Minnesota State Hazard Mitigation Plan 2024

Including Recommended Actions for Climate Change Adaptation and Equity

Department of Public Safety | Division of Homeland Security and Emergency Management

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Minnesota State Hazard Mitigation Plan 2024

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Acronyms and Abbreviations

ACS	American Community Survey
ASCE	American Society of Civil Engineers
ADM	(Minnesota) Department of Administration
ARMER	Allied Radio Matrix for Emergency Response
ATSDR	Agency for Toxic Substances and Disease Registry (Centers for Disease Control)
BAH	(Minnesota) Board of Animal Health
BCA	Benefit–Cost Analysis
BIL	Bipartisan Infrastructure Law
BPS	(U.S. Census) Building Permit Survey
BRIC	Building Resilient Infrastructure and Communities
BWCAW	Boundary Waters Canoe Area Wilderness
BWSR	(Minnesota) Board of Water and Soil Resources
CAF	(Minnesota) Climate Action Framework
CCLD	Construction Codes and Licensing Division (MN DLI)
CDC	Centers for Disease Control
CEMHS	Center for Emergency Management and Homeland Security (Arizona State University)
CFM	Certified Flood Manager
CFR	Code of Federal Regulations
CI	Critical Infrastructure
CliMAT	Climate Mapping and Analysis Tool
CMI	Crop Moisture Index
CMIP6	Coupled Model Intercomparison Project Phase 6 (Climate Model)
COMM	Minnesota Department of Commerce
CRMA	Climate Resilient Mitigation Actions
CRS	Community Rating System
CRV	Current Replacement Value
DEED	Department of Employment and Economic Development
DEM	Digital Elevation Model
DFIRM	Digital Flood Insurance Rate Map
DHS	Department of Human Services
DLI	(Minnesota) Department of Labor and Industry
DMA	Disaster Mitigation Act
DOT	(U.S.) Department of Transportation
DPS	(Minnesota) Department of Public Safety
DRAP	Disaster Recovery Assistance Program
EAP	Emergency Action Plan
EAS	Emergency Alert System
EDA	(U.S.) Economic Development Administration
EM	Emergency Manager (usually Emergency Management Director)
EMS	Emergency Medical Service
EMPG	Emergency Management Performance Grants
EPA	Environmental Protection Agency

EPCRA	Emergency Planning and Community Right-to-Know Act
EQB	(Minnesota) Environmental Quality Bureau
ERP	Real Property Department (ADM)
FBI	Federal Bureau of Investigation
FCA	Facility Condition Assessment
FDR	Flood Damage Reduction
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FHM	(MN DNR) Flood Hazard Mitigation Assistance Program
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FMA	Flood Mitigation Act
FPA	Federal Power Act
FSA	Farm Services Administration
GIS	Geographic Information System
GLISA	Great Lakes Integrated Sciences + Assessments (Center)
HAN	(Minnesota Department of Health) Health Alert Network
HAZUS	HAZards US (FEMA software tool)
HHPD	High Hazard Potential Dam
HIFLD	Homeland Infrastructure Foundation Level Data
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
HSEM	(Minnesota) Homeland Security and Emergency Management
HUD	(U.S.) Department of Housing and Urban Development
IBC	International Building Code
ICAT	Interagency Climate Adaptation Team
IFR	Interim Final Rule
IRC	International Residential Code
IWMS	Integrated Workplace Management System
JFO	Joint Field Office
LCCMR	Legislative-Citizen Commission on Minnesota Resources
LIDAR	LIght Detection and Ranging
LUG	Local Unit of Government
MAC	Metropolitan Airport Commission
MCD	Minnesota Department of Commerce
MCES	Metropolitan Council Environmental Services
MDA	Minnesota Department of Agriculture
MDE	Minnesota Department of Education
MDH	Minnesota Department of Health
MEOP	Minnesota Emergency Operations Plan
METC	Metropolitan Council
MGS	Minnesota Geological Survey
MIFC	Minnesota Inter-Agency Fire Coordination Center
MHIRA	Multi-Hazard Identification and Risk Assessment

MMI	Modern Mercalli Intensity Scale
MN DNR	Minnesota Department of Natural Resources
MN PFA	Minnesota Public Facilities Authority
MnDOT	Minnesota Department of Transportation
MnGeo	Minnesota Geospatial Information Office
MNHS	Minnesota Historical Society
MNAFPM	Minnesota Association of Floodplain Managers
MNSCU	Minnesota State Colleges and Universities
MPCA	Minnesota Pollution Control Agency
MPR	Minnesota Public Radio
MRTF	Minnesota Recovers Task Force
NASA	National Aeronautics and Space Administration
NCA5	Fifth National Climate Assessment
NCEI	National Centers for Environmental Information
NDMC	National Drought Monitor Center
NDMS	National Disaster Medical System
NDRF	National Disaster Recovery Framework
NRCS	National Resources Conservation Service (USDA)
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NGO	Non-governmental Organization
NID	National Inventory of Dams
NIST	National Institute of Standards and Technology
NLD	National Levee Database
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Interest
NRCS	Natural Resource Conservation Service
NSMB	North Shore Management Board
NWS	National Weather Service
OSA	(Minnesota) Office of the State Auditor
PA	Public Assistance
PDA	Preliminary Damage Assessment
PDM	Pre-Disaster Mitigation
PDSI	Palmer Drought Severity Index (PDSI)
PGA	Peak Ground Acceleration
PHSI	Palmer Hydrological Drought Index
PTSD	Post-traumatic stress disorder
PUC	Public Utilities Commission
RIM	Reinvest in Minnesota Reserve Program (BWSR)
RL	Repetitive Loss
SCO	State Coordinating Officer
SHELDUS	Spatial Hazard Events and Losses Database for the United States
SFHA	Special Flood Hazard Area
SFMD	State Fire Marshal Division (Department of Public Safety)
SHMO	State Hazard Mitigation Officer

SHMT	State Hazard Mitigation Team
SPI	Standardized Precipitation Index
SRL	Severe Repetitive Loss
SWCD	Soil and Water Conservation District
TCMA	Twin Cities Metro Area
TRI	Toxic Release Inventory
UMD	University of Minnesota Duluth
UMTC	University of Minnesota Twin Cities
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USDM	United States Drought Monitor
USDOT	United States Department of Transportation
USFS	United States Forest Service
USGS	United States Geological Survey
WMA	Wildlife Management Area
WNV	West Nile Virus
WRP	Wetlands Reserve Program (BWSR)
WUI	Wildland–Urban Interface

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March 5, 2024

MEMORANDUM FOR RECORD

SUBJECT: Adoption of State Hazard Mitigation Plan

Minnesota adopts the 2024 State of Minnesota All-Hazard Mitigation Plan Update, Including Recommended Actions for Climate Change Adaptation.

The purpose of this Plan is to identify the State's major hazards, assess the vulnerability, and to reduce risk using the technical and program resources to implement mitigation projects. The Plan identifies goals and recommended actions and initiatives for state government agencies to reduce and/or prevent injury and damage from hazardous events. The intent of the Plan is to provide unified guidance for ensuring coordination of recovery-related hazard mitigation efforts following a major emergency/disaster, and to implement an on-going comprehensive state hazard mitigation strategy intended to reduce the impact of loss of life and property due to effects of natural hazards. This Plan update includes an integration of climate change considerations, risk analysis of state-owned critical facilities, and an updated flood hazard analysis.

The State Hazard Mitigation Team will continue to coordinate with state agencies (Natural Resources, Transportation, Health, Commerce, Labor and Industry, Administration) and other partners to implement mitigation measures. The Recovery Mitigation Branch in coordination with other branches in HSEM will continue to cross train and work together in preparation, response, recovery, and long-term recovery to integrate mitigation strategies and actions. Through continued collaboration, providing technical resources through state agency staff expertise and support, and training and education, the State of Minnesota will continue to increase its resiliency to the effects of natural hazards.

Sincerely,

Kristi Rollwagen

Kristi Rollwagen, Director
MN Homeland Security and Emergency Management

Section 1: Introduction

1.1 Introduction

The State of Minnesota is vulnerable to a variety of potential hazards. These hazards, both natural and human-caused, threaten loss of life and property. Events such as riverine and flash flooding, wildfires, blizzards, tornados and straight-line winds, extreme temperatures (both heat and cold), bluff erosion, coastal erosion, hailstorms, earthquakes, ice and severe storms, drought, and many human-caused incidents have the potential for inflicting devastating economic loss and personal hardship. Natural disasters cost the state and its taxpayers money—both directly and indirectly. Many severe weather events in Minnesota do not warrant federal disaster designation, often resulting in the state, local governments, businesses, and citizens bearing the recovery costs. Risk and vulnerability to natural and human-caused hazards may continue to increase as Minnesota's population grows and the climate changes.

The authority for this document is the Robert T. Stafford Disaster Relief and Emergency Assistance Act as amended through Public Law 117-328, December 29, 2022, and the Disaster Mitigation Act of 2000 (FEMA, 2023g). This All-Hazard Mitigation Plan (hereafter referred to as the Plan) conforms to the 44 Code of Federal Regulations (CFR) Parts 201 and 206: Mitigation Planning and the Hazard Mitigation Grant Program Requirements. The state will continue to comply with all applicable federal statutes and regulations during the periods for which it receives grant funding, in compliance with 44 CFR 13.11(c), and will amend the Plan whenever necessary to reflect changes in state or federal laws and statutes as required in 44 CFR 13.11(d).

Homeland Security and Emergency Management (HSEM), a Minnesota Department of Public Safety (DPS) division, is responsible for ensuring the state has a Federal Emergency Management Agency (FEMA)-approved All-Hazard Mitigation Plan to address the many hazards that impact the state. State All-Hazard Mitigation Plans must be updated every five years, and Minnesota's last plan was approved on March 11, 2019. The 2024 Plan update was funded through DR-4531 grant funding (FEMA, 2024c). HSEM contracted with U-Spatial at the University of Minnesota to update the state profile, natural hazard risk assessment, vulnerability assessments, and other plan sections, including mapping. HSEM and U-Spatial have worked together on previous updates to the Plan. In addition, U-Spatial updates many of the state's multi-jurisdictional county hazard mitigation plans.

HSEM led the planning process, coordinating the review of mitigation goals, strategies, and actions, as well as updating the state's capability assessment. To gather additional input and review, HSEM utilized the federal/state interagency group (the Silver Jackets) and met with the state Climate Change Subcabinet, Resiliency and Adaptation Action Team.

The plan's guiding principles include fostering cooperative relationships, following the planning process, focusing on reducing risks, and improving mitigation capabilities. State hazard mitigation planning aims to foster partnerships for natural hazard mitigation, promoting more resilient and sustainable states and communities and reducing the costs associated with disaster response and recovery.

FEMA is committed to promoting resilience as expressed in Presidential Policy Directive 8 (PPD-8): *National Preparedness*; the President's State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience; the Administrator's 2011 *FEMA Climate Change Adaptation Policy Statement* (Administrator Policy 2011-OPPA-01); and the *2022–2026 FEMA Strategic Plan*. FEMA recognizes challenges posed by climate change, including more intense storms, frequent heavy precipitation, heat waves, drought, extreme flooding, and higher sea levels. These phenomena may have impacts on mitigation, preparedness, response and recovery operations, as well as the resilience of critical infrastructure and various emergency assets. FEMA encourages recipients and sub-recipients of hazard mitigation grants to consider climate change adaptation and resilience in their planning efforts. Minnesota continues to focus on climate adaptation and resilience within the Plan, local hazard mitigation plans and other related plans and efforts.

The fact that mitigation represents a sound financial investment is supported by evidence. The Natural Hazard Mitigation Saves: 2019 Report examined two sets of mitigation strategies and found that society saves $6 for every $1 spent through mitigation grants funded through select federal agencies and a corresponding benefit-cost ratio (BCR) of 4:1 for investments to exceed select provisions of the 2015 model building codes (Multi-Hazard Mitigation Council, 2019).

Just implementing these two sets of mitigation strategies would prevent 620 deaths, 1 million nonfatal injuries, and 4,100 cases of post-traumatic stress disorder (PTSD) in the long term. In addition, designing new buildings to exceed the 2015 International Building Code (IBC) and International Residential Code (IRC), the model building codes developed by the International Code Council (also known as the I-Codes) would result in 87,000 new, long-term jobs, and the Natural Hazard Mitigation Saves: 2019 Report approximate 1% increase in utilization of domestically produced construction materials.

Given the rising frequency of disaster events and the increasing cost of disaster recovery across the nation, mitigation actions are crucial for saving money, property, and, most importantly, lives. Activities designed to reduce disaster losses may also spur job growth and other forms of economic development.

Historical data records show that climate change is increasing the severity, extent, and impact of some hazards. The Minnesota Department of Natural Resources (MN DNR) State Climatology Office, housed at the University of Minnesota, has provided expertise and guidance about the scientific confidence that recently observed and projected future changes to common weather hazards are attributable to climate change beyond Minnesota's typical and historical climate variations. Hazard mitigation planning is a proven and effective means by which to reduce losses by identifying ways to lessen or avoid the impact of disasters upon people and property. Although mitigation efforts cannot eliminate impacts of disastrous events, the state shall endeavor to reduce the impacts of hazardous events to the greatest extent possible. The engagement of the state Climate Change Subcabinet in the planning process to update this Plan has resulted in the addition of climate change adaptation recommendations. Incorporation of these recommendations will help the state to be more resilient and adapt to climate change through mitigation and cooperation with state agencies.

This plan represents the efforts of the State of Minnesota in fulfilling the responsibility for hazard mitigation planning. The purpose of this Plan is to identify the state's major hazards, assess the vulnerability to those hazards, and take steps to reduce vulnerability using the technical and program resources of Minnesota agencies. The process has included consideration of current and expected future impacts from Minnesota's already changing climate, as relevant to hazard mitigation planning. The plan identifies goals and recommends actions and initiatives for the state government to adapt to, reduce, and/or prevent injury and damage from hazardous events. The intent of the plan is to provide unified guidance for ensuring coordination of recovery-related hazard mitigation efforts following a major emergency/disaster, and to implement an ongoing comprehensive state hazard mitigation strategy intended to reduce the impact of loss of life and property due to disasters. In addition to post-disaster hazard mitigation, pre-disaster mitigation and climate change adaptation can reduce the impacts to Minnesotans' lives and property.

1.1.2 Hazard Mitigation Definition

Hazard mitigation may be defined as any action taken to eliminate or reduce the future risk to human life and property from natural and human caused hazards. Potential types of hazard mitigation measures include the following:

- Structural hazard control or protection projects
- Retrofitting of at-risk facilities
- Acquisition and relocation of at-risk structures
- Development of mitigation standards, regulations, policies, and programs
- Public awareness and education programs
- Development or improvement of warning systems

1.1.1 Scope

The State of Minnesota aims to focus on projects that make the state and its people and property more resilient to the effects of natural hazards. The plan evaluates and prioritizes the major natural and human-caused hazards affecting the State of Minnesota as determined by frequency of events, economic impact, deaths, and injuries. The plan assesses hazard risk, reviews current state and local hazard mitigation and climate adaptation capabilities, develops mitigation and climate adaptation strategies, and identifies state agency and other interagency working groups' actions to address mitigation and climate adaptation needs in an equitable fashion. The plan does not attempt to develop local plans or projects. Recommendations are based on input from federal, state, and local agencies and national best practices. The plan identifies existing resources that may be used as a tool to assist communities to succeed in their mitigation and climate adaptation efforts. This is accomplished by establishing statewide mitigation recommendations, providing technical resources for mitigation and climate adaptation through federal, state, and local agency staff expertise and support, providing financial assistance through various programs, offering training and education, and other agency initiatives.

1.1.3 Climate Change Adaptation Definition

Climate change increases the frequency, variability, duration, and intensity of natural hazards. Climate change adaptation may be defined as developing and implementing strategies, initiatives, and measures to help human and natural systems prepare for and address climate change impacts (hereafter referred to as climate adaptation).

1.1.4 Resilience Definition

Resilience may be defined as the ability (or capacity) of a system or community to survive disruption and to anticipate, adapt, and flourish with change.

1.1.5 Planning for Equitable Outcomes

FEMA defines equity as the consistent and systematic fair, just and impartial treatment of all individuals. Centering equity in the mitigation plan helps ensure an inclusive planning process that benefits the whole community. Inclusive planning processes take time and thoughtful planning to set up so that everyone has the resources to meaningfully participate, make progress, and benefit from hazard mitigation. Equity is essential to reducing risk to the whole community, including those that face barriers to accessing assistance and to populations that are disproportionately affected by disasters.

1.1.6 Benefits

There are many benefits to hazard mitigation, climate adaptation, and resilience planning:

- Saving lives, protecting the health of the public, and reducing injuries
- Preventing or reducing property damage
- Reducing economic losses
- Minimizing social dislocation and stress, especially for vulnerable populations
- Reducing agricultural losses and protecting soil health
- Maintaining critical facilities in functioning order
- Protecting infrastructure from damage
- Protecting mental health to increase individual resilience, especially for vulnerable populations
- Reducing legal liability of government and public officials
- Maintaining critical ecosystem services
- Reducing greenhouse gas emissions as a co-benefit of adaption and resilience actions
- Providing awareness and education for governments, businesses, non-governmental organizations (NGOs) and individuals to make better-informed decisions and take action to reduce risk and improve quality of life.

1.2 Authorities

Hazard mitigation planning for the state aligns with Minnesota HSEM's mission of helping Minnesota communities prepare for, respond to, and recover from emergencies and disasters. For the 2024 plan update, elements of Minnesota's Climate Action Framework are included to meet the goal of adapting to the changing climate, reducing risks and impacts, and increasing the resilience of our communities.

1.2.1 Governor's Executive Order 23-13

Each department, independent division, bureau, board, commission and independent institution of the state government, hereinafter referred to as "agency" or "agencies," shall carry out the necessary planning for emergency preparedness, response, recovery, hazard mitigation, continuity of operations and service continuation responsibilities described in Minnesota Governor's Executive Order 23-13: *Assigning Emergency Responsibilities to State Agencies (October 27, 2023)*, the specific emergency assignments contained in the Minnesota Emergency Operations Plan, the State All-Hazard Mitigation

Plan and such other duties as may be requested by the Division of Homeland Security and Emergency Management. The head of each agency shall be accountable for the execution of the responsibilities described in this Executive Order.

Section 2000 of the Executive Order directs that "The Division of Homeland Security and Emergency Management shall facilitate hazard mitigation efforts statewide by coordinating maintenance of the Minnesota All-Hazard Mitigation Plan and working with local jurisdictions to develop and update mitigation plans and projects."

1.2.2 Governor's Executive Order 19-37

Through the [Minnesota Governor's Executive Order 19-37](),"Establishing the Climate Change Subcabinet and the Governor's Advisory Council on Climate Change to Promote Coordinated Climate Change Mitigation and Resilience Strategies in the State of Minnesota," the Climate Change Subcabinet was formed. Led by the Commissioner of the Minnesota Pollution Control Agency, the purpose of the Subcabinet is to identify policies and strategies that will put Minnesota back on track to meet or exceed our goals, established under [Minnesota Statutes 2019, section 216H.02](), to reduce statewide greenhouse gas emissions across all sectors to a level at least 30% below 2005 levels by 2025, and to a level at least 80% below 2005 levels by 2050. Additionally, the Subcabinet will identify policies and strategies that will enhance the climate resiliency of Minnesota's natural resources, working lands, and communities.

Five Action Teams were developed under the Climate Change Subcabinet. HSEM Hazard Mitigation staff members participated in the Resiliency and Adaptation Action Team, which focuses on climate projections and tools to understand how the changing climate many impact communities, capacity building and preparation, and resilient and green infrastructure (Climate Change Subcabinet, 2019).

1.2.3 Minnesota Statute, Chapter 12, Emergency Management

Minnesota State Statute, Chapter 12, Emergency Management directs that all emergency management functions of the state be coordinated to the maximum extent with the comparable functions of the federal government, including its various departments and agencies, of other states and localities, and of private agencies of every type, to the end that the most effective preparations and use may be made of the nation's labor supply, resources, and facilities for dealing with any disaster that may occur (Minnesota Emergency Management Act of 1996).

1.2.4 Hazard Mitigation Assistance Administrative Plan and Procedures

The State of Minnesota Hazard Mitigation Assistance Administrative Plan and Procedures is required by Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), Public Law 93-288 as amended, and the Disaster Mitigation Act of 2000, Public Law 106-390. These requirements direct the state to administer cost-sharing Hazard Mitigation Assistance (HMA) grant programs to be used to fund state and local hazard mitigation projects. Section 404 of the Stafford Act is closely tied to the post-disaster hazard mitigation plans defined and required in Section 409 of the Stafford Act and the Disaster Mitigation Act of 2000. Sections 322 and 404 of the Stafford Act, in combination with several other state and federal programs and activities, help to form an overall pre- and post-disaster hazard mitigation strategy for the State of Minnesota and affected local governments in the state. The purpose of the administrative plan is to describe the organization, staffing, and procedures the State of Minnesota will use when implementing the Section 404 Hazard Mitigation Grant Program in both the post- and pre-disaster mitigation environment. This manual is updated to reflect changes in policy, lessons learned administering the plan and procedures, post-disaster after action reports, and input from the Minnesota Recovers Task Force. This manual is updated following each Presidential Disaster Declaration.

1.2.5 Hazard Mitigation Assistance Program and Policy Guidance

As part of Federal Emergency Management Agency (FEMA) Hazard Mitigation Assistance (HMA) grant programs, guidance was developed that provides general HMA information and summarizes the specific sub-grantee responsibilities relative to the program. Under Section 404 of the Stafford Act, FEMA hazard mitigation monies are provided to the state. In Minnesota, these monies are awarded to the Minnesota Division of Homeland Security and Emergency Management (HSEM) which serves as the grantee. Potentially eligible sub-grantees (applicants) include state and local governments, certain private non-profit organizations or institutions, and tribal nations or authorized tribal organizations. HSEM ensures the policies outlined in the guidance are followed in the award of HMA grant funding for projects in the state. The guidance, along with the state's Hazard Mitigation Grant Program Administrative Plan, provide direction to sub-grantees regarding management of their grants (FEMA, 2024d).

1.3 Hazard Mitigation Programs

Under the FEMA HMA program there are three distinct hazard mitigation assistance programs available: the Hazard Mitigation Grant Program, the Building Resilient Infrastructure and Communities grant program, and the Flood Mitigation Assistance grant program. Although all three programs have unique statutory authorities, program requirements and triggers for funding, all of the programs also have the common goal of providing funds to states and local communities to reduce the loss of life and property from future natural hazard events. Each of the three HMA grant programs provides funding opportunities for pre- and post-disaster mitigation. Brief descriptions of the HMA grant programs are listed below.

Hazard Mitigation Grant Program

The Hazard Mitigation Grant Program (HMGP) assists in implementing long-term hazard mitigation measures following Presidential disaster declarations. Funding is available to implement projects in accordance with state, tribal, and local priorities (FEMA, 2023f).

Building Resilient Infrastructure and Communities

Building Resilient Infrastructure and Communities (BRIC) provides funds on an annual basis for hazard mitigation planning and the implementation of mitigation projects prior to a disaster. The goal of the BRIC program is to invest in a variety of mitigation activities with an added focus on infrastructure projects benefitting disadvantaged communities, nature-based solutions, climate resilience and adaption and adopting hazard resistant building codes (FEMA, 2024e).

Flood Mitigation Assistance (FMA)

The Flood Mitigation Assistance (FMA) Grant Program provides funds on an annual basis so that measures can be taken to reduce or eliminate the risk of flood damage to buildings insured under the National Flood Insurance Program (NFIP) (FEMA, 2022a).

1.4 Plan Organization

Each section in the plan has been revised and updated by state hazard mitigation staff, the Minnesota Silver Jackets, and other state agencies. The numbering of sections has changed to better accommodate the large amount of content in the previous Section Four: Risk Assessment and Vulnerability Analysis. This previous section was broken into new sections Four, Five, and Six. Climate change adaptation and planning for equitable outcomes is addressed throughout in greater depth than the previous plan. The interactive website companion for this Plan is new and will allow for greater accessibility and engagement with this Plan.

The contents of this Plan are outlined as follows:

Section 1: Introduction

Purpose, scope, and a description of changes included in the plan update.

Section 2: Planning Process

Includes a description of how the plan was updated utilizing subject matter experts, the MN Resiliency and Adaptation Action Team (established under Executive Order 19-37), and a federal collaborative risk management group, the Silver Jackets. Other training sessions, outreach, and educational opportunities HSEM mitigation staff utilized to promote mitigation, resilience, climate change and adaptation are further summarized in this section.

Section 3: State Profile & Climate

Includes geographic, demographic, and economic characteristics, and Minnesota's changing climate; how mitigation relates to development; and economic trends as well as climate change adaptation. Population (AKA social) vulnerability and resilience is also discussed in general and additional mentions are found in individual hazard sections as applicable.

Section 4: Hazards Risk Assessment

This section provides a summary of state and federal disaster declarations. Critical infrastructure, state facilities, and data assets are also described in this section.

Section 5: Natural Hazards

Section 5 provides information on the nature of each hazard that the State of Minnesota is susceptible to, a history of the hazard in the state and the probability of its occurrence in the future. All hazard history and risk maps in this document have been updated as of August 2023 in the companion website. Climate change considerations are included for each hazard as well as the probability of future events. The natural hazards included in this Plan are flooding, wildfire, windstorms, tornadoes, hail, lightning, coastal erosion, winter storms, land subsidence, drought, extreme cold, extreme heat, earthquakes, dam/levee failure, and erosion/landslides/mudslides.

Section 6: Human-Caused Hazards

The human-caused hazards included in this Plan are hazardous materials, infectious disease, terrorism, transportation incidents, nuclear power plant incidents, and ground and surface water supply.

Section 7: Hazard Mitigation and Climate Adaptation Strategy

This section was updated to follow guidance from FEMA's 2023 Local Mitigation Planning Handbook. Four FEMA strategy types are utilized: Local Planning and Regulations, Structure and Infrastructure Projects, Natural Systems Protection and Education and Awareness Programs (FEMA, 2023e). HSEM defined a fifth strategy in 2016, Mitigation Preparedness and Response Support for local emergency management professionals, which has been helpful for local governments to categorize their mitigation actions. In the 2019 Minnesota State Plan, a sixth strategy type was included for state planning: Data for Climate Adaptation. The mitigation actions listed for each natural hazard are broad enough for any jurisdiction to utilize them in the development of local mitigation plans. An assessment of state and local mitigation capabilities, pre- and post-disaster funding programs and the severe and repetitive loss strategy requirement are addressed.

Section 7.6 Inventory of Programs, Policies, and Funding provides information on resources available to assist with hazard mitigation planning and project implementation. Many organizations have capabilities that may assist local jurisdictions or the state to increase resilience to hazards. A comprehensive list of federal and state agencies and other organizations that may assist in mitigation, resilience, and climate adaptation projects is included. The 2020 Climate Change Subcabinet Report contains state agency programs, policies, and funding resources (Climate Change Subcabinet, 2020). In addition, a 2017 report from the Interagency Climate Adaptation Team (ICAT) includes six recommendations that were developed for climate change adaptation (ICAT, 2017). The recommendations address resources such as habitat and the built environment and are summarized with links to the full report in Sections 7.5 and 7.6. The ICAT group has since been replaced with the Governor's Climate Change Subcabinet; however, the recommendations of the report are still relevant and continue to be used in the planning process.

Section 7 states the goals, objectives, actions, and projected funding sources to guide the mitigation program, including resilience and climate adaptation. The State Capability Assessment lists the programs and the funding sources in place that are used in statewide mitigation efforts and addresses where gaps exist. Additional information on climate adaptation and addressing equity in hazard mitigation planning is included.

Section 8: Coordination of Local Mitigation Planning

A description of how the state prioritizes local jurisdictional funding and technical assistance is explained. FEMA climate change adaptation and resilient project types are included in the state's updated priority. This section describes how local mitigation planning and projects are prioritized, coordinated, and funded. Local funding and technical assistance are available from the local, state and federal levels. Local planning capabilities differ, but a lack of capability does not exclude a community from any of the grant programs.

Local plan integration portrays the importance of having a FEMA-approved and locally adopted mitigation plan at the time of a disaster. Jurisdictions must address the hazard and mitigation project type in their plan to be eligible for FEMA pre- and post-disaster funding. The state supports and is actively working to integrate climate change and resilience into local planning efforts.

1.5 Plan Website

This Plan is accompanied by a website that allows for easy stakeholder and community engagement, as well as interactive maps, dashboards, and infographics. The natural hazard histories are complete on the website. A broad overview of the companion website features are as follows:

- Home Page
    - Highlights of natural hazards
    - Major state and federal disasters
    - Feedback form
- State Profile
    - Critical Infrastructure
    - Utility & transportation Infrastructure
    - Other assets
    - Hydrography
- Equity
    - Minnesota demographics and economy
    - Population change and vulnerabilities
- Natural Hazards
    - Natural hazard priorities
    - Links to each natural hazard history, risk, and vulnerability page with dashboards
- Strategy & Goals
    - Links to PDF strategy and goal documents
- Climate Change
    - Climate change dashboard and information
    - Minnesota Climate Stories survey
- Resources
    - Links to mitigation related resources and programs

2024 Minnesota Hazard Mitigation Plan Website

Table 1 summarizes the 2024 plan update.

Table 1. 2024 Plan update summary

Section	Update
Section 1 Introduction	Section numbers were changed for better organization. Planning for Equitable Outcomes section added. BRIC added to Hazard Mitigation Programs. ICAT was replaced by the Governor's Climate Change Subcabinet.
Section 2 Planning Process	Updated state agency participation. Updated federal disaster declarations.
Section 3 State Profile & Climate	Plan website developed for state profile. Integration of FEMA National Risk Index (including Community Resiliency Index and Social Vulnerability Index). Interactive map of critical infrastructure statewide. Updated content for projected population change. Using the Fifth National Climate Assessment (NCA5), the importance of climate change adaptation is discussed for increasing the resilience of communities and the environment.
Section 4 Hazards Risk Assessment	Updated statewide essential facilities and critical facilities were compiled from public databases. Counties were asked to update their essential facilities specifically for this Plan. County- and city-owned structure database continues to be updated at the city/county hazard mitigation plan level. A geospatial data asset section has been added.
Section 5 Natural Hazards	Hazards are addressed similarly to the 2019 analysis. Sections in written plan no longer include complete hazard histories, this information is comprehensive on the website.
Section 6 Human-Caused Hazards	Non-natural hazard description updated.
Section 7 State Hazard Mitigation and Climate Adaptation Strategy	Management and data gaps and needs. New climate change adaptation actions. Updated Climate Action Framework and work towards resilience goals information included. New state and interagency programs, including building codes. Based on evaluation of hazards, new mitigation actions and projects have been included. Interagency workgroups continue to work to identify problems and resolutions based on the inter-agency nature of the work; Silver Jackets, Governors Climate Change Sub-Cabinet, and GIS collaborations.
Section 8 Coordination of Local Mitigation Planning	Resource lists were updated and now include climate adaptation resources. New success stories for hazard mitigation, resilience and climate change adaptation included.

Section 2: Planning Process

2.1 Plan Update Process

> *S1. Does the plan describe the planning process used to develop the plan?*
>
> *44 CFR Reference §§201.4(b) and (c)(1)*

HSEM serves as the lead agency for the preparation of the State Hazard Mitigation Plan and serves as the lead agency for monitoring, evaluating, and updating the plan. The State Hazard Mitigation Officer (SHMO) is responsible for coordinating plan updates and maintenance. Significant input into all phases of the plan is derived from the state agencies' subject matter experts, the Minnesota Silver Jackets, and the State Climate Change Subcabinet. HSEM applied to FEMA's DR-4531 grant for funds to update this Plan (FEMA, 2024c). The grant was awarded in October of 2022, and in January 2023 an HSEM contract with U-Spatial at the University of Minnesota was executed, with U-Spatial to update the state profile and risk and vulnerability assessments for all natural hazards. Both U-Spatial and HSEM coordinated to lead the subject matter review for natural hazards and climate change.

The federal/state/local hazard risk management team, the Minnesota Silver Jackets and the State Hazard Mitigation Team (SHMT) continually meet to identify, assess, and brainstorm interagency solutions to current and new natural hazards in the state. The goal of each Silver Jackets meeting is to increase the resilience of the state through cross-programmatic education and data sharing. Special topical information sharing from subject matter experts is a monthly occurrence. The implementation of interagency projects and ongoing applications for new interagency projects has resulted in studies, workshops, and a more risk-aware Minnesota. The monthly Silver Jackets efforts are continually tracked, and all activities are listed in Section 2.2.1 The Minnesota Silver Jackets.

No new changes in federal or state laws required revisions, so no consultation for advice on how to conform to new legislation was needed. A representative from Pew Charitable Trusts Flood-Prepared Communities coordinates roundtable meetings with congressional staff, State NFIP Coordinator, MN Association of Floodplain Managers legislative liaison, HSEM, and others to review any flood-related legislation.

An assessment of resource availability for implementing the 2019 Plan Update would indicate that all state agencies are meeting their program goals, and that interagency work continues to improve the overall efficacy of hazard mitigation. There were no opportunities for large-scale cooperation from the Minnesota Recovers Task Force, as no disaster event rose to the level of a special state legislative session. No specific implementation problems occurred on the state hazard mitigation side other than shortage of qualified personnel to handle the workload. There are currently only two state staff assigned to handle all the hazard mitigation assistance grants for the state of Minnesota.

Some implementation issues did occur during the COVID-19 crisis; however, the positive working relationship between state and FEMA staff ensure continued successful outcomes, even if some work may have been delayed. Section 8.3 indicates the process utilized during each presidential disaster—

each disaster being an opportunity for state hazard mitigation staff and FEMA staff to improve, streamline, and increase knowledge through training and experience. Continued improvement is a path that hazard mitigation and other state staff continually pursue.

This document is not an integrated hazard mitigation and climate adaptation plan. Climate change was included in the 2019 Plan and is updated with the most recent scientific data and projections. Recommended actions for climate adaptation from the Minnesota Climate Action Framework are included in this Plan as a means to reach a larger audience and promote the work of state agency experts and stakeholder input.

Continued review of implementation issues, stakeholder participation, and capability assessment will assist Minnesota in keeping its mitigation planning on track and ensure measures and capacity are in line with needs. Reviews of the hazards, risk assessment, and associated mitigation actions and projects will also keep Minnesota's efforts on track. Addressing the above items regularly and consistently will allow for enhanced adaptability to new federal and state guidance and plan adoption.

Each section of the plan was reviewed and revised by state hazard mitigation staff and multiple state and federal agency staff. Membership on the Silver Jackets team includes staff from federal and state agencies. An opportunity for the public, businesses, and other organizations to review and comment will be provided during the posting of the plan on the MN HSEM website and on the companion interactive website.

The state will submit the plan to the FEMA Region 5 office for review and approval before a formal adoption process is pursued. Once approved, the plan will be adopted by the Governor. The option exists for state agency heads or groups to adopt as a measure of support. Once the plan has been approved, an official notice announcing the approval will be posted in the State Register and on the HSEM website.

Activities pertinent to the collaborations, results, outreach activities, and plan review and update are included in the following agency coordination section.

2.2 Agency Coordination

S2. Does the plan describe how the state coordinated with other agencies and stakeholders?

44 CFR Reference §§201.4(b) and (c)(1)

Hazard mitigation plans, policies, and programs are directed by federal legislation (CFR 44 Emergency Management and Assistance), and Federal Executive Orders (11988 Floodplain Management and 19900 Protection of Wetlands). The state takes its role very seriously regarding emergency management. HSEM and other state agencies that participate in preparedness, recovery, response, and mitigation abide by the following policies and executive orders. The Governor's Executive Order 23-13 assigns Emergency Responsibilities to state agencies and Recovery/Hazard Mitigation requirements (2023). This policy indicates the importance of coordination with federal agencies, other state agencies, and local governments in emergency management.

The following interagency groups exemplify how planning goals can be achieved and how mitigation planning and project implementation can be integrated into existing efforts. Hazard mitigation staff have developed and continue to strengthen relationships with state and federal agency partners. Relationships with the emergency management sector are strong.

FEMA requires coordination with agencies and stakeholders responsible for emergency management, economic development, land use development, housing, health and social services, infrastructure, and natural and cultural resources. The plan has sufficient coordination with all sectors of emergency management, from federal to local government representatives, though tribal representation is lacking.

Milestones for the state and the Plan include:

- June 12, 2019—Presidential Declaration for severe storms, straight-line winds, and flooding (DR-4442). Incident Period March 12, 2019–April 28, 2019.
- April 7, 2020—Presidential Declaration for Coronavirus Disease (DR-4531). Incident Period January 20, 2020—May 11, 2023.
- July 13, 2022—Presidential Declaration for severe storms, straight-line winds, and flooding (DR-4659). Incident Period April 15, 2022–June 15, 2022.
- July 8, 2022—Presidential Declaration for severe storms, straight-line winds, tornados, and flooding (DR-4658). Incident Period May 8, 2022–May 13, 2022.
- August 9, 2022—Presidential Declaration for severe storms, straight-line winds, tornados, and flooding. Incident period May 29, 2022–May 30, 2022.
- July 19, 2023—Presidential Declaration for severe storms and flooding (DR-4722). Incident Period May 15, 2023–June 23, 2023.
- June—December 2023—Subject matter experts provide updates to Plan.
- October 25, 2023—Presented the Plan and requested feedback from climate professionals at the Midwest Climate Resilience Conference
- October 2023–January 2024—Silver Jacket members review of Plan.
- TBD—Submitted State Hazard Mitigation Plan draft to FEMA.
- TBD—Submit final State Hazard Mitigation Plan to FEMA.
- After approval, the Plan is sent to the Governor for adoption.

See the Silver Jackets timeline in the next section and MDH Climate and Health Programs for additional planning process activities.

2.2.1 The Minnesota Silver Jackets

The Minnesota Silver Jackets, a natural hazards risk management team, is the leading committee to review the plan and provide input. Silver Jackets members include representatives from federal and state agencies (Table 2). The name "Silver Jackets" comes from the different colored jackets which various agencies wear when responding to disasters, e.g., USACE personnel wear red jackets, and FEMA personnel wear blue, so "silver" represents a unified interagency team. While Silver Jackets typically provide information on flooding, the Minnesota group is all-hazard-oriented.

The Minnesota Silver Jackets team conducts monthly meetings to discuss agency updates, interagency projects, current disaster declarations and response efforts, and other pertinent topics.

Most meetings include educational special presentations by subject matter experts regarding topics that directly relate to team activities or impact those activities in some way. Many of the topics are included in the next update of the Plan for FEMA. Presenters have been team members and other professional affiliates of the team. Topics have included state drone and date resources, new federal funding opportunities, and localized climate modeling tools. The presentations are usually related to recent disasters or the publication of benchmark reference reports or conference proceedings. This activity allows the agency representatives on the team to have direct access to leading-edge technology and the experts who created it. It improves awareness across agency boundaries, promotes innovation that leads to improving processes, and generates additional interagency project ideas. From the March 2019 approval of the Plan, the Silver Jackets met monthly to share federal/state and local emergency management, floodplain management, and other relevant information. The COVID-19 pandemic disrupted many Silver Jackets activities, and monthly meetings were limited. However, 2023 brought a revival of group participation and presentations.

Table 2. Silver Jackets membership

Agency	Name	Title
FEMA Region 5	Tim Little	Community Planning Capacity Building Coordinator
FEMA Region 5	Kyle Acevedo	Grants Management Specialist (BRIC)
FEMA Region 5	Andrew Davis	Program Analyst (Safeguarding Tomorrow RLF)
FEMA Region 5	Andrew Weeldreyer	Grants Management Specialist
FEMA Region 5	Rachel Buvala	Community Outreach Coordinator
FEMA Region 5	Meghan Cuneo	Community Planning
FEMA Region 5	Megan Burrows	Community Planning
Hennepin County	Eric Waage	Director, Emergency Management
Metropolitan Council	Eric Wojchik	Senior Planner
Metropolitan Council	Lisa Barajas	Director of Community Development
MN Department of Natural Resources	Ceil Strauss	NFIP State Coordinator
MN Department of Natural Resources	Pat Lynch	Flood Hazard Mitigation (FHM) Grants Administrator
MN Department of Natural Resources	Matt Bauman	Hazard Mitigation Grant Assistant Program Manager
MN Department of Natural Resources	Jason Boyle	Dam Safety Engineer
BWSR	Rita Weaver	Chief Engineer
MN Department of Commerce	Doug Renier	Office of Energy Security
MN Department of Transportation	Solomon Woldeamlak	State Waterway Engineer
MN Department of Transportation	Nicolas Olson	State Hydrologic Engineer
MN Department of Transportation	Rachel Pichelmann	Engineer
MN HSEM	Wayne Lamoreaux	Deputy Public Assistance Officer
MN HSEM	Kristy Dellwo	Hazard Mitigation Planner
MN HSEM	Niki Anderson	Hazard Mitigation Planner
MN HSEM	Vacant	State Hazard Mitigation Officer

Agency	Name	Title
MN HSEM	Caleb Sturgill	Engineering Specialist
MN HSEM	Angela Wynn	Disaster Recovery Coordinator
MN Pollution Control Agency	Laura Millberg	Climate Change Resilience Coordinator
MN Pollution Control Agency	Sharon Stephens	Climate Change Adaptation Coordinator
MN Pollution Control Agency	Jim Chiles	Agency Rules
National Weather Service	Mike Welvaert	Service Coordination Hydrologist, North Central River Forecast Center
National Weather Service	Shawn DeVinny	NWS La Crosse
National Weather Service	Craig Schmidt	Service Hydrologist, NWS Chanhassen
National Weather Service	Andrew Kalin	NWS Sioux Falls
National Weather Service	Amande Lee	NWS Grand Forks
National Weather Service	Steve Gohde	NWS Duluth
National Weather Service	Ketzel Levens	NWS Duluth
National Weather Service	Jordan Wendt	NWS NCRFC
Natural Resources Conservation Services	Elizabeth Oolman	Hydrology and Hydraulics Engineer
St. Paul, City of	Lucy Angelis	Emergency Management
United States Army Corps of Engineers	Garrett Ray	Detroit District
United States Army Corps of Engineers	Karla Sparks	Silver Jackets Coordinator
Minnesota Geospatial Information Office	Alison Slaats	Information Officer
United States Geological Services	Julia Prokopec	Hydrologist
United States Geological Services	Mitch Bergson	National Map Liaison (IA, MN, WI)
United States Geological Services	Andrew Strassman	La Crosse District
United States Geological Services	James Fallon	Data Chief

The following list is a timeline of Silver Jackets milestones from March 2019 to February 2024:

- September 8, 2020—MN Silver Jackets goals updated to align with the 2019 State Hazard Mitigation Plan.
- February 8, 2022—Terry Zien, USACE and Jen Davis, HSEM presented at a Silver Jackets webinar to highlight the FY23 Call for Interagency Non-Structural Flood Risk Management Proposals.
- February 21, 2023—Cody Robinson, MPCA presented to MN Silver Jackets about the MPCA's drone resources and opportunities for collaboration.
- May 18, 2023—Nick Olson, MnDOT, presented to MN Silver Jackets about BridgeWatch and how it could be useful across state agencies.
- June 6, 2023—USACE facilitated flood emergency action plan workshop for Pipestone and Rock Counties, MN, in Pipestone, MN. Also included was the Pipestone National Monument and a site visit to evaluate flooding and water quality concerns.

- November 13, 2023—State of Minnesota Hazard Mitigation Plan Update—presented by Kristy Dellwo, HSEM and Stacey Stark, UMN Duluth to Silver Jackets. Presented on the progress of the State Plan and requested members input potential projects and resources into strategy section. Requested subject matter review of draft sections of the plan.
- November 22, 2023—Craig Schmidt, NOAA, requested feedback and testing of the new NWS AHPS webpage from the MN Silver Jackets.
- December 21, 2023—Nicolaus Woodroffe, FEMA Mitigation Team, presented the new SWIFT Current Program to MN Silver Jackets.
- January 18, 2024—Suzi Clark with the University of Minnesota Climate Adaptation Partnership (MCAP) presented new climate modeling tools they are creating for localized regions of Minnesota to MN Silver Jackets.
- February 15, 2024—State of Minnesota Hazard Mitigation Plan Update presentation by Kristy Dellwo, HSEM and Stacey Stark, UMN Duluth to Silver Jackets. Discuss final draft of plan.

2.2.2 Minnesota Department of Health—Climate and Health Program

Emergency management addresses manmade disasters and natural hazards events, such as flooding, wildfires, and extreme heat, which are predicted to occur more often and worsen with climate change. In the past, the Minnesota Department of Health's Minnesota Climate and Health Program (Program) has worked with emergency managers and others to better understand the future risks of climate change and to provide tools to emergency managers and public health professionals (referred to as EMP) to plan for these risks.

Additionally, MDH produced a whitepaper on the development of the regional profiles and lessons learned: Advancing Health & Disaster Resiliency in Minnesota (Whitepaper) (state.mn.us). The whitepaper contains an evaluation from 2021 that found that All Hazard Mitigation Plans authored in 2019–2020 compared to plans authored in 2010–2013 had a higher composition of mitigation actions to address climate-related hazards, with the greatest increase in plans addressing flooding and severe storms.

The Program offers other resources that can be helpful to EMP:

- Webinars on the health impacts of climate change: Trainings and Resources—MN Dept. of Health (state.mn.us)
- A Minnesota Extreme Heat Toolkit that contains information on how to prepare for and respond to extreme heat events: Minnesota Extreme Heat Toolkit (state.mn.us)
- A GIS tool that visualizes datasets that contribute to a community's vulnerability to extreme heat: Heat Vulnerability in Minnesota (umn.edu)

2.2.3 Geospatial Advisory Council Emergency Preparedness Committee

The Minnesota Geospatial Information Office (MnGeo) and the Geospatial Advisory Council—Emergency Preparedness Committee have been engaged to help facilitate geospatial data collection for this Plan. In addition, the Emergency Preparedness Committee has developed workflow for local jurisdictions to update publicly available critical facilities information (e.g., fire stations, schools, law enforcement facilities) for planners to use in geospatial analysis statewide.

2.2.4 Minnesota Association of Floodplain Managers

The Minnesota Association of Floodplain Managers (MnAFPM) was formed in 2002. The goal of the organization was to form a network of associates who could bring their ideas and experiences to a forum for people to share and learn from. The result of the association is a network of floodplain managers who can improve the effectiveness and efficiency of all aspects of floodplain management in the State of Minnesota. The board now conducts meetings periodically to discuss the status of the association and to discuss any upcoming floodplain management issues. HSEM staff have been members of the state floodplain manager association and often participate on the annual conference committee and the board. Continued collaboration with the national association and national conference attendance will ensure state of Minnesota floodplain managers are aware of cutting-edge developments in the field and able to provide information to local units of government at home. Opportunity exists to pursue national flood policy based on state interests through the national association.

2.2.5 Pew Charitable Trusts

The Pew Charitable Trusts are an independent, nonprofit, global research and public policy organization. They are a non-partisan, non-governmental organization dedicated to serving the public. The focus of our interaction is the Flood-Prepared Communities and other NFIP and flood-related projects. The SHMO attended multiple roundtables with Congressional representatives and state Representative's staff, with the State NFIP Coordinator, MNAFPM Legislative Liaison, and others to discuss Pew Charitable Trusts Federal Flood Policy; Federal Flood Risk Management Standards, Flood-Prepared Communities, Disclosure Policy for new homebuyers/renters, and State Revolving loan fund for Flood Mitigation. The round table meetings are an opportunity to educate elected officials and thank them for their continued support of smart flood policy.

2.3 Monitoring, Evaluating, and Updating the Plan

S17. Is there a description of the method and schedule for keeping the plan current?

44 CFR Reference §§201.4(c)(5)(i) and 201.4(d)

Provisions for monitoring, evaluating, and updating the plan are located in the Code of Federal Regulations (44 CFR). The 44 CFR regulations require that the state "must review and revise its plan to reflect changes in development, progress in statewide mitigation efforts, and changes in priorities, and resubmit it for approval to the appropriate Regional Director every five years."

HSEM serves as the lead agency for preparation of the State Plan and serves as lead agency for monitoring, evaluating, and updating the plan. The State Hazard Mitigation Officer (SHMO) is responsible for coordinating plan updates and maintenance. This position is located within HSEM and serves as the lead coordinator of the State Hazard Mitigation Team (SHMT). Significant input into all phases of the planning process is derived from the SHMT, state stakeholders, and the Silver Jackets Team. See Table 3 for an outline of responsibilities and schedule.

The SHMT will be regularly involved in monitoring, evaluating, and updating of information and projects for inclusion in the 2029 Plan Update over the next five years.

Triggers for mid-cycle Plan updates include, but are not limited to:

- If a disaster requires HSEM to reassess its goals and objectives.
- If a reassessment indicates that some adjustments are needed on goals and objectives, the SHMT will coordinate that process.
- If changes in federal or state laws require revisions, the SHMT and appropriate State Stakeholder Agencies will be consulted for advice on how to conform to new legislation.

Table 3. Plan monitoring, evaluating, and updating matrix

Monitoring, Evaluating, and Updating Activity	Responsibility	Schedule
Review and update the Hazard Analysis and Risk Assessment	HSEM, SHMT, Silver Jackets, Subject matter experts	Every five years
Provide updates, evaluate progress of mitigation and adaptation actions and projects	SHMT, Silver Jackets,	Ongoing, Annual
Identification of implementation issues	HSEM, SHMT, Silver Jackets,	Annual
State Capability Assessment Updates	SHMT, Silver Jackets	Ongoing, Every five years
Plan review, evaluate, and provide input	SHMT, State Agencies, Silver Jackets,	Every five years
Plan Adoption by State of Minnesota	Governor or designee	Every five years
Plan Approval by FEMA	FEMA	Every five years
Review and update the Hazard Analysis and Risk Assessment	HSEM, SHMT, Silver Jackets, Subject matter experts	Every five years

As part of the monitoring, evaluating, and updating component, the update evaluation will use the following criteria:

- Do the goals and objectives still address current and expected conditions?
- What was the nature and the magnitude of problems encountered and changes that have occurred?
- Were the current resources appropriate for implementing the plan?
- What implementation problems occurred, as technical, political, legal, or coordination issues?
- Were the outcomes as expected?
- Did the agencies participate as originally proposed?

This process will require the SHMT to participate in updating all parts of the Plan. Approval of the updated Plan will be required by all State Agency Administrators and the Governor.

Multiple activities will be addressed differently for future monitoring, evaluating, and updating efforts for the state mitigation Plan. More frequent (quarterly) review of implementation issues, stakeholder participation, and the capability assessment will assist Minnesota in keeping its mitigation planning on track and ensure measures and capabilities are in line with needs. Reviews of the hazards, Risk Assessment, and associated mitigation and adaptation actions and projects will also keep Minnesota's efforts on track. Addressing the above items regularly and consistently will allow for enhanced adaptability to new federal and state guidance and Plan adoption.

The Silver Jackets will meet annually in January of each year to track and record projects related to natural hazard mitigation, adaptation, and risk awareness education. Each participating agency will be requested to provide end-of-year summaries of mitigation, adaptation and resilience programs, projects, success stories and barriers to implementation. This yearly assessment will better enable the five-year review tracking of the Plan. The SHMO is the state lead of the Silver Jackets and will collect this information.

The next update process will be further refined and simplified to allow for a more efficient process for the collection and update of hazard-specific information, local data integration, and agency-specific capabilities and mitigation measures.

2.4 Monitoring Progress of Mitigation Activities

S18. Does the plan describe the systems for monitoring implementation and reviewing progress?

44 CFR Reference §§201.4(c)(5)(ii) and 201.4(c)(5)(iii)

The plan is a document that requires regular monitoring, review, and evaluation. Also, the Federal Hazard Mitigation Planning regulations require the plan to be updated and submitted for approval to the Regional Administrator of FEMA every five years. The plan will be reviewed post-disaster or as needed. Mitigation staff will initiate planning to update the plan at least 24 months before FEMA approval is required to integrate input from federal, state, and local agencies and the public.

The Silver Jackets meet regularly and will conduct a review of the plan as necessary. The SHMO and SHMT will lead the Silver Jackets to:

- Review the goals and action items to determine their relevance to changing situations in the state.
- Review the risk assessment as necessary to incorporate current information, including updated hazard profiles and any new data on vulnerable state facilities.
- Consider recommendations by the Silver Jackets members to increase hazard mitigation involvement by federal agency representatives, state agencies and local jurisdictions.
- Discuss changes in policies, priorities, programs, and funding that alter the plan's goals and objectives, projects, and timelines.

Specifically, the SHMO and SHMT will continue to present funding opportunities for both disasters and non-disasters to all emergency management directors in the state and Silver Jackets. HSEM works directly with the MN DNR flood hazard mitigation staff in times of flood disasters to gage matching funds availability. Each meeting with the Silver Jackets, MDH and other state agencies is an opportunity to promote the Plan, funding opportunities and coordination. Each disaster is an opportunity to review existing hazards, conduct additional research, and gather more information for inclusion in the next update of the Plan.

The State of Minnesota will update its plan as necessary to reflect:

- **Hazards addressed in the plan**—All of the natural and human-caused hazards that have been identified as posing a threat to the state of Minnesota have been included in the plan. As situations change or new information becomes available 1) the hazards currently included in the plan will be updated and 2) new hazards identified as a threat will be added to the plan.
- **State-owned structures**—A state-owned and other critical facilities database is still a priority, though funding is lacking. This database inventories all state-owned structures and will be maintained, as necessary.
- **County- and city-owned structures**—Funding for geocoding county and city critical facilities will continue to be pursued.
- **New mitigation actions and projects**—Additional actions and projects may be identified during the plan evaluation.
- **Problem identification and resolution**—Recommendations developed to overcome problems (technical, political, legal, and financial) may affect the mitigation strategy.

Review and update will involve all the original participants in the planning process and others identified as important for the plan update. This process will occur, as needed, or at a minimum, every five years. The plan will be resubmitted to FEMA for their review as required by the federal DMA 2000 planning guidelines.

The SHMO has the overall authority and responsibility for the maintenance of the Plan. The updated plan will be submitted to FEMA for review. Once FEMA has determined the plan is "Approved—Pending Adoption," the updated plan must be submitted for approval by the Governor.

Disasters provide an opportunity to evaluate the effects of the disaster, improve resistance to the hazard, review the accuracy of hazard-specific sections, and determine if the planning efforts affected damage reduction. In the case of a disaster declaration in the state, the plan can be updated if HSEM believes this is necessary.

Plan Distribution

The plan, and any changes to it, will be available in an electronic format on the HSEM website. Revised portions of the plan will be annotated with the date of the revision. Digital and/or hard copies of the plan will be distributed to state and federal agencies as requested.

2.5 Acknowledgements

The State Hazard Mitigation Team would like to acknowledge and thank those individuals, agencies, and organizations that provided guidance, input, and support in the development of the 2024 State Hazard Mitigation Plan update (Table 4). The Plan intends to provide unified guidance for ensuring coordination of both pre- and post-disaster-focused hazard mitigation and adaptation efforts. To implement an ongoing, comprehensive state hazard mitigation and adaptation strategy, the Silver Jackets are the primary force behind the review and coordination of the plan update. Subject matter experts were consulted on specific natural hazards and other information needed to comprehensively update the plan. Staff from the Minnesota Board of Water & Soil Resources (BWSR) provided grant information and success stories, in addition to many goals/strategies/actions for flooding and other hazards. Minnesota DNR Climatology Office staff reviewed all natural hazard assessments in Section 5 and the State Profile in Section 3 and provided content throughout the plan about climate change that is consistent with their office messaging. Minnesota DNR Water and Ecological Resources staff provided up-to-date information on flood mapping, NFIP participation, state flood hazard mitigation grants, and success stories. Minnesota DNR Dam Safety and USACE provided current dam information for the dam hazard profile and goals/strategies/actions. Minnesota DNR Forestry provided information on wildfire hazards. MDH provided helpful resources and a review of the population vulnerability content throughout. The state climatology office has been working with HSEM and MDH on many ongoing projects. Their updates on all natural hazards, specifically drought and flooding, are comprehensive. The Coastal Erosion Hazard Mapping workgroup, whose activities spawned from the BWSR One Watershed, One Plan initiative, as well as resources from the Great Lakes Coastal Flood Study (FEMA, 2018) greatly contributed to the content and currency of the coastal erosion and flooding section.

We thank those with a passion for mitigation and adaptation for making Minnesota more resilient to future events.

Table 4. Subject matter experts

Agency	Name	Title
City of Afton	Ron Moorse	City Administrator
City of Moorhead	Bob Zimmerman	Engineering Director
MN DNR	Alex Gehrig	Acting Wildfire Prevention Supervisor
MN DNR	Clinton Little	Coastal Program Specialist
MN DNR	Luigi Romolo	State Climatologist
MN DNR	Kenneth Blumenfeld	Senior Climatologist
MN DNR—Ecological and Water Resources)	Pat Lynch	Flood Hazard Mitigation (FMH) Grants Administrator
MN DNR—Ecological and Water Resources	Ceil Strauss	National Flood Insurance Program (NFIP) State Coordinator
MN DNR—Ecological and Water Resources	Matt Bauman	Flood Hazard Mitigation Grant Assistance Program Manager
MN DNR—Ecological and Water Resources	Julie McDonnell	Coastal Program Specialist
HSEM	Carter Oster	Intelligence Coordinator
HSEM	Patrick McLaughlin	All-Hazard Planner
HSEM	Wayne Lamoreaux	Deputy Public Assistance Officer
MDH	Kirk Smith	Epidemiologist Program Manager
MDH	Carly Baade	Health Program Rep Senior
MDH	Elizabeth Schiffman	Epidemiologist Supervisor
MDH	Kristin Raab	Research Scientist Supervisor
MN Department of Labor and Industry	Greg Metz	Assistant Director
MN Office of Traffic Safety	Karen Aldridge	Research Analysis Specialist
MN State Fire Marshall	Amanda Swenson	Interim State Fire Marshal

Agency	Name	Title
MnDOT	Brian Shekleton	Principal Climate & Resilience Planner
MnDOT	Rachel Pichelmann	Hydraulic Resiliency Engineer
MnDOT	Nathanial Sievert	Airport Operations Program Administrator
MnDOT	Doug Maki	Asset Management & Resiliency Engineer
MnDOT	Robert Clarksen	Transportation Planning Coordinator
MPCA	Laura Millberg	Climate Change Resilience Coordinator
MPCA	Casey Scott	Wastewater Research Specialist
Star Energy Services, LLC	Kristi Robinson	Director of Operations

Section 3 State Profile & Climate

3.1 Geographic Characteristics

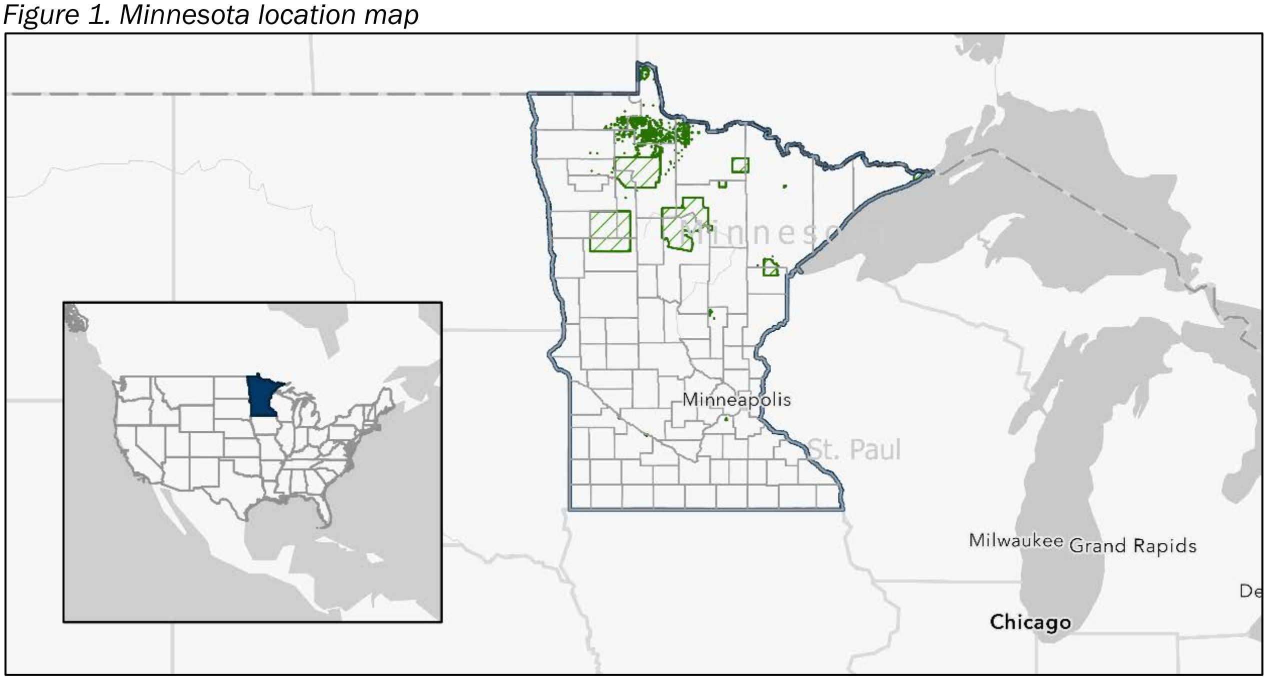
Minnesota is located in the north-central United States (Figure 1). Near the geographic center of North America, it is bordered on the north by the Canadian provinces of Manitoba and Ontario, on the west by North Dakota and South Dakota, on the south by Iowa, and on the east by Wisconsin and Lake Superior. Minnesota entered the Union on May 11, 1858, as the 32nd state.

Minnesota is divided into 87 counties. There are also seven Anishinaabe (Chippewa, Ojibwe) reservations and four Dakota (Sioux) communities in Minnesota.

Minnesota covers 86,943 square miles, of which 4,780 square miles are inland waters and 2,546 square miles consist of a portion of Lake Superior under the state's jurisdiction. Of the 50 states, Minnesota ranks 12th in total land area. From north to south the state measures 406 miles, and from east to west it measures 358 miles at its maximum extent and about 180 miles at its narrowest point.

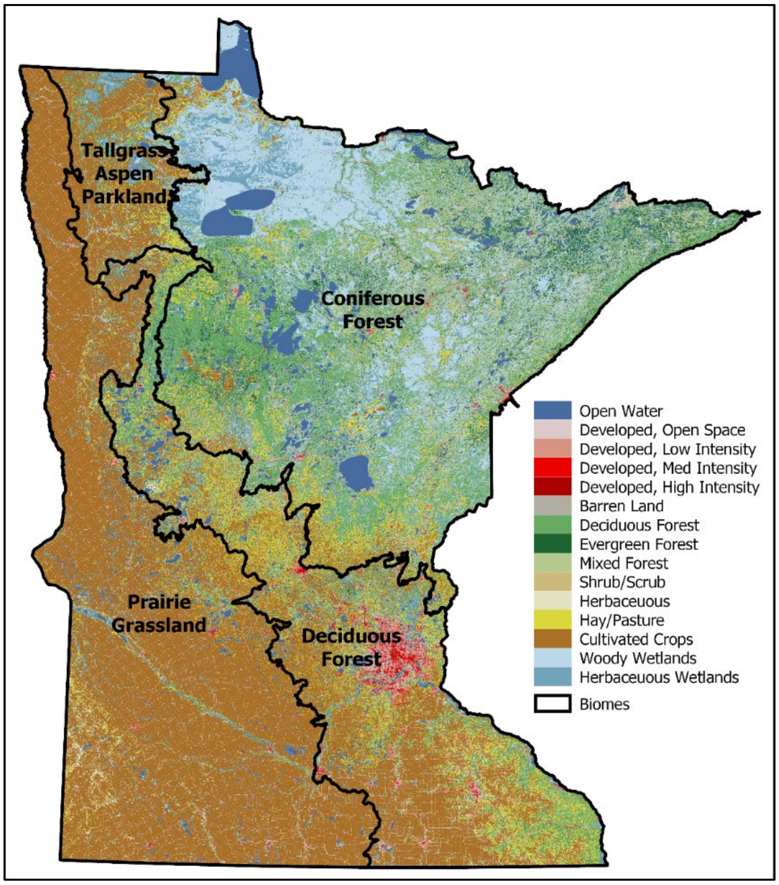
The mean elevation is approximately 1,200 feet. Three areas in the state reach higher than 1,600 feet: the Iron Range (paralleling the north shore of Lake Superior), the Coteau Des Prairies (also known as Buffalo Ridge), and a small area in the Lake Itasca region. The highest point in the state is Eagle Mountain in the extreme northeast, at 2,031 feet. The lowest elevation is 602 feet along the shores of Lake Superior.

Figure 1. Minnesota location map



SOURCE: (ESRI, 2024)

Figure 2. Land cover and ecological regions in Minnesota



SOURCE: (MN DNR, 1999; USGS, 2016)

The natural environment of the state is broken into four ecological regions. A small region in the far northwest and north-central part of the state is in the tallgrass aspen parkland biome. The coniferous forest in Minnesota is found in the northeastern half of the state and extends diagonally into the deciduous forest; prairie grassland is found in the western and southwestern parts of the state. Most of these forests were cleared and converted to farmland during Minnesota's first 50 years of statehood. The state once had 18 million acres of prairie that stretched across the southern portion of the state and northward along the western border. Like the deciduous forest, the vast majority of the prairie grassland biome has been converted to agricultural land (Figure 2).

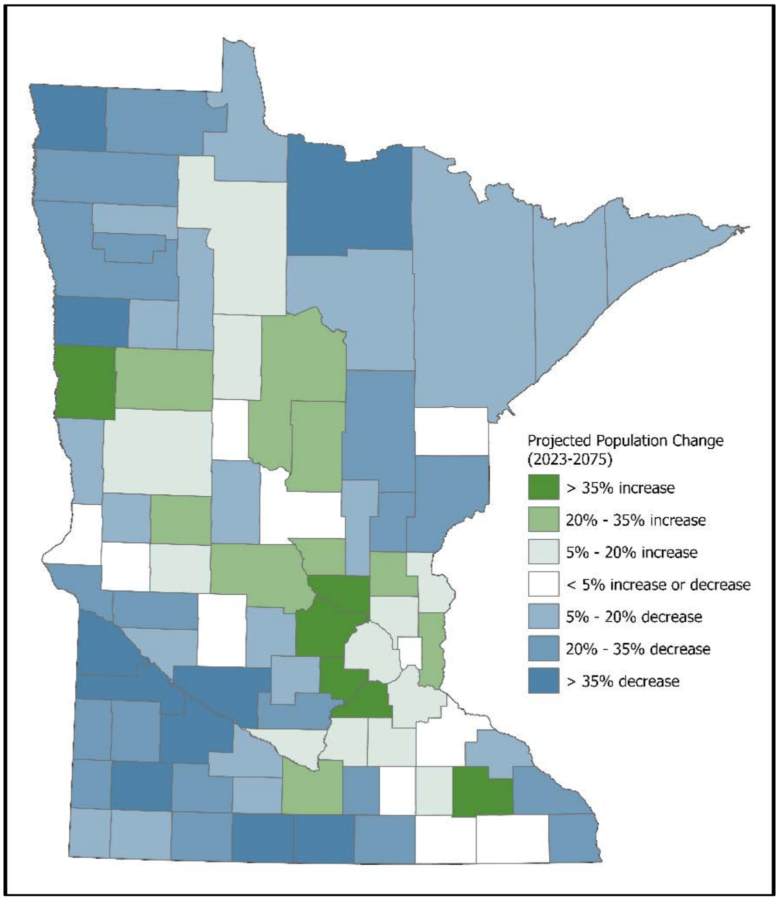
3.2 Demographic Characteristics

Minnesota is home to 5.7 million residents, 55% of whom live in the Twin Cities Seven-County Metro Region. According to the 2020 U.S. Census Bureau data, Minnesota's total population on April 1, 2020 was 5,706,494. This is a 7.6% increase from 2010, when the population was 5,303,925.

View the projected population change from 2023–2075 on the Equity Page of the Plan website

Population projections through 2075 (Figure 3) indicate that the strongest areas of growth will remain the outer ring suburbs within the seven-county metropolitan area surrounding the Twin Cities of Minneapolis and St. Paul. Strong increases are also projected for the Rochester and St. Cloud areas. The five counties with the greatest increase in population are Carver (17.4%), Scott (16.2%), Wright (13.3%), Olmsted (12.9%), and Washington (12.4%). Minnesota's most rural counties have experienced population declines since the 1940s. The five counties with the greatest population loss include Koochiching (−9.4%) Yellow Medicine (−8.7%), Kittson (−7.6%), Lac qui Parle (−7.4 %), and Lake of the Woods (−7.0%) (US Census Bureau, 2023c).

Figure 3. Projected population change, 2023–2075



SOURCE: (MINNESOTA STATE DEMOGRAPHIC CENTER, 2020)

Age trends are also transforming the Minnesota population. The number of Minnesotans aged 65 years and older is projected to increase to about one-fifth of the state population by 2033. The under-18 age group has decreased in population by 1.4%. Thirty-six percent of the youngest residents (age 0–4) are of color, compared to 7% of residents 65% and older (Minnesota Compass, 2023).

As shown in Table 5, Minnesota ranks among the top five states in the United States in several important factors, such as home ownership, labor force participation, and high school completion According to the U.S. Census (2023a).

The Minnesota State Demographic Center has published a report on the economic outcomes for the state's 17 largest cultural groups, as well as descriptive social characteristics (birthplace, age, educational attainment, etc.) that may influence economic outcomes. In Minnesota, as is true across the nation, race is associated with the likelihood of living in poverty (MDA, 2018).

Table 5. Minnesota American Community Survey (ACS) rankings, 2019 vs 2022

Reported in 2019 Plan	2022 ACS 1-Year Ranking Tables
2nd in home ownership (74.5% owner-occupied)	9th in home ownership (72.1% owner-occupied)
4th in labor force participation (69.9% for ages 16 and over)	2nd in labor force participation (79.1% for ages 16 and over)
2nd in high school completion (92.6% for ages 25 and over)	4th in high school completion (94.0% for ages 25 and over)
5th lowest poverty rate (10.8% of all people)	5th lowest poverty rate (9.6% of all people)

SOURCE: (US CENSUS BUREAU, 2023A)

3.3 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: 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. 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. ATSDR's 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, 2020).

The ATSDR SVI aggregates U.S. Census data to determine the social vulnerability of every census tract. The ATSDR SVI ranks each census tract on 15 social factors compiled in the census and groups them into four related themes:

- Socioeconomic:
  - Proportion individuals below poverty level
  - Proportion civilian unemployed 16+yrs
  - Per capita income in 1999
  - Proportion persons with no high school diploma 25+yrs
- Housing Composition and Disability:
  - Proportion persons 65 years or older
  - Proportion persons 17 years or younger
  - Proportion persons with disability 5+yrs
  - Proportion single-parent HH with children under 18 yrs
- Minority Status and Language:
  - Proportion minority
  - Proportion persons 5+yrs who speak English less than 'well'
- Housing and Transportation:
  - Proportion housing with 10+units
  - Proportion mobile home
  - Proportion HH with more people than rooms
  - Proportion HH with no vehicle access
  - Proportion of persons who are in institutional & non-institutional group quarters

Census tracts within Minnesota were ranked and given a percentile value from 0 to 1, with higher values indicating greater vulnerability. More information and full SVI documentation is available on FEMA's National Risk Index website.

Population vulnerability is dynamic. As population demographics and economic and housing characteristics change, so will a population's vulnerability to hazards and climate changes. The Social Vulnerability Index used in the FEMA National Risk Index was published in 2020.

Explore population vulnerability on the in the Minnesota Demographics and Economy dashboard on the Plan website

The full results of this ranking, as well as the ATSDR Social Vulnerability Ranking by county, can be seen in Appendix A: Social Vulnerability Ranking.

3.4 Economic Characteristics

Minnesota currently ranks 10th in the nation with 15 Fortune 500 Companies, three fewer than in 2018. The top five companies in 2023 remain unchanged from 2019 and include UnitedHealth Group (ranking 5th with $324.1 billion in revenues, Target, Best Buy, CHS, and 3M. The 15 companies represent sectors of health care, transportation, retail, food production, chemicals, utilities, insurance and finance (Niepow, 2023). Minnesota's top employers include Mayo Clinic (49,200), the State of Minnesota (38,000), and Fairview Health Services (37,689). Healthcare services and manufacturing are the largest sectors by employment. Minnesota's seasonally adjusted unemployment rate fell to 2.9% in December of 2023 (MN DEED, 2023).

Minnesota ranks 20th nationwide in real per capita GDP. In 2022, Minnesota had a per capita personal income (PCPI) of $68,840, ranking 13th in the United States and was 105.1 percent of the national average. In 2022, Minneapolis-St. Paul-Bloomington, MN-WI (MSA) had a PCPI of $75,164. This PCPI ranked 24th in the United States and was 114.8 percent of the national average (Bureau of Economic Analysis, U.S. Department of Commerce, 2023).

Minnesota's agricultural landscape includes a vibrant mix of farms and agribusinesses that sell into local and regional markets, generating an estimated $184 million in economic activity each year. Minnesota ranks first in the nation in production of sugar beets, turkeys, sweet corn for processing, and green peas for processing (MDA, 2024). In the 2017 Agricultural Census (the 2022 census had not been released at the time of this writing), Minnesota had 67,100 farms operated on 25.4 million acres. And comprised 5% of U.S. agriculture sales (USDA, 2018). Agriculture supports many other industries, such as manufacturing, transportation, wholesale and retail trade, services, construction, banking, insurance, and real estate. The economic contribution of Minnesota's agricultural industry reaches far beyond the agricultural sector due to the "multiplier effect." Minnesota's changing climate will increasingly present challenges for the agricultural sector with ripple effects for the state's economy.

Tourism is also a key sector of Minnesota's economy, and similarly one that is at risk due to Minnesota's changing climate. Leisure and hospitality in Minnesota generated $22.8 billion in total economic impact of sales and $2.2 billion in state and local sales taxes in 2022. In 2022, the annual number of travelers (in person-trips) in Minnesota was 76.6 million, over 13 times the total population of the state (Explore Minnesota, 2024).

3.5 Development Trends

S7. Was the risk assessment revised to reflect changes in development?

44 CFR Reference §201.4(d)

According to the 2024 State of Rural Minnesota report by the Center for Rural Policy and Development, the share of Minnesota's population is becoming increasingly urban, with signs indicating that this trend may be intensifying. Thirty-seven counties (43%) in Minnesota had a lower population in 2022 than in 2010. Most of those counties are concentrated in Southwest and Northwest Minnesota. Although the overall population in Minnesota is growing, the rate at which it is growing is declining. This declining rate of growth is consistent across the state as regions that have experienced population growth are seeing less growth than they did in the 2000s (Center for Rural Policy and Development, 2024).

Each year, the Metropolitan Council surveys communities in the seven-county Twin Cities region to gather data about building permits issued during each calendar year. This survey provides the most complete and consistent information to ensure communities get their share of state funding in the region of the state where the most growth is occurring. According to the Metropolitan Council 2020 Building Permit Survey, the net housing production in 2000–2010 averaged 14,6000 added housing units compared to 2010–2020 with an average of 12,900 added housing units (METC, 2024). Commercial, industrial, public, and institutional construction activity also measures economic development and informs local planning. These data are available in a spatial database format (METC, 2023).

The Metropolitan Council Historical Generalized Land Use dataset encompasses the seven county Twin Cities (Minneapolis and St. Paul) Metropolitan Area. The dataset was developed for long-range planning for the Twin Cities area, including to monitor growth and to evaluate changing trends in land consumption for various urban purposes. The data were interpreted from 1984, 1990, 1997, 2000, 2005, 2010, 2016, and 2020 air photos and other source data, with additional assistance from county parcel data and assessor's information (METC, 2020).

The two datasets were combined to consider where non-residential permits were issued in the seven-county Twin Cities region between 2017–2023 where the land-use was classified as agricultural, recreation/park/preserve, or undeveloped in 2016. A total of 585 new non-residential permits were issued in the primary community designations of suburban (25%), suburban edge (30%), and emerging suburban edge (19%). Of these 585 permits, four permits in Anoka County and one permit in Scott County intersect the 1% annual chance flood zone.

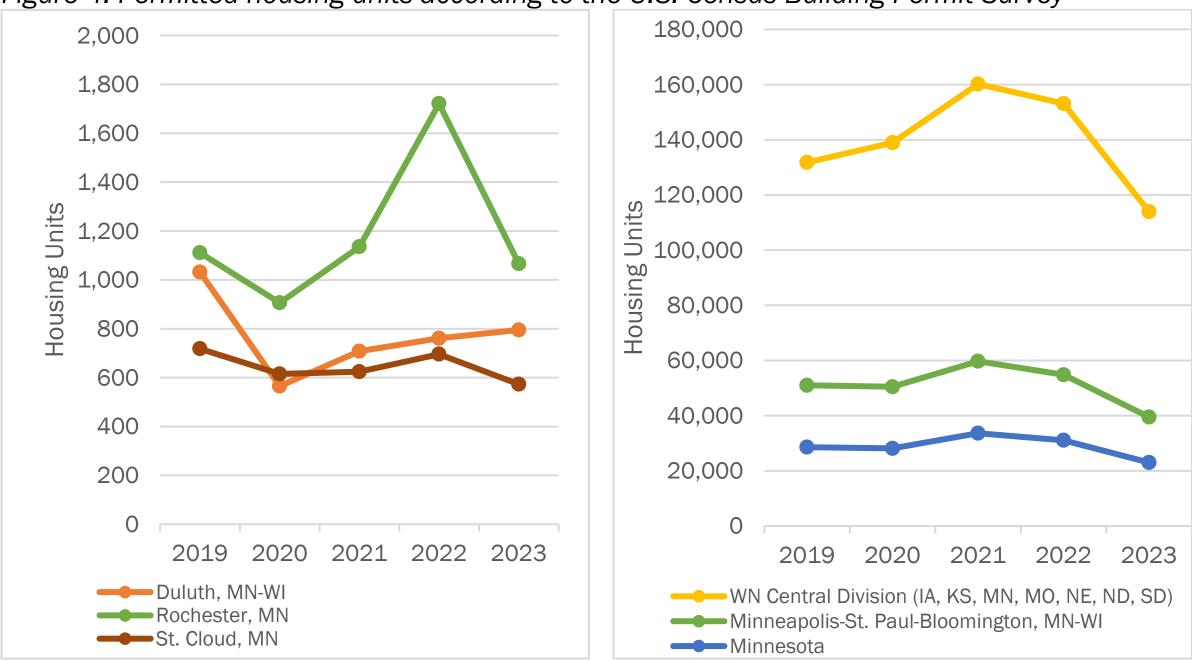
The U.S. Census Building Permits Survey (BPS) provides national, state, and local statistics on new privately-owned residential construction based on building permits issued and the structure values (US Census Bureau, 2023b). This also provides some insights as to how development is occurring in

Minnesota in the four largest metropolitan areas in the state. The charts below show residential permits issued (by number of units permitted) for the years 2019–2023 (Figure 4).

One ongoing challenge associated with population growth is maintaining a balance between development and natural resource protection. Each community is responsible for ensuring ordinances that protect residents from flooding, wildfire and other hazards are enforced. Communities with floodplain ordinances and communities that participate in Firewise are more resistant to associated hazards. Comprehensive plans, land-use plans, watershed management plans and all types of long-term community planning are a local responsibility. Hazard mitigation plans (HMPs) requiring federal funding aim to give incentives to these communities to reduce vulnerability to all hazards for existing properties. The state does not dictate how communities grow; however, the current participation of Minnesota's counties (and some tribes and cities) in all-hazard mitigation planning is a positive step towards making the state and its residents disaster resilient.

Utilizing land use and comprehensive planning resources will ensure Minnesota remains safe for its residents, as well as environmentally and economically sound. It is up to local jurisdictions to enforce existing regulations, and work with communities to develop and grow sustainably, and out of harm's way, to the maximum extent possible.

Figure 4. Permitted housing units according to the U.S. Census Building Permit Survey



3.6 Climate

Minnesota has a highly variable, continental-type climate as described in this section. Despite its high degree of natural variability, climate scientists are finding clear evidence that recent temperature and precipitation increases are exceeding the historical variability of Minnesota's climate and can be attributed to climate change.

Minnesota's position near the center of the continent, and halfway between the Equator and North Pole, subjects it to a wide variety of air mass types throughout the year. Frequent outbreaks of continental polar air occur in every season, with occasional bitterly cold Arctic outbreaks during the winter. Similarly, the state experiences occasional mild to warm conditions in all seasons, with extreme heat episodes common during the summer, particularly in the southern and western portions of Minnesota.

Minnesota's typical variability is such that during the course of a single year, most communities will experience heavy snow, frigid wind chills, howling winds, intense thunderstorms, torrential rains, and heat waves, as well as dozens of bright and sunny days.

3.6.1 Climate and Natural Hazards

In a typical year, more than 40 tornadoes will strike Minnesota (NWS Storm Prediction Center, 2022), as will lines and clusters of thunderstorms producing hail or damaging winds (NCEI, 2023).

Drought is also a natural consequence of Minnesota's varying climate, and even though it does not affect the state every year, all areas have suffered from severe episodes of it at one point or another, with drought conditions being more frequent in the southwest than in the northeast.

Minnesota's climate exhibits geographic variations related to latitude and access both to moisture from the Gulf of Mexico and colder air masses from Canada. As a result, southern Minnesota is warmer than northern Minnesota, and eastern and southern Minnesota are wetter than western and northern parts of the state.

The mean annual temperature in Minnesota ranges from 36–39 °F in the northern counties to 44–46 °F in the Twin Cities region and southernmost counties (MN DNR, 2024b). Temperatures in the state have been as high as 115 °F and as low as −60 °F, a range of 175 degrees, which is unrivaled over most parts of the world (MN DNR, 2024a).

Annual precipitation in the state generally ranges from around 22 inches in the far northwest, to 37 inches in the southeast, with a historical statewide average of about 28.5 inches. Approximately 60-70% of annual precipitation falls during the growing season (May through September). Historical averages show that the driest month for most of the state is February, while the wettest is June. On a statewide scale, the two driest years on record were 1910 and 1976, with an average precipitation of less than 16 inches.

In 2019, the state averaged over 35 inches of precipitation, making it Minnesota's wettest year on record. Other very wet years include 2010, 1977, 1968, and 1965, each with over 33 inches averaged statewide. The wettest growing seasons occurred in 2010, 1993, 1944, and all averaging more than 23 inches of rain across the state (Seeley, 2015). These wet years and growing seasons only tell part of the story, however, because very wet and very dry periods can also affect only *portions* of Minnesota, and some recent differences across the state illustrate this point. For instance, each of the five wettest years on record in southeastern Minnesota have occurred since the year 2000 (2019, 2016, 2010, 2007, and 2004), but only two of those years (2019 and 2010) ranked in northwestern Minnesota's top five. The years 2006 and 2011 ranked as the ninth and tenth driest on record in northeastern Minnesota, but those same years were much closer to average in south-central Minnesota.

Mean seasonal snowfall ranges from less than 35 inches in southwestern Minnesota to more than 90 inches along Lake Superior's North Shore to less than 35 inches in southwestern Minnesota. On average, there are 110 days every year in which there is snow cover of one inch or more, ranging from 85 days in the south to 140 days in the north. Snow has fallen every month except July. Heavy snowfalls of greater than four inches are common anytime from mid-November through early April, with earlier and later-season snowfall events most likely in northern parts of the state.

Heavy snowstorms are common to Minnesota's winters, with daily snowfall totals of four inches or more occurring an average of 3–4 times per winter in southern Minnesota, six times per winter in Duluth, and up to 8 times per winter on the high terrain that runs parallel to Lake Superior shore. These heavy snows can be particularly abundant during snowy winters, and when the circulation of a strong winter storm ingests deep moisture from the Gulf of Mexico, snowfall totals can exceed one—or even two—feet. On January 7, 1994, an observer near Finland, MN recorded a state-record 36 inches of snow in 24 hours, with a three-day total 46.5 inches—also a state record (MN DNR, 2023c). With multiple snowstorms producing a foot of snow or more across many different parts of Minnesota, the winter of 2022–23 broke all-time seasonal snowfall records at Duluth and St. Cloud, with 140.1 and 88.2 inches, respectively. The Twin Cities recorded its third-snowiest winter since 1885, with 90.3 inches.

Blizzards, containing both heavy snow and strong, gusty winds occur one to two times per year on average, typically in open country or along the shore of Lake Superior. Occasionally, however, intense blizzards strike the heart of the Twin Cities, as occurred with the "Holiday Lights Howler" of December 23, 2020 (MN DNR State Climatology Office, 2020), and the "Thunder Blizzard" of April 2018 (MN DNR State Climatology Office, 2018). "Ground blizzards" of severe blowing snow but little falling snow typically affect areas near the Red River and the Minnesota River one to two times per winter, but active winter weather patterns with frequent "Alberta Clippers" can produce an unusual number of these dangerous prairie storms During the 2021–22 "Winter of Whiteouts," the National Weather Service issued Blizzard Warnings on 11 different days, often for ground blizzard conditions (MN DNR State Climatology Office, 2022).

3.6.2 Minnesota's Climate is Changing

Minnesota's climate change summary is informed primarily by the Midwest Chapter of the Fifth National Climate Assessment (NCA5) dated November 2023 and with interpretations from the MN DNR State Climatology Office (Wilson et al., 2023).

Rising global temperatures and the resulting increases in atmospheric moisture from evaporation of ocean waters have allowed Minnesota to become warmer, wetter, and more humid during the past several decades. The ten combined warmest and wettest years between 1895 and 2022 all occurred since 1998. Nights have warmed faster than days since 1970, and winter has warmed several times faster than summer. Even with the drought conditions of the early 2020s in Minnesota, heavy precipitation continues to show long-term increases, with damaging rain and snowfall events reported somewhere in the state each year of the decade through 2023. Despite no increase in the highest temperatures of summer, maximum annual heat index values (one measure of how hot it feels) have been rising across the state, because increased humidity during heat waves.

Even though periods of intense growing-season drought have defined the climate of the early 2020s in much of Minnesota, long-term increases in annual precipitation have continued because of heavy and even record-setting precipitation during the cold season. For instance, record-dry conditions during

May through mid-August of 2021 led to parts of northwestern and northern Minnesota reaching "Exceptional Drought"—the worst category on the US Drought Monitor. A shift to a stormy pattern during the following winter and spring, however, produced unprecedented precipitation between December in May in the exact same areas, with historic flooding along the Rainy River.

The observed changes in our climate have altered growing seasons, damaged forests, challenged natural resource management, limited recreational opportunities, destroyed infrastructure, and affected the conditions of lakes, rivers, wetlands, and groundwater aquifers that provide water for drinking and agriculture. Climate models project that temperature and precipitation increases will continue in Minnesota through the 21st century, with hotter summers and increased drought severity during dry periods as well.

To help the public understand how the changing climate has affected and is expected to affect the behavior of common weather hazards in the Minnesota, the MN DNR State Climatology Office developed graphical summaries of the scientific confidence associated with each hazard's relationship to climate change (Table 6 and Table 7). Climate change in Minnesota has by far the strongest associations with (1) sharp declines in the frequency and severity of extreme cold outbreaks, tied to a persistent warming of winters, and (2) sharp increases in the frequency and intensity of extreme precipitation events. For instance, from 1970 through 2023, Minnesota's winters warmed at a rate of almost one degree F per decade, and approximately three-four times faster than summer. During that same period, the coldest night of the year has warmed almost twice as fast as winter as a whole—up to two degrees F per decade (or 20 degrees F per century).

Despite major losses to cold extremes, the warming climate and increased abundance of atmospheric moisture has led to an uptick in many heavy snowfall metrics across Minnesota, leading to moderately high confidence that the changing climate is increasing heavy snowfall events—even as other winter characteristics decline. The intensity and frequency of tornadoes and severe convective storms are weakly connected at best to recent climate changes, and since the 1950s, despite superior detection and verification capabilities, the number of damaging tornadoes rated at least F-2 or EF-2 in Minnesota has shown no increases. Dramatic changes in the seasonal and geographical ranges of severe convective weather have, on the other hand, already affected Minnesota. In 2021, a damaging tornado crossed the Boundary Waters into Canada, becoming the latest on record so far north in the state. Then, on December 15th, an outbreak of destructive thunderstorm winds and over 20 tornadoes struck the southeastern parts of the state, producing the latest tornadoes on record by 29 days.

The climatic picture is expected to change further beyond the 2020s and especially as Minnesota approaches the middle of the 21st century (Table 7). Dramatic losses in extreme cold and additional increases in heavy and extreme precipitation are expected to remain the state's leading climate change symptoms. Although Minnesota has not yet observed increases in the frequency, severity, or duration of summertime high temperatures or drought (through 2023), climate model projections summarized in NCA5 indicate that heat waves are all but certain to increase by mid-century. A 2018 study conducted by NOAA scientists indicates that by the 2050s, heat waves in Minnesota will be more attributable to climate change than to natural variability (Lopez et al., 2018).

Table 6. Confidence that climate change has already impacted common Minnesota weather/climate hazards

Confidence	Hazard	Recent & Current Observations
Highest	Extreme cold	Rapid decline in severity & frequency
	Extreme rainfall and heavy snowfall	Becoming larger and more frequent
Moderately High	Humid heat waves	Some increase in maximum dew point and Heat Index values since 1980
Moderately Low	Tornadoes, hail, thunderstorm winds	Intensity and frequency unchanged, but seasons expanding aggressively
Low	Drought and dry spells	Intense & major episodes in early 2020s but no long-term trend
Lowest	Summer high temperature extremes	Highest temperatures still *well* within historical ranges, and number of hot days increasing only slightly in isolated locations

SOURCE: (BLUMENFELD, K. MINNESOTA STATE CLIMATOLOGY OFFICE, PERSONAL COMMUNICATION, DECEMBER 21, 2023)

Table 7. Confidence that climate change will impact common Minnesota weather/climate hazards through 2070

Confidence	Hazard	Expectations through 2070
Highest	Extreme cold	Continued rapid decrease in severity and frequency
	Extreme rainfall	Unprecedented events more common
High	Heat waves	Summer high temperatures, maximum dew point and heat index values all projected to increase
Moderately High	Drought	Increased severity likely as summer heat increases; frequency and duration projections unclear
Moderately Low	Heavy snowfall	Greater extremes, but events less frequent as winter rain increases
	Tornadoes, hail, thunderstorm winds	Intensity and frequency unclear but continued seasonal expansion and larger "outbreaks" possible

SOURCE: (BLUMENFELD, K. MINNESOTA STATE CLIMATOLOGY OFFICE, PERSONAL COMMUNICATION, DECEMBER 21, 2023)

3.7 Climate Change Impacts and Resilience Planning

The NCA5 states that even if the world decarbonizes rapidly, the Nation will continue to face climate impacts and risks. Adequately and equitably addressing these risks involves longer-term inclusive planning, investments in transformative adaptation, and mitigation approaches that consider equity and justice. In the Midwest, rising temperatures, extreme precipitation, drought, and other climate-related events are impacting agriculture, ecosystems, cultural practices, health, infrastructure, and waterways. Communities, Indigenous Peoples, governments, and businesses are embracing adaptation approaches that include climate-smart agriculture, improved landscape management, innovative green infrastructure financing, and collaborative decision-making.

NCA5 includes these key messages for the Midwest region (Chapter 24: Midwest):

- Changes in precipitation extremes, timing of snowmelt, and early-spring rainfall are expected to pose greater challenges for crop and animal agriculture, including increased pest and disease transmission, muddier pastures, and further degradation of water quality. Climate-smart agriculture and other adaptation techniques provide a potential path toward environmental and economic sustainability.
- Increasing incidence of flooding and drought is expected to further alter aquatic ecosystems, while terrestrial ecosystems are being reshaped by rising temperatures and decreasing snow and ice cover. In response, communities are adapting their cultural practices and the ways they manage the landscape, preserving and protecting ecosystems and the services they provide.
- Climate change has wide-ranging effects on lives and livelihoods. Mitigation and adaptation strategies, such as expanded use of green infrastructure, heat-health early warning systems, and improved stormwater management systems, when developed in collaboration with affected communities, have the potential to improve individual and community health.
- Increases in temperatures and extreme precipitation events are already challenging aging infrastructure and are expected to impair surface transportation, water navigation, and the electrical grid. Shifts in the timing and intensity of rainfall are expected to disrupt transportation along major rivers and increase chronic flooding. Green infrastructure and public and private investments may mitigate losses, provide relief from heat, and offer other ways to adapt the built environment to a changing climate.
- Climate-related changes to water quantity and quality are increasing the risks to ecosystem health, adequate food production, surface water and groundwater uses, and recreation (high confidence). Projected increases in droughts, floods, and runoff events across the Mississippi River basin and the Great Lakes will adversely impact ecosystems through increased erosion, harmful algal blooms, and expansion of invasive species.

Key messages from the NCA5 are indicated in green throughout this document.

3.7.1 Climate Change Adaptation

Since 2009, Minnesota state agencies have been collaborating on climate adaptation efforts, first through the Interagency Climate Adaptation Team (ICAT) and more recently through Action Teams and Goal Teams in support of the Climate Change Subcabinet and implementation of *Minnesota's Climate Action Framework (CAF)*. To address the most challenging sources of greenhouse gases and ensure Minnesota's resilience through CAF implementation, the Governor's FY24-25 biennial budget proposed historic investments across the enterprise of more than $700 million. Much of that budget request was funded during the 2023 legislative session. State agencies now are implementing the various programs that received funding.

The Minnesota Pollution Control Agency (MPCA) received initial seed funding for climate resilient infrastructure planning from the 2021 legislative session, followed by an historic biennial appropriation of $100 million from the 2023 session to provide grants to local governments and Tribal Nations for planning and implementing projects that increase resilience of stormwater, wastewater, and other community infrastructure. MPCA awarded more than $3 million to political subdivisions during FY22, FY23, and FY24 for these resilience planning grants, with more to follow in FY25. In FY24, MPCA opened a new funding opportunity of $35 million for Implementation Grants for Stormwater Resilience. Another new funding opportunity is anticipated to follow for Implementation Grants for Wastewater and Community Resilience. Stormwater Implementation Grants will be offered again in FY25. See Section 7 for more information about state programs.

Climate change adaptation is important for increasing the resilience of communities and the environment. The shocks caused by more extreme weather events and the stressors of longer-term changes to the climate affect all natural systems. For human communities, these impacts challenge the surroundings in which they live, the critically important ecosystem services upon which they depend, public health, local facilities and infrastructure, the safety of their residences, and the viability of their livelihoods. Development trends can further exacerbate both climate impacts and population vulnerability. Communities are only as resilient as the most vulnerable within them.

The Minnesota Pollution Control Agency (MPCA) had funded studies to identify climate-vulnerable populations, resilience indicators, and strategies to reduce risk in 23 cities throughout Minnesota (paleBLUEdot, 2018). A valuable section in these plans was the outlining of climate adaptation and resilience goals for environmental hazards of climate change that continue to be applicable, including heat stress and extreme weather, air quality impacts, flood vulnerability, vector-borne disease risks, water quality and quantity risks, and waterborne illness risks. In addition, goals were outlined to build capacity for preparing for and responding to population risks of climate change impacts and economic resilience in support of climate resilience.

Following completion of the 2019 State Plan, HSEM encouraged jurisdictions, through various modes of outreach, to integrate the MDH Regional Climate Profile information and the paleBLUEdot climate adaptation goals and strategies throughout their Hazard Mitigation Planning processes. Hazard mitigation can be used to reduce the risk of damaging climate change impacts on communities and the environment such as increased flash flooding. The impacts of climate change are discussed regionally and by natural hazard in each risk and vulnerability section of this report.

3.7.2 Health Impacts of Climate Change in Minnesota

Climate change already impacts our health, and these impacts are expected to worsen in the years ahead. The risks are especially high for Minnesotans who are less able to cope due to their age, income, housing insecurity, preexisting health conditions, and more.

Heat, air pollution (including wildfire smoke and allergens like pollen), extreme precipitation, floods, droughts, and ecosystem changes are all “climate hazards” that impact our health. Some of these climate hazards have a direct effect, like a heat-related illness from a heatwave, while some have an indirect impact, like exacerbation of asthma from mold growth in a flooded basement.

Heat

Minnesotans will experience a wide range of impacts from the increased frequency and severity of extreme heat events. Higher heat, increased humidity, and longer and more frequent extreme heat events can lead to direct health impacts of dehydration and heatstroke. Untreated heat stroke can lead to death. Heat-related illness directly accounted for 75 deaths in Minnesota from 2000–2022.

Heat can also worsen existing health conditions, such as respiratory and cardiovascular diseases. The people most at risk include those who are more exposed and those who may be more susceptible due to physiological reasons. People more likely to be exposed to heat include outdoor workers in agriculture and construction, student athletes, people who live in cities (due to the heat island effect), people without air conditioning, and unhoused persons.

People at higher risk because of physiological reasons include those with underlying medical conditions, pregnant people, older adults, infants, and young children.

Just as one example of the devastating effects of heat, in the summer of 2011, Minnesota had six days when the heat index was 105 degrees F or higher—and that same summer there were 1,302 emergency department visits and 3 deaths due to heat. What makes these numbers tragic is that heat-related illnesses are preventable.

Indirect impacts of extreme heat include infrastructure failures like roads buckling and power outages; strain on essential services, such as emergency medical services and law enforcement response time due to increases in crime; and disruptions to important social and economic networks, such as school and event cancellations, which reduces access to education, physical activity, and community support.

Air Pollution

In general, we breathe clean air in Minnesota, according to federal standards. But on some days and in some locations, air is unhealthy due to ozone or fine particulate matter. Greenhouse gas emissions can increase air pollution, and rising temperatures can also affect the formation and release of pollutants. Unhealthy air days are expected to become more frequent, and more intense due to climate change.

Climate change is likely to increase three main air contaminants in Minnesota: ozone, particulate matter (including wildfire smoke), and allergens. These air pollutants can cause or exacerbate cardiovascular and respiratory diseases, chronic obstructive pulmonary disease (COPD), allergies, and asthma.

Pollen is intensifying with climate change, and can trigger allergies, asthma attacks, and affect other respiratory conditions. In Minnesota, asthma affects one in 16 children (6.4%) and one in 13 adults (7.4%). People with asthma need to be especially aware of pollen sources and seasons to prevent an allergy-related asthma attack.

There are three pollen seasons in Minnesota: trees, grasses, and weeds. Trees are the first to release pollen, typically starting in early April, grasses usually ramp up pollen release in early June, and weeds typically begin releasing pollen in mid-June and continue until the first hard frost. Research shows that the growing season for ragweed pollen, which is highly allergenic, has increased by 15 to 25 days in and around Minnesota. The lengthening pollen season is strongly related to climate change characteristics, such as lengthening of the frost-free season and later timing of the first fall frost.

Indirect health effects from air pollution can include reduced visibility on a high smog day, reduced productivity at work or school due to allergies or asthma, and reduced productivity and degradation of crops and water sources, which can lead to economic burdens.

Those most at risk include:

- Children, because they have developing lungs, are outside more, and they play vigorously and inhale more air per pound of body weight compared to adults.
- Adults over 60, because their bodies are aging.
- People with chronic respiratory or cardiovascular disease because they are more susceptible to air pollution.
- Individuals living near other sources of air pollution (such as roadways, freeways, and heavy industry), because they are chronically exposed to air pollution.
- People of color, because they are more likely to be exposed to more air pollution and have a disproportionate burden of heart and lung diseases, which may increase susceptibility.

Extreme Precipitation, Floods, Drought

Rain is falling more frequently in extreme, heavy, localized events, leading to some parts of our state experiencing flooding while other parts experience drought.

Increased frequency and severity of heavy rainfalls can lead to flooding, which results in both direct and indirect health impacts like:

- Injury or even death from drowning.
- Illnesses from being exposed to contaminated drinking water or recreational sources.
- Mental health stress from experiencing the trauma of the event or later from being displaced or dealing with damaged homes and business.
- Respiratory ailments from exposure to mold from flooded basements.
- Carbon monoxide poisoning from exposure to carbon monoxide when using secondary power sources, like generators.
- Flooding can also disrupt economic and social networks and put a strain on essential services.

The people most at risk are Minnesotans who are more likely to be exposed to flood waters, like those who live in a flood plain or near water bodies, or people who cannot easily evacuate or recover from flooding destruction, such as people who do not have reliable transportation, people who can't use the stairs when elevators are out of service, people in wheelchairs, people with disabilities, older adults, and lower income people.

Heavy rain events can cause standing water in backyards or basements. Many homeowners have experienced wet basements, which is mentally and financially stressful, and if mold starts to grow that can become a health problem.

Localized flash flooding can also be a problem where our infrastructure is undersized, and people get caught off guard by flooded roads. This is an important public health safety concern as almost half of flash flood fatalities occur in vehicles. It takes as little as six inches of fast-moving water to knock over and carry away an adult, and as little as 12 inches can carry away a small car.

Another public health concern with precipitation changes exacerbated by climate change is waterborne disease outbreaks. Heavy downpours can lead to a host of problems, including increased runoff and sewage overflows, which can cause outbreaks of waterborne diseases such as E. coli and Cryptosporidium. Runoff can carry viruses and other disease-causing agents into wells and recreational waters, contaminating them and causing health problems.

Zoonotic Diseases

Zoonotic diseases or zoonoses are caused by germs like viruses, bacteria, parasites, and fungi that spread between animals and people. Increases in temperatures and changes in rain patterns are changing our ecosystems, which can affect the spread of diseases carried by insects, ticks, rodents, birds, and other animals.

Diseases from ticks include Lyme disease, Anaplasmosis, and Babesiosis. As temperatures increase, disease-transmitting ticks will become active sooner and stay active longer, allowing more time to develop and feed on hosts. Ticks thrive in warm humid environments.

Additionally, there may be a decreased die off over the winter months if temperatures do not get very cold. An increase in winter temperatures can also lead to new tick species moving into and surviving in Minnesota, which can lead to the introduction of new diseases.

People more at risk for diseases carried by insects, ticks, and rodents are people who spend more time outdoors or are more exposed to these pests.

Harmful Algal Blooms

An increase in water temperatures can lead to blue-green algal blooms, which contain toxins that can pose harmful health risks. People or pets who drink or swim in water with dangerous levels of harmful algal bloom (HAB) contamination may experience stomach illness, skin irritation, allergic responses, and damage to the liver and nervous system. In extreme cases, dogs and other animals have died after drinking water containing these toxins.

Harmful algal blooms in Minnesota lakes result from several factors including runoff from fertilizers, discharges from waste treatment plants, warmer waters, and higher temperatures. While HABs can occur naturally, the frequency of outbreaks is increasing in part because human activities create favorable conditions for the blooms.

Zoonotic diseases and HABs can have an indirect health effect when they threaten the livelihoods of people who work in recreation-dependent economies that revolve around camping, fishing, and hunting.

Mental Health

Climate change threatens our mental health through direct exposure to a climate-related disaster (e.g., flooding); through the disruption to a major determinant of health, such as a loss of livelihood or a cultural tradition; and through awareness or uncertainty of climate change as an existential threat. These experiences may overlap and lead to compounded impacts on an individual or even an entire community, such as family farmers burdened with decadal drought who are more likely to commit suicide.

Existing research has associated several mental health conditions with climate change, such as psychological distress, grief reactions, depression, post-traumatic stress disorder, interpersonal conflicts, drug or alcohol abuse, loss of identity, and suicide ideation.

People most at risk of climate change-related mental health impacts include:

- Children and youth, who are highly vulnerable to the health impacts of climate change and can be at increased risk for distress and anxiety in the aftermath of an extreme event.

- Women, who have a higher prevalence of Post-Traumatic Stress Disorder (PTSD) and other mental health disorders after disasters than men.
- Elderly, who tend to have higher rates of untreated depression and physical ailments that contribute to their overall vulnerability.
- Communities of color and immigrants, because of racism, socioeconomics, and limited access to quality healthcare and mental healthcare.
- People who speak limited English, because of social isolation related to language barriers that may inhibit their ability to prepare for, respond to, and cope with climate changes and related disasters.
- A combination of risk factors makes people who are experiencing homelessness more at risk to the negative impacts of climate change.
- Healthcare and public safety workers are at an increased risk for short-term and long-term mental health consequences.
- Lesbian, gay, bisexual, transgender, queer and other identities may be at increased risk due to societal stigmatization, harassment, and abuse.

3.7.3 Climate Change Data and Tools in Minnesota

The University of Minnesota Extension and the University of Minnesota's Water Resources Center coordinate the Minnesota Climate Adaptation Partnership (MCAP), which brings together federal and state agencies, organizations, and individuals statewide with an interest in climate adaptation. MCAP received funding after the 2021 legislative session to develop high resolution (2.6 mile/4km grid) dynamically downscaled climate projections utilizing the University of Minnesota's Supercomputing Institute. This data is being made publicly accessible via the new Minnesota CliMAT—Climate Mapping and Analysis Tool. This interactive online tool provides highly localized climate projections for Minnesota. MN CliMAT is based on data from the latest generation of global climate models, called CMIP6. With the dynamically downscaled climate projection data, users can visualize even how small cities will likely be impacted in the coming decades (Liess, S. et al., 2023).

With funding from the 2023 legislative session, MCAP is hiring regional Extension Educators to provide training and technical assistance, including Climate Data Workshops that will equip professionals across agricultural, natural resources, urban planning, public health and other sectors to make climate-informed decisions.

Some curated results from ClimMAT tool are shown on the climate change page of the Plan website

Section 4 Hazards Risk Assessment

S3. Does the risk assessment include an overview of the type and location of all natural hazards that can affect the state?

44 CFR Reference §201.4(c)(2)(i)

4.1 Overview

This section of the plan is a result of a risk and vulnerability assessment conducted for the State of Minnesota. The risk assessment is intended to support the state's long-term hazard mitigation planning efforts. It was prepared to satisfy the requirements of the Disaster Mitigation Act (DMA) of 2000 and to provide a statewide overview of natural hazards and their risks. This plan also includes an overview of seven human-caused hazards.

The framework of the risk assessment was developed to provide a basis for activities proposed during the state's mitigation planning effort and should be used by state and local officials to plan and prioritize resource allocations. The risk assessment results should be used to identify and prioritize appropriate mitigation actions to minimize potential losses from hazards identified in this study.

The hazards profiled in the Minnesota Risk Assessment were selected from the comprehensive list of natural hazards FEMA identified in the 1997 publication, *Multi-Hazard Identification and Risk Assessment: A Cornerstone of the National Mitigation Strategy (MHIRA)* (FEMA, 1997).

All 22 hazards that potentially affect the state are described, as is the nature of each hazard, history, location of occurrence, and probability of future occurrence.

4.2 Presidential Disaster Declaration History

The state of Minnesota has been granted Presidential Disaster Declarations 78 times between 1957 and 2023 (66 years). Of those declarations, 53 (68%) involved flooding in 37 different years. In the period of 2019-2023, there were four disaster declarations related to COVID-19. The six disasters in Minnesota not related to COVID-19 all included flooding. Disaster Declarations for the last five years are listed in Table 8.

Each of the 87 counties in the state has been included in a Presidential Disaster Declaration. FEMA maintains a chronological history of Minnesota disasters at www.fema.gov. Records contain information on the type of programs: Public Assistance, Individual Assistance, and number of applicants for Individuals and Household Program, Other Needs Assessment, Small Business Administration disaster loan program, state match, if any, and total dollar amounts where available. All jurisdictions in the state are vulnerable to natural hazards, especially flooding and severe storms.

A map showing FEMA Disaster Declarations by county can be found on the Plan website

Table 8. FEMA Disaster Declarations, 2019–2023 as of 11/28/23

DR/EM Number	Incident Period	Designated Counties	Incident Description	Public Assistance (PA) Individual Assistance (IA) Hazard Mitigation Assistance (HMA) (Grant Program)
DR-4722-MN	April 11–30, 2023 Declaration Date: July 19,2023	Aitkin, Big Stone, Carlton, Chippewa, Clay, Grant, Houston, Kittson, Lac qui Parle, Lake of the Woods, Mahnomen, Marshall, Mille Lacs, Morrison, Norman, Pine, Pope, Prairie Island Community (Indian Reservation), Renville, Roseau, St. Louis, Stevens, Swift, Traverse, Wabasha, and Wilkin Counties	Severe Storms and Flooding	PA—$10,452,712 (estimated) PA—$1,276,650 (to date)
DR-4658-MN	May 8–13, 2022 Declaration Date: July 8, 2022	Aitkin, Big Stone, Cass, Chippewa, Cottonwood, Douglas, Grant, Kandiyohi, Lac qui Parle, Lincoln, Morrison, Nobles, Pope, Redwood, Renville, Stearns, Stevens, Swift, Todd, Traverse, Wadena, Wilkin, and Yellow Medicine Counties	Severe Storms, Straight-line Winds, Tornadoes, and Flooding	PA—$11,030,912 HMA—$615,065
DR-4659-MN	Apr 22, 2022 –Jun 15, 2022 Declaration Date: July 13, 2022	Beltrami, Clearwater, Cook, Kittson, Koochiching, Lake, Lake of the Woods, Mahnomen, Marshall, Norman, Pennington, Polk, Red Lake, Roseau, and St. Louis Counties and the Bois Forte Band of Chippewa, Leech Lake Band of Ojibwe, Red Lake Nation, and the White Earth Nation.	Severe Storms, Straight-line Winds, and Flooding	PA—$20,924,846 HMA—$300,750
DR-4666-MN	May 29–30, 2022 Declaration Date: Aug 9, 2022	Aitkin, Big Stone, Cass, Chippewa, Crow Wing, Douglas, Grant, Itasca, Kanabec, Kandiyohi, Lac qui Parle, Lyon, Nobles, Pine, Pope, Renville, Rock, Stevens, Swift, Todd, Traverse, Wadena, and Yellow Medicine Counties.	Severe Storms, Straight-line Winds, Tornadoes, and Flooding	PA—$6,551,072
DR-4531-MN	Jan 20, 2020–May 11, 2023 Declaration Date: Apr 7, 2020	Statewide	Covid-19 pandemic	IA—$35,550,649 PA—$467,019,182 HMA—$14,036,474

DR/EM Number	Incident Period	Designated Counties	Incident Description	Public Assistance (PA) Individual Assistance (IA) Hazard Mitigation Assistance (HMA) (Grant Program)
EM-3453-MN	Jan 20, 2020–May 11, 2023 Declaration Date: Mar 13, 2020	Re-declared as above	Covid-19 pandemic	N/A
EM-3503-MN	Jan 20, 2020–May 11, 2023 Declaration Date: Mar 13, 2020	Upper Sioux Community	Covid-19 pandemic	N/A
EM-3508-MN	Jan 20, 2020–May 11, 2023 Declaration Date: Mar 13, 2020	Shakopee Community (Indian Reservation)	Covid-19 pandemic	N/A
DR-4414-MN	Oct 9, 2018–2018 Declaration Date: Feb 1, 2019	St. Louis County	Severe Storms and Flooding	PA—$9,849,973 HMA—$1,291,864
DR-4442-MN	Mar 12, 2019–Apr 28, 2019 Declaration Date: Jun 12, 2019	Big Stone, Blue Earth, Brown, Chippewa, Clay, Cottonwood, Dodge, Faribault, Fillmore, Freeborn, Goodhue, Grant, Houston, Jackson, Kittson, Lac Qui Parle, Le Sueur, Lincoln, Lyon, Mahnomen, Marshall, Martin, McLeod, Mower, Murray, Nicollet, Nobles, Norman, Olmsted, Pennington, Pipestone, Polk, Ramsey, Red Lake, Redwood, Renville, Rock, Roseau, Scott, Sibley, Steele, Stevens, Swift, Traverse, Wabasha, Waseca, Washington, Watonwan, Wilkin, Winona, and Yellow Medicine Counties and the Prairie Island Indian Community, Red Lake Band of Chippewa, Upper Sioux Community, and the White Earth Nation.	Severe Winter Storm, Straight-line Winds, and Flooding	PA—$80,254,655 HMA—$8,600,173

Source: (FEMA, 2023b)

4.3 State Disaster Declarations

The State Disaster Assistance program and eligibility is described in Section 5.7.8. Since the inception of the state recovery program in 2014, there have been 72 state-declared disasters in 82 counties or reservations. The ten counties where the most funds have been obligated are shown in Table 9.

Tables in Appendix B: State Disaster Assistance Program Summary indicate the county/tribe, number of applicants, actual project cost, and state share paid from 2019 to 2023. Other documentation includes hazard type and date of incident and declaration. Table 10 shows the year, number of state disasters per year, and state expenditures to date.

Table 9. Ten counties with the highest State Disaster Assistance

County	Total PDA	Count of DR
St. Louis	$25,786,585	6
Crow Wing	$18,940,117	7
Renville	$14,965,242	9
Cass	$11,791,226	9
Le Sueur	$10,641,924	3
Steele	$10,525,546	2
Goodhue	$10,219,473	3
Morrison	$9,733,781	5
Lake	$9,172,976	2
Fillmore	$9,110,439	5

Source: HSEM Angela Wynn 8/21/23

Table 10. Financial summary, State Public Assistance Program

Year	# State Disasters	Public Disaster Assistance (PDA) to date
2019	5	$43,980,575
2020	9	$24,494,025
2021	5	$1,984,923
2022	9	$33,211,917
2023	3	$0

Source: HSEM Angela Wynn 8/21/23

4.4 Identifying Hazards

S4. Does the risk assessment provide an overview of the probabilities of future hazard events?

44 CFR Reference §201.4(c)(2)(i)

Based on previous plans, and state and federal disaster declarations, the following 15 natural hazards and seven other hazards were considered for inclusion in this Plan (Table 11).

Table 11. Hazards included in this Plan

Natural Hazards		
Flooding	Dam Failure	Coastal Erosion and Flooding
Wildfire	Extreme Heat	Erosion, Landslides, Mudslides
Windstorms	Drought	Land Subsidence
Tornadoes	Lightning	Extreme Cold
Hail	Winter Storms	Earthquakes
Other Hazards		
Terrorism	Hazardous Materials Incidents	Infectious Disease Outbreaks
Fires (Structures and Vehicles)	Transportation Incidents	Nuclear Generating Plant Incidents
Ground and Surface Water Supply Contamination		

The DMA of 2000 and supporting requirements in the Interim Final Rule (IFR) requires states to first identify hazards that may affect them, and then perform a comprehensive multi-hazard assessment, which includes a review of detailed information concerning hazard characteristics, past occurrences, and probability of future occurrences. The initial hazard identification cataloged potential hazards statewide and determined which have the most chance of significantly affecting the state and its citizens. The hazards include those that have occurred in the past, as well as those that may occur in the future. A variety of sources were used in the investigation, as noted earlier.

The qualitative ranking system rated each of the 22 hazards by its probability and potential for mitigation. This ranking is not intended to supplant detailed risk assessment, but rather to allow time and technical resources to be focused on the most significant hazards.

Defined in Table 12 and Table 13, each hazard was determined to have a high, medium, or low ranking for probability and mitigation potential. Each of the ranking levels has several criteria. These criteria were used as general guidelines, so in some cases the rankings were weighted toward one or two of the criteria rather than all of them.

