of Water and Soil Resources in January, 2005.
 - The District will work to implement measures to reduce erosion and sedimentation.
 - Encouraging the adoption of land use practices which reduce soil loss.
 - Using measures during construction which minimizes the loss of soil.
 - Implementing measures to reduce stream bank and channel erosion

- Urging the counties to adopt a soil loss ordinance.

4.8.5 Vulnerability in Marshall County:

Any residential land that lies in Marshall County has the potential to be impacted by subsidence; however, the incidence of subsidence is not likely in most areas of Marshall County. All roadways, houses or businesses built have the potential to be vulnerable to subsidence. Houses or businesses located near a body of water or waterway, especially the rivers in Marshall County, and anything located on the top of a considerable slope is also more vulnerable. In addition, large amounts of rain or the spring thaw increase the vulnerability of areas in the County.

4.8.6 Subsidence and Climate Change in Marshall County:

Changes in climate have the potential to impact subsidence in Marshall County. Periods of excessive and prolonged rainfall can cause ground water levels to rise and swell prone soils, particularly cohesive soils with a high clay content (and to a lesser extent silt), which are particularly susceptible to volumetric change. Conversely, excessive and prolonged dry periods cause shrinkage. In winter, waterlogged ground can move further by frost heave.

4.8.7 Relationship to other Hazards:

Subsidence can be related to other hazards such as severe summer storms, because they can cause excessive or prolonged periods of rain, which can cause the ground to become susceptible to volumetric change. Drought also has the potential to be related to subsidence because periods of drought can cause shrinkage of soils, which can impact subsidence. Additionally, flooding can cause excessive water on the ground, which can cause volumetric changes.

4.9 Tornado

Tornado was identified in the prior hazard mitigation plan from January 2008 for Marshall County, but was included as part of the Summer Weather hazard profile. For the 2015 update, tornado was identified as a separate hazard to determine the impact potential it has on Marshall County. Included in this hazard profile for tornado are additional analyses to provide a more in-depth look at what a tornado is, the history of tornadoes in Marshall County and the potential they have to impact the county residents. A definition of tornadoes is provided prior to taking a closer look at the effect tornadoes have on Marshall County in order to provide the reader with knowledge of the hazard.

Tornadoes can and do occur in all months of the year; however, the most tornadoes usually occur during severe thunderstorms in the warm months. Tornadoes are defined as violently-rotating columns of air extending from thunderstorms to the ground, with wind speeds between 40-300 mph. Funnel clouds are rotating columns of air not in contact with the ground; however, the column of air can reach the ground very quickly and become a tornado.

Figure 17: Average Annual Number of Tornadoes per Year/Month in Minnesota

Minnesota Tornado Statistics		
1950 - 2012	Totals	Annual Average
Tornadoes	1721	27
Tornado Deaths	99	
Tornado Injuries	1981	

Tornado Totals and Averages by Month (1950 - 2010)										
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Total
Totals	19	71	244	605	415	195	76	27	1	1653
Average	0.3	1.2	4.0	9.9	6.8	3.2	1.2	0.4	0.02	27
Percent	1	4	15	37	25	12	4	2	0	100

Greatest Number of Tornadoes in Minnesota (1950-2015)	
One Year	113 in 2010
One Month	71 in June 2010
One Day	48 on June 17, 2010

4.9.1 Enhanced Fujita (EF) Scale:

On February 1, 2007, the National Weather Service adopted “Enhanced Fujita (EF) Scale”. The EF Scale evaluates and categorizes tornado events by intensity. Both the original Fujita Scale and the EF Scale estimate the intensity of a tornado (3-second gust speed) based on the magnitude of damage.

The original scale had a lack of damage indicators and with the increasing standards for buildings the rating of tornadoes was becoming inconsistent. The EF Scale evaluates tornado damage with a set of 28 indicators (see NOAA website). Each indicator is a structure with a typical damage description for each magnitude of a tornado. The Fujita Scale Table is both a breakdown of the Fujita Scale and a comparison to the Enhanced Fujita Scale.

Table 55: Fujita scale

FUJITA SCALE			DERIVED EF SCALE		OPERATIONAL EF SCALE	
F Number	Fastest 1/4-mile (mph)	3 Second Gust (mph)	EF Number	3 Second Gust (mph)	EF Number	3 Second Gust (mph)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-206	162-209	3	138-167	3	136-165
4	207-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over 200

Tornadoes can be from twenty feet in width to larger than a mile on the ground and are transparent until the vortex fills with water vapor, dust, dirt, or debris. Uniquely dangerous are rain-wrapped tornadoes. If there is heavy rainfall near a tornado, a tornado can become masked or wrapped in the rainfall and become hidden. During a possible tornado event, the National Weather Service issues warning to the public to take shelter even if no tornado is visible, because it may be rain-wrapped or not coming from a west, southwest direction unlike the majority of storms in the Midwest.

According to the National Oceanic Atmospheric Administration (NOAA) National Severe Storms Laboratory thunderstorms develop in warm, moist air in advance of eastward-moving cold fronts. These thunderstorms often produce large hail, strong winds, and tornadoes. Tornadoes in the winter and early spring are often associated with strong, frontal systems that form in the Central States and move east.

4.9.2 Tornado Risk in Marshall County:

The overall probability that tornadoes will occur each year in Marshall County is Likely and its relative impact is Moderate and thus the overall risk for Marshall County is Low. The risk for tornadoes for each of the cities is different and was determined based upon the specific data collected and outlined in the history section of this hazard profile. In assessing tornado data for the 2015 update, data from 2009 to 2014 was used to determine the risk for each of the cities and the county as a whole. Most notable is the unincorporated areas of Marshall County, and the cities of Stephen, Oslo, Newfolden, and Viking, which all have a likely probability as there is a history of tornadoes affecting those cities. The table provided below provides the name of each of the cities in the County, the probability that tornadoes will have an impact on that jurisdiction, the impact potential, as well as the overall risk calculated by the determine probability and impact ratings.

Table 56: Tornado Risk by City in Marshall County

Tornado Storms			
City	Probability	Impact	Risk
Alvarado	Possible	Low	Little to No
Argyle	Possible	Low	Little to No
Grygla	Possible	Low	Little to No
Holt	Possible	Low	Little to No
Middle River	Possible	Low	Little to No
Newfolden	Likely	Low	Little to No
Oslo	Likely	Low	Little to No
Stephen	Likely	Moderate	Low
Strandquist	Possible	Low	Little to No
Viking	Likely	Low	Little to No
Warren	Possible	Low	Little to No
Marshall County	Likely	Low	Little to No
Total	Likely	Moderate	Low

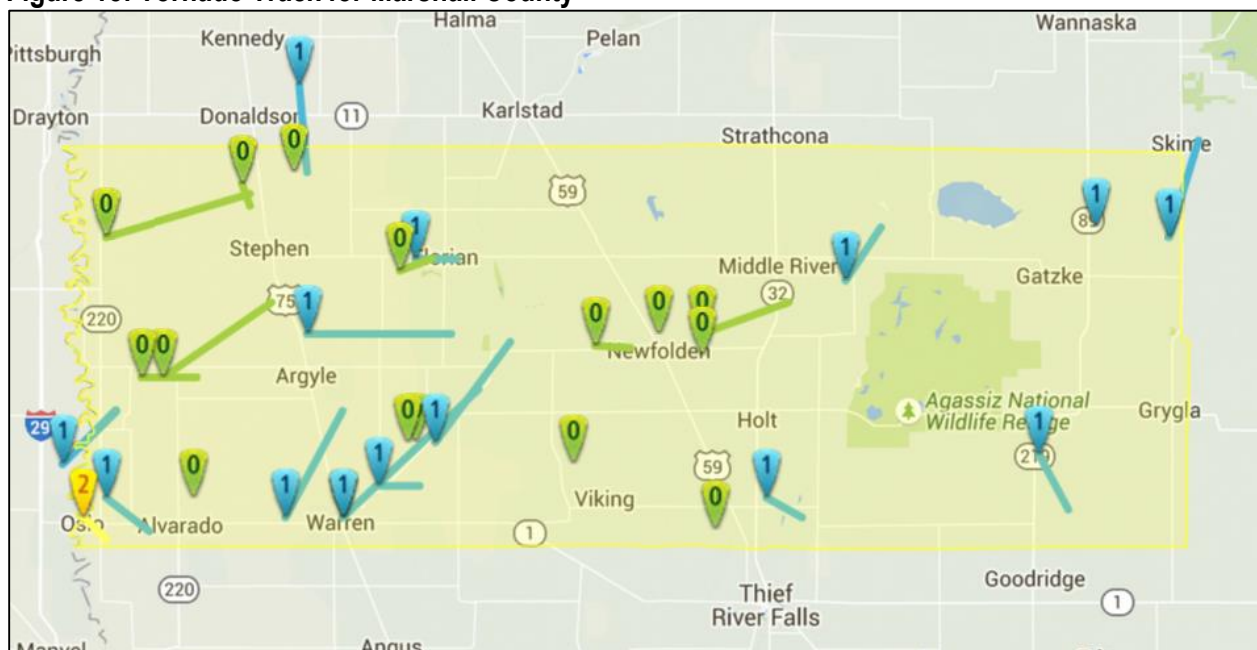
4.9.3 Tornado History in Marshall County:

Tornadoes in Marshall County peak in the months of June and July. The typical time of day for tornadoes in Marshall County range between 4:00 P.M. and 7:00 P.M. Most of these are minor tornadoes, with wind speeds under 125 miles per hour. A typical Minnesota tornado lasts approximately ten minutes, has a path length of five to six miles, is nearly as wide as a football field, and has a forward speed of about thirty-five miles an hour and affects less than 0.1% of the county warned. The history of tornado events in Marshall County was provided by National Oceanic Atmospheric Administration (NOAA). From 2009 to 2014, there have been 13 recorded events of tornadoes in Marshall County. A comprehensive list of the last 50 years of data can be found in Appendix B.

According to records, the longest tracking tornado in Marshall County during these years took place on June 16, 2010 and affected Radium, which is listed as a ghost town. The tornado was an F1 and was 200 yards wide and tracked 7 miles long. There were no injuries or fatalities during this tornado event. According to the National Climatic Data Center, this tornado tracked for roughly 7 miles, snapping off numerous trees in shelterbelts along its path. The roof was torn off a small shed near Old Mill State Park and some row crops showed ground scouring. Peak winds were estimated at 105 mph.

The following image shows the tornado track for the tornadoes which, have occurred in the county from 1964 to 2014. There have been 31 reported tornadoes in Marshall County during this timeframe, with no fatalities and 4 injuries. The numbers on the map correspond to the Fujita Scale number for each tornado that is a scale from 0-5, with 0 being the least severe and 5 being the most severe.

Figure 18: Tornado Track for Marshall County



Source: Tornado History Project for Marshall County, MN

Previous Problems

The January 2008 mitigation plan for Marshall County indicated that previous problems in Marshall County were storm shelter availability. The plan identified that the mobile home park in Argyle was in need of a shelter and senior housing also need protection. The plan additionally indicated, that the water table in

Strandquist is high, so while construction of basements is possible, they have to be specially designed. This prevents some people from having a shelter. There was also a trailer park in Viking which was in need of some additional sheltering.

Warning systems including sirens were also identified as a problem for some cities and townships in Marshall County in the January 2008 plan. According to 2008 plan, there had been no outside funding available for these warning systems. Also according to the plan, the sirens in Grygla and Stephen do not have a backup power sources. Which could have caused a problem if a tornado (or another storm) occurs during a period of no electricity and citizens are not provided any warning. The sirens in Argyle are between thirty and forty years old. Citizens are also complaining that some areas can no longer hear the sirens. Strandquist does not have a siren, and Newfolden's siren did not ring during one storm event, though this lack of warning was not related to maintenance issues.

Disaster Declarations

Of the aforementioned severe summer storms, there has been four tornado or severe storm incidences, which has been declared a disaster by FEMA in the last 50 years in Marshall County. These disasters were all major declared disasters, which is when the President believes an event has caused damage of such severity that it is beyond the combined capabilities of state and local governments to respond. 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. The beginning and ending date of the incident are included for these declared disasters, as well as information on the type of assistance program that was provided.

Table 57: Major Declared Disasters for Tornado (Disaster declared for Marshall County)

IH Program Declared	IA Program Declared	PA Program Declared	HM Program Declared	Declaration Date	Disaster Type	Incident Type	Title	Incident Begin Date	Incident End Date
No	Yes	Yes	Yes	6/14/2002	DR	Severe Storm(s)	SEVERE STORMS, FLOODING AND TORNADOES	6/9/2002	6/28/2002
No	Yes	Yes	Yes	5/16/2001	DR	Flood	SEVERE WINTER STORMS, FLOODING, AND TORNADOES	3/23/2001	7/3/2001
No	Yes	Yes	Yes	6/11/1993	DR	Severe Storm(s)	SEVERE STORMS, TORNADOES & FLOODING	5/6/1993	8/25/1993
No	Yes	Yes	Yes	7/17/1975	DR	Severe Storm(s)	SEVERE STORMS, TORNADOES & FLOODING	7/17/1975	7/17/1975

4.9.4 Mitigation During the Past Five Years in Marshall County:

Mitigation actions for tornadoes from Marshall County's January 2008 All Hazard Mitigation Plan stated the mitigation action for tornadoes was to improve shelter opportunities by providing unprotected residents a shelter and annually prepare chosen shelter sites.

4.9.5 Vulnerability in Marshall County:

The most active "tornado month" in Marshall County is June (33% of all occurrences), with July next (28% of all occurrences, and then May (17% of all occurrences). During these three months, over 75 percent of all tornadoes occur when many people may be enjoying outdoor recreational activities in Marshall County. Tornadoes have never been reported in the Minnesota during December, January and February. There are portions of the Old Mill State Park and the Florian County Park within Marshall County and residents partaking in recreational activities in these parts of the county could be at an increased risk during the summer months. State Wildlife Management Areas also are located in Marshall County and 10.9 percent of the county is forested. These areas could also have residents partaking in recreational activities during the summer months.

Schools, hospitals, fire departments, police departments and other critical facilities are also at increased vulnerability because if they could become damaged by a tornado. The county would need to rely on other facilities within the county or surrounding counties depending upon the amount of damage. Trailer parks, mobile homes and other areas where there is limited sheltering options are also at an increased risk

4.9.6 Tornado and Climate Change:

According to the National Center for Atmospheric Research, the main climate change connection to tornadoes is via the basic instability of the low-level air that creates the convection and thunderstorms in the first place. Warmer and moister conditions are the keys for unstable air and the oceans are warmer because of climate change. However, some studies state that trends in severe storms including 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).

4.9.7 Relationship to Other Hazards in Marshall County:

Tornadoes are related to numerous other hazards. Structural fires have the potential to be related to tornadoes because strong winds from tornadoes may ignite a structural fire. Flood, lightning strikes, and high winds may also cause structural fires in their aftermath. Downed power lines, natural gas leaks or other sources of ignition initiated by tornadoes may start a fire in structures. Routes to structures may be restricted due to flooding or debris from storms. Tornadoes develop out of thunderstorms, where there's already a steady, upward flow of warm, low-pressure air to get things started, so tornadoes are very strongly related to summer storms. Hail can also occur as part of thunderstorms which cause tornadoes and can cause damage depending on the size and duration of the hail.

4.10 Windstorms

Windstorms were not identified in the prior hazard mitigation plan from January 2008 for Marshall County, as a separate hazard, but was part of the "summer storm" hazard. It was identified as a separate hazard to be included in this 2015 plan update. Analyses are also included in this 2015 plan which takes an in depth look at what windstorms are, the history of them within Marshall County and the potential they have to impact the county residents. A definition of windstorms is provided prior to taking a closer look at the effect hail has on Marshall County in order to provide the reader with knowledge of the hazard.

FEMA defines winds in excess of 58 miles per hour, excluding tornadoes, as windstorms. Straight-line winds and windstorms are used interchangeably in the Plan. This hazard is treated as a different category than Tornadoes (which may also include high winds). Windstorms are among the nation's most severe natural hazards in terms of both lives lost and property damaged.

Severe winds can damage and destroy roofs, toss manufactured homes off their pier foundations, and tear light-framed homes apart. There are several different types of windstorms. A "downburst" is defined as a strong downdraft with an outrush of damaging winds on or near the earth's surface. When people experience property damage from a downburst, they often do not believe that "just wind" could have caused the damage, and they assume that they were hit by a tornado. Downbursts may have wind gusts up to 130 mph and are capable of the same damage as a medium-sized tornado. A "gust front" is the leading edge of the thunderstorm downdraft air. It is most prominent near the rain-free cloud base and on the leading edge of an approaching thunderstorm and is usually marked by gusty, cool winds and sometimes by blowing dust. The gust front often precedes the thunderstorm precipitation by several minutes. Straight-line winds, when associated with a thunderstorm, are most frequently found with the gust front. These winds originate as downdraft air reaches the ground and rapidly spreads out, becoming a strong horizontal flow.

Table 58: Effects of Wind Speed

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	Roof surfaces peel off, windows break, trailer houses overturn
113+ mph	Roofs torn off houses, weak buildings and trailer houses destroyed, large trees uprooted

4.10.1 Windstorm Risk in Marshall County:

The overall probability that windstorms will occur each year in Marshall County is Highly Likely and its relative impact is Low and thus the overall risk for Marshall County is Little to No. The risk for windstorms for each of the cities is different based upon the location of the city within the County as the data was available based upon East or West Marshall County. In assessing windstorm data for the 2015 update, data from 2009 to 2014 Marshall County was used to determine the overall risk of windstorms. The table provided below provides the name of each of the cities in the County, the probability that windstorms will have an impact on that jurisdiction, the impact potential, as well as the overall risk calculated by the determine probability and impact ratings. Most notable are the cities in the western portion of the county including Alvarado, Argyle, Oslo, Warren, Stephen, Strandquist, and Viking.

Table 59: Windstorm Hazard Risk Assessment

Windstorm			
	Probability	Impact	Risk
Alvarado	Highly Likely	Low	Little to No
Argyle	Highly Likely	Low	Little to No
Grygla	Likely	Low	Little to No
Holt	Likely	Low	Little to No
Middle River	Likely	Low	Little to No
Newfolden	Likely	Low	Little to No
Oslo	Highly Likely	Low	Little to No
Stephen	Highly Likely	Low	Little to No
Strandquist	Highly Likely	Low	Little to No
Viking	Highly Likely	Low	Little to No
Warren	Highly Likely	Low	Little to No
Marshall County	Highly Likely	Low	Little to No
Total	Highly Likely	Low	Little to No

4.10.2 Windstorm History in Marshall County:

Windstorm history in Marshall County was obtained from the National Climatic Data Center. Records show high wind events in Marshall County in the years of 2009, 2010 and 2011. A comprehensive list of the last 50 years of data can be found in Appendix B. There have been three high wind events reported in Marshall County in the past five years.

According to the National Oceanic Atmospheric Administration, the most recent report of high wind in Marshall County was on October 7, 2011. This high wind event affected both east and west Marshall County. It was reported that in Marshall County, a strong early October low-pressure system tracked north-northeast through the western high plains into southern Manitoba, with a tight surface pressure gradient to its east. As clearing spread into eastern North Dakota and portions of northwest Minnesota on the 7th, very strong wind gusts mixed down to the surface. Many stations experienced sustained winds around 40 mph or wind gusts greater than 58 mph. The highest wind gust was 71 mph, which was reported near Northwood, North Dakota and Euclid, Minnesota. The strong winds resulted in many downed trees, scattered power outages, and minor shingle damage to homes. There was no reported deaths/injuries or crop/property damage from this event.

Another high wind event which occurred in west Marshall County was on October 27, 2010. According to the National Oceanic Atmospheric Administration, a strong area of surface low pressure over central Minnesota on Tuesday morning (26th) continued to deepen and move north during the day. This ended up being a record low-pressure event and also created an intense pressure gradient across eastern North Dakota and portions of northwest and west central Minnesota. Wind speeds across many reporting sites

had sustained speeds of 40 mph or wind gusts over 58 mph. There was no reported deaths/injuries or crop/property damage from this event.

Additionally, in January 2009, it was reported from the National Oceanic Atmospheric Administration that a high wind event affected both east and west Marshall County. The storm event was described as an area of surface low pressure which moved across southern Canada, with gusty northwest winds in its wake. Wind speeds were sustained around 40 mph with a few locations experiencing gusts to 58 mph. There was no reported deaths/injuries or crop/property damage from this event.

Table 60: Windstorms in Marshall County from 2009-2014

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	01/31/2009	13:21	CST-6	High Wind	40 kts. MS	0	0	0.00K	0.00K
EAST MARSHALL (ZONE)	EAST MARSHALL (ZONE)	MN	01/31/2009	16:00	CST-6	High Wind	40 kts. MS	0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	10/27/2010	14:54	CST-6	High Wind	50 kts. MG	0	0	0.00K	0.00K
EAST MARSHALL (ZONE)	EAST MARSHALL (ZONE)	MN	10/07/2011	16:00	CST-6	High Wind	35 kts. MS	0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	10/07/2011	16:00	CST-6	High Wind	35 kts. MS	0	0	0.00K	0.00K
Totals:								0	0	0.00K	0.00K

Damages to crops from windstorms is another data point that can help determine the vulnerability of a county to windstorms. Included in the 2014 Minnesota All-Hazard Mitigation Plan was the indemnity claims for wind on crops from 2000-2013. Marshall County had \$ \$897,761 in claims during this timeframe.

4.10.3 Mitigation Actions for Windstorms in Past Five Years in Marshall County:

Mitigation actions relating to windstorms in the January 2008 mitigation plan for Marshall County included working with the electric companies in Marshall County to look at power infrastructure in order to prevent massive outages from ice and windstorms. A goal of this was to identify areas prone to power loss and correlate to strategies that reduce this hazard.

4.10.4 Vulnerability of Jurisdictions within Marshall County:

According to the 2014 Minnesota All-Hazard Mitigation Plan it was determined that the probability of a high wind event in Minnesota is at least annually. Most occur during the months of April through September. This recurrence is expected to remain relatively stable, although there will be year-to-year fluctuations. Long-term changes in weather patterns may also influence the number of windstorms that occur. The state hazard mitigation plan determined a vulnerability ranking for each county in Minnesota. Marshall County

was ranked among about a third of the counties in the state with a Low overall ranking. Low ranking according to the state plan indicated this ranking reflects less vulnerability based on, in general, less than one wind event per year and compared to building exposure. Relatively low building exposure accounts for counties with more than one wind event. It was indicated that Marshall County has 0.79 events per year greater than 65 knots. The building exposure was listed as \$583,449,000.

Windstorms have a higher likelihood of occurring in the summer months, so individuals partaking in outdoor recreational activities or working in fields in agricultural jobs would be at an increased risk to windstorms.

4.10.5 Windstorm and Climate Change in Marshall County:

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. Lack of high-quality long-term data sets make an assessment of changes in wind speeds very difficult (Kunkel, K.E. et al, 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 (NCA, page 26). 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” (NCA, page 59).

4.10.6 Relationship to Other Hazards in Marshall County:

Windstorms are related to summer storms and tornadoes, which both are highly likely to occur in Marshall County and there is an extensive history of summer storms and tornadoes occurring each year in Marshall County.

4.11 Hail

Hail was not identified in the prior hazard mitigation plan from January 2008 for Marshall County, as a separate hazard, but was included in the “summer storm” hazard. It was identified as a separate hazard to be included in this 2015 plan update. Additionally, analyses are included in this 2015 plan update to include an in-depth look at what hail is, the history of it within Marshall County and the potential it has to impact county residents. A definition of hail is provided prior to taking a closer look at the effect hail has on Marshall County in order to provide the reader with knowledge of the hazard.

A hailstorm is an outgrowth of severe thunderstorms and develops within an unstable air mass. Warm moist air rises rapidly into the upper atmosphere and subsequently cools, leading to the formation of ice crystals. These are bounced about by high-velocity updraft (or strong) winds and accumulate into frozen droplets, falling as precipitation after developing enough weight (FEMA, 1997).

Hailstorms cause millions in property, livestock, and crop damage each year. Severe hailstorms cause considerable damage to buildings, automobiles, and airplanes. Significant property damage does not occur until hailstone size reaches about 1.5 inches in diameter. This size will cause damage to cars, windows, and siding. When hailstones get larger and approach three inches in diameter, roofs start to experience major damage. Combined property and crop damage annual totals for recent years in Minnesota were \$2.4 million (2012), \$817,000 (2011), and \$11.5 million (2010) (NCDC).

The National Weather Service (NWS) defines severe thunderstorms as those with downdraft winds in excess of 58 miles an hour and/or hail 1 inch in diameter or greater. While only about 10% of thunderstorms are classified as severe, all thunderstorms are dangerous because they produce numerous dangerous conditions, including one or more of the following: hail, strong winds, lightning, tornadoes, and flash flooding. The land area affected by individual hail events, an average of 15 miles in diameter around the center of the storm, is similar to the area affected by the parent thunderstorm. Hail risk at a point or over an area is a function of the target at risk (property or crop) and the hail frequency, intensity and size.

The size of hailstones varies and is a direct consequence of the severity of the thunderstorm. Hail quarter size (1 inch in diameter) or larger is considered severe. Hailstorms occur most frequently during the late spring and early summer, when the jet stream moves northward across the Great Plains. During this period, extreme temperature changes occur from the surface up to the jet stream, resulting in the strong updrafts required for hail formation.

4.11.1 Hail Risk in Marshall County:

The overall probability that hail will occur each year in Marshall County is highly likely and its relative impact is Low and thus the overall risk for Marshall County is Little to No. The risk for hail for each of the cities is different based on the data available by individual city. In assessing hail data for the 2015 update, data from 2009 to 2014 was used to determine the risk. The table provided below provides the name of each of the cities in the County, the probability that hail will have an impact on that jurisdiction, the impact potential, as well as the overall risk calculated by the determine probability and impact ratings. Most notable are the cities Viking, Warren and unincorporated Marshall County which all have a highly likely probability and Moderate risk that hail events will occur each year.

Table 61: Hail Hazard Risk Assessment

Hail			
City	Probability	Impact	Risk
Alvarado	Highly Likely	Low	Little to No
Argyle	Highly Likely	Low	Little to No
Grygla	Highly Likely	Low	Little to No
Holt	Likely	Low	Little to No
Middle River	Highly Likely	Low	Little to No
Newfolden	Highly Likely	Low	Little to No
Oslo	Likely	Low	Little to No
Stephen	Highly Likely	Low	Little to No
Strandquist	Highly Likely	Low	Little to No
Viking	Highly Likely	Moderate	Moderate
Warren	Highly Likely	Moderate	Moderate
Marshall County	Highly Likely	Moderate	Moderate
Total	Highly Likely	Low	Little to No

4.11.2 Hail History in Marshall County:

According to the 2014 Minnesota All-Hazard Mitigation Plan, in Minnesota, between 2008 and 2012 the month with the most hail was July, with August next. During these three months, 81% of the hail occurred; May had 32%, July had 28%, and June had 21%. The size of the hail reported is generally in the pea to dime-sized category, with several reports annually of baseball-size and larger.

The National Oceanic Atmospheric Administration (NOAA) provided the history of hail events in Marshall County. From 2009 to 2014, there have been 31 recorded events of severe hail events in Marshall County, which can be seen in the table below. Of these 31 hail events, the cities which have had the most occurrences of hail from 2009-2014 was Viking with 4 hail events and next was Warren with 3 events. The largest reported hail size was 2 inches reported in August 2014 in Thief Lake, however there was no reported crop or property damage from this event.

Table 62: Hail History in Marshall County from 2009-2014 from NOAA

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
BIG WOODS	MARSHALL CO.	MN	07/23/2009	19:38	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
WARREN	MARSHALL CO.	MN	07/23/2009	19:58	CST-6	Hail	0.88 in.	0	0	0.00K	0.00K
GATZKE	MARSHALL CO.	MN	07/23/2009	20:35	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
GRYGLA	MARSHALL CO.	MN	04/02/2010	09:05	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
VIKING	MARSHALL CO.	MN	05/28/2010	09:20	CST-6	Hail	0.88 in.	0	0	0.00K	0.00K
VIKING	MARSHALL CO.	MN	05/28/2010	09:30	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
FLORIAN	MARSHALL CO.	MN	06/21/2010	14:59	CST-6	Hail	0.75 in.	0	0	0.00K	0.00K
BIG WOODS	MARSHALL CO.	MN	06/24/2010	14:10	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
ALVARADO	MARSHALL CO.	MN	06/24/2010	14:38	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
ALVARADO	MARSHALL CO.	MN	06/26/2010	16:20	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
WARREN ARPT	MARSHALL CO.	MN	06/26/2010	16:45	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
MARCH	MARSHALL CO.	MN	06/26/2010	16:55	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
MARCH	MARSHALL CO.	MN	06/26/2010	17:00	CST-6	Hail	0.88 in.	0	0	0.00K	0.00K
STEPHEN	MARSHALL CO.	MN	07/03/2010	20:40	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
THIEF LAKE	MARSHALL CO.	MN	08/17/2010	16:25	CST-6	Hail	0.88 in.	0	0	0.00K	0.00K
THIEF LAKE	MARSHALL CO.	MN	08/17/2010	16:30	CST-6	Hail	2.00 in.	0	0	0.00K	0.00K
THIEF LAKE	MARSHALL CO.	MN	08/17/2010	16:30	CST-6	Hail	2.00 in.	0	0	0.00K	0.00K
VIKING	MARSHALL CO.	MN	08/17/2010	16:35	CST-6	Hail	1.25 in.	0	0	0.00K	0.00K
WARREN	MARSHALL CO.	MN	07/04/2011	17:31	CST-6	Hail	1.50 in.	0	0	0.00K	0.00K
BIG WOODS	MARSHALL CO.	MN	07/16/2011	22:15	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
GATZKE	MARSHALL CO.	MN	07/17/2011	20:00	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
NEWFOLDEN	MARSHALL CO.	MN	07/24/2011	18:00	CST-6	Hail	1.50 in.	0	0	0.00K	0.00K
ESPELIE	MARSHALL CO.	MN	07/24/2011	18:15	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
ARGYLE	MARSHALL CO.	MN	06/21/2012	17:00	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
VIKING	MARSHALL CO.	MN	07/04/2012	10:15	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
STEPHEN	MARSHALL CO.	MN	08/25/2012	00:49	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
ROSEWOOD	MARSHALL CO.	MN	07/24/2013	14:45	CST-6	Hail	0.75 in.	0	0	0.00K	0.00K
STRANDQUIST	MARSHALL CO.	MN	08/18/2013	18:20	CST-6	Hail	0.88 in.	0	0	0.00K	0.00K
NEWFOLDEN	MARSHALL CO.	MN	08/18/2013	19:02	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
MIDDLE RIVER	MARSHALL CO.	MN	09/02/2014	17:15	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
MIDDLE RIVER	MARSHALL CO.	MN	09/02/2014	17:20	CST-6	Hail	1.25 in.	0	0	0.00K	0.00K
Totals:								0	0	0.00K	0.00K

4.11.3 Mitigation Actions for Hail in Past Five Years in Marshall County:

There were no mitigation actions specified for hail in the January 2008 mitigation plan for Marshall County.

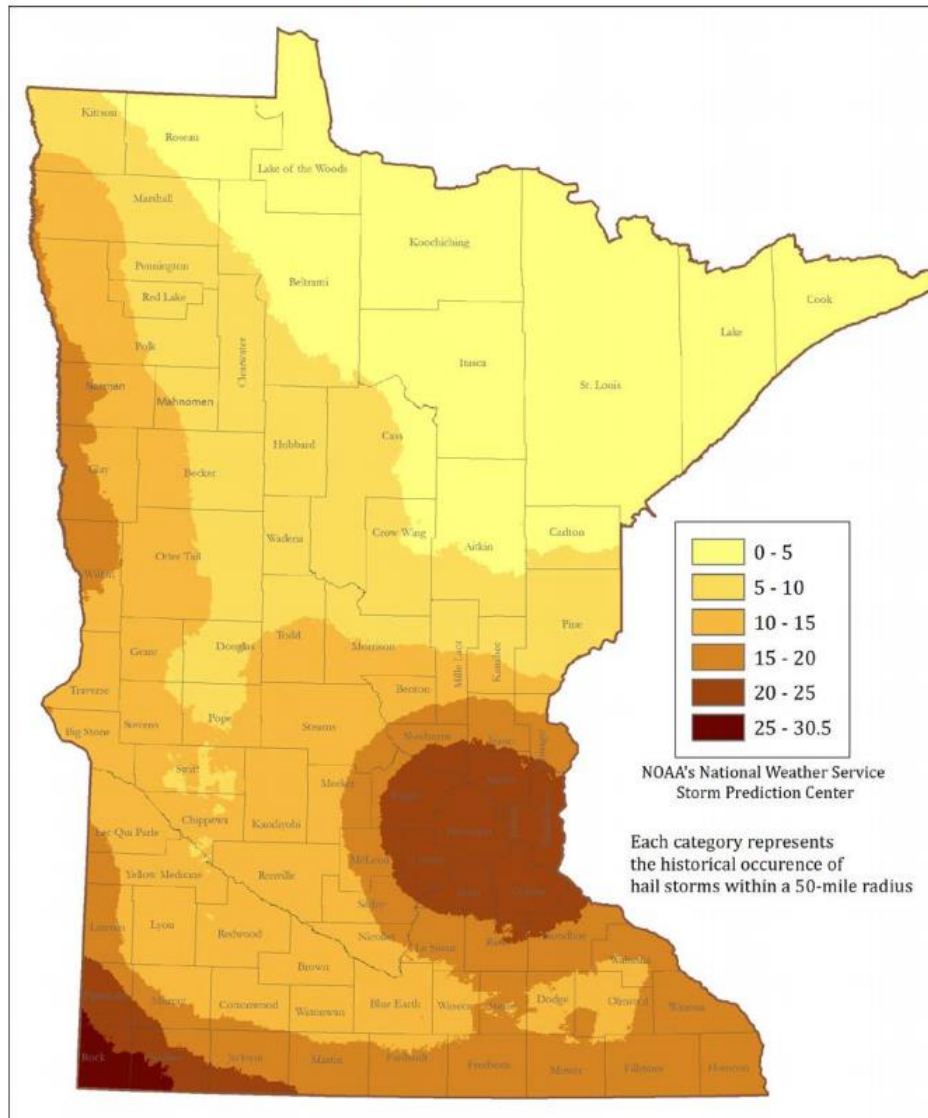
4.11.4 Vulnerability of Jurisdictions within Marshall County:

The following figure was provided by the 2014 Minnesota All-Hazard Mitigation Plan and depicts the severe hail event frequency by county, from 1955 to 2012. The figure shows that in Marshall County, the southwest portion of the county, which includes the city of Oslo, has experienced 15-20 severe hail events. The majority of the remainder of the western portion of the county has experienced 10-15 severe hail events. The majority of the eastern portion of the county has experienced 5-10 severe hail events. The very northeastern portion of the county has experienced the fewest, with 0-5 severe hail events from 1955-2012. This indicates the southwest portion of Marshall County is at the highest risk. In addition, the data provided from the National Oceanic Atmospheric Administration indicated that the cities of Viking, Warren and the unincorporated areas of Marshall County are at an increased risk of hail events with an extensive history.

The storm frequency maps were created using a GIS density estimation technique. This is sometimes known as a "hotspot" analysis. The GIS tool "smooth's" the data from discrete points to capture important patterns while leaving out noise or other fine-scale phenomena. While storms are recorded as discrete events at a particular point in space, their frequency in a region does not actually abruptly change at a county line. The frequency maps were created by using a circular "kernel" of data, continuously across a dataset, to calculate the "density" of storms in every "kernel". The result is a continuous surface of data, illustrating the high and low frequency of storms over a period of time.

Figure 19: Hail Event Frequency by County

Figure 36 Severe Hail Event Frequency, 1955-2012



The vulnerability of damage due to hail is statewide. The vulnerability ranking was also included in the 2014 Minnesota All-Hazard Mitigation Plan for each county in the state. The impact of Extreme Damage Due to Hail shows that impact due to one event may be very large. The assumption for ranking is that given the same size hail event the building exposure is the determining factor in determining vulnerability.

- High – building exposure over \$3 billion.
- Medium – building exposure is less than or equal to \$3 billion but exceeds \$1 billion.
- Low – building exposure is less than or equal to \$1 billion.

According to the 2014 Minnesota All-Hazard Mitigation Plan, Marshall County had an average of 9.19 hail events per year with a total of \$583,449,000 in building exposure. Overall, Marshall County is ranked Low for hail vulnerability.

