

## Exhibit B

# Multi-Hazard Mitigation Plan

## St. Louis County, Minnesota, 2020



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# Multi-Hazard Mitigation Plan

## St. Louis County, Minnesota

2020

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# Section 1 – Introduction

## 1.1 Introduction

Hazard mitigation is defined as any sustained action to reduce or eliminate long-term risk to human life and property from hazards. The Federal Emergency Management Agency (FEMA) has made reducing hazards one of its primary goals; hazard mitigation planning and the subsequent implementation of resulting projects, measures and policies is a primary mechanism in achieving FEMA's goal.

From 1980-2018, the cost of damages due to natural disasters in the U.S. has exceeded \$1.6 trillion. 2017 was a record year with \$306 billion in damage (NOAA, n.d.). While the costliest disasters may occur in the coastal states, in 2018, wildfires, hailstorms, drought, and tornadoes caused many billion-dollar disasters across the nation.

Hazard mitigation planning and preparedness will be the most effective instrument to diminish losses by reducing the impact of disasters upon people and property. Although mitigation efforts will not eliminate all disasters, each county shall endeavor to be as prepared as possible for a disaster.

The Multi-Hazard Mitigation Plan (MHMP) is a requirement of the Federal Disaster Mitigation Act of 2000 (DMA 2000). The development of a local government plan is required in order to maintain eligibility for federal hazard mitigation grant funding programs. In order for communities to be eligible for future mitigation funds, they must adopt an MHMP.

Researchers at the National Institute of Building Sciences looked at the results of 23 years of federally funded mitigation grants provided by the Federal Emergency Management Agency (FEMA), U.S. Economic Development Administration (EDA) and U.S. Department of Housing and Urban Development (HUD) and found mitigation funding can save the nation \$6 in future disaster costs, for every \$1 spent on hazard mitigation (National Institute of Building Sciences, 2017).

St. Louis County is vulnerable to a variety of potential natural disasters, which threaten the loss of life and property in the county. Hazards such as tornadoes, flooding, wildfires, blizzards, straight-line winds, ice storms and droughts have the potential for inflicting vast economic loss and personal hardship. In 2013, Minnesota had some of the highest weather-related disaster claims in the country (MN Environmental Quality Board, 2014).

This Multi-Hazard Mitigation Plan represents the efforts of St. Louis County and its local governments to fulfill the responsibility for hazard mitigation planning. The intent of the plan is to reduce the actual threat of specific hazards by limiting the impact of damages and losses.

### 1.1.1 Scope

The St. Louis County Emergency Management Coordinator and U-Spatial@UMD have combined efforts to update the 2013 St. Louis County Multi-Hazard Mitigation Plan. U-Spatial@UMD contracted with Hundrieser Consulting LLC for additional emergency management planning expertise and facilitation.



This Multi-Hazard Mitigation Plan evaluates and ranks the major natural hazards affecting St. Louis County as determined by frequency of event, economic impact, deaths and injuries. Mitigation recommendations are based on input from state and local agencies, public input and national best practices.

U-Spatial@UMD performed the hazard risk assessment for 1% annual chance floods using the FEMA Hazus GIS tool. The Minnesota Homeland Security and Emergency Management (HSEM) office has determined that Hazus should play a critical role in Minnesota's risk assessments.

This is a multi-jurisdictional plan that covers St. Louis County, including the cities of Aurora, Babbitt, Biwabik, Brookston, Buhl, Chisholm, Cook, Duluth, Ely, Eveleth, Floodwood, Gilbert, Hermantown, Hibbing, Hoyt Lakes, Iron Junction, Kinney, Leonidas, McKinley, Meadowlands, Mountain Iron, Orr, Proctor, Rice Lake, Tower, Virginia and Winton. The St. Louis County risks and mitigation activities identified in this plan also incorporate the concerns and needs of townships, school districts and other entities participating in this plan.

Members from each of these jurisdictions actively participated in the planning process by attending workgroup meetings, providing information, suggesting mitigation strategies and reviewing the plan document. *Appendix K – Local Mitigation Survey Report* includes jurisdictionally-specific input. The information in these forms was used to help identify mitigation actions for local implementation (see also Section 2.2). Each jurisdiction will adopt the plan by resolution after approval by FEMA. County and local city resolutions will be added by St. Louis County after final approval by FEMA, in Appendix D in the back of the plan.

St. Louis County has specified the following goals for this Multi-Hazard Mitigation Plan update:

- Include more recent data documenting the critical infrastructure and hazards faced by St. Louis County.
- Reformat and reorganize the plan to reflect definitions of hazards as expressed in the 2014 State of Minnesota Multi-Hazard Identification and Risk Assessment Plan.
- Reflect current hazard mitigation priorities in St. Louis County.

### 1.1.2 Hazard Mitigation Definition

Hazard mitigation may be defined as any action taken to eliminate or reduce the long-term risk to human life and property from natural hazards. Following are examples of hazard mitigation measures that fall within one of five types of mitigation strategies:

- *Planning* – Development of mitigation standards, regulations, policies and programs.
- *Structure and Infrastructure Projects* – Structural retrofits, property acquisition, local flood reduction projects and safe room construction.
- *Natural Systems Protection* – Sediment and erosion control, stream corridor restoration, forest and vegetative management, and floodplain and stream restoration.
- *Education and Awareness Programs* – Outreach programs, hazard awareness campaigns, real estate disclosure and promotion of family/personal emergency preparedness.

- *Mitigation Preparedness & Response Support* – Emergency planning and services such as warning siren systems, mass notification systems and installing generators for critical facilities.

### 1.1.3 *Benefits of Mitigation Planning*

The benefits of hazard mitigation planning include the following:

- Saving lives, protecting the health of the public, and reducing injuries
- Preventing or reducing property damage
- Reducing economic losses
- Minimizing social dislocation and stress
- Reducing agricultural losses
- Maintaining critical facilities in functioning order
- Protecting infrastructure from damage
- Protecting mental health
- Reducing legal liability of government and public officials

## 1.2 *State Administration of Mitigation Grants*

FEMA currently has three mitigation grant programs that are administered by the State of Minnesota: the Hazard Mitigation Grant Program (HMGP), the Pre-Disaster Mitigation program (PDM) and the Flood Mitigation Assistance (FMA) program. The HMGP, PDM and FMA programs are administered through the state of Minnesota Department of Public Safety, Division of Homeland Security and Emergency Management. All applicants must have or be covered under an approved Hazard Mitigation Plan. Eligible applicants include state and local governments, certain private non-profit organizations or institutions, and tribal communities.

## Section 2 – Public Planning Process

### 2.1 Steering Committee Information

The St. Louis County Multi-Hazard Mitigation Plan steering committee is headed by the St. Louis County Emergency Management Coordinator, who is the primary point of contact. Members of the St. Louis County MHMP steering committee include representatives from the public, private and governmental sectors. Table 1 identifies the steering committee individuals and the organizations they represent.

*Table 1. Multi-Hazard Mitigation Steering Committee*

Name	Agency/Organization	Participant Title
Dewey Johnson	St. Louis County Sheriff's Office - Emergency Management	Emergency Management Coordinator
John Werner	Rice Lake	Mayor
Allen Lewis	City of Virginia	Fire Chief
Bill Hennis	City of Virginia	Lead Engineer
Bill Manney	City of Chisholm	Administrator
Bob Brown	Chisolm Fire	Fire Chief
Chris Clark	Virginia Fire	Fire Marshal
Clark Niemi	Town of White	Foreman
Clayton Cich	Fredenberg Township	Supervisor
Clyde Mortinsen	Canosia Township	Asst. Fire Chief
Daniel Golen	Canosia Township	Supervisor
Dave Marshall	Vermilion College	Director of Facilities
Dave Olds	Hibbing Community College	Director of Facilities
Dave Yapel	SLC Planning / GIS	GIS Manager
Duane Nelson	Wuori Township	Township Supervisor
Gary Oswell	Canosia Township	Road Foreman
Gina Godeen	NHED Colleges	Safety / Emergency Management
Jason Meyer	St. Louis County Land & Min	Dep Land & Min Director
Jeri Bonnette	Alango Township	Clerk
Jesse Anderson	City of Tower	Emergency Management Director
Jim F. Williams	City of Duluth	Director of Public Admin
Jim Foldesi	St. Louis County	Public Works Director
Jim Hofsommer	Colvin Township	Supervisor
Jim Park	Biwabik Township	Supervisor
Jim Ray	Fredenberg Township	Supervisor
John E. Stoessel	City of Meadowlands	City Clerk
Josh Sanders	Enbridge	ER Coordinator
Keith Perrhing	Mesabi Range	Supervisor

Name	Agency/Organization	Participant Title
Lottie Haller	Town of Gnesen	Clerk
Mark Pannkuk	St. Louis County	Area Land Manager
Mark Weber	St. Louis County	Land Commissioner
Megan Deslangchamps	Lavell Township	Clerk
Natalie Beck	Town of Colvin	Clerk
Paul Senet	Hermantown	Public Works Director
Phillip Anderson	Vermilion Lake Township	Supervisor
Richelle Cole	City of Virginia Library	Library Clerk
Ron Gajewski	Solway Township	Supervisor
Sandi Nelson	Cotton Township	Dep Clerk
Scott Lesnau	St. Louis County Public Health	PHN Emergency Preparedness Coordinator
Shawn Krizaj	Duluth Fire / Emergency Management Director	Chief
Steve Leslie	St. Louis County	Supervisor - P4
Steven Lotz	Vermillion Lake FD	Chief
Todd Johnson	Lake County Power	Operations Manager
Toni Blomdahl	Rice Lake	Clerk-Treasurer
Vernon VanGuilder	Floodwood Police Dept.	Chief
Vic Lund	St. Louis County	Traffic Engineer
Warren LaPlante	Allete/MN Power	Manager, Security & Emergency Management
Warren Topker	Lavell Township	Supervisor

Jurisdictional representatives participating on the steering committee were contacted throughout the plan update process to help facilitate local participation and provide feedback on the hazards of concern to their community. Information was used to develop local mitigation actions which they would seek to implement upon plan adoption (see Section 5.3.2 and Appendix G Mitigation Actions by Jurisdiction).

## 2.2 Review of Existing Plans, Capabilities & Vulnerabilities

St. Louis County and its local communities utilized a variety of planning documents to direct community development. These documents include a Comprehensive/Master Plan, Capital Improvements Plan, Emergency Operations Plan, Transportation Plan, Continuity of Operations Plan, etc. (see Appendix J for a full listing of plans and programs in place in St. Louis County). The planning process also incorporated the existing natural hazard mitigation elements from previous planning efforts. In addition, the 2019 Minnesota All-Hazard Mitigation Plan was consulted.

In the development of the St. Louis County Multi-Hazard Mitigation Plan, UMD consultants reviewed and incorporated a variety of planning documents that direct community development and influence land use decisions for the county and its jurisdictions. In addition, UMD consultants worked closely with

the St. Louis County Emergency Management Coordinator, other key county staff and local city officials to collect specific feedback on local mitigation capabilities and vulnerabilities that either support or hinder the ability to mitigate against natural hazards at the county and local level. Following is a summary of the assessment tools used to gather information on local capabilities and vulnerabilities during the planning process:

**Capabilities Assessment (hazard specific)** – In this assessment, detailed information was collected on current *Plans and Programs in Place* and *Program Gaps or Deficiencies* that currently exist to mitigate destruction caused by each natural hazard addressed in the plan. This information was used to inform where there were current mechanisms in place to incorporate or implement mitigation measures (i.e., existing programs, plans or policies) and where there were areas that needed to be addressed. *Section 4.3 Hazard Profiles* identifies current gaps and deficiencies for mitigation and *Section 5.1.3 Plans and Programs in Place to Address Natural Hazards* describes the mitigation capabilities that are in place to support mitigation.

**Local Mitigation Surveys** – As part of St. Louis County’s 2020 Multi-Hazard Mitigation Plan update, participating jurisdictions and key county personnel were asked to fill out a two-part “Local Mitigation Survey” (LMS) form. *Part A: “Past Events & Vulnerability Assessment”* collected detailed information from each jurisdiction on the following: 1) Severe weather or disaster events & impacts that have occurred within the last five years; 2) Actions taken within the last five years that have helped reduce local vulnerabilities to future disaster events; 3) Any changes within the last five years that have increased local vulnerabilities to future disaster events; and 4) Any concerns or specific ideas for mitigation projects to help reduce or eliminate risk resulting from future severe weather or disaster events. *Part B: “Local Mitigation Capabilities Assessment”* collected detailed information on each jurisdiction’s capabilities in place to help support mitigation in the community, including: 1) Plans, authorities, or policies; 2) Staff (organizational capacity); 3) Programs; and 4) Funding or other resources. Information was further collected on what program gaps or deficiencies exist that are a barrier to accomplishing mitigation in the community.

Information from the LMS forms were used to inform Section 4, Risk Assessment and the development of local-level mitigation actions (see *Appendix G: Mitigation Actions by Jurisdiction*).

## 2.3 Planning Process Timeline and Steps

In order to update the 2013 St. Louis County Multi-Hazard Mitigation Plan, UMD consultants worked in coordination with the St. Louis County Emergency Management Coordinator, and members of the steering committee. The updated plan includes not only new data documenting the types of hazards faced by St. Louis County residents and emergency planning officials, but also new thinking about how to best address these hazards.

### 2.3.1 St. Louis County Stakeholder Participation

In January of 2019, U-Spatial@UMD hosted a kickoff webinar that was attended by the St. Louis County Emergency Management Coordinator. The webinar included a project overview, U-Spatial@UMD background, the roles and responsibilities of the Emergency Management Coordinator,

contents of the Multi-Hazard Mitigation Plan, planning process and projected timeline (see Appendix E for webinar slides).

On January 15, 2019, St. Louis County issued a news release inviting public feedback and participation for the MHMP update (for complete documentation, see *Appendix F: Public Outreach & Engagement Documentation*).

Two initial steering committee meetings took place in May of 2019: in Virginia, Minnesota, on May 28<sup>th</sup>, and in Duluth, Minnesota, on May 29<sup>th</sup>. These meetings included the St. Louis County MHMP steering committee and the UMD planning team. The steering committee was provided with an overview of the purpose, process and timeline for the St. Louis County Multi-Hazard Mitigation Plan update, as well as the role and responsibilities of steering committee members. Appendix E provides documentation of steering committee meeting summaries, including a list of invited stakeholders, participant sign-in sheets and presentation slides.

Steering committee members were engaged in providing feedback on plans and programs in place as they relate to hazards facing the county, and they discussed potential mitigation actions to be added to the plan. This information was used to inform the development of mitigation strategies in the updated plan.

On December 13, 2019, and December 18, 2019, members of the steering committee convened again with the UMD planning team to conduct a review and discussion of the draft mitigation action charts developed for St. Louis County and the city jurisdictions participating in the plan. See Appendix E for a full meeting summary.

In order to provide opportunity for public input, St. Louis County issued a second news release on January 15, 2020, inviting public review and feedback on the draft plan. The news release provided information on where the plan could be viewed and comments submitted. U-Spatial@UMD hosted a webpage to post the full draft St. Louis County MHMP, including excerpts of the St. Louis County Master Mitigation Action Chart, each of the jurisdictional mitigation action charts, and an electronic feedback form.

Appendix F provides documentation of the public outreach for feedback on the draft plan by St. Louis County and jurisdictions. The public feedback period for the draft plan was open from January 15 to January 31, 2020, for a total of 17 days.

*Table 2. St. Louis County Hazard Mitigation Update Meetings and Public Outreach*

Meeting Type	Date	Location
Kickoff Webinar	1/3/2019	Hosted online by U-Spatial@UMD in Duluth
Public Outreach	1/15/2019	News release inviting public feedback and participation.
Steering Committee	5/28/2019	St. Louis County Public Works Building, Virginia, MN
Steering Committee	5/29/2019	St. Louis County Public Safety Office – EOC, Duluth, MN
Steering Committee	12/13/2019	St. Louis County Public Safety Office – EOC, Duluth, MN
Steering Committee	12/18/2019	Hosted online by U-Spatial@UMD in Duluth

Meeting Type	Date	Location
Public Outreach	1/15/2020 – 1/31/2020	Public review period for draft plan

At the close of the public outreach period, the UMD consultants worked with the St. Louis County Emergency Management Coordinator and members of the steering committee to incorporate comments from the public into the Multi-Hazard Mitigation Plan.

For more information on the planning process, see sections 5 and 6.

### 2.3.2 Overview of Jurisdictional Participation

Throughout the planning process, St. Louis County requested the participation of city representatives for the provision of local-level information, review and feedback to the plan update. Table 3 provides an overview of the participation of each city that took part in the St. Louis County MHMP update planning process, with reference to the location of supporting documentation.

Table 3. Jurisdictional Participation in Planning Process

Jurisdiction	Local Mitigation Survey, (Appendix K)	Planning Team Mtg. #1 (Appendix E)	Local Mitigation Action Chart Review (Section 5.3.2)	Planning Team Mtg. #2 (Appendix E)	Draft MHMP Review (Appendix F)
St. Louis County	X	X	X	X	X
City of Aurora	X		X		
City of Babbitt	X		X		
City of Biwabik	X		X		X
City of Brookston			X		
City of Buhl	X		X		
City of Chisholm	X	X	X		
City of Cook	X		X	X	
City of Duluth	X	X	X	X	
City of Ely	X		X		
City of Eveleth	X		X		
City of Floodwood	X	X	X	X	
City of Gilbert	X		X		
City of Hermantown	X	X	X	X	
City of Hibbing	X		X		
City of Hoyt Lakes	X		X		
City of Iron Junction	X		X		
City of Kinney			X		
City of Leonidas			X		
City of McKinley			X		
City of Meadowlands	X	X	X		
City of Mountain Iron	X		X		X
City of Orr	X		X		X
City of Proctor	X		X		
City of Rice Lake	X	X	X	X	
City of Tower	X	X	X		

Jurisdiction	Local Mitigation Survey, (Appendix K)	Planning Team Mtg. #1 (Appendix E)	Local Mitigation Action Chart Review (Section 5.3.2)	Planning Team Mtg. #2 (Appendix E)	Draft MHMP Review (Appendix F)
City of Virginia	X	X	X	X	X
City of Winton	X		X		



## Section 3 – St. Louis County Profile

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

### 3.1 General County Description

St. Louis County is located in northeastern Minnesota. The county shares its boundary on the north with Canada, on the west side with Koochiching County, Itasca County and Aitkin County, on the east side with Lake County, and on the south side with Carlton County and Lake Superior.

Part of the Fond du Lac Indian Reservation is located in St. Louis County, southwest of the St. Louis River in the Brookston, Stony Brook and Arrowhead area. Part of the Bois Forte Indian Reservation is also located in the county: the Nett Lake Village on Nett Lake, the Indian Point neighborhood on Pelican Lake near Orr, and the Vermilion Reservation on Lake Vermilion near Tower.

St. Louis County covers 6,859 square miles, making it the largest county east of the Mississippi River. The county's estimated population in 2010 was 200,226. There are 24 cities, 73 townships and 12 unorganized territories within the county. The three primary population centers in the county are the Duluth area, the Iron Range and Northern Lakes.

The largest employment sectors in St. Louis County are education and health services, comprising approximately 34% of jobs in the county workforce. The percent of the county's population living below the poverty level was 15.4%, compared to a 10.5% average for the state of Minnesota.

### 3.2 Environmental Characteristics

St. Louis County is known for its natural beauty, including the Superior National Forest, Voyageurs National Park, the Boundary Waters Canoe Area, five state parks and 1,040 lakes.

The lowest elevation point in Minnesota is in Duluth by Lake Superior. It is at 602 feet above sea level, with the terrain rising steeply from there to an altitude of 1,428 feet above sea level at the Duluth International Airport.

The highest elevation point in St. Louis County is Pike Mountain on the Laurentian Divide northeast of Virginia, at 1,950 feet above sea level.

### 3.3 Geology

St. Louis County contains the majority of Minnesota's iron mines, which produce 85% of the country's domestic iron (St. Louis County, 2019).

### 3.4 Hydrography

Surface water is one of the county's primary assets. According to the county's Comprehensive Water Management Plan, approximately 22.6% of the county is covered by wetlands (bog/marsh/fen) and

another 8.7% is covered by lakes, streams and rivers. The city of Duluth has 42 named streams, 16 of which are designated trout streams. Several lakes in the county are among the most popular for fishing in the Midwest. In addition, the county borders Lake Superior, the largest freshwater lake in world by surface area. The plan notes that it is critical to protect these resources so as to maintain the recreation, aesthetic, ecological and economic value they hold for citizens of St. Louis County.

Three of the state's drainage basins are located in St. Louis County, including:

- **Upper Mississippi Basin** (water flows west and southward) which is located in the southwest corner of the county around Prairie Lake and the Hibbing area near the Itasca County line;
- **Lake Superior Basin** (water flows east and southward) which includes the Mesabi Iron Range on the northern portion of the basin and the Duluth area;
- **Rainy River Basin** (water flows north and westward) which includes the cities of Orr, Cook, Tower and Ely, Boundary Waters Canoe Area and Voyageurs National Park.

Each of the basins are divided into major watersheds. These watersheds include: Mississippi-Grand Rapids, St. Louis, Lake Superior South, Cloquet, Little Fork, Vermilion River, Rainy Lake and Rainy River Headwaters.

Impaired waters are an increasing problem as St. Louis County currently has various water bodies that are on the Minnesota Pollution Control Agency Impaired Waters list, including Lake Superior, Island Lake, Boulder Lake, East Vermilion Lake, Trout Lake, Lac la Croix, Namakan Lake, Kabetogama Lake, Pelican Lake, St. Louis River, Whiteface River and Little Fork River, among others (Minnesota Pollution Control Agency, 2019). Impaired waters have become a priority issue because they do not meet state water quality standards, they affect growth and health of communities and economies, and the Clean Water Act has a mandate requiring every state to address impairments. Impairments found in St. Louis County waters include E. coli, mercury in fish tissue, PCB in fish tissue, mercury in water column and turbidity.

Basic hydrography in St. Louis County is mapped in Figure A - 1 in Appendix A.

### 3.4.1 Groundwater

The groundwater resources of St. Louis County are dominated by the extensive areas in which the underlying bedrock is exposed or is less than 30 feet from the surface soils. Fully three-fourths of the county has bedrock within 30 feet of the surface. This means that groundwater is being extracted from either shallow surficial-drift aquifers or from fractures within the crystalline bedrock aquifer. The one exception is the sedimentary sandstone aquifer band beginning near Buhl and running southwest along the southern edge of the Iron Range.

Notes on St. Louis County's bedrock aquifers include:

- Much of the county is underlain by a Precambrian undifferentiated aquifer consisting of igneous and metamorphic rocks. Well depths range from 30 to 450 feet deep. The common yield is 5-25 gallons per minute (gpm) but may exceed 100 gpm. The water is usually "hard".

- Along the North Shore lies the North Shore Volcanic aquifer. Water comes from interflow sediments and joints and fractures in the basalt. Wells are typically 20-930 feet deep. Yields are low, at 5-25 gpm with some wells exceeding 100 gpm. Some areas will contain noticeable levels of salt.
- A thin band of the Biwabik Iron-Formation aquifer stretches from just east and north of Babbitt across the entire range past the county line near Nashwauk. The aquifer is generally confined but some local areas are unconfined. Common well depths fall in the 170-600 foot range. This is the most productive source of groundwater on the Iron Range with typical yields ranging 250-750 gpm, and some exceeding 1,000 gpm. Localities will evidence hard water and large iron concentrations.
- The Mesabi, and to a lesser extent, the Vermilion Iron Range, have extensive areas of mine pit lakes which formed after mining and associated pumping activity ceased. These pit lakes are primarily ground water and are the source of drinking water for several cities. There are also numerous mine tailing basins and overburden piles throughout the range.
- The lone sedimentary bedrock lies along the southern edge of the range running from Buhl in an increasingly wider band to the western county line. Although some test holes in the Hibbing area have penetrated the Cretaceous and some bedrock wells may be open to the base of the Cretaceous, no water wells on record use the Cretaceous as a sole aquifer.
- The southwestern quarter of the county has a generally deeper depth to bedrock and is underlain by the Proterozoic aquifer. Wells range from 30-500 feet deep and yield 5-70 gpm; some will exceed 250 gpm. Quality is generally good with small levels of dissolved solids. It is commonly used in conjunction with the underlying Biwabik Iron Formation aquifer for public and industrial supplies.

Surficial-drift aquifers are exposed at the land surface while buried drift aquifers are located beneath a confining layer. Overall, one-third of Minnesota is covered by surficial-drift aquifers. Notes on both types in St. Louis County include:

- Surficial drift aquifers generally consist of sand and gravel deposits located at or near the land surface. Generally, they are unconfined aquifers. Well depths will range from 30-240 feet. Common yields will be from 100-800 gpm with some wells exceeding 2,000 gpm. Water quality is generally good but can be contaminated by nearby sources such as septic systems, feedlots and chemical activities.
- Surficial-drift aquifers are limited in St. Louis County with the most productive areas being two small outwash plains south of Hibbing and near Keewatin. Larger, but less productive, areas are found in a southwest-northeast band north of Duluth and in a series of bands north of the Iron Range.
- A low to moderate yielding buried drift aquifer is situated in a broad band across the Iron Range running from Aurora to the western county line. Commonly, well depths in this type of aquifer will range from 80-380 feet. Yields will vary from 100-600 gpm with some wells exceeding 1,500 gpm. Usually the water will be hard with large iron, sulfate and chloride concentrations being possible in some areas. Numerous mine pit lakes and tailings basins are in this area.

- Most of St. Louis County is covered with a thin to moderately deep layer of glacial till. The southwestern and far northwestern sections possess clay and silt lake deposits. All these areas generally have poor sustained yield ratings.

Groundwater sensitivity to pollution is measured by flow rate and soil permeability. For near surface materials, areas with a high sensitivity to pollution are areas where it takes hours to a week for a contaminant to reach the aquifer; areas with very low sensitivity to pollution are areas where it takes months to years for a contaminant to reach the aquifer. For the bedrock aquifers, areas with a high sensitivity to pollution are areas where it takes hours to months for a contaminant to reach the aquifer; areas with very low sensitivity to pollution are areas where it takes a century or more for a contaminant to reach the aquifer. The buried sand and gravel aquifer is relatively shallow and has many areas of moderate to high pollution sensitivity.

Figure A - 28 in Appendix A maps pollution sensitivity of near-surface materials from the transmission time of water through three feet of soil and seven feet of surficial geology, to a depth of 10 feet from the land surface.

### 3.4.2 Lakes

There are over one thousand lakes in St. Louis County. The coast of Lake Superior creates part of the county's southern border, and the lake is the largest freshwater lake in the world by surface area. The freshwater port in Duluth is an important economic hub for the region.

Rainy Lake forms part of the boundary with Canada on St. Louis County's northern edge. It covers a total of 210,200 acres. Its primary outflow is the Rainy River, while its primary inflows are Namakan Lake, Kabetogama Lake and the Seine River.

Lake Vermilion is a major lake in the county, covering 39,271 acres. It is the seventh largest lake in Minnesota, stretching 37 miles end-to-end. Portions of its northern shore and some of its islands are part of the Superior National Forest, while on the northern shore there is also an entry point into the Boundary Waters Canoe Area Wilderness (MN DNR, n.d.).

### 3.4.3 Rivers

The major rivers in the county include the St. Louis River, Cloquet River, Vermilion River and Little Fork River.

The St. Louis River begins near Hoyt Lakes before flowing through the Superior National Forest and eventually reaching Lake Superior. The river's watershed covers 3,650 square miles. Whitewater rafting is possible in the lower portion of the river (MN DNR, n.d.).

The Cloquet River flows from Katherine Lake in the central region of Lake County to its confluence with the St. Louis River. The uppermost 32 miles are not regarded as canoeable since there is rarely enough flow for paddling (MN DNR, n.d.). The river is 104 miles in length.

The Vermilion River flows between Crane Lake and Lake Vermilion. The Little Fork River flows north into the Rainy River.

### 3.4.4 Dam & Levee Inventory

Dams and levees are artificial barriers that have the ability to impound water, wastewater, or any liquid material for the purpose of storage or control and are an important part of St. Louis County's infrastructure. Dams maintain lake levels and impound water for flood control, power production and water supply. A complete listing of dams in the county is provided in Table 4.

Levees are used to increase cultivation in agriculture and to protect population and structures from floods. However, there are no levees in St. Louis County.

Table 4. Dams in St. Louis County

Name	Owner	Waterway	Primary Type	NID Height (ft)	Primary Purpose
Boulder Lake	MN Power and Light	Boulder Creek	Concrete, Multi-Arch, Earth	20	Hydroelectric, Recreation
Burntside Lake	MNDNR	Burntside River	Unknown	Unknown	Unknown
Bear Island	USFS	Bear Island River	Unknown	Unknown	Unknown
Buhl Detention	MNDNR-Wildlife	McQuade Creek	Earth	15	Fish and Wildlife Pond
Canosia WMA	MNDNR-Wildlife	Cloquet River-TR	Earth	14	Other
Canosia WMA 6	MNDNR-Wildlife	Cloquet River-TR	Earth	7	Other
Canosia WMA 78	MNDNR-Wildlife	Cloquet River-TR	Earth	8	Other
Chez Pond	Dudderar, Frederick A Jr	Talmadge River-TR	Earth	26	Fish and Wildlife Pond
Daniels Pond	Daniels, Russel	Vermilion River-TR	Earth	12	Other
Donna Lake	County of St. Louis and MNDNR-Fisheries	Spring Creek	Earth	10	Fish and Wildlife Pond
Douglas Tailings	County of St. Louis (partial ownership)	Dempsey Creek-TR	Earth	40	Tailings
Elephant Creek	USDA FS	Elephant Creek	Concrete, Gravity	7	Fish and Wildlife Pond, Recreation
Ely Lake	MNDNR	Ely Creek	Gravity	8	Recreation
Erie Basin 1	Cliffs Natural Resources to sell to Polymet Mining Company	Embarrass River-TR	Earth	200	Tailings
Erie Basin 2	Cliffs Natural Resources to sell to Polymet Mining Company	Embarrass River-TR	Earth	250	Tailings
Erie Pier Dike	Duluth Port Authority	Lake Superior	Earth	11	Other
Esquagama Lake	MNDNR	Embarrass River	Gravity	12	Other

Name	Owner	Waterway	Primary Type	NID Height (ft)	Primary Purpose
Eveleth Taconite Tailings	United Taconite - Cliffs	St. Louis River-TR	Earth	50	Tailings
Fish Lake	MN Power and Light	Beaver River	Concrete, Gravity, Earth	25	Hydroelectric, Recreation
Floodwood Lake	MNDNR	Floodwood River	Gravity	8	Other
Fond du Lac	MN Power and Light	St. Louis River	Gravity, Earth, Arch	80	Hydroelectric
French River Headwaters	MNDNR-Fisheries	French River	Earth	18	Fish and Wildlife Pond
Hartley Pond	City of Duluth	Tischer Creek	Gravity, Earth	14.5	Flood Control
Hibbing Taconite Starter No. 1	Hibbing Taconite Company	Day Brook	Earth	100	Tailings
Hibbing Taconite Starter No. 2	Hibbing Taconite Company	Day Brook	Earth	100	Tailings
Hibbing Taconite Starter No. 3	Hibbing Taconite Company	Shannon River-TR	Earth	100	Tailings
Hibbing Taconite Starter No. 4	Hibbing Taconite Company	Shannon River	Earth	100	Tailings
Inland Steel Tailings	ArcelorMittal Minorca Mine	Wouri Creek-OS	Earth	44	Tailings
Island Lake	MN Power and Light	Cloquet River	Concrete, Gravity, Earth	57	Hydroelectric, Recreation
Kettle Falls	Boise Cascade Corp	Rainy River	Buttress	26	Recreation
Hibbing Taconite Stockpile	<i>Unknown</i>	<i>Unknown</i>	<i>Unknown</i>	<i>Unknown</i>	<i>Unknown</i>
Laskin Energy	MN Power and Light	Partridge River - Offstr	Earth	19	Other
Little Stone Lake	County of St. Louis	Pine Creek-TR	Earth	20	Recreation
Minntac Tailings	US Steel	Closed System-OS	Earth	50	Tailings
Minorca Pit South	ArcelorMittal Minorca Mine	Silver Lake Outlet	Earth	30	Tailings
NSPC Initial Tailings	US Steel	Swan River-OS	Earth	45	Tailings
NSPC Stage 2 Tailings	US Steel	Hay Creek-OS	Earth	30	Tailings
Pelican Lake	County of St. Louis - Hwy	Pelican River	Gravity	10	Other
Pike River	MNDNR-Fisheries	Pike River	Gravity	30	Recreation

Name	Owner	Waterway	Primary Type	NID Height (ft)	Primary Purpose
Pioneer Clarification	City of Ely	Lonsdorf Creek	Earth	25	Tailings
Pioneer Tailings	City of Ely	Lonsdorf Creek	Earth	25	Tailings
Plant Site Settling	ArcelorMittal Minorca Mine	Sand River-OS	Earth	15	Tailings
Poly Met HRF Dam	Poly Met Mining	Unknown	Earth	111	Tailings
Polymet-LTV	Cliffs Natural Resources to sell to Polymet Mining Company	Embarrass River-TR	Earth	69	Tailings
Rice Lake	MN Power and Light	Beaver River	Concrete, Gravity, Earth	11	Hydroelectric, Recreation
Lake Vermilion	MNDNR-Fisheries	Vermilion River	Unknown	Unknown	Unknown
Prairie Lake	MNDNR	Prairie River	Unknown	Unknown	Unknown
Sauntry Creek Settling	ArcelorMittal Minorca Mine	Sauntry Creek	Earth	32	Tailings
Schweiger Pond	Schweiger, Burt	Cloquet River-TR	Earth	14	Fish and Wildlife Pond
Sherman Group Tailings	RGGS	Dempsey Creek-OS	Earth	48	Tailings
Sherman Mine Wastewater	US Steel	Dempsey Creek-TR	Earth	20	Tailings
Smith Lake	MNDNR	Little Cloquet River	Gravity	9	Recreation
Wabigone Tailings	Hanna Mining Company Age	Dempsey Creek-TR	Earth	10	Tailings
St. Louis River	Oglebay Norton Co	St. Louis River	Other, Gravity	28	Water Supply
Sturgeon Lake	MNDNR	Sturgeon River	Gravity	8	Recreation
Upland Cell II Interior	ArcelorMittal	Wouri Creek-OS	Earth	60	Tailings
West Two Rivers	US Steel	West Two River	Earth	40	Water Supply
Western Hibtac	Hibbing Taconite Company	Rock Lake Creek	Earth	100	Tailings
Whiteface Lake	MN Power and Light	Whiteface River	Concrete, Earth	39	Hydroelectric, Recreation
Whitewater Reservoir	Minnesota Power	St. Louis River-TR	Earth	40	Water Supply
Whitewater Reservoir Saddle Dam	Minnesota Power	St. Louis River	Earth	36	Water Supply
Whitney Clearwater	Hanna Mining Company Age	Closed System - Offstream	Earth	25	Tailings
Whitney Tailings	Hanna Mining Company Age	Closed System - Offstream	Earth	37	Tailings

Name	Owner	Waterway	Primary Type	NID Height (ft)	Primary Purpose
Wolf Lake	MNDNR	Wolf Creek	Gravity	16	Recreation
Wynne Lake	MNDNR	Embarrass River	Gravity	15	Other
Whiteface Lake Section 2	MN Power and Light	Whiteface River	<i>Unknown</i>	<i>Unknown</i>	<i>Unknown</i>
Whiteface Lake Section 3	MN Power and Light	Whiteface River-TR	<i>Unknown</i>	<i>Unknown</i>	<i>Unknown</i>

### 3.4.5 Wetlands

St. Louis County is estimated to have 31% of its total area (1,109,903 acres) in wetlands (Figure A - 1). The most common wetland type in the county is bog, with an estimated 822,817 acres, followed by shrub swamp, with an estimated 274,204 acres.

The Minnesota Board of Water and Soil Resources recognize that St. Louis County has more than 80% of its original pre-settlement wetlands.

Important benefits of wetlands include storage area for excess water during flooding; filtering of sediments and nutrients before they enter lakes, rivers and streams; and fish and wildlife habitat.

The towns with the highest percentage of wetlands are located in the area west of Highway 53 and south of the area from Hibbing to Fayal, and this is the area of highest concentration of bogs and shrub swamps.

Invasive plants have spread throughout many wetlands in Minnesota. These plants can take over entire native communities and threaten wetland ecosystems. Eurasian watermilfoil, spiny waterfleas, white perch and zebra mussels have been documented in St. Louis County (MN DNR, 2019).

## 3.5 Climate

The climate of St. Louis County is classified as a continental climate regime, characterized by wide variations in temperature. The climate of the county, especially along the North Shore, is greatly influenced by Lake Superior. The presence of the lake results in cooler summer temperatures and warmer winter temperatures. The lake also affects winter precipitation as heavy lake-effect snowfall generally occurs five to seven miles inland from Lake Superior.

January is the coldest month on average in St. Louis County, with an average monthly minimum temperature of 3°F (based on data from 1895-2018). The coldest month on record for the county was January 1912, with a month-long average minimum temperature of -14°F (MN DNR, n.d.). The record cold temperature for all of Minnesota was -60°F, set in Tower on February 3, 1996.

July is the hottest month on average in St. Louis County, with an average monthly maximum temperature of 65°F (based on data from 1895-2018). The hottest month on record for the county was July 1916, with a month-long average maximum temperature of 71°F (MN DNR, n.d.).



### 3.5.1 Climate Change

Minnesota's climate is currently changing in ways that are pushing us to adapt to weather patterns and extreme events that pose major threats to our health, homes, environment and livelihoods. These events cost our state millions in property loss, damaged infrastructure, disrupted business, medical care and support services, and put residents and responders at risk. Understanding how our weather is changing now and into the future will help planners and decision-makers in emergency management and supporting fields extend our progress in climate adaptation and lead to more resilient communities (MDH, 2018).

The National Climate Assessment suggests that infrastructure planning (particularly water resources infrastructure) should "be improved by incorporating climate change as a factor in new design standards and asset management and rehabilitation of critical and aging facilities, emphasizing flexibility, redundancy, and resiliency" (Georgakakos, et al., 2014).

Federal, state, and tribal governments are increasingly integrating climate change adaptation into existing decision-making, planning, or infrastructure-improvement processes (Georgakakos, et al., 2014). Definite predictions are difficult to make, as changes may vary depending on geographical location, even within Minnesota. Intense study of these topics is ongoing.

In August 2018, the Minnesota Department of Health Climate & Health Program published "Planning for Climate & Health Impacts in Northeast Minnesota: Emergency Management Considerations for HSEM Region 2." This report is one of a series of custom climate profile reports produced for each of the six HSEM regions in the state for reference to climate change projection data, impacts, and considerations for emergency management and preparedness professionals in this HSEM region.

#### Climate Data Trends

Over 50 years of storm data on record document that Minnesota has experienced an increase in the number and strength of weather-related natural disasters, particularly those related to rising temperatures and heavy downpours.

According to the 2015 Minnesota Weather Almanac,

*During the three most recent decades, the Minnesota climate has shown some very significant trends, all of which have had many observable impacts...Among the detectable measured quantity changes are: (1) warmer temperatures, especially daily minimum temperatures, more weighted to winter than any other season; (2) increased frequency of high dew points, especially notable in mid- to late summer as they push the Heat Index values beyond 100°F; and (3) greater annual precipitation, with a profound increase in the contribution from intense thunderstorms (Seeley M., 2015).*

Temperature and precipitation projections below are taken from the Minnesota Department of Health Region 2 profile. Appendix L provides the full MDH profile for Region 2, which includes St. Louis County. The information in this report was used to help inform the updated risk assessments in Section 4 – Risk Assessment of this plan for natural hazards and their relationship to climate change.