Table 14 lists the name of the hazard, the relative rankings for probability and mitigation potential. Guidance provided by FEMA in the document served as the basis for selecting the natural hazards profiled in the report.

Table 12. Probability ranking and criteria for hazard identification

Ranking	Criteria
High	The hazard has impacted the state annually, or more frequently. The hazard is widespread, generally affecting regions or multiple counties in each event. There is a reliable methodology for identifying events and locations.
Medium	The hazard impacts the state occasionally, but not annually. The hazard is somewhat localized, affecting only relatively small or isolated areas when it occurs. The methodology for identifying events is not well-established or is not applied across the entire state.

Ranking	Criteria
Low	The hazard occurs only very infrequently, generally less than every five years on a large scale, although localized events may be more frequent. The hazard is generally very localized and on a small scale (i.e. sub-county level) A methodology for identifying event occurrences and/or severities is poorly established in the state or is available only on a local basis.

Table 13. Mitigation potential ranking and criteria for hazard identification and disposition

Ranking	Criteria
High	Methods for reducing risk from the hazard are technically reliable. The state or counties have experience in implementing mitigation measures. Mitigation measures are eligible under federal grant programs. There are multiple possible mitigation measures for the hazard. The mitigation measure(s) are known to be cost-effective. The mitigation measures protect lives and property for a long period of time or are permanent risk reduction solutions.
Medium	Mitigation methods are established. The state or counties have limited experience with the kinds of measures that may be appropriate to mitigate the hazard. Some mitigation measures are eligible for federal grants. There is a limited range of effective mitigation measures for the hazard. Mitigation measures are cost-effective only in limited circumstances. Mitigation measures are effective for a reasonable period of time.
Low	Methods for reducing risk from the hazard are not well-established, are not proven reliable, or are experimental. The state or counties have little or no experience in implementing mitigation measures, and/or no technical knowledge of them. Mitigation measures are ineligible under federal grant programs. There is a very limited range of mitigation measures for the hazard, usually only one feasible alternative. The mitigation measure(s) have not been proven cost effective and are likely to be very expensive compared to the magnitude of the hazard. The long-term effectiveness of the measure is not known or is known to be relatively poor.

Table 14. Hazard identification and disposition

Hazard	Section in Plan	Probability	Mitigation Potential
Flooding	5.1	High	High
Wildfire	5.2	High	High
Windstorms	5.3	High	High
Tornadoes	5.4	High	High
Hail	5.5	High	Medium
Dam Failure	5.6	Medium	Medium
Extreme Heat	5.7	High	Medium
Drought	5.8	High	Medium
Lightning	5.9	High	Low
Winter Storms	5.10	High	Low
Coastal Erosion and Flooding	5.11	Medium	Medium

Hazard	Section in Plan	Probability	Mitigation Potential
Erosion, Landslides and Mudslides	5.12	Medium	Low
Land Subsidence	5.13	Medium	Low
Extreme Cold	5.14	High	Low
Earthquakes	5.15	Low	Low
Fire (Structure and Vehicle)	6.1	Medium	Low
Ground and Surface Water Supply	6.2	Medium	Medium
Hazardous Materials	6.3	Medium	Low
Nuclear Incidents	6.4	Low	Low
Infectious Disease Outbreak	6.5	Medium	Medium
Transportation	6.6	Low	Low
Terrorism	6.7	Medium	Low

The mitigation potential for drought and extreme heat were increased to “medium” potential following conversations with the State Climate Office. The current Minnesota Statewide Drought Plan includes a framework for preparing for and responding to droughts which defines water use restrictions and goals. Educational efforts have also emphasized a conservation lifestyle. Similarly, there has been a great deal of research and educational material output from the MDH related to extreme heat. See Section 5.7 Extreme Heat and Section 5.8 Drought for more information.

As expected, the classification process provided a clear stratification of the hazards based on these criteria. The state has identified floods, tornadoes, straight-line winds and wildfires as the hazards that present the highest risk to the state and the most potential for mitigation, based on this limited assessment. In the sections that follow, these hazards are afforded detailed risk assessments in order to identify the areas of the state that are most at risk, and this information is in turn used as the basis for determining appropriate actions to reduce the risks.

As discussed earlier, this ranking system is not intended to supersede more detailed and focused risk assessment procedures. As the state re-evaluates and updates this Plan, it may be appropriate to revisit this ranking methodology and perform full risk assessments for additional hazards.

It is important to understand the meanings of several terms that appear in both the federal hazard mitigation planning rules and this Plan. The terms probability, vulnerability and risk appear many times in both places, and those terms and others are defined below and given some context in terms of this Plan.

Probability is the likelihood that events of particular severities will occur. The ability to calculate probability varies considerably depending on the hazard in question. In many areas of the country, flood studies of various kinds can provide reasonably accurate inundation boundaries for a defined return period. On the other hand, tornadoes are notoriously difficult to predict, although general areas of impact can be determined (it is also possible to predict the seasons of the year that are most likely to produce tornadoes). Probability is a key element of risk because it determines how often the events are likely to happen. Climate change may also affect these probabilities.

It is important to note that risk is cumulative. This means that although natural hazards may not affect a place in any particular year, the probability of one or more events (in some places multiple events) occurring "adds up" over time. Risk calculations incorporate all expected future events—usually with some limit on the time horizon that is considered—in order to account for both repetitive events and for the probabilities that accumulate over time. So, over time the possibility of the hazard event happening increases.

Vulnerability can be defined as to the extent to which people will experience harm and property will be damaged from a hazard. Vulnerability is the susceptibility of people to injury as the result of a hazardous event and the susceptibility of the things people value to damage as the result of a hazardous event. Some add the concept of resilience to the definition of vulnerability (Buckle, 2020). Buckle identifies potential social, economic, and environmental effects and introduces the notion that vulnerability is associated with an ability to recover.

Risk is often expressed in dollar costs of future expected losses. Although the concept may generate disagreement, it is possible to assign a value to many community "assets" including physical components such as buildings and infrastructure, functional ones such as government or business operations, and even injuries and casualties.

It is calculated in this way so that different kinds of losses can be adequately compared. For example, without a common basis for comparison, it would be virtually impossible to determine if the risk of injury from future tornadoes is greater than damage to vehicles in future floods. When the expected losses are converted to and expressed in dollars, the damages can be compared and prioritized. In combination with the concepts discussed above, almost any kind of hazard can be quantified and its risk expressed. The exceptions to this idea are infrequent or highly unpredictable events such as meteors impacting the earth, or manmade hazards such as terrorism. In these cases, the element of probability is virtually impossible to characterize, and the risk calculus cannot be accurate without it.

4.5 Data Sources Supporting Risk Assessment

This Hazard Mitigation Plan introduces a web-based interactive tool to support hazard history and risk analysis as well as to engage its audience of emergency planners, state agency stakeholders, and residents of Minnesota. The website exposes the data used in this Plan which reveals both strengths and limitations of the data and its availability.

The natural hazard risk assessments were based on primary, published sources such as the U.S. National Oceanographic and Atmospheric Administration (NOAA), the U.S. Geological Survey (USGS), the U.S. Army Corps of Engineers (USACE), the U.S. Department of Agriculture (USDA), the Minnesota Department of Natural Resources (MN DNR), the Minnesota Division of Homeland Security and Emergency Management (HSEM), and FEMA among others. All data and maps in this document have been updated as of August 2023 with the most recent data available, unless otherwise noted.

Much of the storm data used in this Plan is from the NOAA National Centers for Environmental Information's (NCEI) Storm Events Database. The NCEI receives storm data from the National Weather Service (NWS), which receives the information from various local, state, and federal sources. The Storm Events Database events:

- Record the occurrence of storms and other significant weather phenomena having sufficient intensity to cause loss of life, injuries, significant property damage, and/or disruption to commerce.
- Include rare, unusual weather phenomena that generate media attention.
- Include other significant meteorological events, such as record maximum or minimum temperatures or precipitation that occur in connection with another event.
- Have economic and property loss estimates that are often preliminary in nature and may not match the final assessment of losses related to given weather events.
- May, in some cases, be underreported (NCEI, 2023).

Records in the Storm Events Database go back as far as January 1950; however, only tornado events were being reported from the beginning. Revisions to the type of storm events reported to the database are ongoing. As of July 16, 2018, 55 different types of storm events were being reported to the Storm Events Database (NCEI, 2023). Storm Events Database hazard categories used in this Plan are listed in Table 15. For some hazards, other sources are used in the hazard histories to create a more comprehensive record.

The economic and property loss estimates as well as property indemnity claims have been pulled from the Spatial Hazard Events and Losses Database for the United States (SHELDUS) database (CEMHS, 2023). These data are compiled from NCEI records as well as other sources to create more accurate losses per county, as the loss data are distributed appropriately.

Table 15. National Centers for Environmental Information (NCEI) event types

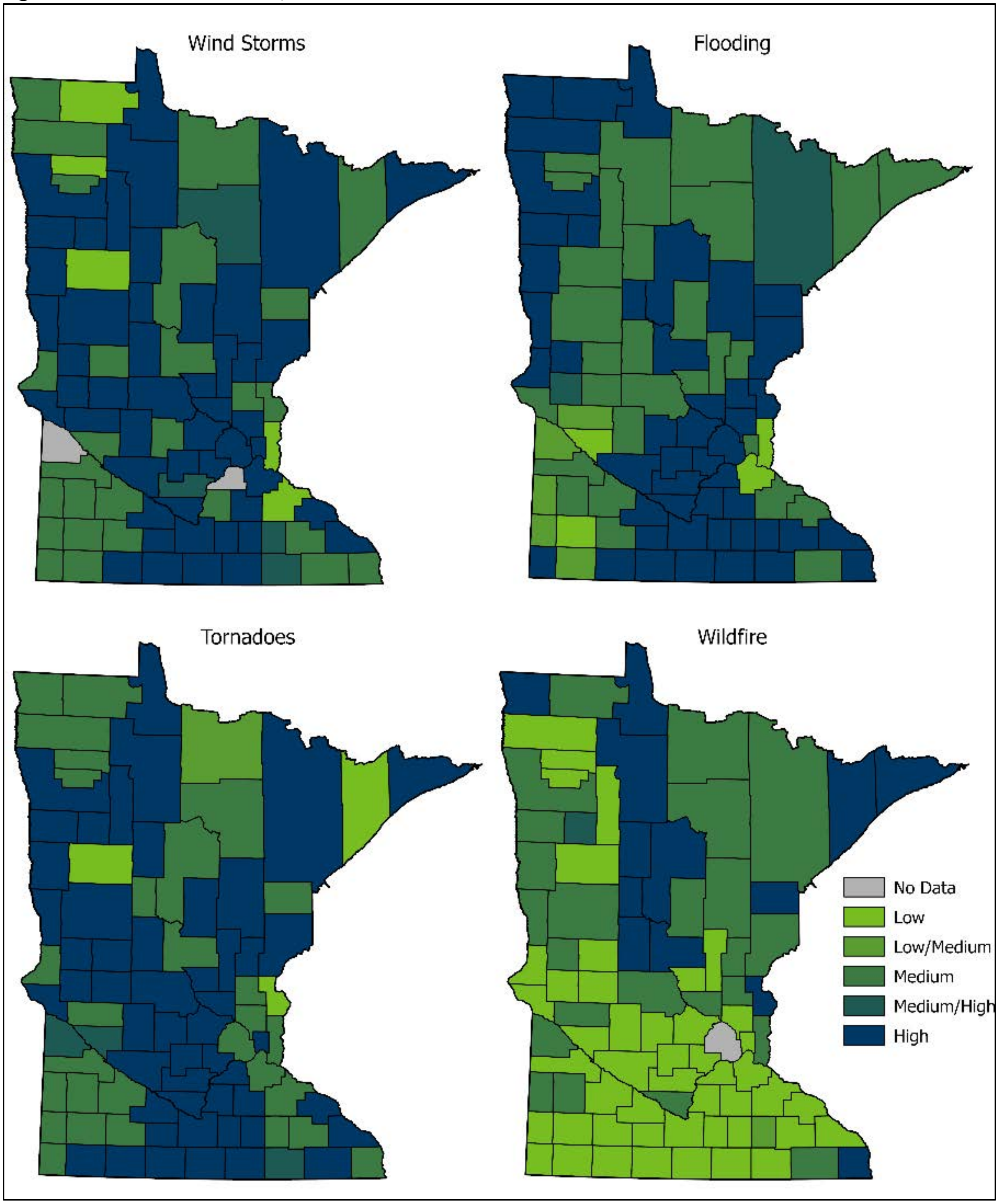
Hazard	NCEI Event Types	Period of Record
Tornadoes	Tornado	1950–present
Windstorms	Thunderstorm Wind, High Wind, Strong Wind	1955–present
Hail	Hail	1955–present
Flooding	Flood, Flash Flood, Heavy Rain	1996–present
Lightning	Lightning	1996–present
Extreme Cold	Cold, Wind Chill	1996–present
Extreme Heat	Excessive Heat, Heat	1996–present
Winter Storms	Winter Weather, Winter Storm, Blizzard, Heavy Snow, Ice Storms, Lake Effect Snow, Sleet	1996–present
Coastal Flooding	Coastal Flooding, Lakeshore Flooding	1996–present

Source: (NCEI, 2023).

4.6 Natural Hazard Risk Assessment by County

The most recent Multi-Hazard Mitigation Plans in each of the 87 Minnesota counties were reviewed for hazard prioritization. Not every county ranked hazards with the same definitions and a best attempt was made to align these assessments. The jurisdictional ranking for all of the natural hazards included in this Plan can be seen in Appendix C: County Hazard Prioritization. Figure 5 shows the perceived risk of counties and tribal governments identifying risk rankings for the top four Minnesota hazards. Each individual hazard profile in Section 5 includes an analysis of risks and vulnerabilities by county.

Figure 5. Perceived risk of top four natural hazards, 2023



Source: (U-Spatial, UMN, 2023)

4.7 Critical Infrastructure Data Sources

S5. Does the risk assessment address the vulnerability of state assets located in hazard areas and estimate the potential dollar losses to these assets?

44 CFR References §§201.4(c)(2)(ii) and 201.4(c)(2)(iii)

The systems and networks that make up the infrastructure of our society and economy, such as energy, transportation, finance, or communications are often taken for granted, yet a disruption to just one of those systems could have major consequences across other sectors—especially at the local and regional level. Protecting, strengthening, and maintaining these assets and systems requires a proactive and collaborative effort across all levels of government and society to maintain public confidence, resilience and the nation's safety, prosperity, and well-being.

HSEM leads the state effort to keep Minnesota secure and help protect lifelines from intentional and unintentional human-caused activity, as well as natural disasters. Part of that effort includes assessing and prioritizing Critical Infrastructure and Key Resources (CIKR) across the state. HSEM coordinates Federal, State, Local and Tribal efforts to increase the security and resiliency of Minnesota's CIKR focusing on the community lifelines with the partners in Table 16.

Table 16. State partners for critical infrastructure and key resources

Lifeline Category	Examples	Partner and/or Steward of Assets and Data
Safety and Security	Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety	MN Department of Public Safety MN Department of Corrections Counties, Tribal Nations, and Local Jurisdictions MN Department of Administration—ADMIN MN Geospatial Information Office—MnGeo
Food, Hydration, Shelter	Food, Hydration, Shelter, Agriculture	MN Department of Education—MDE MN Department of Agriculture—MDA MN Housing MN Pollution Control Agency—MPCA MN Department of Labor and Industry—DLI
Health and Medical	Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management	MN Department of Health—MDH MN Board of Pharmacy MN Emergency Medical Services Regulatory Board—EMSRB
Energy	Power Grid, Fuel	MN Department of Commerce—COMM MN Public Utilities Commission—PUC MN Rural Electric Association—MREA MN Municipal Utilities Association—MMUA

Lifeline Category	Examples	Partner and/or Steward of Assets and Data
Communications	Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch	MN Department of Commerce—COMM MN Homeland Security and Emergency Management—HSEM Minnesota Public Utilities Commission—PUC MN Geospatial Information Office—MnGeo
Transportation	Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime	MN Department of Transportation—MnDOT
Hazardous Materials	Facilities, HAZMAT, Pollutants, Contaminants	MN Pollution Control Agency—MPCA
Water Systems	Potable Water Infrastructure, Wastewater Management	MN Pollution Control Agency -MPCA MN Department of Health -MDH

Critical facility location data are important to use in mapping for county and state emergency response as well as all kinds of mitigation and resilience planning. While many public nationwide and statewide CI datasets exist for planning across jurisdictions, they are often outdated or inaccurate, requiring validation and editing before sharing. Furthermore, hazard mitigation planning requires critical infrastructure and state asset locations and basic capacity and condition information for assessing risks and vulnerabilities. Most of the planners identifying mitigation actions and resiliency measures are not state employees, so free and public access to basic facility location and data is important.

Many city, county, and tribal jurisdictions keep their own safety and security facility data up to date, but their accurate locations may not be reflected in the multiple statewide datasets, stewarded by multiple agencies in Minnesota.

The Critical Infrastructure Assets workgroup of the MN Geospatial Advisory Council Emergency Preparedness Committee (MN EPC-CIA), with the support of U-Spatial at UMN has been working to solicit verification of essential facilities such as fire, police, EMS, and shelters in local jurisdictions through the Hazard Mitigation Planning process to improve statewide datasets. Sixty-six counties have contributed updated data this way. The resulting data are known to be locally verified and/or more current than their counterparts in national datasets.

Other statewide datasets are stewarded by state agencies and are also known to be more current than their counterparts in national datasets. The publicly available resources for The MN EPC-CIA coordinates with the MN Geospatial information Office to summarize “best available” public, statewide geospatial CI datasets on their website for hazard mitigation and climate resilience planners and geospatial professionals to access. The databases containing these facilities do not include replacement values or capacity of the facilities. Table 17 also documents the source of critical infrastructure location data used in this Plan, with the exception of the state-owned properties.

Table 17. Essential facilities data sources 2023

Facilities	Count 2023	Original Source	Notes
Schools	3143	MN Department of Education	Filtered by schools with lunch programs. Does not include school level “district” or “library.” Includes post-secondary schools.
Police Stations	506	Homeland Infrastructure Foundation Level Data 2020 (HIFLD)	Significant edits and deletions were contributed by individual county staff. These data are now available through the MnGeo -GeoCommons.
Fire	997	Homeland Infrastructure Foundation Level Data 2020 (HIFLD)	Significant edits and deletions were contributed by individual county staff. These data are now available through the MnGeo -GeoCommons.
Critical Care	1824	MN Department of Health	Hospitals, Nursing Homes, Assisting Living and Boarding Care Homes, Hospice Care, Dialysis centers, and Supervised living facilities.
Shelter	1509	Homeland Infrastructure Foundation Level Data 2020 (HIFLD)	Significant edits and deletions were contributed by individual county staff.

4.8 Statewide Critical Infrastructure Systems

Minnesota Infrastructure has been given a grade of “C” due to much of it aging and reaching the end of its expected lifespan. New materials, expanded environmental awareness, and increased regulation require improvements to water treatment plants and updates to the energy grid. Upgrades are needed to better meet and prepare for current and future climate trends. Emergency repairs are disruptive and expensive (ASCE, 2022).

4.8.1 Highways and Bridges

The primary mode of transportation in Minnesota is highways. Minnesota has the fourth largest highway system in the United States. Minnesota has nearly 143,000 miles of streets, roads and highways and 19,600 bridges. MnDOT is directly responsible for the trunk highway system and its bridges. Minnesota faces a growing transportation funding shortfall. The Minnesota State Highway Investment Plan, published in 2017 with an update pending, estimates that state roads are underfunded by $17.7 billion over the next 20 years, for an annual funding gap of $885 million (MnDOT, 2017).

Centerline miles are defined as the measure in length of roads and highways throughout the country. Trunk Highways (Interstate, U.S., and MN Hwy routes) contain only 9% of the centerline mileage in Minnesota, but they carry 58% of the annual miles of vehicle travel. By contrast, County State Aid and County Road routes contain 32% of the centerline mileage, but they carry only 24% of the annual miles of vehicle travel (Table 18).

Table 18. Miles vs travel comparison

Route Type	Center Line Miles	Vehicle Miles Traveled (VMT)	% Miles	% VMT
Interstate	913	10,705,095,457	0.6	20.8
US Hwy	3,220	8,587,324,786	2.3	16.7
MN Hwy	7,561	10,169,068,884	5.3	19.8
County State Aid	30,659	11,338,117,712	21.7	22.6
County Road	13,930	818,313,448	9.8	1.6
Municipal State Aid	3,734	3,852,700,240	2.6	7.5
Municipal Street	19,222	4,816,004,995	13.5	904
Township	55,518	1,132,403,966	39.1	2.2
Other	7,199	66,831,413	5.1	0.1

SOURCE:(MNDOT, 2023D)

The Seven-County Metro Area contains only 12% of the centerline mileage in Minnesota, but it accounts for 46% of the annual miles of vehicle travel. The Greater Minnesota counties contain 88% of the centerline mileage in the state and account for 54% of the annual miles of vehicle travel (MnDOT, 2023d).

Minnesota has nearly 20,000 bridges ranging from roads on culverts to massive spans across rivers and lakes. The Interstate 35W bridge collapse on August 1, 2007 was a catalyst in Minnesota that spurred increased bridge inspections and maintenance along with replacement of impaired bridges. MnDOT's Bridges and Structures program sets criteria for design, inspection, and maintenance. Inspection reports are retained, and the results are digested in annual bridge reports. An excerpt from the annual report provides condition of highway bridges (Table 19.) The program also provides tools to determine the hydraulics for construction, replacement, or modification of bridges.

Table 19 Condition of highway bridge structures

Route System	Hwy On Bridge	Condition (# Of Bridges)					
		Good		Fair		Poor	
Trunk Highway	3,512	1,332	(37.9%)	2,081	(59.3%)	99	(2.8%)
Local Highway	9,793	6,354	(64.9%)	2,962	(30.2%)	477	(4.9%)
Total 6	13,305	7,686	(57.8%)	5,043	(37.9%)	576	(4.3%)

SOURCE: (MNDOT, 2023C)

4.8.2 Railroads

The majority of railroads in Minnesota are owned and operated by companies dedicated to freight operations (Table 20). The Northstar Line is a commuter rail that operates on 40 miles of existing track and right-of-way between Big Lake and Minneapolis and is owned by the BNSF Railway. Amtrak operates the only intercity passenger rail service in Minnesota on the Empire Builder route, which connects Seattle and Chicago.

Minnesota has two light rail lines. One runs between downtown Minneapolis and the Mall of America in Bloomington, and the other runs between downtown Minneapolis and downtown St. Paul. Both lines are operated by Metro Transit.

Table 20. Freight railroads operating in Minnesota

Type	Number of Operators	Miles of Track Operated in Minnesota	Percent of Total Miles Operated
Major Railroads	4	3,634	73.8
Regional and Short Line Railroads	12	1,016	20.6
Switching and Terminal Railroads	3	156	3.2
Captive Industry Railroads	2	119	2.4
Total	21	4,925	100%

SOURCE: (MNDOT, 2015)

Class I railroads are defined as the largest railroads with revenues exceeding $319.3 million (based on 2004 dollar values). There are seven such carriers operating in the United States, four of which operate in Minnesota: Burlington Northern Santa Fe (BNSF), Union Pacific, Canadian National, and Canadian Pacific. Class II railroads are defined as railroads operating 350 miles or more with operating revenues of at least $40 million but less than $319.3 million. Class II railroads are also known as regional railroads. In Minnesota there is one Class II railroad: Genesee & Wyoming, Inc. operates the former Dakota, Minnesota and Eastern railroad line west of Tracy, Minnesota. Class III railroads encompass all remaining railroads with revenues less than $40 million and that are engaged in line-haul movement (MnDOT, 2015).

4.8.3 Commercial Waterways

The Mississippi River System stretches over 195 miles in Minnesota and supports four ports that have a combined 2019 tonnage of 11 million net tons. The river accounts for over 50% of the state's agricultural exports. The largest river commodities are agricultural products such as corn, soybeans, and wheat. In 2019, more than 3.6 million tons of grain were shipped down the river in Minnesota. River ports also handle commodities such as fertilizer, cement, steel, scrap metal, petroleum, caustic soda, and anhydrous ammonia, among others.

The Mississippi River Navigation System is maintained by the U.S. Army Corps of Engineers (USACE), which dredges rivers to maintain channels for nine-foot-deep barges and operates the 29 locks and dams on the Upper Mississippi. The locks are also used by recreational boaters at no cost. The commercial barge operators on the river pay a user fee of 29 cents per gallon of fuel purchased. These fees are used to pay for half of major federal lock structure improvements.

Minnesota contains three active ports on Lake Superior, Silver Bay, Two Harbors, and Duluth/Superior. In 2019 the combined waterway tonnage for these ports was 56.1 million tons. In 2019 the total amount of taconite shipped from Minnesota accounted for 75% of Minnesota's Great Lakes tonnage for the year. Western coal is the second leading commodity shipped from Duluth/Superior, while other commodities include grain, cement, salt, steel, limestone, and wind generator components (MnDOT, 2023b).

4.8.4 Aeronautics

Aviation is an important part of the transportation system in Minnesota. The aviation industry consists of three distinct parts. Minnesota airports contribute $18.2 billion annually to the state economy (MnDOT, 2023a).

- General aviation may be characterized as small aircraft used for private or small business purposes. The aircraft include business jets, single and multiple engine airplanes, balloons, and ultralight/experimental aircraft. Drones are a newer enterprise that fits under general aviation. Both private and public sectors operate aircraft in this category. General aviation is the largest part of the industry, consisting of 75%.
- Air carriers that charge for transporting people and cargo make up 20% of the industry.
- Military activity comprises 5% of the industry.

Minnesota airports are comprised of the following:

- Eight commercial airports with runway lengths capable of handling large airliners.
- Ninety-nine paved runways designed for smaller private and business type aircraft.
- Five paved runways with seaplane bases for smaller private and business type aircraft.
- Twenty-one turf airstrips for light recreational and private aircraft.

4.8.5 Water and Sewer Infrastructure

The Minnesota Pollution Control Agency issues permits to more than 800 municipal wastewater treatment plants and over 850 industrial wastewater treatment plants. Permits put limits on what can be in their discharged water and require certain types of reporting (MPCA, 2023b).

Minnesota has a vast amount of aging infrastructure. This infrastructure protects public health and provides vital services to residents throughout the State. Maintaining, rehabilitating and replacing this infrastructure over the next few decades will be challenging without proper planning. Many communities do not have a large enough population base to spread the costs across these large capital projects.

The Infrastructure Stress Transparency Tool (IST) is an online tool that provides public access to sewer financials, production, and ages by city and sanitary district (OSA, 2023). The goal of creating these maps and reports is to better inform the decision-making process at all levels of government to improve the long-term financial planning for our civil infrastructure needs.

The 2023 MPCA Wastewater Infrastructure Needs Survey reports the predominant collection sewer system age for systems representing about 20,000 (19,548) miles of sewer lines. Of these, about 33% have pipes predominantly less than 30 years old, 28% have pipes predominantly between 30 and 50 years old, and 38% of these sewer systems are predominantly over 50 years old.

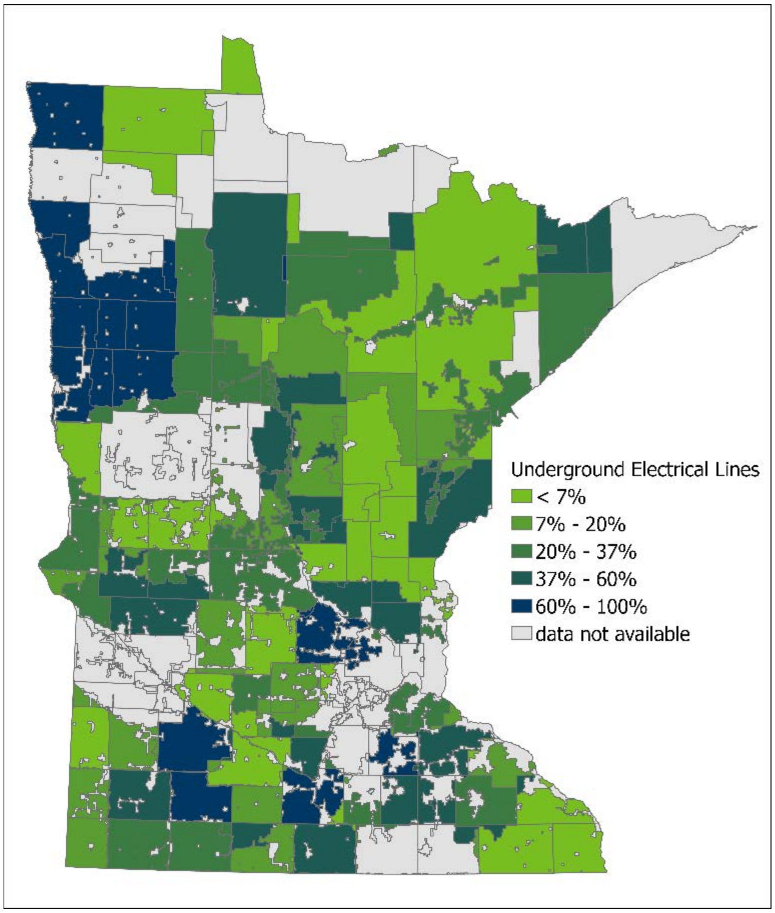
Of the 622 city-owned facilities represented by these systems, 108 cities have sewer systems with half of the pipes are over 50 years old, 250 cities using sewer systems where half of the pipes are less than 30 years old, and 151 cities have wastewater treatment facilities less than 20 years old. Minnesota has 104 cities with wastewater treatment facilities over 40 years old (Scott, Casey, personal communication, January 9, 2024).

Approximately 80% of Minnesotans are served by community water systems, and the source is groundwater for about two-thirds of these systems. Much of the drinking water infrastructure in the state is over 50 years old or older, and reaching the end of its useful life. According to the 2022 Minnesota Infrastructure Report Card (2022), Minneapolis averaged approximately 44 prominent water main breaks a year, most involving pipes involved over 100 years old. St Paul averaged 124 water main breaks along 1,200 miles of its service lines where the infrastructure is over 100 years old in a five-year period from 2016-2021. The U.S. Environmental Protection Agency estimates the 20-year drinking water infrastructure need for Minnesota is over $7 billion (ASCE, 2022).

4.8.6 Electric Utility Infrastructure

Electric utilities in Minnesota are classified as either investor-owned, cooperative utilities, or municipal utilities. The Minnesota Public Utilities Commission (MPUC) regulates all investor-owned utilities. Minnesota is ahead of many other states with one third of electricity produced by renewable energy. There are major transmission upgrades planned in Minnesota that will enhance capacity in the system, however, the distribution system also needs investment to ensure reliability in the face of increasingly severe storms. Many utilities are hardening their electric service lines to improve resilience to wind events, tornadoes, and ice storms which are the top threats to electric service disruptions (Figure 6). The Rural Electric Cooperative Annex to this Plan (Annex 1) provides much more information about the status of the rural electric cooperative service line status. Electric cooperatives serve approximately 1.7 million Minnesotans and serve consumers in every county. Over 135,250 miles of power lines are operated and maintained by electric cooperatives.

Figure 6. Undergrounded electric service lines by provider



4.9 State Facilities

4.9.1 State-Owned Properties

State-owned and operated facilities are important centers that link the government of the State of Minnesota to the public it serves. These facilities range from the State Capitol building in St. Paul to storage buildings for transportation centers throughout the state. These facilities are hubs for everything from administrative activities to public safety functions and every conceivable role in between. Should these facilities be rendered inoperable by an incident, the public would lose a vital link with their government and the services it provides.

State-owned properties (active or inactive, and not buildings under construction or leased) were identified using the state integrated workplace management system (IWMS), Archibus, managed by the Minnesota Department of Administration (ADM) Enterprise Real Property Department (ERP). Only nineteen agencies use this IWMS, so it is not comprehensive.

Furthermore, some agencies do not have all buildings assessed in order for a value to be calculated. ERP uses a standardized facility condition assessment (FCA) process to populate current replacement value (CRV) for each building. CRV is a calculated dollar amount representing the estimated cost to replace a building and is based on 2023 RS-Means construction costs for basic labor, materials, and equipment. A system quantity is needed from the building being assessed and is applied as a multiplying factor to the system unit cost. Facility Condition Index (FCI) is the condition metric calculated for each building. If the FCI is more than .30 (deferred maintenance is more than 30% of CRV) the FCI rating is considered "poor," and if the FCI is greater than .50, the FCI is considered "crisis." The FCI provides an excellent means for maintenance prioritization based on overall building conditions, and provides insight to problem areas, neglected building systems, or where maintenance needs to be applied based on limited funds.

The buildings reported in Archibus for this query totaled over $9.7 billion (Table 21). Data are not available for agencies not listed below.

Table 21. State-owned facility exposure reported in Archibus

Agency Name	# Structures	Current Replacement Value (Sum)	Deferred Maintenance Sum	% structures with FCI "crisis" or "poor"
Agriculture	1	$9,178,375	$3,416,935	100%
Amateur Sports Commission	23	$183,360,488	$70,875,439	26%
Department of Administration	31	$2,015,957,228	$185,928,141	10%
Department of Commerce	1	$859,475	$67,214	none
Department of Corrections	337	$2,772,181,202	$639,785,254	25%
Department of Employment & Economic Development	2	$7,282,779	$884,299	none
Department of Human Services	165	$906,843,937	$159,789,920	17%
Department of Natural Resources	2959	$696,487,204	$157,173,307	23%
Department of Transportation	904	$1,324,675,985	$187,588,172	7%
Historical Society	148	$248,380,125	$64,647,392	29%
Iron Range Resource	82	$81,705,001	$17,700,707	29%
Military Affairs	67	$677,391,570	$210,860,394	55%
Minnesota State Academies	19	$124,284,991	$29,827,862	42%
Minnesota Veterans Affairs	76	$461,275,344	$105,884,214	25%
Minnesota Zoological Garden	125	$195,109,121	$47,966,298	22%
MN State Fair/State Agricultural Society	78	N/A	N/A	N/A
Perpich Center	5	$41,059,137	$7,570,439	none
Pollution Control Agency	18	$12,510,166	$1,535,223	none
Public Safety	6	$4,988,504	$1,260,045	17%

SOURCE: (MN ENTERPRISE REAL PROPERTY, 2023)

Critical facilities are not easily identified in the state-owned building database. There is no differentiation between the functions performed within the facility, and the facility itself. In some cases, the occupants of a facility are critical assets, but not the actual building or location. On the other hand, the building itself may be a critical facility because the functions performed at the facility are necessarily intertwined with the structure (e.g. a state prison). Archibus does track building criticality related to deferred maintenance and building replacement costs. For some agencies an assessment of building capacity, room type, and available internet options to identify buildings that can serve as a locational backup during a disaster.

Essential facilities reported by state databases were evaluated for risk of exposure to flood, as were all state buildings. There may be some redundancies between these datasets.

4.9.2 Minnesota Universities and Colleges

The University of Minnesota (UMN) and Minnesota State systems track their capital building assets in separate IWMS systems. In 2023, the five campuses of UMN totaled its building assets at $16.57 billion (USERV Finance and Payroll, 2023). Minnesota State consists of 26 colleges and 7 universities with 54 campuses throughout the state. There are 919 buildings in the Minnesota State system, and building assets are listed at $12.93 billion (Gerner, Michelle, personal communication, January 2, 2024).

4.9.3 State-Leased Properties

The state maintains some liability for properties it leases from other owners as well as properties it rents out. The Department of Administration reports the state leases 664 properties from non-state entities with an annual rent expense of $130.7 million. The state also has at least 53 leases to non-state entities, for a total annual rent income of $1.3 million.

4.9.4 Properties in Minnesota's Risk Management Fund

The Department of Administration provided a Construction Occupancy Protection Exposure (COPE) report of all properties insured through the State of Minnesota's Risk Management Fund. These properties may be redundant with properties reported in as leased or in Archibus, however, the total exposure of state properties value is presumed to be more comprehensive. The structure and contents exposure totaled $21.5 billion as of January 30, 2024.

4.9.5 Federal Public Assistance Review of State Facilities and Infrastructure

The Risk Management department of ADM carries comprehensive insurance on most state-owned facilities, including flood insurance. While this coverage is not a mitigation measure, it reduces the burden to the Public Assistance (PA) program when declarations are declared in Minnesota. The number of structures covered by the Risk Management comprehensive policy has increased since the last plan update due to more participation of agencies.

A review of Public Assistance data from the years of 1999–2018 in Table 22, reveals some relative risk among agencies. The complete list of requests can be found in Appendix D: PA Grant Program (CDFA Number 97.036), Funded Projects.

Table 22. Public assistance by agency, 1999–2018

PA Data for DR-1283 to DR-4390 (1999–2018)	Cost of all project type categories
Metropolitan Airports Commission	$394,709
Metropolitan Council	$1,530,218
Minnesota Department of Military Affairs	$3,958,277
Minnesota Department of Administration	$41,871

PA Data for DR-1283 to DR-4390 (1999–2018)	Cost of all project type categories
Minnesota Department of Corrections	$111,945
Minnesota Department of Education	$951
Minnesota Department of Health	$63,326
Minnesota Department of Human Services	$6,238
Minnesota Department of Natural Resources	$12,579,805
Minnesota Department of Agriculture	$10,195
Minnesota Department of Transportation	$1,944,601
Minnesota Emergency Medical Regulatory Board	$14,017
Minnesota Historical Society	$3,128
Minnesota Pollution Control Agency	$579,623
Minnesota State Building Codes and Standards	$20,428
Minnesota State Patrol	$298,309
Minnesota Zoological Garden	$60,349
Minnesota Department of Labor & Industry	$14,218
University Of Minnesota	$1,923,596
Total	$23,555,804

Public Assistance by damage category is also available in Appendix D: PA Grant Program (CDFA Number 97.036), Funded Projects. The most common category used is Category B—Protective Measures. A comparison of the two agencies with the highest payments was performed to illustrate mitigation actions in Table 23.

Based on the previous plan, most recovery costs for MnDOT for roads and infrastructure come from the Federal Highway Administration. Category E damages are for state owned structures such as garages and visitor centers. MnDOT is currently insuring these structures in the Risk Management policy.

Table 23. Public Assistance comparison by damage category for MnDOT and MN DNR

Damage Category	MnDOT	MN DNR
A—Debris Removal	$305,318	$528,412
B—Protective Measures	$375,496	$211,080
C—Roads and Bridges	$0	288,987
D—Water Control Facilities	$0	$1,482,733
E—Public Buildings	$375,496	$688,336
F—Utilities	$0	$0
G—Parks, Recreational Facilities	$0	$4,944,704
Total	$1,056,310	$8,144,252

Section 5 Natural Hazards

Each natural hazard is assessed below by addressing historical events, probability of occurrence, vulnerability of state assets, critical facilities, and populations as available, as well as any known expected vulnerabilities due to climate change.

5.1 Flooding

A flood is the partial or complete inundation of normally dry land. Floods in Minnesota occur in low-lying areas near streams, rivers, lakes, ponds, and intersections; along roads and roadside ditches; and in heavily paved, human-occupied areas of many cities and towns. The various types of flooding include riverine flooding, flash flooding, ice jam floods, coastal flooding, and dam-break floods. Coastal flooding is considered in section 5.11 with coastal erosion. Section 5.6, Dam and Levee Failure, addresses flooding due to dam or levee failure. Flooding behavior and impacts can be similar in all types of floods. Common impacts of flooding include damage to personal property, buildings, and infrastructure; bridge and road closures; service disruptions; and injuries or even fatalities (FEMA, 2013).

Riverine Flooding, also known as overbank flooding, involves water rising out of the banks of streams and rivers. The size of the river and the number of other sources that feed it will determine the amount of time required for the rise to occur. In general, large rivers can take weeks for floods to work through them, whereas many smaller streams are considered “flashy” and may rise and fall within hours or a small number of days.

Riverine floods occur in floodplains that range from narrow, confined channels in the steep valleys of mountainous and hilly regions, to wide, flat areas in plains and coastal regions. The amount of water in the floodplain is a function of the size and topography of the contributing watershed, the regional and local climate, and land use characteristics. In steep valleys, flooding is usually rapid and deep, but of short duration, while flooding in flat areas is typically slow, relatively shallow, and may last for long periods.

In Minnesota, the primary historical cause of flooding in large rivers has been from the “spring freshet,” or, more simply, the melting and drainage of the winter snowpack into area streams and rivers. The larger the snowpack and the greater its water content, the more likely area streams and rivers will be to see flooding, and this annual event has typically marked the highest level a given river will reach that year. In recent years, however, many large rivers have experienced peak levels and flows from warm-season heavy rainfall events.

When large rivers flood from rainfall rather than snowmelt, it is usually attributable to either repeated episodes of heavy rainfall over a period of days or weeks, or from a massive singular extreme rainfall event. Continuing with the example of the Minnesota River at Jordan, the crest in June of 1993 resulted from a four-week period in which the entire basin received a half-dozen rainfall events with daily totals in the range of 1-2 inches, and maximum daily values of 3-4 inches. By contrast, the crest in September of 2010 resulted from a single mega-rain event with a 5,000 square-mile, 20-county footprint of six-inch rainfall totals including pockets of totals in excess of 10 inches. Either type of rainfall scenario saturates the ground and overloads the streams and basins that drain into larger rivers, and almost always entails flash-flooding in those smaller and streams and basins prior to the larger river flooding.

Flash Flooding refers to acute, significant, and sometimes catastrophic surges in water levels near streams, ponds, and even in low-lying areas, typically resulting from prolonged bouts of excessive rainfall. The storms that produce flash flooding may need only a few hours to produce excessive runoff, and as a result warning time in flash flood scenarios is usually minimal. Flash floods transport enormous volumes of water at high velocity, carrying large amounts of debris downstream, tearing out trees, undermining buildings and bridges, scouring new channels, and producing a wide array of significant damages.

The intensity of flash flooding is a function of the intensity and duration of rainfall, steepness of the watershed, stream gradients, watershed vegetation, soil moisture and storage capacity, natural and artificial flood storage areas, and configuration of the streambed and floodplain. Dam failure and ice jams may also lead to flash flooding. Urban areas are increasingly subject to flash flooding due to the removal of vegetation, covering of ground cover with impermeable surfaces, and construction of drainage systems. Urban streets can flood within minutes during a heavy deluge that overwhelms stormwater system capacity. Flash urban flooding may recede quickly, but can result in significant property damage to vehicles, basements and first floors, and building functions such as HVAC systems and appliances.

Local flash flooding can be very destructive along the steep bluffs of Lake Superior and the hilly terrain and narrow valleys of southeast Minnesota; however, flash flooding can occur anywhere in Minnesota. Typically, a flash flood occurs within six hours of a rain event, or after a dam or levee failure, or following a sudden release of water held by an ice or debris jam. Flash floods often catch people unprepared. The actual time threshold may vary in different parts of the country. Ongoing flooding can intensify to flash flooding in cases where intense rainfall results in a rapid surge of rising flood waters.

The Minnesota State Climatology Office defines a flash flood as “the occurrence of 6 inches or more rainfall within a 24-hour period.” The size of a flash flood is measured via area in square miles over which rainfall of four inches or more occurs. The rationale for using these criteria is that a rainfall of six inches in a 24-hour period will produce a river flow in equivalent to that in the 1%-annual-chance return period in Minnesota and that four-inch and greater rainfall generally leads to reports of increased erosion or other economic damages.

Ice jam floods usually occur in the spring and are most likely to occur where the channel slope naturally decreases, when culverts freeze solid, in reservoir headwaters, near natural channel constructions (e.g., bends and bridges), and along shallows. The resulting impacts are similar to a flash flood.

5.1.1 Flood History

Notable floods in Minnesota from 2019 through 2023 are summarized in Table 24.

> *All floods recorded by the NCEI Storm Events Database are viewable by county in the Flooding History Dashboard on the Plan website.*

Table 24. Major Minnesota floods, 2019–2023

Dates	All Counties Affected	Flood Description
September 2023	St. Louis, Lake	More than four inches of rain fell in Duluth (and up to 6.3 inches in one neighborhood in mid-September) bringing Duluth's September's total to just under 10 inches of rain - more than seven inches above average, according to the National Weather Service. Water was forced up from sewers and leading to flooding across streets and the interstate highway [MPR].
April 2023 (DR-4722-MN)	Aitkin, Big Stone, Carlton, Chippewa, Clay, Grant, Houston, Kittson, Lac qui Parle, Lake of the Woods, Mahnomen, Marshall, Mille Lacs, Morrison, Norman, Pine, Pope, Prairie Island Community (Indian Reservation), Renville, Roseau, St. Louis, Stevens, Swift, Traverse, Wabasha, and Wilkin Counties	A near-record snowfall season across Minnesota and Wisconsin led to a snowpack with snow-water-equivalent (SWE) values of 4 to 6 inches across much of the region by mid-March. Below normal temperatures for the first of spring kept much of the snowpack intact until the end of the month when it started to melt. The melt accelerated in early April. On April 08, highs were in the 60s across the region. On April 09-10 they were in the 70s, and during April 11-14, many locations saw highs in the 80s! This rapid snowmelt led to widespread flooding across the low-lying areas, ditches, and ravines. As a result, many gravel roads and culverts were washed out or needed to be repaired, costing nearly $2.3 million in damages. [NCEI]
June 2022	Benton, Morrison, Stearns, Todd	During the late afternoon, and early evening of Thursday, June 23rd, a small complex of storms developed in central Minnesota. With back-building storms across central Minnesota, rainfall amounts were excessive. Some areas received up to 7 inches of rainfall and possibly more. The worst areas were across Todd, Morrison, Stearns and Benton Counties. In addition to the heavy rainfall, and flash flooding, the initial hazard was isolated large hail. MN DNR Climate Journal entry
May 2022 (DR-4658-MN)	Aitkin, Big Stone, Cass, Chippewa, Cottonwood, Douglas, Grant, Kandiyohi, Lac qui Parle, Lincoln, Morrison, Nobles, Pope, Redwood, Renville, Stearns, Stevens, Swift, Todd, Traverse, Wadena, Wilkin, and Yellow Medicine Counties	Precipitation totals from a multi-day rain event included 4.08 inches at International Falls, 3.92 inches at Red Lake Falls, 3.84 inches at Thorhult, and 2.88 inches at Waskish. The heavy rains led to some stream flooding as well, with the Red Lake River surging to within about 16 inches of record levels. MN DNR Climate Journal entry
April 2022 (DR-4659-MN)	Beltrami, Clearwater, Cook, Kittson, Koochiching, Lake, Lake of the Woods, Mahnomen, Marshall, Norman, Pennington, Polk, Red Lake, Roseau, and St. Louis Counties and the Bois Forte Band of Chippewa, Leech Lake Band of Ojibwe, Red Lake Nation, and the White Earth Nation.	Spring snowmelt, record April precipitation and frequent May rain events led to strong hydrologic responses within the Rainy Lake basin. Namakan Lake, Kabetogama Lake and Rainy Lake rose above the flood of record during the months of May and June before subsiding in July and returning to levels closer to normal. These high lake levels led to significant damage to homes and businesses along the shoreline along with docks and other related structures. Additionally, some roads were covered in water with one being temporarily raised to maintain access to a few resorts. In addition to the costs of the damage itself, many resorts in the area suffered from lost revenue by having to close during the beginning of peak tourist season in the area.

Dates	All Counties Affected	Flood Description
		MN DNR Climate Journal entry
July 2020	Le Sueur, Nicollet, Renville, Sibley	A very anomalous moist atmosphere was in place for this flash flood event to develop. Precipitable water values (PWATs) were over 2 inches across southern Minnesota which is well over climatological normals. The main event was the flash flood event where storms formed Saturday afternoon between Redwood Falls and the Twin Cities metro area. The first concentrated area of flash flooding occurred over Sibley County where the recurrence interval was over 200 years for the 3, 6, and 12 hour periods. The highest known totals for this storm were between 9 and 11.5 inches. Other high totals in that area included 10.70 inches near Lafayette and 9.15 inches in Gibbon. This was the first mega-rain event in Minnesota since 2016. MN DNR Climate Journal entry
June 2020	Blue Earth, Dakota, Goodhue, Le Sueur, Nicollet, Renville, Rice, Sibley	During the evening of Sunday, June 28th, a complex of thunderstorms that developed across Iowa previously, moved slowly northward across southern Minnesota before stalling in central Minnesota Monday morning. There were several areas that the storms trained for a few hours and caused rainfall amounts of 4 of 8 inches and some rainfall rates as high as 2 inches per hour. Based on the return period from precipitation amounts in a specific time frame, the values were a 100 to 200-year event. Flash flood guidance values were 2 to 3 times above normal. As the runoff continued through the morning, the flash flood event become more areal flooding as the flood waters receded into creeks, streams, and eventually the mainstem rivers. MN DNR Climate Journal entry
June 2020	Fillmore, Winona	Heavy rains from Tropical Depression Cristobal fell across southeast Minnesota on June 9th. This heavy rain created some flash flooding with mudslides across portions of Fillmore and Winona Counties. Mudslides occurred near Whalan that impacted State Highway 16. Mudslides also occurred near Elba and Whitewater State Park and near Winona that brought down some power lines. MN DNR Climate Journal entry

Dates	All Counties Affected	Flood Description
March 2019 (DR-4442-MN)	Big Stone, Blue Earth, Brown, Chippewa, Clay, Cottonwood, Dodge, Faribault, Fillmore, Freeborn, Goodhue, Grant, Houston, Jackson, Kittson, Lac Qui Parle, Le Sueur, Lincoln, Lyon, Mahnomen, Marshall, Martin, McLeod, Mower, Murray, Nicollet, Nobles, Norman, Olmsted, Pennington, Pipestone, Polk, Ramsey, Red Lake, Redwood, Renville, Rock, Roseau, Scott, Sibley, Steele, Stevens, Swift, Traverse, Wabasha, Waseca, Washington, Watonwan, Wilkin, Winona, and Yellow Medicine Counties and the Prairie Island Indian Community, Red Lake Band of Chippewa, Upper Sioux Community, and the White Earth Nation.	There were many factors that led to a severe Spring flood melt along the Minnesota and Mississippi Rivers and several of their tributaries during the last two weeks of March. As area rivers, streams and creeks began to thaw, ice jams developed, which led to more areal flooding beyond the flooded riverbeds. Although most of the mainstem rivers along the Minnesota River crested the last week of March, flood waters continued into April. During the third week of March, the Minnesota Department of Transportation started to close roads along mainstem rivers. County roads were already impacted as flood waters started to spread out across counties from melted snow and recent rainfall from storms. *MN DNR Climate Journal Entry*

Sources: (FEMA, 2023b; MN DNR, 2023a; NCEI, 2023)

The precipitation in the year 2019, despite being the highest on record for Minnesota, was distributed across the calendar and resulted in few floods. That year, there were many 10% annual chance rains, generally in the 3–4.5" range, and Minnesota had a record-high number of 1-inch daily rains among weather stations (Blumenfeld, K. Minnesota State Climatology Office, personal communication, January 5, 2024).

The July 2020 event was characterized as an historic mega rain events (which requires at least 1,000 square miles of six inches or more rain) by the Minnesota Climatology Office, the first since 2016 (MN DNR, 2020b). Most of the time these high amounts of rainfall are characterized to show unusually high amounts of damage to communities. While this event represented catastrophic potential, the event in 2020 actually did not do much damage, probably because of the dry conditions that had emerged already by that time (Blumenfeld, K. Minnesota State Climatology Office, personal communication, January 5, 2024).

5.1.2 Probability of Occurrence

Flooding is the number one natural hazard to impact Minnesota. Flooding accounts for the most federal disaster declarations of any hazard. All portions of the State of Minnesota are subject to flooding. Some locations, however, are more susceptible to severe, repeated flooding than others. As noted by the MN DNR Division of Waters, one river that has flooded consistently nearly every other or every third year is the Red River of the North. Repeated flooding at this location is due primarily to two factors: (1) The river flows north, often into areas that have not yet thawed, hence the water backs up;

(2) Flat terrain around the river allows flooding above the banks to go on for miles (much further than most rivers in Minnesota).

A Hazus 1%-annual-chance flood boundary was mapped for each county using DFIRMs (digital flood insurance rate maps), Q3 flood boundaries (FEMA surveyed older data), or a Hazus Hydrologic and Hydraulic Model derived boundaries if no other boundary data were available. Q3 Flood Data are derived from the Flood Insurance Rate Maps (FIRMS), published by FEMA, and follow standards required for mapping at a scale of 1:24000; however, these maps are often outdated. As of October 2023, 68 counties have preliminary or approved DFIRMs (see Appendix E: FEMA Flood Mapping Products Available or In Progress for Each County). More information about the NFIP and the MN DNR's Floodplain Management Unit can be found in Section 7.7.

At the time of the flood analysis in 2019, 20% of Minnesota counties did not have FEMA flood insurance rate maps available county-wide. In 2023, only Clearwater, Cook, Faribault, Hubbard, Lake, Kanabec, and Martin (8%) did not have any county-wide FEMA FIRMs (Table 25) (FEMA, 2023d). The majority of the flood analysis for these counties was dependent on the Hydrology and Hydraulic (H&H) method. The H&H method was performed at a ten square mile drainage area minimum, and only in incorporated jurisdictions using a 10-meter digital elevation model (DEM). A 10-meter DEM was then used to create a flood depth grid for every county based on the existing or HH derived flood boundary. Table 25 shows the counties where the primary source was a DFIRM, but many of these also had some Q3 or H&H used also.

Table 25. Floodplain sources used for risk calculation in 2023

Primary Source of 1% Annual Chance Flood Boundary	Counties	Ratio
DFIRM	69	79%
Q3	11	12%
HH	7	8%
Total	87	

Source: (FEMA, 2023c)

The Flooding Risk and Vulnerability dashboard indicates the flood boundary data that are DFIRMs.

5.1.3 Vulnerability

A potential structure loss estimation was performed using Hazus, a risk mitigation tool developed by FEMA (FEMA, 2023d). Hazus flood modeling was performed one county at a time.

The Hazus flood model performs an assessment of flood damage to each structure, based on flood depth determined by the generated flood grid and the characteristics of the structure. How the economic loss potential is estimated varies depending on building inventory inputs available for each county. Forty-six counties had Hazus flood analyses performed since 2020 by U-Spatial at UMN using building-level data obtained from a county assessor who may have been able to provide additional building level attributes (also known as Hazus Level 2). The results from the 2020 or newer analyses were used. For other counties, publicly available parcel data were used and assumptions were made in varying degrees to create a set of input locations representing the building-level data. The structure locations were identified by the largest feature in the parcel in the Microsoft Building Footprint data. If no structure was found where a parcel had structure value, a centroid was used.

Also of note, for those areas of the county that were not modeled with a DFIRM or Q3 flood boundary, only major rivers flowing through incorporated jurisdictions were modeled with and H&H boundary.

Tables showing the statewide flood risk assessment results using updated flood boundary data in 2023 are found in Table 26 and in Appendix F: Statewide Flood Risk Assessment Results: 35,449 structures were found to be potentially damaged in a 1% annual chance flood. The estimated total building loss is estimated to be $2.66 billion.

Table 26. Potential structure loss by county, 1% annual chance flood

County	# Damaged Buildings	Potential Structure Loss
Aitkin	1713	$ 18,268,498
Anoka	1781	$114,433,667
Becker	15	$639,930
Beltrami	21	$1,034,534
Benton	551	$19,201,710
Big Stone	266	$2,671,827
Blue Earth	122	$4,299,574
Brown	273	$9,212,115
Carlton	49	$579,847
Carver	267	$20,476,747
Cass	19	$1,275,094
Chippewa	55	$2,598,310
Chisago	181	$14,902,729
Clay	988	$38,108,407
Clearwater	14	$185,530
Cook	N/A	N/A
Cottonwood	240	$4,229,113
Crow Wing	854	$43,653,093
Dakota	386	$294,212,449
Dodge	97	$2,655,310
Douglas	229	$4,696,080
Faribault	12	$174,347
Fillmore	559	$8,975,561
Freeborn	78	$1,128,556
Goodhue	374	$67,819,118
Grant	43	$1,501,223
Hennepin	2178	$174,096,408
Houston	502	$12,486,753
Hubbard	7	$441,012
Isanti	1145	$27,399,101
Itasca	269	$7,786,500
Jackson	88	$1,138,610

County	# Damaged Buildings	Potential Structure Loss
Kanabec	77	$974,515
Kandiyohi	226	$13,677,023
Kittson	355	$2,387,717
Koochiching	412	$23,257,103
Lac qui Parle	220	$5,981,687
Lake	N/A	N/A
Lake of the Woods	311	$5,976,733
Le Sueur	884	$9,157,380
Lincoln	49	$1,302,118
Lyon	51	$1,083,899
Mahnomen	34	$5,382,357
Marshall	858	$9,037,646
Martin	N/A	N/A
McLeod	90	$19,896,690
Meeker	807	$21,095,379
Mille Lacs	971	$22,411,061
Morrison	107	$4,079,780
Mower	159	$10,138,586
Murray	234	$4,190,180
Nicollet	84	$2,895,373
Nobles	569	$9,433,924
Norman	613	$6,848,976
Olmsted	168	$17,392,634
Otter Tail	31	$1,077,878
Pennington	53	$1,079,979
Pine	846	$26,338,803
Pipestone	135	$11,497,271
Polk	917	$18,993,101
Pope	61	$2,265,439
Ramsey	1541	$474,225,512
Red Lake	22	$380,181
Redwood	59	$1,520,683
Renville	212	$9,327,309
Rice	257	$29,774,653
Rock	1037	$7,779,227
Roseau	605	$7,291,260
Saint Louis	2688	$402,292,497
Scott	453	$207,797,052
Sherburne	436	$31,917,525
Sibley	114	$6,941,994
Stearns	826	$39,131,390
Steele	208	$19,229,343
Stevens	167	$2,256,650

County	# Damaged Buildings	Potential Structure Loss
Swift	119	$4,451,174
Todd	701	$12,245,948
Traverse	489	$5,308,339
Wabasha	305	$17,147,100
Wadena	203	$6,210,375
Waseca	54	$839,462
Washington	577	$100,949,917
Watonwan	51	$1,940,273
Wilkin	193	$2,129,028
Winona	1113	$52,608,688
Wright	1357	$113,207,551
Yellow Medicine	287	$17,194,730

Damages to crops from floods may also reflect jurisdictional exposure. The Spatial Hazard Events and Losses Database for the United States (SHELDUS) (CEMHS, 2023) is a source of other monetary damage reporting. Table 27 shows the 10 counties in Minnesota with the greatest property damages from flooding, from 1960 to 2022. The monetary damage data FEMA's Willingness to Pay (WTP) values were used to multiply against the number of windstorm related deaths and injuries in each county; $4,017,000 for each hospitalized injury and $12,500,000 for each person killed (FEMA, 2023a). See Appendix G: Monetary Damages from Flooding for the full table of monetary damages from flooding.

Table 27. Top ten counties with monetary damages from flooding 1960–2022

County	Property Damage (ADJ)	Crop Damage (ADJ)	Injuries (WTP)	Fatalities (WTP)	Total Damages
Polk	$995,812,502	$1,055,536	$6,049,000	$1,050,000	$1,003,967,038
Anoka	$316,975,316	$36,477,447	$8,349,000	$23,550,000	$385,351,763
Olmsted	$288,372,991	$38,892,900	$6,049,000	$38,550,000	$371,864,890
Roseau	$300,098,880	$10,175,364	$6,049,000	$1,050,000	$317,373,245
Marshall	$40,563,610	$123,148,972	$6,049,000	$1,050,000	$170,811,581
Kittson	$33,007,469	$125,828,439	$6,049,000	$1,050,000	$165,934,907
Pennington	$21,229,225	$132,588,943	$6,049,000	$1,050,000	$160,917,168
Houston	$95,837,933	$51,160,185	$79,649,000	$24,375,000	$251,022,119
Clearwater	$21,440,849	$122,371,142	$6,049,000	$1,050,000	$150,910,991
Cass	$20,451,273	$122,339,283	$6,049,000	$1,050,000	$149,889,557

Source: (FEMA, 2023a)

Repetitive Loss and Severe Repetitive Loss Properties

Repetitive loss and Severe Repetitive Loss properties and the HSEM mitigation program to facilitate acquisition of them is covered in Section 7.8. Appendix H also lists properties by jurisdiction.

Vulnerability of Critical Infrastructure

The most recent critical facilities data sources are described in Section 4.7. These facility locations were used with the 2023 1% annual chance floodplain (using the boundary only, not depth) to identify structures potentially at risk. Estimated economic losses related to these specific buildings were not available. Table 28 lists the 53 vulnerable schools, fire stations, EMS facilities, shelters, and police stations by county. Hospitals were included in the analysis, but none was found in the 1%-annual-chance floodplain.

The names and locations of these facilities can be found by county in the Flooding Risk & Vulnerability dashboard.

Another 555 critical facilities assets were found to be vulnerable throughout the state in categories including: airports, ARMER Sites, dialysis centers, electric transmission substations, nursing home/assisted living facilities, power plants, EPA risk management plan registered facilities, supervised living facilities, and EPA Resource Conservation and Recovery Act solid hazardous waste disposal facilities. Correctional facilities were included in the analysis, but none were found in the 1% annual chance floodplain. Wastewater treatment facilities were excluded from the analysis because many are intentionally built near water, but risk could not be determined appropriately.

A summary of these vulnerabilities can be found in Appendix I: Critical Infrastructure in the 1% Annual Chance Flood Boundary.

Table 28. Schools, fire stations, police stations, EMS, and shelter vulnerabilities to the 1% annual chance flood

County	Emergency Medical Service (EMS)	Fire Station	Law Enforcement Facility	School-PK-12	Shelter	Total
Cass		1				1
Chippewa		1	1			2
Clay				1	3	4
Fillmore			1		1	2
Hennepin			1	1	1	3
Isanti				1		1
Itasca				1		1
Kittson				2		2
Koochiching		1				1
Lac Qui Parle	1					1
Marshall					1	1
Mille Lacs				2	2	4
Nobles					1	1
Norman	1	1				2
Olmsted	1	1				2
Polk		1			1	2
Renville	2	1				3
Saint Louis		1		1	1	3
Scott	1					1
Sibley				2		2
Traverse		2				2
Wabasha	2	2			1	5
Winona	1	1		2	3	7
Total	9	13	3	13	15	53

Vulnerability of Other Assets

State-owned properties were intersected with the 1% annual chance flood boundary to reveal any vulnerabilities. A total of 260 state-owned properties fell in the flood boundary according to a physical address if the location coordinates were not known. Many of the at-risk structures had the same physical address, indicating that the structure location may be unknown or inaccurate. More analysis is needed to confirm these locations. The state-owned properties in the 1% annual chance flood boundary are listed in Appendix J: State-Owned Structures and Other Assets in 1% Annual Chance Flood Boundary.

Though many are not owned or operated by the state, campgrounds, and manufactured home parks are frequently located by water and often contain vulnerable populations. The locations of the mapped sites were also intersected with the 1% annual chance flood boundary. Eighty-one campgrounds and 19 manufactured home parks were found to be at risk (Appendix J).

Other notable structures of public value are properties on the National Register of Historic Places. The 1% annual chance flood analysis showed that 77 such places were at risk.

These asset locations are identified in the Other State Assets Dashboard on the State Profile page of the Plan website.

The properties insured through the State of Minnesota's Risk Management Fund were intersected with the 1% annual chance flood boundary that was created statewide Nine counties have state-insured properties that appear to fall in this floodplain (Table 29):

Table 29. State-insured properties in 1% annual chance floodplain

County	Number of Properties	Sum of Structure & Contents Exposure Reported
Chippewa	2	$17,151,581
Fillmore	19	$3,677,040
Pipestone	4	$2,431,744
Ramsey	3	$1,676,063
Rice	4	$1,571,015
Steele	1	$1,165,157
Swift	1	$226,000
Wabasha	1	$88,171
Winona	1	$29,924

Vulnerability of state Infrastructure and agricultural areas are also a concern. Stormwater systems are often designed for a fraction of the conveyance needed in a mega rain event. The cost effectiveness of designing and installing systems to higher standards is not cost effective due to the lack of frequency of the events.

Population Vulnerability

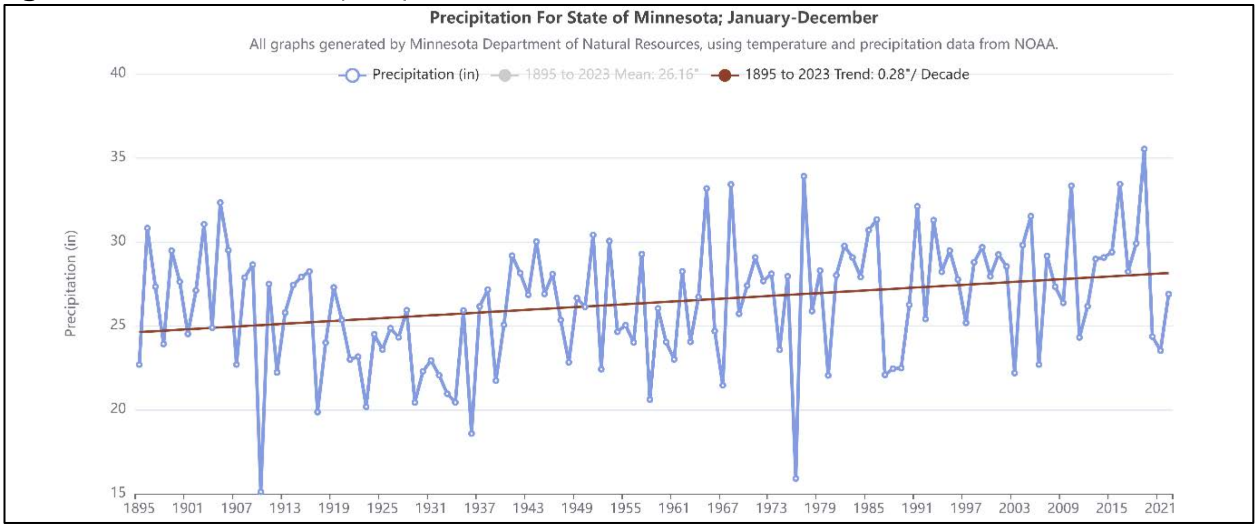
River flooding in large rivers like the Mississippi, Minnesota and its tributaries can flood surface streets and low-lying areas, resulting in drinking water contamination, evacuations, and damage to buildings, injury, and death. Flooded buildings can experience mold growth that can trigger asthma attacks and allergies during cleanup efforts. Mental stress following flooding events can cause substantial health impacts, including sleeplessness, anxiety, depression, and post-traumatic stress disorder.

Precipitation events can transport pathogens that cause gastrointestinal illnesses, putting populations who rely on untreated groundwater (such as wells) at an increased risk of disease, particularly following large rainfall events. Many midwestern communities use wells as their drinking water sources. Adaptive measures, such as water treatment installations, may substantially reduce the risk of gastrointestinal illness, in spite of climate change (USGCRP, 2018).

5.1.4 Flooding and Climate Change

Higher temperatures globally have evaporated more surface and ocean water into the atmosphere, which in turn has provided more potential moisture for precipitating weather systems. In Minnesota, the result has been increased precipitation, with annual totals increasing at an average rate of just over a quarter inch per decade statewide since 1895 (see Figure 7).

Figure 7. Statewide annual precipitation, 1895–2022



SOURCE:(MN DNR, 2023B)

> Key Message #1 in the Water Chapter of the NCA5 states that climate change will continue to cause profound changes in the water cycle.

Snow cover will decrease and melt earlier and heavier rainfall is leading to increasing flooding (Payton et al., 2023). Additional increases in heavy and extreme precipitation are expected to remain the state's leading climate change symptoms. Heavy rains are now more common in Minnesota and more intense than at any time on record. Long-term observation sites have seen dramatic increases in one-inch rains, three-inch rains, and the size of the heaviest rainfall of the year. Since 2000, Minnesota has seen a significant uptick in devastating, large-area extreme rainstorms as well. Rains that historically would have been in the 98th percentile annually (the largest 2%) have become more common. (MN DNR, 2024a).

This precipitation increase is found in all seasons, but spring and summer are becoming wetter at faster rates than fall and winter. Whereas temperature increases have been greatest in the northern parts of the state, precipitation increases have been well distributed geographically, and have somewhat favored southern Minnesota, which has better access to moisture from the Gulf of Mexico and is more frequently near the "low-level jet" airflow (a relatively fast-moving zone of winds in the lower atmosphere) that influences precipitation production.

5.2 Wildfire

Wildfire or wildland fire consists of uncontrolled fire spreading through vegetative fuels, exposing and possibly consuming structures. They often begin unnoticed, spread quickly, and are usually signaled by dense smoke that may fill the area for miles around. Wildfires can be caused through acts such as arson or campfires or can be caused by natural events such as lightning. Wildfires can be categorized into four types by source and behavior:

- Wildland fires are fueled primarily by natural vegetation in grasslands, brush lands and forests.
- Firestorms occur during extreme weather (e.g., high temperatures, low humidity, and high winds) with such intensity that fire suppression is virtually impossible. These events typically burn until the conditions change or the fuel is exhausted.
- Interface or intermix fires occur in areas where both vegetation and structures provide fuel. These are also referred to as wildland/urban interface fires.
- Prescribed fires and prescribed natural fires are intentionally set or natural fires that are allowed to burn for beneficial purposes.

The following factors contribute significantly to wildfire behavior:

- Topography: As slope increases, the rate of wildfire spread increases. South facing slopes are also subject to greater solar radiation, making them drier and thereby intensifying wildfire behavior. However, ridge tops may mark the end of wildfire spread, since fire spreads more slowly or may even be unable to spread downhill.
- Fuel: Size class, moisture content and volume are the methods of classifying fuel, with volume also referred to as fuel loading (measured in tons of vegetative material per acre). As fuel loading increases, fire intensity (energy released) and flame length increase, making fire suppression more difficult. Fuels with low moisture content ignite easier than wet fuels. The fuel's continuity is also an important factor, both horizontally and vertically.
- Weather: The most variable factor affecting wildfire behavior is weather. Important weather variables are temperature, humidity, wind, and lightning. Weather events ranging in scale from localized thunderstorms to large fronts can have major effects on wildfire occurrence and behavior. Extreme weather, such as high temperatures and low humidity, can lead to extreme wildfire activity. In contrast, cooling and higher humidity often signal reduced wildfire occurrence and easier containment.

If not promptly controlled, wildfires may grow into an emergency or disaster. Even small fires can threaten lives and resources and destroy properties. It is also important to note that in addition to affecting people, wildfires may severely affect livestock and pets. Such events may require emergency watering/feeding, shelter, evacuation and even burying of animals.

The indirect effects of wildfires can also be catastrophic. In addition to stripping the land of vegetation and destroying forest resources, large, intense fires can harm the soil and waterways. Soil exposed to intense heat may lose its capability to absorb moisture and support life. Exposed soils erode quickly and enhance siltation of rivers and streams, thereby increasing flood potential, harming aquatic life, and degrading water quality. Lands stripped of vegetation are also subject to increased landslide hazards.

Wildfires can occur at any time of day and during any month of the year; however, the greatest wildland fire activity usually occurs from snowmelt in March or April, through green-up in late May or early June. Careless fire use, arson, equipment uses, and weather conditions such as wind, low humidity, and lack of precipitation are the chief factors determining the number of fires and acreage burned. Generally, fires are more likely when vegetation is dormant or after extended drought periods.

Wildland fires can cause significant injury, death, and damage to property. Much of the state is covered with forests. The potential for property damage from fire increases each year as more recreational properties are developed on wooded land and increased numbers of people use these areas. Fires can extensively impact the economy of an affected area, especially the logging, recreation, and tourism industries, upon which many northern counties depend. There can be major direct costs associated with timber salvage and the restoration of the burned area. Burned woodlands and grasslands may need to be replanted quickly to prevent the possibility of widespread soil erosion, landslides, mudflows, and floods which could compound the damage.

5.2.1 Wildfire History

In the period of 2019-2023, there have been 6,039 wildfires recorded in the state using MN DNR and USFS records combined. Table 30 show the ten Minnesota counties with the most wildfires over ten acres, 1985-2023, and the number of wildfires from 2019-2023. Only Aitkin, Mille Lacs, and Pine were not in the top ten counties from 2019-2023. Clearwater, Mahnomen, and Lake Counties ranked sixth, ninth, and tenth respectively. The year 2021 recorded over 2,100 wildfires. Since 2019, nearly one in three wildfires were caused by debris fires burning out of control and only 2.5% of fires result from natural cause (e.g., lightning) (MN DNR, 2023e; USFS, 2024a).

Minnesota DNR wildfire costs, including preparedness, prevention and suppression, topped $23 million in 2023 (MN DNR, 2023d).

Wildfire frequency has varied throughout time in Minnesota. Short- or long-term droughts are generally the rule for those high-frequency years.

Table 30. Top counties with fires greater than ten acres

County	# Wildfires, 1985-2023	#Wildfires, 2019-2023	Average fires/year, 2019-2023
Morrison	822	38	7.6
Beltrami	691	26	5.2
Kittson	594	47	9.4
Roseau	561	24	4.8
Becker	552	24	4.8
Marshall	535	54	10.8
Aitkin	510	7	1.4
St. Louis	476	44	8.8
Mille Lacs	347	9	1.8
Pine	339	12	2.4

SOURCE:(MN DNR, 2023E)

The largest fire between 2019 and 2023 occurred in 2021 when the Greenwood Fire, triggered by lightning, started near Greenwood Lake in Stony River Township. It burned over 26,800 acres in Lake County, over 12,900 acres of which were on public land. The fire led to extensive evacuations and destroying 70 buildings (USFS, 2024b).

One of the most notorious fires in recent history, the Pagami Creek Fire burned over 92,000 acres in northern Minnesota in August and September of 2011. The fire was started by lightning in and smoldered in a boggy landscape until late August, when low humidity and high winds resulted in the fire spreading through understory growth and jumping through forests as a crown fire. Smoke from the fire traveled as far away as Michigan, Illinois, and Ontario (Seeley, 2015).

The extensive costs associated with wildfire are difficult to capture in a single estimate. Besides evacuations and structural damage, the Pagami Creek Fire resulted in substantial costs associated with mobilizing more than 960 firefighters and support personnel to suppress the fire and support affected communities. The Minnesota National Guard was called up to assist with response efforts. Some sources cite that the fire-fighting effort alone cost nearly 23 million dollars. Despite major investments in fighting the fire, essential resources were limited due to aircraft and personnel being dedicated to competing wildfires in the south and west regions of the U.S. In addition, months of battling the flames required a massive cleanup of more than 150 miles of fire hose, water pumps, watercraft, and other gear.

The DNR is the leading state agency for wildland fire prevention and response. However, other agencies also respond to fires in designated protection areas including local fire departments and federal agencies such as the Bureau of Indian Affairs, Forest Service, Fish and Wildlife Service and the National Park Service.

Unattended debris fires continue to be the leading cause of wildfires. From 2019-2023, vehicles caused over 16% of all fires started by equipment. When parking off-highway, residents should avoid dry, fine vegetation such as grass, since hot exhaust can readily ignite it (MN DNR, 2021b).

The causes of wildfire and event size by county can be explored on the Plan website

Peat Fires and Peat Fire History

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, concentrated primarily in northern Minnesota.

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.

Peat fires can be extremely difficult to battle because the fire smolders beneath the ground as a glowing combustion rather than as an open flame. Pumping water on a peat fire is often ineffective. Heavy equipment may be needed to alternately work and pack the soil, exposing hot pockets and then sealing them off from surface oxygen. A peat fire can take weeks or months to extinguish, and the costs to fight the fire can be substantial.

In 1988, peat fires burned 45,000 acres starting in the spring near Warroad and Baudette on the northern border of Minnesota, one of the largest peat fires. In December 2011, the MN DNR noted a high incidence of peat fires across the state, warning landowners to take caution in burning brush and grasses. Peat fires are normally rare in the middle of winter, but the lack of precipitation in the fall of 2011 made conditions just right.

In March of 2012, dry conditions and sparks from a train ignited a peat bog in a remote area near Brainerd. Over 20 firefighters were dispatched, but the location was too rugged to reach with their vehicles. Then in October of the same year, a series of 8 wildfires flared up and shifted through Northwestern Minnesota. Many of the fires ignited peat bogs making the event more dangerous and unpredictable. One of the eight fires to hit the area had been caused by the reigniting of a peat bog that had been smoldering since the summer of 2012.

Prairie Fires and Prairie Fire History

Brushland or prairie fires are the primary type of wildland fire in the agricultural areas of southern Minnesota. It is the introduction of fire by prescription, sparks from machines, or lightning that ignite most prairie wildland fires. These fires are usually less of a risk to large populations, infrastructure or wildlife because of the nature of them being in an agricultural or other sparsely populated area. Additionally, many of these fires will occur on private lands and historical records related to their occurrence are difficult to find.

5.2.2 Probability of Occurrence

Like most weather-related phenomena, wildfire probability cannot be accurately predicted in the short-term. It is reasonable to assume that wildfire incidence will remain stable over the long-term, bearing in mind that weather patterns (in particular, periods of drought and very low humidity); fuel load, insect infestations, and human behavior can all greatly influence near-term probabilities. The qualitative probability is rated High for the state, although the rating is only intended for general comparison to other hazards that are being considered for this stage of the planning process. The MN DNR Wildfire Information Center provides daily fire weather forecasts, current data on wildfire conditions and burning restrictions throughout the state.

The likelihood of fire is also greatly dependent on local geography including vegetation and topography and the frequency can only be considered at county or sub-county level. For example, the frequency of large (> 10 acre) fires in Marshall County from 2019-2023 was about ten per year. The frequency of the same size of fire in Aitkin and Mille Lacs County is about one to two per year. There are 59 counties in Minnesota that have a frequency of less than one fire per year which burned ten or more acres since the last Hazard Mitigation Plan update.

The Wildfire History Dashboard can be viewed by county and by year to explore the historical frequency of wildfires on the Plan website

5.2.3 Vulnerability

Fires in Minnesota can be classified by their fuel source and setting: forest wildfires, prairie fires and peat fires occur in distinct regions throughout the state. A wildfire hazard potential (WHP) map for the conterminous United States was produced by www.firelab.org that can help inform evaluations of wildfire risk or prioritization of fuels management needs across very large areas. Areas with higher WHP values represent fuels with a higher probability of experiencing torching, crowning and other forms of extreme fire behavior under conducive weather conditions, based primarily on 2020 landscape conditions.

Minnesota ranks 22nd in the country mapped as high or very high WHP at 5%. WHP is often used to represent areas most likely to experience high-intensity wildfire (Dillon & Gilbertson-Day, 2020).

The Wildfire Hazard Potential Map can be viewed in the Wildfire Risk & Vulnerability Dashboard.

On its own, WHP is not an explicit map of wildfire threat or risk, but when paired with spatial data depicting highly valued resources and assets such as communities, structures or power lines, it can approximate relative wildfire risk to those resources and assets. WHP is also not a forecast or wildfire outlook for any particular season, as it does not include any information on current or forecasted weather or fuel moisture conditions. Rather, it is intended for long-term strategic planning and fuels management.

The immediate danger from wildfire is the destruction of timber, property, wildlife, and injury or loss of life to persons who live in the affected area or who are using recreational facilities in the area. Long-term effects include large amounts of scorched and barren land, which may not return to its pre-fire condition for many years. Major fires can completely destroy ground cover, which can in turn cause erosion. Flash floods, landslides, and mudflows can occur if heavy rains follow a major fire. A large blowdown, such as the 1999 event in the Boundary Waters Canoe Area Wilderness (BWCAW), makes losses due to wildfire greater now than in the past.

Structures in jurisdictions that interface or mix with forests, peat bogs and prairies are vulnerable to damages to wildfire statewide. Even counties with higher population densities are not completely “built out” and have large wildland or agriculture tracts. Structural damage due to wildfire also depends on the location of the structure in relation to the fuel source. Economic activity and the environment are also vulnerable to wildfire damages. Loss of jobs and revenue associated with the lumber industry and tourism may be depressed for years since timber stands take time to grow back. Peat is considered a non-renewable fossil fuel so permanent damage may take place due to wildfire.

For fires outside urban areas, vulnerabilities are dependent upon fuel sources and availability. One major example of property wildfire vulnerabilities is the area impacted by the July 4, 1999 massive windstorm. This windstorm raked northeastern Minnesota with straight-line winds exceeding 90 miles per hour. In less than 30 minutes, the storm cut an unbroken fuel pathway (10–12 miles long and 40 miles wide) through the BWCAW in the Superior National Forest, along the Gunflint Trail outside Grand Marais, with an estimated 80–120 tons of fuel per acre on over 477,000 acres. Much of this land cannot be legally, cost-effectively, or safely salvaged or cleared. Downed trees and outbreaks of insects and disease previous to the blowdown storm of July 4, 1999 have significantly increased the fire risk in the area. The task of mitigating fire risk and managing any fires that may occur is complicated by: the remoteness and inaccessibility of the area; the number of government entities that have responsibility for land within the area; the extent of the area affected; constraints on the type of activity that can take place within the BWCAW; and the large number of permanent and seasonal residents and tourists that may be affected by a fire in the area. The size and severity of the Ham Lake and Cavity Lake fires can be attributed to the unique fuel conditions in that part of the state. Following the 1999 blowdown, several mitigation projects occurred in the affected area, including: construction of helipads and safety zones, development of an evacuation plan for the Gunflint Trail, fuel reduction projects, development of the Northeastern Minnesota Wildfire Integrated Response Plan, Community Wildfire Protection Plans, Firewise programs, and defensible space and sprinkler projects around structures.

The SILVIS Lab at University of Wisconsin–Madison created a dataset documenting the changes of the wildland–urban interface (WUI) in the United States from 2000 to 2020. Radeloff et al. (2018) define WUI as the area where structures and other human development meet or intermingle with wildland vegetation. With the increase of development in metropolitan fringes and rural areas, the WUI is growing. The expansion of the WUI in recent decades has significant implications for wildfire management and impact as it 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 (Radeloff et al., 2018).

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. Concentrations of interface and intermix values in Minnesota are located north of the Twin Cities metro area and around the Duluth area. There are also areas located throughout the north-central portion of the state (Radeloff et al., 2023). Table 31 lists the top 15 counties by area of Wildland-Urban Interface (WUI).

As wildfires affect more people, active public involvement becomes integral to the success of any wildfire management initiative. A Community Wildfire Protection Plan (CWPP) is an example of a community-based plan with two objectives. First, to identify and prioritize Wildland Urban Interface (WUI) areas within Lake County (including state, county, federal and nonfederal lands) for hazardous fuels reduction treatments and recommends methods for achieving hazardous fuels reductions. Second, the plan outlines measures for reducing fire danger to structures throughout Lake County in at-risk communities. Lake, Cook, St. Louis, Itasca, Mahnomen, and Pine Counties have a CWPP; and the communities of Kensington, Leech Lake, Northwest Angle, and Karlstad have active CWPPs.

See the Wildfire Risk Dashboard on the Plan website for a map of the WUI in Minnesota.

Minnesota has adopted the national Firewise program, which addresses the risks of homes in the wildland/urban interface to wildland fire. The goal of this program is making homes able to survive an approaching wildfire.

Geography will make certain populations more disposed to wildfire risk, but certain demographic groups are also more vulnerable. Wildfires commonly result in more particulate matter and degradations in air quality which will impact children, the elderly, and those with a range of chronic health conditions. Exposure to particulate matter can aggravate illnesses, such as chronic obstructive pulmonary disease (COPD), cardiovascular disease, asthma, and development of chronic lung disease. It is also associated with cardiopulmonary mortality. Even short-term ozone exposure can exacerbate asthma and COPD (US EPA, 2016).

Table 31. Top 15 counties in Minnesota by area of wildland-urban interface (WUI)

Rank	County	WUI (Acres)
1	St. Louis	372,408
2	Crow Wing	203,488
3	Cass	175,034
4	Itasca	167,712
5	Beltrami	107,207
6	Hubbard	98,903
7	Anoka	95,094
8	Aitkin	81,131
9	Carlton	80,411
10	Becker	58,449
11	Pine	58,449
12	Sherburne	52,222
13	Isanti	46,721
14	Otter Tail	42,239
15	Chisago	41,393

Source: (Radeloff et al., 2023)

Vulnerability of State Assets

State-owned and insured properties were overlaid with the WHP dataset to identify state interests in a high or very-high wildfire hazard potential area due to fuels and landscape conditions. The assets in Table 32 were identified using the latitude and longitude supplied coordinates in the state owned buildings and state-insured buildings provided by the Minnesota Department of Administration (ADM, 2023).

Table 32. State assets at risk of "high" or "very high" wildfire hazard potential

County	Agency	Building Use	Count	Total Replacement Value
Anoka	MN DNR	Brooder House	1	$105,360
Anoka	MN DNR	Cold Storage	2	$256,728
Anoka	MN DNR	Garage	1	$157,444
Beltrami	MN DNR	Adirondack	1	n/a
Cook	MN DNR	Vault Toilet	1	$17,684

County	Agency	Building Use	Count	Total Replacement Value
Crow Wing	MN DNR	Interp Occupied	1	$184,180
Kittson	MN DNR	Cold Storage	2	$503,856
Kittson	MN DNR	Heated Storage	1	$307,139
Kittson	MN DNR	Picnic	1	$566,541
Kittson	MN DNR	Restroom/Shower	1	$326,914
Kittson	MN DNR	Shop	1	$261,813
Kittson	MN DNR	Vault Toilet	1	$18,202
Lake	MN DNR	Vault Toilet	1	$42,100
Lake of the Woods	MN DNR	Cold Storage	4	$853,797
Lake of the Woods	MN DNR	Dormitory	2	$695,522
Lake of the Woods	MN DNR	Fire	1	$20,323
Lake of the Woods	MN DNR	Garage	2	$205,970
Lake of the Woods	MN DNR	Interp Unoccupied	1	$62,152
Lake of the Woods	MN DNR	Office	1	$567,598
Lake of the Woods	MN DNR	Oil House	2	$82,621
Lake of the Woods	MN DNR	Picnic	1	$42,605
Lake of the Woods	MN DNR	Shop	1	$209,234
Lake of the Woods	MN DNR	Vault Toilet	1	$15,354
Marshall	MN DNR	Cold Storage	3	$560,780
Marshall	MN DNR	Feed Storage	3	$118,076
Marshall	MN DNR	Garage	3	$138,202
Marshall	MN DNR	Office	2	$997,399
Marshall	MN DNR	Oil House	1	$16,501
Marshall	MN DNR	Picnic	1	$655,270
Marshall	MN DNR	Pump House	2	$130,167
Marshall	MN DNR	Res Essential	2	$1,159,160
Marshall	MN DNR	Res Nonessential	1	$849,932
Marshall	MN DNR	Restroom/Shower	1	$192,191
Marshall	MN DNR	Shop	2	$1,282,876
Marshall	MN DNR	Shower	1	$562,045
Marshall	MN DNR	Vault Toilet	1	$18,202
Morrison	Minnesota Veterans Affairs	Equip Storage	1	$1,602,339
Morrison	MN DNR	Cold Storage	4	$1,044,641
Morrison	MN DNR	Salt/Sand	1	$738,413
Morrison	MN DNR	Shop	1	$2,149,454
Roseau	MN DNR	Cabin	2	$119,178
Roseau	MN DNR	Cold Storage	3	$208,754
Roseau	MN DNR	Contact Station	1	$221,568
Roseau	MN DNR	Feed Storage	2	$70,036
Roseau	MN DNR	Fire	1	$16,967
Roseau	MN DNR	Fish Cleaning	1	$67,825

County	Agency	Building Use	Count	Total Replacement Value
Roseau	MN DNR	Garage	1	$51,484
Roseau	MN DNR	Heated Storage	1	$191,908
Roseau	MN DNR	Picnic	1	$81,960
Roseau	MN DNR	Pump House	1	$15,166
Roseau	MN DNR	Res Essential	1	$443,540
Roseau	MN DNR	Vault Toilet	4	$41,768
Sherburne	MN DNR	Vault Toilet	1	$10,588
St Louis	MN DNR	Fire	1	$15,716
St Louis	MN DNR	Picnic	1	$200,251
St Louis	MINN STATE-Minnesota North College–X450	Modular Housing	1	$1,229,868
Todd	MINN STATE–Central Lakes College–Staples–X71000	West–Heavy Equipment	1	$12,018,300

Wildfire Smoke

Forest fires in northern Minnesota, the western U.S., and portions of Ontario and Manitoba, combined with regional and local wind patterns to resulting in hazardous smoke reports becoming more common. There was a quick smoke front on July 6, 2015. In August 2018 there were smoky skies off and on. There was another smoke episode on September 13-15, 2020, and 2021 was a "summer of smoke" (MN DNR, 2022)—the MPCA created an interactive story map that provides details of this unprecedented smoke event. The fine particulate matter from smoke creates imminent health hazards for vulnerable populations, and MPCA forecasters and analysts remained busy during that time, and for much of the summer, issuing Air Quality Alerts.

On June 14, 2023, Minnesota had the worst air quality in the country, with the Air Quality Index reaching the "Very Unhealthy" category. The average Air Quality Index (AQI) for June 14 for the Twin Cities was 175, which is the highest daily average measure recorded in the Twin Cities since Air Quality Index records began in 1980 (MN DNR, 2023a).

5.2.4 Wildfire and Climate Change

The changing climate poses a complex web of issues for wildfire in Minnesota. Climate change likely is affecting the frequency and intensity of Canadian wildfires, similar to its effect on wildfires in the western U.S. and Alaska (Wehner, 2017). Small particulate pollution from smoke plumes has numerous health impacts as described above, and if severe enough can result in spikes of demand for emergency services. The Midwest Based even on intermediate (RCP4.5) future climate projections, many Midwest counties will experience increased exposure to wildfire smoke (Mills et al., 2018).

According to the NCA5, Key Message #3 in the Midwest Chapter, Climate Adaptation will require innovative collaborations between public health and other sectors such as emergency management (Wilson et al., 2023).

Changes in Minnesota's climate also may be influencing the frequency, severity, and areal coverage of wildfires. For example, warmer winters with inconsistent snow cover, the arrival of wet conditions prior to the growing season, plus early and more frequent thaws, all combine to prolong the exposure of susceptible vegetation to dry conditions, potentially extending the peak wildfire season.

Minnesota's changing climate also may affect fire-damaged areas. For instance, heavy rains in burned areas can lead to erosion and mudslides. Documented and projected increases in the frequency and intensity of heavy and extreme rainfall suggest that Minnesota is becoming and will become more prone to post-fire landscape hazards. Climate change also is having an impact on the pests that damage the health and composition of Minnesota forests, although the ultimate consequences for wildfire are complex and uncertain. Shorter winters are allowing two reproductive cycles of the Eastern Larch Beetle, which has now killed off at least 143,000 acres of mature tamarack forest in Minnesota since 2001 and affected about 535,000 acres to some degree during that period. The decline in severity and frequency of extreme cold may allow more rapid establishment of Emerald Ash Borer to latitudes further north than without climate change. Minnesota forests are home to an estimated 1 billion ash trees. Many of these trees are in nearly pure stands of black ash growing in wet areas. So while the deaths of these lowland species will increase fuel loading, their decreased transpiration will increase water on the ground. The ultimate contribution to wildfire will depend on the interplay between increased precipitation, warming temperatures, extreme heat, and periods of drought as our climate continues to 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.

The varied impacts of climate change are complicated by how these changes also interact with and reinforce one another. Drought and heat may both contribute to wildfires, which may in turn lead to changes in plant and animal populations and other ecological shifts. Increasing events of extreme heat and drought can increase the number of wildfires (Blumenfeld, K. Minnesota State Climatology Office, personal communication, January 9, 2019).

5.3 Windstorms

A windstorm hazard is a wind strong enough to cause light damage to trees and buildings. Wind speeds during a windstorm typically exceed 34 miles per hour (29.5 knots). Wind damage can be caused by gusts or sustained winds (Pielke, 2012). Windstorms encompass a large variety of damaging wind types, including straight-line wind (thunderstorm wind not associated with rotation), downdraft (a small-scale column of air that rapidly sinks toward the ground), downburst (a strong downdraft with an outrush of damaging winds on or near the earth's surface), gustnado (small whirlwind originating from the ground and not connected to any cloud-based rotation), and a derecho (widespread, long-lived wind storm associated with a band of rapidly moving showers or thunderstorms) (NOAA, 2020).Tornadoes and hurricanes are categorized as separate hazards from windstorms.

NOAA's National Centers for Environmental Information Storm Events Database includes storm events classified using the following criteria to define each of three storm events:

- Strong windstorm events are "non-convective winds gusting less than 50 knots (58 mph), or sustained winds less than 35 knots (40 mph), resulting in a fatality, injury, or damage."
- High windstorm events are "sustained non-convective winds of 35 knots (40 mph) or greater lasting for one hour or longer or gusts of 50 knots (58 mph) or greater for any duration."
- Thunderstorm windstorm events are "winds arising from convection (occurring within 30 minutes of lightning being observed or detected), with speeds of at least 50 knots (58 mph) or winds of any speed producing a fatality, injury, or damage." Downbursts and gustnadoes are classified as thunderstorm windstorm events (NCEI, 2023).

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 33 lists the expected effects of increasing wind speeds.

Table 33. 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; 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: (NWS, 2018)

5.3.1 Windstorm History

According to the National Centers for Environmental Information, there have been 148 high-wind events, 47 strong-wind events, and 2078 thunderstorm wind events recorded in Minnesota between 2019 and September 9, 2023, affecting every county. Almost 25% of the thunderstorm wind events (487) occurred in the first six months of 2022 (NCEI, 2023). Notable wind events since 2019 are described briefly in Table 34.

The Windstorm History Dashboard on the Plan website details the history of wind-related events by county, year, and month.

Table 34. A sample of notable windstorms reaching over 80 knots, 2019–September 2023

Date	Region	NWS Remarks
9/5/2019	Northwest MN	Thunderstorms crossed the border north of Langdon just after midnight on the 5th and tracked to the east-southeast through the pre-dawn hours, staying mainly north of a line from Langdon to Park Rapids. Trees and power lines were blown down, some falling on buildings. Roof damage was reported, and a grain cart was toppled onto the railroad tracks.
7/25/2020	Northwest MN	Friday, July 24th, was one of the hottest and most humid days of 2020. During the early evening, thunderstorms broke out along two lines, bringing a period of very strong winds to eastern Grand Forks and eastern Walsh counties, continuing up toward the Lake of the Woods region. Meanwhile, another cluster of storms over south central North Dakota moved east-northeast, tracking through the Fargo-Moorhead area and into west central Minnesota during the overnight hours. These storms also produced some strong wind gusts. A microburst (downburst wind) likely initiated over the west end of Long Lake and moved rapidly eastward across Long Lake Point Road. A trailer home was blown over and demolished. Several large tree limbs were broken down by the wind, while a pontoon was flipped over by the combination of wave and wind action.
5/11/2022	Southwest MN (DR-4658: Cottonwood and Nobles)	Storms produced hail up to ping-pong ball size, wind to 90 mph, and a few tornadoes across southwest Minnesota. Presidential Disaster Declarations were granted to Cottonwood and Nobles Counties for damages to public infrastructure. Power poles were snapped by thunderstorm winds. Crop damage is an estimate from insured losses. Information provided by the United States Department of Agriculture.
5/12/2022	West Central MN	A large-scale Derecho moved from northeastern Nebraska, through eastern South Dakota and into portions of far southeastern North Dakota and west-central Minnesota. Widespread strong to severe thunderstorms were observed, with large hail, tornadoes, and damaging wind gusts all being reported during this time. The most concentrated area of damage based on reports of farm equipment, trailers, semis, trees, power lines, and other debris, occurred near the upper Minnesota River Valley, northward to Alexandria and Long Prairie. Ten tornadoes were confirmed this day, with two in Lac Qui Parle County, including a house in Bellingham that had much of its roof removed. In northwestern Swift County, a tornado tipped over trailers and various farm equipment was heavily damaged. Two tornadoes were in Todd County, including one that moved through Clarissa. Two more were in Morrison County, and one was on the east side of Lake Alexander, where many trees came down on vehicles, sheds, and cabins. A tornado also occurred in Douglas County, on the northwest side of Alexandria, where EF2 damage was noted. The ninth tornado touched down south of Lowry in Pope County, and the tenth was in northwestern Stearns County, affecting the north side of Sauk Centre. A peak wind of 94 mph was measured at a MN RWIS station. Widespread downburst wind damage was noted across Wadena and Aldrich Townships, with numerous large tree branches and limbs torn down, roofing material torn up, and spruce trees uprooted.
5/30/2022	Southwest MN (DR 4666) Lyon, Rock, and Nobles Counties	Widespread winds of 60 to 90 mph caused scattered tree damage, with isolated pockets of more significant structural damage. Presidential Disaster Declarations were granted to Lyon, Rock, and Nobles Counties in Minnesota for damages to public infrastructure.

Date	Region	NWS Remarks
9/5/2023	Northeast MN	Thunderstorms developed ahead of a cold front moving across northern Minnesota during the afternoon hours of the 5th. Storms along the Iron Range of northeastern Minnesota were quite strong and produced damaging winds from the Hibbing area northeast to the Isabella area. Widespread tree damage was observed along with concentrated corridors of more significant damage. NWS meteorologists performed a storm survey of the hardest hit areas near Aurora and Hoyt Lakes and found damage indicative of straight-line winds in excess of 90 mph. Additional storms were seen elsewhere across the region that produced minor tree damage and marginally severe hail. Numerous 12 inch plus diameter pine trees were snapped or uprooted.

Source: (NCEI, 2023).

A memorable derecho occurred in the Arrowhead Region in July of 1999, resulting in a severe blowdown. The blowdown impacted 180,000 acres and resulted in a Presidential Disaster Declaration for Cook County. Much of the blowdown was located within the BWCAW and the Superior National Forest. According to the NCEI, timber loss was approximately .5 to .75 million cords and valued at between $12 and $18 million, though salvage value was only around $5 million. Twenty people had to be airlifted to hospitals after suffering injuries from falling trees. The cost of damage and debris clearance for Lake and Cook counties was estimated at nearly $5 million (NCEI, 2023). This storm contributed to fire risk in subsequent years.

5.3.2 Probability of Occurrence

Although windstorms occur year-round throughout the state of Minnesota, the majority of windstorms occur during the months of May through August. This recurrence is expected to remain relatively stable, although there will be year-to-year fluctuations. Long-term changes in weather patterns may also influence the number of windstorms that occur.

A value representing the expected number of windstorms was developed for each county using the average frequency of windstorms events in a 50-mile radius, normalized by the county's area. All other factors being equal, a larger county will have more storms, so this method adjusts for area and reporting bias in order to compare county to county. This value represents the expected number of windstorms in the county, based on local and regional trends in reported data as opposed to administrative boundaries. Appendix K: Windstorm Vulnerability Ranking shows the expected number of windstorms data by county. The county expected number of windstorms is used in a vulnerability index described below.

5.3.3 Vulnerability

Vulnerability to injury from all kinds of windstorm decreases with adequate warnings, warning time, and sheltering in a reinforced structure. Vulnerability to structures depends upon construction of the building and infrastructure. Higher damages occur when windstorms strike a densely populated area.

The FEMA National Risk Index was used to demonstrate windstorm vulnerability in the Windstorm Risk & Vulnerability dashboard.

Table 35 shows the ten counties in Minnesota with the greatest monetary damages (CEMHS, 2023) windstorms ≥ 50 knots, from 1960 to 2017. The monetary damage data is from the Spatial Hazard Events and Losses Database for the United States (SHELDUS) (CEMHS, 2023).FEMA's Willingness to Pay (WTP) values were used to value the number of windstorm related deaths and injuries in each county. According to the Standard Economic Value Methodology Report, updated May 2023, the value of Statistical Life is $12,500,000, and the hospitalized injury value is $4,017,000 (FEMA, 2023a).

Table 35. Counties with greatest monetary damages from windstorms, 1960–2022

County	Total Value of Statistical Life/Injury (WTP)	Property Damage (ADJ)	Crop Damage (ADJ)	Total Property and Crop Damages
Dakota	$292,827,506	$281,473,359	$5,677,073	$287,150,433
Scott	$213,680,568	$183,069,270	$15,305,649	$198,374,919
Hennepin	$119,210,926	$117,066,834	$1,072,046	$118,138,880
Blue Earth	$171,816,253	$25,851,743	$72,982,255	$98,833,998
Anoka	$72,740,473	$71,338,646	$700,913	$72,039,559
Wilkin	$73,953,656	$7,098,769	$33,427,444	$40,526,213
Clay	$71,941,888	$5,745,489	$33,098,200	$38,843,689
Carver	$40,490,994	$36,324,857	$2,083,068	$38,407,925
Mahnomen	$69,005,962	$4,682,702	$32,161,630	$36,844,332
Norman	$66,918,524	$4,214,054	$31,352,235	$35,566,289

SOURCE: (CEMHS, 2023).

In another attempt to assess how vulnerable a county is to windstorms, a vulnerability score was constructed. The vulnerability score uses the total replacement value of all the buildings in a county (building exposure) and the expected number of windstorms value together for this score. The expected storm values were scored as a percentage of the highest number of storms in a county. The building exposure values were scored using the percentage of the log the highest exposure (to moderate the extremely high value of Hennepin and other metro counties). Finally, the two scaled scores were added to produce a vulnerability score. Table 36 displays the 10 counties with the highest vulnerability ranking.

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 to mitigate these vulnerabilities have been taken but have not proven sufficient (American Meteorological Society, 2004). 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 (MDH, 2020). 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 for community emergency management to know where mobile homes around the state are located.

*Table 36. Counties most vulnerable to windstorms, 1955–2023**

County	Vulnerability Rank	Building Exposure in Millions	Avg Annual Count	Expected Annual Count
Saint Louis	1	$27,025	8.28	5.25
Hennepin	2	$226,787	6.47	2.67
Dakota	3	$79,526	3.37	2.46
Otter Tail	4	$9,148	5.51	4.18
Stearns	5	$20,670	4.07	3.13
Anoka	6	$64,821	2.90	1.84
Wright	7	$23,009	3.60	2.82
Washington	8	$53,817	2.16	1.64
Cass	9	$6,081	3.49	3.66
Olmsted	10	$36,252	4.35	1.89

*The historical average annual windstorm count is included for reference, but only the expected annual windstorm count is used in the index. Building exposure was calculated from structures obtained for each individual county.

Source: (NCEI, 2023)

The Plan website County Profile includes a dashboard that maps the statewide licensed mobile home parks and recreational vehicle parks for which location information could be obtained.

From 2013–2022, electric cooperatives in Minnesota received funding for natural disaster recovery efforts for 10 different events. Historically, electric cooperatives are vulnerable to natural hazards and are often the electric cooperative's infrastructure damage costs that make the county eligible for a Presidentially Declared Disaster. With the frequency of more extreme weather events, the need for electric cooperatives to incorporate mitigation efforts into their infrastructure is critical to maintain electric service to the end consumer.

Strong windstorms can have a significantly detrimental impact to overhead electrical lines. Multiple windstorms affected central Minnesota in 2022 causing three declared disaster events. These events resulted in week-long power outages to some consumers due to the large amount of widespread damage.

Windstorms can occur year-round throughout Minnesota and are the leading cause for natural hazard electrical system damage. Typically, the damage caused by windstorms is coupled with other weather events occurring at the same time such as winter storms and tornados. While heavily vegetated areas can compound damage caused by windstorms, areas with little vegetation also may experience significant damage as there is little windbreak to buffer the effect from the storms. Windstorms have been a part of ten federally declared disasters in Minnesota in the past ten years. Similarly, most electric cooperatives ranked windstorms as the natural hazard that most frequently affects the electrical grid. See the 2023 Rural Electric Cooperative Annex attached to this Plan for more information.

5.3.4 Windstorms and Climate Change

Lack of high-quality long-term data sets makes assessment of changes in wind speeds very difficult (Kunkel et al., 2013). In general, one analysis found no evidence of significant changes in wind speed distribution. Other trends in severe storms, including the number 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 (USGCRP, 2018).

5.4 Tornadoes

Tornadoes are defined as violently rotating columns of air extending from thunderstorms to the ground, with wind speeds between 65 and 235 mph. They have been observed in a wide variety of meteorological conditions but tend to develop under three main scenarios: (1) within supercells, which are large, often isolated, rotating thunderstorms that form near boundaries separating warm and humid air from cooler and/or drier air and when winds aloft are strong—these are the largest, most visible, and most damaging types of tornadoes, (2) in connection with thunderstorm squall lines—these tornadoes can be difficult to detect and observe, 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. Only the first two types of tornadoes have been observed in Minnesota, although tornadoes associated with the remnant circulations of decaying tropical weather systems have been observed in other Midwestern states.

Since 2007, tornado strength in the United States has been ranked on the Enhanced Fujita Scale (EF scale), replacing the Fujita Scale introduced in 1971. The EF Scale uses principles similar to the Fujita Scale, with six categories from 0–5, based on wind estimates and damage caused by the tornado. The EF Scale is used extensively by the National Weather Service in investigating tornadoes (all tornadoes are now assigned an EF Scale number) and by engineers to correlate building damage with approximate wind speeds. Table 37 below outlines the Fujita Scale, the Derived EF Scale, and the Operational EF Scale. Though the Enhanced Fujita Scale itself ranges up to EF28 for the damage indicators, the strongest tornadoes attain the EF5 range (262–317 mph).

Table 37. Fujita Scale, Derived EF Scale, and Operational EF Scale

Fujita Scale			Derived EF Scale		Operational EF Scale	
F Scale	Fastest ¼-mile (mph)	3-second Gust (mph)	EF Scale	3-second Gust (mph)	EF Scale	3-second Gust (mph)
0	40–72	45–78	0	65–85	0	65–85
1	73–112	79–117	1	86–109	1	86–110
2	113–157	118–161	2	110–137	2	111–135
3	158–207	162–209	3	138–167	3	136–165
4	208–260	210–261	4	168–199	4	166–200
5	261–318	262–317	5	200–234	5	>200

Source: (NCEI, 2023)

5.4.1 Tornado History

Minnesota lies along the northern edge of the region of maximum tornado occurrence in the United States. Tornado Alley, as this part of the central United States has come to be known, reaches across parts of Texas, Oklahoma, Kansas, Missouri, eastern Nebraska, and western Iowa. In Minnesota, tornadoes occur every month from March through November. The earliest tornado occurrence, within a calendar year, happened on March 6, 2017, when four tornadoes were recorded near the towns of Bricelyn, Bancroft, Orrock, and Ellendale (NCEI, 2023). The latest tornado occurrence took place on November 16, 1931, east of Maple Plain (MN DNR, 2016).

In 2010, a historic year for tornadoes in Minnesota, 126 tornados were recorded (60 of those occurring on June 17, 2010). This year of devastation resulted in three deaths and 46 injuries (all occurring on June 17 and one injury on August 13). The year 2010 beat both previous state records of the most tornadoes in a year (79 tornadoes in 2001) and the most tornadoes in a day (27 tornadoes on June 16, 1992). In 2017, 70 tornadoes occurred in Minnesota (NCEI, 2023). Tornadoes of magnitude EF2 or greater since January 2013 are listed in Table 38.

Despite a higher number of tornadoes reported in recent years, the number of fatalities and injuries due to tornadoes has been decreasing. This is in part due to better National Weather Service tornado detection tools, namely the NEXRAD Doppler radar network installed in the mid-1990s. Also, the ability to alert the public has improved with more National Weather Service radio transmitters and a close relationship with media outlets. An energetic spotter network has also been a key to alerting the public in Minnesota. The increasing number of tornadoes reported may be a direct result of improved communication networks, public awareness, warning systems, and training.

The Tornado History Dashboard on the Plan website details the history of tornadic events by county, year, and month.

Table 38. Tornadoes in Minnesota, ≥ EF2, January 2019–December 2023

Location/Date	EF Rating Injuries Length/Width	Event Description
Polk County, Rindal 6/8/2019	EF2 0 deaths/0 injuries 3.6mi/400ft	This tornado was first reported as a funnel cloud by spotters near the Sand Hills Golf Course. Numerous large trees were snapped or uprooted along its path with machinery tossed, a roof torn off a pole barn, several steel grain bins tossed and crumpled, and a barn completely collapsed at one farmstead. Peak winds were estimated at 115 mph.
Otter Tail County, Vining 7/8/2020	EF2 0 deaths/0 injuries 2mi/300ft	The tornado, wrapped in heavy rain and downburst winds, snapped multiple power poles at three points along its path. It also tossed calving sheds and flipped an irrigation system, while surrounding winds blew down trees in and around its path. Peak winds were estimated at 115 mph.

Location/Date	EF Rating Injuries Length/Width	Event Description
Grant County, Ashby 7/8/2020	EF4 0 deaths/0 injuries 2.36mi/650ft	This tornado began in Grant County, but after about two miles, it crossed into Otter Tail County, where it ended about 5 miles east of Dalton. The total track through both counties was about 9 miles. Peak winds were estimated at 170 mph, based on available damage indicators. At least 10 farmsteads were impacted, with three homes, one pole shed, and one machine shed destroyed.
Otter Tail County, Dalton 7/8/2020	EF4 1 death/2 injuries 6.5mi/650ft	This tornado began in Grant County, but after about two miles, it crossed into Otter Tail County, where it ended about 5 miles east of Dalton. The total track through both counties was about 9 miles. Peak winds were estimated at 170 mph, based on available damage indicators. At least 10 farmsteads were impacted, with three homes, one pole shed, and one machine shed destroyed.
Grant County, Herman Muni Arpt 8/14/2020	EF2 0 deaths/0 injuries 13.4mi/150ft	This tornado was the fourth of five tornadoes in Grant County. The tornado crossed U. S. Highway 59 about two miles south of Elbow Lake, the south end of Pomme de Terre Lake, and the Tipsinah Mounds Golf Course. It snapped and uprooted numerous trees, several power poles, and ravaged corn fields. It tore down a small tower, roofing, and roof sections from homes and a golf course clubhouse. Peak winds were estimated at 115 mph.
Cook County, Hovland 10/10/2021	EF2 0 deaths/0 injuries 4mi/500ft	A rare late-season strong tornado caused tree damage across parts of the Boundary Waters Canoe Area Wilderness in northern Cook County. Significant tree damage was observed along the Border Route Trail, of which passage was made impossible as the tornado reached its maximum width of around 500 yards as it moved across the trail. The tornado then crossed the International Border and continued into Northwestern Ontario, Canada. No private property was damaged along the course of the tornado.
Freeborn County, Hartland 12/15/2021	EF2 0 deaths/0 injuries 2.17mi/55ft	A fast-moving tornado touched down to the southwest of Hartland and moved into town, damaging numerous buildings, trees, and utility poles. The most significant damage was to two buildings along Broadway and Johnson in the center of town with significant damage to the walls of low-rise commercial buildings. More tree and roof damage was observed to the northeast with some branches observed along State Highway 13. The tornado dissipated to the northeast in a field with no further damage observed.
Mower County, Taopi 4/12/2022	EF2 0 deaths/2 injuries 3.93mi/475ft	This EF2 tornado formed southwest of Taopi and quickly intensified and caused significant damage in Taopi. Most buildings were damaged and 10 were destroyed. Cars were tossed, grain bins destroyed, and numerous trees and power lines downed. Two people were injured seeking shelter from the storm when they became trapped under debris. Just outside of Taopi, part of the roof was removed from a farmhouse, several outbuildings were damaged, and several head of cattle were missing.
Wilkin County, Tenney 5/12/2022	EF2 0 deaths/0 injuries 9.77mi/100ft	This tornado was best marked by the trail of at least 23 power poles which were cracked or completely snapped along it's, route. Widespread tree damage and large steel grain bins at the Campbell elevator complex were partially caved in. Peak winds were estimated at 115 mph, equating to an EF2 rating. The path length was 9 miles.

Location/Date	EF Rating Injuries Length/Width	Event Description
Wadena County, Verndale 5/12/2022	EF2 0 deaths/0 injuries 17.45mi/500ft	This tornado crossed from far northwest Todd County. It caused extreme damage which included numerous snapped power poles and numerous trees which were snapped or uprooted. Extensive damage was noted to farm buildings which had steel roofing and sidewall panels torn off, and turnkey barns and other industrial buildings lost roofing material. Peak winds estimated to 115 mph, with a maximum width of 500 yards.
Grant County, Barrett 5/30/2022	EF2 0 deaths/0 injuries 6.84mi/350ft	This tornado was wrapped in damaging downburst winds and rain as it rapidly tracked northeast for roughly 6 miles to around 3 SE of Elbow Lake by 419 pm CDT. Numerous wooden single and double X-Braced power poles were snapped. Numerous trees of all kinds were snapped or uprooted. Several farm buildings and grain bins were destroyed. Max winds to 120 mph, Max width to 350 yards.
Grant County, Wendell 5/30/2022	EF2 0 deaths/0 injuries 11.01mi/400ft	This tornado was wrapped in damaging downburst winds and rain as it rapidly tracked to the northeast for about 11 miles. Numerous ash, spruce, cottonwood, and willow trees were snapped or uprooted. Numerous wooden power poles were snapped Numerous farm outbuilding and steel grain bins were destroyed, with roofing and wall panels carried downwind for a mile or more. Max winds were 115 mph, with a max width to 400 yards.
Douglas County, Forada 5/30/2022	EF2 0 deaths/0 injuries 17.16mi/800ft	This tornado immediately demolished a garage and broke many hundreds of trees before hitting an area of homes along the east side of Maple Lake in the city of Forada. Dozens of homes had roofs torn off, garages and sheds destroyed. It threw a car several hundred feet. The tornado tore part of the roof off from the fire station. It continued beyond Forada and hit numerous farmsteads before hitting the west side of the city of Nelson, where a farm lost most outbuildings and a home lost its roof. Maximum winds were estimated to be 120 mph.
Wadena County, Aldrich 5/30/2022	EF2 0 deaths/0 injuries 9.45mi/450ft	This tornado was wrapped in damaging downburst winds and rain as it rapidly tracked to the north northeast from the Todd County line, across far southeast Wadena County for about 9.5 miles, to the Cass County line. It snapped numerous single pole and double X-braced power poles. it tumbled at least three center pivot irrigation systems. Numerous oak, ash, and pine trees were snapped. The Old Wadena and Bullard Campgrounds had swaths of pine trees laid down. One cabin had the roof and sidewalls torn out. Peak winds to 130 mph. Time estimated based on radar.
Becker County, Rochert 6/24/2022	EF2 0 deaths/0 injuries 30.9mi/600ft	This tornado was likely wrapped in downburst winds for portions of its nearly 31 mile path through Little Toad Lake, Toad Lake, and Wolf Lake, ending around 2 se of Menagha by 1035 pm cdt. Numerous pine, oak, and poplar trees were violently snapped or uprooted along with several wooden power poles. Farm outbuilding roofs were ripped off. A modern hog barn, an older style barn, and several smaller outbuildings were blown down at various farmsteads. Max winds to 115 mph, with a max width of 600 yards.
Mahnomen County,	EF2 0 deaths/0	This tornado touched down south of Mahnomen at 4:15 PM. The highest damage it caused was rated as an EF-2. Among the damage it caused as it continued across its 6 mile path was trees

Location/Date	EF Rating Injuries Length/Width	Event Description
Waubun 6/24/2023	injuries 6.22mi/250ft	snapped and uprooted (both hard and soft wood), metal garage slid off its foundation and collapsed, crop damage, Quonset caved in on one side, roofing blown off homes, broken power line poles, and lifting fuel tankers full of 250 gallons of fuel and throwing them at a barn. Damage dollar amounts are estimated.