4.11.5 Hail and Climate Change in Marshall County:

According to the 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 (NCA, 2013, p. 26). 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 (NCA, 2013, p. 59). The occurrence of very heavy precipitation has increased in Minnesota in recent decades and future projections also indicate this will continue (Interagency Climate Adaptation Team, 2013, p. 14). While it is unknown if this precipitation will occur during severe storms that produce hail, the possibility has not been ruled out.

4.11.6 Relationship to Other Hazards in Marshall:

Hail is related to summer storms and tornadoes as hail can occur as part of one of these other natural hazards and has a higher likelihood of occurring in the summer months in Marshall County.

4.12 Erosion

Erosion was not identified in the prior hazard mitigation plan from January 2008 for Marshall County, but was identified as one of the hazards to be included in this 2015 plan update. Additionally, analyses are included in this 2015 plan update to include an in-depth look at what erosion is, the history of it within Marshall County and the potential it has to impact county residents. A definition of erosion is provided prior to taking a closer look at the effect erosion has on Marshall County in order to provide the reader with knowledge of the hazard.

Erosion is a broad subject and is being addressed differently than in the previous version of the state mitigation plan. Coastal erosion along the Lake Superior and landslides were discussed in detail in the previous plan (Coastal erosion along Lake Superior will be discussed after the other geological hazards).

Streambank and bluff erosion were mostly associated with flood or heavy rain conditions. The perspective that caused a shift to look at erosion differently:

Rivers are still adjusting to late glacial events.

- Recent increases in flow lead to a more rapid adjustment.
- Certain reaches of rivers are more sensitive to changes in flow.

Areas that are well beyond and high above the flood plain are susceptible to episodic failure.

Human caused runoff and sediment add to the natural process.

- Policy makers and homeowners need to look beyond the flood plain and understand and predict bank and bluff failure along the entire meander belts of our rivers.

Erosion hazard as stated in the 1999 FEMA Riverine Erosion Hazard Mapping Feasibility Study, erosion hazard area is defined by Section 577 of National Flood Insurance Reform Act (NIFRA): "Erosion hazard area means, based on erosion rate information and other historic data available, an area of erosion or avulsion is likely to result in damage or loss of property or infrastructure within a 60 year period."

Stream banks are the portions of the river or stream channel which restrict lateral movement of water.

Stream bank erosion is a natural process, but the acceleration of this natural process leads to land loss,

stream channel instability, increased sediment, habitat loss and other adverse effects. EPA Stream Channel Erosion EPA, WARSSS, Channel Processes:

Bluffs are tall steep features distinguished from stream banks based on height. Bluffs are defined as features with greater than 10 feet of relief in 20 foot by 30 foot area. The vertical nature of bluffs makes them susceptible to sudden and catastrophic failure. (Day, Stephanie, 2013, Special Hazard Mitigation Risk Assessment of Near Channel Riverine Erosion Hazards in Blue Earth County – Streambanks, Bluffs and Ravines) During periods of moderate and high flow, bluffs are eroded by the river in deeply incised channels lacking a floodplain. Bluffs also fail due to landslides and mass wasting. The river removes the soils deposited by mass wasting and landslides. As a result the eroded, nearly vertical slope cannot stabilize and re-establish itself with vegetation.

Landslides – Mass Wasting

The USGS definition of landslides includes a wide range of ground movements, such as rock falls, deep failure of slopes, and shallow debris flows. Although gravity acting on an over-steepened slope is the primary reason for a landslide, there are other contributing factors:

- erosion by rivers create over steepened slopes
- rock and soil slopes are weakened through saturation by snowmelt or heavy rains
- excess weight from the accumulation of rain or snow, or from man-made structures may stress weak slopes to failure and other structures

Slope materials that become saturated with water may develop a debris flow or mud flow. The resulting slurry of rock and mud may pick up trees, houses, and cars, thus blocking bridges and tributaries causing flooding along its path.

The EPA defines mass wasting as: “The erosional processes associated with mass wasting include two primary types:

- shallow, fast movements of debris avalanche/debris torrents and mudflows that generally move only once, and
- slow, deep-seated slump/earthflow erosional processes that move intermittently over varying time scales in response to infrequent events and/or disturbance factors.

Erosion associated with mass wasting processes is extremely difficult to predict due to the episodic nature of climatic events that initiate movement. Often landslides occur many years following vegetation and land use changes due to complex interactions of root mass decay and soil saturation from major storms.” (EPA, Hillslope Processes: Mass Wasting)

Landslides often occur together with other major natural disasters, thereby exacerbating relief and reconstruction efforts.

Flows are a form of rapid mass movement by loose soils, rocks, and organic matter, together with air and water that form slurry flowing rapidly downhill. Flows are distinguished from slides by high water content and velocities that resemble those of viscous liquids.

Lateral spreads are large movements of rock, fine-grained soils (i.e., quick clays), or granular soils, distributed laterally. Liquefaction may occur in loose, granular soils, and can occur spontaneously due to changes in pore-water pressure or due to earthquake vibrations.

Falls and topples are masses of rocks or material that detach from a steep slope or cliff that free-fall, roll, or bounce. Movements are typically rapid to extremely rapid. Currents, tides, waves, and wind are natural factors that contribute to the rate of erosion.

Streambank Erosion/Channel Enlargement

Bank erosion takes place by two processes, channel migration and channel widening (Day, 2013): Enlargement of channels can be caused by combined processes of incision, bank erosion and direct modification by construction activities. Lateral erosion may occur in stable streams, but the point bar follows at the same rate, thus the stream does not get wider over time. This contrasts with enlargement, where the width of the stream gets wider over time due to lateral erosion, often concurrently on both banks. The results of enlargement are increased erosion from the stream bed and banks, increased deposition due to decreased shear stress and stream power, loss of habitat, increased water temperatures, and a shift in the evolutionary state of morphological stream types. Increased flows due to watershed changes, storm drains from urban runoff, power generation due to "ramping flows" from reservoir releases and contraction scour below culverts and bridges can all contribute to channel enlargement. Combined processes of incision, degradation, aggradation, and lateral accretion can be associated with enlargement. EPA, Channel Processes: Channel Enlargement

4.12.1 Erosion Risk in Marshall County:

The overall probability that erosion will occur each year in Marshall County is possible and its relative impact is Low and thus the overall risk for Marshall County is Little to No. The risk for erosion for each of the cities is different based on the data available by individual city. In assessing erosion data for the 2015 update, data from 2009 to 2014 was used to determine the risk. The table provided below provides the name of each of the cities in the County, the probability that erosion will have an impact on that jurisdiction, the impact potential, as well as the overall risk calculated by the determine probability and impact ratings. Most notable are the cities of Oslo and Stephen which both have a higher likelihood and a history of erosion.

Table 64: Erosion Hazard Risk Assessment

Erosion			
City	Probability	Impact	Risk
Alvarado	Possible	Low	Little to No
Argyle	Possible	Low	Little to No
Grygla	Possible	Low	Little to No
Holt	Possible	Low	Little to No
Middle River	Possible	Low	Little to No
Newfolden	Possible	Low	Little to No
Oslo	Highly Likely	Moderate	Moderate
Stephen	Highly Likely	Moderate	Moderate
Strandquist	Possible	Low	Little to No
Viking	Possible	Low	Little to No
Warren	Possible	Low	Little to No
Marshall County	Possible	Low	Little to No
Total	Possible	Low	Little to No

4.12.2 Erosion History in Marshall County:

According to the January 2008 Marshall County All Hazard Mitigation Plan, Oslo has a large flooding problems due to the close proximity of the Red River. There is a dike protecting Oslo, but portions of it need strengthening when flooding occurs. Extra soil cannot be permanently kept on the land due to subsidence/erosion concerns.

Wind erosion in Marshall County is a problem that contributes to the sediment blockages. It also contributes to loss of topsoil, increased maintenance costs for ditches and higher amounts of sediment in surface and groundwater supplies.

The previous plan also indicated that sedimentation, the deposit of eroded matter into ditches, rivers and streams, is a potential problem in Marshall County. Over time, this process will cause the volume flowing through a particular channel to increase. The channel also may narrow or become shallower as sediment is deposited. This causes flooding if left unchecked for too long. This process also renders dikes and levees endangered if they are not heightened and expanded on a regular basis. Removing sediment from a channel or ditch will help combat this, but care must be taken. If grass is not lining the sides of the waterway, erosion will increase. This is just sediment that will settle somewhere else. Because grasses grow slowly, people line the ditches with bales of straw. This is a good idea to slow down both the water flow and the erosion process, but if the bales are still there when winter comes, it becomes a hazard for snowmobiles. There are permits required before removing sediment out of certain places. The process can get extremely difficult at times.

Previous Problems

The January 2008 mitigation plan for Marshall County listed some previous problems related to erosion in the county. One was that the lagoon for the city of Stephen was leaking. Repairs need to be made or a contamination problem might surface. Other water quality issues brought forth by the Thief River Subwatershed of the Red Lake Watershed include the possible effects of subsurface drainage and the increase of tiling acres. Channel and streambank erosion are also a problem, as well as a high level of suspended/dissolved solids in local rivers. Poorer quality water has also been noted as coming from impoundments.

Subsidence concerns were listed as a previous problem. A constantly changing river has homes and land near it in danger of subsidence. Marshall County does not want to limit growth in the area, just regulate it to avoid future problems. Big Woods Township has a problem with subsidence. Portions of the dike in Oslo have to be strengthened every year that flooding endangers the city. The extra soil cannot be kept on the dike permanently or subsidence would threaten it. The cemetery might also need to be relocated in Oslo. In Warren, the Snake River had been subsiding, causing people to lose portions of their backyard. The Thief River Subwatershed of the Red Lake Watershed has noted problems with subsidence including river and ditch bank failures, active erosion, culvert and road washouts and sedimentation. Problems have a high severity ranking and are widespread in extent. Problems may become worse immediately after the spring thaw or other large events.

4.12.3 Mitigation Actions for Erosion in Marshall County in the Past Five Years:

Mitigation actions related to erosion from the January 2008 mitigation plan for Marshall County included the Conservation Reserve Enhancement Program (CREP), which was started to reduce flooding in 51,000 acres in the Red River Valley. This program would let farmers and ranchers take land that is near a body of water, frequently flooded and generally unproductive and set it aside. Farmers receive an easement for a period of years for partaking in this program. By doing this, neighboring land not in the CREP program may also see a reduction in flooding damage and reap additional benefits, including water quality betterment, increased erosion control, reduced pollution levels and improved wildlife habitat. Wetland restorations will be a big part of this program, 24,000 acres are targeted to be restored in the Red River Valley. Since farmland rehabilitation after a flooding event can be high-priced, CREP is a good way to help the farmer with the additional expense.

In addition, the Red River Basin Riparian Project is a project that allows landowners in the Red River Basin in Minnesota and North Dakota to restore riparian corridors. Best Management Practices (BMPs) are used to accomplish this goal including native timber management, riparian forest buffer, grazing management and floodplain function restoration. Benefits of the project include: flood damage reduction, sediment removal, erosion control, an increase in biologic diversity, and water quality improvement.

The Marshall County Comprehensive Local Water Plan had an objective that promotes a soil loss limits program. The water plan was being updated at the time the previous mitigation plan was being written. Accomplishments listed in the water plan include suspended sediment monitoring on the Thief, Mud, Moose and Red Lake Rivers and starting the development of a potential soil loss limits ordinance (which is not yet completed).

The following goals and policies are listed in the Ten Year Updated Watershed Management Plan for the Middle-Snake-Tamarac Rivers Watershed District. Written in 1994, it was amended in 2004 and approved

by the MN Board of Water and Soil Resources in January, 2005. The District will work to implement measures to reduce erosion and sedimentation.

- Encouraging the adoption of land use practices which reduce soil loss.
- Using measures during construction which minimizes the loss of soil.
- Implementing measures to reduce stream bank and channel erosion
- Urging the counties to adopt a soil loss ordinance.

The Marshall County Comprehensive Local Water Plan also had an objective that strives to identify high priority erosion prone lands that have the potential to cause sedimentation. Methods to complete objective include computerizing the soil survey. It can be viewed on the web.

4.12.4 Vulnerability of Jurisdictions to Erosion in Marshall County:

Erosion is a problem for parts of Marshall County, the main problems stemming from the natural erosion/sedimentation process. Those most affected live or have property on or near a waterway. The problem of erosion can come on quite suddenly, with land dropping off with little or no warning. Farmers are also at an increased vulnerability because valuable cropland can be affected. As stated in the Community Profile section of this plan, 69.9 percent of the land in Marshall County is used for agricultural purposes. Sediment from erosion and run-off from agriculture is a statewide impact. The cities of Oslo and Stephen, have the highest possibility of erosion occurring, and are at an increased risk because of their proximity to rivers.

4.12.5 Erosion and Climate Change in Marshall County:

Changes in climate have the potential to impact erosion in Marshall County. Natural and human caused changes in hydrology play a critical role in the failure of stream banks, bluffs and ravines, as more water is entering ravines and rivers. Land use changes have increased runoff to rivers from urban and agricultural land uses while infiltration and evapotranspiration has been reduced. Vegetation changes, such as conversion of native prairie, pastures and wetlands to row crops and removing trees and vegetated buffers, reduce soil stability, reduce evapotranspiration and increase runoff. Drainage of surface and subsurface soils for crop production alter hydrology by increasing runoff. Climate and changing summer storm intensity also results in increased runoff and higher flows which worsening near channel erosion.

4.12.6 Relationship to Other Hazards in Marshall County:

Wildfires have the potential to be related to erosion. An uncontrolled wildfire can have many long-lasting effects that scar the land. The burned and smoldered land may take years to gain back the habitat and vegetation that once was a representation of it. This bare land is very prone to erosion. The addition of water to this naked landscape can cause landslides, flash floods, and mud flows to occur.

Erosion can also be related to other hazards such as summer storms, because they can cause excessive or prolonged periods of rain which can cause the ground to become susceptible to volumetric change. Drought also has the potential to be related to erosion, because periods of drought can cause shrinkage of soils, which can impact erosion. Additionally, flooding can cause excessive water on the ground which can cause volumetric changes and cause erosion.

4.13 Extreme Heat

Extreme heat was not identified as a separate hazard in the prior hazard mitigation plan from January 2008 for Marshall County, but was included in the “Drought and Extreme Heat” category. It was identified as a separate hazard to be included in this 2015 plan update. Additionally, analyses are included in this 2015 plan update to include a more in-depth look at what extreme heat is, the history of it within Marshall County and the potential it has to impact the county residents. A definition of extreme heat is provided prior to taking a closer look at the effect extreme heat has on Marshall County in order to provide the reader with knowledge of the hazard.

Extreme summer heat is the combination of very high temperatures and exceptionally humid conditions. If such conditions persist for an extended period of time, it is called a heat wave (FEMA, 1997). Heat stress can be indexed by combining the effects of temperature and humidity. The index estimates the relationship between dry bulb temperatures (at different humidity) and the skin’s resistance to heat and moisture transfer - the higher the temperature or humidity, the higher the “feels like” temperature. The major human risks associated with extreme heat are as follows:

- Heatstroke: Considered a medical emergency, heatstroke is often fatal. It occurs when the body’s responses to heat stress are insufficient to prevent a substantial rise in the body’s core temperature. While no standard diagnosis exists, a medical heatstroke condition is usually diagnosed when the body’s temperature exceeds 105°F due to environmental temperatures. Rapid cooling is necessary to prevent death, with an average fatality rate of 15%, even with treatment.
- Heat Exhaustion: While much less serious than heat stroke, heat exhaustion victims may complain of dizziness, weakness, or fatigue. Body temperatures may be normal or slightly to moderately elevated. The prognosis is usually good with fluid treatment.
- Heat Syncope: This refers to the sudden loss of consciousness and is typically associated with people exercising who are not acclimated to warm temperatures. Causes little or no harm to the individual.
- Heat Cramps: May occur in people unaccustomed to exercising in the heat and generally ceases to be a problem after acclimatization.
-

In addition to affecting people, severe heat places significant stress on plants and animals. The effects of severe heat on agricultural products may include reduced yields and even loss of crops.

Table 20: Heat Disorders

Danger Category		Heat Disorders	Apparent Temperatures (°F)
IV	Extreme Danger	Heatstroke or sunstroke imminent.	>130
III	Danger	Sunstroke, heat cramps, or heat exhaustion likely; heat stroke possible with prolonged exposure and physical activity.	105-130
II	Extreme Caution	Sunstroke, heat cramps, and heat exhaustion possible with prolonged exposure and physical activity.	90-105
I	Caution	Fatigue possible with prolonged exposure and physical activity.	89-90

4.13.1 Extreme Heat Risk in Marshall County:

The overall probability that extreme heat will occur each year in Marshall County is unlikely and its relative impact is Low and thus the overall risk for Marshall County is Little to No. The risk for extreme heat for each of the cities is different based on the data available for each individual city or portion of the county. In assessing extreme heat data for the 2015 update, data from 2009 to 2014 was used to determine the risk. The table provided below provides the name of each of the cities in the County, the probability that extreme heat will have an impact on that jurisdiction, the impact potential, as well as the overall risk calculated by the determined probability and impact ratings.

Table 65: Extreme Heat Hazard Risk Assessment

Extreme Heat			
City	Probability	Impact	Risk
Alvarado	Unlikely	Low	Little to No
Argyle	Unlikely	Low	Little to No
Grygla	Unlikely	Low	Little to No
Holt	Unlikely	Low	Little to No
Middle River	Unlikely	Low	Little to No
Newfolden	Unlikely	Low	Little to No
Oslo	Unlikely	Low	Little to No
Stephen	Unlikely	Low	Little to No
Strandquist	Unlikely	Low	Little to No
Viking	Unlikely	Low	Little to No
Warren	Unlikely	Low	Little to No
Marshall County	Unlikely	Low	Little to No
Total	Unlikely	Low	Little to No

4.13.2 Extreme Heat History in Marshall County:

The National Oceanic and Atmospheric Administration Storm Events Database indicated there have not been any excessive heat events in the past 50 years in Marshall County.

4.13.3 Mitigation Actions for Extreme Heat in the Past Five Years in Marshall County:

There were no mitigation actions stated in the previous plan from January 2008 for extreme heat.

4.13.4 Extreme Heat and Climate Change in Marshall County:

Minnesota's average temperature has increased more than 1.5 degrees F since record keeping began in 1895, with increased warming happening in recent decades (Interagency Climate Adaptation Team, p. 4). 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 (Kunkel, K.E. et al, 2013). The Midwest has experienced major heat waves and their frequency has increased over the last six decades (Perera et al. 2012). For the U.S., mortality increases 4% during heat waves compared with non-heat wave days (Anderson and 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 both increased summer temperatures and humidity (Schoof 2012).

4.13.5 Relationship to Other Hazards in Marshall County:

Excessive heat spanning over weeks or months could lead to drought conditions within Marshall County, which could have the potential to impact the agricultural industry. As noted in the Community Profile section of this plan, agriculture is a big industry within Marshall County and 69.9 percent of the land within the

county is used for agricultural purposes. Excessive heat conditions within the county could also have the potential to impact the health of the residents within the county. The elderly and children are the most vulnerable to heat-related illnesses and may not stay adequately hydrated.

4.14 Lightning

Lightning was not identified as a separate hazard in the prior hazard mitigation plan from January 2008 for Marshall County, but was included in the “Summer Weather” category. It was identified as a separate hazard to be included in this 2015 plan update. Additionally, analyses are included in this 2015 plan update to include a more in-depth look at what lightning is, the history of it within Marshall County and the potential it has to impact the county residents. A definition of lightning is provided prior to taking a closer look at the effect extreme heat has on Marshall County in order to provide the reader with knowledge of the hazard.

Lightning typically occurs as a by-product of a thunderstorm. In only a few millionths of a second, the air near a lightning strike is heated to 50,000°F, a temperature hotter than the surface of the sun. The hazard posed by lightning is significant. High winds, rainfall, and a darkening cloud cover are the warning signs for possible cloud-to-ground lightning strikes. While many lightning casualties happen at the beginning of an approaching storm, more than half of lightning deaths occur after a thunderstorm has passed. Lightning has been known to strike more than 10 miles from the storm in an area with clear sky above.

According to the National Oceanic and Atmospheric Administration (NOAA), 30 million points on the ground are struck on average each year in the U.S. (NOAA, Severe Weather 101).

Lightning is the most dangerous and frequently encountered weather hazard that most people in the United States experience annually. Lightning is the second most frequent killer in the U.S., behind floods and flash floods, with nearly 100 deaths and 500 injuries annually. The lightning current can branch off to strike a person from a tree, fence, pole, or another tall object. In addition, an electrical current may be conducted through the ground to a person after lightning strikes a nearby tree, antenna, or other tall object. The current may also travel through power lines, telephone lines, or plumbing pipes to damage property or fires.

4.14.1 Lightning Risk for Marshall County:

The overall probability that lightning will occur each year in Marshall County is unlikely and its relative impact is “No Impact” and thus the overall risk for Marshall County is Little to No. The risk for lightning for each of the cities is different based on the data available for each individual city or portion of the county. In assessing lightning data for the 2015 update, data from 2009 to 2014 was used to determine the risk. The table provided below provides the name of each of the cities in the County, the probability that lightning will have an impact on that jurisdiction, the impact potential, as well as the overall risk calculated by the determined probability and impact ratings.

Table 66: Lightning Hazard Risk Assessment

Lightning			
City	Probability	Impact	Risk
Alvarado	Unlikely	No Impact	Little to No
Argyle	Unlikely	No Impact	Little to No
Grygla	Unlikely	No Impact	Little to No
Holt	Unlikely	No Impact	Little to No
Middle River	Unlikely	No Impact	Little to No
Newfolden	Unlikely	No Impact	Little to No
Oslo	Unlikely	No Impact	Little to No
Stephen	Unlikely	No Impact	Little to No
Strandquist	Unlikely	No Impact	Little to No
Viking	Unlikely	No Impact	Little to No
Warren	Unlikely	No Impact	Little to No
Marshall County	Unlikely	No Impact	Little to No
Total	Unlikely	No Impact	Little to No

4.14.2 History of Lightning in Marshall County:

The National Oceanic and Atmospheric Administration Storm Events Database indicated there have not been any lightning events in the past 50 years in Marshall County.

4.14.3 Mitigation Actions for Lightning for Marshall County in the Past Five Years:

There were no mitigation actions listed in the previous plan from January 2008 for lightning.

4.14.4 Vulnerability of Jurisdictions for Lightning:

All humans and structures in the state are vulnerable to damage from lightning. Individual who partake in outdoor recreational activities, or those who work outside, especially during the summer months when lightning is more likely, are at an increased risk.

4.14.5 Lightning and Climate Change:

According to the Draft National Climate Assessment (NCA), the projected possible intensity and frequency of tornadoes, hail, and damaging thunderstorm winds, the conditions likely associated with lightning are uncertain (NCA, 2013, p. 26). Severe rain events are becoming more common and may include an additional risk of lightning.

4.14.5 Relationship to Other Hazards:

Lightning has the ability to create forest fires as well as local and large-scale power outages that can be damaging or disruptive to communication systems and electrical systems. These effects of lightning can

result in millions of dollars in damage each year. In the Midwest alone costs to repair power and communication systems amount up to \$65 million annually (Changnon and Kunkel, 2006).

4.15 Wildfires

Wildfires were identified and included in the prior hazard mitigation plan from January 2008 for Marshall County under the “Fire” hazard category. Wildfires were also identified as one of the hazards to be included in this 2015 plan update. Additionally, analyses are included in this 2015 plan update to include a more in-depth look at what wildfires are, the history of wildfires within Marshall County and the potential they have to impact the county residents. A definition of wildfires from the Minnesota All Hazard Mitigation Plan from 2014 is provided prior to taking a closer look at the effect wildfires have on Marshall County in order to provide the reader with knowledge of the hazard.

A wildfire is an uncontrolled fire spreading through vegetative fuels, exposing, and possibly consuming structures. Wildfires often begin unnoticed, spread quickly, and are usually signaled by dense smoke that may fill the area for miles around. Wildfires can be caused by humans through acts such as arson or campfires, or can be caused by natural events such as lightning. Wildfires can be categorized into four types. The first type is wildfires that are fueled primarily by natural vegetation in grasslands, brushlands, and forests. The second type is firestorms, which occur during extreme weather (e.g., high temperatures, low humidity, and high winds) with such intensity that fire suppression is virtually impossible. These events typically burn until the conditions change or the fuel is exhausted. The third type is interface or intermix fires that occur in areas where both vegetation and structures provide fuel. The fourth and final type are prescribed fires and prescribed natural fires which are intentionally set or natural fires that are allowed to burn for beneficial purposes.

4.15.1 Wildfire Risk in Marshall County:

The overall probability that wildfire will occur each year in Marshall County is likely and its relative impact is Moderate and thus the overall risk for Marshall County is Moderate. The risk for wildfire for each of the cities is different based on the data available by individual city. In assessing wildfire data for the 2015 update, data from 2009 to 2014 was used to determine the risk. The table provided below provides the name of each of the cities in the County, the probability that wildfires will have an impact on that jurisdiction, the impact potential, as well as the overall risk calculated by the determined probability and impact ratings. Most notable are the cities in the western portion of the county including Alvarado, Argyle, Oslo, Warren, Stephen, Strandquist, and Viking.

Table 67: Wildfire Risk by City in Marshall County

Wildfire			
City	Probability	Impact	Risk
Alvarado	Likely	Moderate	Low
Argyle	Likely	Moderate	Low
Grygla	Unlikely	Low	Little to No
Holt	Unlikely	Low	Little to No
Middle River	Unlikely	Low	Little to No
Newfolden	Unlikely	Low	Little to No
Oslo	Likely	Moderate	Low
Stephen	Likely	Moderate	Low
Strandquist	Unlikely	Low	Little to No
Viking	Unlikely	Low	Little to No
Warren	Likely	Moderate	Low
Marshall County	Likely	Moderate	Low
Total	Likely	Moderate	Low

4.15.3 History of Wildfires in Marshall County:

According to the Minnesota All Hazard Mitigation Plan, there was an average of 28 wildfires per year and an average of 134 acres burned per year. This is based upon data from October 14, 2003 to October 13, 2013. The total cost from 2003 to 2013 was \$1,093,249.

According to the National Climatic Data Center (NCDC), there has been one wildfire in western Marshall County in October 2012. The cities in the western portion of the county including Alvarado, Argyle, Oslo, Warren, Stephen, Strandquist, and Viking. There were no deaths, or injuries and no damage incurred during this wildfire according to the NCDC. Details of this event were provided by the NCDC and indicated a fire which started in Marshall County on September 30th became a wildfire on Tuesday October 2nd, when south winds increased dramatically. Dry conditions brought on by the drought made burn conditions extremely volatile. The south winds increased in the morning and gusted from 40 to 50 mph by afternoon. The fire consumed over twelve square miles and led to the evacuation of over 400 people from Karlstad, Minnesota. Seven homes, two garages, a warehouse, and numerous other outbuildings were burned in the fire. One fireman battling the blaze suffered from heat exhaustion. The fire was 95 percent contained by Wednesday, October 3rd.

Table 68: History of Wildfires

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrtyD	CrD
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	10/02/2012	07:00	6 CST-	Wildfire		0	0	0.00K	0.00K

4.15.4 Presidential Declared Disasters for Wildfire

There are no reported presidential declared disasters related to fire in Marshall County.

4.15.5 Mitigation in the Past Five Years for Marshall County:

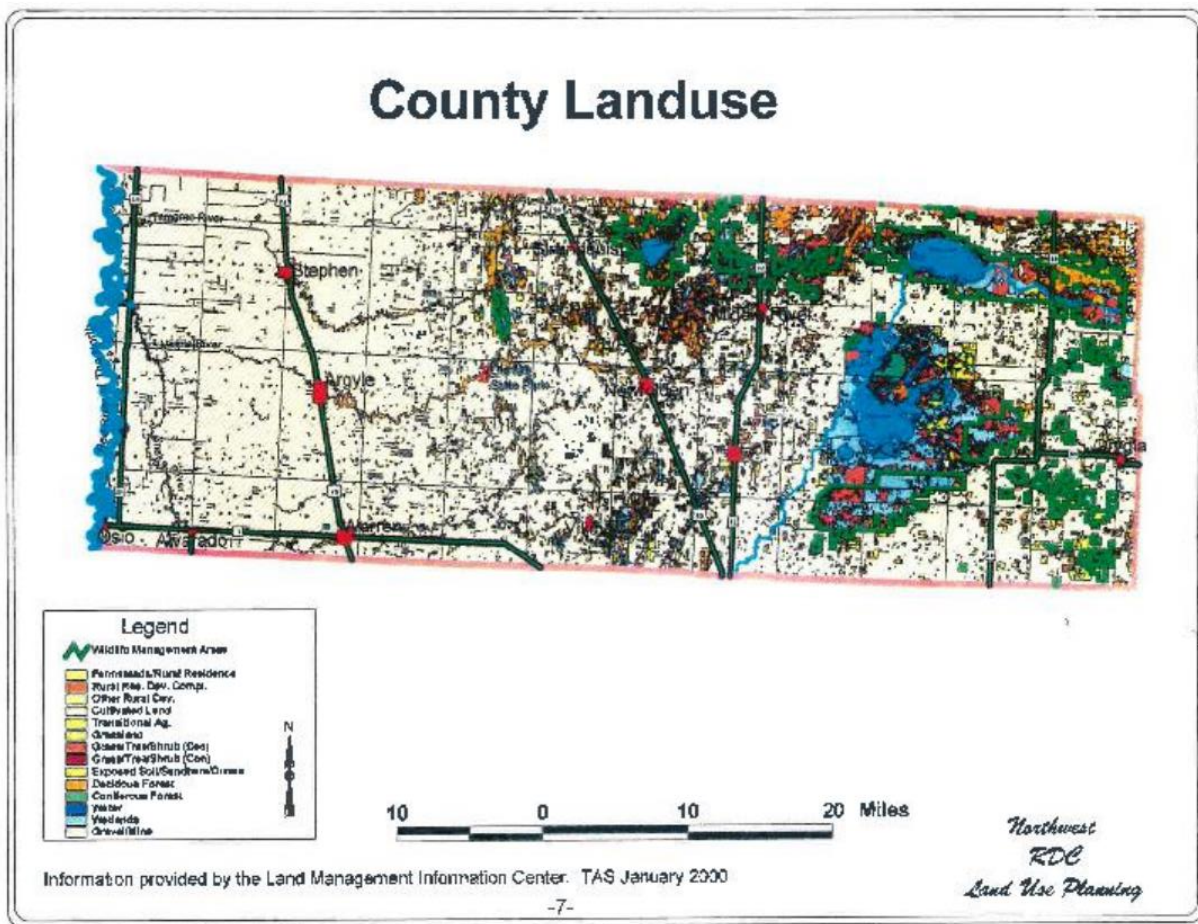
Mitigation actions for fire from Marshall County's January 2008 All Hazard Mitigation Plan stated the mitigation action for fire was to search for available funding to locate available grants to replace necessary equipment and utilize county-wide resources and strengthen response. Mitigation actions for wildfire from Marshall County's January 2008 All Hazard Mitigation Plan stated the mitigation action for wildfire was to minimize the amount of fuel in fire-prone areas. The Minnesota Department of Natural Resources (DNR) has also adopted the Firewise Program. As more people build homes in the forests and fields of Minnesota, firefighters are less able to protect people's assets while combating a wildfire. The main view of this program is to protect homes from fire by having the communities resolve potential problems before these problems become fire hazards. Such mitigation activities include thinning of trees, road improvement, and the introduction of additional fire hydrants to deficient areas.

4.15.6 Vulnerability of Jurisdictions within Marshall County:

The following factors contribute significantly to wildfire behavior: topography, and weather. With regards to topography, as slope increases, the rate of wildfire spread increases. South facing slopes are also subject to greater solar radiation, making them drier and thereby intensifying wildfire behavior. However, ridge tops may mark the end of wildfire spread, since fire spreads more slowly or may even be unable to spread downhill. Regarding wildfire, the most variable factor affecting wildfire behavior is the weather. Important weather variables are temperature, humidity, wind, and lightning. Weather events ranging in scale from localized thunderstorms to large fronts can have major effects on wildfire occurrence and behavior. Extreme weather, such as high temperatures and low humidity, can lead to extreme wildfire activity. By contrast, cooling and higher humidity often signals reduced wildfire occurrence and easier containment.

According to the land use map for Marshall County, there is higher vulnerability to potential wildfires in the eastern portion of the county where there are more forests and grasslands which could potentially be the source of a wildfire or be burned in the path of a wildfire. The cities which are in the eastern portion of the county and potentially more vulnerable are Grygla, Holt, Middle River, and Newfolden and unincorporated areas of the county.

Figure 21: Land Use in Marshall County



4.15.7 Wildfire and Climate Change in Marshall County:

According to the 2014 National Climate Assessment, temperatures are predicted to rise in the state of Minnesota into mid-century and this could lead to more extreme heat events. The increase in the number of extreme heat events could increase loads on electrical grids, causing increasing possibility of structural fires due to overloaded electrical grids. In addition, lightning strikes can cause structural fires and several types of extreme weather events have already increased in frequency and/or intensity due to climate change, and further increases are projected, according to the 2014 National Climate Assessment.

According to the Minnesota All Hazard Mitigation Plan from 2014 and information provided by local representatives, droughts and associated fires have been happening throughout Minnesota's history. While there was no apparent change in drought duration in the Midwest over the past century (Dai 2010), the average number of days without precipitation is projected to increase in the future (Kunkel, K.E. et al, 2013). Temperatures are predicted to rise, 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 lead to changes in forest composition and/or distribution. The northern boreal forest may give way to more deciduous forests or grassland, with a period of dying or diseased trees during

the transition. This weather fluctuation can lead to dry conditions that may cause increased fire risk in both grassland and forest environments. National and global studies agree that wildfire risk will increase in the region, but few studies have specifically looked at wildfire potential in the assessment area. At a global scale, the scientific consensus is that fire risk will increase by 10 to 30 percent due to higher summer temperatures (IPCC 2007).

4.15.8 Relationship to other Hazards in Marshall County:

Wildfires are associated with other hazards such as summer storms, flooding and drought. As a natural hazard, a wildfire is often the direct result of a lightning strike from a summer storm that may destroy personal property and public land areas, especially on state and national forest lands. Drought is an associated hazard because drought conditions cause high temperatures and dry conditions, which can increase the risk of fires. Drought risk potential is equally as likely in all of the cities throughout the county.

An uncontrolled wildfire can have many long-lasting effects that scar the land. The burned and smoldered land may take years to gain back the habitat and vegetation that once was a representation of it. This bare land is very prone to. The addition of water to this naked landscape can cause landslides, flash floods, and mudflows to occur.

4.16 Structural Fires

Structural fires were identified and included in the prior hazard mitigation plan from January 2008 for Marshall County and was also identified as one of the hazards to be included in this 2015 plan update. Additionally, analyses are included in this 2015 plan update to include a more in-depth look at what structural fires are, the history of structural fires within Marshall County and the potential they have to impact the county residents. A definition of structural fires is provided by the Minnesota All Hazard Mitigation Plan from 2014 is provided prior to taking a closer look at the effect structural fires have on Marshall County in order to provide the reader with a knowledge of the hazard.

According to the Minnesota All Hazard Mitigation Plan from 2014, structural fires have many causes: cooking, heating, open flame and arson are the typical leading causes each year. Other causes include careless smoking, misuse of materials, improper storage, equipment/appliance malfunctions, improper building wiring, industrial mishaps, and instances such as train derailments or transportation collisions.

4.16.1 Structural Fire Risk in Marshall County:

While the probability of structural fires in Marshall County is highly likely, its relative impact is Moderate, and thus the overall risk for fires in Marshall County is Moderate. The risk for fires for each of the cities is different and was determined based upon the specific data collected and outlined in the history section of this hazard profile. In assessing fires for the 2015 update, data from 2009 to 2014 was used to determine the risk for Marshall County including each of the cities and the county as a whole. Most notable are the cities of Grygla, Middle River and Oslo, as they are at moderate risk of fire because of the history of structural fires which have caused extensive damage to these cities. The table provided below provides the name of each of the cities in the County, the probability that fire will have an impact on that jurisdiction, the impact potential, as well as the overall risk calculated by the determine probability and impact ratings.