## Temperature

*The continued rise in winter temperatures will result in less snow pack, which will increase chances for grassland/wildfires as well as drought. The warmer winter temperatures will also have major consequences for our ecosystems, including native and invasive species, whose growth, migration, and reproduction are tied to climate cues. The increase in Lyme disease across Minnesota is also likely influenced in part by the loss of our historical winters, due to a longer life-cycle period for ticks. Freeze-thaw cycles are likely to increase as well, damaging roads, power lines and infrastructure, and causing hazardous travel conditions. By mid-century our average summer highs will also see a substantial rise, coupled with an increase in more severe, prolonged heat waves that can contribute to drought and wildfires and pose a serious health threat, particularly to children and seniors (MDH, 2018).*

## Precipitation

*There has been an increase in total average as well as heavy precipitation events, with longer periods of intervening dry spells. Our historical rainfall patterns have changed substantially, giving rise to larger, more frequent heavy downpours. Minnesota's high-density rain gauge network has captured a nearly four-fold increase in "mega-rain" events just since the year 2000, compared to the previous three decades. Extreme rainfall events increase the probability of disaster-level flooding. However, there is also an increased probability that by mid-century heavy downpours will be separated in time by longer dry spells, particularly during the late growing season. Over the past century, the Midwest hasn't experienced a significant change in drought duration. However, the average number of days without precipitation is projected to increase in the future, leading Minnesota climate experts to state with moderate-to-high confidence that drought severity, coverage, and duration are likely to increase in the state. Modeling future precipitation amounts and patterns is less straight-forward compared to temperature. Some climate models do a better job than others representing rainfall for the Midwest, and available data sources only provide average estimates on a monthly scale, masking the spikes in extremes that trigger flood and drought disasters (MDH, 2018).*

## 3.6 Demographics

Duluth is the largest city in St. Louis County (pop. 86,265) and the designated county seat. There are 24 cities, 73 townships and 12 unorganized territories within the county.

Table 5 summarizes the population by community according to the 2010 U.S. Census. Figure 1 shows St. Louis County population density by census block.

Table 5. St. Louis County Population by Community, 2010

Community	2010 Population	% of County
Babbitt	1,475	0.74
Biwabik	969	0.48
Brookston	141	0.07
Buhl	1,000	0.50

Community	2010 Population	% of County
Chisholm	4,976	2.49
Cook	574	0.29
Duluth	86,265	43.08
Ely	3,460	1.73
Eveleth	3,718	1.86
Floodwood	528	0.26
Gilbert	1,799	0.90
Hermantown	9,414	4.70
Hibbing	16,361	8.17
Hoyt Lakes	2,017	1.01
Iron Junction	86	0.04
Leonidas	52	0.03
McKinley	128	0.06
Meadowlands	134	0.07
Mountain Iron	2,869	1.43
Orr	267	0.13
Proctor	3,057	1.53
Tower	500	0.25
Virginia	8,712	4.35
Winton	172	0.09
Alango Township	258	0.13
Alborn Township	460	0.23
Alden Township	213	0.11
Angora Township	249	0.12
Arrowhead Township	223	0.11
Ault Township	109	0.05
Balkan Township	832	0.42
Bassett Township	41	0.02
Beatty Township	372	0.19
Birch Lake UT	505	0.25
Biwabik Township	804	0.40
Breitung Township	605	0.30
Brevator Township	1,269	0.63
Camp 5 Township	35	0.02
Canosia Township	2,158	1.08
Cedar Valley Township	195	0.10
Cherry Township	860	0.43
Clinton Township	1,015	0.51
Colvin Township	317	0.16

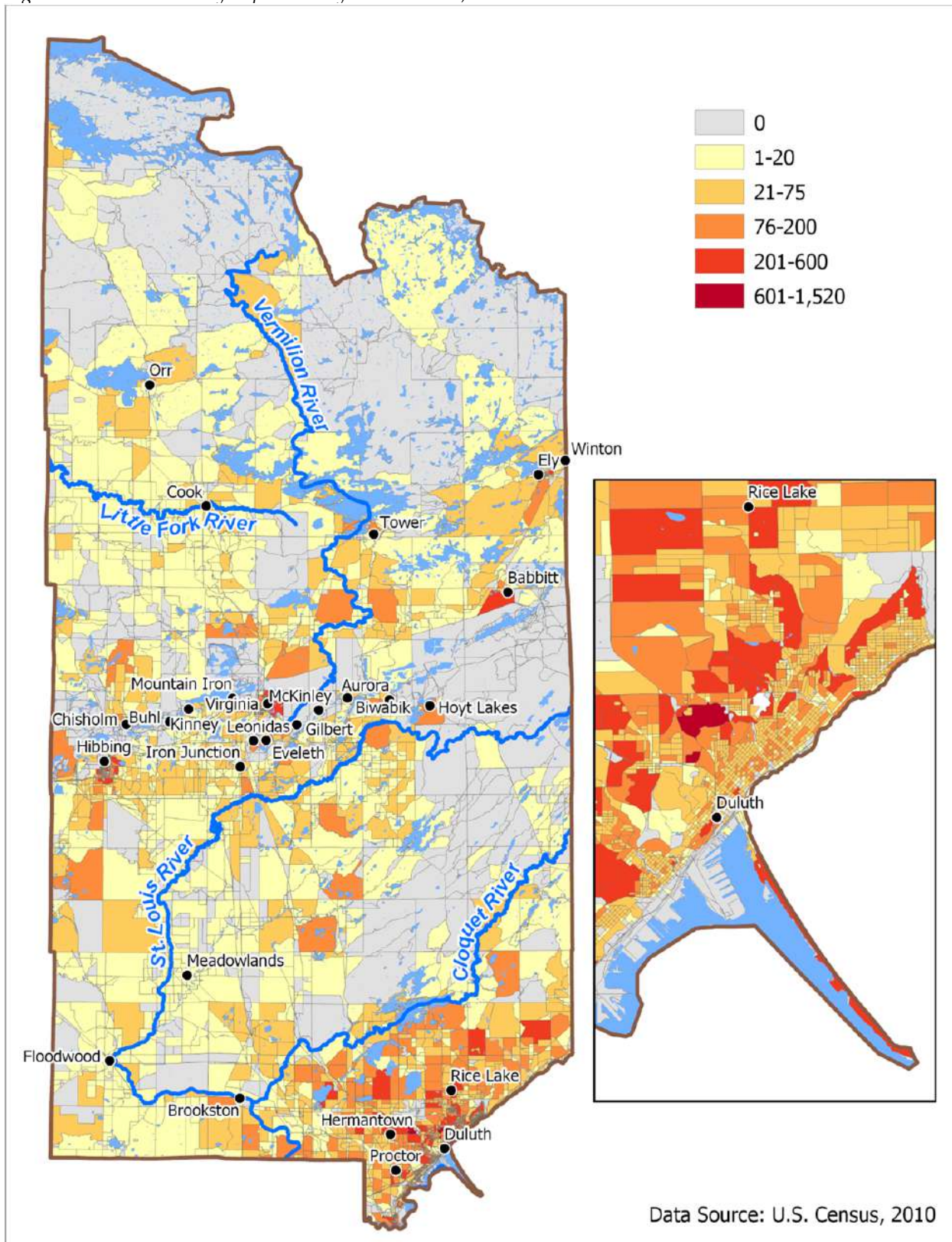
Community	2010 Population	% of County
Cotton Township	445	0.22
Crane Lake Township	82	0.04
Culver Township	294	0.15
Duluth Township	1,941	0.97
Eagles Nest Township	242	0.12
Ellsburg Township	219	0.11
Elmer Township	151	0.08
Embarrass	607	0.30
Fairbanks Township	63	0.03
Fayal Township	1,809	0.90
Field Township	391	0.20
Fine Lakes Township	134	0.07
Floodwood Township	280	0.14
Fredenberg Township	1,337	0.67
French Township	567	0.28
Gheen UT	18	0.01
Gnesen Township	1,683	0.84
Grand Lake Township	2,779	1.39
Great Scott Township	561	0.28
Greenwood Township	939	0.47
Halden Township	129	0.06
Hay Lake UT	83	0.04
Industrial Township	800	0.40
Janette Lake UT	295	0.15
Kabetogama Township	135	0.07
Kelsey Township	140	0.07
Kugler Township	175	0.09
Lakewood Township	2,190	1.09
Lavell Township	303	0.15
Leiding Township	400	0.20
Linden Grove Township	145	0.07
McCormack UT	209	0.10
McDavitt Township	459	0.23
Makinen UT	1,310	0.65
Meadowlands Township	304	0.15
Midway Township	1,399	0.70
Morcom Township	94	0.05
Morse Township	1,213	0.61

Community	2010 Population	% of County
Ness Township	62	0.03
Nett Lake UT	319	0.16
New Independence Township	299	0.15
Normanna Township	796	0.40
Northeast St. Louis UT	248	0.12
Northland Township	169	0.08
North Star Township	190	0.09
Northwest St. Louis UT	301	0.15
Owens Township	263	0.13
Pequaywan Township	130	0.06
Pike Township	417	0.21
Portage Township	170	0.08
Potshot Lake UT	74	0.04
Prairie Lake Township	50	0.02
Rice Lake Township*	4,095	2.05
Sand Lake UT	1,066	0.53
Sandy Township	356	0.18
Solway Township	1,944	0.97
Stoney Brook Township	332	0.17
Sturgeon Township	140	0.07
Toivola Township	170	0.08
Van Buren Township	189	0.09
Vermilion Lake Township	278	0.14
Waasa Township	249	0.12
White Township	3,229	1.61
Whiteface Reservoir UT	473	0.24
Willow Valley Township	126	0.06
Wuori Township	572	0.29
<b>Total</b>	<b>200,226</b>	

Source: U.S. Census Bureau, 2010

\* Rice Lake was founded as a township in 1870, but became a city in October of 2015.

Figure 1. St. Louis County Population by Census Block, 2010

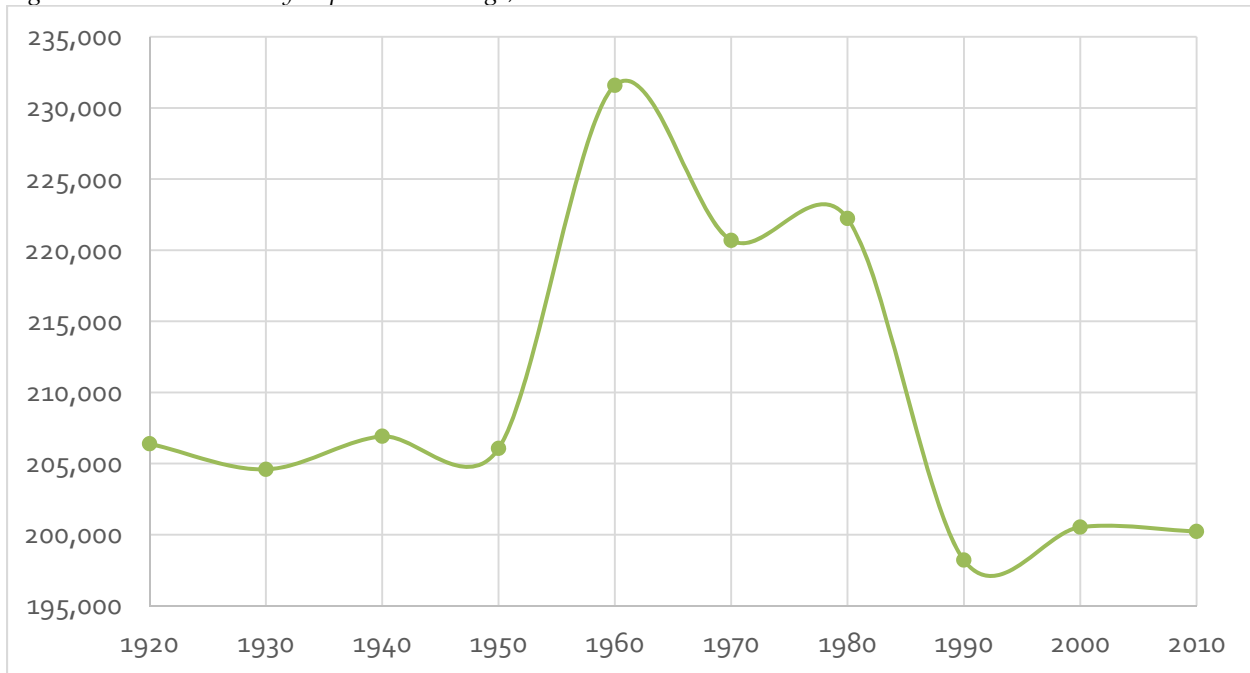


Population growth trends have an important influence on the needs and demands of a variety of services such as transportation, law enforcement and emergency response. An understanding of population trends and location of population concentrations is important for making projections regarding potential impacts in the event of a disaster.

In 2010, St. Louis County had a population of 200,226 residents, averaging 32 persons per square mile of land area. Duluth, the largest city in the county and the county seat, had a population of 86,265.

St. Louis County's population has fluctuated during the past century, reaching a high of 231,588 people in 1960, before decreasing to 198,213 people in 1990 (Figure 2).

Figure 2. St. Louis County Population Change, 1920-2010

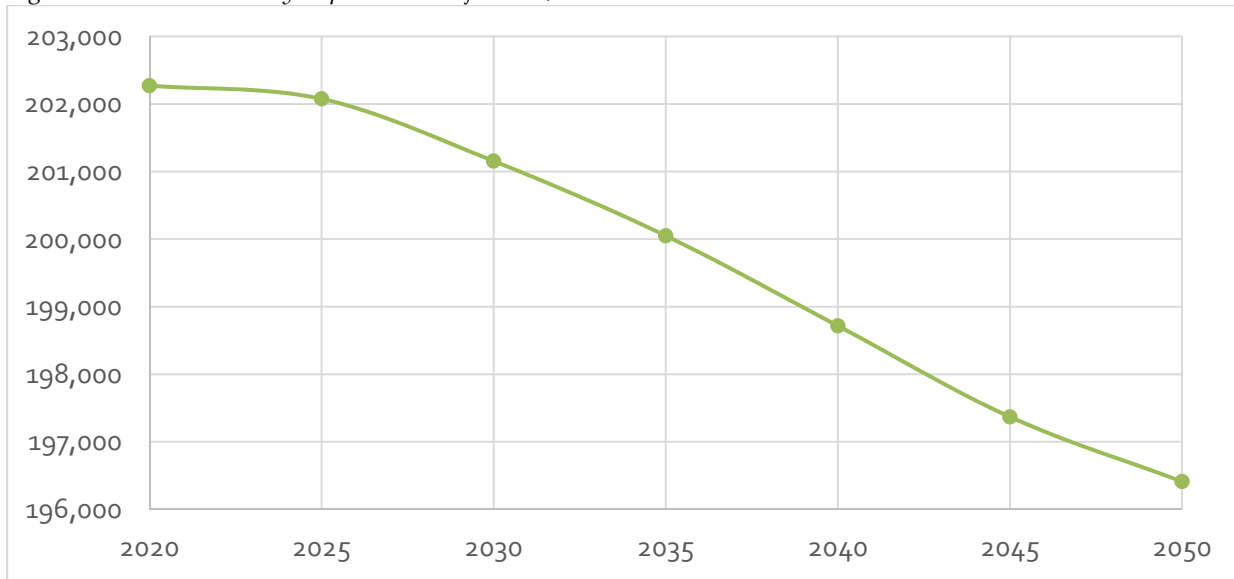


Source: U.S. Census Bureau

St. Louis County's population is projected to slowly decrease, reaching a low of 196,412 in 2050 (Figure 3).



Figure 3. St. Louis County Population Projections, 2020-2050



Source: Minnesota State Demographic Center, Minnesota Planning, March 2017 release

### 3.6.1 Population Vulnerability

The degree to which a person is vulnerable to the impacts of a hazard depends on how well they are able to react before, during, and after a hazardous event. The Centers for Disease Control and Prevention (CDC) Agency for Toxic Substances & Disease Registry (ATSDR) defines social vulnerability as "...the resilience of communities when confronted by external stresses on human health, stresses such as natural or human-caused disasters, or disease outbreaks" (2018). These stressors now increasingly include the more extreme weather events and longer-term impacts of Minnesota's changing climate.

Reducing social vulnerability can decrease both human suffering and economic loss. The ATSDR Social Vulnerability Index (SVI) uses U.S. Census variables at the tract-level to help local officials identify communities that may need support in preparing for hazards or recovering from disaster. Certain social conditions, such as high poverty, low percentage of vehicle access, or crowded households can increase a community's social vulnerability (ATSDR, 2018).

The ATSDR SVI ranks census tracts on 15 social factors which are grouped into four themes (Table 6).



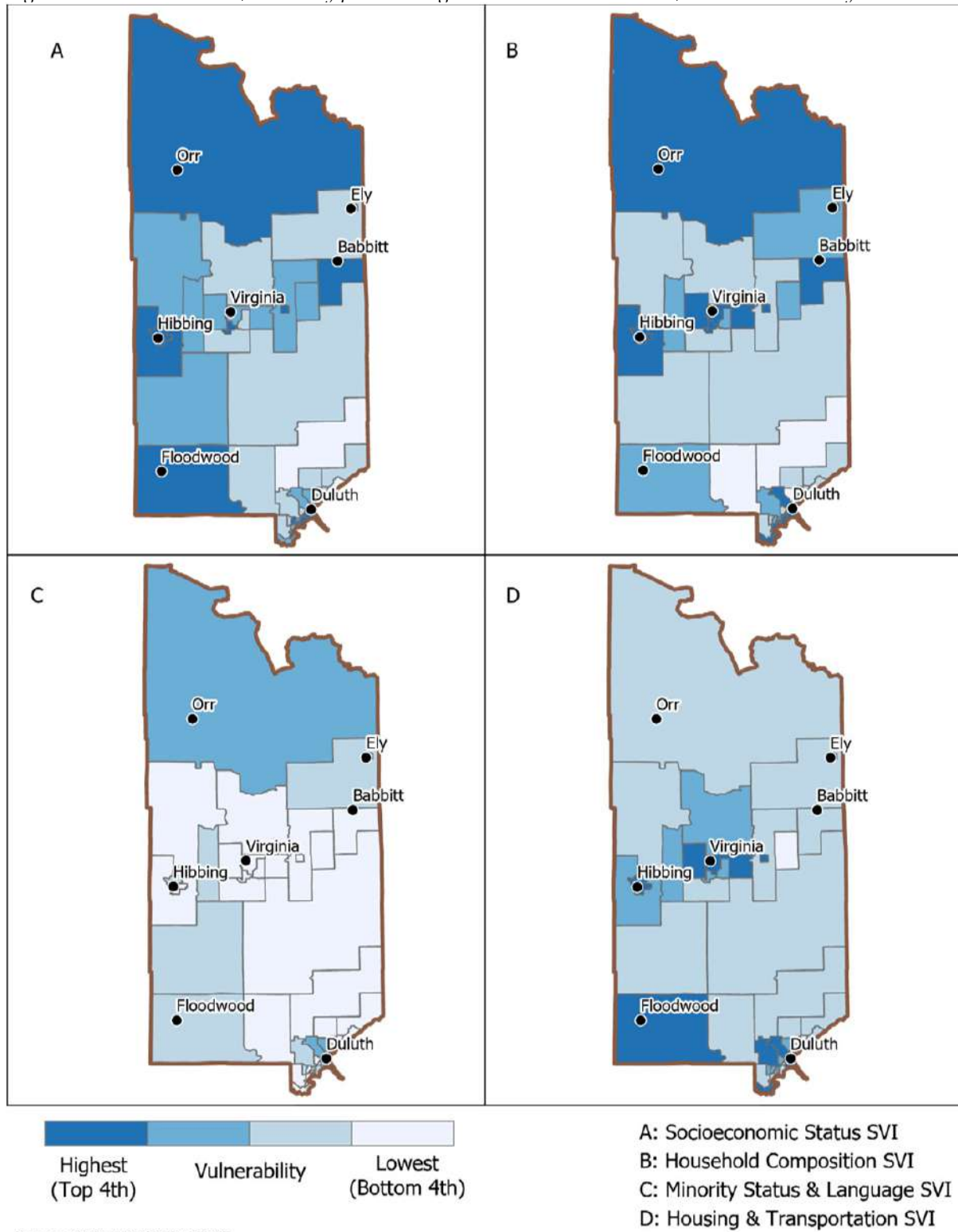
Table 6. Social Vulnerability Index (SVI) Variables

Theme	Social Factors
Socioeconomic Status	<ul style="list-style-type: none"> <li>• Proportion individuals below poverty level</li> <li>• Proportion civilians unemployed 16+yrs</li> <li>• Per capita income in 1999</li> <li>• Proportion persons with no high school diploma 25+yrs</li> </ul>
Household Composition & Disability	<ul style="list-style-type: none"> <li>• Proportion persons 65 years or older</li> <li>• Proportion persons 17 years or younger</li> <li>• Proportion persons with disability 5+yrs</li> <li>• Proportion single-parent HH with children under 18 yrs</li> </ul>
Minority Status & Language	<ul style="list-style-type: none"> <li>• Proportion minority</li> <li>• Proportion persons 5+yrs who speak English less than 'well'</li> </ul>
Housing & Transportation	<ul style="list-style-type: none"> <li>• Proportion housing with 10+units</li> <li>• Proportion mobile home</li> <li>• Proportion HH with more people than rooms</li> <li>• Proportion HH with no vehicle access</li> <li>• Proportion of persons who are in institutional &amp; non-institutional group quarters</li> </ul>

Source: (CDC, 2019)

Census tracts within Minnesota were ranked and given a percentile value from 0 to 1, with higher values indicating greater vulnerability. Theme-specific percentile rankings were generated by summing the percentiles of the variables comprising each theme and ordering the summed percentiles for each theme. For more information about the SVI methodology, visit <https://svi.cdc.gov/>. A map of each SVI theme for Saint Louis County is displayed in Figure 4.

Figure 4. 2016 SVI Themes, ranked by percentile against all MN census tracts, Saint Louis County



### 3.7 Economy

St. Louis County is dominated by the education/health service industries. Trade/transportation/utilities and leisure/hospitality are also major components of the county's economy.

The number of jobs in the county rose by only 1% between 2008 and 2018. Table 7 provides an overview of the annual average employment by major industry sector in St. Louis County.

*Table 7. Annual Average Employment by Major Industry Sector, St. Louis County*

Industry	Number of Jobs (2008)	Number of Jobs (2018)
Natural Resources and Mining	3,184	3,565
Construction	3,900	4,462
Manufacturing	5,521	4,812
Trade, Transportation, Utilities	18,051	17,793
Information	NA	1,053
Financial Activities	4,543	4,335
Professional /Business Services	7,559	6,503
Education and Health Services	32,075	33,914
Leisure and Hospitality	11,341	12,164
Public Administration	5,668	6,067
Other Services	3,228	3,767
<b>Total Number of Jobs:</b>	<b>97,117</b>	<b>98,437</b>

*Source: Minnesota Dept. of Employment and Economic Development. Note: data discrepancies between segment values and totals exist due to data suppression for confidentiality.*

According to the 2013-2017 American Community Survey five-year estimates, the median household income in St. Louis County was \$50,936, compared to a Minnesota average of \$65,699. The median household income in St. Louis County increased by 13% since the 2006-2010 estimates. The percent of the county's population living below the poverty level was 15.4%, compared to a 10.5% average for the state of Minnesota.

### 3.8 Critical Infrastructures

Critical infrastructures are among the most important assets of a community. While the purpose of these infrastructures differ in nature, their continued operations are integral to the health, safety, economic and cultural well-being of the residents of St. Louis County.

Critical infrastructures have been identified based on FEMA guidelines (FEMA, 2013) as well as input from St. Louis County. Critical infrastructures have been classified into the following groups: emergency and shelter facilities; infrastructure systems; high potential loss structures; and significant county assets. For the complete list of critical infrastructures in St. Louis County, see Appendix B.

#### 3.8.1 Emergency & Shelter Facilities

Emergency and shelter facilities are vital to the health and welfare of entire populations, providing services and functions essential to communities, especially during and after a disaster (FEMA).

Emergency and shelter facilities include: healthcare facilities, emergency services, evacuation centers/shelters, and schools (which are often used as evacuation centers/shelters).

Figure A - 3 displays the locations of the emergency and shelter facilities within St. Louis County.

### Healthcare Facilities

Healthcare facilities are located throughout the county, including a boarding care home, dialysis centers, hospice centers, hospitals, nursing homes and supervised living facilities. Hospitals are located in Duluth, Ely, Cook, Hibbing, Virginia and Aurora.

### Emergency Services

**Law Enforcement:** The Babbitt, Chisholm, Duluth, Ely, Eveleth, Floodwood, Gilbert, Hermantown, Hibbing, Hoyt Lakes, Proctor, and Virginia Police Departments are administered at the city level. The City of Biwabik contracts with the Gilbert Police Department for services.

The St. Louis County Sheriff's Office is responsible for all law enforcement activity in the unincorporated areas of St. Louis County and some cities contract with the county for law enforcement services. Offices are kept in Duluth, Buhl, Cook, Virginia, and Mountain Iron. State Patrol Offices are in Duluth and Virginia. The Bois Forte Reservation law enforcement is administered at the reservation level in Orr.

Duluth hosts a U.S. Marshals Service and U.S. Customs and Border Protection Services. National Park Services are stationed in Crane Lake and Kabetogama.

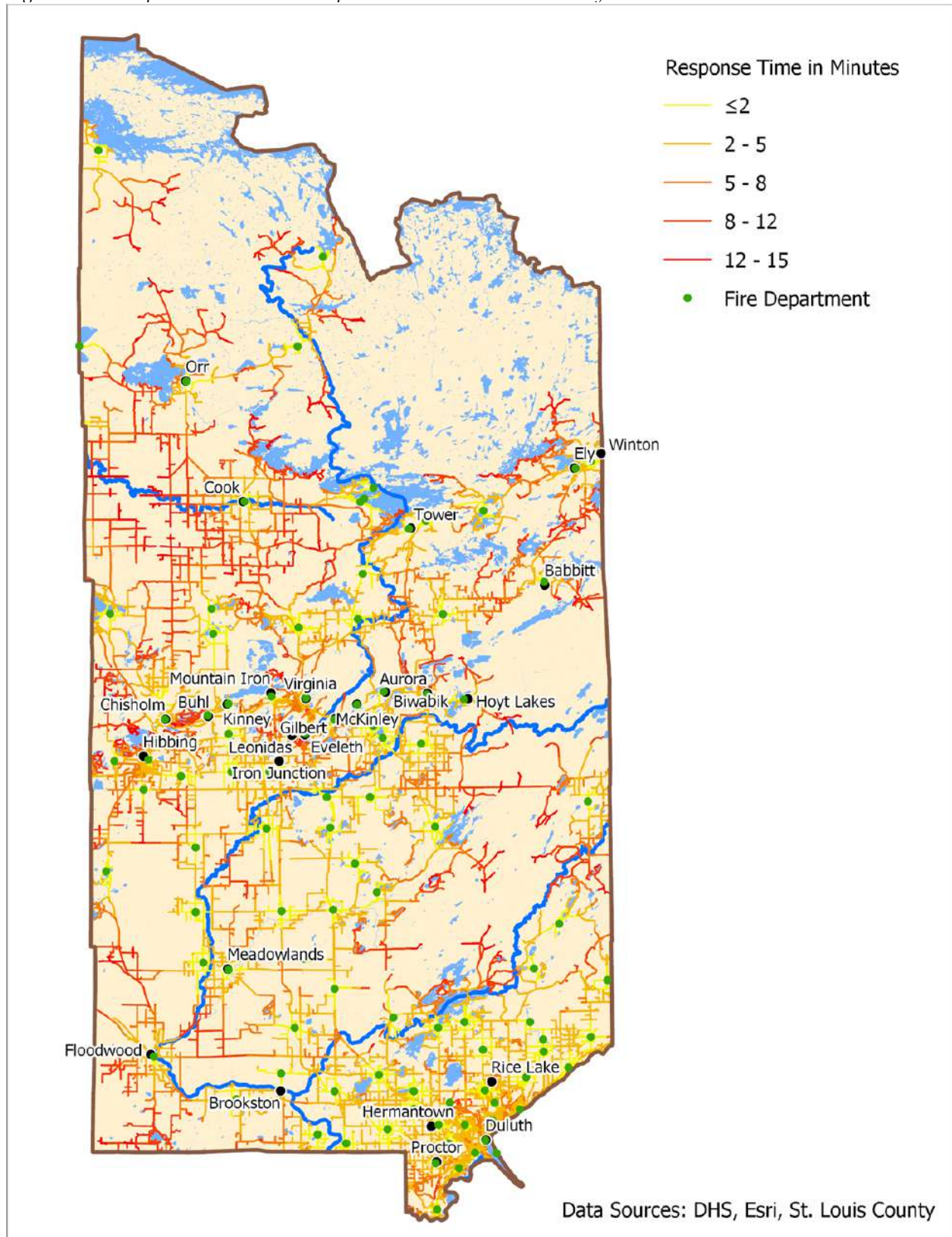
There are 10 emergency operations centers (EOCs) throughout the county. All are located in cities with populations greater than 1,000 residents.

**Fire & Rescue Services:** There are 87 fire departments located throughout St. Louis County.

The St. Louis County Rescue Squad responds to calls involving wilderness search and rescue; boat and water safety; first aid; and public safety. Squad members are trained in specialized skills above and beyond the basic skills of first aid, cross country navigation, wilderness survival, emergency driving, and small boat handling. Since the Rescue Squad was founded in 1958, the total call load has been approximately 40% wilderness-related, 25% public safety-related, and 35% split between water and miscellaneous calls (St. Louis County, n.d.).

Figure 5 shows fire departments and fire response times in St. Louis County. These drive times were created using the ArcGIS Network Analyst extension and Esri's Business Analyst. The user may note discrepancies between MnDOT road data and the map in this document; Network Analyst requires a seamlessly-connected data source in order to perform the calculations for drive times, which Business Analyst provides but MnDOT does not. The Business Analyst data was used for this reason. According to this model, all of the county is within 15 minutes of a fire department.

Figure 5. Fire Departments and Fire Response Times in St. Louis County



### Schools & Evacuation Centers/Shelters

There are 93 schools located in St. Louis County.

FEMA and the American Red Cross have designated 64 facilities within St. Louis County as shelters to be used in the event of an issued evacuation (Figure A - 3).

### 3.8.2 Infrastructure Systems

Infrastructure systems include the transportation systems and utility systems which are fundamental to the functioning of communities. These systems allow for emergency facilities to operate and connect to residents; they are the lifelines for communities.

Figure A - 6 displays St. Louis County's transportation systems.

#### Transportation Systems

**Roadways:** The St. Louis County Public Works Department is responsible for the maintenance and snow removal of over 3,000 miles of county-state aid highways (CSAH), county roads and unorganized township roads. The department is also responsible for the inspection and maintenance of over 600 state bridges over 10 feet in length, 300 bridges less than 10 feet in length, and approximately 40,000 traffic signs. There are a total of 17 tool houses located within the county's four maintenance districts.

**Railways:** A railroad network runs throughout the county. All railways are mapped in Appendix A (Figure A - 6).

**Navigable Waters:** This plan only references navigable waterways which are included in the U.S. Department of Transportation/Bureau of Transportation Statistics' National Transportation Atlas Database. A general definition of navigable waterways is defined by the US Army Corps of Engineers as, "...waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce..." (Code of Federal Regulations, n.d.).

According to this definition, there are three navigable waterways in St. Louis County: Lake Superior, Rainy Lake and the Pigeon River.

**Airports:** There are airports located throughout the county, including the Duluth International Airport. All airports are mapped in Appendix A (Figure A - 6).

#### Utility Systems

The infrastructure of utility system networks facilitates the process of moving utilities from their source to the consumer. A map of the utilities systems in St. Louis County is displayed in Figure A - 5.

**Water & Sewer:** There are 141 wastewater treatment plants in the county.

**Energy:** There are 58 electrical substations in St. Louis County in addition to various electric transmission lines (Figure A - 5).



**Communication:** Established in 2004, the Allied Radio Matrix for Emergency Response (ARMER) Program, administered in coordination with the Minnesota Statewide Radio Board, manages the implementation of a 700/800 megahertz (MHz) shared digital trunked radio communication system capable of servicing the radio communication needs of every public safety entity operating in Minnesota (MN Department of Public Safety, n.d.). There are 36 ARMER towers in St. Louis County (Figure A - 5).

### 3.8.3 High Potential Loss Structures

High potential loss structures are structures which would have a high loss or negative impact on the community if they were damaged or destroyed (FEMA). These structures include dams, levees and facilities storing hazardous materials.

A map displaying the locations of these structures is in Figure A - 16.

#### Dams & Levees

As described in Section 3.4.4, there are 67 dams and no levees in St. Louis County.

#### Hazardous Materials Facilities

Hazardous materials facilities contain extremely hazardous materials that would threaten the public if released. The inventory of these facilities in St. Louis County includes those required to submit a Tier II report to the EPA (due to the quantity of hazardous chemicals being stored). There are 232 Tier II facilities in St. Louis County (see Appendix B for a complete list).

### 3.8.4 Significant County Assets

Significant county assets include larger employers which represent a primary economic sector of a community; buildings of government services deemed to be significant; and cultural or historic assets that are deemed important to a community. An inventory of St. Louis County's significant county assets are listed in Appendix B.

#### Leading Employers

While every employer is an important asset to a community, the loss or disruption of certain employers, or the primary economic sector of a community, will have a large negative impact on the respective communities. St. Louis County identified 16 leading employers in the county.

#### Government Buildings

Government buildings deemed to be significant is at the discretion of the communities, but often include: city halls, courthouses, public works garages, libraries, etc. Previously mentioned government emergency services (police and fire) are not included in this list.

#### Cultural Resources

St. Louis County did not identify any cultural resources in the county for the purposes of this analysis.

### 3.9 Land Use and Ownership

St. Louis County covers a total of 6,859 square miles (4,389,760 acres). Land characteristics vary greatly throughout the county. The majority of the county's population lives in the city of Duluth, the adjacent cities of Hermantown and Proctor, and the surrounding townships. The next greatest population concentration is in the Iron Range communities, including Hibbing, Chisholm, Mountain Iron, Virginia, Eveleth and Hoyt Lakes.

St. Louis County has over 1,000 lakes with significant development on them. This includes year-round homes, seasonal cabins and resorts. There are large areas in St. Louis County that have very low-density development and are primarily used for forestry, wildlife habitat and recreation.

The county's public lands include: Voyageurs National Park, Boundary Waters Canoe Area Wilderness, Superior National Forest, four state parks and off road vehicle park, Giants Ridge Recreation area, state forests and tax forfeited lands.

In 2017, 779 farms existed in the county, covering 138,753 acres (3% of the county). Of this farming land, 48% is cropland, 32% is woodland, 12% is pastureland, and the rest is classified as "other." The number of farms in the county increased by 14% between 2012 and 2017, while the number of acres farmed increased by 9%. The average size of each farm is 178 acres (Census of Agriculture, 2017).

According to Minnesota DNR data, the number of feedlots in St. Louis County is 40. Feedlots in St. Louis County are mapped in Figure A - 26 (*Appendix A: St. Louis County Maps*).

Land ownership categories from the 2008 U.S. Geological Survey GAP (Gap Analysis Program) are shown in Figure A - 8 (*Appendix A: St. Louis County Maps*). Land cover is mapped in Figure A - 7.

#### 3.9.1 Facility Replacement Costs

St. Louis County-specific building data was sourced from the parcel tax databases and parcel polygon data included building valuations and occupancy class. Structure values for each parcel were aggregated within each parcel and assigned to the parcel centroid point. Records were aggregated to the relevant census administrative boundaries for the flood hazard analysis. This process also provided total facility replacement costs and total building exposure by general occupancy class (defined by Hazus tools). The total estimated building exposure for St. Louis County is shown in Table 8.

Table 8. St. Louis County Total Building Exposure

General Occupancy	Estimated Total Buildings	Total Building Exposure (Building + Contents)
Residential	143,231	\$10,285,546
Commercial	4,250	\$121,445
Other	8,181	\$517,265
<b>Totals</b>	<b>155,662</b>	<b>\$10,924,257</b>



## Section 4 – Risk Assessment

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

Basing risk assessments on the best information available is important in developing effective mitigation actions that benefit communities. Geographic Information System (GIS) tools are not only helpful in producing maps, but they also show structures at risk and may determine damage estimates for potential hazard scenarios. MN Homeland Security and Emergency Management (HSEM) mitigation staff encourages the use of GIS tools in risk assessments because they produce good information to use in the risk assessment process.

This assessment identifies the characteristics and potential consequences of a disaster, how much of the community could be affected by a disaster, and the impact on community assets. A risk assessment consists of three components — hazard identification and prioritization, risk profile and vulnerability profile.

### 4.1 Hazard Identification/Profile

#### 4.1.1 Hazard Identification

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

Natural hazards are identified in the FEMA publication “Multi-Hazard Identification and Risk Assessment – A Cornerstone of the National Mitigation Strategy,” also known as MHIRA. FEMA Region V developed a list based on state mitigation plans in the region.

Table 9 lists the natural hazards included in the 2019 Minnesota State Hazard Mitigation Plan.

*Table 9. Natural Hazards in the 2019 Minnesota State Hazard Mitigation Plan*

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

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

#### 4.1.2 Hazard Prioritization and Vulnerability Assessment by Jurisdiction

##### Prioritization of Hazards

As part of the plan update process, the steering committee reviewed, updated and prioritized the hazards faced by residents of St. Louis County, updated the existing mitigation actions published in the 2013 Multi-Hazard Mitigation Plan, and proposed new mitigation actions.

To engage in this process, the committee drew on a number of data sources. First, the committee examined the natural hazards identified in the 2013 Multi-Hazard Mitigation Plan (Table 10). The natural hazards that pose risk to St. Louis County were discussed and adjusted to reflect the definitions of natural hazards used in the 2019 Minnesota State Hazard Mitigation Plan. This was done in order to assure that the risks faced by St. Louis County were categorized the same way as the priority hazards established by the State of Minnesota.

*Table 10. Natural hazards identified in the 2013 St. Louis County Multi-Hazard Mitigation Plan*

Natural Hazards			
Drought	Earthquakes	Extreme Temperatures (Summer and Winter)	Flooding
Hailstorms	Heavy Rainfall	Lightning	Solar Storms
Thunderstorms	Tornadoes	Wildland Fires	Windstorms
Winter Storms (Blizzards, Snow, Ice Storms)			

While the focus of this MHMP is on natural hazards, planning took place with the understanding that many non-natural hazards could occur as a result of natural disasters (i.e. disruption in electrical service due to downed power lines from heavy snow, ice storms or high wind events).

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

The prioritization of hazards for the St. Louis County MHMP update (Table 11) was based upon group review and discussion of the natural hazards that pose risk to the county during the MHMP kick-off steering committee meetings on May 28-29, 2019. In the review of each hazard, the group was asked to consider if the risk to severe natural hazards had increased or decreased since the last plan, and if this affected their priority level to mitigate against that hazard. The group agreed that since the 2013 plan, their prioritization of hazards had not changed, with the exception of coastal flooding and coastal erosion which was moved in priority from moderate to high for the coastal areas in southern St. Louis County along Lake Superior. Severe winter storms and severe summer storms continued to be high priority hazards to address countywide as previously in 2013. Wildfire continued to be a high priority in the northern part of St. Louis County while it remained moderate in the southern part of the county. Extreme temperatures remained moderate countywide, and drought and dam failure remained low

countywide. *Appendix E: Steering Committee Meetings* provides the steering committee discussion notes from the May 28-29, 2019 meetings.

*Table 11. Prioritization of Hazards for St. Louis County*

Natural Hazards	Risk Severity (North St. Louis County)	Risk Severity (South St. Louis County)
Severe Summer Storms (Thunderstorms, Lightning, Hailstorms, Windstorms, Tornadoes)	High	High
Severe Winter Storms (Blizzards, Heavy Snow, Ice Storms)	High	High
Flash Flood, Riverine Flood, Coastal Flood	Moderate	Moderate/High* (Coastal Flood – High)
Extreme Heat/Extreme Cold	Moderate	Moderate
Landslides/Soil Erosion/ Coastal Erosion	Moderate	Moderate/High* (Coastal Erosion – High)
Wildfire	High	Moderate
Drought	Low	Low
Dam/Levee Failure	Low	Low

### Vulnerability Assessment by Jurisdiction

Jurisdictions in St. Louis County have varying vulnerabilities to and concerns about impacts to their communities. Interviews with jurisdictional representatives in addition to the Local Mitigation Survey resulted in some specific concerns. Participants were asked to provide feedback on how they felt vulnerability to natural hazards had either increased (due to changes such as development) or decreased (due to local mitigation efforts) over the past five years. Following is an overview of responses related to noted local vulnerabilities (see Appendix K for the full Local Mitigation Survey Report). This information was used to help tie local vulnerability back to the exposure of people, buildings, infrastructure and the environment to the natural hazards listed in Table 11, and to assist local governments in development of related local mitigation actions. Cities not listed did not note any change in risk or local vulnerability to hazard events.