SOURCE: (NCEI, 2023)

5.4.2 Probability of Occurrence

The NOAA Storm Prediction Center indicates Minnesota averaged 33 tornadoes per year from 1950 to 2023. According to the National Centers for Environmental Information's (NCEI) Storm Event Database, in Minnesota, tornadoes are most prevalent in the months of May, June, and July; more than half of tornadoes occur in late afternoon. The majority of tornadoes are ≤ F1, have an average tornado path of three miles long, and a width slightly wider than 100 yards. About 2% of tornadoes were ranked at EF4, F4, or F5 (NCEI, 2023).

There are multiple ways to calculate the probability of tornadoes in a county. While tornado paths are recorded as distinct events with specific start and end points, the destruction from a tornado is often greater than the tornado's path and not confined to county boundaries. Therefore, when determining an area's risk, a fixed distance around tornado paths should be factored in.

The average tornado count by county is shown in the Tornado History Dashboard and the tornado frequency within 50 miles layer is shown in the Tornado Risk and Vulnerability Dashboard on the Tornado Page of the Plan website.

One method of examining tornado frequency is counting the number of tornadoes that intersect (either touch down or travel through) each county and dividing by the period of record. A second method calculates all ≥ F1 tornadoes' paths occurring within 50 miles (approximately an hour) of any location within Minnesota. To create the latter, a raster consisting of 900-square-meter cells was created over the entire state, and from each cell, a 50-mile search radius was performed counting the number of tornado lines that intersected the search radius. A value representing the expected number of tornadoes was then developed for each county using the average frequency data in a 50-mile radius, normalized by the county's area. This method adjusts for area and reporting bias in order to compare county to county. This value represents the expected number of tornadoes in the county based on local and regional trends in reported data as opposed to administrative boundaries. Appendix L: Tornado Vulnerability Ranking shows the expected number of tornadoes by county.

5.4.3 Vulnerability

Tornadoes cause death, injury, destruction of property, damage to public spaces and infrastructure, and significant disruption to commerce and day-to-day activities in their aftermath. Injured victims of tornadoes may be unable to work for days or weeks, while other victims who do not suffer directly nevertheless cannot work because of damage to their business or place of employment. Others may suffer from a loss of goods and services in the tornado-affected area. Vulnerability to tornadoes is quite complex and is governed by a host of socioeconomic, cultural, and physical factors. In general, tornado casualties decrease when people receive adequate warnings with sufficient time to seek shelter in a reinforced structure.

Minnesota is facing a serious public safety threat due to weather radar gaps in the state. These gaps are areas on the map where radar signal is limited or nonexistent, which can make it difficult to detect severe weather and tornadoes, leaving Minnesotans vulnerable to storms with little or no warning. Critical features of both summer and winter storms are best tracked near the base of the storm, typically at or below 6,000 feet above ground level.

In recent years, there have been instances where people have been injured or killed by tornadoes that occurred in the radar gap. In one case, a first responder was killed while storm spotting in Kandiyohi County in 2022. Residents expect that their weather apps are accurate, but this tornado went largely undetected by the NWS radar network (Tri-County News, 2023).

Coleman et al. examined NCEI tornado data to see if there is a correlation between the use of tornado warning sirens in Minnesota and the number of tornado-related deaths and injuries (2011). From 1950 to 1970, there were 332 tornado events resulting in 71 deaths and 1,292 injuries. There were 1,650 tornado events reported from 1970 to 2018 with 28 deaths and 685 injuries (NCEI, 2023). In the period of 2019 to 2023 there were 500 tornado events (53 episodes) reported with 2 deaths, and unknown injuries (zero reported). Assuming that event reporting is more frequent, and injuries are under-reported in recent years, there still seems to be evidence that warning sirens save lives and reduce injuries. However, there are likely other influencing factors such as warnings via mass-media, expansion of the NOAA weather radio's broadcast and tone alerts, and more efficient dissemination of warnings, including the use of storm-based warnings and the Common Alerting Protocol (Coleman et al., 2011).

The vulnerability to structures depends upon the strength and path of the tornado. Densely developed jurisdictions will experience higher levels of damage than rural communities.

In the article "The Frequency of High-Impact Convective Weather Events in the Twin Cities Metropolitan Area, Minnesota," Kenneth Blumenfeld examines the frequencies and recurrence intervals of high-end convective weather events in the Twin Cities Metropolitan Area (TCMA). According to Blumenfeld (Blumenfeld, 2010),

> …thunderstorms capable of serious damage and disruption strike the TCMA *regularly*. Major damage from a convective weather episode is 'normal,' and tornadoes--including long-lasting and violent ones--are part of the area's history, and should be expected to be part of its future. (p. 630)

Blumenfeld (2010) states communicating to the public the risk of a serious tornado outbreak in the future is challenging because it has been decades since the last violent single or multiple-tornado event in the TCMA. Also, the significant population growth of the area since the 1965 tornado outbreak means many of the residents may not be aware of what to do during the next major tornado outbreak. It is important for emergency preparedness officials, especially in urban areas facing similar challenges, to ask themselves, "Do all groups have equal access to warning information? Can the disabled and elderly be notified and moved to safety quickly? Are people responding to warnings based on their beliefs about the unlikelihood of tornadoes hitting urban areas?" (Blumenfeld, 2010).

Death, injury, crop, and property damage data from the Spatial Hazard Events and Losses Database for the United States (SHELDUS) was used to identify the ten Minnesota counties that have suffered the greatest monetary loss due to tornadoes from 1960 to 2022 (CEMHS, 2023). Table 39 shows the results.

Table 39. Property damages from tornadoes ≥ F1, by county, 1960–2022.

County	Property Damage (ADJ)
Hennepin	$266,011,696
Nicollet	$198,948,293
Murray	$52,107,577
Brown	$73,779,916
Le Sueur	$61,308,264
Yellow Medicine	$65,859,903
Freeborn	$55,151,725
Cottonwood	$49,646,811
Rice	$46,605,820
Washington	$40,521,447

Source: (CEMHS, 2023)

A vulnerability score was constructed to assess county vulnerability to tornadoes in a second way. The vulnerability score uses the total replacement value of all the buildings in a county (also known as the building exposure) and the expected number of tornadoes together for this score. The expected tornado values were scored as a percentage of the highest number of events in a county, and the building exposure values were scored as a percentage of the highest building exposure value. The log of the building exposure values was used to moderate the extremely high value of Hennepin and other metro counties. Finally, the two scaled scores were added to produce a vulnerability index.

Table 40 displays the ten counties in Minnesota with the highest vulnerability ranks. Appendix L: Tornado Vulnerability Ranking provides the vulnerability ranking using this index for all counties.

Table 40. Ten counties with highest tornado vulnerability rank

County	Vulnerability Rank	Building Exposure in Millions	Avg Annual Count*	Expected Annual Count
Hennepin	1	$226,787	0.46	0.36
Otter Tail	2	$9,148	1.25	1.01
Stearns	3	$20,670	0.81	0.69
Dakota	4	$79,526	0.59	0.34
Becker	5	$10,075	0.47	0.59
Saint Louis	6	$27,025	0.59	0.39
Anoka	7	$64,821	0.41	0.21
Wright	8	$23,009	0.38	0.39
Ramsey	9	$88,890	0.12	0.09
Olmsted	10	$36,252	0.53	0.26

*The historical average annual tornado count is included for reference, but only the expected annual tornado count is used in the index.

Source:(FEMA, 2023d; NCEI, 2023)

5.4.4 Tornadoes and Climate Change

Minnesota's climate is undergoing distinct changes, but as reported by the MN DNR State Climatology Office, these changes are only weakly connected to increases in tornadoes or severe convective storms. Minnesota, like all parts of the U.S., has seen increases in the weakest class of tornadoes (rated F-0 or EF-0), but these increases are known to be linked to improved spotting, detection, and verification procedures within the National Weather Service.

When examining tornadoes that cause significant structural damage and are rated EF-2 or above, Minnesota has seen no recent trends towards increasing frequencies—whether measured as raw counts, or as days with one or more of these tornadoes (MN DNR, 2019).

The tornado trends in Minnesota match those found nationally. The 5th NCA states that while the average annual number of tornadoes appears to have remained relatively constant, there is evidence that tornado outbreaks have become more frequent, tornado seasons are extending into later in the fall, and that tornado strength has increased (Marvel et al., 2023). An October 10, 2021 tornado in the Boundary Waters Canoe Area Wilderness became the latest on record so far north in the state. Then, on December 15, 2021, an outbreak of destructive thunderstorm winds and over 20 tornadoes struck the southeastern parts of the state, producing the latest tornadoes on record by 29 days (Blumenfeld, K. Minnesota State Climatology Office, personal communication, December 21, 2023).

However, climate scientists are unclear about whether the recent statistical behavior of these severe convective storm events has any relationship with the changing climate. This uncertainty results from the fact that tornadoes and their parent thunderstorms operate on smaller scales and more localized processes than the global climate. There has been some indication that, on a national basis, tornadoes are being clustered into fewer days, suggesting a greater tendency towards outbreaks. Scientific modelling studies indicate that the meteorological conditions supportive of severe thunderstorms should increase in the future, but it is unclear whether the specific conditions required for the formation of tornadoes, and particularly significant tornadoes, will increase (Kossin, 2017). Until more studies are completed, the Minnesota State Climatology Office recommends assuming that tornadoes will remain an important and dangerous part of Minnesota's climate, even if they do not increase in frequency or severity in response to changing climatic conditions.

5.5 Hail

A hailstorm forms in severe thunderstorms and develops within an unstable air mass. Warm moist air rises rapidly into the upper atmosphere and subsequently cools, leading to the formation of ice crystals. These are bounced about by high velocity updraft (or strong) winds and accumulate into frozen droplets, falling as precipitation after developing enough weight (NOAA, 2021).

A number of factors determine the damage potential from hail including hailstone size, texture, numbers, fall speed, speed of storm translation, and strength of the accompanying wind (TORRO, 2021). The maximum hailstone size is the most important parameter relating to structural damage. Studies have determined that most property damage begins when hailstone diameters are ≥ .75 in., while crop damage can occur from hailstones as small as .25 depending on the crop and growth stage (Changnon et al., 2009). Table 41 shows the TORnado and storm Research Organization's (TORRO) Hailstorm Intensity Scale, which describes the typical damage from different sized hailstones.

Table 41. TORRO Hailstorm Intensity Scale

	Intensity Category	Typical Hail Diameter (in.)	Typical Damage Impacts
H0	Hard Hail	.2	No damage
H1	Potentially Damaging	.2–.6	Slight general damage to plants, crops
H2	Significant	.4–.8	Significant damage to fruit, crops, vegetation
H3	Severe	.8–1.2	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	1–1.6	Widespread glass damage, vehicle bodywork damage
H5	Destructive	1.2–2	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Destructive	1.6–2.4	Bodywork of grounded aircraft dented; brick walls pitted.
H7	Destructive	2–3	Severe roof damage, risk of serious injuries
H8	Destructive	2.4–3.5	Severe damage to aircraft bodywork
H9	Super Hailstorms	3–4	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
H10	Super Hailstorms	> 4	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

Source: (TORRO, 2021)

5.5.1 Hail History

Hailstorms occur throughout the year, though they are most frequent between May and August. 27% of hailstorms in Minnesota occurred in July. The average size hailstone in Minnesota measures around 1.2 inches in diameter (H5 category). Less than 1% of hail events had hailstones greater than 2 inches in diameter. Two hail events, one occurring in 1968 and the other in 1986, produced hailstones measuring six inches in diameter and currently hold the record for the largest measured hailstones in the state (NCEI, 2023).

Since 1980, Minnesota has experienced six hailstorm events that resulted in damages exceeding $1 billion and four of these events occurred since the 2019 Hazard Mitigation Plan Table 42 (Smith, 2024). Total property and crop damage due to hail from 2019 through 2021 was nearly $20 million; an annual average of $6.6 million (CEMHS, 2023).

The Hail History Dashboard on the Plan website details the history of wind-related events by county, year, and month.

Table 42. Notable hail events in Minnesota, January 2019–October 2023

Date	Location	Remarks
8/11/2023	Central & Southern MN	Numerous supercell thunderstorms developed across much of the southern half of MN during the afternoon and evening producing widespread hailstones measuring .7–3.75” in diameter. The event was categorized as a billion-dollar disaster in Minnesota by the National Centers for Environmental Information (NCEI).

Date	Location	Remarks
7/13/2023	Southwest MN	Storms produced up to baseball size hail causing an estimated $700,000 in damages across southwest Minnesota (Lincoln, Pipestone, Nobles, and Rock counties). Later in the evening the storms moved to the southeast portion of the state and dropped hail the size of ping pong balls near Plainview, MN, and teacup size hail near Altura, MN. An estimated $1 million in damages was reported to crops, cars, and housing structures.
6/17/2021	Southeast MN	Multiple thunderstorms developed across southern Minnesota producing 1.5–3” diameter hailstones. Lonsdale and Conception, MN reported hailstones measuring 2.5” and Cannon Falls measured 3” hailstones. Reports of baseball size hail were reported near the cities of Northfield, Stanton, and Goodview. An estimated 150 houses were exposed to 2” or greater hail and another 1,000 houses to 1.5” or greater hail. The total damages were estimated at $5.5 million.
8/9/2020	Carver & Hennepin Counties	Storms produced up to baseball size hail. Hail was measured at 1.25” in diameter near West Bloomington, 2.5” in Loretto, and 2.75” near Victoria. The baseball size hail was reported in Loretto, Victoria, southern Kanabec County, southeast Wright County, Jordan, and near Northfield. Hail fell for long periods of time (5-15 minutes) and damaged many roofs and cars.
7/11/2020	South-Central MN	Thunderstorms produced hailstones measuring up to 2.5” in diameter in parts of Kandiyohi, Renville, McLeod, and Sibley counites. The large swaths of hail destroyed thousands of acres of corn, soybeans, kidney beans, sugar beets, peas, sweet corn, and alfalfa. An estimated $3.2 million in damages was reported.
6/2/2020	Southeast MN	Two rounds of severe storms ripped through southeastern Minnesota. The first round produced hailstones measuring 1.25–2” in diameter, causing extensive roof damage in the City of Winona with damages totaling $1.8 million.

Source: (NCEI, 2023)

5.5.2 Probability of Occurrence

From 1955 through April 2023, an annual average of 121 hailstorms, producing hailstones at least one-inch in diameter, impacted Minnesota (NCEI, 2023). While all counties in Minnesota are affected each year by hail, the frequency counties experience hailstorms are not the same. Two methods were used to calculate the probability of hailstorm occurrences for each county.

The first method divides the total hail events that occurred in each county by the years (68.3) of record. Using this method, Hennepin County has the highest average annual hailstorm count (7.71) and Cook County the lowest (.35). More hail events reported in the Twin Cities Metro region are somewhat due to the density in reporting of storms and damage. A limitation with this method is it relies on county boundaries and does not account for differences between county areas.

All other factors being equal, the larger counties will have more storms, so a second method adjusts for area to compare counties. First, the start and end point of each hailstorm was identified. Next, a raster layer made up of 900-square-meter cells was generated over Minnesota, and for each cell, a 50-mile search radius was performed counting the number of unique hail lines that intersected the search radius. Annual frequency counts were then calculated for each raster cell, and then a mean annual frequency was calculated for each county. Finally, each county's mean annual frequency was normalized by the county's area to produce the expected annual frequency of hailstorms for each county. Using this method, Otter Tail County has the highest average annual hailstorm count (3.82) and Cook County the lowest (.08). Appendix M: Hail Vulnerability Ranking shows the average and expected annual number of hailstorms data by county. The county expected number of hailstorms is also used in a vulnerability index described below.

5.5.3 Vulnerability

The FEMA National Risk Index was used to demonstrate windstorm vulnerability in the Hail Risk & Vulnerability Dashboard.

Hailstorms cause millions of dollars in property, livestock, and crop damage each year. According to the Spatial Hazard Events and Losses Database for the United States (SHELDUS), combined property and crop damage totals for recent years in Minnesota were $10,102,000 (2021), $8,883,629 (2020), and $995,429 (2019). The ten counties in Minnesota that have suffered the greatest monetary loss due to hailstorms from 1960 through 2021 are shown in Table 43 (CEMHS, 2023).

Table 43. Counties with the greatest monetary damages from hailstorms, 1960 through 2021

County	Damaging Hailstorms	Crop Damage (ADJ 2022)	Property Damage (ADJ 2022)	Total Damages
Hennepin	73	$1,484,387	$94,576,258	$96,060,646
Blue Earth	72	$86,669,544	$8,398,847	$95,068,392
St. Louis	27	$54,693	$81,583,578	$81,638,271
Rice	69	$4,075,073	$68,669,936	$72,745,009
Wright	76	$2,270,639	$43,626,949	$45,897,588
Lincoln	70	$39,803,564	$1,063,554	$40,867,117
Traverse	44	$36,714,707	$1,560,985	$38,275,692
Sherburne	51	$529,446	$35,067,172	$35,596,619
Renville	77	$34,593,811	$927,201	$35,521,012
Anoka	44	$385,413	$33,399,004	$33,784,417

Source: (CEMHS, 2023)

In another attempt to assess how vulnerable a county is to hailstorms, a vulnerability score was constructed. The vulnerability score uses the total replacement value of all the buildings in a county (building exposure) and the expected number of hailstorms value together for this score. The expected annual count values were scored as a percentage of the highest number of storms in a county, and the building exposure values were scored as a percentage of the highest building exposure value. This was done to moderate the extremely high value of Hennepin and other metro counties with the rest of the state. Finally, the two scaled scores were added to produce a vulnerability score. Table 44 displays the ten counties with the highest vulnerability ranking.

Table 44. Ten counties with highest vulnerability rank to hailstorms, 1955 through April 2023

County	Vulnerability Rank	Building Exposure in Millions	Avg Annual Count*	Expected Annual Count
Hennepin	1	$226,787	7.71	2.15
Saint Louis	2	$27,025	6.63	3.11
Otter Tail	3	$9,148	6.46	3.82
Dakota	4	$79,526	4.12	1.93
Stearns	5	$20,670	6.00	2.75
Wright	6	$23,009	4.50	2.38
Anoka	7	$64,821	3.51	1.51
Washington	8	$53,817	2.72	1.29
Polk	9	$4,300	6.01	2.98
Cass	10	$6,081	3.37	2.73

*The historical average annual hailstorm count is included for reference, but only the expected annual hailstorm count is used in the index.

SOURCE: (NCEI, 2023)

5.5.4 Hail and Climate Change

According to the NCA5 Key Message #5 in the Climate Trends chapter, extreme events are becoming more frequent.

Trends in severe storms, including the numbers of 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 (Marvel et al., 2023). The NCA reports that in Minnesota's neighboring Great Plains region, hail size, frequency of large hail, and length of hail season are projected to increase through the rest of this century (Knapp et al., 2023). The occurrence of very heavy precipitation has increased in Minnesota in recent decades, and future projections also indicate this will continue (Blumenfeld, K. Minnesota State Climatology Office, personal communication, December 21, 2023).

5.6 Dam and Levee Failure

Dams and levees—artificial barriers that can impound water, wastewater, or any liquid material for the purpose of storage or control—are an important part of Minnesota's infrastructure. Dams maintain lake levels and impound water for flood control, power production, and water supply. Levees are used to increase cultivation in agriculture and to protect population and structures from floods. Severe flood damage may result from a failed structure or its overtopping. Overtopping is when floodwaters simply exceed the design capacity of the structure, thus the water flows over the lowest crest of the system. Such overtopping can lead to erosion on the landward side, which may then lead to failure. Many factors affect the impact of a failure, such as the volume of impounded liquid, location of structures and critical facilities, intended purpose of the dam or levee, and/or its construction type. Failure may occur from one or a combination of the following reasons:

- Prolonged periods of rainfall and flooding.
- Inadequate spillway capacity, resulting in overtopping flows.
- Internal erosion caused by embankment or foundation leakage or piping.

- Improper maintenance, including failure to remove trees, repair internal seepage problems, replace lost material from the cross section of the dam and abutments, or maintain gates, valves, and other operational components.
- Improper design, including the use of improper construction materials and construction practices.
- Improper operation, including the failure to remove or open gates or valves during high flow.
- Upstream dam failure on the same waterway that releases water to a downstream dam.
- Earthquake activity, which typically causes longitudinal cracks at the tops of the embankments resulting in weakened structures.

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

A levee breach can be caused by surface erosion due to water velocities or subsurface actions. Subsurface actions usually involve sand boils whereby the upward pressure of water flowing through porous soil under the levee exceeds the static pressure of the soil weight above it (i.e., under seepage). These boils can indicate instability of the levee foundation given the liquefied substrate below it, leading to breaching. Additionally, as mentioned above, levees can be subjected to overtopping, thereby causing landward erosion. To prevent this type of landward erosion, many levees are reinforced with rocks or concrete. The concern with levees is that they may fail when exposed to floodwaters for an unusually long period. The prolonged hydraulic forces may weaken the structure to the point of failure. Monitoring and reinforcement measures may prevent that from happening.

5.6.1 Dam Failure History

According to the MN DNR there are over 1,150 dams in Minnesota: approximately 650 are public, and of those, over 300 are owned by the state. Most of the public dams are more than 50 years old and require ongoing or emergency repairs and reconstruction to maintain their structural integrity. Through state bonding, the MN DNR spends approximately $2 million annually on repairs and reconstruction. An estimated $103 million is needed over the next 20 years to assure public dams remain in a safe and usable condition (MN DNR, 2020a).

Notable incidents relating to dams since 2019 are listed in Table 45. These events show how important design, operation, maintenance, and nature play a role in potential failures. Economic impacts were not available with the dam incident history provided below.

Table 45. Notable dam incidents in Minnesota, 2019–2023

Date	County	Dam	Status	MN Dam Safety Engineer Remarks
2019	Brown	Lake Hanska MN00070 Low Hazard Potential	Repaired	Overtopping. Exempt dam (less than 6 feet). Spring flood overtopped right embankment.
2019	Sibley	High Island Lake MN01330 Low Hazard Potential	Breached	Piping. Seepage flow under outlet structure. Reverse flow.

Date	County	Dam	Status	MN Dam Safety Engineer Remarks
2019	Olmsted	Lake Zumbro Confined Disposal Facility MN01822 Low Hazard Potential	Breached	Foundation failure. 30-foot wide, vertical wall, 50 feet north of outlet. Failure of rock foundation under core trench.
2020	Freeborn	Fountain Lake Confined Disposal Facility MN01804 Significant Hazard Potential	Repaired	Upstream slide prior to first filling.
2022	Sibley	Sibley 34 MN01847	Breached	Erosion around sheet pile weir.

Source: ((Boyle, Jason (MN Dam Safety Engineer), personal communication, November 3, 2023)

One of the costliest dam failures occurred in 2012 when an earthen dike on Forebay Lake that feeds the Thomson Hydro-Power Dam was saturated with water and gave way and subsequently washed out a 100-foot deep gap in Highway 210 in Jay Cooke State Park (Kraker, D., 2017). Carlton County saw record rainfalls in a 24-hour period and the St. Louis River at Scanlon subsequently rose 11 feet and hit a record crest of 16.62 feet. Some evacuation of homes was necessary. High water at Thomson Dam overtopped the Thomson Reservoir, but the reservoir did not fail. Operators of the dam activated the Emergency Action Plan thereby averting injuries. The alarm was sounded due to the channel collapse as opposed to concerns about catastrophic failure of the dam. Approximately $3 million in damages to public structures were recorded based on FEMA and MnDOT records. The recorded damages were impacted by three different dynamics: extreme rain with previously saturated ground, structural failure, and designed overtopping.

See the Dam and Levee Failure Risk Dashboard for dam and levee locations, hazard ratings, and dam incident history

5.6.2 Dam Regulation

The agencies with regulatory authority of dams in Minnesota are as follows:

- 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.

The authorities vary between agencies, but the overall design, construction, operation, and maintenance of dams come under their authority. They also classify dams for emergency response purposes. This classification system does not imply that the dam is unsafe. Regulatory agencies require Emergency Action Plans (EAP) for all high hazard dams.

5.6.3 Vulnerability

The National Inventory of Dams (NID) reports 1163 dams in the state, 55 of which have a high hazard potential and 131 of which have a significant hazard potential (USACE, 2023) (see Appendix N).

The President signed the Water Infrastructure Improvements for the Nation Act or the "WIIN Act," on December 16, 2016, which adds a new grant program under FEMA's National Dam Safety Program (33 U.S.C. 467f). Section 5006 of the Act, Rehabilitation of High Hazard Potential Dams, provides technical, planning, design, and construction assistance in the form of grants for rehabilitation of eligible high hazard potential dams (HHPDs).

High Hazard Potential is a classification standard for any dam whose failure or mis-operation will cause loss of human life and significant property destruction. Dams are classified according to the Minnesota Rule 6115.0340 based on the consequences of dam failure or mis-operation. The state classification system generally aligns with the classifications in FEMA-333, with the Class I definition in state rules being roughly equivalent with the definition of a high hazard dam in FEMA-333.

Generally, the consequences of a failure of a Class I dam are very serious or major, including the loss of life. Class I dams typically have homes downstream that would subject the occupants to hazardous conditions. Class II dams would have no potential loss of life but would have impacts on infrastructure. Class III dam impacts would be limited to rural or local infrastructure.

The latest dam safety project priority needs list can be found on the Minnesota Legislative Reference Library website. The MN DNR developed a risk priority system for the HHPD grant program in 2019. The risk priority system was based off of the recommendations in the grant application guidelines and included assessment of consequences of failure [Population At Risk (PAR), warning time, economic losses, and environmental losses] and the likelihood of failure (hydraulic capacity and structural stability). Both the hydraulic and structural capacity take into account subjective aspects. The MN DNR prioritization system is summarized in Table 46 and the application is available in Appendix N.

Table 46. MN DNR dam prioritization system

Consequences	PAR	Warning Time	Economic Losses	Environmental Losses
Very High	>100	Not sufficient	>$1B	Severe, permanent
High	>100	Some evacuation	$100M–$1B	Significant, long term
Moderate	10–100	Majority evacuated	$10M–$100M	Remediated, several years
Low	10–1	Most evacuated	<$10M	Some, remediated

Emergency Action Plans

Class I (high hazard) dams are required to have a contingency plan (emergency action plan) according to Minnesota Rule 6115.0490. Fifty-three of the 55 High Hazard dams in the NID for Minnesota have

EAPs. The two dams that do not have EAPs are not yet constructed. The MN DNR has a list of all non-federal dams with EAPs, which includes several Class II (significant hazard) dams. The NID lists 29 Class II dams with EAPs of the 131 significant hazard dams in the NID. Dam owners will have their EAP on file. The MN DNR also has the non-federal EAPs on file.

Local emergency managers should also have a copy of the EAPs for their area. The EAPs include a dam breach inundation zone that can be used for local planning purposes, though the EAP may contain security information that cannot be published.

Challenges

Dams are owned by various entities, including federal, state, local, private, and utilities. It is a significant challenge if the dam owner is not the same entity as the one implementing the local mitigation policy or program. A state high hazard dam owner cannot implement downstream land use controls or make changes to local mitigation policies or programs, nor can a county emergency manager implement physical changes to a state-owned high hazard dam. Communication between the high hazard dam owner and the local government entities who can implement policies regarding land use controls or development in the breach shadow is important. Another challenge is the availability of resources to implement local mitigation actions. Plan updates and policy development need to be funded, and staffing may also be limited. The state dam safety office reaches out to local emergency managers on an annual basis to ensure that local emergency managers are aware of the presence of a high hazard dam in their area and are familiar with the emergency action plan for the high hazard dam. Local emergency managers that have a HHPD within their jurisdiction should identify this hazard and provide mitigation ideas within their Local Hazard Mitigation Plan with the coordination of the dam owner.

Opportunities for implementing local mitigation actions could involve grants to local entities to update their floodplain ordinance, their county all hazards plan, zoning requirements, and land use controls related to potential breach inundation areas downstream of a high hazard dam. Evacuation routes could be developed and updated locally. High hazard dams are required to have an Emergency Action Plan (EAP), and part of the EAP must include the potential breach inundation area.

Funding

High hazard potential dam owners could receive funding assistance from several federal and state programs depending on the owner type and the type of work (removal/rehabilitation). Funding for addressing deficiencies in government owned high hazard dams is typically provided, at least in part, by the State through general obligation bonding funds. Dam Safety priorities must follow MN Statutes Chapter 103G.511 subd. 6 and subd. 12, which includes potential danger to life and potential damage to property. High hazard dams are prioritized over lesser hazard dams. The HHPD federal grant program requires screening and priority tools as defined in the program.

In 2014, there were five high hazard dams in poor condition in Minnesota. Currently, there is only one high hazard dam in poor condition. State appropriations have and will continue to provide risk reduction benefits related to dams. A significant challenge has been finding enough funding to complete construction for larger dams, particularly for the one remaining high hazard dam in poor condition. That project is currently estimated to cost in excess of $20,000,000.

5.6.4 Levee Failure History

According to the National Levee Database, Minnesota has 134 levee systems and 220 miles of levees. The U.S. Army Corp of Engineers has management responsibility for 42 (31%) of the levees.

Levees garnered attention after the 2005 Hurricane Katrina devastation in New Orleans. There is no official historical source for failed levees in Minnesota. Failed levees for the protection of life and property have been reported as part of Presidential Disaster Declarations in Minnesota. The most notable event due to floodwaters overtopping a levee was the 1997 flood in East Grand Forks (DR-1175). Extensive damages were due to water cresting over earthen levees. The Red River crested at 54.32 feet. The earthen levees in place were designed to protect to level of a 100-year flood plus three feet of freeboard, or 52 feet. During the flood fight, there were 3.5 million sandbags used plus many cubic yards of clay and gravel. The one inch per hour (two feet per day) rise of the river overcame the reinforcement efforts (FEMA, 2019).

Significant resources go into providing flood forecasts so that the appropriate flood fighting measures may be taken. NOAA provides flood forecasts based on extensive surveys of snow cover. Communities use the NOAA forecasts to activate the flood fight plans to ensure all levee components are in place. Engineers determine the height and width of sandbags to be added to a levee. Patrols walk the levees to determine leaks or degradation. All these actions usually prevent losses; however, there are extreme conditions that may not be overcome. The East Grand Forks example shows how a heavy snowpack and a fast, late spring snowmelt overcame that city's defenses. Exposure to high levels of water and hydraulic pressure for an extended period of time is another extreme condition where levees may fail. Even though spring floods are an annual event, the probability of catastrophic failure is low due to the ongoing planning and response efforts by local, state, and federal agencies.

5.6.5 Levee Regulation

Levees for agricultural purposes are permitted by watershed districts or county soil and water conservation districts administered by the Board of Soil and Water Resources (BWSR). The number of levees for agriculture was not known at the time of this Plan update. Agricultural levees funded by the U.S. Natural Resources Conservation Service are not regulated by the state and are handed over to the property owners after construction is complete. The Minnesota Silver Jackets team is taking on a project to identify levees at several communities in Minnesota to assess the location and impact of levees.

Using flood analysis and mapping projects, the National Flood Insurance Program (NFIP) is responsible for identifying flood risks behind levees within the FEMA Special Flood Hazard Area (SFHA). While the SFHA represents flooding that has only a 1% chance of an annual occurrence, FEMA has established criteria for those levees that may be affected should a flood occur. Levees on FEMA maps are shown as accredited levees, provisionally accredited levees, non-accredited, (including emergency levees) and levees under construction or restoration.

An *accredited levee* is certified if evidence has been presented showing the structure meets current design, construction, maintenance, and operation standards to provide protection from floods that fall into the 1% annual chance of inundation zone. Evidence is typically a statement by a licensed professional engineer or federal agency responsible for levee design. The levee owner is responsible for ensuring that the levee is being maintained and operated properly and for providing evidence of certification FEMA will accredit (formally recognize) levees that have evidence that they will provide adequate protection. Therefore, on flood hazard maps, the area behind the accredited levees will be shown as moderate risk zones. FEMA accredits levees that meet the criteria and maps areas behind those levees as having a certain risk level, but it does not perform the actual certifications. There are 53 accredited levees in Minnesota, four more since the 2019 Hazard Mitigation Plan Update Table 47.

Table 47. FEMA-accredited levee systems

Levee System Name	County	Waterway
Austin Flood Control Project 1	Mower	Cedar River
Austin Flood Control Project 2	Mower	Cedar River
Austin Flood Control Project 3	Mower	Cedar River
Bear Creek Levee	Olmsted	Bear Creek
Black Bear–Miller Lake	Crow Wing	Bear Creek
Blue Lake WWTP Levee	Scott	Minnesota River
Brentwood Rolyn Acres Levee	Clay	Oakport Coulee
Brookdale Levee	Clay	Red River of the North
Burnsville Sanitary Levee	Dakota	Minnesota River
City of Ada Judicial Ditch 51 Levee	Norman	Judicial Ditch 51
City of Ada Marsh River Flood Risk Reduction	Norman	Marsh River
City of Crookston Levee 1	Polk	Red Lake River
City of Crookston Levee 2	Polk	Red Lake River
City of Crookston Levee 3	Polk	Red Lake River
City of Crookston Levee 4	Polk	Red Lake River
City of Crookston Levee Ash Street Road Raise	Polk	Red Lake River
City of Crookston Levee Elm Street Levee	Polk	Red Lake River
City of Montevideo Levee	Chippewa	Chippewa River
Dawson	Lac qui Parle	Lac qui Parle River
Gilmore Creek–Winona	Winona	Gilmore Creek
Hendrum Flood Control Levee Project	Norman	Red River
Horn Park Flood Mitigation Project 1	Clay	Red River of the North
Horn Park Flood Mitigation Project 2	Clay	Red River of the North
Metropolitan (Pigs Eye) Wastewater Treatment Plant Levee	Ramsey	Mississippi River
Middle River–Argyle	Marshall	Middle River
Minnesota River–Chaska	Carver	Minnesota River
Minnesota River–Granite Falls, Segment #2	Yellow Medicine	Minnesota River
Minnesota River–Henderson–North Levee	Sibley	Minnesota River
Minnesota River–Henderson–South Levee	Sibley	Minnesota River
Minnesota River–Lehillier	Blue Earth	Minnesota River
Minnesota River–Mankato–River Levee	Blue Earth	Minnesota River
Mississippi River–South St. Paul	Dakota	Mississippi River
Mississippi River–Winona City & Prairie Island	Winona	Mississippi River
Moorhead Country Club Mitigation Project 3	Clay	Red River of the North
Pig's Eye Wastewater Treatment Facility Levee	Ramsey	Mississippi River
Red River of the North–East Grand Forks	Polk	Red River of the North

Levee System Name	County	Waterway
Red River of the North–East Grand Forks Point	Polk	Red River of the North
Red River of the North–Fargo–Ridgewood Addition	Cass, Wright	Red River of the North
Red River of the North–Halstad	Norman	Red River of the North
Red River of the North–Oslo	Marshall	Red River of the North
Redwood River–Marshall–Left Bank Downstream	Lyon	Redwood River
Redwood River–Marshall–Right Bank Downstream	Lyon	Redwood River
Redwood River–Marshall–Right Bank Upstream	Lyon	Redwood River
Rochester Levee & Channel	Olmsted	Bear Creek
Root River–Houston	Houston	Root River
Root River-Houston	Houston	Root River
Root River/ Rush Creek–Rushford–East Levee–Levees D, E, and F	Fillmore	Root River/Rush Creek
Root River/ Rush Creek–Rushford–North Levee–Levee C	Fillmore	Root River/Rush Creek
Root River/ Rush Creek–Rushford–West Levee–Levees A and B	Fillmore	Root River/Rush Creek
South Branch Yellow Medicine–Minneota	Lyon	South Branch Yellow Medicine River
Snake River–Alvarado	Marshall	Snake River
Valleyfair Amusement Park Levee	Scott	Minnesota River
Vermillion River–Hastings	Dakota	Vermillion River

SOURCE: (GARRY BENNETT, FLOODPLAIN & DAM SAFETY HYDROLOGIST MN DNR, PERSONAL COMMUNICATION, FEBRUARY 12, 2024)

The inability to provide full and prompt documentation of a levee's status does not necessarily mean that the levee no longer provides the level of protection for which it was designed. It also does not mean that the flood hazard map should show the levee as providing protection against the flood that may occur in the 1% annual chance. FEMA has created the Provisionally Accredited Levee (PAL) designation to facilitate the certification process for communities whose levees are reasonable expected to continue to provide protection from those 1% floods. FEMA Provisionally Accredited Levees are listed in *Table 48*.

Table 48. FEMA provisionally accredited levees

Levee System Name	Counties	Waterway
Mississippi River–St. Paul	Ramsey	Most of levee is accredited, but a small portion is not
Redwood River–Marshall–Left Bank Upstream 1963 level	Lyon	Surrounding land are not shown as protected by levee, but are mapped as 500-year
South St. Paul–Segment #2	Dakota	A portion of this levee near the border with Inver Grove Heights is not accredited.

SOURCE: SOURCE: (GARRY BENNETT, FLOODPLAIN & DAM SAFETY HYDROLOGIST MN DNR, PERSONAL COMMUNICATION, FEBRUARY 12, 2024)

Non-Certified and Emergency Levees

Non-accredited levees are not shown on the FEMA FIRM map as reducing the flood hazard during the 1% annual chance flood (Table 49). Emergency levees are a subset of non-accredited levees. They are built when floods are predicted without minimal engineering design. Usually, emergency levees are removed after the flood event to receive Public Assistance funding under Category B. Some communities may have earthen works in place that were constructed before the flood event.

Table 49. Communities that have used non-accredited emergency levees

Name	County
Aitkin	Aitkin
Fridley	Anoka
New Ulm	Brown
Springfield	Brown
Carver	Carver
Watertown	Carver
Windom	Cottonwood
Inver Grove Heights	Dakota
Blue Earth	Faribault
Peterson	Fillmore
Preston	Fillmore
Cannon Falls	Goodhue
Bradford Twp	Isanti
Jackson	Jackson
Hallock	Kittson
St Vincent	Kittson
Kasota	LeSueur
Hutchinson	McLeod
St Peter	Nicollet
Norman County	Norman
Perley	Norman
Fisher	Polk
Duxby	Roseau
Elk River	Sherburne
Lake City	Wabasha
Wabasha	Wabasha
Wabasha county	Wabasha
Afton	Washington
Lake St Croix Beach	Washington
Newport	Washington
St Mary's Point	Washington
Stillwater	Washington
Elba	Winona
Delano	Wright
Otsego	Wright

Source: (Jiwani, Suzanne Jiwani (Floodplain Mapping Engineer, MN DNR), personal communication, January 2, 2019)

5.6.6 Probability of Occurrence

A general probability for dam or levee failure cannot be determined since each structure is unique in its engineering, construction, maintenance, and the intensity of the flooding that may cause damage.

5.6.6 Vulnerability

Communities downstream of high-risk dams and those which have needed protection by emergency levees are vulnerable to flooding due to dam or levee failure. An emergency levee is not maintained by the community and is not provisionally accredited. Therefore, communities with emergency levees are likely more vulnerable to flooding than provisionally accredited or accredited levees. High-risk dams are required to have Emergency Action Plans so this regulatory component can indicate a higher vulnerability to flooding.

5.6.7 Dam/Levee 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 hydrograph or expected flow pattern. Spillways are put in place on dams as a safety measure in the event of the reservoir filling too quickly. Spillway overflow events are mechanisms that also result in increased discharges downstream. It is conceivable that bigger rainfalls at earlier times in the year could threaten a dam's designed margin of safety, causing dam operators to release greater volumes of water earlier in a storm cycle in order to maintain the required margins of safety. Such early releases of increased volumes can increase flood potential downstream.

Climate change may increase the probability of design failures. Some spillways may not be large enough to convey the increased flow pattern. A spillway that is undersized could lead to dam overtopping and failure. The forebay canal in Carlton County had operated as designed for nearly 100 years before the failure from the June 2012 storm event. The intensity of the 2012 rain event caused a failure of the canal wall, which caused significant damage.

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

5.7 Extreme Heat

Extreme summer heat is the combination of very high temperatures and exceptionally humid conditions. If such conditions persist for an extended period of time, it is called a heat wave (FEMA, 1997). Heat stress can be indexed by combining the effects of temperature and humidity. The index estimates the relationship between dry bulb temperatures (at different humidity) and the skin's resistance to heat and moisture transfer—the higher the temperature or humidity, the higher the apparent temperature (NWS, 2021b). The relationship between the apparent temperature and heat disorder risk is shown in Table 50.

Table 50. Heat index and disorders

Danger Category		Heat Disorders	Apparent Temperatures (°F)
IV	Extreme Danger	Heatstroke or sunstroke imminent.	>125
III	Danger	Sunstroke, heat cramps, or heat exhaustion likely; heat stroke possible with prolonged exposure and physical activity.	103–125

II	Extreme Caution	Sunstroke, heat cramps, and heat exhaustion possible with prolonged exposure and physical activity.	90–103
I	Caution	Fatigue possible with prolonged exposure and physical activity.	80–90

Source: (NWS, 2021b).

The major human risks associated with extreme heat are as follows:

Heatstroke: Considered a medical emergency, heatstroke is often fatal. It occurs when the body's responses to heat stress are insufficient to prevent a substantial rise in the body's core temperature. While no standard diagnosis exists, a medical heatstroke condition is usually diagnosed when the body's temperature exceeds 105 °F due to environmental temperatures. Rapid cooling is necessary to prevent death, with an average fatality rate of 15%, even with treatment.

Heat Exhaustion: While much less serious than heatstroke, heat exhaustion victims may complain of dizziness, weakness, or fatigue. Body temperatures may be normal or slightly to moderately elevated. The prognosis is usually good with fluid treatment.

Heat Syncope: This refers to sudden loss of consciousness and is typically associated with people exercising who are not acclimated to warm temperatures. This causes little or no harm to the individual.

Heat Cramps: May occur in people unaccustomed to exercising in the heat and generally ceases to be a problem after acclimatization.

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

5.7.1 Extreme Heat History

The hottest temperature ever recorded in Minnesota occurred in Beardsley in Big Stone County in July of 1917, with a record of 115 °F (MN DNR, 2023c). 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).

Extreme heat has been Minnesota's third deadliest weather factor since 1990. There were fifty-four heat-related deaths in Minnesota from 2000–2016 (MDH, 2017).

An extraordinary end-of-summer heat wave led to one of the hottest Labor Days on September 4, 2023. Labor Day had high temperatures of over 100 °F recorded at 11 NWS cooperating weather stations, and over 90 °F at 97 weather stations. Only three did not record a 90 °F temperature during the five-day. This was truly a statewide (and regional) heat wave, the temperature reaching or exceeding 90 °F all the way up to the Canadian border (MN DNR, 2023a).

Heat Index values of 100 °F or higher can be expected most years in southern and central Minnesota, and sometimes occur multiple times per year. Values into the 110s °F are far less common, and generally occur only every few to several years. August 2, 2022 was hot and muggy across much of southern and central Minnesota, but a brief surge in humidity during the very late afternoon and early evening pushed dew point temperatures higher. As a result, even though the daily high temperature had already been reached across most of the area, heat index values peaked between 5 and 8 PM when the dew point reached into the mid to upper 70s °F at many locations. The heat index values soared into the 105 to 115 °F range at 15 reporting stations, with the high value of 115 °F recorded at Hutchinson (MN DNR, 2023a).

In June of 2021, Minnesota experienced one of the longest and most severe heat waves to occur so early in the season from June 3 to June 11. Over 20 different stations recorded high temperatures of 100 °F or higher on one or both of the days of June 4th and 5th.

June of 2020 also had a recording breaking high temperatures. The Twin Cities and St. Cloud both recorded highs of 96 °F, Brainerd recorded a high of 93, and Rochester recorded 91 °F. The low temperature of 74 °F in the Twin Cities was the highest on record for the date. Milan, in west-central Minnesota, led the state again with a high of 99 °F. Milan has reached 98 °F or higher four times during June, and the first eight days of the month have been its warmest in its 126-year observing history.

A notorious extreme heat wave affected most of Minnesota in 2011. Minneapolis experienced its most humid day on record and tied the all-time record for a heat index in the city, with 119 degrees. Meteorologists labeled the event a “humidity storm.” During heat waves, the urban heat island—a metropolitan area that is significantly warmer than surrounding rural areas due to human activities — effect can spike temperatures by as much as nine degrees. During the heat wave, ultraviolet monitoring showed dangerously high levels of radiation, which can cause acute and chronic effects on the skin, eyes, and immune system. During July of 2011, the average UV index was 9.7, the highest for any July since 1994. The level was above 10 on the days during peak intensity, a level which is associated with high risk levels for serious health effects (MDH, 2018).

5.7.2 Probability of Occurrence

Heat and Excessive heat events are reported by the NWS 24 times a year on average statewide (NCEI, 2023). Counties in central and southern Minnesota are more likely to experience the events. The urban Hennepin County experiences excessive heat events almost every other year on average, and two of the northern most counties (Cook and Koochiching) have never had a Heat and Excessive Heat event declared by the NWS. 2023 and 2021 mark the 5th and 15th years respectively that the Twin Cities with the most days reaching 90 °F or hotter. In 2023, that was 33 days, and in 2021, that was 27 days, compared the 1991-2020 climate normal of 13 days per year (MN DNR, 2023a).

> *Heat and Excessive heat events by county can be explored on the Extreme Heat Dashboard on the Plan website.*

Since 1871, the Twin Cities has seen temperatures over 100 °F in 32 summers, a frequency of approximately 21%, and an average of 2 days each of these 32 summers. occurrences of high heat are just one or two days. From 2019-2023, only 2022 had a day over 100 °F in the Twin Cities. The high temperature of 101 °F at the Twin Cities airport set a record for June 20, 2022 and was just the tenth 100-degree reading on record during June in Minnesota (MN DNR, 2023a).

While average annual and seasonal high temperatures appear to be happening earlier in the year, there are no increases in the highest temperatures of summer and the probability of occurrence of heat waves has not yet departed from the historical record. (Blumenfeld, K. Minnesota State Climatology Office, personal communication, December 21, 2023).

5.7.3 Vulnerability

In Minnesota, the impacts of increased extreme heat events and heat waves will impact both urban and rural regions. While the temperatures in metropolitan areas can be higher due to the heat island effect, the Minnesota Department of Health and other health departments across the United States have observed that there are typically more emergency department visits for heat-related illnesses in rural areas than in urban areas during a heat wave. This may be due to a number of factors, including a lack of air conditioning or healthcare resources in rural areas, as well as more people exposed to heat in rural areas due to job types, like farming and forestry. For the U.S., mortality increases 4% during heat waves compared with non-heat wave days (Anderson & Bell, 2011).

The Minnesota Department of Health report *Planning for Climate & Health Impacts in Metro Minnesota* notes several adverse impacts on the metro region during the 2011 heat wave, with 800 people taken to emergency departments or hospitalized, infrastructure damage with roads, including I-94, buckling due to heat, and strains on essential services when utilities were struggling to meet cooling demands. The heat wave required an upsurge in activity for paramedics, emergency services personnel, and police officers who checked on people susceptible to heat, such as the elderly and the homeless. In addition, utilities were strained while attempting to meet cooling demands. One utility in northeastern Minnesota used more power during a single day of the heat wave than any other day throughout the utility's records (MDH, 2018).

> *The FEMA National Risk Index was used to demonstrate windstorm vulnerability in the Extreme Heat Risk & Vulnerability Dashboard*

Increasing temperatures impact 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 NCA5, 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 pose 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 (ICAT, 2017) 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, 2015)

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. Additionally, 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, 2015).

Environmental factors increase vulnerabilities. Some factors that intensify extreme heat are poor air quality, a high ratio of impervious surfaces (roads, buildings, etc.) compared to green space, and a long distance to cooling centers and emergency medical services (Saint Paul–Ramsey County Public Health, 2016) According to the NCA5, historical and systemic biases make communities of color especially vulnerable to the negative impacts of extreme heat.

Key Message #3 in the Midwest Chapter of the NCA5 states that Mitigation and adaptation strategies, such as expanded use of green infrastructure and heat-health early warning systems, have the potential to improve both individual and community health (Wilson et al., 2023).

5.7.4 Extreme Heat and Climate Change

Climate models project that temperature and precipitation increases will continue in Minnesota through the 21st century, with hotter summers and increased drought severity during dry periods as well. Already, the maximum annual heat index values have been rising across the state, because increased humidity during heat waves (Blumenfeld, K. Minnesota State Climatology Office, personal communication, December 21, 2023).

The average number of days per year with temperatures over 95 °F under a moderate carbon emissions (SSP 245), mid-century (2040–2059) scenario is illustrated in the Climate Dashboard on the Plan website

On average, by mid-century (2040–2059), under a moderate emissions (SSP 245) scenario, annual number of days that exceed 95 °F in the state of Minnesota, is projected to increase 7.1 days relative to historical simulations (1995–2014). The average number of days is compared to a modeled historical value for each county and ranges from 0 to 18 more days over 95 °F (Liess, S. et al., 2023).

Greenhouse gas concentrations will continue rising through the century, and the air's ability to trap heat from the earth's surface will increase accordingly. Warming of the atmosphere will evaporate even more water into the air, further limiting the amount of cooling Minnesota will be able to achieve at night and during the winter. As warmer winters and warmer baseline conditions transition into summer, it will be much easier to attain extreme heat (ICAT, 2017).

Minnesota's annual average temperature has increased more than 1.5 °F since record keeping began in 1895, and the three most recent 10-year periods (through 2015) have been by far the warmest on record (ICAT, 2017). 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).

5.8 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 (Figure 8). 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 150 different definitions of drought, not just because it is difficult to define but because drought affects different regions in different ways. 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 are meteorological, hydrological, agricultural, ecological, and socio-economic drought (NDMC, 2024).

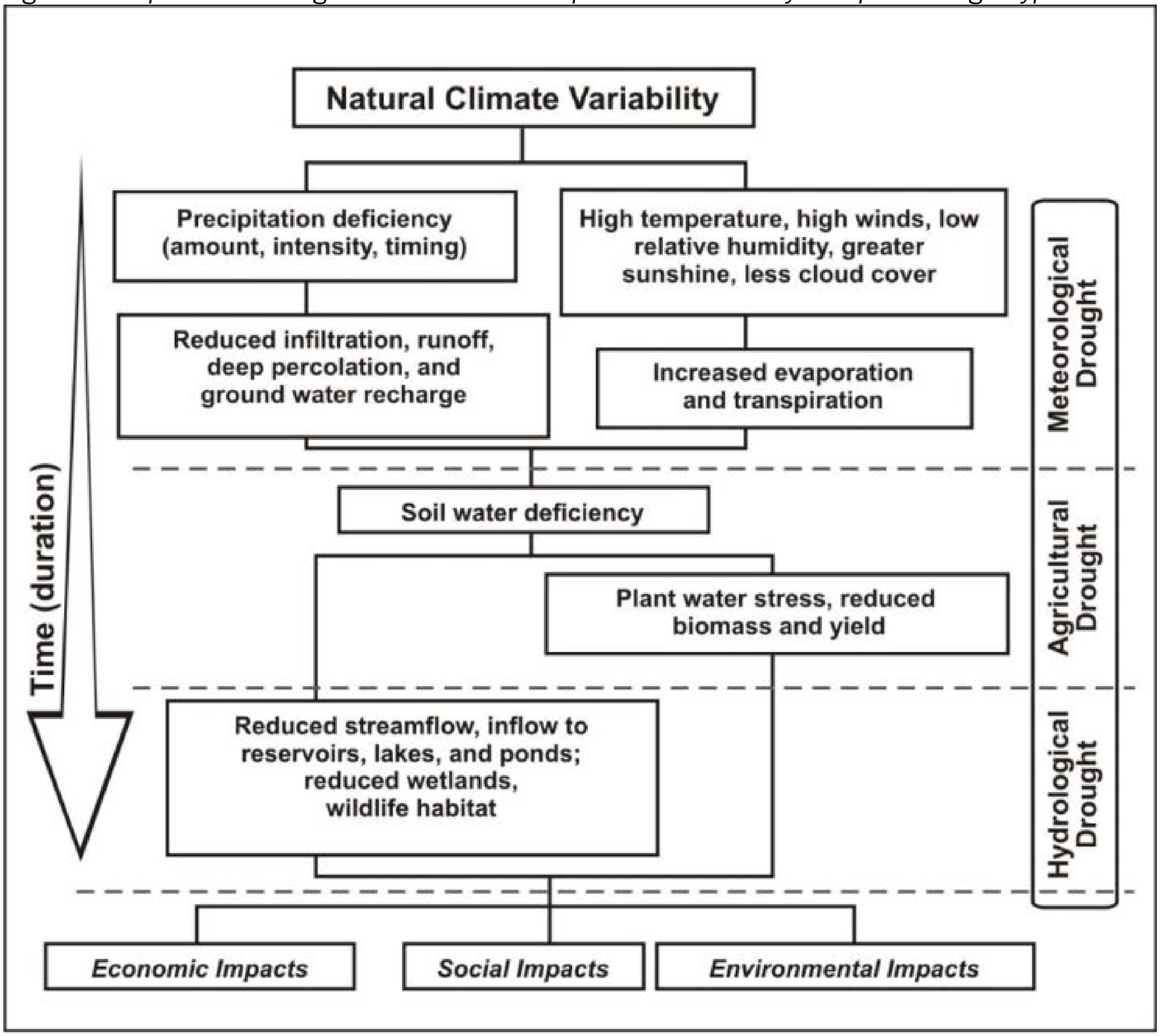
Meteorological drought

In general, meteorological drought refers to a shortage of precipitation relative to normal climatic conditions over an unspecified time period of time. Not only is this the prevailing interpretation of drought, but meteorological drought is also the most frequently occurring type because precipitation is the main driver of the hydrological cycle. Because the measure of normal climatic conditions varies by location, meteorological drought is often referred to as *region-specific*. It is also important to consider the distribution of annual precipitation. Shortfalls in precipitation occurring during naturally dry seasons will require a different assessment than when shortfalls are observed during months where precipitation is naturally higher. In Minnesota, most of the observed droughts fall into the category of meteorological drought, or at the very least, they start off that way. This is especially true when deficiencies in rainfall occur during the wettest and warmest months of summer.

Hydrological drought

Hydrological drought occurs when deficiencies in precipitation result in reduced streamflows, reduced lake and reservoir levels, and depleted groundwater supplies. Hydrological drought may be considered a consequence of meteorological drought in that it can often occur in the weeks or months following a sustained meteorological drought. The timing of this lag effect varies from location to location and is dependent upon several factors, such as the size of a given lake, reservoir, or watershed. It is also dependent upon the time of the year since seasons dictate precipitation type, precipitation amount, and temperature regimes. Northern regions often depend on snowmelt to help replenish water supplies in a region. Warm winters associated with mid-winter melt conditions may deliver snowmelt runoff during months when snow would normally be stored for delivery in the spring. Another key factor to consider about hydrological drought is that it can very well occur in regions that are not deficient in precipitation at all. The basic premise of hydrology is that water flows to lower elevations, therefore, deficiencies in precipitation in the upper reaches of a basin may trigger hydrological drought in lower reaches that are currently observing normal climatic conditions. In Minnesota, the impacts of hydrological drought are numerous. For instance, streamflow deficiencies have, in part, led to significant reductions in thermoelectric power generation. In addition to the power sector, hydrological drought plays a major role in public water supply and water quality. During prolonged drought events, groundwater levels can be adversely affected to the point where wells can go dry.

Figure 8. Sequence of drought occurrence and impacts for commonly accepted drought types.



SOURCE: (NDMC, 2024).

Agricultural drought

Agricultural drought is observed during situations where moisture demands for crop and plant life are not met. Agricultural drought is, therefore, connected to both meteorological and hydrological drought in that it is measured as a deficiency in the collective water budget of the region over which it is considered. Water budget factors for agricultural drought include precipitation, evapotranspiration (the combination of evaporation and transpiration), soil moisture storage, and runoff. Although a given crop has fixed water supply requirements, many other variables that control the overall water budget for a region vary, and thus, agricultural drought can be triggered under varying meteorological conditions. These variables include temperature, which controls the surface water demand; precipitation, which controls the surface water supply; and more critically, soil type, which dictates soil porosity. Even changes in the slope and aspect of the landscape can alter the balance of water. In Minnesota, the impacts and potential devastation of agricultural drought largely depends on the geography, severity, and duration of the drought event. Geography is significant because some crops are less vulnerable to immediate shortfalls in precipitation, while other crops can be impacted quickly. For example, sugar beets, which are grown in the northwest, are less vulnerable to early drought conditions than other arable crops because their deep root systems can grow deeper into the soil. Corn on the other hand, which is grown throughout much of the state, is more vulnerable to drought. Timing of drought is also a critical factor. For example, soybeans, which are grown in the western and southern counties, are most susceptible to drought stress during the stages of germination and seed reproduction. Regardless of which crops are impacted, the cost of drought to the agricultural industry is well documented. In 1988, drought cost the state over one billion dollars (MN DNR, 1988).

Ecological drought

Perhaps the most nascent drought type in the literature, ecological drought, occurs when the combined effects of meteorological and/or hydrological drought begin to impact the delicate balance of a given ecosystem. Because ecosystems are generally quite sensitive to small changes in environmental conditions, the impacts and feedback mechanisms associated with ecological drought are typically numerous and mutually inclusive. In Minnesota, sustained reductions in lake levels, for example, may result in sustained increases in water temperatures, which can impact aquatic plant life and fish populations. This can have a direct impact on the amphibious and terrestrial wildlife that rely on wetlands as a source of food. In extreme cases, prolonged drought conditions may result in severe reductions in wetlands, which then become more vulnerable to invasive species that can further alter the local ecology of a region. Moreover, drought conditions can cause a reduction in terrestrial vegetation, which in turn may lead to animal scarcity due to migration and/or starvation. Impacts of ecological drought in Minnesota are also observed in the state’s forestry resources. Tree damage from drought often lingers for several years after the event is over. In addition, drought-impacted trees are much more vulnerable to insect infestations and disease. During the drought of 1988, for example, many thousands of trees were lost due to prolonged moisture deficiencies.

Socioeconomic drought

Socioeconomic drought occurs when the collective impacts of the preceding four drought types begin to affect the economy of a given region. Like hydrological drought, there is a lag effect associated with it. The timing of this lag effect is chiefly dependent upon each individual drought impact. Because this drought type is associated with the supply and demand of economic goods, economic impacts could be observed early into a drought onset, or they can linger on long after a given drought has ended. A few of the impacts of socioeconomic drought in Minnesota include reductions in crop yields or livestock holdings, reductions in hydroelectric power productions, and impacts to tourism and recreation. In the case of the latter, it is quite difficult to quantify the economic impact of drought on tourism. This is true because it is almost impossible to estimate indirect losses that may result from negative perceptions of drought-related actions or negative experiences, which in turn may prevent tourists from participating in future recreational activities (Thomas et al., 2013). In Minnesota, water and snow/ice related activities are responsible for a significant portion of tourism and recreation revenues.

According to Explore Minnesota, travel and tourism generates more than $11 billion in gross sales each year and accounts for over 200,000 full- and part-times jobs.

5.8.1 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 an 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.

The Plan website includes a Drought History Dashboard that displays maps, charts, and tables prepared by the U.S. Drought Monitor.

In total, there are four drought categories: moderate (D1), severe (D2), extreme (D3), and exceptional drought (D4). A fifth category, abnormally dry (D0) 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. D0 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. 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.

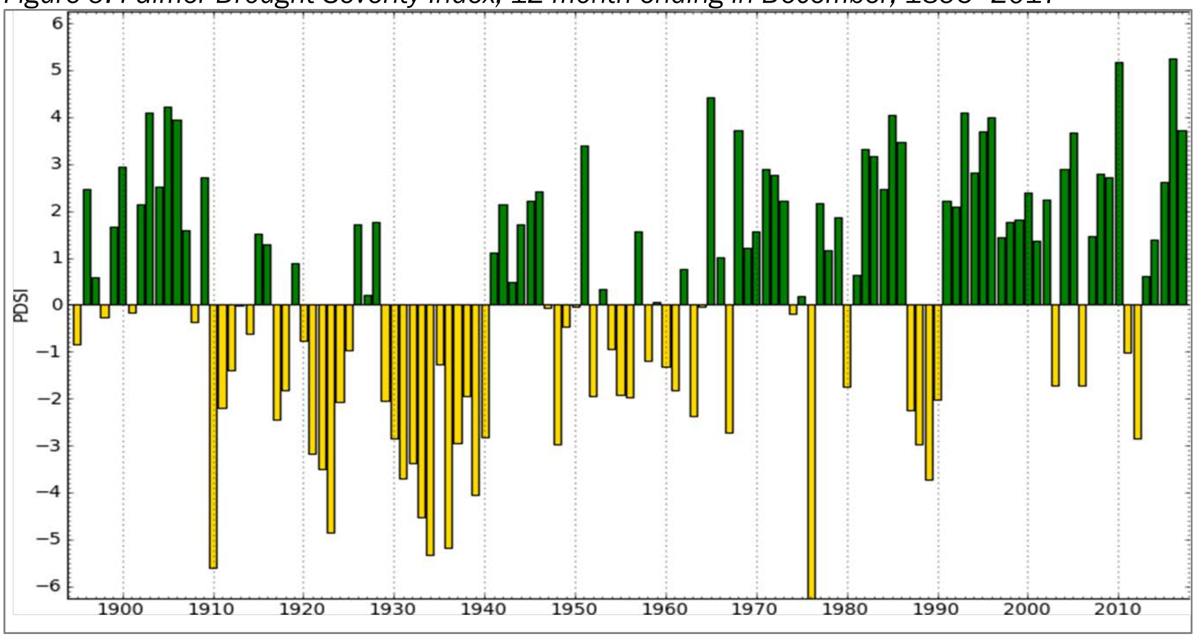
Palmer Drought Indices

Developed in 1965 by W.C. Palmer, the Palmer Drought Severity Index (PDSI), published weekly, is a measure of long-term meteorological drought (Palmer, 1965). The PDSI measures the duration and intensity of drought events by measuring departure of the moisture supply based on a supply-and-demand concept of the water balance equation. It uses temperature and rainfall information to determine dryness in a given area, and accounts for all of the basics of the water balance equation, including evapotranspiration, soil recharge, runoff, and moisture loss from the surface layer (Hayes et al., 2007).

An example of the PDSI by Climate Division map is shown in Figure 9. The primary strengths of the PDSI are its effectiveness in measuring long-term meteorological and agricultural drought in the mid-latitudes, it takes antecedent moisture conditions into account, and it is used globally as a standard for drought quantification. The index, however, does have its weaknesses. It does not take streamflow or delayed runoff (snow and ice conditions) situations into account, nor does it provide a means for comparing dryness from one region to another, which is somewhat problematic given that drought definitions vary spatially. The index is also less effective in areas of varying topography. Despite these weaknesses, the PDSI continues to be used and regarded as reliable.

The Palmer Hydrological Drought Index (PHDI), the Palmer Z-Index, and the Crop Moisture Index (CMI) are three indices derived from the PDSI. The PHDI is a long-term drought index used to measure the hydrological impacts of drought and better reflect groundwater storage and reservoir levels; it is more useful for water resource applications. The Palmer Z-index is useful for short time scales of a month or less and is intended as a drought measure based on soil moisture conditions (NCEI, 2024). The CMI monitors agricultural drought conditions in the short-term (up to four weeks) by measuring weekly precipitation and temperature levels (averaged over a climate division) in agricultural producing areas. It is a relatively good indicator of soil moisture and is most useful during the growing season; thus, it is intended as a summer drought index.

Figure 9. Palmer Drought Severity Index, 12-month ending in December, 1895–2017



Source: West Wide Drought Tracker, Western Regional Climate Center

Standardized Precipitation Index

The Standardized Precipitation Index (SPI) is a prolifically used drought index for quantifying meteorological drought on a variety of time scales (Figure 10). At long time scales, the SPI is effective for reflecting reservoir storage and groundwater. At short time intervals, the SPI is an excellent proxy of soil moisture. The prime advantage that the SPI has over other indices is that it is specifically designed to allow for comparing drought conditions in different climatic regions. Unlike other drought indices, the SPI is easy to interpret in that its value is essentially a normalized precipitation anomaly. For instance, an SPI value of -2.0 is basically a precipitation total that is two standard deviations below the long-term average. These two factors have made the SPI very popular among drought scientists. The primary disadvantage of the SPI is that it does not consider evapotranspiration. An alternative version of the SPI, the Standardized Precipitation-Evapotranspiration Index (SPEI), does incorporate evapotranspiration (Figure 11).

Figure 10. 90-day SPI for Minnesota

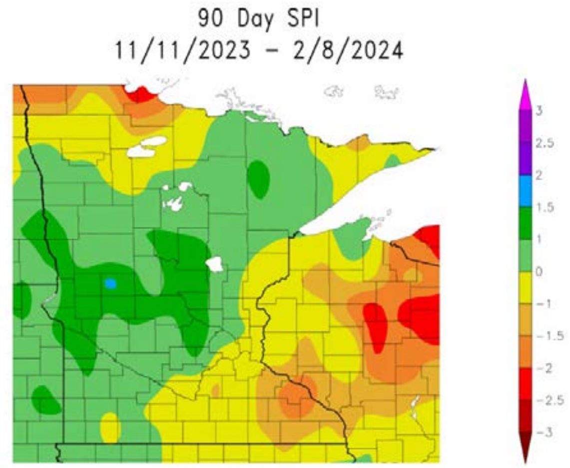
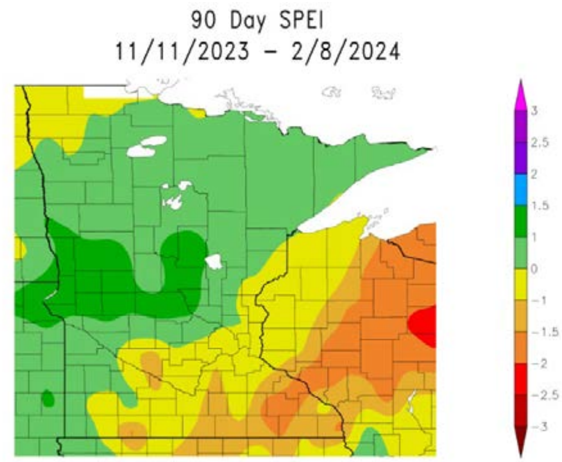


Figure 11. 90-day SPEI for Minnesota



Source: (High Plains Regional Climate Center, 2024)

Other Drought Indices

In addition to the above, the following list of indices are also frequently used to monitor drought conditions in Minnesota and throughout the United States.

1) Keetch-Byram Drought Index (KBDI): a useful index for measuring wildfire risk associated with extended periods of surface moisture deficiencies. The KBDI ranges from 0 to 800, with the latter indicating extreme dryness.

2) Vegetation Drought Response Index (VegDRI): is an indicator of vegetation stress. Maps are produced every two weeks. The VegDRI utilizes a combination of climate data and remote sensing producing an integrated representation of relative greenness at high spatial resolutions.

3) United States Geological Survey's (USGS) Average Streamflow Percentiles: Produced by the USGS, these maps indicate average streamflow over various time scales compared to historical streamflow for the day of the year. Streamflow values are displayed as percentile classes, providing a quick and useful approach to assessing hydrological drought.

Monitoring Drought

Each week hundreds of drought scientists collaborate with a National Drought Mitigation Center (NDMC) assigned drought author to develop an accurate depiction of drought on the USDM weekly map. In Minnesota, scientists at the DNR State Climatology Office are tasked with providing vital information to the drought map authors. Meteorologists from various National Weather Service Offices also contribute. It is important to note that monitoring occurs with the same level of scrutiny regardless of drought conditions in the state. Understanding normal conditions throughout the state is crucial when assessing drought conditions. All contributors utilize the aforementioned drought indices and drought products to assist their drought assessments. In addition, the Minnesota Department of Natural Resources' Ecological and Water Resources Division uses actual precipitation, stream flow, lake level, and ground water level data to assess the status of hydrologic conditions in Minnesota. The Ecological and Water Resources Division produces maps of stream flow, precipitation, and seasonal departures from normal.

Because drought is often insidious in nature, data, value-added climate products and drought proxies do not always provide enough information to make an accurate judgement. In such cases, drought map contributors rely on local citizens to assist in providing critical information related to drought onset and drought-related impacts. One such resource that allows citizens to contribute is the NDMC's Drought Impact Reporter (DIR). Scientists at the Minnesota State Climate Office encourage citizens to visit the DIR website and report drought related impacts. The DIR Dashboard can be viewed on the NDMC website. Citizens are also welcome to call or email the MN State Climatology Office.

5.8.2 Drought History

Minnesota has been collecting streamflow records as a way of monitoring droughts since the early 1900's. Since this time Minnesota has experienced several major state-wide droughts. Two widespread droughts have affected the State since the 2019 Minnesota Hazard Mitigation Plan. The histories below were provided by the MN State Climatology Center (Romolo, L., Minnesota State Climatology Office, personal communication, December 21, 2023).

Drought of 2021

The drought of 2021 resulted from a combination of persistent below-normal precipitation, combined with above normal temperatures. The drought itself began in the fall of 2020, when the entire state began experiencing a shortfall in precipitation. By late December, much of the state was classified as abnormally dry, with moderate drought being reported in the northwest and southeast counties. This was followed by a weak snowpack season over the winter of 2020-2021. Snow depth rankings in February 2021 were well below normal. The drought waxed and waned slightly during the spring, but it wasn't until early summer that the drought really set in.

June was the third warmest and seventh driest June on record (1895-2021). As a result, by late June, over 80% of the state was experiencing moderate drought. The following month, Minnesota experienced its second-driest July on record going back to 1895. By the middle of July, 52% of the state was classified as severe drought or worse, and extreme drought was reported in the northwest. Impacts to both agriculture and streamflows were being reported regularly indicating that much of the state was experiencing Hydrological and Agricultural drought. Almost all basins in the northern half of the state were classified as low flow or minimum flows. By the end of July, roughly 78% of the state was in severe drought or worse and over 35% of the state was classified as extreme drought.

The Minnesota Drought Task Force was activated for the first time since 2012. Drought conditions continued to worsen, and on August 10, 2021, a band of exceptional drought was reported in the northwestern portion of the state. This marked the first time in the USDM's Drought Monitor Map 20-year history that exceptional drought was reported in Minnesota. It is important to note, however, that equivalent drought conditions had occurred prior to the existence of the USDM Drought Monitor map, particularly during the dust bowl era, for example, and during the 1988 drought. Much needed rainfall in late-August helped alleviate drought conditions in the southern half of the state. Extreme drought was now limited to the northern half of the state and streamflows in the south began to improve. More consistent rainfall during the fall helped improve conditions in the state, but moderate drought in the north continued through winter. A healthy snowpack season, followed by spring precipitation ended the drought in late spring of 2022.

The drought of 2021 proved to be the worst drought in Minnesota since 1988 and was the first drought since that time that persisted through the entire growing season. Impacts were numerous across many sectors including tourism, water resources and agriculture. Some of the major impacts included:

Hay shortages were reported all through the drought. By early-July, 46% of pasture and range lands were ranked as poor or very poor. Farmers were reporting that they needed to travel great distances for hay supplies. Some Wildlife Management Areas were opened for haying due to the extreme drought.

By mid-July, Minnesota Public Radio reported that drought was posing a threat to Minnesota's livestock.

Burning restrictions were implemented during the months of June and July, as the drought increased wildfire risks across the entire state. Burning restrictions continued in many counties through late summer, with the final restrictions on counties in northeast MN lifted September 21, 2021.

On July 15, 2021, the MN DNR reported that lack of rain was creating challenges at boat launches. This issue was echoed in another news release August 12, 2021, indicating that persistent low water conditions were continuing to affect boaters. On August 30 the MN DNR reported that waterfowl hunters needed to be aware of low water on Minnesota's wetlands.

Drought clearly had a large impact on Minnesota recreation, though the monetary value of this impact is unknown.

On October 13, 2021, the MN DNR announced a $13.3 million funding proposal to address 2021 drought impacts on natural resources. This funding would support addressing drought impacts on Minnesota's ecology--for example, the impact that drought had on high seedling mortality.

On May 22, 2022, Minnesota Legislature passed a bill that directs $18.4 million to address drought and disaster relief, mostly for livestock and specialty crop farmers impacted by the 2021 drought.

Drought of 2022

Minnesota enjoyed only a small handful of drought-free weeks before drought set in again in July 2022. Lack of rainfall across the southern half of the state in June, combined with above normal temperatures led to the classification of moderate and severe drought in the seven-county metro area and westward. Temperatures in June were anywhere from 3-4° above normal over much of the southern half of the state, and by the end of the month, many stations in the south reported 2-4 inches of deficit in June precipitation. July was generally dry and warmer than normal, which exacerbated drought conditions. The dryness continued over much of the summer, but not to the levels observed in the previous year.

By mid-October conditions became very dry and a large portion of southern Minnesota was experiencing severe and extreme drought. The drought held steady through the fall, and by December minor improvements in the south were offset by expansion to the west-central and north-west counties. Fortunately, the winter of 2022-23 proved to be one of the snowiest winters the state has observed. In Duluth, a total of 140.1 inches of snow was recorded, setting an all-time seasonal snowfall record. For the Twin Cities, it was the third snowiest winter with a seasonal snowfall total of 90.3. A protracted melt season replenished soils and healthy spring rains helped eliminate the drought. By mid-May, only a sliver of moderate drought remained in south-eastern Minnesota. Because the drought peaked in the middle of the fall, impacts to agriculture and water resources were modest compared to previous droughts.

Between 1989 and 2022, over $2.3 billion (2021 USD adjusted) of indemnity payments were paid to Minnesota counties for crop loss caused by droughts. Table 51 displays the top 10 counties that received the highest total payments.

Table 51. Estimated crop indemnity payments (2021 USD adjusted) due to drought, 1989–2022

County	Total Crop Indemnity Payments
Stearns	$154,660,198
Polk	$93,588,406
Marshall	$84,146,401
Morrison	$82,107,282
Otter Tail	$73,958,665
Lyon	$61,528,223
Redwood	$55,965,415
Norman	$53,801,126
Wright	$50,084,758
Renville	$49,853,036

Source: (CEMHS, 2023)

The only other widespread severe drought in Minnesota since the historic drought of 1988, was the drought of 2011–2012. This drought began in the fall of 2011, which ranks among the driest fall seasons on record. The drought continued into the 2012 growing season with July 2012 having the lowest precipitation levels on record. That year, the U.S. Department of Agriculture (USDA) declared 75 Minnesota counties disaster areas. The 2012 drought is considered to be the most extensive drought to impact the U.S. since the 1930s—estimated to have cost the U.S. approximately $33 billion (Rippey, 2015).

5.8.3 Probability of Occurrence

Drought is a naturally occurring aspect of Minnesota's climate. It usually occurs somewhere in the state almost every year in some form or another for at least a few weeks at a time. Typically, drought will occur within a given location in the state, but impacts are usually not observed until drought has developed over a sustained period of at least one month or longer. Because the geography of Minnesota is such that it lies in the path of two primary low-pressure system storm tracks that originate in Colorado and Alberta, Canada, droughts in the state are often of short duration. These storm tracks are responsible for the bulk of the precipitation in Minnesota. On occasion, and for reasons that we do not fully understand, one or both storm tracks can sometimes get displaced. When these displacements are extended temporally, drought conditions in the state can become quite severe. In addition, blocking patterns are also responsible for drought conditions in Minnesota. A blocking pattern is any circulation pattern in the atmosphere that obstructs the normal west-to-east migration of high- and low-pressure systems. When blocking patterns develop, they can remain in place for a few days or, in severe cases, several weeks. If a sustained blocking pattern is associated with high pressure over Minnesota, drought conditions can develop quickly.

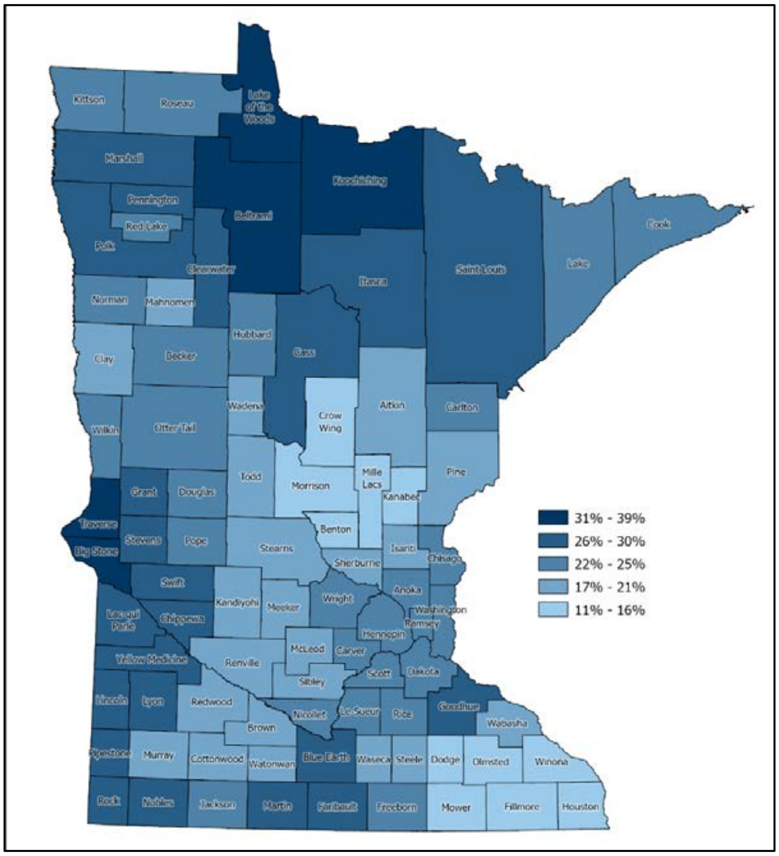
As is the case in many locations, temperature plays a fundamental role in Minnesota drought severity. Higher than normal temperatures during periods of reduced precipitation can augment drought conditions by increasing the water demand of a given environment. Conversely, lower than normal temperatures decrease the water demand and can attenuate or even delay the effects of a given drought.

Drought is highly unpredictable and may also be localized, making it difficult to determine probability with any accuracy. Interpreting what is “too dry” or what is “too long” is difficult. What we do know is that when a serious hydrologic imbalance occurs in Minnesota, soil moisture reserves, groundwater supplies, lake levels, and stream flows are negatively influenced. Water-dependent industries, including agriculture, public utilities, forestry, and tourism are profoundly affected. Because long-term (months/years) climate variations are unpredictable, drought is also largely unpredictable. Understanding the nature of drought in Minnesota is essential for building higher coping and adaptation capacities.

The first step to understanding drought risk and drought probability is to identify the geography of drought in Minnesota. Figure 12 illustrates the percentage of time each county of Minnesota was in at least moderate (D1) drought or worse. Data for this map spans the period from January 2014 through December 2023. Though the map does not provide detailed information related to specific drought event duration or intensity, it does provide a relatively accurate spatial representation of drought occurrence in Minnesota.

According to Figure 12, from 2014–2023, counties in the north-central and west-central regions of the state were in droughts greater than D0 at least 31% of the time. Conversely, counties in southeast and central Minnesota experienced droughts greater than D0 less than 17% of the time.

Figure 12. Percent of time in at least Moderate (D1) Drought, 2014–2023



Source: (NDMC, 2024b)

5.8.4 Vulnerability

Regardless of the mechanisms that initiate drought emergence, all counties in Minnesota are vulnerable to this hazard and its potential impacts. Impacts of drought in the state cover a broad spectrum of vulnerability sectors. These include:

- Water Resources Sector
- Agriculture Sector
- Wildfire Sector
- Fisheries and Wildlife Sector
- Health Sector
- Energy Sector
- Tourism and Recreation Sector

The collective socioeconomic and ecological severity of a given drought depends on the number of sectors that are impacted. Impacts, in turn, depend on many factors. These include the total area of the drought, the total population affected by the drought, the duration of the drought, and the type of drought that is occurring, the latter of which depends on how drought is defined in a given location.

Droughts can contribute to poor air quality by increasing the risk of wildfires and creating a dustier than normal environment. Recently, Canadian wildfires, exacerbated by drought conditions, caused unprecedented air quality issues in Minnesota the summers of 2021 and 2023. By mid-September 2023 the Minnesota Pollution Control Agency (MPCA) had issued 20 AQI alerts covering 52 days, eclipsing the previous record of 13 alerts covering 42 days in all of 2021 (MPCA, 2023a). Populations vulnerable to these conditions include children, older adults, and those with respiratory issues.

According to drought risk score data from FEMA's National Risk Index, counties in Minnesota with the highest risk (≥80th percentile) of being negatively impacted by drought are in the northwestern and southern regions of the state.

The Drought Risk Index map of Minnesota can be found in the Drought Risk & Vulnerability section of the Plan website.

5.8.5 Drought and Climate Change

Droughts have been happening throughout Minnesota's history. While the degree at which climate change will impact future droughts is not certain, an increase in efforts and resources are being devoted to project these impacts. In 2023, the NCA5 was completed by the U.S. Global Change Research Program. It provided a comprehensive scientific review of how climate change is impacting the U.S. as well as providing climate change projections.

According to the report, a warming climate is contributing to oscillations between extreme droughts and floods, threatening the agriculture and livestock in the Midwest which produces more than 30% of the world's corn and soybeans (Wilson et al., 2023). Climate change is attributed to an estimated $31.9 billion (2022 USD adjusted) of US crop indemnity payments over the last 30 years, with the largest portion of payments going to farmers affected by drought (Wilson et al., 2023). In Minnesota, drought alone represents 25% of the total crop indemnity payments made in the state (CEMHS, 2023).

Climate projections indicate an increase in annual precipitation of 0.2%-0.5% in the western Midwest and the increase in cumulative runoff is expected to continue through the midcentury (Wilson et al., 2023).

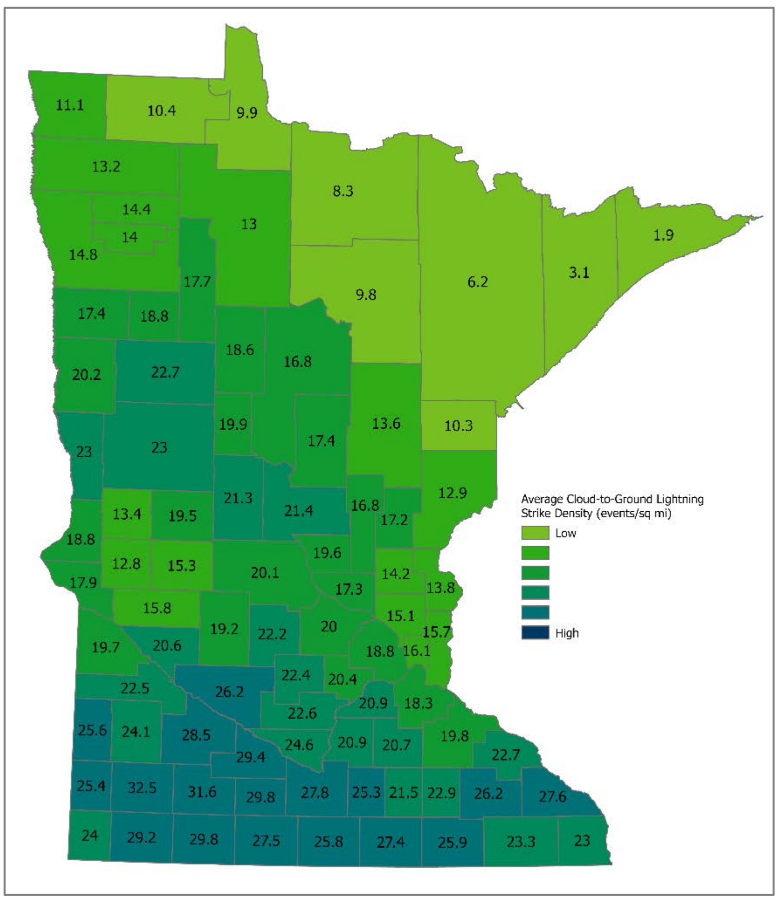
Key Message #5 in the Midwest Chapter of the NCA 5 states that Managing Extremes Is Necessary to Minimize Impacts on Water Quality and Quantity. The extreme variability between wet and dry periods is expected to negatively impact the water quality and quantity of the Mississippi River System and adversely affect dependent ecosystems and commerce (Wilson et al., 2023).

5.9 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. Initially air acts as an insulator between the positive and negative electric charges in the cloud and between the cloud and the ground; however, when the differences in charges becomes too great for the insulating capacity, there is a rapid discharge of electricity that we know as lightning (NWS, 2024a).

The National Lightning Detection Network® (NLDN) operated by Vaisala, is the longest continuously operating and most scientifically validated lightning detection network in the world. Lightning events include both in-cloud flashes and cloud to ground strokes are detected, the latter being dangerous to life and property. There are an average of 6.3 events per square mile per year in Minnesota (Vaisala, 2024).

Figure 13. Average cloud-to-ground lightning strikes by county, 2021



The hazard posed by lightning is significant. High winds, rainfall, and a darkening cloud cover are the warning signs for possible cloud-to-ground lightning strikes. While many lightning casualties happen at the beginning of an approaching storm, more than half of lightning deaths occur after a thunderstorm has passed. Lightning has been known to strike more than 10 miles from the storm in an area with clear sky above. According to the National Weather Service, the chance of an individual in the U.S. being killed or injured by lightning during a given year is 1 in 1,222,000 (NWS, 2024a).

Lightning is a major weather hazard that most people in the United States experience annually. The lightning current from a tree, fence, pole, or other tall object can branch off to strike a person. In addition, an electrical current may be conducted through the ground to a person after lightning strikes a nearby tree, antenna, or another tall object. The current may also travel through power lines, telephone lines, or plumbing pipes to damage property or cause fires. There is little an individual can do to substantially reduce risk outdoors in a thunderstorm. The only completely safe action is to get inside a safe building or vehicle.

5.9.1 Lightning History

According to an annual report published by Vaisala, over 194 million lightning events occurred across the U.S. in 2021. In 2021, Minnesota ranked #24 in the United States with 2,632,119 cloud-to-ground strikes. This is an average 4.51 per square mile and #33 in the country for lightning density. (Vaisala, 2021). The average cloud-to-ground strokes by county in Minnesota is shown in Figure 13.

Between 1996 and 2023, the National Centers for Environmental Information (NCEI) recorded a total of nine deaths due to lightning in Minnesota, 72 injuries, and $23.3 million in property damage. Most injuries occurred between May and August. The event with the highest number of injuries occurred in July of 2001, when 25 people were injured at Camp Ripley; however, everyone survived (NCEI, 2023).

According to NCEI records, between 2019 and 2023, lightning caused zero fatalities and 4 injuries (Table 52) in Minnesota. The causes of those fatalities are described below. During this period, $1.06 million of property damage was also reported due to lightning. Property damage from this source is known to be under-reported (NCEI, 2023).

Table 52. Lightning injuries reported in Minnesota, 2019–2023

County	Events	Injuries	Property Damage
Clay	1	0	$250,000
St. Louis	4	0	$243,500
Crow Wing	1	0	$200,000
Olmsted	2	0	$175,000
Houston	1	0	$50,000
Marshall	1	0	$40,000
Mower	2	0	$32,000
Carlton	1	0	$20,000
Polk	1	0	$15,000
Dakota	1	3	$10,000
Dodge	1	0	$10,000
Winona	1	0	$10,000
Pine	1	0	$5,000
Murray	1	0	$2,000
Pennington	1	0	$500
Washington	1	1	$0

Source: (NCEI, 2023)

5.9.2 Probability of Occurrence

The probability of lightning occurring in the state is high. However, the site-specific incidence of lightning is considered low because of the localized nature of the hazard. The annual incidence of lightning across the state is presumed to remain stable, although year-to-year fluctuations are expected.

5.9.3 Vulnerability

All humans and structures in the state are vulnerable to lightning. According to the State Climatology Office, lightning is a serious hazard in Minnesota, and the risks are greatest during the summer, when outdoor recreational activities are most common. Southern Minnesota typically sees 3–4 times more lightning strikes annually than northern Minnesota. However, the abundant lakes, boats, parks, and trails in northern Minnesota place clusters and concentrations of people at risk to afternoon and evening thunderstorms, especially on weekends and during the major summer holidays.

5.3.4 Lightning and Climate Change

The conditions associated with lightning are uncertain. These conditions—tornadoes, large hail, and damaging thunderstorms—are difficult to compare historically but may become more concentrated on fewer days or multiple events may occur at one time. These events could happen without necessarily increasing overall numbers or severity (ICAT, 2017). Severe rain events are certain to be more common and may include an additional risk of lightning. Vaisala documents the unusual severe weather of 2021 in December, which caused thunderstorms and lightning in southern Minnesota (Vaisala, 2021). Climate change may influence the seasonality of hazards such as lightning.

5.10 Winter Storms

Winter storms encompass a number of winter weather events which the National Weather Service (NWS) organizes into the following categories: blizzard, heavy snow, ice storm, lake-effect snow, winter storm, and winter weather (NCEI, 2023). Winter weather events are common in Minnesota and can be costly. According to the Spatial Hazard Events and Losses Database (SHELDUS), winter weather events in Minnesota have cost more than $1.02 billion dollars in damages from 1960 through 2021, and $10 million for the three years of 2019–2021 (CEMHS, 2023) .

The most dramatic and destructive of all winter storms, a blizzard is a winter storm that has the following conditions for at least three consecutive hours: (1) sustained winds or frequent gusts of 35 mph or greater, and (2) falling and/or blowing snow which reduces visibility to less than ¼ mile. With the heavy snow and winds they bring, blizzards can completely shut down travel in large areas and even be life-threatening to humans and animals in their path. According to NCEI, Blizzards have claimed the lives of 14 people in Minnesota since 1996, and one person since 2019. While few deaths or injuries tend to be reported in the NCEI Storm Events Database as directly attributable to winter weather events, indirect deaths due to stress on those with other serious health conditions were likely to have occurred (NCEI, 2023).

While there is no fixed temperature requirement for blizzard conditions, the life-threatening nature of low temperatures in combination with blowing snow and poor visibility increases dramatically when temperatures fall below 20° F. In Minnesota, blizzards typically occur between October and April, with the majority occurring in the months of January, March, and November, respectively.

A heavy snow event is characterized as snow accumulation meeting or exceeding the local/regional defined 12 and/or 24-hour warning criteria. Depending on the area, this could mean 4–8 inches or more of snow in 12 hours or less, or 6–10 inches or more of snow in 24 hours or less.

An ice storm is characterized by a buildup of ice (typically ¼–½ inch or more) due to freezing rain or other type of precipitation; however, even small accumulations of ice on sidewalks, streets, and highways may create extremely hazards conditions to motorists and pedestrians. The terms “freezing rain” and “freezing drizzle” warn the public that a coating of ice is expected on the ground and other exposed surfaces.

A winter storm is an event that has more than one winter hazard (e.g., heavy snow and blowing snow; snow and ice; snow and sleet; sleet and ice; or snow, sleet, and ice) and meets or exceeds locally/regionally defined 12- and/or 24-hour warning criteria for at least one of the precipitation elements. Winter weather is a winter precipitation event that causes a death, injury, or a significant impact to commerce or transportation, but does not meet locally/regionally defined warning criteria. The winter weather classification is also used to document out-of-season occurrences of winter precipitation.

Lake-effect snow forms when below freezing air passes over a lake’s warmer waters causing lake water to evaporate and warm the air. When the air moves away from the lake it cools and the moisture in the air falls to the ground, potentially as snow. The snowfall rate of lake-effect snow varies, but a typical warning of lake-effect snow accumulation is 6–8 inches within 12 hours or 8–10 inches in 24 hours. As with heavy snow events, lake-effect snow may cause structural damage due to the weight of snow accumulation.

5.10.1 Winter Storm History

Mean seasonal snowfall ranges from more than 90 inches along Lake Superior’s North Shore to less than 35 inches in southwestern Minnesota. The earliest measurable snowfall occurred on September 14, 1964, when International Falls (Koochiching County) received 0.3 inches. The latest measurable snowfall occurred on June 4, 1935 when Mizpah (also in Koochiching County) received 1.5 inches (MN DNR, 2023c). Heavy snowfalls of greater than four inches are common anytime from mid-November through early April, with earlier and later-season snowfall events most likely in northern parts of the state (Seeley, 2015).

The Minnesota record for 24-hour snowfall occurred in January of 1994, when Finland, Minnesota (Lake County) recorded 36 inches. That snowstorm also holds the record for maximum single-storm snowfall, with a total of 47 inches. The state record for maximum snowfall is 75 inches, reported near Grand Portage, Minnesota (Cook County) in March of 1950. Grand Portage also holds the record for maximum seasonal snowfall, with 171 inches in the winter of 1949–1950 (MN DNR, 2023c).

In the winter of 2022–23, the Minnesota Department of Transportation (MnDOT) spent $174 million on its snow and ice removal operations, the highest annual cost of winter maintenance of the five years between 2019–2023. The average annual cost of snow and ice operations between 2019 and 2023 was $139.5 million (MnDOT, 2024).

Table 53 below lists notable winter storms and blizzards from 2019–2023 as recounted in the MN DNR Climate Journal (MN DNR, 2023a).

Table 53. Notable winter storms and blizzards, 2019–2023

Date	Description
January 2–5, 2023	The New Year greeted Minnesota with a large, messy winter storm, as a concoction of heavy snow, freezing rain, sleet, rain, and thunderstorms pounded parts of the state. The storm produced widespread accumulations of over one foot, with 15.1 inches for a storm total in the Twin Cities, making this the 14th-largest snowstorm on record since 1884. "Big Mess" Snowstorm Clobbers Minnesota:
December 22, 2022	An enormous, powerful, and deadly winter storm overtook much of Minnesota and the surrounding region after an abundant and powdery snowfall ending on Thursday December 22, 2022, set the stage for a long-lasting and brutally cold regional ground blizzard.* The virtually impossible and life-threatening conditions on nearly all exposed roads in between cities and towns severely impeded holiday travel across multiple northern and central states. Snow & Holiday Blizzard
December 13–17, 2022	A powerful winter storm lasting multiple days brought wind, rain, heavy mixed precipitation, and intense wet snow to Minnesota from Tuesday December 13th, lasting into Saturday December 17th, 2022. Across the state, but especially in northern Minnesota, the storm damaged countless trees, blocked roads, closed snowmobile trails, and knocked out power to tens of thousands of customers. Its massive geographic footprint and duration meant that virtually all of the Dakotas, Minnesota, and Wisconsin received significant snowfall accumulations, with Winter Storm and even Blizzard Warnings covering the entire 300,000 square-mile area at times.
December 15–16, 2021	This storm's out-of-season timing, as much as its potency, made it a "career" or "generational" event that had never before been recorded in Minnesota: A powerful cyclone brought warm air, high dew point temperatures and summer-like severe weather into Minnesota. As of December 29, twenty tornadoes have been confirmed, the strongest of which, rated EF-2, struck the town of Hartland in Freeborn County. Damaging thunderstorm winds tracked across several states and qualified as a "derecho," and the same system brought additional damaging non-thunderstorm winds due to the pressure gradient. The warm air out ahead of the storm brought the fastest snow melt seen in December in the Twin Cities. The snow depth went from 12 inches on December 11 to zero on the 16th. Historic Mid-December Severe Weather and Wind Event
October 20, 2020	With 7.9 inches of snow in the Twin Cities, 7.0 inches at St. Cloud, and a large swath of 6–9 inches stretching across the state, this was the heaviest snow on record so early in the season throughout much of central and southern Minnesota. The heavy, wet snow plastered all surfaces, compacting into thick sheets of ice on area roads, and knocking out power in the eastern Twin Cities area. Record October Snowstorm
December 23, 2020	This event came too late for the voting, but would have certainly been a top five weather event. The combination of the snow with high winds was what made this event a spectacular storm. Whiteout conditions dominated open areas, and even spread into the urban areas during the afternoon and evening, prompting the National Weather Service to cover 70 of Minnesota's 87 counties with Blizzard Warnings, possibly the greatest coverage of such warnings on record. These Blizzard Warnings included the core of the Twin Cities for just the third time in the past 30 years. The other two instances were both locally infamous: the Halloween Blizzard of 1991, and the "Thunder Blizzard" of April 2018. Holiday Lights Howler
April 12, 2020	For the third year in a row, mid-April brought a major winter weather event to southern Minnesota. Although not as potent as the storms in 2018 and 2019, this one did produce accumulations of up to 10 inches, including 6.6 inches In the Twin Cities. In southern Minnesota, mid-April snows exceeding four inches generally only occur 5–10% of the time, or every 10–20 years on average. This marked the first time on record (back to the 1870s) that the Twin Cities had experienced such a storm in three consecutive Aprils. Easter Sunday Winter Storm

Date	Description
February 22–24, 2019	No memorable winter would be complete without a hallmark storm, and this one was the fiercest one in a winter brimming with contenders. The brunt of the storm missed the Twin Cities, but blizzard conditions quickly developed in the south. Roads became impassible over the southern fifth of the state. Governor Walz declared a State of Emergency in Freeborn and Steele Counties. The National Guard troops were used to rescue stranded motorists and the St. Cloud State men's hockey team had to find shelter in the Watonwan County Jail. Winter "Bomb"
January 17 to 18, 2020	A strong winter storm developed as an upper-level trough moved across the Northern Plains. Initially light freezing rain and snow caused dangerous travel conditions as this system was approaching Friday January 17. Strong southeast winds gusting as high as 60 mph resulted in blowing snow and even whiteout conditions across southeast North Dakota and the Red River Valley in Minnesota through the day on the 17th. Eventually heavy snow spread across the region from the south to the north late afternoon through the night, with several bands resulting in higher totals in excess of 8 inches. While there was a lull in winds as they shifted, strong northwest winds arrived during the nighttime period and blizzard conditions developed across the entire Red River Valley into the Devils Lake Basin. These blizzard conditions continued through the afternoon Saturday January 18th mainly in the open country. (NWS, 2020)

5.10.2 Probability of Occurrence

As shown in the section above, Minnesota experiences a variety of severe winter weather events annually. Although it is impossible to predict probabilities for this type of event over short periods of time, the state can presumably expect one ice and ice/snow storm every year on average and one major annual blizzard.

The Winter Storm Dashboard on the Plan website depicts the average annual number of various winter weather events for each county in Minnesota

5.10.3 Vulnerability

Transportation systems, electrical distribution systems, and structures are vulnerable to winter storms throughout the entire state. Damage and disruption affect the state dramatically in numerous ways. However, while dollar amounts have been stated in the disaster history, total damages due to winter storms and weather cannot be easily and comprehensively assessed.

Winter storms tend to be very disruptive to transportation and commerce. Some storms can coat trees, cars, roads, and other surfaces with ice. Even small accumulations of ice can be extremely hazardous to motorists, bicyclists, and pedestrians. The most prevalent impacts of heavy accumulations of ice are slippery roads and walkways that lead to vehicle and pedestrian accidents; collapsed roofs from fallen trees and limbs and heavy ice and snow loads; and felled trees, telephone poles and lines, electrical wires, and communication towers. As a result of severe ice storms, telecommunications and power can be disrupted for days. Heavy snow or accumulated ice can also isolate people from assistance or services.

Heavy accumulations of ice can bring down electrical wires, telephone lines, and even trees, telephone poles, and communication towers. The NWS notes that a significant number of snow and ice storm-related deaths are the result of traffic accidents. Heavy snow events may cause structural damage due to the weight of snow accumulation.

Some of the longest duration power outages are caused by winter storms due to the widespread impact this type of event can have. Typically, the southern third of Minnesota is at risk for damage from severe winter storms due to the icing that can occur on the overhead power lines and structures. From the 2023 Electric Cooperative Survey, winter storms were ranked the most adversely impactful to utility infrastructure by 68% of respondents (HSEM, 2023).

Counties prioritize winter weather as high, moderate, or low hazard risk based on all kinds of perceptions and mitigation capabilities that don't appear to trend geographically. A county ranking the hazard high may be adjacent to a county that ranks the risk low. This could be due to very localized vulnerabilities such as demographics, access to services, resilience of energy infrastructure, and historical events that had a lasting impression on the community.

The FEMA National Risk Index was used to demonstrate winter storm vulnerability in the Winter Storm Risk & Vulnerability Dashboard

5.10.4 Winter Storms and Climate Change

Historically, winter storms have had a large impact on public safety in Minnesota. If the frequency of snowstorms and annual total snowfalls increase, as anticipated effects of Climate Change, the effects on public safety will also increase. Pressures on energy use, reduced reliability of services, potential outages, and potential rise in household energy costs are major climate change risks to public health that can occur from winter weather.

Table 6 in Section 3.6.1 discusses confidence that climate change will impact common Minnesota weather/climate hazards beyond 2025, there is some weak evidence that warming winters may make heavy snowfall events less frequent as winter warms.

5.11 Coastal Erosion and Flooding

This plan identifies coastal erosion and flooding as a hazard of moderate risk and separates it from other erosion and flooding as hazards. 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 storm intensity and lake levels, which vary due to precipitation, evaporation, and other natural processes. Ice cover, or the lack thereof, 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, 2018).

Northeast Minnesota has 189 miles of Lake Superior shoreline and a coastal population of 216,268 (NOAA, 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.

Erosion along 36 miles of unstable, tall clay shoreline is a particular problem for the north shore of Lake Superior Typically, shorelines are quite high—25 feet or higher in many places—and erosion and bluff instability can harm the aquatic zone near the shore.

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 wider (USACE, 1974). Occasional dramatic losses of rare beach habitat as well as shoreline encroachment into residential years are of great concern to residents of the Point. Dredging/beach nourishment projects continue today. The United States Army Corps of Engineers (USACE) is currently conducting a Section 111 Study to determine if and to what extent the federal structures cause or exacerbate erosion of Minnesota Point. Upon completion of the Study, USACE will present findings, propose a solution, and indicate USACE liability for the cost of the fix. The City of Duluth will be responsible for costs not covered by USACE.

In addition to the USACE study, there are currently two efforts underway to increase understanding of the issues and support longer term resilience of Minnesota Point. With support from the Association of State Floodplain Managers (ASFPM), Coastal Program and staff from City of Duluth, Fond du Lac Band of Lake Superior Chippewa, the Park Point Community Club, and University of Minnesota Duluth (UMD) are working together on a project to increase understanding of Minnesota Point hazard issues and develop best practices and an action plan. Further, a citizen-led effort to develop a 50-year plan for resilience, called MP50, is meeting quarterly with staff of the City of Duluth, the Coastal Program, and University of Minnesota –Duluth and the Duluth Seaway Port Authority. The group has held events to increase awareness of the issues and seek input and support for a plan to reduce flooding and erosion.

Large lakes in Minnesota can also experience coastal erosion and lakeshore flooding. The Lake of the Woods, located in the northern most part of the state and a southern portion of the Canadian provinces of Ontario and Manitoba, is the sixth largest freshwater lake that is partially located in the United States. The Lake of the Woods is large enough in size (300,000 acres) and has wind fetch lengths long and wide enough (ranging from 25 to 32 miles) to lead to substantial wave growth and wind setup conditions throughout the lake (USACE, 2017).

A Great Lakes Coastal Flood Study was initiated in 2014 for the purpose of updating the coastal flood hazard information and Flood Insurance Rate Maps (FIRM) for Great Lakes coastal communities using analysis of historic storm and high water events and an extensive storm surge study (FEMA, 2018).Preliminary FEMA maps are now available for St. Louis County.

5.11.1 Coastal Erosion History

Severe flood events on the Lake Superior coast may 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 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, dunes, 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 (FEMA, 2018). In addition, periods of high water levels have plagued the city of Duluth's sanitary sewer collection system with flooding (Berg, 1985) and contribute to storm-sewer overflows and discharges of raw sewage into Lake Superior.

Major storm winds and waves come from the northeast, with a great impact on the north and northeast-facing shores. The differences in coastal aspects result in areas of higher and lower susceptibility among Lake Superior coasts. Johnson et al. (1995) 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. Many landowners inquire at SWCDs and County P&Zs and are surprised to find they've bought or built in an erosion hazard area. Cities also are concerned about coastal erosion, especially as it affects infrastructure.

A lack of validated current coastal erosion data has weakened coastal setback enforcement on the North Shore of Lake Superior. The Coastal Erosion Hazard Mapping (CEHM) initiative combines current research and technology to produce a coastal erosion rate map and to develop common guidance for landowners (ARDC, 2022). The North Shore Erosion Mapping Tool, data viewer developed through CEHM, identifies erosion potential in high, medium, and low categories. CEHM has also leveraged NOAA's 2019 Great Lakes Hardened Shoreline Classification which classifies shoreline type, structure type and structure condition (NOAA, 2019b). The USGS Inventory of landslides in the northwestern, northeastern, southern, and southeastern parts of Minnesota provides location of coastal landslides with estimated dates (DeLong, et al., 2022).

The City of Duluth completed a FEMA Advanced Assistance Coastal Resilience and Mitigation Study from Kitchi Gammi Park to the St. Louis County line and for the harbor side of Park Point Recreation area. The City of Duluth also completed studies and projects for coastal armoring and recreation amenities from the lake side of Canal Park to 20th Avenue East (City of Duluth, 2022). A significant coastal erosion mitigation project in the City of Duluth's Kitchi Gammi Park (Brighton Beach) is underway. When complete, the park will feature a stabilized shore with public improvements at a safer shoreline setback and elevation.

Many Duluth residents along the shore have completed their own private improvements to repair shorelines with armoring and seawall installation, to reduce future shoreline erosion and loss of "land"/property and ultimately protect homes and other structures. The city has built seawalls and riprap along Congdon Blvd to protect the roadway and utilities.

5.11.2 Coastal Flooding History

The NCEI storm events database reports six lakeshore (coastal) flooding events on the north shore of Lake Superior. These occurred in 2017, 2018, and 2019 (four episodes). The four episodes recorded between 2019 and 2023 are summarized in Table 54 (NCEI, 2023).

Table 54. Lakeshore coastal flooding events, 2019–2023

Date	County	Description
10/21/2019	St. Louis	Large waves in excess of 12 feet and potentially record high water levels led to water pushing ashore into the Canal Park and Park Point areas. Large logs and rocks were being pushed up onto the beach along these locations as well. Access to Park Point over the Duluth Aerial Lift Bridge was suspended for a time due to water over the roadway on the bridge approach. Damage occurred to homes and property along Park Point as well.
11/30/2019	St. Louis	A prolonged period of strong northeast winds pushed water onto shore in the Canal Park area leading to flooding there and along Harbor Drive, closing the street, on the harbor side of Canal Park. Access to Park Point was closed at the Aerial Lift Bridge for a period due to deep water at the foot of the approach. Eventually, limited access was provided to residents of Park Point. Additionally, beach erosion from the waves was widespread along Park Point.
12/1/2019	St. Louis	A prolonged period of strong northeast winds pushed water on shore in the Canal Park area leading to flooding there and along Harbor Drive, closing the street, on the harbor side of Canal Park. Access to Park Point was closed at the Aerial Lift Bridge for a period due to deep water at the foot of the approach. Eventually, limited access was provided to residents of Park Point. Additionally, beach erosion from the waves was widespread along Park Point.
12/29/2019	Cook	Persistent northeast winds and large waves led to water flooding the streets of downtown Grand Marais.

In October 2018, winds of 64 mph were reported at 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. This storm also caused residents of Minnesota Point to be blocked off from the City of Duluth because of the aerial lift bridge closure.

Local and state officials called on FEMA, which provided a hazard mitigation grant of more than $9 million for construction of a new Lakewalk. Consulting coastal engineers designed a new seawall that would last longer and withstand stronger storms (FEMA, 2022b).

5.11.3 Probability of Occurrence

The frequency of coastal flooding events is not able to be stated based on a shorter period of reporting relative to the time cycles of water levels that contribute to large lakeshore flooding events in Minnesota. Since the almost three decades that events have been recorded in the NCEI storm events database (1996), all events have occurred in the last decade. (NCEI, 2023).

Regulatory flood zone mapping will include coastal AE and VE zones along the Lake Superior shoreline. Coastal AE Zones contain a wave height component, ranging from 0 to 3 feet in height. VE Zones have a wave component that is greater than 3 feet in height (FEMA, 2021; NOAA, 2019a). Updates to the discovery and mapping process are found on the [Great Lakes Coastal Flood Study] website. Preliminary FEMA maps are available for St. Louis County.

Coastal erosion is usually a gradual process, and sudden incidents prompting emergency action are rare. Such rare events include strong storms with high winds or heavy wave action that can cause sudden failure of bluffs. Coastal property owners are acutely aware of hazards during periods of high-water levels and especially right after a damaging storm or a bluff failure, but this awareness can fade over time if low lake levels slow the erosion rate.

5.11.4 Vulnerability

Wind, waves, water levels, and human activities constantly affect the communities along the shores of the Great Lakes. Shoreline flooding and erosion are natural processes, occurring at high, average, and even low Great Lakes' water levels. However, during periods of high water, flooding and erosion are more obvious, causing serious damage to homes and businesses, roads, water and wastewater treatment facilities, and other structures in coastal communities. Long-term and seasonal variations in precipitation and evaporation rates primarily control the Great Lakes' water levels and their fluctuations.

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).

As the frequency of high lake levels increase, bluff recession rates also increase. Increasing assaults by wave action against the base of the bluff cause erosion and beach-building sediments. Navigational improvements and dredge-material disposal practices deplete both tributary and shore land sources of sediment; removing these sediments from the shore system contributes to erosion. Ice ridges that form and break up each winter along the shoreline cause erosion by trapping sand in floating fragments of ice that are carried offshore into deep water. This continual natural process is one of the principal mechanisms by which sand is lost from the near shore system.

The apparent increasing frequency and severity of coastal storms has instigated an urgent need to improve the resiliency of coastal infrastructure. The City of Duluth, in partnership with St. Louis County, intends to apply for a FEMA Hazard Mitigation grant to cost-effectively increase the resilience of coastal infrastructure to improve current conditions and mitigate future hazards (Lake Superior Coastal Hazard Mitigation Project Stakeholder Advisory Group, 2022).

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.

Continued shoreline development is probable, and it contributes to erosion problems. Erosion rates can accelerate with increases in impervious surfaces, changing and eliminating vegetation cover, and alterations to the beach sand. 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.

Low elevation beaches and sandspits, such as that of Minnesota Point in St. Louis County, are vulnerable to even minor fluctuations in lake levels, which may induce significant coastal flooding and erosion problems.

5.11.5 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 2 °C per decade, Lake Superior's rising water temperatures are leading to more storm events. Li et. al modelled increasing wave action with warming Lake Superior water temperatures to demonstrate that increasing storm events in recent years will intensify with high water levels (Li et al., 2021). Increased wave action due to high water levels are also evidenced in the Great Lakes Coastal Flood Study for Lake Superior (FEMA, 2018).

5.12 Erosion, Landslides, and Mudslides

Erosion and other forms of slope failure resulting in landslide and mudslide events are hazards caused by numerous diverse mechanisms. 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, erosion, fire, or additional human-induced activities. Slopes greater than ten degrees are more likely to slide, as are slopes where the height from the top of the slope to its toe is greater than 40 feet. Slopes are also more likely to fail if vegetative cover is low and/or soil water content is high. Potential impacts include environmental disturbance, property and infrastructure damage, and injuries or fatalities (FEMA, 2013).

The USGS definition of landslides includes a wide range of ground movement, such as rock falls, deep failure of slopes, and shallow debris flows. Although gravity acting on an over-steepened slope is the primary reason for a landslide, there are other contributing factors. Rivers create steepened slopes with erosion over time, rock and soil slopes are weakened through saturation by snowmelt or heavy rains, and the excess weight from accumulation of rain or snow or from man-made structures can stress weak slopes (DeLong, et al., 2022).

The most common type of landslide in Minnesota are shallow slope failures that occur during heavy rain (DeLong, et al., 2022). Landslides and mudslides often occur together with other major natural disasters, thereby exacerbating relief and reconstruction efforts. Wildfires may remove vegetation from hillsides, significantly increasing runoff and landslide potential. Floods and landslides are closely related, and both involve precipitation, runoff, and ground saturation that may be the result of severe thunderstorms. However, landslides also take place over time and often take place when no natural disaster is evident.

Streambank erosion is a natural process, but acceleration of this natural process leads to land loss, stream channel instability, increased sediment, habitat loss, and other adverse effects. Bank erosion takes place by two processes, channel migration and channel widening. Widening of channels can be caused by natural processes of incision and bank erosion or by direct modification by construction activities. The result is more erosion from stream bed and banks, increased sediment deposition, and loss of habitat. Increased flows due to watershed changes, stormwater runoff, reservoir releases, and scour below culverts and bridges can all contribute to channel enlargement and therefore bank erosion (Day, 2013).

Bluff erosion occurs on features with greater than ten feet of relief in a 20–30-foot area. The vertical nature of bluffs makes them susceptible to sudden and catastrophic failure. During periods of moderate and high flow, bluffs are eroded by the river in deeply incised channels lacking a floodplain. Bluffs also fail due to landslides and mass wasting. The river removes soil deposited by mass wasting and landslides. As a result the eroded, nearly vertical slope cannot stabilize and reestablish itself with vegetation (Day, 2013). Coastal erosion and wave action due to storms on large lake shorelines can also lead to landslides. Coastal erosion and coastal flooding are addressed in Section 5.11.

5.12.1 Landslide History

On December 2, 2023, a 19-year-old man died in a landslide at Minneopa State Park near Mankato, Minnesota in Blue Earth County. This was the most tragic landslide event since 2019; however, there have been other notable landslide events in Minnesota in the last two decades (MPR, 2023).

On April 28, 2018, an estimated 400,000 pounds of rock and soil came loose on the bluff to cover Wabasha Street in Ramsey County. After having an engineering firm study the slope, city officials decided to build a 12-foot-high retaining wall that will run about 250 feet along Wabasha Street. Ramsey County received $766,770 from the state's disaster-assistance fund to help with repair costs (Stanley, 2018).

Minnesota's wettest recorded month in June 2014 led to a federal disaster level failure beneath Fairview Riverside Hospital Minneapolis. Two years prior, a similarly rainy period resulted in loss of life as well as property damage (Jennings, 2016).

On May 22nd, 2013, two children were killed, and four more people injured in a landslide in Lilydale Regional Park along the Mississippi River. The incident was preceded by several weeks of heavy rain, which inundated the soils around the area (Gottfried, 2013). Engineers investigating the landslide said that groundwater played a major role and that all bluff areas like Lilydale have similar risks.

The 2012 flood washed out roads and caused larger landslides along highway 210 in Jay Cooke State Park, which took five years and $21.3 million to repair (Kraker, D., 2017).

The 2021 USGS publication of an inventory of landslides presents an overview of the distribution of landslides in many of the most landslide-prone areas of Minnesota. This resource, identified as an action in the 2019 Minnesota State Plan, has greatly helped Minnesota HSEM as well as planners and resource managers to understand the landslide hazard in Minnesota (DeLong, S.B. et al., 2021). The landslide inventory documents landslide point locations (observed or in historical records), and scarp or deposit areas observed or indicated using LiDAR data.