Table 69: Structural Fire Hazard Risk Assessment

Structural Fires			
City	Probability	Impact	Risk
Alvarado	Likely	Moderate	Moderate
Argyle	Likely	Low	Little to No
Grygla	Highly Likely	Moderate	Moderate
Holt	Possible	Low	Little to No
Middle River	Highly Likely	Moderate	Moderate
Newfolden	Likely	Moderate	Moderate
Oslo	Highly Likely	Moderate	Moderate
Stephen	Likely	Low	Little to No
Strandquist	Possible	Low	Little to No
Viking	Likely	Moderate	Moderate
Warren	Likely	Moderate	Moderate
Marshall County	Likely	Moderate	Moderate
Total	Highly Likely	Moderate	Moderate

The 2015 update utilized the frequency X consequence ($R = FC$) formula and each jurisdiction has its own unique risk score based on the 28 points of data analyzed. The risk determined for the 2015 update represents a significant change from the previous plan. The last plan update was done in January 2008 and indicated that fire had the potential to have a limited impact on Marshall County and no significant threat is posed. This meant that the hazard was found to occur once a year or more and could have limited impact on single or multiple sites in Marshall County. The 2015 update indicated Fire has a highly likely probability and a Moderate impact and risk on Marshall County.

4.16.2 Fire History in Marshall County:

The table below outlines the historical structural fires that have taken place in Marshall County and its participating jurisdictions from the Minnesota Department of Public Safety. The data was provided by the annual Fire in Minnesota Report, and is based on numbers provided by Minnesota fire departments. The report includes information on fire causes, fatalities and trends within these categories. More information is below that was provided from the 2013 Fire in Minnesota Report.

Causes

The report states that in the past five years, cooking caused the largest percentage of structure fires (48 percent) with heating and open flame as the second and third leading causes. Cooking, heating and open flame accounted for 68 percent of total structure fires with known causes. Fires in residential spaces represent 76 percent of all structure fires and 94 percent of fire deaths in structures. Seventy-four percent of civilian injuries occurred in residential fires.

Fatalities

Historically, Minnesotans have been at greatest risk of fire death and injury in their own homes. In 2013, 73 percent of fire deaths and 74 percent of civilian injuries occurred in residential settings. Ninety-four percent of structural fire deaths were in residential property. The presence or absence of working smoke alarms is often a factor in fire fatalities. In 12 percent of fire deaths occurring in dwellings, smoke alarms were not present or not working. In 58 percent of residential deaths, it was not known whether alarms were present or functioning.

The table below outlines the historical structural fires that have taken place in Marshall County from the Minnesota Department of Public Safety. One can see that the average loss per fire was greatest in 2013 with an average loss of \$14,597. Additionally, one can see that 2012 was a year with the highest number of fire and other runs in the past 7 years.

Table 70: Structural Fire Data for Marshall County from 2007 to 2013

Year	Fire Runs	Other Runs	Total Loss	Fire Rate	Average Loss per Fire	Fire Deaths
2013	56	144	\$671,450	218	\$14,597	0
2012	129	191	\$956,150	101	\$9,658	1
2011	99	149	\$253,100	135	\$3,420	0
2010	82	115	\$328,000	147	\$4,824	0
2009	59	107	\$104,300	189	\$1,968	0
2008	28	22	\$64,350	318	\$4,022	0
2007	92	121	\$953,900	130	\$12,388	0

Source: Fire In Minnesota Report from the State Fire Marshall for years 2007-2013

The table below provides the data by Fire Department within Marshall County as well as the number of fires, non-fires and dollar loss per fire department. One can see the Warren Fire Department responded to the most fires with a total of 10 fire responses. Argyle Fire Department responded to the most non-fires, with a total of 62 non-fire responses. The Oslo Fire Department had the largest dollar loss, with a total of \$345,000.

Table 71: Fire Department Responses and Dollar Loss as Reported Via Minnesota Fire Incident Reporting System (MFIRS)

Fire Department	County	Fires	Non-Fires	Dollar Loss
Alvarado	Marshall	8	19	\$13,000
Argyle	Marshall	8	62	\$0
Grygla	Marshall	3	0	\$170,200
Middle River	Marshall	2	0	\$105,000
Newfolden	Marshall	7	9	\$17,050
Oslo	Marshall	8	12	\$345,000
Stephen	Marshall	7	21	\$5,200
Viking	Marshall	3	1	\$8,000
Warren	Marshall	10	25	\$8,000

Source: Fire in Minnesota Report from the State Fire Marshall for 2013

4.16.3 Presidential Declared Disasters: Fire

There are no reported presidential declared disasters related to fire in Marshall County.

4.16.5 Mitigation Actions for the Past Five Years in Marshall County:

Mitigation actions for fire from Marshall County's January 2008 All Hazard Mitigation Plan stated the mitigation action for fire was to search for available funding to locate available grants to replace necessary equipment and utilize county-wide resources and strengthen response.

4.16.6 Vulnerability in Marshall County:

Structural failures, such as inadequate design, older homes, poor maintenance, natural gas explosion or human factors (neglect or human error), can lead to increased vulnerability to fires. Most structural failures occur within residential homes and low-occupancy buildings where there are fewer people around to notice serious issues that could lead to a collapse or fire. There have been some structural collapses involved in commercial and industrial facilities that have caused numerous fatalities and injuries, but such incidents are rare and are usually due to overloading or design flaws. However, the majority of fatalities due to structure collapse involve residential structures.

Structural fires have the potential to cause extensive damage and dollar loss to critical infrastructure within the county. Citizens, who are elderly, are at an increased risk because if there is a fire, they may have difficulty getting out of their residence without assistance. As noted in the Community Profile section of this plan, the elderly population within Marshall County was 19.2% in 2010 and continues to grow. There is steady growth expected in the elderly population in Marshall County over the next 20 years.

4.16.7 Fire and Climate Change:

According to the 2014 National Climate Assessment, temperatures are predicted to rise in the state of Minnesota into mid-century and this could lead to more extreme heat events. The increase in the number of extreme heat events could increase loads on electrical grids, causing increasing possibility of structural fires due to overloaded electrical grids. In addition, lightning strikes can cause structural fires and several types of extreme weather events have already increased in frequency and/or intensity due to climate change, and further increases are projected, according to the 2014 National Climate Assessment.

4.16.8 Relationship to other Hazards in Marshall County:

Structural fires are associated with other hazards such as summer storms, flood and winter storms. Summer storms are related because lightning strikes may ignite a structural fire. Windstorms that result in structural damage to structures increases the fuel load, which may escalate the risk of a structural fire. Flood, tornado, and high winds may also cause structural fires in their aftermath. Downed power lines, natural gas leaks or other sources of ignition initiated by natural hazards may spark a fire in structures. Routes to structures may be restricted due to flooding or debris from storms.

Winter storms, such as blizzards or ice storms, may impair the movement of response vehicles and decrease response time to structural fires. The reduced response time could potentially increase the amount of damage. The entire county of Marshall is equally as likely to be moderately impacted by winter storms each year.

4.17 Hazardous Material

Hazardous Material was identified in the prior hazard mitigation plan from January 2008 for Marshall County and was also identified as one of the hazards to be included in this 2015 plan update. Additionally, analyses are included in this 2015 plan update to include a more in-depth look at what hazardous material is, the history of it within Marshall County and the potential it has to impact the county residents. A definition of hazardous material is provided prior to taking a closer look at the effect hazardous material has on Marshall County in order to provide the reader with a knowledge of the hazard.

Hazardous materials are materials that if released, can pose a threat to human health or the environment. Hazardous material releases can cause long/short term health effects, damage to property, expensive cleanup/contractor costs, serious injury, and even death. Hazardous materials are stored and transported throughout Minnesota and the Nation in various quantities. Hazardous materials are transported by various methods such as railcars, barges, air cargo and trucks. Hazardous materials incidents can occur in two ways: (1) a release from a bulk storage unit at a fixed facility, and (2) the accidental release of a hazardous material during handling. The handling of a hazardous material includes the transportation, off-loading, and physical handling of the hazardous material.

The release of a hazardous material during handling would most likely be the initial responsibility of the facility or carrier. If the facility or carrier could not contain the release, then resources would need to be mobilized to remediate the release. Once a hazardous material release is recognized, immediate action must be taken to respond to the release to preserve health and safety and reduce the impact to the neighboring community and the environment. Hazardous material releases in highly populated areas could result in either evacuation or “shelter-in-place” situations. A hazardous material release may be a rare occurrence, but one major release could have a significant impact on a region.

Fixed Facilities:

Hazardous materials being used or stored at industrial facilities and in buildings is defined as a *fixed facility* hazardous material release hazard. Fixed facilities include industrial facilities that store hazardous materials required for their processing or facilities that store hazardous materials that result from an industrial process. An uncontrolled release or mishandling of hazardous materials from a fixed facility may result in possible injury or fatality, severe financial loss or liability, contamination, and disruption of critical infrastructure.

Transport:

A hazardous material is a substance or material, which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated. Transported hazardous materials are classified into one of nine hazard classes. The hazard class is the category of a hazard assigned to a hazardous material according to 49 CFR 173 and the HMT. If a material falls into any of the following classes it is considered a hazardous material:

- Class 1 – Explosives
- Class 2 -- Gases
- Class 3 -- Flammable Liquids (and Combustible Liquids)
- Class 4 -- Flammable Solids; Spontaneously Combustible Materials; Dangerous when Wet Materials

- Class 5 -- Oxidizers and Organic Peroxides
- Class 6 -- Toxic Materials and Infectious Substances
- Class 7 -- Radioactive Materials
- Class 8 -- Corrosive Materials
- Class 9 -- Miscellaneous Dangerous Goods

In Marshall County, of the various modes of transporting hazardous materials, rail and truck are by far the most common means of shipment. These modes of transportation are detailed in the Community Profile section of this plan.

Truck:

Although rail transports larger gross tonnage of hazardous materials, the number of truck traffic counts carrying hazardous materials shipments is greater. This is due to the larger volumes involved in a single rail shipment. The majority of hazardous materials transport is conducted on Federal or State highways.

4.17.1 Hazardous Materials Risk in Marshall County:

While the probability for hazardous material releases is likely within Marshall County, its relative impact is Low, and thus the overall risk for hazardous material releases in Marshall County is Little to No. The risk for hazardous material release was determined based on specific data collected and outlined in the history section of this hazard profile. In assessing hazardous material releases for the 2015 update, data from 2009-2014 for the county was available by cities that have been affected. Most notable are the cities of Newfolden, Viking and Warren, which have a Low-risk potential based upon recent history of hazardous material releases in these cities. The table provided below provides the name of each of the cities in the County, the probability that hazardous material will have an impact on that jurisdiction, the impact potential, as well as the overall risk calculated by the determine probability and impact ratings.

Table 72: Hazardous Materials Risk by City for Marshall County

HAZMAT			
City	Probability	Impact	Risk
Alvarado	Unlikely	Low	Little to No
Argyle	Unlikely	Low	Little to No
Grygla	Unlikely	Low	Little to No
Holt	Unlikely	Low	Little to No
Middle River	Unlikely	Low	Little to No
Newfolden	Likely	Moderate	Low
Oslo	Unlikely	Low	Little to No
Stephen	Unlikely	Low	Little to No
Strandquist	Unlikely	Low	Little to No
Viking	Likely	Moderate	Low
Warren	Likely	Moderate	Low
Marshall County	Likely	Low	Low
Total	Likely	Low	Little to No

*Note frequency data was only available from 1982-2014

The 2015 update utilized the frequency X consequence ($R = FC$) formula and each jurisdiction has its own unique risk score based on the 28 points of data analyzed. The risk determined for the 2015 update represents a significant change from the previous plan. The 2015 update indicated there is Little to No overall risk for Marshall County for hazardous material. Whereas the last plan update was done in January 2008 indicated that hazardous had the potential to have a substantial major impact on Marshall County and a significant threat is posed. This meant that the hazard was found to occur once in five years and could have a substantial or major impact on single sites in Marshall County.

4.17.2 Hazardous Material History in Marshall County:

The data from Marshall County for hazardous material incidence from the Right to Know Network for the years of 2009-2014 was gathered as part of this report. During those years, there were a total of four hazardous material incidents resulting in no hospitalizations and or injuries. There were no reported fatalities, need for evacuation, or property damage. These four incidents took place in the cities of Viking, Warren and Newfolden. More recently in 2014, there was only one hazardous material incident in Marshall County, which occurred near the city of Warren. This incident did not result in any fatalities, hospitalizations or injuries and there was no reported property damage. The discharger for the incident was Viking Gas Transmission.

Source: The Right to Know Network provides data from the Emergency Response Notification System (ERNS) database reported to the National Response Center.

Previous Problems

There were previous problems related to hazardous materials listed in the January 2008 mitigation plan. One was anhydrous facility protection. It stated that there are some anhydrous tanks that are west of Newfolden near the road. Some people feel that the facility is unprotected. Valley Township also has an anhydrous plant in the area. Residents are concerned that meth manufacturing in the area might increase due to the facility. Additionally, many anhydrous facilities are going out of business, due to the price increase and the switch to a urea fertilizer.

Another problem listed in the previous mitigation plan was hazardous materials spill. It was stated that Newfolden is concerned about the possibility of a spill occurring from the railroad. Some citizens would like to know what is being hauled through the city. Other residents wonder about what trucks haul through the county. Additional methods of contamination include pipelines and fixed facilities, such as propane and anhydrous locales.

4.17.3 Presidential Declared Disasters: Hazardous Material

There have not been any reported presidential declared disasters related to hazardous material for Marshall County.

4.17.4 Mitigation Actions during the Past Five Years in Marshall County:

Mitigation actions for hazardous material and contamination from Marshall County's January 2008 All Hazard Mitigation Plan stated the mitigation action for hazardous material and contamination was to decrease transportation contamination and spill potential by addressing access and visibility issues caused by long or frequent railroad traffic. They also indicated they would reduce stationary structure contamination by addressing problems related to meth and mitigate noted city lagoon and water issues.

Current Strategies related to anhydrous facility protection from the January 2008 plan included the following:

- County law enforcement officials are informed about the manufacturing and creation of meth. Potential problem locations should be passed on to an officer for increased patrols. Any suspicious activity should immediately be reported to law enforcement.
- The Department of Agriculture does a great job of setting security measures for anhydrous facilities and enforcing rules to protect surrounding areas.
- Legislation passed to ban over-the-counter sales of tablets containing pseudoephedrine, which is used to manufacture meth. Medications such as Sudafed and Claritin-D are affected.
- The presence of anhydrous in a region means that there is a possibility of tampering due to the production of meth. Anhydrous is one of the chief ingredients, and there have been spills due to tank tampering. Meth is a large problem for Minnesota and the labs that produce the drug are dangerous and costly to clean up. Often, those that try meth are hooked from the first use. There has been a need to increase jail space in the region, partially due to the arrests from meth

Current strategies related to hazardous materials spills stated that the county emergency response personnel participate in annual exercises on a county-wide and beyond the scale that deals with a potential spill situations. It was also stated that vulnerable locales have been identified or are known by the Marshall County Emergency Operations Plan. Plans to deal with a large-scale spill are also documented. For more information, please see Marshall County Emergency Management.

The Emergency Planning and Community Right-to-Know Act (EPCRA), also known as SARA Title III, was enacted in November 1986 to enable state and local governments to adequately prepare and plan for chemical emergencies. Facilities that have spilled hazardous substances, or that store, use, or release certain chemicals are subject to various reporting requirements. Common EPCRA topics include: emergency planning; hazardous chemical inventory reporting; chemical information; toxic chemical release reporting; risk management plans, and the toxics release inventory (TRI) database. The TRI database includes facilities that manufacture (including importing), process, or otherwise use a listed toxic chemical above threshold quantities. Facilities covered by EPCRA must submit an emergency and hazardous chemical inventory form to the Local Emergency Planning Committee (LEPC), the State Emergency Response Commission (SERC) and the local fire department annually. This report, also called a Tier I or Tier II, includes basic information including facility identification; employee contact information for emergencies and non-emergencies; and site specific information including facility description, chemical types and descriptions, releases or incidents, and chemical storage capacity, capabilities, and locations.

4.17.5 Vulnerability in Marshall County:

Within Marshall County, there are areas that are more susceptible to hazardous material spills. Transportation routes, such as roadways and railways within Marshall County are more vulnerable. There are four freight railways that run through Marshall County: Burlington Northern Santa Fe Railroad, Northern Plains Railroad, Canadian Pacific Railroad, and Minnesota Northern Railroad. Trains and trucks can carry various hazardous material, which if there was a derailment or crash could pose a threat to those motorists or residents within the area. The areas within the county surrounding pipelines are also vulnerable. There are three pipelines that run through Marshall County: TransCanada, Enbridge, and Viking Gas Transmission. Land used for agricultural purposes also has the potential to be more vulnerable because of

hazardous material that may be used to treat the land.

4.17.6 Hazardous Material Release and Climate Change in Marshall County:

There is no documented link between hazardous material and climate change.

4.17.7 Relationship to other Hazards in Marshall County:

Hazardous material incidences can have an impact on public health. Any hazardous material release or spill has the potential to have an impact on public health or safety.

4.18 Invasive Species

Invasive Species was a new hazard identified to be included in the 2015 plan update for Marshall County. The prior plan from January 2008 for Marshall County did not include invasive species. Since invasive species is a new hazard, a definition is provided in order to orient the reader with a background of what invasive species are, what history they have in Marshall County and the potential invasive species and what their impact may have on the residents of Marshall County.

Invasive species are non-native organisms that pose a threat to an ecosystem, to the environment, to the economy, or to human health. They may be animals, plants, or microorganisms that usurp the habitats of native life forms, causing them to decline in population or to disappear from their natural environment. These organisms are introduced either accidentally or intentionally by human beings or their activities. Not all introduced species are invasive; however, an organism that is beneficial in one place may become a nuisance in another. Species described as “introduced” are not considered a threat to their new environment, whereas invasive species are regarded as pests.

4.18.1 Invasive Species Program:

To address the problems caused by invasive species, the 1991 Minnesota Legislature directed the Minnesota Department of Natural Resources (DNR) to establish the Invasive Species Program. The program is designed to implement actions to prevent the spread of invasive species and manage invasive aquatic plants and wild animals (Minnesota Statutes 84D). Most of the invasive species prevention and management activities are conducted or directed by staff from DNR's Division of Ecological and Water Resources – Invasive Species Program. In addition, the program hires approximately 150 seasonal staff during the summer to inspect boats at public water accesses and help implement management activities. In total, the equivalent of more than 25 full-time positions is focused on invasive species work. The DNR's Invasive Species Program addresses many species that are present in Minnesota, such as Eurasian watermilfoil, purple loosestrife, zebra mussels, and spiny water fleas. The program also attempts to prevent the introduction of invasive species that have the potential to move into Minnesota, for example, hydrilla and water chestnut. To do so, the program identifies potentially invasive species in other areas of North America and the world, predicts pathways of spread, and develops and implements solutions that reduce the potential for introduction and spread. Prevention activities are often undertaken in collaboration with other states, agencies, and partners with similar concerns. Prevention efforts today not only reduce the spread of invasive species, but also buy critical time needed for research and management that may provide long-term control solutions.

4.18.2 Factors that Make a Species Invasive:

In most cases, invasive species are very competitive, highly adaptive, and extremely successful at reproducing. Factors relating to the new environment, however, are also important. For example, an organism may have been held in check in its place of origin by predators; if its new environment lacks predators, there may be nothing to stop it spreading uncontrollably. A predatory animal in its natural environment may be part of a stable ecosystem, as prey animals have adapted to deal with it. In a new environment, where potential prey lacks these adaptations, it may threaten other species with extinction.

4.18.3 Invasive Species Risk in Marshall County:

The overall probability for invasive species within Marshall County is unlikely, its relative impact is low and thus the overall risk for invasive species within Marshall County is Little to No. The risk for invasive species in Marshall County is different for each city and was determined based upon the specific data collected and outlined in the history section of this hazard profile. In assessing invasive species for the 2015 update, data from 2009-2014 was used to determine the risk for Marshall County, including each of the cities and the county as a whole. Most notable is the city of Oslo with a possible probability, which is more than other cities in the county and is due to bodies of water within the city limits. The table provided below provides the name of each of the cities in the County, the probability that invasive species will have an impact on that jurisdiction, the impact potential, as well as the overall risk calculated by the determine probability and impact ratings.

Table 73: Invasive Species Risk by City in Marshall County

Invasive Species			
City	Probability	Impact	Risk
Alvarado	Unlikely	Low	Little to No
Argyle	Unlikely	Low	Little to No
Grygla	Unlikely	Low	Little to No
Holt	Unlikely	Low	Little to No
Middle River	Unlikely	Low	Little to No
Newfolden	Unlikely	Low	Little to No
Oslo	Possible	Low	Low
Stephen	Unlikely	Low	Little to No
Strandquist	Unlikely	Low	Little to No
Viking	Unlikely	Low	Little to No
Warren	Unlikely	Low	Little to No
Marshall County	Unlikely	Low	Little to No
Total	Unlikely	Low	Little to No

4.18.4 Invasive Species History in Marshall County:

According to the Department of Natural Resources Minnesota's natural resources are threatened by a number of invasive species such as zebra mussels, Eurasian watermilfoil, common buckthorn, and emerald

ash borer. Invasive species in Minnesota occur on land or in the water. The MN DNR works to help prevent the spread and promote the management of invasive species.

According to the Department of Natural Resources Designation of Infested Waters published on July 29, 2015, Marshall County, Minnesota has one designated infested water, which is the Red River. This is infested with the Zebra Mussel and affects multiple counties in the surrounding area. The city of Oslo lies on the Red River and would be the area of Marshall County most likely to be impacted by aquatic invasive species. Zebra mussels can also move to new waterways through downstream flow. The Red River infestation illustrates this type of AIS spread. In June, researchers in North Dakota found many larval zebra mussels, called veligers, at six sites on the Red River. On July 9, Fargo city staff found an adult zebra mussel attached to a water intake on the river. The infestation of the Red River is not surprising because the Otter Tail River in Minnesota, which flows into the Red River, has been infested with zebra mussels since 2012. Zebra mussels likely colonized the Red River by floating downstream during their early life stage when they are small and are carried by currents before they attach to hard objects.

4.18.5 Presidential Declared Disasters: Invasive Species

There have not been any presidentially declared disasters for invasive species for Marshall County.

4.18.6 Mitigation (Past 5 Years):

No mitigation actions for invasive species were listed in Marshall County's January 2008 All Hazard Mitigation Plan, although the Minnesota Department of Natural Resources has efforts in place to prevent and control invasive species. Efforts to prevent invasive species from becoming established in new areas focus on tighter import controls, checks on imported goods, and, where practical, subjecting goods and materials to treatment with insecticides or sterilization procedures. Control of species that have already become established can be difficult. The methods used can include pesticides for plants and insects, physical removal of large plants, culling of animal pests, and the introduction of natural predators for plants and small animals. The Emergency Manager provided an update with regards to the mitigation actions since the last plan. The Marshall County Soil and Water Conservation Office has put up educational signs at every boat access in Marshall County. They have also conducted public education with flyers, newsletters, and a poster board at the County Fair.

Aquatic Invasive Species (AIS) Prevention

The Aquatic Invasive Species Prevention is a Minnesota State Department of Natural Resources program created to prevent introductions of new invasive species into Minnesota. Another goal of this program is to prevent the spread of invasive species within Minnesota and reduce the impacts caused by invasive species in Minnesota's ecology, society and economy. The amount designated for each county is based on the number of watercraft trailer launches as well as the number of watercraft parking spaces within each county. Marshall County was allocated \$6,895.00 for 2014 and \$15,323.00 for 2015 and years following.

Aquatic Invasive Species Laws

Laws regarding Aquatic Invasive Species are in place to prevent the spread of aquatic invasive species. The laws are as follows:

- 21 days - When moving equipment from a lake or river, all visible zebra mussels, facet snails and aquatic plants must be removed whether dead or alive. Equipment must be dry for at least 21 days and AIS free before placing in another waterbody.

- Pull the Plug - All water draining devices must be removed or set to "open" when on public roads - including live-wells.
- Bait Disposal - Dispose of all unwanted bait in the trash, dumping unused bait on land or in the water is not legal.

4.18.7 Vulnerability:

A vulnerability with invasive species is how new invasive species are introduced to an area. Organisms can spread outside their native habitats through international trade and travel. Insects, fungi, and microorganisms can arrive on imported fruit and vegetables, on garden and houseplants, and in soil carried with these items. In some cases, imported garden plants themselves have become invasive. People can unwittingly carry microorganisms and even plant seeds from one country to another. Ships can carry a whole host of potentially harmful life forms, from marine organisms clinging to the sides or in ballast water to small mammals, such as rats and mice, inside the ship itself.

Many invasive species have been introduced deliberately. Animals kept as pets can, if allowed to breed in the wild outside their original environment, become a major threat to an ecosystem. Animals and plants have sometimes been brought to new environments for agricultural or other commercial purposes, only to become a major pest. Some organisms have been imported in an attempt to control other invasive species.

4.18.8 Invasive Species and Climate Change:

According to the Minnesota All Hazard Mitigation Plan from 2014, climate change will exacerbate a range of risks to the Great Lakes region, including changes in the range and distribution of important commercial and recreational fish species, increased invasive species, declining beach health, and harmful blooms of algae. Declines in ice cover will continue to lengthen the commercial navigation season (but also lead to increased danger in ice-based recreation activities.)

4.18.9 Relationship to other Hazards:

Applicability is unknown.

4.19 Dam / Levee Failure

Dam/Levee failure (stated as Flood Control Structure Failure in the previous plan) was identified in the prior hazard mitigation plan from January 2008 for Marshall County and was also identified as one of the hazards to be included in this 2015 plan update. Additionally, analyses are included in this 2015 plan update to include a more in-depth look at what dam/levee failure is, the history of it within Marshall County and the potential it has to impact the county residents. A definition of dam/levee failure is provided prior to taking a closer look at the effect dam/levee failure has on Marshall County in order to provide the reader with knowledge of the hazard.

Dams and levees are an important part of the infrastructure of Minnesota. Dams maintain lake levels and impound water for flood control, power production and water supply. Levees are used to increase cultivation in agriculture and to protect population and structures from floods. Both structures are artificial barriers that have the ability to impound water, wastewater, or any liquid-borne material for the purpose of storage or the control of water. The concern of profiling dams and levees as part of the flooding section is the damage that may result due to a failed structure or overtopping. There are many factors that affect the

impact of a failure such as how much liquid is being impounded, the location of structures and critical facilities, intended purpose and type of construction of the dam or levee. 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.

Dams are complicated structures, and it can be difficult to predict how a structure will respond to distress. The modes and causes of failure are varied, multiple, and often complex and interrelated, i.e., often the triggering cause may not have resulted in failure had the dam not had a secondary weakness. These causes illustrate the need for careful, critical review of all facets of a dam. (National Research Council, 1983).

A levee is any artificial barrier that will divert or restrain the flow of a stream or other body of water for the purpose of protecting an area from inundation by flood waters. Generally, a levee is subjected to water loading for a few days or weeks in a given year; unlike a dam that is retaining water most days in the same year.

A levee breach results when a portion of the levee breaks away, providing an opening for water to flood the landward side of the structure. Such breaches can be caused by surface erosion due to water velocities, or they can be the result of subsurface actions. Subsurface actions usually involve sand boils whereby the upward pressure of water flowing through porous soil under the levee exceeds the static pressure of the soil weight above it (i.e., under seepage). These boils can indicate instability of the levee foundation given the liquefied substrate below it, leading way to breaching. Levee overtopping is similar to dam overtopping in that the flood waters simply exceed the design capacity of the structure, thus flowing over the lowest crest of the system. Such overtopping can lead to erosion on the landward side which may then lead to breaching. In order to prevent this type landward erosion, many levees are reinforced or armored with rocks or concrete. The concern with levees is that they may fail when exposed to floodwaters for an unusually long period of time. The prolonged hydraulic forces may weaken the structure to the point of failure unless monitoring and reinforcement measures are being taken.

4.19.1 Dam/Levee Failure Risk in Marshall County:

The overall probability that dam/levee failure will occur each year in Marshall County is possible and its relative impact is Low and thus the overall risk for Marshall County is Little to No. The risk for dam/levee failure for each of the cities is different based on the data available by individual city and their proximity to dams with higher hazard potential. In assessing dam/levee failure data for the 2015 update, data from 2009

to 2014 Marshall County was used to determine the overall risk of dam/levee failure. The table provided below provides the name of each of the cities in the County, the probability that dam/levee failure will have an impact on that jurisdiction, the impact potential, as well as the overall risk calculated by the determine probability and impact ratings. Most notable is the city of Warren because of its proximity to dams with a higher hazard potential.

Table 74: Dam/Levee Failure Hazard Risk Assessment

Dam/Levee Failure			
City	Probability	Impact	Risk
Alvarado	Possible	Low	Little to No
Argyle	Possible	Low	Little to No
Grygla	Possible	Low	Little to No
Holt	Possible	Low	Little to No
Middle River	Possible	Low	Little to No
Newfolden	Possible	Low	Little to No
Oslo	Possible	Low	Little to No
Stephen	Possible	Low	Little to No
Strandquist	Possible	Low	Little to No
Viking	Possible	Low	Little to No
Warren	Possible	Moderate	Low
Marshall County	Possible	Low	Little to No
Total	Possible	Low	Little to No

4.19.2 Dam/Levee Failure History in Marshall County:

There was no record of dam or levee failure in Marshall County in the past five years. There are however three dams in Marshall County with a significant hazard rating. This is not the highest hazard rating, but is greater than the other dams in the county. These dams are the MCCREA 12, Warren Diversion and Warren Storage Dams.

- The Warren Storage Dam is located by Radium Township between the cities of Warrant and Viking north of 250th St.
- The Warren Diversion Dam is located in Warren by the Snake River south of Great Eastern and east of the Warren Riverside Golf Course.
- The MCCREA 12 Dam is located east of Warren on the corner of 240th St and 280th Ave.

The following table details all of the dams which are located in Marshall County. Additional information provided in this table is the identification number, the status of the dam and whether or not the dam is state regulated. Inspection dates and the date of the next inspection are also included so one can see if an inspection has been recently conducted to ensure safety. The owner of the dam and condition is also

stated. There are a total of 31 dams located in Marshall County. Of these 31, all but three have a low hazard rating. The three which have a significant hazard rating are the MCCREA 12, Warren Diversion and Warren Storage Dams

Table 75: List of Dams in Marshall County

DAM_NAME	NID_ID	Inspecting_Group	Status_of_Dam	STAT_E_REG	Next_Insp_Year	INSP_DATE	Owner	ConditionDate	ConditionAssessment	ConditionAssessmentDetail	HazardRating
EAST PARK WMA POND	MN00368	Dam Safety	Active	Y	2015	04/14/2010	SWCD of Marshall County	27-May-09	Satisfactory		Low
ECKVOLL WMA	MN00923	Dam Safety	Active	Y	2015	10/26/2007	MNDNR-Wildlife	16-Dec-14	Satisfactory		Low
ELM LAKE	MN00412	Dam Safety	Active	Y	2015	07/06/2007	MNDNR-Wildlife	28-May-09	Satisfactory		Low
LOST RIVER POOL	MN00924	Dam Safety	Active	Y	2015	08/27/2007	MNDNR-Fisheries	29-May-09	Fair		Low
MCCREA 12	MN01448	Dam Safety	Active	Y	2017	06/13/2013	WD of Middle - Snake - Tamarac Rivers	13-Jun-13	Satisfactory	Meets applicable hydrologic and seismic regulatory criteria	Significant
MIDDLE RIVER	MN00552	Exempt	Exempt - removed	N	Exempt	09/25/2001	MNDNR-Parks		Not Rated	Not under state jurisdiction	Low
MOOSE RIVER	MN01179	Exempt	Exempt - failed	N	Exempt	10/16/2008	MNDNR-Wildlife				

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DAM_NAME	NID_ID	Inspecting_Group	Status_of_Dam	STAT_E_REG	Next_Inspection_Year	INSP_DATE	Owner	ConditionDate	ConditionAssessment	ConditionAssessmentDetail	Hazard Rating
OLD MILL STATE PARK	MN00228	Exempt	Exempt - removed	N	Exempt	10/17/2008	MNDNR-Parks	23-Oct-08	Not Rated	Not under state jurisdiction	
POOL NO. 1	MN00641	Federal	Active-Fed	N	Federal		USF&W				Low
POOL NO. 10	MN00638	Federal	Active-Fed	N	Federal		USF&W				Low
POOL NO. 11	MN00637	Federal	Active-Fed	N	Federal		USF&W				Low
POOL NO. 14	MN00636	Federal	Active-Fed	N	Federal		USF&W				Low
POOL NO. 15	MN00635	Federal	Active-Fed	N	Federal		USF&W				Low
POOL NO. 17	MN00634	Federal	Active-Fed	N	Federal		USF&W				Low
POOL NO. 18	MN00633	Federal	Active-Fed	N	Federal		USF&W				Low
POOL NO. 19	MN00632	Federal	Active-Fed	N	Federal		USF&W				Low
POOL NO. 20	MN00624	Federal	Active-Fed	N	Federal		USF&W				Low
POOL NO. 21	MN00625	Federal	Active-Fed	N	Federal		USF&W				Low
POOL NO. 22	MN00626	Federal	Active-Fed	N	Federal		USF&W				Low
POOL NO. 23	MN00627	Federal	Active-Fed	N	Federal		USF&W				Low
POOL NO. 24	MN00628	Federal	Active-Fed	N	Federal		USF&W				Low
POOL NO. 25	MN00629	Federal	Active-Fed	N	Federal		USF&W				Low
POOL NO. 27	MN00630	Federal	Active-Fed	N	Federal		USF&W				Low
POOL NO. 3	MN00640	Federal	Active-Fed	N	Federal		USF&W				Low
POOL NO. 7	MN00639	Federal	Active-Fed	N	Federal		USF&W				Low
POOL NO. 8	MN00378	Federal	Active-Fed	N	Federal		USF&W				Low

DAM_NAME	NID_ID	Inspecting_Group	Status_of_Dam	STAT_E_REG	Next_Inspection_Year	INSP_DATE	Owner	ConditionDate	ConditionAssessment	ConditionAssessmentDetail	Hazard Rating
STEPHEN CITY	MN00352	Dam Safety	Active	Y	2016	04/18/2008	City of Stephen	27-May-09	Satisfactory		Low
TAMARAC RIVER R1	MN00889	Dam Safety	Active	Y	2016	04/14/2010	SWCD of Marshall County	28-May-09	Satisfactory		Low
THIEF LAKE	MN00218	Dam Safety	Active	Y	2016	04/12/2012	MNDNR-Wildlife	27-May-09	Fair		Low
WARREN DIVERSION	MN01351	Dam Safety	Active	Y	2017	06/13/2013	WD of Middle - Snake - Tamarac Rivers	13-Jun-13	Satisfactory	Meets applicable hydrologic and seismic regulatory criteria	Significant
WARREN STORAGE	MN01350	Dam Safety	Active	Y	2017	06/13/2013	WD of Middle - Snake - Tamarac Rivers	13-Jun-13	Satisfactory	Meets applicable hydrologic and seismic regulatory criteria	Significant

4.19.3 Mitigation Actions for Dam/Levee Failure in Past Five Years in Marshall County:

There were no mitigation actions from the January 2008 mitigation plan for Marshall County.

4.19.4 Vulnerability of Jurisdictions within Marshall County:

Residents residing or participating in recreation activities near the Warren Riverside Golf Course in the City of Warren or any residents located near the MCCREA 12 Dam or the Warren Storage Dam could be at an increased risk due to these dams having significant hazard ratings. However, dam and levee failure is sometimes unpredictable and any people within proximity to a dam, of which there are 31 throughout Marshall County, would be potentially vulnerable.

4.19.5 Dam/Levee Failure and Climate Change in Marshall County:

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 change the hydrograph, or expected flow pattern. Spillways are put in place on dams as a safety measure in the event of the reservoir filling too quickly. Spillway overflow events are a mechanism that also results in increased discharges downstream. 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 the dam construction.

4.19.6 Relationship to Other Hazards in Marshall County:

Dam or levee failures can have a greater environmental impact than that associated with a flood event. Large amounts of sediment from erosion would alter the landscape changing the ecosystem. Hazardous materials are carried away from flooded out properties and distributed throughout the floodplain. Industrial and agricultural chemicals and wastes, solid wastes, raw sewage, and common household chemicals comprise the majority of hazardous materials spread by flood waters along the flood zone, polluting the environment and contaminating everything they come in contact with, including the community's water supply. The soil loss from erosion and scouring would be significantly greater because of a large amount of fast moving water affecting a small localized area, which would likely change the ecosystem.

4.20 Water Supply Contamination

Water Supply Contamination was identified as a hazard in the prior hazard mitigation plan from January 2008 for Marshall County. It was identified to be included in this 2015 plan update. Additionally, analyses are included in this 2015 plan update to include a more in-depth look at what water supply contamination is, the history of it within Marshall County and the potential it has to impact the county residents. A definition of water supply contamination is provided prior to taking a closer look at the effect water supply contamination has on Marshall County in order to provide the reader with knowledge of the hazard.