#### City of Chisholm

- A couple of senior assisted living housing developments have been built, therefore creating a challenge with a large number of senior citizens needing assistance during a disaster event.
- The implementation of detention and retention ponds would be beneficial to handle the runoff from large storms. We plan to continue our annual goal of at least one street reconstruction per year which includes new storm sewer and catch basins.

### **City of Duluth**

- New development does create additional impervious surfaces and may create additional stormwater runoff.
- No zoning changes have been made that increase vulnerability to future severe weather events. Additional development pressure in areas susceptible to severe weather or disaster events has continued, including along Park Point and near certain rivers and streams; zoning rules have sought to minimize risk.
- After four declared storm-related disasters in a little over two years from 2016 to 2018, Duluth is already seeing the more frequent and severe storms that are projected for the area in association with climate change. More powerful storms are producing larger precipitation amounts, higher wind speeds, larger waves, and more coastal flooding and, at times, coming in such quick succession that the city is unable to complete repair work from one disaster before another disaster occurs. In the 12 months from October 2017 to October 2018, Duluth saw three declared coastal storm surge disasters, each of which hit the same public assets in the same way, each compounding the damage from prior storms before repairs could be completed.
- A sustained surge in new development has added significant impermeable surfaces in the last five years. That development has been offset to an unknown degree by green and gray stormwater infrastructure projects that have mitigated flood hazards. With significant ongoing development anticipated, the city of Duluth will need to continue to aggressively pursue smart flood mitigation projects to ensure that we at least do not lose ground.
- The arrival of Emerald Ash Borer to Duluth's extensive ash forests makes Duluth more vulnerable to wind events that will more easily take down dead, dying, and brittle ash trees, and to floods which may be worse if black ash wetlands convert to grassy wetlands with diminished floodwater retention capacity.

### **City of Hermantown**

- New development certainly increases the costs of damages associated with tornadoes, windstorms, hail, floods, etc. We have many assisted living facilities within the city that support more vulnerable populations.

### **City of Hoyt Lakes**

- The Polymet mining project is within our city limits and is essentially in our backyard. We have been working with Polymet on what their needs may be now and in the future. The construction phase up to completion and into operation will present many challenges for emergency response to the site.

## City of Proctor

- The school has constructed a new multi-use hockey facility which at times could have a large concentration of individuals in the building during a disaster event. Drainage may be undersized for the facility.
- The city still has a need for additional storm sewer upgrades, purchase of additional pumps, and sand bags in the event of flooding.
- Proctor has Kingsbury Creek running through the middle of town and large stormwater pipes under Highway 2. Both of these could not handle the water during the June 2012 flood. We would encounter the same problems in another similar event.

### 4.1.3 Hazard Profiling Concept of Planning

The risk assessments identify the characteristics and potential consequences of a disaster, how much of the community could be affected by a disaster, and the impact on community assets. A risk assessment consists of three components—hazard identification, risk profile and vulnerability profile.

### 4.1.4 GIS and Risk Assessment

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

FEMA's Hazus tool in ArcGIS was used to estimate the damages incurred for a 1% annual chance flood and for general asset assessment. Hazus also generates aggregated loss estimates for the entire county due to a 1% annual chance flood. Aggregate inventory loss estimates, which include building stock analysis, are based upon the assumption that building stock is evenly distributed across each census block. Therefore, it is possible that overestimates of damage will occur in some areas while underestimates will occur in other areas. With this in mind, total losses tend to be more reliable over larger geographic areas (groups of many blocks) than for individual census blocks. It is important to note that Hazus is not intended to be a substitute for detailed engineering studies.

### 4.1.5 National Centers for Environmental Information (NCEI) Records

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

The NCEI data included 1,438 reported events in St. Louis County between 1950 and July of 2019. However, some weather event categories only had available data going back as recent as 1996. No records before 1950 were available. A summary table of events related to each hazard type is included in the hazard profile sections that follow. A full table listing all events, including additional details, is included in Appendix C. NCEI hazard categories used in this plan are listed in Table 12.

Table 12. National Centers for Environmental Information Historical Hazards

Hazard	
Tornado	Hail
Thunderstorm Wind	Flood/Flash Flood
Winter Weather/ Winter Storm/Blizzard	Cold/Wind Chill
Excessive Heat/Heat	Lightning

#### 4.1.6 FEMA Declared Disasters

Another historical perspective is derived from FEMA-declared disasters. Nine major disaster and two emergency declarations in St. Louis County have been made between 1957 and June 2019 (Figure 6).

Figure 6. FEMA Disaster Declaration by County

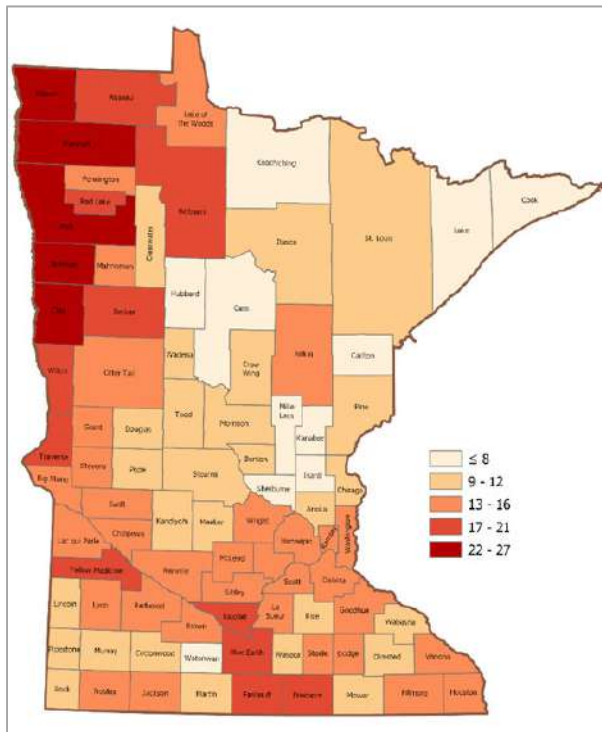


Table 13 and Table 14 show the details of the disasters including payments for Public Assistance (PA) and Individual Assistance (IA), listed under the flooding and severe storm profiles. No declarations were made for the other storms listed in the NCEI database. Reviewing the federal payments for damages from the declared disasters is a way of correlating the impact from the NCEI report.

Table 13. FEMA-Declared Major Disasters in St. Louis County (1957-June 2019)

Incident	Declaration Date and Disaster Number	Incident Period	Total PA Obligated by FEMA for Disaster in Minnesota	Total PA Obligated by FEMA for Disaster in St. Louis County	Individual Assistance in Minnesota	Individual Assistance in St. Louis County
Severe Storms, Flooding	2/1/2019 DR-4414	10/9/2018 – 10/11/2018	Yes, Amount Unknown	Yes, Amount Unknown	None	None
Severe Storms, Tornadoes, Straight-line Winds, Flooding	9/5/2018 DR-4390	6/15/2018 – 7/12/2018	\$13,018,824*	Yes, Amount Unknown	None	None

Incident	Declaration Date and Disaster Number	Incident Period	Total PA Obligated by FEMA for Disaster in Minnesota	Total PA Obligated by FEMA for Disaster in St. Louis County	Individual Assistance in Minnesota	Individual Assistance in St. Louis County
Severe Storms, Flooding	7/6/2012 DR-4069	6/14/2012 – 6/21/2012	\$42,656,571*	Yes, Amount Unknown	None	None
Severe Winter Storms, Flooding, Tornadoes	5/16/2001 DR-1370	3/23/2001 – 7/3/2001	\$36,227,572*	Yes, Amount Unknown	Yes, Amount Unknown	Yes, Amount Unknown
Severe Storms, Winds, Flooding	7/28/1999 DR-1283	7/4/1999 – 8/2/1999	\$11,679,939*	Yes, Amount Unknown	Yes, Amount Unknown	Yes, Amount Unknown
Severe Flooding, High Winds, Severe Storms	4/8/1997 DR-1175	3/21/1997 – 5/24/1997	Yes, Amount Unknown	Yes, Amount Unknown	Yes, Amount Unknown	Yes, Amount Unknown
Severe Thunderstorms, Winds, Flooding, Tornadoes, Heat	8/18/1995 DR-1064	7/9/1995 – 7/14/1995	Yes, Amount Unknown	Yes, Amount Unknown	None	None
Severe Storms, Flooding	8/25/1972 DR-350	8/25/1972	Yes, Amount Unknown	Yes, Amount Unknown	Yes, Amount Unknown	Yes, Amount Unknown
Heavy Rains, Flooding	7/22/1970 DR-291	7/22/1970	Yes, Amount Unknown	Yes, Amount Unknown	Yes, Amount Unknown	Yes, Amount Unknown

Source: Data downloaded from <https://www.fema.gov/openfema-dataset-disaster-declarations-summaries-v1> on 4/3/2019.

Values are estimates collected at the time of the disaster. \*According to <https://www.fema.gov/disasters/state-tribal-government/o/MN> as of 6/18/2019.

Table 14. FEMA-Declared Emergencies in St. Louis County (1957-June 2019)

Incident	Declaration Date and Disaster Number	Incident Period	Individual Assistance in Minnesota	Public Assistance (all affected areas)
Hurricane Katrina Evacuation	9/13/2005 EM-3242	8/29/2005 – 10/1/2005	None	Yes, Amount Unknown
Drought	6/17/1976 EM-3013	6/17/1976	None	Yes, Amount Unknown

\* Data downloaded from <https://www.fema.gov/openfema-dataset-disaster-declarations-summaries-v1> on 4/3/2019. Values are estimates collected at the time of the disaster.

St. Louis County has been part of several state disaster declarations (Table 15). The State Disaster Program was signed into state law in 2014. It is ½ the threshold of the federal/FEMA public assistance (only) program threshold.

Table 15. State Disaster Declarations in St. Louis County

Incident	Declaration Date and Disaster Number	Incident Period	Obligated Assistance
Severe Winter Storms, Flooding	5/25/2018 SD-025	4/13/2018 – 5/4/2018	\$675,000
Severe Winter	11/27/2017	10/27/2017	\$2,834,840

Incident	Declaration Date and Disaster Number	Incident Period	Obligated Assistance
Storm	SD-024		
Severe Thunderstorms, High Winds, Flooding	10/4/2016 SD-010	7/19/2016 -7/21/2016	\$3,526,511

Table 16 depicts the historical projects in St. Louis County resulting from hazard mitigation funding.

*Table 16. Historical Hazard Mitigation Funding (HMGP and PDM) in St. Louis County*

Year	Project Description	Sub-Grantee	Funding Type	Federal Share
2012	City of Duluth Acquisitions	Duluth	HMGP	\$538,599
2010	St. Louis County Plan Update	St. Louis County	PDM	\$68,967
2009	City of Ely Power Line Conversion	Ely	HMGP	\$480,007
2008	Arrowhead Fire Mitigation Project Sprinkler Installation	Cook County/Lake County/St. Louis County	PDM	\$450,000
2007	St. Louis County Wildfire Sprinkler Retrofit Project	St. Louis (County)	HMGP	\$417,615
2001	ARDC Mitigation Plan	Arrowhead Regional Development Comm.	HMGP	\$77,987
1999	City of Biwabik, Sewer project	Biwabik	HMGP	\$189,675
1999	St. Louis County NOAA Transmitters	St. Louis (County)	HMGP	\$83,589
1998	Backup Generator	City of Hibbing	HMGP	\$30,035
1998	Hibbing-Brooklyn Addition Sewer Project	City of Hibbing	HMGP	\$215,892
1998	Hibbing-Sargent Addition Sewer Project	City of Hibbing	HMGP	\$98,250
1998	Culvert Upsize	St. Louis County	HMGP	\$245,304
1998	Hibbing-Park Addition Sewer Project	City of Hibbing	HMGP	\$113,700
1998	Virginia-Storm Water Runoff Project	City of Virginia	HMGP	\$43,313
1998	Hibbing Storm Water Catch Basin	City of Hibbing	HMGP	\$11,839
1998	Hibbing-Bunker Road Sewer Project	City of Hibbing	HMGP	\$72,375
1998	Hibbing-By Pass Sanitary Sewer- 169/37	City of Hibbing	HMGP	\$395,075
1997	MNDOT -Living Snow fence	Minnesota Department of Transportation-District-7	HMGP	\$247,952
1997	MNDOT (St. Louis) -Living Snow Fence	MN Department of Transportation - District 1	HMGP	\$15,000
1997	Overhead To Underground Power Line Conversion	Lake County Cooperative Light & Power Association	HMGP	\$44,667
<b>Total HMGP/PDM Funding – St. Louis County</b>				<b>\$3,839,841</b>

\* Data provided by MN HSEM in March 2019

## 4.2 Future Development

Because St. Louis County is vulnerable to a variety of natural hazards, the county government—in partnership with the state government—must make a commitment to prepare for the management of



these events. St. Louis County is committed to ensuring that county elected and appointed officials become informed leaders regarding community hazards so that they are better prepared to set and direct policies for emergency management and county response.

At the local jurisdictional level, several communities did note an increase in development over the last five years as a factor for an increase in vulnerability to severe weather or disaster events (see Section 4.1.2, *Vulnerability Assessment by Jurisdiction*). In the development of local mitigation actions, all jurisdictions were encouraged to consider hazard mitigation strategies that would reduce risk in relation to future development, such as the update of local comprehensive plans, enforcement of ordinances and incorporation of infrastructure improvements to reduce local vulnerabilities (see *Appendix G Mitigation Actions by Jurisdiction*).

St. Louis County Emergency Management will work to keep the jurisdictions covered by the Multi-Hazard Mitigation Plan engaged and informed during the plan's cycle. By keeping jurisdictional leaders involved in the monitoring, evaluation and update of the MHMP, they will keep their local governments aware of the hazards that face their communities and how to mitigate those hazards through planning and project implementation.

Section 6 of this plan further outlines the process by which St. Louis County will address the maintenance of this plan, including monitoring, evaluation, and update of the plan, as well as implementation and continued public involvement.

### 4.3 Hazard Profiles

As part of the risk assessment, each natural hazard that poses risk to the county was independently reviewed for its past hazard history, relationship to future trends, and jurisdictional vulnerability to future events. A capabilities assessment was also conducted by the county to review the plans and programs that are in place or that are lacking (program gaps or deficiencies) for the implementation of mitigation efforts, as related to each natural hazard. An assessment was also conducted for local jurisdictions to identify the plans, policies, programs, staff and funding they have in place in order to incorporate mitigation into other planning mechanisms (see Section 5.1 Community Capability Assessments and *Appendix K: Local Mitigation Survey Report*).

#### 4.3.1 Tornadoes

Tornadoes are defined as violently-rotating columns of air extending from thunderstorms to the ground, with wind speeds between 40-300 mph. They develop under three scenarios: (1) along a squall line; (2) in connection with thunderstorm squall lines during hot, humid weather; and (3) in the outer portion of a tropical cyclone. 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.

Since 2007, tornado strength in the United States is ranked based on the Enhanced Fujita scale (EF scale), replacing the Fujita scale introduced in 1971. The EF scale uses similar principles to the Fujita scale, with six categories from zero to five, based on wind estimates and damage caused by the tornado. The EF Scale is used extensively by the NWS in investigating tornadoes (all tornadoes are now assigned an EF Scale number), and by engineers in correlating damage to buildings and techniques with

different wind speeds caused by tornadoes. To see a comparative table of F and EF scales, see <http://www.spc.noaa.gov/faq/tornado/ef-scale.html>.

In Minnesota, the peak months of tornado occurrence are June and July. The typical time of day for tornadoes in Minnesota ranges 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 10 minutes, has a path length of five to six miles, is nearly as wide as a football field, has a forward speed of about 35 miles an hour, and affects less than 0.1% of the county warned.

### Tornado History in St. Louis County

According to the NCEI, 36 tornadoes were reported in St. Louis County between 1950 and July of 2019, causing three deaths, 37 injuries, and over \$6 million dollars in property damage. Tornado classification ranged from Fo/EFo to F3 on the Fujita Scale/Enhanced Fujita Scale.

The most recent tornado occurred in June 2016, with what started as a severe thunderstorm creating large hail and damaging winds across the area. The tornado developed east of the Burlington Northern Santa Fe Railroad near the St. Louis River and tracked east-northeast for approximately 3.1 miles. The EF1 tornado resulted in damage to roofs and structures as well as uprooting several trees, traveling a total of 7.23 miles. No deaths or injuries were reported.

In August of 2015, an EF1 tornado occurred near Moilan Lake, uprooting several trees, with winds up to 95 miles per hour.

A waterspout formed on Lake Superior in August of 2012, making landfall on Park Point before crossing into St. Louis Bay. While no damage was reported, two floats, each weighing approximately 500 lbs., were lifted and rotated.

On August 6, 1969, a number of tornadoes were reported in the county, reaching a scale of F3. Two deaths and 32 injuries were recorded within St. Louis County. Figure 7 below shows tornado touchdown points and tracks in St. Louis County. Historic tornado events in the county are listed in Table 17.

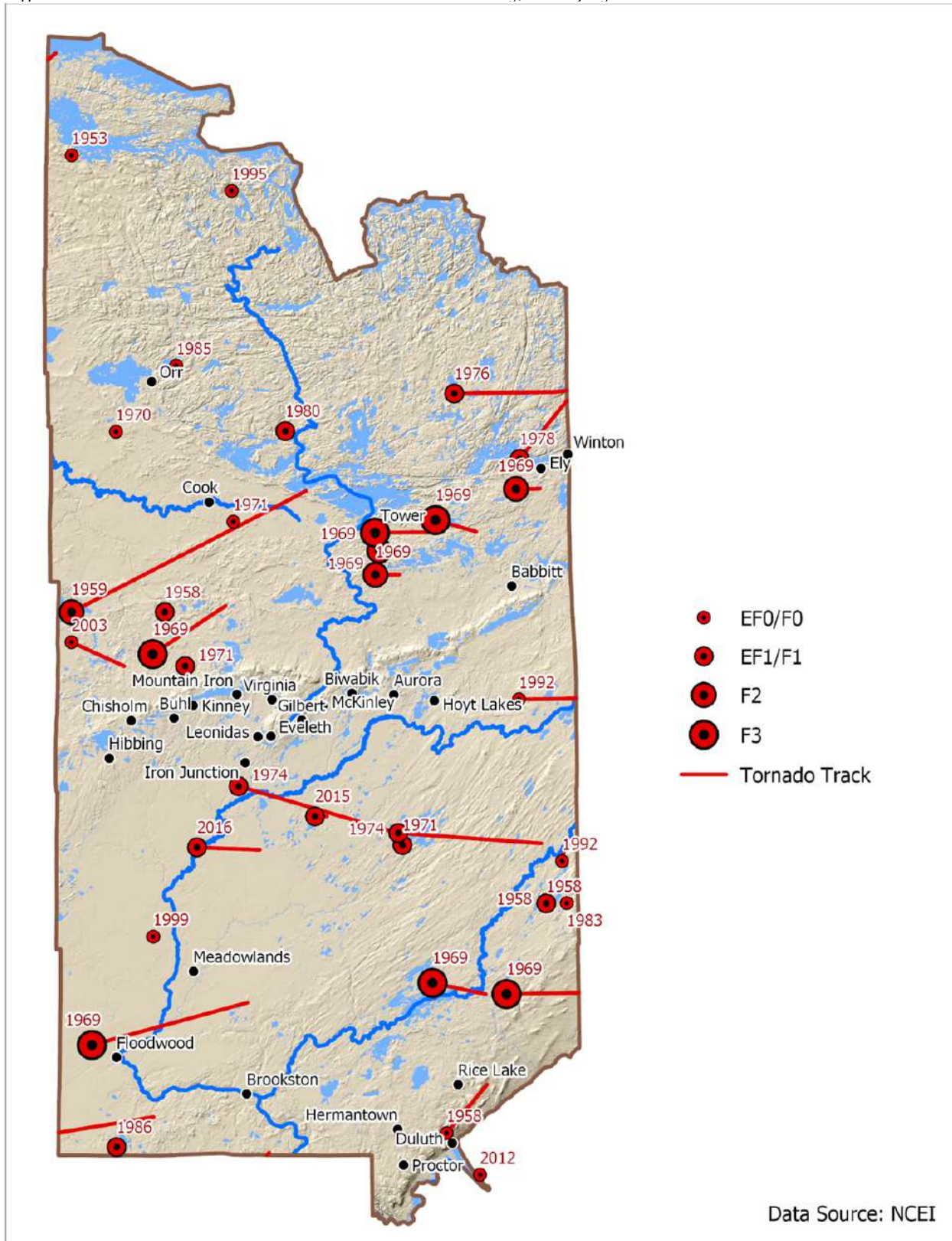
Table 17. Historic Tornado Events in St. Louis County, 1950-July 2019

Location or County	Date	Magnitude	Deaths	Injuries	Property Damage
Casco	6/19/2016	EF1	0	0	unknown
Central Lakes	8/8/2015	EF1	0	0	unknown
Duluth Sky Harbor Apt	8/9/2012	EFo	0	0	unknown
Side Lake	7/14/2003	Fo	0	0	unknown
Toivola	7/27/1999	Fo	0	0	unknown
Crane Lake	8/22/1995	Fo	0	0	unknown
Central Lakes	7/12/1995	Fo	0	0	\$2,000
St. Louis County	9/16/1992	Fo	0	0	\$25,000
St. Louis County	9/16/1992	Fo	0	0	unknown
St. Louis County	6/21/1986	F1	0	0	\$2,500

Location or County	Date	Magnitude	Deaths	Injuries	Property Damage
St. Louis County	7/20/1985	F0	0	0	\$2,500
St. Louis County	6/30/1983	F0	0	0	\$30
St. Louis County	6/12/1980	F1	0	0	\$25,000
St. Louis County	8/14/1978	F1	0	2	\$250,000
St. Louis County	4/14/1976	F1	0	0	\$25,000
St. Louis County	8/25/1974	F1	0	0	unknown
St. Louis County	8/25/1974	F1	0	0	\$250,000
St. Louis County	8/9/1971	F1	0	1	\$2,500
St. Louis County	6/30/1971	F0	0	0	unknown
St. Louis County	6/19/1971	F1	0	0	\$25,000
St. Louis County	9/20/1970	F0	0	0	\$2,500
St. Louis County	8/6/1969	F3	0	0	\$2,500
St. Louis County	8/6/1969	F3	2	3	\$250,000
St. Louis County	8/6/1969	F2	0	0	\$25,000
St. Louis County	8/6/1969	F3	0	0	\$250,000
St. Louis County	8/6/1969	F2	0	0	\$25,000
St. Louis County	8/6/1969	F3	0	20	\$2,500,000
St. Louis County	8/6/1969	F3	0	0	\$250,000
St. Louis County	8/6/1969	F2	0	0	\$25,000
St. Louis County	8/6/1969	F3	0	9	\$2,500,000
St. Louis County	9/6/1959	F2	0	0	\$25,000
St. Louis County	7/1/1958	F1	1	2	\$30
St. Louis County	5/26/1958	F0	0	0	unknown
St. Louis County	5/26/1958	F1	0	0	unknown
St. Louis County	5/26/1958	F0	0	0	unknown
St. Louis County	6/20/1953	F0	0	0	unknown

Source: National Centers for Environmental Information

Figure 7. Tornado Touchdowns and Paths in St. Louis County, 1950-July 2019



## Tornadoes and Climate Change

Tornadoes and other severe thunderstorm phenomena frequently cause as much annual property damage in the U.S. as do hurricanes, and often cause more deaths. Although recent research has yielded insights into the connections between global warming and the factors that cause tornadoes and severe thunderstorms, such as atmospheric instability and increases in wind speed with altitude (Del Genio, Yao, & Jonas, 2007), these relationships remain mostly unexplored, largely because of the challenges in observing thunderstorms and tornadoes and simulating them with computer models (National Climate Assessment Development Advisory Committee, 2013).

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

The earliest reported tornado in Minnesota occurred on March 6, 2017, when two tornadoes touched down in southern Minnesota, which was 12 days earlier than the previous record. The Zimmerman tornado occurred 115 miles further north than the previous record from 1968. According to State Meteorologist Paul Huttner, "Those records fit seasonally and geographically with longer term climate trends pushing weather events earlier in the season and further northward" (Huttner, 2017).

The state of Wisconsin has recorded three tornadoes in January and six in December during the period of 1844-2013 (National Weather Service Weather Forecast Office, 2014), including a January tornado in 2008.

## Vulnerability

The county has experienced tornadoes in 20 of the 68 full years on record, or in 29% of the years on record.

The likelihood of a tornado does not vary geographically in St. Louis County. However, certain populations may be more vulnerable and less resilient to the impacts of a tornado. Because communication is so important before a tornadic event, citizens that are in living in rural areas, have limited mobility, do not live near an outdoor warning siren or do not use social media may be more affected. According to the Social Vulnerability Index results in Figure 4 citizens with social factors that make up the household composition and disability theme may be greatest in the northern portion of the county and in the Duluth area. As with all summer storms, those who work outdoors or do not have permanent housing are also at greater risk.

People living in mobile home parks are particularly vulnerable to tornadoes. While Minnesota law requires most mobile home parks to have storm shelters, many do not (Sepic, 2017). Figure A - 9 displays the locations of the 21 mobile home parks in St. Louis County.

St. Louis County Emergency Management identified that there are several program gaps and deficiencies that make its citizens more vulnerable to summer storms (includes tornadoes) and should be addressed with new mitigation efforts to reduce vulnerability. They include:

*Aboveground Power Lines* – A majority of the power lines in the county are aboveground and subject to damage from high winds and falling tree limbs from severe summer storms. Power lines that are aboveground are susceptible to coming down during severe storms, resulting in power outages. St. Louis County is very large and encompasses very rural areas.

*Backup Power* – Following the 2016 blowdown and prolonged power outage, it was quickly learned that not all county facilities had backup power to continue operations during the outage. St. Louis County started to evaluate all critical buildings and services. Many cities and townships do not have adequate backup power to their facilities.

*Communications* – Not all residents have opted in to the Northland Alert notification system for cell phones. St. Louis County has recently created a Facebook page but that is currently our only social media.

*Warning Sirens* – Not all areas have outdoor warning sirens. Due to the vast area of St. Louis County, having sirens to cover the entire county isn't feasible.

*Storm Shelters / Community Safe Rooms* – Additional storm shelter areas would enhance public safety. Construction or retrofit of facilities to serve as community safe rooms for severe wind events should also be evaluated for areas where there are vulnerable populations, such as campgrounds, mobile home parks and schools.

#### 4.3.2 Windstorms

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. 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 strong horizontal flow.

When wind speeds are not able to be measured, they are estimated. Part of the process to determine wind speed is observing the damage. Table 18 lists the expected effects of increasing wind speeds.



Table 18. Effects of Wind Speed

Wind Speed	Effects
26-38 knots (30-44 mph)	Trees in motion. Lightweight loose objects (e.g., lawn furniture) tossed or toppled.
39-49 knots (45-57 mph)	Large trees bend; twigs, small limbs break; and a few larger dead or weak branches may break. Old/weak structures (e.g., sheds, barns) may sustain minor damage (roof, doors). Buildings partially under construction may be damaged. A few loose shingles may be removed from houses. Carports may be uplifted; minor cosmetic damage may occur to mobile homes.
50-64 knots (58-74 mph)	Large limbs break; shallow-rooted trees may be pushed over. Semi-trucks may be overturned. More significant damage to old/weak structures occurs. Shingles, awnings may be removed from houses; damage to chimneys and antennas occurs; mobile homes and carports incur minor structural damage.
65-77 knots (75-89 mph)	Widespread damage to trees with trees broken/uprooted. Mobile homes may incur more significant structural damage; Roofs may be partially peeled off industrial/commercial/warehouse buildings. Some minor roof damage may occur to homes. Weak structures (e.g., farm buildings, airplane hangars) may be severely damaged.
78+ knots (90+ mph)	Many large trees broken and uprooted. Mobile homes may be severely damaged; moderate roof damage to homes may occur. Roofs may be partially peeled off homes and buildings. Moving automobiles may be pushed off dry roads. Barns and sheds may be demolished.

Source: (National Weather Service, 2018)

### Windstorm History in St. Louis County

St. Louis County frequently experiences winds blowing over 50 knots (Figure 8). According to NCEI records, there were 464 thunderstorm/high wind events reported between 1950 and July 2019, with wind speeds of up to 88 knots. These winds can inflict damage to buildings and in some cases overturn high-profile vehicles.

On July 21, 2016, straight-line winds of 60-80 mph occurred in the region. Duluth was one of the hardest-hit areas, with multiple wind gusts recorded of 100 mph, and power outages for 75,000 people. Some homes were without power for as long as a week. Minnesota Power described the storm's devastation as the worst in at least half a century.

In June of 2016, winds of up to 52 knots occurred, injuring two campers when a tree fell onto their tent in Voyageurs National Park.

On July 21, 2014, two campers were injured by a falling tree on Loon Lake. Wind speeds reached 70 knots. The following day, two more campers were injured when a tree fell on their campsite on Lac La Croix Lake.

Winds of up to 50 knots blew down trees on Echo Trail, and two campers were injured when a tree fell on their tent.

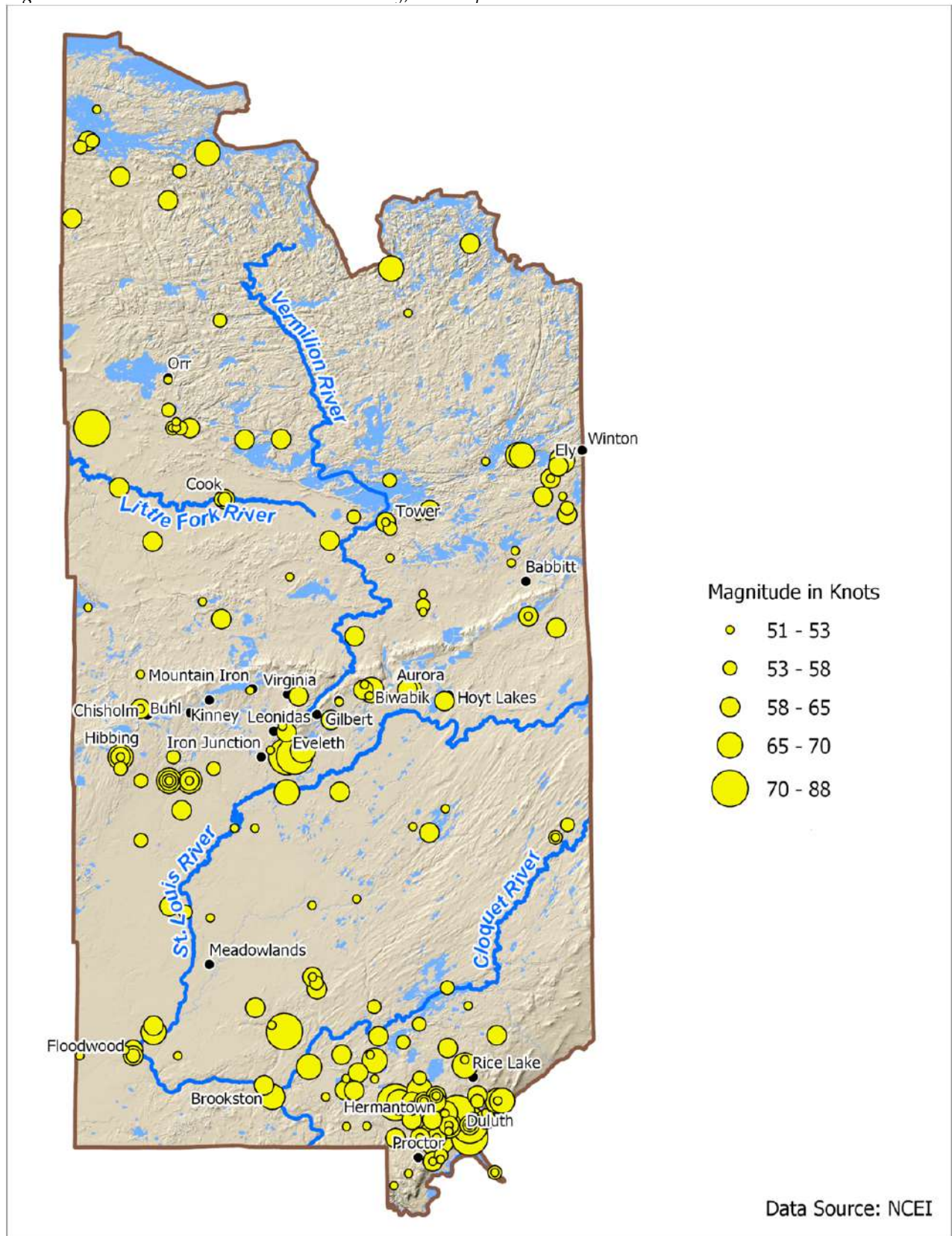
### Windstorms and Climate Change

Lack of high-quality long-term data sets make assessment of changes in wind speeds very difficult (Kunkel, 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. 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).



Figure 8. Severe Windstorms in St. Louis County, 1955-April 2019



## Vulnerability

Vulnerability to injury from all kinds of windstorms decreases with adequate warnings, warning time, and sheltering in a reinforced structure. Vulnerability to structures depends upon construction of the building and infrastructure. Residents of mobile homes are more vulnerable to fatality or injury from windstorms because mobile homes are not able to withstand high winds as well as other structural dwellings. Wind in excess of 50 mph (43.4 knots) is the lower limit of wind speeds capable of damaging mobile homes (American Meteorological Society, 2004). Steps to mitigate these vulnerabilities have been taken but have not proven sufficient. For example, mobile home parks with 10 or more homes that received their primary license after March 1, 1998, are required to provide storm shelters that meet standards specified by the commissioner of administration (Minnesota Department of Health, 2018). However, mobile home parks often do not provide the required storm shelters. Building codes have also changed to improve the strength of new mobile home construction, but there are still many older mobile homes in use that do not meet these new standards.

According to NOAA's Storm Prediction Center, from 1985-2002, 49% of tornado fatalities in the United States were people who remained within or attempted to flee from mobile homes (American Meteorological Society, 2004). Given the vulnerability of mobile home residents to windstorm events, it is important to have a general understanding of where mobile homes are located. Figure A - 9 displays the locations of the 21 mobile home parks in St. Louis County.

The likelihood of a windstorm event does not vary geographically in St. Louis County. Because communication is so important before a windstorm event, citizens that are in living in rural areas, have limited mobility, do not live near an outdoor warning siren or do not use social media may be more affected. According to the Social Vulnerability Index results in Figure 4, citizens with social factors that make up the household composition and disability theme may be greatest in the northern portion of the county and in the Duluth area. As with all summer storms, those who work outdoors or do not have permanent housing are also at greater risk.

St. Louis County Emergency Management identified that there are several program gaps and deficiencies that make its citizens more vulnerable to summer storms (includes windstorms) and should be addressed with new mitigation efforts to reduce vulnerability. They include:

*Aboveground Power Lines* – A majority of the power lines in the county are aboveground and subject to damage from high winds and falling tree limbs from severe summer storms. Power lines that are aboveground are susceptible to coming down during severe storms, resulting in power outages. St. Louis County is very large and encompasses very rural areas.

*Backup Power* – Following the 2016 blowdown and prolonged power outage, it was quickly learned that not all county facilities had backup power to continue operations during the outage. St. Louis County started to evaluate all critical buildings and services. Many cities and townships do not have adequate backup power to their facilities.

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### 4.3.3 *Lightning*

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 can strike more than 10 miles from the storm in an area with clear sky above.

Lightning strikes the ground approximately 25 million times each year in the U.S. According to the NWS, the chance of an individual in the U.S. being killed or injured by lightning during a given year is 1 in 240,000 (NOAA National Severe Storms Laboratory, n.d.).

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 other 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 cause fires.

### *Lightning History in St. Louis County*

The NCEI has recorded 20 lightning events between 1996 and July 2019, resulting in one death, 12 injuries, and over \$1.3 million in property damage.

On June 28, 2015, lightning strikes resulted in three people being injured in the county. A 12-year old boy was critically injured after being struck by lightning at the Enger Park Golf Course in Duluth. At a baseball field in Cherry, MN, a 51-year-old father and his 4-year old daughter were struck by lightning. The man suffered a heart attack and was hospitalized for many days.

In August of 2012, a group of people was sailing near Park Point in Duluth. As the storm approached they rushed to shore. However, lightning struck them, killing a 9-year old boy and injuring four others.

A 16-year old boy was struck by lightning along West Skyline Parkway in Duluth in July of 2010. He was knocked unconscious, and sustained third-degree burns.

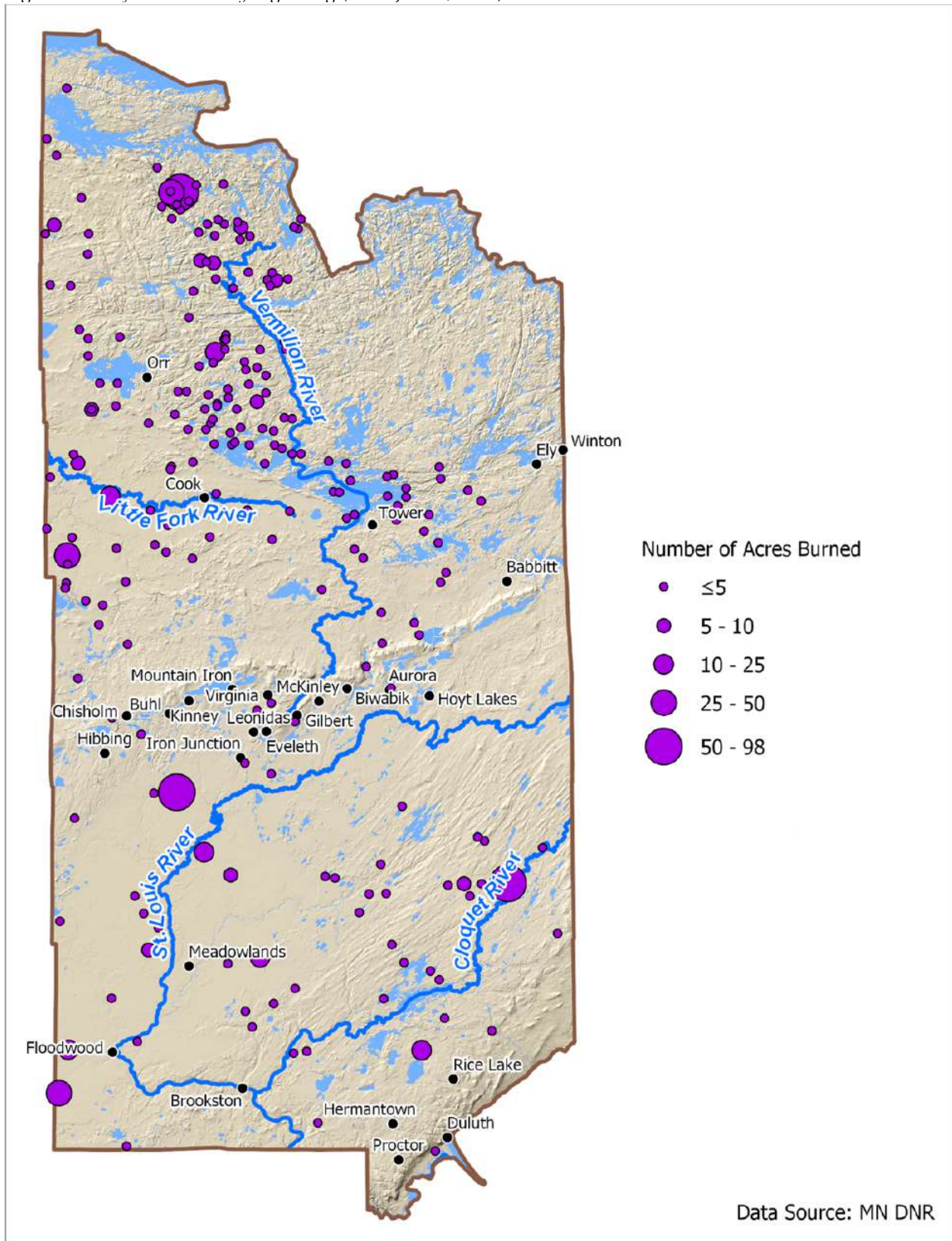
In July of 1998, lightning struck a wooden church in Mountain Iron, destroying the building. Property damage was estimated at \$400,000.