This inventory is included in the Landslide History, Risk, and Vulnerability Dashboard on the Plan website

Features were recorded in 44 counties in the USGS landslide inventory statewide; 39 counties included more than ten landscape features in this inventory.

The Minnesota Department of Transportation (MnDOT) provided spatial data from a slope vulnerability assessment completed statewide in 2019. This assessment sought to identify slope failure risks along state trunk highways in several MnDOT districts. Then using GIS modeling, researchers mapped and ranked slopes along highways according to failure vulnerability and then developed a method for MnDOT to quantify failure risk for asset and emergency management planning. The assessment resulted in a statewide map also shown the Landslide Risk Dashboard classifying potential risks areas into four categories: high risk—a site visit or action is recommended; moderate risk—further evaluation is required, low risk—the area should be monitored, or no action is required. The MnDOT assessment classified 191,852 acres in the state highway corridors as high risk, 84,283 acres as moderate risk, and 43,283 for monitoring.

5.12.2 Probability of Occurrence

Landslide susceptible areas within Minnesota primarily occur on steep slopes adjacent to rivers, lakes, and transportation corridors. The local variation in landslide susceptibility is related to the underlying geology and glacial history (DeLong, S.B. et al., 2021).

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

Landslides are most likely to occur in the landslide prone areas where slope failures have already been documented. The ten counties with the most landslide features in the USGS landslide inventory are shown in Table 55.

Table 55. Counties with ten or more landslide features in USGS Inventory and acres of at-risk highway corridor

County	Total Landslide Features	Acres of highway corridor at moderate or high risk for slope failure.
Blue Earth	2225	4319
Carlton	1803	3944
Saint Louis	1687	9275
Nicollet	1411	2477
Brown	721	1926
Polk	640	10568
Sibley	616	2733
Le Sueur	535	1320
Norman	511	3265
Hennepin	487	6211
Fillmore	465	7521
Cook	462	3103
Scott	404	1777
Red Lake	363	2324
Winona	311	7206
Clay	301	6818

County	Total Landslide Features	Acres of highway corridor at moderate or high risk for slope failure.
Carver	257	2957
Olmsted	224	3089
Kittson	221	2495
Houston	216	3139
Lake	186	5832
Faribault	107	839
Wilkin	93	1876
Cottonwood	84	899
Otter Tail	79	66
Mahnomen	75	3262
Marshall	75	1167
Ramsey	74	3636
Washington	64	2880
Dakota	63	2538
Wabasha	54	5960
Goodhue	49	48812
Redwood	34	1071
Martin	29	383
Waseca	27	414
Watonwan	18	662
Wright	16	8115
Anoka	15	492
Dodge	12	864
Rice	10	1421

Source: (DeLong, S.B. et al., 2021; Muehlbach et al., 2019)

5.12.3 Vulnerability

Human life and safety, structures, and infrastructure are all vulnerable to landslides. Erosion is a statewide hazard, but the drivers of landslide susceptibility vary widely within the state. All streams in Minnesota are susceptible to erosion with damaging erosion occurring during a flash flood caused by a heavy rain event or up to sixty years of the hydraulic pressure exerted on its banks. However, the Minnesota and Red River Valleys each have unique erosion concerns based on the geomorphology of the valleys. Agricultural practices can create conditions conducive to landslide occurrence just as urban land use does.

In De Long, et al., four major areas of different landslide susceptibility were studied: the Red River, the North Shore of Lake Superior, The Minnesota River to the Twin Cities, and the Mississippi River Valley in Southeast Minnesota. At some point glaciers covered every part of Minnesota and later deposited unconsolidated sediment varying in materials and stability. Flowing water from melting glaciers formed river valleys bounded by steep and potentially unstable slopes in these areas (DeLong, S.B. et al., 2021).

The Red River Valley

Clays are present in northwestern Minnesota because the Red River Valley is the floor of ancient glacial Lake Agassiz, a large lake that formed at the edge of a retreating ice-age (Clayton & Moran, 1982). Both glacial and lake sediments were deposited, and these clays are exposed along the rivers of the Red River Valley. bank failures are typically the result of slumping in which a block of earth moves downward along a curved failure plane, commonly with a backward rotation of the slump block.

North Shore of Lake Superior

Red clay erosion is significant in the western Lake Superior basin. The predominant red clays are interspersed with sands and silts that are geologically young and are undergoing a high rate of natural erosion. Surveys of land erosion have been compiled since the 1977 to address the pervasive erosion and associated damages and costs (EPA, 1980).

The Lake Superior South watershed represents the glacial ice margin in with unconsolidated glacial material that causes great variation in the underlying geology. The diverse geology across this region could explain trends in the frequency and distribution of slope failures and the different types of failures that occur, but also presents a challenge for modeling landslide susceptibility (Richard, 2020).

Minnesota River to the Twin Cities

Deeply incised rivers in Blue Earth County create unique hazards not seen in other areas in Minnesota. The geologic history of this area paired with modern land use, creates rivers highly susceptible to significant bluff failures, bank erosion, and ravine growth (Day, 2013)

The river bluffs around the Twin Cities have a high risk of natural landslides in the spring, when ice thaws within the bluff and destabilizes rock (Stanley, 2018). Marine sedimentary units under exposed bedrock allows undercutting facilitated by springs, sapping, and mechanical erosion (Jennings, 2016).

Dry sand and gravel lack cohesion and typically seek an angle of repose of approximately 30 to 45° depending on the average grain size and mixture. If storm water is focused and creates a ravine in dry sediment, newly formed steep slopes quickly fail to the angle of repose. This style of failure has occurred along the high terraces of the Minnesota River in Eden Prairie both recently and historically (Jennings, 2016).

All the landslide incidents involving loss of life, and several of the incidents involving critical infrastructure damage have occurred in the Minnesota River Valley.

Mississippi River Valley in Southeast Minnesota

In southeastern Minnesota, which was not glaciated in the most recent glacial period, rivers have eroded through older glacial sediment and bedrock, resulting in steep bedrock slopes prone to landslides that incorporate bedrock debris (DeLong, et al., 2022).

5.12.4 Landslides and Climate Change

The conditions that make certain lithologies more vulnerable to erosion, landslides, and mudslides will be exacerbated by the expected increase in the magnitude and frequency of flooding events. The expected increase in storm activity from climate change may increase the risk of soil saturation. Changing summer storm intensity may result in increased runoff and higher flows, leading to near channel erosion (DeLong, et al., 2022).

According to NCA5, Key Message #1 in the Land Chapter, climate change has increased regional intensity and frequency of extreme rain, droughts, temperature highs, fires, and urban floods, threatening roads and other infrastructure.

Structures of all kinds are at risk where there may be increases in erosion, slope failure, fire, flooding, and shoreline retreat. Water supplies have been threatened in California years fire, as erosion and extreme rain washes excess sediment and pollutants downstream, shortening the lifespan of water-storage reservoirs (Thornton et al., 2023).

5.13 Land Subsidence (Sinkholes and Karst)

Subsidence is the gradual settling or sudden sinking of the earth's surface due to subsurface movement of earth materials. Subsidence commonly involves a gradual sinking, but it also refers to an instantaneous or catastrophic collapse. The level of subsidence ranges from a broad lowering to collapse of land surface. Many causes of subsidence are human induced, such as groundwater pumping, aquifer system compaction, drainage of organic soils, underground mining, and hydrocompaction. Natural compaction and thawing permafrost can also have natural causes of subsidence. Areas located above or adjacent to karst topography have a greater risk of experiencing subsidence. Sudden collapses of surface areas can damage and destroy buildings and infrastructure (FEMA, 2013).Other problems associated with subsidence include the formation of sinkholes, flooding and pollution.

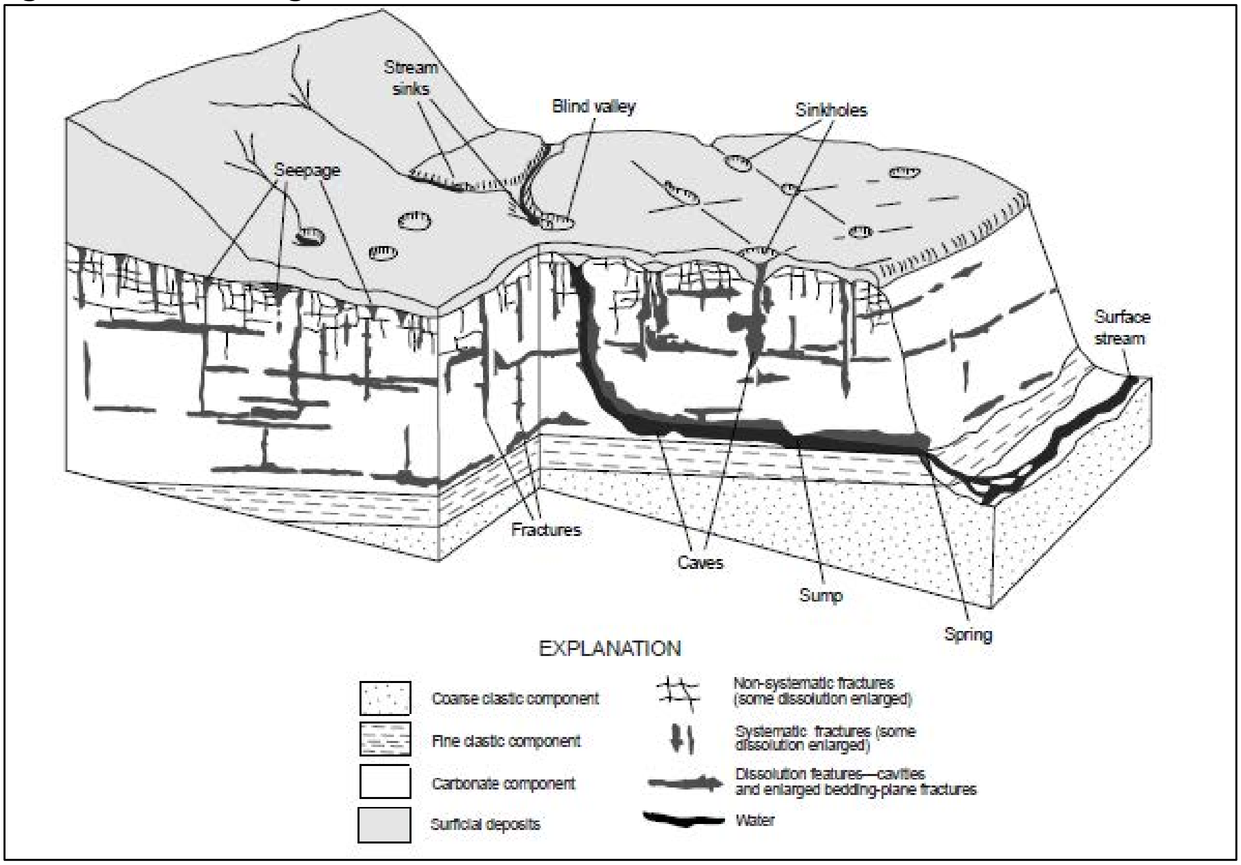
The change in the local environment affecting the soil mass causing subsidence and sinkholes collapse is called a triggering mechanism. Water is the main factor affecting the local environment that causes subsidence. The main triggering mechanisms for subsidence are water level decline, changes in groundwater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

Sinkholes and subsidence are also common in those areas of the state underlain by abandoned coal and iron mines. Pillows left for roof support in the mines generally deteriorate over time and eventually collapse, removing roof support. This is particularly a problem where mines underlie more recently developed residential areas and roads.

In Minnesota, the primary natural causes of land subsidence are karst landforms, which develop on or in limestone, dolomite, or gypsum by dissolution and are identified by the presence of features such as sinkholes, underground (or internal) drainage through solution-enlarged fractures (joints), and caves. Karst landforms can be hazardous because of the sinkholes that form there and for the ease with which pollutants can infiltrate into the water supply. Figure 14 illustrates a cross-section of karst drainage and related landforms, karst-prone areas, and karst lands in southeastern corner of the state.

University of Minnesota and MN DNR karst geologists have found various karst features as far north as Pine County. The areas shown on the map in Figure 15 in Section 5.13.2 are areas where karst features can form on the land surface and where karst conditions are present in the subsurface. Karst processes provide a direct, rapid exchange between surface and ground waters and significantly increase the risk of groundwater contamination from surface pollutants.

Figure 14. Karst drainage and related landforms



SOURCE: (LIVELY, 2020)

5.13.1 Land Subsidence History

In Minnesota, limestone and dolostone underlie the southeastern corner of the state, which includes the Minneapolis-St. Paul Metropolitan Area. Similar rocks are also found deep beneath the surface in northwestern Minnesota. In southeastern Minnesota, carbonate rocks from the Cedar Valley Group of geological formations down through the bottom of the Prairie du Chien Group contain caves and other karst features. Because most of Minnesota is buried beneath a thick cover of glacial sediments, the karst landscape may not be apparent. In parts of southeastern Minnesota, erosion has removed most of this glacial cover and exposed the carbonate bedrock. Counties known for karst features include parts of Dakota, Rice, Dodge, and Mower, and most of Goodhue, Olmstead, Winona, Wabasha, Houston, and Fillmore. Fillmore County has more caves, sinkholes, and disappearing streams than all other Minnesota counties combined.

According to 2024 data from the MN DNR, there 15,619 sinkholes, 289 stream sinks/sieves, and 93 tile drain outlets in Minnesota (MN DNR, UMN, 2024).

The limestone landscape in southeastern Minnesota makes the protection of water resources difficult. Petroleum and other chemicals released from underground storage can travel quickly into groundwater supplies. Manure from agricultural spills can result in fish kills miles from the release point. Chemicals used on the landscape can reappear at unexpected times and locations. As rainwater infiltrates limestone, hidden, rapid pathways can form between pollution release points and drinking water wells and surface water. This quick transportation of pollutants means that conventional hydrogeologic tools, such as monitoring wells, are limited in their usefulness (MPCA, 2018).

The collapse of carbonate bedrock beneath liquid storage basins has been reported in Minnesota. Since 1976, three communities in southeastern Minnesota (Altura, Bellechester, and Lewiston) have had municipal sewage lagoons collapse, resulting in millions of gallons of sewage being released into a nearby aquifer (MPCA, 2018).

In July of 2018, a sinkhole opened up in Redwood Falls after heavy rain. One person drove into the sinkhole but was not injured due to his seatbelt and airbag (ABC7 News, 2018).

Another sinkhole appeared on Highway 61 on June 20, 2014 following heavy rains during the previous 24 hours. Ramsey County Parks noted the sinkhole in the median of Highway 61, just south of the intersection of County Road B and Highway 61, according to information in the 2018 Ramsey County HMP.

In June of 2016, another Ramsey County resident reported that a sinkhole on city park property behind her residence had become quite large. Originally, she noticed it to be a foot wide and a foot deep. About a week later, it was three feet wide and much deeper.

5.13.2 Probability of Occurrence

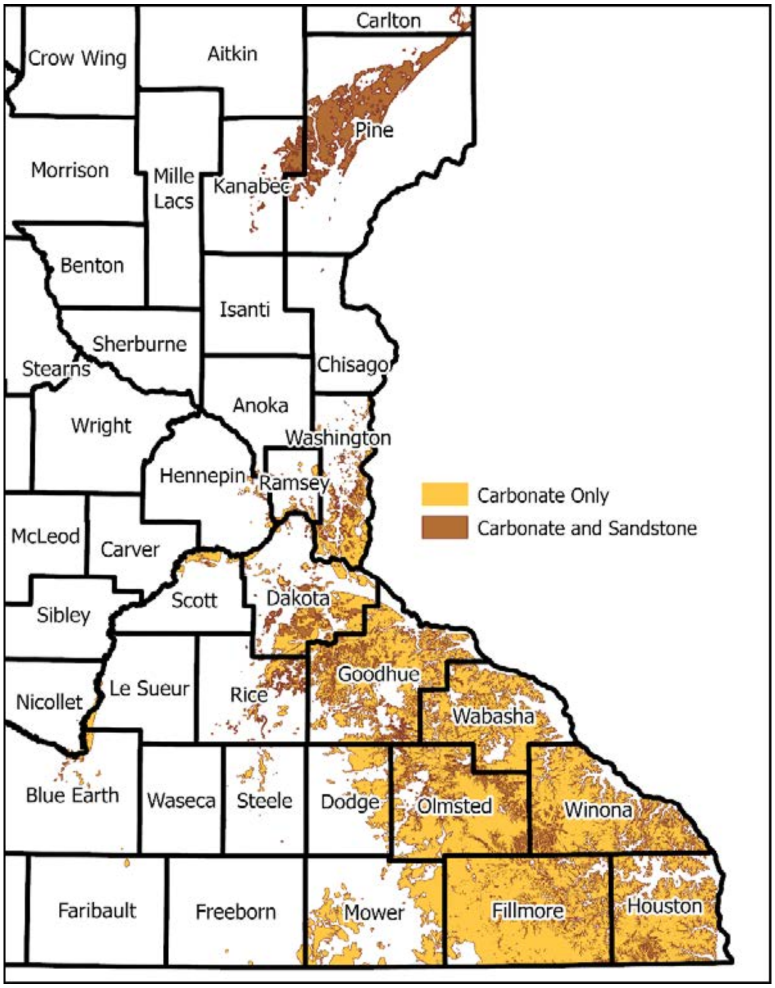
The probability of sinkholes and land subsidence in Minnesota is directly related to local landscape conditions and triggers likely to produce these conditions. Sinkhole probability is highly site-specific and cannot be accurately characterized on a statewide basis, except in the most general sense. In Minnesota, karst features are most widespread in the southeast. Figure 15 shows the extent of karst-prone areas in the state and know features related to land subsidence on top of these areas.

5.13.3 Vulnerability

Table 56 shows the vulnerability of Minnesota counties to land subsidence from sinkholes, stream sinks/sieves and springs. The counties of Fillmore, Olmsted, and Winona have the highest vulnerability based on the number of significant karst features.

While Fillmore County has more sinkholes than all other Minnesota counties combined, the 2017 Fillmore County HMP notes that the county has not recorded any significant sinkhole, cave collapse, or subsidence-related disasters.

Figure 15. Karst features in Minnesota



Source: (MN DNR, 2024a)

According to the 2017 Wabasha County HMP, issues relating to land subsidence since Wabasha County's previous plan in 2009 were minimal. The Wabasha Soil and Water Conservation District (SWCD) works with the Natural Resource Conservation Service (NRCS) on practices to address sinkholes and with other agencies to monitor and assess related effects. The SWCD also collaborates with NRCS to educate the public on karst landforms and sinkholes.

The 2018 Winona County HMP notes that the county maintains an ongoing, but limited, education and awareness program through the SWCD in relationship to karst features and the dangers associated with sinkholes. Winona County also maintains a specific ordinance for karst, which restricts new development in areas with karst features. Olmsted County's Zoning Ordinance regulates development in areas prone to land subsidence.

While most of Minnesota's karst features are located in the southeastern corner of the state, Pine County in east-central Minnesota has 573 sinkholes and 24 stream sinks/sieves. Approximately 15% of the county is estimated as karst-prone (MN DNR, UMN, 2024).

Table 56. Top ten Minnesota counties with significant karst features

County	Number Karst Features Recorded	Count of Structures in Karst-prone Area Buildings in features	Acres in Karst-prone Area	2020 Total Population in Karst-prone Area
Fillmore	10,975	18,507	441,058	17,048
Olmsted	1702	45,674	302,814	112,523
Winona	1671	10,678	253,830	13,829
Goodhue	514	12,678	227,403	19,603
Houston	378	8500	205,735	8260
Wabasha	268	6923	179,793	7219
Pine	623	5660	155,196	7205
Mower	394	11,970	116,263	21880

Dakota	78	16,648	113,511	37464
Washington	63	10,678	61,580	66334

Source:(MN DNR, 2024c; MN DNR, UMN, 2024; U.S. Census Bureau, 2020)

5.13.4 Land Subsidence and Climate Change

The increased magnitude and frequency of flooding events resulting from climate change may in turn increase the risk of land subsidence in Minnesota if associated geological conditions exist.

5.14 Extreme Cold

Winter in Minnesota can be a brutal and dangerous time. Low temperatures and arctic-like wind chill factors can cause cold-related illnesses such as frostbite and hypothermia which can be deadly.

Wind Chill is a term used to describe what the air temperature feels like due to the combination of cold temperatures and winds blowing on exposed skin. As wind increases, heat is carried away from the body at a faster rate, driving down both skin temperature (which can cause frostbite) and eventually the internal body temperature (which can cause hypothermia) (NWS, 2024b).

Frostbite occurs when skin tissue and blood vessels are damaged from exposure to temperatures below 32°F. The most susceptible parts of the body are fingers, toes, ear lobes, or the tip of the nose. Hypothermia occurs when the body temperature falls below 95°F. Young children under the age of two and the elderly (more than 60 years of age) are most susceptible to hypothermia. Anyone who is exposed to severe cold without enough protection can develop hypothermia. Hypothermia is the greatest and most life-threatening cold weather danger.

The National Weather Service (NWS) issues Wind Chill Advisories and Wind Chill Warnings. The six WFOs in Minnesota use slightly different criteria for issuing cold-related advisories and warnings. A Wind Chill Advisory is issued when wind chill values are forecast to be at or below -20°F to -25°F (depending on the WFO's temperature threshold) for more than an hour. A Wind Chill Warning is issued when wind chill values are forecast to be at or below -35 °F to -40 °F (depending on the WFO's temperature threshold) for more than an hour.

5.14.1 Extreme Cold History

Extreme cold temperatures affect the state nearly every year. A record low temperature for Minnesota of -60°F was set in the town of Tower on February 2, 1996. Numerous record low temperatures were set during the same period at St. Cloud, Rochester, and the Twin Cities. Minneapolis/St. Paul set three new record low temperatures as well as recording the second 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 record low temperature set in the Twin Cities and the coldest temperature recorded this century. The Governor closed all schools that day.

Since the 2019 State Plan, two deaths in January 2019 and two deaths in December 2022 were attributed to extreme cold events. While few deaths or injuries tend to be reported in the NCEI Storm Events Database as directly attributable to extreme cold events, indirect deaths due to stress on those with other serious health conditions were likely to have occurred (NCEI, 2023).

The following are Events including extreme cold from 2019-2023 in Minnesota from the MN Department of Natural Resources Climate Journal (MN DNR, 2023a).

In early February 2021, Minnesota experienced a sudden and intense cold outbreak, with temperatures plunging well below normal and lasting until February 20th or 21st. Despite not being historically extreme, the event brought some of the coldest temperatures of the winter, with numerous stations recording lows of -40 degrees Fahrenheit or lower. Particularly notable was the prolonged duration and the lateness of the cold snap in the season, contrasting with the previous mild winter months, which had ranked among the warmest on record for many stations in the state.

In March 2019, Minnesota experienced an Arctic cold outbreak, breaking numerous cold weather records across the state and resulting in some of the coldest daytime temperatures ever recorded for that time of year. Despite the extreme cold, there were no reported deaths or significant damage. Notable facts include temperatures falling into the -10s and -20s, with wind chills reaching -30s and -40s, and several stations recording their lowest March high temperatures on record.

In January 2019, Minnesota experienced an Arctic outbreak, with some of the lowest air temperatures since 1996 and wind chills reaching levels not seen since the 1980s. The extreme cold led to natural gas shortages, power outages affecting 7,000 customers, broken water mains, and an increase in frostbite cases. Schools were closed for four days, the University of Minnesota shut down, and the Twin Cities saw wind chills as low as -55 °F, the coldest since January 1985 (MN DNR, 2023a).

5.14.2 Probability of Occurrence

Based on records in the NCEI Storm Events Database through October of 2023, the relative frequency of extreme cold/wind chill events is over 90 extreme cold/wind chill events each year statewide. Below zero temperatures occur 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 (NCEI, 2023). The measure of ≤-18 °F is used as the threshold for counting extreme cold days in Minnesota based on a general standard used by the National Weather Service for recording such an event in the NCEI Storm Events Database (NWS, 2021a).

> *The Extreme Cold History Dashboard includes a map of MN weather stations across the state and reports the average number of days each year that a daily minimum temperature of ≤ –18 °F is recorded.*

The Midwestern Regional Climate Center summarizes the annual average number of days with at least one hour of wind chills greater than or equal to -20 °F. In Minnesota this varies from an average of 39.4 days in International Falls to an average of 15.3 days in Minneapolis–St Paul (MRCC, 2024).

5.14.3 Vulnerability

The risk of extreme cold does not vary geographically within the state. Residents living in climates such as these must always be prepared for situations that put their lives or property at risk. The youngest and more elderly residents, homeless persons, individuals with chronic medical conditions, and those who are working or recreating outdoors are most at risk for frostbite and hypothermia (MDH, 2021).

It is not always the depth of the cold that poses a threat but rather unpreparedness for the cold, such as an individual with a vehicle breakdown who lacks a personal winter safety kit in the vehicle. The cost of propane can make rural residents more vulnerable to issues with extreme cold. A propane shortage and resulting crisis, such as that which occurred in 2014, may increase the cost of heating homes and farms to a prohibitive amount (Eaton, 2014). The Minnesota Department of Commerce presents options and suggestions for homeowners who use propane (COMM, 2024).

The CDC publication “Extreme Cold: A Prevention Guide to Promote Your Personal Health and Safety” outlines preparation measures that individuals can take to reduce their vulnerability to extreme cold. Highlights in this document include advice about travel preparations, securing your home water supply, and safety during recreation (CDC, 2021).

The FEMA National Risk Index was used to demonstrate extreme cold vulnerability in the Extreme Cold Risk & Vulnerability Dashboard.

5.14.4 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, cold temperatures have always been a part of Minnesota’s climate, and extreme cold events will continue.

As the climate changes, an increase in extreme precipitation or storm events could lead to a higher risk of residents being exposed to cold temperatures during power outages or other storm-related hazards. Extreme and changing temperatures are already challenging aging infrastructure and are expected to impair surface transportation and the electrical grid.

Key Message #4 in NCA5 in the Midwest Chapter states that green infrastructure and public and private investments may mitigate losses, provide relief from heat, and offer other ways to adapt the built environment to a changing climate.

5.15 Earthquake

An earthquake is a sudden motion or trembling caused by an abrupt release of accumulated strain in the tectonic plates that comprise the earth’s crust. These rigid plates are some 50 to 60 miles in thickness and move slowly and continuously over the earth’s interior. The plates meet along their edges, where they move away, past or under each other at rates varying from less than a fraction of an inch up to five inches per year. While this movement sounds minimal, at a rate of two inches per year a distance of 30 miles would be covered in approximately one million years (FEMA, 1997).

The tectonic plates continually bump, slide, catch and hold as they move past each other which causes stress to accumulate along faults. When this stress exceeds the elastic limit of the rock, an earthquake occurs, immediately causing ground motion and seismic activity. Secondary hazards may also occur, such as surface faulting, sinkholes, and landslides. While the majority of earthquakes occur near the edges of the tectonic plates, earthquakes may also occur at the interior of plates.

The vibration or shaking of the ground during an earthquake is described by ground motion. The severity of ground motion generally increases with the amount of energy released and decreases with distance from the fault or epicenter of the earthquake. Ground motion causes waves in the earth's interior, also known as seismic waves, and along the earth's surface, known as surface waves. The following are the two kinds of seismic waves:

- **P (primary) waves** are longitudinal or compressional waves similar in character to sound waves that cause back-and-forth oscillation along the direction of travel (vertical motion), with particle motion in the same direction as wave travel. They move through the earth at approximately 15,000 mph.
- **S (secondary) waves**, also known as **shear waves**, are slower than P waves and cause structures to vibrate from side-to-side (horizontal motion) due to particle motion at right-angles to the direction of wave travel. Unreinforced buildings are more easily damaged by S waves.

Seismic activity is described in terms of magnitude and intensity. *Magnitude* (M) describes the total energy released by the seismic wave, commonly referred to using the Richter scale, and *Intensity* (I) subjectively describes the effects at a particular location. Although an earthquake has only one magnitude, its intensity varies by location. Magnitude is expressed on a logarithmic scale, meaning that an increase in value of one digit equates to a 10-fold increase that may in turn equate to approximately 30 times more energy. The largest known earthquakes have had magnitudes around 9.0, and the famous San Francisco earthquake of 1906 had a magnitude near 8.3. Although there have been notable exceptions, earthquakes with magnitudes less than 5.5 usually do not cause major damage or injuries. Intensity is a measure based on people's observations or felt reports at a particular location and is expressed by the Modified Mercalli Intensity (MMI) scale.

Another way of expressing an earthquake's severity is to compare its acceleration to the normal acceleration due to gravity. If an object is dropped while standing on the surface of the earth (ignoring wind resistance), it will fall towards earth and accelerate faster and faster until reaching terminal velocity. The acceleration due to gravity is often called "g" and is equal to 9.8 meters per second squared (980 cm/sec/sec). This means that every second something falls towards earth, its velocity increases by 9.8 meters per second. Peak Ground Acceleration (PGA) measures the rate of change of motion relative to the rate of acceleration due to gravity. For example, acceleration of the ground surface of 244 cm/sec/sec equals a PGA of 25%. All of Minnesota falls within the lowest category of PGA measures detectable.

It is possible to approximate the relationship between PGA, the Richter scale and the MMI (Table 57). The relationships are, at best, approximate, and depend upon such specifics as the distance from the epicenter and depth of the epicenter. An earthquake with 10% PGA would roughly correspond to an MMI intensity of V or VI, described as being felt by everyone, overturning unstable objects, or moving heavy furniture.

The peak acceleration in Minnesota is depicted on the Earthquake History, Risk, and Vulnerability Dashboard on the Plan website

Table 57. Earthquake PGA, magnitude, and intensity comparison

PGA (%g)	Magnitude (Richter)	Intensity (MMI)	Description (MMI)
<0.17	1.0–3.0	I	*I.* Not felt except by a very few under especially favorable conditions.
			II. Felt only by a few persons at rest, especially on upper floors of buildings.
0.17–1.4	3.0–3.9	II–III	*III.* Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck.
1.4–9.2	4.0–4.9	IV–V	*IV.* Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rock noticeably. *V.* Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
9.2–34	5.0–5.9	VI–VII	*VI.* Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight. *VII.* Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
34–124	6.0–6.9	VII–IX	*VIII*. Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. *IX.* Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
>124	7.0 and higher	VIII or higher	*X*. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent. *XI*. Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.

PGA (%g)	Magnitude (Richter)	Intensity (MMI)	Description (MMI)
			XII. Damage total. Lines of sight and level are distorted. Objects thrown into the air.

SOURCE: (WALD ET AL., 1999)

5.15.1 Earthquake History

The Midwest is far from any plate margin, but even here, earthquakes do occasionally happen. Although the earthquake-generating mechanism in the Midwest is not completely understood, it may be related to the westward drift of the North American plate away from its spreading center, the Mid-Atlantic ridge, toward the subduction and transform zones along the Pacific coast. This westward drift sets up a subtle but pervasive compression that is oriented roughly east-west for most of North America, and this stress can reactivate minor movement along some ancient faults. The great forces that originally formed these ancient faults have long since ceased, but the faults themselves remain as zones of weakness that, if oriented appropriately to the modern stress field, could be slightly reactivated.

Minnesota has one of the lowest occurrence levels of earthquakes in the United States, but a total of 21 small to moderate earthquakes have been documented since 1860 (Table 58). Although the two earliest recorded earthquakes may have had magnitudes of 4.7 to 5.0, the 1917 Staples earthquake documented a 4.3 magnitude. The largest earthquake on record in Minnesota occurred in 1975, with a magnitude of 4.6 and an intensity of VI. Also felt in Iowa and the Dakotas, the earthquake damaged walls and basement foundations in the town of Morris, located in Stevens County. Although less dramatic than the Staples or Morris events, the 1993 Dumont earthquake and the 1994 Granite Falls earthquake are more typical of those that occur in Minnesota. The magnitude 4.1 Dumont earthquake was felt over 26,873 square miles and was associated with intensity V-VI near the epicenter. The shaking near the epicenter was accompanied by a loud, explosive noise that alarmed many people, but no injuries or serious damage occurred. In contrast to the Dumont event, the much weaker Granite Falls earthquake (magnitude 3.1) was felt over only 4,478 square miles, and although intensity V may have occurred locally near the epicenter, most reported intensities were III to IV.

Some areas of Minnesota experience earthquake-like events because of mining explosions. From 1997 to 2023 there were 256 recorded events with the vast majority of these located around mining operations in the Iron Range. These explosions ranged in magnitude from 1.8 to 3.4, with an average magnitude of 2.9. These explosions are not included in the report, tables, or maps of Minnesota's earthquake history, which focuses only on naturally occurring seismic activity.

The most recent earthquake in Minnesota occurred in 2017 near Mankato, with a magnitude of 2.8. Although the event was initially reported as an explosion from a quarry blast (Reinan, 2017), further analysis resulted in USGS reclassifying this event as an earthquake (USGS, 2017). There were no reports of significant damage. Table 58 documents Minnesota's earthquake history.

Several earthquakes occurring outside of Minnesota have still been felt in the state. In the autumn of 1968, an earthquake in Illinois was strong enough to be felt throughout the Twin Cities area and southern Minnesota, with a maximum intensity of I–IV.

Table 58. Earthquakes in Minnesota, 1860–2023

Epicenter (Nearest Town)	Date	Maximum Intensity	Magnitude
Mankato	04/25/2017	V	2.8
Alexandria	04/29/2011	III	2.5
Granite Falls	02/09/1994	V	3.1
Dumont	06/04/1993	V–VI	4.1
Walker	09/27/1982	II	2.0
Cottage Grove	04/24/1981	III–IV	3.6
Nisswa	07/26/1979	III	1.0
Rush City	05/14/1979	N/A	0.1
Evergreen	04/16/1979	N/A	3.1
Milaca	03/05/1979	N/A	1.0
Morris	07/09/1975	VI	4.7
Pipestone	09/28/1964	N/A	3.4
Alexandria	02/15/1950	V	3.6
Detroit Lakes	01/28/1939	IV	3.9
Bowstring	12/23/1928	IV	3.8
Staples	09/03/1917	VI–VII	4.3
Red Lake	02/06/1917	V	3.8
New Ulm	02/12/1881	VI	3.0–4.0
St. Vincent	12/28/1880	II–IV	3.6
New Prague	12/16/1860	VI	4.7
Long Prairie	(Date unknown) 1860–61	VI–VII	5.0

Source: (Minnesota Geological Survey, 2020)

5.15.2 Probability of Occurrence

Probabilistic ground motion maps are typically used to assess the magnitude and frequency of seismic events. These maps measure the probability of exceeding a certain ground motion, expressed as peak ground acceleration (PGA), over a specified period of years. The magnitudes of earthquakes are generally measured using the Richter scale. The severity of earthquakes is site specific and influenced by proximity to the epicenter and soil type, among other factors.

According to the Minnesota Geological Survey (MGS), Minnesota has one of the lowest occurrence levels of earthquakes in the United States. MGS further notes that although weak to moderate earthquakes do occur occasionally in Minnesota, a severe earthquake is very unlikely. Average recurrence rates for Minnesota earthquakes have been estimated by the MGS (Mooney, 1979) as follows:

- Magnitude 4.0–10 years
- Magnitude 4.5–30 years
- Magnitude 5.0–89 years
- Magnitude 5.5–266 years

Current data and knowledge indicate that, although weak to moderate earthquakes do occur occasionally in Minnesota, a severe earthquake is very unlikely. Although a zero probability of a damaging earthquake occurring in the time span of a human life cannot be assigned, the threat is very small compared to other natural hazards such as flooding and tornadoes.

5.15.3 Vulnerability

The entire state of Minnesota has a low vulnerability to earthquakes. The absence of major earthquakes, together with the infrequency of earthquakes in general, implies a low risk level for Minnesota. An earthquake history for the state has significant implications for public policy. For example, the location and design of nuclear power plants must be guided by an assessment of the probability of a damaging earthquake. Minnesota has two nuclear plants in operation, at Prairie Island (near Red Wing) and Monticello. The Monticello plant lies within the probable felt areas of three Minnesota earthquakes. The Prairie Island plant probably lies within the felt area of one Minnesota earthquake, as well as within the felt areas of several earthquakes with epicenters outside of Minnesota.

Building construction codes present another aspect of public policy dependent upon earthquake history. Certain standards of construction must be met depending upon earthquake zoning classification. The Uniform Building Code of the International Conference of Building Officials assigns every location in the United States to a five-grade Seismic Risk Zone (0 = least risk; 4 = greatest risk); Minnesota rates in Seismic Risk Zone 0. North Dakota and Wisconsin are also in Zone 0 in their entirety, in addition to most of Iowa and South Dakota.

5.15.4 Earthquakes and Climate Change

There is no evidence that climate change will increase the risk of earthquakes in Minnesota.

Section 6 Human-Caused Hazards

6.1 Introduction

This plan also includes an overview of seven human-caused hazards: structure and vehicle fires, ground and surface water supply, hazardous materials, nuclear incidents, infectious disease outbreaks, transportation incidents, and terrorism. Compared with the natural hazards included in this Plan, the hazards included in this section are believed to be of moderate to low probability and mitigation potential. HSEM coordinates with other state agencies that are charged with monitoring risk and developing mitigation tools for these plans. Strategies and actions for these hazards are not included in this Plan.

Human-caused hazards are assessed below by stating historical events, plans and programs in place, and any known expected vulnerabilities due to climate change.

6.2 Structure and Vehicle Fires

This section addresses fires to property that are not considered wildfires. The two types of property fires are classified as structure fires and vehicle fires.

- **Structure fires** are classified by occupancy of a structure and include a variety of buildings including assembly, business, educational, industrial, institutional, mercantile, storage, and residential. Residential buildings include single-family homes, multi-family homes, apartments, hotels, and motels. Structures are classified by the occupancy and the type of hazards and risks associated with the use of that structure.
- **Vehicle fires** include those occurring to mobile property such as aircraft, automobiles, trucks, trains, buses, and boats.

Fires have many causes: cooking, unintentional, electrical malfunction, open flame, and arson are the typical leading causes each year. Each year the State Fire Marshal Division works directly with the fire departments across the state of Minnesota to report the causes of fires. While there are a wide variety of fire causes, the number one cause year after year is related to cooking.

Weather events may cause structural fires in their aftermath. Downed power lines, natural gas leaks, or other sources of ignition initiated by natural hazards may spark structure fires. Routes to structures for response vehicles may be restricted due to flooding or debris from storms. Blizzards and ice storms may also impair the movement of response vehicles. Operation of critical response facilities located in flood hazard zones may be impaired if they become inundated with floodwaters.

Extreme cold can also increase the risk of household fires. When homes are too cold due to power failures or inadequate heating systems, residents are more likely to use alternative heating methods such as space heaters, wood-burning stoves, and fireplaces, all of which increase fire risk. The highest percentage of heating fires in Minnesota involve fireplaces or chimneys followed by heating units including boilers and furnaces. High heating costs can also prompt the use of alternative heating methods.

6.2.1 Fire History

According to the 2021 report Fire in Minnesota by the DPS State Fire Marshal Division (SFMD), there have been 1,647 civilian deaths in Minnesota since 1990. According to 2020 U.S. Census data, 45% of the state population lives in greater Minnesota, where the per capita fire death rate in 2021 was 1.69 deaths for every 100,000 people. In the Twin Cities Metro Region, the per capita fire death rate for the same year was 0.76 per 100,000 people. This equates to a statewide rate of 1.17 deaths per 100,000, which is slightly above the national per capita fire death rate (1.15 per 100,000). In 2021, over $343 million in property loss. At the time the 2021 report was written, three Minnesota counties had been fatality-free for the previous 28 years: Traverse, Stevens, and Murray (SFDM, 2021).

Across Minnesota in 2021, one fire was reported every 30 minutes and 55 seconds. One structure fire was reported every 1.27 hours. Rural structure fires occurred every 3.09 hours, and metro structure fires occurred every 2.40 hours. One arson fire was reported every 10.38 hours (SFDM, 2021).

In 2022, there were 70 civilian deaths in the state due to fires, the highest number in 27 years (Schindeldecker, 2023).

6.2.2 Plans and Programs in Place

Funding for fire suppression and education is available through the Federal Assistance to Firefighters Grant (AFG), Staffing for Adequate Fire and Emergency Response (SAFER) Grants, and Fire Prevention and Safety (FP&S) Grants. Firefighter training reimbursement is available through the Minnesota Board of Firefighter Training and Education.

Minnesota State Fire Code, fire prevention, investigation, and automatic sprinkler information are available through the State Fire Marshal.

6.3 Ground and Surface Water Supply

Clean water is a prized commodity. Increased population, climate change, pollution, and unabated water usage are leading to shortages of drinking water around the world. With more than 11,000 lakes, 69,000 river and stream miles, and extensive groundwater systems, water is a major part of Minnesota's culture, economy, and natural ecosystems. Minnesota is fortunate in its abundance of clean water, but potential misuse or mishaps may negatively impact the opportunities afforded by this important resource.

Groundwater is an important resource for residents of Minnesota, providing drinking water for 75% of residents and irrigation for agriculture, which is a large contributor to Minnesota's economy. Monitoring groundwater quality and availability is vital for preserving this natural resource. Ground water quality in Minnesota is generally good and is most concerned by naturally occurring amounts of arsenic and boron, and human sources of nitrate, pesticides, fuel oils, and industrial chemicals. Groundwater in parts of the central and southwestern regions of the state is contaminated with high nitrate concentrations from agriculture. Nitrate levels are higher in groundwater under agricultural land than water below urban areas (MPCA, 2024).

Availability of groundwater in Minnesota varies by region and is generally more difficult to access in the northeast and is scarce and/or nonexistent in areas of the southwest (MPCA, 2024). The availability of groundwater is most dependent upon geologic conditions that determine the type and properties of aquifers (MN DNR, 2021a).

Minnesota's groundwater systems are a function of the state's geology. There are three basic types of aquifers in Minnesota: igneous and metamorphic rock aquifers, sedimentary rock aquifers, and glacial sand and gravel aquifers. Areas where the characteristics of the groundwater system are similar are summarized in six groundwater provinces described below.

Province 1: Sand aquifers are usually greater than 100 feet thick and yield large quantities of water. Aquifers in agricultural areas often have high concentrations of nitrate and pesticides may be in low concentration. Low concentrations of fuel oils and industrial chemicals are often found in shallow aquifers from urban areas.

Province 2: Small, isolated sand and gravel aquifers occur more than 100 feet below the land surface. Deeper sedimentary rock aquifers provide moderate to good quantities of water. Aquifers are generally safe from contamination but may have high concentrations of dissolved chemicals such as calcium.

Province 3: Sedimentary rock aquifers provide large quantities of water. When these aquifers are close to the land surface, they are vulnerable to contamination. In these aquifers, nitrate is often present at high concentrations and pesticides are detected. Sand aquifers generally occur only along rivers.

Province 4: Sand aquifers are thick and yield large quantities of water. When these aquifers are near the land surface, they may be vulnerable to contamination. In agricultural areas, shallow groundwater often has detectable concentrations of pesticides and high concentrations of nitrate. Bedrock aquifers yield low to moderate quantities of water in areas where sand aquifers do not occur.

Province 5: Sand aquifers are isolated and occur more than 100 feet below the land surface. In areas where these are not present, bedrock aquifers provide low to moderate quantities of water. Aquifers are generally not vulnerable to contamination except sand aquifers located along rivers. Groundwater often contains a high concentration of dissolved chemicals, such as calcium and sulfate.

Province 6: Igneous and metamorphic rocks occur at or near the land surface. Groundwater occurs in fractures and faults in this rock. The quantities of available water are small. Water quality varies with this type of rock. Concentrations of dissolved solids are usually low, but concentrations of iron, manganese, and boron can be high.

The groundwater provinces are depicted in Figure 16. Minnesota's principal aquifers are overlaid on this map (MN DNR, 2021a; MPCA, 2024).

There are many ways water supplies, aquifers, and wells may become contaminated, including the following examples:

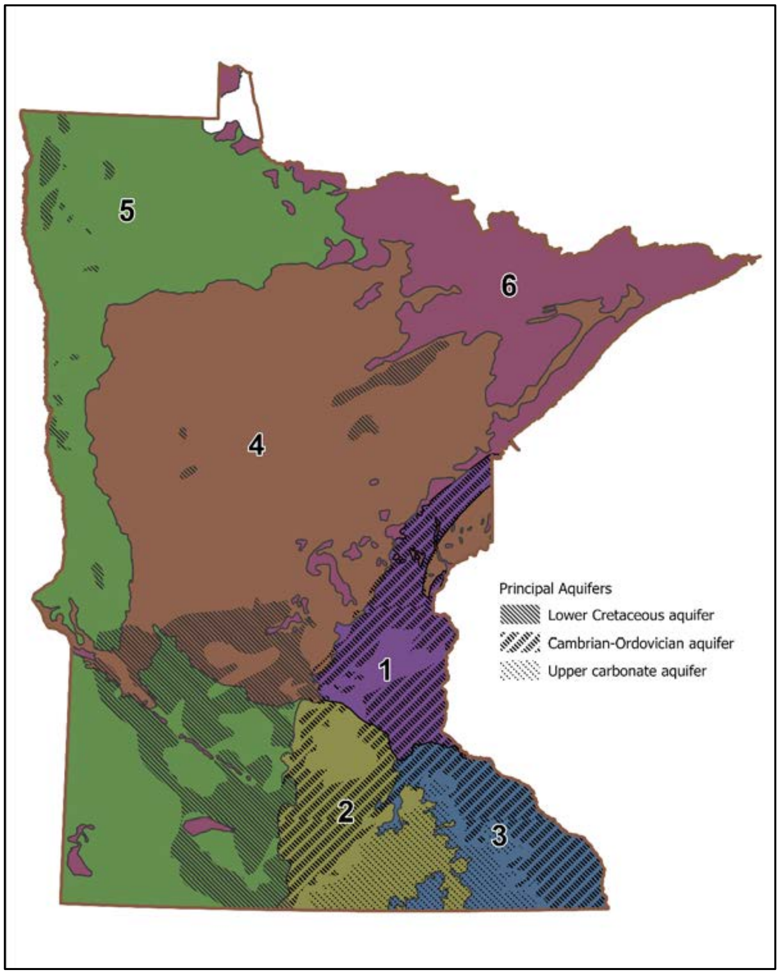
- Sewage, partially treated wastewater, sludge
- Leakage from underground storage tanks
- Stormwater runoff
- Runoff from construction sites
- Mines, tailings, and spoils

- Landfills and dumps
- Industrial effluents and dumps
- Pesticides
- Animal production wastes
- Agricultural run-off from crops

Flooding is a primary hazard that leads to water contamination. Bacteria and nitrate from farms, septic systems, and other sources flow into wells and aquifers affecting drinking water supplies. Sewage bypass from treatment plants into streams is caused by damage to the plant or lack of treatment capacity. Levees containing tailing in ponds may rupture releasing the metals and minerals into streams and aquifers. Hazardous material storage at facilities like gas stations, chemical plants, and landfills may fail leading to a release of contents. Impacts to clean water from floods may be mitigated with proper design, maintenance, and monitoring of point sources for pollution.

Drought impacts the availability of clean water. Details about drought are in Section 5.6 of this Plan. The [Aquifer Storage and Recovery Project] in Salina, Puerto Rico by FEMA is an example of how to address drought in relation to clean water. In 2015, Puerto Rico suffered nearly a yearlong drought that drastically affected the water supply and farmlands throughout many communities on the island. FEMA funded a project in 2016 to recharge aquifers from streams that would eventually drain into the sea. Similarly in Minnesota, communities are installing retention basins and rain gardens to decrease stormwater discharge. A side benefit of these projects may be the charging of aquifers to ensure that there are ample water supplies for the future.

Figure 16. Groundwater provinces and principal aquifers



Runoff and erosion increase turbidity and contribute to algae in freshwater. Heavy rains and flooding accelerate this situation. Increased flow in streams accelerates erosion of streambanks where soils are loose and inadequately protected. Eroded soils mix with water and are transported downstream and increase sediment along the way to the mouth of the major river. Large areas not equipped to handle runoff, such as construction sites, have soils that find their way into stormwater systems unless protective measures are taken.

Runoff from fields and lawns treated with phosphorus-rich fertilizer provides nutrition for algae blooms that negatively impact habitat. Measures taken by local jurisdictions and property owners could increase the health of streams and lakes.

Three-quarters of Minnesota's residents get their water from aquifer-tapping wells, and today parts of the state seem to be on a path that is not sustainable. Some cities have to look harder for good municipal water or pay to treat it. In the Twin Cities, concern is growing over whether suburbs should shift from tapping wells to pulling water from the Mississippi River. Elsewhere, Park Rapids, Marshall, and other cities have had to spend millions of dollars to respond to dropping water levels or contamination. Research is also taking place regarding use of nitrates in agriculture and how to reduce water use to maintain lawns.

Solutions are being implemented to slow water from entering the sewage infrastructure, to reduce flooding, and to reduce demands on water supply. Some examples include the City of Mankato re-using wastewater to wash city-owned vehicles and to sell to landscapers (Dunbar, 2014), rain-harvesting for use in toilets and landscaping at the St Paul Saints Stadium (CHS Field, 2018), and use of stormwater to water many golf courses (Humphreys, 2021).

6.3.1 Plans and Programs in Place

Clean Water, Land, and Legacy Amendment

Minnesotans care deeply about the quality and availability of their water. In 2008, citizens chose to invest in water resources. Minnesotans voted to increase their sales tax by three-eighths of 1% and passed the Clean Water, Land, and Legacy Amendment. From July 1, 2009, through June 30, 2034, about $90 million will be invested annually from the Clean Water Fund to protect drinking water sources and to protect, enhance, and restore lakes, rivers, streams, and groundwater. With this significant investment comes a responsibility to ensure progress is being made and that funds are making a difference for the state's water resources and its citizens.

Seven state agencies are charged with specific responsibilities in managing Minnesota's water resources: Metropolitan Council, Minnesota Board of Water & Soil Resources, Minnesota Department of Agriculture, Minnesota Department of Health, Minnesota Department of Natural Resources, Minnesota Pollution Control Agency, and the Minnesota Public Facilities Authority.

Following the initial passage of the Clean Water, Land and Legacy Amendment, decision makers and stakeholders alike have raised questions about the water resource outcomes Minnesotans can expect to achieve after 25 years of investment, as well as the pace of progress that will be required to achieve those outcomes over time.

Minnesota's Clean Water Roadmap lays out a course for the future that includes long-term goals and interim benchmarks for statewide outcomes that can be achieved with Clean Water Fund investments. Ultimately, the Roadmap is a big picture guide for more detailed planning and policymaking and is not itself a specific plan or strategy (Clean Water Fund, 2014).

The Clean Water Roadmap will help the seven agencies with Clean Water Fund responsibilities:

- Define aspirational, yet achievable goals for outcomes associated with 25 years of Clean Water Fund expenditures,
- Establish interim benchmarks, to assess progress towards the 25-year goals,
- Adjust program or funding priorities based on progress made towards the benchmarks and the 25-year goals, and
- Create realistic expectations among interested stakeholders and citizens about the potential for progress with the addition of Clean Water Fund dollars.

The Clean Water Legacy funds tracking page shows funding to date and links to information about the projects funded.

Minnesota Buffer Law

Minnesota's buffer law establishes new perennial vegetation buffers of up to 50 feet along lakes, rivers, and streams and buffers of up to 16.5 feet along ditches. These buffers will help filter out phosphorous, nitrogen, and sediment. According to a BWSR report, statewide, 89% of the parcels adjacent to Minnesota waters meet preliminary compliance with the law. Soil Water Conservation Districts (SWCDs) are reporting encouraging progress in their work with landowners around the state. BWSR also provides support for shore and streambank restoration to SWCDs (MN BWSR, 2018).

Drinking Water Protection Program

The Minnesota Department of Health (MDH) is the state authority for drinking water. Several programs at MDH work together to ensure safe and adequate drinking water. The Drinking Water Protection program focuses on public water supplies. Public water supplies serve 25 people or more in places where they live, work, gather, and play. Program functions include:

- Helping public water suppliers to protect the water supply (groundwater, river, or lake).
- Administering grants to protect water supplies and for infrastructure and activities.
- Coordinating training and certification for water operators.
- Reviewing plans for new infrastructure or changes in water treatment procedures.
- Enforcing federal safe drinking water standards through inspections and corrective action.
- Sampling water or assisting public water operators in sampling.
- Helping public water suppliers address contamination problems.
- Communicating important information about drinking water with the public and other stakeholders.

In addition, MDH provides pre- and post-disaster support regarding the safety of the drinking water supply with testing and technical advice on how to protect and restore safe water supplies. See: MDH Drinking Water Protection.

River Health and Restoration

One of the primary objectives of the MN DNR's River Ecology Unit is to ensure that an adequate amount of water is flowing in rivers and streams throughout the year to protect fish and wildlife. This is done by studying rivers in each of the state's 39 major watersheds to determine how much water these ecosystems need to be healthy. In conjunction with natural flow regimes, healthy rivers have stable banks, high water quality, natural shapes, variation in depths, water velocities, streambed substrates, types of cover, connectivity to other water bodies, and healthy floodplains. The River Ecology Unit is also actively involved in restoring degraded stream channels. Restoration projects that the program has worked on include the removal or modification of dams on the Pomme de Terre River in Appleton and on the Red River of the North in Fargo/Moorhead. Since the 2019 plan, the unit greatly expanded efforts related to the Geomorphic Approach for road/watercourse intersections, and is administering a Clean Water Legacy funded culvert/bridge replacement cost share grant in 2023-2024. See: DNR River Ecology Unit.

Soil and Water Conservation Districts (SWCDs)

SWCDs were formed in the early to mid-1940s in response to national concern over floods, erosion, and the dust storms of the 1930s. Today, SWCDs work in partnership with federal, state, and local governments to conserve and manage land and water resources in the county where they are located. The Dakota County SWCD provides a comprehensive catalog of resources to address diverse conservation challenges relating to clean water. These resources exemplify potential resources provided by SWCDs statewide.

6.4 Hazardous Material Incidents

Approximately 6,000 facilities in Minnesota report their storage of hazardous chemicals to the DPS EPCRA Program and their local fire department. Facilities meeting the reporting criteria submit this information annually as required under Section 312 of the federal Emergency Planning and Community Right-to-Know Act (EPCRA). The information is used by emergency planners and responders to plan for and respond to hazardous materials emergencies.

Over 400 facilities in Minnesota report their routine chemical emissions and on- and off-site chemical management activities to the DPS EPCRA Program and the U.S. Environmental Protection Agency (EPA). Facilities meeting the reporting criteria submit this information annually as required under Section 313 of the federal EPCRA, known as the Toxic Release Inventory (TRI). TRI data can be used to prioritize environmental regulatory efforts and promote pollution prevention and waste reduction.

Nearly 400 facilities in Minnesota submit Risk Management Plans (RMPs) to the EPA, summarizing procedures they have implemented to prevent accidental releases of certain chemicals into the air. Facilities meeting the reporting criteria submit this information every five years as required under Section 112r of the Clean Air Act Amendments of 1990. The information is used by emergency planners and responders to plan for and respond to hazardous chemical emergencies.

Hazardous material releases may occur from any of the following:

- Fixed site facilities (e.g., refineries, chemical plants, storage facilities, manufacturing, warehouses, wastewater treatment plants, swimming pools, dry cleaners, automotive sales/repair, gas stations)
- Highway and rail transportation (e.g., tanker trucks, chemical trucks, railroad tankers and intermodal containers)
- Marine transportation (e.g., bulk liquefied gas carriers, oil tankers, tank barges)
- Air transportation (e.g., cargo packages)
- Pipeline transportation (e.g., liquid petroleum, natural gas, other chemicals)

The Office of Pipeline Safety, which is housed within DPS, has overseen pipeline operations throughout the state since 1987. The main office is in St. Paul, with field offices located in Grand Rapids, Detroit Lakes, and Mankato. In Minnesota, there are 93 pipeline operators, nearly 1.5 million gas meters, over 65,000 miles of pipeline, and 900 to 1000 inspection days annually.

Natural hazards, such as wildfires, floods, high winds, and lightning may act as catalyst for a hazardous materials release. For example, people are often warned to shut off natural and propane gas when floods are imminent to prevent structural fires. More often, releases are related to human activity, including terrorism.

The secondary events to a leak or spill may expose humans, animals, and food to toxins. Fires and explosions may expose large areas to contaminants. Populations may need to be evacuated, monitored, decontaminated, and perhaps treated for exposure. Long-term remediation before normal activity resumes may impact the state's tourism if natural resources are involved. Impacts to commerce may occur due to transportation stoppage or embargo of food products.

6.4.1 Hazardous Materials Incident History

Table 59 shows significant events in Minnesota for all hazardous material modes including pipelines. Initiating calls appear under all appropriate categories. For example, a spill call requiring CAT/ERT response is listed under both "Spills" and "CAT/ERT Request." These numbers reflect only calls resulting in a Minnesota Duty Officer (MDO) report.

The MPCA's Emergency Management Unit (EMU) fields over 2,500 spill calls annually in the state, including chemical fires, train derailments, pipeline breaks and tanker truck accidents, among others.

On March 30, 2023, at 1 a.m., a Burlington Northern Santa Fe (BNSF) train derailed in Raymond, Minnesota. Two cars containing denatured ethanol, a highly flammable product, ruptured and caught fire. Seven ethanol cars were in the derailment pileup and three more were also burning from their lids or bottom valves. The cars on fire continued to burn for two days. There were also six other ethanol cars involved in the derailment that were not in the fire area. The local fire department and law enforcement ordered a mandatory evacuation of the city (NTSB, 2023).

Table 59. 2022 annual initiating calls to Minnesota Duty Officer (MDO)

Initiating Call Category	Initiating calls to MDO*
Air Quality	127
Fire Marshal Investigation	408
Methamphetamine Lab	0
Spills	2639
Wastewater Bypass	140
**Bomb Squad	131
**Chemical Assessment Team/Emergency Response Team Request (CAT/ERT)	36
**Pipeline Break/Leak	102
**Tank Pulls (Contaminated Soil)	229
**SARA Title III Release	15
**WMD Threat	0

**Related to discharges of oil and hazardous substances.

Source: MDO W. Waterkamp, personal communication, October 10, 2023

6.4.2 Plans and Programs in Place

The links below profile the wide range of capabilities available in Minnesota regarding hazardous materials:

- Gopher State One Call
- Office of Pipeline Safety
- Minnesota Duty Officer Program
- Emergency Planning and Community Right-To-Know Act (EPCRA)
- HSEM Emergency Response
- MPCA Emergency Response

6.5 Nuclear-Generating Plant Incidents

Nuclear-generating plants use the heat from nuclear fission in a contained environment to convert water to steam. Steam then powers generators to produce electricity. The design, construction, and operation of nuclear generating plants are closely monitored by the U.S. Nuclear Regulatory Commission (NRC).

In 2006, the Minnesota Department of Health (MDH) assumed part of the NRC's regulatory authority over certain radioactive materials in the state. Since then, the MDH is responsible for licensing, rulemaking, inspection, and enforcement activities for: (1) radioactive materials produced as a result of processes related to the production or utilization of special nuclear material; (2) uranium and thorium source materials; and (3) special nuclear material in quantities not sufficient to form a critical mass.

The potential danger from an accident at a nuclear generating plant is exposure to radiation. This exposure would most probably come from the release of radioactive material from the plant to the environment. The release may be characterized by a plume (cloud-like formation) of radioactive gasses and particles. The major hazards to the people in the vicinity of the plume are radiation exposure to the body from the cloud and particles deposited on the ground, inhalation of radioactive materials, and ingestion of radioactive materials.

The effects of radiation exposure depend on the intensity and length of time of exposure to radiation. Low exposure, comparable to chest x-rays, may slightly increase the risk of cancer. Much higher exposure can cause fatalities.

Nuclear generating plants do not explode like nuclear detonation devices since the fuel is of low enrichment. There is no risk of a nuclear explosion with the associated physical mass destruction (Patrick McLaughlin, HSEM, Personal Communication, August 18, 2023)

6.5.1 Nuclear-Generating Plant History

The Monticello Nuclear Generating Plant (MNGP), located in Monticello, Minnesota, is owned by Xcel Energy Inc. It is a one-unit, boiling water reactor, rated at 671-megawatt capacity. MNGP completed a nine-year process of virtually rebuilding the plant to increase its generation an additional 71 megawatts. Major equipment was installed during the refueling/power uprate outages in 2009, 2011, and 2013. The plant generates approximately 10% of the electricity used by Xcel's customers in the Upper Midwest.

MNGP began commercial operation in June 1971. In 2006, the NRC renewed MNGP's license for 20 years, which allows operations until 2030.

The Prairie Island Nuclear Generating Plant is located five miles north of Red Wing, Minnesota, and is also owned by Xcel Energy Inc. The plant has two pressurized water reactors, which generate approximately 20% of the energy used by Xcel's customers in the Upper Midwest. The two reactors combined produce 1,100 megawatts of electricity and began operation in 1973 (unit 1) and 1974 (unit 2). The NRC initially licensed the reactors for 40 years of operation, and then extended the licenses for 20 more years, until 2033 and 2034.

On December 7, 1979, following the March 1979 Three-Mile Island nuclear power plant accident in Pennsylvania, President Carter transferred the federal lead role in off-site radiological emergency planning and preparedness activities from the NRC to the Federal Emergency Management Agency (FEMA). FEMA established the Radiological Emergency Preparedness (REP) Program to (1) ensure that the public health and safety of citizens living around commercial nuclear power plants would be adequately protected in the event of a nuclear power station accident and (2) inform and educate the public about radiological emergency preparedness. FEMA's REP Program responsibilities encompass only off-site activities; that is state and local government emergency preparedness activities that take place beyond the nuclear power plant boundaries. Onsite activities continue to be the responsibility of the NRC.

6.5.2 Plans and Programs in Place

Annual exercises are held so the NRC and FEMA may evaluate utility, local, and state response organizations. In addition, FEMA evaluates the local and state plans and preparation activities annually and issues a letter of certification if the planning for a response to an incident provides reasonable assuredness of safety to the public.

Nuclear power plants are not immune to natural hazards, but the potential impacts are minimal. Sites are evaluated for vulnerabilities to natural hazards before a construction permit is issued. Plants are then designed to withstand the most violent forces of nature. Procedures are also developed to implement regimens to protect the plant. The aftermath of a natural hazard should have no impact to public health and safety based on the robust design of the facility and the vigilance of the plant staff

6.6 Infectious Disease Outbreak

Infectious diseases have the potential to affect any form of life. Some infectious diseases that were nearly eradicated have re-emerged. New strains of some infectious diseases, such as the flu, present seasonal threats to the populace and require continuous monitoring. Pathogens new to science (e.g., SARS-CoV-2) can emerge and cause widespread epidemics. An "epidemic" is defined as a disease occurring suddenly in numbers clearly in excess of normal expectancy, especially infectious diseases, but is applied also to any disease, injury, or other health-related event occurring in such outbreaks. A "pandemic" is defined as an epidemic that affects the entire world. As seen with COVID-19, epidemics/pandemics can result in deaths numbering in the many hundreds of thousands across the nation and world, and hospital capacities can be exceeded, resulting in shortfalls in healthcare for any condition. In addition, if the health of the general public is perceived to be threatened on a large scale, riots or states of lawlessness are a possibility. State agencies' activities are directed in the Minnesota Emergency Operations Plan (MEOP).

6.6.1 Infectious Disease History

The Minnesota Department of Health (MDH) Health Alert Network (HAN) enables information exchange during disease outbreaks, environmental threats, natural disasters, and acts of terrorism. They also provide health advisories on an as-needed basis. Below is a list of health advisories issued in the last 3 years (Table 60).

Table 60. HAN health advisories in Minnesota, 2019–September 2023

Date	Health Advisory
1/22/2019	University Tuberculosis Outbreak
3/11/2019	Zika Travelers Update
4/16/2019	Shortage of Pharmaceuticals Used to Prevent and Treat *Neisseria gonorrhoeae* Infections
05/20/2019	National Hepatitis A Outbreak
6/7/2019	Spike in Drug Overdoses
6/18/2019	Typhoid Fever in Ramsey County
7/9/2019	Cyclospora Increase
8/13/2019	Severe acute Lung Disease Among Youth Who Report Vaping
9/5/2019	Increase in Blastomycosis Cases
9/11/2019	Update on Sever Acute Lung Injury Among Patients Who Report Vaping
10/10/2019	Legionellosis in Albert Lea
1/14/2020	Mercury-containing Skin Lightening Product Associated with Acute Health Effects
1/22/2020	Outbreak of 2019 Novel Coronavirus (2019-nCoV) in Wuhan, China
1/31/2020	Updated Patients Under investigation (PUI) Interim Guidance
2/3/2020	HIV Outbreak in Persons Who Inject Drugs
3/2/2020	Updated COVID-19 Guidance and Lab Testing
3/5/2020	Evaluation and Testing for COVID-19 in Minnesota
3/10/2020	Listeriosis Outbreak Along Hwy 94
3/12/2020	SARS-CoV-2 (COVID-19) Testing Urgent Notice
3/13/2020	COVID-19 Infection Prevention and Control in Healthcare
3/17/2020	Shortage of SARS-CoV-2 Testing
3/25/2020	Newborn Screening Continues During COVID-19 Outbreak
3/30/2020	Non-Pharmaceutical Treatments of COVID-19
4/1/2020	Updated SARS-CoV-2 Testing
4/23/2020	Expanded SARS-CoV-2 Testing
5/15/2020	Multisystem Inflammatory Syndrome in Children
5/20/2020	Expanded Testing for SARS-CoV-2
6/2/2020	Mass Gathering Testing for SARS-CoV-2
6/22/2020	New Syphilis and Hepatitis A Cases in the Tri-County Area
6/25/2020	Testing Asymptomatic Persons for SARS-CoV-2
7/24/2020	Severe Lung Injury Associated with Vaping June-July 2020
7/30/2020	New Testing Priorities for SARS-CoV-2
10/9/2020	STED Testing Kit Shortage
10/14/2020	Antigen-based Tests for Detection of SARS-CoV-2
11/16/2020	Bamlanivimab for Mild/Moderate COVID-19 Patients
12/7/2020	Quarantine Duration for SARS-CoV-2 Contacts
1/26/2021	Gonococcal Treatment Change
2/9/2020	Minnesota Resource Allocation Platform (MNRAP) Launch
2/16/2021	Quarantine for Vaccinated Health Care Workers
3/2/2021	COVID-19 Vaccine Breakthrough Cases
3/4/2021	HIV Outbreak and Syphilis Concern in Duluth Area

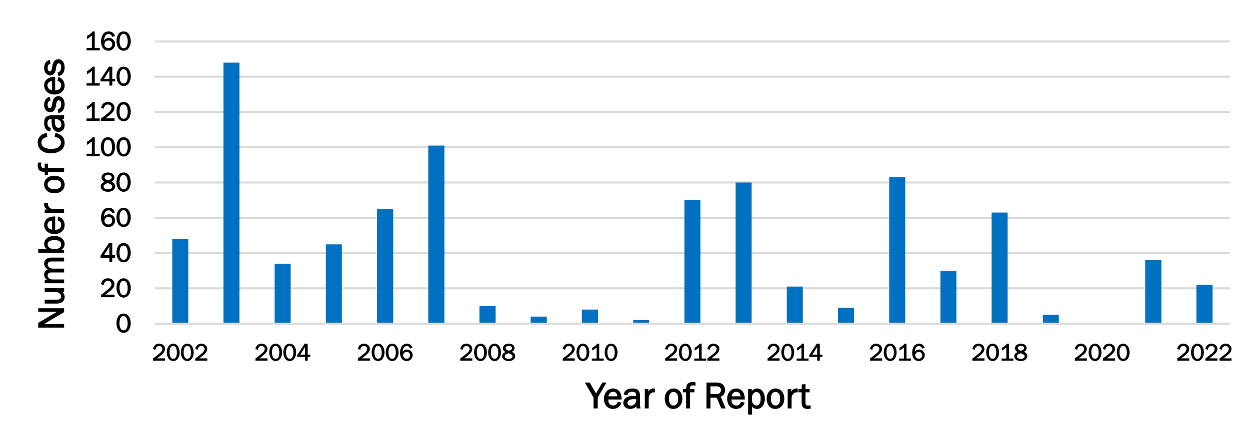
Date	Health Advisory
3/25/2021	SARS-CoV-2 variant Surveillance
4/13/2021	Immediate Pause on Johnson and Johnson Vaccine Administration
6/28/2021	Pause on Monoclonal Antibody Treatment Bamlanivimab/Etesevimab
6/30/2021	Increased RSV and Other Non-SARS-CoV-2 Viral Activity
6/30/2021	Melioidosis in Minnesota Not Associated with Travel
7/1/2021	Brucellosis Outbreak Associated with Soft Cheese in Twin Cities
7/9/2021	Legionellosis in Albert Lea
8/2/2021	REGEN-COV Approved for Post-Exposure Prophylactic Use
8/4/2021	Use of Palivizuma and Off-Season RSV Activity
8/5/2021	FDA Recall of Ultrasound Gel Due to *Burkholderia cepacian* complex
8/26/2021	Hospital Admission Screening for CPO and *C. auris*
9/2/2021	*Campylobacter* Outbreak in Hennepin and Ramsey Counties Among MSM
10/25/2021	CDC Health Advisory: Meliodiosis Source Implicated
11/30/2021	Increasing Influenza Activity in College & University Settings
12/2/2021	First COVID-19 Omicron Variant Case in Minnesota
4/6/2022	COVID-19 Therapeutics in Minnesota
4/26/2022	Pediatric Hepatitis, Adenovirus and Gastrointestinal Illness
5/24/2022	Monkeypox
6/13/2022	Travel-Associated Measles Cases in Hennepin County
7/13/2022	Monkeypox Reporting, Testing, and Vaccination
9/21/2022	Tenth Travel-Associated Measles Case
10/4/2022	Palivizumab and Early Season RSV Activity
10/12/2022	Be on Alert for Measles, Cases Continue to Occur in Minnesota
10/13/2022	Monkeypox (MPX) Testing and Treatment
10/19/2022	Ebola Monitoring: Outbreak in Central Uganda
12/8/2022	Group A Streptococcus Infections
12/16/2022	Flu and Oseltamivir
12/21/2022	Legionnaires' Disease in Duluth Area
2/10/2023	Take-Home Lead Exposure
5/18/2023	CDC HAN Potential Risk for New Mpox Cases
7/18/2023	Animal Anthrax Cases in Kittson County
7/19/2023	Legionnaires' Disease in Grand Rapids
8/1/2023	Bicillin Shortage for Syphilis Treatment

SOURCE: (MDH, 2024)

West Nile Virus (WNV) was first identified in Minnesota in 2002 and remains the most common mosquito-borne disease statewide. After arriving, the abundant bird and mosquito populations allowed for rapid establishment of the virus. In severe cases, WNV can cause inflammation of the brain (encephalitis); however, most people who are bitten by infected mosquitoes will either experience mild illness or no symptoms at all. The highest risk areas for the virus in the state are in the western and central regions. Open areas, including farmland and prairie, are the prime habitats for Culex tarsalis, the primary mosquito vector of WNV in Minnesota. Most cases occur in late summer. In 2022, 22 cases of WNV disease were reported in Minnesota, consistent with recent years but a decrease from the most recent outbreak year, 2018, in which 63 cases were reported (Figure 17).

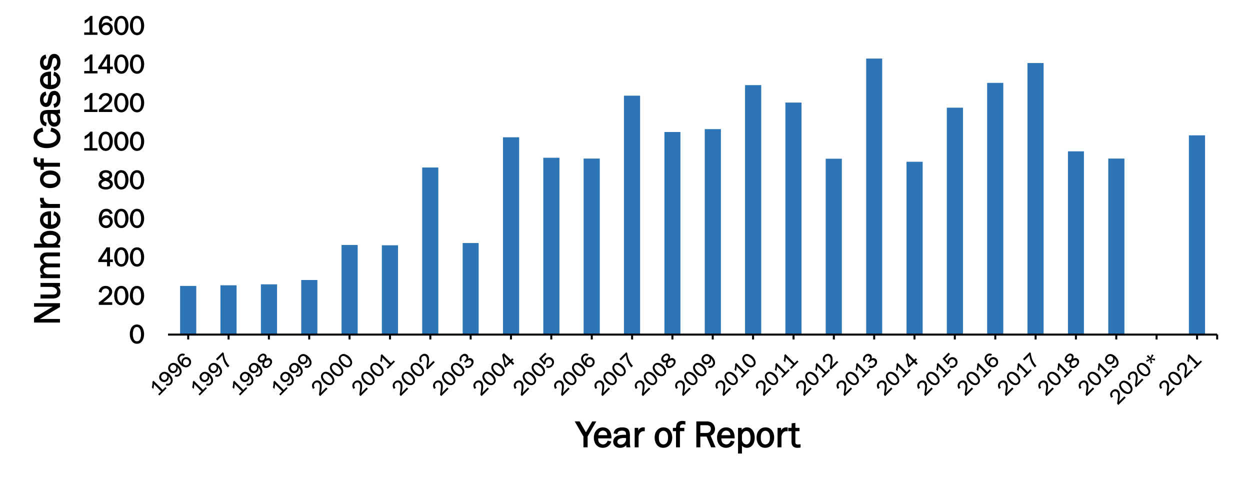
Tickborne diseases, such as Lyme disease, are another important public health concern in Minnesota. Both humans and animals can be affected when bitten by an infected blacklegged tick (AKA deer tick). MDH began collecting information on diagnoses of Lyme disease in 1982, and while surveillance has changed since that time, MDH still collects data on each report it receives. Despite yearly fluctuations, cases have been increasing over time, especially since 2000 (Figure 18). The case totals MDH reports likely underestimate the true total of cases because many cases are not reported.

Figure 17. Reported cases of West Nile Virus disease in Minnesota by year, 2002–2022 (n=884)



Source: (MDH, 2022b)

Figure 18. Reported Cases of Lyme Disease in Minnesota by year, 1996–2021 (n=22,048)



*MDH did not perform surveillance for vector-borne diseases in 2020 due to the COVID-19 pandemic.
Source: (MDH, 2022a)

6.6.2 Plans and Programs in Place

Minnesota Department of Health (MDH) has multiple divisions that deal with emergency preparedness and response:

- Infectious Disease Epidemiology, Prevention, and Control (IDEPC)
- Environmental Health
- Public Health Laboratory
- Emergency Preparedness and Response Division.

The Emergency Preparedness & Response Division coordinates preparedness activities and assists MDH staff, local public health agencies, hospitals, health care organizations, tribes, and public safety officials in their efforts to plan for, respond to, and recover from public health emergencies. HSEM coordinates with MDH and other agencies as directed in the MEOP during emergencies and disasters. Agencies also train together to prepare for actual emergencies.

MDH leads the health response for emergencies in Minnesota. Various plans detail what MDH will do during emergencies. MDH has an *All-Hazards Response and Recovery Base Plan* that describes actions MDH will take in response to incidents that have public health and/or medical implications. This plan includes operational annexes detailing how MDH will provide response support in areas such as infection prevention and control, health care surge, and safe drinking water. MDH also has several emergency and disease specific annexes such as the *All Hazards Response and Recovery Plan: Pandemic Influenza Response and Recovery Annex*.

MDH provides several resources to support emergency response. The Health Alert Network (HAN) is a notification system designed to quickly distribute urgent information from public health to thousands of healthcare professionals—doctors, nurses, and other key partners across Minnesota. Minnesota Responds is a partnership that integrates and engages local, regional, and statewide volunteer programs to strengthen public health and health care, reduce vulnerability, build resilience, and improve preparedness, response, and recovery capabilities. MNTrac (Minnesota system for Tracking Resources, Alerts, and Communication) is a web application designed to track bed capacity including National Disaster Medical System (NDMS) responses and pharmaceuticals and resources from all hospitals within the state to support surge capacity needs. Additionally, MNTrac supports real-time reporting of hospital diversion status, emergency incident planning, emergency communication, and emergency alert notifications. MDH can also request large quantities of medical countermeasures (MCMs) from the federal Strategic National Stockpile (SNS), which can be quickly mobilized for emergency distribution.

An outbreak of a highly contagious animal disease in Minnesota could have public health or economic ramifications for the state and potentially the whole nation. The Minnesota Board of Animal Health (BAH) leads Minnesota's response to domestic animal disease emergencies and prioritizes emergency preparedness in its routine work. They work with federal, state, and local government agencies, industry organizations, and livestock producers before, during, and after a contagious animal disease event. This work encompasses adequate preparation with these partners to promote disease prevention and aid in response to contagious animal diseases. Response plans are simulated periodically via tabletop exercises and field events to provide training for staff and partners.

The BAH website provides information on foreign animal diseases and has many other resources regarding animal health and disease. Assets available to support an animal disease emergency include:

- A Minnesota agriculture incident management team;
- University of Minnesota laboratories accredited by the National Animal Health Laboratory Network to conduct disease surveillance testing;
- State and federal animal health employees trained as responders in outbreak control;
- Minnesota Veterinary Medical Reserve Corps—an organization of veterinary professionals with a subset of their membership trained in animal disease response; and,
- USDA financial support, disease confirmation testing, and national regulatory authority for disease response.

Infectious disease is predicted to become increasingly significant as people and goods move more readily around the globe, organisms become resistant to treatments and control methods, and livestock and people encroach on natural habitat. New diseases are discovered when they move from wildlife populations and impact people and livestock, and diseases are found in new places with the movement of people and goods around the world.

6.6.3 Climate Change and Infectious Diseases

Climate change has the potential to affect human health by changing the occurrence of vector-borne diseases. Elements of climate change such as warmer temperatures, shorter/milder winters, and earlier spring seasons impact the ecology of vectors, their hosts, and the environments where they live. Some of these changes may result in an increase in vectors and the diseases they transmit, while others may influence which species of ticks, mosquitoes, and pathogens can survive and thrive in Minnesota. Temperature, precipitation, and humidity drive many of the cycles that maintain pathogens in nature, and changes to these over the long- or short-term can impact the risks for human disease.

6.7 Transportation Incidents

The areas of transportation discussed in this section are highways, railroads, commercial waterways, and aeronautics. Minnesota's transportation infrastructure is outlined in Section 4.8.

6.7.1 Transportation Incident History

The DPS maintains a database of crash events and trends (Table 61). Records are available from 1984 to present, and record highs reflect this period. The fatality rate is the number of people who died in traffic crashes divided by the number of vehicle miles traveled. It is expressed as the number of people who died for every 100 million vehicle miles traveled. Economic cost estimates are based on factors such as productivity losses, medical expenses, administrative expenses, motor vehicle damage, and employers' uninsured costs.

Table 61. Traffic crash trends, 2018–2022

	2018	2019	2020	2021	2022	Record High	
Crashes							
Fatal Crashes	349	333	369	451	418	878	1973
Injury Crashes	20,244	19,902	15,071	17,483	17,367	33,868	1978
Serious	1,341	1,297	1,310	1,451	1,635	5,109	1984
Minor	7,327	7,260	5,940	6,840	6,330	12,326	1985
Possible	11,576	11,345	7,821	9,192	9,402	18,578	1996
Property Damage-Only Crashes	58,622	60,401	41,687	45,817	52,481	94,810	1975
Total Crashes	79,215	80,636	57,127	63,751	70,266	123,106	1975
Injuries							
Serious	1,660	1,520	1,569	1,723	1,911	6,573	1984
Minor	9,429	9,346	7,656	8,912	8,047	17,670	1985
Possible	16,788	16,394	11,304	13,448	13,747	28,631	1996
Total Injuries	27,877	27,260	20,529	24,083	23,705	50,332	1978
Fatalities							
Motor Vehicle Occupant	258	248	256	340	295	544	2002
Motorcycle	58	44	64	69	80	121	1980
Pedestrian	45	50	45	56	45	157	1971
Bicycle	7	10	10	8	6	24	1977

	2018	2019	2020	2021	2022	Record High	
All-Terrain Vehicle	10	4	13	12	14	14	2022
Commercial Bus	1	0	0	0	0	9	1984
Farm Equipment	0	0	0	0	1	5	2013
Other Type Vehicle	2	0	6	1	3	9	2008
Minnesota Fatality Rate	0.63	0.60	0.76	0.85	0.77	23.6	1934
U.S. Fatality Rate	1.25	1.10	1.37	1.43	1.35	18.0	1925
Minnesota Economic Loss ($ millions)	$1,794	$1,874	$1,642	$2,034	$2,239	$2,239	2022
Total Fatalities	381	364	394	488	444	1,060	1968

SOURCE: KAREN ALDRIDGE, MNDPS OFFICE OF TRAFFIC SAFETY, PERSONAL COMMUNICATION (DECEMBER 18, 2023)

Minnesota has over 20,000 bridges ranging from roads on culverts to massive spans across rivers and lakes. The Interstate 35W bridge collapse on August 1, 2007, was a catalyst in Minnesota that spurred increased bridge inspections and maintenance along with replacement of impaired bridges. MnDOT's Bridges and Structures program sets criteria for design, inspection, and maintenance. Inspection reports are retained, and the results are digested in annual bridge reports. The program also provides tools to determine the hydraulics for construction, replacement, or modification of bridges (MnDOT, 2019a).

MnDOT and MN DPS have highway safety components built into many of their programs. The following links show the in-depth capabilities available in the state:

- Child Passenger Safety
- Speed/Aggressive Driving
- Move Over Law
- Bike/Pedestrian Safety
- State Aid for Local Transportation
- Rail Grade Crossing Safety

Natural hazards impact highway safety. The most impactful hazards are:

- Winter storms/blizzards that shut down highways and make travel hazardous;
- Floods that inundate roadways and wash away culverts, bridges, and roads; and
- Tornadoes/high winds that have potential for traffic accidents and debris.

6.7.2 Railroads

A summary of major rail accidents in Minnesota is provided in Table 62.

Table 62. Major rail accidents in Minnesota

Date	Accident	Location	Fatalities	Injuries
5/25/2015	Employee fatality during maintenance	Minneapolis	1	0
9/30/2010	Collision of two freight trains	Two Harbors	0	5
12/29/2009	Derailment of freight train	Minneapolis	1	0
6/14/1984	Head-on collision of two freight trains	Motley	3	4

SOURCE: (NTSB, 2024A)

Rail safety has many facets. Legislation was signed into law by Governor Mark Dayton in 2014 to help protect those who live and work near railways that carry crude oil and other hazardous materials (SF 3187, 2023). The new law includes:

- Increased oversight of railroad companies.
- Requirements for more railway inspections.
- Provisions for better emergency response training and preparedness in communities across the state.

The DPS is involved in the following ways:

- Working with railroad and pipeline companies in developing safety protocols and facilitating coordination between these companies and local public safety officials.
- Assisting local governments as they incorporate emergency response information into their emergency operations plans.
- Collaborating with local emergency managers and responders to understand the dangers of oil and other hazardous substances traveling through Minnesota.
- Partnering with the Minnesota Department of Transportation, Minnesota Pollution Control Agency, and the railroads to carry out the rail safety legislation.

Rail crossing safety is a life safety issue for motorists, bicyclists, and pedestrians. Crude oil and hazmat transportation may be a secondary hazard if train cars become derailed due to a crash at a crossing.

Minnesota Operation Lifesaver is a private nonprofit educational organization dedicated to ending deaths and injuries at highway-rail crossings and on railroad property.

There are over 4,000 railroad grade crossings in Minnesota. In the early 1990s, over 100 automotive crashes per year occurred at rail crossings in the state. However, currently the state records around 45 crashes per year, of which five involve fatalities. MnDOT oversees crossings on all roadways (MnDOT, 2019b).

Accidents due to natural hazards aren't frequently reported since operations are usually curtailed during hazard events. The most impactful hazards are:

- Winter storms/blizzards that slow down or stop rail transport.
- Floods that may inundate and/or wash away tracks adjacent to culverts and bridges.
- Tornadoes/high winds that have potential for accidents and interruptions due to debris.

6.7.3 Commercial Waterways

Water transportation incidents are investigated by the National Transportation Safety Board (NTSB). The NTSB is an independent federal agency that investigates every civil aviation accident in the United States as well as significant accidents in other modes of transportation, including marine transportation. The NTSB determines probable cause for each accident investigated and then issues recommendations aimed to prevent future accidents.

The NTSB's marine accident report database includes reports for three accidents in Minnesota. The most recent incident occurred in October of 2017 when a towing vessel on the Mississippi River struck a fixed pier of the St. Paul Union Pacific Rail Bridge. No injuries or pollution were reported; however, damages to the bridge and barge were estimated at $800,000 and $153,000, respectively. In June of 2013 an uninspected towing vessel lost engine throttle control and was swept into a dam gate of Lock and Dam 7 on the Mississippi River, where the vessel capsized. One crewmember died. Approximate damage to the vessel was estimated at $500,000. In July of 1999, two recreational vessels collided on the St. Croix River near Bayport, Minnesota. One of the vessels had three occupants, and the other had two: all five died as a result of the accident (three from drowning, two from blunt force trauma) (Karen Aldridge, DPS Office of Traffic Safety, Personal Communication, December 18, 2023).

Commercial waterways also allow recreational boating. Boating statistics from the U.S. Coast Guard (USCG) are included in Table 63 to give a better indication of the hazards that may be encountered.

Table 63. Recreational boating statistics for Minnesota, 2018–2022

	2018	2019	2020	2021	2022
Alcohol Use as a Contributing Factor					
Accidents	8	10	12	14	10
Deaths	2	2	5	6	5
Injuries	10	4	5	9	5
Accidents and Casualties					
Total Accidents	77	100	105	87	90
Fatal Accidents	13	10	16	18	14
Deaths	14	10	16	18	15

SOURCE: (USCG, 2023)

Natural hazards impact commercial waterways. The most impactful hazards are:

- Icing of rivers and lakes. Shipping seasons are set to accommodate these occurrences.
- High winds due to sudden storms that make lake transport hazardous.
- High river levels after floods hamper commercial transportation due to high flow velocities.

6.7.4 Aeronautics

Aviation accidents are the least frequent type of transportation accident. The National Transportation Safety Board, the federal agency responsible for aviation accident information, indicates that from 2019-2023, there were 115 air transportation accidents in Minnesota. Most of these accidents involved small aircraft, and many resulted in only minimal injuries. Of the total accidents, 20 were fatal (NTSB, 2024b).

MnDOT has an aeronautics office that ensures the safety of the state's aviation system. Just like the highway department works to keep the roads and highways safe, the aeronautics office works with the aviation community to make the aviation system safe. The office helps airports with the following:

- Paved runways and taxiways
- Painted markings
- Lights to identify the runways and taxiways
- Navigation equipment
- Weather information for flying

- Maintenance equipment to plow snow and mow grass around runways
- Promotion of aviation to continue having qualified employees who keep the state's aviation system successful and thriving.

Airport facilities are vulnerable to all types of natural hazards such as flooding. Airports often close due to a variety of atmospheric-related natural hazards. Significant investments in de-icing commercial airliners and plowing runways are made during the winter months.

Floods are seldom reported, but an example of flood prevention is the removable floodwall installed in 2009 at St. Paul Holman Field and utilized several times since. In Figure 19, the system is seen withholding several feet of floodwaters from the Mississippi River. This flood protection system is the largest American-made removable flood wall in the world. The flood barriers span multiple runways for a total linear span of nearly a mile. This system also includes an architectural half-wall area. The removable floodwall takes about one week to erect after airport staff determine that flooding is probable based on a flood gauge located nearby. The system is cost beneficial compared to when the airport was completely inundated with floodwater. All operations were fully curtailed for weeks, and full restoration took longer. Another benefit of the wall is that the beauty of the scenic Mississippi River valley is not marred by permanent structures when the river is running at normal levels.

Communities should explore local, state, and regional climate change projections and vulnerability assessments (detailed below) for additional information to evaluate hazards, understand risks, and determine the highest potential for losses.

Figure 19. Removable floodwall at the St. Paul Holman Field

6.8 Terrorism

The Federal Emergency Management Agency (FEMA) defines terrorism as the use of force or violence against persons or property in violation of the criminal laws of the United States for purposes of intimidation, coercion, or ransom. Terrorism can be used to accomplish:

- Create fear among the public.
- Try to convince citizens that their government is powerless to prevent terrorism.
- Get immediate publicity for their cause.

U.S. Code 18 U.S.C. § 2331 defines the Federal Crime of Terrorism as an offense that:

- Is calculated to influence or affect the conduct of government by intimidation or coercion or to retaliate against government conduct; and
- Is a violation of one of several listed statutes, including § 930(c) (relating to killing or attempted killing with a dangerous weapon during an attack on a federal facility); and § 1114 (relating to killing or attempted killing of officers and employees of the U.S.)

Based upon definitions provided by the Federal Bureau of Investigation (FBI), terrorism can be divided into two subcategories: domestic terrorism and international terrorism.

The FBI divides terrorist-related activity into three categories:

1. A terrorist incident is a violent or dangerous act to human life, in violation of the criminal laws of the United States or of any state, to intimidate or coerce a government, the civilian population, or any segment thereof.
2. A suspected terrorist incident is a potential act of terrorism to which responsibility cannot be attributed at the time to a known or suspected terrorist group or individual.
3. Terrorism prevention is a documented instance in which a violent act by a known or suspected terrorist group or individual with the means and a proven propensity for violence is successfully interdicted through investigative activity.

According to the FBI, **domestic terrorism** is actions perpetrated by individuals and/or groups inspired by or associated with primarily U.S.-based movements that espouse extremist ideologies of a political, religious, social, racial, or environmental nature. Domestic organizations fall into four (4) broad categories: special interest, rightwing, leftwing, and lone wolf/homegrown violent extremists (FBI, 2024).

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

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

International terrorism is that perpetrated by individuals and/or groups inspired by or associated with designated foreign terrorist organizations or nations (state-sponsored) (FBI, 2024).

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

- Are violent or dangerous to human life that violate federal or state law;
- Appear to be intended (i) to intimidate or coerce a civilian population; (ii) to influence the policy of a government by intimidation or coercion; or (iii) to affect the conduct of a government by mass destruction, assassination, or kidnapping; and
- Occur primarily outside the territorial jurisdiction of the U.S. or transcend national boundaries in terms of the means by which they are accomplished, the persons they appear intended to intimidate or coerce, or the locale in which their perpetrators operate or seek asylum.

FBI Director Christopher Wray testified before the House Homeland Security Committee on September 17, 2020 in which he described the greatest threat to the homeland as that posed by lone actors radicalized online who look to attack soft targets with easily accessible weapons. He described that this approach is done from both domestic violent extremists (DVEs) and homegrown violent extremists (HVEs). As described by him, these are two distinct sets of individuals that generally self-radicalize and mobilize to conduct violence on their own.

DVEs: “Individuals who commit violent criminal acts in furtherance of ideological goals stemming from domestic influences, such as racial bias and anti-government sentiment” (Wray, 2020).

HVEs: “Individuals who have been radicalized primarily in the United States, and who are inspired by, but not receiving individualized direction from, foreign terrorist organizations (FTOs)” (Wray, 2020).

In Minnesota, agencies such as the Minnesota Fusion Center, the Federal Bureau of Investigation’s (FBI) Joint Terrorism Task Force, and regional law enforcement working groups work together to gather evidence, make arrests, share intelligence, and prevent terrorist attacks. The FBI, as the lead agency in terrorism investigations, uses the U.S. Code of Federal Regulations 18 U.S.C. § 2331 definition of terrorism as either domestic or international, depending on the origin, base, and objectives of the terrorist organization.

6.8.1 History of Terrorism

On December 14, 2022, River William Smith, of Savage, MN was arrested and charged with illegally possessing a variety of weapons and attempting to obtain machine guns and hand grenades from an undercover FBI agent. According to the US Department of Justice (DOJ), Smith also made claims that he was preparing for a “violent exchange with police” and reportedly shared “an intense dislike of minorities, Jewish individuals, and homosexuals,” according to the complaint. Smith also told the informant that he had considered joining an extremist group called “The Base” (Wiita, 2022)

On January 13, 2021, Abdelhamid al-Madioum pled guilty of providing and attempting to provide material support and resources to a designated foreign terrorist organization, ISIS. In June 2015, al-Madioum traveled with his family from St. Louis Park, MN to Casablanca, Morocco to visit extended family. Al-Madioum then traveled from Morocco to Istanbul Turkey where he met with his fighters who brought him to Syria and subsequently Mosul, Iraq. He served as a member of ISIS until his surrender to the Syrian Democratic Forces in March 2019. He was returned to MN in September 2020 (U.S. Attorney’s Office, District of Minnesota, 2021).

On September 03, 2020, Benjamin Ryan Teeter and Michael Robert Solomon were arrested by the FBI for conspiring to provide material support to a foreign terrorist organization, Hamas (Office of Public Affairs, 2020). The arrests were the result of an investigation that began in May 2020. Throughout the investigation, Teeter and Solomon communicated with a confidential human source (CHS) in which they proposed assisting Hamas as a means to further their own ideological goals for a domestic movement called the Boogaloo Bois. Teeter and Solomon provided the CHS with homemade manufactured suppressors and 3D printed "auto sear(s)" that would be used by Hamas to convert semi-automatic rifles into fully automatic rifles. On June 01, 2022 Teeter was sentenced to 48 months in prison followed by five years of supervised release (U.S. Attorney's Office, District of Minnesota, 2022).

On March 19, 2020, Muhammad Massood, a licensed medical doctor in Pakistan, and employed at the time as a Research Coordinator at a medical clinic in Rochester, Minnesota under an H-1B Visa was arrested by the FBI while attempting to board a flight Los Angeles, California from Minneapolis-St. Paul International Airport. Massood made several statements to others that included pledging his allegiance to ISIS. He also expressed desire to conduct "lone wolf" terrorist attacks in the US. Massood intended to travel from Los Angeles to ISIS territory via cargo contain in order to circumvent travel restrictions at the time due to the COVID-19 Pandemic (AP News, 2022).

On January 19, 2018, Tnuza Jamal Hassan of Minneapolis set nine fires in an attempt to kill people at St. Catherine's University. The self-radicalized Hassan told investigators that she tried to join al-Qaida and that she was willing to carry out a suicide bombing if asked. She traveled as far as Dubai on her way to Afghanistan in 2017 but was stopped due to the lack of a visa. Hassan also told investigators that they were "lucky" she didn't know how to build a bomb, according to the criminal complaint.

On August 05, 2017, the Dar al-Farooq Islamic Center (DAF) in Bloomington, Minnesota, was targeted by a militia group known as the "White Rabbits," which consisted of four Illinois residents. A PVC pipe bomb was thrown through a window causing extensive damage. The defendants targeted the Islamic center "with intent to damage the mosque because of its religious character and with intent to obstruct Muslims from worshipping there," the Justice Department said in a statement.

On September 17, 2017, twenty-year-old Dahir Adan, while wearing a security guard uniform and armed with two steak knives, went on a mass stabbing attack at the Crossroads Center shopping mall in St. Cloud, Minnesota. While the Islamic State claimed that Adan was a "soldier of the Islamic State," the FBI has been unable to confirm the relationship. There were ten people injured before the perpetrator was shot dead by an off-duty police officer.

June 2016, three Minnesota men were found guilty of attempting to join ISIS and were convicted of conspiracy to commit murder outside the United States. Their convictions were upheld in 2018.

A 2015 report from the House Homeland Security Committee titled "Combating Terrorist and Foreign Fighter Travel" highlights that since 2011 Minnesota had more cases (58) of people trying to travel to Syria to join ISIS than any other state in the country.

In April of 2015, six young men of Somali decent were charged with trying to join ISIS.

Late 1990–2015, more than 20 Somali youth wererecruited by al-Shabaab and left the Twin Cities to fight in Somali (MN DHS, 2015).

Created in the wake of 9/11, the Terrorist Screening Center (TSC) maintains the TSC Watchlist as a single nationwide database that identifies information about those known or reasonably suspected of being involved in terrorist activity who try to obtain visas, enter into the country, board aircraft, or engage in suspicious activities. While there are over 20,000 contacts with watch-listed people annually nationwide, Minnesota ranks second in the United States with Hennepin County having the most watch-listed encounters of any county in the country.

6.8.2 Vulnerability

In terms of national consequence to Homeland Security, Minnesota is home to 19 Fortune 500 companies and statewide revenues exceed $300 billion per year. Minnesota is at an increased risk from terrorism as a target of economic strategic value with financial centers, agri-business, and an international airport located within our borders. Two large public venues include the Mall of America in Bloomington, with over 40 million visitors annually and over 12,000 parking spaces for visitors, and the U.S. Bank Stadium in the heart of Minneapolis, which has 66,200 seats.

Section 7: Hazard Mitigation and Climate Adaptation Strategy

S8. Does the mitigation strategy include goals to reduce/avoid long-term vulnerabilities from the identified hazards?

44 CFR Reference §201.4(c)(3)(i)

S9. Does the plan prioritize mitigation actions to reduce vulnerabilities identified in the risk assessment?

44 CFR Reference §§201.4(c)(3)(iii) and (iv)

S10. Does the plan identify current and potential sources of funding to implement mitigation actions and activities?

44 CFR Reference §201.4(c)(3)(iv)

S11. Was the plan updated to reflect changes in development, progress in statewide mitigation efforts, and changes in priorities?

44 CFR Reference §201.4(d)

Hazard mitigation, as defined by the Disaster Mitigation Act of 2000, is any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards. Researchers at the National Institute of Building Sciences looked at the results since 1995 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 hazard mitigation funding can save the nation $6 in future disaster costs, for every $1 spent on hazard mitigation (National Institute of Building Sciences, 2017).

Hazard mitigation can take many different forms from construction projects to public education. Climate adaptation strategies that address the effects of current and future changing conditions are included. Minnesota's Climate and Health Program at Minnesota Department of Health (MDH) have been working to improve the State's and partners' ability to protect the public's health by implementing strategies to adapt and mitigate climate change with education, research, and building capacity.

The development of hazard mitigation/climate adaptation goals allows the State of Minnesota to create a vision for preventing future disasters, establish a common set of hazard mitigation/climate adaptation actions across state, tribal, and local agencies, prioritize those actions, and evaluate the success of such actions. The previous Minnesota Hazard Mitigation Strategy was based on the results of the statewide risk assessment, local and tribal risk assessments and mitigation strategies, and additional recommendations by mitigation stakeholders plus information gathered during the development and revisions of ICAT Climate Change Adaptation reports, and continued workgroup efforts. The new updated (2024) Minnesota hazard Mitigation and Climate Adaptation Strategy is coordinated with the new Minnesota's Climate Action Framework (CAF), a broad-based effort to address climate change initiated by the Governor's Office, pushed forward by State Agency heads, and more recently supported by actions of the Minnesota State Legislature during the 2023 legislative session.

The goals are broad, forward-looking statements that outline in general terms what the state would like to accomplish in collaboration with its partners. The inclusion of more far-reaching and broadly accepted climate change and adaptation strategies to updated hazard mitigation strategies will increase the value, visibility, and implementation possibilities to reduce risk statewide.

7.1 Update

The goals and objectives for the 2024 Plan have been updated to coordinate with climate change adaptation goals, priority actions, and state action steps from Minnesota's Climate Action Framework (CAF) published in September 2022. FEMA has updated and released many new project types and guidance materials. This plan aims to integrate traditional project types, new FEMA mitigation strategies and project types, and climate adaptation recommendations for action.

CAF Goal 3, Resilient Communities, prioritizes—among other key actions—providing Minnesota communities with the data, tools, and technical expertise they need to implement community-specific adaptation action and increase resilience (Climate Change Subcabinet, 2022). Additional actions to support climate adaptation and resilience were added to the standard hazard mitigation actions.

The FEMA publication Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (FEMA, 2013) illustrated aligning strategies with specific natural hazards. Since the release of that document, HSEM has utilized the new, updated strategies of Local Planning and Regulations, Structure and Infrastructure Projects, Natural Systems Protection and Education and Awareness Programs, replacing the previous strategies Prevention, Property Protection, Public Education and Awareness, Natural Resource Protection, and Emergency Services.

There is one hazard mitigation action strategy type that has changed in this Plan. Data in the 2019 plan has been updated to Technical Assistance, Tools, and Data to expand the scope of the strategy and include more action items.

With the passage of historic federal and state funding to support design and construction of climate-resilient infrastructure, the implementation of structure and infrastructure projects at the state and local levels has emerged as the most important action strategy. Federal funding for drinking water and transportation infrastructure and state funding for resilient stormwater management and sustainable land management will translate directly to increased preparedness of state and local assets for the more extreme precipitation events characteristic of climate change.

The need for dissemination of data and technical assistance to use data tools is a theme throughout the CAF. The need to utilize accurate current and projected climate data is important at both the state and local levels. Data collection, tool development, and training materials all require funding as well as coordination with other state agencies to address data accuracy and to identify data gaps. Comprehensive spatial data is also needed to inform better understanding of state asset vulnerability. Information about projected changes in development is difficult to collect. The emphasis of "Technical Assistance, Tools, and Data" as a data strategy was developed to address these needs.

The update to the state's 2014 list of mitigation actions is included in Appendix O: 2019–2024 Update on Goals and Strategies.

7.2 State Plan Goals and Objectives

The natural hazard and climate adaptation goals, strategies, and actions are listed to provide a path for local communities and state agencies to utilize grant programs based on project type. Based on state agency and local priorities, the grant programs can guide communities to develop an overall hazard mitigation strategy and implement projects to make their communities more disaster resistant to the changing climate.

The 2024 goals and objectives for the Minnesota State Hazard Mitigation Plan are:

Goal 1: Enhance the State's capacity to make Minnesota more resilient to the effects of all hazards consistent with Minnesota's Climate Action Framework and in coordination with the Resilient Communities Goal Team.

Objectives:

- Increase awareness and knowledge of hazard mitigation and climate adaptation principles and practice among state agency program administrators.
- Leverage state agency subject matter experts to empower local community applicants to apply to HMA and other resilience programs.
- Coordinate state programs and state capabilities to increase hazard mitigation and adaptation project implementation.
- Increase awareness of grant funding to buyout properties on the Severe Repetitive Loss and Repetitive Loss lists.
- Assess vulnerabilities for critical facilities.
- Develop and/or improve hazard vulnerability assessments for state owned/operated, infrastructure and critical facilities.
- Develop continuity of operations plans to enhance state and local resilience to all hazards.
- Improve state agency awareness of eligibility for hazard mitigation grant funds.
- Prioritize and fund high priority mitigation and adaptation projects to decrease vulnerability of state-owned infrastructure and critical facilities.

Goal 2: Build and support local capacity and commitment to increase resiliency to all hazards consistent with Minnesota's Climate Action Framework and in coordination with the Resilient Communities Goal Team.

Objectives:

- Increase awareness and knowledge of hazard mitigation and climate adaptation principles and practice among local public officials.

- Encourage the use of FEMA Advance Assistance and phased applications by local governments utilizing state agency experts.
- Provide direct technical assistance to local public officials and help communities obtain funding for hazard mitigation and climate adaptation planning and project activities.
- Encourage communities to update and implement local hazard mitigation plans and incorporate climate adaptation with other land use planning mechanisms.
- Improve compliance with state floodplain regulations and encourage participation in the National Flood Insurance Program (NFIP) and Community Rating System (CRS).
- Provide training and assist jurisdictions in developing and implementing cost-beneficial hazard mitigation and climate adaptation projects.
- Maximize available post-disaster “windows of opportunity” to implement major hazard mitigation and climate adaptation outreach initiatives, including social media.
- Promote use of available funds for buying out Severe Repetitive Loss and Repetitive Loss properties.
- Improve data on locally owned/operated infrastructure and critical facilities.
- Improve vulnerability assessments for locally owned/operated infrastructure and critical facilities.

7.3 Mitigation, Climate Adaptation, and Resilience Strategies

Traditional hazard mitigation actions in this Plan are categorized into the following strategy types, as described in the FEMA publication Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (2013). This includes FEMA Climate Resilient Mitigation Actions (CRMA) released in 2016. FEMA continues to add job aids, benefit/cost analysis tools and supplemental information to develop projects. See Mitigating Flood and Drought Conditions Under Hazard Mitigation Assistance for updated information.

Technical Assistance, Tools, and Data: Collection, development, funding for, and dissemination of data of all types. State asset data is needed to better assess hazard vulnerability. Data collection on changes in development is necessary to address future hazards.

Local Planning and Regulations: Government, administrative, or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and stormwater management regulations. Inclusion of tribal nations, environmental justice communities, and vulnerable populations. Integration of emergency management and public health planning, exercises and training.

Structure and Infrastructure Projects: Actions that involve the construction of structures to reduce the impact of a hazard, such as dams, levees, floodwalls, seawalls, retaining walls, and safe rooms; and actions that involve the modification of existing buildings or structures to protect them from a hazard or remove them from the hazard area. Examples include acquisition, elevation, structural retrofits, storm shutters, and shatter-resistant glass. CRMA project types include flood diversion and storage (FDS) and green infrastructure (GI).

Natural Systems Protection: Actions that, in addition to minimizing hazard losses, preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation. CRMA project types include aquifer storage and recovery (ASR) and floodplain and stream restoration (FSR). Continue and expand partnerships among government and non-government organizations for conservation/adaptation.

Education and Awareness Programs: Actions to inform and educate citizens, practitioners, public officials, and property owners about the hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, continuing professional education, and school-age and adult education programs. Develop knowledge for decision-making in cooperation with vulnerable communities and tribal nations. Integration of emergency management and public health planning, exercises, and training.

A sixth type was determined by Minnesota HSEM for use in local Hazard Mitigation Plans:

Mitigation Preparedness and Response Support: Actions that protect people and property prior to, during and immediately after a disaster or hazard event. Services include warning systems and emergency response services. These activities are typically not considered mitigation, but support reduction of the effects of damaging events.

Mitigation Preparedness and Response Support actions are the primary role of local emergency managers (EMs); they prepare, train for, and respond to events. Preparedness, response, and recovery are components of the emergency management cycle, however most requested project types (generators and sirens) are considered preparedness activities, not mitigation, and as such are not eligible under the FEMA Hazard Mitigation Assistance. Emergency Protective Measures, Response and Recovery Planning, Response and Recovery Training, and Warning Systems and Power Supply continue to be included in local hazard mitigation plans as they are local priorities. This project type includes integration of emergency management and public health planning, exercises, and training.

7.4 Mitigation, Climate Adaptation and Resilience Actions

The actions outlined in this section are intended to further specify how the state can reduce deaths, injuries, property losses, and other losses due to natural hazards using the strategies in Section 7.3.

Traditional hazard mitigation actions and potential resources are listed under each natural hazard. The timeline for actions depends on funding availability and staffing resources. The potential resources are included in Section 7.6. State policy recommendations and strategies are provided in Table 64.

Based on the state mitigation program history and FEMA eligibility requirements, planning measures are a high priority. New hazard research on coastal erosion and bluff erosion is included in the Plan. The research is based in science with climate change projections. The hazard update process includes the identification of goals, strategies, and actions to increase resilience.

7.4.1 Minnesota's Climate Action Framework (September 2022)

Climate change is no longer a far-off possibility. Minnesotans across our state are suffering its devastating effects right now—and it will get worse. Luckily, we can all be a part of the solution. Addressing climate change presents us with a historic opportunity to strengthen our economy, improve our health, and create a more equitable Minnesota for everyone.

To guide this work, the State of Minnesota has developed a Climate Action Framework (CAF). This plan sets a vision for how our state will address and prepare for climate change. It identifies immediate, near-term actions we must take to achieve our long-term goal of a carbon-neutral, resilient, and equitable future for Minnesota.

Minnesota's Climate Action Framework is organized around six goals:

1. **Clean transportation:** Connect and serve all people through a safe, equitable, and sustainable transportation system.
2. **Climate-smart natural and working lands:** Enhance climate benefits by absorbing and storing carbon, reducing emissions, and sustaining resilient landscapes.
3. **Resilient communities:** Provide each Minnesota community with tools to plan for and become resilient to its unique climate impacts.
4. **Clean energy and efficient buildings:** Expand the use of carbon-free energy and create healthy, comfortable buildings that are cheaper to operate and pollute less.
5. **Healthy lives and communities:** Protect the health and wellbeing of all Minnesotans in the face of climate change.
6. **Clean economy:** Build a thriving carbon-neutral economy that produces goods and services with environmental benefit and equitably provides family-sustaining job opportunities.

Within each goal is a summary of the challenges, priority actions and larger initiatives needed to achieve the goal, measures to help gauge progress, and equity considerations and opportunities for addressing them.

The Climate Action Framework sets a vision for how Minnesota will address and prepare for climate change. It identifies immediate, near-term actions to achieve our long-term vision of a carbon-neutral, resilient, and equitable future for the State. It is a foundational document designed to broadly guide the direction of climate action in the state for many years. The Framework is informed by public input received as a part of previous climate work [including the Interagency Climate Adaptation Team (ICAT) 2017 report and recommendations], as well as specific input received throughout the framework development process beginning in 2021. The document was shaped by input from the 11 tribal nations who share Minnesota's geography and the Governor's Advisory Council on Climate Change. Through the winter and spring of 2022, the subcabinet convened workgroups to provide detailed input on each of the framework chapters. The subcabinet also shared its proposals broadly and received more than 130 written comments and nearly 3,000 responses to online surveys.

Moving forward, the Climate Change Subcabinet will continue to seek input, report on progress, and revisit and refine action steps as the Framework is implemented.

7.4.2 Funding Resources

Funding is available following a disaster as HMGP funds, or annually with the release of the non-disaster grants, BRIC, PDM, and FMA. Mitigation and other strategic planning documents are typically due for review on a set schedule: state mitigation plans every five years; local hazard mitigation plans every five years. Other planning documents may be created or updated dependent upon funding availability. With the goal of integrating climate change and adaptation into local hazard mitigation plans and the State Hazard Mitigation Plan, local jurisdictions and state agencies can utilize the increasing variety of mitigation project types to increase resilience.

Since the last plan was approved in March 2019, the State of Minnesota has received seven Presidentially Declared Disasters (DR-4414, DR-4442, DR-4531, DR-4658, DR- 4659, DR-4666 and DR-4722 and DR-4390). These disasters have emphasized the vulnerabilities and obstacles the state faces in relation to natural hazards such as flooding, severe storms, straight-line winds, and ice storms. Ten disasters occurred between 2019 and 2023; the multitude of these disasters has offered opportunities for the state to strengthen its mitigation capabilities through the availability of HMA funding. Federally approved and funded mitigation projects are being administered by the state through post-disaster HMGP funding and annual congressionally appropriated BRIC, PDM, and FMA program funding. However, we have utilized all of these programs to implement projects that address the state's hazard mitigation goals and objectives meeting the priorities and criteria outlined in the mitigation strategy.

In addition to federal programs, several programs at the state level support the state's goals and objectives are being used to advance mitigation statewide. The State Capability Assessment in Section 7.7 provides some of the programs and initiatives currently supporting mitigation in Minnesota. Further, this assessment demonstrates the success of the state's mitigation programs administered by both federal and state agencies. Interagency projects funded through the Silver Jackets in the past five years have been very successful, as has partnering with the MN DNR Flood Hazard Mitigation Grant Assistance Program (FHM) on flood buyouts. Continued collaboration with agencies in the Climate Change Subcabinet will further increase the resiliency of Minnesotans. MDH addresses climate change from a public health standpoint, specifically addressing vulnerable populations. The 2014 MDH Climate Change Vulnerability Assessment identifies extreme heat events, air pollution, vector-borne disease, flooding and flash flooding, and drought in its plan. MDH and HSEM have developed materials to help locals understand and address these hazards at the regional level.

Flood mitigation projects remain the highest priority in the state due to the high occurrence and high mitigation potential. Localized pluvial flood risk is a newer and continually increasing threat due to high intensity (cloudburst) localized storms characteristic of more heat and moisture in the atmosphere because of climate change. Tornadoes and severe storm mitigation measures are also higher risk as demonstrated by the hazard analysis and risk assessment process, and while lives can be saved and damages can be reduced, not all damages can be completely mitigated. Depending upon the funding source—disaster or non-disaster—project priority is subject to an evaluation process. HMGP, PDM, BRIC, and FMA priorities are dependent on many factors, including causes of disaster (e.g., flooding vs windstorm) and congressional priorities. Generally, public education and various types of hazards or risk reduction training and education measures are also a high priority.

With each project evaluation, the benefit-cost ratio, feasibility, and environmental review issues are analyzed. Only projects that meet the criteria of being cost-beneficial, feasible, and able to pass the National Environmental Policy Act (NEPA) process review are selected for further review and implementation. Based on the state's past mitigation successes, the following discussion of high-priority actions considers and explains how each activity contributes to the overall mitigation strategy of the state. The state aims to geographically disperse funds and maximize the number of people protected to ensure available funding is used responsibly. By including environmental benefits in certain circumstances in a FEMA benefit–cost analysis (BCA), mitigation projects can further increase resilience to the effects of certain hazards.

7.4.3 Mitigation Strategy and Action Tables

State policy recommendations and strategies are provided in Table 64. State Mitigation and climate adaptation actions, funding and resources, and timeline are outlined in the tables listed below. Appendix O includes a list of deleted and updated actions from the 2019 plan.