Water supply contamination is the introduction of point and non-point source pollutants into public groundwater and/or surface water supplies. Microbiological and chemical contaminants can enter water supplies. Chemicals can leach through soils from leaking underground storage tanks, feedlots, improperly cased and managed wells and waste disposal sites. Pesticides from farm fields, manure from feedlots and contaminants from wastewater treatment plants can also be carried to lakes and streams during heavy rains or snow melt.

4.20.1 Water Contamination Risk in Marshall:

The overall probability that water contamination will occur each year in Marshall County is possible and its relative impact is Moderate and thus the overall risk for Marshall County is Low. The risk for water contamination for each of the cities is different based on the data available by individual city. In assessing

water contamination data for the 2015 update, data from 2009 to 2014 was used to determine the risk. The table provided below provides the name of each of the cities in the County, the probability that water contamination will have an impact on that jurisdiction, the impact potential, as well as the overall risk calculated by the determined probability and impact ratings. Most notable are the cities of Alvarado, Argyle, Oslo, Stephen, and Warren because of their proximity to potential contamination risks and/or the history of water contamination in that city.

Table 76: Water Contamination Risk by City in Marshall County

Water Contamination			
City	Probability	Impact	Risk
Alvarado	Likely	Moderate	Low
Argyle	Likely	Moderate	Low
Grygla	Unlikely	Low	Little to No
Holt	Unlikely	Low	Little to No
Middle River	Unlikely	Low	Little to No
Newfolden	Unlikely	Low	Little to No
Oslo	Likely	Moderate	Low
Stephen	Likely	Moderate	Low
Strandquist	Unlikely	Low	Little to No
Viking	Unlikely	Low	Little to No
Warren	Likely	Moderate	Low
Marshall County	Unlikely	Low	Little to No
Total	Possible	Moderate	Low

4.20.2 Water Supply Contamination History in Marshall County:

It was stated in the January 2008 Mitigation Plan for Marshall County that old landfills may pose a threat to Marshall County. Years back, landfills were not closed according to today's standards. Many chemicals that are illegal today were legal in years past. Some of these landfills have a danger of leaking and contaminating groundwater. The Minnesota Pollution Control Agency (MPCA) has a closed landfill program (CLP) that monitors and mitigates old landfills. Currently, Marshall County has no landfills on this list.

Additionally, in Marshall County, certain lakes and rivers have mercury warnings posted. Fish that come from these waters may be toxic to eat because they contain high levels of mercury. There are questions on whether animals that eat amounts of these fish become contaminated too. Mercury poisoning might occur from ingestion of the contaminated meat. Other items monitored in rivers, ditches and lakes include ammonia, biota types, chloride, fecal coliform, low oxygen, pH, turbidity, temperature and PCBs. Below is a list of the impaired waters in Marshall County from the Minnesota Pollution Control Agency:

- Aquatic life in the Tamarac River is threatened by biota.
- Aquatic life in the Snake River in Marshall County is threatened by low oxygen, turbidity and biota.

- The Red River is impaired because of mercury and PCBs.
- One body of water in Marshall County is impaired because of mercury.

Marshall and Polk Rural Water System 2014 Drinking Water Report

The Marshall and Polk Rural Water System issued the results of monitoring done on its drinking water for the period from January 1 to December 31, 2014. The Marshall and Polk Rural Water System services the cities of Alvarado, Oslo, Argyle, and Warren. The purpose of this report is to advance consumers' understanding of drinking water. The Marshall and Polk Rural Water System provides drinking water to its residents from groundwater sources. Four wells ranging from 171 to 419 feet deep that draw water from the Quaternary Buried Artesian Aquifer is one water source. Another water source is purchased treated water from the Grand Forks-Traill Water District, which obtains its water from 15 wells in the Elk Valley Aquifer. The Minnesota Department of Health has determined that the source (used to supply the drinking water detected levels which exceeded federal standards for TTHM (Total trihalomethanes). It was noted in this report that some people who drink water containing trihalomethanes in excess of the Maximum Contaminant Level over many years may experience problems with their liver, kidneys, or central nervous systems and may have an increased risk of getting cancer. Samples collected in June, September and December 2014 were below the Maximum Contaminant Level and the water system has returned to compliance levels.

City of Grygla

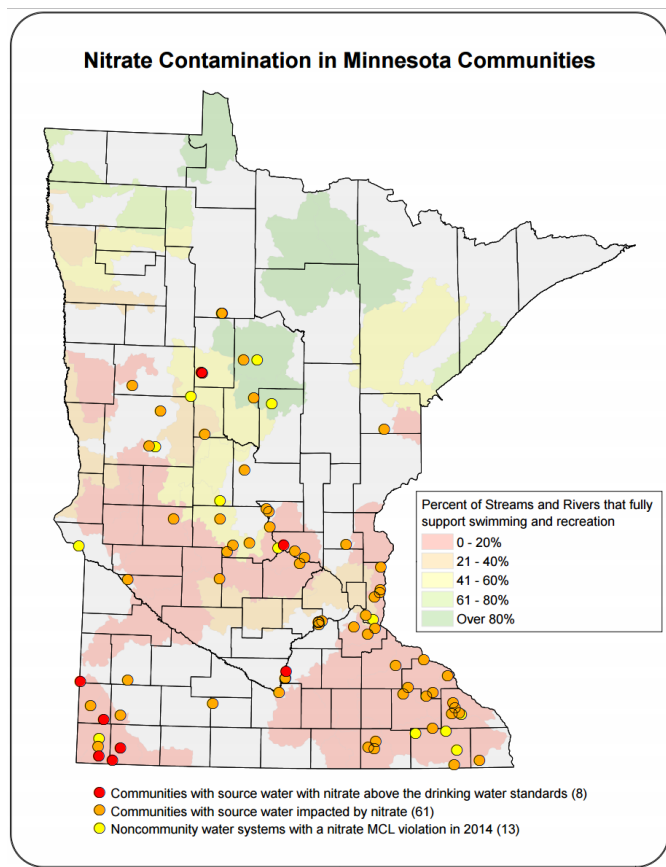
The City of Grygla issued the results of monitoring done on its drinking water for the period from January 1 to December 31, 2014. The information was from the 2014 Drinking Water Report for the City of Grygla. The City of Grygla provides drinking water to its residents from a groundwater source: an 180 foot deep well. The Minnesota Department of Health has determined that the source(s) used to supply the drinking water is not particularly susceptible to contamination. No contaminants were detected at levels that violated federal drinking water standards. However, some contaminants were detected in trace amounts that were below legal limits. There were trace amounts of alpha emitters, fluoride haloacetic acids, TTHM, chlorine, copper and lead from the drinking water report in 2014.

Nitrate Levels in Minnesota Drinking Water

According to the State of Minnesota Office of the Governor website a publication dated May 6, 2015 indicated that Governor Mark Dayton and Health Commissioner Dr. Ed Ehlinger released the findings of the state's annual drinking water report, which show nitrate levels in drinking water supplies are of increasing concern in Minnesota. Elevated levels of nitrate – which can lead to Blue Baby Syndrome in infants and other adverse human health effects – have caused an increasing number of Minnesota communities to install expensive nitrate treatment systems to ensure their water supplies are safe to drink. Some communities have resorted to temporarily distributing bottled water to their residents after detecting unsafe levels of nitrates in their drinking water. The report released today, which was compiled by the Minnesota Department of Health (MDH), also shows that as much as 10 percent of small (“non-community”) drinking water systems in the state have source water with elevated levels of nitrate – which is a significant cause of concern for human health. The following figure shows that there are no communities with source water impacted by nitrate in Marshall County. There are also no communities with source water with nitrate above the drinking water standards. There are also no non-community water systems with nitrate MCL violations in 2014 in Marshall County.

The Minnesota Department of Health indicated that it is often difficult to pinpoint where the nitrate in drinking water comes from because there are so many possibilities. The source of nitrate and nitrogen may be from runoff or seepage from fertilized soil, municipal or industrial wastewater, landfills, animal feed lots, septic systems, urban drainage, or decaying plant material. The Minnesota Department of Health website also stated that Federal law requires that public water systems be tested for nitrate, but testing is not required for residential wells. If your infant will be drinking water from a private well, you should have an inexpensive test done for nitrate, in addition to the usual test for bacterial contamination. Many private laboratories can test water samples for nitrates. In some Minnesota counties, well owners can make arrangements with their local public health department to have their wells tested.

Figure 22: Nitrate Contamination in Minnesota Communities



4.20.3 Mitigation Actions for Water Contamination in the Past Five Years in Marshall County:

Mitigation actions for hazardous material and water supply contamination from Marshall County's January 2008 All Hazard Mitigation Plan stated the mitigation action for hazardous material and contamination was to decrease transportation contamination and spill potential by addressing access and visibility issues caused by long or frequent railroad traffic. They also indicated they would reduce stationary structure contamination by addressing problems related to meth and mitigate noted city lagoonal and water issues.

Additional mitigation strategies or programs for Marshall County are described below.

A wellhead protection plan has been written for areas of Marshall County. Although the Minnesota Department of Health is involved, a wellhead protection plan is primarily written by either the water system or another appointed local party. The focus of the plan is to prevent drinking water from becoming contaminated by managing contamination sources. Specific requirements for the report vary, depending on the type of system, use and community. The Minnesota Department of Health had a goal that by 2006, all groundwater based community and non-transient non-community public water systems would have, at a minimum, begun the wellhead protection planning process. In Marshall County, Marshall-Polk Rural Water System and Kittson-Marshall Rural Water System have completed wellhead protection plans.

The Red River Basin Riparian Project is a project that allows landowners in the Red River Basin in Minnesota and North Dakota to restore riparian corridors. Best Management Practices (BMPs) are used to accomplish this goal including native timber management, riparian forest buffer, grazing management and floodplain function restoration. Benefits to the project include:

- Flood damage reduction
- Sediment removal
- Erosion control
- Increase in biologic diversity
- Water quality improvement

The Environmental Quality Incentives Program (EQIP) is a conservation program sponsored by the Natural Resources Conservation Service (NRCS). The program helps landowners protect soil/water resources through methods such as terracing, conservation tillage, nutrient management plans, animal waste management structures, wetland restoration, stream bank protection, grassed waterways, buffer/filter strips and pest management as well as many others.

The Greenway on the Red (GOR) is a project with multiple partners which hopes to establish a six hundred mile continuous greenway from Lake Traverse to Lake Winnipeg. Flood mitigation is the main purpose of this project, but a few of the many additional benefits include higher water quality, the stability of channels, and restoration of riparian and wetland areas in the floodplain. The project also supports additional mapping tools and database development such as digital elevation modeling for the entire Red River Basin (south of Manitoba) and the Red River Basin Decision Information Network. The implementation of the GOR was recently prioritized by the Governors and the Premier.

Additionally, it was stated that a law became effective on January 1, 2004 that prohibits the amount of phosphorus fertilizer that is applied to lawns. The main reason for this law is to reduce the amount of phosphorus runoff into lakes, rivers and streams, cutting water contamination. This is not a ban, but just a reminder to fertilize only when necessary, and exemptions do exist.

Statewide Mitigation Actions

According to the Minnesota Department of Health website there are a number of programs and services in place in the state of Minnesota to protect groundwater from contamination to keep drinking water supplies are safe for human consumption.

Programs in state and local government agencies are responsible for protecting groundwater from contamination so that drinking water supplies from water are safe for human consumption. The Minnesota Department of Health (MDH) has many roles in this effort including protecting water, ensuring that drinking

water from wells is tested and is safe, and recommending cleanup of contaminated sites. Other state agencies also have diverse and important roles in ensuring that the drinking water from wells is safe for human consumption.

4.20.4 Vulnerability to Jurisdictions within Marshall County

Within Marshall County all residents are potentially vulnerable to water supply contamination. Locations where ground water meets surface water and aquifers also have the potential to be vulnerable to water supply contamination. Additionally, residents who reside in the cities of Oslo, Stephen and Alvarado are close to rivers which have a history of levels of substances such as mercury, low oxygen, turbidity and biota. There is also a history of water contamination from the Marshall and Polk Rural Water System, which services the cities of Alvarado, Oslo, Argyle, and Warren.

4.20.5 Water Supply Contamination and Climate Change:

According to the Environmental Protection Agency, climate change can have a variety of impacts on surface water, drinking water, and ground water quality. Higher water temperatures and changes in the timing, intensity, and duration of precipitation can affect water quality. Higher air temperatures (particularly in the summer), earlier snowmelt, and potential decreases in summer precipitation could increase the risk of drought. The frequency and intensity of floods could also increase. In addition, sea level rise may affect freshwater quality by increasing the salinity of coastal rivers and bays and causing saltwater intrusion—the movement of saline water into fresh ground water resources in coastal regions.

4.20.6 Relationships with Other Hazards:

Water supply contamination can be linked to various other hazards. Private wells and community water supplies can become contaminated by human and animal waste from infectious disease. In addition, lakes, streams, pools or water parks could also become contaminated by infectious disease from humans and/or animals. A spill or release of hazardous waste could also have an impact on a surrounding area's water supply. Lastly, wastewater treatment plant failure can occur if facilities are not adequately protected from flooding or protection is compromised. Water supplies can become contaminated by the untreated wastes. Sewer back-up, and flood waters can contaminate wells through well cap or vent.

4.21 Transportation Incidents

The following information was provided in the Community Profile Section of this plan and the portions which relate to the Transportation Incidents Hazard Profile are included below.

Roadways

The major highways which run through Marshall County are U.S. highway 59 and U.S. Highway 75. U.S. Route 59 is a north–south United States highway (though it is signed east–west in parts of Texas). A latecomer to the U.S. numbered route system, U.S. 59 is now a border-to-border route, part of NAFTA Corridor Highway System. It parallels U.S. Route 75 for nearly its entire route, never much more than 100 miles (160 km) away, until it veers southwest in Houston, Texas. Its number is out of place since U.S. 59 is either concurrent with or entirely west of U.S. Route 71. The highway's northern terminus is nine miles (14 km) north of Lancaster, Minnesota, at the Canadian border, where it continues as Manitoba Highway 59. Its southern terminus is at the Mexican border in Laredo, Texas, where it continues as Mexican Federal Highway 85D.

U.S. Route 75 is a north–south U.S. Highway. The highway's northern terminus is in Kittson County, Minnesota, at the Canadian border, where it once continued as Manitoba Highway 75 on the other side of the now-closed border crossing. Its southern terminus is at Interstate 30 and Interstate 45 in Dallas, where it is known as North Central Expressway.

U.S. 75 was a border-to-border route, from Canada to the Gulf of Mexico at Galveston, Texas. However, the entire segment south of Dallas has been decommissioned in favor of Interstate 45, a cutoff section of town-to-town surface road having become State Highway 75.

There are also Minnesota State Highways 1, 32, 89, 219, 220 and 317 which run through the county.

Railroads

Minnesota currently has 4,444 route miles of railroads serviced by 20 freight railroad companies. Northstar commuter rail operates on 40 miles of existing track and right-of-way owned by the BNSF Railway between Big Lake and Minneapolis. Amtrak operates the only intercity passenger rail service in Minnesota on the Empire Builder route connecting Seattle with Chicago.

Minnesota has one operating light rail line between downtown Minneapolis and the Mall of America in Bloomington. This 12-mile line is owned and operated by Metro Transit. A second 11-mile light rail line is scheduled to open in 2014 between downtown Minneapolis and downtown St. Paul.

Goods between Chicago and ports in the northwest are hauled through Minnesota on railroads. These goods move in both traditional rail cars and increasingly in shipping containers loaded directly onto flatbed rail cars. Grain and lumber are also transported to the Midwest and the rest of the nation and the world. The growth of the oil industry in North Dakota has increased shipments of commodities into, out of and through Minnesota by rail. These commodities include sand, crude oil and various other products. Ethanol and propane are also transported by railroads in the state. Iron ore and coal are raw materials transported through Minnesota to other parts of the country and the world via rail. Minnesota is fourth in the nation in total tons of commodities originating in the state and eighth in total tons of commodities terminating in the state.

Railroads

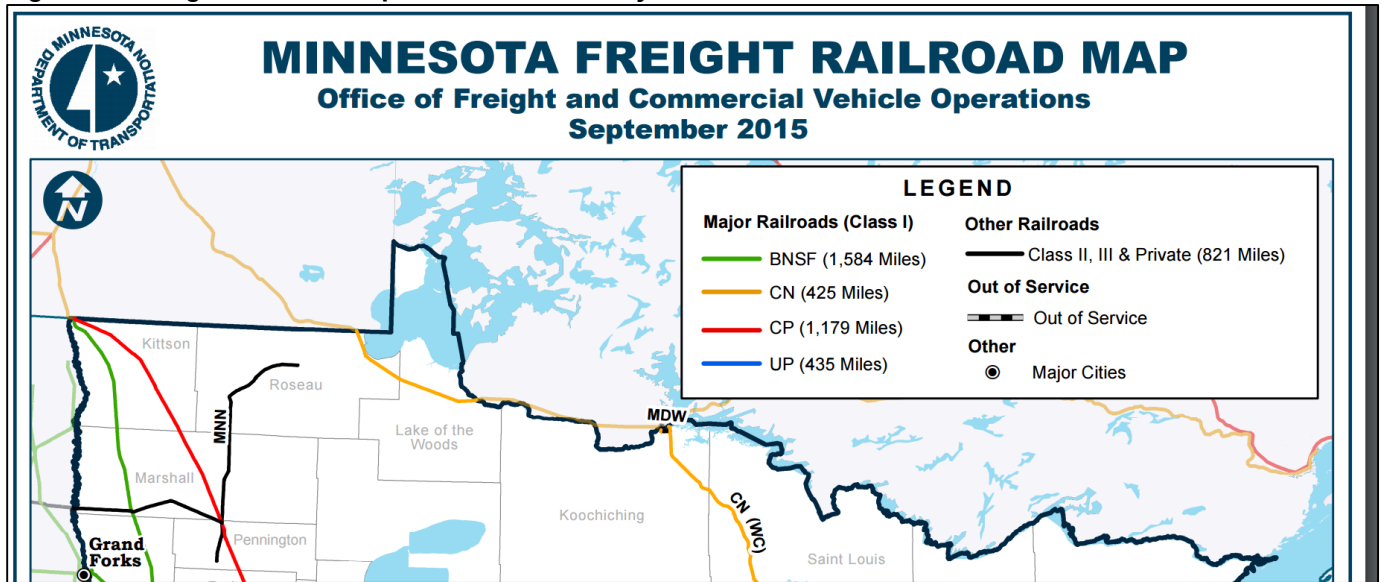
Two major freight railways run through Marshall County. Burlington Northern Santa Fe railroad and the Canadian Pacific (Soo Line) both run through the county. The BNSF Railway is the second-largest freight railroad network in North America, second to the Union Pacific Railroad (its primary competitor for Western U.S. freight), and is one of seven North American Class I railroads. The Burlington Northern Santa Fe (BNSF) line in Marshall County runs alongside highway 75 and goes through the cities of Stephen, Argyle and Warren.

The Soo Line Railroad (reporting mark SOO) is the primary United States railroad subsidiary of the Canadian Pacific Railway (CP), controlled through the Soo Line Corporation, and one of seven U.S. Class I railroads. This railway runs through the cities of Strandquist and Newfolden in Marshall County. It runs alongside highway 59 in Marshall County.

There are two Class III private railway lines which run through the county. The first is the Minnesota Northern line and it runs through the cities of Middle River and Holt and runs alongside state highway 32 in

Marshall County. The other is the northern plains railroad which runs through Oslo and Warren on the way to Thief River Falls.

Figure 23: Freight Railroad Map for Marshall County



The efficiency of a railroad is affected by the physical condition of the rail lines. The Federal Railroad Administration (FRA) track classification is based upon the physical characteristics of the roadbed, track geometry, and track structure. There are four different track classifications with maximum freight and passenger speed. Characteristics related to the roadbed include drainage and vegetation. Track geometry includes gauge, alignment, elevation, and surface. Track structure involves ballast, ties, rail, spikes, joints, and switches. These characteristics determine the allowable operating speeds for each rail line.

Aeronautics

The National Transport Safety Board makes statistics available on a national basis in regards to flight safety. Minnesota specific information was not available. However, the national data indicates that the level of risk for flying is less than land travel in terms of fatalities per 100,000 miles. The impact of an incident involving a large aircraft may be large and involve an integrated response between Fire, EMS, Law Enforcement plus other agencies. Aircraft parked on the tarmac at airports are vulnerable to damage during high wind or hail storm events.

Airports

Below is Minnesota's complete list of airfields in Marshall County. List of airfields and airports are split into two classifications, Public Airports and Private Airports. Private airports may allow access if scheduled ahead of time or if heading to a hanger attached to that field. Listed below are Marshall County Airports.

- Johnson Airport-Private
- Arthur Field Airport-Private
- Hagens Private Airport-Private

- Klamar Field Airport-Private
- Paul Field Airport-Private
- Grygla Muni-Mel Wilkens Field Airport-Public
- Chanlin Field Airport-Private
- Stephen Muni Airport-Public
- Warren Muni Airport-Public

4.21.1 Transportation Incidents History in Marshall County:

Vehicle Crash History

2014 Minnesota Motor Vehicle Crash Facts summary provides information on the crashes, deaths and injuries that occurred on Minnesota roadways during 2014. Data for Marshall County indicated that there was one fatal crash in 2014. There were 13 crashes which resulted in injury during 2014 in Marshall County and 14 crashes which resulted in property damage. The total number of crashes in 2014 in Marshall County was 28, which was a slight decrease from the total of 29 which occurred in 2013.

The Minnesota Office of Traffic Safety also provides County-Specific Fact Sheets and the following information was provided by the 2010-2014 Minnesota Crash Statistics for Marshall County. In total there were 197 crashes during this time frame and a total of 7 deaths. Of these 7 deaths, 3 were alcohol related, and 4 were due to unbelted motor vehicle incidents. There were a total of 187 instances of Driving While Impaired (DWI) in Marshall County. In 2014, Minnesota recorded 91 impaired-related traffic deaths, accounting for 25 percent of all traffic deaths, about the same as in the recent past. Impaired-related crashes, injuries and fatalities continue to be a serious problem in Minnesota. Overall, males and young adults are overrepresented in impaired-related crashes and account for a disproportionate share of fatalities. More than 600,000 Minnesotans with driver license records have a DWI.

Other Transportation Incidents

There was no other record of railway or airplane accidents in Marshall County during the 2009-2014 timeframe.

4.21.2 Transportation Incident Risk for Marshall County:

The overall probability that a transportation incident will occur each year in Marshall County is highly likely and its relative impact is Low and thus the overall risk for Marshall County is Little to No. The risk for a transportation incident for each of the cities is the same because data was only available on the county-wide level. In assessing transportation incident data for the 2015 update, data from 2009 to 2014 was used to determine the risk. The table provided below provides the name of each of the cities in the County, the probability that a transportation incident will have an impact on that jurisdiction, the impact potential, as well as the overall risk calculated by the determined probability and impact ratings.

Table 78: Transportation Incident Hazard Risk Assessment

Transportation Incidents			
City	Probability	Impact	Risk
Alvarado	Highly Likely	Low	Little to No
Argyle	Highly Likely	Low	Little to No
Grygla	Highly Likely	Low	Little to No
Holt	Highly Likely	Low	Little to No
Middle River	Highly Likely	Low	Little to No
Newfolden	Highly Likely	Low	Little to No
Oslo	Highly Likely	Low	Little to No
Stephen	Highly Likely	Low	Little to No
Strandquist	Highly Likely	Low	Little to No
Viking	Highly Likely	Low	Little to No
Warren	Highly Likely	Low	Little to No
Marshall County	Highly Likely	Low	Little to No
Total	Highly Likely	Low	Little to No

4.21.3 Mitigation Actions for Transportation Incidents in Marshall County in the Past Five Years:

There are no mitigation actions specific to transportation incidents in the previous Marshall County plan from February 2008.

4.21.4 Vulnerability to Residents in Marshall County:

Any resident who uses the various transportation methods in Marshall County including highway, railway, and air are potentially vulnerable to a transportation incident. In addition, residents who live closer to a roadway have the potential to be the victim of someone driving while impaired and potentially driving off the road. Residents who reside near a railway, such as in the cities of Strandquist, Newfolden, Stephen, Argyle and Warren, are at an increased risk.

4.21.5 Transportation Incidents and Climate Change in Marshall County:

According to the 2013 Report of the Interagency Climate Adaptation Team report "Adapting to Climate Change in Minnesota," the impacts of climate change on the Department of Transportation (MnDOT) are significant. MnDOT is committed to addressing climate change adaptation in our statewide vision: that Minnesota's multimodal transportation system, "is flexible and nimble enough to adapt to changes in society, technology, the environment and the economy." Climate issues will affect many functional groups within MnDOT, including Bridge Hydraulics, Water Resources, Maintenance, Design, Construction, Materials, and Freight, Rail and Waterways.

The predictions for increased frequency and intensity of rainfall events, extreme heat events resulting in decreased air quality, and an increased number of freeze/thaw cycles will affect the way MnDOT designs,

builds and maintains the state's multi-modal transportation infrastructure. It will also compel MnDOT to inventory all transportation assets, assess which ones are most vulnerable to the impacts of climate change and determine a cost-effective method to mitigate and minimize those impacts. Emergency preparedness plans will be updated to reflect those lessons learned as a result of recent flash flooding events.

4.21.6 Relationship to Other Hazards in Marshall County:

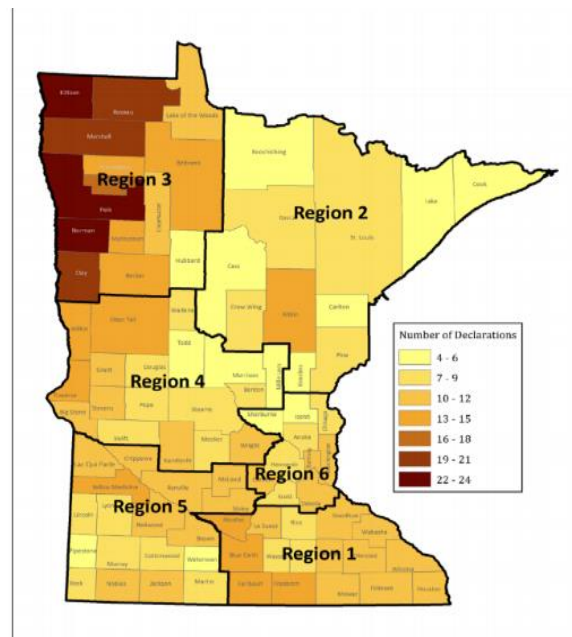
Hazardous material incidences are generally associated with transportation accidents or accidents at fixed facilities. All highways and railroads associated with transport and anywhere that hazardous material are used or stored are susceptible to a spill. In addition tornadoes, windstorms and winter storms all have the potential to cause high winds or damage to infrastructure which could make roadways impassable. Winter storms also have the potential to make roadways slippery with icy and snowy conditions. Whiteout conditions are also a possibility with winter storms which could lead to increased transportation incidents. These natural hazards, such as tornadoes, windstorms, winter storms, hail and lightning also could cause an increase in railroad or air accidents because of conditions which make it difficult to navigate or cause hazardous conditions.

4.22 Risk Assessment Summary

While the jurisdictional risk remained fairly consistent from the past plan, one fact remains, Marshall is still at risk despite its efforts to mitigate natural hazards. According to the most recent MN state plan, Marshall County lies within the region in Minnesota that has the highest number of disaster declarations in the entire state. Within Marshall County and its participating jurisdictions the hazards that have had the highest number of disaster declarations for the county has been flooding. However, flooding has also had the highest amount of mitigation actions, so one can recognize that the county is taking steps towards mitigating the impact and risk of flooding on the county.

While the past plan evaluated twelve hazards this update identified 18 hazards as having a potential impact on the community. In taking a more in-depth look at each of the hazards and determining the frequency with which they occur in Marshall County and calculating the impact and risk potential on the community, mitigation actions can be identified and prioritized accordingly. Of the 18 hazards in Marshall County, the hazard with the highest impact potential is flood, with fire and winter storms next. These hazards are highly likely to occur in Marshall County each year and have a high or moderate risk potential for the community. Other hazards, such as infectious disease, fire, transportation incidents,

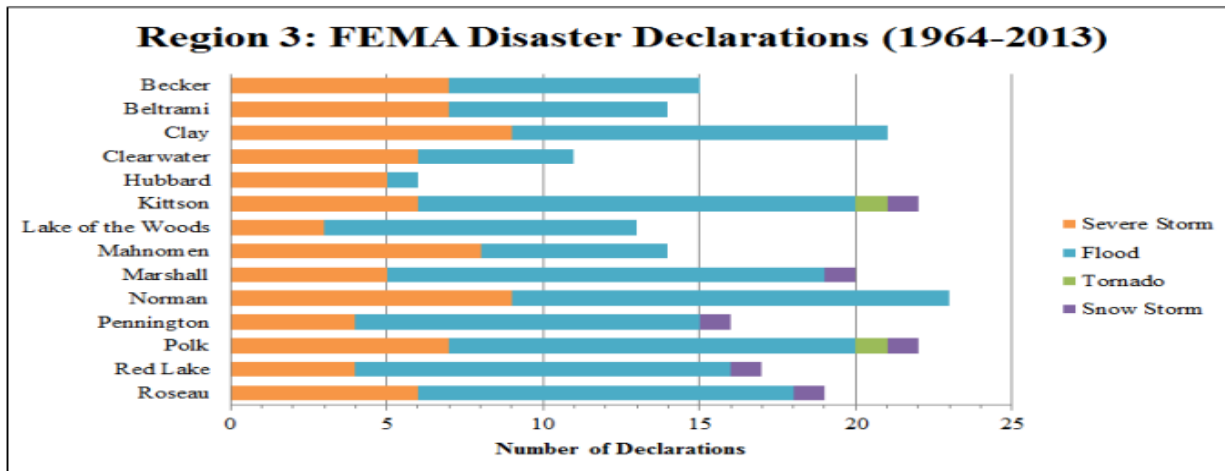
Figure 24: Disaster Declarations by Region in Minnesota



A summary of FEMA Disaster Declarations by County is shown in the following figures

windstorms, and hail have a highly likely probability of occurring each year, but their impact on the community is not as significant and there is less risk potential related to these hazards.

Figure 25: Disaster Declarations by County



Through Marshall County's risk analysis, it was determined that the city of Warren has the highest number of moderate impact and risk analysis ratings compared to other cities in the county. Warren had a moderate impact and risk analysis ratings for the fires, winter storms, dam/levee failure, and hail hazards. This is important information for mitigation actions and prioritizing Warren among the other cities in the county. A more detailed look at which hazards were at the High, Moderate and Low-level prioritization could be seen in table 79 below.

Within Marshall County, the hazard with the highest risk potential is flooding. There are five cities within Marshall County which have a moderate-risk potential for flooding. These cities are the City of Alvarado, the City of Argyle, the City of Grygla, the City of Middle River and the City of Stephen. This is the only hazard of the 18 reviewed as part of the 2015 update which has this many areas with a moderate-risk potential. The hazard which has the greatest number of mitigation actions is also flooding. This indicates the county is aware of the risk potential and has been taking action to mitigate the impact of flooding in the County of Marshall.

Table 79 shows the hazard prioritizations for Marshall County as a whole while Tables 79 through 90 show the hazard prioritization for each individual city in Marshall County including Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, Warren, and the unincorporated areas of Marshall County.

Table 79: Marshall County Hazard Prioritizations

Marshall County Hazard Prioritizations	
Level	Hazard
High	<ul style="list-style-type: none"> • Flood
Moderate	<ul style="list-style-type: none"> • Fire • Winter Storms
Low	<ul style="list-style-type: none"> • Drought • Hazardous Material • Infectious Disease • Invasive Species • Subsidence • Tornado • Dam/Levee Failure • Windstorm • Hail • Erosion • Extreme Heat • Lightning • Transportation Incidents • Wildfire • Water Contamination

Table 80: City of Alvarado Hazard Prioritizations

City Alvarado Hazard Prioritizations	
Level	Hazard
High	<ul style="list-style-type: none"> • None
Moderate	<ul style="list-style-type: none"> • Fires • Flood • Winter Storms
Low	<ul style="list-style-type: none"> • Drought • Hazardous Material • Infectious Disease • Invasive Species • Subsidence • Tornado

	<ul style="list-style-type: none"> • Dam/Levee Failure • Windstorm • Hail • Erosion • Extreme Heat • Lightning • Transportation Incidents • Wildfire • Water Contamination
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Table 81: City of Argyle Hazard Prioritizations

City Argyle Hazard Prioritizations	
Level	Hazard
High	<ul style="list-style-type: none"> • None
Moderate	<ul style="list-style-type: none"> • Flood • Winter Storms
Low	<ul style="list-style-type: none"> • Drought • Fires • Hazardous Material • Infectious Disease • Invasive Species • Subsidence • Tornado • Dam/Levee Failure • Windstorm • Hail • Erosion • Extreme Heat • Lightning • Transportation Incidents • Wildfire • Water Contamination

Table 82: City of Grygla Hazard Prioritizations

City Grygla Hazard Prioritizations	
Level	Hazard
High	<ul style="list-style-type: none"> • None

Moderate	<ul style="list-style-type: none"> • Fires • Flood • Winter Storms
Low	<ul style="list-style-type: none"> • Drought • Hazardous Material • Infectious Disease • Invasive Species • Subsidence • Tornado • Dam/Levee Failure • Windstorm • Hail • Erosion • Extreme Heat • Lightning • Transportation Incidents • Wildfire • Water Contamination

Table 83: City of Holt Hazard Prioritizations

City Holt Hazard Prioritizations	
Level	Hazard
High	<ul style="list-style-type: none"> • None
Moderate	<ul style="list-style-type: none"> • Winter Storms
Low	<ul style="list-style-type: none"> • Drought • Fires • Flood • Hazardous Material • Infectious Disease • Invasive Species • Subsidence • Tornado • Dam/Levee Failure • Windstorm • Hail • Erosion • Extreme Heat

	<ul style="list-style-type: none"> • Lightning • Transportation Incidents • Wildfire • Water Contamination
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Table 84: City of Middle River Hazard Prioritizations

City Middle River Hazard Prioritizations	
Level	Hazard
High	<ul style="list-style-type: none"> • None
Moderate	<ul style="list-style-type: none"> • Fires • Flood • Winter Storms
Low	<ul style="list-style-type: none"> • Drought • Hazardous Material • Infectious Disease • Invasive Species • Subsidence • Tornado • Dam/Levee Failure • Windstorm • Hail • Erosion • Extreme Heat • Lightning • Transportation Incidents • Wildfire • Water Contamination

Table 85: City of Newfolden Hazard Prioritizations

City Newfolden Hazard Prioritizations	
Level	Hazard
High	<ul style="list-style-type: none"> • None
Moderate	<ul style="list-style-type: none"> • Fires • Winter Storms
Low	<ul style="list-style-type: none"> • Drought • Flood

	<ul style="list-style-type: none"> • Hazardous Material • Infectious Disease • Invasive Species • Subsidence • Tornado • Dam/Levee Failure • Windstorm • Hail • Erosion • Extreme Heat • Lightning • Transportation Incidents • Wildfire • Water Contamination
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Table 86: City of Oslo Hazard Prioritizations

City Oslo Hazard Prioritizations	
Level	Hazard
High	<ul style="list-style-type: none"> • None
Moderate	<ul style="list-style-type: none"> • Fires • Winter Storms • Erosion
Low	<ul style="list-style-type: none"> • Drought • Flood • Hazardous Material • Infectious Disease • Invasive Species • Subsidence • Tornado • Dam/Levee Failure • Windstorm • Hail • Extreme Heat • Lightning • Transportation Incidents • Wildfire • Water Contamination

Table 87: City of Stephen Hazard Prioritizations

City Stephen Hazard Prioritizations	
Level	Hazard
High	<ul style="list-style-type: none"> • None
Moderate	<ul style="list-style-type: none"> • Flood • Winter Storms • Erosion
Low	<ul style="list-style-type: none"> • Drought • Fires • Hazardous Material • Infectious Disease • Invasive Species • Subsidence • Tornado • Dam/Levee Failure • Windstorm • Hail • Extreme Heat • Lightning • Transportation Incidents • Wildfire • Water Contamination

Table 88: City of Strandquist Hazard Prioritizations

City Strandquist Hazard Prioritizations	
Level	Hazard
High	<ul style="list-style-type: none"> • None
Moderate	<ul style="list-style-type: none"> • Winter Storms
Low	<ul style="list-style-type: none"> • Drought • Fires • Flood • Hazardous Material • Infectious Disease • Invasive Species • Subsidence • Tornado

	<ul style="list-style-type: none"> • Dam/Levee Failure • Windstorm • Hail • Erosion • Extreme Heat • Lightning • Transportation Incidents • Wildfire • Water Contamination
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Table 89: City of Viking Hazard Prioritizations

City Viking Hazard Prioritizations	
Level	Hazard
High	<ul style="list-style-type: none"> • None
Moderate	<ul style="list-style-type: none"> • Fires • Winter Storms • Hail
Low	<ul style="list-style-type: none"> • Drought • Flood • Hazardous Material • Infectious Disease • Invasive Species • Subsidence • Tornado • Dam/Levee Failure • Windstorm • Erosion • Extreme Heat • Lightning • Transportation Incidents • Wildfire • Water Contamination

Table 90: City of Warren Hazard Prioritizations

City Warren Hazard Prioritizations	
Level	Hazard
High	<ul style="list-style-type: none"> • None
Moderate	<ul style="list-style-type: none"> • Fires

	<ul style="list-style-type: none"> • Winter Storms • Dam/Levee Failure • Hail
Low	<ul style="list-style-type: none"> • Drought • Flood • Hazardous Material • Infectious Disease • Invasive Species • Subsidence • Tornado • Windstorm • Erosion • Extreme Heat • Lightning • Transportation Incidents • Wildfire • Water Contamination

Table 91: Unincorporated Hazard Prioritizations for Marshall County

Unincorporated Hazard Prioritizations for Marshall County	
Level	Hazard
High	<ul style="list-style-type: none"> • None
Moderate	<ul style="list-style-type: none"> • Fires • Winter Storms • Hail
Low	<ul style="list-style-type: none"> • Drought • Flood • Hazardous Material • Infectious Disease • Invasive Species • Subsidence • Tornado • Dam/Levee Failure • Windstorm • Erosion • Extreme Heat • Lightning • Transportation Incidents • Wildfire • Water Contamination

The hazard prioritizations were based using the best possible information concerning risks and vulnerabilities. The following factors were considered when prioritizing the hazards: Probability or Frequency of a “Disastrous” Event and impacts concerning Casualties/Trauma, Communication/Lack thereof, Continuity of Government, Debris, Emergency Services Disrupted/Limited, Evacuation Needs, Fatalities, Hazardous Material Release, Overwhelm of First Responders, Mass Care Needs, Physical Damage / Asset Destruction, Power, Disruption/Outages, Transportation, Disruption/Failure, and Economic Loss. For more information on these determinations, see the risk assessment methodology and individual hazard profiles.