Lightning in Hibbing in August of 1996 toppled a power line, which ignited a fire in a local restaurant, resulting in \$400,000 of damage.

Lightning is also the cause of many wildfires in St. Louis County. Between 1985 and June 4, 2019, there were 225 wildfires initiated by lightning in the county, burning a total of 665 acres (Figure 9).



Figure 9. Wildfires Caused by Lightning (1985-June 4, 2019)



### Lightning and Climate Change

The projected possible intensity and frequency of tornadoes, hail, and damaging thunderstorm winds, the conditions associated with lightning, are uncertain (National Climate Assessment Development Advisory Committee, 2013). Severe rain events are becoming more common and may include an additional risk of lightning.

### Vulnerability

The magnitude of summer storms each year is unpredictable and within St. Louis County the vulnerability of jurisdictions to lightning does not vary geographically. As with all summer storms, those who work outdoors or do not have permanent housing are most at risk.

St. Louis County Emergency Management identified that there are several program gaps and deficiencies that make its citizens more vulnerable to summer storms (includes lightning) and should be addressed with new mitigation efforts to reduce vulnerability. They include:

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### 4.3.4 Hail

Hailstorms are a product of severe thunderstorms. Hail forms when strong updrafts within the storm carry water droplets above the freezing level, where they remain suspended and continue to grow larger, until their weight can no longer be supported by the winds. Hailstones can vary in size, depending on the strength of the updraft. The NWS uses the following descriptions when estimating hail sizes: pea size is ¼-inch, marble size is ½-inch, dime size is ¾-inch, quarter size is 1-inch, golf ball size is 1 ¾-inches, and baseball size is 2 ¾-inches. Individuals who serve as volunteer "storm spotters"

for the NWS are located throughout the state, and are instructed to report hail dime size ( $\frac{3}{4}$ -inch) or greater. Hailstorms can occur throughout the year; however, the months of maximum hailstorm frequency are typically between May and August. Although hailstorms rarely cause injury or loss of life, they can cause significant property damage.

### Hail History in St. Louis County

Hail is a common occurrence in St. Louis County (Figure 10). Since 1950, the NCEI has reported over \$50 million in property damage due to hail in the county.

In July of 2006 a hailstorm in Babbitt caused thousands of dollars of damage to vehicles, while also damaging the local building center and greenhouse.

A hailstorm with hail reaching 3.5 inches in West Duluth occurred in August of 1998, causing extensive damage to vehicles, roofs, gardens and patio furniture. The NCEI estimated there was \$50 million in property damage, based on insurance claims.

On August 3, 1989, three people were injured when hail of 4.5 inches in size occurred in Voyageurs National Park. Boats, vehicles and windows sustained severe damage as well.

Table 19 shows storms producing hail greater than one inch diameter in St. Louis County.

Figure 10. Severe Hailstorms in St. Louis County, 1955-April 2019

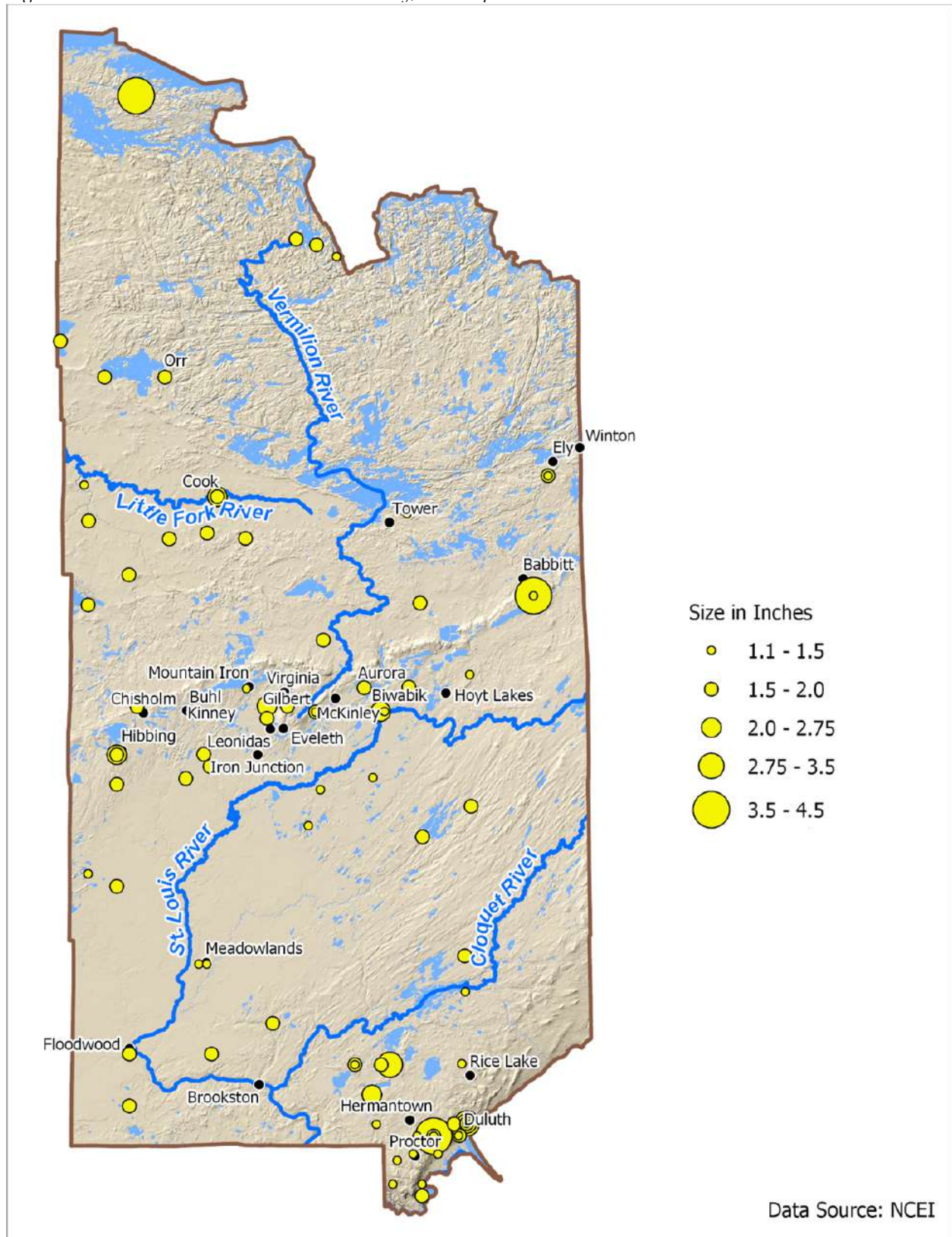




Table 19. Storms producing hail of greater than 1-inch diameter in St. Louis County, 1950-July 2019

Date	Hail Size (inches)	Injuries	Date	Hail Size (inches)	Injuries	Date	Hail Size (inches)	Injuries
7/26/2019	1.25	0	5/14/2007	2	0	8/27/1994	1.75	0
7/26/2019	1.25	0	5/14/2007	2	0	9/11/1990	1.25	0
9/12/2018	1.25	0	5/14/2007	2	0	6/29/1990	2	0
7/2/2018	1.75	0	5/14/2007	2	0	8/3/1989	4.5	3
9/14/2017	2	0	5/14/2007	1.75	0	8/3/1989	1.75	0
9/14/2017	1.75	0	5/14/2007	1.75	0	8/8/1984	1.75	0
9/14/2017	1.75	0	5/14/2007	1.75	0	8/8/1984	1.75	0
9/14/2017	1.75	0	5/14/2007	1.5	0	8/8/1984	1.5	0
9/14/2017	1.5	0	5/14/2007	1.5	0	7/12/1982	2	0
7/17/2017	2.5	0	7/28/2006	1.5	0	7/12/1982	2	0
7/17/2017	1.75	0	7/28/2006	1.5	0	7/12/1982	2	0
7/17/2017	1.25	0	7/16/2006	4	0	5/10/1982	1.75	0
6/19/2016	1.25	0	5/28/2006	1.75	0	5/10/1982	1.75	0
6/5/2016	1.5	0	5/5/2005	1.75	0	5/10/1982	1.75	0
3/8/2016	1.5	0	4/18/2004	2	0	5/10/1982	1.75	0
8/8/2015	1.5	0	4/18/2004	1.75	0	8/29/1980	1.5	0
5/7/2014	1.5	0	4/18/2004	1.25	0	7/10/1980	2.75	0
7/22/2012	1.75	0	7/19/2003	1.75	0	7/4/1980	1.75	0
7/2/2012	1.75	0	9/2/2002	2.75	0	6/25/1979	1.5	0
7/2/2012	1.5	0	9/2/2002	2	0	7/16/1977	2.5	0
7/2/2012	1.25	0	8/1/2002	1.75	0	7/16/1977	1.75	0
5/28/2012	1.75	0	6/22/2002	1.75	0	8/12/1975	1.75	0
5/28/2012	1.5	0	6/22/2002	1.75	0	6/3/1974	1.75	0
8/8/2011	1.5	0	7/1/2000	1.75	0	8/17/1971	1.25	0
7/27/2010	1.5	0	9/7/1999	1.25	0	5/21/1970	1.75	0
6/24/2010	1.75	0	8/23/1998	3.5	0	8/12/1968	1.75	0
5/24/2010	1.5	0	8/23/1998	1.5	0	8/12/1968	1.75	0
9/26/2008	1.5	0	8/23/1998	1.25	0	7/16/1965	1.5	0
8/28/2008	1.25	0	9/18/1997	2	0	7/1/1965	1.75	0
7/11/2008	1.25	0	7/11/1996	2.5	0	5/4/1964	1.5	0
8/27/2007	1.75	0	7/11/1996	1.75	0	9/8/1958	4	0
6/7/2007	1.75	0	8/22/1995	2.75	0	5/26/1958	2.5	0
5/14/2007	3	0	7/21/1995	1.75	0			
5/14/2007	2.5	0	8/27/1994	2.5	0			

Source: National Centers for Environmental Information

### Hail and Climate Change

According to the Federal Advisory Committee Draft National Climate Assessment (NCA), trends in severe storms, including the numbers of hurricanes and the intensity and frequency of tornadoes, hail,

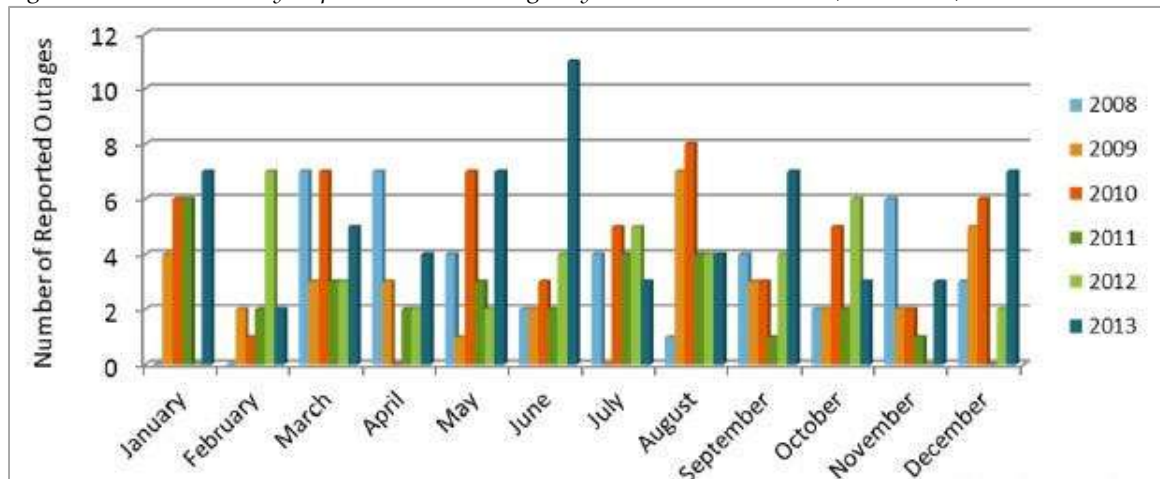
and damaging thunderstorm winds are uncertain. Since the impact of more frequent or intense storms can be larger than the impact of average temperature, climate scientists are actively researching the connections between climate change and severe storms (National Climate Assessment Development Advisory Committee, 2013).

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

### Severe Summer Storms and Electrical Outages

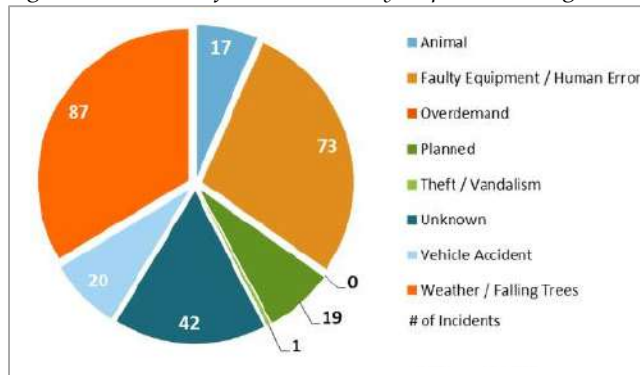
According to NOAA data, the natural hazards that caused the greatest overall property loss in Minnesota between 1996 and 2014 were thunderstorms and lightning, at \$86.3 million per year. The state also experienced 23 electric transmission outages from 1992 to 2009, five of which were due to heat waves and thunderstorms. On average, the number of people affected annually by all electric outages during 2008 to 2013 in Minnesota was 449,995, with a high of 1,460,810 in 2011 (U.S. Department of Energy, 2015). Figure 11 below shows the seasonality of electric outages by month for the years 2008-2013, and Figure 12 shows the causes of outages in the state between 2008 and 2013, with the largest cause being weather/falling trees.

Figure 11. Electric Utility Reported Power Outages by Month in Minnesota (2008-2013)



Source: U.S. Department of Energy, 2015

Figure 12. Causes of Electric-Utility Reported Outages in Minnesota (2008-2013)



Source: U.S. Department of Energy, 2015

### Vulnerability

Summer storms affect St. Louis County each year, so there is a 100% probability that the county and its jurisdictions will be affected. According to the 68-full-year NCEI record, there is a 75% chance of a significant hailstorm any year in St. Louis County and a 54% chance in each year that there will be a hailstorm that produces hail greater than one inch in size.

The magnitude of summer storms each year is unpredictable and within St. Louis County the vulnerability of jurisdictions to summer storms does not vary geographically. As with all summer storms, those who work outdoors or do not have permanent housing are at greater risk.

St. Louis County Emergency Management identified that there are several program gaps and deficiencies that make its citizens more vulnerable to summer storms (includes hail) and should be addressed with new mitigation efforts to reduce vulnerability. They include:

**Aboveground Power Lines** – A majority of the power lines in the county are aboveground and subject to damage from high winds and falling tree limbs from severe summer storms. Power lines that are aboveground are susceptible to coming down during severe storms, resulting in power outages. St. Louis County is very large and encompasses very rural areas.

**Backup Power** – Following the 2016 blowdown and prolonged power outage, it was quickly learned that not all county facilities had backup power to continue operations during the outage. St. Louis County started to evaluate all critical buildings and services. Many cities and townships do not have adequate backup power to their facilities.

**Communications** – Not all residents have opted in to the Northland Alert notification system for cell phones. St. Louis County has recently created a Facebook page but that is currently our only social media.

**Warning Sirens** – Not all areas have outdoor warning sirens. Due to the vast area of St. Louis County, having sirens to cover the entire county isn't feasible.

*Storm Shelters / Community Safe Rooms* – Additional storm shelter areas would enhance public safety. Construction or retrofit of facilities to serve as community safe rooms for severe wind events should also be evaluated for areas where there are vulnerable populations, such as campgrounds, mobile home parks and schools.

#### 4.3.5 *Flash Flood and Riverine Flood*

Flooding is the most significant and costly natural hazard in Minnesota. The type, magnitude, and severity of flooding are functions of the amount and distribution of precipitation over a given area, the rate at which precipitation infiltrates the ground, the geometry and hydrology of the catchment, and flow dynamics and conditions in and along the river channel. Flash floods generally occur in the upper parts of drainage basins and are typically characterized by periods of intense rainfall over a short duration. These floods arise with very little warning and often result in locally intense damage, and sometimes loss of life, due to the high energy of the flowing water. Flood waters can snap trees, topple buildings, and easily move large boulders or other structures. Six inches of rushing water can upend a person; another 18 inches might carry off a car. Generally, flash floods cause damage over relatively localized areas, but they can be quite severe. Flash floods in urban areas involve the overflow of storm drain systems and can be the result of inadequate drainage combined with heavy rainfall or rapid snowmelt. Flash floods can occur at any time of the year in Minnesota, but they are most common in the spring and summer. St. Louis County frequently experiences flash floods.

Riverine floods refer to floods on large rivers at locations with large upstream catchments. Riverine floods are typically associated with precipitation events that are of relatively long duration and occur over large areas. Flooding on small tributary streams may be limited, but the contribution of increased runoff may result in a large flood downstream. The lag time between precipitation and the flood peak is much longer for riverine floods than for flash floods, generally providing ample warning for people to move to safe locations and, to some extent, secure some property against damage.

Nationwide, floods caused 4,586 deaths from 1959 to 2005 while property and crop damage averaged nearly \$8 billion per year (in 2011 dollars) from 1981-2011 (Georgakakos, et al., 2014).

During the past several decades, agencies have used the “100-year floodplain” as the design standard for projects funded by the federal government. However, today floods of that magnitude are occurring far more often than once per century (Natural Resources Defence Council, 2015). In recognition of increasing risks, in January of 2015 the President issued an executive order that updates flood protection standards that guide federally-funded projects in or near floodplains or along coastlines. These new standards require federally-funded projects to either build two feet above the 100-year flood elevation for standard projects and three feet above for critical buildings like hospitals and evacuation centers; or build to the 500-year flood elevation (The White House, 2015).

#### *Flood History in St. Louis County*

St. Louis County has experienced many floods and flash floods, some resulting in severe property damage.

Thunderstorms in June of 2016 resulted in flooding west of Cook, after more than 4.5 inches of rain fell. A road washed out near the intersection of Highway 5 and Lender Road.

In July of 2014 water levels on Rainy Lake rose to levels not seen since 1950, following weeks of heavy rains over the Rainy Lake Basin. High water levels on Lake Kabetogama inundated docks, in addition to damaging and destroying lakeshore property.

In June of 2012, the region's most damaging flood on record severely impacted St. Louis County, resulting in the declaration of a state of emergency in Duluth, Hermantown, Cloquet, Barnum, Moose Lake and Superior, WI.

According to the United States Geological Survey report *Floods of June 2012 in Northeastern Minnesota* (USGS),

*During June 19–20, 2012, heavy rainfall, as much as 10 inches locally reported, caused severe flooding across northeastern Minnesota. The floods were exacerbated by wet antecedent conditions from a relatively rainy spring, with May 2012 as one of the wettest Mays on record in Duluth. The June 19–20, 2012, rainfall event set new records in Duluth, including greatest 2-day precipitation with 7.25 inches of rain. The heavy rains fell on three major watersheds: the Mississippi Headwaters; the St. Croix, which drains to the Mississippi River; and Western Lake Superior, which includes the St. Louis River and other tributaries to Lake Superior. Widespread flash and river flooding that resulted from the heavy rainfall caused evacuations of residents, and damages to residences, businesses, and infrastructure. In all, nine counties in northeastern Minnesota were declared Federal disaster areas as a result of the flooding... Flood-peak streamflows in June 2012 had annual exceedance probabilities estimated to be less than 0.002 (recurrence interval greater than 500 years) for five streamgages, and between 0.002 and 0.01 (recurrence interval greater than 100 years) for four streamgages.*

Table 20 below lists St. Louis County's historical floods as recorded by the NCEI. No deaths or injuries were recorded with these floods.

Table 20. St. Louis County Historical Floods, 1996-July 2019

Location or County	Date	Type	Deaths	Injuries	Property Damage
Side Lake	9/15/2018	Flash Flood	0	0	unknown
Cook	7/12/2018	Flash Flood	0	0	unknown
Palmers	7/8/2018	Flash Flood	0	0	unknown
Cook	6/16/2018	Flash Flood	0	0	unknown
Cook	6/16/2018	Flash Flood	0	0	unknown
Missabe Jct	6/15/2018	Flash Flood	0	0	unknown
Missabe Jct	6/15/2018	Flash Flood	0	0	unknown
Markham	9/14/2017	Flash Flood	0	0	unknown
Markham	9/14/2017	Flash Flood	0	0	unknown
Polo	9/14/2017	Flash Flood	0	0	unknown

Location or County	Date	Type	Deaths	Injuries	Property Damage
Polo	9/14/2017	Flash Flood	0	0	unknown
Makinen	9/14/2017	Flash Flood	0	0	unknown
Central Lakes	9/14/2017	Flash Flood	0	0	unknown
Bear River	6/13/2016	Flood	0	0	\$1,000
Crane Lake	7/1/2014	Flood	0	0	\$1,000
Kabetogama	6/14/2014	Flood	0	0	unknown
Kabetogama	6/14/2014	Flood	0	0	unknown
Mahoning	4/30/2013	Flood	0	0	unknown
Pequaywan Lake	6/21/2012	Flood	0	0	unknown
Pequaywan Lake	6/21/2012	Flood	0	0	unknown
Duluth Hgts	6/20/2012	Flash Flood	0	0	unknown
Duluth Intl Arpt	6/20/2012	Flash Flood	0	0	unknown
Saginaw	6/20/2012	Flash Flood	0	0	unknown
Hermantown	6/20/2012	Flash Flood	0	0	unknown
Missabe Jct	6/20/2012	Flash Flood	0	0	unknown
Duluth Hgts	6/20/2012	Flash Flood	0	0	unknown
Fond Du Lac	6/20/2012	Flash Flood	0	0	unknown
Floodwood	6/20/2012	Flash Flood	0	0	unknown
Duluth Hgts	6/19/2012	Flash Flood	0	0	unknown
Duluth Hgts	6/19/2012	Flash Flood	0	0	unknown
Hunters Park	6/19/2012	Flash Flood	0	0	unknown
Hermantown	6/19/2012	Flash Flood	0	0	unknown
Duluth Hgts	6/19/2012	Flash Flood	0	0	unknown
Duluth Hgts	6/19/2012	Flash Flood	0	0	unknown
Hermantown	6/19/2012	Flash Flood	0	0	unknown
Duluth Hgts	5/28/2012	Flash Flood	0	0	unknown
Fond Du Lac	8/8/2011	Flash Flood	0	0	unknown
Sturgeon	6/27/2011	Flash Flood	0	0	unknown
Smithville	8/7/2010	Flash Flood	0	0	unknown
North Hibbing	8/1/2010	Flash Flood	0	0	unknown
Kabetogama	7/1/2010	Flash Flood	0	0	unknown
Duluth	10/18/2007	Flood	0	0	unknown
Gheen	5/21/2007	Flash Flood	0	0	unknown
Southern St. Louis / Carlton (Zone)	6/25/2002	Flood	0	0	unknown
Southern St. Louis / Carlton (Zone)	6/24/2002	Flood	0	0	unknown
Southern St. Louis / Carlton	6/23/2002	Flood	0	0	unknown

Location or County (Zone)	Date	Type	Deaths	Injuries	Property Damage
Virginia	6/22/2002	Flash Flood	0	0	unknown
Central Portion	7/5/1999	Flash Flood	0	0	unknown
Southeast Portion	7/5/1999	Flash Flood	0	0	unknown
Duluth	6/24/1997	Flash Flood	0	0	unknown
Southern St. Louis / Carlton (Zone)	4/6/1997	Flood	0	0	\$160,800
Duluth	7/6/1996	Flash Flood	0	0	\$300,000

Source: National Centers for Environmental Information

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. Five USGS gauging stations are located in St. Louis County, listed in Table 21 below, along with data on their highest-recorded gauge heights.

Table 21. Historical Flood Crests for USGS Gauging Stations in St. Louis County

Historical Flood Crests for Vermilion River near Crane Lake		Historical Flood Crests for St. Louis River near Skibo		Historical Flood Crests for Knife River near Two Harbors		Historical Flood Crests for Stoney Brook near Brookston		Historical Flood Crests for Superior Bay, Duluth	
Date	Height (Feet)	Date	Height (Feet)	Date	Height (Feet)	Date	Height (Feet)	Date	Height (Feet)
4/25/1985	15.20	6/24/2012	20.79	6/20/2012	12.81	5/2/2013	8.62	N/A	N/A
Apr. 1979	15.15	4/25/2016	20.22	7/5/1999	12.14	5/2/2014	8.08	N/A	N/A
4/14/2011	14.76	5/9/2013	19.97	5/10/1979	11.16	3/17/2016	8.08	N/A	N/A
5/26/2001	14.19	4/23/2017	19.57	6/24/1997	10.29	4/27/2008	7.70	N/A	N/A
4/26/2008	14.01	9/7/2015	19.51	6/29/1991	9.82	5/18/2017	7.53	N/A	N/A
5/4/2013	13.98	N/A	N/A	7/4/1993	9.53	3/25/2009	6.49	N/A	N/A
6/4/2014	13.96	N/A	N/A	9/24/1977	8.94	3/25/2012	6.49	N/A	N/A
4/26/1996	13.38	N/A	N/A	5/29/1978	8.43	4/4/2006	5.91	N/A	N/A
8/24/1988	13.23	N/A	N/A	8/25/1995	8.19	5/18/2015	5.65	N/A	N/A
4/25/1982	13.04	N/A	N/A	9/4/1980	8.09	8/21/2010	5.52	N/A	N/A

Source: USGS

## Flooding and Climate Change

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. The Midwest has seen a 45% increase in very heavy precipitation (defined as the heaviest 1% of all daily events) from 1958 to 2011 (National Climate Assessment Development Advisory Committee, 2013). This precipitation change has led to amplified magnitudes of flooding. Increased precipitation may also

show seasonal changes, trending toward wetter springs and drier summers and falls. An example of a recent year with this character was 2012, when many MN counties were eligible for federal disaster assistance for drought, while others were eligible for flooding, and seven were eligible for both in the same year (Seeley M. , 2013). In 2007, 24 Minnesota counties received drought designation, while seven counties were declared flood disasters. In 2012, 55 Minnesota counties received federal drought designation at the same time 11 counties declared flood emergencies. In addition, the yearly frequency of the largest storms – those with three inches or more of rainfall in a single day – has more than doubled in just over 50 years. In the past decade, such dramatic rains have increased by more than 7% (MN Environmental Quality Board, 2014).

Southeastern Minnesota has experienced three 1000-year floods in the past decade: in September 2004, August 2007, and September 2010 (Meador, 2013). The 2004 flood occurred when parts of south-central Minnesota received over eight inches of precipitation. Faribault and Freeborn counties received over 10 inches in 36 hours. The deluge led to numerous reports of stream flooding, urban flooding, mudslides, and road closures (MN DNR, 2004). During the 2007 event, 15.10 inches fell in 24 hours in Houston County, the largest 24-hour rainfall total ever recorded by an official National Weather Service reporting location. The previous Minnesota record was 10.84 inches in 1972. The resulting flooding from the 2007 rainfall caused seven fatalities (MN DNR, 2007). In September 2010, a storm on the 22-23<sup>rd</sup> resulted in more than six inches of rain falling over 5,000 square miles in southern Minnesota. Rainfall totals of more than eight inches were reported in portions of 10 counties. The heavy rain, falling on soils already sodden from a wet summer, led to numerous reports of major rural and urban flooding. For many monitoring locations in southern Minnesota, stream discharge resulting from the deluge was the highest ever seen during an autumn flood (Minnesota Climatology Working Group, 2010).

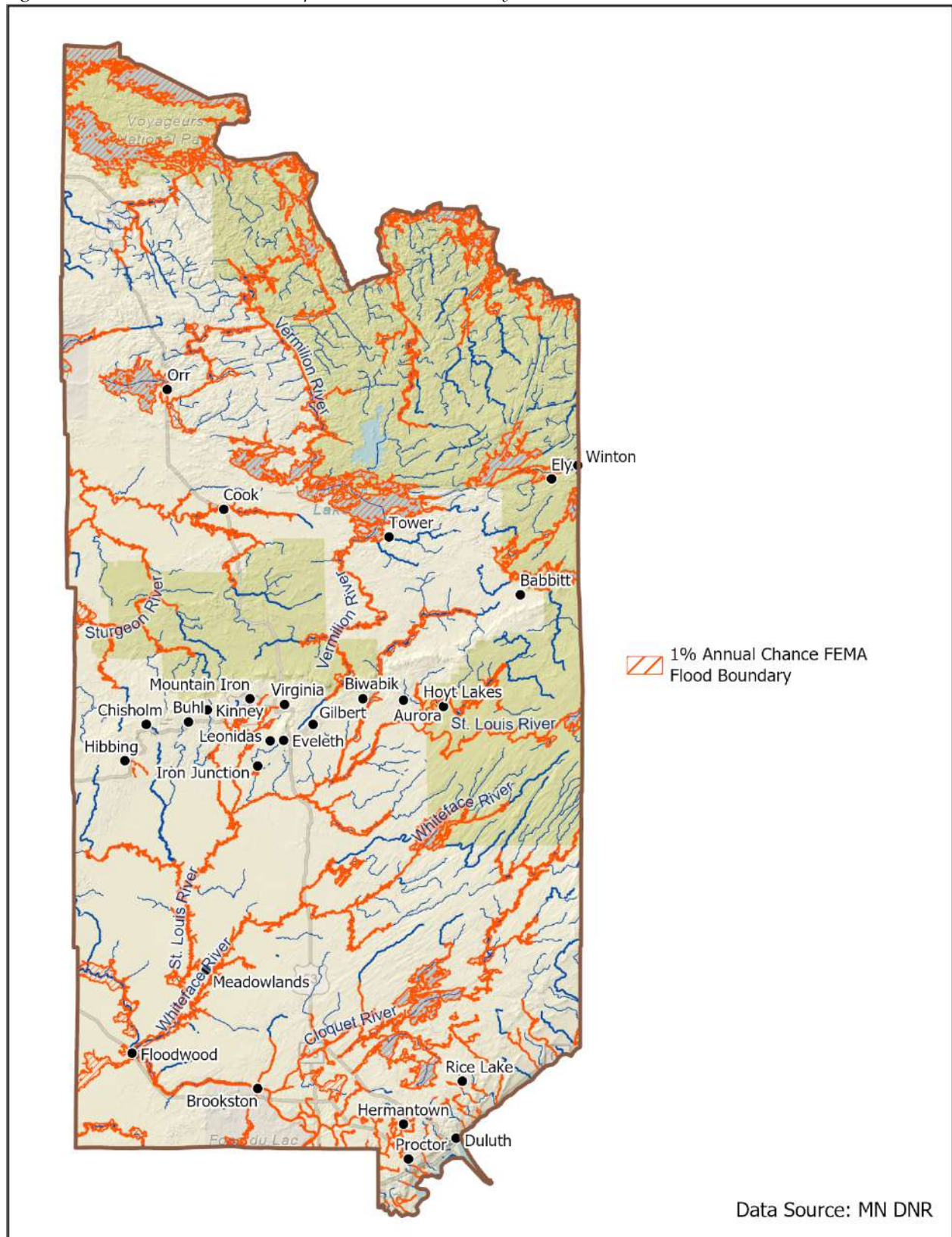
June 2014 was the wettest month on record in Minnesota, with a state-averaged rainfall of 8.03 inches. This broke the previous record of 7.32 inches, which occurred in both July 1897 and June 1914. Rainfall totals for much of the state ranked above the 95<sup>th</sup> percentile when compared with the historical record; in some cases the totals tripled that of the historical rainfall average for June. A presidential disaster declaration was declared due to the severe storms, winds, flooding, landslides, and mudslides (DR-4182), which included 37 Minnesota counties and three Indian Reservations.

### Vulnerability and Hazus Flood Risk Analysis

A potential risk and economic loss analysis for a 1% annual chance flood was performed using a FEMA tool, Hazus for ArcGIS. A preliminary Digital Flood Insurance Rate Map (DFIRM) defined the 1% annual chance flood boundary and a 10-meter Digital Elevation Model (DEM) was used to create a flood depth grid. Some sections of St Louis County are being updated, however those data were not available at the time of this analysis. The resulting Hazus 1% annual chance floodplain output is shown in Figure 13.



Figure 13. 1% Annual Chance Floodplain in St. Louis County



Losses were based on St. Louis County-specific building data. St. Louis County provided parcel tax and spatial databases that included building valuations, occupancy class, square footage, year built, and number of stories. The quality of the inventory is the limiting factor to a Hazus flood model loss estimation. Best practices were used to use local data and assumptions were made to populate missing (but required) values.

Hazus reports the percent damage of each building in the floodplain, defined by the centroid of each building footprint polygon derived using LiDAR data. After formatting the tax and spatial data, 155,662 points were input to Hazus to represent buildings with a total estimated building plus contents value of \$9.5 billion. Approximately 92% of the buildings (and 70% of the building value) are associated with residential housing.

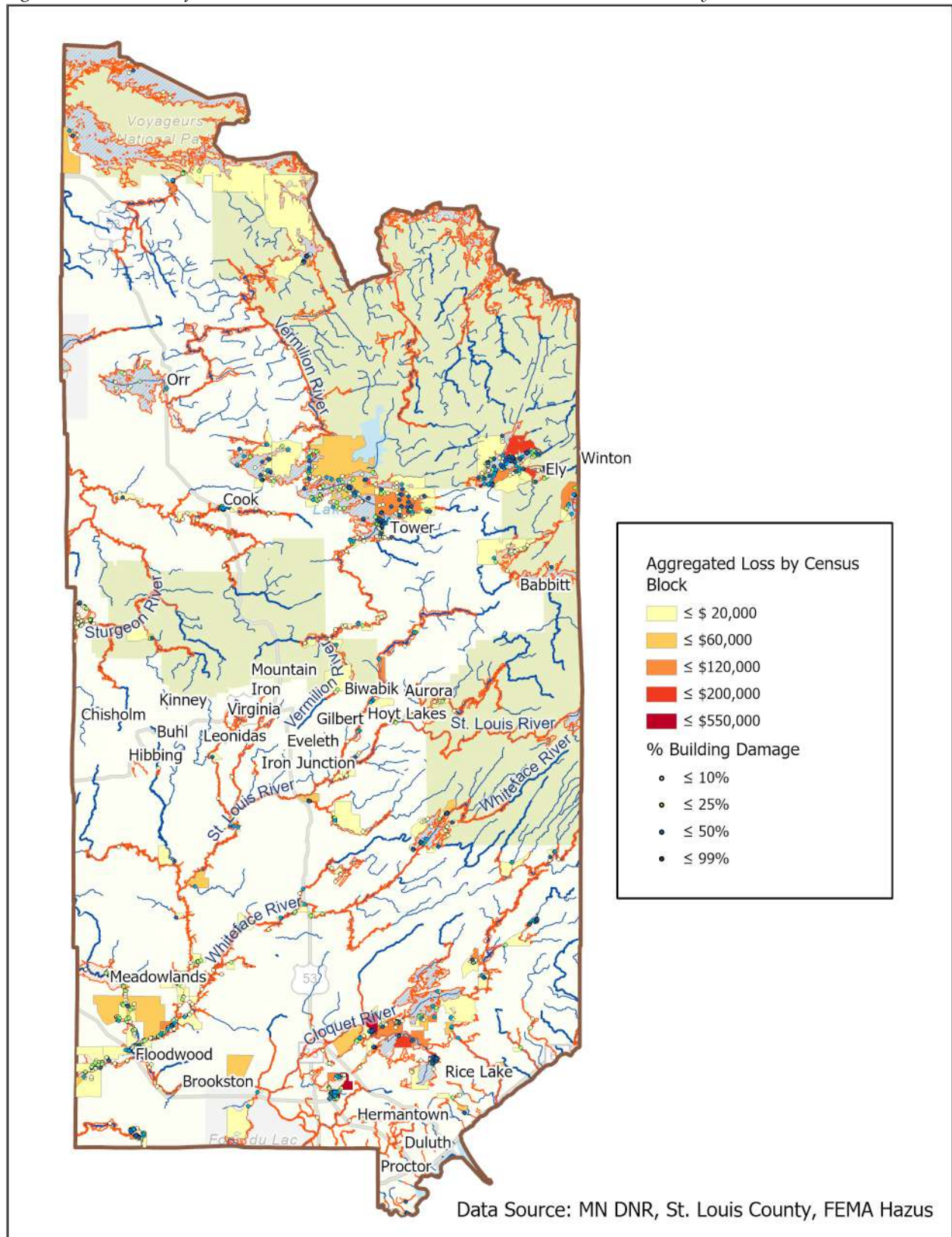
The estimated loss by occupancy class for the whole county is shown in Table 22.

The distinction between the building attributes within a parcel was not known. The maximum damage to a building in that parcel was used to calculate loss estimates. The sum of all the losses in each census block were aggregated for the purposes of visualizing the loss. An overview of these results with the percent damage of buildings is shown in Figure 14. It is possible for a point to report no loss even if it is in the flood boundary. For example, if the water depth is minimal relative to 1<sup>st</sup>-floor height, there may be 0% damage.

*Table 22. Summary of 1% Annual Chance Flood Loss Estimation by Occupancy Class*

General Occupancy	County Total Buildings	County Building + Contents	Buildings In Floodplain	Floodplain Building + Contents Value	Buildings with Damage	Building + Contents Loss
Residential	143,231	\$17,740,213,616	1486	\$115,337,861	873	\$10,285,546
Commercial	4,250	\$2,974,159,224	37	\$2,376,886	25	\$121,445
Other	8,181	\$4,515,299,639	184	\$8,141,624	84	\$517,265
<b>Totals</b>	<b>155,662</b>	<b>\$25,229,672,479</b>	<b>1,707</b>	<b>\$125,856,371</b>	<b>982</b>	<b>\$10,924,257</b>

Figure 14. Overview of 1% Annual Chance Flood Loss Estimation in St. Louis County



The sum of all the losses in each census block were aggregated to the census county subdivision units for the purpose of summarizing losses by jurisdiction. Estimated losses by jurisdiction are shown below in Table 23. Those jurisdictions with the greatest losses are mapped in Figure 15 and Figure 16.

*Table 23. Loss Estimates by Jurisdiction in St. Louis County*

Name	Parcels	Buildings	Estimated Loss
Ault township	4	5	\$74,385.49
Beatty township	17	21	\$598,346.15
Birch Lake UT	12	13	\$306,455.54
Biwabik city	1	1	\$270,341.08
Biwabik township	3	5	\$117,375.29
Breitung township	67	98	\$2,020,229.54
Brookston city	1	1	\$46,568.40
Canosia township	1	1	\$15,812.40
Cedar Valley township	5	12	\$107,909.79
Cherry township	1	1	\$399.76
Colvin township	10	11	\$202,356.97
Cook city	52	69	\$1,268,553.02
Cotton township	6	8	\$130,914.60
Crane Lake township	15	20	\$1,317,880.82
Culver township	1	2	\$113,743.96
Duluth city	4	8	\$298,232.24
Ellsburg township	3	3	\$657.79
Elmer township	7	21	\$118,691.92
Ely city	5	5	\$40,259.38
Embarrass township	3	4	\$37,062.35
Field township	1	1	\$548.40
Fine Lakes township	36	39	\$577,900.64
Floodwood township	9	21	\$177,548.01
Fredenberg township	19	20	\$1,262,004.56
French township	28	32	\$373,422.91
Gnesen township	12	12	\$1,445,134.21
Grand Lake township	65	104	\$2,898,184.93
Greenwood township	63	69	\$1,686,416.27
Halden township	10	21	\$352,251.22
Hay Lake UT	2	2	\$758.67
Hermantown city	2	2	\$136,568.30
Hoyt Lakes city	2	2	\$0.84
Kabetogama township	2	2	\$111,596.55



Name	Parcels	Buildings	Estimated Loss
Kelsey township	3	3	\$21,853.78
Lakewood township	2	2	\$171,803.38
Lavell township	2	2	\$64,940.50
Leiding township	4	4	\$45,263.30
Linden Grove township	1	1	\$2,482.96
Makinen UT	10	18	\$301,909.50
McDavitt township	3	3	\$7,817.69
Meadowlands township	6	12	\$28,199.73
Morse township	110	118	\$8,672,514.16
Ness township	3	5	\$15,480.63
North Star township	3	3	\$114,425.47
Northeast St. Louis UT	7	8	\$13,316.33
Northwest St. Louis UT	16	25	\$605,051.86
Orr city	2	2	\$27,666.54
Owens township	4	4	\$56,335.59
Pequaywan township	12	12	\$308,261.40
Pike township	3	5	\$3,496.89
Portage township	1	1	\$87.70
Potshot Lake UT	9	25	\$321,469.81
City of Rice Lake	27	27	\$3,010,652.54
Sand Lake UT	2	2	\$115,893.75
Solway township	4	4	\$26,368.57
Stoney Brook township	1	1	\$20,428.00
Toivola township	1	1	\$27,494.52
Tower city	7	23	\$98,885.29
Van Buren township	23	40	\$719,593.54
Vermilion Lake township	5	7	\$50,184.43
White township	7	9	\$25,493.21
Whiteface Reservoir UT	17	17	\$604,696.00
Wuori township	1	4	\$1,768.15
<b>Grand Total</b>	<b>765</b>	<b>1,024</b>	<b>\$31,592,347.19</b>

The townships of Breitung, Greenwood and Morse surrounding the cities of Tower and Ely had numerous building identified in the 1% annual chance flood boundary. These buildings are mostly on Lake Vermilion and Burntside Lake shores and islands, and probably represent mostly residential losses. Likewise, the City of Rice Lake and Grand Lake, Gnesen and Fredenberg townships in the

southern part of the county have numerous buildings that are identified in the 1% annual chance flood zone surrounding Fish Lake, Island Lake, Grand Lake and Wild Rice Lake Reservoir.