Table 64. State policy recommendations—all hazard

Strategy	State Mitigation & Climate Adaptation Actions	Funding and Resources
Technical Assistance, Tools, and Data [CAF sub-initiative 3.1.1]	Implement the use of high-resolution, dynamically downscaled climate projections for planning and design efforts across Minnesota (CAF state action step under CAF 3.1.1), with additional funding as needed to make its output compatible with the necessary tools used by planners, architects, designers, and engineers for building and infrastructure design including energy and stormwater modeling. Minnesota CliMAT—Climate Mapping and Analysis Tool (CMIP6) | University of Minnesota Climate Adaptation Partnership (umn.edu)	MN Climate Adaptation Partnership (MCAP)/UMN Extension, U-Spatial, state agencies, legislature, other partners
	https://maps.umn.edu/climatehealthtool/ Create an interactive, comprehensive website that improves visibility of and access to climate information and identifies strategies to help communities expand resilience capacity. (State action step under CAF 3.1.1)	State agencies, other partners
	Provide training to expand local capacity to assess vulnerabilities, and to plan for and implement adaptation strategies that increase public and critical facilities' resilience, reduce private property damage, and limit public health impacts from climate change. (state action step under CAF 3.1.1)	State agencies, MCAP/Extension, and other partners
	Integrate ongoing adaptation strategies into county hazard mitigation plans using Minnesota's state hazard mitigation plan as a guide. Encourage all communities to have a preparedness plan for extreme weather events, including contingencies for multiple events such as a heat wave after flooding. (state action step under CAF 3.1.1)	DPS-HSEM, and other state agencies
	Accelerate updates to FEMA maps statewide using LiDAR and improved forecasting tools to identify locations subject to repeated localized flooding (state action step under CAF 3.1.1).	State agencies
	Advance and promote use of Blue Spot mapping tools and update the Infrastructure Stress Transparency Tool that provides interactive maps of Minnesota's civil infrastructure. (state action step under CAF 3.1.1)	State agencies
	Map areas where people at greatest risk to climate impacts live and address environmental justice areas of concern across the state. Add climate-related data overlays (e.g., urban heat island effect, drought) as needed. (state action step under CAF 3.1.1)	State agencies
	Engagement with MN Geospatial Advisory Council to support 2019 (and forward) priorities. Priorities that will benefit future Jurisdictional HMPs include statewide address points data, street centerline data, and parcel data (all publicly available and including a data standard) and an emergency management damage assessment data standard for rapid, post event damage assessment GPS field collection (see: http://www.mngeo.state.mn.us/councils/statewide/index.html)	MN Geospatial Advisory Council, MnGeo, state agencies, other partners
	Engagement with MN Geospatial Data community to develop a sustainable workflow to acquire and maintain essential state facility data in the Minnesota Geospatial Commons	MN Geospatial Advisory Council, MnGeo, state agencies, other partners
	Engagement with MN Geospatial Data community to develop a sustainable workflow to acquire and maintain MN critical facility data, including Minnesota State Owned Buildings.	MN Geospatial Advisory Council, MnGeo, state agencies, other partners

Strategy	State Mitigation & Climate Adaptation Actions	Funding and Resources
Local Planning and Regulations	Improve codes and standards for all existing commercial and large multi-family projects to optimize energy efficiency, resilience, energy production, and lower carbon outputs (State action step in CAF 4.2.1)	DLI
	Continue the uniform statewide energy code adoption process, evaluating and adopting national model energy codes to ensure aggressive energy savings and address energy code enforcement. (State action step under CAF 4.2.2)	DLI
	Prioritize the use of state bonding funds in support of resilient infrastructure, including water quantity projects, and seek federal funding to address climate vulnerabilities and strengthen resilience. Use existing revolving loan funds and created new public/private resilience financing such as green banks, and other financial tools to provide additional funds. (State action steps under CAF 3.1.2)	State agencies or Legislature or local governments
	Work with local governments in developing regional and local land conservation plans identifying priority locations for protection and restoration. (State action step under CAF 2.2.1)	MN DNR, BWSR, MPCA
	Expand access to building performance assessment tools to inform strategic decisions for investing in structural upkeep, adaptive building reuse, building material uses, and building efficiency upgrades, including in government buildings, institutional buildings, commercial buildings and large multi-family buildings. (State action step under CAF 4.2.1)	State agencies
Structure and Infrastructure Projects	Utilize increased funding from the 2023 Minnesota legislative session and federal BIL, IRA, and CPRG programs specifically for resilient public infrastructure projects through bonding and grants, and continue to provide increased funding for such projects in the future.	Legislature, state agencies and LGUs
	Research ways to increase resiliency of buildings to extreme precipitation, flooding, extended heat waves, urban heat island effects, grid failure from extreme weather, and other climate change impacts—especially in multi-family housing upgrades and for under-resourced communities. Enable the use of the Guaranteed Energy Savings Program for community resilience to multiple climate perils including design and audit assistance. (State action step under CAF 3.3.1)	Commerce, MN Housing, and other state agencies in partnership with utilities
	Encourage new construction and rehabilitation of housing to plan for resiliency/adaptation (e.g., waterproofing basements, raising mechanicals and coordinating with energy improvements, installing mold resistant and passive cooling building features), prioritizing rehabilitation first before new construction, and ensuring new developments build outside of higher risk flood areas that retain the natural benefits those areas often provide. (State action step under CAF 3.3.1)	State agencies and LGUs
	Adopt resiliency provisions in codes, permits, and policies for new construction, rehabilitation and adaptive reuse, and create resilient design standards that also maximize material reuse when possible. (State action step under CAF 3.3.1)	DLI, HSEM, other state agencies
	Design transportation infrastructure for long-term resiliency, including expanding use of culverts and crossings designed to allow better natural flow distribution, capacity for increased volume where appropriate, and aquatic organism passage. (State action step under CAF 3.3.2)	MnDOT, LGUs
	Work with the insurance industry and HSEM to develop solutions to the economic/structural disincentives that currently limit design and construction of more resilient buildings and infrastructure.	State agencies

Strategy	State Mitigation & Climate Adaptation Actions	Funding and Resources
	Promote electrical grid upgrades, load flexibility, greater access to renewable energy and fund research and development to integrate more renewable energy in the grid. Support the deployment of energy storage and demand response, which ensure grid optimization and modernization, as well as the ability to dispatch resources to shift and shape load to reduce the effects of peak usage periods. (State action steps under CAF 4.1.1.)	PUC and state agencies
Natural Systems Protection	Coordinate guidance provided by state agencies to reduce conflicting language.	State agencies
	Mitigate and improve resilience to increased amount and intensity of precipitation, and drought, through practices including agronomic, crop selection and management, soil conservation, soil health, irrigation, and drainage water management.	LGUs, state agencies
	Expand incentive programs for farmers to preserve woodlands and incorporate new trees and natural habitat into agricultural landscapes to protect against wind and water erosion and store carbon. (State action step under CAF 2.3.1)	MN DNR, MDA, MPCA
	Implement the 2020 State Water Plan. Updated every five years, the current plan's focus is how to best prepare for the impact of climate change on Minnesota's water resources. Prioritize the strategies identified to achieve the Water Plan's five primary goals: (1) Ensure drinking water is safe and sufficient; (2) Manage landscapes to protect and improve water quality; (3) Manage landscapes to hold water and reduce runoff; (4) Manage built environments and infrastructure for greater water resiliency; (5) Promote resiliency in quality of life. (State action step under CAF 3.2.3)	State agencies
	Provide funding and technical assistance to establish green infrastructure and other nature-based adaptation in urban areas to control flooding, reduce urban heat, improve water quality, and restore lost habitat. (State action step under CAF 3.3.3)	State agencies
	Promote water storage and water management to hold or distribute water during and after large rain events in urban landscapes, including restoring wetlands to support water storage in flood-prone areas, to protect buildings and infrastructure and support watershed health. Support reuse of water to increase resilience. (State action step under CAF 3.3.3)	State agencies, LGUs and partners
Education and Awareness	Engage with the Minnesota Climate Adaptation Partnership (MCAP) and other partners to provide climate modeling data, technical assistance, and adaptation strategies. (state action step under 3.1.3)	State agencies & partners
	Incorporate climate resiliency into engineering best practices; and partner with engineering and architecture professional associations to provide education and training opportunities. (State action step under CAF 3.3.1)	State agencies
	Increase capacity of the GreenStep Cities program to develop and share resilience best practices and adaptation resources with communities, and expand pilot programs that include tribal nations, schools, counties, and townships. (State action step under 3.1.3)	State agencies & partners. MPCA
	Hold regular town halls with communities and tribal governments throughout Minnesota to ask what would most help with increasing resilience and more sustainable community consumption. Provide community education resources on local climate impacts and actions to describe climate	LGUs, state agencies

Strategy	State Mitigation & Climate Adaptation Actions	Funding and Resources
	related hazards and extreme weather events and prioritize those groups most-at-risk from climate change. (State action steps under CAF 3.1.3)	

Table 65. Flood Goal: Reduce deaths, injuries, property loss, and economic disruption due to all types of flooding (riverine, flash, coastal, and dam/levee failure)

Strategy	Mitigation, Resilience & Climate Adaptation Actions Bolded actions indicate priority for state	Funding and Resources	Timeframe
Technical Assistance, Tools, and Data	Implement the use of high-resolution, dynamically downscaled climate projections for planning and design efforts across Minnesota. (State action step under CAF 3.1.1) 2021 Legislature funded development of MN CliMAT tool. https://app.climate.umn.edu/	MCAP, state agencies, LGUs; Climate Data Workshops University of Minnesota Climate Adaptation Partnerships (umn.edu)	ongoing
	Complete FIRM data for all of MN counties: Current Status: 8 unmapped (neither paper or digital), 9 paper with no digital data. The MN DNR in the process of getting GIS delineations for the remaining 70 counties. The MN DNR plan is to obtain funding from FEMA to digitize the 9 paper counties and then 8 unmapped counties. The 8 unmapped are mostly lake development and the Shoreland rules already require minimum elevations for development.	FEMA, MN DNR	ongoing
	Modify infrastructure and update state floodplain management rules for critical facilities, mitigate risk in areas beyond current FEMA-mapped floodplain areas, and encourage no-net-loss of floodplain storage in response to projected climate conditions. Create resilient design standards for building and updating critical facilities and infrastructure. (State action step under CAF 3.3.2)	State agencies	new
	Improve state owned and operated facility database to indicate structures located in floodplains.	MnGeo-GAC, Admin andHMGP	ongoing
State Policy	Adopt resiliency provisions in codes, permits, and policies for new construction, rehabilitation and adaptive reuse, and create resilient design standards that also maximize material reuse when possible. (State action step under CAF 3.3.1)	State agencies	ongoing
	Implement the 2020 State Water Plan. Updated every five years, the current plan's focus is how to best prepare for the impact of climate change on Minnesota's water resources. Prioritize the strategies identified to achieve the 2020 State Water Plan's five primary goals: (1) Ensure drinking water is safe and sufficient; (2) Manage landscapes to protect and improve water quality; (3) Manage landscapes to hold water and reduce runoff; (4) Manage built environments and infrastructure for greater water resiliency; (5) Promote resiliency in quality of life. (State actions steps under CAF 3.2.3)	State agencies	ongoing

Strategy	Mitigation, Resilience & Climate Adaptation Actions Bolded actions indicate priority for state	Funding and Resources	Timeframe
	Increase water storage, infiltration, and drainage management to reduce runoff and minimize downstream flooding, erosion, and habitat loss. (State action step under CAF 2.4.2)	BWSR, MDA, MPCA, LGUs	new
	Restore natural stream stability where possible to reduce erosion, increase habitat diversity, and decrease maintenance and infrastructure costs. (State action step under CAF 2.4.2)	BWSR, MDA, MPCA, LGUs	new
	Assist local government units with identifying and prioritizing locations for water storage as part of watershed planning, emphasizing practices such as wetland and floodplain restoration, drainage water management, and buffer establishment. (State action step under CAF 2.4.2)	State agencies, LGUs	new
	Encourage multipurpose drainage design and retrofitting that provides adequate drainage capacity while reducing downstream peak flows, erosion, and sedimentation, and improving water quality and aquatic habitat. (State action step under CAF 2.4.2)	State agencies, LGUs	new
	Modify infrastructure and update state floodplain management rules for critical facilities, mitigate risk in areas beyond current FEMA-mapped floodplain areas, and encourage no-net-loss of floodplain storage in response to projected climate conditions. Create resilient design standards for building and updating critical facilities and infrastructure. (State action step under CAF 3.3.2)	DNR, other state agencies	ongoing
	Expand funding and staff resources for the assessment, data monitoring and analysis, planning, design and implementation of adaptation and resiliency projects. Prioritize the use of state bonding funds in support of resilient infrastructure, including water quantity projects, and seek federal funding to address climate vulnerabilities and strengthen resilience. Use existing revolving loan funds and created new public/private resilience financing such as green banks, and other financial tools to provide additional funds. (State action steps under CAF 3.1.2)	HSEM, MPCA	ongoing
	Improve flood risk assessment methods and mapping.	Incorporate FEMA's RISK Map standards into work being done.	ongoing
	Fund partnership efforts to gather, maintain and disseminate current information about populations vulnerable to climate change impacts to better serve their needs.	MDH, MPCA	ongoing
	Integrate climate adaptation into watershed-based planning efforts through collaboration and agency support.	FEMA, MN DNR, BWSR, MPCA	ongoing
	State government establishes a goal and tracking system to increase resiliency to extreme precipitation.	FEMA, MPCA, MnDOT	ongoing
Local Planning and Regulations	**Planning**, technical studies, **training**, adoption of ordinances and legislation, acquisition and use of equipment, establishing shelters, and encouraging participation in NFIP and CRS will be used to prevent or reduce risks to lives and property from flooding.	HMGP-Planning, FMA, BWSR—One Watershed One Plan	Ongoing, as required

Strategy	Mitigation, Resilience & Climate Adaptation Actions Bolded actions indicate priority for state	Funding and Resources	Timeframe
Structure and Infrastructure Projects	Acquire/demolish, elevate or retrofit RL, SRL, substantially damaged properties and other flood-prone properties	HMGP, FMA, MN DNR	Pre- and post-disaster
	Assess vulnerabilities of critical facilities and structures and use climate projections to identify ways to ensure continuity of operations (State action step under CAF 3.3.2).	MnGeo-GAC, Admin, MnDOT, HMGP	Ongoing
Natural Systems Protection	Stream corridor protection projects and restoration and soil erosion control projects will be used to prevent or reduce risks and increase the protection of natural resources from flooding.	Local, HMGP, MN DNR, BWSR, PFA, USACE, NRCS, FSA, MPCA	Ongoing, pre- and post-disaster
	Mitigate and improve resilience to increased amount and intensity of precipitation through practices including agronomic, crop selection and management, soil conservation, soil health, irrigation, and drainage water management.	MDA, BWSR, NRCS, FSA, MPCA, MnDOT	Post-disaster, ongoing
Education and Awareness Programs	Utilize existing and promote public education campaigns (ex. Turn Around Don't Drown and FloodSmart.gov) Access to information will be used to raise public awareness of risks from flooding in order to prevent or reduce those risks.	HMGP 5%, MN DNR NFIP, Risk MAP, NWS, USGS	ongoing
	Educate and inform farmers and rural landowners on impacts of changing weather patterns and ways to mitigate impacts and increase resilience.	MDA, BWSR, NRCS, FSA, MPCA	ongoing
Mitigation Preparedness and Response Support	Technological improvements, **warning systems**, responder training, emergency response services, acquisition and use of equipment, establishment of a state-wide flood monitoring center, and planning will provide emergency services to prevent or reduce the risks to lives and property from flooding.	HMGP and HMGP 5%, State Agencies, Silver Jackets	Pre- and Post-disaster, ongoing

Table 66. Tornado Goal: Reduce deaths, injuries, property loss, and economic disruption due to tornadoes

Strategy	Mitigation & Climate Adaptation Actions Bolded actions indicate priority for state	Funding and Resources	Timeframe
Data	Improve state owned and operated facility database	MnGeo-GAC, Admin, HMGP	Ongoing
Local Planning and Regulations	Adoption of ordinances and legislation, acquisition and use of equipment, planning, **conducting technical training**, studies, and **retrofit or construction of safe rooms will be used to prevent or reduce risks to lives, property**, and economic activity from tornadoes.	HMGP, BRIC	Pre- and post-disaster, ongoing
Structure and Infrastructure Projects	Constructing safe rooms and storm shelters, and retrofits will be used to prevent or reduce risks to property from tornadoes.	HMGP, BRIC	Post-disaster, annually

Strategy	Mitigation & Climate Adaptation Actions Bolded actions indicate priority for state	Funding and Resources	Timeframe
Education and Awareness Programs	**Warning systems**, IPAWS, public education, and access to information will be used to raise public awareness of risks from tornadoes in order to prevent or reduce those risks.	HMGP-5%, NWS, USGS	Ongoing, Pre- and post-disaster
Mitigation Preparedness and Response Support	Warning systems, technological improvements, responder training, planning, emergency response services, and acquisition and use of equipment will provide emergency services to prevent or reduce risks from tornadoes.	SHSP	Annually

Table 67. Wildfire Goal: Reduce deaths, injuries, property loss, natural resource and economic disruption due to wildfires (forest, prairie, grass, and peat bogs)

Strategy	Mitigation & Climate Adaptation Actions Bolded actions indicate priority for state	Funding and Resources	Timeframe
Technical Assistance, Tools, and Data	Map and Assess Vulnerability to Wildfire	MN DNR Firewise, USFS, HMGP-Planning,	Ongoing
	Improve state owned and operated facility database	MnGeo-GAC, Admin, HMGP & BRIC planning	Ongoing
Local Planning and Regulations	Enforcement of regulations, adoption of ordinances, technical studies, and planning will be used to prevent or reduce wild land fires and the risks they pose to lives, property, and the natural environment.	MN DNR Firewise, USFS, HMGP-Planning,	Ongoing, as required
Structure and Infrastructure Projects	Vegetation management, defensible space, water treatment measures (for example: sprinklers) will be used to prevent or reduce the risk of wild land fires.	HMGP, BRIC	Pre- and post-disaster, ongoing
Natural Systems Protection	Vegetation management, defensible space	MN DNR Firewise, USFS	
Education and Awareness Programs	Public education and access to information will be used to raise public awareness of risks from wild land fires in order to prevent or reduce those risks, specifically the Firewise program.	MN DNR Firewise, USFS	HMGP 5%
Mitigation Preparedness and Response Support	Planning, responder training, acquisition and use of equipment, evacuations, warning systems, technological improvements, and emergency response services will provide emergency services to prevent or reduce risks to lives and property from wild land fires.	SHSP	Ongoing

Table 68. Windstorms Goal: Reduce deaths, injuries, property loss, and economic disruption due to windstorms

Strategy	Mitigation & Climate Adaptation Actions Bolded actions indicate priority for state	Funding and Resources	Timeframe
Technical Assistance, Tools, and Data	Improve state owned and operated facility database	MnGeo-GAC, Admin, HMGP	ongoing
Local Planning and Regulations	Planning, training, technical studies, acquisition and use of equipment, adoption of ordinances and legislation, and construction new or retrofit safe rooms will be used to prevent or reduce risks from windstorms to lives, property, and economic activity.	HMGP-5%, NWS, USGS	Post-disaster, annually
Structure and Infrastructure Projects	Constructing safe rooms and storm shelters, retrofitting, and vegetation management will be used to prevent or reduce risks to the protection of property from windstorms.	HMGP, BRIC	Post-disaster, annually
Education and Awareness Programs	Public education, warning systems, and access to information will be used to raise public awareness of risks from windstorms in order to prevent or reduce those risks.	HMGP-5%, NWS	Ongoing, pre- and post-disaster
Mitigation Preparedness and Response Support	Purchase and install generator hook-ups and encourage local generator purchases for identified critical facilities that require back-up power.	County, city, HMGP 5%	Annually

Table 69. Extreme Temperature (Heat/Cold) Goal: Reduce deaths, injuries, and economic disruption due to extreme temperatures

Strategy	Mitigation & Climate Adaptation Actions Bolded actions indicate priority for state	Funding and Resources	Timeline
Technical Assistance, Tools, and Data	None identified	NA	NA
Local Planning and Awareness	Provide funding and technical assistance to help communities reduce their urban heat islands, prioritizing disproportionately impacted communities (State action step under CAF 3.3.4).	MPCA, HMGP, BRIC, MN DNR Urban Forestry	Ongoing
	Encourage the development of resilience hubs which provide and coordinate culturally sensitive, multilingual services to better meet the needs of diverse groups of community members in response to extreme heat and other climate-driven impacts. (State action step under CAF 3.3.4)	MPCA, Commerce, LGUs	New, ongoing
	Planning and the acquisition and use of equipment will be used to prevent or reduce risks from extreme heat/cold.	HMGP-Planning, BRIC-Planning, EMPG	Ongoing, as required

Strategy	Mitigation & Climate Adaptation Actions Bolded actions indicate priority for state	Funding and Resources	Timeline
Structure and Infrastructure Projects	Acquisition and use of equipment and materials to prevent or reduce risks to property and economic disruption from extreme heat/cold.	EMPG, MnDOT & PROTECT	Ongoing, as required
Education and Awareness Programs	Public education and access to information will be used to raise public awareness of the risks from extreme heat/cold in order to prevent or reduce those risks.	HMGP-5%, NWS, USGS	Ongoing, pre- and post-disaster
	Assist vulnerable populations. Organize outreach to vulnerable populations, establish and promote accessible heating or cooling centers in the community. Create a database to track those individuals at high risk of death, such as the elderly, homeless, etc.	HMGP-5%	Ongoing
Mitigation Preparedness and Response Support	Purchase and install generator hook-ups and encourage local generator purchases for identified critical facilities that require back-up power.	County, city, HMGP 5%	Ongoing
	Planning, responder training, warning systems, establishing shelters, and technological improvements will provide emergency services to prevent or reduce risks from extreme heat/cold.	EMPG	Ongoing, as required

Table 70. Winter Storms Goal: Reduce deaths, injuries, property loss, and economic disruption due to winter storms (blizzard, ice, and ice storm)

Strategy	Mitigation & Climate Adaptation Actions Bolded actions indicate priority for state	Funding and Resources	Timeline
Technical Assistance, Tools, and Data	None identified	NA	NA
Local Planning and Regulations	Acquisition and use of equipment, adoption and enforcement of ordinances and legislation, **planning, training**, and technical studies will be used to prevent or reduce risk to the protection of lives, property, and economic activity from the risks from severe winter storms.	HMGP-Planning, BRIC-Planning, EMPG	Ongoing, as required
Structure and Infrastructure Projects	Acquisition and use of equipment and vegetation management will be used to prevent or reduce risks to property from the risks from severe winter storms.	MN DNR, USFS, MnDOT	Pre- and post-disaster, ongoing
	Structural projects for critical infrastructure will be implemented and maintained to prevent or reduce risks from severe winter storms.	HMGP, BRIC	Pre- and post-disaster, ongoing

Strategy	Mitigation & Climate Adaptation Actions Bolded actions indicate priority for state	Funding and Resources	Timeline
Education and Awareness Programs	Public education, warning systems, access to information, and outreach projects will be used to raise public awareness of the risks from severe winter storms in order to reduce those risks.	HMGP-5%, NWS, USGS, State Agencies	Ongoing, pre- and post-disaster
Mitigation Preparedness and Response Support	Acquisition and use of equipment, emergency response services, warning systems, technological improvements, planning, and responder training will provide emergency services to prevent or reduce risks from severe winter storms.	SHSP	Annually

Table 71. Lightning Goal: Reduce deaths, injuries, property losses, loss of services, and economic disruption due to lightning

Strategy	Mitigation & Climate Adaptation Actions Bolded actions indicate priority for state	Funding and Resources	Timeline
Technical Assistance, Tools, and Data	None identified	NA	NA
Local Planning and Regulations	Planning, technical studies, acquisition and use of equipment, adoption of ordinances and legislation, and establishing shelters will be utilized to prevent or reduce the risks from lightning.	HMGP-Planning, BRIC-Planning, EMPG	Ongoing, as required
Structure and Infrastructure Projects	Retrofits and construction of safe rooms and storm shelters will be used to prevent or reduce the risks to property from lightning.	HMGP, BRIC	Ongoing, pre- and post-disaster
Education and Awareness Programs	Public education, outreach projects, and access to information will be used to raise public awareness of risks from lightning in order to prevent or reduce those risks.	HMGP-5%, NWS	Ongoing, pre- and post-disaster

Table 72. Hail Goal: Reduce deaths, injuries, property damage, and economic disruption due to hailstorms

Strategy	Mitigation & Climate Adaptation Actions Bolded actions indicate priority for state	Funding and Resources	Time frame
Technical Assistance, Tools, and Data	None identified	NA	NA
Local Planning and Regulations	Planning, technical studies, and adoption of ordinances and legislation will be used to prevent or reduce risks to life, property, and economic activity from hailstorms.	HMGP-Planning, BRIC-Planning, EMPG	Ongoing, as required

Strategy	Mitigation & Climate Adaptation Actions Bolded actions indicate priority for state	Funding and Resources	Time frame
Structure and Infrastructure Projects	**Retrofit critical facilities** and maintenance of existing structures will be used to prevent or reduce the risks from hailstorms.	HMGP, BRIC	Ongoing, pre- and post-disaster
Education and Awareness Programs	Public education and access to information will be used to raise awareness of the risks of hailstorms in order to prevent or reduce those risks.	HMGP-5%, NWS, USGS	Ongoing, pre- and post-disaster
Mitigation Preparedness and Response Support	Warning systems, responder training, technological improvements, and planning will be used to provide emergency services to prevent or reduce the risks from hailstorms.	SHSP	Annually

Table 73. Dam/Levee Failure Goal: Reduce deaths, injuries, property loss, natural resource and economic disruption due to dam/levee failure.

Strategy	Mitigation & Climate Adaptation Actions	Funding and Resources	Timeline
Technical Assistance, Tools, and Data	Map and Assess Vulnerability of Dams, Levees, and Low Head Dams	USACE, MN DNR, Silver Jackets	Ongoing
Local Planning and Regulations	Inundation mapping and Emergency Action Plans	Silver Jackets	Ongoing
Structure and Infrastructure Projects	Remove obsolete structures	MN DNR, USACE, FERC	Ongoing
Natural Systems Protection	Remove obsolete structures	MN DNR, USACE, FERC	Ongoing
Education and Awareness Programs	Increase dam/levee risk awareness	MN DNR, USACE, FERC, Silver Jackets, HMGP and HMGP 5% Initiative. National Dam Safety awareness day is May 31 annually.	Ongoing
Mitigation Preparedness and Response Support	Support response to dam/levee failure.	SHSP	Annually

Table 74. Drought Goal: Reduce economic loss and environmental impacts due to drought

Strategy	Mitigation & Climate Adaptation Actions	Funding and Resources	Timeline
Technical Assistance, Tools, and Data	Assess vulnerability to drought risk	HMGP—planning, BRIC-planning	Ongoing

Strategy	Mitigation & Climate Adaptation Actions	Funding and Resources	Timeline
Local Planning and Regulations	Planning, acquisition and use of equipment, and technical studies will be used to prevent or reduce risks from drought.	HMGP-Planning, BRIC-Planning, USGS, NWS	Ongoing
	Monitor Drought Conditions U.S. Drought Monitor https://droughtmonitor.unl.edu/	USGS, NWS	Ongoing
	Plan for Drought Plan for future drought events: developing a drought emergency plan, develop criteria or triggers for drought-related actions, develop a drought communication plan and early warning system.	USDA, County SWCD, County and Cities, MPCA	Ongoing
Natural Resource Protection:	Planning and implementing watershed plans will be used to prevent or reduce risks from drought.	MN DNR	As funding allows
Structure and Infrastructure Projects	Retrofit Water Supply Systems	HMGP, BRIC	Pre and post-disaster
	Water treatment measures will be used to prevent or reduce risks to property from drought.	MN DNR	As funding allows
Natural Systems Protection	Enhance Landscaping and Design Measures. Incorporate drought tolerant or xeriscape practices into landscape ordinances to reduce dependence on irrigation. Encourage drought-tolerant landscape design through measures such as: provide incentives for xeriscaping, using permeable driveways and surfaces to reduce runoff and promote groundwater recharge	BWSR, USDA, County SWCD County, Cities, MPCA, MnDOT	As funding allows
Education and Awareness	Mitigate and improve resilience to drought on agricultural land through practices including agronomic, crop selection and management, soil conservation, soil health, irrigation, and drainage water management.	MDA, BWSR, NRCS	Ongoing
	Educate and inform farmers and rural landowners on impacts of changing weather patterns and ways to mitigate impacts and increase resilience.	MDA, BWSR, NRCS, FSA	Ongoing

Table 75. Coastal Erosion and Flooding Goal: Reduce deaths, injuries, property loss, and economic disruption due to coastal erosion and flooding of shoreline: caused primarily by flowing water or wave and/or wind action

Strategy	Mitigation & Climate Adaptation Actions	Funding and Resources	Timeframe
Technical Assistance, Tools, and Data	Map and Assess Vulnerability to Erosion	HMGP, BRIC, MN DNR, BWSR, MnDOT, USDA, NRCS, FSA, SWCDs, Silver Jackets	Ongoing, pre- and post-disaster
	Inventory data and research related to Northshore Coastal Erosion.	HMGP, BRIC, MN DNR, BWSR, USDA-NRCS-FSA, SWCDs, Silver Jackets	Ongoing, pre- and post-disaster

Strategy	Mitigation & Climate Adaptation Actions	Funding and Resources	Timeframe
	Develop data-based tools to aid local SWCDs and Cities develop common guidelines for landowners Lake Superior's North Shore	HMGP, BRIC, MN DNR, BWSR, USDA-NRCS-FSA, SWCDs, Silver Jackets	Ongoing, pre- and post-disaster
	Improve state owned and operated facility database	MnGeo-GAC, Admin, MnDOT, HMGP & BRIC planning	Ongoing
Local Planning and Regulations	Encourage locals to manage development and/or ag land use	HMGP, BRIC, MN DNR, BWSR, USDA-NRCS-FSA, SWCDs	Ongoing, pre- and post-disaster
	Planning, technical studies, land use plans, adoption of setback ordinances, and adoption of building code	HMGP, BRIC, MN DNR, BWSR, USDA-NRCS-FSA, SWCDs	Ongoing, pre- and post-disaster
	Promote site and building design standards	ICAT, LGUs, GreenStep Cities	Ongoing, pre- and post-disaster
Structure and Infrastructure Projects	Remove Existing Buildings and Infrastructure from Erosion Hazard Areas. Acquire/demolish or relocate at-risk buildings and infrastructure and enforce permanent restrictions on development after land and structure acquisition.	HMGP, BRIC, MN DNR, USDA-NRCS-FSA	Ongoing, pre- and post-disaster
Natural Systems Protection	Stabilize Erosion Hazard Areas using best management practices	HMGP, BRIC, MN DNR, BWSR, USDA, NRCS, FSA, MnDOT	Ongoing, pre- and post-disaster
Education and Awareness Programs	Increase Awareness of Erosion Hazards.	HMGP-5%, NWS, USGS, Silver Jackets, BWSR	Ongoing, pre- and post-disaster
	Educate and inform farmers and rural landowners on impacts of changing weather patterns and ways to mitigate impacts and increase resilience.	MDA, BWSR, NRCS, FSA	Ongoing, pre- and post-disaster
Emergency Services:	Planning to implement emergency services will be used to prevent or reduce risks from coastal erosion and flooding.	SHSP	Annually

Table 76. Erosion/Landslide/Mudslide Goal: Reduce deaths, injuries, property loss, and economic disruption due to hillside, coastal, bluff: caused primarily by oversaturation of soil. (Also see Coastal Erosion and Flooding)

Strategy	Mitigation & Climate Adaptation Actions	Funding and Resources	Timeframe
Technical Assistance, Tools, and Data	Map and Assess Vulnerability to Landslides. Ongoing multi-agency workgroups at universities to map and inventory landslide information. The MN DNR has limited information on bluffs and landslides on website.	HMGP, BRIC, MN DNR, MnDOT, USDA, NRCS, FSA, SWCDs, Silver Jackets	Ongoing, Pre and post-disaster
	Improve state owned and operated facility database	Admin	Ongoing
Local Planning and Regulations	Manage Development in Landslide Hazard Areas	LGU's	Ongoing, Pre and post-disaster
Structure and Infrastructure Projects	Prevent Impacts to Roadways	MnDOT, Counties, Cities and Townships, B3-MSBG	Ongoing, Pre and post-disaster

Strategy	Mitigation & Climate Adaptation Actions	Funding and Resources	Timeframe
	Remove Existing Buildings and Infrastructure from Landslide Hazard Areas	HMGP, BRIC, MN DNR, USDA, NRCS, FSA	Ongoing, Pre and post-disaster
Natural Systems Protection	Stabilize Erosion Hazard Areas	HMGP, BRIC, MN DNR, BWSR, USDA, NRCS, FSA, MnDOT	Ongoing, Pre and post-disaster
	Mitigate and improve resilience to increased amount and intensity of precipitation on agricultural land through practices including agronomic, crop selection and management, soil conservation, soil health, and drainage water management.	MDA, BWSR, NRCS, FSA, MnDOT	Ongoing, Pre and post-disaster
Education and Awareness Programs	Increase Awareness of Erosion Hazards	HMGP-5%, NWS, USGS, MPCA	Ongoing, Pre and post-disaster
	Educate and inform farmers and rural landowners on impacts of changing weather patterns and ways to mitigate impacts and increase resilience.	MDA, BWSR, NRCS, FSA	Ongoing, Pre and post-disaster

Table 77. Subsidence Goals: Reduce the threat to public health, property loss, and damages to structures and infrastructure due to sinkholes and karst

Strategy	Mitigation & Climate Adaptation Actions	Funding and Resources	Timeframe
Technical Assistance, Tools, and Data	Map and Assess Vulnerability to Subsidence	HMGP, BRIC, MN DNR, BWSR, USDA-NRCS-FSA, SWCDs	Ongoing
	Improve state owned and operated facility database	Admin	Ongoing
Local Planning and Regulations	Planning, technical studies, and building/development regulations will be used to prevent or reduce risks from sinkholes and karst.	HMGP, BRIC, MN DNR, BWSR, USDA-NRCS-FSA, SWCDs	Ongoing, as required
Structure and Infrastructure Projects	Measures to reduce the volume of water passing into a sinkhole will be used in order to reduce financial loss, property damage, and threats to the public health and safety.	MN DNR, HMGP-5%	Pre-and post-disaster, ongoing
Education and Awareness Programs	Outreach efforts, public education and access to information will be employed to raise public awareness in order to reduce financial loss and risks to lives and property from subsidence.	MN DNR, BWSR, USDA-NRCS-FSA, SWCDs, HMGP-5%, NWS, USGS	Pre- and post-disaster, ongoing
Mitigation Preparedness and Response Support	Planning to implement emergency services will be used to prevent or reduce risks from subsidence.	SHSP	Annually

Table 78. Earthquake Goal: Limit property damage, economic loss, and disruptions in commercial and industrial activities in Minnesota due to earthquake

Strategy	Mitigation & Climate Adaptation Actions	Funding and Resources	Timeframe
Technical Assistance, Tools, and Data	None identified	NA	NA
Local Planning and Regulations	Planning, building code adoptions and management programs will be used to prevent or reduce risks to property and economic activity from earthquakes.	HMGP-Planning, BRIC-Planning, EMPG	Ongoing, as required
Structure and Infrastructure Projects	Repair and retrofitting of structures will be used to prevent or reduce risks from earthquakes.	HMGP, BRIC, EMPG	Ongoing, as required
Education and Awareness Programs	Public education and access to information will be used to raise awareness of the risks from earthquakes in order to prevent or reduce those risks.	HMGP-5%, NWS, USGS	Ongoing, pre- and post-disaster
Mitigation Preparedness and Response Support	Planning, responder training, alert systems, establishing shelters, and technological improvements will provide emergency services to prevent or reduce risks from earthquakes.	SHSP	Annually

7.5 Funding and Project Implementation

RL4. Did Element S10 (funding sources) address RL and SRL properties?

CFR References 44 CFR §§201.4(c)(3)(iv) and 201.4(c)(3)(v)

RL5. Did Element S13 (local and tribal, as applicable, capabilities) address RL and SRL properties?

44 CFR References §§201.4(c)(3)(ii) and 201.4(c)(3)(v)

RL6. Did Element S15 (prioritizing funding) address RL and SRL properties?

44 CFR References §§201.4(c)(4)(iii) and 201.4(c)(3)(v)

The State of Minnesota continues to experience many long-term successes with hazard mitigation. During the last five years, multiple mitigation projects continue to coincide with the objectives and goals in the State Hazard Mitigation Plan to prevent and reduce the risks to lives, property, and economic activity from the effects of all hazards. Minnesota communities continue to benefit from hazard mitigation activities through the implementation of actions in their local hazard mitigation plans, such as acquiring flood-damaged properties, relocating buildings out of flood- and erosion-prone areas, and building tornado safe rooms. These mitigation measures are making communities across the state safer and more secure against the negative impacts of natural and human-caused hazards. The State of Minnesota continues to effectively implement hazard mitigation programs towards achieving its goals as identified in this Plan.

To date, the state has successfully administered HMA funding to assist local governments in implementing hazard mitigation measures that include planning, property acquisitions, electrical utility system and infrastructure retrofit/hardening, wildfire sprinklers, defensible space and wildfire-resistant construction materials, and community tornado safe-rooms. Disaster-specific events and associated disaster response and recovery measures can result in the prioritization of specific hazard mitigation measures that contribute to the disaster recovery process. In Minnesota, this holds true in particular for acquisition or relocation of erosion-prone structures, severe repetitive loss and repetitive loss residential and commercial structures, as well as flood retrofitting projects for critical facilities and infrastructure. Hazard mitigation planning, and the acquisition of hazard-prone (flood and erosion) structures and community tornado safe rooms remain a priority. Since the previous plan there have been no new electrical utility retrofit or wildfire protection projects applications developed.

State and local community mitigation plans review the potential hazards in their respective jurisdictions and consider how those hazards may affect residents, infrastructure, services, business and industry. The planning then identifies the priorities and techniques to mitigate the effects from a particular hazard. Some techniques may be low-cost and can be done at the local level while other measures may need the assistance of state and federal funding.

The difference between this Minnesota All-Hazard Mitigation Plan and local (multi-jurisdictional) plans is that this Plan contains strategies on how to support hazard mitigation and climate adaptation planning and programs statewide. The goals do not recommend specific hazard mitigation/climate adaptation techniques for a specific location but outline support for local governments with technical assistance and grant funding from state and federal agencies in regard to mitigation/adaptation planning and projects. The state program goals also point to how mitigation/adaptation planning needs a broad base of input from state agencies, regional development commissions, universities, the private sector and communities.

7.5.1 Hazard Mitigation Funding

Post-disaster Hazard Mitigation Grant Program (HMGP) funding in the state from DR-824-MN (1989) through DR-4722-MN (2023) has resulted in the following federal HMGP expenditures and obligations for:

- Acquisition projects ~$58 million: 1,151 structures
- Electric distribution over $21.1 million
- Mitigation planning over $4.4 million
- Drainage projects over $16.1 million
- Wildfire projects over $2.8 million
- Emergency Protective Measures over $12.7 million
- Erosion Control projects over $1.1 million

From 2000 through 2023, the State of Minnesota received over $17 million through non-disaster programs: Pre-Disaster Mitigation (PDM) and BRIC, both through the annual competitive program and Congressional Earmarks for the following:

- Local mitigation planning over $3 million
- Tribal mitigation planning ~ $180,000
- Acquisition projects ~$ 1.5 million (18 structures)
- Wildfire projects over $2.8 million
- Emergency Protective Measure projects over $5.4 million

Flood Mitigation Assistance (FMA) through 2023 included the following:

- Acquisition projects $2,747,000 (47 properties)
- Flood Planning $66,160
- FEMA mitigation data is available in the FEMA Media Library.

Applications for DR-4722-MN are currently open for application until July 19, 2024.

7.5.2 Priority Mitigation Actions

Each disaster has its own priority based on the natural hazard that caused damage and each congressional appropriated non-disaster grant (BRIC and FMA) has its own priority list. The priority mitigation actions in Minnesota include the following:

Hazard Mitigation Planning

Planning mitigation measures address multiple objectives in the Plan that largely impact the state goals for the prevention and reduction of risks to lives, property, and economic activity from the effects of all hazards. Hazard mitigation planning is a high priority mitigation measure for implementation in the State of Minnesota. Development of local plans offer communities the opportunity to identify and evaluate hazards; assess risk, probability, vulnerability, and impact; and develop mitigation goals and actions for the prevention and preparation of future hazard events. At the time of this Plan update, of the 87 counties in the state, 57 have approved plans and the remaining 30 have FEMA planning grants or are in the process of applying for a FEMA grant. Of the 11 tribal communities, eight have an approved plan, and three have planning grants.

FEMA Region 5, the MN DNR NFIP Coordinator and HSEM coordinate with local jurisdictions that have Repetitive Loss (RL) and Severe Repetitive Loss (SRL) properties. Local mitigation plans must contain RL/SRL information in order to be eligible for property acquisition projects. HSEM also coordinates potential acquisitions with the MN DNR Flood Hazard Mitigation (FHM) Grant program to determine if funding is available for the local share. Funding for RL and SRL properties is determined at the time of application (either under HMGP or FMA).

Acquire flood-prone (repetitively and severely repetitively damaged) properties and convert to open space/green space

Nearly 1,600 property acquisitions have been funded due to catastrophic flooding in the state. Hazard Mitigation grant programs provide funding for acquisition/demolition of properties. Additional properties are being acquired through FHM funding by the Minnesota Department of Natural Resources.

Application of property acquisitions as a mitigation measure directly address objectives for river and flash flooding and infrastructure failure hazards. Acquisitions are an important way to reduce the risk of future disasters. Property acquisition is one of many forms of hazard mitigation and it is the most permanent form. It removes people from harm's way indefinitely and reduces risks to property from riverine and flash flooding. It is a terrific opportunity for people who live on or near hazard areas to get to safer ground.

Flooding is the highest ranked hazard in this Plan. Acquisition/demolition of RL or SRL properties and conversion to open space is ranked as a high priority for mitigation measures in this Plan. Property acquisitions of homes in special flood hazard areas will directly reduce deaths, injuries, property loss and economic disruption from future flooding events. Loss Avoidance Studies for the cities of Austin, Moorhead and Montevideo demonstrate that flood mitigation through property acquisition has had positive community impacts.

Structures Elevation

Structure elevation activities involve physically raising an existing structure to an elevation no lower than the Base Flood Elevation (BFE) plus one foot to reduce damages due to flooding. The structure is raised or moved so that a higher foundation can be installed. Continuous foundation walls or elevating on fill are common methods used in Minnesota. All utilities are raised above the regulatory flood protection elevation (RFPE) so they are not damaged by water. Any space below the elevated first floor must remain unoccupied. The foundation must be in compliance with American Society of Civil Engineers publication 24-14, and all FEMA criteria must be met. The net result is that the owner is required to carry a National Flood Insurance Program policy to protect against damage to the foundation only. This policy is a huge savings over having the entire structure insured.

Acquire hazard-prone (imminent threat) properties

Acquisition/demolition and relocation of erosion-prone properties are a newer project type in Minnesota. Due to changing intensity and duration of rainfall events, geologically young river systems are eroding. A home with a view is now a home with an encroaching riverbank threatening destruction. The criteria for FEMA erosion-prone buyouts is documenting a 20% rate of erosion per year, with 5-year danger of imminent threat.

Examples of acquiring and demolishing hazard-prone properties occur in Norman County along the Wild Rice Watershed. Extreme and sustained stream flows due to heavy rains undercut the toe of a river bluff and caused extreme rates of erosion, threatening seven homes. In Crookston, the conditions resulted in the acquisition of seven residential properties. In these cases, the homes were appraised at pre-disaster values, so the owners are reimbursed at a higher value than the current state of their property.

Blue Earth County with HMGP DR-4390 funds acquired and demolished two flood-prone properties located within the Special Flood Hazard Area. The properties were being affected by the increased rainfall events in southern Minnesota and were impacted by the snow melt and ice jams along a bridge in 2019. The county has since taken ownership of these properties to maintain them as open space.

Construct or retrofit community tornado safe rooms

Constructing safe rooms or retrofitting existing structures help prevent and reduce risks to life from tornadoes, thunderstorms and lightning, hailstorms, and windstorms. Community tornado safe rooms are for two-hour life safety protection from severe storms. Priority projects address areas with unprotected populations, such as campgrounds, parks, recreational areas, areas with insufficient protection, manufactured home parks, and places with vulnerable populations, such as schools, eldercare and day care centers, government facilities, and critical facilities.

Electrical utility retrofit/hardening

Historically, Minnesota has experienced a great number of ice storms, windstorms, and severe weather events that cut off power for rural electric cooperative customers. HSEM has worked in partnership with rural electric cooperatives to fund projects to limit the loss of electrical services to Minnesotans. The state continues to fund projects that reduce the future risk of life safety and health, property loss and economic disruption effected by hazards from severe winter storms, wind storms, power failure, tornadoes, and lightning.

Wildfire mitigation

The forested northeastern counties of Cook, Lake and St. Louis are the most wildfire-prone in the state. The state has funded many homeowners in the Arrowhead Region to implement wildfire mitigation projects. Counties assisted homeowners with defensible space activities, vegetation management, use of ignition-resistant building materials and installation of external wildfire sprinkler systems. DR-4131-MN funded a project in Lake County to replace standard roofing with wildfire resistant roofing. 55 structures were fitted with metal roofs.

Drainage and flood control mitigation

The state and eligible communities throughout the state have worked in partnership to develop infrastructure mitigation projects. These mitigation projects are broadly defined as drainage and flood control type mitigation. Mitigation projects in development are intended to retrofit existing drainage systems to more effectively handle riverine and overland flooding; protect commercial, residential, and governmental facilities critical to the health, safety and welfare of the populations they serve; and reduce and/or eliminate the long-term risk to people and property from natural hazards. These projects involve storm sewer systems, sanitary sewer systems, potable water treatment facilities, wastewater treatment, buildings, equipment, and life safety. Proposed projects from local jurisdictions are the result of local mitigation plan updates, Risk MAP meetings and Public Assistance/Hazard Mitigation outreach. State agencies recognize potential projects through the vulnerability review process and review of capital improvement plans.

An example of a successful flood mitigation project is from the city of Worthington in Nobles County. Nobles County Ditch No. 12 (CD 12), also known as Okabena Creek, runs through many residential neighborhoods and by commercial facilities in the city of Worthington. CD-12 was originally built over 100 years ago and would flood during winter snowmelt and moderate to heavy rainfall events. In addition, the culvert that crosses under Interstate 90 was restricting flow due to its limited size and was causing flooding upstream in the city. The best option for the city was to construct a regional flood storage basin that would cover approximately ten acres and upsize several culverts on the creek. The implementation of these efforts reduced the impact of flooding to hundreds of homes and businesses.

An additional example of localized flood mitigation is from the city of Chanhassen. A home in the city was in immediate danger of damage due to erosion in a ravine. Stormwater from roads and a golf course drained down the ravine to a creek at its foot. The force of the water caused by extreme rainfalls was essentially causing a flash flood in the ravine. The pressure of the excess water eroded soils and uprooted established trees which accelerated the failure of the soils. The solution was to install a storm drain to capture water at the top of the ravine and direct it through a piping system to the creek below. The ravine was restored to its natural contours and vegetation installed to stabilize the soil for any residual rain that may come down the ravine. Through these mitigation measures risk to the home was eliminated.

The 5 Percent Initiative allows grantees under HMGP to use up to 5% of total HMGP grant funds for projects that are difficult to evaluate using FEMA-approved cost-effectiveness methodologies, but which otherwise meet HMGP eligibility requirements. To demonstrate cost-effectiveness under the 5 Percent Initiative, applicants and sub-applicants must provide a narrative description of the project's cost-effectiveness in lieu of a standard BCA.

Applicants cannot use the 5 Percent Initiative to fund mitigation activities that do not meet the required BCA threshold using a FEMA approved methodology.

Installation of early warning and communication systems

Currently, the use of the 5% Initiative Program is being directed toward implementation of lightning prediction and warning systems. Coaches and referees of outdoor youth sports are trained to stop games and take shelter when lightning is in the area. The problem is that this method is a subjective call based on observation and interpretation of area-wide weather notifications. Systems have been developed to measure atmospheric conditions on site and send a uniform warning. This type of system was installed at the Bielenberg Sports Center and Eagle Valley Golf Course in Woodbury. The sports center may host up to several thousand players and spectators during various summer tournaments. The National Sports Center in Blaine is funded to install a lightning prediction and warning system in 2019. The center hosts the Schwan's Cup each July when more than 20,000 people may be on site at any one time.

7.5.3 Interagency Programs

Minnesota Silver Jackets

The vision of the Minnesota Silver Jackets is to "Create, maintain, and integrate comprehensive partnerships to reduce risk associated with natural hazards in Minnesota." Their mission is "To establish an interagency working group with State and Federal Agencies to: 1) Enable the effective and efficient sharing of information, 2) Identify and promote the sharing and coordination of available agency resources, and 3) Promote natural hazard risk education and information dissemination throughout the state of Minnesota.

The Silver Jackets worked on and continues to implement a variety of mitigation projects and collaborate across agencies. The team has implemented/supported or is in the process of implementing/supporting several interagency projects, including:

- Participation in State Hazard Mitigation Planning update
- Catastrophic bluff erosion and collapse issue—science-based method to assist zoning officials with reducing risk.
- Emergency Action Plan Guide Book Workshops
- Flood Inundation Mapping projects
- River gauge system enhancement
- FEMA Risk MAP process support
- High Water Mark sign and outreach project
- Enhanced hydrologic data instrumentation in the Red River basin.

The Silver Jackets signed-on as a NOAA Weather-Ready Nation Ambassador in October of 2015. The Weather-Ready Nation Ambassador initiative is an effort to formally recognize NOAA partners who are improving the nation's readiness against extreme weather, water, and climate events. As a Weather-Ready Nation Ambassador, the organization is committing to work with NOAA and other ambassadors to strengthen national resilience against extreme weather. The group receives and disseminates newsletters and other risk awareness publications.

River Gauges

River gauges are vitally important for the people of Minnesota, and are used in many ways, including flood warnings, river forecasts for flooding, navigation, water supply, and recreation, water quality monitoring, flood mitigation efforts, and more. Agencies at every level cooperate to install gauges, collect and disseminate data, and share information among all interested parties in order to provide valuable information to the public. This cooperation has resulted in a network of over 350 gauges across the state. The U.S. Geological Survey (USGS) and MN DNR both maintain over 100 gages each, while the Minnesota Pollution Control Agency (MPCA) and U.S. Army Corps of Engineers (USACE) have many gauges as well. Local watershed districts, cities and counties have also added gauges to the mix, and in many cases provide local funding to keep gauges maintained in their areas. Most of these gauges are equipped with NOAA satellite telemetry to provide real-time information to the National Weather Service (NWS), local officials, HSEM, MN DNR, USGS, and the USACE. The data is provided to the public on websites from all the entities and utilized by the private sector for web-based and mobile applications.

The NWS utilizes these real-time reports as input to river models which provide forecasts of river levels and flow, which are used to issue flood warnings for the protection of life and property. The data is also used to calibrate and validate the river model. The USGS and MN DNR take manual measurements of river flow to calibrate the river height/flow relationships, which is vitally important to assure the accuracy of both the gauge readings and river forecasts. All the agencies involved use gauge resources cooperatively in the mitigation, preparation, response, and recovery phases of emergency management. River flow data is also vitally important to dam operators who use it to make decisions on power generation, navigation, flood control and recreational use.

Future development of the National Water Model by the NWS will require continued real-time river information for calibration and validation of the model information. The model is being designed to provide forecast information for any stream in the country, and thus methods to obtain “ground truth” for currently un-gaged streams will need to be pursued.

Climate Change Subcabinet

Executive Order 19-37 Establishing the Climate Change Subcabinet and the Governor's Advisory Council on Climate Change to Promote Coordinated Climate Change Mitigation and Resilience Strategies in the State of Minnesota led to the creation of interagency Action Teams for collaborative efforts to develop a state framework addressing climate change. Implementation of Minnesota’s Climate Action Framework (CAF) published in September 2022 is being tracked through development of interagency workplans and state-level metrics by Goal Teams (reconstituted from the prior Action Teams) for the various goals of the CAF. MPCA is the lead agency for the Subcabinet, providing support from the MPCA Climate Director and Climate Unit staff.

MDH and HSEM

Climate and Health Program: HSEM and MDH collaborations have been ongoing since 2015. HSEM was invited to work with MDH on the Climate & Health Strategic Plan Objective ‘Develop mechanisms to broaden engagement of, and increase coordination among, all stakeholders with the shared problem-solving joint management of health and safety needs both prior and to and during incidents.’ The activity proposed under this objective was for the MDH Climate and Health Program to work in collaboration with key partners to evaluate best practices for incorporating climate change strategies into emergency preparedness plans and processes. After a thorough review of strategies, it was determined that the most useful strategy would be to develop resources for emergency managers and emergency preparedness professionals to help them better understand and utilize climate projection data for planning.

Emergency management professionals are on the frontlines of responding, but often lack access to and understanding of climate trend data to help plan for and minimize the risks of impacts from extreme weather events. As a way to help planners and decision-makers in emergency management and related fields understand regional climate trends, the Minnesota Climate & Health Program developed climate and health data profiles tailored to each of the six HSEM regions across the state. Work on this initiative began in 2017 and a release of the final regional profile reports occurred in August, 2018.

Each regional profile includes a description of climate change trends along with a summary of climate and population projection data. Additionally, each regional profile provides a local case study to illustrate the links between extreme weather and natural disasters and what climate projection data can (and can't) indicate for similar events in the future. This resource provides a framework for discussing projected local risks related to the changing climate and supports the development of climate adaptation strategies that protect community health and safety. All of the profile reports can be found on the MDH website.

Summary

Funding for mitigation planning and projects primarily comes from federal grants. However, the state continues to pursue additional funding sources to assist locals. Interagency collaboration for funding climate adaptation projects will have to continue to come from each agency as its mission dictates.

The following sections contain the Inventory of Programs, Policies, and Funding, which provides information on the funding source, description of the type of funding and monetary capabilities. Mitigation measures identified in local hazard mitigation plans reflect the reliance on federal and state resources to assist with these measures.

7.6 Inventory of Programs, Policies, and Funding

Requirement §201.4(c)(3)(iv): The State mitigation strategy shall include an identification of current and potential sources of Federal, State, local, or private funding to implement mitigation activities.

In addition to FEMA disaster and non-disaster hazard mitigation grants programs, there are funding sources available to the state and local jurisdictions for mitigation projects. A listing of federal, state and other agency resources is contained in this section. The site summary and agencies have all-hazard mitigation information and potential funding capabilities.

7.6.1 Federal Agencies and Programs

The Federal Agency Programs Reference document was updated for the 2018 Interagency Flood Risk Management Community of Practice Training Seminars (Silver Jackets) in 2018. The updated, consolidated information may be used as a catalyst to increase interagency coordination and collaboration among state and federal agencies and improve the combined efficiency and effectiveness of agencies. It lists federal agencies and their activities at times in the emergency management cycle: Preparation, Response, Mitigation and Recovery (Table 79).

Table 79. Available assistance from federal agencies

Agency	Preparation	Response	Mitigation	Recovery
DOT	X	X	X	X
EPA	X	X	X	X
FEMA	X	X	X	X
HUD	X		X	X
NASA	X	X	X	X
NOAA NWS	X	X	X	X
NOAA OCM	X		X	X
NRCS			X	X
USACE	X	X	X	X
USFWS	X		X	X
USGS	X	X	X	X

Another valuable resource is Assistance Listings [previously known as the Catalog of Federal Domestic Assistance (CFDA)]. It provides a full listing of all federal programs available to state and local governments; federally recognized Indian tribal governments; domestic public, quasi-public, and private profit and nonprofit organizations and institutions; specialized groups; and individuals.

The Region 5 Mitigation Funding Resource Guide for Minnesota outlines the numerous federal hazard mitigation funding sources that are available to assist with state and local mitigation projects, ranging from planning and technical assistance to housing and infrastructure. A list of grant programs is provided in Table 80. Each program is denoted by the corresponding recovery support functions established under the National Disaster Recovery Framework (NDRF). The support functions are aimed at restoration and revitalization. Detailed descriptions of each grant program are also provided, including information about the program, eligibility requirements, cost sharing, and application timeframe.

FEMA has developed a Hazard Mitigation & Resiliency Toolkit for FEMA Region 5. It contains a collection of strategies and tools to assist local governments in promoting hazard mitigation through existing policies and programs, or to consider new opportunities to integrate resiliency within the community.

The six support functions are as follows:

Community Planning and Capacity Building support increases community recovery capacity and builds community planning resources needed to effectively plan for, manage, and implement disaster recovery activities.

Economic Recovery support focuses on sustaining and/or rebuilding businesses, employment, and tourism along with the development of economic opportunities that result in sustainable and economically resilient communities.

Health and Social Services support assists in the restoration of public health, health care, and social services networks to promote the resilience, health, and well-being of affected individuals and communities.

Housing support addresses post-disaster housing issues and coordinates the delivery of assistance resources activities to rehabilitate and reconstruct destroyed and damaged housing, when feasible, as well as the development of accessible temporary and permanent housing.

Infrastructure Systems support facilitates efforts by infrastructure owners to achieve recovery goals relating to public engineering of infrastructure systems. Infrastructure systems and services should be restored to support a viable, sustainable community and improve resilience to and protection from future hazards.

Natural and Cultural Resources support addresses long-term environmental and cultural resource recovery needs. This includes the protection of natural and cultural resources and historic properties through response and recovery actions to preserve, conserve, rehabilitate, and restore them in a way consistent with community priorities and in compliance with applicable laws (FEMA, 2012).

Table 80. Region 5 Mitigation Funding Resource Guide summary

Program Name	Recovery Support Area(s)					
Flood Mitigation Assistance (FMA) Program[1]	●			●	●	●
Pre-Disaster Mitigation (PDM) Program[1]	●			●	●	●
Building Resilient Infrastructure and Communities (BRIC) Program	●			●	●	●
Hazard Mitigation Grant Program (HMGP)[2]	●			●	●	●
National Flood Insurance Program (NFIP)[1]	●			●		
Public Assistance (PA) Program[2]			●		●	
Emergency Management Performance Grants (EMPG)[1]	●					

Program Name	Recovery Support Area(s)					
Community Assistance Program—State Support Service Element (CAP—SSSE) [1]	●					
Individuals and Households Program (IHP) [2]				●		
Environmental Planning and Historic Preservation (EHP) Program[2]						●
Flood Plain Management Services (FPMS) Program[1]	●				●	
Continuing Authorities Program[1]	●				●	●
Inspection of Completed Works Program[1]	●				●	
Rehabilitation and Inspection Program[1]					●	
Community Development Block Grant (CDBG) Program[3]	●	●	●	●	●	●
Department of Homeland Security Grant Program (HSGP) [1]	●					
Small Business Administration (SBA) Disaster Loan Program[2]		●		●		
National Earthquake Hazards Reduction Program (NEHRP) [1]	●					
Drought Assistance Programs[2]		●				●
FEMA Firefighter Assistance Grants[1]	●		●			
Forest Legacy Program (FLP) [1]	●					●
Federal Excess Personal Property Program[1]	●					●
Forest Stewardship Program[1]	●					●
Rural Housing Programs[3]			●	●		
Reimbursement for Firefighting on Federal Property[2]	●		●			
Fire Management Assistance Grant Program (FMAGP) [2]	●		●			●

Program Name	Recovery Support Area(s)					
USDA Farm Service Agency (FSA) Emergency Conservation Program (ECP) [2]		●				●
The Conservation Reserve Program (CRP) [1]						●
USDA Farm Service Agency (FSA) Tree Assistance Program (TAP) [2]		●				
USDA Water and Waste Disposal Programs[1]					●	
Internal Revenue Service (IRS) Disaster Assistance and Emergency Relief for Individuals and Businesses[2]		●		●		
National Oceanic and Atmospheric Administration Restoration Center Grants[2]						●
U.S. Department of Housing and Urban Development Programs[3]	●			●		
Department of Transportation/Federal Highway Administration Emergency Relief Program[2]					●	
Department of Commerce/Economic Development Authority (EDA) [1]	●	●			●	
Climate Resilient Mitigation Actions (CRMA)					●	●
Inflation Reduction Act (IRA)		●	●		●	

7.6.2 State Agencies and Programs

Examples of state agencies and programs include:

Minnesota Environmental Quality Bureau (EQB)—The Environmental Quality Board is made up of 9 agency heads and 8 citizen members. They provide leadership and coordination across agencies on priority environmental issues that are multi-jurisdictional, and multi-dimensional, as well as provide for opportunities for public access and engagement.

Climate Solutions and Economic Opportunities—An interagency and partner-collaboration report outlining a foundation for Minnesota's state climate action planning with identified co-benefits for climate change adaptation.

Minnesota Department of Administration—Provides services to government agencies: information technology, facilities and property management, graphic and geographic information systems data and software.

Minnesota Department of Agriculture (MDA)—Responsible for the regulation of pesticides, fertilizers, food safety and feed including emergency response, state Superfund authority and financial assistance for agricultural entities.

Agriculture Best Management Practices (AgBMP) Loan Program—The AgBMP Loan Program is a water quality program that provides low-interest loans to farmers, rural landowners, and agriculture supply businesses.

Minnesota Agricultural Water Quality Certification Program (MAWQCP)—Interagency effort by MDA, MPCA, BWSR, and MN DNR to promote water quality Best Management Practices on agricultural lands that promote resilient resources, reduce emissions and sequester carbon such as cover crops, no till, biomass plantings, riparian buffers and conservation cover. *Funding:* Supplemental grants of $5,000 or 75% Cost Share to install BMPs.

Minnesota Board of Water & Soil Resources (BWSR)—Assists local governments to manage and conserve water and soil resources.

Conservation Easements—Minnesota's premier conservation easement program on privately-owned lands. Administered by the USDA Natural Resources Conservation Service (NRCS). RIM-WRP combines the Reinvest in Minnesota (RIM) Reserve program, administered by BWSR, with the Wetlands Reserve Program (WRP), administered by the USDA Natural Resources Conservation Service (NRCS). The RIM-WRP partnership is implemented by local Soil and Water Conservation Districts. Conservation easements on frequently flooded lands. *Funding:* The RIM-WRP Partnership restores wetlands and grasslands through permanent conservation easements on privately owned lands.

RIM Wetlands Conservation Easements—*Funding:* The RIM Wetlands program restores wetlands and grasslands through permanent conservation easements on privately-owned lands. BWSR has received this funding through the Outdoor Heritage Fund (from the Clean Water, Land and Legacy Amendment).

One Watershed, One Plan—BWSR's vision for One Watershed, One Plan is to align local water planning on major watershed boundaries with state strategies towards prioritized, targeted and measurable implementation plans—the next logical step in the evolution of water planning in Minnesota.

Minnesota Department of Commerce (COMM)—The Market Assurance Division in the Department of Commerce regulates insurance companies & agents, banks, and real estate. The Office of Energy Security within the Department of Commerce manages energy assistance funds and provides information and assistance to consumers and businesses on home improvements, financial assistance, renewable technologies, and utility regulations.

Energy Assistance Program– The Energy Assistance Program (EAP) helps pay home heating costs. Households with the lowest incomes and highest energy costs receive the greatest benefit. Households who are at or below 50% of the state median income are eligible. Size of grant is based on household size, income, fuel type and energy usage. Funds are available for renters or homeowners. *Funding:* Federally funded through U.S. Department of Human Services.

Local Energy Efficiency Program (LEEP)—Program providing local government's investment grade audits for energy projects.

Energy Audit & Renewable Feasibility Study Loan Program *Funding:* 2- or 3-year low interest loan for local governments to complete energy or renewable studies.

Energy Savings Partnership (ESP)—*Funding:* Lease-purchase financing for energy projects at local governments through St Paul Port Authority; low interest rates and low minimum project cost.

Sustainability and Energy Efficiency Resources—Compendium of agency initiatives and sustainability resources for single and multifamily housing.

B3 Design Guidelines—Design guidelines for new buildings or renovations to meet sustainability goals for site, water, energy (SB2030), indoor environment, materials and waste that required for buildings that receive general obligation bond funds.

B3/SB 2030 Energy Efficient Operations Manual—Web-based public building operations manual. B3 Sustainable Building SB 2030—Progressive energy standard designed to significantly reduce the energy and carbon in Minnesota commercial, institutional and industrial buildings.

Zero Net Energy (ZNE) Schools Accelerator—MN ZNE School Roadmap to be used by schools to attain ZNE facility.

Minnesota Emergency Medical Services Regulatory Board—Provides leadership for emergency medical care for the people of Minnesota.

Minnesota Department of Employment and Economic Development (DEED)—Advances the economic vitality of Minnesota through trade and economic development, including the provision of employer and labor market information.

Public Facilities Authority (PFA)—Administers and oversees the financial management of three revolving loan funds and other programs that help local units of government construct facilities for clean water (including wastewater, stormwater and drinking water) and other kinds of essential public infrastructure projects. *Funding:* Provides municipal financing programs and expertise to help communities build public infrastructure that preserves the environment, protects public health, and promotes economic growth.

Small Cities Development Program—The purpose of this program is to provide decent housing, a suitable living environment and expanding economic opportunities, principally for persons of low-and-moderate income to cities and townships with populations under 50,000 and counties with populations under 200,000. *Funding:* Provides federal grants from the U.S. Department of Housing and Urban Development (HUD) to local units of government. State program rules subdivide grant funds into three general categories: Housing Grants, Project Facility Grants, and Comprehensive Grants. Public Facility Grants could include projects involving storm sewer projects and flood control projects.

Greater Minnesota Public Infrastructure Grant Program—Their purpose is to stimulate new economic development and create or retain jobs in Greater Minnesota through public infrastructure investments. *Funding:* Provides grants to cities of up to 50% of the capital costs of the necessary public infrastructure, which expand or retain jobs in the area, increase the tax base, or which expand or create new economic development. Eligible projects include, but not limited to wastewater collection and treatment, drinking water, storm sewers, utility extensions, and streets.

Redevelopment Grant Program—The purpose of this program is to provide grants to assist development authorities with costs related to redeveloping blighted industrial, residential or commercial properties. *Funding:* Grants pay up to 50% of eligible redevelopment costs for a qualifying site, with a 50% local match. Grants can pay for land acquisition, demolition, infrastructure improvements, stabilizing unstable soils, ponding, environmental infrastructure, building construction, design and engineering and adaptive reuse of buildings.

Minnesota Environmental Quality Bureau (EQB)—The Environmental Quality Board is made up of 9 agency heads and 8 citizen members. They provide leadership and coordination across agencies on priority environmental issues that are multi-jurisdictional and multi-dimensional, and provide opportunities for public access and engagement.

Climate Solutions and Economic Opportunities—An interagency and partner-collaboration report outlining a foundation for Minnesota's state climate action planning.

Minnesota and Climate Change: Our Tomorrow Starts Today Report—2014 interagency report that provides an overview of climate change impacts in Minnesota and how Minnesotans are responding.

Minnesota Management & Budget (MMB)—Expedites fiscal management during a state disaster and assists with funding issues when federal assistance is not provided.

Minnesota Department of Health (MDH)—Provides data on the past and current health status of the citizens of Minnesota and other information on protecting the public's health from numerous natural and human-caused disasters, including infectious diseases, extreme weather events, and chemical/radiological contamination.

MDH Climate and Health Program—The program provides webinars, trainings, and communication materials to the public and stakeholders on the health impacts of climate change. The program publishes a monthly newsletter on climate and health with the latest research, events, and tools related to climate adaptation.

MN Climate and Health Profile Report—Summary of MN historic climate trends, future projections, and likely impacts of climate change on health of Minnesotans.

Extreme Heat Toolkit—Provides information to local governments and public health professionals about preparing for and responding to extreme heat events.

MN Climate Change Vulnerability Assessment—Provides communities with information about risks of climate change across MN counties and identifies how to prepare for climate hazards and how to protect vulnerable populations.

Planning for Climate & Health Impacts in Minnesota—The MDH Climate and Health Program developed Climate and health data profiles for each of the six Homeland Security and Emergency Management (HSEM) regions across the state. Each regional profile includes a description of climate change trends along with a summary of climate and population projection data. Additionally, each regional profile provides a local case study to illustrate the links between extreme weather and natural disasters and what climate projection data can (and can't) indicate for similar events in the future. This resource provides a framework for discussing projected local risks related to our changing climate and supports the development of climate adaptation strategies that protect community health and safety.

Health and Climate Change Training Module Series—Developed training modules on a wide range of MN climate change and health topics along with supporting materials available as a "train the trainer" resource.

MDH has a climate and health strategic plan that coordinates climate-related work across multiple programs and areas of disciplines within the department to protect the public's health from climate change impacts.

Minnesota's State Historic Preservation Office (SHPO)—Review and Compliance: The SHPO consults with federal and state government agencies to identify historic properties in government project areas and advise on ways to avoid or reduce adverse effects on those properties.

Minnesota Housing Finance Agency (MHFA) provides low- and moderate-incoming housing and resources.

Sustainability and Energy Efficiency Resources—Compendium of agency initiatives and sustainability resources for single and multifamily housing.

Minnesota Department of Human Services (DHS)—Provides health care, economic assistance, and other services for those in need.

Minnesota Department of Labor & Industry (DLI) —Assists with investigations when workers are injured, detects air contaminants caused by chemical or geological agents and assesses hazards. Statewide building codes and construction planning and inspection.

Metropolitan Council—Provides information on economic development and planning for anticipated growth in the seven county metro areas –Anoka, Carver, Dakota, Ramsey, Scott and Washington Counties.

Livable Communities Grant Program—The Metropolitan Council awards grants to participating communities in the seven-county metro area to help them, among other things, create development or redevelopment that demonstrates efficient and cost-effective use of land and infrastructure, a range of housing types and costs, commercial and community uses, walkable neighborhoods and easy access to transit and open space. *Funding:* Four different accounts to enable communities through the region to carry out their development plans, and leverage millions of dollars in private and public investment while providing jobs and business growth.

Regional Climate Vulnerability Assessment—This resource provides tools for communities, including an interactive Localized Flood Map Screening Tool and an Extreme Heat Map Tool. The webpage also includes story maps and other resources to assist metropolitan communities.

Resilience Plan Element—Web-based portion of the Local Planning Handbook that provides resources for resilience and climate-action planning to local communities, specifically tailored around comprehensive plans.

Minnesota Department of Natural Resources (MN DNR)—The Financial Assistance Directory provides summary level information on all of the Department of Natural Resources' financial assistance programs. The department offers a wide variety of financial assistance programs to cities, counties, townships, non-profits, schools, private individuals, and others. Relevant categories include:

Aquatic Invasive Species

Fire Protection Programs

Forest management

Habitat improvement

Water

MN DNR Division of Ecological and Water Resources—Addresses the conservation of natural systems and the maintenance of biodiversity. Water education information is available on and discusses floodplain management, flood mitigation, drought/water supply, dam safety, flood warning, climatology, and lake and stream gaging.

Flood Hazard Mitigation Grant Assistance (FMA)—The FMA program is under the FEMA Hazard Mitigation Assistance grant programs. The program provides technical and financial assistance to local governmental units for conducting flood risk reduction studies and for planning and implementing flood risk reduction measures. *Funding:* A maximum of 50% of total eligible project costs up to $150,000 with grants more than $150,000 requiring approval by the Legislature.

Dam Safety Grants– Improves the safety and condition of publicly owned dams and water level control structures. *Funding:* Reimbursement of costs, up to 50% for repairs, up to 100% for removals. Grants ranged from $25,000 to $1,000,000.

Wetland Tax Exemption Program—Provides a financial incentive to maintain wetlands in their natural state and to promote an awareness of wetland values. *Funding:* Qualifying areas are exempt from property taxes that remain in effect as long as wetland meets the requirements set forth in the statutes.

Firewise in Minnesota—The Minnesota Firewise Program is administered by the MN DNR. Under this program the MN DNR helps to support community wildfire mitigation efforts by passing federal Fire Plan funds through to local communities as grants for various "on-the-ground" activities including homeowner, mitigation education, home site assessment, access improvement, and dry hydrants. It involves community groups including fire and emergency services, local schools, city staff (i.e.

foresters, planners), and local interest groups. *Funding:* Grant request for 50:50 cost-share funding for assessment & planning, education & mitigation activities. Initial grant request may be for a small amount ($15,000) until Firewise Action Plan is developed. Second grants are available to implement additional actions.

Forest Stewardship—Provides technical advice and long-range forest management planning to interested landowners. All aspects of the program are voluntary. Plans are designed to meet landowner goals while maintaining the sustainability of the land. *Funding:* For the state's cost share program to help defer the costs of implementation of forest management activities. Must enroll forested lands into the Sustainable Forestry Incentive Act or 2c Managed Forest Land to be eligible for property tax relief programs.

Shade Tree Short Course—Provides information to communities on adapting forests to climate change.

Great Lakes Restoration Initiative Funding*:* Grants to help communities engage citizens in tree planting and maintenance in boulevards to help North Shore communities begin to adapt to climate change and stormwater management. Grants to three communities from $30,000-$35,000 and to the city of Duluth $175,000.

MN DNR State Climatology Office—The State Climatology Office exists to study and describe the climate of Minnesota. Each of its members concentrates its efforts on specific topical areas in which climate plays a significant role. As Minnesota's climate information authority, the Climatology Office collects, manages, analyzes, and disseminates climate information in service to the citizens of Minnesota. It is funded by the State of Minnesota Department of Natural Resources, Division of Ecological and Water Resources.

Minnesota Pollution Control Agency (MPCA)—Provides pollution prevention and management information and regulation for Minnesota.

Clean Water Fund—This fund is established under the Federal Clean Water Act and state law to make loans for both point source (wastewater and stormwater) and nonpoint source water pollution control projects. The Public Finance Authority prepares an annual Intended Use Plan (IUP) based on a Project Priority List developed by the MPCA. The IUP describes the projects and activities eligible for funding during the state fiscal year. MPCA dollars mainly go to monitoring and watershed strategies and TMDLs. Strategies and reduction goals are developed to address water pollution problems including restoration and protection.

MN Clean Water Roadmap—Includes information on changing climate patterns (p.8): "It is essential to consider Minnesota's changing temperature and precipitation patterns as protection and restoration strategies are developed and as projects are implemented across the state."

Stormwater Program—Minnesota Pollution Control Agency (MPCA) is the delegated permitting authority for Minnesota of the U.S. Environmental Protection Agency's (EPA) National Pollutant Discharge Elimination System (NPDES). Permits are required for most construction activities designed to limit polluted discharges and implement best management practices, including volume retention, and erosion and sediment control.

Stormwater Financial Assistance is available for public entities to expand or improve stormwater infrastructure. The Industrial Stormwater Best Management Practices Guidebook v1.1 contains best management practices and considerations for extreme weather events in Chapter 8. The Minnesota Stormwater Manual provides a wealth of information in a wiki format. The Manual contains Minimal Impact Design Standards with performance goals, credit calculations, design specification, and an ordinance guidance package. The Manual also contains Stormwater Infiltration Best Management Practices. Climate Benefits of Green Stormwater Infrastructure are explored. Rainwater/stormwater harvesting and reuse is encouraged and can be used for pollution and volume credits towards meeting permit requirements.

Surface Water Ambient (monitoring)—Provides data and information about the potential impacts of climate change on streamflow and water quality. That information, in turn, is ultimately used to inform planning, plans, practices, and projects which have hazard mitigation dimensions.

Watershed Program—MPCA staff work with local units of government in identifying water quality problems, developing restoration and protection strategies, managing funds for development of watershed restoration and protection strategies and total maximum daily loads (TMDL). Watershed project funding includes:

Clean Water Partnership Loans—provides funds for implementing best management practices related to nonpoint source pollution to improve water quality in watersheds.

Section 319 Grant Program—provides funds for nonpoint source BMP implementation, focusing on a small number of specific small watersheds.

Wastewater Program—This MPCA website contains information on permitting and regulations, engineering and technical information.

Wastewater Financial Assistance—This MPCA website offers multiple types of financial assistance and includes a factsheet on Flood guidance for wastewater treatment facilities

Interagency Climate Adaptation Team (ICAT)—The MPCA initiated and coordinates this collaboration of state agencies with the purpose of addressing climate change adaptation issues in the state. ICAT issued the 2017 Report: Adapting to Climate Change in Minnesota which includes five Statewide Climate Adaptation Indicators and six Recommendations for Action. Subsequently, ICAT formed six workgroups to obtain stakeholder input and identify ways to implement the recommendations. Other MPCA information related to mitigation: Preparing for homes and businesses for floods

Community Resilience—Compendium of resources and menu of strategies to help communities reduce risks from climate impacts, including for climate-vulnerable populations.

Minnesota GreenCorps—An AmeriCorps program that pairs members in host sites to preserve and protect Minnesota’s environment, including solid waste, greenhouse gases (GHG), energy use and water reduction; increase community resilience, educate community members, etc.

Minnesota GreenStep Cities—A voluntary challenge, assistance and recognition program to help cities achieve their sustainability and quality-of-life goals. This free, continuous improvement program, managed by a public-private partnership, is based upon 29 best practices including the most recent one for Climate Adaptation and Community Resilience.

Minnesota Department of Public Safety (DPS)—Includes State Fire Marshal, Office of Communications, Office of Pipeline Safety Team, State Patrol, Office of Justice Programs, Bureau of Criminal Apprehension, Alcohol and Gambling, Enforcement and Office of Traffic Safety.

MN DPS Homeland Security and Emergency Management (HSEM)—MN HSEM is also housed under DPS. This site contains information and resources for emergency management in Minnesota.

Minnesota Recovers Task Force—Minnesota Recovers is the state's clearinghouse for all information about floods, tornadoes and other natural disasters that strike Minnesota communities. Information about federal, state and local government disaster-assistance efforts is available on this website. *Funding:* Application for community financial assistance is available. Depending upon disaster, different types of funding become available. Flood-Control Grants, Small Cities Development Program and Public Facilities Authority funding information is available here.

Minnesota Office of the State Archaeologist—Conducts research into the prehistoric and historic archaeology of Minnesota.

Minnesota State Colleges and Universities—Provides information about Minnesota State universities and colleges.

Minnesota Department of Transportation—Works on comprehensive transportation issues in Minnesota. Their Sustainability webpage includes links to greenhouse gas reduction, climate resilience, solar, electric vehicles and other initiatives.

Statewide Extreme Flood Vulnerability Analysis**:** MnDOT is currently developing a process for evaluating flood risk to MnDOT bridges, large culverts, and pipes. Studying the performance of infrastructure under predicted extreme events will help MnDOT assess the impacts of climate changes to plan, design, build, and maintain assets for resilience.

University of Minnesota—The University of Minnesota's mission of education, research, and public engagement; its academic scope; and its statewide presence are marks of distinction and position UMN well to address the critical problems of this new century.

7.6.3 Climate Adaptation Resources

Climate adaptation resources in Minnesota include:

Climate Resilience Toolkit**:** The U.S. Climate Resilience Toolkit is a website designed to help people find and use tools, information, and subject matter expertise to build climate resilience. The Toolkit offers information from across the U.S. federal government in one easy-to-use location. The goal is to improve people's ability to understand and manage their climate-related risks and opportunities, and to help them make their communities and businesses more resilient to extreme events. This inter-agency initiative operates under the auspices of the United States Global Change Research Program. The site is managed by NOAA's Climate Program Office and is hosted by NOAA's National Centers for Environmental Information.

Adaptation Clearinghouse: The Adaptation Clearinghouse seeks to assist policymakers, resource managers, academics, and others who are working to help communities adapt to climate change. Content in the Adaptation Clearinghouse is focused on the resources that help policymakers at all levels of governments reduce or avoid the impacts of climate change to communities in the United States. The Adaptation Clearinghouse tends to focus on climate change impacts that adversely affect people and the built environment. Content focal areas include the water, coastal, transportation, infrastructure and public health sectors, and adaptation planning, policies, laws, and governance. Resources that fall within these areas receive priority and are the most likely to be published in the Adaptation Clearinghouse.

Climate Change Resource Center: The Climate Change Resource Center (CCRC) is a web-based, national platform that connects land managers and decision makers with useable science to address climate change in natural resources planning and management.

The CCRC provides information about climate change impacts on forests and other ecosystems, and approaches to adaptation and mitigation in forests and grasslands. The website compiles and creates educational resources, climate change and carbon tools, video presentations, literature, and briefings on management-relevant topics, ranging from basic climate change information to details on specific management responses. The CCRC is supported by the US Forest Service.

The main components of the CCRC are:

- Educational modules and other educational resources for managers
- Climate change topic pages
- Climate change adaptation and mitigation tools
- Adaptation examples
- Research library

Climate Adaptation Knowledge Exchange (CAKE): The Climate Adaptation Knowledge Exchange (CAKE) is managed by EcoAdapt. It aims to build a shared knowledge base for managing natural and built systems in the face of rapid climate change. It is intended to help build an innovative community of practice. It consists principally of four interlinked components: case studies, virtual library, directory, and tools. It also houses community forums for the discussion of current issues in climate adaptation.

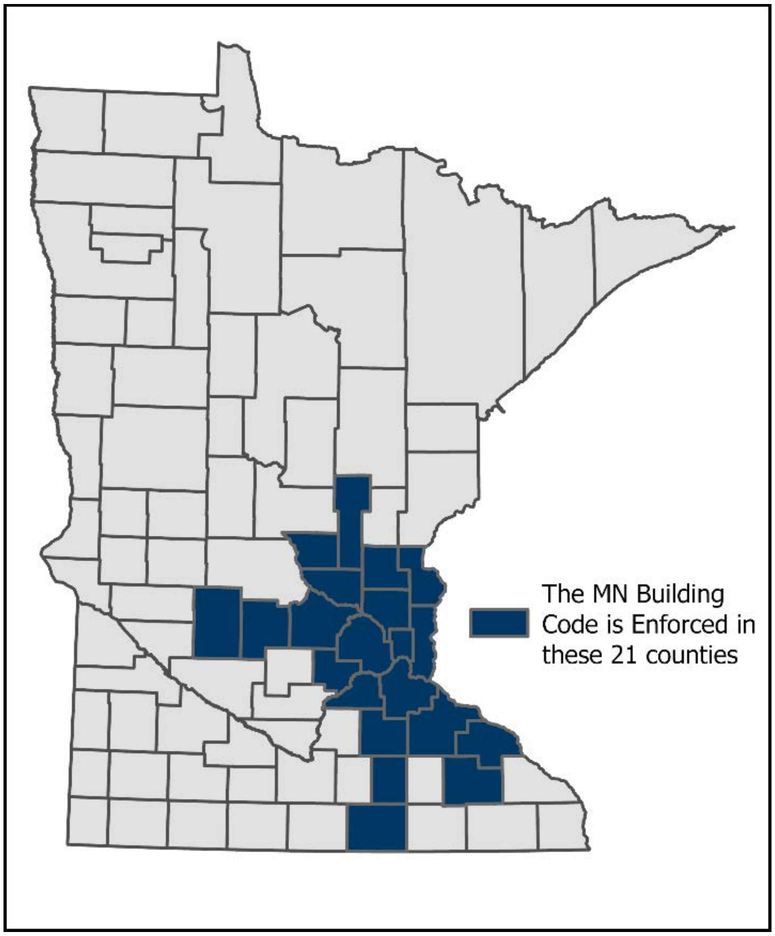
7.6.4 Building Codes

The MN Department of Labor and Industry Construction Codes and Licensing Division (DLI/CCLD) sets a minimum construction standard throughout all of Minnesota in Minnesota Statute 326B.101. Although it is not enforceable by municipalities unless it is adopted by local ordinance, it creates a level playing field for the construction industry. The MN building code is effective March 31, 2020. The next national model will be released in January of 2024 and those will form the 2026 Minnesota State Building Code.

The Minnesota State Building Code is enforced throughout 21 counties, 16 of which have their own county building official (Figure 20). The State Building Code is enforced in 432 of 852 cities, 59 of 1790 townships, and 16 of 87 counties. 217 designated building officials serve 507 municipalities, and 54 of the designated officials serve more than one municipality. DLI/CCLD coordinates with HSEM by having Construction Code Representatives designated and trained in the state emergency response system and authorized to access the State Emergency Operations Center. When disasters occur, those trained individuals will staff the EOC to provide responses to construction codes related questions and provide guidance specific to construction codes (G. Metz DLI, personal communication, December 19, 2023).

There are several challenges related to developing and implementing hazard-resistant building codes statewide. Because vast areas of the state are without local code enforcement, there is no guarantee that construction complies with the minimum construction requirements. Flood-prone areas of the state occur largely in non-code enforced rural and low-population areas, so resources are few and construction is unverified prior to disaster. Building code statutory parameters in Minnesota Statute 326B.101 do not include resilience or hazard mitigation except for fire protection but do include consideration for cost. Resilient buildings have incrementally higher first costs which is a challenge to dispute when resiliency and hazard mitigation is not included in DLI/CCLD scoping.

Figure 20. Minnesota Building Code



Because the DLI/CCLD is charged with carrying out the will of the legislature, it cannot require local municipalities to adopt the state building code. DLI has launched several campaigns to promote building code adoption in regions of the state that have not currently adopted the state building code, and has also attempted to add resiliency to Minnesota Rule 326B.106, however these efforts were largely unsuccessful (G. Metz DLI, personal communication, December 19, 2023).

Regarding state-owned facilities, designs are required to be submitted to DLI/CCLD for plan review to ensure compliance with the state building codes. Construction permits are issued by DLI/CCLD or our pre-qualified delegates to inspect the construction in progress to ensure compliance with the building codes.

7.6.6 Other Organizations

Other organizations that are available to assist the state include:

American Red Cross—Provides relief to victims of disasters and help people prevent, prepare for, and respond to emergencies.

American Water Works Association—Provides information on safe water resources.

League of Minnesota Cities – A membership organization dedicated to promoting excellence in local government. The League serves its more than 800 member cities through advocacy, education and training, policy development, risk management, and other services.

Association of Minnesota Counties—A broad range of services to its members, including education, communications, and intergovernmental relations. AMC works closely with the legislative and administrative branches of government in seeing that legislation and policies favorable to counties are enacted.

Association of State Dam Safety Officials—General Information about dams and dam safety in the US.

Mid-America Earthquake Center (MAE)—One of three national earthquake engineering research centers established by the National Science Foundation.

Minnesota Geological Survey (MGS)—The University outreach center for the science and technology of earth resources in Minnesota.

Minnesota Association of Watershed Districts (MAWD)—Provides educational opportunities, information and training for watershed district managers and staff through yearly tours, meetings and quarterly newsletters.

Minnesota Association of Soil and Water Conservation Districts (MASWCD)—Provides voluntary, incentive driven approaches to landowners for better soil and cleaner water. Provides private landowners with technical assistance to implement a wide variety of conservation practices.

National Association of Counties (NACo)—NACo is the only nation-wide organization representing county governments.

Minnesota Natural Resource Conservation Service—Locally based NRCS staff work directly with farmers, ranchers, and others, to provide technical and financial conservation assistance.

National Drought Mitigation Center—Information on drought preparation and risk management.

National Emergency Management Association (NEMA)—NEMA is the professional association of state, pacific, and Caribbean insular state emergency management directors.

Natural Hazard Mitigation Association—NHMA is an association for those in the hazard mitigation profession by offering workshop and brining expertise and experience to organizations, communities or regions with mitigation planning, training, outreach and implementation.

Association of Minnesota Emergency Managers (AMEM)—AMEM is the professional association of emergency managers in Minnesota.

National Energy Foundation—This is a site for kids, parents and teachers, with a focus on water conservation in the home.

National Fire Protection Association (NFPA)—Provides scientifically-based fire codes and standards, research, training, and education.

National Lightning Safety Institute—Independent, non-profit consulting, education and research organization focusing on lightning safety.

Natural Hazards Center at UC Boulder—Clearinghouse for natural hazards information. Publishes the Natural Hazards Observer.

Societal Aspects of Weather-Injury and Damage Statistics—Contains societal impact data for weather related disasters.

The Disaster Center—Provides news and information on current disasters, and the emergency management field.

The Disaster Research Center (University of Delaware)—Research center for the preparation and mitigation of natural and technological disaster for groups, organizations and communities.

The Tornado Project—Offers tornado books, posters, and videos.

United Nations International Strategy for Disaster Reduction—Increase public awareness of hazard and risk issues for the reduction of disasters in modern societies, motivate public administration policies and measures to reduce risks, and improve access of science and technology for risk reduction in local communities.

University of Wisconsin Disaster Management Center—The center's goal is to help improve the emergency management performance of non-governmental organizations, local and national governments, and international organizations, through a comprehensive professional development program in disaster management.

7.7 State Capability Assessment

S12. Does the plan discuss the evaluation of the state's hazard management policies, programs, capabilities, and funding sources to mitigate the hazards identified in the risk assessment?

44 CFR Reference §201.4(c)(3)(ii)

The state of Minnesota has the legal authority to engage in pre- and post-disaster mitigation activities via federal programs. MN HSEM is continually pursuing ways to improve programs, plans and policies for hazard mitigation to become incorporated into other types of planning, programs and policies. The Minnesota Recovers Task Force (MRTF) is a group of federal, state and local agencies working together to prioritize and coordinate the disaster recovery efforts by its member agencies. The State Hazard Mitigation Officer (SHMO) coordinates mitigation outreach and prioritizes funding for mitigation projects with this task force, with the goal of building long-term disaster resilience into communities. Continued coordination and integration of planning and hazard mitigation make the state of Minnesota more disaster resistant. The Minnesota Silver Jackets brings state and federal agencies together to advise the SHMO on natural hazards, collaborate on resource coordination, and to participate in joint projects aimed towards making Minnesota more disaster-resilient on the local level.

An evaluation of federal and state programs indicates the successes of mitigation efforts. However, much more can be done to integrate mitigation into existing planning efforts. The following is an assessment of existing programs, projects and policies that should be pursued to further increase mitigation efforts and results. Contribution to and participation in existing initiatives and coordinated efforts will strengthen mitigation planning at the state and local level and will continue to integrate hazard mitigation planning at all levels.

7.7.1 National Flood Insurance Program (NFIP)

The Floodplain Management Program with the MN DNR, Ecological and Water Resources Division oversees the administration of the state Floodplain Management Program by promoting and ensuring sound land use development in floodplain areas to promote the health and safety of the public, minimize loss of life, and reduce economic losses caused by flood damages. This unit also exists to oversee and administer the National Flood Insurance Program (NFIP) for the state of Minnesota. See the NFIP Community Status Book for current list of communities that participate in the program.

The goals of the Community Rating System (CRS) are to reduce flood losses, to facilitate accurate insurance rating, and to promote the awareness of flood insurance. The CRS was developed to provide incentives for communities to go beyond the minimum floodplain management requirements to develop extra measures to provide protection from flooding. Participation in CRS is voluntary, and the incentives are in the form of premium discounts. Since the previous plan in March of 2019, four communities joined the CRS, two communities improved their ratings, two communities decreased their ratings and one community dropped out. Table 81 includes the CRS participants in Minnesota.

State mitigation planners will continue to encourage local communities to update their mitigation plans and prioritize mitigation actions according to jurisdictional risks. HSEM will continue to promote participation in the NFIP, CRS and identify funding for the local share for acquisitions of repetitively damaged homes.

Table 81. Minnesota participants in the Community Rating System (CRS)

Community Name	CRS Entry Date	Current Effective Date	Current Class	% Discount
Austin, City of	10/1/91	5/1/08	5	25
Carver, City of	05/1/16	05/1/16	7	15
Granite Falls, City of	5/1/13	10/1/20	10	0
Golden Valley, City of	10/1/14	5/1/19	6	20
Lake St. Croix Beach, City of	10/1/95	10/1/22	9	5
Montevideo, City of	5/1/10	10/1/22	6	20
Moorhead, City of	5/1/10	4/1/23	5	25
Mower County	10/1/95	5/1/00	8	10
Rochester, City of	10/1/91	10/1/96	10	0
St. Louis Park, City of	5/1/19	5/1/19	8	10
West St. Paul, City of	10/1/91	10/1/96	10	0
Wilkin County	05/1/17	05/1/17	9	5

Source: (FEMA, 2024a)

NFIP mapping is an important tool in determining vulnerability to floods for mitigation planning and projects. An important advancement is digital NFIP rate maps. Converting the maps from paper copies affords greater degrees of accuracy and convenience. Community participation in the mapping processes results in digital maps with a higher degree of accuracy. The MN DNR's Floodplain Management Program coordinates the map revision process between FEMA and local jurisdictions. As of January 2024, 67 counties have preliminary or effective Digital Flood Insurance Rate Maps (DFIRMs). The MN DNR Floodplain Management website includes information about FEMA floodplain mapping products, where to find them and how to use them. There is also a page showing the FEMA map status for each county.

7.7.2 FEMA Risk MAP

The vision for FEMA Risk MAP (Risk Mapping, Assessment and Planning) is to deliver quality data that increases public awareness and leads to action that reduces risk to life and property. Risk MAP builds on flood hazard data and maps produced during the Flood Map Modernization program. Risk MAP goes beyond providing the regulatory rate maps required for the NFIP program. Communities are asked to review areas of high flood risk during Risk MAP meetings then develop potential mitigation projects.

The meetings are coordinated by the MN DNR's Floodplain Management Unit with input on hazard mitigation from HSEM mitigation staff. Representatives from the U. S. Army Corp of Engineers and National Weather Service participate as part of the MN Silver Jackets local outreach. County Emergency Management directors are invited to attend these meetings since the potential projects and participants should be integrated into the local multi-jurisdictional mitigation plan processes. The estimated FEMA Map Modernization status in Minnesota current schedule is available here.

The purpose of Risk MAP is to collaborate with tribal, state, and local entities to deliver quality flood data that increases public awareness and leads to action that reduces risk to life and property from flood hazards. The previous map updating process was called Map Modernization. It was a five-year effort from 2003-2008 to modernize Flood Insurance Rate Maps and make them digital for the majority of the population in Minnesota. This was done on a countywide basis without much up-front coordination and scoping with local stakeholders.

Risk MAP is the newer method and uses a collaborative approach at a watershed scale to improve public awareness of flood risk and provide quality data. "Discovery" is the first phase in FEMA's Risk MAP Program and creates an opportunity to take a holistic view of the watershed. Discovery has an important emphasis on developing partnerships, combining resources, and sharing flood risk information to develop a vision for the watershed. The process allows local communities to determine the need for FEMA flood risk products that can potentially be scoped through Risk MAP. Some of the flood risk products can be regulatory, such as Flood Insurance Rate Maps and Flood Insurances Studies, or non-regulatory, such as depth grids, water surface elevation grids, and Hazus risk analysis.

Another important aspect of the Discovery process is discussing the importance of mitigating flood risk. HSEM has participated in Discovery meetings by educating local officials about hazard mitigation programs with the goal of building solutions to their flood hazard risks. Silver Jackets members often attend these meetings to offer their subject matter expertise, historical project knowledge of area and additional programmatic availability.

7.7.3 Flood Hazard Mitigation (FHM)

The Flood Hazard Mitigation Grant Assistance Program was created by the Minnesota Legislature in 1987 to provide technical and financial assistance to local government units for reducing the damaging effects of floods. Under this program the state can make cost-share grants to local units of government for up to 50% of the total cost of a project. The goal of existing regulations and programs for flood damage reduction is to minimize the threat to life and property from flooding. The efforts of local governments to enforce their zoning ordinances, to sponsor flood mitigation public improvement projects, and to acquire or relocate flood-prone buildings have significantly helped to reduce risk to lives and flood damages across the state. See Success Story in Section 6 for more information on the state Flood Hazard Mitigation Grant program.

7.7.4 Firewise

The Minnesota Firewise program, administered by MN DNR, works with local communities by passing federal Fire Plan funds through to local communities as grants for various on-the-ground activities including local Firewise plans, mitigation education, home site assessment, access improvement, and dry hydrants. Firewise does not provide funds to make structures fire resistant.

Community Wildfire Protection Plans (CWPP) are the foundation to make structures in Wildland Urban Interface (WUIs) areas more resilient to wildfires. Regional Firewise coordinators work with county emergency management directors, fire departments, local elected officials, federal agencies and community members to develop a CWPP. The plans cover the development and enforcement of building codes, establishing defensible space around structures, and other measures. CWPPs are used to determine funding for Firewise eligible projects.

Pre-Disaster Mitigation (PDM) and Hazard Mitigation Grant Program (HMGP) funds have been used to install wildfire sprinkler systems to protect structures from wildfires. Several hundred sprinkler systems have been installed in Cook, Lake, and St. Louis counties. Wildfire sprinkler systems combined with defensible space have proven to be effective mitigation techniques. Water is sprayed over structures and surrounding property to increase the moisture content. Wildfires burn around treated areas and the sprinklers extinguish any embers that may fly into the treated area. The net effect is that structures sustain only minimal damage at worst and the workload for fire crews can be focused on controlling the fire instead of trying to save structures. Wildfire sprinklers systems may even inhibit the spread of fire over larger areas. Technology has been changing to accommodate a variety of water source conditions. County emergency managers in wildfire-prone areas are aware of the Firewise program depending on the county's vulnerability to wildfire.

7.7.5 MDH Climate and Health Program

The Minnesota Climate and Health Program (Program) at the Minnesota Department of Health improves our State's and partners' ability to protect the public's health and prevent further harms from climate change through implementing the following strategies to further climate change adaptation and mitigation:

- **Educate:** Resonate with the hearts and minds of the public and decision-makers to build a culture of health and climate action. The Program provides webinars and trainings to the public and stakeholders on the health impacts of climate change. The program publishes a regular newsletter on climate and health with the latest research, events, and tools related to climate adaptation. Click here to subscribe to the Minnesota Climate and Health Newsletter.

- **Research:** Conduct credible and innovative research to facilitate implementation of evidence-based adaptation strategies. The program researched the most likely health impacts of climate change, sharing this information publicly through the Minnesota Climate and Health Profile Report.
- **Build Capacity:** Create tools and products to expand and accelerate health and climate solutions. The program has developed a significant number of tools to help planners and emergency management and preparedness professionals adapt to and mitigate climate change, including the Minnesota Extreme Heat Toolkit, the Heat Vulnerability Assessment Tool, and a series of climate change and health data profiles. The Profiles were developed for each of the six Homeland Security and Emergency Management (HSEM) regions across the state and include a description of climate change trends along with a summary of climate and population projection data. Additionally, each regional profile provides a local case study to illustrate the links between extreme weather and natural disasters and what climate projection data can (and can't) indicate for similar events in the future. The resource provides a framework for discussing projected local risks related to our changing climate and supports the development of climate adaptation strategies that protect community health and safety. More information on the development of the Profiles and the evaluation results can be found here: Advancing Health & Disaster Resiliency in Minnesota (Whitepaper) (state.mn.us)

The Minnesota Climate and Health Program helps coordinate climate-related work across multiple programs and areas of disciplines within the department to protect the public's health from climate change impacts. An update on program successes and next steps can be found here: Minnesota Department of Health Climate & Health Strategic Plan Progress Report (state.mn.us).

7.7.6 Minnesota Recovers Task Force

The Minnesota Recovers Task Force (MRTF) formed in response to the Great Flood of 1993, when the Mississippi and Missouri Rivers and their tributaries overflowed, causing one of the most costly and devastating floods in the history of the United States. The task force's purpose is to combine and coordinate government resources toward long-term recovery efforts and hazard mitigation activities. The MRTF helps get funds and assistance directly to those areas most affected by a recent disaster. This approach is an example of how efficiently funds, ideas and resources can cross agency and political boundaries to accomplish mitigation actions. Based on type, severity and extent of disaster, different subcommittees are formed to assist individuals and communities in need.

Following a major disaster, state disaster relief funds may be allocated to assist local units of government in their disaster recovery. These funds may be appropriated to address those needs, which are not met by other disaster assistance programs. In a presidentially declared disaster, this is typically grant assistance from the FEMA Public Assistance and Individual Assistance Programs, and loan assistance from the Small Business Administration.

Funds are typically allocated to different state agencies and their programs, to acquire and to better publicly owned land and buildings and for other public improvements of a capital nature. In some instances, funds may become available to assist local homeowners, businesses, and non-profit organizations. In these cases, the impact on the community will be weighed when funding decisions are made. The local unit of government should apply on behalf of these groups when a significant impact exists.

While the MRTF is mainly recovery focused, mitigation actions are often funded, including acquisitions and drainage and infrastructure improvements. Funding the local match for mitigation projects has been a priority for the subcommittee as the local share has been identified as an unmet need for many communities post-disaster. A summary of the most recent legislative activities follows:

2019 Disaster Assistance Contingency Account (DACA):

- Appropriates $30,000,000 to the DPS will be maintained in the DACA account
    - Non-federal share of federal public assistance,
    - 75% of state public assistance

In response to Presidential Disaster Declarations DR-4442MN and DR-4531-MN, the task force met. The State legislature did not allot any additional funds for the task force to address unmet needs.

7.7.7 Homeland Security and Emergency Management: Recovery

Coordination of mitigation during long-term recovery is essential for communities to become resilient to future disasters. HSEM has developed the Minnesota Disaster Recovery Assistance Framework to assist local units of government recover from disasters. The Recovery Function Index is a comprehensive guide of 18 functions for funding, programs and policies from insurance assistance, damage assessments, debris management, and housing assistance to public infrastructure recovery.

HSEM has expanded disaster recovery roles to include staff, including a Disaster Recovery Coordinator, Community Recovery Coordinator and Volunteer Resource Coordinator. The Disaster Recovery Coordinator provides coordination between local, state and federal agencies during the recovery phase of the numerous disasters declared in Minnesota, as well as coordinates long-term recovery efforts from state, county and local levels. The state offers multiple Disaster Recovery Workshops to local emergency managers and other interested parties. The role of the Community Recovery Coordinator is to provide technical assistance to local jurisdictions, counties, tribal governments, regional consortiums and non-profit organizations in coordinating long-term recovery activities following a major disaster or emergency. This position also assists in the coordination of voluntary resources in long-term recovery efforts. The role of the Volunteer Resource Coordinator is to coordinate on an ongoing basis with state government, local government and voluntary agencies on response issues, to ensure that the public and private sectors work together to address these issues in a coordinated manner, and that volunteer resources are incorporated into local disaster response and recovery plans to the greatest extent possible.

7.7.8 State Public Assistance Program

Minnesota Statutes Chapter 12 lays out emergency management responsibilities of HSEM and other state agencies. Minnesota Statutes Chapter 12A established a framework for state agencies to help communities recover from disaster. In 2014 Governor Mark Dayton signed legislation establishing the state's Disaster Assistance Contingency Account to assist local communities after a natural disaster when federal aid is not available. The legislation also requires the state to cover the full FEMA match in federally declared disasters. The state and/or county must meet a certain damage threshold in order to qualify for state or federal disaster assistance. The state must have at least half the federal disaster threshold in damage; and counties must meet individual county threshold . Since the inception of the state PA program in 2014 there have been 76 state disaster declarations.

The state Disaster Assistance Contingency Account (DACA) funds 75% of state disaster reimbursement to local units of government and eligible non-profits. This account also supports LGU and eligible non-profits with the 25% match for federal disaster declarations. Since DACA was established in May 2014 more than $100 million have been transferred to provide the state share of state and federal disaster assistance to tribes, counties, cities, townships, and state agencies.

Facts about the State Public Assistance Program include:

Eligibility Criteria

- The state or applicable county government declares a disaster or emergency during the incident period;
- Damages suffered and eligible costs incurred are the direct result of the disaster;
- Federal disaster assistance is not available to the applicant;
- The applicant incurred eligible damages that equal or exceed 50% of the countywide per capita indicator under FEMA's Public Assistance Program;
- The applicant assumes responsibility for 25% of the applicant's total eligible costs;
- The applicant satisfies all requirements in chapter 12B.
- Costs eligible for payment are those eligible for federal financial assistance under FEMA's Public Assistance Program.

The process for a county to request state or federal assistance is found on HSEM’s website. HSEM does not currently have a state mitigation program.

7.7.9 Minnesota GreenStep Cities and Tribal Nations Program

Minnesota GreenStep Cities and Tribal Nations Program is a voluntary challenge, assistance, and recognition program to help cities achieve their sustainability and quality-of-life goals. This free continuous improvement program, managed by a public-private partnership, is based upon 29 best practices. Each of the best practice actions are environmental and sustainability efforts. Each best practice can be implemented by completing one or more actions at a 1, 2, or 3-star level, from a list of four to eight actions. These actions are tailored to all Minnesota cities, focus on cost savings and energy use reduction, and encourage civic innovation. Partners include MPCA, EQB, MN DNR, Commerce, and MnDOT.

A recent update includes FEMA HMA programs. The current resources listed in Best Practice 29.2 under the Implementation Tools tab reads as follows: The Community Resilience Indicator Analysis and Integrating Hazard Mitigation into Local Planning is available from FEMA Hazard Mitigation Assistance programs. Eligible activities are: Aquifer Storage and Recovery, Floodplain and Stream Restoration, Flood Diversion and Storage, and Green Infrastructure Methods focused on mitigating the impacts of flood and drought conditions. (Applicable to 3 Star implementation.)

7.8 Repetitive and Severe Repetitive Loss

Requirement §201.4(c)(3)(v): A State may request the reduced cost share authorized under §79.4(c)(2) of this chapter for the FMA and SRL programs, if it has an approved State Mitigation Plan ... that also identifies specific actions the State has taken to reduce the number of repetitive loss properties (which must include severe repetitive loss properties), and specifies how the State intends to reduce the number of such repetitive loss properties.

It is a priority for the state to ensure property owners in flood risk areas are aware of programs to insure, buyout and/or flood-proof their structures. The National Flood Insurance Program is available to property owners whose communities participate in the program. The MN DNR NFIP state coordinator continually provides education to local units of governments, insurance brokers and others on the benefits of NFIP, the process and benefits. Individual property owners with NFIP protection are eligible for FEMA and state mitigation programs, however participation is voluntary. The state and local jurisdictions make it a priority to educate home and business owners of their options to avoid future flood damage to their properties. The state will continue to promote and elevate the importance of grant funding opportunities to jurisdictions with flood properties.

Acquisition of Severe Repetitive Loss (SRL) Properties: Acquisition of property where the structures are demolished or relocated out of the floodplain works hand in hand with enforcement of NFIP regulations. Acquisition of repetitively damaged properties breaks the cycle of construction, destruction, and reconstruction. SRL properties are the costliest to the NFIP fund due to the number and magnitude of sustained damages. The Biggert-Waters Act of 2012 revised the definition of SRL properties:

(a) Is covered under a contract for flood insurance made available under the NFIP; and

(b) Has incurred flood-related damage—

(i) For which 4 or more separate claims payments have been made under flood insurance coverage with the amount of each such claim exceeding $5,000, and with the cumulative amount of such claims payments exceeding $20,000; or

(ii) For which at least 2 separate claims payments have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the insured structure.

The procedure is that HSEM's mitigation program contacts the local jurisdiction to start the process of acquiring the property. Severe Repetitive Loss Properties Eligible for HMA Funding in Appendix H: Repetitive Loss and Severe Repetitive Loss Properties shows details by jurisdiction.

Acquisition of Repetitive Loss (RL) Properties: Federal, state, and local funding has resulted in the acquisition of a significant number of repetitive loss structures. The NFIP Repetitive Loss Mitigated (in Appendix H) indicates 256 properties have been acquired. The total for these properties for building payments was over $9.7 million, contents payments were over $1.7 million for a total of $11.4 million in losses. The top five counties in number of mitigated properties are listed in Table 82.

Table 82. Top five counties for mitigated properties (Nov 2018–Jan 2024)

County	Number of Mitigated Properties
Mower	117
Clay	32
Marshall	22
Hennepin	13
Yellow Medicine	9

(FEMA, 2024B)

The definition of a repetitive loss property for Flood Mitigation Assistance (FMA) structures covered by a contract for flood insurance made available under the NFIP that:

- Has incurred flood-related damage on two occasions, in which the cost of the repair, on the average, equaled or exceeded 25% of the market value of the structure at the time of each such flood event; and
- At the time of the second incidence of flood-related damage, the contract for flood insurance contains increased cost of compliance coverage.

7.8.1 Flood Mitigation Assistance: Severe Repetitive Loss and Repetitive Loss Properties

There are 85 properties defined as FMA/NFIP SRL. A detailed spreadsheet is included as of 1/28/2024 in Appendix H: Repetitive Loss and Severe Repetitive Loss Properties for RL and SRL for FMA/NFIP. The 321 claims total $8,413,997 in building payments and $2,251,242 in contents for a total of $10,665,239.

There are 549 properties defined as FMA/NFIP RL. A detailed spreadsheet is included as of 1/28/2024 in Appendix H for FMA/NFIP. The 1,451 claims total $24,771,863.97 in building payments and $4,900,243 in contents for a total of $29,672,106.

SRL and RL properties by county are listed in Table 83.

Table 83. FEMA NFIP/FMA Severe Repetitive Loss (SRL) and Repetitive Loss (RL) Properties by County

County Name	# RL Properties	# SRL Properties	Total Building Payments	Total Contents Payments
Anoka	1	0	$22,572.41	$1,057.76
Becker	5	0	$166,247.12	$23,413.20
Benton	4	0	$81,797.09	$10,924.76
Big Stone	2	0	$72,805.96	
Blue Earth	4	0	$304,611.44	$92,334.11
Brown	2	0	$283,767.81	$56,525.73
Carlton	2	0	$102,566.74	$23,961.17

County Name	# RL Properties	# SRL Properties	Total Building Payments	Total Contents Payments
Carver	1	0	$8,068.31	
Chippewa	12	1	$408,493.79	$64,643.30
Chisago	1	0	$4,970.79	
Clay	36	6	$1,826,657.47	$124,967.30
Clearwater	1	0	$25,812.77	$3,300.00
Cook	1	0	$40,851.86	
Cottonwood	1	0	$26,652.49	$9,791.19
Dakota	12	2	$2,077,525.94	$937,806.89
Dodge	3	1	$142,926.02	$39,229.35
Douglas	2	0	$58,894.38	$583.98
Faribault	1	0	$10,580.83	$1,019.00
Fillmore	9	0	$208,599.98	$33,059.16
Freeborn	4	1	$384,400.14	$58,166.64
Goodhue	23	5	$924,487.10	$312,998.51
Hennepin	26	0	$1,215,366.14	$161,474.89
Houston	7	1	$481,009.61	$20,160.17
Hubbard	2	0	$140,917.31	
Isanti	2	0	$35,260.79	$53,326.05
Itasca	1	0	$44,000.00	
Jackson	1	0	$11,696.58	$122.00
Kanabec	1	0	$26,688.85	$321.06
Kandiyohi	1	0	$57,255.67	$47,641.95
Kittson	8	0	$277,930.56	$12,360.16
Lac Qui Parle	2	0	$13,048.58	$1,338.65
Lake	1	0	$872,370.25	$30,986.60
Le Sueur	4	2	$614,588.44	$98,972.85
Lyon	2	0	$21,467.13	
McLeod	2	0	$20,649.83	$5,118.60
Marshall	97	24	$2,398,163.65	$432,565.62
Meeker	1	0	$37,448.03	$18,608.92
Mille Lacs	4	0	$42,956.60	$11,098.77
Morrison	4	0	$107,902.53	$14,643.83
Mower	27	19	$2,389,689.15	$634,411.18
Murray	1	0	$66,044.86	
Nicollet	5	0	$136,976.32	$1,382.47
Nobles	4	0	$33,812.40	
Norman	13	2	$463,679.43	$63,766.07
Olmsted	6	0	$173,910.22	$328.94
Otter Tail	6	0	$76,457.50	$2,288.97

County Name	# RL Properties	# SRL Properties	Total Building Payments	Total Contents Payments
Pine	4	0	$90,211.47	$20,549.40
Pipestone	2	0	$232,681.34	$49,158.47
Polk	14	3	$483,922.31	$59,661.91
Ramsey	6	0	$381,621.24	$500.00
Rice	9	1	$1,311,168.66	$969,957.98
Rock	1	0	$55,475.11	$3,148.70
Roseau	2	0	$57,482.10	$11,000.00
St. Louis	9	0	$132,208.86	$56,123.79
Scott	4	0	$464,866.00	$20,439.22
Sherburne	5	0	$177,927.48	$951.28
Stearns	9	1	$547,093.14	$207,015.00
Steele	9	0	$699,707.77	$21,289.25
Todd	1	0	$72,461.99	$3,490.25
Traverse	8	0	$104,036.90	$10,620.43
Wabasha	9	2	$592,327.47	$56,749.45
Waseca	1	0	$16,739.89	$3,144.29
Washington	67	10	$3,046,378.64	$113,971.91
Watonwan	1	0	$119,071.27	$25,351.46
Wilkin	12	2	$534,208.21	$89,356.86
Winona	2	0	$42,425.16	
Wright	2	0	$17,451.50	$524.75
Yellow Medicine	13	0	$276,317.12	$31,946.31
Unknown	4	1	$125,551.69	$255,816.10
Total	549	85	$26,523,916.19	$5,415,466.61

(FEMA, 2024B)

7.8.2 Severe Repetitive Loss (SRL) and Repetitive Loss (RL) Properties

The NFIP Repetitive Loss List indicates there are 536 properties with 63 meeting the Severe Repetitive Loss definition that have not been mitigated as of 1/18/2024. The full list is provided in Appendix H: Repetitive Loss and Severe Repetitive Loss Properties. The top 10 counties with non-mitigated NFIP properties are listed in Table 84.

Totals paid out of the NFIP for the State of Minnesota include $26,533,444 in building payments and $5,437,797 in contents payments, for a total of $31,971,241 over 1,528 loss events.

HSEM and the MN DNR will continue to offer funds to acquire properties. Additionally, state staff have a relationship with a representative of the Pew Charitable Trusts Flood-Prepared Communities. The Pew representative coordinates roundtable meetings with congressional staff, State NFIP Coordinator, MN Association of Floodplain Managers legislative liaison, SHMO, and others to review flood-related legislation.

Table 84. Top ten counties with NFIP non-mitigated properties

County Name	RL	SRL	Total
Marshall	95	19	114
Washington	66	10	76
Clay	33	4	37
Mower	22	8	30
Goodhue	23	5	28
Hennepin	26	0	26
Polk	14	2	16
Dakota	12	2	14
Norman	13	1	14
Chippewa	12	1	13

(FEMA, 2024b)

Section 8: Coordination of Local Mitigation Planning

8.1. Local Funding and Technical Assistance for Plan Development

S14. Does the plan describe the process to support the development of approvable local and tribal, as applicable, mitigation plans?

44 CFR Reference §§201.3(c)(5) and 201.4(c)(4)(i)

Local mitigation plans in the state of Minnesota include those developed by counties (multi-jurisdictional); Indian Tribes; and single jurisdictions (i.e., Cities of the First Class). Funding for local hazard mitigation programs and technical assistance is available through federal, state, government, and other agencies, as listed in this Plan. The HMGP is a grant program available to assist locals in their hazard mitigation plan (HMP) development. Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. Under the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 it is the responsibility of the state to identify and select hazard mitigation projects to be recommended to FEMA for final approval and funding of the Hazard Mitigation Grant Program.

Local HMPs are consistent with and incorporate information from the state Plan, and these county-level plans are encouraged to incorporate other local planning mechanisms, thus providing a unified mitigation strategy throughout all levels and aspects of government within Minnesota. The state has continually provided guidance and technical support to the development of local mitigation plans and has encouraged the sharing of information between both local planning projects and with the state. MDH is providing Regional Climate Change Data Profiles at HSEM Regional meetings to provide information to each emergency manager (EM) for incorporation into local hazard mitigation and other planning efforts.

FEMA grant funding for planning is available through HMGP and BRIC (FMA for flood-only portions of a plan) for local multi-jurisdictional planning efforts. Up to 7% of the HMGP funds may be used for planning or local multi-jurisdictional HMPs.