As with any assessment involving natural or human-caused hazards, not all potential events may be represented here and an actual incident may occur in a vastly different way than described. This assessment, however, will be used, where possible, to minimize damages from these events in the future. Every type of event is different, ranging from population to property to economic impacts. Incidents also have different probabilities and magnitudes even within hazards. For example, a light snowstorm will be different from a blizzard and a moderate flood will be different from both of those. Some hazards have estimates of dollar losses and population impacts whereas others are more qualitatively assessed based on the information available during the risk assessment process.

Section 5: Capability Assessment

5.1 What Is A Capability Assessment?

The purpose of conducting a capability assessment is to determine the ability of a given jurisdiction to implement mitigation strategies. More specifically, the capability assessment helps to determine what mitigation actions are likely to be successfully implemented given the fiscal, technical, administrative and political framework of a jurisdiction. A capability assessment also provides an opportunity to assess existing plans, policies and current processes already in place. A capability assessment is required for plan approval. This chapter outlines how the mitigation capabilities of Marshall County and the jurisdictions participating were assessed, the results of the assessment and recommendations to improve.

5.1.1 Conducting the Capability Assessment

To yield insight into the jurisdiction's capability to mitigate hazards, the Hazard Mitigation Planning Team administered a multi-part self-assessment that consisted of two surveys. The first survey collected information regarding existing local plans, policies, programs and ordinances. Additionally the survey asked the participants to assess how much influence various mitigation elements (plans, policies, programs and ordinances) had on the governance of their jurisdictions. The second survey consisted of questions regarding the fiscal, technical, administrative and political will of the participating jurisdiction. Participants were asked to determine their capability with regard to the various administrative categories. Representatives from Marshall County and the jurisdictions identified as participating in the plan update were invited to participate.

5.1.2 Hazard Mitigation Plans, Policies, Programs and Ordinances

An evaluation of existing plans, programs, and policies was conducted as a means to provide insight into how mitigation was achieved in the past and how might it be achieved in the future. An assessment was conducted to determine if and/or what plans existed and if they were utilized in the governance of the jurisdiction's mitigation activities. Finally, participants were asked to rank their capability with regard to mitigation and how comprehensiveness (interconnected) the identified local plans, policies, programs, and ordinances. The following are the results of the self-assessment.

Table 92: Plans Policies Programs and Ordinances in Place

<ul style="list-style-type: none">• HMP: Hazard Mitigation Plan• DRP: Disaster Recovery Plan• CLUP: Comprehensive Land Use Plan• FMP: Floodplain Management Plan• SMP: Stormwater Management Plan• EOP: Emergency Operations Plan• COOP: Continuity of Operations Plan• SARA: SARA Title III Emergency Response Plan• TRANS: Transportation Plan										<ul style="list-style-type: none">• CIP: Capital Improvements Plan (that regulates infrastructure in hazard areas)• COMP: Comprehensive Plan• REG-PL: Regional Planning• HPP: Historic Preservation Plan• ZO: Zoning Ordinance• FDPO: Flood Damage Prevention Ordinance• NFIP: National Flood Insurance Program• BC: Building Codes									
DENOTES Multi-Jurisdictional Plan																			
Jurisdiction	HMP	DRP	CULP	FMP	SMP	EOP	COOP	SARA	TRANS	CIP	COMP	REG-PL	HPP	ZO	FDPO	NFIP	BC	Score	
Alvarado	x		X	x		x		x						x		x		M	
Argyle	x			x		x		x						x		x		M	
Grygla	x			x		x		x						x		x		M	
Holt	x					x		x						x				M	
Middle River	x			x		x		x						x		x		M	
Newfolden	x			x		x		x		x				x				M	
Oslo	x		x	x		x		x						x		x		M	
Stephen	x			x		x		x						x		x		M	
Strandquist	x					x		x						x		x		M	
Viking	x					x		x						x				M	
Warren	x			x		x		x						x			x	M	
Marshall County	x			x		x		x						x		x		M	

Note: Scores of High, Moderate and Limited were determined by a self-assessment of the jurisdictions.

The first part of the capability assessment survey indicated that there is a moderate degree of existing plans, policies, and ordinances used to conduct mitigation. It was further suggested that the level of communication between and within agencies only occurred during the last mitigation plan update or after a significant event like a major flood. All indications suggest that Marshall County should institute actions that will enhance its ability to support a comprehensive mitigation program.

5.1.3 Recommendations:

As several jurisdictions have participated in the National Flood Insurance Program, and have requested assistance for mitigation projects, it is obvious that mitigation actions are occurring across Marshall County and within the participating jurisdictions. However, mitigation actions seem to be fragmented across several local plans, policies, programs and ordinances. As such, it is recommended that efforts should be made to unify the county and participating jurisdictions so that mitigation efforts are coordinated and that the reporting of these activities is centralized. Furthermore, the county and jurisdictions should agree on a management process that establishes a governance committee to oversee the mitigation planning process, evaluates mitigation actions, reports mitigation actions for inclusion in plan updates, and other activities that will help to support a comprehensive mitigation plan program. Finally, this update should reflect the noted recommendations by including a management strategy to strengthen capabilities and ensure the county's mitigation program is treated and managed as a true existing risk reduction program.

5.2 Fiscal, Technical, Administrative and Political Capabilities

As part of the capability assessment, each jurisdiction self-assessed their unique technical, fiscal, administrative, and the political will to conduct mitigation projects. The Assessment of Local Capability Table provides an overview of each jurisdiction's rankings. An "L" indicates limited capability, an "M" indicates moderate capability, and an "H" indicates high capability. The results of the self-assessment are listed below.

Table 93: Assessment of Local Capability

Assessment of Local Capability— Multi Jurisdictional Hazard Mitigation Plan				
An “L” indicates low capability; an “M” indicated moderate capability; and an “H” indicates high capability.				
Jurisdiction	Technical Capability	Fiscal Capability	Administrative Capability	Political Capability
Alvarado	M	L	M	H
Argyle	M	L	M	H
Grygla	M	L	M	H
Holt	M	L	M	H
Middle River	M	L	M	H
Newfolden	M	L	M	H
Oslo	M	L	M	H
Stephen	M	L	M	H
Strandquist	M	L	M	H
Viking	M	L	M	H
Warren	M	L	H	H
Marshall County	M	M	H	H

Note: Scores of High, Moderate and Limited were determined by a self-assessment of the jurisdictions.

5.2.1 Technical Capability

With regard to the Marshall County Mitigation Plan, “Technical Capability” was defined as possessing the skills and tools needed for making decisions regarding mitigation activities, programs, and policies. The concept of “technical” was left to the participants to self-define; however, several examples were provided to assist the participant in completing the survey. For instance, having accesses to and/or being able to use geographic information systems (GIS) and database management capabilities would be an indication of possessing the technical capabilities needed to make informed decisions regarding mitigation activities. Not having the ability to manage grants and not having a working knowledge of mitigation programs would be an indication of not possessing the technical capabilities needed to make informed decisions regarding mitigation programs or policies.

The analyses of the responses to the capability assessment indicated that there is generally a Moderate technical capability. The result of the technical capability assessment highlights the notion that the existing capability of most jurisdictions is adequate, but could be improved.

5.2.2 Recommendations:

Local Mitigation Action Plans should include strategies that will strengthen the technical capabilities of the jurisdictions and county. While there is a wide range of technical resources across the county and municipal governments, the development of a systematic protocol for sharing resources could significantly

increase the level of technical capability to analyze natural hazards and develop meaningful actions to reduce their impact. The development of regional mitigation actions could also be used to assist in this effort. In all, Marshall County and its cities should rely on its existing partners (Regional partners, etc.) and local and county departments to ensure those with minimal or limited resources are successful.

5.2.3 Fiscal Capability

With regard to the Marshall County Mitigation Plan, fiscal capability was defined as having the fiscal resources available to implement mitigation policies and projects. It was noted that fiscal capability might take the form of grants received, locally based revenue sources, or other means to fund mitigation activities. For instance, the costs associated with mitigation policy and project implementation varies widely. In some cases, policies are tied primarily to staff costs associated with the creation and monitoring of a given program. In other cases, money is linked to a project, such as property acquisition that can require a substantial commitment from local, state, and federal funding sources.

The analyses of the responses to the capability assessment indicated that there is a moderate to limited fiscal capability at the county and respective municipal levels. Fiscal capability seemed to be influenced by the jurisdictional population in that largest jurisdiction (Marshall County) rated its ability higher than less populated jurisdictions.

NOTE: Population size is not always correlated with risk. The risk of a smaller population can be equal to or even greater than the risk of more populated areas. More populated jurisdictions typically have larger tax bases and/or more resources to address their risk.

5.2.4 Recommendations:

To evaluate the fiscal capabilities needed to successfully implement mitigation policies and projects, jurisdictions should ask several basic questions:

- Does the action require a monetary commitment?
- Does the action require staff resources?
- Can jurisdictions combine resources with other counties or municipalities to address identified problems?
- Is the jurisdiction willing to commit local revenue on a sustained or one-time basis?

In order to implement mitigation projects and policies, some monetary commitment or staff resources will be required. Resources may take the form of a non-federal match requirement or the cost associated with staff time devoted to mitigation policy development and implementation. County and municipal governments should consider combining financial and staff resources to achieve efficiencies in implementing mitigation activities to address hazards across the region. It is important to consider that hazards tend to impact regions and not just individual jurisdictions; thus, combining resource is often a benefit to multiple jurisdictions.

Finally, if local governments have access to ongoing sources of revenue, comprehensive and sustained effort can be achieved. As such, jurisdictions are encouraged to create mitigation based revenue resources. For example, a storm-water management fee or the development of a budgetary line item that specifically addresses hazard mitigation could be adopted.

5.3 Administrative Capability

With regard to the Marshall County Mitigation Plan, administrative capability is defined as the ability to complete the necessary administrative elements of typical mitigation activities and projects. Examples include the availability of jurisdictional staffing, ability to document mitigation progress, grant reporting, and the existing organizational resources needed to implement mitigation strategies.

The analysis of the Administrative Capability Assessment indicated there is moderate to high administrative capability throughout Marshall County. While the Marshall County example suggests that administrative capability is related to the size of the jurisdiction, regional data suggests that administrative capability is not related to the size of the jurisdictions. In most cases and more than likely in Marshall County, a jurisdiction's administrative capability is dependent upon the makeup and relationships of the jurisdiction rather than the resources or population of the jurisdiction.

5.3.1 Recommendations:

The enhancement of administrative capability may be achieved through county/municipal training, outreach and mentoring. Specifically, sharing resources within jurisdictions might improve jurisdictions administrative capabilities. In addition, efforts to demonstrate the impacts of mitigation across a jurisdiction's governmental functions might increase awareness and buy-in. Finally, training of jurisdictional personnel with regard to mitigation related programs and/or the purpose of mitigation can increase specific knowledge skills and abilities.

5.4 Political Capability

One of the most difficult and sensitive capabilities to evaluate involves the political will of a jurisdiction to enact meaningful mitigation policies and projects. With regard to the Marshall County Mitigation Plan, fiscal capability is defined as the level of interest that both the citizens and government officials of a given jurisdiction have in conducting mitigation projects. Examples of political capability included the existence of special interest groups organized around disaster and/or hazard-related causes, recent experience with significant or reoccurring events, history of conducting mitigation projects, and the willingness of elected officials to allocate resources to hazard and/or mitigation projects.

According to the results of the self-assessment, Marshall County and its participating jurisdictions had the same levels of political capability to enact meaningful and proactive mitigation actions. Some comments provided in the self-assessment concerning county and municipal government officials indicated that there is an interest in disaster mitigation activities.

5.4.1 Recommendations:

Political support from elected officials can prove to be critically important. Thus, past events, including flooding, tornadoes, and major winter storms should be used to better educate elected officials regarding the merits of mitigation planning. When possible, local governments who have implemented hazard mitigation projects should attempt to assess their effectiveness following future events.

Documenting mitigation projects and policies that work is a high priority among FEMA officials. Therefore, following disasters, local governments should work with local groups like the silver jackets, the state and FEMA officials to evaluate and show case the success of past mitigation projects. The results should be presented to locally elected officials in order to provide real-world examples of how mitigation can protect

lives and property.

Finally, county extension offices are good resources for training, education, and validation. Working with the State Land Grant University, county extension offices can provide a wealth of knowledge concerning hazard impact and the steps taken to mitigate them.

5.5 Conclusions on Local Capability

The capability of jurisdictions in Marshall County is consistent from jurisdiction to jurisdiction with like sized jurisdiction often claiming the same capabilities. As such, county-level government and the larger municipal governments typically scored higher than smaller municipalities. In addition, larger municipalities tend to function independently. Thus, an important consideration in this plan update should be the concept of comprehensive planning with the integration of mitigation planning efforts made both between and within the participating jurisdictions.

In addition to ensuring mitigation planning efforts are integrated, strategies should be crafted to match the respective jurisdiction's reality. For example, if a jurisdiction does not have the political will to mitigate the harm caused by high winds, i.e., building a storm shelter, strategies directly stating that the jurisdiction is to build a storm shelter will not be as successful as strategies aimed at fostering education and building consensus. As such, strategies should use a building block approach starting at the limited achievable goal and building up to larger goals and eventually achieving the ultimate goal. (Create awareness for the need of a storm shelter, identify partners and build consensus regarding those who deem a storm shelter a worthy endeavor, identify funding concerning how to pay for the project, and then finally build the storm shelter)

The Marshall County Multi-Jurisdictional Hazard Mitigation Plan Update contained in this plan provides the vehicle to begin the process of having a mitigation program. However, in order to succeed it will require clearly articulating the benefits of participating in and sustaining the mitigation planning process and related mitigation based programs. One of the best ways to obtain local buy-in and long-term success is the education, identification, and implementation of achievable mitigation actions. Thus, while promoting the mitigation plan is the responsibility of all agencies, it is highly recommended that the Marshall County Emergency Manager lead this effort. As such, it is recommended that a plan consisting of goals, timeframes and milestones be created for the Marshall County Emergency Manager to create a sustainable mitigation program.

5.6 Linking the Capability Assessment, the Risk Assessment, and the Mitigation Strategy

The conclusions of the Capability Assessment and Risk Assessment serves as the foundation for a meaningful hazard mitigation strategy. During the process of identifying the goals and mitigation actions, each jurisdiction must consider not only their level of hazard risk but also their existing capability to minimize or eliminate that risk. In jurisdictions where the overall hazard risk is considered to be MODERATE, and local capability is considered LIMITED, then specific mitigation actions that account for these conditions should be considered. This may include less costly actions such as minor ordinance revisions or public awareness activities. If necessary, specific capabilities may need to be improved in order to better address recurring threats. Similarly, in cases where the hazard vulnerability is LIMITED and overall capability is MODERATE, more emphasis can be placed on actions that may affect future vulnerability such as guiding development away from known hazard areas.

Section 6: Mitigation Goals, Objectives, & Strategies

The Mitigation Goals, Objectives, and Strategy section describes how Marshall County intends to reduce or eliminate potential losses. The Mitigation Goals, Objectives, and Strategies section provides a framework for the county and participating jurisdictions to mitigate the effects of natural hazard events on their population, economy, and property. The mitigation strategy is the coordinated effort of agencies and partners to develop and implement a comprehensive range of inventive and effective natural hazard mitigation actions.

Mitigation Strategy Approach

- Establish mitigation goals and objectives that aim to reduce or eliminate long-term vulnerability to natural-hazard events
- Identify and analyze a comprehensive range of hazard-specific mitigation strategies that aim to achieve the goals and objectives of the mitigation strategy
- Describe how Marshall County and participating jurisdictions will prioritize, implement, and administer mitigation strategies

The Mitigation Goals, Objectives, and Strategy section is an extension of the previous sections of this report, and incorporates the findings of the hazards risk assessment to assist in prioritizing mitigation actions. In addition, the Mitigation Goals, Objectives, and Strategies section provides consideration of the findings of the capability assessment to identify mitigation actions that are manageable and address potential capability gaps. Finally, a maintenance and management section describes how the strategies are to be managed and accounted for in future updates.

FEMA Requirements Addressed in this Section

The Hazard Mitigation Planning Team developed the mitigation strategy consistent with the process and steps presented in the Federal Emergency Management Agency's (FEMA) How-To-Guide: Developing the Mitigation Plan (FEMA 386-3).

§201.6(c)(3) [The plan shall include the following:] A *mitigation strategy* that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs, and resources, and its ability to expand on and improve these existing tools.

§201.6(c)(3)(i) [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

§201.6(c)(3)(ii) [The hazard mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure. All plans approved by FEMA after October 1, 2008, must also address the jurisdiction's participation in the NFIP, and continued compliance with NFIP requirements, as appropriate.

§201.6(c)(3)(iii) [The hazard mitigation strategy shall include an] action plan, describing how the action identified in paragraph (c)(3)(ii) of this section will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

§201.6(c)(3)(iv) For multi-jurisdictional plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.

6.1 Mitigation Goals, Objectives, & Development

While Marshall County and its cities have engaged in several mitigation actions over the past five years, the area remains at risk. As noted in the past iterations of the Marshall Hazard Mitigation Plan those hazards posing the most risk due to frequency and impact include flood and severe winter/summer storms. While this plan still focuses on those priorities, new to this plan iteration is the emphasis placed on hazardous material incidents. Another area of emphasis new to this iteration of the Marshall County's Hazard Mitigation Plan is its focus on comprehensive practices. Many of the projects were created with an emphasis of incorporating plans and projects from multiple agencies/jurisdictions. Finally, this plan and its projects are a reflection of both existing and future development. Many of the projects in this plan were created to ensure Marshall County and participating jurisdictions are infusing resilience and sustainability into their future endeavors.

The update includes the creation of five new all-encompassing mitigation goals versus the four hazard specific goals that were listed in the immediate past iteration of the Marshall County Hazard Mitigation Plan. In addition, this update eliminates completed projects from the past plan, reassess the validity of past projects as well as adds new projects. The mitigation projects were derived from the updated community profile, hazard profile, a robust 28-point risk assessment and with the input of the local governments and citizens.

6.2 Strategies/Projects

The process of creating new mitigation projects officially commenced on December 2015 with the planning team meeting with each of the jurisdictions. Based on the concepts found in FEMA Publication 386-3, these meetings included a mitigation tutorial, an overview of what mitigation projects are, how to identify potential projects, a review of the past plan and an overview of the purpose of the mitigation plan as set by FEMA, the State of MN and the Mitigation Steering Committee. Attendees were instructed to review the existing mitigation goals, objectives, and strategies of the previous plan to determine what had been accomplished over the past five years, what projects were currently relevant and what new projects should be added to the update. Subsequently, the Mitigation Steering Committee, key stakeholders and public attendees discussed the current mitigation goals, objectives and strategies, and provided feedback on where modifications to the goals, objectives and projects were needed.

In the evaluation of mitigation strategies, stakeholders were instructed to consider the following criteria:

- Funding Options & Cost
- Staff Time
- Feasibility (the findings of the capability assessment)
- Population Benefit

- Property Benefit
- Values Benefit
- Maintenance
- Hazard Rating

In the evaluation and creation of projects, stakeholders were asked to assess each potential project in terms of eliminating risk and probability of success. Stakeholders were also requested to consider and provide direct and indirect costs and benefits with indirect costs and benefits being defined as intangible things such as social effects.

Upon completion of the mitigation project creation/evaluation process, the stakeholders provided a comprehensive list of desired strategies to the Hazard Mitigation Planning Team who subsequently organized the lists into common themes as well as evaluated and prioritized the submitted projects. Once they arranged actionable projects, the mitigation strategies were shared with stakeholders. Stakeholders were asked to accept, reject, modify, and or re-rank/prioritize the projects.

Once the data from all of the jurisdictions was again received, the Hazard Mitigation Planning Team again reorganized the data into a comprehensive list of strategies. The Hazard Mitigation Planning Team, who refined the list by eliminating duplication, providing succinctness, and generally organizing the strategies into a comprehensive and workable format, then reviewed the list. Once the refinement was complete, the mitigation strategies list was again shared with the participating jurisdictions and stakeholders for additional comment. After all of the comments were received and incorporated, a final list of strategies was made public for review and comment. The final comment and review section lasted approximately one month, ending at the end of March 2016.

The following is a summary of the mitigation update planning process:

- 1) New goals
- 2) Prioritization Criteria
- 3) Implementation Process
- 4) Projects
- 5) Mitigation Strategy Implementation and Administration

For this update, the mitigation goals were reorganized to be more general and all encompassing. The goals were also increased from four to five. The mitigation goals were chosen and created by the Mitigation Steering Committee with input from those wishing to participate.

Mitigation Goals:

- Increase community understanding of emergency management and build support for hazard mitigation
- Develop, promote, integrate and track mitigation strategies
- Continue to improve and enhance the county's emergency management program
- Increase the economic stability, core values, and quality of services of the participating jurisdictions
- Increase mitigation resources to eliminate or minimize harm done to people, property, jobs, and natural resources in Marshall County by natural and manmade hazards

6.3 Hazard/Project Relationship

The hazard project relationship table establishes that each of the hazards has at least one project assigned to it. Most hazards have multiple projects assigned to them.

Table 94: Hazards Mitigated by Each Proposed Project

Projects	Flooding (riverine and flash flood)	Dam / Levee Failure	Wildfire	Windstorms	Tornadoes	Hail	Lightning	Winter Storms	Erosion	Land Subsidence	Drought	Extreme Heat	Hazardous Material Release	Invasive Species	Infectious Disease	Fires (Structures and Vehicles)	Transportation Incidents	Water Supply Contamination
Continue Hazard Education	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Continue working with the National Weather Service to improve storm warning and awareness	X	X	X	X	X	X	X	X			X	X						
Increase weather radio use				X	X	X	X	X			X	X						
Provide severe weather information and safe travel plan	X			X	X	X	X	X					X				X	
Communicate hazard information using multiple technologies (IPAWS)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Increase Hazard preparedness (first responders, Volunteer groups, Jurisdictions etc.)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Incorporate mitigation based on the Red Lake and Middle/Snake/Tamarac Watershed's Water Management Plans, Electrical Cooperatives, City/County/Regional jurisdictions and other participating jurisdictions	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Projects	Flooding (riverine and flash flood)	Dam / Levee Failure	Wildfire	Windstorms	Tornadoes	Hail	Lightning	Winter Storms	Erosion	Land Subsidence	Drought	Extreme Heat	Hazardous Material Release	Invasive Species	Infectious Disease	Fires (Structures and Vehicles)	Transportation Incidents	Water Supply Contamination
Incorporate mitigation based on private partners (nursing homes, hospitals),	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Encourage trailer courts to have either an on-site shelter or an evacuation plan to a nearby shelter				X	X			X										
Create, incorporate and update storm plans for public events, schools, hospitals nursing homes and other stakeholders				X	X			X										
Identify & protect areas in Strandquist that may be shelter inhibited because of a high water table.	X			X	X			X										
Identify and build storm shelters in Marshall County for both tornadoes and winter storms					X			X										
Encourage individuals to have a shelter plan in place.				X	X			X										
Create a comprehensive storm shelter plan				X	X			X										
Identify and provide critical infrastructure that needs alternative power methods (Courthouse EOC etc.)	X	X	X	X	X			X				X						
Maintain and provide backup generators	X	X	X	X	X			X				X						

Projects	Flooding (riverine and flash flood)	Dam / Levee Failure	Wildfire	Windstorms	Tornadoes	Hail	Lightning	Winter Storms	Erosion	Land Subsidence	Drought	Extreme Heat	Hazardous Material Release	Invasive Species	Infectious Disease	Fires (Structures and Vehicles)	Transportation Incidents	Water Supply Contamination
Create a large outage events plan			X	X	X			X				X						
Mitigate at risk power lines			X	X				X										
Upgrade emergency communication system	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Decrease areas with no cell phone coverage	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Maintain and upgrade siren warning system			X	X	X													
Ensure that sirens have backup power sources			X	X	X													
Utilize GIS technology in emergency management and hazard mitigation	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mitigate repetitively damaged roads in Marshall County	X																	
Modify, raise or install drainage upon repetitively damaged roads.	X																	
Ensure that flood mitigation is a factor for new infrastructure	X																	
Create an emergency route plan	X							X									X	
Create and implement an ice/log jams and water backup plan.	X																	
Utilize the ring dike program for interested	X																	X

Projects	Flooding (riverine and flash flood)	Dam / Levee Failure	Wildfire	Windstorms	Tornadoes	Hail	Lightning	Winter Storms	Erosion	Land Subsidence	Drought	Extreme Heat	Hazardous Material Release	Invasive Species	Infectious Disease	Fires (Structures and Vehicles)	Transportation Incidents	Water Supply Contamination
landowners.																		
Buyout repetitive loss property	X																	
Update and enforce current floodplain ordinances.	X																	X
Replace old cast iron pipes.	X																	
Look into constructing storm sewers	X																	
Flood proof existing and new structures.	X																	
Inspect local properties, roads and bridges to judge which are the most at risk. Mitigate appropriately	X																	
Create and implement a local eroding riverbank stabilization plan.									X									
Utilize firebreaks around affected CRP			X															
Utilize controlled burns.			X															
Ensure that a large water supply is available to combat extensive fires for both rural and urban settings.			X													X		
Provide protection to cities surrounded by CRP acres during periods of excessive dryness.			X															

Projects	Flooding (riverine and flash flood)	Dam / Levee Failure	Wildfire	Windstorms	Tornadoes	Hail	Lightning	Winter Storms	Erosion	Land Subsidence	Drought	Extreme Heat	Hazardous Material Release	Invasive Species	Infectious Disease	Fires (Structures and Vehicles)	Transportation Incidents	Water Supply Contamination
Replace, maintain and upgrade first responder equipment.	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	
Enforce any set fire or burning or water usage bans			X								X							
Create and implement a water shortage plan											X							
Post adequate signage on all railroad crossings																	X	
Provide maps and available routes information to first responders.	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	
Reduce track blockage.													X				X	
Address maintenance issues relating to existing railroad crossings													X				X	
Secure anhydrous ammonia													X					
Address problems related to city lagoon systems listed on the MPCA's PPL																		X
Fix computer issues seen at the water plant in Argyle																		X
Find cost-effective means to provide storm sewers to Strandquist																		X
Survey/repair potential storm sewer damage caused by frost heave	X																	X

Projects	Flooding (riverine and flash flood)	Dam / Levee Failure	Wildfire	Windstorms	Tornadoes	Hail	Lightning	Winter Storms	Erosion	Land Subsidence	Drought	Extreme Heat	Hazardous Material Release	Invasive Species	Infectious Disease	Fires (Structures and Vehicles)	Transportation Incidents	Water Supply Contamination
Participate/plan in pandemic flu outbreak activities.															X			
Continue participation in hospital planning and health efforts.															X			
Increase the partnerships currently seen between Emergency Management and Public Health, and incorporate mitigation documented in Public Health planning documents															X			
Create and maintain a mosquito control program to include application, and maintenance/purchase of mosquito spraying equipment.															X			
Complete, update and exercise storm/crowd emergency planning for large population gathering events, such as Goose Fest.				X	X	X	X	X										
Complete pump. culvert resizing projects in Grygla	X																	X
Update Floodplain Maps in Newfolden and other pertinent areas.	X																	
Ensure Accesses to Oslo is maintained during Peak Flood	X																	

Projects	Flooding (riverine and flash flood)	Dam / Levee Failure	Wildfire	Windstorms	Tornadoes	Hail	Lightning	Winter Storms	Erosion	Land Subsidence	Drought	Extreme Heat	Hazardous Material Release	Invasive Species	Infectious Disease	Fires (Structures and Vehicles)	Transportation Incidents	Water Supply Contamination
Update Communications systems for all first responders	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Update communications so that all local, county regional and stat responders an effectively communicate	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

6.4 Project Prioritization

To ensure continuity from the immediate past iteration of the mitigation plan the Mitigation Steering Committee decided that the action prioritization methodology would remain the same. Thus, the philosophy and methodology remained intact from the immediate past iteration of the Marshall Hazard Mitigation Plan. As such, it is again noted that each of the proposed projects has value, however, time and financial constraints do not permit all of the proposed actions to be implemented immediately. By prioritizing the actions, the most critical, cost-effective projects can be achieved in the short term. The prioritization of the projects serves as a guide for choosing and funding projects, however, depending on the funding sources, some actions may be best achieved outside the priorities established here.

To ensure that community goals and other factors are taken into account when prioritizing projects, a prioritization model that uses the following factors was again used: cost, staff time, feasibility, population benefit, property benefit, values benefit, maintenance, and hazard rating.

- **Cost** considers the direct expenses associated with the project such as material and contractor expenses.
- **Staff time** evaluates the amount of time needed by a local government employee to complete or coordinate the project.
- **Feasibility** assesses the political, social, and/or environmental ramifications of the project and the likelihood such a project would proceed through permitting, public review processes, and/or private business implementation.
- **Population benefit** considers the possible prevention of deaths and injuries through the project's implementation.

- **Property benefit** estimates the reduction of property losses, including structures and infrastructure, from the hazard being mitigated.
- **Values benefit** considers the economic, ecologic, historic, and social benefits of the project.
- **Maintenance** rates the amount of work required to keep the mitigation measure effective and useful.
- **Hazard rating** is based on the results of the risk assessment and is a measure of the history, probability, severity, and vulnerabilities of the hazard.

Each of the factors was ranked qualitatively for each of the projects. The methods used to assign a category and the associated score is defined in Table 95. The highest possible score is 30. Some factors have a greater range than others, thus indicating a higher weighting. These weightings allow for appropriate prioritization of the project. More specifically, 11 of 30 points account for benefits (population benefit, property benefit, and values benefit), 11 of 30 points account for direct and indirect costs (cost, staff time, and maintenance), 5 of 30 points account for the hazard rating (incorporates hazard probability and impacts; see Section 4.5), and 3 of 30 points account for project feasibility.

Table 95: Prioritization Criteria

Factor	Threshold	Rating	Score
Cost (Range: 1-5)	Little to no direct expenses	Low	5
	Less than \$5,000	Low-Moderate	4
	\$5,000-\$25,000	Moderate	3
	\$25,001-\$100,000	Moderate-High	2
	Greater than \$100,000	High	1
Staff Time (Range: 1-3)	Less than 10 hours of staff time	Low	3
	10-40 hours of staff time	Moderate	2
	Greater than 40 hours of staff time	High	1
Feasibility (Range: 1-3)	Positive support for the project	High	3
	Neutral support for the project	Moderate	2
	Negative support for the project	Low	1
Population Benefit (Range: 1-4)	Potential to reduce more than 20 casualties	Very High	4
	Potential to reduce 6-20 casualties	High	3
	Potential to reduce 1-5 casualties	Moderate	2
	No potential to reduce casualties	Low	1

Property Benefit (Range: 1-4)	Potential to reduce losses to more than 20 buildings or severe damages to infrastructure	Very High	4
	Potential to reduce losses to 6-20 buildings or substantial damages to infrastructure	High	3
	Potential to reduce losses to 1-5 buildings or slight damages to infrastructure	Moderate	2
	No potential to reduce property losses	Low	1
Values Benefit (Range: 1-3)	Provides significant benefits to economic, ecologic, historic, or social values	High	3
	Provides some benefits to economic, ecologic, historic, or social values	Moderate	2
	No or very little benefit to economic, ecologic, historic, or social values	Low	1
Maintenance (Range: 1-3)	Requires very little or no maintenance	Low	3
	Requires less than 10 hours per year	Moderate	2
	Requires more than 10 hours per year	High	1
Hazard Rating (Range: 1-5)	See Risk Assessment	High	3
	See Risk Assessment	Moderate	2
	See Risk Assessment	Low	1

The following table provided an overview of all of the projects and priority scorecard. As previously noted the scorecard allows one to determine the feasibility of a project and otherwise prioritize projects.