Figure 15. Breitung, Greenwood and Morse Townships and the Cities of Tower and Ely

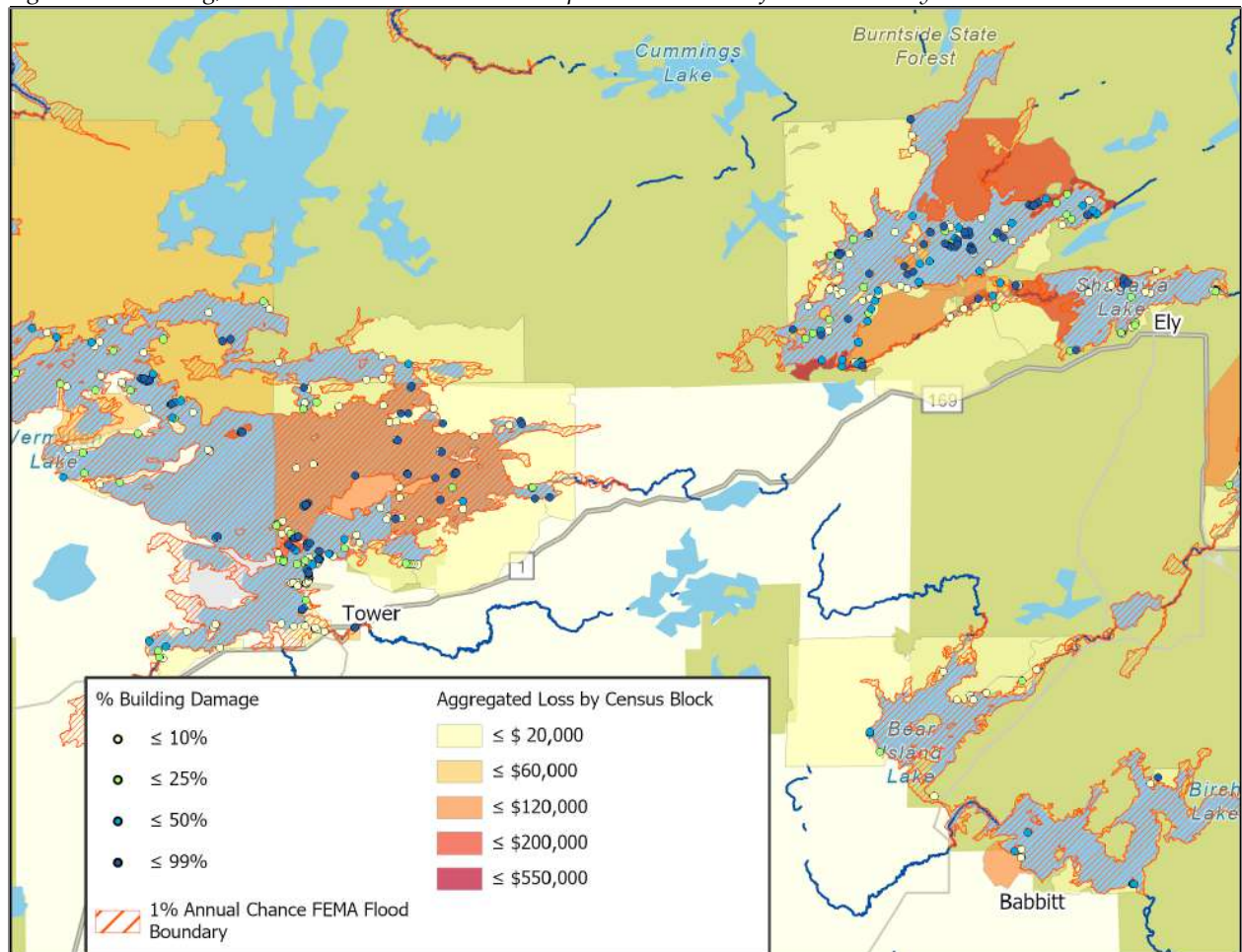
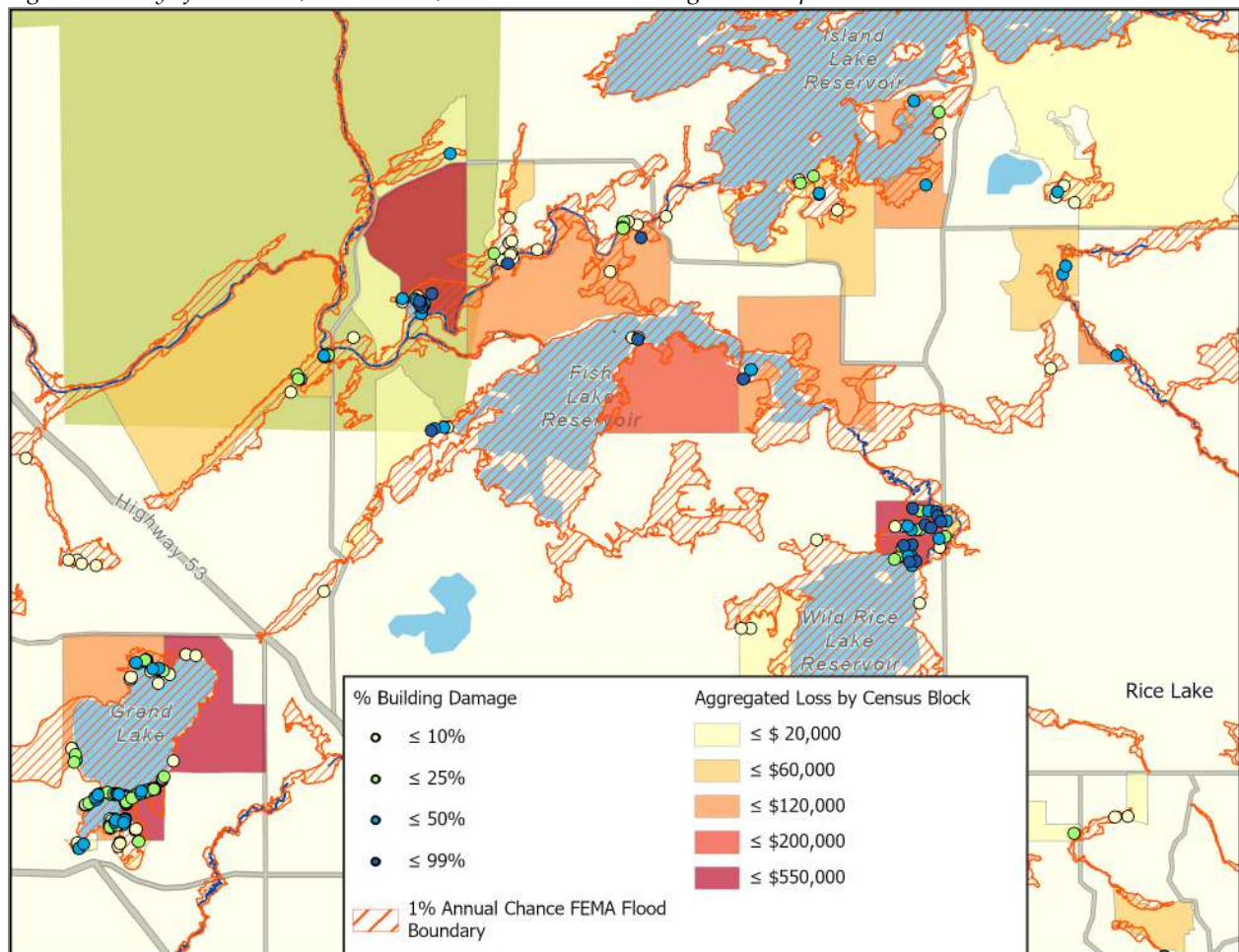


Figure 16. City of Rice Lake, Grand Lake, Gnesen and Fredenberg Townships



### Hazus Critical Infrastructure Loss Analysis

Critical facilities and infrastructure are vital to the public and their incapacitation or destruction would have a significant negative impact on the community. These facilities and infrastructures were identified in Section 3.8 and verified by St. Louis County.

Buildings identified as essential facilities for the Hazus flood analysis include hospitals, police and fire stations, and schools (often used as shelters). Loss of essential facilities are vulnerable to structural failure, extensive water damage, and loss of facility functionality during a flood, negatively impacting the communities relying on these facilities' services. Fortunately, none of St. Louis County's essential facilities included in the Hazus flood analysis are located within the floodplain.

It is important to identify if any critical infrastructure within the 1% annual chance floodplain, given the higher risk of the facility or infrastructure being incapacitated or destroyed during a flood. In St. Louis County, the following critical infrastructure point locations were intersected with the 1% annual chance floodplain. Any point intersecting the floodplain was then checked with aerial photos and address to confirm. Two critical facilities were found to be in the 1% annual chance flood boundary (Table 24). The



United States Customs and Border Protection Office in Crane Lake and the Cook Public Library are shown in Figure 17 and Figure 18 respectively.

Table 24. Critical Infrastructure Locations Identified in the 1% Annual Chance Flood Zone

Name	Location
United States Customs and Border Protection (Federal Police Services)	7544 Gold Coast Road, Crane Lake
Cook Public Library	103 S River St, Cook

Figure 17. Critical Infrastructure Identified in 1% Annual Flood Zone in Crane Lake

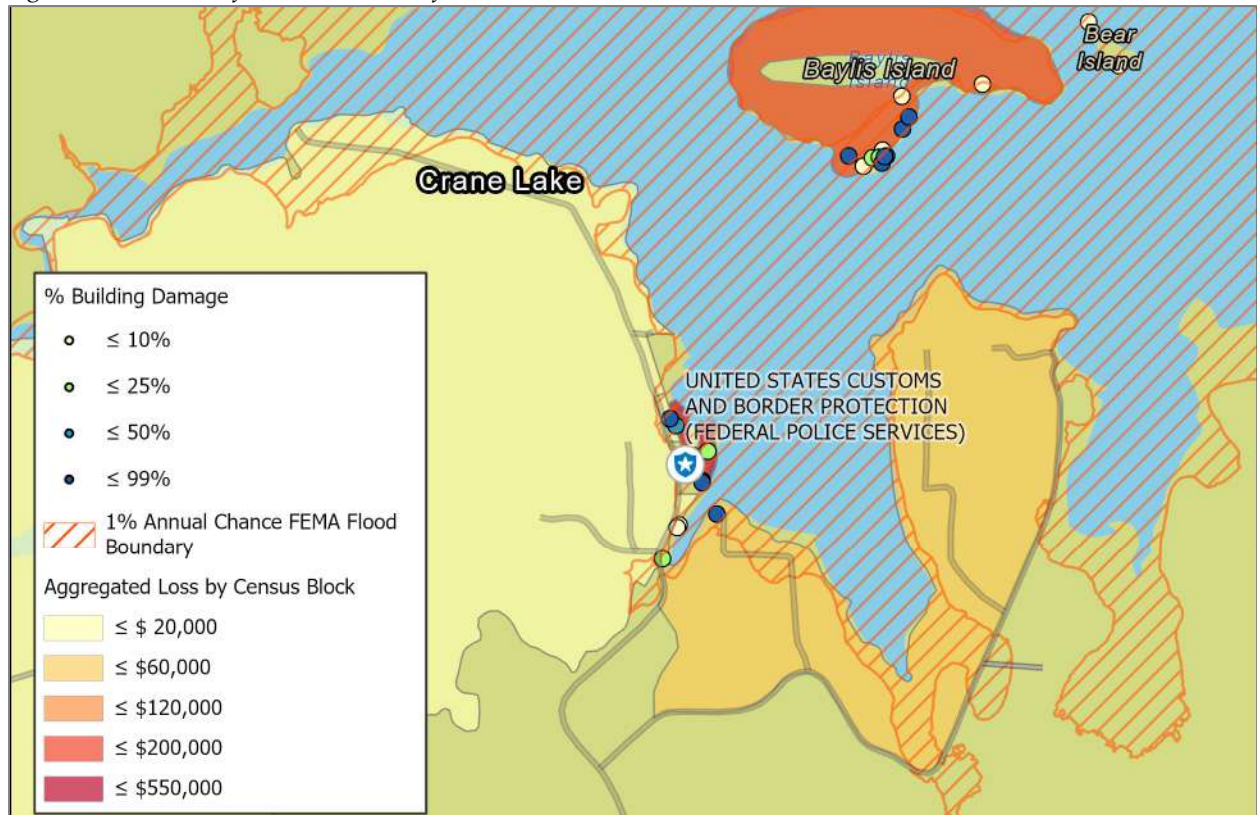
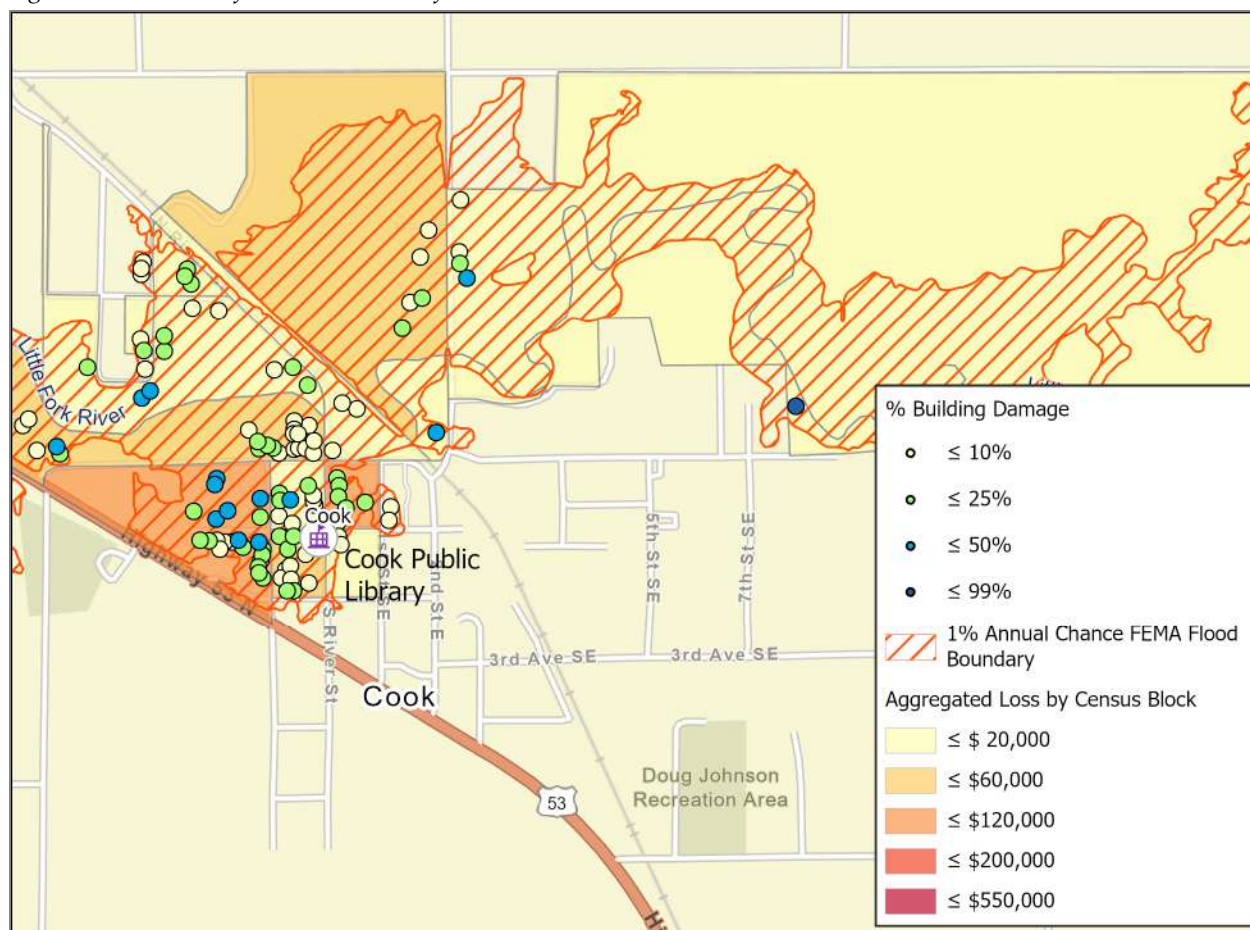


Figure 18. Critical Infrastructure Identified in 1% Annual Flood Zone in Cook



The status of jurisdictional participation in the National Flood Insurance Program and any repetitive loss properties are detailed in Section **Error! Reference source not found..**

St. Louis County Emergency Management identified that there are existing program gaps and deficiencies that make its citizens more vulnerable to flooding and should be addressed with new mitigation efforts to reduce vulnerability. They include:

*Surface Water Run-off Management* – Controlling runoff from various sources continues to be a challenge and priority to control what runs downstream.

*Road Infrastructure* – Continued culvert replacement to prevent road flooding is a strain on our smaller townships that have limited funding for road infrastructure.

#### 4.3.6 Severe Winter Storms – Blizzards, Ice Storms

Blizzards are storms that contain heavy snowfall, strong winds and cold temperatures. The combination of these elements creates blinding snow with near zero visibility, deep snowdrifts, and life-threatening wind chill temperatures. Blizzards are the most dramatic and destructive of all winter storms that occur within St. Louis County, and are generally characterized as storms bearing large amounts of snow accompanied by strong winds. They have the ability to completely immobilize travel

in large areas and can be life-threatening to humans and animals in their path. According to the National Weather Service (NWS), there is no fixed temperature requirement for blizzard conditions, but the life-threatening nature of low temperatures in combination with blowing snow and poor visibility increases dramatically when temperatures fall below 20°F. Blizzards typically occur between October and April; however, they occur most frequently from early November to late March.

The greatest numbers of blizzards historically have occurred in the months of January, followed by March and November, respectively. St. Louis County, along with all areas of Minnesota, is susceptible to blizzards.

*Figure 19. Thanksgiving Weekend Blizzard, 2019*



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Damages from blizzards can range from human and livestock deaths to significant snow removal costs. Stranded drivers can make uninformed decisions, such as leaving the car to walk in conditions that put them at risk. Because of the blinding potential of heavy snowstorms, drivers are also at risk of collisions with snowplows or other road traffic. Drivers and homeowners without emergency plans and kits are vulnerable to the life-threatening effects of heavy snowstorms such as power outages, cold weather, and inability to travel, communicate, obtain goods or reach their destinations. Heavy

snow loads can cause structural damage, particularly in areas where there are no building codes or where residents live in manufactured home parks. The frequency of structural fires tends to increase during heavy snow events, primarily due to utility disruptions and the use of alternative heating methods by residents.

Between the years of 1975 and 1991, there were 49 deaths associated with blizzards statewide, or an average of three deaths per year. Deaths attributable to blizzards have dropped in recent years, primarily due to increased weather awareness and warning capabilities across the state. The economic costs of winter storms are generally not recorded by the NCEI; however, a winter storm in November 2001 resulted in property damage of \$500,000.

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

Communications and power can be disrupted for days while utility companies work to repair extensive damage. Ice forming on exposed objects generally ranges from a thin glaze to coatings more than one inch thick. Even small accumulations of ice on sidewalks, streets, and highways may cause extreme hazards to St. Louis County motorists and pedestrians. Sleet does not stick to trees and wires, but sleet of sufficient thickness does cause hazardous driving conditions. Heavy sleet is a relatively rare occurrence, defined as an accumulation of ice pellets covering the ground to a depth of ½-inch or more.

Ice and sleet storms typically occur from October through April. The NWS notes that over 85% of ice storm-related deaths are the result of traffic accidents. The NCEI has recorded two ice storms in St. Louis County: in January of 1996 and November of 1996. No deaths or injuries were reported.

Observing winter storm watches and warnings and adequate preparation can lessen the impact of blizzard events in Minnesota. Technical advances made in transportation, including safer vehicles and improved construction and maintenance of roads, have also contributed to the decline in deaths related to blizzards. Historical estimates of dollar losses associated with blizzards were not available for the purposes of this analysis. However, costs incurred by state and local government for snow removal associated with disaster declaration DR-1158 (January 1997) totaled over \$27,300,000 dollars. Blizzards rank 9<sup>th</sup> out of the 10 natural hazards economically impacting Minnesota according to the statewide risk analysis. The chance that another winter storm affecting St. Louis County will occur is highly probable.

### Severe Winter Storm History in St. Louis County

The total of notable events defined as heavy snows, blizzards, lake-effect snow, winter weather, ice storms and winter storms in St. Louis County recorded by the NCEI from 1996 to July 2019 is 346. An overview of some of the most notable winter storm events is provided in Table 25 below.

Table 25. Notable Winter Weather Events in St. Louis County

Date	Type	Deaths	Injuries	Property Damage	Description
12/1/2019	Winter Storm, Blizzard, Freezing Rain	0	Unknown	Unknown	The Duluth International Airport reported 11 straight hours of heavy snow, with winds gusting as high as 51 mph and visibilities as low as 1/16 of a mile. Duluth reported 19 straight hours of visibilities limited to a half-mile or less. Snowfall total was 21.7 inches.
4/15/2018	Winter Storm	0	0	\$9,000,000	A severe spring snowstorm resulted in 15-foot waves on Lake Superior, causing high surf that led to coastal flooding in Duluth. The Duluth Lakewalk was heavily damaged, with an estimated \$9 million in property damage.
10/27/2017	Winter Storm	0	0	Unknown	An early winter storm brought gusts over 50 mph, causing waves up to 16 feet. Portions of the Duluth Lakewalk, Brighton Beach, Canal Park and Park Point were damaged. The Minnesota Governor authorized a disaster declaration, with \$2.12 million from the state and \$1.38 million from local governments for repairs and cleanup.
2/29/2012	Blizzard	0	0	\$1,000,000	Blizzard conditions occurred from the Duluth Airport eastward throughout the city and along Lake Superior. Heavy winds damaged the roof of a 157,000 square foot building belonging to the Seaway Port Authority. Damage was estimated at \$1 million.



Date	Type	Deaths	Injuries	Property Damage	Description
11/26/2001	Winter Storm	0	0	\$500,000	Winds gusting over 50 mph occurred in the Duluth Harbor, resulting in 16-foot waves that obliterated parts of the Duluth shoreline and tore apart 5% of the Duluth Lakewalk, causing \$500,000 in damage.
4/22/2001	Ice Storm	0	0	\$4,200,000	Freezing rain fell in the higher elevations inland from Lake Superior, resulting in inch-thick ice on trees, power lines and roadways. Downed power lines caused power outages up to three days in length, affecting approximately 22,000 homes and business. Many homes and vehicles were damaged by collapsing trees and branches.

### Severe Winter Storms and Climate Change

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

According to the 2015 Minnesota Weather Almanac, a recent study of seasonal snowfall records across the state from 1890-2000 showed that 41 of 46 climate stations recorded an increase in average annual snowfall, by as much as 10 inches. Higher snowfall levels can result in greater runoff potential during spring snowmelt, and many watersheds in Minnesota have shown more consistent measures of high-volume flows during spring, often at or above flood stage (Seeley M. , 2015).

### Severe Winter Storms and Electrical Outages

The leading cause of electric outages in Minnesota during 2008 to 2013 was weather/falling trees. Between 2008 and 2013, the greatest number of electric outages in Minnesota occurred during the month of March (U.S. Department of Energy, 2015).

### Vulnerability

The number of heavy snowfall years for the Midwest has fluctuated between 1900 and 2006. The periods of 1900-1920 and 1960-1985 had numerous years with snowfall totals over the 90<sup>th</sup> percentile. In the past three decades, the number of heavy seasonal snowfall totals has been much lower. Despite these generally lower seasonal snowfall totals, some areas of the Midwest have still experienced significant snow totals in the most recent decade. The 100-year linear trends based on decadal values show that the upper Midwest had statistically significant (1% level) upward linear trends in snowstorm frequency from 1901 to 2000 (Kunkel, et al., 2013).

Winter storms affect St. Louis County each year, so there is a 100% probability that the county and its jurisdictions will be affected annually. The amount of snow and ice, number of blizzard conditions, and days of sub-zero temperatures each year are unpredictable and within St. Louis County the

vulnerability of jurisdictions to winter storms does not vary geographically. Citizens living in climates such as these must always be prepared for situations that put their lives or property at risk. It is not always the size of the storm or the depth of the cold, but an unprepared individual with a vehicle breakdown or lack of a personal winter safety kit that are at risk. Rural citizens are more vulnerable to issues with deep snow.

St. Louis County Emergency Management identified that there are several program gaps and deficiencies that make its citizens more vulnerable to severe winter storms and should be addressed with new mitigation efforts to reduce vulnerability. They include:

*Aboveground Power Lines* – A majority of the power lines in the county are aboveground and subject to damage from ice storms, wind, and falling tree limbs. Power lines that are aboveground are susceptible to coming down during severe winter storms, resulting in power outages. St. Louis County is very large and encompasses very rural areas.

*Backup Power* – Following the 2016 blowdown and prolonged power outage, it was quickly learned that not all county facilities had backup power to continue operations during the outage. St. Louis County started to evaluate all critical buildings and services. Many cities and townships do not have adequate backup power to their facilities.

*Communications* – Not all residents have opted in to the Northland Alert notification system for cell phones. St. Louis County has recently created a Facebook page, but that is currently our only social media.

#### 4.3.7 *Extreme Cold*

Winter in St. Louis County can be severe, and especially dangerous for disabled citizens and outdoor workers. Record temperature lows and arctic-like wind chills can cause cold-related illnesses such as frostbite and hypothermia, which can be deadly. Hypothermia is the greatest and most life-threatening cold weather danger.

In St. Louis County, cold winter weather can have severe or fatal impacts. Hypothermia occurs when the core body temperature drops below 96°F. Anyone who is exposed to severe cold without enough protection can develop hypothermia. Frostbite occurs when skin tissue and blood vessels are damaged from exposure to temperatures below 32°F. It most commonly affects the toes, fingers, earlobes, chin, cheeks, nose, and other body parts that are often left uncovered in cold temperatures. The NWS issues “Extreme cold” warnings when it feels like -30°F or colder across a wide area for several hours. Extreme cold watches are issued a day or two before the conditions are expected.

The Wind Chill Index is a calculation that can be made with wind speed to communicate the dangers to bare skin from winter winds and freezing temperatures. The NWS has produced a chart to simplify this calculation. The classification zones are delineated in terms of time to frostbite on bare skin and are due to the lowering of body temperature due to the passing-flow of lower-temperature air. Criteria for issuing official NWS wind chill warnings are set locally.

Medical costs related to extreme heat and cold can be enormous: in 2005 the total was \$1.5 billion nationwide, or more than \$16,000 per patient (Union of Concerned Scientists, 2009).

Below zero temperatures occur almost every winter in Minnesota. January is the coldest month, with daytime highs averaging 20°F and nighttime lows averaging 2°F. However, these averages do not tell the whole story. Maximum temperatures in January have been as high as 61°F and minimums as low as 36°F below zero.

Extreme cold temperatures affect the county nearly every year. Extremely cold air settled over Minnesota on January 31<sup>st</sup> of 1996, and remained entrenched through February 4<sup>th</sup>. A new record low temperature for Minnesota was set in the town of Tower on February 2, 1996, at -60°F. Numerous record low temperatures were set during the period at St. Cloud, Rochester and the Twin Cities. Minneapolis/St. Paul set three new record low temperatures as well as recording the 2<sup>nd</sup> coldest day on record on February 2, 1996. A mean temperature of -25°F was measured that day with a high of -17°F and a low of -32°F in the Twin Cities. This was within two degrees of tying the all-time record low temperature set in the Twin Cities and the coldest temperature recorded this century. Many central and southern Minnesota locations set new record low temperatures the morning of the 2<sup>nd</sup>. The Governor closed all schools that day.

In February of 2014, nearly all of Minnesota was between 10-15°F colder than normal (1981-2010 period) (High Plains Regional Climate Center, 2014). The winter of 2013-2014 was the sixth coldest on record in Minnesota (The Weather Channel, 2014), with schools in the Twin Cities canceling five times in January due to dangerous wind chills. It was the coldest winter in the Twin Cities in 35 years, with an average temperature for December-February of 9.7°F (MN DNR, 2014). Many areas in the state also experienced higher than average precipitation through the winter and spring months.

### Extreme Cold History in St. Louis County

January is the coldest month on average in St. Louis County, with an average monthly minimum temperature of 3°F (based on data from 1895-2018). The coldest month on record for the county was January 1912, with a month-long average minimum temperature of -14°F (MN DNR, n.d.).

The National Centers for Environmental Information (NCEI) has recorded 153 extreme cold/wind chill events since 1996, resulting in 10 deaths and two injuries.

On January 12, 2017, a 29-year-old man was found dead in an Eveleth park after succumbing to hypothermia. Temperatures had fallen to -28°F.

Another death due to hypothermia occurred in central St. Louis County in January of 2016, when a man was found deceased outside. The low temperature was 5°F.

In January of 2015, a woman was found dead on a walking/biking trail. The official cause of death was hypothermia, secondary to alcohol intoxication. The temperature had fallen to teens below zero overnight.



Three deaths were attributed to severe cold in St. Louis County in 2014. In February, a Hibbing man was found dead in a snowbank near a driveway, after temperatures reached 16°F. In mid-January a woman from Embarrass was discovered frozen to death on her driveway. Nearby temperatures of -8°F were reported. On January 2, a Virginia man froze to death after leaving a bar around midnight. The man was intoxicated and crawled under a porch, where he perished.

### Extreme Cold and Climate Change

Although climate research indicates that Minnesota's average winter lows are rising rapidly, and our coldest days of winter are now warmer than we have ever recorded (NCEI, 2018), cold temperatures have always been a part of Minnesota's climate and extreme cold events will continue. An increase in extreme precipitation or storm events such as ice storms as the climate changes could lead to a higher risk of residents being exposed to cold temperatures during power outages or other storm-related hazards during extreme cold.

### Vulnerability

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

Within St. Louis County the risk of extreme cold does not vary geographically. Citizens living in climates such as these must always be prepared for situations that put their lives or property at risk. It is not always the depth of the cold, but an unprepared individual with a vehicle breakdown or lack of a personal winter safety kit that are at risk. Rural citizens not connected to city gas lines are more vulnerable to issues with extreme cold.

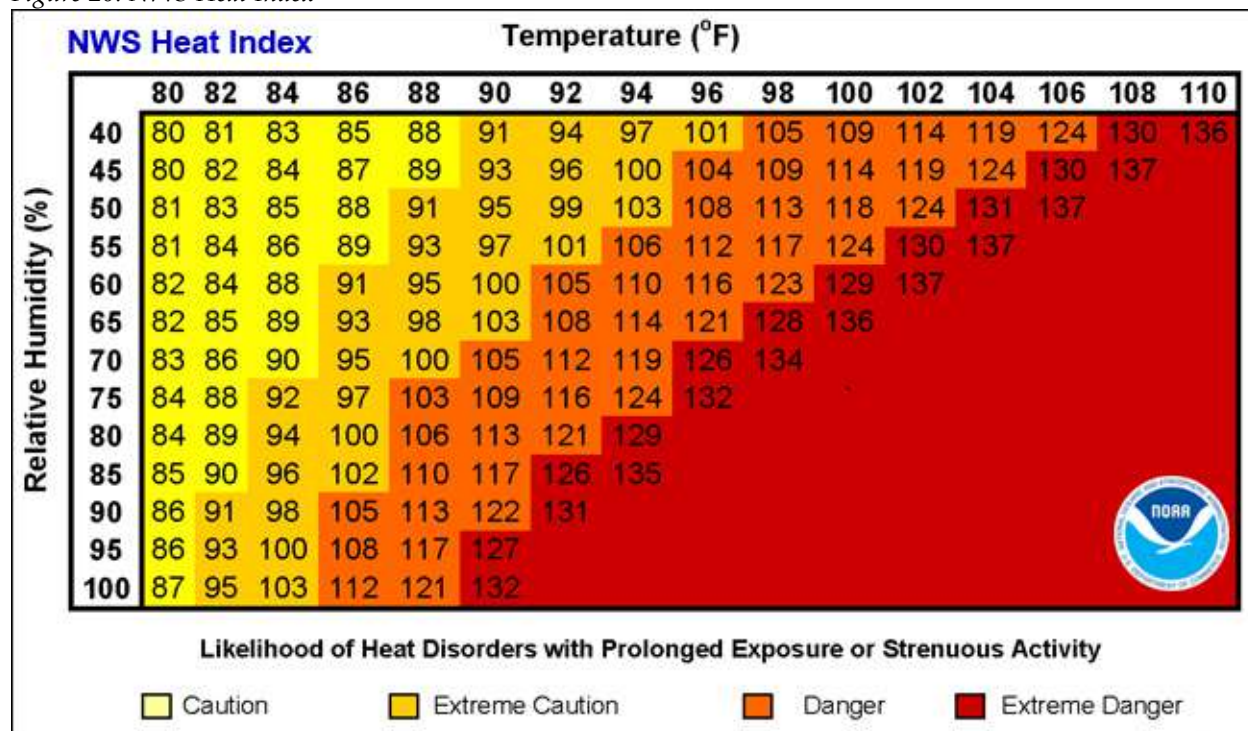
St. Louis County Emergency Management identified that there are program gaps and deficiencies that make its citizens more vulnerable to extreme cold and should be addressed with new mitigation efforts to reduce vulnerability. They include:

*Generators for Backup Power to Healthcare Facilities* – Not all assisted living, long term care and nursing facilities have backup generator power.

### 4.3.8 Extreme Heat

Extreme heat is the combination of very high temperatures and exceptionally humid conditions. When the atmospheric moisture content is high, the rate of perspiration from the body decreases and the human body feels warmer. Heat stress can be indexed by combining the effects of temperature and humidity. The National Weather Service's (NWS) Heat Index (Figure 20) is a measure of how hot the body feels when relative humidity is factored in with actual air temperature. The heat index values are for shady locations - exposure to direct sunlight may increase these values by up to 15°F. The NWS will initiate alert procedures when the Heat Index is expected to exceed 105°-110°F for at least two consecutive days.

Figure 20. NWS Heat Index



Source: (National Weather Service, n.d.)

Figure 21 describes the effects increasing levels of heat has on the body during prolonged exposure and/or physical activity.

Figure 21. Heat Effects on the Body

Classification	Heat Index	Effect on the body
Caution	80°F - 90°F	Fatigue possible with prolonged exposure and/or physical activity
Extreme Caution	90°F - 103°F	Heat stroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity
Danger	103°F - 124°F	Heat cramps or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity
Extreme Danger	125°F or higher	Heat stroke highly likely

Source: (National Weather Service - Amarillo, TX, n.d.)

Extreme heat events are linked to a range of illnesses, even death, and can exacerbate pre-existing chronic conditions such as cardiovascular, respiratory, liver, and neurological diseases, endocrine disorders, and renal disease or failure. Populations who are most vulnerable to extreme heat include persons over 65 or under five years old; living alone, without air-conditioning, or residing on the topmost floor of a building; and with an income at or below the poverty line. People who are exposed to heat because of recreational or job-related activities are also more vulnerable, including athletes,

construction workers, and landscape/agricultural workers (Adapting to Climate Change in Minnesota: 2013 Report of the Interagency Climate Adaptation Team, 2013).

Medical costs related to extreme heat and cold can be enormous: in 2005 the total was \$1.5 billion nationwide, or more than \$16,000 per patient (Union of Concerned Scientists, 2009).

### Extreme Heat History in St. Louis County

July is the hottest month on average in St. Louis County, with an average monthly maximum temperature of 65°F (based on data from 1895-2018). The hottest month on record for the county was July 1916, with a month-long average maximum temperature of 71°F (MN DNR, n.d.).

The National Centers for Environmental Information have recorded severe heat in St. Louis County in July of 2016, July of 2011, and August of 2001. The August event was a two-day heat wave with heat indices of 101. Five people died due to the heat in the Duluth area, ranging from age 47 to 73. All of these victims were found in rooms with poor ventilation and without air conditioning.

In July of 2016, heat indices reached 100 degrees in southern St. Louis County. No deaths or injuries were reported.

### Extreme Heat and Climate Change

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

Recent statistics from NOAA show that there are more human fatalities each year due to heat waves than from floods, lightning, tornadoes and winter storms. Many cities have responded by creating Heat Wave Response Plans to ensure that those in marginal health without air conditioning can obtain the relief and care they need, and the Minnesota Department of Health developed the Extreme Heat Toolkit to help educate at-risk populations on how to reduce risks associated with heat waves (Seeley M., 2015).

Increasing temperatures impacts Minnesota's agricultural industry. Agriculture is highly dependent on specific climate conditions. As a result of increasing temperature, crop production areas may shift to

new regions of the state where the temperature range for growth and yield of those crops is optimal. According to the National Climate Assessment, the Midwest growing season has lengthened by almost two weeks since 1950 due in large part to earlier timing of the last spring freeze. This trend is expected to continue. While a longer growing season may increase total crop production, other climate changes, such as increased crop losses and soil erosion from more frequent and intense storms, and increases in pests and invasive species, could outweigh this benefit. There may also be higher livestock losses during periods of extreme heat and humidity. Losses of livestock from extreme heat lead to a challenge in the disposal of animal carcasses. Currently there are only two rendering facilities in Minnesota available for livestock disposal. If a rendering facility is not available, lost livestock must be composted on an impervious surface. If losses are high, finding an impervious surface large enough is a challenge. In an attempt to adapt to increased temperatures, livestock areas in Minnesota may shift farther north. As a result of new livestock areas and the resulting manure production, farmers may transition to manure-based fertilizer applications in areas where traditionally only commercial fertilizers have been used, with accompanying environmental advantages and disadvantages (Adapting to Climate Change in Minnesota: 2013 Report of the Interagency Climate Adaptation Team, 2013). In order to minimize the detrimental effects of heat stress on animal metabolism and weight gain, Minnesota farmers have also begun redesigning and retrofitting dairy, hog, and poultry barns with better watering, feeding, and ventilation systems (Seeley M. , 2015).

### Vulnerability

Within St. Louis County the risk of extreme heat does not vary geographically. However, those who work outdoors or do not have permanent housing are at greater risk.