8.1.1 Facilitation of Plan Updates

Historically, HSEM funded plans and updates through HMGP or BRIC on a single-county basis. Counties would apply to HSEM/FEMA for plan funding and hire a contractor. To reduce grant responsibilities and improve risk and vulnerability assessments, HSEM applies on behalf of counties for funding and hires U-Spatial at the University of Minnesota to update plans. As funds are available through BRIC or HMGP, county EMs are surveyed to gauge interest in participating in the U-Spatial update process. Some counties in the state are covered by Regional Development Commissions (RDC) that have the capability and capacity to update plans. Counties in other regions do not have the capacity or are not served by an RDC, and most counties opt to participate in the U-Spatial plan update process. The multi-

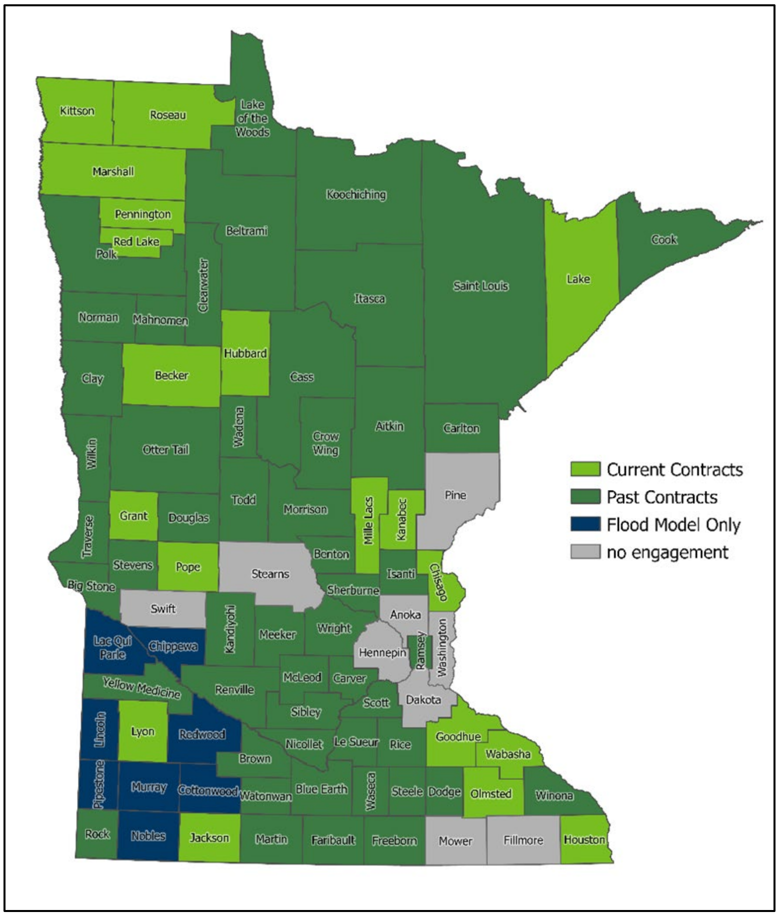


Figure 21. U-Spatial-facilitated hazard mitigation planning

county plan update process does not result in a multi-county plan; each county has its own county and multi-jurisdictional plan.

U-Spatial subcontracts part of the process to a planner who has a specialization in emergency management and hazard mitigation planning, and therefore relationships with many Emergency Management Directors (EM), to conduct outreach and mitigation action development in jurisdictions. Through this collaboration, U-Spatial can stay closely connected to EMs who are typically coordinators for their own HMP. Additionally, U-Spatial has developed and shared best practices for jurisdictional HMPs. U-Spatial conducts a considerable amount of outreach related to the planning process and best practices. Since the 2019 Update, U-Spatial staff have presented at the Esri International Users Conference, the MN Governor's Emergency Management Conference, the Minnesota Association of Emergency Managers Conference, the MN Association of Flood Plain Managers Conference, and have attended many other GIS and/or emergency manager meetings related to local hazard mitigation planning or flood hazards. Figure 21 shows the extent of HMPs that U-Spatial has completed.

The U-Spatial team coordinates and guides each EM throughout the plan update process. Key elements of the plan update that require EM engagement include:

- Webinar orientation with U-Spatial
- Public Outreach: Media Release #1 (plan kickoff) [templates provided]
- Conduct Capabilities Assessment (Plans & Programs in place/program gaps or deficiencies), [worksheet provided]
- Conduct Past Mitigation Action Review [worksheet provided]
- Conduct Local Mitigation Survey [worksheet provided]
- Planning Team Meeting #1
- Develop draft Mitigation Action Charts
- Planning Team Meeting #2
- Complete full draft HMP
- Public Outreach: Media Release #2 (public review period)

- Coordinate local level review of plan & promote public engagement
- Public meetings and outreach

The economy of scale in the process and updates of plans makes the match and in-kind tracking the only financial burden on the local county staff. Other benefits include a comparable structure to the plans that make risk, vulnerability, and capability assessments, as well as mitigation tracking much easier to accomplish.

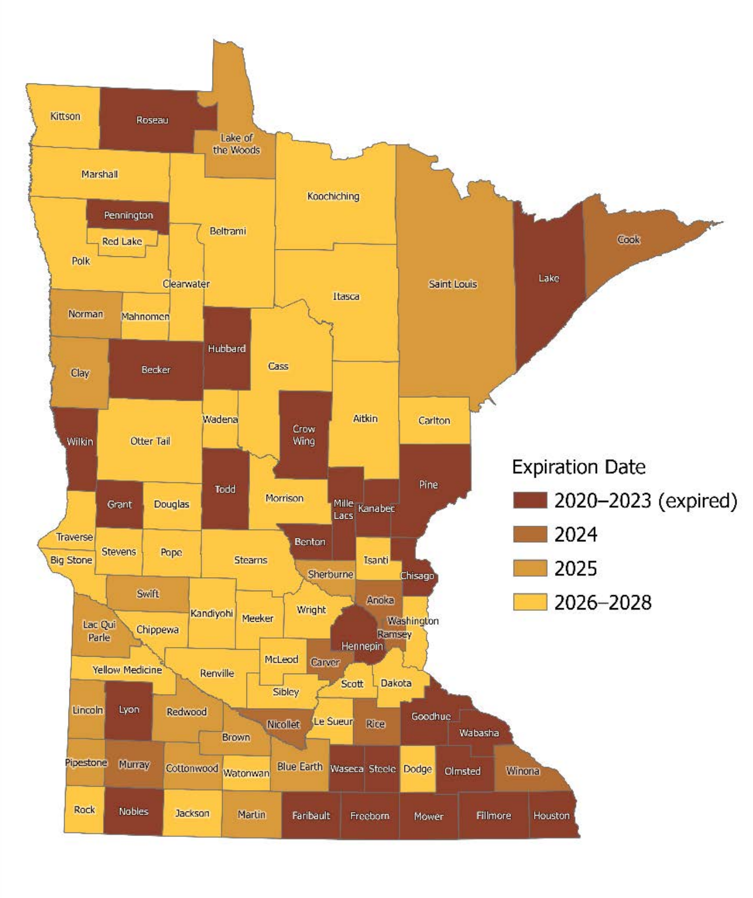
Local plans offer communities the opportunity to identify and evaluate hazards, assess risk, probability, vulnerability, impact, and develop mitigation goals and actions for the prevention and preparation of future hazard events. Of the 87 counties in the state, 57 have approved plans, the remaining have FEMA planning grants or are in the process of applying for a FEMA grant. Two cities have single jurisdiction plans (Saint Paul and Rochester) and the University of Minnesota has a plan that covers all of its campuses. Of the 11 tribal communities, seven have an approved plan, and three have planning grants.

8.1.2 HMP Plan Status

The state maintains a spreadsheet to track state and federal review, local adoption, and plan approval date. The five-year lapse date is tracked to ensure the state provides opportunity to apply for financial assistance in developing an application for funding an updated mitigation plan. HSEM and FEMA crosscheck approval and adoptions status on a regular basis.

The Planning Grant Status in Appendix P: Plan Status lists all jurisdictions' (counties, cities, and tribes) plan status. The document is revised as plans are funded, submitted for review, approved pending adoption or are formally approved. County emergency management directors are aware that it is the responsibility of the jurisdiction to complete plans prior to their expiration date (Figure 22) to be eligible for HMA funding.

Figure 22. Expiration status of Hazard Mitigation Plans (as of February 2024)



8.1.3 Barriers to Local HMP Development

HSEM works diligently to ensure local HMPs are updated every five years and do not expire, but challenges remain to updates, adoption, and implementation. County staff capacity is an ongoing challenge that many of Minnesota's rural counties face when updating their HMPs. Counties often have only one or two staff members dedicated to the entire HMP update process, which causes the timeline for adoption and implementation to be prolonged. HSEM has worked to address this issue by contracting with U-Spatial to provide technical support to counties in the HMP planning process.

Funding availability and the timing of funding opportunities is also a major challenge for local HMP implementation. The need for funding is high as the vast majority of counties in Minnesota request HMA funding for their county HMP updates. While the BRIC program has historically provided consistent funding for planning grants, it is only available once a year and requires a significant amount of planning for local communities to apply. Additionally, based on previous federal disaster declarations in Minnesota, HMGP funding can only fund one or two county plan updates per declaration and does not meet the planning needs of local communities. To address this issue, HSEM has started identifying counties with expiring plans earlier to ensure they have enough time to update their plans before the expiration date. HSEM has also worked with U-Spatial to include more counties in BRIC planning applications to provide needed funding for local HMP updates.

8.2 Mitigation Success Stories in Minnesota

Success stories illustrate how mitigation projects have worked to reduce damages to people and property and keep Minnesota and its population safe. By utilizing existing programs, funding mitigation programs, and coordinating with other planning efforts, losses can be even further reduced. Promoting how mitigation is successful in our local communities is important to the state mitigation program. Publicizing success stories via press releases in the local media, posting on the FEMA website, and other methods of transmitting the message of how mitigation helps locals is a priority for the state.

This section highlights the successes of several state agency funding programs that support effective local mitigation projects. The examples listed here provide information and documentation of the value of comprehensive hazard mitigation and climate adaptation programs and initiatives.

8.2.1 Minnesota DNR's Flood Hazard Mitigation Grant Assistance Program

The MN DNR Flood Hazard Mitigation program has awarded local governments over $79.4 million for local flood projects since 2019, and two of the grants served as match to the FEMA mitigation grants.

Since Minnesota's Flood Hazard Mitigation (FHM) Grant Assistance Program was established by the State Legislature in 1987, communities and citizens across the state have more readily mitigated flood risk and damage. Because of the large number of flood-prone rivers and lakes in Minnesota, there are dozens of additional flood mitigation proposals awaiting funding. Few communities can fund large, costly flood mitigation projects on their own. The partnership of federal, state, and local dollars makes it possible. Our weather history suggests that floods will continue to occur, and that larger, catastrophic storm events are trending upward. Working in partnership with local, state, and federal resources, incidents of repetitive loss to structures and communities have been significantly reduced due to planning and implementation of flood mitigation measures funded in whole or in part with State FHM grant funding. Statewide, to date, over 3,700 flood-prone structures have been removed from the floodplain with assistance from the FHM program.

Many communities around Minnesota have taken action to protect homes and businesses from flood damage. They administer floodplain ordinances, and some home and business owners have wisely purchased flood insurance. But many communities can reflect upon their own flooding histories and anticipate a catastrophic event will occur unless further preventive measures are taken. One frequently used measure is the acquisition and removal of at-risk structures from the floodplain.

The allocation of MN DNR FHM state flood hazard mitigation funding during calendar years 2019 - 2023 are listed below (Table 85). These include projects funded by both bonding and state general funds. In total, over $79 million in state funds were awarded over that five-year period. Projects the MN DNR matched for FEMA hazard mitigation project are indicated. FEMA match dollars for this period (2019-2023) total nearly $480 million.

The MN DNR FHM program has partnered with HSEM to fund the local share of FEMA flood buyouts over the years and will continue to collaborate. The state and federal programs are utilized, in addition to local programs.

Table 85. State of MN DNR Flood Hazard Mitigation Grant Assistance funding, 2019–2023

Year	Award	Grantee	Project Description
2020	$1,011,903	City of Afton Community Flood Protection	Final phase–community protection
2020	$2,000,000	City of Browns Valley	Line item–Toulle Coulee
2020	$1,500,000	City of Breckenridge	Interior drainage
2020	$150,000	City of Carver	Levee reconstruction
2020	$9,253	City of Clara City	Lift station flood protection & flood storage
2020	$269,123	Buffalo-Red River Watershed District	Stony Creek
2020	$250,000	City of Edina	Pumping station–Morningside Pond Area
2020	$1,702,610	City of Faribault	WWTP protection
2020	$1,300,000	Cities of Golden Valley/New Hope/Crystal	Flood storage
2020	$2,600,000	City of Montevideo	Final phase–federal flood control
2020	$2,800,000	City of Moorhead	Community levee and buyouts
2020	$500,000	Cedar River Watershed District	Small impoundments
2020	$22,790	City of Newport	One FEMA buyout
2020	$1,000,000	Roseau River Watershed District	Roseau Lake Bottom
2020	$350,000	Roseau River Watershed District	Whitney Lake flood storage
2020	$400,000	Wild Rice Watershed District	Goose Prairie Flood Project
2020	$350,000	Wild Rice Watershed District	Five FEMA buyouts
2020	$500,000	Bois de Sioux Watershed District	Redpath Impoundment
2020	$250,000	Two Rivers Watershed District	Klondike Impoundment
2020	$600,000	Scott Co SWCD	Line item—Lake McMahon Outlet
2023	$3,300,000	Traverse Co Toelle Coulee	Flood mitigation
2023	$5,450,000	Newfolden	Community Flood Protection
2023	$250,000	Two Rivers WD	Klondike impoundment
2023	$4,400,000	Bois de Sioux Watershed Dist.	Redpath Impoundment
2023	$1,575,000	Roseau River Watershed District	Roseau Lake Bottom storage

Year	Award	Grantee	Project Description
2023	$11,000,000	City of Moorhead	Local flood risk reduction
2023	6,000,000	City of Carver	Levee construction
2023	$1,800,000	City of Mora	Lake outlet
2023	$5,700,000	City of Forest Lake	Flood mitigation
2023	$5,000,000	City of Kasson	Flood mitigation
2023	$3,000,000	Lake Shamineau LID	Lake outlet
2023	$1,915,000	City of Roseau	Local drainage improvements
2023	$2,500,000	City of Sartell	No. Central Watab Watershed
2023	$1,400,000	Sauk River WD	Long Lake outlet
2023	$4,000,000	City of Austin	WWTP flood protection
2023	$2,000,000	City of Golden Valley	Flood storage Isaacson Park Industrial Area & De Cola Pond F diversion
2023	$1,500,000	City of Breckenridge	Improved internal drainage
2023	$500,000	Cedar River Watershed District	Small flood impoundments
2023	$625,000	City of Perley	Road raise
TOTAL	$79,480,679		

8.2.2 Minnesota Board of Water & Soil Resources: Disaster Recovery Assistance Program (DRAP)

Disasters and emergency legislative funding occur frequently and usually unpredictably. These characteristics require a standard operating procedure for Minnesota Board of Water & Soil Resources (BWSR) staff and LGUs to follow to optimize efficiencies, responsiveness, and legislative appropriations. In the event of a disaster, the BWSR's DRAP program policy provides BWSR staff and LGUs the needed implementation information and related processes of BWSR and other state and federal assistance providers.

8.2.3 City of Afton Downtown Improvement Project

The City of Afton is a small rural river town on the St. Croix River, a National Wild and Scenic Waterway. The City of Afton and Washington County partnered together to address needs related to flooding, water quality, historic preservation, and crumbling roads in Afton's 160-year-old "Old Village" area.

Before Improvements

Before this project, the city was facing the following challenges within the "Old Village."

- A deficient flood levee,
- Numerous private septic systems on lots as small as ¼ acres, many of which were in the flood plain of the St. Croix River, including some within the footprint of the levee,
- No storm water infrastructure to manage localized flooding or to treat storm water before it flowed directly to the St. Croix River,
- Crumbling local streets, sidewalks and main street.

As a result of the no longer sufficient levee the city was having to respond to the flooding by taking on major effort to set up flood pumps and schedule volunteers to monitor the flood pumps 24 hours a day and by having volunteers for sandbagging at the areas where the levee was deficient. The additional challenge to the community is that commercial and residential buildings considered to be in the floodplain had restrictions on improvements and had high flood insurance rates. The goals going into designing this project were as follows:

- Protect the "Old Village" from flooding by the construction of a certifiable levee,
- Protect the water quality of Lake St. Croix and Kelle's Creek, both of which are considered impaired waters,
- Address localized flooding and water quality issues,
- Rebuild the crumbling local roadways and the county road that serves as Afton's main street,
- Improve safety and accessibility for vehicles, pedestrians, and bicyclists, and
- Minimize property and business impacts by design and construction.

Projects

To tackle the issues the City of Afton was facing the decision was to take on these challenges and flooding issues and mitigate them by conducting the following projects:

- Having the levee be restored with a levee certified by the Corps of Engineers,
- Setting up a wastewater collection and treatment system to serve the "Old Village,"
- Reconstruct all local roads in the "Old Village" and County Road 21, and
- Construct a storm sewer system and storm water ponds.

The levee restoration resulted in an upgraded levee that is 3 feet above the 100-year floodplain and has two large, automated flood pumps that have been built into the levee so that there isn't a need for sandbagging during a normal flood. With the new protection of the levee commercial and residential properties that were previously restricted due to floodplain requirements, FEMA no longer consider them within the floodplain and therefor address the high flood insurance as well. The community as a whole is benefitting from the reduced flood insurance, improved infrastructure, better water quality of the St. Croix River, and the revitalization of the downtown "Old Village" area.

Funding

The levee project coupled with the MN DNR grant because a catalyst for a broader project that provided an opportunity for buy-in from additional funding partners. The design and construction of the project was a collaboration between the City and Washington County, with public input through an Old Village Task Force and a Design Review Committee, as well as substantial collaboration with tribal communities. The financial feasibility of the project was made possible by the following funding partners:

- Minesota Board of Water & Soil Resources (BWSR)
- Minnesota Department of Natural Resources (MN DNR)
- Minnesota Pollution Control Agency (MPCA)
- Minnesota Public Facilities Authority (MN PFA)
- Valley Branch Watershed District (VBWD)

Awards

- City Engineers Association of Minnesota (CEAM) "Project of the Year"

- American Public Works Association (APWA) "Project of the Year Small Cities/Rural Communities Award"
- American Council of Engineering Companies of Minnesota (ACEC) "Honor Award"
- League of Minnesota Cities (LMC) "City of Excellence Award"

8.2.4 City of Moorhead Flood Mitigation and Resilience Improvements

History

For decades, the City of Moorhead maintained a highly detailed Emergency Flood Operations Plan. The plan included actions required to activate flood mitigation infrastructure (e.g., pump stations, storm sewer gate closures, etc.) and emergency measures (e.g., temporary clay and sandbag levees, temporary sewer plugs, etc.). Over time, the city incrementally constructed flood mitigation improvements based on lessons learned with each new flood event.

However, the floods of 2009, 2010, and 2011 (Table 86) were the impetus for a more comprehensive flood mitigation program. Flooding had become more frequent and more severe with seven of the top ten flood crests between 1997 and 2022.

The 2009 flood event was the first in the city's history where surface water flooding directly threatened properties off the riverfront. During this flood event, the city deployed nine miles of sandbag levees consisting of approximately 2,500,000 sandbags, nine miles of clay levees, and 61 emergency auxiliary pumps; the bulk of which were installed in just one week with significant outside help from MnDOT and USACE (Figure 23).

Table 86. City of Moorhead major floods

Year	Flood crest
2009*	40.84 ft.
2010	36.99 ft.
2011	38.81 ft.
Flood Stage	18 ft.
Major Flood Stage	30 ft.

**Flood of record*

Figure 23. Sandbagging in Moorhead

In addition to risks from direct surface flooding, many of the city's stormwater outfalls were not protected (i.e., gated) to prevent floodwater from backing through the storm sewers and affecting many properties along the riverfront.

Project Description

In response to the record setting flood of 2009, the city carefully crafted a comprehensive flood mitigation strategy aimed at significantly reducing the flood risks. The main goals of the project were to:

- Reduce emergency flood protection measures and flood risk
- Reduce emergency response time through acquisition of at-risk properties and construction of permanent infrastructure
- Keep the community in business during a major flood event
- Send a positive message to new and/or expanding businesses and homeowners
- Avoid continued burden and risk to city and state finances

The project consisted of a voluntary program for buying out riverfront properties, followed by the construction of a system of levees, floodwalls (both permanent and removable), storm sewer gates and pumping stations, and sanitary sewer system improvements designed to a top elevation of river stage 44 feet (3 feet above the flood of record). A summary of the project components, including those within city limits completed by the Buffalo-Red River Water District, is in Table 87.

Table 87. Completed project components

Component	Amount
Voluntary Property Acquisitions	337
Project Easements Acquired	99
Levees & Floodwalls (miles)	18.8
Removable Floodwall Closures	5
Stormwater Pump Stations	24
Stormwater Gates	83
Sanitary Sewer Pumping Stations	6

Figure 24. Example of floodwall project in Moorhead

The city initiated the first phases of the comprehensive project immediately following the 2009 flood crest; however, unlike many projects which are fully planned and designed before construction starts, this project developed incrementally and expanded following the 2010 and 2011 floods. These changes primarily followed increased property owner interest in voluntary acquisition and the resulting ability to construct levees/floodwalls on the acquired property.

Following the 2009 flood, the city received numerous requests for voluntary acquisition. The city prioritized these acquisitions based on risk, with the lowest elevation properties ranking highest for acquisition. Unfortunately, this approach did not prove conducive to constructing flood mitigation infrastructure as acquisitions were scattered throughout the city rather than grouped into “project areas.” To address this issue, the city created several general project phase areas. Relying on past experience and current elevation data, each area was prioritized based on the number of properties at risk, including properties both on and off of the riverfront. Using this information, the voluntary acquisition program focused on the highest priority areas first, with a goal of acquiring as many riverfront properties as possible and replacing those homes with a levee and/or floodwall project.

Funding

The city’s flood mitigation efforts were a cooperative effort between the City of Moorhead and the State of Minnesota, made possible in part by grants provided by the Minnesota Department of Natural Resources. State assistance was not guaranteed to be available on a regular schedule, and therefore, the Moorhead City Council voted to provide an additional $18 million in local funding to ensure the project elements could proceed in a timely manner.

The program was very fortunate to benefit from strong and timely state and local funding support (Table 88). The opportunity to acquire riverfront property was largely driven by flood-fatigued property owners. This interest quickly waned with even one year without major flooding (the interest in voluntary acquisition dropped significantly in 2012, a year with no flooding).

*Table 88. Funding summary of flood mitigation projects**

Funding Source	Amount
State Flood Hazard Mitigation Grants	$125.23M
Federal HMGP Grants	$0.25M
MnDOT Cost-Share	$0.08M
Local	$34.40M
Total	$159.96M

**Includes projects within City limits completed by the Buffalo-Red River Watershed District*

Emergency Measures and Flood Preparedness

Accurate and precise flood forecasts cannot be generated much in advance of a flood event. As a result, the city typically only has about 7–10 days to prepare for a flood crest. Permanent improvements reduce the scope of emergency work needed to be deployed in a short time.

During the implementation of the project, the city experienced four major flood events (2010, 2011, 2013, and 2019). With each completed phase of the project, the city’s reliance on emergency measures was significantly reduced. The reduction of emergency measures also resulted in decreased deployment times.

The work completed to date has dramatically reduced flood risk within the city as laid out in Table 89. The city continues to make progress toward the goals established after the 2009 flood of record.

Table 89. Reduction in emergency measures

	Pre-2009 Conditions		Current conditions	
River stage (feet)	Clay levees (miles)	Sandbags	Clay levees (miles)	Sandbags
38	3.6	670,000	0.06	0
41	10.5	2,850,000	1.47	3,700

8.2.5 FEMA Story Maps Featuring Minnesota Cities

FEMA Region 5 prepared multiple story maps that discuss past flood damage and how various Minnesota cities have recovered from floods and reduced their future flood damage potential. One story map, A Journey to Resilience: How Granite Falls, MN Implemented Two Decades of Flood Mitigation reviews historical flood damage in Granite Falls as well as the various mitigation efforts undertaken by the city. Another story map, The Great Floods of 1993—25 Mitigated Years Later, looks at several cities, including Austin, Minnesota. The story map includes a flood history and discussion of flood risk reduction tools used by the city. A third story map created by FEMA is Red River Flood 1997 and FEMA Region 5 Mitigation Efforts. The story looks at acquisitions from three Minnesota communities following the 1997 flood: East Grand Forks, Moorhead, and Breckenridge.

8.2.6 Metropolitan Council

The Metropolitan Council (Met Council) is the regional policy-making body, planning agency, and provider of essential services for the Twin Cities metropolitan region. The Met Council's focus on climate adaptation is wide-ranging and two-pronged—the Met Council both leads by example and collaborates with communities and stakeholders.

While the Met Council works to create internal goals, objectives, and implementation strategies related to climate adaptation planning, it also works closely with agency partners, external stakeholder groups, and communities to create a vibrant, sustainable, and resilient Twin Cities region. Following is a description of the successful work by Met Council divisions and associated programs to integrate climate adaptation planning.

Agency-Wide Efforts

The Met Council adopted its Climate Action Work Plan in December 2022, which directs the Met Council's climate-related work for the next 3–5 years. The plan includes five core commitments, two of which focus on climate adaptation. Commitment 4 states, "We will reduce risks and impacts of climate change hazards to our facilities and services," and Commitment 5 states, "We will support and collaborate with partners to advance regional climate adaptation efforts" ((Metropolitan Council, 2022).

Through these commitments, the Met Council is bringing together experts from all divisions to align and accelerate the agency's cross-divisional climate adaptation work. Selected actions that will be taken under these commitments include:

Commitment 4, Strategy 1, Action 1: Develop a climate vulnerability screening tool to identify and prioritize Met Council-owned facilities and properties for in-depth climate preparedness reviews. A climate preparedness review should look at the adequacy of existing adaptation measures and emergency plans to respond to major climate events and make recommendations for improved adaptation and resilience.

Commitment 4, Strategy 1, Action 3: Review existing emergency preparedness planning scenarios and make recommendations to ensure those scenarios adequately incorporate anticipated climate change impacts on Met Council services and operations.

Commitment 5, Strategy 2, Action 1: Document and share climate change mitigation and adaptation strategies and guidance for counties, cities, and townships to adopt into local policy, planning, or programs. Resources include environmental justice guidance and materials. (Metropolitan Council, 2022).

In 2023, the Met Council established an internal Climate Risk and Vulnerability Working Group to coordinate and guide the adaptation-related work in the climate plan. A key goal is to develop a climate vulnerability screening tool to identify and prioritize Council-owned facilities and properties for in-depth climate-preparedness reviews. In total, the Met Council will pursue 37 specific actions and/or projects as part of the adaptation-related commitments in the Climate Action Work Plan.

Community Development Division

Metropolitan Council's Community Development division provides resources for communities working to integrate climate adaptation strategies into local comprehensive plans. In Thrive MSP 2040, local governments were encouraged to integrate climate change adaptation strategies into their comprehensive plans, and many did. In 2023, the Minnesota Legislature approved a provision to require local governments to address climate change in their comprehensive plans.

Leading to address climate change in the region is one of the Met Council's primary goals in the next regional development guide, Imagine 2050, which will be released for public comment in late 2024. The Met Council has convened a climate and natural systems technical work group with local government representatives from across the region, including cities, counties, watershed districts, and other organizations to develop policies and objectives for reaching net zero by 2050 and becoming a more climate-resilient region.

In 2023, the Met Council applied for and received a $1 million Climate Pollution Prevention Grant from the U.S. Environmental Protection Agency. The grant focuses on both regional emissions reductions and adaptation strategies. The Met Council is partnering with local governments and stakeholders in 11 of the 15 counties in the greater Twin Cities metro to better coordinate and align climate policy and action work across the region.

The Met Council's award-winning Local Planning Handbook provides guidance and resources on all elements of a comprehensive plan update, including a Resilience Plan Element that addresses four areas: Infrastructure and Environment, Energy Infrastructure and Resources, Healthy Communities and Economy and Society.

The Community Development division has also developed a Climate Vulnerability Assessment (CVA), which considers the climate hazards of localized flooding and extreme heat on regional assets. The CVA includes tools that communities can use to identify potential climate vulnerabilities and engage in adaptation and resilience planning.

The Community Development division has also worked closely with Freshwater Society, communities, and other stakeholders in hosting workshops for community resilience planning. The division has completed several cohorts of community workshops at the watershed district scale in the metro.

Community Development division staff work closely with academic institutions, like the University of St. Thomas Sustainability Communities Partnership, to facilitate climate adaptation projects and research that serves the region.

The division has worked with the Solar Foundation and the McKnight Foundation to fund a new Solar Advisor position to provide technical assistance to metropolitan communities in planning for solar and obtaining SolSmart Certifications during the current comprehensive planning cycle.

Environmental Services Division

Metropolitan Council Environmental Services (MCES) provides wastewater services and integrated planning to ensure sustainable water quality and water supply for the metropolitan region. Multiple climate adaptation strategies are being implemented throughout the division, including through the Inflow and Infiltration Reduction Program, water supply planning, and participation in implementation of the agencywide Climate Action Work Plan.

Inflow and Infiltration Reduction Program

Inflow and Infiltration (I/I) are separate and related challenges that allow clear water from stormwater and groundwater to enter the wastewater system, increasing base flow and peak flow delivered to wastewater treatment plants and resulting in costly and unnecessary expansion of pipes and plant capacity. I/I volumes are affected by increased precipitation and storm intensities. I/I can cause excessive flows, leading to untreated sewage discharges to basements or waterways that endanger public and environmental health.

Previous studies of the regional wastewater system indicate that up to 20% of the annual wastewater flow is from I/I. Reduction of the base flow from I/I preserves system capacity for growth and allows for surface water to recharge the region's aquifers. MCES owns and maintains 640 miles of regional interceptor sewers that collect wastewater flow from 111 communities in the seven-county region. Upstream of the regional and local systems are over a million connections to private properties. Up to 40% of these connections (private sewer service lateral pipes) were constructed prior to 1970 from brittle materials that are past design life and contribute a substantial share of the remaining I/I in the region.

The MCES I/I program began in 2004 to address sources of I/I in the local wastewater systems. Through 2023, more than 50 communities have participated in I/I mitigation work plans and have reported over $300 million of investments into local and private infrastructure. After completion of the work plan, many communities chose to continue investing in I/I source identification and mitigation projects as part of system maintenance and asset management. Since the beginning of the I/I program, regional wastewater volumes have declined, even as precipitation volumes, rainfall intensities, and populations have increased. This flow reduction can be attributed to I/I mitigation, adaptation efforts, and water conservation. It is estimated that reducing I/I at the source avoids billions of dollars in unnecessary capital spending for additional interceptor and treatment plant capacity in the region. In Q1 2024, the Met Council will award up to $12 million in state bond funds to provide grants to municipalities for capital improvements to public infrastructure to reduce I/I.

Following a recommendation and proposal from the Met Council's 2023 I/I Community Task Force, the 2023 Minnesota Legislature— for the first time—approved spending to support local government efforts to reduce I/I from private property. The Met Council was scheduled to sign agreements with cities by the end of 2023. The total amount available for this 2024 program is $1.5 million.

Supporting and Improving Water Resiliency

Laying the groundwork for creation of the 2050 Water Resources Policy Plan, Met Council researchers published a series of papers focused on key water needs and challenges for the region, and policies for how to address them. Water and climate change is one of the topics, and that paper proposes four policies with a total of 30 associated actions related to climate adaptation.

The Met Council works with the legislatively created Metropolitan Area Water Supply Advisory Committee in our role to ensure sustainable water supplies in the seven-county metro area. In 2023, additional content was identified for an update to the Metro Area Water Supply Plan, which will also ensure that the plan is in alignment with the evolving 2050 Water Resources Policy Plan so that the plans support one another.

In 2023, the Council launched, with extensive engagement of local partners, a new subregional water supply planning approach. Preliminary boundaries were established for the subregions with workshops held in three of the seven subregions. In Q1 2024, the White Bear Lake Area Comprehensive Plan work group will be launched. The plan will ensure that communities in the area have access to sufficient drinking water to allow for municipal growth while also ensuring the sustainability of surface and groundwater resources for future generations.

Metro Transit

Metro Transit works with other divisions to implement the adaptation-related actions in the Climate Action Work Plan, and Metro Transit staff lead and serve on the agency-wide Climate Risk and Vulnerability team. As of early 2024, the agency is in the process of developing a Sustainability Plan, which will further address climate adaptation. Metro Transit's Zero Emissions Bus Transition Plan, which is required by Minn. Statute 473.3927, also addresses adaptation by prioritizing the technical viability of zero emission buses.

The Met Council recognizes that climate mitigation and adaptation work serve the same end—creating a more resilient region and state. The information above highlights the work and collaborations related specifically to climate adaptation. The Met Council recognizes that it can achieve much by leading by example through its operations and maintenance function, but it can achieve even more across the region through its ability to convene partnerships and invaluable collaborations, whether it be with communities, watershed districts, agencies, or other stakeholder groups.

Conclusion

There are many more hazard mitigation success stories in Minnesota as a result of FEMA grants, State programs, local initiatives, and individual efforts. Hazard mitigation is effective when there are no (or reduced) damages or impacts from severe weather. Climate adaptation considerations must be included in our efforts to continue to protect people, our natural and built environments. The State will continue to monitor and compile successful mitigation stories for the next update of the state Plan.

8.3 Local Mitigation Project Update

Each disaster and non-disaster funding availability has its own priorities associated with it. The following sections describe how the past seven disasters since the 2019 plan have been prioritized and funded, to date.

8.3.1 FEMA 4414-DR-MN Mitigation Strategy

The Hazard Mitigation Strategy developed for FEMA 4414-DR-MN (declared February 1, 2019) for Public Assistance and Hazard Mitigation identifies action items and provides information on how they will be accomplished. 4414-DR-MN addresses severe storms and flooding. It provides the steps for implementing short- and long-term cost-effective solutions to reduce statewide disaster damage for future events and provides guidance to the Joint Field Office (JFO) and HSEM mitigation staff. The priorities identified for 4414-DR-MN that are listed here are consistent with the State of Minnesota's Hazard Mitigation Plan and are as follows:

- Goal 1: Assist the State, Tribes, and Communities in the development of Hazard Mitigation Grant applications.
    - Provide technical assistance to the State in the administration and implementation of the Hazard Mitigation Grant Program (HMGP).
- Goal 2: Assist the State of Minnesota in increasing awareness and knowledge of coastal floodplain management regulations.
    - Encourage communities to utilize "best available" data to protect their investments when making repairs.
    - Provide appropriate technical assistance to communities on the requirements on the requirements of the NFIP and opportunities to promote resilience and sustainability.
    - Encourage individuals and communities to evaluate their risk and protect their investments through a targeted Flood Insurance Outreach strategy.

Since 4414-DR-MN is a one-county declared disaster, MN HSEM and FEMA Region 5 decided to simply the standard Hazard Mitigation strategy. Of the total available funds ($1,143,919) for 4414-DR-MN, 99% of the funds were awarded as listed in Table 90.

Table 90. FEMA 4414-DR-MN project funding

Project Type	Sub-grantee	County	Project Cost 100%	Federal Share 75%	Local Match 25%
Seawall	City of Duluth	St. Louis	$1,128,229	$846,171	$282,057
Advanced Assistance	City of Duluth	St. Louis	$381,303	$285,977	$95,325

8.3.2 FEMA 4442-DR-MN Mitigation Strategy

The Hazard Mitigation Strategy was developed for FEMA 4442-DR-MN (declared June 12, 2019), for public assistance and statewide hazard mitigation. 4442-DR-MN addresses severe winter storms, straight-line winds, and flooding. The hazard mitigation strategy identifies action items and guidance to the JFO and field offices to implement short- and long-term, cost-effective solutions to reduce statewide disaster damage and provides guidance to the JFO and state mitigation staff. The priorities identified for 4442-DR-MN that are listed here are consistent with the State Hazard Mitigation Plan are as follows:

- Goal 1: Assist the State and Communities in the development of Hazard Mitigation Grant Applications.
  - Provide technical assistance to the State in the administration and implementation of the Hazard Mitigation Grant Program (HMGP).
- Goal 2: Assist the State, Tribes, and Communities in Hazard Mitigation Planning.
  - Provide technical assistance to the State in the development, review, and implementation of State, Tribal, and Local Hazard Mitigation Plans.
- Goal 3: Assist the State of Minnesota in increasing awareness and knowledge of the NFIP and supporting floodplain management compliance and flood insurance.
  - Encourage individuals and communities to elevate their risk and protect their investments through a targeted Flood Insurance Outreach Strategy.
  - Encourage participation in the NFIP through outreach to non-participating communities throughout the state.
  - Provide appropriate technical assistance to communities on the requirements of the NFIP and opportunities to promote resilience and sustainability.
- Goal 4: Coordinate with and provide support to PA and HMA in the recovery, reconstruction, and hazard mitigation of flood-damaged areas through the delivery of best available data and technical assistance opportunities as appropriate.

Of the total available funds ($10,478,625) for DR-4442, 63% ($6,647,797) has been applied for. Applications approved for this disaster are shown in Table 91:

Table 91. FEMA 4442-DR-MN project funding

Project Type	Sub-grantee	County	Project Cost 100%	Federal Share 75%	Local Match 25%
5% Siren	Washington County	Washington	$24,083	$18,062	$6,021
5% Generator	Jackson County	Jackson	$72,073	$54,055	$18,018
5% Generator	City of Windom	Cottonwood	$77,113	$57,835	$19,278
5% Generators	City of Dayton	Hennepin	$246,629	$184,972	$61,657
5% Early Warning System	City of Cook	St. Louis	$27,816	$20,862	$6,954

Project Type	Sub-grantee	County	Project Cost 100%	Federal Share 75%	Local Match 25%
5% Early Warning System	City of Cottage Grove	Washington	$26,278	$19,709	$6,570
5% Generator	City of Scandia	Washington	$85,202	$63,902	$21,301
5% Lightning Detection & Warning System	City of Eagan	Dakota	$34,253	$25,690	$8,563
5% River Level & Lightning Detection	Hennepin County	Hennepin	$91,009	$68,257	$22,752
Plan Update	Chippewa County	Chippewa	$54,489	$40,867	$13,622
Advanced Assistance	City of Northfield	Rice	$32,315	$24,236	$8,079
Advanced Assistance	Capitol Region Watershed District	Ramsey	$500,000	$375,000	$125,000
Advanced Assistance	Pelican River Watershed District	Becker	$197,000	$147,750	$49,250
Advanced Assistance	City of Hammond	Wabasha	$32,315	$24,236	$8,079
Powerline Retrofit	BENCO Electric	State	$423,500	$317,625	$105,875
Slope Stabilization	Rainy Lake Medical	Koochiching	$356,061	$267,046	$89,015
1 Acquisition – Flood prone	City of Austin	Mower	$270,583	$202,937	$67,646
7 Acquisitions – Flood prone*	Wild Rice Watershed District	Norman	$1,626,950	$1,220,213	$406,738
1 Acquisition – Flood prone	Kittson County	Kittson	$253,700	$190,275	$63,425
Culvert	Barnesville Township	Clay	$22,669	$17,002	$5,667
Saferoom*	Springfield School District	Brown	$1,946,253	$1,459,690	$486,563
Saferoom*	City of Springfield	Brown	$868,521	$651,391	$217,130
1 Acquisition – Erosion prone	City of Redwood Falls	Redwood	$634,016	$475,512	$158,504
1 Acquisition – Flood prone	Brown County	Crown	$276,000	$207,000	$69,000
3 Acquisitions – Flood prone*	City of Hutchinson	McLeod	$684,901	$513,676	$171,225

*Received overrun post award. Table shows original request amount.

8.3.3 FEMA 4531-DR-MN Mitigation Strategy

Due to the pandemic, the federal government provided COVID-19 hazard mitigation funds. No mitigation strategy was created at HSEM for FEMA 4531-DR-MN, declared August 5, 2021, because of the unique nature of the disaster and because the federal government already established that funds should go towards projects that addressed climate change, were equitable, or implemented the Federal Flood Risk Management Standard (FFRMS).

Of the total available funds ($14,638,880) for DR-4531, 99% ($14,565,685) has been applied for. Applications approved for this disaster are shown in Table 92.

Table 92. FEMA 4531-DR-MN project funding

Project Type	Sub-grantee	County	Project Cost (100%)	Federal Share (90%)	Local Match (10%)
Flood Reduction	Wild Rice Watershed District	Clay	$3,758,650	$3,382,785	$375,865
Saferoom	St. Clair School District	Blue Earth	$3,201,819	$2,881,637	$320,182
1 Acquisition – Flood prone/Levee Removal	City of Newport	Washington	$455,800	$410,220	$45,580
Infrastructure	City of Duluth	St. Louis	$7,891,330	$7,102,197	$789,133
Advanced Assistance	Nine Mile Watershed District	Hennepin	$180,000	$162,000	$18,000
Plan update	State	State	$237,921	$214,129	$23,792
5% Generator	Grand Rapids Public Utilities	Itasca	$458,575	$412,718	$45,858

8.3.4 FEMA 4658, 4659, 4666-DR-MN Mitigation Strategy (Combined)

The Hazard Mitigation Strategies for the below declared disasters were combined due to the back-to-back nature of the declarations for Public Assistance and statewide Hazard Mitigation.

- FEMA 4658-DR-MN (declared July 8, 2022) for severe storms, straight-line winds, tornadoes, and flooding that occurred between May 8 and May 13, 2022, in 23 counties.
- FEMA 4659-DR-MN (declared July 13, 2022) for severe storms, straight-line winds, and flooding that occurred between April 22 and June 15, 2022, in 15 counties and four tribal nations.
- FEMA 4666-DR-MN (declared August 9, 2022) for severe storms, straight-line winds, tornadoes, and flooding that occurred between May 29 and May 30, 2022, in 23 counties.

The purpose of the Hazard Mitigation Strategy identifies action items and guidance to the JFO and Field Offices to implement short and long-term, cost-effective solutions to reduce statewide disaster damage and provides guidance to the Joint Field Office (JFO) and State Mitigation Staff. The priorities identified for 4658, 4659, and 4666 that are listed here are consistent with the State Hazard Mitigation Plan are as follows:

- Goals: all program goals will consider climate change, future conditions, and equity.
- Goal 1: Identify hazard mitigation opportunities and assist the State of Minnesota and communities in the development of cost-effective and technically feasible mitigation projects.
- Goal 2: Identify risks resulting from inadequate infrastructure and begin the identification of funding sources utilizing a whole-of-government approach across all federal and state agencies for local hazard mitigation initiatives.

- Goal 3: Increase the long-term resilience to natural disasters by encouraging communities to adopt and maintain hazard mitigation plans, compliant with DMA 2000 planning criteria, in order for them to meet Stafford Act Eligibility for HMGP and other hazard mitigation grants.
- Goal 4: Promote and enforce the National Flood Insurance Program (NFIP) policies and regulations through effective floodplain management and insurance outreach, education, and technical assistance.
- Goal 5: Utilize virtual and in-person outreach methods to inform the public about ways to reduce risk of flood damage and encourage awareness and preparedness for future events.

Of the total available funds ($1,856,908) for DR-4658, 48% ($895,193) has been applied for. Applications approved for this disaster are shown in Table 93.

Of the total available funds ($3,107,243) for DR-4659, 88% ($2,720,274) has been applied for. Applications approved for this disaster are shown in Table 94.

Of the total available funds ($904,163) for DR-4666, 83% ($753,313) has been applied for and awarded prior to the February 4, 2024 application deadline. Applications approved for this disaster are shown in Table 95.

Table 93. FEMA 4658-DR-MN project funding

Project Type	Sub-grantee	County	Project Cost 100%	Federal Share 75%	Local Match 25%
Plan Update	Steele County	Steele	$29,500	$22,125	$7,375
5% Generators*	City of Sartell	Stearns	$246,000	$184,500	$61,500
Advanced Assistance	Minnkota Power Cooperative	State	$100,000	$75,000	$25,000
Advanced Assistance	Le Sueur County	Le Sueur	$399,862	$299,897	$99,966
1 Acquisition – Flood prone	City of Lake St. Croix Beach	Washington	$175,000	$131,250	$43,750
1 Acquisition – Flood prone	City of Crookston	Polk	$108,229	$81,172	$27,057
5% Generator	City of Barnesville	Clay	$135,000	$101,250	$33,750

*Received overrun post award. Table shows original request amount.

Table 94. FEMA 4659-DR-MN project funding

Project Type	Sub-grantee	County	Project Cost 100%	Federal Share 75%	Local Match 25%
5 Acquisitions – Flood prone	Wild Rice Watershed District	Norman/Polk	$2,573,205	$1,929,904	$643,301
Plan Update	University of Minnesota		$157,813	$118,360	$39,453
Advanced Assistance	Bois de Sioux Watershed District	State	$402,000	$301,500	$100,500
1 Acquisition – Flood prone	City of Duluth	St. Louis	$264,531	$198,398	$66,133
Saferoom	Halstad Municipal Utility	Norman	$163,825	$122,869	$40,956
5% Early Warning System	Blue Earth County	Blue Earth	$65,658	$49,244	$16,415

*Table 95. FEMA 4666-DR-MN project funding**

Project Type	Sub-grantee	County	Project Cost 100%	Federal Share 75%	Local Match 25%
Powerline Retrofit	Red River Valley Coop	State	$1,004,418	$753,314	$251,105

*Applications pending. Application deadline February 4, 2024.

8.3.5 FEMA 4722-DR-MN Mitigation Strategy

The Hazard Mitigation Strategy for FEMA 4722-DR-MN declared July 19, 2023, for Public Assistance and statewide Hazard Mitigation outlines the tasks and targets to be accomplished for the declared event.

Hazard Mitigation goals and objectives have been established for this disaster and are based on the current state hazard mitigation plan, the conditions of the State, and the priorities of both the State Coordinating Officer (SCO) and the Federal Coordinating Officer (FCO), and are as follows:

- Goals: all program goals will consider climate change, future conditions, and equity.
- Goal 1: Identify hazard mitigation opportunities and assist the State of Minnesota and communities in the development of cost-effective and technically feasible mitigation projects.
- Goal 2: Identify risks resulting from inadequate infrastructure and begin the identification of funding sources utilizing whole of government approach across all federal and state agencies for local hazard mitigation initiatives.
- Goal 3: Increase the long-term resilience to natural disasters by encouraging communities to adopt and maintain hazard mitigation plans, compliant with DMA 2000 planning criteria, in order for them to meet Stafford Act Eligibility for HMGP and other hazard mitigation grants.
- Goal 4: Promote and enforce the National Flood Insurance Program (NFIP) policies and regulations through effective floodplain management and insurance outreach, education, and technical assistance.
- Goal 5: Utilize virtual and in-person outreach methods to inform the public about ways to reduce risk of flood damage and encourage awareness and preparedness for future events.

The FEMA deadline for applications is July 19, 2024. Priorities will be given to complete applications that address:

1. Complete project applications that have been previously submitted by HSEM but not yet funded with high priority given to communities that are identified as disadvantaged.
2. Communities that have completed an Advanced Assistance or Project Scoping project.
3. Outreach to communities that have previously submitted a Notice of Intent to apply for one of HMA's grant programs with high priority given to communities that are identified as disadvantaged.
4. Development or update of local all-hazards mitigation plans.

Advance assistance funds are available to develop data needed for mitigation applications, developing project alternatives, and gathering and calculating benefit cost data. Examples include engineering and design, technical assistance to determine project feasibility, including hydrologic and hydraulic modeling. The 30-day estimate for HMGP funds are $907,608.

8.4 Local Plan Integration

S16. Does the plan describe the process and timeframe to review, coordinate and link local and tribal, as applicable, mitigation plans with the state mitigation plan?

44 CFR References §§201.3(c)(6), 201.4(c)(2)(ii), 201.4(c)(3)(iii), and 201.4(c)(4)(ii)

Once a local (county, tribal, or city) hazard mitigation plan has been reviewed by the local units of government, HSEM reviews it within 45 days and sends it to FEMA for review. FEMA issues an Approval Pending Adoption letter. After all participating jurisdictions adopt the plan by resolution, FEMA produces an approved letter to start the five-year eligibility. The local plan update process includes utilizing the state Plan goals, (new) strategies, and actions as a starting point. At the time of plan update application, each local plan's crosswalk is reviewed and recommendations for improvement are addressed. Many tribal nations have opted to update their plans directly through FEMA non-disaster grant funds. The state will assist as requested on plan or project applications. Tribal nations may also apply as a sub-grantee through the state. As sovereign nations, the decision is up to each tribal government how to prioritize projects.

During the State's update of its hazard mitigation plan, staff and/or a consultant reviews all the counties plans for perceived risk and county capabilities (Appendix C: County Hazard Prioritization and Appendix Q: Local Planning Capabilities). The top four state risks (windstorms, flooding, tornado, and wildfire) are mapped for visual representation and project identification (see Section 4.6 Natural Hazard Risk Assessment by County). County plan rankings for all hazards are reported in Appendix C.

HSEM has developed a process that enables local mitigation plan integration into the state Plan and the identification of potential projects. Prior to sending local plans to FEMA for review of compliance with the Federal Regulations, project officers review local plans. The project officer reviews are completed not only to ensure Federal Regulations are met, but to identify potential projects, identify potential new risks and to integrate into the State Mitigation Plan. When project officers identify a potential mitigation project that could be funded through either disaster or non-disaster grant programs, the officer discusses the options with the local emergency manager or appropriate county staff person. Natural hazards are reviewed and if deviation from previous hazards occurs the project officer discusses the deviation with the county to get a better sense of the new or outdated hazard.

The state tracks all hazard mitigation project applications, from Notice of Interest, through application, benefit cost analysis, historical and environmental review, implementation, and closeout. The projects each entity applies for are tracked at least quarterly. It is really the projects that applicants apply for to address natural hazards that are tracked and integrated into the Plan. Locals are affected by disasters, and the natural hazard type drives the mitigation project type. The acquisition of flood-prone homes is a high priority for the state as it often floods and homes are damaged. Wildfire retrofit projects have been popular in the past, however the state has not experienced a blowdown or wind event to make timber vulnerable to wildfire. With climate change, changing ecosystems and invasive species, interest in wildfire projects may increase in the future. Recent slope failure/bluff erosion projects have been popular for the past five years due to extreme rainfall. The number of imminent threat buyouts/relocation has increased in the past five years also. Most recently the coastal erosion and flooding hazard has become a priority for the state as a declaration (DR-4414) was just declared due to this (new) hazard in St Louis County for damages to the city of Duluth from Lake Superior. As the climate continues to change, the hazards and impacts Minnesotans face will also change. The Plan will reflect local hazards and local priority project types.

8.5 Local Capability Assessment

S13. Does the plan generally describe and analyze the effectiveness of local and tribal, as applicable, mitigation policies, programs, and capabilities?

44 CFR Reference §201.4(c)(3)(ii)

A statewide capability and vulnerability analysis was conducted was completed in 2018 to better understand the capabilities that support mitigation by all jurisdictions in Minnesota. Only approved and active (not expired) plans were reviewed, which included 84 HMP plans (67 counties, seven tribal, and one city). If the HMP mentioned a specific plan, policy, or staff member as a capability it was recorded as a capability. The results of this examination are included in Appendix Q: Local Planning Capabilities. The analysis was not repeated in 2023, as this was intended to be updated on a ten-year cycle. The capabilities assessment in the local Hazard Mitigation Plan process has been improved so that local and tribal capabilities can be compiled more accurately and comprehensively in the 2029 plan.

The following tables summarize the percentage of specific plans that counties identified as a capability in their HMP. Please note, not all capabilities were easily recognized in the HMP, depending on the content of the plan, so capabilities are expected to be underestimated. Water/Watershed Management Plans and NFIP Programs were among the highest planning capability in the state by jurisdiction (Table 96).

Table 96. Local plan capabilities

Capabilities (plans) Cited in Jurisdictional HMP	Percent of Counties with Capability in 2018	Percent of all Jurisdictions (75) with Capability in 2018
Emergency Response/Management Plan	88%	88%
Water/Watershed Management Plan	94%	91%
Comprehensive Plan	76%	73%
Land-use Plan	55%	56%
Pandemic or Public Health Incident Response Plan	42%	44%
National Flood Insurance Program (NFIP)	93%	89%
Wellhead Protection Plan	48%	48%
Capital Improvement Plan	54%	51%
Contingency Plan	25%	25%
Fire Plan	36%	40%
Forest Management Plan	6%	8%

Jurisdictional hazard mitigation plans were also reviewed for county policy capabilities (Table 97). Most (93%) plans identified Land Use, Planning, & Zoning Ordinances as a capability available to the county. This was closely followed by Floodplain & Soil Erosion Ordinances and Building Code ordinances.

Table 97. Local policy capabilities

Capabilities (policies) Cited in Jurisdictional HMP	Percent of Counties with Capability in 2018	Percent of all Jurisdictions (75) with Capability in 2018
Land Use, Planning & Zoning Ordinance	97%	93%
Floodplain & Soil Erosion Ordinance	84%	80%
Building Code	69%	68%
Subdivision Ordinance	52%	47%
Methamphetamine Lab Ordinance	25%	25%
Fire Code	28%	29%

The engagement of County Staff in the hazard mitigation planning process was the third measure of local capabilities (Table 98). The Hazard Mitigation Planning is almost always coordinated by an Emergency Management Coordinator or Director in Minnesota. However, jurisdictions have varying levels of full-time equivalent (FTE) staff dedicated to Emergency Management Coordination.

Table 98. Local staff capabilities

Capabilities (staff) Cited in Jurisdictional HMP	Percent of Counties with Capability in 2018	Percent of Jurisdictions with Capability
Emergency Management Director	100%	100%
Mapping Specialist (GIS)	36%	36%
Public Health Coordinator/Department	84%	80%
Sheriff/Police Department	82%	79%
MN Department of Natural Resources	27%	25%
Soil and Water Conservation District	51%	47%
Public Works/Utility	66%	63%
Schools	64%	60%

8.6 Prioritizing Local Assistance

S15. Does the plan describe the criteria for prioritizing funding?

44 CFR Reference §201.4(c)(4)(iii)

The application process, project review, ranking, and selection criteria for Hazard Mitigation Grant Program planning and projects are described below. All other HMA grant program funds are evaluated first by state mitigation staff and then forwarded to regional FEMA staff for review. All projects must meet eligibility and feasibility requirements described in the Hazard Mitigation Assistance Program and Policy Guidance. Additionally, the non-disaster grants have priorities set by Congress. The state also has its own priorities that depend on available disaster funding. Jurisdictions in declared areas will have priority at disaster funding. Jurisdictions not declared will have priority in non-disaster funding. Additional criteria are included in each disaster or non-disaster strategy.

As part of a Presidential Disaster Declaration, the State is required to submit an Administrative Plan. This document details how the State will administer the Hazard Mitigation Grant Program funds made available by the disaster declaration. The state's FEMA-approved HMGP Administrative Plan describes the organization, staffing, and procedures to be used when implementing the Section 404 Hazard Mitigation Grant Program in both the post and pre-disaster mitigation environment. The following is excerpted from the FEMA approved Administrative Plan for DR-4658, 4659, and 4666.-MN.

Eligibility

A. Applicants

Applicant eligibility criteria will be in accord with federal statutes and regulations. Specifically, potentially eligible applicants will include: state agencies, local governments, private non-profit organizations (or institutions that own or operate a private non-profit facility as defined in 44 CFR 206.2211(e), and Indian tribes. Any questions regarding the eligibility of an applicant will be resolved by the SHMO, or, if necessary, by the Governor's Authorized Representative or their designee.

B. Planning

Up to 7% of the HMGP funds may be used for planning for the State All-Hazard Mitigation Plan or local, multi-jurisdictional mitigation plans. HSEM tracks plan expiration dates and makes funds available for update in a timely manner.

C. Projects

Projects may be of any nature that will result in the reduction or elimination of potential natural hazards and the protection of life and property. Specific types of eligible projects include, but are not limited to:

1. Projects in Disaster Declared jurisdictions;
2. Acquisition and demolition of hazard-prone properties;
3. Flood damage reduction and small flood control projects;
4. New community tornado safe room construction or retrofit projects; currently unprotected populations at mobile home parks, schools, parks and camping facilities, neighborhoods, and apartments with slab-on-grade construction;
5. Any project incorporating Climate Resilient Mitigation Actions (CRMA), including Green Infrastructure;
6. Retrofitting of facilities, including burying or retrofitting of power lines;
7. Wildfire resistant construction materials, defensible space and sprinklers;
8. Soil stabilization to protect critical facilities and/or infrastructure; and
9. Elevation or relocation or hazard-prone facilities.

D. 5% Iniative

These projects, which are only available pursuant to an HMGP disaster, provide an opportunity to fund mitigation actions that are consistent with the goals and objectives of the State, Tribal (Standard or Enhanced), and local/or mitigation plans and meet all HMGP program requirements, but for which it may be difficult to conduct a standard benefit–cost analysis (BCA) to prove cost-effectiveness. For additional information, see Part VII A.14 of the 2015 Hazard Mitigation Assistance Guidance. Activities that might be funded under the 5 Percent Initiative include:

1. The use, evaluation, and application of new, unproven mitigation techniques, technologies, methods, procedures, or products;
2. Equipment and systems for the purpose of warning citizens of impending hazards;
3. Purchase of generators or related equipment, such as generator hook-ups;
4. Hazard identification or mapping and related equipment for the implementation of mitigation activities;
5. GIS software, hardware, and data acquisition whose primary aim is mitigation;
6. Public awareness or education campaigns about mitigation; and
7. Evaluation of model building codes in support of future adoption and/or implementation.

E. Advance Assistance (AA)

Up to 25% of HMGP funds may be used for Advanced Assistance projects. The state will assist jurisdictions utilize AA funds that are available to develop mitigation strategies and obtain data to prioritize, select and develop complete HMGP applications in a timely manner. For additional information, see Part VIII A.12 of the 2015 Hazard Mitigation Assistance Guidance and Job Aid.

F. Codes and Standards

Up to 5% of HMGP funds may be used for Codes and Standards projects.

G. Non-Duplication of Programs

HMGP funds cannot be used as a substitute or replacement to fund projects or programs that are available under other federal authorities, except under limited circumstances in which there are extraordinary threat to life, public health, safety or improved property. Other federal program authorities that should be looked into before requesting use of HMGP monies are, for example: Section 406 of the Stafford Act, Federal Insurance Administration Programs, the U.S. Army Corps of Engineers, the Small Business Administration, and the Natural Resources Conservation Service.

Project criteria: Projects must be in conformance with the State Hazard Mitigation Plan developed as a requirement of Section 409 of the Stafford Act and Section 322 of the Disaster Mitigation Act of 2000. Projects must have a beneficial impact upon the designated disaster area. Projects do not have to be located in the designated disaster area, funding is made available statewide. Projects must be in conformance with 44 CFR Part 9, Floodplain Management and Protection of Wetlands, and 44 CFR Part 10, Environmental Considerations. Projects must solve a problem independently or constitute a functional portion of a solution where there is assurance that the project as a whole will be completed. Projects that merely identify or analyze hazards or problems are not eligible.

Projects must be cost-effective and substantially reduce the risk of future damage, hardship, loss, or suffering resulting from a major disaster. The sub-grantee must demonstrate this by documenting that the project:

- Addresses a problem that has been repetitive or a problem that poses a significant risk if left unsolved.
- Will not cost more than the anticipated value of the reduction in both direct damages and subsequent negative impacts to the area if future disasters were to occur. Both costs and benefits will be computed on a net present value basis.
- Has been determined to be the most practical, effective, and environmentally sound alternative after consideration of a range of options.
- Contributes, to the extent practicable, to a long-term solution to the problem it is intended to address.
- Considers long-term changes to the areas and entities it protects and has manageable future maintenance and modification requirements.
- Environmental Considerations: Projects funded under the HMGP must comply with all appropriate environmental requirements. These include the National Environmental Policy Act (NEPA), P.L. 91-190, as amended; Executive Order 11988, Floodplain Management; Executive Order 12898, Environmental Justice in Minority and Low-Income Populations, and Executive Order 11990, Protection of Wetlands. (Minnesota is a NEPA-compliant state.). The SHMO will ensure through coordination that all required environmental review is performed. The extent of such review will depend upon (1) the nature of a project, (2) environmental contractor assistance, if any, made available by FEMA or funded by the state, and/or (3) the environmental requirements imposed by other agencies participating in a project (if any). Approval to initiate a project will not be granted, nor will any HMGP monies be expended prior to the completion and satisfactory outcome of a required environmental review.

Pre-Identification and Notification of Potential Applicants

Information acquired during the Preliminary Damage Assessment (PDA) process may be used in identifying potential projects if mitigation was included as part of the PDA process. In the event of an expedited presidential declaration request, mitigation may not be included in the PDA. The SHMO will review the existing State Mitigation Plan for identification of potential statewide projects for HMGP funding. Projects that include the acquisition of properties that have severe repetitive (SRL) and repetitive flood insurance claims (RL) will be of high priority.

Information acquired during the Preliminary Damage Assessment (PDA) process may be used if completed by Mitigation in identifying potential projects. In the event of an expedited presidential declaration request, mitigation may not be included in the PDA. The SHMO will review the existing State Mitigation Plan for identification of potential statewide projects for HMGP funding. Following a presidential disaster declaration but prior to the establishment of a JFO, the SHMO will confer with the federal HMO on a number of issues. Among these will be early indications of potential HMGP applicants. Public Assistance staff may also discover potential hazard mitigation projects. Projects that include the acquisition of properties that have repetitive flood-insurance claims will be of high priority.

During Applicant Briefings and individual meetings, potential applicants will be given directions as to how pre-applications for potential hazard mitigation projects can be submitted to the SHMO. At the discretion of the SHMO and in coordination with the federal HMO, press release(s) describing the program may be developed and issued. Such press release(s) would include a point of contact for obtaining additional program information. The release could also include an announcement of HMGP briefings or meetings to be held in the area, should the SHMO decide to hold such briefings. At the discretion of the SHMO and in coordination with the federal HMO, mitigation information describing the program may be disseminated to communities and the public through Disaster Recovery Centers (DRC's) and/or public meetings held by local officials of the disaster-impacted area.

Shortly after the presidential declaration of disaster, the SHMO determines if a separate HMGP briefing (in addition to that given at the Applicant Briefing) would be beneficial, and if so, could be scheduled. Depending on the scope of a disaster, the Minnesota Recovers Task Force (MRTF) may hold a consolidated, multi-agency applicant briefing. Such briefing(s) would include the following: general program overview; eligibility; application process; and technical assistance.

In Minnesota, applicants for HMGP funds will be required to submit a completed application form within a time frame established by the SHMO. The deadline to submit applications to FEMA is 12 months from the date of declaration with a possibility for two-to-three–month time extensions totaling up to an additional six months.

Once an application or Notice of Interest is received by HSEM, it is brought to the attention of the MRTF (if activated). At this time, a consensus is obtained as to which agency represented on the MRTF, if any, can/should fund the project.

Ranking

Review of the application forms by the SHMO may reveal that several eligible projects are competing for insufficient hazard mitigation funding. Should this be the case, projects will be prioritized or ranked in accord with FEMA and state criteria. These criteria are as follows:

1. Measures that best fit within an overall plan for development and/or hazard mitigation in the community, disaster area, or state.
2. Measures that, if not taken, will have a severe detrimental impact on the applicant such as potential loss of life, loss of essential services, damage to critical facilities, or economic hardship on the community.
3. Measures that have the greatest potential impact on reducing future disaster losses.
4. Measures that are designed to accomplish multiple objectives, including damage reduction, environmental enhancement, and economic recovery.
5. Measures that are in accordance with any overall hazard mitigation project priorities established by the State Mitigation Plan.
6. Additional state criteria that may be considered
   - Geographic distribution of projects
   - Projected cost of proposed project
   - Relative cost-effectiveness of projects
   - Conformity of project with existing local hazard mitigation plans and land use/building regulations in the communities.

- Sub-grantees who have an expired plan will be required to update and adopt an all-hazard mitigation plan.
- Applicant's level of interest and demonstrated degree of commitment to hazard mitigation actions and programs.
- Communities with most intense development pressures.

Process for Integrating State and Local Mitigation Measures

Identification of proposed mitigation measures within each local jurisdiction are the responsibility of the local community. The process of identification should take place during the local hazard mitigation planning process, but it may take place post disaster. The transition between identifying potential mitigation projects and submitting applications for funding of those projects is accomplished through the following process:

1. The State notifies potential applicants of Hazard Mitigation Assistance (HMA) program funding availability, program requirements and disaster specific priority.
2. Applicants submit a Notice of Interest (NOI) declaring their intent to apply to HSEM by the established deadline. The NOI will include the name of the applicant, a brief description of the proposed project, date of FEMA plan approval, mitigation measure from the approved plan that corresponds with the proposed project, approximate cost, and the location.
3. NOI's are reviewed to determine initial eligibility and whether the sub-applicant will be invited to complete a full HMA application. The review will consider the level of funding available under the grant; how the proposed project fits within an overall plan for development and/or hazard mitigation in the community and how the project addresses the State's priorities. All NOI's are tracked and are utilized for current and future funding opportunities.
4. If all eligibility requirements are met and funding is available, then a formal invitation to apply for FEMA funding will be sent to the sub-applicant. Project specific application development trainings and technical assistance/benefit cost analysis webinars and workshops will be held based on community need as planned in the disaster strategy document.
5. Upon application completion, the sub-applicant will submit the application to the State for review, approval, and submittal to FEMA. Additional information regarding HSEMs internal process are included in the Administrative Plan, and sub-recipient's instructions are included in the Sub-Grantee Handbook.

Current Status

The State has several Hazard Mitigation funding opportunities currently available. The DR-4722 and Swift Current application period is currently open, as is the 2023 Federal Fiscal Year BRIC and FMA cycle. HSEM will continue to promote grant opportunities to state agency partners and local units of government. As federal grant opportunities continue to include funds for new project types, including Advance Assistance, Resilient Infrastructure (PDM) and Community Flood Mitigation Projects (FMA) HSEM will continue to support planning and project implementation to make Minnesota more resilient.

Appendix A: Social Vulnerability Ranking

County Name	CDC SVI, Key Factors: Population Below 150% Poverty	Population 65+	Population 5+ with Limited English	Disabled Persons	CDC SVI Theme Ranks: Socio-economic	Household Characteristics	Racial/ Ethnic Minority	Housing/ Transportation	Overall Rank
Beltrami	27.4%	16.0%	0.2%	13.6%	3	16	6	2	1
Wadena	26.6%	21.0%	0.0%	15.5%	4	8	66	1	2
Mahnomen	36.2%	17.7%	0.2%	15.3%	2	9	1	27	3
Clearwater	23.5%	20.5%	0.2%	17.7%	1	18	18	16	4
Chippewa	20.8%	21.2%	1.9%	13.2%	5	6	26	24	5
Ramsey	21.2%	14.5%	4.5%	11.5%	9	21	3	4	6
Nobles	24.6%	16.5%	9.9%	11.8%	17	4	2	12	7
Mower	22.9%	18.2%	5.4%	11.1%	12	7	8	21	8
Mille Lacs	19.0%	18.2%	0.3%	15.3%	8	12	37	17	9
Watonwan	21.9%	20.3%	5.9%	13.6%	14	3	5	36	10
Lyon	20.1%	16.0%	2.1%	10.2%	23	15	16	8	11
Kandiyohi	20.7%	18.9%	2.3%	12.0%	18	11	9	31	12
Pipestone	20.9%	21.0%	3.4%	14.0%	16	1	29	44	13
Todd	23.0%	21.4%	2.0%	13.2%	10	13	43	32	14
Pine	19.3%	20.6%	0.3%	17.0%	6	73	38	20	15
Cottonwood	23.2%	22.8%	2.1%	13.5%	24	5	21	39	16
Freeborn	21.1%	22.2%	2.6%	12.2%	21	10	17	41	17
Polk	19.8%	18.4%	0.7%	12.9%	40	17	23	6	18
Rice	15.2%	15.7%	2.6%	8.6%	22	65	14	11	19
Cass	23.9%	25.8%	0.1%	14.3%	7	43	13	53	20
Swift	21.9%	22.0%	1.1%	14.5%	30	2	45	46	21
Stearns	19.3%	15.0%	1.7%	10.6%	26	57	18	13	22
Koochiching	20.2%	25.3%	0.2%	17.3%	15	48	55	26	23
Hennepin	15.7%	14.1%	2.7%	9.9%	37	59	4	15	24
Becker	19.8%	20.7%	0.2%	14.1%	19	22	22	49	25

County Name	CDC SVI, Key Factors: Population Below 150% Poverty	Population 65+	Population 5+ with Limited English	Disabled Persons	CDC SVI Theme Ranks: Socio-economic	Household Characteristics	Racial/ Ethnic Minority	Housing/ Transportation	Overall Rank
Benton	16.2%	13.9%	0.7%	10.9%	47	30	39	5	26
Blue Earth	24.1%	13.7%	0.8%	9.4%	29	84	29	3	27
Itasca	19.6%	23.5%	0.1%	16.6%	20	60	50	29	28
Clay	18.7%	13.0%	0.4%	10.7%	43	70	25	7	29
St. Louis	21.1%	19.4%	0.3%	14.0%	34	76	47	9	30
Aitkin	22.5%	33.1%	0.2%	19.1%	11	34	72	60	31
Otter Tail	17.0%	23.8%	0.9%	13.0%	31	19	61	43	32
Waseca	17.3%	17.8%	0.7%	10.9%	38	26	40	38	33
Norman	16.6%	21.1%	0.4%	12.0%	39	66	41	23	34
Traverse	17.3%	24.8%	0.7%	16.2%	58	24	32	22	35
Steele	17.5%	17.4%	0.7%	10.5%	44	69	24	28	36
Nicollet	14.3%	15.9%	1.0%	12.3%	70	23	33	14	37
Carlton	17.1%	17.3%	0.6%	13.6%	51	24	35	34	38
Hubbard	19.1%	25.4%	0.5%	15.1%	32	36	64	48	39
Pennington	17.0%	18.1%	0.4%	12.3%	64	26	47	18	40
Renville	18.5%	20.9%	0.7%	11.0%	46	49	29	33	41
Olmsted	13.7%	15.4%	2.1%	9.5%	66	46	9	24	42
Winona	19.0%	16.9%	0.7%	10.8%	35	87	52	10	43
Kanabec	19.8%	20.9%	0.1%	17.2%	13	78	76	52	44
Martin	20.8%	23.3%	0.3%	15.0%	28	28	63	68	45
Morrison	19.1%	19.4%	0.3%	12.5%	25	64	83	42	46
Yellow Medicine	18.5%	20.6%	0.6%	13.4%	68	13	42	46	47
Redwood	18.2%	21.3%	0.7%	10.5%	52	34	27	57	48
Roseau	13.6%	17.4%	0.5%	10.7%	54	41	52	37	49
Goodhue	13.1%	19.6%	0.5%	9.6%	49	75	54	30	50
Crow Wing	17.9%	22.5%	0.1%	14.0%	36	62	74	56	51
Grant	19.7%	24.1%	0.0%	14.1%	27	52	79	69	52

County Name	Population Below 150% Poverty	Population 65+	Population 5+ with Limited English	Disabled Persons	Socio-economic	Household Characteristics	Racial/ Ethnic Minority	Housing/ Transportation	Overall Rank
	CDC SVI, Key Factors				CDC SVI Theme Ranks				
Cook	17.9%	28.1%	0.8%	12.6%	59	49	20	51	53
Fillmore	16.6%	20.9%	0.8%	10.8%	42	42	83	59	54
Big Stone	21.0%	26.1%	0.4%	12.3%	50	68	87	35	55
Stevens	19.2%	16.9%	3.7%	10.7%	73	83	27	19	56
Anoka	10.8%	14.0%	1.7%	9.9%	62	49	11	62	57
Wilkin	15.5%	19.7%	0.2%	14.4%	61	32	67	49	58
Dakota	10.8%	14.1%	1.6%	9.2%	72	37	7	64	59
Lincoln	20.0%	24.9%	0.1%	12.5%	33	57	85	76	60
Faribault	18.5%	22.8%	0.2%	12.2%	48	55	45	73	61
Kittson	18.1%	24.9%	0.0%	11.3%	55	72	79	45	62
McLeod	15.0%	18.7%	0.4%	12.6%	57	78	49	55	63
Rock	16.3%	20.1%	0.3%	11.7%	62	38	69	63	64
Wabasha	13.6%	21.6%	0.6%	12.9%	53	39	74	75	64
Sibley	14.5%	18.3%	2.4%	11.0%	56	67	33	77	66
Marshall	14.3%	21.6%	0.5%	12.3%	71	33	69	67	67
Red Lake	18.3%	20.5%	0.1%	12.1%	74	56	58	54	68
Lake	14.5%	26.0%	0.2%	15.6%	69	29	82	70	69
Murray	15.4%	25.8%	1.4%	12.9%	60	20	62	82	70
Meeker	15.4%	19.8%	0.3%	10.9%	65	74	73	58	71
Isanti	14.2%	15.8%	0.2%	12.2%	41	82	71	78	72
Scott	8.7%	10.9%	1.7%	8.0%	84	43	11	72	73
Le Sueur	12.9%	17.5%	1.1%	11.0%	66	40	51	85	74
Lake of the Woods	18.7%	24.0%	0.1%	11.4%	45	85	58	80	75
Douglas	14.3%	23.0%	0.1%	12.5%	75	81	86	40	76
Sherburne	9.3%	11.2%	0.7%	9.6%	86	45	44	65	77
Washington	7.8%	14.9%	0.8%	9.2%	83	54	15	74	78
Lac qui Parle	15.1%	27.2%	0.6%	15.1%	82	31	76	71	79

County Name	CDC SVI, Key Factors				CDC SVI Theme Ranks				
	Population Below 150% Poverty	Population 65+	Population 5+ with Limited English	Disabled Persons	Socio-economic	Household Characteristics	Racial/ Ethnic Minority	Housing/ Transportation	Overall Rank
Brown	13.9%	21.2%	0.6%	10.0%	81	63	68	66	80
Dodge	9.7%	14.8%	0.6%	8.7%	85	47	56	78	81
Wright	9.0%	12.5%	0.5%	9.4%	75	77	57	81	82
Chisago	10.6%	15.4%	0.2%	10.9%	79	86	65	61	83
Pope	15.3%	24.4%	0.2%	13.6%	78	71	81	82	84
Houston	13.6%	21.5%	0.6%	11.0%	80	61	78	86	85
Jackson	15.5%	22.0%	0.9%	12.3%	77	53	58	87	86
Carver	6.0%	12.1%	0.7%	7.0%	87	80	36	84	87

SOURCE: (ATSDR, 2020)

Appendix B: State Disaster Assistance Program Summary

Declaration	Incident Period	Date Declared	Incident Type	Eligible Applicants	Original # Applicants	Total Estimate	Status	Total Payments to date
SD-072	5/11/2023	6/29/2023	Significant rain, flooding	Brown, Cottonwood, Sibley, Waseca, Watonwan	32	$1,135,280	open	$0
SD-071	3/31–4/1/2023	5/5/2023	Severe winter ice, snowstorm	Washington	21	$1,567,200	open	$0
SD-070	12/13–12/16/2022	1/31/2023	Heavy snowstorm, high winds	Aitkin, Carlton, Cass, Crow Wing, Lincoln, Pine, St. Louis	105	$447,060	open	$0
SD-069	11/10/2022	12/21/2022	Severe thunderstorms	St Louis	1	$661,680	open	$0
SD-068	8/24/2022	9/30/2022	Severe thunderstorms, flooding	Houston	3	$117,434	open	$62,547
SD-067	7/23/2022	9/7/2022	Severe thunderstorms with damaging winds, heavy rains, flooding	Houston, Renville	17	$408,269	open	$16,260

Declaration	Incident Period	Date Declared	Incident Type	Eligible Applicants	Original # Applicants	Total Estimate	Status	Total Payments to date
SD-066	6/20–6/24/2022	9/7/2022	Severe thunderstorms with damaging winds, heavy rains, flooding	Aitkin, Becker, Cass, Crow Wing, Itasca, Lac qui Parle, Mahnomen, Morrison, Norman, St. Louis, Todd	69	$5,336,809	open	$123,752
SD-065	4/22–6/15/2022	8/16/2022	Flooding, heavy rains	Becker	7	$112,950	open	$37,007
SD-064	7/15/2022	8/16/2022	Severe thunderstorms with heavy rains, flooding	Cottonwood, Freeborn, Rock	13	$338,362	open	$73,255
SD-063	6/13/2022	8/10/2022	Severe thunderstorms with heavy rains	Cottonwood	2	$62,447	open	$37,407
SD-062	5/8–13/2022	8/10/2022	Severe thunderstorms, heavy rains, damaging winds, large hail and tornadoes	Benton, Lyon, McLeod, Murray	12	$310,597	open	$183,130
SD-061	5/19/2022	6/30/2022	Severe thunderstorm, flash flooding, slope failures	Wadena	9	$173,000	open	$18,528
SD-060	4/12/2022	5/19/2022	Severe thunderstorms, high winds, heavy rain, large hail	Fillmore, Mower, Rice	11	$1,085,141	open	$272,618

Declaration	Incident Period	Date Declared	Incident Type	Eligible Applicants	Original # Applicants	Total Estimate	Status	Total Payments to date
SD-059	3/17–4/2/2022	5/13/2022	Rapid spring snowmelt causing riverine and overland flooding	Big Stone, Stevens, Traverse	11	$267,071	open	$54,921
SD-058	12/15/2021	2/1/2022	Severe thunderstorms with tornadoes, damaging winds, rain, sleet, ice and snow	Dodge, Fillmore, Freeborn, Houston, Mower, Olmsted, Steele, Wabasha	50	$3,151,145	open	$1,608,230
SD-056	8/7/2021	10/1/2021	Severe thunderstorm, heavy rains, and flooding	Houston	7	$211,727	open	$166,182
SD-055	7/23–7/26/2021	9/29/2021	Severe thunderstorms with heavy rains and damaging winds	Itasca	7	$1,330,613	open	$1,039,376
SD-054	5/19–5/20/2021	6/25/2021	Severe thunderstorm, heavy rains, and flooding	Marshall	6	$113,210	open	$82,428
SD-050	7/25–7/27/2020	12/7/2020	Heavy rains, flooding, and slope failures	Brown, Nicollet, Renville, Sibley	18	$415,177	open	$460,768
SD-049	5/27–6/3/2020	11/5/2020	Fires - Civil Unrest	Hennepin	2	$15,658,865	open	$2,311,689
SD-045	6/17/2020	8/14/2020	Severe storms and flooding	Roseau	7	$96,965	open	$257,230

Declaration	Incident Period	Date Declared	Incident Type	Eligible Applicants	Original # Applicants	Total Estimate	Status	Total Payments to date
SD-043	3/9–5/7/2020	7/23/2020	Spring flooding	Hubbard, Kittson, Marshall, Norman, Polk	67	$2,160,231	open	$1,498,463
SD-040	9/20–10/17/2019	1/6/2020	Heavy rains and flooding	Carlton, Kittson, Lake	32	$1,325,465	open	$951,168
SD-034	7/16–7/20/2019	10/9/2019	Severe thunderstorms, heavy rains, damaging winds, flooding	Blue Earth, Cottonwood, Dodge, Fillmore, Freeborn, Houston, Le Sueur	38	$2,060,361	open	$1,111,461
SD-033	6/27–7/9/2019	9/10/2019	Heavy rains and flooding	Dodge, Fillmore, Goodhue, Olmsted, Redwood, Renville, Wabasha	43	$5,098,469	open	$2,905,169
SD-057	8/28/2021	10/5/2021	Severe thunderstorm, heavy rains, and damaging winds	Cottonwood	1	$32,400	44552	$20,355
SD-053	12/23–12/24/2020	2/4/2021	Severe winter storm	Faribault	1	$476,770	44537	$427,972
SD-052	8/13–8/14/2020	12/7/2020	Heavy rains and flooding	Cass, Itasca, Norman	13	$291,284	44257	$238,578
SD-051	8/8/2020	12/7/2020	High winds and heavy rains	Goodhue, Yellow Medicine	6	$234,866	closed	$5,218
SD-050	7/25–7/27/2020	12/7/2020	Heavy rains, flooding, and slope failures	Brown, Nicollet, Renville, Sibley	18	$415,177	closed	$38,048

Declaration	Incident Period	Date Declared	Incident Type	Eligible Applicants	Original # Applicants	Total Estimate	Status	Total Payments to date
SD-048	7/15–7/17/2020	10/19/2020	Severe thunderstorms with heavy rainfalls, flooding, and damaging winds	Cass, Kittson, Marshall	8	$152,225	44369	$131,510
SD-047	7/6–7/8/2020	10/19/2020	Severe thunderstorms with damaging winds	Wilkin	1	$42,955	44154	$23,599
SD-046	6/23–7/3/2020	10/12/2020	Heavy rains and flooding	Kittson, Le Sueur, Morrison, Renville, Washington	19	$1,869,490	44572	$1,109,916
SD-044	6/7–6/10/2020	8/14/2020	Severe weather and flooding	Kittson	13	$322,961	44687	$227,036
SD-043	3/9–5/7/2020	7/23/2020	Spring flooding	Hubbard, Kittson, Marshall, Norman, Polk	67	$2,160,231	closed	$125,085
SD-042	3/29/2020	5/21/2020	Rain and heavy snow	Morrison	2	$244,000	44058	$324,914
SD-041	12/28–12/31/2019	3/20/2020	Severe winter storm	Renville	2	$90,200	43973	$69,670
SD-039	10/12/2019	1/6/2020	Severe thunderstorm; heavy rain and hurricane force winds	Grand Portage Band of Lake Superior Chippewa	1	$253,535	44236	$183,114

Declaration	Incident Period	Date Declared	Incident Type	Eligible Applicants	Original # Applicants	Total Estimate	Status	Total Payments to date
SD-038	10/21/2019	12/20/2019	Severe thunderstorm, gale, force winds and heavy rain	Cass, Itasca	5	$160,842	43958	$124,397
SD-037	9/24/2019	12/5/2019	Severe thunderstorm, tornado	Wabasha	1	$103,650	44319	$123,825
SD-036	3/12–4/28/2019	11/8/2019	Spring Flooding	Dakota, Pope	13	$1,673,860	44482	$1,245,635
SD-035	9/10–9/15/2019	11/8/2019	Severe thunderstorms with heavy rainfalls and flooding	Murray, Pipestone, Roch, Traverse	23	$620,005	44280	$637,028

Source: Wynn, Angela (HSEM), Personal Communication, August 21, 2023

Appendix C: County Hazard Prioritization

H = High, M = Moderate, L = Low. The count of counties ranking the hazard “high” is totaled at the top.

County	Flooding	Wildfire	Wind-storms	Tornadoes	Hail	Dam Failure	Extreme Heat	Drought	Lightning	Winter Storms	Erosion	Land Subsidence	Extreme Cold
Total count of hazards ranked “high”	**47**	**14**	**50**	**52**	**33**	**1**	**5**	**3**	**31**	**53**	**6**	**1**	**9**
Aitkin	H	M	H	H	L		L	L	L	H			L
Anoka	H	L	H	M	H				H				
Becker	M	L	L	L	M	L	L	L	L	M	L	L	
Beltrami	M	H	H	H	H	L	M	L	H	H	M		M
Benton	M	L	H	H	H	L	M	M	H	H	M		M
Big Stone	M	L	H	H	M	L	M	L		M			M
Blue Earth	H	L	H	H	H	L	M	L	H	H	H		M
Brown	H	L	H	H	H	L	M	L	H	H	H		M
Carlton	H	H	M	M	M	L	L	L	L	H			M
Carver	H	L	H	H	H	L	M	M	H	H	M		M
Cass	H	H	M	M	M	L	L	L	L	H			M
Chippewa	L	L	M	M-H	M	L	M	M	M	M			M
Chisago	H	H	M	L	M		M		M	L			L
Clay	H	M	H	H	H	L	M	L	H	H	M		M
Clearwater	M	L	H	H	H	L	M	L	H	H	M		M
Cook	M	H	H	H	H	L	M	M	H	H	M	M	M
Cottonwood	M	L	M	M	M	L	M	L	M	M	L	L	M
Crow Wing	M	M	H	H	H	L	M	L	H	H	L		M
Dakota	L	L	H	M	M			L	L	L			M
Dodge	H	L-M	M-H	M	M-H	L	M-H	L	L	H			M-H
Douglas	M	L	M	H	L	L	L	M	L	H			M
Faribault	H	L	H	H	H	L	M	L	H	H	M	M	M
Fillmore	M	M	M	H	M	H	M	M	M	M		L	M

County	Flooding	Wildfire	Wind-storms	Tornadoes	Hail	Dam Failure	Extreme Heat	Drought	Lightning	Winter Storms	Erosion	Land Subsidence	Extreme Cold
Freeborn	H	L	H	H	H	L	M	L	H	H	M	M	M
Goodhue	M	L	L	M	L		L	L	L	L		L	L
Grant	H	M	H	H	H	L	M	L	H	H	L	L	M
Hennepin	H		H	M	M		M	M	M	H	M	M	M
Houston	H	H	M	M	M	M		H	M	M		H	
Hubbard	M	H	H	H	H	L	M	L	H	M	L	L	M
Isanti	H	M	M	M	M	L	L	M	L	M			M
Itasca	M	M	M-H	M	M	L	L	L	L	H			M
Jackson	H	L	H	H	M	L	M	M	M	H			H
Kanabec	M	M	H	H		M	M	M		M			M
Kandiyohi	M	L	H	H	M	L	L	L	M	M			M
Kittson	H	H	M	M	L	L	M	M	L	H	L	L	M
Koochiching	M	M	M	L-M	L	L	L	L	L	M			H
Lac Qui Parle	L-M	M		M-H		L	M	L					L-M
Lake of the Woods	H	H	H	H	H	L	M	L	H	H	M		M
Lake	M	H	M	L		L	M	M		H			M
Le Sueur	H	L	M	H	M	M	H	L	M	M			M
Lincoln	L-M	M	M	M	M	L	M	M	M	M	L	L	M
Lyon	M	M	M	M	M	L	M	M	M	H			H
Mahnomen	H	M-H	H	H	H	L	L	M	L	H			H
Marshall	H	L	M	M	L	L	L	M	L	M			M
Martin	H	L	H	H	H	L	M	L	H	H	M		M
McLeod	H	L	H	H	M	L	M	L-M	L	M			M
Meeker	H	L	M	H	L	L	M	L-M	L	M			M
Mille Lacs	M	L	H	H	M	L	M	M	L	H			M-H
Morrison	H	H	M	M	M	L	L	M	L	M			M
Mower	H	L	M-H	M-H	M-H		M-H	M-H	M-H	M-H			M-H

County	Flooding	Wildfire	Wind-storms	Tornadoes	Hail	Dam Failure	Extreme Heat	Drought	Lightning	Winter Storms	Erosion	Land Subsidence	Extreme Cold
Murray	L	L	M	M	M	L	M	M	M	M	L	L	M
Nicollet	H	M	H	H	H	L	M	L	H	H	H		M
Nobles	L-M	L	M	H	M	L	M	M	M	H	L	L	M
Norman	H	M	H	H	H	L	M	L	H	H	M		M
Olmsted	H	L	M	M	M	L	M	L	M	H	M	M	M
Otter Tail	M	M	H	H	M	L	L	L	M	H			M
Pennington	M	L	L	M	M	L	L	L	L	M	M	L	
Pine	H	M	H	H	H	M	H	H	H	H			H
Pipestone	L-M	L	M	M	M	M	L	L	M	M	L	L	M
Polk	H	M	H	H	L	L	L	M	L	M			M
Pope	M	L	H	H	L	L	M	M	L	H			M
Ramsey	M	L	H	H	H	L	M	M	H	H	L	L	M
Red Lake	M	L	M	M	M	L	L	L	L	M	L	L	M
Redwood	M	L	M	M	M	L	M	L	M	M	L	L	M
Renville	H	L	H	H	H	L	H	H	H	H			H
Rice	H	L	H	H	H	L	M	L	H	H	H		M
Rock	H	L	M	M	L-M	L	M	M	L	H			H
Roseau	H	M	L	M	M	M	L	L	L	M	M	L	
Saint Louis	M-H	M	H	H	H	L	M	L	H	H	M-H		M
Scott	H	L		H	M	L	L	M	M	H		L	M
Sherburne	H	M	H	H	H	L	M	M	H	H	M		M
Sibley	H	L	M-H	H	M	L	M	L-M	L	M			M
Stearns	M	M	H	H	H		M	L	L	M			M
Steele	H	L	H	H	H	L	M	L	H	H	H		M
Stevens	M-H	L	H	H	H	L	M	L	M	H			M
Swift	L-M	M	H	M	H	L	H	L	H	M			M
Todd	M	H	H	H	H	L	H	L	H	H	L	L	H

County	Flooding	Wildfire	Wind-storms	Tornadoes	Hail	Dam Failure	Extreme Heat	Drought	Lightning	Winter Storms	Erosion	Land Subsidence	Extreme Cold
Traverse	H	L	M	M	M	L	L	L	L	M			L
Wabasha	M	L	H	H	H	L	M	M	H	H	M	L	M
Wadena	H	H	H	M	M	L	L	M	L	M			M
Waseca	H	L	H	H	H	L	M	L	H	H	M	M	M
Washington	L	M	L	M	L	L	L	L	L	H			L
White Earth	M	H	H	H	M	L	M	M	M	H			H
Watonwan	H	L	H	H	H	L	L	L	L	H			M
Wilkin	H	M	H	H	H	L	M	M	H	H	L	L	M
Winona	H	L	H	H	H	M	M	M	H	H	H		M
Wright	H	L	H	H	H	L	M	M	L	H			M
Yellow Medicine	M	L	M	M	M	L	M	L	L	H			M

SOURCE: U-SPATIAL

Appendix D: PA Grant Program (CDFA Number 97.036), Funded Projects

DR-4414 (2019)

Project Worksheet Report (D.1)

Report Generated on:	01-31-2024 13:14
Data Captured As Of:	01-31-2024 12:06
Disaster Number:	4414
State:	MN
Report by :	Applicant
Applicant ID:	000-UL0NF-00
Subgrant Filter by:	All Subgrant Applications

Date: 01-31-2024 13:14 **Federal Emergency Management Agency**

Project Worksheet (D.1)

Disaster: FEMA-4414-DR-MN

Total Number of Records: 1 **Large Project Threshold: $ 128,900.00**

Applicant ID: 000-UL0NF-00 **Applicant / Subdivision: MN. DEPT. OF PUBLIC SAFETY, DIV. OF EMERG. MGMT.** **County: Statewide** **PAC: STACIE GRATHEN**

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial / Final	Completion Dates Projected / Actual	Obligation Dates Requested / Processed	Bundle #
PA-05-MN-4414-PW-00001(0)	Z	Y	N	$ 556,912.13	0		06-11-2019 / 08-13-2019	02-01-2027 /	08-16-2019 / 08-16-2019	PA-05-MN-4414-PW-00001(0)

Categories:	Applicant Totals:	PWs
Category A:	$ 0.00	0
Category B:	$ 0.00	0
Category C:	$ 0.00	0
Category D:	$ 0.00	0
Category E:	$ 0.00	0
Category F:	$ 0.00	0
Category G:	$ 0.00	0
Category Z:	$ 556,912.13	1
Category Totals per Applicant:	**$556,912.13**	**1**

Grand Totals per Category

Categories		PWs
Category A:	$0.00	0
Category B:	$0.00	0
Category C:	$0.00	0
Category D:	$0.00	0
Category E:	$0.00	0
Category F:	$0.00	0
Category G:	$0.00	0
Category Z:	$556,912.13	1
Grand Total PW Amount:	**$556,912.13**	**1**

DR-4531 (2020–2022)

Project Worksheet Report (D.1)

Report Generated on:	01-31-2024 13:01
Data Captured As Of:	01-31-2024 12:06
Disaster Number:	4531
State:	MN
Report by :	Applicant
Applicant ID:	000-U27DN-00,000-UVNZR-00,000-U07SE-00,000-U1UAN-00,000-UNAW8-00,000-UG5EC-00,000-U3V5J-09,000-U5WR5-02,000-UOS69-00,000-UG99B-00,000-UT8QX-00,000-U0YBM-00,000-USN98-00,000-U4K4R-00,053-UYQCK-00,169-U8756-00,000-U7FU8-00,000-U1KJT-00,000-UG7LQ-00,000-UL0NF-00,000-UO5EU-00,000-UOKXB-00,131-00022-00,000-UTOPN-00,169-01C29-00
Subgrant Filter by:	All Subgrant Applications

The report exceeded 100 results, and subsequent information is not shown. The last applicant in the report may not have all of its applications listed as a result. Please consider narrowing down the search criteria.

Date: 01-31-2024 13:01				Federal Emergency Management Agency						
				Project Worksheet (D.1)						
Total Number of Records: 101				Disaster: FEMA-4531-DR-MN						Large Project Threshold: $ 1,000,000.00
Applicant ID: 000-U07SE-00	Applicant / Subdivision: MINNESOTA DEPT. OF MILITARY AFFAIRS							County: Statewide		PAC: TERRI BURLESON
							Review Dates	Completion Dates	Obligation Dates	
							Initial	Projected	Requested	
PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Final	Actual	Processed	Bundle #
PA-05-MN-4531-PW-00243(0)	B	Y	N	$ 154,115.64	100		11-23-2021	10-07-2020	01-21-2022	PA-05-MN-4531-PW-00243(301)
							01-18-2022	10-05-2021	01-21-2022	
PA-05-MN-4531-PW-00569(0)	B	N	N	$ 0.00	100		12-15-2023	10-07-2020		
	Categories:		Applicant Totals:			PWs				
	Category A:		$ 0.00			0				
	Category B:		$ 154,115.64			2				
	Category C:		$ 0.00			0				
	Category D:		$ 0.00			0				
	Category E:		$ 0.00			0				
	Category F:		$ 0.00			0				
	Category G:		$ 0.00			0				
	Category Z:		$ 0.00			0				
	Category Totals per Applicant:		$154,115.64			2				
Applicant ID: 000-U0YBM-00	Applicant / Subdivision: MINNESOTA DEPT. OF TRANSPORTATION							County: Statewide		PAC: TERRI BURLESON
							Review Dates	Completion Dates	Obligation Dates	
							Initial	Projected	Requested	
PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Final	Actual	Processed	Bundle #
PA-05-MN-4531-PW-00030(0)	B	Y	N	$ 52,240.59	100		10-16-2020	10-07-2020	10-26-2020	PA-05-MN-4531-PW-00030(21)
							10-22-2020	11-01-2021	10-26-2020	
PA-05-MN-4531-PW-00030(1)	B	Y	Y	$ 0.00	100			10-07-2020	04-02-2021	PA-05-MN-4531-PW-00030(146)
								11-01-2021	04-02-2021	
PA-05-MN-4531-PW-00302(0)	B	Y	N	$ 1,562,251.94	100		02-28-2022	10-07-2020	04-15-2022	PA-05-MN-4531-PW-00302(369)

PA-05-MN-4531-PW-00331(0)	B	Y	N	$ 336,648.00	100		04-06-2022	10-07-2020	05-25-2022	PA-05-MN-4531-PW-00331(399)
							05-18-2022	03-28-2022	05-25-2022	
PA-05-MN-4531-PW-00333(0)	B	Y	N	$ 791,447.31	100		04-07-2022	10-07-2020	05-27-2022	PA-05-MN-4531-PW-00333(403)
							05-18-2022	02-28-2022	05-27-2022	
PA-05-MN-4531-PW-00334(0)	B	Y	N	$ 676,338.00	100		04-07-2022	10-07-2020	06-06-2022	PA-05-MN-4531-PW-00334(408)
							05-25-2022	03-31-2022	06-06-2022	
PA-05-MN-4531-PW-00341(0)	B	Y	N	$ 217,560.50	50		04-21-2022	10-07-2020	05-09-2022	PA-05-MN-4531-PW-00341(388)
							04-29-2022	03-31-2022	05-09-2022	
PA-05-MN-4531-PW-00344(0)	B	Y	N	$ 477,204.00	100		04-25-2022	10-07-2020	05-25-2022	PA-05-MN-4531-PW-00344(400)
							05-23-2022	03-31-2022	05-25-2022	
PA-05-MN-4531-PW-00353(0)	B	Y	N	$ 711,738.19	100		05-25-2022	10-07-2020	06-21-2022	PA-05-MN-4531-PW-00353(418)
							06-08-2022	12-31-2021	06-21-2022	
PA-05-MN-4531-PW-00354(0)	B	Y	N	$ 76,647.63	100		05-26-2022	10-07-2020	06-21-2022	PA-05-MN-4531-PW-00354(415)
							06-08-2022		06-21-2022	
PA-05-MN-4531-PW-00365(0)	B	Y	N	$ 113,880.00	100		06-23-2022	10-07-2020	07-14-2022	PA-05-MN-4531-PW-00365(428)
							07-12-2022		07-14-2022	
PA-05-MN-4531-PW-00367(0)	B	Y	N	$ 270,805.83	100		06-24-2022	10-07-2020	07-01-2022	PA-05-MN-4531-PW-00367(422)
							06-28-2022	06-30-2022	07-01-2022	
PA-05-MN-4531-PW-00368(0)	B	Y	N	$ 209,657.52	100		06-27-2022	07-01-2022	08-09-2022	PA-05-MN-4531-PW-00368(437)
							07-28-2022	06-14-2022	08-09-2022	
PA-05-MN-4531-PW-00395(0)	B	Y	N	$ 401,992.00	100		07-29-2022	07-01-2022	08-09-2022	PA-05-MN-4531-PW-00395(441)
							08-05-2022	06-14-2022	08-09-2022	
PA-05-MN-4531-PW-00402(0)	B	Y	N	$ 75,853.77	100		08-09-2022	10-07-2020	09-02-2022	PA-05-MN-4531-PW-00402(458)
							08-22-2022		09-02-2022	
PA-05-MN-4531-PW-00420(0)	B	Y	N	$ 219,886.10	100		08-31-2022	10-07-2020	10-11-2022	PA-05-MN-4531-PW-00420(476)
							09-27-2022		10-11-2022	
PA-05-MN-4531-PW-00425(0)	B	Y	N	$ 85,479.45	100		09-06-2022	10-07-2020	12-20-2022	PA-05-MN-4531-PW-00425(513)
							12-09-2022		12-20-2022	
PA-05-MN-4531-PW-00428(0)	B	Y	N	$ 526,109.96	100		09-13-2022	10-07-2020	11-14-2022	PA-05-MN-4531-PW-00428(491)
							11-07-2022		11-14-2022	
PA-05-MN-4531-PW-00484(0)	B	Y	N	$ 169,753.61	100		01-05-2023	10-07-2020	01-24-2023	PA-05-MN-4531-PW-00484(531)
							01-13-2023		01-24-2023	
PA-05-MN-4531-PW-00491(0)	B	Y	N	$ 40,369.75	100		01-10-2023	10-07-2020	01-24-2023	PA-05-MN-4531-PW-00491(528)
							01-13-2023		01-24-2023	
Categories:				**Applicant Totals:**		**PWs**				
Category A:				$ 0.00		0				
Category B:				$ 8,100,340.59		22				
Category C:				$ 0.00		0				
Category D:				$ 0.00		0				
Category E:				$ 0.00		0				
Category F:				$ 0.00		0				
Category G:				$ 0.00		0				
Category Z:				$ 0.00		0				
Category Totals per Applicant:				**$8,100,340.59**		**22**				

Applicant ID: 000-U27DN-00	Applicant / Subdivision: DEPARTMENT OF EMPLOYMENT AND ECONOMIC DEVELOPMENT							County: Statewide		PAC: TERRI BURLESON
							Review Dates	Completion Dates	Obligation Dates	
							Initial	Projected	Requested	
PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Final	Actual	Processed	Bundle #
PA-05-MN-4531-PW-00240(0)	B	Y	N	$ 27,132.00	100		11-19-2021	10-07-2020	12-16-2021	PA-05-MN-4531-PW-00240(275)
							12-03-2021		12-16-2021	

PA-05-MN-4531-PW-00265(0)	B	Y	N	$ 16,065.00	100		01-03-2022	10-07-2020	02-01-2022	PA-05-MN-4531-PW-00265(315)
							01-25-2022		02-01-2022	
PA-05-MN-4531-PW-00293(0)	B	Y	N	$ 14,955.00	100		02-22-2022	10-07-2020	03-04-2022	PA-05-MN-4531-PW-00293(338)
							03-01-2022		03-04-2022	
PA-05-MN-4531-PW-00297(0)	B	Y	N	$ 6,069.00	100		02-24-2022	10-07-2020	03-04-2022	PA-05-MN-4531-PW-00297(339)
							03-01-2022		03-04-2022	
PA-05-MN-4531-PW-00308(0)	B	Y	N	$ 13,135.00	50		03-08-2022	10-07-2020	03-18-2022	PA-05-MN-4531-PW-00308(348)
							03-14-2022		03-18-2022	
PA-05-MN-4531-PW-00345(0)	B	Y	N	$ 14,541.00	100		04-28-2022	10-07-2020	05-24-2022	PA-05-MN-4531-PW-00345(395)
							05-10-2022		05-24-2022	
PA-05-MN-4531-PW-00347(0)	B	Y	N	$ 18,204.00	100		05-16-2022	10-07-2020	05-25-2022	PA-05-MN-4531-PW-00347(401)
							05-23-2022		05-25-2022	
PA-05-MN-4531-PW-00362(0)	B	Y	N	$ 21,312.00	100		06-14-2022	10-07-2020	07-01-2022	PA-05-MN-4531-PW-00362(423)
							06-21-2022		07-01-2022	
Categories:			Applicant Totals:			PWs				
Category A:				$ 0.00		0				
Category B:				$ 131,413.00		8				
Category C:				$ 0.00		0				
Category D:				$ 0.00		0				
Category E:				$ 0.00		0				
Category F:				$ 0.00		0				
Category G:				$ 0.00		0				
Category Z:				$ 0.00		0				
Category Totals per Applicant:				$131,413.00		8				

Applicant ID: 000-U3V5J-09		Applicant / Subdivision: MINNESOTA DEPARTMENT OF NATURAL RESOURCES / REGION 3						County: Statewide		PAC: TERRI BURLESON
							Review Dates	Completion Dates	Obligation Dates	
							Initial	Projected	Requested	
PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Final	Actual	Processed	Bundle #
PA-05-MN-4531-PW-00103(0)	B	Y	N	$ 8,232.04	100		03-26-2021	10-07-2020	04-02-2021	PA-05-MN-4531-PW-00103(100)
							04-01-2021	10-06-2021	04-02-2021	
PA-05-MN-4531-PW-00166(0)	B	Y	N	$ 102,742.65	100		07-19-2021	10-07-2020	09-09-2021	PA-05-MN-4531-PW-00166(229)
							09-02-2021	10-07-2021	09-09-2021	
PA-05-MN-4531-PW-00238(0)	B	Y	N	$ 12,502.08	100		11-19-2021	10-07-2020	01-11-2022	PA-05-MN-4531-PW-00238(286)
							12-20-2021		01-11-2022	
PA-05-MN-4531-PW-00284(0)	B	Y	N	$ 19,620.95	100		02-11-2022	10-07-2020	03-04-2022	PA-05-MN-4531-PW-00284(337)
							02-23-2022		03-04-2022	
PA-05-MN-4531-PW-00319(0)	B	Y	N	$ 322,576.67	100		03-17-2022	10-07-2020	04-22-2022	PA-05-MN-4531-PW-00319(380)
							04-18-2022	12-20-2021	04-22-2022	
PA-05-MN-4531-PW-00438(0)	B	Y	N	$ 473,832.59	100		09-30-2022	10-07-2020	11-10-2022	PA-05-MN-4531-PW-00438(486)
							11-08-2022		11-10-2022	
Categories:			Applicant Totals:			PWs				
Category A:				$ 0.00		0				
Category B:				$ 939,506.98		6				
Category C:				$ 0.00		0				
Category D:				$ 0.00		0				
Category E:				$ 0.00		0				
Category F:				$ 0.00		0				
Category G:				$ 0.00		0				
Category Z:				$ 0.00		0				
Category Totals per Applicant:				$939,506.98		6				

Applicant ID: 000-U4K4R-00			Applicant / Subdivision: MINNESOTA POLLUTION CONTROL AGENCY					County: Statewide		PAC: TERRI BURLESON
							Review Dates	Completion Dates	Obligation Dates	
							Initial	Projected	Requested	
PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Final	Actual	Processed	Bundle #
PA-05-MN-4531-PW-00230(0)	B	Y	N	$ 57,966.11	100		11-04-2021	10-07-2020	11-19-2021	PA-05-MN-4531-PW-00230(271)
							11-16-2021	12-13-2021	11-19-2021	
PA-05-MN-4531-PW-00262(0)	B	Y	N	$ 33,097.00	100		12-28-2021	10-07-2020	02-01-2022	PA-05-MN-4531-PW-00262(314)
							01-25-2022		02-01-2022	
Categories:			Applicant Totals:			PWs				
Category A:			$ 0.00			0				
Category B:			$ 91,063.11			2				
Category C:			$ 0.00			0				
Category D:			$ 0.00			0				
Category E:			$ 0.00			0				
Category F:			$ 0.00			0				
Category G:			$ 0.00			0				
Category Z:			$ 0.00			0				
Category Totals per Applicant:			$91,063.11			2				

Applicant ID: 000-U5WR5-02			Applicant / Subdivision: MINNESOTA DEPARTMENT OF PUBLIC SAFETY / FISCAL AND ADMINISTRATIVE SERVICES					County: Statewide		PAC: TERRI BURLESON
							Review Dates	Completion Dates	Obligation Dates	
							Initial	Projected	Requested	
PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Final	Actual	Processed	Bundle #
PA-05-MN-4531-PW-00310(0)	B	Y	N	$ 448,512.00	100		03-09-2022	10-07-2020	03-30-2022	PA-05-MN-4531-PW-00310(360)
							03-22-2022	03-09-2022	03-30-2022	
PA-05-MN-4531-PW-00361(0)	B	Y	N	$ 643,716.00	100		06-10-2022	10-07-2020	07-18-2022	PA-05-MN-4531-PW-00361(432)
							07-12-2022	04-27-2022	07-18-2022	
Categories:			Applicant Totals:			PWs				
Category A:			$ 0.00			0				
Category B:			$ 1,092,228.00			2				
Category C:			$ 0.00			0				
Category D:			$ 0.00			0				
Category E:			$ 0.00			0				
Category F:			$ 0.00			0				
Category G:			$ 0.00			0				
Category Z:			$ 0.00			0				
Category Totals per Applicant:			$1,092,228.00			2				

Applicant ID: 000-U7FU8-00			Applicant / Subdivision: MINNESOTA STATE UNIVERSITY					County: Statewide		PAC: TERRI BURLESON
							Review Dates	Completion Dates	Obligation Dates	
							Initial	Projected	Requested	
PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Final	Actual	Processed	Bundle #
PA-05-MN-4531-PW-00263(0)	B	Y	N	$ 54,500.00	100		12-28-2021	10-07-2020	01-24-2022	PA-05-MN-4531-PW-00263(306)
							01-20-2022		01-24-2022	
Categories:			Applicant Totals:			PWs				
Category A:			$ 0.00			0				

Category B:	$ 54,500.00	1	
Category C:	$ 0.00	0	
Category D:	$ 0.00	0	
Category E:	$ 0.00	0	
Category F:	$ 0.00	0	
Category G:	$ 0.00	0	
Category Z:	$ 0.00	0	
Category Totals per Applicant:	**$54,500.00**	**1**	

Applicant ID: 000-UG5EC-00 | **Applicant / Subdivision: MINNESOTA DEPARTMENT OF HUMAN SERVICES** | **County: Statewide** | **PAC: TERRI BURLESON**

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates – Initial	Review Dates – Final	Completion Dates – Projected	Completion Dates – Actual	Obligation Dates – Requested	Obligation Dates – Processed	Bundle #
PA-05-MN-4531-PW-00054(0)	B	Y	N	$ 337,653.69	100		12-08-2020	12-15-2020	10-07-2020	09-30-2020	12-21-2020	12-21-2020	PA-05-MN-4531-PW-00054(48)
PA-05-MN-4531-PW-00054(1)	B	Y	Y	$ 0.00	100				10-07-2020	09-30-2020	04-02-2021	04-02-2021	PA-05-MN-4531-PW-00054(157)
PA-05-MN-4531-PW-00062(1)	B	Y	Y	$ 0.00	100				10-07-2020	07-31-2020	04-02-2021	04-02-2021	PA-05-MN-4531-PW-00062(158)
PA-05-MN-4531-PW-00062(0)	B	Y	N	$ 337,963.44	100		12-23-2020	01-04-2021	10-07-2020	07-31-2020	01-08-2021	01-08-2021	PA-05-MN-4531-PW-00062(55)
PA-05-MN-4531-PW-00065(0)	B	Y	N	$ 1,147,724.00	100		01-05-2021	02-22-2021	10-07-2020	04-30-2020	03-23-2021	03-23-2021	PA-05-MN-4531-PW-00065(91)
PA-05-MN-4531-PW-00084(0)	B	Y	N	$ 105,769.99	100		02-18-2021	02-26-2021	10-07-2020		03-04-2021	03-04-2021	PA-05-MN-4531-PW-00084(77)
PA-05-MN-4531-PW-00085(0)	B	Y	N	$ 51,935.40	100		02-18-2021	02-22-2021	10-07-2020		02-23-2021	02-23-2021	PA-05-MN-4531-PW-00085(68)
PA-05-MN-4531-PW-00090(0)	B	Y	N	$ 201,798.25	100		02-22-2021	03-02-2021	12-31-2020	12-31-2020	03-04-2021	03-04-2021	PA-05-MN-4531-PW-00090(78)
PA-05-MN-4531-PW-00096(0)	B	Y	N	$ 7,225,748.38	100		03-02-2021	03-17-2021	02-02-2021	02-02-2021	03-30-2021	03-30-2021	PA-05-MN-4531-PW-00096(96)
PA-05-MN-4531-PW-00098(0)	B	Y	N	$ 1,042,849.25	100		03-05-2021	03-24-2021	12-29-2020	12-29-2020	04-14-2021	04-14-2021	PA-05-MN-4531-PW-00098(167)
PA-05-MN-4531-PW-00110(1)	B	Y	N	$ -448,223.87	31		12-03-2021	12-17-2021	10-07-2020	05-31-2021	12-23-2021	12-23-2021	PA-05-MN-4531-PW-00110(283)
PA-05-MN-4531-PW-00110(0)	B	Y	N	$ 474,250.00	31		04-02-2021	04-06-2021	10-07-2020	05-31-2021	04-08-2021	04-08-2021	PA-05-MN-4531-PW-00110(165)
PA-05-MN-4531-PW-00110(2)	B	Y	N	$ -4,549.33	100		02-09-2022	02-10-2022	10-07-2020	05-31-2021	02-17-2022	02-17-2022	PA-05-MN-4531-PW-00110(318)
PA-05-MN-4531-PW-00113(0)	B	Y	N	$ 428,862.19	100		04-13-2021	04-23-2021	12-31-2020	12-31-2020	05-03-2021	05-03-2021	PA-05-MN-4531-PW-00113(172)
PA-05-MN-4531-PW-00156(0)	B	Y	N	$ 162,955.00	100		07-01-2021	08-05-2021	10-07-2020	08-31-2020	08-05-2021	08-05-2021	PA-05-MN-4531-PW-00156(215)
PA-05-MN-4531-PW-00176(0)	B	Y	N	$ 125,869.90	100		08-13-2021	08-20-2021	10-07-2020		08-25-2021	08-25-2021	PA-05-MN-4531-PW-00176(225)
PA-05-MN-4531-PW-00177(0)	B	Y	N	$ 62,851.60	100		08-18-2021	10-27-2021	10-07-2020		10-27-2021	10-28-2021	PA-05-MN-4531-PW-00177(249)
PA-05-MN-4531-PW-00179(0)	B	Y	N	$ 385,550.14	100		08-19-2021	09-07-2021	03-31-2021	03-31-2021	09-09-2021	09-09-2021	PA-05-MN-4531-PW-00179(228)
PA-05-MN-4531-PW-00186(0)	B	Y	N	$ 28,691.28	100		09-01-2021	09-13-2021	10-07-2020		09-16-2021	09-16-2021	PA-05-MN-4531-PW-00186(235)

PA-05-MN-4531-PW-00217(0)	B	Y	N	$ 601,612.00	100		10-20-2021	10-07-2020	01-24-2022	PA-05-MN-4531-PW-00217(307)
							01-18-2022	02-28-2021	01-24-2022	
Categories:			Applicant Totals:			PWs				
Category A:			$ 0.00			0				
Category B:			$ 12,269,311.31			16				
Category C:			$ 0.00			0				
Category D:			$ 0.00			0				
Category E:			$ 0.00			0				
Category F:			$ 0.00			0				
Category G:			$ 0.00			0				
Category Z:			$ 0.00			0				
Category Totals per Applicant:			**$12,269,311.31**			**16**				
Applicant ID: 000-UG7LQ-00	Applicant / Subdivision: MN DEPT OF LABOR & INDUSTRY							County: Statewide		PAC: TERRI BURLESON
							Review Dates	Completion Dates	Obligation Dates	
							Initial	Projected	Requested	
PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Final	Actual	Processed	Bundle #
PA-05-MN-4531-PW-00312(0)	B	Y	N	$ 68,539.18	100		03-09-2022	10-07-2020	03-30-2022	PA-05-MN-4531-PW-00312(359)
							03-24-2022		03-30-2022	
PA-05-MN-4531-PW-00378(0)	B	Y	N	$ 89,432.26	100		07-07-2022	10-07-2020	08-17-2022	PA-05-MN-4531-PW-00378(442)
							08-09-2022		08-17-2022	
Categories:			Applicant Totals:			PWs				
Category A:			$ 0.00			0				
Category B:			$ 157,971.44			2				
Category C:			$ 0.00			0				
Category D:			$ 0.00			0				
Category E:			$ 0.00			0				
Category F:			$ 0.00			0				
Category G:			$ 0.00			0				
Category Z:			$ 0.00			0				
Category Totals per Applicant:			**$157,971.44**			**2**				
Applicant ID: 000-UL0NF-00	Applicant / Subdivision: MN. DEPT. OF PUBLIC SAFETY, DIV. OF EMERG. MGMT.							County: Statewide		PAC: TERRI BURLESON
							Review Dates	Completion Dates	Obligation Dates	
							Initial	Projected	Requested	
PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Final	Actual	Processed	Bundle #
PA-05-MN-4531-PW-00002(0)	Z	Y	N	$ 568,050.37	0		05-13-2020	04-07-2028	05-19-2020	PA-05-MN-4531-PW-00002(0)
							05-18-2020		05-19-2020	
PA-05-MN-4531-PW-00002(1)	Z	Y	N	$ 2,410,769.96	100		05-13-2022	04-07-2028	07-05-2022	PA-05-MN-4531-PW-00002(426)
							06-10-2022		07-06-2022	
PA-05-MN-4531-PW-00013(1)	B	Y	Y	$ 0.00	100			10-07-2020	04-02-2021	PA-05-MN-4531-PW-00013(162)
									04-03-2021	
PA-05-MN-4531-PW-00013(0)	B	Y	N	$ 5,502,589.55	100		08-12-2020	10-07-2020	12-11-2020	PA-05-MN-4531-PW-00013(42)
							11-25-2020		12-11-2020	
PA-05-MN-4531-PW-00013(2)	B	N	N	$ -5,498,954.28	100		01-20-2023	10-07-2020		
							11-25-2020			
PA-05-MN-4531-PW-00021(0)	B	Y	N	$ 321,858.76	100		09-22-2020	10-07-2020	11-03-2020	PA-05-MN-4531-PW-00021(22)
							10-27-2020	06-06-2020	11-03-2020	
PA-05-MN-4531-PW-00021(1)	B	Y	Y	$ 0.00	100			10-07-2020	04-02-2021	PA-05-MN-4531-PW-00021(101)