Table 96: Project Score Card

Affected Areas	Projects	Cost	Staff Time	Feasibility	Population Benefit	Property Benefit	Values Benefit	Maintenance	Hazard Rating	TOTAL SCORE
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Continue Hazard Education	4	1	3	4	4	3	3	3	21
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Continue working with the National Weather Service to improve storm warning and awareness	5	2	3	4	1	3	3	3	19
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Increase weather radio use	5	2	3	4	1	1	3	3	17
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Provide severer weather information and safe travel plan	5	2	3	4	1	1	3	3	17
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Communicate hazard information using multiple technologies (IPAWS)	4	2	3	4	1	1	2	3	16
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Increase hazard preparedness (first responders, volunteer groups jurisdictions etc.)	3	1	3	4	1	3	3	3	18
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Incorporate mitigation based on the Red Lake and Middle/Snake/Tamarac Watershed's Water Management Plans, Electrical Cooperatives, City/County/Regional jurisdictions and other participating jurisdictions	2	1	3	1	4	2	3	3	17

Affected Areas	Projects	Cost	Staff Time	Feasibility	Population Benefit	Property Benefit	Values Benefit	Maintenance	Hazard Rating	TOTAL SCORE
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Incorporate mitigation based on private partners (nursing homes, hospitals),	4	1	3	4	3	2	3	3	19
The Cities of Viking & Argyle	Encourage trailer courts to have either an on-site shelter or an evacuation plan to a nearby shelter	5	3	2	4	1	1	3	2	16
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Create, incorporate and update storm plans for public events, schools, hospitals nursing homes and other stakeholders	5	2	3	4	1	2	3	2	17
Strandquist	Identify & protect areas in Strandquist that may be shelter inhibited because of a high water table.	2	1	3	1	1	1	2	3	12
The cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Identify and build storm shelters in Marshall County for both tornadoes and winter storms	1	1	3	4	1	1	2	2	14
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Encourage individuals to have a shelter plan in place.	5	2	2	4	1	1	3	2	15
The cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Create a comprehensive storm shelter plan	4	2	3	4	1	1	3	2	16
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Identify and provide critical infrastructure that needs alternative power methods (Courthouse EOC etc.)	1	2	3	4	3	3	2	2	19

Affected Areas	Projects	Cost	Staff Time	Feasibility	Population Benefit	Property Benefit	Values Benefit	Maintenance	Hazard Rating	TOTAL SCORE
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Maintain and provide backup generators	3	2	3	4	3	2	2	2	18
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Create a large outage events plan	5	1	3	4	4	2	3	2	19
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Mitigate at risk power lines	3	2	2	2	1	2	3	2	14
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Upgrade emergency communication system	1	2	3	4	1	1	2	3	16
Marshall County	Decrease areas with no cell phone coverage	2	2	2	1	1	1	3	2	12
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Maintain and upgrade siren warning system	3	2	3	3	1	1	2	2	14
The Cities of Stephen & Grygla	Ensure that sirens have back-up power sources	2	2	3	3	1	1	2	2	14
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Utilize GIS technology in emergency management and hazard mitigation	5	3	3	4	4	2	2	3	21
Marshall County	Mitigate repetitively damaged roads in Marshall County	3	1	3	1	2	2	2	3	14

Affected Areas	Projects	Cost	Staff Time	Feasibility	Population Benefit	Property Benefit	Values Benefit	Maintenance	Hazard Rating	TOTAL SCORE
Marshall County and the cities of Alvarado, Argyle, Grygla, Middle River, Oslo, Stephen & Strandquist	Modify, raise or install drainage upon repetitively damaged roads.	3	1	3	1	2	2	2	3	14
Marshall County and the cities of Alvarado, Argyle, Grygla, Middle River, Oslo, Stephen & Strandquist	Ensure that flood mitigation is a factor new infrastructure instruction	5	3	3	1	4	3	3	3	20
Marshall County, Oslo, Big Woods Township	Create an emergency route plan	5	2	3	4	1	2	3	2	17
Marshall County and the cities of Alvarado, Argyle, Grygla, Middle River, Oslo, Stephen & Strandquist	Create an implement an ice/log jams and water backup plan.	5	2	3	1	3	2	3	3	17
Marshall County	Utilize the ring dike program for interested landowners.	4	2	3	1	3	2	3	3	17
Marshall County and the city of Stephen	Buyout repetitive loss property	1	1	2	1	1	1	3	3	12
Marshall County and the cities of Alvarado, Argyle, Grygla, Middle River, Oslo, Stephen & Strandquist	Update and enforce current floodplain ordinances.	5	3	3	1	4	3	3	3	20
The cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen & Strandquist	Replace old cast iron pipes.	3	1	3	1	1	2	3	1	12
Strandquist	Look into constructing storm sewers	4	1	3	1	3	2	3	2	15
The cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Flood proof existing and new structures.	3	1	3	1	4	3	3	3	18
Marshall County	Inspect local properties, roads and bridges to judge which are the most at risk. Mitigate appropriately	4	2	3	1	3	3	3	3	18
Marshall County	Create and implement a local eroding riverbank stabilization plan.	4	2	3	1	2	2	3	1	14

Affected Areas	Projects	Cost	Staff Time	Feasibility	Population Benefit	Property Benefit	Values Benefit	Maintenance	Hazard Rating	TOTAL SCORE
Marshall County	Utilize firebreaks around affected CRP	4	2	3	4	4	3	2	2	20
Marshall County	Utilize controlled burns.	4	3	3	4	4	3	3	2	22
Marshall County and the city of Alvarado	Ensure that a large water supply is available to combat extensive fires for both rural and urban settings.	3	3	3	4	1	3	2	2	18
The cities of Holt, Strandquist & Viking	Provide protection to cities surrounded by CRP acres during periods of excessive dryness.	4	3	3	4	4	3	2	2	21
The cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Replace maintaining and upgrade first responder equipment.	2	2	3	4	4	2	2	3	20
Marshall County	Enforce any set fire or burning or water usage bans	5	3	3	1	4	3	3	2	19
Marshall County	Create and implement a water shortage plan	5	2	3	1	1	1	3	1	12
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Post adequate signage on all railroad crossings	4	2	3	1	1	1	2	1	11
Marshall County	Provide maps and available routes information to first responders.	3	2	3	1	4	1	2	3	16
The cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Reduce track blockage.	4	3	3	1	1	1	3	1	13
Marshall County and Argyle	Address maintenance issues relating to existing railroad crossings	3	3	3	1	1	1	2	1	12
Marshall County & Newfolden	Secure anhydrous ammonia	4	2	3	1	1	1	2	1	11
The Cities of Stephen & Oslo	Address problems related to city lagoon systems listed on the MPCA's PPL	2	2	3	1	1	1	2	1	11
The City of Argyle	Fix computer issues seen at the water plant in Argyle	3	2	3	1	1	1	2	1	11

Affected Areas	Projects	Cost	Staff Time	Feasibility	Population Benefit	Property Benefit	Values Benefit	Maintenance	Hazard Rating	TOTAL SCORE
The City of Strandquist	Find cost-effective means to provide storm sewers to Strandquist	4	2	3	1	1	1	2	1	11
The City of Argyle	Survey/repair potential storm sewer damage caused by frost heave	4	3	3	1	1	1	2	1	12
Marshall County	Participate/plan in pandemic flu outbreak activities.	5	3	3	1	1	1	3	1	13
Marshall County	Continue participation in hospital planning and health efforts.	5	3	3	1	1	1	3	1	13
Marshall County	Increase the partnerships currently seen between Emergency Management and Public Health, and incorporate mitigation documented in Public Health planning documents	5	3	3	1	1	1	3	1	13
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Create and maintain a mosquito control program to include application, and maintenance/purchase of mosquito spraying equipment.	4	2	3	2	1	1	2	1	12
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Complete, update and exercise storm/crowd emergency planning for large population gathering events, such as Goose Fest.	4	2	3	4	1	1	3	1	15
Marshall County	Complete Pump. Culvert resizing projects in Grygla	3	2	3	1	2	2	2	3	15
Marshall County and Newfolden	Update Floodplain Maps in Newfolden and other pertinent areas.	3	1	3	1	4	3	3	3	18
The City of Oslo	Ensure Accesses to Oslo is maintained during Peak Flood	3	1	3	2	4	2	3	3	18
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Update communications systems for all first responders	2	1	3	4	1	1	2	3	15
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Oslo, Stephen, Strandquist, Viking, & Warren	Update communications so that all local, county regional and state responders can effectively communicate	2	1	3	4	1	1	2	3	15

6.5 Implementation Process

A critical component of any mitigation program is the implementation of the mitigation projects. The proposed and prioritized projects are shown in Table 97 with the associated responsible stakeholders, resources needed, and goal timeframes for the projects. The timeframes are defined as follows:

- Near Term: Within 0-3 years
- Mid Term: Within 3-6 years
- Long Term: Within 7-10 years
- Ongoing: Initiated in the near, mid, or long term and continuing

Note: Some projects may be best achieved outside of the goal timeframes depending on the funding and staff resources available. Others may not be feasible in the goal timeframe due to financial, staff, or political limitations. This prioritized list, however, allows the county, city, and towns to focus on the projects with the greatest benefits. The following is a table of complete actions in order of their priority score. The Table also illustrates the jurisdiction(s) owning the project, coordinating agency, resources and the goal frame of each project.

6.5.1 Mitigating Projects

Mitigation strategies are the foundation of a truly effective emergency management program.

- Mitigation creates safer communities by reducing losses of life and property
- Mitigation enables individuals and communities to recover more rapidly from disasters
- Mitigation lessens the financial impact of disasters on individuals, the Treasury, state, local and tribal communities

The county and participating jurisdictions recognize the importance of incorporating mitigation into the overlapping emergency management functions (prepare, respond, recover), existing local and state building codes, zoning ordinances, and various plans (land use, community development, water improvement development, etc.). For this reason, the aforementioned comprehensive all-hazard mitigation strategies also identified strategies that would, and will, improve the county's and participating jurisdiction's emergency management capabilities, while creating communities that are resilient in the face of disaster.

Table 98: Mitigation Projects

Jurisdictions	Projects	Coordinating Agencies and Partners	Resources Needed	Goal Timeframe	TOTAL SCORE
Marshall County	Utilize controlled burns.	Landowner, NRCS	Time	Ongoing, Short-Term	22

Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen, Strandquist, Viking, & Warren	Utilize GIS technology in emergency management and hazard mitigation	Emergency Management	Grants, HMGP	Long-Term	21
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen, Strandquist, Viking, & Warren	Continue Hazard Education	Emergency Response Personnel	Staff Time	Ongoing, Short-Term	21
The cities of Holt, Strandquist & Viking	Provide protection to cities surrounded by CRP acres during periods of excessive dryness.	Fire Departments, Cities	Budgets, Staff Time	Ongoing, Long-Term	21
Marshall County and the cities of Alvarado, Argyle, Grygla, Middle River, Olso, Stephen & Strandquist	Ensure that flood mitigation is a factor new infrastructure instruction	MNDOT, Marshall County, Emergency Management	MNDOT/County Funds	Ongoing, Long-Term	20
The cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen, Strandquist, Viking, & Warren	Replace maintaining and upgrade first responder equipment.	Fire Departments	County/Dept. Budget, Grants, FEMA, HMGP	Ongoing, Long-Term	20
Marshall County	Utilize firebreaks around affected CRP	Landowner, NRCS	Time	Ongoing, Short-Term	20
Marshall County and the cities of Alvarado, Argyle, Grygla, Middle River, Olso, Stephen & Strandquist	Update and enforce current floodplain ordinances.	Emergency Management, Cities, Marshall County	Staff Time	Ongoing, Long-Term	20

Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen, Strandquist, Viking, & Warren	Continue working with the National Weather Service to improve storm warning and awareness	Emergency Response Personnel, NWS	Staff Time	Ongoing, Long-Term	19
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen, Strandquist, Viking, & Warren	Incorporate mitigation based on private partners (nursing homes, hospitals),	Emergency Management	Staff Time	Long-Term	19
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen, Strandquist, Viking, & Warren	Create a large outage events plan	Emergency Management, Critical Infrastructure	Staff Time	Ongoing, Long-Term	19
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen, Strandquist, Viking, & Warren	Identify and provide critical infrastructure that needs alternative power methods (Courthouse EOC etc.)	Emergency Response Personnel	Staff Time	Ongoing, Long-Term	19
Marshall County	Enforce any set fire or burning or water usage bans	Emergency Response Personnel, DNR	Staff Time	Long-Term	19

Marshall County and the city of Alvarado	Ensure that a large water supply is available to combat extensive fires for both rural and urban settings.	Emergency Management, Fire Departments, Cities	Time, Budgets,	Long-Term	18
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen, Strandquist, Viking, & Warren	Maintain and provide backup generators	Critical Infrastructure	Staff Time	Short-Term	18
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen, Strandquist, Viking, & Warren	Increase hazard preparedness (first responders, volunteer groups jurisdictions etc.)	Emergency Response Personnel	Staff Time	Ongoing, Long-Term	18
Marshall County and Newfolden	Update Floodplain Maps in Newfolden and other pertinent areas.	FEMA, DNR, Newfolden Marshall County	HMGP, FEMA, State	Ongoing, Long-Term	18
The City of Oslo	Ensure Accesses to Oslo is maintained during Peak Flood	Marshall County, Oslo MNDot	Local, HMGP, FEMA, State	Ongoing, Long-Term	18
The cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen, Strandquist, Viking, & Warren	Flood proof existing and new structures.	Structure Owners	Homeowner	Ongoing, Long-Term	18

Marshall County	Inspect local properties, roads and bridges to judge which are the most at risk. Mitigate appropriately	Marshall County, MNDOT, Watersheds	Staff Time, City/County Budget, HMGP, FEMA, State	Ongoing, Short-Term	18
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen, Strandquist, Viking, & Warren	Increase weather radio use	Emergency Response Personnel, NWS	Staff Time	Ongoing, Long-Term	17
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen, Strandquist, Viking, & Warren	Create, incorporate and update storm plans for public events, schools, hospitals nursing homes and other stake holders	Emergency Management	Staff Time	Long-Term	17
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen, Strandquist, Viking, & Warren	Incorporate mitigation based on the Red Lake and Middle/Snake/Tamarac Watershed's Water Management Plans, Electrical Cooperatives, City/County/Regional jurisdictions and other participating jurisdictions	Emergency Management, Watershed	Staff Time	Short-Term	17

Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen, Strandquist, Viking, & Warren	Provide severer weather information and safe travel plan	MNDOT, Emergency Response Personnel	Staff Time	Ongoing, Short-Term	17
Marshall County, Oslo, Big Woods Township	Create an emergency route plan	MNDOT, Marshall County, Emergency Management, Residents	Staff Time	Ongoing, Long-Term	17
Marshall County and the cities of Alvarado, Argyle, Grygla, Middle River, Olso, Stephen & Strandquist	Create an implement an ice/log jams and water backup plan.	Marshall County, MNDOT	Watershed, County & City Budgets, MNDOT	Long-Term	17
Marshall County	Utilize the ring dike program for interested landowners.	Emergency Management, Landowners	State, DNR, Watershed, Landowner, County	Ongoing, Short-Term	17
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen, Strandquist, Viking, & Warren	Communicate hazard information using multiple technologies (IPAWS)	Emergency Response Personnel, NWS	Staff Time	Ongoing, Short-Term	16
The Cities of Viking & Argyle	Encourage trailer courts to have either an on-site shelter or an evacuation plan to a nearby shelter	Trailer Courts	Staff Time	Long-Term	16
The cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen, Strandquist, Viking, & Warren	Create a comprehensive storm shelter plan	Emergency Management	Staff Time	Ongoing, Short-Term	16

Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen, Strandquist, Viking, & Warren	Upgrade emergency communication system	Emergency Response Personnel	County Budget, HMGP, Grants	Ongoing, Long-Term	16
Marshall County	Provide maps and available routes information to first responders.	Emergency Response Personnel	Staff Time	Ongoing, Long-Term	16
Strandquist	Look into constructing storm sewers	Strandquist, MPCA	Budgets, MPCA, Grants	Ongoing, Long-Term	15
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen, Strandquist, Viking, & Warren	Complete, update and exercise storm/crowd emergency planning for large population gathering events, such as Goose Fest.	Emergency Management, Event/Facility Coordinators	Staff Time, Budgets	Ongoing, Long-Term	15
Marshall County	Complete Pump. Culvert resizing projects in Grygla	Marshall County and Grygla		Ongoing, Short-Term	15
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen, Strandquist, Viking, & Warren	update communications so that all local, county regional and state responders can effectively communicate	Emergency Management, First responders, Cities, County and State	Staff Time, Budgets	Long-Term	15

The cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen, Strandquist, Viking, & Warren	Identify and build storm shelters in Marshall County for both tornadoes and winter storms	Emergency Response Personnel	Staff Time	Short-Term	14
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen, Strandquist, Viking, & Warren	Maintain and upgrade siren warning system	Cities, Emergency Management	Staff Time	Ongoing, Long-Term	14
The Cities of Stephen & Grygla	Ensure that sirens have back-up power sources	City, Emergency Management	City Budget, HMGP	Short-Term	14
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen, Strandquist, Viking, & Warren	Mitigate at risk power lines	Power Companies	Staff Time	Short-Term	14
The cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen, Strandquist, Viking, & Warren	Identify and build storm shelters in Marshall County for both tornadoes and winter storms	Emergency Response Personnel	Staff Time	Short-Term	14
Marshall County	Mitigate repetitively damaged roads in Marshall County	MNDOT, Marshall County, Emergency Management	MNDOT/County Funds, FEMA, HMGP	Ongoing, Long-Term	14
Marshall County and the cities of Alvarado, Argyle, Grygla, Middle River, Olso, Stephen & Strandquist	Modify, raise or install drainage upon repetitively damaged roads.	MNDOT, Marshall County	MNDOT/County Funds, FEMA, HMGP	Long-Term	14

Marshall County	Create and implement a local eroding riverbank stabilization plan.	Emergency Management, Watersheds	Staff Time	Short & Long-Term	14
The cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen, Strandquist, Viking, & Warren	Reduce track blockage.	Railroad Companies, Cities, Emergency Mgmt.	Railroad Budget	Long-Term	13
Marshall County	Participate/plan in pandemic flu outbreak activities.	Emergency Management,	Staff Time	Short-Term	13
Marshall County	Continue participation in hospital planning and health efforts.	Emergency Response Personnel, Public Health	Public Health, HMGP, FEMA, State	Ongoing, Long-Term	13
Marshall County	Increase the partnerships currently seen between Emergency Management and Public Health, and incorporate mitigation documented in Public Health planning documents	Emergency Response Personnel, Public Health	Public Health, HMGP, FEMA, State	Ongoing, Short-Term	13

Strandquist	Identify & protect areas in Strandquist that may be shelter inhibited because of a high water table.	Emergency Management, Strandquist	Staff Time, Budgets, FEMA, HMGP	Long-Term	12
Marshall County	Decrease areas with no cell phone coverage	Cell Phone Companies	Cell Company Budget	Long-Term	12
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen, Strandquist, Viking, & Warren	Create and maintain a mosquito control program to include application, and maintenance/purchase of mosquito spraying equipment.	Emergency Management, Cities	Staff Time	Short-Term	12
The City of Argyle	Survey/repair potential storm sewer damage caused by frost heave	Argyle	Budgets, MPCA, Grants	Short-Term	12
Marshall County and Argyle	Address maintenance issues relating to existing railroad crossings	Cities, Railroad Companies	Railroad Budget	Ongoing, Long-Term	12
Marshall County	Create and implement a water shortage plan	Cities, Emergency Management	Staff Time	Long-Term	12

Marshall County and the city of Stephen	Buyout repetitive loss property	Emergency Management, Land/Homeowner	State/County Budget, FEMA, HMGP	Ongoing, Short-Term	12
The cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen & Strandquist	Replace old cast iron pipes.	Cities	City Budget	Ongoing, Long-Term	12
Marshall County & Newfolden	Secure anhydrous ammonia	Emergency Management, Ammonia Retailers	Retailer Budget, USDA	Long-Term	11
The Cities of Stephen & Oslo	Address problems related to city lagoon systems listed on the MPCA's PPL	Cities, MPCA	Budgets, MPCA	Long-Term	11
The City of Argyle	Fix computer issues seen at the water plant in Argyle	Argyle, MPCA, Water Plant	Budgets, Grants	Short-Term	11
The City of Strandquist	Find cost-effective means to provide storm sewers to Strandquist	Strandquist	City Budgets, Loans	Long-Term	11
Marshall County and the cities of Alvarado, Argyle, Grygla, Holt, Middle River, Newfolden, Olso, Stephen, Strandquist, Viking, & Warren	Post adequate signage on all railroad crossings	Railroad Companies	Railroad Budget	Long-Term	11

The development of this plan has provided Marshall County and its participants with a unique opportunity to assess current capabilities, identify gaps, and evaluate the strategies needed to improve the ability to protect the county and participating jurisdictions.

6.5.2 Existing and New Plan Implementation

Marshall County and participating jurisdictions feels that it is imperative to make mitigation a way of life for its participating jurisdictions, agencies, and general community. In order to implement sustainable and resilient strategies, it is essential to integrate mitigation into other community planning initiatives. As such, existing planning mechanism were used to assist the Mitigation Steering Committee and local jurisdictions in identifying areas where hazard mitigation information and/or actions may be incorporated.

During the planning process, the county and participating jurisdictions were asked to investigate opportunities to incorporate mitigation measures that would meet the goals and objectives of the Marshall County Hazard Mitigation Plan. In addition, the county and participating jurisdictions were asked to ensure the implementation and alignment of the Marshall County Hazard Mitigation Plan into existing programs/policies as outlined in Table 99 shown below (see Capability Assessment).

Table 99: Programs/Policies/Plans

Programs/Policies/Plans	Mitigation Integration/ Alignment Required	Represented Jurisdictions
Land Use Plan	Ongoing	Marshall County and the cities of Alvarado, Oslo, Stephen & Strandquist
Marshall County Emergency Operations	Ongoing	All Participating Jurisdictions
Flood Management Plan	Ongoing	Marshall County and the cities of Alvarado, Argyle, Grygla, Middle River, Newfolden, Oslo, Stephen and Warren
Marshall County Zoning Ordinances	Ongoing	All Participating Jurisdictions
NFIP	Ongoing	Marshall County and the cities of Alvarado, Argyle, Grygla, Middle River, Oslo, Stephen & Strandquist
Minnesota State Multi-Hazard Mitigation Plan	Yes I/A	All Participating Jurisdictions
Minnesota State Building Code	Yes I/A	All Participating Jurisdictions

NOTE: This table represents areas where the Marshall County Hazard Mitigation Plan update may be incorporated. The actual implementation process is outlined below.

One of the implementation steps of the Marshall County Hazard Mitigation Plan is to revise all of the aforementioned plans to incorporate the mitigation actions identified in this document. To accomplish the integration of mitigation actions, the Marshall County Emergency Manager will contact the individuals responsible for the above-listed plans, and request that those documents incorporate or reference relevant portions of the Marshall County Hazard Mitigation Plan when and where appropriate (See Section 7).

Revisions to these documents will follow the revision or amendment guidelines established for each plan. In addition, the Marshall County Emergency Manager will send a letter to the pertinent organizations to ensure the incorporation of aid documents with the Marshall County Hazard Mitigation Plan.

Table 100: Jurisdictional Process for Mitigation Incorporation

Jurisdictional Process for Mitigation Incorporation		
Jurisdiction	Form of Governance	Point of Contact
Marshall County	GARY KIESOW	Commissioner
Alvarado	GARY TOREN	Mayor
Argyle	ROBERT CLAUSEN	Mayor
Grygla	RICHARD MOSHER	Mayor
Holt	DALE JOHNSON	Mayor
Middle River	ERIC MIMNAUGH	Mayor
Newfolden	LORI WARNE	Mayor
Oslo	SANDRA SIMONSON	Mayor
Stephen	RICHARD LEE	Mayor
Strandquist	LOYAL LEFROOTH	Mayor
Viking	MICHAEL HESTEKIND	Mayor
Warren	DEB MYRFIELD	Mayor

As Marshall County and its cities develop new plans, such as capital improvement plans, and existing plans are updated, the new plans and updates will utilize the hazard information and projects identified in the Marshall County Hazard Mitigation Plan for consideration and inclusion. Given that limited planning mechanisms exist in the county and jurisdictions, the information in the Marshall County Hazard Mitigation Plan will be valuable for future planning efforts. Table 101 shows examples of projects and how they can be incorporated into existing and future planning documents. Note that some proposed mechanisms may not be feasible at this time due to the staff, technical expertise, and financial resources need to implement the program.

Table 101: Mitigation Strategies

Existing or Anticipated Plan	Mitigation Strategies	Estimated Revision or Creation Timeframe
Building Codes	Adopt building codes that require disaster resistance to hazards such as severe thunderstorms, wind, tornadoes, floods, wildfire, winter storms, terrorism, and earthquakes.	Near Term*
Capital Improvement Plans	When developed, consider and include projects related to hazard mitigation, such as transportation and public utility infrastructure improvements, in the capital improvements schedule.	Long Term*
Ordinances	Adopt ordinances that create disaster resistance such as mowing and fire reduction ordinances and flood	Mid Term

Existing or Anticipated Plan	Mitigation Strategies	Estimated Revision or Creation Timeframe
	ordinances.	
Zoning	Update or create zoning ordinances to limit development in high hazard areas.	Near Term*
Marshall County Community Wildfire Protection Plan	Create a plan that meets federal standards and identifies hazards and mitigation measures specific to wildfire.	Mid Term
Marshall County Emergency Operations Plan	Integrate the operational, response, training, and preparedness needs that are not directly tied to mitigation into the county's emergency operation plan	Mid Term
Marshall County Growth Policy	Incorporate elements of the risk assessment and mitigation strategy into the county's growth policy, considering sustainability and disaster resistance a top priority.	Near Term
Marshall County Subdivision Regulations	Include elements of the risk assessment and mitigation strategy in the county's subdivision regulations, considering sustainability and disaster resistance a top priority.	Near Term

Note: Some activities such as building codes and land use regulations are more easily implemented by some communities than others because of the community, planning, and enforcement resources available.

Section 7: Monitor and Maintain the Mitigation Plan

The Plan Maintenance section of the Marshall County (2016) Hazard Mitigation Plan describes the formal process that will ensure the mitigation plan remains an effective and relevant document. This section establishes the method and schedule for monitoring, evaluating, and updating the Marshall County Hazard Mitigation Plan during a five-year plan update cycle. It also establishes how Marshall County will maintain community involvement in the plan.

Maintenance Approach

- Incorporate hazard mitigation actions into existing planning mechanisms
- Determine how mitigation projects and actions will be monitored
- Establish indicators of effectiveness or success
- Develop an evaluation and revision schedule to ensure the Marshall County Hazard Mitigation Plan is up-to-date at the end of the five-year-cycle
- Establish a process for public input and community involvement during the planning cycle

FEMA Requirements Addressed in this Section

The Hazard Mitigation Planning Team created the Marshall County Hazard Mitigation Plan maintenance strategy consistent with the process and steps presented in the Federal Emergency Management Agency's (FEMA) How-To Guide: Bringing the Plan to Life (FEMA 386-4). The following FEMA requirements are addressed in this section:

- ✓ Requirement §201.6(c)(4)(i): [The plan maintenance process shall include a section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.
- ✓ Requirement §201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans where appropriate.
- ✓ Requirement §201.6(c)(4)(iii): [The plan maintenance process shall include a discussion on how the community will continue public participation in the plan maintenance process.

7.1 Development and Acceptance

Maintaining the Marshall County Hazard Mitigation Plan is crucial if Marshall County is to have a comprehensive mitigation program. As such, this section creates a maintenance timeline, assigning accountability, and creating oversight and governance.

The Hazard Mitigation Planning Team created the monitoring and maintenance section of the Marshall County Hazard Mitigation Plan. The section was presented to the Marshall County Emergency Manager for comment and buy in. Upon some very slight modifications, the section was presented to the Mitigation Steering Committee, participating jurisdictions and the public for comment and approval.

7.2 Process

During the five-year planning cycle, the Marshall County Emergency Manager will undertake the following initiatives:

- Collect annual information from the agencies involved in implementing mitigation projects or activities identified in the Mitigation Strategy section of the Marshall County Hazard Mitigation Plan
- Maintain and update the mitigation action table
- Conduct site visits and obtain reports of completed or initiated mitigation actions to incorporate in the Marshall County Hazard Mitigation Plan revision as needed
- Research and document new natural disaster information pertaining to Marshall County during the planning cycle and incorporate into a revised risk assessment section as needed
- Organize (at a minimum) annual meetings with each of the participating jurisdictions and county commissioners to discuss relevant hazard mitigation issues, provide status updates, and discuss available grant opportunities
- Organize biannual meetings with mitigation steering committee members to discuss relevant hazard mitigation issues, provide status updates, and discuss available grant opportunities
- Coordinate, compile, and disseminate hazard mitigation funding information and applications
- Convene a meeting of the Mitigation Steering Committee within a timely period following a natural disaster, when funding is announced to prioritize and submit potential mitigation actions for funding and/or at the direction of the Disaster and Emergency Services Coordinator

The above activities outline plan maintenance during the four years leading up to the fifth year of the planning cycle (2016-2021). Beginning in August 2017, the Marshall Emergency Manager will reconvene the Planning Committee to discuss and update the status of the hazard mitigation actions listed in the Marshall County Hazard Mitigation Plan. The Marshall Emergency Manager will be responsible for ensuring the compilation, documentation, and incorporation of all changes derived from the activities listed above into a revised plan document.

7.3 Evaluation

The Marshall County Hazard Mitigation Plan will be evaluated annually to determine the effectiveness of its projects, programs, and policies. The Marshall County Emergency Manager will be responsible for scheduling and organizing the planning meetings, collecting, analyzing and incorporating annual reports, and providing revised drafts to the Mitigation Steering Committee. Each year, the Mitigation Steering Committee members will assess the current version of the Marshall County Hazard Mitigation Plan and determine the improvements necessary for the plan update. The Marshall County Emergency Manager will evaluate the Marshall County Hazard Mitigation Plan to determine if other agencies should be added.

A thorough examination of the Marshall County Hazard Mitigation Plan will take place during the fifth year of the process to ensure Marshall County has an updated hazard mitigation plan at the end of the planning cycle. The Mitigation Steering Committee will review the goals and action items to determine their relevance to changing situations in the county, as well as changes in state or federal policy, and to ensure they are addressing current and expected conditions. The Mitigation Steering Committee will look at any changes in county resources that may influence the plan implementation (such as funding), and program changes to determine the need for reassignment. The Mitigation Steering Committee will review all portions

of the Marshall County Hazard Mitigation Plan to determine if this information should be updated or modified given any newly available data.

7.4 Evaluation Criteria

- Are the mitigation actions effective?
- Are there any changes in land development that affect mitigation priorities?
- Do the goals, objectives, and action items meet social, technical, administrative, political, legal, economic, and environmental criteria as defined in FEMA's STAPLEE analysis?
- Are the goals, objectives, and mitigation actions relevant given any changes in Marshall County?
- Are the goals, objectives, and mitigation actions relevant given any changes to state or federal regulations or policy?
- Is there any new data that affects the Risk Assessment portion of the Marshall County Hazard Mitigation Plan?

7.5 Update

The Marshall County Emergency Manager will ensure the Mitigation Steering Committee updates the Hazard Mitigation Plan every five years to reflect the results of the annual reports and on-going plan evaluation. Throughout the planning cycle, the Marshall County Emergency Manager will ensure that new information is compiled and incorporated into the Marshall County Hazard Mitigation Plan. The Marshall County Emergency Manager will also incorporate recommended comments expressed by FEMA in the initial review into the Marshall County Hazard Mitigation Plan revision. At the end of the planning cycle, the Mitigation Steering Committee will submit the updated Marshall County Hazard Mitigation Plan to the State Emergency Management Office and FEMA for review. After FEMA has approved the Marshall County Hazard Mitigation Plan, the county will again formally adopt the Marshall County Hazard Mitigation Plan. The following table is an outline of how the Marshall County Hazard Mitigation Plan will be updated upon FEMA-approval:

Table 102: Marshall County Hazard Mitigation Plan Update Schedule

Marshall County Hazard Mitigation Plan Update Schedule		
Timeframe	Participant	Outcome
First Quarter 2017	Mitigation Steering Committee Participating Jurisdictions	Reconvene Planning Committee to discuss mitigation action progress and possible plan improvements.
First Quarter 2018	Mitigation Steering Committee Participating Jurisdictions	Reconvene Planning Committee to discuss mitigation action progress and possible plan improvements.
First Quarter 2019	Mitigation Steering Committee Participating Jurisdictions	Reconvene Planning Committee to discuss mitigation action progress and possible plan improvements.
Fourth Quarter 2019	Mitigation Steering Committee, Participating Jurisdictions County Commissioners	Apply for plan update grant funding

Marshall County Hazard Mitigation Plan Update Schedule		
Timeframe	Participant	Outcome
First Quarter 2020	Mitigation Steering Committee Participating Jurisdictions	Reconvene Planning Committee to discuss mitigation action progress and possible plan improvements.
Fourth Quarter 2020	Mitigation Steering Committee Participating Jurisdictions MN HSEM	Reconvene Hazard Mitigation Planning Team and begin plan update. Coordinate monthly meetings with Hazard Mitigation Steering Committee.
First Quarter 2021	Mitigation Steering Committee Participating Jurisdictions MN HSEM	Continue plan update.
Fourth Quarter 2021	Mitigation Steering Committee Participating Jurisdictions MN HSEM	Submit plan to FEMA for final approval

7.6 Incorporation into Existing Planning Mechanisms

As part of the local capability assessment conducted during the planning process, the Mitigation Steering Committee identified current plans, programs, policies/ordinances, and studies/reports that will augment or help support mitigation planning efforts. The Mitigation Steering Committee will meet on an annual basis, and will be the mechanism for ensuring the county integrates hazard mitigation into its future planning activities. Following plan approval and adoption, the Mitigation Steering Committee and participating jurisdictions will work to incorporate, where applicable, the Marshall County Hazard Mitigation Plan into the planning mechanisms identified in the mitigation action section.

Throughout the plan maintenance cycle, the Marshall County Emergency Manager will work with the county and participating jurisdictions to integrate hazard mitigation goals and actions into the general operations of key agencies. The Marshall County Emergency Manager will work with agencies to identify opportunities as outlined below:

Update work plans, policies, or procedures to include hazard mitigation concepts

- Identify potential mitigation funding within capital and operational budgets
- Issue plans, policies, executive orders, regulations, or other directives to carry out mitigation actions
- Add hazard mitigation elements to redevelopment plans

7.7 Continued Public Involvement

Marshall County is dedicated to continued public involvement in the hazard mitigation planning and review process. During all phases of plan maintenance, the public will have the opportunity to provide feedback. The Marshall County Hazard Mitigation Plan will be maintained and available for review on the county website. Individuals will have an opportunity to submit comments for the Marshall County Hazard Mitigation Plan update at any time. The Marshall County Emergency Manager will compile all comments and present

them at the annual Mitigation Steering Committee meetings, where members will consider them for incorporation into the revision. To help publicize the revised Marshall County Hazard Mitigation Plan six months prior to the submission of the 2021 Marshall County Hazard Mitigation Plan update, Marshall County will post a notice in the Marshall County paper of record requesting feedback on an updated draft plan. The Hazard Mitigation Planning Team will hold community involvement meetings with representatives from academic institutions, the private sector, community groups, and neighboring jurisdictions. This will provide the public an opportunity to express their concerns, opinions, or ideas about any updates/changes that are proposed to the Marshall County Hazard Mitigation Plan.

7.8 The Hazard Mitigation Steering Committee

The Mitigation Steering Committee oversees changes and modifications to the Marshall County Hazard Mitigation Plan, and will regularly review each goal and objective to determine its relevance to the changing situation of the county. The Mitigation Steering Committee will also monitor and evaluate the mitigation strategies in the current iteration of the Marshall County Hazard Mitigation Plan to ensure that the document reflects current hazard/risk analysis, development trends, code changes, and risk perceptions.

The Mitigation Steering Committee and the participating jurisdictions agree that outreach and input will be solicited throughout the Marshall County Hazard Mitigation Plan's lifecycle through workshops, presentations, meetings, the internet, and other public information and education campaigns.

To ensure the Marshall County Hazard Mitigation Plan is up to date and relevant the Mitigation Steering Committee will meet as per their mandate and/or at the direction of the Marshall County Emergency Services Coordinator.

7.9 Participating Jurisdictions

Participating jurisdictions are key stakeholders within the Marshall County Mitigation Plan, and as such, have agreed to be an active participant in the mitigation process. Participating jurisdictions may be active Mitigation Steering Committee members, but they are not required to be members.

Participating jurisdictions are welcome to attend mitigation-planning meetings and or review the minutes of said meetings.

The participating jurisdictions have agreed to ensure the Marshall County Hazard Mitigation Plan is current and relevant. Participating jurisdictions agree to provide updates of appropriate activities occurring within their jurisdictions on a regular basis, and/or at the direction of the Marshall County Emergency Manager.

Participating jurisdictions have agreed to ensure that within their own jurisdictions the mitigation planning is integrated into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate. Jurisdictions also agree to work with the Marshall County Emergency Manager to identify areas of plan integration, as well as provide regular progress reports of the integration of the mitigation plan into existing and or new plans. Conversely, the Marshall County Emergency Manager agrees to ensure participating jurisdictions are included in the planning process, particularly when plan updates will affect the participating jurisdictions, and when or if changes are made to the Marshall County Hazard Mitigation Plan. Furthermore, the participating jurisdictions agree to work with the Marshall County Emergency Manager and Mitigation Steering Committee when requested.

Appendix A: Inventory of Hazard Mitigation Programs, Policies, and Funding

Federal Agencies and Programs

U.S. Department of Homeland Security

Federal Emergency Management Agency (FEMA)

General information on mitigation planning, hazards, disaster assistance programs, current disasters, etc.

Hazard Mitigation Grant Program (HMGP)

HMGP assists in implementing long-term hazard mitigation measures following Presidential disaster declarations. Funding is available to implement projects in accordance with State, Tribal, and local priorities.

Pre-Disaster Mitigation (PDM)

PDM provides funds on an annual basis for hazard mitigation planning and the implementation of mitigation projects prior to a disaster. The goal of the PDM program is to reduce overall risk to the population and structures, while at the same time, also reducing reliance on Federal funding from actual disaster declarations.

Flood Mitigation Assistance (FMA)

FMA provides funds on an annual basis so that measures can be taken to reduce or eliminate the risk of flood damage to buildings insured under the National Flood Insurance Program (NFIP).

National Flood Insurance Plan

Detailed information on the National Flood Insurance Program and other mitigation activities

Hazard Mitigation Funding Under Section 406 (Public Assistance)

Section 406 provides discretionary authority to fund mitigation measures in conjunction with the repair of the disaster-damaged facilities.