St. Louis County Emergency Management identified that there are program gaps and deficiencies that make its citizens more vulnerable to extreme heat and should be addressed with new mitigation efforts to reduce vulnerability. They include:

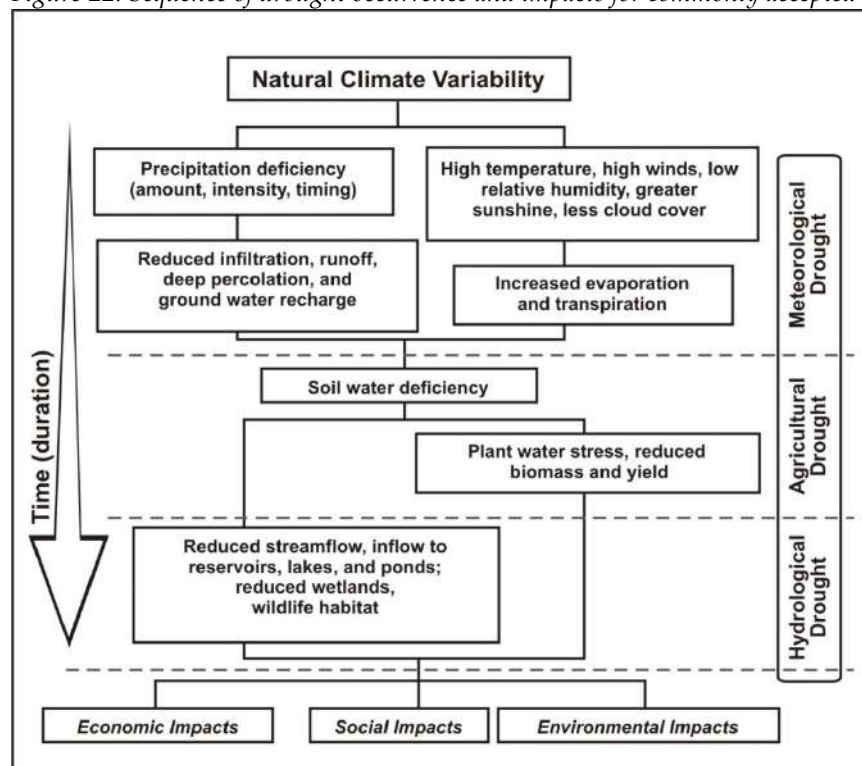
*Generators for Backup Power to Healthcare Facilities* – Not all assisted living, long term care and nursing facilities have backup generator power.

### 4.3.9 Drought

Within the broad domain of natural hazards that comprise disaster science, drought is unequivocally the most difficult to define. This is primarily due to its insidious nature, and because the parameters that typically control it vary both spatially and temporally. For instance, the hydro-meteorological conditions that constitute drought in one location, may not necessarily qualify as drought in a contrasting climate. Even in regions that share a statistically similar climate, other factors such as soil type, antecedent moisture conditions, ground cover and topography all play a vital role in dictating drought emergence. To further complicate matters, drought is associated with a diverse number of climatic and hydrological stressors, which come with a unique set of collective impacts that affect nearly every corner of our economy and environment. Subsequently, there are over a hundred and fifty different definitions of drought, not just because it is difficult to define, but precisely on the grounds that drought affects different regions in different ways (Fu, Svoboda, & Tang, 2013). When one attempts to merge and understand these various definitions and impacts, it is evident that drought can

be integrated into five principal categories. These include: meteorological, agricultural, hydrological, ecological and socio-economic drought (Figure 22).

Figure 22. Sequence of drought occurrence and impacts for commonly accepted drought types



Source: (National Drought Mitigation Center, 2018)

Meteorological drought is qualified by any significant deficit of precipitation. The term agricultural drought indicates an extended dry period that results in crop stress and harvest reduction. Hydrological drought is manifest in noticeably reduced river and stream flow and critically low groundwater tables. Ecological drought occurs when the combined effects of meteorological and/or hydrological drought begin to impact the delicate balance of a given ecosystem. Socioeconomic drought refers to the situation that occurs when water shortages begin to affect people and their lives. It associates economic goods with the elements of meteorological, agricultural and hydrological drought. Many supplies of economic goods (e.g., water, food grains, and hydroelectric power) are greatly dependent on the weather.

### Quantifying Drought Conditions

There are numerous approaches to assessing drought conditions. The current gold standard for accurate drought conditions in the United States is the United States Drought Monitor (USDM) Map. Established by the National Drought Mitigation Center (NDMC) in 1999, the Drought Monitor is a weekly map that depicts drought conditions in all 50 states and Puerto Rico. Each weekly map is produced by a NDMC assigned author. Though drought map authors utilize a broad domain of geospatial, climatic data and drought indices that cover every aspect of drought, perhaps their most valuable resource is the input they receive each week from hundreds of drought experts throughout the

country. The drought monitor map is thus a collective synthesis of the best quantitative and the most reliable qualitative information available (National Drought Mitigation Center, 2018). Figure 23 displays an example map and statistics table prepared by the U.S. Drought Monitor for Minnesota on November 20, 2012. In total, there are four drought categories: moderate (D1), severe (D2), extreme (D3), and exceptional (D4). A fifth category, abnormally dry (Do) is used to depict areas that are abnormally dry but not yet in drought. Abnormally dry conditions are indicative of the meteorological circumstances that precede drought onset and those that are coming out of drought. Do is often considered a bellwether of drought but it is also an accurate warning sign that crop growth may be slowed and wildfire risk may be elevated. Table 26 displays these drought categories along with the potential impacts at each level.

Table 26. USDM Drought Classification

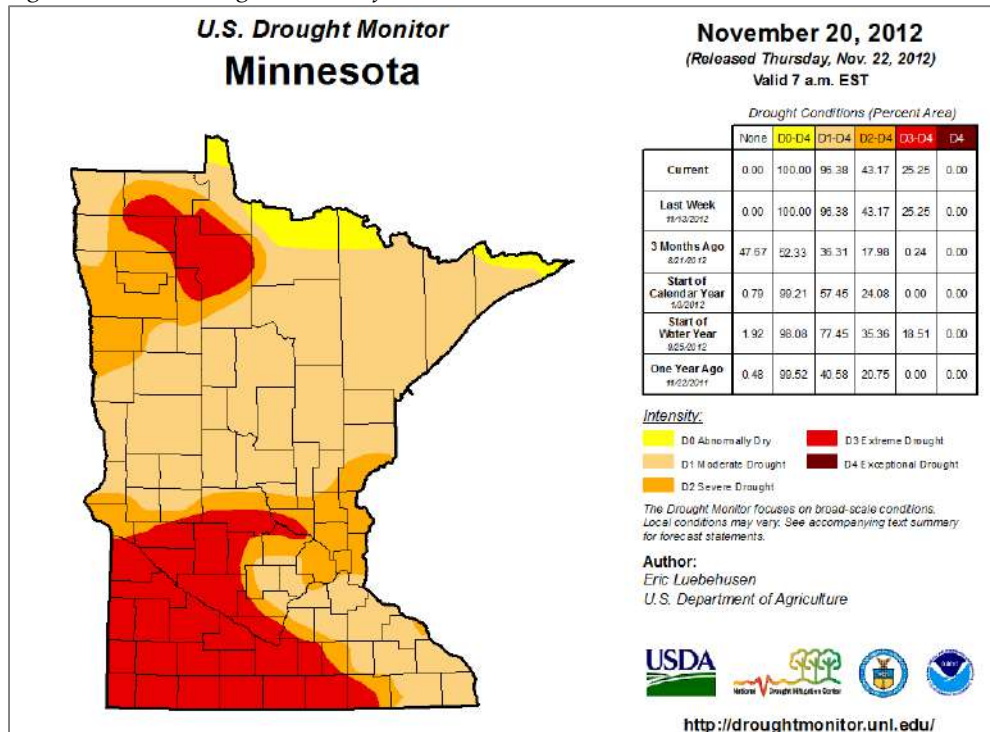
Category	Description	Possible Impacts
Do	Abnormally Dry	Going into drought: <ul style="list-style-type: none"> <li>• Short-term dryness slowing planting, growth of crops or pastures</li> </ul> Coming out of drought: <ul style="list-style-type: none"> <li>• Some lingering water deficits</li> <li>• Pastures or crops not fully recovered</li> </ul>
D1	Moderate Drought	<ul style="list-style-type: none"> <li>• Some damage to crops, pastures</li> <li>• Streams, reservoirs, or wells low, some water shortages developing or imminent</li> <li>• Voluntary water-use restrictions requested</li> </ul>
D2	Severe Drought	<ul style="list-style-type: none"> <li>• Crop or pasture losses likely</li> <li>• Water shortages common</li> <li>• Water restrictions imposed</li> </ul>
D3	Extreme Drought	<ul style="list-style-type: none"> <li>• Major crop/pasture losses</li> <li>• Widespread water shortages or restrictions</li> </ul>
D4	Exceptional Drought	<ul style="list-style-type: none"> <li>• Exceptional and widespread crop/pasture losses</li> <li>• Shortages of water in reservoirs, streams, and wells creating water emergencies</li> </ul>

Source: (USDM, n.d.)

The decision to declare or alter a drought category in a given location is dependent upon a comprehensive set of climate products that are specifically manufactured to quantify drought. Many of these products are referred to as drought indices. These indices each serve a specific purpose. There are indices that are designed for measuring short-term drought, and there are indices that are built to reflect long-term drought. Similarly, other indices are useful for sector specific areas such as water resources or agriculture.



Figure 23. U.S. Drought Monitor for Minnesota, November 20, 2012



Source: (National Drought Mitigation Center, 2018)

### Drought History in St. Louis County

The NCEI Storm Events Database uses the US Drought Monitor's drought classification system as a guide to determine which droughts to include in the database; for locations east of the Rocky Mountains only drought events categorized as severe (D2) or higher are included (National Weather Service, 2018). The following is a summary of droughts in St. Louis County as reported in the Storm Events Database:

#### 2006

- Mid July – September: Hot dry weather in the southern portion of the county put the area in a severe drought (D2); drought worsened through the summer with rainfall 6-12 inches below normal and rivers running at 10% less of the normal flow. By mid-September, the majority of the county was in an extreme drought (D3).
- October – December: Extreme drought conditions (D3) continued to plague northeastern Minnesota. Precipitation across the region was below normal and lake levels were well below normal levels. Lake Superior was at its lowest level since 1926.

#### 2007

- January – March: A mostly dry winter. A February snowstorm alleviated drought conditions in the central and southern portions of the county, but northern portions of the county remained in extreme drought (D3).



- April – June: The extreme drought conditions (D3) north of the Iron Range and severe conditions (D2) between the Range and Duluth were scaled down when the area received much needed rain in May and June.
- July – October: Severe drought conditions returned across the county and by the end of August much of the Arrowhead was in an extreme drought (D3). August rainfall was 1-3 inches below normal across northeast Minnesota. The latter half of September and into October brought several rounds of rainfall, and by mid-October the county was no longer in a drought.

#### 2010

- April-May: Lack of rain led the central and southern portions of the county to be in severe drought (D2) and by May drought conditions in the southern portion of the county worsened to extreme (D3).

#### 2011

- September – December: Rain deficits of 3-5 inches since the summer caused severe drought (D2) conditions to develop in the northeast portion of the county. November and December saw the severe drought (D2) spread to across greater Ely and the Iron Range.

#### 2012

- January – April: The severe drought (D2) in the eastern portion of the county persisted.
- November – December: The entire county were in a severe drought (D2).

#### 2013

- January – April: Severe drought (D2) conditions remained across the entire county until mid-April.

#### 2015

- April 28 – May 18: The west-central portion of the county was in a severe drought (D2).

In addition to highlighting specific notable droughts the USDM database was examined from January 2000 – August 5, 2019 (1,022 weeks) for any occurrence of drought in the county, regardless of the duration or severity of the drought. According to the weekly reported data, the county experienced drought conditions  $\geq D1$  28% of the weeks and drought conditions  $\geq D2$  15% of the weeks.

When comparing the two most recent five-year timeframes (2014-2018 & 2009-2013) the data shows either a decrease or no change in each drought category  $\geq D0$ . Table 27 shows the breakdown of this comparison.

Table 27. Average Percent of St. Louis County's Land Area by Drought Category

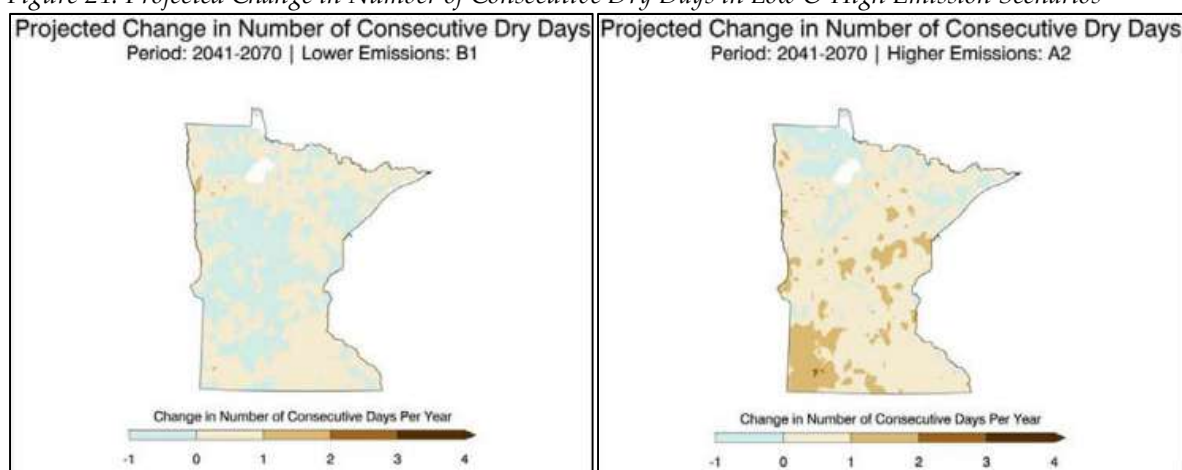
Timeframe	No Drought	DO	D1	D2	D3	D4
2009-2013	48.04%	25.44%	19.80%	6.71%	0%	0%
2014-2018	80.63%	15.70%	3.55%	0.12%	0%	0%
% Change	+67.84%	-38.29%	-82.07%	-98.21%	0%	0%

### Drought and Climate Change

In 2007, 24 Minnesota counties received drought designation, while seven counties were declared flood disasters; in 2012, 55 Minnesota counties received federal drought designation at the same time 11 counties declared flood emergencies (MN Environmental Quality Board, 2014); and in May of 2015, over 90% of Minnesota was undergoing severe or moderate drought (MN DNR, 2015). Droughts have been happening throughout Minnesota's history but it is not yet clear the degree at which climate change may impact future droughts (International Climate Adaptation Team, 2013). While there was no apparent change in drought duration in the Midwest over the past century (Dai, 2011), the average number of days without precipitation is projected to increase in the future (National Climate Assessment Development Advisory Committee, 2013).

The climate models used in the 2014 National Climate Assessment projects Minnesota to have an increase in days over 90°F by mid-century; however, the future drought situation is less clear. The climate model run with the lower emissions scenario projects no significant change in the number of consecutive days of no rain, while the higher emissions scenario show an increase in dry periods, increasing Minnesota's drought risk (Minnesota Pollution Control Agency, 2017). These climate models are shown in Figure 24.

Figure 24. Projected Change in Number of Consecutive Dry Days in Low &amp; High Emission Scenarios



Source: (ICAT, 2017)

Even in areas where precipitation does not decrease, projected higher air temperatures will cause increased surface evaporation and plant water loss, leading to drier soils. As soil dries out, a larger proportion of the incoming heat from the sun goes into heating the soil and adjacent air rather than evaporating its moisture, resulting in hotter summers under drier climatic conditions (Mueller & Seneviratne, 2012).

## Vulnerability

Drought has impacted St. Louis County numerous times over the years. The National Drought Mitigation Center (NDMC) oversees the Drought Impact Reporter (DIR) - a comprehensive database which gathers drought-related reports from a variety of sources and examines the reports for drought-related impacts. The NDMC (n.d.) defines a drought impact as "An observable loss or change that occurred at a specific place and time because of drought." Drought impacts are categorized based on the sector(s) the drought impacts. A single drought impacting multiple sectors will be categorized into the respective sectors.

DIR records show 40 incidents of drought impacting at least one sector in St. Louis County from 1988 - 2018. Table 28 lists the number of times a drought incident was reported for each sector.

*Table 28. Reported Drought Impacts for St. Louis County, 1988-2018*

Sector	# of drought incidents reported
Agriculture	4
Business & Industry	1
Energy	0
Fire	12
Plants & Wildlife	8
Relief, Response & Restrictions	16
Society & Public Health	4
Tourism & Recreation	1
Water Supply & Quality	8

Source: (National Drought Mitigation Center)

Note: For additional information about each category/sector, visit:

<https://droughtreporter.unl.edu/help/dir/mapping.aspx>

Since droughts are regional in nature jurisdictions within St. Louis County do not vary in their vulnerability to drought; however, jurisdictions with a greater number of vulnerable residents may be more negatively impacted. For example, droughts can contribute to poor air quality by increasing the risk of wildfires and creating a dustier than normal environment. Populations vulnerable to these conditions include children, older adults, and those with respiratory issues. The Household Composition & Disability SVI theme map (section 3.6.1) is made up of these population groups and should be reviewed to better understand the vulnerability of each jurisdiction.

St. Louis County Emergency Management did not identify any existing program gaps or deficiencies that make its citizens more vulnerable to droughts.

### 4.3.10 Wildfire

A wildfire is an uncontrolled fire spreading through vegetative fuels, posing danger and destruction to property. Wildfires can occur in undeveloped areas and spread to urban areas where structures and other human developments are more concentrated. While some wildfires start by natural causes like lightning, humans cause four out of every five wildfires. Debris burns, arson or carelessness are the leading causes of wildfires. As a natural hazard, a wildfire is often the direct result of a lightning strike

that may destroy personal property and public land areas, especially on national and state forest lands. The dangers from wildfire include the destruction of timber, property and wildlife, and injury or loss of life to people living in the affected area or using the area for recreational facilities.

While wildfires are often viewed in a negative light, they are a naturally occurring part of the environment. Wildfires are an important component of healthy forest and prairie ecology, and can be beneficial by reducing dangerously high fuel levels and putting nutrients into the ground that spur new growth. In addition, many flora species require fire for seed germination. However, as people settled this country and began clearing land and building homes, roads, railroads and campgrounds, new artificial causes of wildfire emerged and their frequency and level of destruction increased.

Causes of wildfires vary from state to state. For example, in Florida, lightning ignites approximately half of all wildfires, while in Minnesota lightning causes less than 5% of all wildfires. These variations are due to climate, vegetation, topography and weather. People burning debris cause most wildfires in Minnesota. However, wildfires are also caused by vehicle exhaust, sparks from trains and heavy equipment, camping, smoking and lightning.

Topography affects the movement of air and fire over the ground surface. The slope and shape of terrain can change the rate of speed at which the fire travels. Weather affects the probability of wildfire and has a significant effect on its behavior. Temperature, humidity and wind affect the severity and duration of wildfires.

Homes threatened by wildfire are primarily those located in the “wildland-urban interface.” This is the zone where homes and subdivisions have been located in wildland areas where natural wildfires can have an impact. While wildfires are necessary for healthy ecosystems, they burn whatever fuel is in their path, whether vegetation or buildings.

One of the most common causes of a home being damaged or destroyed is due to radiant heat. In a wildfire, radiant heat is the heat given off by burning vegetation. The high temperatures of some wildfires can cause the deck, siding or roof of a home to ignite, because the fire was too near the home. Studies in western wildfires have shown that approximately 85% of homes surviving a major wildfire had 30-50 feet of defensible space around them, coupled with fire-resistant roofing.

Approximately 1,600 wildfires occurred each year in Minnesota on average from 1976-2011 (MN DNR, 2011). Wildfires occur throughout the spring, summer and fall, however, most wildfires in Minnesota take place in March, April and May. During this period, much of the existing vegetation has been killed due to winter temperatures and is dead, brown and combustible. Also, there is little green vegetation to serve as a barrier for a moving wildfire.

### Wildfire History in St. Louis County

The Minnesota DNR responded to 5,982 wildfires in St. Louis County between 1985 and June 4, 2019, burning a total of 31,655 acres (Figure 25). Of these wildfires, only 225 were initiated by natural causes (i.e. lightning). The largest fire occurred in May of 1992, burning 5,200 acres south of Tower. Its cause was arson.

These include fires not only on state lands, but also rural private lands for which there is not another agency with primary responsibility. Wildfires that are not included in this data are those that occur on federal lands and those that are responded to by local fire departments.

According to St. Louis County Emergency Management, the most recent larger wildfires in the county were the Skibo Fire near Hoyt Lakes and the Foss Lake Fire near Ely. These fires were not included in the DNR dataset. The Skibo Fire occurred in May of 2016, burning over 1,000 acres. The Duluth News Tribune reported that the fire was apparently caused by sparks from a passing train (Duluth News Tribune, 2016). The Foss Lake Fire also occurred in May of 2016. It was started as a prescribed, 78-acre burn by the USFS, and was part of the North Arm Fuels Reduction Project. However, the fire escaped, burning approximately 1,015 acres.

According to data from the MN DNR, there are 630,975 acres of peat in St. Louis County. Peat is partially decayed plant matter found in ancient bogs and swamps. Minnesota has approximately six million acres of peatland, the highest total acreage in the contiguous United States. Peat fires are deep-rooted fires that burn underground, lasting for weeks, months, or even years. They can smolder during winter months beneath the snow, surfacing again in the spring to burn above ground. Peat ignites when its moisture content is low, and then it supports combustion rather than flame. Once started, combustion is persistent because peat contains oxygen and needs little or no outside oxygen to continue burning. Peat's insulating qualities mean the fire loses little heat. As the peat dries, it becomes water repellent. These factors result in long-lasting fires that require extensive operations to extinguish. St. Louis County has not identified peat fires as an issue in the country. However, it was noted that there is a peat farm near Floodwood that burns every few years.

### Wildfire and Climate Change

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

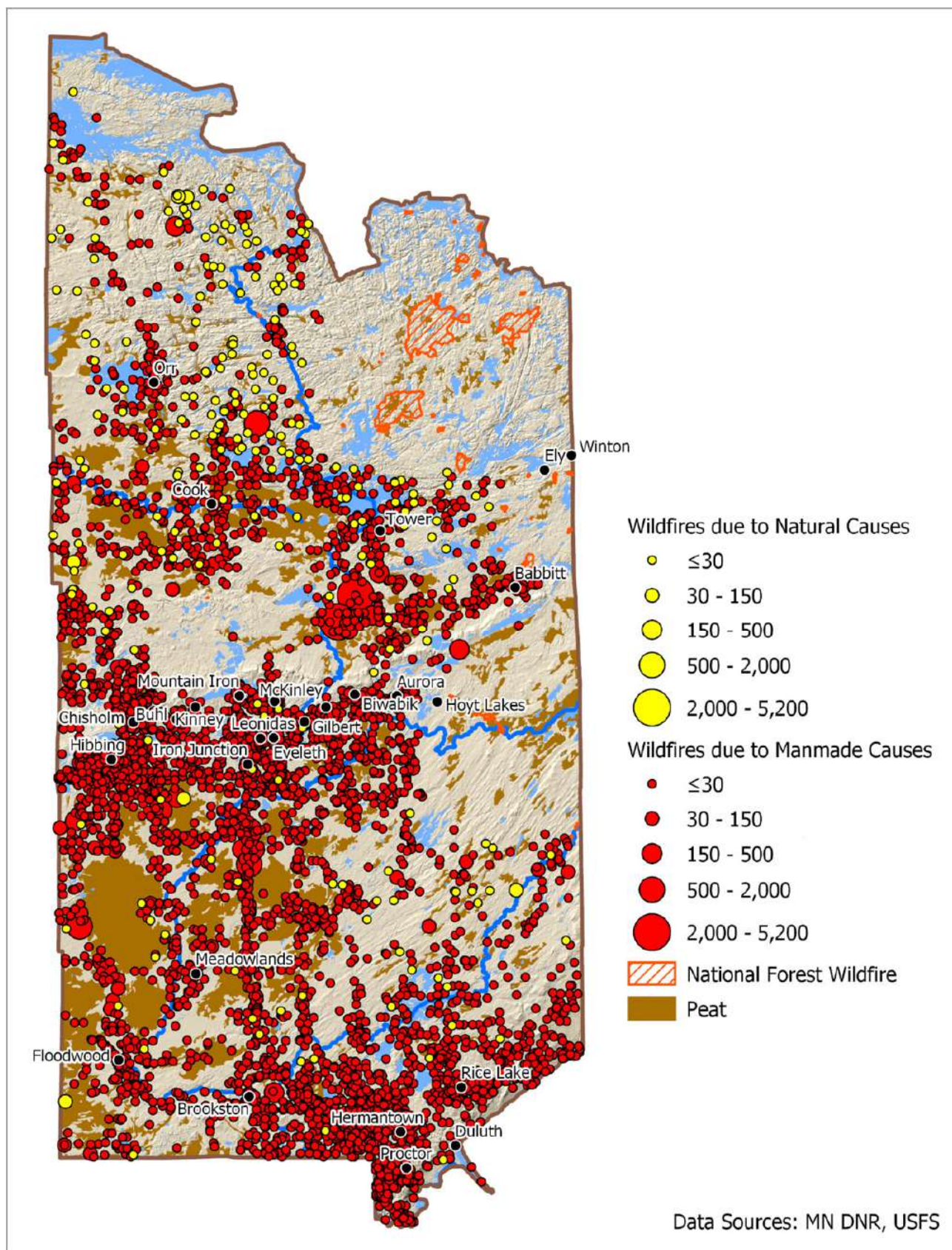
Climate data experts project conditions leading to a higher frequency of late growing season drought conditions, elevated winter temperatures with reduced snowpack, prolonged high heat days, and extended periods of low rainfall. Similar conditions in the past likely contributed to the 2011 Pagami wildfire disaster (*Appendix L, Planning for Climate & Health Impacts in Northeast Minnesota*)

### Vulnerability

The northern part of St. Louis County is much more wooded than the southern part of the county. It contains the Superior National Forest and the Boundary Waters Canoe Area Wilderness, in addition to being sparsely populated. These factors make the northern portion of the county more vulnerable to wildfires.

*Figure 25. Wildfires by Acres Burned (1985-June 4, 2019) and Peat in St. Louis County*







Blowdowns and tree mortality are also big concerns as they lead to increased fuel for wildfire. Vast acreages of blowdown in St. Louis County forest occurred after 1999 and 2016 windstorms. Spruce budworm and the resulting mortality from this insect outbreak increases the buildup of standing dead and down fuels, another growing concern.

An analysis of the Pagami Creek Fire and its impacts on public health was done in the neighboring Lake County (*Appendix L, Planning for Climate & Health Impacts in Northeast Minnesota*). The fire burned large portions of the BWCA wilderness, endangering visitors spread throughout a large area and beyond the reach of easy communication. Particulate matter from the fires posed a serious threat to respiratory health, particularly for individuals with asthma, lung disease, heart ailments, and other conditions. Air quality alerts were released across numerous states. Many county and Forest Service roads were closed. Smoke and ash from the fire made land and air travel extremely dangerous. In some areas, visibility was reduced to one-and-a-half miles. (MDH, 2018)

The SILVIS Lab at University of Wisconsin – Madison created a nationwide dataset documenting the 2010 Wildland Urban Interface. With the increase of development in metropolitan fringes and rural areas, the wildland-urban interface (WUI) is increasing. The WUI is defined as the area where structures and other human development meet or intermingle with undeveloped wildland. The expansion of the WUI in recent decades has significant implications for wildfire management and impact. The WUI creates an environment in which fire can readily move between structural and vegetation fuels. Its expansion has increased the likelihood that wildfires will threaten structures and people.

There are two types of WUI: intermix and interface. Intermix WUI are areas where housing and vegetation intermingle; interface WUI are areas with housing in the vicinity of contiguous wildland vegetation. Figure 26 below maps the WUI in St. Louis County. Areas of interface and intermix values are primarily located in the Duluth area, along with smaller segments around the range cities.

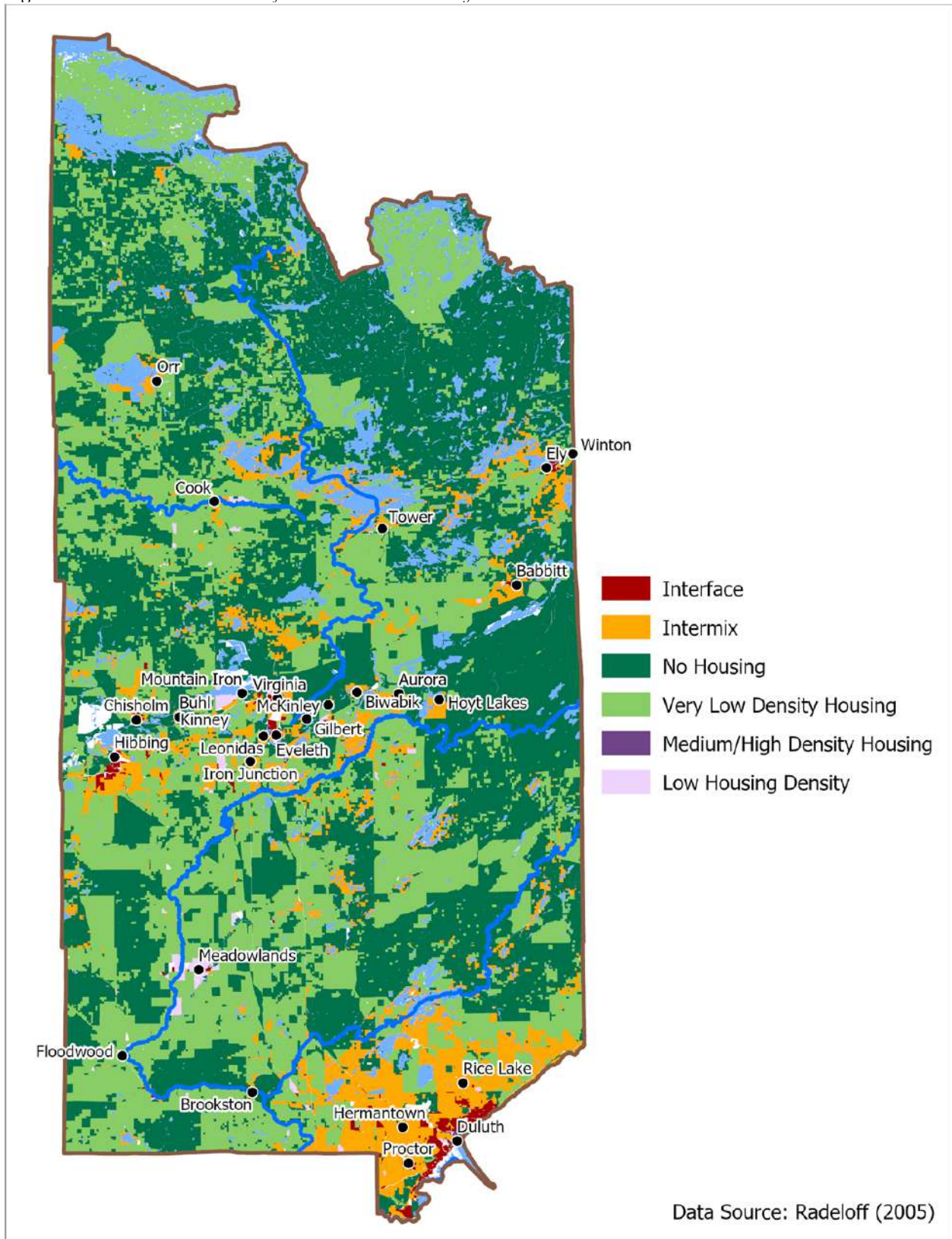
St. Louis County Emergency Management identified that there are several program gaps and deficiencies that make its citizens more vulnerable to wildfires and should be addressed with new mitigation efforts to reduce vulnerability. They include:

*Dry Hydrants and Water Access* – The CWPP identifies areas within the county where improved water access (such as underground tanks and dry hydrants) are needed for fighting wildfires. These areas are rural and not supported by a municipal water source.

*Public Awareness* – Raising public awareness of wildfire safety and dangerous conditions is an ongoing effort of St. Louis County Emergency Management, local fire departments, as well as MN DNR Forestry and the U.S. Forest Service. We continue to try and get additional people signed up for the Northland Alert notification system.

*Agency Coordination* – All St. Louis County Public Safety Agencies utilize an 800mhz statewide radio system called ARMER (Allied Radio Matrix for Emergency Response). The MN DNR and USFS utilize VHF for operations but do have ARMER capabilities for interoperability. Agencies continue to make agency coordination work better.

Figure 26. Wildland Urban Interface in St. Louis County



#### 4.3.11 Landslides and Soil Erosion

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

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

#### Landslides and Soil Erosion History in St. Louis County

The South St. Louis SWCD has noted that soil erosion and landslides can be an issue with severe storms; however, a database is not maintained. It was also noted that many problematic areas were fixed after the flooding of June 2012. However, it remains an issue for Lake Superior shoreline landowners.

#### Landslides/Soil Erosion and Climate Change

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

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

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

## Vulnerability

Figure A - 27 in Appendix A maps soil erodibility in St. Louis County using the Soil Erodibility Factor (K-Factor), which is a quantitative description of soil's inherent erodibility, by measuring the susceptibility of soil particles to shift due to rainfall and runoff. The Soil Erodibility Factor ranges in value from 0.02 to 0.69; however, all areas in St. Louis County are 0.43 or less.

St. Louis County Emergency Management did not identify any existing program gaps or deficiencies that make its citizens more vulnerable to soil erosion or landslides.

### 4.3.12 Coastal Erosion and Flooding

Coastal erosion is defined as the wearing away of land and the loss of beach, shoreline, or dune material over a period of time as a result of natural coastal processes or human influences. Characteristics such as supply of sand and processes such as sea level change, currents, tides, waves, and wind are natural factors that contribute to the rate of erosion. Human-caused contributors to erosion include dredging tidal entrances, jetty and groin construction, hardening shorelines with seawalls, beach nourishment, and construction of harbors and sediment-trapping dams.

Coastal flooding is primarily caused by storm surge and waves, but many other factors have an influence. On the Lake Superior shoreline, flooding is dependent on anthropogenic activities as well as lake levels, which vary as a result of precipitation, evaporation, and other natural processes. Ice cover also impacts the risk of a flood hazard significantly. These phenomena distinguish the analysis of flood hazards on the Great Lakes from those for ocean coastal areas—as well as from riverine flooding or erosion (FEMA, Great Lakes Coastal Flood Study, 2018).

Northeast Minnesota has 189 miles of Lake Superior shoreline and a coastal population of 216,268 (NOAA OCM, 2018). Section 304(1) of the Coastal Zone Management Act identifies the coastal zone as the coastal waters (including lands therein and thereunder) and the adjacent shorelands (including the waters therein and thereunder), strongly influenced by each other and in proximity to the shorelines of the several coastal states, and includes islands, transitional and intertidal areas, salt marshes, wetlands, and beaches.

### Coastal Erosion

Shoreline erosion of St. Louis County's Minnesota Point (aka Park Point) in Duluth has been a studied concern since at least 1970 when the residential population of that area was at a peak. Dredging operations in the Duluth harbor of Lake Superior have benefitted the erosion-prone areas by making the beach slope flatter and slowing the erosion rate (USACE, 1974). Occasional dramatic losses of beach are of great concern to residents of the point, and dredging/beach nourishment projects continue today. In 2019, USACE has another planned dredging operation in the harbor that will provide clean sediment for Minnesota Point (City of Duluth, 2019).

A survey of St. Louis County's Minnesota Point residents showed that 88% rated long-term lake level fluctuations as very important to extremely important in the cause of coastal flooding and erosion problems (Rasid, 1992). The results suggest residents perceive the hazards of coastal erosion from their

own personal experience, in that Minnesota Point has experienced fluctuating water levels more than high wave impact.

Results from a 1998 survey questionnaire of Minnesota Point residents showed that 54% of the residents experienced either flooding of basements due to a rise in the water table or direct inundation of water to yards and buildings, such as garages and storage sheds, during the reported average of 18 years spent on Minnesota Point. Beach erosion, loss of land, and landscaping, destruction or damage of shore protection devices, and damage to buildings and related structures were the common types of reported erosion issues (Rasid, 1992).

Small lakes can experience shoreline erosion due to wind and wave action as well, particularly where native upland vegetation has been replaced with turf or aquatic vegetation has been removed. Excessive and/or chronic recreational activity too close to the shore can also make shorelines vulnerable to erosion (MN DNR, 2018).

### *Coastal Erosion History*

The most extensive study of coastal erosion on the North Shore of Lake Superior was conducted in 1988, using aerial photographs taken in the 1930s, 1975, and 1988/89 (Johnson, 1995) (Johnston, Sales, Bonde, Aunan, & Raby, 1989). This research showed that the North Shore of Lake Superior is variable in its geology and geometry, and these variations result in varying rates of erosion. The study showed that non-bedrock areas at or near the shoreline receded at an average rate of .46 ft. /yr., and a maximum of 1.1 ft. /yr.

Major storm winds and waves come from the northeast, with a greater impact on the north and northeast-facing shores. (Johnson, 1995). These differences in coastal aspects indicate areas of higher and lower susceptibility among Lake Superior coasts.

A corresponding mapping project and report were produced with the research, (Johnston, Sales, Bonde, Aunan, & Raby, 1989) that cited growing concerns for reducing the economic and environmental losses along the shores of Lake Superior that arose from increases in development pressures and water levels of the mid-1980s.

### *Coastal Flooding*

Severe flood events on the Lake Superior occur when high lake levels are combined with strong winds that drive water and waves onshore. When large waves are paired with elevated lake levels, the waves are able to reach farther onshore, eroding the backshore, and potentially reaching developed lakefront areas. Whether wave hazards reach development depends on local conditions—for instance, in many areas the bluffs are high enough to limit the wave effects to the bluff face. However, in other areas, the bluff or shore protection structures may be overtopped or waves may pass over inundated, low-lying areas. Waves can cause dramatic structural damage to buildings, including splintering walls and causing homes to float off foundations or even to collapse (Great Lakes Coastal Flood Study, 2018). In addition, periods of high water levels have plagued the city of Duluth's sanitary sewer collection system with flooding (Berg, 1985).

### *Coastal Flooding History*

Coastal communities face flood risks from a combination of increased water levels and/or high-energy waves. When storms affect the coast, communities can face serious threats to human safety, extensive damage to infrastructure and the built environment, and negative economic impacts. To help protect against these impacts, more stringent building practices and flood insurance are required in the hazardous areas along the coast.

In October 2018, winds of 64 mph were reported at the Duluth harbor. Waves reached as high as 14 to 18 feet, causing the Canal Park business district near Lake Superior to close due to standing floodwater and the City's very popular Lakewalk to be closed.

During the Thanksgiving Blizzard of 2019, Canal Park in Duluth again experienced some flooding. Lake Superior produced waves of 10-15 feet and access to Park Point was closed to non-residents.

### *Coastal Erosion and Flooding and Climate Change*

Heavy, extreme precipitation is expected to be a primary symptom of climate change in northern Minnesota. Erosion is exacerbated during storm events. At an average increase of two degrees per decade, Lake Superior's rising water temperatures are leading to more storm events. Storm events which have also increased in recent years, further intensify with high water levels. Increased wave action due to high water levels are evidenced in the Great Lakes Coastal Flood Study 2018 draft for Lake Superior from the FEMA and partners.

### *Vulnerability*

Continued shoreline development is inevitable, and it contributes to erosion problems. Erosion rates can accelerate with increases in impervious surfaces, changing and eliminating vegetation cover, and alterations to beach makeup. Serious situations are rare but massive/fast erosion can occur during one storm event leaving houses dangling from cliffs or beginning to slide down hillsides. The effective management of areas with high erosion potential is necessary to protect property owners and provide measures for reducing erosion.

Natural processes of deep-water waves and swells determine Lake Superior water fluctuation. These natural processes are further modified by International Joint Commission (IJC) navigation control structures. IJC strives to keep Lake Superior's monthly mean water level between 593.36 and 601.97 feet, but because meteorological conditions greatly affect lake levels, attempts to balance the system can be difficult (Rasid, 1992).

Low elevation beaches and sandspits, such as that of Park Point in St. Louis County, are vulnerable to even minor fluctuations in lake levels, which may induce significant coastal flooding and erosion problems. Park Point frequently experiences dangerous rip currents, commonly associated with warm days and high off-lake winds and waves. According to the NWS, there is an average 12 fatalities and twice that many rescued on the Great Lakes each year.

St. Louis County Emergency Management and the city of Duluth (a Lake Superior coastal community) identified that there are several program gaps and deficiencies that make its citizens more vulnerable



to coastal erosion and coastal storms and should be addressed with new mitigation efforts to reduce vulnerability. They include:

*Public Education & Awareness* – There is a need to increase public education and outreach about flooding events and being safe during a flood. There is also a need to increase public education about the FEMA National Flood Insurance Program (NFIP).

*Climate Change Impact Studies to Inform Coastal Mitigation Planning* – To mitigate coastal storm hazards, St. Louis County and the city of Duluth need to improve its understanding of how climate change is likely to impact coastal storm hazards and vulnerable coastal infrastructure and how such infrastructure can be cost-effectively protected from harm in its current location, eliminated altogether, or relocated to a less vulnerable location. Future studies should focus on the areas of Park Point closest to the Duluth canal entry and the Superior entry where the loss of land mass is most pronounced.