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial Final	Completion Dates Projected Actual	Obligation Dates Requested Processed	Bundle #
								06-06-2020	04-02-2021	
PA-05-MN-4531-PW-00036(1)	B	Y	Y	$ 0.00	100			10-07-2020	04-02-2021 04-02-2021	PA-05-MN-4531-PW-00036(102)
PA-05-MN-4531-PW-00036(0)	B	Y	N	$ 68,881.36	100		10-28-2020 11-03-2020	10-07-2020	11-13-2020 11-13-2020	PA-05-MN-4531-PW-00036(30)
PA-05-MN-4531-PW-00044(0)	B	Y	N	$ 95,351.53	100		11-18-2020 11-19-2020	10-07-2020	11-20-2020 11-20-2020	PA-05-MN-4531-PW-00044(33)
PA-05-MN-4531-PW-00044(1)	B	Y	Y	$ 0.00	100			10-07-2020	04-02-2021 04-02-2021	PA-05-MN-4531-PW-00044(103)
PA-05-MN-4531-PW-00075(1)	B	Y	Y	$ 0.00	100			01-31-2021 10-07-2020	04-02-2021 04-02-2021	PA-05-MN-4531-PW-00075(104)
PA-05-MN-4531-PW-00075(0)	B	Y	N	$ 169,224.87	100		01-19-2021 01-21-2021	01-31-2021 10-07-2020	01-26-2021 01-26-2021	PA-05-MN-4531-PW-00075(57)
PA-05-MN-4531-PW-00082(0)	B	Y	N	$ 51,443.38	100		02-18-2021 02-24-2021	10-07-2020 10-07-2020	03-04-2021 03-04-2021	PA-05-MN-4531-PW-00082(72)
PA-05-MN-4531-PW-00082(1)	B	Y	N	$ -51,443.38	100		08-18-2021 08-20-2021	10-07-2020 10-07-2020	08-25-2021 08-25-2021	PA-05-MN-4531-PW-00082(226)
PA-05-MN-4531-PW-00105(1)	B	Y	N	$ 74,023.00	100		07-03-2023 07-10-2023	07-01-2022	08-03-2023 08-03-2023	PA-05-MN-4531-PW-00105(581)
PA-05-MN-4531-PW-00105(0)	B	Y	N	$ 126,168.41	100		03-29-2021 04-01-2021	10-07-2020	04-02-2021 04-02-2021	PA-05-MN-4531-PW-00105(97)
PA-05-MN-4531-PW-00165(0)	B	Y	N	$ 47,000.00	100		07-16-2021 07-22-2021	10-07-2020	07-23-2021 07-23-2021	PA-05-MN-4531-PW-00165(209)

Categories:	Applicant Totals:	PWs
Category A:	$ 0.00	0
Category B:	$ 906,143.20	8
Category C:	$ 0.00	0
Category D:	$ 0.00	0
Category E:	$ 0.00	0
Category F:	$ 0.00	0
Category G:	$ 0.00	0
Category Z:	$ 2,978,820.33	1
Category Totals per Applicant:	**$3,884,963.53**	**9**

Applicant ID: 000-UNAW8-00 | **Applicant / Subdivision: MINNESOTA DEPARTMENT OF HEALTH** | **County: Statewide** | **PAC: TERRI BURLESON**

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial Final	Completion Dates Projected Actual	Obligation Dates Requested Processed	Bundle #
PA-05-MN-4531-PW-00012(0)	B	Y	N	$ 456,070.47	100		08-11-2020 10-22-2020	10-07-2020 02-03-2021	10-26-2020 10-26-2020	PA-05-MN-4531-PW-00012(16)
PA-05-MN-4531-PW-00012(1)	B	Y	Y	$ 0.00	100			10-07-2020 02-03-2021	04-02-2021 04-02-2021	PA-05-MN-4531-PW-00012(118)
PA-05-MN-4531-PW-00015(0)	B	Y	N	$ 240,243.27	100		08-14-2020 08-31-2020	10-07-2020 10-07-2020	09-10-2020 09-10-2020	PA-05-MN-4531-PW-00015(9)
PA-05-MN-4531-PW-00015(1)	B	Y	Y	$ 0.00	100			10-07-2020 10-07-2020	04-02-2021 04-02-2021	PA-05-MN-4531-PW-00015(119)
PA-05-MN-4531-PW-00045(1)	B	Y	Y	$ 0.00	100			10-08-2020 10-08-2020	04-02-2021 04-02-2021	PA-05-MN-4531-PW-00045(120)
PA-05-MN-4531-PW-00045(2)	B	Y	N	$ 0.00	100		03-23-2022 03-23-2022	10-08-2020 10-08-2020		
PA-05-MN-4531-PW-00045(0)	B	Y	N	$ 337,539.79	100		11-19-2020	10-08-2020	12-08-2020	PA-05-MN-4531-PW-00045(37)

							12-03-2020	10-08-2020	12-08-2020	
PA-05-MN-4531-PW-00046(1)	B	Y	Y	$ 0.00	100			11-17-2020	04-02-2021	PA-05-MN-4531-PW-00046(121)
								11-16-2020	04-02-2021	
PA-05-MN-4531-PW-00046(0)	B	Y	N	$ 2,957,635.97	100		11-20-2020	11-17-2020	12-30-2020	PA-05-MN-4531-PW-00046(50)
							12-17-2020	11-16-2020	12-30-2020	
PA-05-MN-4531-PW-00047(1)	B	Y	Y	$ 0.00	100			10-19-2020	04-02-2021	PA-05-MN-4531-PW-00047(122)
								02-03-2021	04-02-2021	

Categories:	Applicant Totals:	PWs
Category A:	$ 0.00	0
Category B:	$ 303,368,651.55	58
Category C:	$ 0.00	0
Category D:	$ 0.00	0
Category E:	$ 0.00	0
Category F:	$ 0.00	0
Category G:	$ 0.00	0
Category Z:	$ 0.00	0
Category Totals per Applicant:	**$303,368,651.55**	**58**

Grand Totals per Category

Categories		PWs
Category A:	$0.00	0
Category B:	$329,936,420.22	132
Category C:	$0.00	0
Category D:	$0.00	0
Category E:	$0.00	0
Category F:	$0.00	0
Category G:	$0.00	0
Category Z:	$2,978,820.33	1
Grand Total PW Amount:	**$332,915,240.55**	**133**

Project Worksheet Report (D.1)

Report Generated on:	01-31-2024 13:05
Data Captured As Of:	01-31-2024 12:06
Disaster Number:	4531
State:	MN
Report by :	Applicant
Applicant ID:	000-UG5EC-00,000-U3V5J-09,000-U5WR5-02,000-UOS69-00,000-UG99B-00,000-UT8QX-00,000-U0YBM-00,000-USN98-00,000-U4K4R-00,053-UYQCK-00
Subgrant Filter by:	All Subgrant Applications

Date: 01-31-2024 13:05 — Federal Emergency Management Agency

Project Worksheet (D.1)

Disaster: FEMA-4531-DR-MN

Total Number of Records: 47 — Large Project Threshold: $ 1,000,000.00

Applicant ID: 000-U0YBM-00 — Applicant / Subdivision: MINNESOTA DEPT. OF TRANSPORTATION — County: Statewide — PAC: TERRI BURLESON

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial / Final	Completion Dates Projected / Actual	Obligation Dates Requested / Processed	Bundle #
PA-05-MN-4531-PW-00030(1)	B	Y	Y	$ 0.00	100			10-07-2020	04-02-2021	PA-05-MN-4531-PW-00030(146)
								11-01-2021	04-02-2021	
PA-05-MN-4531-PW-00030(0)	B	Y	N	$ 52,240.59	100		10-16-2020	10-07-2020	10-26-2020	PA-05-MN-4531-PW-00030(21)
							10-22-2020	11-01-2021	10-26-2020	
PA-05-MN-4531-PW-00302(0)	B	Y	N	$ 1,562,251.94	100		02-28-2022	10-07-2020	04-15-2022	PA-05-MN-4531-PW-00302(369)
							03-30-2022	01-08-2022	04-15-2022	
PA-05-MN-4531-PW-00396(0)	B	Y	N	$ 599,143.78	100		08-01-2022	10-07-2020	09-02-2022	PA-05-MN-4531-PW-00396(460)
							08-31-2022		09-02-2022	
PA-05-MN-4531-PW-00485(0)	B	Y	N	$ 403,502.52	100		01-06-2023	10-07-2020	01-25-2023	PA-05-MN-4531-PW-00485(532)
							01-20-2023		01-25-2023	

Categories:	Applicant Totals:	PWs
Category A:	$ 0.00	0
Category B:	$ 2,617,138.83	4
Category C:	$ 0.00	0
Category D:	$ 0.00	0
Category E:	$ 0.00	0
Category F:	$ 0.00	0
Category G:	$ 0.00	0
Category Z:	$ 0.00	0
Category Totals per Applicant:	$2,617,138.83	4

Applicant ID: 000-U3V5J-09 — Applicant / Subdivision: MINNESOTA DEPARTMENT OF NATURAL RESOURCES / REGION 3 — County: Statewide — PAC: TERRI BURLESON

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial / Final	Completion Dates Projected / Actual	Obligation Dates Requested / Processed	Bundle #
PA-05-MN-4531-PW-00103(0)	B	Y	N	$ 8,232.04	100		03-26-2021	10-07-2020	04-02-2021	PA-05-MN-4531-PW-00103(100)
							04-01-2021	10-06-2021	04-02-2021	
PA-05-MN-4531-PW-00166(0)	B	Y	N	$ 102,742.65	100		07-19-2021	10-07-2020	09-09-2021	PA-05-MN-4531-PW-00166(229)
							09-02-2021	10-07-2021	09-09-2021	

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial / Final	Completion Dates Projected / Actual	Obligation Dates Requested / Processed	Bundle #
PA-05-MN-4531-PW-00238(0)	B	Y	N	$ 12,502.08	100		11-19-2021	10-07-2020	01-11-2022	PA-05-MN-4531-PW-00238(286)
							12-20-2021		01-11-2022	
PA-05-MN-4531-PW-00284(0)	B	Y	N	$ 19,620.95	100		02-11-2022	10-07-2020	03-04-2022	PA-05-MN-4531-PW-00284(337)
							02-23-2022		03-04-2022	
PA-05-MN-4531-PW-00319(0)	B	Y	N	$ 322,576.67	100		03-17-2022	10-07-2020	04-22-2022	PA-05-MN-4531-PW-00319(380)
							04-18-2022	12-20-2021	04-22-2022	
PA-05-MN-4531-PW-00438(0)	B	Y	N	$ 473,832.59	100		09-30-2022	10-07-2020	11-10-2022	PA-05-MN-4531-PW-00438(486)
							11-08-2022		11-10-2022	
Categories:				Applicant Totals:		PWs				
Category A:				$ 0.00		0				
Category B:				$ 939,506.98		6				
Category C:				$ 0.00		0				
Category D:				$ 0.00		0				
Category E:				$ 0.00		0				
Category F:				$ 0.00		0				
Category G:				$ 0.00		0				
Category Z:				$ 0.00		0				
Category Totals per Applicant:				$939,506.98		6				

Applicant ID: 000-U4K4R-00	Applicant / Subdivision: MINNESOTA POLLUTION CONTROL AGENCY							County: Statewide		PAC: TERRI BURLESON
PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial / Final	Completion Dates Projected / Actual	Obligation Dates Requested / Processed	Bundle #
PA-05-MN-4531-PW-00230(0)	B	Y	N	$ 57,966.11	100		11-04-2021	10-07-2020	11-19-2021	PA-05-MN-4531-PW-00230(271)
							11-16-2021	12-13-2021	11-19-2021	
PA-05-MN-4531-PW-00262(0)	B	Y	N	$ 33,097.00	100		12-28-2021	10-07-2020	02-01-2022	PA-05-MN-4531-PW-00262(314)
							01-25-2022		02-01-2022	
Categories:				Applicant Totals:		PWs				
Category A:				$ 0.00		0				
Category B:				$ 91,063.11		2				
Category C:				$ 0.00		0				
Category D:				$ 0.00		0				
Category E:				$ 0.00		0				
Category F:				$ 0.00		0				
Category G:				$ 0.00		0				
Category Z:				$ 0.00		0				
Category Totals per Applicant:				$91,063.11		2				

Applicant ID: 000-U5WR5-02	Applicant / Subdivision: MINNESOTA DEPARTMENT OF PUBLIC SAFETY / FISCAL AND ADMINISTRATIVE SERVICES							County: Statewide		PAC: TERRI BURLESON
PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial / Final	Completion Dates Projected / Actual	Obligation Dates Requested / Processed	Bundle #
PA-05-MN-4531-PW-00310(0)	B	Y	N	$ 448,512.00	100		03-09-2022	10-07-2020	03-30-2022	PA-05-MN-4531-PW-00310(360)
							03-22-2022	03-09-2022	03-30-2022	
PA-05-MN-4531-PW-00361(0)	B	Y	N	$ 643,716.00	100		06-10-2022	10-07-2020	07-18-2022	PA-05-MN-4531-PW-00361(432)
							07-12-2022	04-27-2022	07-18-2022	
Categories:				Applicant Totals:		PWs				
Category A:				$ 0.00		0				
Category B:				$ 1,092,228.00		2				

Category C:	$ 0.00	0	
Category D:	$ 0.00	0	
Category E:	$ 0.00	0	
Category F:	$ 0.00	0	
Category G:	$ 0.00	0	
Category Z:	$ 0.00	0	
Category Totals per Applicant:	$1,092,228.00	2	

Applicant ID: 000-UG5EC-00	Applicant / Subdivision: MINNESOTA DEPARTMENT OF HUMAN SERVICES	County: Statewide	PAC: TERRI BURLESON

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial / Final	Completion Dates Projected / Actual	Obligation Dates Requested / Processed	Bundle #
PA-05-MN-4531-PW-00054(1)	B	Y	Y	$ 0.00	100			10-07-2020	04-02-2021	PA-05-MN-4531-PW-00054(157)
								09-30-2020	04-02-2021	
PA-05-MN-4531-PW-00054(0)	B	Y	N	$ 337,653.69	100		12-08-2020	10-07-2020	12-21-2020	PA-05-MN-4531-PW-00054(48)
							12-15-2020	09-30-2020	12-21-2020	
PA-05-MN-4531-PW-00062(1)	B	Y	Y	$ 0.00	100			10-07-2020	04-02-2021	PA-05-MN-4531-PW-00062(158)
								07-31-2020	04-02-2021	
PA-05-MN-4531-PW-00062(0)	B	Y	N	$ 337,963.44	100		12-23-2020	10-07-2020	01-08-2021	PA-05-MN-4531-PW-00062(55)
							01-04-2021	07-31-2020	01-08-2021	
PA-05-MN-4531-PW-00065(0)	B	Y	N	$ 1,147,724.00	100		01-05-2021	10-07-2020	03-23-2021	PA-05-MN-4531-PW-00065(91)
							02-22-2021	04-30-2020	03-23-2021	
PA-05-MN-4531-PW-00084(0)	B	Y	N	$ 105,769.99	100		02-18-2021	10-07-2020	03-04-2021	PA-05-MN-4531-PW-00084(77)
							02-26-2021		03-04-2021	
PA-05-MN-4531-PW-00085(0)	B	Y	N	$ 51,935.40	100		02-18-2021	10-07-2020	02-23-2021	PA-05-MN-4531-PW-00085(68)
							02-22-2021		02-23-2021	
PA-05-MN-4531-PW-00090(0)	B	Y	N	$ 201,798.25	100		02-22-2021	12-31-2020	03-04-2021	PA-05-MN-4531-PW-00090(78)
							03-02-2021	12-31-2020	03-04-2021	
PA-05-MN-4531-PW-00096(0)	B	Y	N	$ 7,225,748.38	100		03-02-2021	02-02-2021	03-30-2021	PA-05-MN-4531-PW-00096(96)
							03-17-2021	02-02-2021	03-30-2021	
PA-05-MN-4531-PW-00098(0)	B	Y	N	$ 1,042,849.25	100		03-05-2021	12-29-2020	04-14-2021	PA-05-MN-4531-PW-00098(167)
							03-24-2021	12-29-2020	04-14-2021	
PA-05-MN-4531-PW-00110(1)	B	Y	N	$ -448,223.87	31		12-03-2021	10-07-2020	12-23-2021	PA-05-MN-4531-PW-00110(283)
							12-17-2021	05-31-2021	12-23-2021	
PA-05-MN-4531-PW-00110(0)	B	Y	N	$ 474,250.00	31		04-02-2021	10-07-2020	04-08-2021	PA-05-MN-4531-PW-00110(165)
							04-06-2021	05-31-2021	04-08-2021	
PA-05-MN-4531-PW-00110(2)	B	Y	N	$ -4,549.33	100		02-09-2022	10-07-2020	02-17-2022	PA-05-MN-4531-PW-00110(318)
							02-10-2022	05-31-2021	02-17-2022	
PA-05-MN-4531-PW-00113(0)	B	Y	N	$ 428,862.19	100		04-13-2021	12-31-2020	05-03-2021	PA-05-MN-4531-PW-00113(172)
							04-23-2021	12-31-2020	05-03-2021	
PA-05-MN-4531-PW-00156(0)	B	Y	N	$ 162,955.00	100		07-01-2021	10-07-2020	08-05-2021	PA-05-MN-4531-PW-00156(215)
							08-05-2021	08-31-2020	08-05-2021	
PA-05-MN-4531-PW-00176(0)	B	Y	N	$ 125,869.90	100		08-13-2021	10-07-2020	08-25-2021	PA-05-MN-4531-PW-00176(225)
							08-20-2021		08-25-2021	
PA-05-MN-4531-PW-00177(0)	B	Y	N	$ 62,851.60	100		08-18-2021	10-07-2020	10-27-2021	PA-05-MN-4531-PW-00177(249)
							10-27-2021		10-28-2021	
PA-05-MN-4531-PW-00179(0)	B	Y	N	$ 385,550.14	100		08-19-2021	03-31-2021	09-09-2021	PA-05-MN-4531-PW-00179(228)
							09-07-2021	03-31-2021	09-09-2021	
PA-05-MN-4531-PW-00186(0)	B	Y	N	$ 28,691.28	100		09-01-2021	10-07-2020	09-16-2021	PA-05-MN-4531-PW-00186(235)
							09-13-2021		09-16-2021	

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial / Final	Completion Dates Projected / Actual	Obligation Dates Requested / Processed	Bundle #
PA-05-MN-4531-PW-00217(0)	B	Y	N	$ 601,612.00	100		10-20-2021	10-07-2020	01-24-2022	PA-05-MN-4531-PW-00217(307)
							01-18-2022	02-28-2021	01-24-2022	
			Categories:	Applicant Totals:			PWs			
			Category A:	$ 0.00			0			
			Category B:	$ 12,269,311.31			16			
			Category C:	$ 0.00			0			
			Category D:	$ 0.00			0			
			Category E:	$ 0.00			0			
			Category F:	$ 0.00			0			
			Category G:	$ 0.00			0			
			Category Z:	$ 0.00			0			
Category Totals per Applicant:				$12,269,311.31			16			

Applicant ID: 000-UOS69-00	Applicant / Subdivision: MINNESOTA DEPARTMENT OF VETERANS AFFAIRS							County: Statewide		PAC: TERRI BURLESON
PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial / Final	Completion Dates Projected / Actual	Obligation Dates Requested / Processed	Bundle #
PA-05-MN-4531-PW-00283(0)	B	Y	N	$ 4,123,131.67	100		02-11-2022	10-07-2020	04-05-2022	PA-05-MN-4531-PW-00283(364)
							03-21-2022	11-30-2021	04-05-2022	
PA-05-MN-4531-PW-00351(0)	B	Y	N	$ 946,916.65	100		05-20-2022	10-07-2020	06-16-2022	PA-05-MN-4531-PW-00351(412)
							06-08-2022	02-28-2022	06-16-2022	
PA-05-MN-4531-PW-00357(0)	B	Y	N	$ 609,614.09	100		06-01-2022	10-07-2020	07-08-2022	PA-05-MN-4531-PW-00357(427)
							07-01-2022	12-31-2021	07-08-2022	
PA-05-MN-4531-PW-00363(0)	B	Y	N	$ 137,523.10	100		06-21-2022	10-07-2020	07-01-2022	PA-05-MN-4531-PW-00363(425)
							06-30-2022	07-31-2022	07-01-2022	
PA-05-MN-4531-PW-00407(0)	B	Y	N	$ 748,931.99	100		08-11-2022	10-07-2020	10-07-2022	PA-05-MN-4531-PW-00407(467)
							10-03-2022		10-07-2022	
PA-05-MN-4531-PW-00482(0)	B	Y	N	$ 182,530.00	100		12-29-2022	10-07-2020	01-24-2023	PA-05-MN-4531-PW-00482(530)
							01-13-2023		01-24-2023	
PA-05-MN-4531-PW-00540(0)	B	Y	N	$ 81,580.00	100		09-28-2023	10-07-2020	10-17-2023	PA-05-MN-4531-PW-00540(593)
							10-03-2023		10-17-2023	
			Categories:	Applicant Totals:			PWs			
			Category A:	$ 0.00			0			
			Category B:	$ 6,830,227.50			7			
			Category C:	$ 0.00			0			
			Category D:	$ 0.00			0			
			Category E:	$ 0.00			0			
			Category F:	$ 0.00			0			
			Category G:	$ 0.00			0			
			Category Z:	$ 0.00			0			
Category Totals per Applicant:				$6,830,227.50			7			

Applicant ID: 000-USN98-00	Applicant / Subdivision: MINNESOTA MANAGEMENT AND BUDGET DEPT.							County: Statewide		PAC: WILLIAM HARRIS
PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial / Final	Completion Dates Projected / Actual	Obligation Dates Requested / Processed	Bundle #
PA-05-MN-4531-PW-00516(0)	B	Y	N	$ 934,307.15	100		01-26-2023	10-07-2020	04-10-2023	PA-05-MN-4531-PW-00516(557)
							03-27-2023		04-10-2023	
			Categories:	Applicant Totals:			PWs			

Categories	Applicant Totals	PWs
Category A:	$ 0.00	0
Category B:	$ 934,307.15	1
Category C:	$ 0.00	0
Category D:	$ 0.00	0
Category E:	$ 0.00	0
Category F:	$ 0.00	0
Category G:	$ 0.00	0
Category Z:	$ 0.00	0
Category Totals per Applicant:	$934,307.15	1

Applicant ID: 000-UT8QX-00 | Applicant / Subdivision: MINNESOTA DEPT OF AGRICULTURE | County: Statewide | PAC: TERRI BURLESON

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial / Final	Completion Dates Projected / Actual	Obligation Dates Requested / Processed	Bundle #
PA-05-MN-4531-PW-00286(0)	B	Y	N	$ 20,907.38	100		02-15-2022 / 02-22-2022	10-07-2020 /	03-04-2022 / 03-04-2022	PA-05-MN-4531-PW-00286(340)
PA-05-MN-4531-PW-00304(0)	B	Y	N	$ 86,448.00	100		03-02-2022 / 03-15-2022	10-07-2020 /	03-18-2022 / 03-18-2022	PA-05-MN-4531-PW-00304(351)

Categories:	Applicant Totals:	PWs
Category A:	$ 0.00	0
Category B:	$ 107,355.38	2
Category C:	$ 0.00	0
Category D:	$ 0.00	0
Category E:	$ 0.00	0
Category F:	$ 0.00	0
Category G:	$ 0.00	0
Category Z:	$ 0.00	0
Category Totals per Applicant:	$107,355.38	2

Applicant ID: 053-UYQCK-00 | Applicant / Subdivision: MINNESOTA SENIOR LIVING | County: Hennepin | PAC: WILLIAM HARRIS

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial / Final	Completion Dates Projected / Actual	Obligation Dates Requested / Processed	Bundle #
PA-05-MN-4531-PW-00538(0)	B	Y	N	$ 298,791.68	100		06-15-2023 / 06-28-2023	10-07-2020 /	07-07-2023 / 07-07-2023	PA-05-MN-4531-PW-00538(579)
PA-05-MN-4531-PW-00541(0)	Z	Y	N	$ 14,939.58	100		10-05-2023 / 11-06-2023	04-07-2028 /	11-13-2023 / 11-13-2023	PA-05-MN-4531-PW-00541(597)

Categories:	Applicant Totals:	PWs
Category A:	$ 0.00	0
Category B:	$ 298,791.68	1
Category C:	$ 0.00	0
Category D:	$ 0.00	0
Category E:	$ 0.00	0
Category F:	$ 0.00	0
Category G:	$ 0.00	0
Category Z:	$ 14,939.58	1
Category Totals per Applicant:	$313,731.26	2

Grand Totals per Category

Categories		PWs
Category A:	$0.00	0
Category B:	$25,179,929.94	41
Category C:	$0.00	0
Category D:	$0.00	0
Category E:	$0.00	0
Category F:	$0.00	0
Category G:	$0.00	0
Category Z:	$14,939.58	1
Grand Total PW Amount:	**$25,194,869.52**	**42**

Project Worksheet Report (D.1)

Report Generated on:	01-31-2024 13:10
Data Captured As Of:	01-31-2024 12:06
Disaster Number:	4531
State:	MN
Report by :	Applicant
Applicant ID:	169-U8756-00,000-U7FU8-00,000-U1KJT-00,000-UG7LQ-00,000-UL0NF-00,103-UVC0E-00,000-UO5EU-00,000-UOKXB-00,000-UTOPN-00,169-01C29-00
Subgrant Filter by:	All Subgrant Applications

Date: 01-31-2024 13:10 — Federal Emergency Management Agency

Project Worksheet (D.1)

Disaster: FEMA-4531-DR-MN

Total Number of Records: 49 — Large Project Threshold: $ 1,000,000.00

Applicant ID: 000-U1KJT-00 — Applicant / Subdivision: MINNESOTA ZOOLOGICAL GARDEN — County: Statewide — PAC: TERRI BURLESON

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial / Final	Completion Dates Projected / Actual	Obligation Dates Requested / Processed	Bundle #
PA-05-MN-4531-PW-00358(0)	B	Y	N	$ 54,036.57	100		06-02-2022 / 06-13-2022	10-07-2020 /	06-21-2022 / 06-21-2022	PA-05-MN-4531-PW-00358(416)

Categories:	Applicant Totals:	PWs
Category A:	$ 0.00	0
Category B:	$ 54,036.57	1
Category C:	$ 0.00	0
Category D:	$ 0.00	0
Category E:	$ 0.00	0
Category F:	$ 0.00	0
Category G:	$ 0.00	0
Category Z:	$ 0.00	0
Category Totals per Applicant:	$54,036.57	1

Applicant ID: 000-U7FU8-00 — Applicant / Subdivision: MINNESOTA STATE UNIVERSITY — County: Statewide — PAC: TERRI BURLESON

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial / Final	Completion Dates Projected / Actual	Obligation Dates Requested / Processed	Bundle #
PA-05-MN-4531-PW-00263(0)	B	Y	N	$ 54,500.00	100		12-28-2021 / 01-20-2022	10-07-2020 /	01-24-2022 / 01-24-2022	PA-05-MN-4531-PW-00263(306)

Categories:	Applicant Totals:	PWs
Category A:	$ 0.00	0
Category B:	$ 54,500.00	1
Category C:	$ 0.00	0
Category D:	$ 0.00	0
Category E:	$ 0.00	0
Category F:	$ 0.00	0
Category G:	$ 0.00	0
Category Z:	$ 0.00	0
Category Totals per Applicant:	$54,500.00	1

Applicant ID: 000-UG7LQ-00 | **Applicant / Subdivision: MN DEPT OF LABOR & INDUSTRY** | **County: Statewide** | **PAC: TERRI BURLESON**

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial	Review Dates Final	Completion Dates Projected	Completion Dates Actual	Obligation Dates Requested	Obligation Dates Processed	Bundle #
PA-05-MN-4531-PW-00312(0)	B	Y	N	$ 68,539.18	100		03-09-2022	03-24-2022	10-07-2020		03-30-2022	03-30-2022	PA-05-MN-4531-PW-00312(359)
PA-05-MN-4531-PW-00378(0)	B	Y	N	$ 89,432.26	100		07-07-2022	08-09-2022	10-07-2020		08-17-2022	08-17-2022	PA-05-MN-4531-PW-00378(442)

Categories:	Applicant Totals:	PWs
Category A:	$ 0.00	0
Category B:	$ 157,971.44	2
Category C:	$ 0.00	0
Category D:	$ 0.00	0
Category E:	$ 0.00	0
Category F:	$ 0.00	0
Category G:	$ 0.00	0
Category Z:	$ 0.00	0
Category Totals per Applicant:	$157,971.44	2

Applicant ID: 000-UL0NF-00 | **Applicant / Subdivision: MN. DEPT. OF PUBLIC SAFETY, DIV. OF EMERG. MGMT.** | **County: Statewide** | **PAC: TERRI BURLESON**

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial	Review Dates Final	Completion Dates Projected	Completion Dates Actual	Obligation Dates Requested	Obligation Dates Processed	Bundle #
PA-05-MN-4531-PW-00002(1)	Z	Y	N	$ 2,410,769.96	100		05-13-2022	06-10-2022	04-07-2028		07-05-2022	07-06-2022	PA-05-MN-4531-PW-00002(426)
PA-05-MN-4531-PW-00002(0)	Z	Y	N	$ 568,050.37	0		05-13-2020	05-18-2020	04-07-2028		05-19-2020	05-19-2020	PA-05-MN-4531-PW-00002(0)
PA-05-MN-4531-PW-00013(1)	B	Y	Y	$ 0.00	100				10-07-2020		04-02-2021	04-03-2021	PA-05-MN-4531-PW-00013(162)
PA-05-MN-4531-PW-00013(0)	B	Y	N	$ 5,502,589.55	100		08-12-2020	11-25-2020	10-07-2020		12-11-2020	12-11-2020	PA-05-MN-4531-PW-00013(42)
PA-05-MN-4531-PW-00013(2)	B	N	N	$ -5,498,954.28	100		01-20-2023	11-25-2020	10-07-2020				
PA-05-MN-4531-PW-00021(1)	B	Y	Y	$ 0.00	100				10-07-2020	06-06-2020	04-02-2021	04-02-2021	PA-05-MN-4531-PW-00021(101)
PA-05-MN-4531-PW-00021(0)	B	Y	N	$ 321,858.76	100		09-22-2020	10-27-2020	10-07-2020	06-06-2020	11-03-2020	11-03-2020	PA-05-MN-4531-PW-00021(22)
PA-05-MN-4531-PW-00036(1)	B	Y	Y	$ 0.00	100				10-07-2020		04-02-2021	04-02-2021	PA-05-MN-4531-PW-00036(102)
PA-05-MN-4531-PW-00036(0)	B	Y	N	$ 68,881.36	100		10-28-2020	11-03-2020	10-07-2020		11-13-2020	11-13-2020	PA-05-MN-4531-PW-00036(30)
PA-05-MN-4531-PW-00044(1)	B	Y	Y	$ 0.00	100				10-07-2020		04-02-2021	04-02-2021	PA-05-MN-4531-PW-00044(103)
PA-05-MN-4531-PW-00044(0)	B	Y	N	$ 95,351.53	100		11-18-2020	11-19-2020	10-07-2020		11-20-2020	11-20-2020	PA-05-MN-4531-PW-00044(33)
PA-05-MN-4531-PW-00075(1)	B	Y	Y	$ 0.00	100				01-31-2021	10-07-2020	04-02-2021	04-02-2021	PA-05-MN-4531-PW-00075(104)
PA-05-MN-4531-PW-00075(0)	B	Y	N	$ 169,224.87	100		01-19-2021	01-21-2021	01-31-2021	10-07-2020	01-26-2021	01-26-2021	PA-05-MN-4531-PW-00075(57)

PA-05-MN-4531-PW-00082(0)	B	Y	N	$ 51,443.38	100		02-18-2021	10-07-2020	03-04-2021	PA-05-MN-4531-PW-00082(72)
							02-24-2021	10-07-2020	03-04-2021	
PA-05-MN-4531-PW-00082(1)	B	Y	N	$ -51,443.38	100		08-18-2021	10-07-2020	08-25-2021	PA-05-MN-4531-PW-00082(226)
							08-20-2021	10-07-2020	08-25-2021	
PA-05-MN-4531-PW-00105(0)	B	Y	N	$ 126,168.41	100		03-29-2021	10-07-2020	04-02-2021	PA-05-MN-4531-PW-00105(97)
							04-01-2021		04-02-2021	
PA-05-MN-4531-PW-00105(1)	B	Y	N	$ 74,023.00	100		07-03-2023	07-01-2022	08-03-2023	PA-05-MN-4531-PW-00105(581)
							07-10-2023		08-03-2023	
PA-05-MN-4531-PW-00165(0)	B	Y	N	$ 47,000.00	100		07-16-2021	10-07-2020	07-23-2021	PA-05-MN-4531-PW-00165(209)
							07-22-2021		07-23-2021	
Categories:				**Applicant Totals:**		**PWs**				
Category A:				$ 0.00		0				
Category B:				$ 906,143.20		8				
Category C:				$ 0.00		0				
Category D:				$ 0.00		0				
Category E:				$ 0.00		0				
Category F:				$ 0.00		0				
Category G:				$ 0.00		0				
Category Z:				$ 2,978,820.33		1				
Category Totals per Applicant:				**$3,884,963.53**		**9**				

Applicant ID: 000-UO5EU-00		Applicant / Subdivision: SOUTHWEST MINNESOTA STATE UNIVERSITY					County: Statewide			PAC: TERRI BURLESON
							Review Dates	Completion Dates	Obligation Dates	
							Initial	Projected	Requested	
PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Final	Actual	Processed	Bundle #
PA-05-MN-4531-PW-00295(0)	B	Y	N	$ 24,578.71	100		02-24-2022	10-07-2020	03-04-2022	PA-05-MN-4531-PW-00295(341)
							03-01-2022		03-04-2022	
Categories:				**Applicant Totals:**		**PWs**				
Category A:				$ 0.00		0				
Category B:				$ 24,578.71		1				
Category C:				$ 0.00		0				
Category D:				$ 0.00		0				
Category E:				$ 0.00		0				
Category F:				$ 0.00		0				
Category G:				$ 0.00		0				
Category Z:				$ 0.00		0				
Category Totals per Applicant:				**$24,578.71**		**1**				

Applicant ID: 000-UOKXB-00		Applicant / Subdivision: ST CLOUD STATE UNIVERSITY					County: Statewide			PAC: TERRI BURLESON
							Review Dates	Completion Dates	Obligation Dates	
							Initial	Projected	Requested	
PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Final	Actual	Processed	Bundle #
PA-05-MN-4531-PW-00244(0)	B	Y	N	$ 102,477.00	100		11-24-2021	10-07-2020	12-22-2021	PA-05-MN-4531-PW-00244(281)
							12-14-2021		12-22-2021	
PA-05-MN-4531-PW-00249(0)	B	Y	N	$ 9,047.00	100		12-02-2021	10-07-2020	01-14-2022	PA-05-MN-4531-PW-00249(293)
							01-11-2022		01-14-2022	
PA-05-MN-4531-PW-00252(0)	B	Y	N	$ 7,630.00	100		12-06-2021	10-07-2020	01-11-2022	PA-05-MN-4531-PW-00252(288)
							12-21-2021		01-11-2022	
PA-05-MN-4531-PW-00259(0)	B	Y	N	$ 109,948.30	100		12-16-2021	10-07-2020	02-01-2022	PA-05-MN-4531-PW-00259(316)

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates	Completion Dates	Obligation Dates	Bundle #
							01-27-2022		02-01-2022	
PA-05-MN-4531-PW-00275(0)	B	Y	N	$ 115,403.75	100		01-25-2022	10-07-2020	02-01-2022	PA-05-MN-4531-PW-00275(317)
							01-27-2022		02-01-2022	
PA-05-MN-4531-PW-00296(0)	B	Y	N	$ 119,900.00	100		02-24-2022	10-07-2020	04-06-2022	PA-05-MN-4531-PW-00296(365)
							03-30-2022		04-06-2022	
PA-05-MN-4531-PW-00318(0)	B	Y	N	$ 5,104.00	100		03-16-2022	10-07-2020	03-23-2022	PA-05-MN-4531-PW-00318(353)
							03-21-2022		03-23-2022	
PA-05-MN-4531-PW-00325(0)	B	Y	N	$ 127,324.00	100		03-25-2022	10-07-2020	04-06-2022	PA-05-MN-4531-PW-00325(366)
							03-30-2022		04-06-2022	
PA-05-MN-4531-PW-00336(0)	B	Y	N	$ 73,474.65	100		04-11-2022	10-07-2020	04-15-2022	PA-05-MN-4531-PW-00336(374)
							04-12-2022		04-15-2022	
PA-05-MN-4531-PW-00369(0)	B	Y	N	$ 66,355.75	100		06-27-2022	10-07-2020	07-01-2022	PA-05-MN-4531-PW-00369(424)
							06-29-2022		07-01-2022	
PA-05-MN-4531-PW-00373(0)	B	Y	N	$ 8,393.00	100		07-01-2022	10-07-2020	07-14-2022	PA-05-MN-4531-PW-00373(429)
							07-07-2022		07-14-2022	
PA-05-MN-4531-PW-00374(0)	B	Y	N	$ 47,526.65	100		07-06-2022	10-07-2020	07-14-2022	PA-05-MN-4531-PW-00374(430)
							07-07-2022		07-14-2022	
PA-05-MN-4531-PW-00375(0)	B	Y	N	$ 11,119.45	100		07-06-2022	10-07-2020	08-09-2022	PA-05-MN-4531-PW-00375(438)
							07-19-2022		08-09-2022	

Categories:	Applicant Totals:	PWs
Category A:	$ 0.00	0
Category B:	$ 803,703.55	13
Category C:	$ 0.00	0
Category D:	$ 0.00	0
Category E:	$ 0.00	0
Category F:	$ 0.00	0
Category G:	$ 0.00	0
Category Z:	$ 0.00	0
Category Totals per Applicant:	$803,703.55	13

Applicant ID: 000-UTOPN-00	Applicant / Subdivision: UNIVERSITY OF MINNESOTA	County: Statewide	PAC: TERRI BURLESON

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates	Completion Dates	Obligation Dates	Bundle #
							Initial	Projected	Requested	
							Final	Actual	Processed	
PA-05-MN-4531-PW-00213(0)	B	Y	N	$ 109,975.00	100		10-13-2021	10-07-2020	11-04-2021	PA-05-MN-4531-PW-00213(262)
							10-27-2021	12-07-2021	11-04-2021	
PA-05-MN-4531-PW-00215(0)	B	Y	N	$ 234,052.00	100		10-14-2021	10-07-2020	10-27-2021	PA-05-MN-4531-PW-00215(251)
							10-26-2021	10-07-2020	10-28-2021	
PA-05-MN-4531-PW-00237(0)	B	Y	N	$ 157,592.54	100		11-16-2021	10-07-2020	05-25-2022	PA-05-MN-4531-PW-00237(398)
							05-17-2022	04-25-2021	05-25-2022	
PA-05-MN-4531-PW-00287(0)	B	Y	N	$ 13,099.68	100		02-15-2022	10-07-2020	03-18-2022	PA-05-MN-4531-PW-00287(347)
							03-03-2022		03-18-2022	
PA-05-MN-4531-PW-00314(0)	B	Y	N	$ 4,332,544.94	100		03-15-2022	10-07-2020	07-01-2022	PA-05-MN-4531-PW-00314(419)
							06-14-2022		07-01-2022	
PA-05-MN-4531-PW-00316(0)	B	Y	N	$ 980,626.45	100		03-15-2022	10-07-2020	04-22-2022	PA-05-MN-4531-PW-00316(384)
							04-20-2022		04-22-2022	
PA-05-MN-4531-PW-00332(1)	B	Y	N	$ 2,380.32	100		05-09-2023	07-01-2022	05-17-2023	PA-05-MN-4531-PW-00332(571)
							05-15-2023	05-27-2021	05-18-2023	
PA-05-MN-4531-PW-00332(0)	B	Y	N	$ 499,004.76	100		04-06-2022	10-07-2020	04-22-2022	PA-05-MN-4531-PW-00332(381)
							04-19-2022	05-27-2021	04-22-2022	
PA-05-MN-4531-PW-00356(0)	B	Y	N	$ 58,248.52	100		05-31-2022	10-07-2020	07-01-2022	PA-05-MN-4531-PW-00356(421)

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates	Completion Dates	Obligation Dates	Bundle #
							06-16-2022		07-01-2022	
PA-05-MN-4531-PW-00461(0)	B	Y	N	$ 176,992.48	100		11-22-2022	10-07-2020	01-05-2023	PA-05-MN-4531-PW-00461(522)
							01-03-2023		01-05-2023	
Categories:				Applicant Totals:			PWs			
Category A:				$ 0.00			0			
Category B:				$ 6,564,516.69			9			
Category C:				$ 0.00			0			
Category D:				$ 0.00			0			
Category E:				$ 0.00			0			
Category F:				$ 0.00			0			
Category G:				$ 0.00			0			
Category Z:				$ 0.00			0			
Category Totals per Applicant:				**$6,564,516.69**			**9**			
Applicant ID: 103-UVC0E-00		Applicant / Subdivision: SOUTH CENTRAL COLLEGE						County: Nicollet		PAC: TERRI BURLESON
							Review Dates	Completion Dates	Obligation Dates	
							Initial	Projected	Requested	
PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Final	Actual	Processed	Bundle #
PA-05-MN-4531-PW-00360(0)	B	Y	N	$ 57,771.28	100		06-09-2022	10-07-2020	06-21-2022	PA-05-MN-4531-PW-00360(417)
							06-14-2022		06-21-2022	
Categories:				Applicant Totals:			PWs			
Category A:				$ 0.00			0			
Category B:				$ 57,771.28			1			
Category C:				$ 0.00			0			
Category D:				$ 0.00			0			
Category E:				$ 0.00			0			
Category F:				$ 0.00			0			
Category G:				$ 0.00			0			
Category Z:				$ 0.00			0			
Category Totals per Applicant:				**$57,771.28**			**1**			
Applicant ID: 169-01C29-00		Applicant / Subdivision: WINONA STATE UNIVERSITY						County: Winona		PAC: TERRI BURLESON
							Review Dates	Completion Dates	Obligation Dates	
							Initial	Projected	Requested	
PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Final	Actual	Processed	Bundle #
PA-05-MN-4531-PW-00481(0)	B	Y	N	$ 502,146.10	100		12-28-2022	10-07-2020	02-14-2023	PA-05-MN-4531-PW-00481(548)
							02-08-2023		02-14-2023	
Categories:				Applicant Totals:			PWs			
Category A:				$ 0.00			0			
Category B:				$ 502,146.10			1			
Category C:				$ 0.00			0			
Category D:				$ 0.00			0			
Category E:				$ 0.00			0			
Category F:				$ 0.00			0			
Category G:				$ 0.00			0			
Category Z:				$ 0.00			0			
Category Totals per Applicant:				**$502,146.10**			**1**			
Applicant ID: 169-U8756-00		Applicant / Subdivision: MINNESOTA STATE COLLEGE						County: Winona		PAC: TERRI BURLESON

		SOUTHEAST								
PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial Final	Completion Dates Projected Actual	Obligation Dates Requested Processed	Bundle #
PA-05-MN-4531-PW-00266(0)	B	Y	N	$ 10,828.00	100		01-04-2022 01-20-2022	10-07-2020	01-24-2022 01-24-2022	PA-05-MN-4531-PW-00266(305)

Categories:	Applicant Totals:	PWs
Category A:	$ 0.00	0
Category B:	$ 10,828.00	1
Category C:	$ 0.00	0
Category D:	$ 0.00	0
Category E:	$ 0.00	0
Category F:	$ 0.00	0
Category G:	$ 0.00	0
Category Z:	$ 0.00	0
Category Totals per Applicant:	$10,828.00	1

Grand Totals per Category

Categories		PWs
Category A:	$0.00	0
Category B:	$9,136,195.54	38
Category C:	$0.00	0
Category D:	$0.00	0
Category E:	$0.00	0
Category F:	$0.00	0
Category G:	$0.00	0
Category Z:	$2,978,820.33	1
Grand Total PW Amount:	$12,115,015.87	39

DR-4442 (2019)

Project Worksheet Report (D.1)

Report Generated on:	01-31-2024 12:46
Data Captured As Of:	01-31-2024 12:06
Disaster Number:	4442
State:	MN
Report by :	Applicant
Applicant ID:	000-U07SE-00,000-U3V5J-09,000-U3V5J-06,000-U0YBM-00,000-UL0NF-00
Subgrant Filter by:	All Subgrant Applications

Date: 01-31-2024 12:46 — Federal Emergency Management Agency

Project Worksheet (D.1)

Disaster: FEMA-4442-DR-MN

Total Number of Records: 21 — Large Project Threshold: $ 128,900.00

Applicant ID: 000-U07SE-00 — Applicant / Subdivision: MINNESOTA DEPT. OF MILITARY AFFAIRS — County: Statewide — PAC: TERRI BURLESON

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial / Final	Completion Dates Projected / Actual	Obligation Dates Requested / Processed	Bundle #
PA-05-MN-4442-PW-00042(0)	B	Y	N	$ 86,893.76	100		10-28-2019	12-12-2019	11-26-2019	PA-05-MN-4442-PW-00042(25)
							11-25-2019		11-26-2019	
PA-05-MN-4442-PW-00045(0)	B	Y	N	$ 110,000.07	100		10-30-2019	12-12-2019	11-26-2019	PA-05-MN-4442-PW-00045(26)
							11-21-2019		11-26-2019	
PA-05-MN-4442-PW-00243(0)	Z	Y	N	$ 1,267.84	100		12-29-2019	06-12-2027	01-23-2020	PA-05-MN-4442-PW-00243(191)
							01-18-2020		01-23-2020	

Categories:	Applicant Totals:	PWs
Category A:	$ 0.00	0
Category B:	$ 196,893.83	2
Category C:	$ 0.00	0
Category D:	$ 0.00	0
Category E:	$ 0.00	0
Category F:	$ 0.00	0
Category G:	$ 0.00	0
Category Z:	$ 1,267.84	1
Category Totals per Applicant:	$198,161.67	3

Applicant ID: 000-U0YBM-00 — Applicant / Subdivision: MINNESOTA DEPT. OF TRANSPORTATION — County: Statewide — PAC: TERRI BURLESON

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial / Final	Completion Dates Projected / Actual	Obligation Dates Requested / Processed	Bundle #
PA-05-MN-4442-PW-00339(0)	A	Y	N	$ 21,017.07	100		01-24-2020	12-12-2019	02-26-2020	PA-05-MN-4442-PW-00339(375)
							02-25-2020	03-12-2021	02-26-2020	
PA-05-MN-4442-PW-00343(0)	A	Y	N	$ 182,440.07	100		01-25-2020	12-12-2019	02-21-2020	PA-05-MN-4442-PW-00343(293)
							02-20-2020	03-12-2021	02-21-2020	
PA-05-MN-4442-PW-00393(0)	B	Y	N	$ 19,278.28	100		01-29-2020	12-12-2019	02-21-2020	PA-05-MN-4442-PW-00393(294)
							02-20-2020	03-12-2021	02-21-2020	
PA-05-MN-4442-PW-00540(0)	A	Y	N	$ 62,481.78	100		02-12-2020	12-12-2019	05-04-2020	PA-05-MN-4442-PW-00540(766)
							04-29-2020	03-12-2021	05-04-2020	
PA-05-MN-4442-PW-01261(0)	B	Y	N	$ 107,067.85	100		08-11-2020	12-12-2019	08-20-2020	PA-05-MN-4442-PW-01261(1216)
							08-20-2020	02-18-2021	08-20-2020	

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial / Final	Completion Dates Projected / Actual	Obligation Dates Requested / Processed	Bundle #
PA-05-MN-4442-PW-01528(0)	Z	Y	N	$ 1,232.52	100		01-04-2021 01-07-2021	06-12-2027	01-12-2021 01-12-2021	PA-05-MN-4442-PW-01528(1494)
		Categories:		Applicant Totals:		PWs				
		Category A:		$ 265,938.92		3				
		Category B:		$ 126,346.13		2				
		Category C:		$ 0.00		0				
		Category D:		$ 0.00		0				
		Category E:		$ 0.00		0				
		Category F:		$ 0.00		0				
		Category G:		$ 0.00		0				
		Category Z:		$ 1,232.52		1				
Category Totals per Applicant:				**$393,517.57**		**6**				
Applicant ID: 000-U3V5J-06		Applicant / Subdivision: MINNESOTA DEPARTMENT OF NATURAL RESOURCES / SOUTHERN REGION (4)						County: Statewide		PAC: TERRI BURLESON
PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial Final	Completion Dates Projected Actual	Obligation Dates Requested Processed	Bundle #
PA-05-MN-4442-PW-01459(1)	G	Y	N	$ -240,772.00	100		10-18-2021 10-18-2021	12-21-2021 04-28-2019	10-27-2021 10-27-2021	PA-05-MN-4442-PW-01459(1630)
PA-05-MN-4442-PW-01459(0)	G	Y	N	$ 240,772.00	0		10-27-2020 04-21-2021	12-21-2021 04-28-2019	04-23-2021 04-23-2021	PA-05-MN-4442-PW-01459(1593)
PA-05-MN-4442-PW-01473(0)	G	Y	N	$ 21,588.05	0		10-30-2020 11-05-2020	12-12-2020	11-13-2020 11-13-2020	PA-05-MN-4442-PW-01473(1425)
PA-05-MN-4442-PW-01473(1)	G	Y	N	$ 0.00	0		12-09-2021 08-09-2022	12-21-2021		
PA-05-MN-4442-PW-01480(1)	E	Y	N	$ 0.00	0		12-09-2021 08-09-2022	12-21-2021		
PA-05-MN-4442-PW-01480(0)	E	Y	N	$ 15,037.45	0		11-05-2020 11-19-2020	12-12-2020	11-20-2020 11-20-2020	PA-05-MN-4442-PW-01480(1442)
PA-05-MN-4442-PW-01558(0)	G	Y	N	$ 38,976.18	0		01-28-2021 02-04-2021	12-12-2020	02-05-2021 02-05-2021	PA-05-MN-4442-PW-01558(1525)
		Categories:		Applicant Totals:		PWs				
		Category A:		$ 0.00		0				
		Category B:		$ 0.00		0				
		Category C:		$ 0.00		0				
		Category D:		$ 0.00		0				
		Category E:		$ 15,037.45		1				
		Category F:		$ 0.00		0				
		Category G:		$ 60,564.23		3				
		Category Z:		$ 0.00		0				
Category Totals per Applicant:				**$75,601.68**		**4**				
Applicant ID: 000-U3V5J-09		Applicant / Subdivision: MINNESOTA DEPARTMENT OF NATURAL RESOURCES / REGION 3						County: Statewide		PAC: TERRI BURLESON
PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial Final	Completion Dates Projected Actual	Obligation Dates Requested Processed	Bundle #
PA-05-MN-4442-PW-01561(0)	G	Y	N	$ 12,547.18	100		02-01-2021 02-05-2021	12-12-2020	02-10-2021 02-10-2021	PA-05-MN-4442-PW-01561(1530)
PA-05-MN-4442-PW-01627(0)	G	Y	N	$ 231,153.62	100		01-11-2022	12-12-2020	01-26-2022	PA-05-MN-4442-PW-01627(1641)

							01-25-2022	11-30-2020	01-26-2022	
		Categories:		Applicant Totals:		PWs				
		Category A:		$ 0.00		0				
		Category B:		$ 0.00		0				
		Category C:		$ 0.00		0				
		Category D:		$ 0.00		0				
		Category E:		$ 0.00		0				
		Category F:		$ 0.00		0				
		Category G:		$ 243,700.80		2				
		Category Z:		$ 0.00		0				
		Category Totals per Applicant:		$243,700.80		2				
Applicant ID: 000-UL0NF-00	Applicant / Subdivision: MN. DEPT. OF PUBLIC SAFETY, DIV. OF EMERG. MGMT.							County: Statewide		PAC: TERRI BURLESON
							Review Dates	Completion Dates	Obligation Dates	
							Initial	Projected	Requested	
PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Final	Actual	Processed	Bundle #
PA-05-MN-4442-PW-00030(0)	Z	Y	N	$ 556,912.13	0		10-22-2019	06-12-2027	11-26-2019	PA-05-MN-4442-PW-00030(12)
							11-25-2019		11-26-2019	
PA-05-MN-4442-PW-00030(1)	Z	Y	N	$ 1,552,225.70	0		09-02-2020	06-12-2027	09-18-2020	PA-05-MN-4442-PW-00030(1317)
							09-03-2020		09-18-2020	
PA-05-MN-4442-PW-00030(2)	Z	Y	N	$ 3,482,948.46	0		01-28-2021	06-12-2027	03-17-2021	PA-05-MN-4442-PW-00030(1568)
							02-01-2021		03-17-2021	
		Categories:		Applicant Totals:		PWs				
		Category A:		$ 0.00		0				
		Category B:		$ 0.00		0				
		Category C:		$ 0.00		0				
		Category D:		$ 0.00		0				
		Category E:		$ 0.00		0				
		Category F:		$ 0.00		0				
		Category G:		$ 0.00		0				
		Category Z:		$ 5,592,086.29		1				
		Category Totals per Applicant:		$5,592,086.29		1				

Grand Totals per Category

Categories		PWs
Category A:	$265,938.92	3
Category B:	$323,239.96	4
Category C:	$0.00	0
Category D:	$0.00	0
Category E:	$15,037.45	1
Category F:	$0.00	0
Category G:	$304,265.03	5
Category Z:	$5,594,586.65	3
Grand Total PW Amount:	$6,503,068.01	16

DR-4658 (2022)

Project Worksheet Report (D.1)

Report Generated on: 01-31-2024 12:51
Data Captured As Of: 01-31-2024 12:06
Disaster Number: 4658
State: MN
Report by : Applicant
Applicant ID: 000-U3V5J-08,000-U3V5J-06,000-U0YBM-00,000-UL0NF-00
Subgrant Filter by: All Subgrant Applications

Date: 01-31-2024 12:51 — Federal Emergency Management Agency
Project Worksheet (D.1)
Disaster: FEMA-4658-DR-MN
Total Number of Records: 11 — Large Project Threshold: $ 1,000,000.00

Applicant ID: 000-U0YBM-00 | Applicant / Subdivision: MINNESOTA DEPT. OF TRANSPORTATION | County: Statewide | PAC: TERRI BURLESON

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial / Final	Completion Dates Projected / Actual	Obligation Dates Requested / Processed	Bundle #
PA-05-MN-4658-PW-00132(0)	E	Y	N	$ 11,120.00	100		12-15-2022	01-08-2024	02-01-2023	PA-05-MN-4658-PW-00132(179)
							01-24-2023		02-01-2023	
PA-05-MN-4658-PW-00200(0)	B	Y	N	$ 6,301.08	100		01-13-2023	01-08-2023	01-24-2023	PA-05-MN-4658-PW-00200(157)
							01-20-2023	06-27-2022	01-24-2023	
PA-05-MN-4658-PW-00242(0)	A	Y	N	$ 4,784.96	100		02-01-2023	01-08-2023	03-15-2023	PA-05-MN-4658-PW-00242(270)
							03-09-2023	06-27-2022	03-15-2023	
PA-05-MN-4658-PW-00285(0)	A	Y	N	$ 64,671.21	100		02-27-2023	01-08-2023	03-15-2023	PA-05-MN-4658-PW-00285(271)
							03-14-2023	06-27-2022	03-15-2023	
PA-05-MN-4658-PW-00289(0)	A	Y	N	$ 79,241.07	100		03-01-2023	01-08-2023	03-22-2023	PA-05-MN-4658-PW-00289(279)
							03-16-2023		03-22-2023	
PA-05-MN-4658-PW-00297(0)	B	Y	N	$ 11,930.13	100		03-06-2023	01-08-2023	03-08-2023	PA-05-MN-4658-PW-00297(260)
							03-06-2023	07-19-2022	03-08-2023	
PA-05-MN-4658-PW-00306(0)	E	N	N	$ 0.00	0		03-13-2023	01-08-2024		
							08-07-2023			
PA-05-MN-4658-PW-00311(0)	E	Y	N	$ 0.00	100		03-20-2023	01-08-2024		
							04-20-2023			
PA-05-MN-4658-PW-00314(0)	F	Y	N	$ 53,302.18	100		03-23-2023	01-08-2024	04-13-2023	PA-05-MN-4658-PW-00314(296)
							04-05-2023	06-27-2022	04-13-2023	

Categories:	Applicant Totals:	PWs
Category A:	$ 148,697.24	3
Category B:	$ 18,231.21	2
Category C:	$ 0.00	0
Category D:	$ 0.00	0
Category E:	$ 11,120.00	3
Category F:	$ 53,302.18	1
Category G:	$ 0.00	0
Category Z:	$ 0.00	0
Category Totals per Applicant:	$231,350.63	9

Applicant ID: 000-U3V5J-06 | Applicant / Subdivision: MINNESOTA DEPARTMENT OF NATURAL RESOURCES / SOUTHERN REGION (4) | County: Statewide | PAC: TERRI BURLESON

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial / Final	Completion Dates Projected / Actual	Obligation Dates Requested / Processed	Bundle #
PA-05-MN-4658-PW-00125(0)	F	Y	N	$ 6,800.00	100		12-14-2022 / 01-06-2023	01-08-2024 / 05-23-2022	01-12-2023 / 01-12-2023	PA-05-MN-4658-PW-00125(118)

Categories:	Applicant Totals:	PWs
Category A:	$ 0.00	0
Category B:	$ 0.00	0
Category C:	$ 0.00	0
Category D:	$ 0.00	0
Category E:	$ 0.00	0
Category F:	$ 6,800.00	1
Category G:	$ 0.00	0
Category Z:	$ 0.00	0
Category Totals per Applicant:	$6,800.00	1

Applicant ID: 000-UL0NF-00	Applicant / Subdivision: MN. DEPT. OF PUBLIC SAFETY, DIV. OF EMERG. MGMT.	County: Statewide	PAC: TERRI BURLESON

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial / Final	Completion Dates Projected / Actual	Obligation Dates Requested / Processed	Bundle #
PA-05-MN-4658-PW-00093(0)	Z	Y	N	$ 651,110.97	15		12-05-2022 / 12-07-2022	07-08-2030 /	12-13-2022 / 12-13-2022	PA-05-MN-4658-PW-00093(75)

Categories:	Applicant Totals:	PWs
Category A:	$ 0.00	0
Category B:	$ 0.00	0
Category C:	$ 0.00	0
Category D:	$ 0.00	0
Category E:	$ 0.00	0
Category F:	$ 0.00	0
Category G:	$ 0.00	0
Category Z:	$ 651,110.97	1
Category Totals per Applicant:	$651,110.97	1

Grand Totals per Category

Categories		PWs
Category A:	$148,697.24	3
Category B:	$18,231.21	2
Category C:	$0.00	0
Category D:	$0.00	0
Category E:	$11,120.00	3
Category F:	$60,102.18	2
Category G:	$0.00	0
Category Z:	$651,110.97	1
Grand Total PW Amount:	$889,261.60	11

DR-4659 (2022)

Project Worksheet Report (D.1)

Report Generated on: 01-31-2024 12:55
Data Captured As Of: 01-31-2024 12:06
Disaster Number: 4659
State: MN
Report by : Applicant
Applicant ID: 000-U07SE-00,000-U3V5J-01,000-U3V5J-08,000-U0YBM-00,000-UL0NF-00
Subgrant Filter by: All Subgrant Applications

Date: 01-31-2024 12:55 — Federal Emergency Management Agency
Project Worksheet (D.1)
Disaster: FEMA-4659-DR-MN
Total Number of Records: 30 — Large Project Threshold: $ 1,000,000.00

Applicant ID: 000-U07SE-00 | Applicant / Subdivision: MINNESOTA DEPT. OF MILITARY AFFAIRS | County: Statewide | PAC: TERRI BURLESON

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial / Final	Completion Dates Projected / Actual	Obligation Dates Requested / Processed	Bundle #
PA-05-MN-4659-PW-00214(0)	B	Y	N	$ 837,245.14	100		12-19-2022	01-13-2023	12-27-2022	PA-05-MN-4659-PW-00214(157)
							12-21-2022	08-14-2022	12-27-2022	
PA-05-MN-4659-PW-00255(0)	Z	Y	N	$ 3,612.84	100		01-04-2023	07-13-2030	01-12-2023	PA-05-MN-4659-PW-00255(198)
							01-06-2023		01-12-2023	

Categories:	Applicant Totals:	PWs
Category A:	$ 0.00	0
Category B:	$ 837,245.14	1
Category C:	$ 0.00	0
Category D:	$ 0.00	0
Category E:	$ 0.00	0
Category F:	$ 0.00	0
Category G:	$ 0.00	0
Category Z:	$ 3,612.84	1
Category Totals per Applicant:	$840,857.98	2

Applicant ID: 000-U0YBM-00 | Applicant / Subdivision: MINNESOTA DEPT. OF TRANSPORTATION | County: Statewide | PAC: TERRI BURLESON

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial / Final	Completion Dates Projected / Actual	Obligation Dates Requested / Processed	Bundle #
PA-05-MN-4659-PW-00407(0)	A	Y	N	$ 51,437.05	100		03-01-2023	01-13-2023	03-15-2023	PA-05-MN-4659-PW-00407(378)
							03-10-2023		03-15-2023	
PA-05-MN-4659-PW-00479(0)	B	Y	N	$ 579,178.35	100		04-13-2023	01-13-2023	04-26-2023	PA-05-MN-4659-PW-00479(455)
							04-21-2023		04-26-2023	
PA-05-MN-4659-PW-00489(0)	B	Y	N	$ 54,631.80	100		04-24-2023	01-13-2023	05-10-2023	PA-05-MN-4659-PW-00489(473)
							05-08-2023		05-10-2023	

Categories:	Applicant Totals:	PWs
Category A:	$ 51,437.05	1
Category B:	$ 633,810.15	2
Category C:	$ 0.00	0
Category D:	$ 0.00	0

Category E:				$ 0.00		0				
Category F:				$ 0.00		0				
Category G:				$ 0.00		0				
Category Z:				$ 0.00		0				
Category Totals per Applicant:				$685,247.20		3				
Applicant ID: 000-U3V5J-01	Applicant / Subdivision: MINNESOTA DEPARTMENT OF NATURAL RESOURCES / NORTHWEST REGION 1							County: Statewide		PAC: TERRI BURLESON
							Review Dates	Completion Dates	Obligation Dates	
							Initial	Projected	Requested	
PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Final	Actual	Processed	Bundle #
PA-05-MN-4659-PW-00189(0)	C	Y	N	$ 67,506.28	0		12-14-2022	01-13-2024	02-01-2023	PA-05-MN-4659-PW-00189(254)
							01-31-2023		02-01-2023	
PA-05-MN-4659-PW-00217(0)	C	Y	N	$ 20,000.00	100		12-20-2022	01-13-2024	01-12-2023	PA-05-MN-4659-PW-00217(189)
							01-06-2023		01-12-2023	
PA-05-MN-4659-PW-00219(0)	C	Y	N	$ 14,965.00	100		12-20-2022	01-13-2024	03-08-2023	PA-05-MN-4659-PW-00219(373)
							03-06-2023	11-04-2022	03-08-2023	
PA-05-MN-4659-PW-00326(0)	G	Y	N	$ 59,962.50	0		02-01-2023	01-13-2024	03-01-2023	PA-05-MN-4659-PW-00326(362)
							02-28-2023		03-01-2023	
PA-05-MN-4659-PW-00344(0)	C	Y	N	$ 5,258.37	0		02-06-2023	01-13-2024	02-23-2023	PA-05-MN-4659-PW-00344(326)
							02-15-2023		02-23-2023	
PA-05-MN-4659-PW-00414(0)	C	Y	N	$ 89,192.98	100		03-07-2023	01-13-2024	03-22-2023	PA-05-MN-4659-PW-00414(398)
							03-16-2023		03-22-2023	
PA-05-MN-4659-PW-00428(0)	G	Y	N	$ 46,924.69	0		03-13-2023	01-13-2024	03-22-2023	PA-05-MN-4659-PW-00428(405)
							03-16-2023		03-22-2023	
PA-05-MN-4659-PW-00488(0)	Z	Y	N	$ 15,190.49	100		04-20-2023	07-13-2030	05-03-2023	PA-05-MN-4659-PW-00488(466)
							05-02-2023		05-03-2023	
Categories:				Applicant Totals:		PWs				
Category A:				$ 0.00		0				
Category B:				$ 0.00		0				
Category C:				$ 196,922.63		5				
Category D:				$ 0.00		0				
Category E:				$ 0.00		0				
Category F:				$ 0.00		0				
Category G:				$ 106,887.19		2				
Category Z:				$ 15,190.49		1				
Category Totals per Applicant:				$319,000.31		8				
Applicant ID: 000-U3V5J-08	Applicant / Subdivision: MINNESOTA DEPARTMENT OF NATURAL RESOURCES / REGION 2							County: Statewide		PAC: TERRI BURLESON
							Review Dates	Completion Dates	Obligation Dates	
							Initial	Projected	Requested	
PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Final	Actual	Processed	Bundle #
PA-05-MN-4659-PW-00127(0)	C	Y	N	$ 19,202.70	100		12-06-2022	01-13-2024	01-24-2023	PA-05-MN-4659-PW-00127(225)
							01-19-2023	08-31-2022	01-25-2023	
PA-05-MN-4659-PW-00144(0)	C	Y	N	$ 21,759.36	100		12-08-2022	01-13-2024	01-24-2023	PA-05-MN-4659-PW-00144(226)
							01-19-2023	06-30-2022	01-25-2023	
PA-05-MN-4659-PW-00173(0)	B	Y	N	$ 15,015.22	100		12-13-2022	01-13-2023	01-12-2023	PA-05-MN-4659-PW-00173(183)
							01-05-2023		01-12-2023	
PA-05-MN-4659-PW-00175(0)	C	Y	N	$ 28,334.20	100		12-13-2022	01-13-2024	01-12-2023	PA-05-MN-4659-PW-00175(185)

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial / Final	Completion Dates Projected / Actual	Obligation Dates Requested / Processed	Bundle #
							01-09-2023	09-18-2022	01-12-2023	
PA-05-MN-4659-PW-00224(0)	C	Y	N	$ 95,415.66	100		12-21-2022	01-13-2024	02-01-2023	PA-05-MN-4659-PW-00224(256)
							01-31-2023	01-25-2022	02-01-2023	
PA-05-MN-4659-PW-00278(0)	D	Y	N	$ 51,791.97	91		01-18-2023	01-13-2024	03-01-2023	PA-05-MN-4659-PW-00278(357)
							02-23-2023		03-01-2023	
PA-05-MN-4659-PW-00286(0)	G	Y	N	$ 10,000.00	100		01-19-2023	01-13-2024	02-08-2023	PA-05-MN-4659-PW-00286(276)
							02-01-2023		02-08-2023	
PA-05-MN-4659-PW-00329(0)	C	Y	N	$ 45,251.40	100		02-02-2023	01-13-2024	04-05-2023	PA-05-MN-4659-PW-00329(415)
							03-22-2023		04-05-2023	
PA-05-MN-4659-PW-00349(0)	G	Y	N	$ 61,502.00	0		02-06-2023	01-13-2024	02-23-2023	PA-05-MN-4659-PW-00349(337)
							02-17-2023		02-23-2023	
PA-05-MN-4659-PW-00363(0)	G	Y	N	$ 22,482.50	100		02-09-2023	01-13-2024	02-15-2023	PA-05-MN-4659-PW-00363(309)
							02-14-2023		02-15-2023	
PA-05-MN-4659-PW-00384(0)	G	N	N	$ 0.00	0		02-16-2023	01-13-2024		
							02-27-2023			
PA-05-MN-4659-PW-00397(0)	C	Y	N	$ 376,910.00	0		02-23-2023	01-13-2024	04-26-2023	PA-05-MN-4659-PW-00397(456)
							04-25-2023		04-26-2023	
PA-05-MN-4659-PW-00415(0)	G	Y	N	$ 42,494.00	0		03-07-2023	01-13-2024	05-10-2023	PA-05-MN-4659-PW-00415(477)
							05-03-2023		05-10-2023	
PA-05-MN-4659-PW-00434(0)	G	Y	N	$ 38,829.80	0		03-14-2023	01-13-2024	05-03-2023	PA-05-MN-4659-PW-00434(465)
							05-02-2023		05-03-2023	
PA-05-MN-4659-PW-00509(0)	C	Y	N	$ 262,931.00	0		06-06-2023	01-13-2024	10-16-2023	PA-05-MN-4659-PW-00509(522)
							10-13-2023		10-16-2023	
PA-05-MN-4659-PW-00517(0)	G	Y	N	$ 153,103.02	50		06-21-2023	01-13-2024	07-21-2023	PA-05-MN-4659-PW-00517(508)
							07-14-2023		07-21-2023	

Categories:	Applicant Totals:	PWs
Category A:	$ 0.00	0
Category B:	$ 15,015.22	1
Category C:	$ 849,804.32	7
Category D:	$ 51,791.97	1
Category E:	$ 0.00	0
Category F:	$ 0.00	0
Category G:	$ 328,411.32	7
Category Z:	$ 0.00	0
Category Totals per Applicant:	$1,245,022.83	16

Applicant ID: 000-UL0NF-00	Applicant / Subdivision: MN. DEPT. OF PUBLIC SAFETY, DIV. OF EMERG. MGMT.	County: Statewide	PAC: TERRI BURLESON

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial / Final	Completion Dates Projected / Actual	Obligation Dates Requested / Processed	Bundle #
PA-05-MN-4659-PW-00123(0)	Z	Y	N	$ 651,110.97	0		12-05-2022	07-13-2030	12-14-2022	PA-05-MN-4659-PW-00123(121)
							12-07-2022		12-14-2022	

Categories:	Applicant Totals:	PWs
Category A:	$ 0.00	0
Category B:	$ 0.00	0
Category C:	$ 0.00	0
Category D:	$ 0.00	0
Category E:	$ 0.00	0
Category F:	$ 0.00	0
Category G:	$ 0.00	0

Category Z:	$ 651,110.97	1
Category Totals per Applicant:	**$651,110.97**	**1**

Grand Totals per Category

Categories		PWs
Category A:	$51,437.05	1
Category B:	$1,486,070.51	4
Category C:	$1,046,726.95	12
Category D:	$51,791.97	1
Category E:	$0.00	0
Category F:	$0.00	0
Category G:	$435,298.51	9
Category Z:	$669,914.30	3
Grand Total PW Amount:	**$3,741,239.29**	**30**

DR-4666 (2022)

Project Worksheet Report (D.1)

Report Generated on:	01-31-2024 12:57
Data Captured As Of:	01-31-2024 12:06
Disaster Number:	4666
State:	MN
Report by :	Applicant
Applicant ID:	000-U3V5J-01,000-U3V5J-08,000-U0YBM-00,000-UL0NF-00
Subgrant Filter by:	All Subgrant Applications

Date: 01-31-2024 12:57 | Federal Emergency Management Agency

Project Worksheet (D.1)

Disaster: FEMA-4666-DR-MN

Total Number of Records: 8 | Large Project Threshold: $ 1,000,000.00

Applicant ID: 000-U0YBM-00 | Applicant / Subdivision: MINNESOTA DEPT. OF TRANSPORTATION | County: Statewide | PAC: TERRI BURLESON

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates: Initial / Final	Completion Dates: Projected / Actual	Obligation Dates: Requested / Processed	Bundle #
PA-05-MN-4666-PW-00122(0)	A	Y	N	$ 4,667.68	100		02-27-2023	02-09-2023	03-15-2023	PA-05-MN-4666-PW-00122(118)
							03-01-2023	06-07-2022	03-15-2023	
PA-05-MN-4666-PW-00123(0)	A	Y	N	$ 5,669.02	100		02-27-2023	02-09-2023	03-15-2023	PA-05-MN-4666-PW-00123(119)
							03-01-2023	06-07-2022	03-15-2023	
PA-05-MN-4666-PW-00125(0)	A	Y	N	$ 119,937.43	100		03-02-2023	02-09-2023	04-26-2023	PA-05-MN-4666-PW-00125(132)
							04-21-2023	05-23-2022	04-26-2023	
PA-05-MN-4666-PW-00127(0)	A	Y	N	$ 84,703.39	100		03-02-2023	02-09-2023	04-26-2023	PA-05-MN-4666-PW-00127(133)
							04-21-2023	08-10-2022	04-26-2023	

Categories:	Applicant Totals:	PWs
Category A:	$ 214,977.52	4
Category B:	$ 0.00	0
Category C:	$ 0.00	0
Category D:	$ 0.00	0
Category E:	$ 0.00	0
Category F:	$ 0.00	0
Category G:	$ 0.00	0
Category Z:	$ 0.00	0
Category Totals per Applicant:	$214,977.52	4

Applicant ID: 000-U3V5J-01 | Applicant / Subdivision: MINNESOTA DEPARTMENT OF NATURAL RESOURCES / NORTHWEST REGION 1 | County: Statewide | PAC: TERRI BURLESON

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates: Initial / Final	Completion Dates: Projected / Actual	Obligation Dates: Requested / Processed	Bundle #
PA-05-MN-4666-PW-00033(0)	A	Y	N	$ 10,795.46	100		12-02-2022	02-09-2023	01-12-2023	PA-05-MN-4666-PW-00033(51)
							01-06-2023		01-12-2023	

Categories:	Applicant Totals:	PWs
Category A:	$ 10,795.46	1
Category B:	$ 0.00	0
Category C:	$ 0.00	0
Category D:	$ 0.00	0

Category E:				$ 0.00		0				
Category F:				$ 0.00		0				
Category G:				$ 0.00		0				
Category Z:				$ 0.00		0				
Category Totals per Applicant:				**$10,795.46**		**1**				
Applicant ID: 000-U3V5J-08		**Applicant / Subdivision: MINNESOTA DEPARTMENT OF NATURAL RESOURCES / REGION 2**						**County: Statewide**		**PAC: TERRI BURLESON**
							Review Dates	**Completion Dates**	**Obligation Dates**	
							Initial	**Projected**	**Requested**	
PW #	**Cat.**	**Elig.**	**Cost Share**	**Project Amount 100%**	**% Compl**	**Inspection Date**	**Final**	**Actual**	**Processed**	**Bundle #**
PA-05-MN-4666-PW-00120(0)	G	Y	N	$ 14,541.42	100		02-22-2023	02-09-2024	03-01-2023	PA-05-MN-4666-PW-00120(115)
							02-24-2023		03-01-2023	
PA-05-MN-4666-PW-00126(0)	A	Y	N	$ 9,763.45	100		03-02-2023	02-09-2023	04-12-2023	PA-05-MN-4666-PW-00126(128)
							04-10-2023		04-12-2023	
Categories:				**Applicant Totals:**		**PWs**				
Category A:				$ 9,763.45		1				
Category B:				$ 0.00		0				
Category C:				$ 0.00		0				
Category D:				$ 0.00		0				
Category E:				$ 0.00		0				
Category F:				$ 0.00		0				
Category G:				$ 14,541.42		1				
Category Z:				$ 0.00		0				
Category Totals per Applicant:				**$24,304.87**		**2**				
Applicant ID: 000-UL0NF-00		**Applicant / Subdivision: MN. DEPT. OF PUBLIC SAFETY, DIV. OF EMERG. MGMT.**						**County: Statewide**		**PAC: TERRI BURLESON**
							Review Dates	**Completion Dates**	**Obligation Dates**	
							Initial	**Projected**	**Requested**	
PW #	**Cat.**	**Elig.**	**Cost Share**	**Project Amount 100%**	**% Compl**	**Inspection Date**	**Final**	**Actual**	**Processed**	**Bundle #**
PA-05-MN-4666-PW-00038(0)	Z	Y	N	$ 651,110.97	0		12-05-2022	08-09-2030	12-13-2022	PA-05-MN-4666-PW-00038(37)
							12-07-2022		12-13-2022	
Categories:				**Applicant Totals:**		**PWs**				
Category A:				$ 0.00		0				
Category B:				$ 0.00		0				
Category C:				$ 0.00		0				
Category D:				$ 0.00		0				
Category E:				$ 0.00		0				
Category F:				$ 0.00		0				
Category G:				$ 0.00		0				
Category Z:				$ 651,110.97		1				
Category Totals per Applicant:				**$651,110.97**		**1**				

Grand Totals per Category		
Categories		PWs
Category A:	$235,536.43	6
Category B:	$0.00	0
Category C:	$0.00	0

Category D:	$0.00	0
Category E:	$0.00	0
Category F:	$0.00	0
Category G:	$14,541.42	1
Category Z:	$651,110.97	1
Grand Total PW Amount:	**$901,188.82**	**8**

DR-4722 (2023)

Project Worksheet Report (D.1)

Report Generated on:	01-31-2024 13:12
Data Captured As Of:	01-31-2024 12:06
Disaster Number:	4722
State:	MN
Report by :	Applicant
Applicant ID:	000-U0YBM-00,000-UL0NF-00
Subgrant Filter by:	All Subgrant Applications

Date: 01-31-2024 13:12 — **Federal Emergency Management Agency**

Project Worksheet (D.1)

Disaster: FEMA-4722-DR-MN

Total Number of Records: 1 — **Large Project Threshold: $ 1,000,000.00**

Applicant ID: 000-UL0NF-00 | **Applicant / Subdivision: MN. DEPT. OF PUBLIC SAFETY, DIV. OF EMERG. MGMT.** | **County: Statewide** | **PAC: WILLIAM HARRIS**

PW #	Cat.	Elig.	Cost Share	Project Amount 100%	% Compl	Inspection Date	Review Dates Initial / Final	Completion Dates Projected / Actual	Obligation Dates Requested / Processed	Bundle #
PA-05-MN-4722-PW-00002(0)	Z	Y	N	$ 707,034.61	0		09-12-2023 / 09-13-2023	07-19-2031 /	10-06-2023 / 10-06-2023	PA-05-MN-4722-PW-00002(0)

Categories:	Applicant Totals:	PWs
Category A:	$ 0.00	0
Category B:	$ 0.00	0
Category C:	$ 0.00	0
Category D:	$ 0.00	0
Category E:	$ 0.00	0
Category F:	$ 0.00	0
Category G:	$ 0.00	0
Category Z:	$ 707,034.61	1
Category Totals per Applicant:	**$707,034.61**	**1**

Grand Totals per Category

Categories		PWs
Category A:	$0.00	0
Category B:	$0.00	0
Category C:	$0.00	0
Category D:	$0.00	0
Category E:	$0.00	0
Category F:	$0.00	0
Category G:	$0.00	0
Category Z:	$707,034.61	1
Grand Total PW Amount:	**$707,034.61**	**1**

SOURCE: LAMOREAUX, WAYNE (HSEM), PERSONAL COMMUNICATION, JANUARY 31, 2024

Appendix E: FEMA Flood Mapping Products Available or In Progress for Each County

Estimated FEMA Map Modernization Status in Minnesota - by County

DEPARTMENT OF NATURAL RESOURCES

2/2/2024

Note: Dates shown as Month-Year are estimates; Dates shown as MM/DD/YY are actual date

County	Status	Preliminary Map	Local Official / Open House	90-day starts	90-day ends	LFD*	Effective map date**
AITKIN	Co Modernization						NA
ANOKA	Effective	9/30/2011; rev 7/16/13	12/15/11	2/21/14	5/21/14	6/16/15	12/16/15
BECKER	No Map						NA
BELTRAMI	No Map						NA
BENTON	Effective	9/29/09	12/8/09	5/18/10	8/16/10	2/16/11	8/16/11
BIG STONE	Effective	10/01/04	2/16/05	6/21/05	9/21/05	10/17/05	4/17/06
BLUE EARTH	LFD	12/9/09; rev 4/20/11; 9/12/18; 8/28/20 (3 panels); 2/15/23 (panels)	6/1/11; 11/7/18; 1/5/21; 6/10/21	9/21/11; 7/29/21; 11/10/21	12/20/11; 10/26/21; 2/8/22	8/22/23	**2/22/24**
BROWN	Effective	6/15/06	8/9/06	1/4/08	4/4/08	3/25/09	9/25/09
CARLTON	LFD	5/28/2021	8/19/21; 9/23/21	3/31/22; 6/24/22	6/29/22 9/22/22	9/13/23	**3/13/24**
CARVER	Effective	9/30/11; rev 9/14/15 & 1/31/18	3/8/2012; 7/19/2016	12/29/16	3/29/17	6/21/18	12/21/18
CASS	No Map						NA
CHIPPEWA	90-Day Started	12/20/22	7/19/23	2/1/24	**5/1/24**	**2024**	**2025**
CHISAGO	Effective	2/19/10	5/12/10	11/11/10	2/10/11	10/17/11	4/17/12
CLAY	Effective	2/13/09	6/3/09	1/4/10	4/4/10	10/17/11	4/17/12
CLEARWATER	No Map						NA
COOK	No Map						NA
COTTONWOOD	Effective	06/25/19	12/18/19	7/15/20	10/13/20	3/24/21	9/24/2021
CROW WING	Effective	5/27/2011; rev 6/30/11	9/28/11	11/5/15; 12/11/15	2/2/16; 3/9/16	2/15/17	8/15/17
DAKOTA	Effective	7/3/08	9/24/08	11/24/08; 11/17/10	2/22/09; 2/18/11	rescinded; reissue 6/2/11	12/02/11
DODGE	90-Day Ended	2/15/2023	4/11/23	9/11/23	12/6/23	**Mar-24**	**Sep-24**
DOUGLAS	Effective	6/4/08	9/25/08	NA	NA	5/18/09	11/18/09
FARIBAULT	No New Map						NA
FILLMORE	Effective	6/30/11; rev 4/29/16 & rev 7/30/18	4/8/15	02/27/17	05/27/17	2/15/19	8/15/19
FREEBORN	Effective	6/30/11	11/10/11	5/10/13	8/7/13	5/19/14	11/19/14
GOODHUE	Effective	8/22/07; 2/10/20 (panels)	11/7/07; 3/11/20	2/8/08	5/8/08	3/25/09	9/25/09
GRANT	No New Map						NA
HENNEPIN	Effective	Dec 2005; rev 8/17/12 & 2/28/13	5/22/06	4/5/13	7/3/13	5/4/16	11/4/16
HOUSTON	Effective	12/31/14; rev 1/15/16 & 12/29/17	4/9/15	5/26/16	8/26/16	6/7/18	12/7/18
HUBBARD	No Map						NA
ISANTI	Effective	4/25/02	7/10/02	1/22/03	4/22/03	5/5/03	11/5/03
ITASCA	90-day Started	10/20/20; 9/30/21 (panel) rev; 10/4/22 corrections	3/31/22; 4/12/22	11/29/23	2/27/24	**TBD**	**TBD**
JACKSON	No New Map						NA
KANABEC	No New Map						NA
KANDIYOHI	Effective	12/31/05; rev 2/14/13	4/16/13	10/17/14	1/14/15	3/30/15	9/30/15
KITTSON	Effective	7/20/12; rev 9/23/16	9/11/12	3/20/13	6/17/13	3/29/17	9/29/17
KOOCHICHING	Effective	7/9/2020	10/22/20; 3/23/21	9/3/21	12/2/21	5/17/22	11/17/22
LAC QUI PARLE	Effective	7/6/04	9/22/04	done	done	9/16/05	3/16/06
LAKE	No Map						NA
LAKE OF THE WOODS	Effective	5/29/20	10/23/20; 2/18/21	8/11/21	11/9/21	4/27/22	10/27/22
LE SUEUR	LFD	7/14/22	9/21/22	2/16/23	5/17/23	1/17/24	**7/1724**
LINCOLN	Effective	9/30/21	1/4/22; 2/23/22	7/20/22	10/19/22	3/7/23	9/7/23
LYON	Effective	12/28/06; 9/28/09; 9/30/20 (panels)	4/4/07; 1/7/21	11/20/07; 7/8/21	2/20/08; 10/5/21	5/26/10; 3/15/22 (panels)	11/26/10; 9/15/22 (panels)
MAHNOMEN	Effective	10/17/12	3/20/13	4/25/13; 3/27/14	7/23/13; 6/24/14	11/19/14	4/2/15
MARSHALL	Effective	9/30/11; rev 10/20/16 & 2/28/18	12/2/14; 5/1/18 (levees)	10/1/15; 8/15/19	12/30/15; 11/12/19	9/23/20	3/23/21
MARTIN	No New Map						NA

County	Status	Preliminary Map	Local Official / Open House	90-day starts	90-day ends	LFD*	Effective map date**
MC LEOD	Effective	9/30/11	1/8/13	5/17/13	8/14/13	1/7/14	7/7/14
MEEKER	Effective	10/29/10	12/15/10	2/10/11	5/11/11	10/3/11	4/3/12
MILLE LACS	Effective	8/11/10; 9/16/11	12/14/10	1/20/11	4/20/11	9/4/12	3/4/13
MORRISON	LFD	11/3/22	1/19/23	6/4/23	9/2/23	1/31/24	**7/31/24**
MOWER	Effective	6/30/11	11/9/11	1/2/12	4/1/12	3/4/13	9/4/13
MURRAY	Co Modernization+	**2024**					NA
NICOLLET	Effective	3/31/2011; rev late 2011; 9/12/18; 2/28/20	5/31/11; 11/8/18; 4/9/20	7/29/21	10/26/21	4/13/22	10/13/22
NOBLES	Effective	7/26/10; rev 11/21/12	1/25/11	5/15/13	8/12/13	11/19/13	5/19/14
NORMAN	Effective	2/8/13; 4/12/18 (levee panels)	3/19/13	7/9/13	10/9/13	3/30/15;6/20/19 (levee panels)	9/30/15; 12/20/19
OLMSTED	Effective; Preliminary (levee panels)	6/30/11; rev 9/14/15; 5/29/20 (Zumbro panels); 12/20/23 (levee)	4/17/13; 11/10/2020 (panels); 2/23/21; **2024 (levee)**	7/17/13; 3/17/16; 7/27/21 (panels)	10/15/13; 6/17/16; 10/25/21 (panels)	10/19/16; 3/21/23 (Zumbro panels)	4/19/17; 9/21/23 (panels)
OTTER TAIL	No Map						NA
PENNINGTON	Effective	3/31/20; 12/17/21 (panels)	6/17/20; 12/2/20	12/9/20	3/8/21	6/1/22	12/1/22
PINE	Effective	6/15/10	3/15/11	NA	NA	10/03/11	4/3/12
PIPESTONE	LFD	8/26/22	11/30/22	4/20/23 (4/19/23 for Edgerton)	7/20/23 (7/19/23 for Edgerton)	10/25/23	**4/25/24**
POLK	Update TBD	7/4/2014; **rev ??**	8/27/14; **??**	1/28/15; 3/11/15	4/27/15; 6/8/15	??	**??**
POPE	90-day ended	5/29/20; 11/23/22 (panels)	8/20/20; 1/6/21	7/20/21; 4/2423 (panels)	10/18/21; 7/22/23 (panels)	**Mar-24**	**Sep-24**
RAMSEY	Effective	9/30/08	12/16/08	4/21/09	7/20/09	12/4/09	6/4/10
RED LAKE	Effective	3/29/19	6/11/19	1/15/20	4/14/20	9/9/20	3/9/21
REDWOOD	Effective	9/30/10; rev 10/17/12	2/22/11	5/19/11	8/17/11	1/16/13	7/16/13
RENVILLE	Effective	9/19/06	1/17/07	5/7/08	8/5/08	3/25/09	9/25/09
RICE	Effective	4/30/09; 11/15/19 (4 panels)	7/28/09; 7/16/20	1/6/10; 3/3/21	4/6/10; 6/2/21	10/3/11; 10/6/21 (panels)	4/3/12; 4/6/22 (panels)
ROCK	Open House	8/26/22	12/1/22	**TBD**	**TBD**	**TBD**	**TBD**
ROSEAU	Effective	6/20/11; rev 5/15/15	9/29/11	5/17/13; 3/22/16	8/18/13; 6/22/16	10/19/16	4/19/17
SCOTT	Effective	9/30/11; rev 7/13/18	6/25/13	1/29/15; 3/23/2019	4/29/15; 6/21/2019	8/12/2020	2/12/21
SHERBURNE	Effective	3/2/10	4/6/10	6/26/10	9/24/10	5/16/11	11/16/11
SIBLEY	No New Map						NA
ST. LOUIS	90-day Started	10/28/22	2/15/23 & 2/16/23	10/25/23	1/23/24	**2024**	**2024**
STEARNS	Effective	12/31/09	5/11/10	10/26/10; 5/10/11	1/25/11; 8/8/11	8/16/11	2/16/12
STEELE	Effective	9/25/09	4/7/10	10/26/10	1/24/11	6/2/11	12/02/11
STEVENS	90-day Ended	5/29/2020; 9/30/21 rev (panels); 2/28/23 (panels)	8/31/20; 10/19/20	12/29/20; 2/5/22 rev panels; 8/1/23 (Swan Lake)	3/29/21 5/9/22 rev panels; 10/30/23 (Swan Lake)	**Mar-24**	**Sep-24**
SWIFT	Effective	9/21/04	9/21/04	12/29/04	3/29/04	8/16/05	2/16/06
TODD	Effective	2/17/09	6/2/09	10/22/09	1/20/10	8/4/10	2/4/11
TRAVERSE	No New Map						NA
WABASHA	Data Dev (Risk MAP)+	**Feb-24**	**2024**	**2024**	**2024**	**2025**	**2025**
WADENA	No New Map						NA
WASECA	LFD	9/30/21	8/31/22; 9/7/22	12/21/22	3/21/23	9/27/23	**3/27/24**
WASHINGTON	Effective	11/30/07	1/23/08	4/23/08	7/22/08	8/3/09	2/3/10
WATONWAN	Effective	4/24/20; 10/29/21 rev panels	11/12/20; 2/23/21	7/8/22; 8/12/22	10/6/22; 11/10/22	6/7/23	12/7/23
WILKIN	Effective; LFD (panels)	5/18/11; 12/28/18 (panels); 3/8/23 rev panels	9/22/11; 2/20/19 (panels)	1/26/14; 8/21/2019	4/25/14; 11/19/19	11/18/14; 12/20/23 (panels)	5/18/15; **6/20/24 (panels)**
WINONA	Data Dev (Risk MAP)+	**Feb-2024**	**2024**	**2024**	**2024**	**2025**	**2025**
WRIGHT	LFD	6/22/11; 7/31/18; 4/29/22 rev (panels)	12/14/11; 8/2/22	8/4/16; 5/24/19; 5/3/23 (panels)	11/2/16; 8/21/19; 8/1/23 (panels)	12/20/23	**6/20/24**
YELLOW MEDICINE	Effective	2004; rev 8/29/16; rev 1/11/19 (panel)	9/23/04; 11/9/16	10/1/19	12/29/19	4/7/21	10/7/21

* LFD (Letter of Final Determination) - FEMA letter to community will become effective in 6 months. ** Community must adopt new maps by this date.

Appendix F: Statewide Flood Risk Assessment Results

County	Flood Model	Est Total # Structures	Total Building Exposure (Structure + Content)	Est # Damaged Buildings	Est Building Loss
Aitkin	DFIRM (Q3)	30,356	$2,463,060,602	1,713	$18,268,498
Anoka	DFIRM	156,464	$64,821,631,628	1,781	$114,433,667
Becker	DFIRM	35,000	$10,075,465,857	15	$639,930
Beltrami	Q3 (HH)	32,649	$5,840,773,262	21	$1,034,534
Benton	DFIRM	23,081	$3,379,156,264	492	$14,740,528
Big Stone	DFIRM	7,548	$608,283,232	266	$2,671,827
Blue Earth	DFIRM	33,924	$9,529,706,896	118	$4,285,780
Brown	DFIRM	24,742	$2,732,164,986	273	$9,212,115
Carlton	DFIRM (HH)	30,650	$4,802,478,760	49	$579,847
Carver	DFIRM	50,425	$23,584,420,398	240	$19,078,090
Cass	Q3 (HH)	46,368	$6,081,776,350	19	$1,275,094
Chippewa	DFIRM	12,566	$1,663,233,514	40	$2,131,482
Chisago	DFIRM	44,782	$10,526,824,652	181	$14,902,729
Clay	DFIRM	33,479	$9,166,737,552	988	$38,108,407
Clearwater	HH	9,585	$941,525,450	14	$185,530
Cook	HH	7,661	$2,018,226,202	0	N/A
Cottonwood	DFIRM	13,106	$1,079,206,242	239	$4,222,279
Crow Wing	DFIRM	61,496	$12,303,879,896	854	$43,653,093
Dakota	DFIRM	156,320	$79,526,361,686	375	$292,085,488
Dodge	DFIRM	15,020	$2,479,648,308	97	$2,655,310
Douglas	DFIRM (HH)	34,504	$7,911,391,296	129	$2,681,932
Faribault	HH	16,311	$1,512,602,906	12	$174,347
Fillmore	DFIRM	24,499	$1,966,204,644	558	$8,973,781
Freeborn	DFIRM	27,161	$2,551,063,619	78	$1,128,556
Goodhue	DFIRM	35,465	$8,790,726,868	371	$67,709,957
Grant	Q3 (HH)	7,405	$1,005,529,036	43	$1,501,223
Hennepin	DFIRM	730,834	$226,787,654,956	2,077	$167,746,902

County	Flood Model	Est Total # Structures	Total Building Exposure (Structure + Content)	Est # Damaged Buildings	Est Building Loss
Houston	DFIRM	24,335	$2,748,334,742	502	$12,486,753
Hubbard	HH	24,329	$5,807,481,428	7	$441,012
Isanti	DFIRM	40,804	$5,203,044,198	1,129	$26,895,634
Itasca	Q3 (HH)	50,469	$8,434,901,042	269	$7,786,500
Jackson	DFIRM (HH)	21,966	$1,598,699,642	88	$1,138,610
Kanabec	HH	25,543	$2,678,877,978	46	$817,327
Kandiyohi	DFIRM	48,502	$5,685,114,748	226	$13,677,023
Kittson	DFIRM (HH)	4,988	$295,550,299	355	$2,387,717
Koochiching	DFIRM	11,536	$1,396,413,698	412	$23,257,103
Lac Qui Parle	DFIRM	10,510	$770,323,126	220	$5,981,687
Lake	none	21,764	$3,265,724,844	0	N/A
Lake Of The Woods	DFIRM	5,566	$678,637,712	311	$5,976,733
Le Sueur	DFIRM	134,177	$3,456,595,520	874	$7,628,603
Lincoln	DFIRM	8,973	$635,328,610	49	$1,302,118
Lyon	DFIRM	13,757	$1,831,998,664	51	$1,083,899
Mahnomen	DFIRM	5,390	$497,655,990	34	$5,382,357
Marshall	DFIRM (HH)	13,032	$1,121,483,250	858	$9,037,646
Martin	HH	18,836	$2,435,064,114	0	N/A
Mcleod	DFIRM	25,146	$4,463,896,390	90	$19,896,690
Meeker	DFIRM	33,590	$3,191,784,366	807	$21,095,379
Mille Lacs	DFIRM	26,330	$4,694,170,270	965	$20,639,058
Morrison	DFIRM	31,401	$4,591,114,841	103	$3,924,738
Mower	DFIRM	29,688	$4,117,316,616	159	$10,138,586
Murray	DFIRM	10,974	$798,625,368	234	$4,190,180
Nicollet	DFIRM	18,999	$3,971,471,538	75	$1,380,474
Nobles	DFIRM	19,590	$2,020,518,034	569	$9,433,924
Norman	DFIRM	7,944	$550,955,320	613	$6,848,976
Olmsted	DFIRM	78,780	$36,252,047,132	127	$15,619,229
Otter Tail	Q3 (HH)	59,313	$9,148,966,765	31	$1,077,878
Pennington	DFIRM	11,555	$1,921,372,696	53	$1,079,979

County	Flood Model	Est Total # Structures	Total Building Exposure (Structure + Content)	Est # Damaged Buildings	Est Building Loss
Pine	DFIRM	35,005	$5,003,525,200	846	$26,338,803
Pipestone	DFIRM	11,124	$1,248,442,322	135	$11,497,271
Polk	DFIRM	24,980	$4,300,486,228	917	$18,993,101
Pope	Q3 (HH)	21,147	$4,147,069,310	61	$2,265,439
Ramsey	DFIRM	261,619	$88,890,751,550	1,043	$454,055,096
Red Lake	DFIRM	4,674	$428,626,376	22	$380,181
Redwood	DFIRM	19,008	$1,797,035,052	59	$1,520,683
Renville	DFIRM (HH)	19,330	$1,638,308,476	198	$8,938,588
Rice	DFIRM	34,157	$9,173,193,638	250	$29,771,018
Rock	DFIRM	52,033	$1,379,884,186	1,035	$7,682,755
Roseau	DFIRM	16,791	$2,391,962,278	605	$7,291,260
Saint Louis	DFIRM	157,409	$27,025,937,440	2,688	$402,292,497
Scott	DFIRM	64,336	$29,101,579,816	449	$207,785,399
Sherburne	DFIRM	49,547	$17,989,448,262	390	$27,484,383
Sibley	Q3 (HH)	17,187	$1,780,382,368	103	$6,717,364
Stearns	DFIRM	93,095	$20,670,229,696	825	$39,040,940
Steele	DFIRM	22,688	$4,907,411,664	208	$19,229,343
Stevens	DFIRM (HH)	16,397	$1,189,958,992	167	$2,256,650
Swift	DFIRM	1,263	$96,578,712	119	$4,451,174
Todd	DFIRM	29,606	$1,960,150,454	701	$12,245,948
Traverse	Q3	5,463	$323,209,506	489	$5,308,339
Wabasha	Q3	26,554	$3,408,532,434	248	$14,724,870
Wadena	Q3	13,483	$1,939,190,290	202	$6,209,976
Waseca	DFIRM (HH)	14,344	$1,999,220,414	33	$673,433
Washington	DFIRM	116,694	$53,817,541,981	535	$93,886,505
Watonwan	DFIRM	10,616	$1,002,686,228	51	$1,940,273
Wilkin	DFIRM	7,575	$1,061,956,754	193	$2,129,028
Winona	Q3	29,346	$5,038,128,727	992	$46,129,128
Wright	DFIRM	100,304	$23,009,783,375	1,299	$110,442,737
Yellow Medicine	DFIRM	13,194	$1,357,289,646	286	$16,001,186

County	Flood Model	Est Total # Structures	Total Building Exposure (Structure + Content)	Est # Damaged Buildings	Est Building Loss
Total		3,828,157	$946,491,705,378	35,449	$2,662,370,107

Source: (FEMA, 2023c, 2023d)

Appendix G: Monetary Damages from Flooding

County	Injuries	Fatalities	Property Damage (ADJ)	Crop Damage (ADJ)	Total Monetary Damage
Aitkin	$6,049,000	$1,050,000	$6,682,455	$893,004	$14,674,458
Anoka	$8,349,000	$23,550,000	$316,975,316	$36,477,447	$385,351,763
Becker	$6,049,000	$1,050,000	$6,364,790	$6,425,371	$19,889,161
Beltrami	$6,049,000	$1,050,000	$20,316,702	$122,376,526	$149,792,228
Benton	$6,049,000	$23,550,000	$11,276,124	$6,574,148	$47,449,272
Big Stone	$6,049,000	$1,050,000	$17,235,185	$38,623,978	$62,958,164
Blue Earth	$6,049,000	$1,275,000	$32,034,663	$47,626,607	$86,985,270
Brown	$6,049,000	$1,275,000	$16,592,766	$37,850,087	$61,766,852
Carlton	$8,349,000	$1,050,000	$63,532,761	$893,004	$73,824,765
Carver	$6,808,000	$1,275,000	$30,300,312	$36,586,336	$74,969,648
Cass	$6,049,000	$1,050,000	$20,451,273	$122,339,283	$149,889,557
Chippewa	$6,049,000	$1,050,000	$17,716,274	$36,452,214	$61,267,487
Chisago	$6,049,000	$1,050,000	$4,804,969	$18,354	$11,922,322
Clay	$6,049,000	$1,050,000	$62,844,786	$17,315,321	$87,259,107
Clearwater	$6,049,000	$1,050,000	$21,440,849	$122,371,142	$150,910,991
Cook	$6,049,000	$1,050,000	$7,670,350	$1,112	$14,770,462
Cottonwood	$8,349,000	$1,050,000	$19,286,840	$41,954,745	$70,640,585
Crow Wing	$6,049,000	$1,050,000	$6,772,320	$894,780	$14,766,100
Dakota	$6,808,000	$8,550,000	$51,317,926	$36,584,947	$103,260,873
Dodge	$6,815,659	$1,050,000	$20,795,423	$39,252,218	$67,913,300
Douglas	$6,049,000	$1,050,000	$7,028,172	$893,004	$15,020,175
Faribault	$6,049,000	$1,275,000	$17,352,137	$41,438,399	$66,114,536
Fillmore	$6,049,000	$1,050,000	$91,458,472	$44,282,786	$142,840,258
Freeborn	$12,949,000	$8,775,000	$20,637,934	$42,135,156	$84,497,090
Goodhue	$8,349,000	$42,300,000	$26,966,298	$38,771,597	$116,386,895
Grant	$6,049,000	$1,050,000	$11,460,756	$18,354	$18,578,110
Hennepin	$9,108,000	$23,550,000	$27,557,947	$36,477,447	$96,693,394
Houston	$79,649,000	$24,375,000	$95,837,933	$51,160,185	$251,022,119
Hubbard	$6,049,000	$1,050,000	$20,229,285	$122,470,774	$149,799,059

County	Injuries	Fatalities	Property Damage (ADJ)	Crop Damage (ADJ)	Total Monetary Damage
Isanti	$6,049,000	$1,050,000	$5,843,628	$893,004	$13,835,631
Itasca	$6,049,000	$1,050,000	$20,138,561	$122,325,370	$149,562,931
Jackson	$6,049,000	$1,050,000	$18,350,327	$49,688,931	$75,138,258
Kanabec	$6,049,000	$1,050,000	$6,010,775	$893,004	$14,002,779
Kandiyohi	$6,049,000	$1,050,000	$15,692,510	$36,452,214	$59,243,724
Kittson	$6,049,000	$1,050,000	$33,007,469	$125,828,439	$165,934,907
Koochiching	$6,049,000	$1,050,000	$4,948,247	$1,112	$12,048,359
Lac qui Parle	$6,049,000	$1,050,000	$18,616,554	$36,452,214	$62,167,767
Lake	$6,049,000	$16,050,000	$7,395,905	$0	$29,494,905
Lake of the Woods	$10,649,000	$1,050,000	$6,206,741	$0	$17,905,741
Le Sueur	$6,049,000	$8,775,000	$16,769,783	$36,561,103	$68,154,886
Lincoln	$6,049,000	$1,050,000	$7,385,027	$25,593,369	$40,077,396
Lyon	$6,049,000	$8,550,000	$18,615,508	$65,590,095	$98,804,604
Mahnomen	$6,049,000	$1,050,000	$5,648,137	$7,665,397	$20,412,534
Marshall	$6,049,000	$1,050,000	$40,563,610	$123,148,972	$170,811,581
Martin	$6,049,000	$1,275,000	$17,162,300	$42,623,557	$67,109,857
McLeod	$6,049,000	$1,275,000	$16,478,248	$36,762,507	$60,564,754
Meeker	$6,049,000	$1,050,000	$5,691,805	$18,354	$12,809,159
Mille Lacs	$6,049,000	$1,050,000	$6,182,957	$893,004	$14,174,961
Morrison	$6,049,000	$1,050,000	$19,495,350	$3,754,250	$30,348,599
Mower	$6,049,000	$8,550,000	$24,092,496	$40,312,105	$79,003,601
Murray	$6,049,000	$1,050,000	$18,787,459	$59,398,119	$85,284,578
Nicollet	$6,049,000	$8,775,000	$27,133,661	$36,762,507	$78,720,168
Nobles	$6,049,000	$1,050,000	$20,120,581	$56,356,566	$83,576,147
Norman	$6,049,000	$1,050,000	$65,610,580	$69,595,811	$142,305,391
Olmsted	$6,049,000	$38,550,000	$288,372,991	$38,892,900	$371,864,890
Otter Tail	$6,049,000	$1,050,000	$7,360,626	$1,792,929	$16,252,555
Pennington	$6,049,000	$1,050,000	$21,229,225	$132,588,943	$160,917,168
Pine	$6,049,000	$1,050,000	$7,801,527	$893,004	$15,793,530
Pipestone	$6,049,000	$1,050,000	$15,079,739	$23,612,962	$45,791,700
Polk	$6,049,000	$1,050,000	$995,812,502	$1,055,536	$1,003,967,038
Pope	$6,049,000	$1,050,000	$15,623,150	$36,452,214	$59,174,364

County	Injuries	Fatalities	Property Damage (ADJ)	Crop Damage (ADJ)	Total Monetary Damage
Ramsey	$9,108,000	$8,550,000	$25,231,487	$36,477,447	$79,366,934
Red Lake	$6,049,000	$1,050,000	$6,539,502	$181,078	$13,819,580
Redwood	$6,049,000	$8,550,000	$18,106,841	$36,686,390	$69,392,232
Renville	$6,049,000	$8,775,000	$17,863,912	$38,273,035	$70,960,947
Rice	$6,049,000	$1,275,000	$20,642,262	$36,561,103	$64,527,365
Rock	$6,049,000	$1,050,000	$17,586,427	$18,409,905	$43,095,332
Roseau	$6,049,000	$1,050,000	$300,098,880	$10,175,364	$317,373,245
Scott	$6,808,000	$1,275,000	$31,955,349	$36,586,336	$76,624,686
Sherburne	$6,049,000	$1,050,000	$7,860,323	$22,758	$14,982,081
Sibley	$6,049,000	$1,275,000	$19,866,471	$36,561,103	$63,751,574
St. Louis	$8,349,000	$1,050,000	$32,702,539	$5,552	$42,107,092
Stearns	$8,349,000	$1,050,000	$15,938,048	$22,758	$25,359,807
Steele	$6,049,000	$1,275,000	$64,474,232	$51,324,219	$123,122,451
Stevens	$6,049,000	$1,050,000	$15,618,136	$36,452,214	$59,169,350
Swift	$6,049,000	$1,050,000	$15,867,121	$36,452,214	$59,418,335
Todd	$6,049,000	$3,549,975	$6,156,202	$893,004	$16,648,180
Traverse	$6,049,000	$1,050,000	$14,359,684	$2,068,468	$23,527,152
Wabasha	$6,049,000	$28,125,000	$53,280,101	$39,226,543	$126,680,644
Wadena	$6,049,000	$1,050,000	$4,908,348	$264,652	$12,272,000
Waseca	$6,049,000	$1,275,000	$16,224,959	$36,561,103	$60,110,062
Washington	$6,808,000	$1,050,000	$19,406,910	$36,477,447	$63,742,357
Watonwan	$6,049,000	$1,275,000	$19,758,912	$36,561,103	$63,644,015
Wilkin	$6,049,000	$1,050,000	$76,742,448	$784,274	$84,625,721
Winona	$6,049,000	$54,375,000	$83,967,064	$39,956,227	$184,347,291
Wright	$6,049,000	$1,050,000	$47,186,597	$43,587	$54,329,184
Yellow Medicine	$6,049,000	$1,050,000	$17,367,144	$36,559,714	$61,025,857

SOURCE: (CEMHS, 2023)

Appendix H: Repetitive Loss and Severe Repetitive Loss Properties

Repetitive Loss Summary

(Current as of 01/28/2024)

State/County/Community	State	Repetitive Loss Properties	Total Losses	Total Building Payments	Total Contents Payments
	Grand Total	549	1451	$24,771,864	$4,900,243
BENTON COUNTY * (270019)	MINNESOTA	3	6	$75,315	$10,319
FOLEY, CITY OF (270020)	MINNESOTA	1	2	$6,482	$605
ORTONVILLE, CITY OF (270028)	MINNESOTA	2	6	$72,806	$0
ST. CLAIR, CITY OF (270033)	MINNESOTA	1	3	$80,372	$29,421
NEW ULM, CITY OF (270036)	MINNESOTA	1	2	$16,229	$4,223
SPRINGFIELD, CITY OF (270038)	MINNESOTA	1	3	$267,539	$52,302
CARLTON COUNTY * (270039)	MINNESOTA	1	2	$64,837	$20,040
MOOSE LAKE, CITY OF (270045)	MINNESOTA	1	2	$37,730	$3,921
CARVER COUNTY* (270049)	MINNESOTA	1	2	$8,068	$0
CHIPPEWA COUNTY * (270066)	MINNESOTA	6	14	$223,332	$37,180
GRANITE FALLS, CITY OF (270068)	MINNESOTA	10	22	$173,817	$6,924
DILWORTH, CITY OF (270080)	MINNESOTA	1	2	$20,407	$179
GEORGETOWN, CITY OF (270082)	MINNESOTA	2	5	$12,883	$0
WINDOM, CITY OF (270090)	MINNESOTA	1	2	$26,652	$9,791
DAKOTA COUNTY * (270101)	MINNESOTA	4	12	$194,862	$40,295

State/County/Community	State	Repetitive Loss Properties	Total Losses	Total Building Payments	Total Contents Payments
BURNSVILLE, CITY OF (270102)	MINNESOTA	2	9	$192,041	$275,125
HASTINGS, CITY OF (270105)	MINNESOTA	4	12	$179,733	$6,643
INVER GROVE HEIGHTS, CITY OF (270106)	MINNESOTA	1	3	$0	$8,278
FILLMORE COUNTY* (270124)	MINNESOTA	1	4	$108,482	$30,000
PRESTON, CITY OF (270129)	MINNESOTA	2	4	$21,731	$0
RUSHFORD VILLAGE, CITY OF (270131)	MINNESOTA	1	2	$5,780	$0
SPRING VALLEY, CITY OF (270132)	MINNESOTA	5	14	$72,607	$3,059
FREEBORN COUNTY * (270134)	MINNESOTA	2	6	$106,493	$17,573
ALBERT LEA, CITY OF (270135)	MINNESOTA	2	13	$277,907	$40,594
GOODHUE COUNTY * (270140)	MINNESOTA	11	28	$407,108	$14,137
PINE ISLAND, CITY OF (270145)	MINNESOTA	7	18	$309,775	$249,720
RED WING, CITY OF (270146)	MINNESOTA	3	6	$77,336	$10,000
BROOKLYN PARK, CITY OF (270152)	MINNESOTA	1	3	$114,578	$0
DAYTON, CITY OF (270157)	MINNESOTA	1	2	$7,815	$0
EDINA, CITY OF (270160)	MINNESOTA	5	15	$151,450	$35,545
GOLDEN VALLEY, CITY OF (270162)	MINNESOTA	1	2	$8,394	$0
HOPKINS, CITY OF (270166)	MINNESOTA	1	2	$124,763	$53,410
MINNEAPOLIS, CITY OF (270172)	MINNESOTA	3	7	$153,519	$6,217
MINNETONKA, CITY OF (270173)	MINNESOTA	1	3	$30,070	$1,780
MOUND, CITY OF (270176)	MINNESOTA	1	3	$68,970	$8,323
ORONO, CITY OF (270178)	MINNESOTA	1	2	$171,824	$16,871

State/County/Community	State	Repetitive Loss Properties	Total Losses	Total Building Payments	Total Contents Payments
ROBBINSDALE, CITY OF (270181)	MINNESOTA	1	2	$3,687	$1,917
ST. LOUIS PARK, CITY OF (270184)	MINNESOTA	1	3	$14,965	$8,372
TONKA BAY, CITY OF (270187)	MINNESOTA	1	3	$81,172	$10,472
WAYZATA, CITY OF (270188)	MINNESOTA	3	8	$75,848	$5,141
HOUSTON COUNTY * (270190)	MINNESOTA	3	8	$143,570	$0
HUBBARD COUNTY * (270195)	MINNESOTA	2	4	$140,917	$0
ISANTI COUNTY * (270197)	MINNESOTA	3	6	$48,702	$53,326
KANABEC COUNTY * (270214)	MINNESOTA	1	2	$26,689	$321
KITTSON COUNTY * (270224)	MINNESOTA	6	9	$259,756	$15,391
HALLOCK, CITY OF (270226)	MINNESOTA	2	4	$36,402	$0
ST. VINCENT, CITY OF (270232)	MINNESOTA	1	2	$5,755	$2,269
BOYD, CITY OF (270240)	MINNESOTA	1	2	$5,249	$1,339
DAWSON, CITY OF (270241)	MINNESOTA	1	2	$7,800	$0
LE SUEUR, CITY OF (270248)	MINNESOTA	1	9	$125,097	$0
WATERVILLE, CITY OF (270251)	MINNESOTA	2	6	$115,989	$15,778
LYON COUNTY * (270256)	MINNESOTA	1	3	$16,507	$0
MARSHALL, CITY OF (270258)	MINNESOTA	1	2	$4,960	$0
GLENCOE, CITY OF (270263)	MINNESOTA	1	2	$10,408	$5,119
OSLO, CITY OF (270272)	MINNESOTA	3	5	$76,649	$23,064
WARREN, CITY OF (270274)	MINNESOTA	68	180	$1,002,993	$30,275
LITCHFIELD, CITY OF (270285)	MINNESOTA	1	2	$37,448	$18,609

State/County/Community	State	Repetitive Loss Properties	Total Losses	Total Building Payments	Total Contents Payments
ISLE, CITY OF (270288)	MINNESOTA	1	2	$18,716	$7,121
PRINCETON, CITY OF (270292)	MINNESOTA	1	3	$6,576	$1,637
MOWER COUNTY * (270307)	MINNESOTA	6	24	$343,311	$88,363
ADAMS, CITY OF (270308)	MINNESOTA	2	4	$25,905	$412
SAINT PETER, CITY OF (270317)	MINNESOTA	1	2	$8,444	$719
WORTHINGTON, CITY OF (270321)	MINNESOTA	4	8	$33,812	$0
NORMAN COUNTY* (270322)	MINNESOTA	10	25	$368,076	$53,417
ADA, CITY OF (270323)	MINNESOTA	1	3	$12,825	$0
HALSTAD, CITY OF (270324)	MINNESOTA	1	4	$8,517	$10,000
EYOTA, CITY OF (270329)	MINNESOTA	1	2	$20,076	$0
ORONOCO, CITY OF (270330)	MINNESOTA	1	2	$61,216	$0
OTTER TAIL COUNTY * (270339)	MINNESOTA	5	11	$56,888	$1,289
PIPESTONE, CITY OF (270359)	MINNESOTA	2	5	$232,681	$49,158
CROOKSTON, CITY OF (270364)	MINNESOTA	1	2	$4,245	$0
NEW BRIGHTON, CITY OF (270380)	MINNESOTA	1	2	$16,789	$0
MORRISTOWN, CITY OF (270405)	MINNESOTA	1	2	$4,425	$0
NORTHFIELD, CITY OF (270406)	MINNESOTA	5	16	$1,284,934	$961,886
ROSEAU, CITY OF (270414)	MINNESOTA	1	2	$43,359	$0
ST. LOUIS COUNTY * (270416)	MINNESOTA	2	5	$62,895	$4,415
DULUTH, CITY OF (270421)	MINNESOTA	3	6	$14,360	$41,440
FLOODWOOD, CITY OF (270423)	MINNESOTA	2	5	$20,238	$0