U.S. Department of Agriculture (USDA)

Natural Resources Conservation Service (NRCS)

To provide leadership in a partnership effort to help conserve, improve, and sustain our natural resources and environment

Community Facility Grants

Assistance for the development of essential community facilities. Grant funds can be used to construct, enlarge, or improve community facilities for health care, public safety, and community and public services.

Emergency Watershed Protection (EWP)

Program is for emergency measures, including the purchase of flood plain easements, for runoff retardation

and soil erosion prevention to safeguard lives and property from floods, drought, and the products of erosion on any watershed whenever fire, flood or any other natural occurrence is causing or has caused a sudden impairment of the watershed.

Environmental Quality Incentives Program (EQIP)

Provides technical assistance, cost-share payments, and incentive payments to assist crop, livestock, and other agricultural producers with environmental and conservation improvements to their operations.

Wetlands Reserve Program

Voluntary program offering landowners the opportunity to protect, restore, and enhance wetlands on their property. Provides technical and financial support to help landowners.

Conservation Easements

In cooperation with Minnesota BWSR funding for conservation easements on frequently flooded lands is available. One of many Reinvest in Minnesota (RIM) - NRCS partnerships.

Farm Service Agency (FSA)

Disaster Assistance Programs available, include:

Conservation Loans

Conservation Reserve Program

Emergency Conservation Program

Non-Insured Crop Disaster Assistance Program

Emergency Farm Loans

U.S. Department of Commerce (DOC)

Economic Development Administration (EDA)

To generate jobs, help retain existing jobs, and stimulate industrial and commercial growth in economically distressed areas of the U.S.

U.S. Census Bureau

Profile of Minnesota and each Minnesota County

National Oceanic and Atmospheric Administration (NOAA)

NOAA, Coasts

Provides detailed information on coastal water issues, including the Great Lakes

NOAA, National Climatic Data Center

Current and historical archive of climatic data and information

NOAA, Drought Information Center

Updated drought conditions including monitors and outlooks

NOAA, National Severe Storms Laboratory

Comprehensive information on severe weather research

NOAA, National Weather Service (NWS)

Provides all available weather information including warning updates

Advanced Hydrologic Prediction Service (AHPS)

A program designed to provide improved river and flood forecasting and water information. AHPS provides a suite of graphical and numeric products over the internet to assist community leaders and emergency managers in making better informed life and cost-saving decisions about evacuations and movement of property before flooding occurs.

Flood Inundation Mapping

This interactive web page shows the spatial extent of possible or expected flooding in a given area. It can be used to show if roadways and structures will be impacted by floodwaters. At the limited number of forecast locations where inundation maps are currently available, this web page is accessed by clicking on the inundation mapping tab on the hydrograph webpage. In collaboration with partners, this product will be expanded to new locations.

Flash Flood Guidance

The North Central River Forecast Centers issues Flash Flood Guidance throughout the day for every county in their area. The river forecast centers determine 1, 3 and 6 hour flash flood guidance values for all counties, and 12 and 24 hour values for parts of the eastern United States. Flash Flood Guidance estimates the average number of inches of rainfall for given durations required to produce flash flooding in the indicated county.

North Central River Forecast Center

Contains a variety of seasonal products including the Spring Hydrologic Outlook

U.S. Army Corps of Engineers (USACE)

Planning programs include Flood Risk Management, Planning Assistance to States, Flood Plain Management Services, and Silver Jackets.

Planning Assistance to States (PAS)

Funded annually by Congress. Federal allotments for each State or Tribe from the nation-wide appropriation are limited to \$2,000,0000 annually, but typically are much less. Individual studies, of which there may be more than one per State or Tribe per year, generally cost \$25,000 to \$75,000. The studies may be phased over several years and cover a wide range of water resource planning activities. PAS studies are cost shared on a 50 percent Federal-50 percent non-Federal basis. The entire local sponsor contribution may be work in kind, and WRDA 2007, Section 2013 provided authority for 100 percent Federal funded PAS studies for hydrologic, economic, and environmental data and analyses.

Floodplain Management Services

A full range of technical services and planning guidance on flood and floodplain issues is provided upon request. These services are generally made available to other federal, state, and local agencies, but some may also be used by nongovernmental organizations and individuals and are 100 percent federally funded.

Regional Flood Risk Management Team

This Regional Flood Risk Management Team (RFRMT) will integrate pre-flood mitigation with a long-term strategy to plan and implement pre- and post-flood emergency actions, while developing promising

nonstructural alternatives and other flood risk mitigation actions recognized to reduce future flood risk within the region.

Cold Regions Research and Engineering Laboratory (CRREL)

Engineering and technology for use in cold regions

Flood Damage Reduction Studies & Projects

Flood damage reduction is one of the primary missions of the U.S. Army Corps of Engineers. As such, the Corps of Engineers may undertake studies and build projects to reduce and/or minimize flood damages. The Corps of Engineers may investigate flooding problems and opportunities in response to directives, called authorizations, from the Congress. Congressional authorizations are contained in public laws and in resolutions of either the House Public Works and Transportation Committee or the Senate Environment and Public Works Committee.

Continuing Authorities Program

Under the Continuing Authorities Program (CAP) legislation authorizes the Corps of Engineers to plan, design, and construct certain types of water resource and ecosystem restoration projects without additional and specific congressional authorization. The purpose is to implement projects of limited scope and complexity. Each authority has specific implementation guidelines, total program and per-project funding limits.

Funding: Studies are cost shared 50/50 during feasibility. Most projects are cost shared 65 percent Federal and 35 percent local during implementation, unless otherwise noted.

Small Flood Control Projects authorized by Section 205 of the 1948 Flood Control Act. Per-project: Federal funding limit of \$7 million. Designed to implement projects that reduce overland flood damages. Projects must be engineering sound, economically justified, and environmentally acceptable.

Emergency Streambank Protection Projects authorized by Section 14 of the 1946 Flood Control Act. Per-project Federal funding limit of \$1.5 million. Designed to protect essential public facilities threatened by flood-induced erosion.

Aquatic Ecosystem Restoration authorized by Section 206 of the 1996 Water Resources Development Act. Per-project Federal funding limit of \$5 million. Designed to develop aquatic ecosystem restoration and protection projects that improve the quality of the environment, are in the public interest, and are cost effective.

Project Modifications for the Improvement of the Environment authorized by Section 1135 of the 1986 Water Resources Development Act. Federal funding limit of \$5 million. Designed to modify existing Corps projects for the purpose of improving environmental quality.

Section 524 of the Water Resources Development Act of 2000: Minnesota Dams

Provides for inventory, inspection, modification and/or rehabilitation of dams originally constructed by the Civilian Conservation Corps, Works Progress Administration, and Works Projects Administration (WPA) in Minnesota. Oversight of 361 of the original 417 WPA dams falls to the Minnesota Department of Natural Resources (DNR) through the office of the State Dam Safety Engineer. The rest are owned and operated by individual counties and the National Park Service.

Federal Energy Regulatory Commission (FERC)

Regulates dams that generate electric hydropower.

U.S. Geologic Survey (USGS)

Excellent source of natural disaster information (earthquakes, drought, floods, etc.).

Real-Time Data for Minnesota Streamflow

Users can select data from multiple sites using a broad set of filters, such as by state, county, watershed and a latitude/longitude box. This new web service can benefit users with programs that download tab-delimited real-time data from 138 gages. This data is also available in coordination with NWS-AHPS and the Corps of Engineers websites, although USGS quality assures and maintains the data.

Water Watch

The site displays maps, graphs, and tables describing real-time, recent, and historic streamflow conditions for the United States. The real-time information generally is updated on an hourly basis. The stream gage-based maps shows conditions for real-time, average daily, and 7-day average stream flow. The real-time streamflow maps highlight flood and high flow conditions. Water Watch also includes tables of current streamflow information and locations of flooding.

Flood Watch

In coordination with USGS's Water Watch Web site the state map shows the location of stream gages where the water level is above flood or at high flow. High flow conditions are expressed as percentiles that compare the current (i.e., within the past several hours) instantaneous flow value to historical daily mean flow values for all days of the year.

Water Alert

The U.S. Geological Survey WaterAlert service sends e-mail or text messages when certain parameters measured by a USGS data-collection station exceed user-definable thresholds.

StreamStats

A Web-based Geographic Information System (GIS) that provides users with access to an assortment of analytical tools that are useful for water-resources planning and management, and for engineering design applications.

USGS Programs in Minnesota

Details USGS activities in Minnesota.

Earthquake Hazards Program

Up- to-date information on world seismicity.

U.S. Department of Housing and Urban Development (HUD)

Community Development Block Grants

Disaster grants are used to rebuild resilient communities after a disaster.

Disaster Recovery Assistance

Disaster relief and recovery assistance in the form of special mortgage financing for rehabilitation of impacted homes.

Neighborhood Stabilization Program

Funding for the purchase and rehabilitation of foreclosed and vacant property in order to renew neighborhoods devastated by the economic crisis.

U.S. Department of Transportation (DOT)

Federal Highway Administration (FHWA)

Provides funding for mitigation activities such as snow fences and living snow fences as part of construction funding

U.S. Small Business Administration (SBA)

Provides training and advocacy for small firms.

Another valuable resource is the Catalog of Federal Domestic Assistance (CFDA). It provides a full listing of all federal programs available to state and local governments; federally recognized Indian tribal governments; domestic public, quasi- public, and private profit and nonprofit organizations and institutions; specialized groups; and individuals.

State Agencies and Programs

This section is an inventory of state programs that are important to mitigation efforts statewide. Additional information for agencies with programs that may assist in mitigation efforts are listed with applicable programs and funding the program may offer. The following also lists programs utilized by the state of Minnesota to assist with implementation of mitigation actions. A brief description of each program follows, as does funding information.

Minnesota Department of Administration (ADMIN)

Provides services to government agencies: information technology, facilities and property management, graphic and geographic information systems data and software.

Minnesota Department of Agriculture (MDA)

Responsible for the regulation of pesticides, fertilizers, food safety and feed including emergency response, state Superfund authority and financial assistance for agricultural entities.

Minnesota Board of Water and Soil Resources (BWSR)

Assist local governments to manage and conserve water and soil resources.

Program: Reinvest In Minnesota (RIM)

Funding: Minnesota's premier conservation easement program on privately owned lands.

Program: Reinvest In Minnesota -Wetlands Reserve Program, RIM-WRP

Funding: Administered by the USDA Natural Resources Conservation Service (NRCS). The RIM-WRP partnership is implemented by local Soil and Water Conservation Districts. Conservation easements on frequently flooded lands.

Minnesota Department of Commerce (COMM)

The Market Assurance Division in the Department of Commerce regulates insurance companies & agents, banks, and real estate.

The Office of Energy Security within the Department of Commerce manages energy assistance funds, and provides information and assistance to consumers and businesses on home improvements, financial assistance, renewable technologies, and utility regulations.

Program: Consumer Response Team (CRT)

The Minnesota Department of Commerce Consumer Response Team (CRT) is comprised of investigators who respond to consumer phone calls specifically about insurance. The CRT attempts to resolve disputes between consumers and the insurance industry informally. In the Twin Cities metro area call (651) 296-2488 or statewide toll-free at 800-657-3602.

Program: Weatherization Assistance Program (WAP)

Assists income eligible households with emergency repair and replacement services. The Weatherization Assistance Program (WAP) uses energy conservation techniques to reduce the cost of home energy. Correcting health and safety hazards and potentially life-threatening conditions is the first consideration in WAP activities. Households where one or more members have received TANF (Temporary Assistance for Needy Families) or SSI (Supplemental Security Income) within the last 12 months.

Households at or below 200% of Federal Poverty Income Guidelines are income eligible for WAP. Homeowners and renters may be income eligible for WAP.

Priority is given to households with at least one elderly or disabled member and to customers with the highest heating costs.

Funding: Federally funded through the U.S. Department of Energy and the Department of Health and Human Services.

Program: Energy Assistance Program (EAP)

The Energy Assistance Program (EAP) helps pay home heating costs. Households with the lowest incomes and highest energy costs receive the greatest benefit.

Households who are at or below 50 percent of the state median income are eligible
Size of grant is based on household size, income, fuel type, and energy usage
Households with the lowest income and highest fuel costs receive the highest grants
Funds are available for renters or homeowners

Funding: Federally funded through the U.S. Federally funded through U.S. Department of Human Services

Program: Office of Energy Security (OES)

The OES works to communicate the preparedness actions of utilities that serve areas affected by disasters. The OES and Public Utilities Commission (PUC) coordinate responses from utilities with regard to restoration activities and typically work through single points of contact at utilities and utility associations. The OES makes information available through its Energy Information Center on energy conservation measures that homeowners may pursue in the event of an emergency that affects the supply or distribution of energy to an area of the state.

Minnesota Emergency Medical Services Regulatory Board (EMSRB)

Provides leadership for emergency medical care for the people of Minnesota.

Minnesota Department of Employment and Economic Development (DEED)

To advance the economic vitality of Minnesota through trade and economic development, including the provision of employer and labor market information.

Program: Public Facilities Authority (PFA)

The authority administers and oversees the financial management of three revolving loan funds and other programs that help local units of government construct facilities for clean water (including wastewater, storm water and drinking water) and other kinds of essential public infrastructure projects

Funding: Provides municipal financing programs and expertise to help communities build public infrastructure that preserves the environment, protects public health, and promotes economic growth.

Program: Small Cities Development Program

The purpose is to provide decent housing, a suitable living environment and expanding economic opportunities, principally for persons of low-and-moderate income to cities and townships with populations under 50,000 and counties with populations under 200,000.

Funding: Provides federal grants from the U.S. Department of Housing and Urban Development (HUD) to local units of government. State program rules subdivide grant funds into three general categories: Housing Grants, Project Facility Grants, and Comprehensive Grants. Public Facility Grants could include projects involving storm sewer projects and flood control projects.

Program: Greater Minnesota Business Development Public Infrastructure Grant Program

The purpose is to stimulate new economic development, create or retain jobs in Greater Minnesota, through public infrastructure investments.

Funding: Provides grants to cities of up to 50% of the capital costs of the public infrastructure necessary, which expand or retain jobs in the area, increase the tax base, or which expand or create new economic development. Eligible projects include, but not limited to wastewater collection and treatment, drinking water, storm sewers, utility extensions, and streets.

Program: Minnesota Redevelopment Grant Program

The purpose is to provide grants to assist development authorities with costs related to redeveloping blighted industrial, residential or commercial properties.

Funding: Grants pay up to 50% of eligible redevelopment costs for a qualifying site, with a 50% local match. Grants can pay for land acquisition, demolition, infrastructure improvements, stabilizing unstable soils, ponding, environmental infrastructure, building construction, design and engineering and adaptive reuse of buildings.

Minnesota Management & Budget (MMB)

Expedite fiscal management during a state disaster. Assist with funding issues when federal assistance is not provided.

Minnesota Department of Health (MDH)

Detailed information on services and current events affecting the citizens of Minnesota.

Minnesota's State Historic Preservation Office (SHPO)

Review and Compliance: The SHPO consults with federal and state government agencies to identify historic properties in government project areas and advise on ways to avoid or reduce adverse effects on those properties.

Minnesota Housing Finance Agency (MHFA)

Provides low- and moderate-income housing and resources.

Minnesota Department of Human Services (DHS)

Provides health care, economic assistance, and other services for those in need.

Minnesota Department of Labor & Industry (DLI)

Assist with investigations when workers are injured, and detect air contaminants caused by chemical or geological agents, and assessing hazards. Statewide building codes and construction planning and inspection.

Metropolitan Council

Provides information on economic development and planning for anticipated growth in the seven county metro areas –Anoka, Carver, Dakota, Ramsey, Scott and Washington Counties.

Program: Livable Communities Grant Program

The Council awards grants to participating communities in the seven-county area to help them, among other things, create development or redevelopment that demonstrates efficient and cost-effective use of land and infrastructure, a range of housing types and costs, commercial and community uses, walkable neighborhoods and easy access to transit and open space.

Funding: Four different accounts to enable communities through the region to carry out their development plans, and leverage millions of dollars in private and public investment while providing jobs and business growth.

Minnesota Department of Military Affairs - National Guard (DMA)

Information on the capabilities of the Minnesota National Guard.

Minnesota Department of Natural Resources (MN DNR)

The Financial Assistance Directory provides summary level information on all of the Department of Natural Resources' financial assistance programs. The department offers a wide variety of financial assistance programs to cities, counties, townships, non-profits, schools, private individuals and others. See MN DNR [website](#). Categories include:

- Aquatic Invasive Species
- Enforcement (snowmobile & OHV safety)

- Fire Protection Programs
- Forest management
- Gifts and donations
- Habitat improvement
- Land conservation
- Recreation (general, trails, and water)
- Road Improvements
- Water

MN DNR Division of Ecological and Water Resources

The conservation of natural systems and the maintenance of biodiversity. Water education information is available on and discusses floodplain management, flood mitigation, drought/water supply, dam safety, flood warning, climatology, and lake and stream gaging.

Program: Flood Hazard Mitigation Grant Assistance: Flood Damage Reduction (FDR) Program

To provide technical and financial assistance to local governmental units for conducting flood damage reduction studies and for planning and implementing flood damage reduction measures.

Funding: A maximum of 50% of total eligible project costs up to \$150,000 with grants more than \$150,000 requiring approval by the Legislature.

Program: Dam Safety Grants

To improve the safety and condition of publicly owned dams and water level control structures.

Funding: Reimbursement of costs, up to 50% for repairs, up to 100% for removals. Grants ranged from \$25,000 to \$1,000,000

Program: Wetland Tax Exemption Program

To provide a financial incentive to maintain wetlands in their natural state and to promote an awareness of wetland values.

Funding: Qualifying areas are exempt from property taxes that remain in effect as long as wetland meets the requirements set forth in the statutes.

Program: FireWise in Minnesota

The Minnesota FireWise Project is working with local communities by passing federal Fire Plan funds through to local communities as grants for various "on-the-ground" activities including homeowner, mitigation education, home site assessment, access improvement, and dry hydrants. It involves community groups including fire and emergency services, local schools, city staff (i.e. foresters, planners), and local interest groups.

Funding: Grant request for 50:50 cost-share funding for assessment & planning, education & mitigation activities. Initial grant request may be for a small amount (\$15,000) until FireWise Action Plan is developed. Second grants are available to implement additional actions.

Program: Forest Stewardship Program

To provide technical advice and long-range forest management planning to interested landowners. All aspects of the program are voluntary. Plans are designed to meet landowner goals while maintaining the sustainability of the land. The entire property except active farming.

Funding: For the state's cost share program to help defer the costs of implementation of forest management activities. Must enroll forested lands into the Sustainable Forestry Incentive Act or 2c Managed Forest Land to be eligible for property tax relief programs

Program: Minnesota State Climatology Office

The State Climatology Office workgroups exists to study and describe the climate of Minnesota. Each of its members concentrates its efforts on specific topical areas in which climate plays a significant role.

Minnesota Pollution Control Agency (PCA)

Provides pollution control information for Minnesota.

Program: Stormwater Program

Minnesota Pollution Control Agency (MPCA) is the delegated permitting authority for Minnesota of the U.S. Environmental Protection Agency's (EPA) National Pollutant Discharge Elimination System (NPDES). Permits are required for most construction activities designed to limit polluted discharges and implement best management practices.

Funding: The Clean Water Revolving Fund, also known as the Clean Water State Revolving Fund or simply SRF, is established under the Federal Clean Water Act and state law to make loans to for both point source (wastewater and stormwater) and nonpoint source water pollution control projects. The PFA prepares an annual Intended Use Plan (IUP) based on a Project Priority List developed by the MPCA. The IUP describes the projects and activities eligible for funding during the state fiscal year.

Program: Interagency Climate Adaptation Team

A collaboration of state agencies with the purpose of addressing climate change issues in the state.

Other MPCA work related to mitigation:

Preparing for homes and businesses for floods

Preparing wastewater treatment plants for floods

Preparing feedlots for floods

Minnesota Department of Public Safety (DPS)

State Fire Marshal, Office of Communications, Office of Pipeline Safety Team, State Patrol, Office of Justice Programs, Bureau of Criminal Apprehension, Alcohol and Gambling, Enforcement and Office of Traffic Safety.

MN DPS Homeland Security and Emergency Management (HSEM)

This site contains information on Emergency Management.

Program: Minnesota Recovers Task Force: Minnesota's Official Disaster Information Center

Minnesota Recovers is the state's clearinghouse for all information about floods, tornadoes and other natural disasters that strike Minnesota communities. Information about federal, state and local government disaster assistance efforts is available on this website.

Funding: Application for community financial assistance is available. Depending upon disaster, different types of funding become available. Flood-Control Grants, Small Cities Development Program and Public Facilities Authority funding information is available here.

Minnesota Office of the State Archaeologist

Conduct research into the prehistoric and historic archeology of Minnesota.

Minnesota State Colleges and Universities (MNSCU)

Provide information about Higher education in Minnesota.

Minnesota Department of Transportation (DOT)

Comprehensive transportation issues in Minnesota.

University of Minnesota

University of Minnesota's mission of education, research, and public engagement; our academic scope; and our statewide presence are marks of distinction and position us well to address the critical problems of this new century.

Other Organizations

The following is a list of associations and organizations that may fund, educate or in some way assist mitigation in the state. The list is a resource for local mitigation planners and has been utilized by the state in the update of this plan.

American Red Cross

Provide relief to victims of disasters and help people prevent, prepare for, and respond to emergencies.

American Water Works Association

Information on safe water resources.

League of Minnesota Cities

A membership organization dedicated to promoting excellence in local government. The League serves its more than 800 member cities through advocacy, education and training, policy development, risk management, and other services.

Association of Minnesota Counties

A broad range of services to its members, including education, communications, and intergovernmental relations. AMC works closely with the legislative and administrative branches of government in seeing that legislation and policies favorable to counties are enacted.

Association of State Dam Safety Officials

General Information about dams and dam safety in the US.

Mid-America Earthquake Center (MAE)

One of three national earthquake engineering research centers established by the National Science Foundation.

Minnesota Geological Survey (MGS)

The University outreach center for the science and technology of earth resources in Minnesota.

Minnesota Association of Watershed Districts (MAWD)

Provides educational opportunities, information and training for watershed district managers and staff through yearly tours, meetings and quarterly newsletters.

Minnesota Association of Soil and Water Conservation Districts (MASWCD)

Provide voluntary, incentive-driven approaches to landowners for better soil and cleaner water. Provide private landowners with technical assistance to implement a wide variety of conservation practices.

Minnesota Independent Insurance Agents

See calendar for NFIP training.

National Association of Counties (NACO)

NACO is the only nation-wide organization representing county governments.

Minnesota Natural Resource Conservation Service

Locally based NRCS staff work directly with farmers, ranchers, and others, to provide technical and financial conservation assistance.

National Drought Mitigation Center

Information on drought preparation and risk management.

National Emergency Management Association (NEMA)

NEMA is the professional association of state, pacific, and Caribbean insular state emergency management directors.

Natural Hazard Mitigation Association

NHMA is an association for those in the hazard mitigation profession by offering workshops and bringing expertise and experience to organizations, communities or regions with mitigation planning, training, outreach and implementation.

Association of Minnesota Emergency Managers (AMEM)

AMEM is the professional association of Emergency Managers in Minnesota.

National Energy Foundation

This is the site for kids, parents and teachers, with a focus on water conservation in the home.

National Fire Protection Association (NFPA)

Provides scientifically based fire codes and standards, research, training, and education.

National Lightning Safety Institute

Independent, non-profit consulting, education and research organization focusing on lightning safety.

Natural Hazards Center at the University of Colorado

Clearinghouse for natural hazards information. Publishes the Natural Hazards Observer.

WeatherREADY

The goal of Weather Ready is to raise national awareness of the need to prepare for severe weather. Sponsored by the Weather Channel

Societal Aspects of Weather-Injury and Damage Statistics

Contains societal impact data for weather related disasters.

The Disaster Center

Provides news and information on current disasters, and the emergency management field.

The Disaster Research Center (University of Delaware)

Research center for the preparation and mitigation of natural and technological disaster for groups, organizations and communities.

The Tornado Project

Offers tornado books, posters, and videos.

United Nations International Strategy for Disaster Reduction

Increase public awareness of hazard and risk issues for the reduction of disasters in modern societies, motivate public administration policies and measures to reduce risks, and improve access to science and technology for risk reduction in local communities.

University of Wisconsin Disaster Management Center

The center's goal is to help improve the emergency management performance of non-governmental organizations, local and national governments, and international organizations, through a comprehensive professional development program in disaster management.

Appendix B: Historical List of Hazard Events for Marshall County

B.1 Drought Data from National Climatic Data Center for 1/1/1964 to 4/30/2015

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	07/18/2006	07:00	CST	Drought		0	0	0.00K	0.00K
EAST MARSHALL (ZONE)	EAST MARSHALL (ZONE)	MN	07/18/2006	07:00	CST	Drought		0	0	0.00K	0.00K
EAST MARSHALL (ZONE)	EAST MARSHALL (ZONE)	MN	08/01/2006	00:00	CST	Drought		0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	08/01/2006	00:00	CST	Drought		0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	09/01/2006	00:00	CST	Drought		0	0	0.00K	0.00K
EAST MARSHALL (ZONE)	EAST MARSHALL (ZONE)	MN	09/01/2006	00:00	CST	Drought		0	0	0.00K	0.00K
EAST MARSHALL (ZONE)	EAST MARSHALL (ZONE)	MN	10/01/2006	00:00	CST-6	Drought		0	0	0.00K	0.00K
EAST MARSHALL (ZONE)	EAST MARSHALL (ZONE)	MN	11/01/2006	00:00	CST-6	Drought		0	0	0.00K	0.00K
EAST MARSHALL (ZONE)	EAST MARSHALL (ZONE)	MN	12/01/2006	00:00	CST-6	Drought		0	0	0.00K	0.00K
EAST MARSHALL (ZONE)	EAST MARSHALL (ZONE)	MN	01/01/2007	00:00	CST-6	Drought		0	0	0.00K	0.00K
EAST MARSHALL (ZONE)	EAST MARSHALL (ZONE)	MN	02/01/2007	00:00	CST-6	Drought		0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	02/13/2007	06:00	CST-6	Drought		0	0	0.00K	0.00K
EAST MARSHALL (ZONE)	EAST MARSHALL (ZONE)	MN	03/01/2007	00:00	CST-6	Drought		0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	03/01/2007	00:00	CST-6	Drought		0	0	0.00K	0.00K
EAST MARSHALL (ZONE)	EAST MARSHALL (ZONE)	MN	04/01/2007	00:00	CST-6	Drought		0	0	0.00K	0.00K
EAST MARSHALL (ZONE)	EAST MARSHALL (ZONE)	MN	07/17/2012	05:00	CST-6	Drought		0	0	0.00K	0.00K
EAST MARSHALL (ZONE)	EAST MARSHALL (ZONE)	MN	08/01/2012	00:00	CST-6	Drought		0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	08/28/2012	05:00	CST-6	Drought		0	0	0.00K	0.00K

EAST MARSHALL (ZONE)	EAST MARSHALL (ZONE)	MN	09/01/2012	00:00	CST-6	Drought		0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	09/01/2012	00:00	CST-6	Drought		0	0	0.00K	0.00K
EAST MARSHALL (ZONE)	EAST MARSHALL (ZONE)	MN	10/01/2012	00:00	CST-6	Drought		0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	10/01/2012	00:00	CST-6	Drought		0	0	0.00K	0.00K
EAST MARSHALL (ZONE)	EAST MARSHALL (ZONE)	MN	04/28/2015	06:00	CST-6	Drought		0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	04/28/2015	06:00	CST-6	Drought		0	0	0.00K	0.00K
Totals:								0	0	0.00K	0.00K

B.2 Infectious Disease Data for Northwestern Region (Beltrami, Clearwater, Hubbard, Kittson, Lake of the Woods, Marshall, Pennington, Polk, Red Lake, Roseau counties) as reported by the Minnesota Department of Health:

The following table represents communicable diseases that have been reported to the Minnesota Department of Health in 2013. The area where occurrences developed is classified as the following counties: Beltrami, Clearwater, Hubbard, Kittson, Lake of the Woods, Marshall, Pennington, Polk, Red Lake, and Roseau. These counties were listed as making up the Northwestern Region in Minnesota.

Communicable Disease	Number of Occurrences
Anaplasmosis	95
Campylobacteriosis	18
Cryptosporidiosis	5
West Nile	9
Escherichia Coli	3
Giardiasis	3
Haemophilus Influenzae invasive disease	7
HIV (non-AIDS)	1
AIDS	2
Lyme disease	54
Meningococcal Disease	0
Pertussis	4
Salmonellosis	12
Chlamydia Trachomatis (STD)	424
Gonorrhea (STD)	56
Streptococcus Pneumoniae invasive disease	14
Streptococcal invasive disease - Group A	6
Streptococcal invasive disease - Group B	12
Tuberculosis	2
Viral Hepatitis, Type A	0
Viral Hepatitis, Type B	0
Viral Hepatitis, Type C	3

Source: Minnesota Department of Health Annual Summary of Communicable Diseases Reported to the Minnesota Department

of Health, 2013

B.3 Wildfire Data from National Climatic Data Center for 1/1/1964 to 4/30/2015

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	10/02/2012	07:00	CST-6	Wildfire		0	0	0.00K	0.00K
Totals:								0	0	0.00K	0.00K

B.4 Structural Fire Data for Marshall County from 2007 to 2013

Year	Fire Runs	Other Runs	Total Loss	Fire Rate	Average Loss per Fire	Fire Deaths
2013	56	144	\$671,450	218	\$14,597	0
2012	129	191	\$956,150	101	\$9,658	1
2011	99	149	\$253,100	135	\$3,420	0
2010	82	115	\$328,000	147	\$4,824	0
2009	59	107	\$104,300	189	\$1,968	0
2008	28	22	\$64,350	318	\$4,022	0
2007	92	121	\$953,900	130	\$12,388	0

2013 Data by Fire Department for Marshall County

Fire Department	County	Fires	Non-Fires	Dollar Loss
Alvarado	Marshall	8	19	\$13,000
Argyle	Marshall	8	62	\$0
Grygla	Marshall	3	0	\$170,200
Middle River	Marshall	2	0	\$105,000
Newfolden	Marshall	7	9	\$17,050
Oslo	Marshall	8	12	\$345,000
Stephen	Marshall	7	21	\$5,200
Viking	Marshall	3	1	\$8,000
Warren	Marshall	10	25	\$8,000

B.5 Flood Data from National Climatic Data Center for 1/1/1964 to 4/30/2015

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								0	0	12.343M	300.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	04/10/1996	13:00	CST	Flood		0	0	0.00K	0.00K
ALVERADO	MARSHALL CO.	MN	05/17/1996	02:00	CST	Flash Flood		0	0	10.00K	0.00K
WARREN	MARSHALL CO.	MN	05/17/1996	22:00	CST	Flash Flood		0	0	100.00K	0.00K

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WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	04/19/1997	00:00	CST	Flood		0	0	10.000M	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	04/02/1999	00:00	CST	Flood		0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	04/07/2001	00:02	CST	Flood		0	0	500.00K	0.00K
ARGYLE	MARSHALL CO.	MN	07/19/2001	01:00	CST	Flash Flood		0	0	0.00K	0.00K
GRYGLA	MARSHALL CO.	MN	07/31/2001	17:45	CST	Flash Flood		0	0	2.00K	0.00K
VIKING	MARSHALL CO.	MN	07/31/2001	18:00	CST	Flash Flood		0	0	1.00K	0.00K
STRANDQUIST	MARSHALL CO.	MN	08/14/2001	17:00	CST	Flash Flood		0	0	0.00K	0.00K
NEWFOLDEN	MARSHALL CO.	MN	06/09/2002	15:00	CST	Flash Flood		0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	06/12/2002	06:00	CST	Flood		0	0	0.00K	0.00K
EAST MARSHALL (ZONE)	EAST MARSHALL (ZONE)	MN	06/12/2002	06:00	CST	Flood		0	0	0.00K	0.00K
ARGYLE	MARSHALL CO.	MN	08/27/2002	23:00	CST	Flash Flood		0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	03/28/2004	12:54	CST	Flood		0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	04/01/2004	00:00	CST	Flood		0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	05/11/2004	21:36	CST	Flood		0	0	0.00K	0.00K
EAST MARSHALL (ZONE)	EAST MARSHALL (ZONE)	MN	05/11/2004	21:37	CST	Flood		0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	06/02/2004	13:36	CST	Flood		0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	04/01/2005	00:00	CST	Flood		0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	06/14/2005	03:00	CST	Flood		0	0	0.00K	0.00K
FLORIAN	MARSHALL CO.	MN	07/20/2005	01:00	CST	Flash Flood		0	0	0.00K	0.00K
NEWFOLDEN	MARSHALL CO.	MN	08/17/2005	18:30	CST	Flash Flood		0	0	0.00K	0.00K
COUNTYWIDE	MARSHALL CO.	MN	03/31/2006	00:00	CST	Flood		0	0	0.00K	0.00K

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COUNTYWIDE	MARSHALL CO.	MN	04/01/2006	00:00	CST	Flood		0	0	1.590M	0.00K
ARGYLE	MARSHALL CO.	MN	08/16/2006	22:00	CST	Flash Flood		0	0	50.00K	200.00K
STEPHEN ARPT	MARSHALL CO.	MN	03/22/2009	11:15	CST-6	Flood		0	0	5.00K	0.00K
STEPHEN ARPT	MARSHALL CO.	MN	04/01/2009	00:00	CST-6	Flood		0	0	5.00K	0.00K
STEPHEN ARPT	MARSHALL CO.	MN	03/18/2010	10:48	CST-6	Flood		0	0	0.00K	0.00K
STEPHEN ARPT	MARSHALL CO.	MN	04/01/2010	00:00	CST-6	Flood		0	0	0.00K	0.00K
ESPELIE	MARSHALL CO.	MN	05/24/2010	19:30	CST-6	Flash Flood		0	0	5.00K	50.00K
STEPHEN ARPT	MARSHALL CO.	MN	04/08/2011	09:51	CST-6	Flood		0	0	0.00K	0.00K
STEPHEN ARPT	MARSHALL CO.	MN	05/01/2011	00:00	CST-6	Flood		0	0	0.00K	0.00K
STEPHEN ARPT	MARSHALL CO.	MN	04/30/2013	01:56	CST-6	Flood		0	0	5.00K	0.00K
MIDDLE RIVER	MARSHALL CO.	MN	06/24/2014	09:30	CST-6	Flash Flood		0	0	20.00K	50.00K
ALVARADO	MARSHALL CO.	MN	07/21/2014	22:00	CST-6	Flash Flood		0	0	50.00K	0.00K
Totals:								0	0	12.343M	300.00K

B.6 Hail Data from National Climatic Data Center for 1/1/1964 to 4/30/2015

<u>Location</u>	<u>County/Zone</u>	<u>St.</u>	<u>Date</u>	<u>Time</u>	<u>T.Z.</u>	<u>Type</u>	<u>Mag</u>	<u>Dth</u>	<u>Inj</u>	<u>PrD</u>	<u>CrD</u>
Totals:								0	0	0.00K	0.00K
<u>MARSHALL CO.</u>	MARSHALL CO.	MN	07/13/1968	12:45	CST	Hail	1.00 in.	0	0	0.00K	0.00K
<u>MARSHALL CO.</u>	MARSHALL CO.	MN	06/16/1973	20:00	CST	Hail	1.75 in.	0	0	0.00K	0.00K
<u>MARSHALL CO.</u>	MARSHALL CO.	MN	07/05/1974	23:30	CST	Hail	1.75 in.	0	0	0.00K	0.00K
<u>MARSHALL CO.</u>	MARSHALL CO.	MN	08/31/1975	15:15	CST	Hail	2.00 in.	0	0	0.00K	0.00K
<u>MARSHALL CO.</u>	MARSHALL CO.	MN	08/31/1975	15:15	CST	Hail	2.75 in.	0	0	0.00K	0.00K
<u>MARSHALL CO.</u>	MARSHALL CO.	MN	06/13/1980	20:31	CST	Hail	1.75 in.	0	0	0.00K	0.00K