*Demolition of Relocation of Vulnerable Coastal Infrastructure* – When possible, there is a need to demolish vulnerable infrastructure close to the shoreline, relocating inland where necessary. When demolition is not possible, we need to improve the ability of coastal infrastructure to withstand coastal storm damage by constructing shoreline armoring to contemporary coastal engineering standards.

#### 4.3.13 Dam & Levee Failure

Dams are structures that retain or detain water behind a large barrier. When full or partially full, the difference in elevation between the water above the dam and below creates large amounts of potential energy, allowing the chance for failure. Dams can fail due to either 1) water heights or flows above the capacity for which the structure was designed; or 2) deficiencies in the structure such that it cannot hold back the potential energy of the water. If a dam fails, issues of primary concern include loss of human life/injury, downstream property damage, lifeline disruption (transportation routes and utility lines required to maintain or protect life), and environmental damage. Dams require constant monitoring and regular maintenance to insure their integrity.

#### Dam & Levee Regulation

The agencies with regulatory authority of dams in Minnesota are:

- The MN DNR Dam Safety Program has the mission of protecting the life and safety of people by ensuring that dams are safe. Minnesota's program sets minimum standards for dams and regulates the design, construction, operation, repair, and removal of dams. Both privately and publicly owned dams are regulated.
- The U.S. Army Corp of Engineers (USACE) maintains the lock and dam system on the Mississippi River and has regulatory authority over the flood control dams that it owns. USACE also participates with local communities in all phases of flood control that includes dams, levees, or other means.
- The Federal Power Act (FPA) authorizes the Federal Energy Regulatory Commission (FERC) to issue exemptions or licenses to construct, operate and maintain dams, water conduits, reservoirs, and transmission lines to improve navigation and to develop power from streams and other bodies of water over which it has jurisdiction. 16 U.S.C. § 797(e). Regulatory tools



include the Federal Power Act, Public Utility Regulatory Policies Act, the Electric Consumers Act of 1986 and the Energy Policy Act of 1992.

### Dam & Levee Failure History in St. Louis County

According to the State Dam Safety Engineer at the MN DNR, there have been 10 cases of dam failure in St. Louis County. A brief description of these events based on MN DNR data is provided below.

At the Hibbing Taconite stockpile a rotational failure of a stockpile road embankment occurred in July of 2017. There was a bulldozer on site at the time of failure, but no injuries as there were indications it was failing. The dam was replaced.

The western embankment at the Inland Steel Tailings Basin failed in April of 2014. The cause was likely piping due to high water flowing through coarse roadway material. High water was likely due to spring snowmelt. In addition, excessive ice in the reclaim pond prevented flow from the Upland II decant from flowing to the main reclaim pond. The dam was repaired.

In March of 2010, the Minorca Pit South Dam had an interior dike failure at an earthen weir, causing water to flow into Higgins Pit. All of the water from the breach was contained within the pit, though it raised 8-10 feet.

The Minntac Dam experienced an interior dike failure in 2010, approximately 20 feet deep.

In January of 2007 the Hibbing Taconite Internal Weir failed, causing the plant to be shut down for two months.

The LTV Ash Pond is included in the dam failure database, noting a year of 2002; however, no other details were available.

The Finstad Dam suffered an earthen embankment breach in 1994 due to animal burrowing. The dam was removed.

On March 23, 1989, the LTV Steel 1W Dam had an interior dam failure likely due to piping below ice. Layered ice formed at the outlet culvert, reducing outflows and causing water levels to rise. Water started piping under the ice and along the culvert, causing the culvert and dam to fail. Two attempts at blasting the ice were made in the days prior to the dam failure. The dam was rebuilt, but subsequently buried when cells 1W and 2W were merged.

The Schweiger Dam failed in 1981 when the owner was attempting to perform repairs on the spillway. The dam was rebuilt.

In September of 1972, the Hartley Dam had its left earthen embankment washed out due to overtopping by floodwaters resulting from a heavy rainfall. The dam was rebuilt.

There are no levees in St. Louis County.

### Dam Failure and Climate Change

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

While climate change will not increase the probability of catastrophic dam failure, it may increase the probability of design failures. Minnesota had a dam failure due to a large storm event in June 2012. The Forebay canal in Carlton County had operated as designed for nearly 100 years. The intensity of the 2012 rain event caused a failure of the canal wall, which caused significant damage. Climate change is adding a new level of uncertainty that needs to be considered with respect to assumptions made during dam construction.

### Vulnerability

Although dam regulatory authorities vary between various federal and state agencies, all authorities attempt to classify dams according to the potential impacts from a dam failure or mis-operation. In response to the numerous classification systems, FEMA's Interagency Committee on Dam Safety created a hazard potential classification system that is adaptable to any agency's current system.

Table 29 provides an overview of the main criteria agencies consider when determining a dam's hazard potential classification. This classification system does not imply that the dam is unsafe, but rather categorizes dams based on the probable loss of human life and the impacts on economic, environmental, and lifeline interests (2004).

*Table 29. Hazard Potential Classification Criteria*

Hazard Potential Classification	Loss of Human Life	Economic, Environmental, Lifeline Losses
Low	None expected	Low and generally limited to owner
Significant	None expected	Yes
High	Probable - one or more expected.	Yes (but not necessary for this classification)

*Source:* (US Army Corps of Engineers, 2008)

Minnesota's hazard classifications for dams are as follows:

- **High (Class I)** - loss of life or potential serious hazards; damage to health, main highways, high-value industrial or commercial properties, or major public utilities; or serious direct or indirect economic loss to the public;
- **Significant (Class II)** - possible health hazard or probable loss of high-value property; damage to secondary highways, railroads or other public utilities; or limited direct or indirect economic loss to the public other than that described in Class III (Low); and

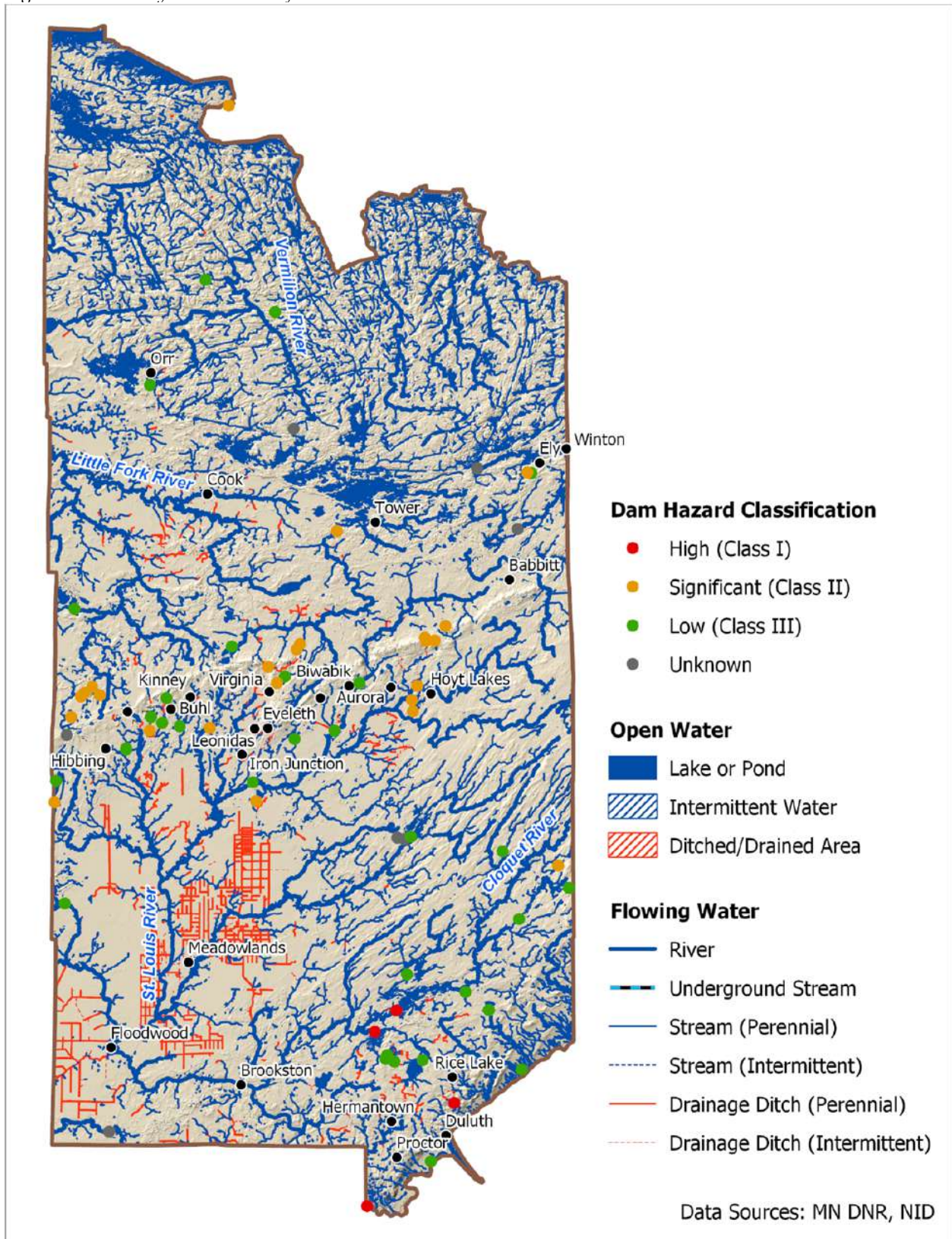
- **Low (Class III)** - property losses restricted mainly to rural buildings and local county and township roads that are an essential part of the rural transportation system serving the area involved.

Class I dam owners are required to have an Emergency Action Plan (EAP) on file, notifying individuals whose lives, property, or health may be endangered by failure, mis-operation, or other circumstances affecting the dam (Minnesota Legislature - Office of the Revisor of Statutes, 2008).

Dams for which a hazard potential (as defined above) has not been designated, or is not provided, are classified as "Undetermined".

Figure 27 below maps the dams in St. Louis County by hazard classification. Four dams in the county are listed as a high hazard (Fish Lake, Fond du Lac, Hartley Pond and Island Lake), all of which have their own Emergency Action Plans (EAPs). In addition, the Laskin Energy and Rice Lake dams also have EAPs.

Figure 27. Dams by Hazard Classification



In addition to dams being classified by their hazard potential, the physical condition of dams are inspected and given a condition ranking. The condition of a dam is categorized into one of the following classifications:

- **Satisfactory** - No existing or potential dam safety deficiencies are recognized. Acceptable performance is expected under all loading conditions (static, hydrologic, seismic) in accordance with the applicable regulatory criteria or tolerable risk guidelines.
- **Fair** - No existing dam safety deficiencies are recognized for normal loading conditions. Rare or extreme hydrologic and/or seismic events may result in a dam safety deficiency. Risk may be in the range to take further action.
- **Poor** - A dam safety deficiency is recognized for loading conditions which may realistically occur. Remedial action is necessary. "Poor" may also be used when uncertainties exist as to critical analysis parameters which identify a potential dam safety deficiency. Further investigations and studies are necessary.
- **Unsatisfactory** - A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution.
- **Not Rated** - The dam has not been inspected, is not under state jurisdiction, or has been inspected but, for whatever reason, has not been rated (US Army Corps of Engineers, 2008).

Dams in "Poor" or "Unsatisfactory" condition are more vulnerable to failure and pose a greater threat to the surrounding community and infrastructure. There are four dams in the county with conditional assessments ranked as "poor": Chez Pond, Bear Island, Pike River and Burntside Lake (Figure 28).

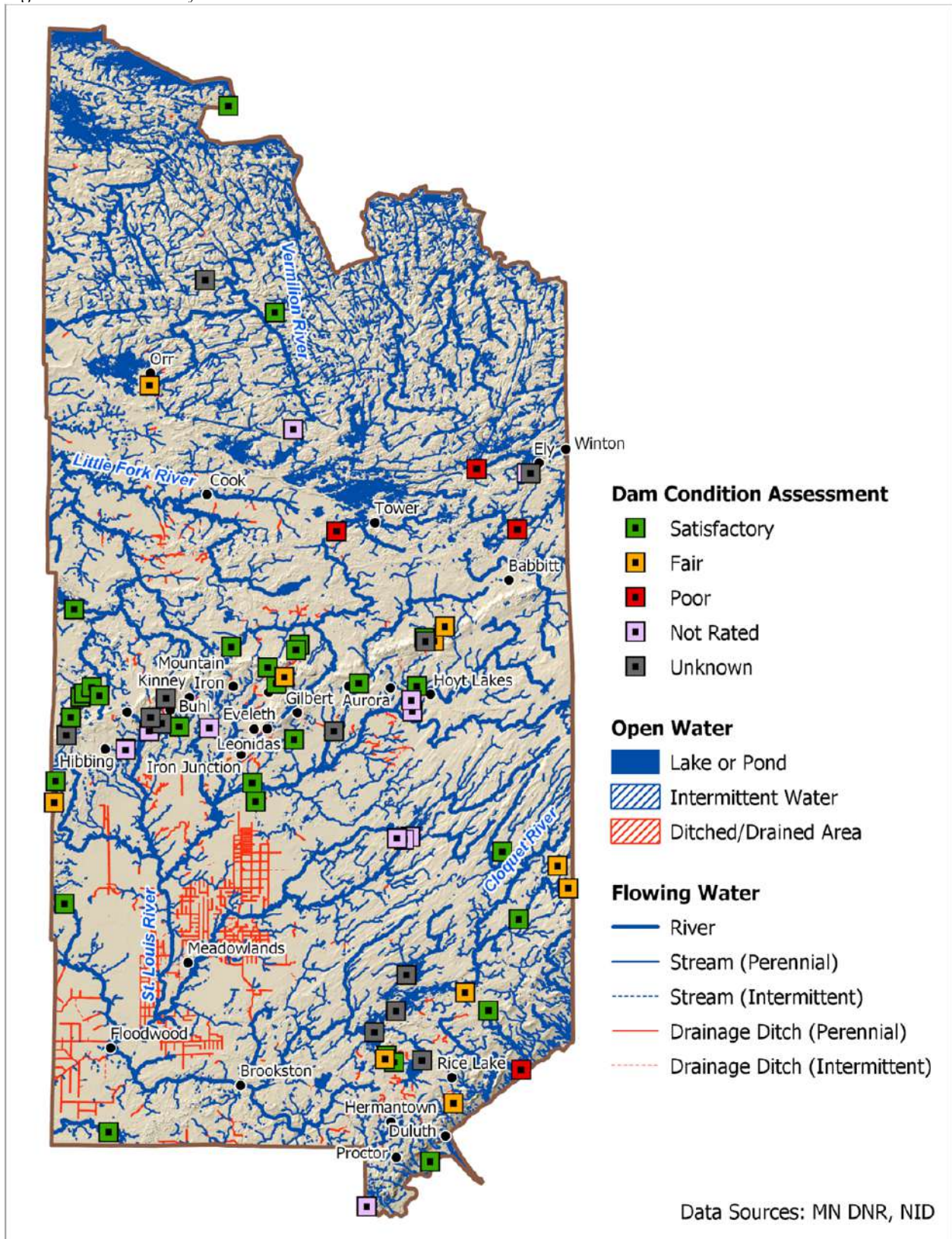
Levees are used to increase cultivation in agriculture and to protect population and structures from floods. However, there are no levees in St. Louis County.

St. Louis County Emergency Management identified that there are program gaps and deficiencies that make its citizens more vulnerable to dam failure and should be addressed with new mitigation efforts to reduce vulnerability. They include:

*Emergency Notification Improvements* – Program gaps identified during the last exercise dealt with notifications within Minnesota Power structure and also with resident notification. St. Louis County will now use Everbridge to try and close the public notification gap.



Figure 28. Condition of Dams



## Section 5 – Mitigation Strategy

The goal of mitigation is to protect lives and reduce the future impacts of hazards including property damage, disruption to local and regional economies, the amount of public and private funds spent to assist with recovery, and to build disaster-resistant communities. Mitigation actions and projects should be based on a well-constructed risk assessment, provided in Section 4 of this plan. Mitigation should be an ongoing process adapting over time to accommodate a community's needs.

### 5.1 Community Capability Assessments

The capability assessment identifies current activities and existing planning tools used to mitigate hazards. The capability assessment identifies the policies, regulations, procedures, programs and projects that contribute to the lessening of disaster damages. The assessment also provides an evaluation of these capabilities to determine whether the activities can be improved in order to more effectively reduce the impact of future hazards. The following sections identify existing plans and mitigation capabilities within all of the communities:

- *Appendix J:* Lists the plans and programs in place in St. Louis County as related to hazard mitigation.
- *Appendix K:* As part of the St. Louis County MHMP update, the county, its cities and its townships were asked to participate in filling out a "Local Mitigation Survey" (LMS) form to report on their current mitigation capabilities and program gaps. Appendix K lists the LMS reports gathered for St. Louis County.

Information from the capability assessments was used to support development of local mitigation actions for implementation over the next five years (see column J *Comments on Implementation, Administration & Integration into Local Planning Mechanisms*).

#### 5.1.1 National Flood Insurance Program (NFIP)

The NFIP is a federal program created by Congress to mitigate future flood losses nationwide through sound, community-enforced building and zoning ordinances and to provide access to affordable, federally-backed flood insurance protection for property owners. The NFIP is designed to provide an insurance alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by floods. Participation in the NFIP is based on an agreement between local communities and the federal government that states that if a community will adopt and enforce a floodplain management ordinance to reduce future flood risks to new construction in Special Flood Hazard Areas (SFHAs), the federal government will make flood insurance available within the community as a financial protection against flood losses.

Table 30 below lists St. Louis County participation in the NFIP.



Table 30. St Louis County Participation in the NFIP

Community Name	Participation in the National Flood Insurance Program (NFIP)?		Initial FIRM Date
City of Aurora	Participating in NFIP	Map date 1976	04/05/1974
City of Biwabik	Participating in NFIP	No FEMA Mapped High Risk Areas	05/17/1974
City of Brookston	Participating in NFIP	05/01/1987	08/02/1974
Canosia Township	Participating in NFIP	Map date 1992	12/20/1974
City of Cook	Participating in NFIP	Map date 12/06/2001	03/29/1974
City of Duluth	Participating in NFIP	Map date 11/04/1992	08/16/1974
Duluth Township	Participating in NFIP	Map date 02/19/1992	12/20/1974
Fayal Township	Participating in NFIP	Map date 02/19/1992	12/20/1974
City of Floodwood	Participating in NFIP	Map date 07/17/1978	03/29/1974
Gnesen Township	Participating in NFIP	Map date 02/19/1992	12/20/1974
Greenwood Township	Participating in NFIP	Map Date of 02/19/1992	12/16/1977
City of Hermantown	Participating in NFIP	Map date 11/18/1981	01/13/1978
City of Hibbing	Participating in NFIP	Map date 09/27/1991	01/24/1975
City of Iron Junction	Participating in NFIP	Map date 10/25/1974	12/25/1974
Lakewood Township	Participating in NFIP	Map date 01/19/1992	12/20/1974
Midway Township	Participating in NFIP	Map date 01/19/1992	12/20/1974
City of Mountain Iron	Participating in NFIP	Map date 02/23/1979	11/16/1976
City of Orr	Participating in NFIP	Map date 12/13/1974	12/13/1974
City of Proctor	Participating in NFIP	Map date 05/04/1989	04/05/1975
City of Rice Lake	Participating in NFIP	Map date 02/19/1992	12/20/1974
St. Louis County	Participating in NFIP	Map date 02/19/1992	12/20/1974
City of Tower	Participating in NFIP	Map date 08/11/1978	12/13/1974
City of Virginia	Participating in NFIP	No FEMA Mapped High Risk Areas	05/17/1974
City of Winton	Participating in NFIP	Map date 07/02/1976	08/02/1974

Source: MN DNR (data current as of 10/1/2018)

Repetitive loss properties are defined as properties that have had two or more flood insurance claims of \$1,000 or more in any rolling 10-year period. Property owners are asked to consider mitigation activities such as acquisition, relocation, or elevation, among other options. FEMA's Repetitive Loss (RL) properties strategy is to eliminate or reduce the damage to property and the disruption to life caused by repeated flooding of the same properties. Property owners are notified of their status by FEMA. St. Louis County has eight repetitive loss properties, as described in Table 31.

Table 31. Repetitive Loss Properties in St. Louis County

Location	Total Losses	Number of Properties	Property Type	Total Building Payments	Total Contents Payments	Total Payments
Duluth	6	3	2 single family residences, 1 'other – non-residential'	\$14,360	\$41,440	\$55,800
Floodwood	5	2	Single family	\$20,237	\$0.00	\$20,237
Proctor	3	1	2-4 family	\$28,380	\$10,268	\$38,649

Location	Total Losses	Number of Properties	Property Type	Total Building Payments	Total Contents Payments	Total Payments
			residence			
St. Louis County	5	2	Single family	\$62,895	\$4,414	\$67,310

Source: MN DNR (data current as of 3/31/2019)

No properties are classified as “Severe Repetitive Loss” (SRL). An SRL property is defined as a residential property that is covered under an NFIP flood insurance policy and:

- That has at least four NFIP claim payments (including building and contents) over \$5,000 each, and the cumulative amount of such claims payments exceeds \$20,000; or
- For which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building.
- For both (a) and (b) above, at least two of the referenced claims must have occurred within any 10-year period, and must be greater than 10 days apart.

For more on the areas that flood repeatedly in St. Louis County, see Section 4.4.5 *Flash Flood and Riverine Flood*.

### 5.1.2 Plans and Ordinances

St. Louis County and its incorporated communities have a number of plans and ordinances in place to ensure the safety of residents and the effective operation of communities, including an Emergency Operations Plan, Capital Improvements Plan, Comprehensive/Master Plan and Economic Development Plan.

### 5.1.3 Plans and Programs in Place to Address Natural Hazards

St. Louis County has numerous plans and programs in place to address natural hazards from warning to response. Some of these programs are specific to a hazard and others address impacts and human safety for many types of events. The natural hazard(s) the plan or program is most relevant to is highlighted.

Summer Storms   Winter Storms   Floods   Erosion   Extreme Temps   Drought   Dam Failure   Wildfire

*Emergency Operations Plan* – St. Louis County maintains an all-hazards Emergency Operations Plan which details key emergency management functions (i.e. public information and warning, evacuation, mass care sheltering, etc.) that may be necessary in advance of, during and following hazard events that pose risk to life safety. It is intended to assist key county/city officials and emergency organizations to carry out their responsibilities for the protection of life and property under a wide range of emergency conditions. This includes events such as severe summer and winter storm events, extreme temperatures, flooding and wildfire.

Summer Storms   Winter Storms   Floods   Erosion   Extreme Temps   Drought   Dam Failure   Wildfire

*Public Warning and Notification* – In the event of emergencies or hazardous conditions that require timely and targeted communication to the public, St. Louis County utilizes the Everbridge Emergency Notification System termed Northland Alert, the county website, and local news media. The county

promotes the use of NOAA weather radios by critical facilities and the public to receive information broadcast from the National Weather Service. Local newspaper & radio stations and their websites may assist with sharing public information. St. Louis County has a procedure in place to alert fire and EMS agencies of severe weather warnings through paging when certain warnings are issued.

Summer Storms Winter Storms Floods Erosion Extreme Temps Drought Dam Failure Wildfire  
**Backup Power** – The St. Louis County Emergency Operations Center, Government Services Center, Duluth, Hibbing and Virginia Court Houses, Northland Office Building, Jail & two temporary lock-ups and the St. Louis County Public Safety Building have generator backup power.

Summer Storms Winter Storms Floods Erosion Extreme Temps Drought Dam Failure Wildfire  
**Severe Weather Warnings** – Severe weather warnings are issued by the National Weather Service office in Duluth, MN. St. Louis County has an Emergency Conditions Policy in place.

Summer Storms Winter Storms Floods Erosion Extreme Temps Drought Dam Failure Wildfire  
**School Closings** – All school districts within the county have a school closing policy and communications plan in place if inclement weather or extreme temperatures create a hazardous situation for students or staff.

Summer Storms Winter Storms Floods Erosion Extreme Temps Drought Dam Failure Wildfire  
**Mass Care Shelter Facilities** – St. Louis County works with local jurisdictions to be ready to activate shelter facilities if people are displaced due to severe storms, extreme temperatures, flooding, wildfire or other hazard events. St. Louis County Public Health has recently taken over shelter responsibility and has been training on shelter setup and operation. Red Cross is an assisting partner and will assist when resources are available. From January through March, 2019, St. Louis County and the city of Duluth conducted a pilot project for a warming shelter in West Duluth when the temperature fell below zero degrees Fahrenheit. The pilot project operated for 29 days, and provided 599 “bed-nights” to 164 individuals. The Duluth Transit Authority provided free transportation between the Transit Center and the Warming Center. During the winter of 2019-2020, Gloria Dei Lutheran Church has volunteered to be a Warming Center and CHUM has changed its overnight policies to allow unlimited entry to the Drop-In Center overnight. A third site in Lincoln Park is under consideration.

Summer Storms Winter Storms Floods Erosion Extreme Temps Drought Dam Failure Wildfire  
**Snow Removal** – The St. Louis County Public Works Department is responsible for the removal of snow and ice from county roads, as well as some township roads and city streets based on interagency agreements. The department completes its snow removal process in accordance with the St. Louis County Public Works Department Snow Removal Policy. MNDOT removes snow from state highways as well as disperses salt/sand as needed.

Summer Storms Winter Storms Floods Erosion Extreme Temps Drought Dam Failure Wildfire  
**Outdoor Warning Sirens** – There are outdoor warning sirens located in the cities of Duluth, Proctor, Floodwood and Gilbert in St. Louis County. St. Louis County 9-1-1 Communications activates the sirens per their standard operating procedure. Sirens are also activated when a city or county public safety official (police, fire) requests activation due to imminent danger to life and/or property.

Summer Storms Winter Storms Floods Erosion Extreme Temps Drought Dam Failure Wildfire

*Severe Weather Awareness Weeks* – St. Louis County helps promote and participates in the National Weather Service’s “Severe Weather Awareness Week” held in April each year and the “Winter Hazard Awareness Week” in November each year. Each week-long event seeks to educate residents on the dangers of severe storms and highlights the importance of preparing for severe weather before it strikes.

Summer Storms Winter Storms Floods Erosion Extreme Temps Drought Dam Failure Wildfire

*SKYWARN Program* – St. Louis County, through the National Weather Service (NWS), has trained SKYWARN weather spotters throughout the county. St. Louis County has a Radio Amateur Civil Emergency Services (RACES) group of which many members work with the NWS during severe weather.

Summer Storms Winter Storms Floods Erosion Extreme Temps Drought Dam Failure Wildfire

*National Flood Insurance Program* – St. Louis County and all city jurisdictions participate in the National Flood Insurance Program (NFIP).

Summer Storms Winter Storms Floods Erosion Extreme Temps Drought Dam Failure Wildfire

*Floodplain & Shoreland Ordinances* – St. Louis County participates in many plans and programs to regulate development and setbacks on shoreline to enforce state floodplain and shoreland standards. These plans and programs include: North Shore Management Plan, Coastal Barrier Resource System, Road Drainage, Duluth National Pollutant Discharge Elimination System Storm Water Management Permit, Flood Mitigation Assistance, Repetitive Flood Claims and Severe Repetitive Loss.

Summer Storms Winter Storms Floods Erosion Extreme Temps Drought Dam Failure Wildfire

*Stormwater Management Ordinance & Plans* – The St. Louis County Water Plan addresses ground and surface water, public water supply and wastewater management.

Summer Storms Winter Storms Floods Erosion Extreme Temps Drought Dam Failure Wildfire

*Local Fire Departments* – There are 87 fire departments located in St. Louis County. Fire departments work wildfires in cooperation with the MN DNR and U.S. Forest Service. Many departments in northern St. Louis County have contracts to assist the MN DNR with wildfires. Non-organized townships have fire coverage through contracts with St. Louis County and the closest fire department.

Summer Storms Winter Storms Floods Erosion Extreme Temps Drought Dam Failure Wildfire

*Mutual Aid Agreements* – St. Louis County has a countywide Fire Chief’s Association and they participate in a countywide automatic mutual aid program. There are other mutual aid associations in St. Louis County that have written agreements for mutual aid. The associations are Lakehead Fire Department Mutual Aid Association, East Range Fire Coalition and the Laurentian Fire Mutual Aid Association.

Summer Storms Winter Storms Floods Erosion Extreme Temps Drought Dam Failure Wildfire

*St. Louis County Firewise Program* – St. Louis County has a contractor serving as the county Firewise Coordinator. The Coordinator works with local fire departments, MN DNR, U.S. Forest Service and land

owners on Firewise projects, such as assisting property owners with removal of bio-fuels (Chipper Days) and conducting Level 1 Firewise Assessments for homeowners.

Summer Storms Winter Storms Floods Erosion Extreme Temps Drought Dam Failure **Wildfire**

*St. Louis County Community Wildfire Protection Plan (CWPP)* – St. Louis County has a CWPP in place from 2008 that is currently being updated. The CWPP identifies and prioritizes the Wildland-Urban Interface (WUI) high-risk wildfire areas within the county and identifies wildfire mitigation activities and projects for implementation, such as: fire prevention & education programs, biomass removal, external wildfire sprinklers and improvement of ingress/egress. The CWPP is developed in collaboration with county and city government, local fire departments, MN DNR, U.S. Forest Service, USDA and local residents.

Summer Storms Winter Storms Floods Erosion Extreme Temps Drought Dam Failure **Wildfire**

*Burning Permits/Restrictions* – The MN DNR regulates when burning permits are available and requires permit holders to register their burning permit online prior to burning. Burning permits are issued by MN DNR Fire Wardens scattered throughout the county. St. Louis County 9-1-1 Communications has access to the statewide burning permit website.

Summer Storms Winter Storms Floods Erosion Extreme Temps Drought Dam Failure **Wildfire**

*Fire Prevention Week* – Fire Prevention Week is held annually each October with the main emphasis on educating youth through visiting schools. Most fire departments participate and provide an opportunity for local residents to learn fire safety with open houses.

Summer Storms Winter Storms Floods Erosion Extreme Temps **Drought** Dam Failure **Wildfire**

*Wildfire Public Education & Awareness* – St. Louis County Emergency Management works in concert with the MN DNR and U.S. Forest Service to educate the public about wildfire through visitor centers, printed/online information and special events. A “Living with Fire” public event was held by the St. Louis County Firewise Coordinator with Fire Adaptive Communities, MN DNR Forestry, U.S. Forest Service, Emergency Management and local public safety agencies. This event was free and open to the public to raise awareness of wildfire and how they can make their property more wildfire resistant.

Summer Storms Winter Storms Floods Erosion Extreme Temps **Drought** Dam Failure **Wildfire**

*St. Louis County Water Plan* – The St. Louis County Water Plan describes both surface and groundwater quantities and quality. It also addresses the county’s water needs and concerns.

Summer Storms Winter Storms Floods Erosion Extreme Temps **Drought** Dam Failure **Wildfire**

*Public Awareness* – In the event of drought conditions, St. Louis County Emergency Management works with the MN DNR and U.S. Forest Service to raise public awareness of the dry conditions and increased danger of wildfire.

Summer Storms Winter Storms **Floods** Erosion Extreme Temps Drought Dam Failure **Wildfire**

*Soil and Water Conservation Districts (SWCD’s)* – There are two SWCDs that serve St. Louis County: the South St. Louis County SWCD and the North St. Louis County SWCD. Both SWCDs provide access to natural resource management and conservation services and provide technical, financial, and

educational assistance to landowners to address natural resource concerns. Each SWCD also manages their allocation of the Erosion Control and Water Management Program, or State Cost-Share Program. This program provides funds to Soil and Water Conservation Districts to share the cost of systems or practices for erosion control, sedimentation control, or water quality improvements designed to protect and improve soil and water resources. Through the Cost-Share Program, land owners and/or occupiers can request financial and technical assistance for the implementation of conservation practices. Projects that may be eligible for cost-share funding include projects such as: critical area stabilization, diversions, field windbreaks, grassed waterway, filter strips, sediment basins, streambank, shoreland, and roadside protection, stripcropping, terraces, unused well sealing and forestry conservation practice.

Summer Storms Winter Storms Floods Erosion Extreme Temps Drought **Dam Failure** Wildfire

**Minnesota Power Dam Safety** – The dams in southern St. Louis County are owned and controlled by Minnesota Power. The Minnesota Power Dam Safety Engineer meets with St. Louis County annually to discuss and update all plans.

Summer Storms Winter Storms Floods Erosion Extreme Temps Drought **Dam Failure** Wildfire

**Emergency Notifications** – St. Louis County works with Minnesota Power on emergency notification for all residents that could be directly impacted by a dam failure. St. Louis County 9-1-1 Communications has an Everbridge group built for each area that could be affected by dam failure. The notification process is tested annually.

Summer Storms Winter Storms Floods Erosion Extreme Temps Drought **Dam Failure** Wildfire

**Exercises** – Minnesota Power conducts tabletop, functional and full-scale exercises regularly to test and improve its current plans. St. Louis County participates in these exercises.

See *Appendix J* for a list of all plans and programs, ordinances and staff in place in St. Louis County, and *Appendix K: Local Mitigation Survey Report* further details each jurisdiction’s plans, policies, programs, staff, funding and other resources they have in place in support of hazard mitigation.

## 5.2 Mitigation Goals

In Section 4 of this plan, the risk assessment identified St. Louis County as prone to a number of natural hazards. The steering committee members understand that although hazards cannot be eliminated altogether, St. Louis County can work toward building disaster-resistant communities.

The goals and strategies developed for the 2019 Minnesota State Hazard Mitigation Plan for natural hazards were adopted for use in the St. Louis County Plan (Table 32). This framework will allow for integration of the mitigation actions that are listed by St. Louis County and its jurisdictions into the state plan. The state will then be able to develop a statewide strategy that will benefit all of Minnesota.

*Table 32. Goals from the 2019 Minnesota State Hazard Mitigation Plan*

<b>Flooding Goal:</b> Reduce deaths, injuries, property loss and economic disruption due to all types of flooding (riverine, flash, coastal, dam/levee failure).
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<b>Wildfire Goal:</b> Reduce deaths, injuries, property loss, natural resource and economic disruption due to wildfires (forest, prairie, grass, and peat bogs).
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<b>Windstorms Goal:</b> Reduce deaths, injuries, property loss, and economic disruption due to windstorms.
<b>Hail Goal:</b> Reduce deaths, injuries, property damage, and economic disruption due to hailstorms.
<b>Winter Storms Goal:</b> Reduce deaths, injuries, property loss, and economic disruption due to winter storms (blizzard, ice, and ice storm).
<b>Lightning Goal:</b> Reduce deaths, injuries, property losses, loss of services, and economic disruption due to lightning.
<b>Tornado Goal:</b> Reduce deaths, injuries, property loss, and economic disruption due to tornadoes.
<b>Drought Goal:</b> Reduce economic loss and environmental impacts due to drought.
<b>Extreme Heat Goal:</b> Reduce deaths, injuries, and economic disruption due to extreme heat.
<b>Extreme Cold Goal:</b> Reduce deaths, injuries, and economic disruption due to extreme cold.
<b>Dam/Levee Failure Goal:</b> Reduce deaths, injuries, property loss, natural resource and economic disruption due to dam/levee failure.
<b>Erosion/Landslide/Mudslide Goal:</b> Reduce deaths, injuries, property loss, and economic disruption due to hillside, coastal, bluff: caused primarily by oversaturation of soil.

### 5.3 Mitigation Action and Project Strategies

The mitigation actions in this plan are summarized into four main strategy types, as described in the FEMA publications *Local Mitigation Planning Handbook* (2013) and *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards* (2013). Also included are the new FEMA Climate Resilient Mitigation Actions (CRMA) released in 2016. Minnesota HSEM recommends the use of these mitigation strategies to be in alignment with the state plan and those recommended by FEMA. A fifth strategy type was determined by Minnesota HSEM for use within the state. They are listed in Table 33 below:

Table 33. Mitigation Strategies and Action Types

Mitigation Strategy	Description	Example Mitigation Actions
Local Planning and Regulations	These actions include government authorities, policies, or codes, that influence the way land and buildings are developed and built.	<ul style="list-style-type: none"> <li>• Comprehensive plans</li> <li>• Land use ordinances</li> <li>• Planning and zoning</li> <li>• Building codes and enforcement</li> <li>• Floodplain ordinances</li> <li>• NFIP Community Rating System</li> <li>• Capital improvement programs</li> <li>• Open space preservation</li> <li>• Shoreline codes</li> <li>• Stormwater management regulations and master plans</li> </ul>

Mitigation Strategy	Description	Example Mitigation Actions
Structure and Infrastructure Projects	<p>These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure.</p> <p>This type of action also involves projects to construct manmade structures to reduce the impact of hazards.</p> <p>Many of these types of actions are projects eligible for funding through the FEMA Hazard Mitigation Assistance program.</p>	<ul style="list-style-type: none"> <li>• Acquisitions and elevations of structures in flood prone areas</li> <li>• Utility undergrounding</li> <li>• Structural retrofits</li> <li>• Floodwalls and retaining walls</li> <li>• Detention and retention structures</li> <li>• Culverts</li> <li>• Safe rooms</li> </ul>
Natural Systems Protection	These are actions that minimize damage and losses and also preserve or restore the functions of natural systems.	<ul style="list-style-type: none"> <li>• Sediment and erosion control</li> <li>• Stream corridor restoration</li> <li>• Forest management</li> <li>• Conservation easements</li> <li>• Wetland restoration and preservation</li> </ul>
Education and Awareness Programs	These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. These actions may also include participation in national programs, such as StormReady or Firewise Communities. Although this type of mitigation reduces risk less directly than structural projects or regulation, it is an important foundation. A greater understanding and awareness of hazards and risk among local officials, stakeholders, and the public is more likely to lead to direct actions.	<ul style="list-style-type: none"> <li>• Radio or television spots</li> <li>• Websites with maps and information</li> <li>• Real estate disclosure</li> <li>• Presentations to school groups or neighborhood organizations</li> <li>• Mailings to residents in hazard-prone areas.</li> <li>• StormReady</li> <li>• Firewise Communities</li> </ul>
Mitigation Preparedness and Response Support	This is a State of Minnesota mitigation strategy with the intent of covering preparation and actions that protect life and property during a natural disaster.	<ul style="list-style-type: none"> <li>• Emergency operations plan</li> <li>• Flood fight plans and preparedness</li> <li>• Dam emergency action plans</li> <li>• Warning</li> <li>• Backup power</li> <li>• Emergency capabilities</li> </ul>

In the review and discussion of selected mitigation strategies and actions, steering committee members and the public were asked to consider the ranking of mitigation actions by priority for implementation. Table 34 provides criteria that were taken into consideration in the process.

### 5.3.1 Hazard Mitigation Actions

St. Louis County and its included municipalities share a common Multi-Hazard Mitigation Plan and worked closely to develop it. Local leaders work together with the St. Louis County Emergency Management Coordinator to assure that the hazards and mitigation actions included in this plan are accurate and addressed in their jurisdictions.

The St. Louis County mitigation action chart is provided in Table 35. The St. Louis County risks and mitigation activities identified in Table 35 also incorporate the concerns and needs of townships and other entities participating in this plan. Appendix G contains the jurisdictional mitigation action charts for the cities of Aurora, Babbitt, Biwabik, Brookston, Buhl, Chisholm, Cook, Duluth, Ely, Eveleth, Floodwood, Gilbert, Hermantown, Hibbing, Hoyt Lakes, Iron Junction, Kinney, Leonidas, McKinley, Meadowlands, Mountain Iron, Orr, Proctor, Rice Lake, Tower, Virginia and Winton.

Following is an overview the mitigation action charts and description of each element of the chart (columns A-K).

#### **Column A – Numbered Item**

Each mitigation action is identified by a number.

#### **Column B – Hazard**

Each mitigation action is identified by the hazard that it relates to. Actions that fall under “All-Hazards” relate to both natural and non-natural hazards. Other actions are specific to the natural hazards addressed in Section 4.3, Hazard Profiles.

#### **Column C – Mitigation Strategy**

Each mitigation action is identified by one of the following five mitigation strategies.

- Local Planning and Regulations
- Structure and Infrastructure Projects
- Natural Systems Protection
- Education and Awareness Programs
- Mitigation Preparedness and Response Support

See Section 5.3 and Table 33 for a description of each mitigation strategy and related types of actions.