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<u>MARSHALL CO.</u>	MARSHALL CO.	MN	06/20/1983	11:40	CST	Hail	1.50 in.	0	0	0.00K	0.00K
<u>MARSHALL CO.</u>	MARSHALL CO.	MN	06/25/1984	20:50	CST	Hail	1.75 in.	0	0	0.00K	0.00K
<u>MARSHALL CO.</u>	MARSHALL CO.	MN	08/08/1984	15:22	CST	Hail	1.75 in.	0	0	0.00K	0.00K
<u>MARSHALL CO.</u>	MARSHALL CO.	MN	08/08/1984	15:44	CST	Hail	1.75 in.	0	0	0.00K	0.00K
<u>MARSHALL CO.</u>	MARSHALL CO.	MN	04/29/1985	19:00	CST	Hail	1.00 in.	0	0	0.00K	0.00K
<u>MARSHALL CO.</u>	MARSHALL CO.	MN	06/29/1989	14:45	CST	Hail	1.75 in.	0	0	0.00K	0.00K
<u>MARSHALL CO.</u>	MARSHALL CO.	MN	07/05/1989	19:10	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>SW Stephen</u>	MARSHALL CO.	MN	08/18/1994	19:05	CST	Hail	1.00 in.	0	0	0.00K	0.00K
<u>Goodridge</u>	MARSHALL CO.	MN	08/22/1995	18:40	CST	Hail	1.00 in.	0	0	0.00K	0.00K
<u>ARGYLE</u>	MARSHALL CO.	MN	07/05/1996	17:45	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>THIEF RIVER FALLS</u>	MARSHALL CO.	MN	08/21/1996	06:30	CST	Hail	1.00 in.	0	0	0.00K	0.00K
<u>THIEF LAKE REFUGE</u>	MARSHALL CO.	MN	06/27/1997	18:45	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>THIEF LAKE REFUGE</u>	MARSHALL CO.	MN	06/27/1997	18:55	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>STEPHEN</u>	MARSHALL CO.	MN	08/05/1997	15:00	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>STEPHEN</u>	MARSHALL CO.	MN	05/27/1998	19:25	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>ARGYLE</u>	MARSHALL CO.	MN	05/27/1998	19:55	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>VIKING</u>	MARSHALL CO.	MN	05/28/1998	15:10	CST	Hail	1.00 in.	0	0	0.00K	0.00K
<u>STEPHEN</u>	MARSHALL CO.	MN	05/28/1998	15:45	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>HOLT</u>	MARSHALL CO.	MN	07/14/1998	06:20	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>STEPHEN</u>	MARSHALL CO.	MN	08/31/1998	17:30	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>WARREN</u>	MARSHALL CO.	MN	06/04/1999	05:30	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>GRYGLA</u>	MARSHALL CO.	MN	06/06/1999	14:50	CST	Hail	1.00 in.	0	0	0.00K	0.00K
<u>OSLO</u>	MARSHALL CO.	MN	07/14/1999	00:00	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>OSLO</u>	MARSHALL CO.	MN	07/14/1999	00:15	CST	Hail	1.75 in.	0	0	0.00K	0.00K
<u>GATZKE</u>	MARSHALL CO.	MN	07/21/1999	11:04	CST	Hail	1.00 in.	0	0	0.00K	0.00K
<u>MIDDLE RIVER</u>	MARSHALL CO.	MN	07/21/1999	11:10	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>OSLO</u>	MARSHALL CO.	MN	07/25/1999	09:30	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>ARGYLE</u>	MARSHALL CO.	MN	07/25/1999	09:45	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>NEWFOLDEN</u>	MARSHALL CO.	MN	07/25/1999	10:45	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>GRYGLA</u>	MARSHALL CO.	MN	07/25/1999	11:35	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>WARREN</u>	MARSHALL CO.	MN	08/15/1999	13:15	CST	Hail	1.25 in.	0	0	0.00K	0.00K
<u>STEPHEN</u>	MARSHALL CO.	MN	05/05/2000	19:05	CST	Hail	1.75 in.	0	0	0.00K	0.00K
<u>STEPHEN</u>	MARSHALL CO.	MN	05/05/2000	19:20	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>MIDDLE RIVER</u>	MARSHALL CO.	MN	05/05/2000	20:25	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>ALVARADO</u>	MARSHALL CO.	MN	06/09/2000	00:40	CST	Hail	0.88 in.	0	0	0.00K	0.00K
<u>ALVARADO</u>	MARSHALL CO.	MN	06/09/2000	01:00	CST	Hail	0.88 in.	0	0	0.00K	0.00K
<u>STEPHEN</u>	MARSHALL CO.	MN	06/09/2000	01:30	CST	Hail	1.50 in.	0	0	0.00K	0.00K
<u>STEPHEN</u>	MARSHALL CO.	MN	06/09/2000	01:30	CST	Hail	1.75 in.	0	0	0.00K	0.00K
<u>STEPHEN</u>	MARSHALL CO.	MN	06/09/2000	02:45	CST	Hail	1.00 in.	0	0	0.00K	0.00K
<u>BIG WOODS</u>	MARSHALL CO.	MN	09/05/2000	17:50	CST	Hail	0.88 in.	0	0	0.00K	0.00K
<u>MIDDLE RIVER</u>	MARSHALL CO.	MN	07/17/2001	17:15	CST	Hail	1.00 in.	0	0	0.00K	0.00K

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<u>ARGYLE</u>	MARSHALL CO.	MN	07/18/2001	21:45	CST	Hail	1.00 in.	0	0	0.00K	0.00K
<u>GRYGLA</u>	MARSHALL CO.	MN	07/31/2001	11:45	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>HOLT</u>	MARSHALL CO.	MN	07/31/2001	13:00	CST	Hail	0.88 in.	0	0	0.00K	0.00K
<u>GRYGLA</u>	MARSHALL CO.	MN	07/31/2001	13:30	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>STEPHEN</u>	MARSHALL CO.	MN	08/14/2001	15:35	CST	Hail	0.88 in.	0	0	0.00K	0.00K
<u>ROSEWOOD</u>	MARSHALL CO.	MN	08/17/2001	13:35	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>STEPHEN</u>	MARSHALL CO.	MN	08/17/2001	14:30	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>MIDDLE RIVER</u>	MARSHALL CO.	MN	08/17/2001	15:05	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>NEWFOLDEN</u>	MARSHALL CO.	MN	08/26/2001	16:08	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>NEWFOLDEN</u>	MARSHALL CO.	MN	08/26/2001	16:15	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>VIKING</u>	MARSHALL CO.	MN	09/06/2001	14:35	CST	Hail	1.00 in.	0	0	0.00K	0.00K
<u>HOLT</u>	MARSHALL CO.	MN	04/23/2002	20:00	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>NEWFOLDEN</u>	MARSHALL CO.	MN	04/23/2002	21:01	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>ARGYLE</u>	MARSHALL CO.	MN	05/12/2002	17:17	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>ARGYLE</u>	MARSHALL CO.	MN	05/12/2002	17:35	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>GRYGLA</u>	MARSHALL CO.	MN	05/29/2002	15:15	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>STEPHEN</u>	MARSHALL CO.	MN	06/22/2002	07:35	CST	Hail	1.75 in.	0	0	0.00K	0.00K
<u>GATZKE</u>	MARSHALL CO.	MN	08/14/2002	18:55	CST	Hail	0.88 in.	0	0	0.00K	0.00K
<u>ARGYLE</u>	MARSHALL CO.	MN	06/28/2003	18:20	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>STEPHEN</u>	MARSHALL CO.	MN	07/14/2003	15:45	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>STRANDQUIST</u>	MARSHALL CO.	MN	07/14/2003	15:45	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>GATZKE</u>	MARSHALL CO.	MN	07/29/2003	15:20	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>GRYGLA</u>	MARSHALL CO.	MN	09/17/2003	02:00	CST	Hail	0.88 in.	0	0	0.00K	0.00K
<u>HOLT</u>	MARSHALL CO.	MN	09/17/2003	16:30	CST	Hail	1.25 in.	0	0	0.00K	0.00K
<u>GATZKE</u>	MARSHALL CO.	MN	09/17/2003	16:55	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>HOLT</u>	MARSHALL CO.	MN	05/11/2004	17:30	CST	Hail	0.88 in.	0	0	0.00K	0.00K
<u>GATZKE</u>	MARSHALL CO.	MN	05/11/2004	17:55	CST	Hail	0.88 in.	0	0	0.00K	0.00K
<u>ROSEWOOD</u>	MARSHALL CO.	MN	05/11/2004	18:30	CST	Hail	0.88 in.	0	0	0.00K	0.00K
<u>HOLT</u>	MARSHALL CO.	MN	05/11/2004	19:30	CST	Hail	0.88 in.	0	0	0.00K	0.00K
<u>HOLT</u>	MARSHALL CO.	MN	05/11/2004	20:55	CST	Hail	0.88 in.	0	0	0.00K	0.00K
<u>FLORIAN</u>	MARSHALL CO.	MN	05/19/2004	19:25	CST	Hail	1.00 in.	0	0	0.00K	0.00K
<u>ALVARADO</u>	MARSHALL CO.	MN	08/29/2004	15:37	CST	Hail	1.50 in.	0	0	0.00K	0.00K
<u>WARREN</u>	MARSHALL CO.	MN	08/29/2004	16:00	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>NEWFOLDEN</u>	MARSHALL CO.	MN	08/29/2004	17:40	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>MIDDLE RIVER</u>	MARSHALL CO.	MN	05/08/2005	18:00	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>GATZKE</u>	MARSHALL CO.	MN	05/08/2005	19:00	CST	Hail	0.88 in.	0	0	0.00K	0.00K
<u>ALVARADO</u>	MARSHALL CO.	MN	06/19/2005	16:00	CST	Hail	0.88 in.	0	0	0.00K	0.00K
<u>WARREN</u>	MARSHALL CO.	MN	06/19/2005	16:05	CST	Hail	0.88 in.	0	0	0.00K	0.00K
<u>NEWFOLDEN</u>	MARSHALL CO.	MN	07/03/2005	03:15	CST	Hail	0.88 in.	0	0	0.00K	0.00K
<u>STEPHEN</u>	MARSHALL CO.	MN	07/19/2005	19:55	CST	Hail	1.75 in.	0	0	0.00K	0.00K
<u>STEPHEN</u>	MARSHALL CO.	MN	07/19/2005	20:20	CST	Hail	0.75 in.	0	0	0.00K	0.00K

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<u>STEPHEN</u>	MARSHALL CO.	MN	07/19/2005	21:20	CST	Hail	1.75 in.	0	0	0.00K	0.00K
<u>FLORIAN</u>	MARSHALL CO.	MN	07/19/2005	21:55	CST	Hail	1.75 in.	0	0	0.00K	0.00K
<u>NEWFOLDEN</u>	MARSHALL CO.	MN	07/19/2005	22:12	CST	Hail	1.50 in.	0	0	0.00K	0.00K
<u>OSLO</u>	MARSHALL CO.	MN	09/05/2005	04:00	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>WARREN</u>	MARSHALL CO.	MN	09/05/2005	04:45	CST	Hail	1.00 in.	0	0	0.00K	0.00K
<u>MARCH</u>	MARSHALL CO.	MN	09/17/2005	00:10	CST	Hail	0.88 in.	0	0	0.00K	0.00K
<u>STRANDQUIST</u>	MARSHALL CO.	MN	06/05/2006	19:40	CST	Hail	1.00 in.	0	0	0.00K	0.00K
<u>GATZKE</u>	MARSHALL CO.	MN	06/26/2006	13:53	CST	Hail	0.88 in.	0	0	0.00K	0.00K
<u>GATZKE</u>	MARSHALL CO.	MN	06/26/2006	15:35	CST	Hail	1.00 in.	0	0	0.00K	0.00K
<u>STEPHEN</u>	MARSHALL CO.	MN	06/30/2006	19:15	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>STEPHEN</u>	MARSHALL CO.	MN	07/27/2006	16:04	CST	Hail	1.75 in.	0	0	0.00K	0.00K
<u>GRYGLA</u>	MARSHALL CO.	MN	08/05/2006	18:20	CST	Hail	2.75 in.	0	0	0.00K	0.00K
<u>GRYGLA</u>	MARSHALL CO.	MN	09/07/2006	15:10	CST	Hail	0.75 in.	0	0	0.00K	0.00K
<u>ROSEWOOD</u>	MARSHALL CO.	MN	06/09/2007	15:44	CST-6	Hail	0.75 in.	0	0	0.00K	0.00K
<u>GRYGLA</u>	MARSHALL CO.	MN	06/23/2007	06:31	CST-6	Hail	0.75 in.	0	0	0.00K	0.00K
<u>WARREN</u>	MARSHALL CO.	MN	08/10/2007	15:40	CST-6	Hail	0.75 in.	0	0	0.00K	0.00K
<u>WARREN</u>	MARSHALL CO.	MN	08/10/2007	15:41	CST-6	Hail	0.75 in.	0	0	0.00K	0.00K
<u>MIDDLE RIVER</u>	MARSHALL CO.	MN	08/26/2007	20:20	CST-6	Hail	1.50 in.	0	0	0.00K	0.00K
<u>MIDDLE RIVER</u>	MARSHALL CO.	MN	08/26/2007	21:15	CST-6	Hail	0.88 in.	0	0	0.00K	0.00K
<u>STEPHEN</u>	MARSHALL CO.	MN	08/30/2007	18:26	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<u>STEPHEN</u>	MARSHALL CO.	MN	08/30/2007	18:45	CST-6	Hail	0.88 in.	0	0	0.00K	0.00K
<u>VIKING</u>	MARSHALL CO.	MN	05/31/2008	15:00	CST-6	Hail	0.75 in.	0	0	0.00K	0.00K
<u>STEPHEN</u>	MARSHALL CO.	MN	06/12/2008	17:55	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<u>ROSEWOOD</u>	MARSHALL CO.	MN	07/11/2008	08:30	CST-6	Hail	0.75 in.	0	0	0.00K	0.00K
<u>STRANDQUIST</u>	MARSHALL CO.	MN	07/11/2008	14:35	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<u>NEWFOLDEN</u>	MARSHALL CO.	MN	07/16/2008	20:45	CST-6	Hail	0.88 in.	0	0	0.00K	0.00K
<u>BIG WOODS</u>	MARSHALL CO.	MN	07/23/2009	19:38	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
<u>WARREN</u>	MARSHALL CO.	MN	07/23/2009	19:58	CST-6	Hail	0.88 in.	0	0	0.00K	0.00K
<u>GATZKE</u>	MARSHALL CO.	MN	07/23/2009	20:35	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<u>GRYGLA</u>	MARSHALL CO.	MN	04/02/2010	09:05	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<u>VIKING</u>	MARSHALL CO.	MN	05/28/2010	09:20	CST-6	Hail	0.88 in.	0	0	0.00K	0.00K
<u>VIKING</u>	MARSHALL CO.	MN	05/28/2010	09:30	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<u>FLORIAN</u>	MARSHALL CO.	MN	06/21/2010	14:59	CST-6	Hail	0.75 in.	0	0	0.00K	0.00K
<u>BIG WOODS</u>	MARSHALL CO.	MN	06/24/2010	14:10	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<u>ALVARADO</u>	MARSHALL CO.	MN	06/24/2010	14:38	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<u>ALVARADO</u>	MARSHALL CO.	MN	06/26/2010	16:20	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<u>WARREN ARPT</u>	MARSHALL CO.	MN	06/26/2010	16:45	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<u>MARCH</u>	MARSHALL CO.	MN	06/26/2010	16:55	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<u>MARCH</u>	MARSHALL CO.	MN	06/26/2010	17:00	CST-6	Hail	0.88 in.	0	0	0.00K	0.00K
<u>STEPHEN</u>	MARSHALL CO.	MN	07/03/2010	20:40	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<u>THIEF LAKE</u>	MARSHALL CO.	MN	08/17/2010	16:25	CST-6	Hail	0.88 in.	0	0	0.00K	0.00K

<u>THIEF LAKE</u>	MARSHALL CO.	MN	08/17/2010	16:30	CST-6	Hail	2.00 in.	0	0	0.00K	0.00K
<u>THIEF LAKE</u>	MARSHALL CO.	MN	08/17/2010	16:30	CST-6	Hail	2.00 in.	0	0	0.00K	0.00K
<u>VIKING</u>	MARSHALL CO.	MN	08/17/2010	16:35	CST-6	Hail	1.25 in.	0	0	0.00K	0.00K
<u>WARREN</u>	MARSHALL CO.	MN	07/04/2011	17:31	CST-6	Hail	1.50 in.	0	0	0.00K	0.00K
<u>BIG WOODS</u>	MARSHALL CO.	MN	07/16/2011	22:15	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<u>GATZKE</u>	MARSHALL CO.	MN	07/17/2011	20:00	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<u>NEWFOLDEN</u>	MARSHALL CO.	MN	07/24/2011	18:00	CST-6	Hail	1.50 in.	0	0	0.00K	0.00K
<u>ESPELIE</u>	MARSHALL CO.	MN	07/24/2011	18:15	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
<u>ARGYLE</u>	MARSHALL CO.	MN	06/21/2012	17:00	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<u>VIKING</u>	MARSHALL CO.	MN	07/04/2012	10:15	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<u>STEPHEN</u>	MARSHALL CO.	MN	08/25/2012	00:49	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<u>ROSEWOOD</u>	MARSHALL CO.	MN	07/24/2013	14:45	CST-6	Hail	0.75 in.	0	0	0.00K	0.00K
<u>STRANDQUIST</u>	MARSHALL CO.	MN	08/18/2013	18:20	CST-6	Hail	0.88 in.	0	0	0.00K	0.00K
<u>NEWFOLDEN</u>	MARSHALL CO.	MN	08/18/2013	19:02	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<u>MIDDLE RIVER</u>	MARSHALL CO.	MN	09/02/2014	17:15	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<u>MIDDLE RIVER</u>	MARSHALL CO.	MN	09/02/2014	17:20	CST-6	Hail	1.25 in.	0	0	0.00K	0.00K
Totals:								0	0	0.00K	0.00K

B.7 Windstorm Data from National Climatic Data Center for 1/1/1964 to 4/30/2015

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	11/02/1997	05:00	CST	High Wind	47 kts.	0	0	0.00K	0.00K
EAST MARSHALL (ZONE)	EAST MARSHALL (ZONE)	MN	11/01/1999	03:00	CST	High Wind	60 kts.	0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	11/01/1999	03:00	CST	High Wind	60 kts.	0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	12/25/1999	18:00	CST	High Wind	75 kts.	0	0	0.00K	0.00K
EAST MARSHALL (ZONE)	EAST MARSHALL (ZONE)	MN	12/25/1999	18:00	CST	High Wind	75 kts.	0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	02/11/2002	12:00	CST	High Wind	56 kts. M	0	0	0.00K	0.00K
EAST MARSHALL (ZONE)	EAST MARSHALL (ZONE)	MN	02/11/2002	12:00	CST	High Wind	56 kts. M	0	0	0.00K	0.00K

EAST MARSHALL (ZONE)	EAST MARSHALL (ZONE)	MN	04/06/2002	08:45	CST	High Wind	51 kts. M	0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	04/06/2002	08:45	CST	High Wind	51 kts. M	0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	11/29/2002	04:15	CST	High Wind	50 kts. M	0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	05/21/2005	20:00	CST	High Wind	54 kts. MG	0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	11/08/2005	18:49	CST	High Wind	52 kts. MG	0	0	0.00K	0.00K
EAST MARSHALL (ZONE)	EAST MARSHALL (ZONE)	MN	11/08/2005	23:21	CST	High Wind	40 kts. MS	0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	01/31/2009	13:21	CST-6	High Wind	40 kts. MS	0	0	0.00K	0.00K
EAST MARSHALL (ZONE)	EAST MARSHALL (ZONE)	MN	01/31/2009	16:00	CST-6	High Wind	40 kts. MS	0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	10/27/2010	14:54	CST-6	High Wind	50 kts. MG	0	0	0.00K	0.00K
EAST MARSHALL (ZONE)	EAST MARSHALL (ZONE)	MN	10/07/2011	16:00	CST-6	High Wind	35 kts. MS	0	0	0.00K	0.00K
WEST MARSHALL (ZONE)	WEST MARSHALL (ZONE)	MN	10/07/2011	16:00	CST-6	High Wind	35 kts. MS	0	0	0.00K	0.00K
Totals:								0	0	0.00K	0.00K

B.8 Tornado Data from National Climatic Data Center from 1/1/1964 to 4/30/2015

<u>Location</u>	<u>County/Zone</u>	<u>St.</u>	<u>Date</u>	<u>Time</u>	<u>T.Z.</u>	<u>Type</u>	<u>Mag</u>	<u>Dth</u>	<u>Inj</u>	<u>PrD</u>	<u>CrD</u>
Totals:								0	4	410.00K	20.00K
<u>MARSHALL CO.</u>	MARSHALL CO.	MN	09/09/1964	16:20	CST	Tornado	F1	0	0	25.00K	0.00K
<u>MARSHALL CO.</u>	MARSHALL CO.	MN	06/27/1976	17:10	CST	Tornado	F1	0	4	250.00K	0.00K
<u>MARSHALL CO.</u>	MARSHALL CO.	MN	08/08/1984	15:24	CST	Tornado	F0	0	0	0.00K	0.00K
<u>MARSHALL CO.</u>	MARSHALL CO.	MN	08/08/1984	15:48	CST	Tornado	F0	0	0	0.00K	0.00K
<u>MARSHALL CO.</u>	MARSHALL CO.	MN	06/13/1991	18:18	CST	Tornado	F0	0	0	0.00K	0.00K
<u>MARSHALL CO.</u>	MARSHALL CO.	MN	06/26/1991	01:05	CST	Tornado	F1	0	0	0.00K	0.00K

<u>MARSHALL CO.</u>	MARSHALL CO.	MN	06/26/1991	01:15	CST	Tornado	F1	0	0	0.00K	0.00K
<u>NEWFOLDEN</u>	MARSHALL CO.	MN	07/21/1996	13:37	CST	Tornado	F0	0	0	0.00K	0.00K
<u>OSLO</u>	MARSHALL CO.	MN	07/14/1999	00:02	CST	Tornado	F2	0	0	100.00K	0.00K
<u>GATZKE</u>	MARSHALL CO.	MN	07/18/2001	20:05	CST	Tornado	F1	0	0	0.00K	0.00K
<u>HOLT</u>	MARSHALL CO.	MN	08/08/2004	15:02	CST	Tornado	F1	0	0	15.00K	0.00K
<u>MIDDLE RIVER</u>	MARSHALL CO.	MN	07/11/2005	13:40	CST	Tornado	F0	0	0	0.00K	0.00K
<u>STEPHEN</u>	MARSHALL CO.	MN	07/27/2006	16:09	CST	Tornado	F1	0	0	10.00K	0.00K
<u>FLORIAN</u>	MARSHALL CO.	MN	08/26/2007	19:43	CST-6	Tornado	EF1	0	0	0.00K	0.00K
<u>NEWFOLDEN</u>	MARSHALL CO.	MN	08/26/2007	20:59	CST-6	Tornado	EF0	0	0	0.00K	0.00K
<u>VIKING</u>	MARSHALL CO.	MN	07/11/2008	14:25	CST-6	Tornado	EF0	0	0	0.00K	0.00K
<u>STEPHEN ARPT</u>	MARSHALL CO.	MN	07/16/2008	20:00	CST-6	Tornado	EF0	0	0	10.00K	20.00K
<u>BIG WOODS</u>	MARSHALL CO.	MN	05/24/2010	13:48	CST-6	Tornado	EF0	0	0	0.00K	0.00K
<u>BIG WOODS</u>	MARSHALL CO.	MN	06/17/2010	16:23	CST-6	Tornado	EF1	0	0	0.00K	0.00K
<u>GATZKE</u>	MARSHALL CO.	MN	06/17/2010	16:44	CST-6	Tornado	EF1	0	0	0.00K	0.00K
<u>RADIUM</u>	MARSHALL CO.	MN	06/17/2010	17:26	CST-6	Tornado	EF1	0	0	0.00K	0.00K
<u>STEPHEN ARPT</u>	MARSHALL CO.	MN	06/21/2010	13:49	CST-6	Tornado	EF0	0	0	0.00K	0.00K
<u>FLORIAN</u>	MARSHALL CO.	MN	06/21/2010	14:59	CST-6	Tornado	EF0	0	0	0.00K	0.00K
<u>NEWFOLDEN</u>	MARSHALL CO.	MN	06/21/2010	15:30	CST-6	Tornado	EF0	0	0	0.00K	0.00K
<u>LUNA</u>	MARSHALL CO.	MN	06/26/2010	16:47	CST-6	Tornado	EF1	0	0	0.00K	0.00K
<u>STEPHEN ARPT</u>	MARSHALL CO.	MN	07/16/2011	19:25	CST-6	Tornado	EF0	0	0	0.00K	0.00K
<u>ESPELIE</u>	MARSHALL CO.	MN	07/24/2011	18:12	CST-6	Tornado	EF1	0	0	0.00K	0.00K
<u>ROSEWOOD</u>	MARSHALL CO.	MN	07/24/2011	18:42	CST-6	Tornado	EF0	0	0	0.00K	0.00K
<u>STEPHEN ARPT</u>	MARSHALL CO.	MN	06/03/2012	17:16	CST-6	Tornado	EF0	0	0	0.00K	0.00K
<u>OSLO</u>	MARSHALL CO.	MN	06/03/2012	18:20	CST-6	Tornado	EF1	0	0	0.00K	0.00K
Totals:								0	4	410.00K	20.00K

B.9 Winter Storm Data from National Climatic Data Center for 1/1/1964 to 4/30/2015

<u>Location</u>	<u>County/Zone</u>	<u>St.</u>	<u>Date</u>	<u>Time</u>	<u>T.Z.</u>	<u>Type</u>	<u>Mag</u>	<u>Dth</u>	<u>Inj</u>	<u>PrD</u>	<u>CrD</u>
Totals:								0	0	5.000M	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/17/1996	15:00	CST	Blizzard		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/17/1996	15:00	CST	Blizzard		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	02/10/1996	10:00	CST	Blizzard		0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	02/10/1996	10:00	CST	Blizzard		0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	02/27/1996	10:00	CST	Blizzard		0	0	0.00K	0.00K

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<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	02/27/1996	10:00	CST	Blizzard	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	03/23/1996	19:00	CST	Blizzard	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	03/23/1996	19:00	CST	Blizzard	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	11/16/1996	16:00	CST	Blizzard	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	11/16/1996	16:00	CST	Blizzard	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	12/17/1996	01:00	CST	Blizzard	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	12/17/1996	01:00	CST	Blizzard	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	12/20/1996	22:00	CST	Blizzard	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/09/1997	14:00	CST	Blizzard	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/09/1997	14:00	CST	Blizzard	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/15/1997	09:00	CST	Blizzard	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/15/1997	09:00	CST	Blizzard	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/21/1997	22:00	CST	Blizzard	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/21/1997	22:00	CST	Blizzard	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	03/04/1997	02:00	CST	Blizzard	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	04/05/1997	14:30	CST	Blizzard	0	0	5.000M	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/05/1998	08:00	CST	Heavy Snow	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	03/13/1998	09:00	CST	Blizzard	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	03/13/1998	09:00	CST	Blizzard	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	11/10/1998	06:00	CST	Blizzard	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	11/10/1998	06:00	CST	Blizzard	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	11/18/1998	06:00	CST	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL</u>	WEST MARSHALL	MN	11/18/1998	06:00	CST	Winter Storm	0	0	0.00K	0.00K

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(ZONE)	(ZONE)										
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	12/18/1998	12:00	CST	Blizzard		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/13/1999	11:00	CST	Winter Storm		0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/17/1999	09:00	CST	Heavy Snow		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/17/1999	09:00	CST	Heavy Snow		0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	02/12/1999	03:00	CST	Blizzard		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	02/12/1999	03:00	CST	Blizzard		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	03/17/1999	08:00	CST	Blizzard		0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	03/17/1999	08:00	CST	Winter Storm		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	04/01/1999	09:00	CST	Winter Storm		0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	04/03/1999	13:00	CST	Winter Storm		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	04/03/1999	13:00	CST	Winter Storm		0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	12/16/2000	09:00	CST	Blizzard		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	12/16/2000	09:00	CST	Blizzard		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	12/20/2000	01:00	CST	Winter Storm		0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	12/20/2000	08:30	CST	Winter Storm		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	12/20/2000	11:47	CST	Blizzard		0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	10/24/2001	10:00	CST	Blizzard		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	10/24/2001	10:00	CST	Blizzard		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	10/25/2001	09:00	CST	Blizzard		0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	12/05/2001	09:00	CST	Winter Storm		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	12/05/2001	09:00	CST	Winter Storm		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	12/22/2001	15:51	CST	Blizzard		0	0	0.00K	0.00K

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<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	03/08/2002	15:35	CST	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	03/08/2002	15:35	CST	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/26/2003	15:53	CST	Winter Storm	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	02/11/2003	09:55	CST	Blizzard	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	02/11/2003	09:55	CST	Blizzard	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	03/26/2003	22:50	CST	Heavy Snow	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	03/27/2003	03:58	CST	Heavy Snow	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	04/04/2003	10:10	CST	Heavy Snow	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	12/15/2003	11:05	CST	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/02/2004	04:40	CST	Winter Storm	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/02/2004	04:40	CST	Winter Storm	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/24/2004	15:25	CST	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/24/2004	15:25	CST	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	03/01/2004	10:04	CST	Winter Storm	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	12/11/2004	21:20	CST	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	12/11/2004	21:20	CST	Winter Storm	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	12/29/2004	15:30	CST	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	12/29/2004	15:30	CST	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	12/31/2004	15:35	CST	Winter Storm	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	12/31/2004	15:35	CST	Winter Storm	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/01/2005	00:00	CST	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/01/2005	00:00	CST	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL</u>	WEST MARSHALL	MN	01/21/2005	04:20	CST	Blizzard	0	0	0.00K	0.00K

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(ZONE)	(ZONE)										
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/21/2005	14:56	CST	Blizzard		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	11/27/2005	12:29	CST	Winter Storm		0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	11/27/2005	12:29	CST	Winter Storm		0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	03/01/2006	06:00	CST	Heavy Snow		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	03/01/2006	06:00	CST	Heavy Snow		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	12/30/2006	09:26	CST-6	Heavy Snow		0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	12/30/2006	15:32	CST-6	Winter Storm		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/12/2007	03:09	CST-6	Extreme Cold/wind Chill		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	02/03/2007	04:47	CST-6	Extreme Cold/wind Chill		0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	02/24/2007	09:30	CST-6	Winter Storm		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	02/24/2007	09:30	CST-6	Winter Storm		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	02/28/2007	04:00	CST-6	Winter Storm		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	03/01/2007	00:00	CST-6	Winter Storm		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	03/15/2007	08:12	CST-6	Heavy Snow		0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	04/01/2007	08:55	CST-6	Heavy Snow		0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	12/04/2007	10:30	CST-6	Heavy Snow		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	12/04/2007	10:30	CST-6	Heavy Snow		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/17/2008	21:00	CST-6	Extreme Cold/wind Chill		0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/17/2008	21:00	CST-6	Extreme Cold/wind Chill		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/29/2008	06:00	CST-6	Extreme Cold/wind Chill		0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/29/2008	18:00	CST-6	Extreme Cold/wind Chill		0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	02/08/2008	20:50	CST-6	Blizzard		0	0	0.00K	0.00K

<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	02/09/2008	18:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	02/09/2008	18:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	02/19/2008	10:13	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	02/19/2008	10:13	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	04/25/2008	21:00	CST-6	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	12/13/2008	04:03	CST-6	Blizzard	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	12/13/2008	04:03	CST-6	Blizzard	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	12/15/2008	04:01	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	12/15/2008	04:01	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	12/19/2008	14:20	CST-6	Winter Storm	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/02/2009	15:43	CST-6	Heavy Snow	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/04/2009	08:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/04/2009	11:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	03/09/2009	14:56	CST-6	Blizzard	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	03/10/2009	21:30	CST-6	Blizzard	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	03/24/2009	14:51	CST-6	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	03/24/2009	14:51	CST-6	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	12/13/2009	02:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	12/23/2009	04:10	CST-6	Heavy Snow	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	12/23/2009	04:10	CST-6	Heavy Snow	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	12/24/2009	10:51	CST-6	Blizzard	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/07/2010	15:11	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>WEST MARSHALL</u>	WEST MARSHALL	MN	01/22/2010	04:43	CST-	Winter Storm	0	0	0.00K	0.00K

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(ZONE)	(ZONE)				6					
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/22/2010	11:54	CST-6	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/25/2010	04:19	CST-6	Blizzard	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	02/06/2010	15:52	CST-6	Winter Storm	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	11/29/2010	12:00	CST-6	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	11/30/2010	08:00	CST-6	Blizzard	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	12/30/2010	14:30	CST-6	Blizzard	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	12/31/2010	04:20	CST-6	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	12/31/2010	04:20	CST-6	Blizzard	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/01/2011	00:00	CST-6	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/01/2011	00:00	CST-6	Blizzard	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/21/2011	00:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	02/01/2011	21:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	02/01/2011	21:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	02/08/2011	03:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	02/08/2011	03:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	03/11/2011	20:00	CST-6	Blizzard	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/18/2012	09:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/18/2012	18:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/27/2012	03:00	CST-6	Heavy Snow	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	02/10/2012	02:45	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	02/10/2012	02:45	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	02/11/2012	00:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K

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<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	02/11/2012	00:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	02/25/2012	21:00	CST-6	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	10/04/2012	00:00	CST-6	Winter Storm	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	10/04/2012	00:00	CST-6	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/11/2013	18:00	CST-6	Blizzard	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/11/2013	18:00	CST-6	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/19/2013	06:00	CST-6	Blizzard	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/20/2013	18:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/20/2013	18:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	02/10/2013	06:00	CST-6	Winter Storm	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	02/17/2013	15:39	CST-6	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	02/18/2013	00:00	CST-6	Blizzard	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	03/03/2013	21:00	CST-6	Heavy Snow	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	03/04/2013	06:00	CST-6	Heavy Snow	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	03/17/2013	16:00	CST-6	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	03/17/2013	16:00	CST-6	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	03/18/2013	06:00	CST-6	Blizzard	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	04/14/2013	12:00	CST-6	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	04/14/2013	12:00	CST-6	Winter Storm	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	12/03/2013	04:54	CST-6	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	12/03/2013	04:54	CST-6	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	12/06/2013	15:29	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>EAST MARSHALL</u>	EAST MARSHALL	MN	12/06/2013	15:29	CST-	Extreme Cold/wind	0	0	0.00K	0.00K

(ZONE)	(ZONE)				6	Chill					
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	12/28/2013	10:21	CST-6	Blizzard	0	0	0.00K	0.00K	
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	12/28/2013	18:46	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K	
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	12/28/2013	21:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K	
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/03/2014	15:00	CST-6	Blizzard	0	0	0.00K	0.00K	
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/04/2014	13:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K	
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/04/2014	18:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K	
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/16/2014	00:00	CST-6	Blizzard	0	0	0.00K	0.00K	
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/16/2014	00:00	CST-6	Blizzard	0	0	0.00K	0.00K	
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/22/2014	02:58	CST-6	Blizzard	0	0	0.00K	0.00K	
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/22/2014	15:38	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K	
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/22/2014	15:38	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K	
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/26/2014	06:00	CST-6	Blizzard	0	0	0.00K	0.00K	
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/26/2014	06:00	CST-6	Blizzard	0	0	0.00K	0.00K	
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/26/2014	22:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K	
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/26/2014	22:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K	
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	02/13/2014	08:41	CST-6	Blizzard	0	0	0.00K	0.00K	
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	02/26/2014	16:32	CST-6	Blizzard	0	0	0.00K	0.00K	
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	02/26/2014	21:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K	
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	02/28/2014	18:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K	
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	02/28/2014	18:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K	
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	03/01/2014	00:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K	
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	03/01/2014	00:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K	

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<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	03/21/2014	00:00	CST-6	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	03/21/2014	00:00	CST-6	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	03/21/2014	07:07	CST-6	Blizzard	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	03/31/2014	00:00	CST-6	Blizzard	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	03/31/2014	00:00	CST-6	Winter Storm	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	04/01/2014	00:00	CST-6	Winter Storm	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	04/01/2014	00:00	CST-6	Blizzard	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/02/2015	15:00	CST-6	Heavy Snow	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/02/2015	18:00	CST-6	Heavy Snow	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/03/2015	09:35	CST-6	Blizzard	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/03/2015	14:49	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/03/2015	14:49	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/06/2015	18:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	01/06/2015	18:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	01/08/2015	09:00	CST-6	Blizzard	0	0	0.00K	0.00K
<u>WEST MARSHALL (ZONE)</u>	WEST MARSHALL (ZONE)	MN	02/21/2015	21:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
<u>EAST MARSHALL (ZONE)</u>	EAST MARSHALL (ZONE)	MN	02/21/2015	21:00	CST-6	Extreme Cold/wind Chill	0	0	0.00K	0.00K
Totals:							0	0	5.000M	0.00K