#### **Column D – Mitigation Action**

Each mitigation action provides a concise, action-oriented description of the action or project to be undertaken.

#### **Column E - Reduces Risk to New / Existing Buildings or Infrastructure**

Each mitigation action identifies if the activity reduces risk to new or existing buildings and infrastructure. This element of the chart ensures jurisdictions include consideration of actions that address the built environment.

### Column F – Status

Each mitigation action identifies the status of implementation. Status categories include:

- New – New actions that have been identified since the last plan.
- Ongoing – Actions from the last plan that require continuing application.
- In Progress – Actions from the last plan that are currently being acted upon.

Mitigation actions that have been completed or deleted from the 2013 St. Louis County Multi Hazard Mitigation Plan are identified and reported on in Appendix H. Completed and deleted mitigation actions are not carried over into the updated mitigation action chart.

### Column G – Priority

Each mitigation action identifies the jurisdiction’s priority ranking for implementation of the action. See Table 34.

*Table 34. Criteria for Mitigation Action Priority Ranking*

Ranking	Criteria
High Priority	<ul style="list-style-type: none"> <li>• Methods for reducing risk from the hazard are technically reliable.</li> <li>• The county has experience in implementing mitigation measures.</li> <li>• Mitigation measures are eligible under federal grant programs.</li> <li>• There are multiple mitigation measures for the hazard.</li> <li>• The mitigation measure(s) are known to be cost effective.</li> <li>• The mitigation measures protect lives and property for a long period of time, or are permanent risk reduction solutions.</li> </ul>
Moderate Priority	<ul style="list-style-type: none"> <li>• Mitigation methods are established.</li> <li>• The county has limited experience with the kinds of measures that may be appropriate to mitigate the hazard.</li> <li>• Some mitigation measures are eligible for federal grants.</li> <li>• There is a limited range of effective mitigation measures for the hazard.</li> <li>• Mitigation measures are cost-effective only in limited circumstances.</li> <li>• Mitigation measures are effective for a reasonable period of time.</li> </ul>
Low Priority	<ul style="list-style-type: none"> <li>• Methods for reducing risk from the hazard are not well-established, are not proven reliable, or are experimental.</li> <li>• The State or Counties have little or no experience in implementing mitigation measures, and/or no technical knowledge of them.</li> <li>• Mitigation measures are ineligible under federal grant programs.</li> <li>• There is a very limited range of mitigation measures for the hazard, usually only one feasible alternative.</li> <li>• The mitigation measure(s) have not been proven cost effective and are likely to be very expensive compared to the magnitude of the hazard.</li> <li>• The long-term effectiveness of the measure is not known, or is known to be relatively poor.</li> </ul>

### Column H – Expected Timeframe

Each mitigation action identifies the anticipated timeframe for implementation of the action. Most mitigation actions fall within the next 5-year planning cycle. Actions that have a specific timeframe are noted.

**Column I – Responsible Party**

Each mitigation action identifies what personnel, department or agency will be lead for the administration or implementation of the action.

**Column J - Comments on Implementation, Administration & Integration into Local Planning Mechanisms**

Each mitigation action provides a description of how the jurisdiction will work to incorporate the mitigation activity into other existing planning mechanisms, such as Capital Improvement Plans, ordinance enforcement, public outreach measures or partnership coordination.

**Column K – Possible Funding**

Each mitigation action identifies where potential funding may come from to support implementation of the mitigation activity, such as existing county or city funding, state or federal funding. Projects that may be eligible for future FEMA Hazard Mitigation Assistance grant funding are noted.

Table 35. St. Louis County Mitigation Action Chart (2020-2025)

St. Louis County Mitigation Action Chart										
A	B	C	D	E	F	G	H	I	J	K
#	Hazard	Mitigation Strategy	Mitigation Action	Reduces Risk to New/Existing Buildings or Infrastructure	Status	Priority	Expected Time-frame	Responsible Party	Comments on Implementation, Administration & Integration into Local Planning Mechanisms	Possible Funding
1	All-Hazards	Education & Awareness Programs	<b>NORTHLAND ALERT</b> Conduct public outreach to increase public awareness of the county's "Northland Alert" emergency notification system and to sign up for it online.	n/a	New	High	2020-2025	SLC Emergency Mgmt. in cord. with local City & Twp. Govt's	SLC utilizes the Everbridge Emergency Notification system, termed "Northland Alert." The system is administered by SLC Emergency Management. Public outreach is done via the SLC Facebook page and County website. Additional means of conducting public outreach are conducted such news releases to local media across the county.	County funding, MLSCP funding
2	All-Hazards	Mitigation Preparedness & Response Support	<b>SHELTER FACILITIES</b> Work with the American Red Cross to increase the amount of shelter facilities with MOU's in the county.	n/a	Ongoing	Mod.	2020-2025	SLC Public Health Dept.	SLC Public Health is currently working with the American Red Cross on this effort. In the event of an incident that requires temporary evacuation or sheltering, the Red Cross will determine what shelters to use and SLC PH will open and run them.	County funding
3	All-Hazards	Mitigation Preparedness & Response Support	<b>EOP UPDATES</b> Update the SLC County Emergency Operations Plan (EOP) to ensure it adequately details the needed steps to respond to all potential hazards.	n/a	Ongoing	High	2020-2025	SLC Emergency Mgmt.	SLC Emergency Mgmt. maintains an updated EOP to meet MN HSEM MN WALK Requirements for EOP updates. The EOP undergoes an annual cyclical review process that includes reviews by the SLC County Board, HSEM and peer Emergency Managers from HSEM Region 2.	County funding



St. Louis County Mitigation Action Chart										
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#	Hazard	Mitigation Strategy	Mitigation Action	Reduces Risk to New/Existing Buildings or Infrastructure	Status	Priority	Expected Time-frame	Responsible Party	Comments on Implementation, Administration & Integration into Local Planning Mechanisms	Possible Funding
4	Severe Winter & Summer Storms	Mitigation Preparedness & Response Support	<b>GENERATOR BACKUP POWER</b> Identify St. Louis County critical buildings and services that do not have adequate backup power and obtain appropriate generators to install at those locations.	n/a	<b>New</b>	High	2020-2025	SLC Public Works and Property Mgmt. Dept.	SLC Property Mgmt. Dept. maintains an inventory of what county facilities have backup power and is currently evaluating what facilities do not have generator backup power. The county will work to purchase and install either permanent or portable generators based on a case-by-case basis.	County funding, FEMA HMA grant funding
5	Severe Winter & Summer Storms	Education & Awareness Programs	<b>PUBLIC EDUCATION &amp; AWARENESS</b> Provide education and awareness to local residents and visitors on severe winter, spring and summer storms and promote personal and family emergency preparedness.	n/a	Ongoing	High	2020-2025	SLC Emergency Mgmt.	SLC Emergency Management participates in the NWS "Winter Hazard Awareness Week" held in November each year and the "Severe Weather Awareness Week" held in April each year. Information is shared with the public via the County Facebook page and also via local news sources. Cities and townships are encouraged to share the information locally via their own communication channels. Residents are encouraged to be prepared for extended power outages due to severe storm events with their own backup power, food, water and other emergency supplies.	County funding, MLSCP funding

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6	Severe Winter & Summer Storms	Mitigation Preparedness & Response Support	<b>NOAA WEATHER RADIOS</b> Promote placement of severe weather radios in schools and county buildings and encourage use by local residents.	n/a	Ongoing	Mod.	2020-2025	SLC Emergency Mgmt.	SLC Emergency Management promotes the use of NOAA weather radios by critical facilities and the public to receive information broadcast from the National Weather Service. The County website, Facebook page and local newspaper and radio stations assist to promote this information.	County funding
7	Severe Winter & Summer Storms	Structure & Infrastructure Projects	<b>POWER LINE FAILURE</b> Work with rural & municipal electrical coops in the County to identify and implement projects to bury or strengthen power lines to mitigate against power failure.	Yes (Power System Infrastructure)	New	High	2020-2025	SLC Public Works Dept. in cord. with rural & municipal electric providers (i.e., Lake Country Power, North Star Electric Coop)	SLC Public Works involvement with this is permitting for work in the road ROW. Rural & municipal electrical providers work to identify and implement measures for the loss of power outages in their service areas. Examples from Lake Country Power and North Star Electric Cooperative include increasing the size of poles to better survive severe storm events; rebuilding aged overhead lines and utilizing underground when advantageous to overhead; developing long-range plans, and annually inspecting all lines & poles for necessary maintenance.	Rural or Municipal Coop funding, FEMA HMA Grant funding

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8	Severe Summer Storms / Tornado	Mitigation Preparedness & Response Support	<b>SKYWARN TRAINING</b> Work with the National Weather Service to offer SKYWARN training to first responders and the public across the county to have a system of trained storm spotters in place.	n/a	Ongoing	Mod.	2020-2025	SLC Emergency Mgmt. in cord. with NWS	This is an ongoing effort of the SLC Emergency Mgmt. program. On an annual basis we work with the NWS to schedule and promote SKYWARN trainings with First Responders and the public.	County, funding, NWS funding
9	Severe Summer Storms / Tornado	Mitigation Preparedness & Response Support	<b>WARNING SIRENS</b> Work with cities that own warning sirens to ensure their functionality.	n/a	Ongoing	Mod.	2020-2025	SLC Emergency Mgmt. in cord. with City EM's	SLC Emergency Management keeps track of where all warning sirens are located in the county and encourages the departments that maintain them to keep up with regular testing and maintenance. All sirens are owned by the cities where they are located. During dangerous high wind or tornado events the SLC 9-1-1 Center activates sirens for cities who have them, so ensuring functionality of all sirens is of importance to SLC.	Municipal funding

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10	Severe Summer Storms / Tornado	Structure & Infrastructure Projects	<b>STORM SHELTERS / SAFE ROOMS</b> Provide technical support to municipalities within the County that may need assistance in the construction or retrofit of storm shelter facilities or tornado safe rooms.	n/a	New	High	2020-2025	SLC Emergency Mgmt. in cord. with municipal gov'ts and other partners	SLC Emergency Management will seek to provide assistance to townships or cities if they request assistance to apply for a FEMA HMA grant for a tornado safe room under the umbrella of the County. Responsibility for such projects will fall under each city or township. There are other governmental subdivisions in St. Louis County that have park systems, including the MN DNR and the City of Duluth. The County will collaborate as needed on any safe room projects pursued by those entities.	FEMA HMA Grant funding, Other funding TBD
11	Extreme Temps	Mitigation Preparedness & Response Support	<b>EXTREME TEMPS OUTREACH</b> Expand information and delivery methods on the risks of extreme heat and extreme cold to county residents, especially the elderly and people who participate in physically strenuous activities.	n/a	Ongoing	High	2020-2025	SLC Emergency Mgmt. in cord. with SLC PH Dept.	During periods of extreme temps SLC Emergency Mgmt. and SLC Public Health work to inform the public on dangerous conditions due to heat/cold, in particular to the elderly or to youth. SLC Emergency Mgmt. will continue to refine and develop products to convey to the public during these incidents through channels such as SLC Facebook and local media sources. We are also working on the new tools at hand to accomplish this such as use of Everbridge.	County funding

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12	Wildland Fire	Local Planning & Regulations	<b>WOODY DEBRIS PILES</b> Work with local governments, MN DNR, Tribal & County partners to increase the number of disposal sites for woody debris removed by land owners, and assist in maintaining and elimination of these piles.	Yes ( <i>New and Existing Buildings</i> )	<b>New</b>	High	2020-2025	SLC Firewise Coordinator in cord with local gov'ts, MN DNR, USFS, tribal and county partners	Through collaborative planning efforts with partner agencies, the FW Coordinator will work to increase the number of disposal sites, create proper signage, install gates where appropriate and maintain consistent hours of operation. Planning efforts will include ways of monitoring piles and eliminating piles through mutual operation agreements with partners. SLC Public Works and Land Departments can provide locations such as gravel pits where property owners can bring downed trees. Note there is an associated cost for the county to grind and remove the trees. In 2016 FEMA reimbursed SLC for some of these costs.	Mutual Operations Agreements with Partners. Possible FEMA HMA grant funding

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13	Wildland Fire	Local Planning & Regulations	<b>HAZARDOUS TREE/WOODY DEBRIS REMOVAL</b> Provide assistance to land owners and local governments with removal of downed trees after a blow-down event, as well as removal of trees killed by insects in order to protect the defensible space zone around structures.	Yes (Existing Buildings)	New	High	2020-2025	SLC Firewise Coordinator in cord with local gov'ts, MN DNR, USFS, tribal and county partners	This is an effort that falls under the St. Louis County Firewise Coordinator, in coordination with local governments, MN DNR, U.S. Forest Service, Tribal and County partners. The issue of downed and insect-killed trees is an increasing and ongoing problem throughout the County and poses a severe wildfire risk. Under the SLC Firewise Program we will work to develop a strategic plan and sustainable way to remove and dispose of these hazardous fuels. This process will need to include all agencies, local governments and private landowners.	County funding, MN DNR, USFS, Tribal & Local Gov'ts, Private Lake / Road Associations
14	Wildland Fire	Local Planning & Regulations	<b>CWPP PLANNING &amp; IMPLEMENTATION</b> Monitor and update the St. Louis County Community Wildfire Protection Plan (CWPP) for the implementation of priority wildfire risk-reduction activities, such as hazardous fuels reduction treatments.	Yes (Existing Buildings)	Ongoing	High	2020-2025	SLC Firewise Coordinator	The last St. Louis County CWPP was updated in 2013 and is currently undergoing a new update under the County's new Firewise Coordinator (completion by early 2020). The CWPP identifies and prioritizes high risk areas within the County for hazardous fuels reduction treatments and additional mitigation measures. The FW Coordinator and FW Committee are responsible for the monitoring and update of the CWPP on an annual basis, as well as the tracking and implementation of projects.	County funding, USFS Stevens Grant, MNDNR Firewise Grant



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15	Wildland Fire	Education & Awareness Programs	<b>FIREWISE OUTREACH &amp; EDUCATION</b> Continue to build and maintain the St. Louis County Firewise program in collaboration with communities and key partners.	Yes (Existing Buildings)	Ongoing	High	2020-2025	SLC Firewise Coordinator	St. Louis County participates in the MN DNR Firewise Program through the program & project activities of the SLC Firewise Coordinator. Examples include conducting Level-1 & Level II Firewise Assessments on private properties, organizing Chipper Days and other public outreach events. Work is done in partnership with key agencies such as the MN DNR, U.S. Forest Service and groups such as area community groups (i.e. lake & road associations).	County funding, USFS Stevens Grant, MNDNR Firewise Grant
16	Wildland Fire	Local Planning & Regulations	<b>NEW DEVELOPMENT: INGRESS/EGRESS PLANNING</b> Promote all new and existing development in rural areas to have adequate access and egress for emergency response vehicles.	Yes (New & Existing Buildings)	Ongoing	High	2020-2025	SLC Planning & Community Development Dept.	This is part of the St. Louis County Subdivision Ordinance #60 and Comprehensive Plan (Ordinance #65), adopted January 22, 2019.	County funding
17	Wildland Fire	Education & Awareness Programs	<b>HOMEOWNER OUTREACH &amp; ASSISTANCE</b> Provide targeted wildfire mitigation information, training, and assistance to homeowners in high-risk WUI areas to increase defensible space and reduce fuels around structures.	Yes (Existing Buildings)	Ongoing	High	2020-2025	SLC Firewise Coordinator	These efforts are under the program direction of the SLC Firewise Coordinator to carry out and report on to the SLC Emergency Management Coordinator and SLC CWPP Committee.	County funding, FEMA HMA Grant funding

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18	Wildland Fire	Structure & Infrastructure Projects	<b>STRUCTURE PROTECTION (NEW DEVELOPMENT OR RETROFITS)</b> Promote the use of building materials (i.e., metal roofs, external wildfire sprinkler systems) in new development or retrofit projects for properties located in high-risk WUI areas that can reduce the chance of property damages from wildfire.	Yes (Existing Buildings)	Ongoing	High	2020-2025	SLC Firewise Coordinator in cord. with SLC Emergency Mgmt.	SLC Firewise actively promotes fire-safe building materials to homeowners. From approximately 2012-2014 SLC Emergency Management worked with property owners on the installation of external wildfire sprinkler systems in high-risk wildfire areas with the help of a FEMA HMA grant. Future sprinkler grants or metal roof grant programs may be pursued in the future based on wildfire activity and need in the next 5 years.	County funding, FEMA HMA grant funding, MN DNR Firewise grant funding
19	Wildland Fire	Natural Systems Protection	<b>RAIL CORRIDOR VEGETATION MANAGEMENT</b> Work with the rail companies that operate trains through St. Louis County (CN, CP and BNSF) to reduce risk of rail-induced grassfires that can spread to become large acreage fires.	Yes (New & Existing Buildings)	Ongoing	High	2020-2025	SLC Emergency Mgmt.	St. Louis County Emergency Management will continue to encourage railway companies to plan for and implement vegetation management programs within the railway right-of-way. It is the responsibility of the respective railway companies to manage vegetation within the railway corridor to reduce risk to wildland fire, but this is largely still an issue.	Railway Company
20	Flood	Local Planning & Regulations	<b>NATIONAL FLOOD INSURANCE PROGRAM</b> Administer and enforce St. Louis County's participation in the National Flood Insurance Program (NFIP).	Yes (NFIP Enforcement)	Ongoing	High	2020-2025	SLC Planning & Community Development Dept.	St. Louis County participates and enforces the regulations of the NFIP. The program is administered by the SLC Planning & Community Development Dept.	County funding

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21	Flood	Structure & Infrastructure Projects	<b>CULVERT MAPPING</b> Complete development of an accurate GIS inventory of all roadway hydraulic structures (culverts, storm sewers, bridges) to 1) Support program for assessment of structure conditions to ensure good condition and hydraulic capacity; 2) Support watershed level system analysis; and 3) Support active monitoring of structures during a flooding disaster.	Yes (Transportation Infrastructure)	New	High	2020-2025	SLC Public Works Dept. in cord. with City and Twp. Gov'ts.	The SLC Public Works Dept. coordinates a transportation plan with MnDOT and local communities. Continued culvert replacement is needed to prevent road flooding. This is a strain on our smaller townships that have limited funding for road infrastructure.	County funding
22	Flood	Structure & Infrastructure Projects	<b>SURFACE WATER RUNOFF MANAGEMENT</b> Control runoff in identified areas where additional runoff sources contribute to downstream flooding to roads or structures.	Yes (Transportation Infrastructure)	New	High	2020-2025	SLC Public Works Dept. in cord. with City and Twp. Gov'ts.	Implementation of this activity will fall under the directive of SLC Public Works Dept. and guidance in the St. Louis County Water Plan. The plan addresses ground and surface water, public water supply and wastewater management. The current plan is good until 2020.	County funding, FEMA HMA Grant funding, Watershed Planning & Implementation grants

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23	Flood	Local Planning & Regulations	<b>STORMWATER MANAGEMENT GUIDELINES</b> Ensure that current SLC storm water management guidelines are adequate to limit post development run-off and will not result in storm water run-off created flood damages.	Yes ( <i>New/Existing Buildings or Infrastructure</i> )	Ongoing	High	2020-2025	SLC Planning & Community Development Dept. in cord. with City and Twp Gov'ts.	The SLC Planning & Community Development Dept. will continue to apply stormwater management guidelines. This is part of Comp Plan Ordinance 65 and Zoning Ordinance 62.	County funding
24	Flood	Structure & Infrastructure Projects	<b>TRANSPORTATION INFRASTRUCTURE</b> Maintain bridge, road, and culvert infrastructure at a level that is capable of sustaining a major storm event and will not be vulnerable to washouts. Identify and address measures for transportation infrastructure impacted by heavy rain events using system analysis including the use of GIS and hydraulic modeling to inform design.	Yes ( <i>Transportation Infrastructure</i> )	Ongoing	High	2020-2025	SLC Public Works Dept. in cord with MnDOT, City & Twp. Gov'ts	The St. Louis County Public Works Department coordinates a transportation plan with MnDOT and local communities on an annual basis to maintain and improve existing infrastructure as well as to identify and address new flood damaged areas that require mitigation measures.	County funding, FEMA HMA grant funding, other State funding programs (TBD)

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25	Flood	Local Planning & Regulations	<b>ICE DAMS &amp; BEAVER DAM MANAGEMENT</b> Address ice dams that may impact the road system in a timely manner in order to prevent damage to infrastructure and over-the-road flooding, in particular during the spring thaw. Also monitor and address beaver dams adjacent to roads that may cause localized flooding.	Yes ( <i>Transportation Infrastructure</i> )	Ongoing	High	2020-2025	SLC Hwy. Dept. in cord. with City & Twp. Gov't's.	This is an annual part of the SLC Highway Dept. work plan for roads maintenance and safety of county-owned roads. Public Works needs additional equipment to de-ice culverts and implement new technology. Activities may also include replacing culverts that are frequent problem locations. Beaver dams are addressed on an as-needed basis by the County Hwy. Dept.	County funding
26	Flood	Local Planning & Regulations	<b>NEW DEVELOPMENT</b> Steer development away from areas that may be difficult to serve with reliable road access.	n/a	Ongoing	Mod.	2020-2025	SLC Planning & Community Development Dept. in cord. with City & Twp. Gov'ts	This is included in the Ordinance 65, Comp Land Use Plan, Zoning Ordinance 62 and Subdivision Ordinance 60.	County funding
27	Flood	Local Planning & Regulations	<b>FLOODPLAIN ORDINANCE</b> Administer and enforce the County's Floodplain Ordinance.	Yes ( <i>New Development</i> )	Ongoing	Mod.	2020-2025	SLC Planning & Community Development Dept.	The SLC Planning & Community Development Dept. does floodplain checks on all permits and administers the County's Floodplain Ordinance #43.	County funding

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28	Flood	Local Planning & Regulations	<b>COMMUNITY ASSISTANCE</b> Work with cities and townships within the County to identify flood mitigation solutions for high-risk areas.	Yes ( <i>New/Existing Buildings</i> )	Ongoing	High	2020-2025	SLC Planning & Community Development Dept., SLC Public Works, & SLC Emergency Management Mgmt.	This is an ongoing programmatic effort of the SLC Planning & Community Development Dept., SLC Public Works and SLC Emergency Management Dept. A current example is working in partnership with the City of Duluth to address coastal flood erosion issues to the downtown Lakewalk and the shoreline of Park Point.	County funding
29	Flood	Local Planning & Regulations	<b>HOMES IN FLOODPLAIN (BUYOUTS)</b> Identify and acquire repetitive flood properties through a buyout process and convert them to open space.	Yes ( <i>Property Buyouts</i> )	Ongoing	High	2020-2025	SLC Planning & Development Dept.	The MN DNR Floodplain Manager reports that there are 2 repetitive loss properties in unincorporated areas of St. Louis County, as well as repetitive loss properties in 3 other cities (Floodwood, Proctor and Duluth). If in the future there are willing sellers for the properties, St. Louis County Planning Dept. will work with the MN DNR to evaluate working with them to sell or encouraging the cities where they are located to do so for buyouts.	County funding, FEMA HMA grant funding, MLSCP funding
30	Flood	Structure & Infrastructure Projects	<b>DRAINAGE DITCH MAINTENANCE</b> Work with right of way owners to address ditch and drainage maintenance concerns.	Yes ( <i>Transportation Infrastructure</i> )	Ongoing	Mod.	2020-2025	SLC Hwy. Dept.	This is a regular maintenance effort by the SLC Public Works Dept. in maintaining the County roads system.	County funding



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31	Flood/ Erosion	Local Planning & Regulations	<b>SHORELAND MANAGEMENT</b> Maintain and facilitate an effective zoning process for shoreland management and enforce all shoreland management standards.	Yes ( <i>New Development</i> )	Ongoing	Mod.	2020-2025	SLC Planning & Community Development Dept.	Shoreland Management is addressed under St. Louis County Zoning Ordinance 62 and enforced by the SLC Planning & Community Development Department.	County funding
32	Flood/ Erosion	Natural Systems Protection	<b>SHORELINE STABILIZATION</b> Repair, restore and stabilize shorelines of streams, rivers and lakes that experience damaging erosion from heavy rain and flood events.	n/a	<b>New</b>	High	2020-2025	SLC North and South SWCDs	The SWCDs assisted with restoration efforts following the 2012 flood. However, without special funding the SWCDs cannot do such restoration work, as the cost-share programs are limited. FEMA HMA grants would be one funding mechanism to support the SWCD's to assist with specific regional projects as identified by municipalities.	FEMA HMA grant funding, MN DNR Flood Hazard grant program, MLSCP funding
33	Erosion / Land Subsidence	Natural Systems Protection	<b>HILLSIDE STABILIZATION</b> Address existing hillside slumping/slide sites that have the potential to impact road and bridge infrastructure to stabilize and reduce chance of failure.	Yes ( <i>Transportation Infrastructure</i> )	<b>New</b>	High	2020-2025	SLC Public Works Dept. in cord with MnDOT, SWCDs, and City & Twp Gov'ts	It is estimated that there are roughly 20 locations throughout SLC impacting county roads. One option is to map known problem sites using GIS, soil maps and other resources to develop a future vulnerability analysis as Winona County did. SLC Public Works will work with key partners to inventory sites, study mitigation alternatives, prioritize measures and then implement stabilization efforts.	County funding, MnDOT, FEMA HMA grant funding, MLSCP funding

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34	Coastal Erosion	Local Planning & Regulations / Natural Systems Protection	<b>LAKE SUPERIOR COASTAL EROSION RESILIENCY</b> Work with key partner agencies and the City of Duluth on planning & project efforts that reduce future coastal erosion damages from Lake Superior storms and addresses current coastal erosion issues threatening infrastructure.	Yes (Coastal Infrastructure)	New	High	2020-2025	SLC Emergency Mgmt. in cord. with City of Duluth, MN DNR & SLC South SWCD	The City of Duluth is lead on this efforts and St. Louis County is a partner in a two-part effort. Part 1: The city of Duluth will first be proposing a FEMA HMA grant application to conduct an assessment study of Lake Superior coastal areas in all of SLC, including a vulnerability assessment and cost benefit analysis. Part 2 is implementation of the approved grant and actions identified.	County funding, MLSCP funding, SWCD Cost Share funding, other State funding programs
35	Dam Failure	Local Planning & Regulations	<b>UPPER STONE LAKE DAM EVACUATION &amp; RESPONSE PLAN</b> Work with the MN DNR Dam Safety Dept. to develop an Evacuation and Response Plan for the Upper Stone Lake Dam.	n/a	New	High	2020-2025	SLC Emergency Mgmt. in cord. with MN DNR Dam Safety Program	St. Louis County Emergency Management will be the lead County department to develop and implement an evacuation & response plan should the dam breach. The MN DNR Dam Safety Program classifies the Stone Lake Dam as a Class II - Significant Hazard Dam. Class 2 dams are not required to have an Emergency Action Plan (EAP) but the MN DNR encourages owners to adopt one. The structure is inspected by the MN DNR Dam Safety Dept. every 4 years with maintenance recommendations sent to the county as a report. Periodic maintenance is also done by SLC Land & Minerals Dept.	County funding

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36	Dam Failure	Mitigation Preparedness & Response Support	<b>EMERGENCY NOTIFICATION IMPROVEMENTS</b> Plan for the effective use of Everbridge to notify residents who live downstream of a dam in the event of dam failure.	n/a	<b>New</b>	High	2020-2025	SLC Emergency Mgmt. in cord. with MN Power	SLC Emergency Management works with Minnesota Power on notification for all residents that could be affected by dam failure. The SLC Everbridge system has a communications group built for each area that could be affected by dam failure. The notification process is tested annually.	County funding

The mitigation activities listed in the **St. Louis County Mitigation Action Chart** were identified for inclusion in the county's 2020 Multi-Hazard Mitigation Plan Update through county staff participation in the planning process and mitigation action chart development. Mitigation activities are based upon existing mitigation efforts that are incorporated into county planning mechanisms and determination of new, cost-effective and sustainable activities that will support long-term risk reduction to the people, property and environment of St. Louis County.

### 5.3.2 Mitigation Actions by Community

This plan is a multi-jurisdictional plan that covers St. Louis County, its school districts and the cities of Aurora, Babbitt, Biwabik, Brookston, Buhl, Chisholm, Cook, Duluth, Ely, Eveleth, Floodwood, Gilbert, Hermantown, Hibbing, Hoyt Lakes, Iron Junction, Kinney, Leonidas, McKinley, Meadowlands, Mountain Iron, Orr, Proctor, Rice Lake, Tower, Virginia and Winton.

Steering committee members, elected government officials and staff from each city jurisdiction actively participated in the development of mitigation action charts for implementation over the next five-years (2020-2025). Identification of local mitigation actions were informed by a community's known high-risk hazards, vulnerabilities and capabilities for mitigation (i.e., policies, programs, staff, funding or other resources).

The following representatives provided review and input to mitigation actions to be included in their respective draft Mitigation Action Chart (MAC) as part of the St. Louis County 2020 MHMP Update.

Table 36. Representatives that reviewed and provided input to Mitigation Action Charts

Name of Jurisdiction	MAC Reviewers
St. Louis County	<p><i>County Staff:</i>  Dewey Johnson, SLC EM Coordinator  R.C. Boheim, South St. Louis SWCD District Manager  Gloria Erickson, SLC Firewise Coordinator  <b>Jason Meyer</b>, SLC Deputy Land and Minerals Director  David Yapel, SLC GIS Manager  Jennifer Bourbonais, SLC Planning Department  Mark Weber, SLC Land Commissioner  Carol Andrews, SLC Public Works Envr. Project Manager  Jim Foldesi, SLC Public Works Director/Highway Engineer  Matt Hemmila, SLC Public Works, Deputy Director - Engineering  Brian Boder, SLC Public Works Deputy Director - Maintenance  Vic Lund, SLC Public Works Traffic Engineer</p> <p><i>Other Stakeholders:</i>  Derek Howe, Chief Operating Officer, Lake Country Power  Ann Ellis, General Manager, North Star Electric Cooperative</p>
City of Aurora	Becky Lammi, City Administrator
City of Babbitt	Cathy Bissonette, Clerk-Treasurer Tony Chamberlin, Fire Chief
City of Biwabik	Jeff Jacobson, City Administrator Dan Mackey, Fire Chief David Levelwind, Water Operator
City of Brookston	Gene Nelson, City Councilor
City of Buhl	Ryan Pervenzan, City Clerk/Treasurer Dianne Thronson, Finance Manager
City of Chisholm	Bill Manney, City Administrator Bob Brown, City Emergency Manager and City Fire Chief Mandy Galli, City Building Official and Safety Director Larry Folstad, City Public Works Supervisor

Name of Jurisdiction	MAC Reviewers
City of Cook	Theresa Martinson, Administrator/Clerk-Treasurer Dawn Kehoe, Office Assistant
City of Duluth	Shawn Krizaj, Fire Chief/Emergency Management Director Jim Filby Williams, Director of Public Administration Adam Fulton, Deputy Director of Planning & Economic Development Carrie Pederson, Chief Engineer of Transportation
City of Ely	Gloria Erickson, SLC Firewise Coordinator George Burger, Emergency Management Director Harold Langowski, Public Works Director Tom Erchul, Fire Chief
City of Eveleth	Jackie Monahan-Junek, City Administrator Jerry Rosati, Public Works Director Mark Karpen, Assistant Public Works Director Tim Koivunen, Police Chief / EM Director Jesse Linde, Deputy Police Chief Robert Vlaisavljevich, Mayor
City of Floodwood	Jess Rich, City Administrator
City of Gilbert	Ty Techar, Chief of Police James Paulsen, Interim City Clerk
City of Hermantown	Jim Crace, Chief of Police David Bolf, City Engineer
City of Hibbing	Jesse Story, City Engineer/Director of Public Works Erik Jankila, Fire Chief Mary Ann Kepler, City Clerk-Treasurer John Sporer, Public Works Superintendent
City of Hoyt Lakes	Rebecca Burich, City Clerk Tim Soular, East Range Police Chief/Emergency Manager
City of Iron Junction	Van Rioux, City Clerk-Treasurer Travis McDonald, Mayor
City of Kinney	Debra Bachel, City Clerk
City of Leonidas	Mary Beltezore, City Clerk Kyle Andrews, Mayor
City of McKinley	Michelle Tveit, City Clerk Tony Nygaard, Mayor
City of Meadowlands	John Stoessel, City Clerk Betsy Crabb, Mayor Mary Ann Durovec, Deputy Mayor/City Councilor Mike Josephson, City Councilor Donna Perkins, City Councilor Jamie Durovec, City Councilor Marge Dunder, City Treasurer Jesse Otten, Public Works Kathy Matvey, EMT/Ambulance
City of Mountain Iron	Craig Wainio, City Administrator/City EM
City of Orr	Cheri Carter, Clerk-Treasurer
City of Proctor	Mark Casey, City Administrator
City of Rice Lake	Toni Blomdahl, Clerk-Treasurer John Werner, Mayor
City of Tower	Victoria Ranua, City Clerk Treasurer

Name of Jurisdiction	MAC Reviewers
	Steve Altenburg, Fire Chief Tom Gorsma, Public Works Director
City of Virginia	Allen Lewis, Fire Chief Bill Hennis, City Engineer
City of Winton	Anne Jackson, City Clerk Kathy Brandau, Mayor Marlene Zorman, City Councilor Lee Tessier, Council Adam Masloski, Council

Mitigation actions are separated by jurisdiction in Appendix G.

## Section 6 – Plan Maintenance

### 6.1 Monitoring, Evaluation, and Updating the Plan

The St. Louis County Multi-Hazard Mitigation Plan (MHMP) should be considered a living document. The plan should be updated and approved by FEMA a minimum of every five years. The guidance in this section will function as the primary tool when reviewing progress on the implementation of the St. Louis County MHMP.

The St. Louis County Emergency Management Coordinator or their designee is the individual responsible for leading all efforts to monitor, evaluate, and update the hazard mitigation plan within the 5-year window. Since the last plan was updated in 2012, St. Louis County has made great efforts to increase the public's access to information, access to services and opportunities to offer feedback via our website. In 2018 the website was completely redesigned to be more user friendly, and is now also more easily accessed by mobile devices.

Throughout the next five-year planning cycle (2020-2025), St. Louis County Emergency Management will work to continue to engage jurisdictional stakeholders and the public in the monitoring, evaluation, and update of the mitigation efforts outlined in this plan. Our outreach will be done primarily through the use of our county website as well as through other outreach, as appropriate, such as local news media, social media, special events or in-person meetings.

The expansive geography of the county makes it challenging for local governments, residents and other stakeholders to attend meetings in person, and attendance has been consistently very low. Use of technology has become extremely common in all areas of life and business and we have embraced that fact. It is expected that, unless a face-to-face meeting is required, the trend towards using online services will continue, and will likely increase with residents, visitors, agencies, other local governments and businesses.

If there is a need for a face to face meeting due to new developments or a declared disaster occurring in the county, a meeting to update the public on pertinent mitigation strategies may be held. Depending on St. Louis County opportunities and fiscal resources, mitigation projects may be implemented independently by individual communities or through local partnerships in collaboration with St. Louis County.

Most of the mitigation actions outlined in this plan will be integrated into other existing planning mechanisms. Monitoring will include the record of how the actions have been implemented in the various jurisdictions via other planning tools.

St. Louis County will continue to review the MHMP goals and objectives to determine their relevance to changing situations in St. Louis County. In addition, state and federal policies will be reviewed to ensure they are addressing current and future/expected conditions. St. Louis County will also review the risk assessment portion of the plan to determine if this information should be updated or modified. The



parties responsible for the various implementation actions will report on the status of their projects, and will include which implementation processes worked well, any difficulties encountered, how coordination efforts are proceeding, and which strategies should be revised.

Updates or modifications to the MHMP during the five-year planning process will require a public notice and a meeting prior to submitting revisions to the individual jurisdictions for approval. The plan will be updated via written changes, submissions as the committee deems appropriate and necessary, and as approved by county commissioners.

Throughout the five-year window of the plan, each respective county department and jurisdiction will be required to report on the status of mitigation actions in their charts to the St. Louis County Emergency Management Coordinator so that progress notes may be maintained for the next plan update.

## 6.2 Implementation

St. Louis County and its included municipalities share a common Multi-Hazard Mitigation Plan and work together closely to develop, revise, and implement it. This MHMP provides a comprehensive chart of mitigation actions for St. Louis County and its jurisdictions (see Section 5.3.1, *Hazard Mitigation Actions*). The cities of Aurora, Babbitt, Biwabik, Brookston, Buhl, Chisholm, Cook, Duluth, Ely, Eveleth, Floodwood, Gilbert, Hermantown, Hibbing, Hoyt Lakes, Iron Junction, Kinney, Leonidas, McKinley, Meadowlands, Mountain Iron, Orr, Proctor, Rice Lake, Tower, Virginia and Winton participated in the MHMP planning process and identified the specific mitigation strategies that they would seek to implement in their communities during the 5-year planning cycle. These mitigation actions are provided in Section 5.3.

A number of implementation tools are available to address hazards. Many of these tools are below, however, in some cases additional discussion is needed in order to identify what strategies are most appropriate to use. This will be part of an ongoing discussion as St. Louis County looks for opportunities for plan implementation. The following tools will be considered:

**Education:** In many cases, education of residents has been identified as one of the most effective mitigation strategies.

**Capital Investments:** Capital investments such as fire and ambulance equipment, sprinkler systems and dry hydrants are tools that can limit risks and impacts of natural and man-made hazards.

**Data Collection and Needs Assessments:** Data collection and needs assessments can aid in gaining a better understanding of threats and allow planning for mitigation strategies accordingly. As resources are limited for this part of the planning process, additional data collection is likely to be an ongoing activity as resources become available.

**Coordination:** Responsibilities for mitigation strategies run across various county departments, local fire and ambulance departments, city and township governments, and a host of state and federal agencies. Ongoing coordination is an important tool to ensure resources are used efficiently.

Coordination can also avoid duplication of efforts or prevent gaps that are created because of unclear roles and responsibilities. The mitigation plan review process can function as a tool to have an ongoing discussion of roles, responsibilities, and opportunities for coordination.

**Regional Cooperation:** Counties and public safety services providers throughout the northeastern region of Minnesota often share similar challenges and concerns. In some cases, a regional approach may be warranted as a mitigation strategy in order to save resources. Mutual aid agreements are a tool already in use for a number of services. Needs assessments for fire and ambulance services and development of assistance for volunteer recruiting, training, and retention could benefit from a regional approach. Cooperation among counties could also help in lobbying for certain funding priorities that address concerns relating to challenges in service delivery in rural areas. Organizations such as FEMA Region V and the MN Department of HSEM through the Regional Program Coordinator can offer tools and resources to assist in these cooperative efforts.

**Regulation:** Regulation is an important mitigation tool for St. Louis County. Regulation plays a particularly important role for land use, access to structures and the protection of water resources and public health.

### 6.3 Continued Public Involvement

Continued public involvement is critical to the successful implementation of the Multi-Hazard Mitigation Plan (MHMP). The St. Louis County Emergency Management Coordinator and the St. Louis County Emergency LEPC members will continue to engage new public stakeholders in planning discussions and project implementation during the five-year cycle of this plan.

In order to seek continued public participation after the plan has been approved and during the five-year window of implementation for this plan, St. Louis County will take the following measures:

- The plan will be posted on the St. Louis County Emergency Management website for the public to read and provide feedback. Collected feedback will be reviewed and the plan will be amended as necessary.
- Following any major storms or natural disasters, St. Louis County Emergency Management will seek to gather concerns and new ideas for mitigation from local residents to include in the next update of the plan. This may be done through public meetings, outreach via social media (i.e., Sheriff's Office Facebook Page), or news releases via local media.
- Each community participating in the plan will be responsible to keep their local government, schools and community members updated and engaged in the implementation of their respective mitigation action charts (see *Appendix G: Mitigation Actions by Jurisdiction*). Each respective jurisdiction will be required to report on the status of mitigation actions in their charts to the St. Louis County Emergency Management Coordinator.
- Jurisdictions will use numerous means of public outreach to engage new public stakeholders in providing input on mitigation efforts or concerns on hazards by sharing information at city

council / township board meetings, sharing information at special events, working with local schools and partner organizations, and posting information on relevant local or social media that their communities use to inform and engage the public. As mitigation projects are implemented, jurisdictions will work to keep the public updated and engaged in those local efforts.