State/County/Community	State	Repetitive Loss Properties	Total Losses	Total Building Payments	Total Contents Payments
PROCTOR, CITY OF (270425)	MINNESOTA	1	3	$28,380	$10,269
SCOTT COUNTY* (270428)	MINNESOTA	1	2	$12,796	$500
SHAKOPEE, CITY OF (270434)	MINNESOTA	3	11	$452,070	$19,939
SHERBURNE COUNTY * (270435)	MINNESOTA	5	13	$177,927	$951
ST. CLOUD, CITY OF (270456)	MINNESOTA	1	2	$13,677	$0
SARTELL, CITY OF (270460)	MINNESOTA	1	3	$36,236	$3,588
WAITE PARK, CITY OF (270461)	MINNESOTA	6	16	$487,484	$203,427
OWATONNA, CITY OF (270463)	MINNESOTA	9	18	$699,708	$21,289
BROWNS VALLEY, CITY OF (270480)	MINNESOTA	5	15	$68,650	$10,000
WABASHA COUNTY * (270483)	MINNESOTA	2	5	$37,902	$27,600
HAMMOND, CITY OF (270485)	MINNESOTA	1	2	$90,045	$21,000
LAKE CITY, CITY OF (270486)	MINNESOTA	1	2	$15,888	$0
WABASHA, CITY OF (270490)	MINNESOTA	5	12	$233,085	$500
WASHINGTON COUNTY * (270499)	MINNESOTA	9	21	$289,150	$15,019
POLK COUNTY * (270503)	MINNESOTA	9	20	$256,767	$20,216
LAKE ELMO, CITY OF (270505)	MINNESOTA	1	3	$73,842	$0
MARINE-ON-ST. CROIX, CITY OF (270509)	MINNESOTA	1	4	$42,972	$0
NEWPORT, CITY OF (270510)	MINNESOTA	2	6	$30,841	$4,637
ST. PAUL PARK, CITY OF (270514)	MINNESOTA	1	2	$100,321	$13,515
MADELIA, CITY OF (270517)	MINNESOTA	1	3	$119,071	$25,351
WINONA COUNTY * (270525)	MINNESOTA	2	4	$42,425	$0

State/County/Community	State	Repetitive Loss Properties	Total Losses	Total Building Payments	Total Contents Payments
WRIGHT COUNTY * (270534)	MINNESOTA	2	4	$28,575	$525
BUFFALO, CITY OF (270535)	MINNESOTA	1	2	$4,571	$0
YELLOW MEDICINE COUNTY * (270544)	MINNESOTA	3	8	$109,404	$25,023
STEARNS COUNTY* (270546)	MINNESOTA	1	3	$9,696	$0
DODGE COUNTY * (270548)	MINNESOTA	3	9	$142,926	$39,229
TODD COUNTY * (270551)	MINNESOTA	1	2	$72,462	$3,490
DETROIT LAKES, CITY OF (270564)	MINNESOTA	1	2	$8,644	$0
MCLEOD COUNTY * (270616)	MINNESOTA	1	2	$10,242	$0
MORRISON COUNTY * (270617)	MINNESOTA	4	8	$107,903	$14,644
CLEARWATER COUNTY* (270618)	MINNESOTA	2	4	$69,813	$3,300
COOK COUNTY * (270619)	MINNESOTA	1	2	$40,852	$0
SIBLEY COUNTY * (270620)	MINNESOTA	1	4	$373,503	$83,195
TRAVERSE COUNTY* (270621)	MINNESOTA	2	4	$16,008	$620
DOUGLAS COUNTY * (270623)	MINNESOTA	2	4	$58,894	$584
MILLE LACS COUNTY * (270624)	MINNESOTA	1	2	$4,223	$2,340
NICOLLET COUNTY * (270625)	MINNESOTA	2	4	$66,181	$663
OLMSTED COUNTY * (270626)	MINNESOTA	1	2	$46,383	$0
KANDIYOHI COUNTY* (270629)	MINNESOTA	1	2	$57,256	$47,642
LAKE COUNTY * (270630)	MINNESOTA	1	3	$872,370	$30,987
JACKSON COUNTY * (270632)	MINNESOTA	1	2	$11,697	$122
ROSEAU COUNTY * (270633)	MINNESOTA	1	2	$14,123	$11,000

State/County/Community	State	Repetitive Loss Properties	Total Losses	Total Building Payments	Total Contents Payments
MARSHALL COUNTY* (270638)	MINNESOTA	22	55	$610,765	$35,792
BECKER COUNTY * (270639)	MINNESOTA	4	8	$157,604	$23,413
ROCK COUNTY * (270642)	MINNESOTA	1	3	$55,475	$3,149
MURRAY COUNTY * (270645)	MINNESOTA	1	2	$66,045	$0
RICE COUNTY * (270646)	MINNESOTA	3	7	$21,809	$8,072
WASECA COUNTY * (270647)	MINNESOTA	1	2	$16,740	$3,144
FARIBAULT COUNTY * (270669)	MINNESOTA	1	3	$10,581	$1,019
OTTERTAIL, CITY OF (270675)	MINNESOTA	1	2	$19,569	$1,000
CHISAGO COUNTY * (270682)	MINNESOTA	1	2	$4,971	$0
MEDICINE LAKE, CITY OF (270690)	MINNESOTA	1	3	$7,674	$698
PINE COUNTY * (270704)	MINNESOTA	4	9	$90,211	$20,549
DENNISON, CITY OF (270713)	MINNESOTA	1	3	$13,732	$175
WEST ST. PAUL, CITY OF (270729)	MINNESOTA	1	2	$7,052	$0
MIDWAY, TOWNSHIP OF (270741)	MINNESOTA	1	2	$6,335	$0
AFTON, CITY OF (275226)	MINNESOTA	7	16	$273,614	$9,414
ANOKA, CITY OF (275227)	MINNESOTA	1	3	$22,572	$1,058
AUSTIN, CITY OF (275228)	MINNESOTA	19	64	$1,475,522	$300,024
BAYPORT, CITY OF (275229)	MINNESOTA	21	67	$914,776	$14,414
BLOOMINGTON, CITY OF (275230)	MINNESOTA	2	4	$15,220	$2,729
BLUE EARTH COUNTY * (275231)	MINNESOTA	3	7	$224,240	$62,913
BRECKENRIDGE, CITY OF (275232)	MINNESOTA	12	26	$495,402	$89,357

State/County/Community	State	Repetitive Loss Properties	Total Losses	Total Building Payments	Total Contents Payments
CLAY COUNTY * (275235)	MINNESOTA	25	64	$777,093	$76,491
EAST GRAND FORKS, CITY OF (275236)	MINNESOTA	4	9	$191,213	$39,058
LA CRESCENT, CITY OF (275237)	MINNESOTA	4	11	$337,439	$20,160
LAKELAND, CITY OF (275238)	MINNESOTA	8	38	$460,422	$30,463
LAKELAND SHORES, CITY OF (275239)	MINNESOTA	1	2	$5,469	$0
LAKE ST. CROIX BEACH, CITY OF (275240)	MINNESOTA	2	6	$40,607	$0
LILYDALE, CITY OF (275241)	MINNESOTA	2	12	$1,573,209	$612,758
MONTEVIDEO, CITY OF (275243)	MINNESOTA	6	14	$178,258	$27,463
MOORHEAD, CITY OF (275244)	MINNESOTA	9	35	$608,232	$285,455
NORTH MANKATO, CITY OF (275245)	MINNESOTA	2	4	$62,351	$0
ROCHESTER, CITY OF (275246)	MINNESOTA	3	6	$46,235	$329
ST. MARYS POINT, CITY OF (275247)	MINNESOTA	9	20	$344,434	$8,688
ST. PAUL, CITY OF (275248)	MINNESOTA	5	10	$364,833	$500
STILLWATER, CITY OF (275249)	MINNESOTA	1	3	$213,830	$11,000
UNKNOWN (UNKNOWN)	MINNESOTA	12	43	$862,805	$146,065

Source: (FEMA, 2024b)

Severe Repetitive Loss Summary

(Current as of 01/28/2024)

State/County/Community	State	Severe Repetitive Loss Properties	Total Losses	Total Building Payments	Total Contents Payments
	Grand Total	85	321	$8,413,997	$2,251,242
CHIPPEWA COUNTY * (270066)	MINNESOTA	1	2	$25,106	$0
BURNSVILLE, CITY OF (270102)	MINNESOTA	1	7	$131,692	$6,813
ALBERT LEA, CITY OF (270135)	MINNESOTA	1	6	$257,250	$20,500
GOODHUE COUNTY * (270140)	MINNESOTA	3	11	$182,041	$4,650
PINE ISLAND, CITY OF (270145)	MINNESOTA	1	5	$35,035	$129,236
LE SUEUR, CITY OF (270248)	MINNESOTA	1	9	$125,097	$0
WARREN, CITY OF (270274)	MINNESOTA	20	35	$233,686	$7,301
MOWER COUNTY * (270307)	MINNESOTA	3	14	$264,912	$72,263
NORMAN COUNTY* (270322)	MINNESOTA	2	10	$111,521	$4,389
NORTHFIELD, CITY OF (270406)	MINNESOTA	1	5	$73,165	$0
SHAKOPEE, CITY OF (270434)	MINNESOTA	1	7	$417,870	$19,939
WAITE PARK, CITY OF (270461)	MINNESOTA	1	4	$371,831	$175,475
WABASHA COUNTY * (270483)	MINNESOTA	1	2	$30,347	$0
POLK COUNTY * (270503)	MINNESOTA	2	7	$347,605	$241,083
DODGE COUNTY * (270548)	MINNESOTA	1	4	$77,824	$18,416
SIBLEY COUNTY * (270620)	MINNESOTA	1	4	$373,503	$83,195
MARSHALL COUNTY* (270638)	MINNESOTA	3	6	$262,802	$18,839
AFTON, CITY OF (275226)	MINNESOTA	1	4	$103,130	$1,000

State/County/Community	State	Severe Repetitive Loss Properties	Total Losses	Total Building Payments	Total Contents Payments
AUSTIN, CITY OF (275228)	MINNESOTA	16	63	$1,349,234	$465,708
BAYPORT, CITY OF (275229)	MINNESOTA	7	28	$402,199	$1,356
BRECKENRIDGE, CITY OF (275232)	MINNESOTA	2	4	$91,738	$12,000
CLAY COUNTY * (275235)	MINNESOTA	4	15	$527,558	$23,864
EAST GRAND FORKS, CITY OF (275236)	MINNESOTA	2	4	$65,769	$13,266
LA CRESCENT, CITY OF (275237)	MINNESOTA	1	4	$56,313	$1,005
LAKELAND, CITY OF (275238)	MINNESOTA	1	13	$257,274	$13,353
LILYDALE, CITY OF (275241)	MINNESOTA	1	10	$1,549,048	$597,022
MOORHEAD, CITY OF (275244)	MINNESOTA	3	17	$241,267	$263,924
UNKNOWN (UNKNOWN)	MINNESOTA	3	21	$449,183	$56,645

Source: (FEMA, 2024b)

Appendix I: Critical Infrastructure in 1 % Annual Chance Flood Boundary

County	Airport	ARMER Site	Dialysis Center	Electric Transmission Substation	Emergency Medical Service (Ems)	Fire Station	Law Enforcement Facility	Nursing Home / Assisted Living	Power Plant	EPA Risk Management Plan Registered Facility	K- 12 Schools	Shelter	Supervised Living Facility	EPA RCRA Solid Hazardous Waste Disposal Facilities	Total
Aitkin	3			2		1								6	12
Anoka	2			3										24	29
Becker														1	1
Benton														4	4
Big Stone				1										1	2
Blue Earth				2										2	4
Brown		1		4										2	7
Carlton				3					2					1	6
Carver	3			2										3	8
Cass						1									1
Chippewa				2		1	1						1	15	20
Chisago	1													1	2
Clay			1	5				1		1	1	3		2	14
Crow Wing	5														5
Dakota	3			3					3	1				24	34
Fillmore				2			1		1			1		3	8
Freeborn														1	1
Goodhue				1					1					10	12

County	Airport	ARMER Site	Dialysis Center	Electric Transmission Substation	Emergency Medical Service (Ems)	Fire Station	Law Enforcement Facility	Nursing Home / Assisted Living	Power Plant	EPA Risk Management Plan Registered Facility	K- 12 Schools	Shelter	Supervised Living Facility	EPA RCRA Solid Hazardous Waste Disposal Facilities	Total
Grant														1	1
Hennepin	7			5			1		2		1	1		33	50
Isanti											1			1	2
Itasca	1			4							1			2	8
Jackson														1	1
Kanabec				1											1
Kandiyohi										1				1	2
Kittson				1							2			3	6
Koochiching	1					1								1	3
Lac Qui Parle				3	1									3	7
Lake Of The Woods	1													1	2
Le Sueur				2						1				6	9
Lincoln														1	1
Lyon				1										2	3
Marshall	1			4								1		2	8
Mcleod	1	1		1					1						4
Meeker														1	1
Mille Lacs				1							2	2			5
Morrison				1					1						2
Mower										1				6	7
Murray														2	2
Nicollet														1	1
Nobles				2								1		5	8

County	Airport	ARMER Site	Dialysis Center	Electric Transmission Substation	Emergency Medical Service (Ems)	Fire Station	Law Enforcement Facility	Nursing Home / Assisted Living	Power Plant	EPA Risk Management Plan Registered Facility	K- 12 Schools	Shelter	Supervised Living Facility	EPA RCRA Solid Hazardous Waste Disposal Facilities	Total
Norman	2			1	1	1								1	6
Olmsted				4	1	1				1			1	7	15
Otter Tail	1			1					1						3
Pennington														1	1
Pine														1	1
Pipestone									1	1				3	5
Polk	2					1						1		4	8
Ramsey	2			4					3					54	63
Renville			1		2	1		2						5	11
Rice	1													1	2
Rock				1										2	3
Roseau		2												1	3
Saint Louis	6			2		1					1	1		26	37
Scott	4				1				2					41	48
Sibley											2			1	3
Stearns				1											1
Steele				1					1					5	7
Stevens														1	1
Swift				3											3
Todd														2	2
Traverse						2				1				3	6
Wabasha				3	2	2			1			1		3	12
Waseca									1					2	3

County	Airport	ARMER Site	Dialysis Center	Electric Transmission Substation	Emergency Medical Service (Ems)	Fire Station	Law Enforcement Facility	Nursing Home / Assisted Living	Power Plant	EPA Risk Management Plan Registered Facility	K- 12 Schools	Shelter	Supervised Living Facility	EPA RCRA Solid Hazardous Waste Disposal Facilities	Total
Washington	2								1					17	20
Watonwan	1													4	5
Wilkin				1											1
Winona					1	1		1	1		2	3		17	26
Wright	2			1					1					4	8
Yellow Medicine				1											1
Total	52	4	2	80	9	14	3	4	24	8	13	15	2	379	609

Source: (FEMA, 2023c; MN Geospatial Information Office, 2024)

Appendix J: State-Owned Structures and Other Assets in 1% Annual Chance Flood Boundary

State-Owned Structures in 1% Annual Chance Flood Boundary

County	Number of Flooded Structures	Agency	Address	City	Zip code
Anoka	1	R29 - Department of Natural Resources	5463-A West Broadway	Forest Lake	55025
Anoka	9	R29 - Department of Natural Resources	5463-C West Broadway	Forest Lake	55025
Blue Earth	10	R29 - Department of Natural Resources	50317 Fish Hatchery Rd	Waterville	56096
Blue Earth	2	R29 - Department of Natural Resources	52698 Hwy 68	Lake Crystal	56055
Chippewa	1	E40 - Historical Society	151 Pioneer Dr., Box 303	Montevideo	56265
Clay	2	T79 - Department of Transportation	500 Hwy 10	Hawley	56549
Clay	4	T79 - Department of Transportation	500 Us Hwy 10 East	Hawley	56549
Dakota	1	R29 - Department of Natural Resources	1350 Dam Rd	Hastings	55033
Fillmore	2	R29 - Department of Natural Resources	21071 County Rd 118	Preston	55965
Fillmore	33	R29 - Department of Natural Resources	21071 Cty 118	Preston	55965
Fillmore	1	E40 - Historical Society	21899 County Road 118	Preston	55965
Fillmore	20	R29 - Department of Natural Resources	28376 Co Rd S	Peterson	55962
Fillmore	2	R29 - Department of Natural Resources	38468 270Th St	Peterson	55962
Fillmore	1	E40 - Historical Society	Forestville State Park	Preston	55965
Goodhue	1	R29 - Department of Natural Resources	1000 Levee Rd	Red Wing	55066
Goodhue	25	R29 - Department of Natural Resources	29223 Co 28 Blvd	Lake City	55041
Hennepin	45	R29 - Department of Natural Resources	101 Snelling Lake Rd	St. Paul	55111
Hennepin	1	T79 - Department of Transportation	8300 West 78Th Street	Bloomington	55439
Hubbard	3	R29 - Department of Natural Resources	301 S Grove Ave	Park Rapids	56470
Isanti	1	R29 - Department of Natural Resources	421St Ave Nw	Cambridge	55008
Itasca	7	R29 - Department of Natural Resources	Co Rd 551	Side Lake	55781
Kittson	23	R29 - Department of Natural Resources	3793 230Th St	Lake Bronson	56734

Lac Qui Parle	1	R29 - Department of Natural Resources	3749 State Park Rd	Montevideo	56265
Marshall	24	R29 - Department of Natural Resources	42280 240Th Ave Ne	Middle River	56737
Nobles	2	T79 - Department of Transportation	13605 I-90 Eastbound	Adrian	56110
Nobles	2	T79 - Department of Transportation	14396 I-90 Westbound	Adrian	56110
Pine	7	E40 - Historical Society	12551 Voyageur Lane	Pine City	55063
Ramsey	1	P01 - Military Affairs	206 Airport Rd	St. Paul	55107
Roseau	1	R29 - Department of Natural Resources	1101 Lake St Ne	Warroad	56763
Saint Louis	1	R29 - Department of Natural Resources	7128 Handberg Rd	Crane Lake	55725
Saint Louis	1	R29 - Department of Natural Resources	7128 Handberg Vault Concrete	Crane Lake	55725
Saint Louis	2	R29 - Department of Natural Resources	7516 Bay Side Drive	Crane Lake	55725
Saint Louis	3	R29 - Department of Natural Resources	9380 Angus Rd Vermilion Lk Twshp	Tower	55790
Saint Louis	1	R29 - Department of Natural Resources	Normanna Rd	Duluth	55803
Swift	4	T79 - Department of Transportation	500 22Nd Street South	Benson	56215
Wabasha	1	R29 - Department of Natural Resources	1500 Marina Dr	Wabasha	55981
Wabasha	1	R29 - Department of Natural Resources	Hwy 61	Kellogg	55945
Wabasha	1	R29 - Department of Natural Resources	Wabasha Cty Rd 4	Plainview	55964
Winona	1	R29 - Department of Natural Resources	14672 Co Rd 112	Altura	55910
Winona	9	R29 - Department of Natural Resources	14674 Co Rd 112	Altura	55910
Winona	1	R29 - Department of Natural Resources	14674 County Rd 112	Altura	55910
Yellow Medicine	1	R29 - Department of Natural Resources	5908 Hwy 67	Granite Falls	56241

Other Assets in 1% Annual Chance Flood Boundary

County	Campground	Manufactured Home Parks	Registered Historic Places	Total
Aitkin	6			6
Anoka			1	1
Big Stone	2			2
Blue Earth	1		3	4
Cass	2			2
Chippewa		1	1	2

County	Campground	Manufactured Home Parks	Registered Historic Places	Total
Chisago			1	1
Clay		1	1	2
Crow Wing	1		1	2
Dakota			2	2
Dodge		1		1
Fillmore	3		3	6
Goodhue	1		4	5
Hennepin			3	3
Houston	2		3	5
Isanti		1		1
Itasca	1			1
Kandiyohi		1		1
Kittson			1	1
Koochiching	1		2	3
Lac Qui Parle	1		1	2
Lake Of The Woods	3	3		6
Le Sueur	2			2
Lincoln	1			1
Lyon			1	1
Mcleod	1		2	3
Meeker	1		3	4
Mille Lacs	4	1	1	6
Morrison			1	1
Nicollet	1		1	2
Nobles	3			3
Olmsted		1	1	2
Pine	1	1	1	3
Pipestone	1			1
Pope	1		1	2
Ramsey			9	9
Redwood	2		1	3

County	Campground	Manufactured Home Parks	Registered Historic Places	Total
Rice	2		2	4
Rock	1		1	2
Saint Louis	7		7	14
Scott			3	3
Sherburne	1			1
Stearns	4	2	2	8
Steele	1			1
Swift	1			1
Todd	4			4
Traverse			1	1
Wabasha	6	3	2	11
Wadena	4	1		5
Washington			7	7
Watonwan	1		1	2
Winona	5	2	1	8
Wright	2		1	3
Total	81	19	77	177

Appendix K: Windstorm Vulnerability Ranking

County	Vulnerability Rank	Building Exposure in Millions	Avg Annual Count	Expected Annual Count
Saint Louis	1	$27,025	8.28	5.25
Hennepin	2	$226,787	6.47	2.67
Dakota	3	$79,526	3.37	2.46
Otter Tail	4	$9,148	5.51	4.18
Stearns	5	$20,670	4.07	3.13
Anoka	6	$64,821	2.90	1.84
Wright	7	$23,009	3.60	2.82
Washington	8	$53,817	2.16	1.64
Cass	9	$6,081	3.49	3.66
Olmsted	10	$36,252	4.35	1.89
Ramsey	11	$88,890	2.29	0.71
Itasca	12	$8,434	3.99	2.85
Scott	13	$29,101	2.59	1.61
Goodhue	14	$8,790	2.38	2.78
Carver	15	$23,584	2.72	1.66
Becker	16	$10,075	2.35	2.31
Polk	17	$4,300	4.16	3.00
Sherburne	18	$17,989	1.88	1.58
Crow Wing	19	$12,303	3.99	1.83
Rice	20	$9,173	2.01	2.05
Clay	21	$9,166	2.53	2.00
Blue Earth	22	$9,529	2.41	1.85
Aitkin	23	$2,463	2.24	2.84
Morrison	24	$4,591	1.94	2.26
Pine	25	$5,003	2.12	2.18
Beltrami	26	$5,108	3.26	2.13
Chisago	27	$10,526	1.28	1.36
Kandiyohi	28	$5,685	2.34	1.89
Mower	29	$4,117	2.53	2.08
Winona	30	$5,038	2.65	1.90
Fillmore	31	$1,966	2.47	2.47
Mcleod	32	$4,463	3.34	1.79
Douglas	33	$7,911	2.37	1.31
Renville	34	$1,638	2.25	2.27
Freeborn	35	$2,551	2.26	2.02
Isanti	36	$5,203	1.25	1.47
Meeker	37	$3,191	1.87	1.83
Hubbard	38	$5,807	1.97	1.36
Le Sueur	39	$3,456	1.44	1.72
Wabasha	40	$3,408	1.97	1.60

County	Vulnerability Rank	Building Exposure in Millions	Avg Annual Count	Expected Annual Count
Sibley	41	$1,780	1.68	1.99
Nobles	42	$2,020	2.03	1.91
Steele	43	$4,907	1.24	1.31
Todd	44	$1,960	1.31	1.88
Martin	45	$2,435	1.94	1.75
Marshall	46	$1,121	2.15	2.11
Pope	47	$4,147	1.47	1.30
Houston	48	$2,748	1.38	1.57
Nicollet	49	$3,971	1.41	1.32
Redwood	50	$1,797	2.18	1.76
Carlton	51	$4,802	1.43	1.10
Jackson	52	$1,598	1.47	1.78
Faribault	53	$1,512	1.47	1.79
Brown	54	$2,732	1.93	1.40
Dodge	55	$2,479	1.63	1.31
Lyon	56	$1,831	1.93	1.41
Benton	57	$3,379	0.82	1.01
Wilkin	58	$1,061	1.85	1.53
Yellow Medicine	59	$1,357	1.32	1.43
Lake	60	$3,265	0.85	0.94
Murray	61	$798	1.37	1.56
Rock	62	$1,379	1.74	1.36
Kanabec	63	$2,678	0.99	1.01
Waseca	64	$1,999	1.66	1.18
Koochiching	65	$1,396	1.51	1.34
Cottonwood	66	$1,079	1.84	1.45
Norman	67	$550	1.79	1.58
Lac Qui Parle	68	$770	1.59	1.46
Chippewa	69	$1,663	1.25	1.09
Pipestone	70	$1,248	1.22	1.19
Wadena	71	$1,939	1.60	0.96
Roseau	72	$2,391	1.90	0.82
Stevens	73	$1,189	1.26	1.10
Grant	74	$1,005	1.50	1.14
Mille Lacs	75	$0	1.62	1.46
Swift	76	$96	1.44	1.41
Clearwater	77	$941	1.18	1.05
Lincoln	78	$635	1.22	1.13
Watonwan	79	$1,002	1.03	0.99
Pennington	80	$1,921	1.01	0.67
Traverse	81	$323	0.90	1.12
Big Stone	82	$608	1.53	0.93

County	Vulnerability Rank	Building Exposure in Millions	Avg Annual Count	Expected Annual Count
Kittson	83	$295	1.91	0.92
Mahnomen	84	$497	0.99	0.74
Cook	85	$2,018	0.37	0.17
Lake of the Woods	86	$678	1.04	0.48
Red Lake	87	$428	0.88	0.52

SOURCE: (NCEI, 2023)

Appendix L: Tornado Vulnerability Ranking

County	Vulnerability Rank	Building Exposure in Millions	Avg Annual Count	Expected Annual Count
Hennepin	1	$226,787	0.46	0.36
Otter Tail	2	$9,148	1.25	1.01
Stearns	3	$20,670	0.81	0.69
Dakota	4	$79,526	0.59	0.34
Becker	5	$10,075	0.47	0.59
Saint Louis	6	$27,025	0.59	0.39
Anoka	7	$64,821	0.41	0.21
Wright	8	$23,009	0.38	0.39
Ramsey	9	$88,890	0.12	0.09
Olmsted	10	$36,252	0.53	0.26
Washington	11	$53,817	0.40	0.17
Polk	12	$4,300	1.10	0.63
Scott	13	$29,101	0.29	0.25
Blue Earth	14	$9,529	0.60	0.45
Beltrami	15	$5,108	0.60	0.54
Carver	16	$23,584	0.31	0.25
Cass	17	$6,081	0.40	0.48
Goodhue	18	$8,790	0.47	0.41
Kandiyohi	19	$5,685	0.79	0.47
Rice	20	$9,173	0.54	0.37
Clay	21	$9,166	0.62	0.37
Douglas	22	$7,911	0.38	0.39
Sherburne	23	$17,989	0.19	0.21
Crow Wing	24	$12,303	0.35	0.27
Renville	25	$1,638	0.38	0.54
Morrison	26	$4,591	0.43	0.41
Pope	27	$4,147	0.44	0.38
Itasca	28	$8,434	0.16	0.25
Todd	29	$1,960	0.37	0.43
Redwood	30	$1,797	0.43	0.43
Marshall	31	$1,121	0.53	0.47
Le Sueur	32	$3,456	0.38	0.35
Meeker	33	$3,191	0.38	0.35
Hubbard	34	$5,807	0.34	0.27
Mcleod	35	$4,463	0.37	0.30
Steele	36	$4,907	0.41	0.28
Mower	37	$4,117	0.46	0.31
Freeborn	38	$2,551	0.91	0.36
Chisago	39	$10,526	0.28	0.13
Nicollet	40	$3,971	0.37	0.28

County	Vulnerability Rank	Building Exposure in Millions	Avg Annual Count	Expected Annual Count
Sibley	41	$1,780	0.53	0.37
Brown	42	$2,732	0.46	0.31
Aitkin	43	$2,463	0.28	0.31
Pine	44	$5,003	0.19	0.20
Faribault	45	$1,512	0.57	0.32
Isanti	46	$5,203	0.19	0.17
Lyon	47	$1,831	0.43	0.30
Waseca	48	$1,999	0.38	0.28
Dodge	49	$2,479	0.26	0.26
Yellow Medicine	50	$1,357	0.34	0.31
Chippewa	51	$1,663	0.34	0.30
Martin	52	$2,435	0.31	0.25
Roseau	53	$2,391	0.54	0.24
Swift	54	$96	0.71	0.37
Winona	55	$5,038	0.32	0.12
Wabasha	56	$3,408	0.19	0.17
Norman	57	$550	0.38	0.32
Benton	58	$3,379	0.10	0.17
Clearwater	59	$941	0.31	0.29
Stevens	60	$1,189	0.26	0.27
Grant	61	$1,005	0.44	0.28
Fillmore	62	$1,966	0.35	0.21
Nobles	63	$2,020	0.60	0.21
Wilkin	64	$1,061	0.51	0.26
Cottonwood	65	$1,079	0.35	0.26
Murray	66	$798	0.49	0.27
Jackson	67	$1,598	0.31	0.22
Lac Qui Parle	68	$770	0.19	0.27
Pennington	69	$1,921	0.16	0.19
Carlton	70	$4,802	0.12	0.08
Kanabec	71	$2,678	0.16	0.15
Wadena	72	$1,939	0.32	0.18
Watonwan	73	$1,002	0.31	0.19
Lake	74	$3,265	0.09	0.07
Mahnomen	75	$497	0.31	0.22
Koochiching	76	$1,396	0.09	0.15
Houston	77	$2,748	0.16	0.06
Mille Lacs	78	$0	0.24	0.22
Pipestone	79	$1,248	0.22	0.13
Kittson	80	$295	0.49	0.19
Lake Of The Woods	81	$678	0.24	0.15
Big Stone	82	$608	0.19	0.16

County	Vulnerability Rank	Building Exposure in Millions	Avg Annual Count	Expected Annual Count
Rock	83	$1,379	0.21	0.10
Lincoln	84	$635	0.26	0.15
Traverse	85	$323	0.28	0.17
Red Lake	86	$428	0.29	0.14
Cook	87	$2,018	0.06	0.01

Source: (NCEI, 2023)

Appendix M: Hail Vulnerability Ranking

County	Vulnerability Rank	Building Exposure in Millions	Avg Annual Count	Expected Annual Count
Hennepin	1	$226,787	7.71	2.15
Saint Louis	2	$27,025	6.63	3.11
Otter Tail	3	$9,148	6.46	3.82
Dakota	4	$79,526	4.12	1.93
Stearns	5	$20,670	6.00	2.75
Wright	6	$23,009	4.50	2.38
Anoka	7	$64,821	3.51	1.51
Washington	8	$53,817	2.72	1.29
Polk	9	$4,300	6.01	2.98
Cass	10	$6,081	3.37	2.73
Becker	11	$10,075	3.60	2.38
Ramsey	12	$88,890	3.22	0.56
Olmsted	13	$36,252	5.12	1.23
Scott	14	$29,101	3.31	1.25
Goodhue	15	$8,790	1.91	2.08
Carver	16	$23,584	2.62	1.34
Clay	17	$9,166	3.04	1.93
Beltrami	18	$5,108	4.37	2.26
Sherburne	19	$17,989	2.41	1.37
Itasca	20	$8,434	3.26	1.76
Crow Wing	21	$12,303	3.35	1.39
Morrison	22	$4,591	2.43	1.96
Rice	23	$9,173	2.29	1.53
Blue Earth	24	$9,529	2.44	1.40
Chisago	25	$10,526	1.06	1.14
Pine	26	$5,003	2.37	1.58
Marshall	27	$1,121	2.99	2.21
Kandiyohi	28	$5,685	2.74	1.49
Aitkin	29	$2,463	1.82	1.90
Douglas	30	$7,911	2.19	1.12
Hubbard	31	$5,807	2.32	1.31
Mower	32	$4,117	2.16	1.41
Isanti	33	$5,203	1.35	1.27
Mcleod	34	$4,463	3.57	1.35
Todd	35	$1,960	1.88	1.66
Meeker	36	$3,191	2.51	1.45
Winona	37	$5,038	2.81	1.19
Fillmore	38	$1,966	2.41	1.63
Renville	39	$1,638	2.57	1.66
Nobles	40	$2,020	2.97	1.58
Le Sueur	41	$3,456	1.41	1.27
Freeborn	42	$2,551	2.12	1.41
Martin	43	$2,435	1.96	1.34
Pope	44	$4,147	1.85	1.08
Sibley	45	$1,780	1.57	1.45
Steele	46	$4,907	0.99	0.95
Redwood	47	$1,797	2.07	1.38
Wabasha	48	$3,408	2.04	1.07
Jackson	49	$1,598	2.13	1.36
Nicollet	50	$3,971	1.43	0.94

County	Vulnerability Rank	Building Exposure in Millions	Avg Annual Count	Expected Annual Count
Faribault	51	$1,512	1.72	1.32
Norman	52	$550	2.19	1.56
Roseau	53	$2,391	3.53	1.09
Brown	54	$2,732	1.50	1.02
Benton	55	$3,379	1.53	0.91
Carlton	56	$4,802	1.66	0.70
Wilkin	57	$1,061	1.82	1.31
Houston	58	$2,748	1.15	0.94
Lyon	59	$1,831	3.35	1.10
Yellow Medicine	60	$1,357	1.38	1.16
Rock	61	$1,379	1.87	1.15
Dodge	62	$2,479	1.90	0.91
Murray	63	$798	1.53	1.27
Clearwater	64	$941	1.74	1.23
Kanabec	65	$2,678	1.15	0.83
Lac Qui Parle	66	$770	2.01	1.21
Koochiching	67	$1,396	2.15	1.01
Cottonwood	68	$1,079	1.85	1.09
Waseca	69	$1,999	1.57	0.88
Wadena	70	$1,939	2.22	0.85
Pipestone	71	$1,248	1.84	0.98
Chippewa	72	$1,663	1.49	0.88
Mille Lacs	73	$0	1.54	1.27
Lake	74	$3,265	0.81	0.52
Pennington	75	$1,921	1.44	0.73
Stevens	76	$1,189	1.68	0.85
Grant	77	$1,005	1.84	0.90
Kittson	78	$295	2.56	1.04
Swift	79	$96	1.40	1.11
Lincoln	80	$635	1.46	0.93
Mahnomen	81	$497	1.46	0.88
Watonwan	82	$1,002	1.28	0.72
Traverse	83	$323	1.26	0.87
Big Stone	84	$608	1.37	0.78
Lake of the Woods	85	$678	1.57	0.68
Red Lake	86	$428	1.59	0.55
Cook	87	$2,018	0.35	0.08

Source: (NCEI, 2023)

Appendix N: High Hazard Potential Dams

MN DNR Risk Prioritization for High Hazard Potential Dams

	Consequences				**Hydraulics and Hydrology (H&H)**	**Structural**
	Population At Risk (PAR)				% of In Design Flood (IDF)	Static stabilty criteria
	warning time				History of overtopping	*Observations (sinkholes, etc.)*
	loss of reservoir				*Spillway redundancy*	*Seepage history*
	Critial facilities down stream				*Condition of spillway*	*Instrumentation readings*
	Economic/ environmental				*Operational issues*	*Known design/construction issues*
	EAP current	consequences x-axis	likelihood y-axis	*+ additional considerations (subjective)*		*Operational issues*
	Consequences ***PAR***	Consequences ***Warning Time***	Consequences ***Economic Losses***	Consequences ***Environmental Losses***	likelihood ***H and H***	likelihood ***FOS, structural stability***
Very High	>100	Not sufficient	>$1B	Severe, permanent	10 or has overtopped	<1
High	>100	Some evacuation	$100M to $1B	Significant, long term	10-100 or has nearly overtopped	1 to 1.1
Moderate	10-100	Majority evacuated	$10M to $100M	Remediated, several years	100-1000 or close to overtopped	1.1 to 1.2
Low	1-10	Most evacuated	<$10M	Some, remediated	1000-PMP or not opertopped (choose worst for highest)	1.2 to 1.5
Example						
Dam A	Moderate	High	Low	Moderate	High	Moderate
Dam B	Moderate	Very High	Low	Moderate	Moderate	Moderate
Dam C	Moderate	Very High	Low	Moderate	Low	Moderate
Dam A - 100 year breach	PAR = 74 based on 37 impacted structures	less than 2 hours	Hwy XX and three township roads overtopped, crops	Woody wetlands and some deciduous forest	nearly overtopped	poor condition
Dam B - 500 year breach	PAR = 90 based on 45 structures impacted	1st structure reached within 5 minutes	Overtops Highway XXX, crops	Impacts to woody wetlands and deciduous forest around stream	100 year	poor condition
Dam C - 100 year breach	PAR = 50 based on over 20 structures, depths up to 10 feet (PMF = over 25	no times in reports - structures are within ~0.2 miles	Overtops US XX and Flood St., crops	Impacts to woody wetlands around stream	1000-PMP	poor condition
	Assume ave cost to replace:	V high				
	$200,000	high		Dam A		
		mod		Dam B		
		low		Dam C		

High Hazard Potential Dams from the National Inventory of Dams

County	Dam Name	NID ID	Federally Regulated Dam	Primary Purpose	River or Stream Name	NID Storage (Acre-Ft)	Condition Assessment	EAP Last Revision Date
Benton	Sartell	MN00505	Yes	Hydroelectric	Mississippi River	15,500	Fair	12/2/2022
Carlton	Thomson Dam No 3	MN00604	Yes	Hydroelectric	St Louis River	4,352	Satisfactory	12/31/2009
Carlton	Thomson Spillway Section 4	MN00604	Yes	Hydroelectric	St Louis River	4,352	Satisfactory	
Carlton	Thomson	MN00604	Yes	Hydroelectric	St Louis River	4,352	Fair	2/13/2023
Carlton	Thomson Dam No. 9	MN00604	Yes	Hydroelectric	St Louis River	4,352	Satisfactory	12/31/2009
Carlton	Thomson Dam No 2a & 2b	MN00604	Yes	Hydroelectric	St Louis River	4,352	Satisfactory	12/31/2009
Carlton	Thomson Dam No 10	MN00604	Yes	Hydroelectric	St Louis River	4,352	Satisfactory	12/31/2009
Carlton	Thomson Dam No 12	MN00604	Yes	Hydroelectric	St Louis River	4,352	Satisfactory	12/31/2009
Carlton	Thomson Dam No 5	MN00604	Yes	Hydroelectric	St Louis River	4,352	Satisfactory	12/31/2009
Carlton	Thomson Dam No 5-1/2	MN00604	Yes	Hydroelectric	St Louis River	4,352	Satisfactory	12/31/2009
Carlton	Thomson Dam No 11	MN00604	Yes	Hydroelectric	St Louis River	4,352	Satisfactory	12/31/2009
Carlton	Thomson Canal Dam	MN00604	Yes	Hydroelectric	St. Louis River	4,352	Satisfactory	12/31/2009
Carlton	Thomson Dam No 6	MN00604	Yes	Hydroelectric	St Louis River	4,352	Satisfactory	12/31/2009
Cass	Pillager	MN00608	Yes	Hydroelectric	Crow Wing	4,853	Fair	3/1/2022
Cass	Sylvan	MN00601	Yes	Hydroelectric	Crow Wing	9,216	Fair	3/1/2022
Chisago	Taylors Falls Wall	MN01694	No	Hydroelectric	St. Croix River	12,700	Satisfactory	12/1/2022

County	Dam Name	NID ID	Federally Regulated Dam	Primary Purpose	River or Stream Name	NID Storage (Acre-Ft)	Condition Assessment	EAP Last Revision Date
Clay	Fargo-Moorhead Diversion	MN01721	No	Flood Risk Reduction	Red River	512,000		
Crow Wing	Brainerd	MN00597	Yes	Hydroelectric	Mississippi River	13,000	Satisfactory	12/22/2022
Crow Wing	Pine River Dam - Dikes 13 and 14	MN00582	Yes	Fish and Wildlife Pond	PINE RIVER	187,700	Not Available	9/1/1990
Crow Wing	Pine River Dam	MN00582	Yes	Recreation	PINE RIVER	187,700	Not Available	
Dakota	Sunset Lake	MN01012	No	Flood Risk Reduction	Minnesota River-TR	200	Satisfactory	3/1/2016
Dakota	Lake Byllesby Perimeter Embankment	MN00514	Yes	Hydroelectric	Cannon River	24,000	Satisfactory	12/29/2020
Dakota	Lake Byllesby	MN00514	Yes	Hydroelectric	Cannon River	24,000	Satisfactory	12/22/2022
Fillmore	Lanesboro	MN00517	No	Hydroelectric	Root River South Branch	1,000	Satisfactory	4/28/2023
Kandiyohi	New London	MN00062	No	Recreation	Crow River Middle Fork	13,371	Satisfactory	1/25/2019
Kittson	Lake Bronson	MN00017	No	Flood Risk Reduction	Two Rivers South Branch	6,000	Poor	4/4/2023
Lac qui Parle	Lac Qui Parle Dam	MN00580	Yes	Flood Risk Reduction	MINNESOTA	122,800	Not Available	10/1/1995
Lake	Northshore Mining	MN01477	Yes	Tailings	Beaver R-TR OS	31,500		10/1/2014
Olmsted	South Zumbro Wr-4	MN00991	No	Flood Risk Reduction	Willow Creek-TR	968	Satisfactory	4/1/2015
Olmsted	South Zumbro Kr-6	MN01017	No	Flood Risk Reduction	Cascade Creek N Fork-TR	600	Satisfactory	4/1/2015
Olmsted	South Zumbro Sr-2	MN00989	No	Flood Risk Reduction	Silver Creek	3,276	Satisfactory	4/1/2015

County	Dam Name	NID ID	Federally Regulated Dam	Primary Purpose	River or Stream Name	NID Storage (Acre-Ft)	Condition Assessment	EAP Last Revision Date
Olmsted	South Zumbro Kr-3	MN00994	No	Flood Risk Reduction	Cascade Creek N Fork	257	Satisfactory	4/1/2015
Olmsted	South Zumbro Wr-6a	MN00990	No	Flood Risk Reduction	Willow Creek	1,696	Satisfactory	4/1/2015
Olmsted	South Zumbro Kr-7	MN00993	No	Flood Risk Reduction	Cascade Creek N Fork-TR	763	Satisfactory	4/1/2015
Olmsted	South Zumbro Br-1	MN00992	No	Flood Risk Reduction	Bear Creek	2,429	Satisfactory	4/1/2015
Otter Tail	Orwell Dam	MN00574	Yes	Flood Risk Reduction	OTTER TAIL RIVER	20,600	Not Available	2/1/1992
Ramsey	Battle Creek	MN01014	No	Flood Risk Reduction	Battle Creek	340	Satisfactory	3/1/2018
Redwood	Redwood Falls	MN00511	No	Hydroelectric	Redwood River	1,000	Satisfactory	4/1/2023
Rice	King'S Mill	MN00353	No	Recreation	Cannon River	25,500	Fair	3/13/2018
Sherburne	Elk River	MN00516	No	Recreation	Elk River	2,800	Satisfactory	1/7/2019
St. Louis	Hartley Pond	MN00004	No	Flood Risk Reduction	Tischer Creek	90		1/25/2018
St. Louis	Inland Steel Tailings	MN00670	No	Tailings	Wouri Creek-OS	14,500	Satisfactory	2/21/2020
St. Louis	Eveleth Taconite Tailings	MN00673	No	Tailings	St. Louis River-TR	2,419	Satisfactory	4/19/2022
St. Louis	Hibbing Taconite Tailings Basin	MN00665	No	Tailings	Day Brook	125,000	Satisfactory	6/30/2023
St. Louis	Hibbing Taconite Reclaim Pond	MN00666	No	Tailings	Shannon River-TR	75,000	Satisfactory	6/30/2023
St. Louis	Island Lake North Dike	MN00612	Yes	Hydroelectric	Cloquet River	177,000	Satisfactory	
St. Louis	Island Lake	MN00612	Yes	Hydroelectric	Cloquet River	177,000	Fair	2/13/2023

County	Dam Name	NID ID	Federally Regulated Dam	Primary Purpose	River or Stream Name	NID Storage (Acre-Ft)	Condition Assessment	EAP Last Revision Date
St. Louis	Fish Lake	MN00614	Yes	Hydroelectric	Beaver River	41,728	Satisfactory	2/13/2023
St. Louis	Fond Du Lac	MN00603	Yes	Hydroelectric	St Louis River	2,675	Satisfactory	2/13/2023
Stearns	St. Cloud	MN00506	Yes	Water Supply	Mississippi River	2,254	Satisfactory	3/7/2023
Traverse	White Rock Dam	MN00577	Yes	Flood Risk Reduction	BOIS DE SIOUX	95,500	Not Available	5/1/1995
Wabasha	Lake Zumbro	MN00358	No	Hydroelectric	Zumbro River	35,000	Satisfactory	8/1/2022
Yellow Medicine	Canby R-6	MN01015	No	Flood Risk Reduction	Canby Creek	900	Fair	5/1/2023
Yellow Medicine	Canby R-4a	MN01016	No	Flood Risk Reduction	County Ditch 19-TR	770	Satisfactory	5/1/2023
Yellow Medicine	Canby R-1	MN00972	No	Flood Risk Reduction	Canby Creek	6,100	Satisfactory	5/1/2023

Appendix O: 2019–2024 Update on Goals and Strategies

2019–2024 Update on Goals and Actions

Hazard/Mitigation Strategy	Update Since Approval of 2019 Plan
State Policy Recommendations: All Hazards/All Strategies	Goals for all of the strategies were updated to align with the Climate Action Framework. Goals were previously aligned with the 2017 ICAT recommendations and needed to be revised based on new state priorities. Additionally, MCAP's new Minnesota CliMAT—Climate Mapping and Analysis Tool (CMIP6) was added as a resource.

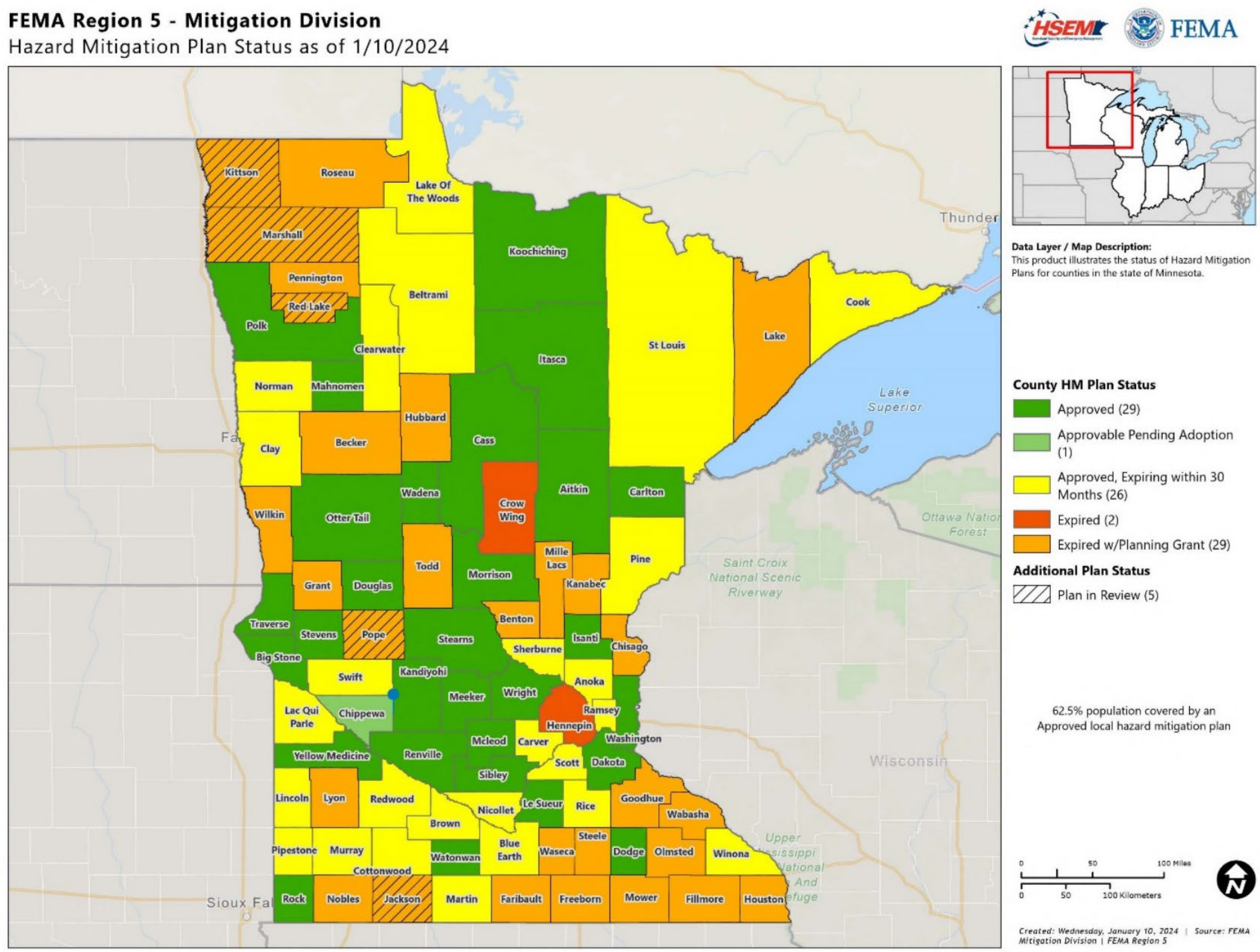
2019–2024 Update on Actions

Hazard/Mitigation Strategy	Mitigation, Resilience, and Climate Adaptation Actions	Status
Flood Goal/Technical Assistance, Tools, and Data	Implement the use of high-resolution, dynamically downscaled climate projections for planning and design efforts across Minnesota. (State action step under CAF 3.1.1) 2021 Legislature funded development of MN CliMAT tool. https://app.climate.umn.edu/	Ongoing/ *Revised
	Modify infrastructure and update state floodplain management rules for critical facilities, mitigate risk in areas beyond current FEMA-mapped floodplain areas, and encourage no-net-loss of floodplain storage in response to projected climate conditions. Create resilient design standards for building and updating critical facilities and infrastructure. (State action step under CAF 3.3.2)	New
Flood Goal/State Policy	Adopt resiliency provisions in codes, permits, and policies for new construction, rehabilitation, and adaptive reuse, and create resilient design standards that also maximize material reuse when possible. (State action step under CAF 3.3.1)	Ongoing/ *Revised
	Implement the 2020 State Water Plan. Updated every five years, the current plan's focus is how to best prepare for the impact of climate change on Minnesota's water resources. Prioritize the strategies identified to achieve the 2020 State Water Plan's five primary goals: (1) Ensure drinking water is safe and sufficient; (2) Manage landscapes to protect and improve water quality; (3) Manage landscapes to hold water and reduce runoff; (4) Manage built environments and infrastructure for greater water resiliency; (5) Promote resiliency in quality of life. (State actions steps under CAF 3.2.3)	Ongoing/ *Revised
	#4 Require incorporation of water-sensitive infrastructure—such as protection of natural areas, development of green infrastructure, and minimization of impervious areas to treat both water quality and quantity—all in comprehensive plans and watershed plans	Deleted

	Increase water storage, infiltration, and drainage management to reduce runoff and minimize downstream flooding, erosion, and habitat loss. (State action step under CAF 2.4.2)	New
	Restore natural stream stability where possible to reduce erosion, increase habitat diversity, and decrease maintenance and infrastructure costs. (State action step under CAF 2.4.2)	New
	Assist local government units with identifying and prioritizing locations for water storage as part of watershed planning, emphasizing practices such as wetland and floodplain restoration, drainage water management, and buffer establishment. (State action step under CAF 2.4.2)	New
	Encourage multipurpose drainage design and retrofitting that provides adequate drainage capacity while reducing downstream peak flows, erosion, and sedimentation, and improving water quality and aquatic habitat. (State action step under CAF 2.4.2)	New
	Modify infrastructure and update state floodplain management rules for critical facilities, mitigate risk in areas beyond current FEMA-mapped floodplain areas, and encourage no-net-loss of floodplain storage in response to projected climate conditions. Create resilient design standards for building and updating critical facilities and infrastructure. (State action step under CAF 3.3.2)	Ongoing/ *Revised
	Expand funding and staff resources for the assessment, data monitoring and analysis, planning, design and implementation of adaptation and resiliency projects. Prioritize the use of state bonding funds in support of resilient infrastructure, including water quantity projects, and seek federal funding to address climate vulnerabilities and strengthen resilience. Use existing revolving loan funds and created new public/private resilience financing such as green banks, and other financial tools to provide additional funds. (State action steps under CAF 3.1.2)	Ongoing/ *Revised
	Adopt new statewide policies that promote reuse of water	Deleted
Flood Goal/Structure & Infrastructure Projects	Assess vulnerabilities of critical facilities and structures and use climate projections to identify ways to ensure continuity of operations (State action step under CAF 3.3.2).	Ongoing/ *Revised
Extreme Temperature (Heat/Cold) Goal/Local Planning & Awareness	Provide funding and technical assistance to help communities reduce their urban heat islands, prioritizing disproportionately impacted communities (State action step under CAF 3.3.4).	Ongoing/ *Revised
	Encourage the development of resilience hubs which provide and coordinate culturally sensitive, multilingual services to better meet the needs of diverse groups of community members in response to extreme heat and other climate-driven impacts. (State action step under CAF 3.3.4)	New

**Revised actions were updated from the 2017 ICAT recommendations to align with the MN Climate Action Framework*

Appendix P: Plan Status



Appendix Q: Local Planning Capabilities

Planning Capabilities Referenced in Local Plans

Jurisdiction	Emergency Response/Management Plan	Water / Watershed Management Plan	Comprehensive Plan	Land-use Plan	Pandemic or Public Health Incident Response Plan	National Flood Insurance Program (NFIP)	Wellhead Protection Plan	Capital Improvement Plan	Contingency Plan	Fire Plan	Forest Management Plan
(Percentage of counties with capability)	88%	94%	76%	55%	42%	93%	48%	54%	25%	36%	6%
Aitkin		X			X	X				X	X
Anoka	X	X	X	X	X	X		X		X	
Becker	X	X	X	X		X		X	X	X	
Beltrami	X	X	X	X	X	X		X		X	
Benton	X	X	X	X		X	X	X			X
Big Stone		X	X								
Blue Earth	X	X		X	X	X	X	X	X	X	
Boise Forte	X				X				X	X	
Brown	X	X	X	X	X	X	X	X			
Carlton	X	X	X	X	X	X	X	X		X	
Cass	X	X	X	X	X	X		X	X	X	X
Chippewa	X	X	X	X	X	X	X	X	X	X	
Chisago	X	X	X			X			X	X	
City of Rochester	X	X	X	X	X	X	X	X	X	X	X
Clay	X	X	X	X		X		X	X		
Clearwater	X	X	X		X	X	X	X	X		X
Dakota	X	X	X		X	X	X	X			
Douglas	X	X	X	X	X	X	X	X	X	X	
Faribault	X	X	X	X		X	X	X			
Fillmore	X		X	X		X					
Fond Du Lac	X	X		X			X			X	X
Goodhue	X	X	X			X		X			
Grant	X	X	X			X	X	X			
Houston		X	X					X			
Hubbard	X	X	X			X		X			
Isanti	X	X	X			X	X				
Itasca		X				X		X		X	
Jackson	X	X	X	X	X	X	X	X			

Jurisdiction	Emergency Response/Management Plan	Water / Watershed Management Plan	Comprehensive Plan	Land-use Plan	Pandemic or Public Health Incident Response Plan	National Flood Insurance Program (NFIP)	Wellhead Protection Plan	Capital Improvement Plan	Contingency Plan	Fire Plan	Forest Management Plan
Kanabec	X	X	X		X	X	X			X	
Kandiyohi	X	X	X	X	X	X					
Kittson	X	X		X		X					
Koochiching	X	X		X		X				X	
Lake	X	X	X	X	X					X	
Lake of the Woods	X	X	X	X		X		X			
Leech Lake Band of Ojibwe		X				X				X	
LeSueur	X	X	X	X	X	X	X	X			
Lyon	X	X	X	X	X	X		X	X	X	
Mahnomen		X	X	X		X		X		X	
Marshall	X	X				X					
Martin	X	X	X	X		X					
McLeod	X	X	X	X	X	X		X			
Meeker	X	X	X	X	X	X		X			
Mille Lacs	X	X	X		X	X	X		X	X	
Mille Lacs Band of Ojibwe	X		X	X	X		X	X			
Morrison	X	X		X		X	X				
Mower	X	X		X	X				X		
Nicollet	X	X	X	X		X					
Norman	X	X			X	X			X		
Olmsted	X	X	X	X		X	X	X	X		
Pennington	X	X	X			X	X		X	X	
Pine	X	X			X	X	X			X	
Polk	X	X		X		X				X	
Pope	X	X		X	X	X		X			
Prairie Island Indian comm	X			X		X				X	
Red Lake	X	X	X			X	X	X			
Renville		X	X	X	X		X				
Rock	X	X	X	X	X	X	X				
Roseau	X	X	X			X		X			
Scott	X	X	X			X		X			
Sherburne	X		X			X			X		
Sibley	X					X		X			
St. Louis	X					X	X		X	X	
Stearns	X	X	X			X	X				

Jurisdiction	Emergency Response/Management Plan	Water / Watershed Management Plan	Comprehensive Plan	Land-use Plan	Pandemic or Public Health Incident Response Plan	National Flood Insurance Program (NFIP)	Wellhead Protection Plan	Capital Improvement Plan	Contingency Plan	Fire Plan	Forest Management Plan
Steele	X	X	X			X	X	X			
Stevens	X	X	X	X	X	X	X			X	
Traverse	X	X				X	X				
Upper Sioux Com.	X	X	X		X	X	X			X	
Wabasha	X	X				X	X	X			
Wadena	X	X	X	X		X	X				
Waseca		X	X	X		X					
Watonwan		X	X			X					
White Earth Res.	X	X	X	X	X	X					
Wilkin	X	X	X			X	X				
Wright	X	X	X			X	X	X		X	
Yellow Medicine	X	X	X	X	X	X	X	X	X	X	

Local Policy and Staff Capabilities Referenced in Local Plans

Jurisdiction	Land Use, Planning, & Zoning Ordinance	Floodplain & Soil Erosion Ordinance	Building Code	Subdivision Ordinance	Methamphetamine Lab Ordinance	Fire Code	Emergency Mgmt. Director	Mapping Specialist (GIS)	Public Health Coordinator/Department	Sheriff/Police Department	MN Department of Natural Resources	Soil and Water Conservation District	Public Works / Utility	Schools
Percentage of counties with capability	97%	84%	69%	52%	25%	28%	100%	36%	84%	82%	27%	51%	66%	64%
Aitkin	X	X	X				X			X			X	X
Anoka	X	X	X	X			X	X		X			X	
Becker	X	X	X				X		X	X	X	X		X
Beltrami	X	X	X		X		X		X	X	X	X	X	X
Benton	X	X	X	X			X	X	X	X	X	X	X	X
Big Stone	X	X	X				X		X	X	X	X		
Blue Earth	X	X	X	X			X	X	X	X	X	X	X	

Jurisdiction	Land Use, Planning, & Zoning Ordinance	Floodplain & Soil Erosion Ordinance	Building Code	Subdivision Ordinance	Methamphetamine Lab Ordinance	Fire Code	Emergency Mgmt. Director	Mapping Specialist (GIS)	Public Health Coordinator/Department	Sheriff/Police Department	MN Department of Natural Resources	Soil and Water Conservation District	Public Works / Utility	Schools
Boise Forte						X	X		X	X			X	
Brown	X	X	X	X		X	X	X	X	X	X			
Carlton	X	X	X	X		X	X	X	X	X	X		X	X
Cass	X	X	X			X	X		X	X			X	X
Chippewa	X	X	X				X		X	X	X	X	X	X
Chisago	X		X	X		X	X		X					X
City of Rochester	X	X	X				X	X	X	X	X	X	X	X
Clay	X	X	X			X	X	X	X				X	X
Clearwater	X	X	X		X		X		X			X		
Dakota	X	X	X	X		X	X	X		X		X	X	
Douglas	X	X	X	X	X	X	X		X	X	X	X	X	X
Faribault	X	X					X		X	X				X
Fillmore	X		X	X			X		X	X		X	X	X
Fond Du Lac	X	X	X			X	X						X	
Goodhue	X	X	X	X			X	X				X	X	X
Grant	X	X		X			X			X		X		X
Houston	X	X		X			X		X	X				
Hubbard	X	X		X			X		X	X	X	X	X	X
Isanti	X	X	X	X			X		X	X			X	X
Itasca		X	X	X			X	X	X	X	X	X	X	X
Jackson	X	X	X	X	X		X	X		X		X	X	
Kanabec	X	X			X		X		X	X	X	X		X
Kandiyohi	X	X	X			X	X		X	X				
Kittson	X	X	X	X			X		X			X		X
Koochiching	X	X		X	X		X		X	X	X	X	X	
Lake	X		X	X	X		X		X	X	X		X	X
Lake of the Woods	X	X	X				X		X	X		X	X	X
Leech Lake Band of Ojibwe	X		X				X			X				
LeSueur	X	X	X			X	X	X	X	X			X	
Lyon	X	X			X	X	X	X	X	X			X	
Mahnomen	X	X	X				X		X	X	X	X	X	X
Marshall	X						X		X	X			X	X
Martin	X	X	X			X	X		X	X			X	
McLeod	X	X		X	X		X	X	X			X		X

Jurisdiction	Land Use, Planning, & Zoning Ordinance	Floodplain & Soil Erosion Ordinance	Building Code	Subdivision Ordinance	Methamphetamine Lab Ordinance	Fire Code	Emergency Mgmt. Director	Mapping Specialist (GIS)	Public Health Coordinator/Department	Sheriff/Police Department	MN Department of Natural Resources	Soil and Water Conservation District	Public Works / Utility	Schools
Meeker	X	X	X	X	X	X	X		X	X		X	X	X
Mille Lacs	X	X	X		X		X		X	X				X
Mille Lacs Band of Ojibwe							X	X						
Morrison	X	X	X	X			X	X	X	X	X	X	X	X
Mower	X	X	X				X		X	X	X	X	X	X
Nicollet	X	X		X		X	X		X	X				X
Norman	X	X	X			X	X	X	X	X			X	X
Olmsted	X	X	X	X			X	X	X			X	X	X
Pennington	X	X	X	X		X	X		X			X		X
Pine	X	X	X		X		X		X	X			X	X
Polk	X		X	X			X		X	X			X	
Pope	X	X		X	X		X		X	X			X	X
Prairie Island Indian comm	X		X		X	X	X							
Red Lake	X		X				X			X		X	X	X
Renville	X				X		X		X	X			X	
Rock	X	X					X		X	X				
Roseau	X	X	X				X		X	X		X		X
Scott	X	X	X	X			X	X	X	X				
Sherburne	X	X	X	X			X			X				
Sibley	X	X					X	X	X	X			X	X
St. Louis	X		X	X			X	X	X	X	X	X	X	
Stearns	X					X	X		X	X				X
Steele	X	X		X		X	X	X					X	
Stevens	X	X	X		X		X	X	X	X		X	X	X
Traverse	X	X					X					X		X
Upper Sioux Com.		X			X		X		X	X				
Wabasha	X	X		X			X	X	X					
Wadena	X	X	X	X	X	X	X		X	X				X
Waseca			X				X	X	X	X			X	
Watonwan	X						X			X		X	X	
White Earth Res.	X	X	X				X	X	X					X
Wilkin	X	X		X			X		X	X		X	X	
Wright	X	X		X	X	X	X	X	X			X	X	X

Jurisdiction	Land Use, Planning, & Zoning Ordinance	Floodplain & Soil Erosion Ordinance	Building Code	Subdivision Ordinance	Methamphetamine Lab Ordinance	Fire Code	Emergency Mgmt. Director	Mapping Specialist (GIS)	Public Health Coordinator/Department	Sheriff/Police Department	MN Department of Natural Resources	Soil and Water Conservation District	Public Works / Utility	Schools
Yellow Medicine	X	X	X				X		X	X			X	X

Appendix R: State Hazard Mitigation Planning Tool

Appendix S: References

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Annex 1: Rural Electric Cooperative

See next page.

Minnesota All Hazard Mitigation Plan – Rural Electric Cooperative Annex

Introduction

Electric cooperatives are private, locally operated, not-for-profit electric utility businesses that serve approximately 1.7 million Minnesotans and serve consumers in every county of Minnesota. Electric cooperatives were originally formed to serve rural areas of the United States. Today, electric cooperatives are most likely to serve residential consumers than commercial and industrial consumers. By operating and maintaining over 135,250 miles of power lines, electric cooperatives are often subjected to natural hazards that can disrupt electrical service to the end consumer.

From 2013 – 2022 electric cooperatives in Minnesota have received funding for natural disaster recovery efforts for 11 different events. Historically, electric cooperatives are vulnerable to natural hazards are often times the electric cooperative's infrastructure damage costs make the county eligible for a Presidentially Declared Disaster. With the frequency of more extreme weather events, the need for electric cooperatives to incorporate mitigation efforts into their infrastructure is critical to maintain electric service to the end consumer.

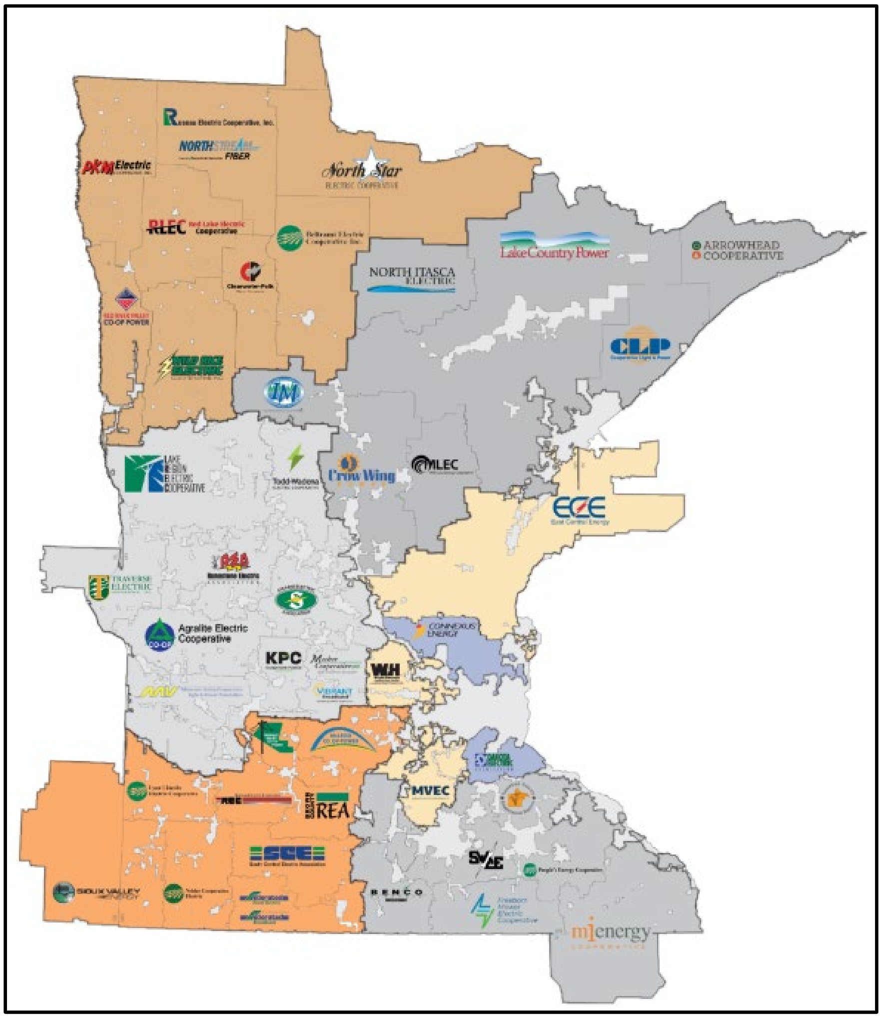
Table 1 Ten-Year History of Declared Disasters Affecting Electric Cooperatives

ID	Type	Date
DR-4722-MN	Severe Storms and Flooding	April 11, 2023 – April 30, 2023
DR-4666-MN	Severe Storms, Straight-line Winds, Tornados and Flooding	May 29, 2022 – May 30, 2022
DR-4659-MN	Severe Storms, Straight-line Winds, and Flooding	April 22, 2022 – June 15, 2022
DR-4658-MN	Severe Storms, Straight-line Winds, Tornados and Flooding	May 8, 2022 – May 13, 2022
DR-4442-MN	Severe Winter Storm, Straight-line Winds and Flooding	March 12, 2019 – April 28, 2019
DR-4414-MN	Severe Storms and Flooding	October 9, 2018 – October 11, 2018
DR-4390-MN	Severe Storms, Straight-line Winds, Tornados and Flooding	June 15, 2018 – July 12, 2018
DR-4290-MN	Severe Storms and Flooding	September 21, 2016 – September 24th, 2016
DR-4182-MN	Severe Storms, Straight-line Winds, Flooding, Landslides and Mudslides	June 11, 2014 – July 11, 2014
DR-4131-MN	Severe Storms, Straight-line Winds and Flooding	June 20, 2013 – June 26, 2013
DR-4113-MN	Severe Winter Storm	April 9, 2013 – April 11, 2013

Minnesota Cooperatives

There are forty-four electric distribution cooperatives and six generation and transmission (G&T) cooperatives that serve consumers in Minnesota. The G&T cooperatives generate or obtain power to transmit to their member-cooperatives and customers. The distribution cooperatives purchase wholesale power and distribute the power to the end users, the cooperative member. Additionally, many distribution cooperatives also offer broadband services in rural areas of the state and maintain communication infrastructure.

Figure 1 Minnesota Distribution Electric Cooperatives



Plan Participants

Of the 51 electric cooperatives in Minnesota, 47 cooperatives provided direct input to the Rural Electric Cooperative Annex of the Minnesota All Hazard Mitigation Plan. In addition, 52% of the electric cooperatives also participated in either the local counties' or cities' Hazard Mitigation Plan or Climate Mitigation Plan. The distribution cooperative participants serve all or portions of all the 87 counties in

Minnesota. Together, the distribution cooperatives planning effort is for over 125,000 miles of power line with the G&T cooperatives planning efforts addressing over 10,000 miles of transmission line and assets.

The following table lists the participating cooperatives, the counties in which they operate, miles of power line and number of accounts served.

Table 2 Electric Cooperatives Participation and Service Area

Cooperative Name	Serving Counties Of	Miles of Power Line	Number of Accounts	Percent of System Overhead
Agralite Electric Cooperative	Big Stone, Pope, Stevens, Swift	2,430	5,294	52%
Arrowhead Cooperative, Inc.	Cook, Lake	557	4,371	60%
Basin Electric Power Cooperative	Generation & Transmission Provider	2,500+	131 distribution cooperatives	100%
Beltrami Electric Cooperative	Beltrami, Cass, Clearwater, Hubbard, Itasca, Koochiching	3,553	21,937	26%
BENCO Electric Cooperative	Blue Earth, Brown, Faribault, Freeborn, Le Sueur, Martin, Nicollet, Sibley, Waseca, Watonwan	3,635	20,014	76%
Brown County Rural Electric Association	Brown, Blue Earth, Cottonwood, Nicollet, Redwood, Renville, Sibley, Watonwan	1,525	4,541	52%
Clearwater-Polk Electric Cooperative, Inc.	Beltrami, Clearwater, Hubbard, Mahnomen, Polk	1,504	4,380	89%
Connexus Energy	Anoka, Chisago, Hennepin, Isanti, Mille Lacs, Ramsey, Sherburn, Washington	9,310	140,985	32%
Cooperative Light & Power Association	Lake, St. Louis	1,018	6,370	54%
Crow Wing Power	Cass, Crow Wing, Morrison	5,574	39,637	46%
Dairyland Power Cooperative	Generation & Transmission Provider	3,197	24 distribution cooperatives	100%
Dakota Electric Association	Dakota, Goodhue, Rice, Scott	4,273	112,000	27%
East Central Energy[1]	Aitkin, Benton, Carlton, Chisago, Isanti, Kanabec, Mille Lacs, Morrison, Pine, Sherburne, Washington	8,472	63,422	59%
East River Electric Power Cooperative	Generation & Transmission Provider	3,259	25 distribution cooperatives	100%
Federated Rural Electric Association	Jackson, Martin	2,463	6,904	64%
Freeborn Mower Electric Cooperative	Freeborn, Mower	2,962	21,104	59%
Goodhue County Cooperative Electric Association	Dakota, Dodge, Goodhue, Olmsted, Rice, Wabasha	1,341	5,240	66%
Great River Energy	Generation & Transmission Provider	4,819	27 distribution cooperatives	100%
Iowa Lakes Electric Cooperative[2]	Martin	4,827	12,882	74%

[1] East Central Energy numbers also include power line and consumers served in Wisconsin.
[2] Iowa Lakes Electric Cooperative's numbers also include power line and consumers served in Iowa. There are only 6 Minnesota services served by this electric cooperative.

Itasca-Mantrap Cooperative Electrical Association	Becker, Cass, Clearwater, Hubbard, Wadena	2,143	12,341	43%
Kandiyohi Power Cooperative	Chippewa, Kandiyohi, Stearns	1,623	8,851	37%
L & O Power Cooperative	Generation & Transmission Provider	195	4 distribution cooperatives	100%
Lake Country Power	Aitkin, Carlton, Cass, Itasca, Koochiching, Lake, Pine, St. Louis	8,377	50,607	74%
Lake Region Electric Cooperative	Becker, Clay, Douglas, Grant, Otter Tail, Wilkin	5,842	29,565	70%
Lyon-Lincoln Electric Cooperative, Inc.	Lincoln, Lyon, Yellow Medicine	1,670	3,916	63%
McLeod Cooperative Power Association	Carver, Kandiyohi, McLeod, Meeker, Renville, Sibley, Wright	1,921	6,975	73%
Meeker Cooperative Light & Power Association	Kandiyohi, McLeod, Meeker, Renville, Stearns, Wright	1,946	7,885	57%
MiEnergy Cooperative[3]	Fillmore, Houston, Mower, Omstead, Winona	5,697	23,293	86%
Mille Lacs Energy	Aitkin, Crow Wing, Mille Lacs	2,002	13,527	59%
Minnesota Valley Cooperative Light & Power Association	Chippewa, Lac qui Parle, Lincoln, Lyon, Redwood, Renville, Swift, Yellow Medicine	3,037	5,325	88%
Minnesota Valley Electric Cooperative	Blue Earth, Carver, Dakota, Hennepin, Le Sueur, Scott, Sibley, Waseca	4,146	44,835	47%
Minnkota Power Cooperative, Inc.	Generation & Transmission Provider	3,350	11 distribution cooperatives	100%
Nobles Cooperative Electric	Murray, Nobles	2,278	6,957	45%
North Itasca Electric Cooperative, inc.	Beltrami, Itasca, Koochiching	1,351	5,504	57%
North Star Electric Cooperative	Koochiching, Lake of the Woods, Roseau, St. Louis	1,459	5,554	67%
People's Energy Cooperative	Dodge, Fillmore, Mower, Olmsted, Wabasha, Winona	2,868	24,425	73%
PKM Electric Cooperative	Kittson, Marshall, Polk	2,298	3,961	71%
Red Lake Electric Cooperative, Inc.	Marshal, Pennington, Polk, Red Lake	2,626	4,381	88%
Red River Valley Cooperative Power Association	Clay, Norman, Polk	1,792	4,779	61%
Redwood Electric Cooperative	Brown, Lyon, Redwood	1,329	4,480	73%
Renville-Sibley Cooperative Power Association	Chippewa, Kandiyohi, Redwood, Renville, Sibley	1,026	1,884	68%
Roseau Electric Cooperative, Inc.	Beltrami, Lake of the Woods, Marshall, Roseau	2,175	6,650	83%
Runestone Electric Association	Douglas, Grant, Otter Tail, Pope, Stearns, Stevens, Todd	2,998	15,000	63%
Sioux Valley Energy[4]	Pipestone, Rock	6,132	28,016	38%
South Central Electric Association	Blue Earth, Brown, Cottonwood, Jackson, Martin, Murray, Redwood, Watonwan	2,467	5,933	49%
Stearns Electric Association	Douglas, Kandiyohi, Morrison, Pope Stearns, Todd	4,193	27,967	62%
Steele-Waseca Cooperative Electric	Blue Earth, Dodge, Faribault, Freeborn, Goodhue, Le Sueur, Rice, Steele, Waseca	2,205	11,693	81%

[3] MiEnergy Cooperative's numbers also include power line and consumers served in Iowa.
[4] Sioux Valley Energy's numbers also include power line and consumers served in South Dakota.

Todd-Wadena Electric Cooperative	Becker, Cass, Douglas, Hubbard, Morrison, Otter Tail, Todd, Wadena	2,290	9,300	79%
Traverse Electric Cooperative, Inc.[5]	Big Stone, Grant, Stevens, Traverse, Wilkin	1,747	3,192	66%
Wild Rice Electric Cooperative, Inc.	Becker, Clay, Clearwater, Mahnomen, Norman, Polk	4,014	14,617	87%
Wright-Hennepin Cooperative Electric Association	Hennepin, Wright	4,200	57,501	43%

Plan Development

The State of Minnesota has put renewed emphasis on the evolution of low-carbon grid with high resiliency with new policies towards electric utilities. To complement the State's plans, the electric cooperatives of Minnesota collaborated to create a planning document specific to natural hazard damage mitigation. Contribution from the various generation, transmission and distribution electric cooperative entities included participation in surveys, meetings and conferences regarding resiliency of the electric grid.

Benefits of Hazard Mitigation Planning

A cooperative hazard mitigation approach that includes Minnesota Homeland Security and Emergency (HSEM) and electric cooperatives will result in a consensus on action plans to reduce or eliminate long-term risks to human life and property from natural hazards.

This plan is intended to:

- Increase awareness of risks and utility infrastructure vulnerabilities to natural hazards
- Establish hazard mitigation goals
- Identify strategies to help implement mitigation measures
- Establish priorities for the use of cooperative and public resources to increase resiliency
- Enable cooperatives, as sub-applicants, to seek hazard mitigation funding from the Federal Emergency Management Agency (FEMA)
- Improve recovery efforts related to natural hazards
- Minimize public safety concerns and power supply disruptions to consumers served by electric cooperatives

Planning Overview

The Minnesota Rural Electric Association (MREA) initiated updating the Rural Electric Cooperative Annex as the document had not been updated since 2014. With changes in the type and frequency of natural hazards, there was value to meet with Minnesota HSEM and individual cooperatives for feedback for an effective hazard mitigation plan for electric cooperatives.

Input from HSEM, MREA and individual electric cooperatives was sought in multiple methods ranging from meetings, an online survey, conferences and a review of the draft plan. The 2023 Rural Electric

[5] Traverse Electric Cooperative's numbers also include power line and consumers served in North Dakota and South Dakota.

Cooperative Annex was included with the Minnesota State Hazard Mitigation Plan filed with FEMA in 2023.

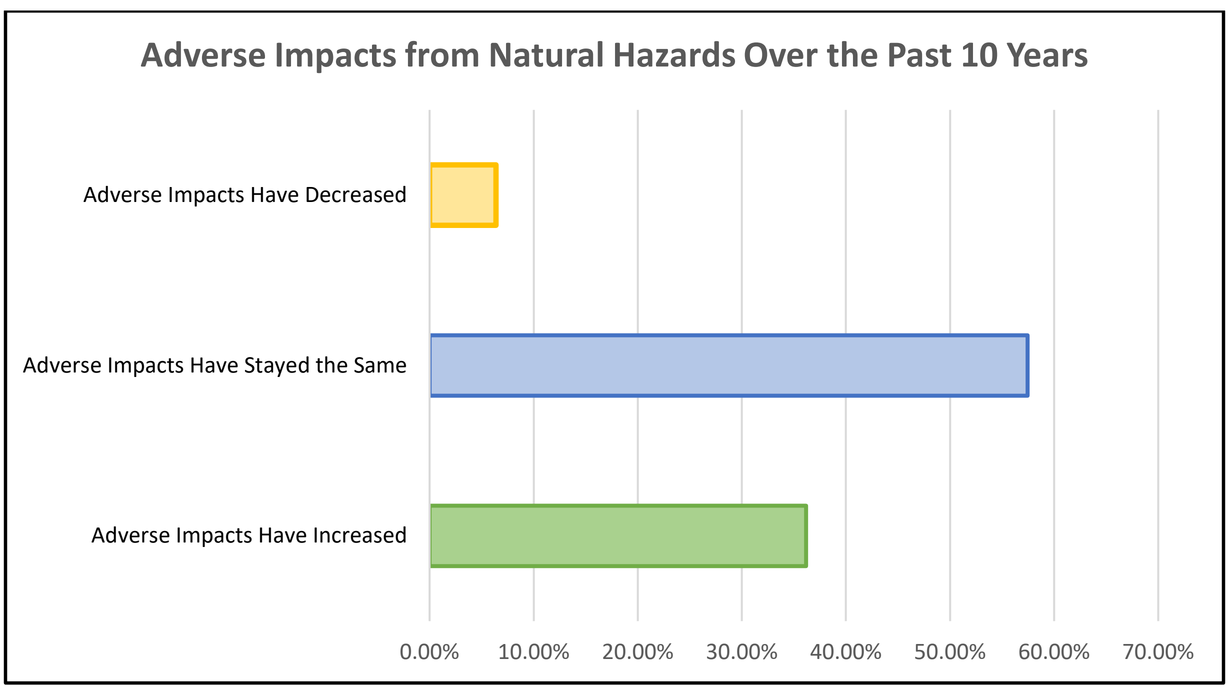
Table 3 Time of Feedback Events

Date	Discussion Topic	Participants
6/15/2023	Updating the Rural Cooperative Electric Annex	MN HSEM, MN Commerce, MREA
6/29/2023	Revision to the Electric Cooperative Survey	MN HSEM, MN Commerce, MREA
8/02/2023	Online Survey	MREA, electric cooperatives
8/29/2023	Review of Survey Results	MREA, MN Commerce, MN HSEM
9/27/23	Presentation of Rural Cooperative Electric Annex	MREA, electric cooperatives
10/02/2023	Review of Draft Updated Rural Cooperative Electric Annex	MN HSEM, MN Commerce, MREA
January 2024	Pre-Hazard Mitigation Education Session	MN HSEM, electric cooperatives, MREA

Hazard Concerns

Various natural hazards have adverse impact on the electrical grid. For Minnesota, the natural hazards with the most adverse impact are flooding, tornados, wildfires, windstorms and winter storms. The type of damages and the length to repair the damages from these natural hazards can vary. In addition, the likelihood of where the type of natural hazards occur in Minnesota varies throughout the state.

Figure 2 Adverse Impacts from Natural Hazards Survey Responses



47 Responses from 2023 Electric Cooperative Natural Hazard Survey

From the 2023 Electric Cooperative Survey 95.4% of the respondents stated that adverse impacts from natural hazards have either increased or stayed the same during the past ten years. For electric cooperatives in Minnesota, the main types of natural hazards are flooding, windstorms, winter storms, tornados and wild fires.

Flooding

Flooding occurrences can happen throughout the state of Minnesota and have a negative effect on electrical infrastructure. Flooding with flowing waters can cause erosion around power poles and underground cable. The erosion around the electrical infrastructure can cause power poles to significantly lean causing strain on the conductor which may cause power outages. Additionally, erosion caused by running waters can remove the soil around underground electrical cables, creating a potential hazard to the public. In general, flooding doesn't cause a significant amount of power outages, but is can cause a significant amount of electrical infrastructure to require repair after the flood waters recede.

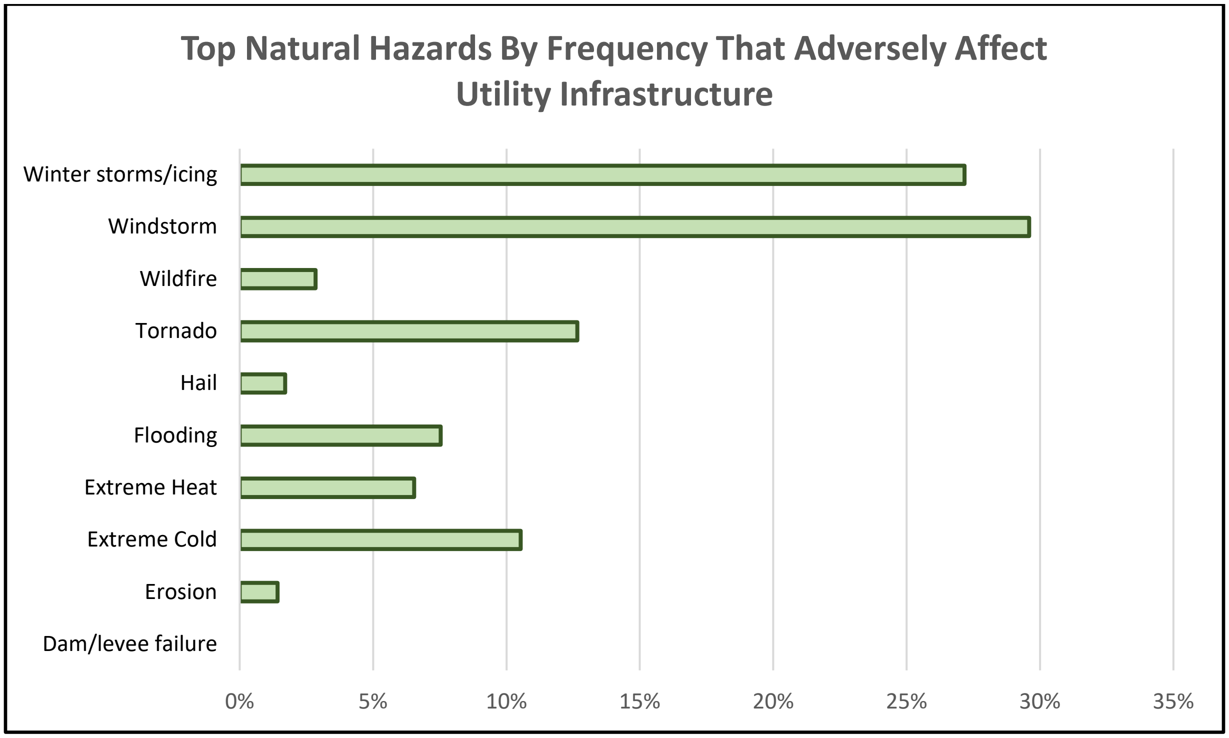
Electrical infrastructure located in flood plains are most susceptible to damage from a flooding event. With Minnesota having multiple river systems, flooding can occur throughout the state with a heavier prevalence in the areas of the Red River Valley, Minnesota River Valley, Mississippi River and its tributaries. Nine of the ten federally declared natural hazard disasters in Minnesota during the past ten years had a flooding component as the cause for the disaster.

Windstorms

Strong windstorms can have a significantly detrimental impact to overhead electrical lines. In Minnesota, there is a risk of straight-line winds typically coupled with severe thunderstorms, winter storms and potentially tornados. Most recently, multiple windstorms affected central Minnesota in 2022 causing three declared disaster events. These events resulted in week-long power outages to some consumers due to the large amount of widespread damage.

Windstorms can occur year-around throughout Minnesota and are the leading cause for natural hazard electrical system damage. Typically, the damage caused by windstorms are coupled with other weather events occurring at the same time such as winter storms and tornados. While heavily vegetated areas can compound damages caused by windstorms, often areas with little vegetation are significantly damaged as there is little windbreak to buffer the effect from the storms. Windstorms have been a part of ten federally declared disasters in Minnesota in the past ten years. Similarly, the majority of electric cooperatives ranked windstorms as the most frequent natural hazard that affects the electrical grid.

Figure 3 Ranked Natural Hazards by Frequency Survey Responses

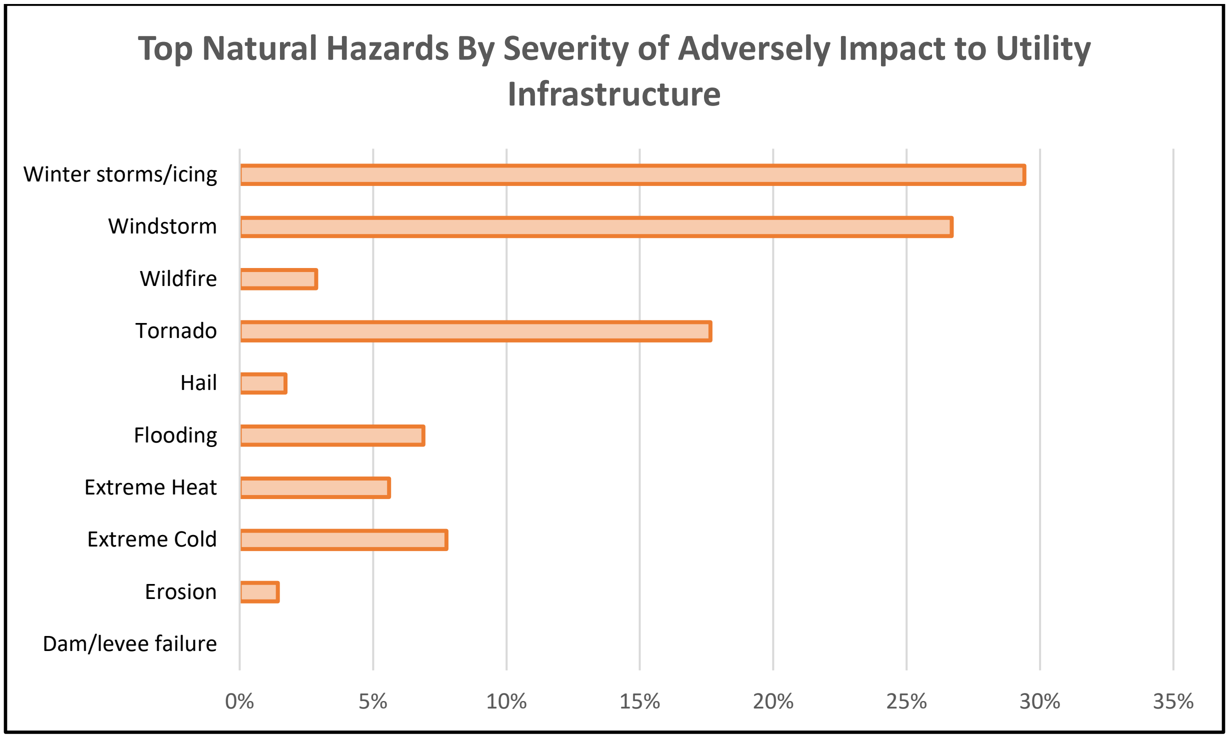


47 Respondents ranked their top five natural hazards that caused frequent adverse damage to electric infrastructure.

Winter Storms

Some of the longest duration power outages are caused by winter storms due to the widespread impact this type of event can have. Typically, the southern third of Minnesota is at risk for damage from severe winter storms due to the icing that can occur on the overhead power lines and structures. The last major winter storm occurring in March 2019 caused in part by a bomb cyclone that formed over the Plains of the United States. In the past ten years, severe winter storms that reach the level of a federal disaster occurred twice in 2013 and 2019. From the 2023 Electric Cooperative Survey, winter storms were ranked the highest in being most adversely impactful to utility infrastructure by 68% of respondents.

Figure 4 Ranked Natural Hazards by Severity Survey Responses



47 Respondents ranked their top five natural hazards that caused the most severe adverse damage to electric infrastructure.

Tornados

Tornadic activity in Minnesota can be sporadic although all regions of the state are affected. Minnesota experiences 30 – 50 tornados annually. Most of the tornados occur between May – September although in 2021 southern Minnesota experienced 22 tornadoes in the middle of December. The majority of the tornados are EF-0 or EF-1 classification. EF-4 and EF- 5 tornados are rare with only one EF-4 tornado having occurred since 2013.

Like windstorms, tornadic events cause significant damage to overhead electrical power lines. In addition, tornadic activity can also affect electrical substations which can lead to long term power outages. Unlike the widespread damages of windstorms, tornadic activity is typically concentrated to smaller areas, limiting the overall impact of the natural hazard event.

Wildfire

Wildfires are a less common natural hazard that occurs in Minnesota. Historically the significant wildfire events have been limited to the northeast region of Minnesota in heavily forested areas. Both overhead and underground electrical infrastructure can be affected by wildfires although less damage is observed from underground electrical facilities.

Significant wildfire events are rare in Minnesota with the last federally declared event occurring in 2002. Minor wildfire events do occur annually and often affect electrical infrastructure in remote areas.

Mitigation Strategies

Many natural hazard events can have the effects on the electric grid mitigated in multiple of ways. From the Electric Cooperative Survey, the top five mitigation methods favored by the utilities include:

- Replacing overhead line with underground line
- Targeted infrastructure replacement
- Increased vegetation management
- Installation of electronic sectionalizing devices
- Adding electrical looping feeds to an area

Replacing Overhead Line with Underground Line

In Minnesota, the most common and effective way to reduce natural hazards exposure is to rebuild the distribution electric line underground. Placing an electric line underground removes the infrastructure from the weather elements like windstorms, tornadic activity, winter storms and wild fire. The additional benefit is the underground electric line also can reduce outages due to animal contact, the leading cause of power outages nationally. The downfall to underground electrical infrastructure is the cost is often higher than building overhead electrical lines and repair of faulted cable during Minnesota winters can be of lengthy durations.

Undergrounding electrical infrastructure is highly effective, however, in some portions of Minnesota the terrain is not feasible for this type of construction. In northern Minnesota, much of the terrain is rock, limiting the ability to trench or bore in electrical lines. In other areas of northern Minnesota, the high-water table prevents successful burial of electrical lines as the freeze-thaw cycles cause the electrical line to be pushed closer to the surface.

Undergrounding substation and transmission electrical infrastructure is often not feasible due to the negative impact to the environment and to the lengthy durations required for accessing and repairing failed equipment. In addition, the costs of undergrounding substation and transmission often outweighs any benefits gained with improved resiliency.

Targeted Infrastructure Replacement

With approximately 10,000 miles of transmission electrical line and over 127,000 miles of distribution electrical line, it is not feasible to expect all of the cooperative-owned electric grid in Minnesota to be rebuilt as underground infrastructure. Instead, many electrical cooperatives are targeting specific infrastructure segments to be replaced. The different segments of electrical infrastructure targeted for replacement is often in relation to historical natural hazards that occurred in the area or due to the age and condition of the existing power line. Utilities that target infrastructure replacement often will utilize populations affected as a metric and the lack of alternative power feeds in the area.

Increased Vegetation Management

Electric utilities will spend a significant portion of their annual maintenance budget on vegetation management. Vegetation near overhead power lines not only increases the possibility for momentary and substantiated power outages, but also decreases the efficiency of transporting power. Vegetation management as a natural hazard mitigation method is often ignored as this method needs to be repeated on a cyclical basis to be effective.

In certain areas where undergrounding electric line is not feasible, vegetation management is a key tool to preventing power outages that occur during natural hazard events. Many electrical utilities have an arborist assist the utility with vegetation management plans to best fit the type of vegetation in the area. Long term vegetation management plans are often utilized by electrical cooperatives including vegetation removal, trimming and spraying to maintain a proper clearance around the power lines.

Installation of Electronic Sectionalizing Devices

One method to decrease the duration of power outages caused by a temporary or permanent fault on power lines is to install electronic sectionalizing devices. During natural hazards events, often power is interrupted to a widespread area when the damage occurred in a specific area. This is due to the long lengths of electrical line between sectionalizing devices. A sectionalizing device can automatically or manually isolate power outages to a smaller area where the damage occurred, maintaining power to other areas served by the same power line segment. Some sectionalizing devices can also be used to change the feed of power to an area, dramatically shorting the length of power outage to the larger population.

The technology of sectionalizing devices has improved over time and many sectionalizing devices can now be incorporated with SCADA (Supervisory, Control and Data Acquisition) systems. This allows the electric utility to virtually see where the electrical system damage has occurred, allowing for quicker power restoration.

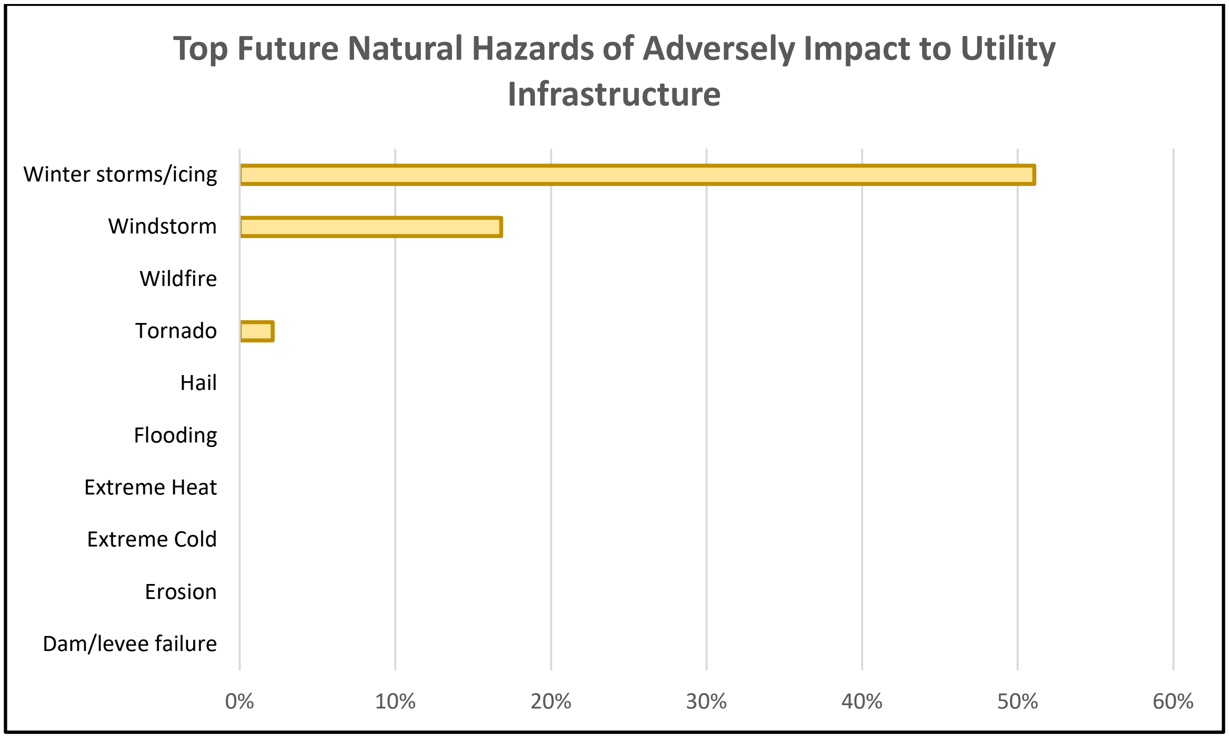
Adding Electrical Loop Feeds to an Area

Other successful mitigation strategies include building contingency to the existing transmission and distribution line to provide alternative ways to serve power into an area. This method would allow for shorter restoration of power to the area as a whole, but still may lead to long power outage durations for a discrete population in the affected area.

Current and Future Resiliency Efforts

Minnesota electric cooperatives believe that winter storms and windstorms will most likely be the cause of future natural hazard events. With that focus in mind, electric utilities should plan for mitigation efforts to limit damage from these types of future events. Both windstorms and winter storms can damage wide areas resulting in multiple day power outages. Projects that can minimize adverse effects from the two natural hazards include the various mitigation methods listed in the previous section.

Figure 5 Top Future Natural Hazards of Concern Survey Responses



47 Respondents ranked their top natural hazards that caused the most adverse damage to electric infrastructure in the future.

Identification of Projects

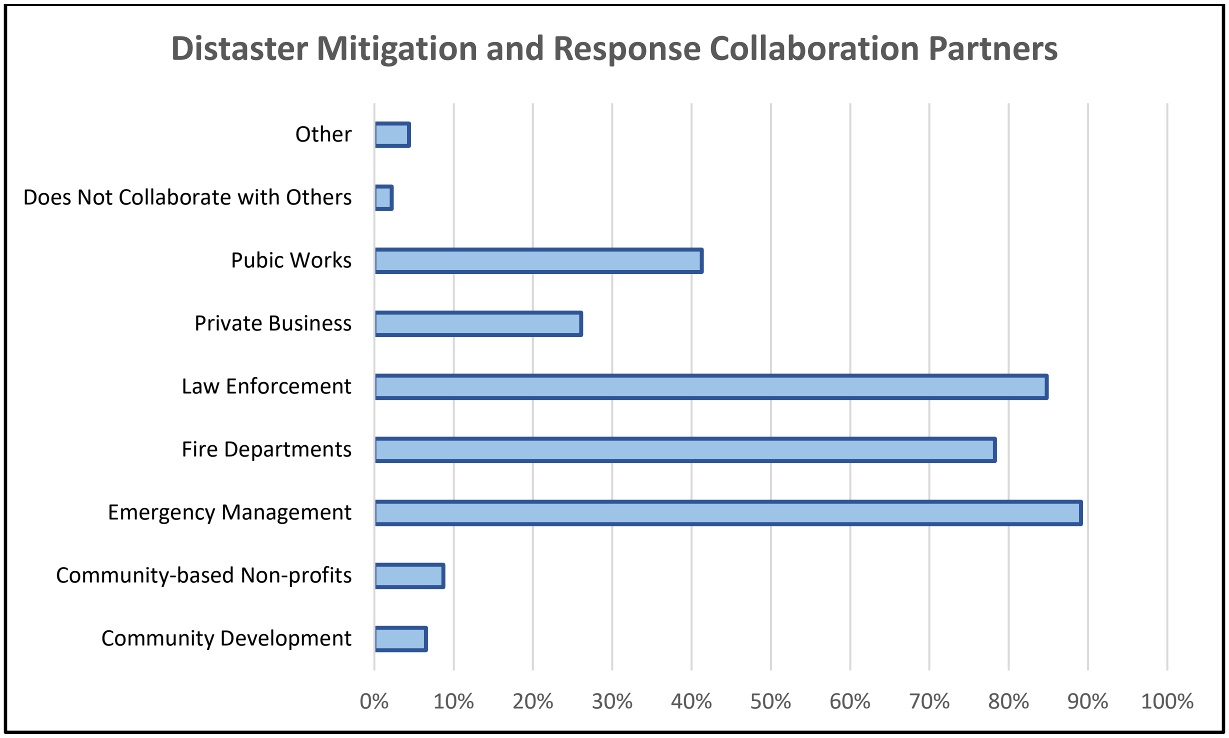
It is recommended that electric cooperatives identify a list of potential pre-hazard mitigation projects that would address the common natural hazards affecting the electric grid. These identified projects can be incorporated into planning documents and other mitigation grant opportunities. Specific to FEMA mitigation programs, projects should have an identified Scope of Work, Benefit-Cost Analysis, Budgetary Analysis and supporting environmental documentation in compliance with NEPA and Section 106 federal requirements. The potential list of pre-hazard mitigation projects should be reviewed annually and companion documentation should be revised as needed.

Cooperation with Minnesota Departments

Electric cooperatives will continue to collaborate with the Minnesota Division of Homeland Security and Emergency Management along with the Minnesota Department of Commerce to strategically address the need for a more resilient power grid. A training event with the Minnesota Division of Homeland Security and Emergency Management regarding mitigation FEMA funding is planned for January 2024. Additionally, the Department of Commerce is actively encouraging electric cooperatives to apply for resilience and smart grid funding through various Infrastructure Investment and Jobs Act (IIJA) and Inflation Reduction Act (IRA) programs.

Many individual electric cooperatives may also participate with their local counties and cities with local climate plan and emergency management plans. Today electric cooperatives collaborate with many different local government agencies and businesses with emergency response plans. Additional collaboration is expected as electrification continues to expand within transportation and business.

Figure 6 Disaster Mitigation and Response Collaboration with Others Survey Responses



47 Respondents to this survey question. Responses that included "Others" listed collaboration with Minnesota and North Dakota Fusion Center, federal agencies and statewide organizations.

Mitigation Metrics

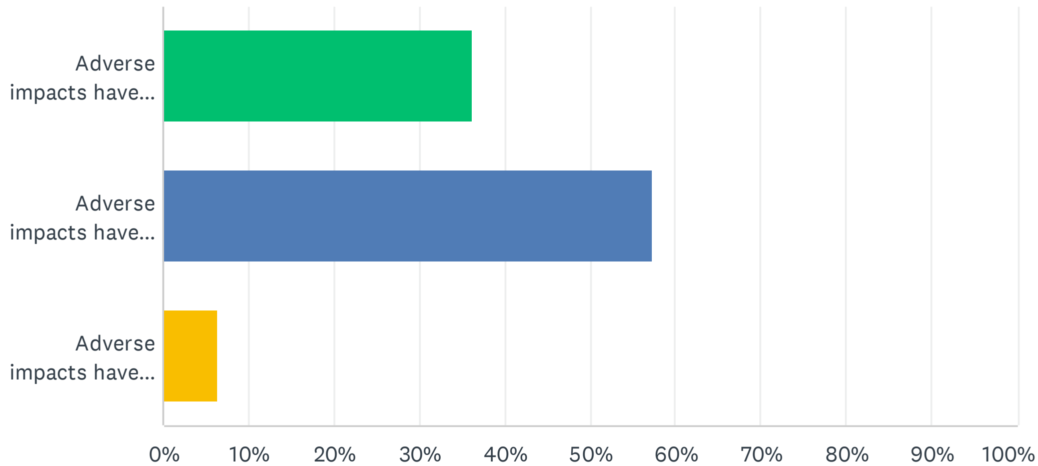
As natural hazards change in frequency and severity over time, so will the impacts of the natural hazards to the electric grid. This Annex is to be reviewed and updated every five years in concurrence with Minnesota's Hazard Mitigation Plan. Specifically, the Electric Cooperative Survey is to be revisited to track how natural hazards impact the electric grid as the mitigation efforts are implemented. New technologies may complement existing best practice mitigation methods that can be included into the Annex and the Survey.

Incorporated Plans, Studies, Reports and Technical Data

The Rural Electric Cooperative Annex incorporated information from multiple levels of government hazard mitigation plans along with a hazard identification study from Great River Energy. The survey questions and aggregated responses are found on the following pages.

Q3 In the past 10 years, how have the adverse impacts from natural hazards changed at your utility?

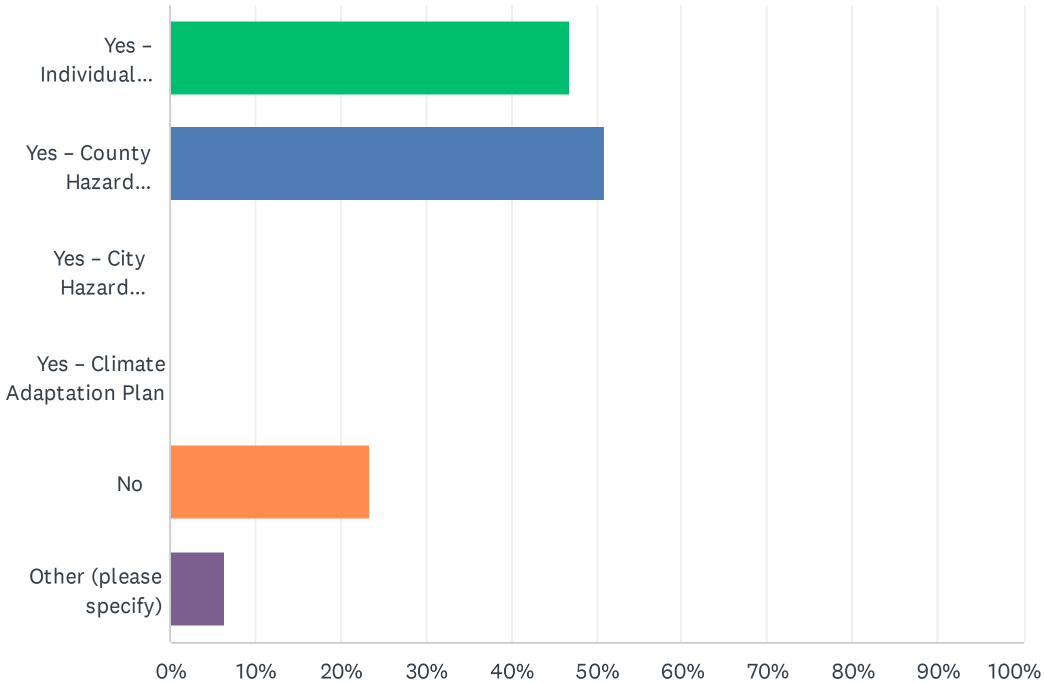
Answered: 47 Skipped: 0



ANSWER CHOICES	RESPONSES	
Adverse impacts have increased	36.17%	17
Adverse impacts have stayed the same	57.45%	27
Adverse impacts have decreased	6.38%	3
TOTAL		47

Q4 Has your utility conducted a hazard analysis/risk assessment or been included in a hazard mitigation plan within the past 5 years? (Choose all that apply)

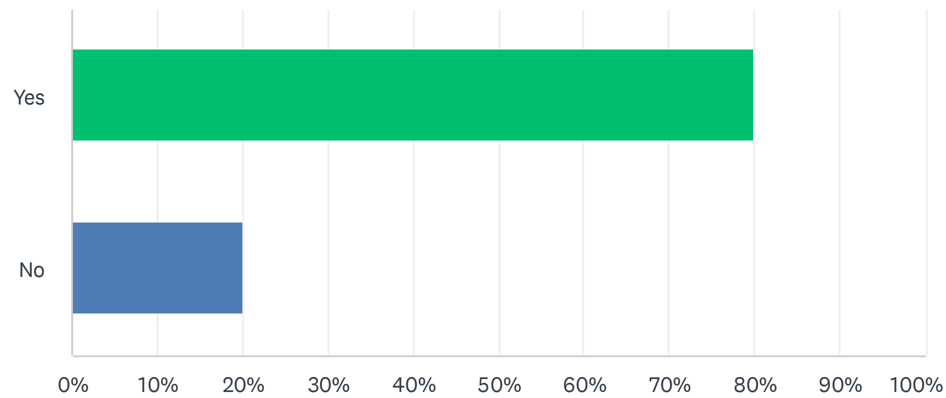
Answered: 47   Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes – Individual utility plan and/or assessment	46.81%	22
Yes – County Hazard Mitigation Plan	51.06%	24
Yes – City Hazard Mitigation Plan	0.00%	0
Yes – Climate Adaptation Plan	0.00%	0
No	23.40%	11
Other (please specify)	6.38%	3
Total Respondents: 47		

Q5 Does your utility's Emergency Response Plan include steps for communicating with the County's Emergency Manager(s) during a significant power outage event?

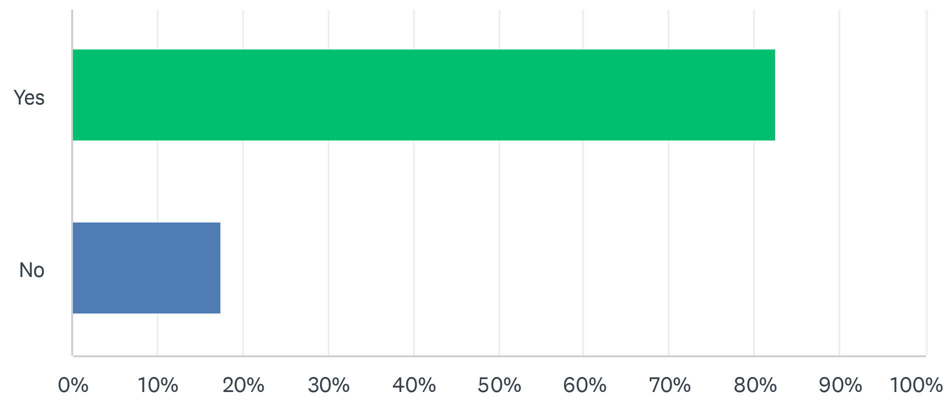
Answered: 45 Skipped: 2



ANSWER CHOICES	RESPONSES	
Yes	80.00%	36
No	20.00%	9
TOTAL		45

Q6 Does your utility's Emergency Response Plan prioritize restoration to critical electrical loads such as hospitals, fire departments, nursing homes, etc.?

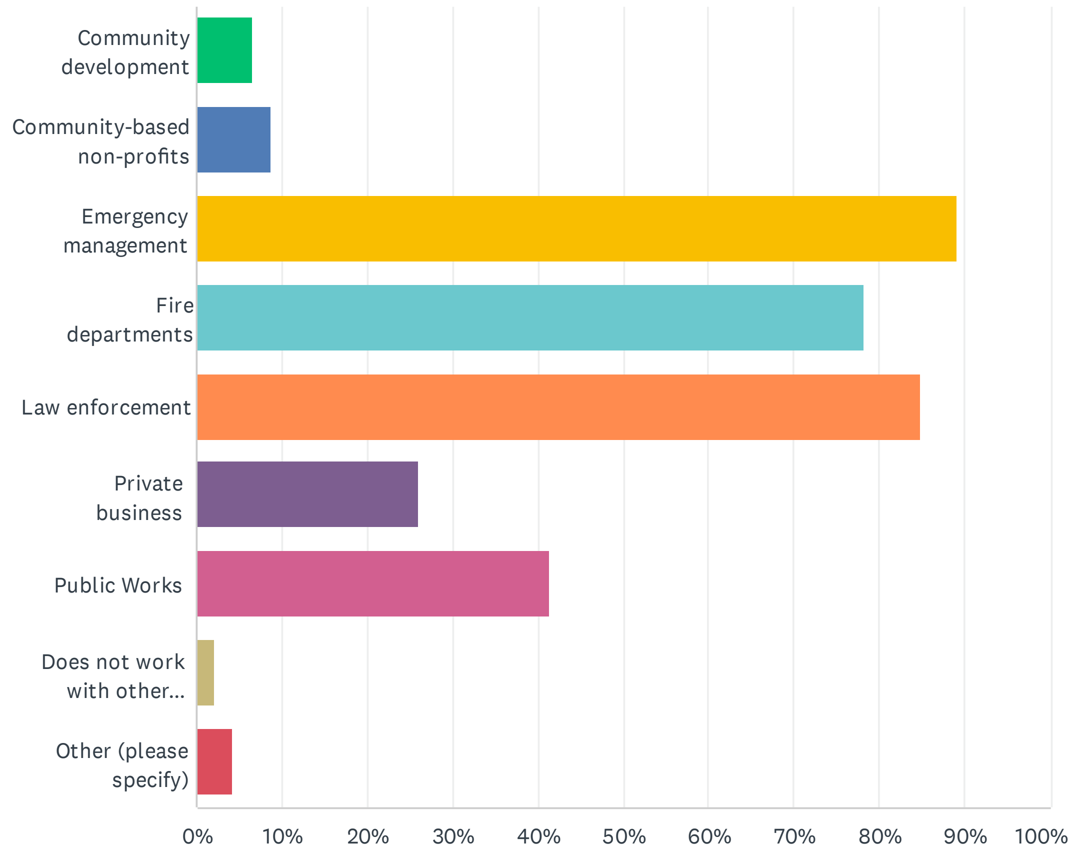
Answered: 46 Skipped: 1



ANSWER CHOICES	RESPONSES	
Yes	82.61%	38
No	17.39%	8
TOTAL		46

Q7 Which entities does your utility work with for disaster mitigation, preparedness, response, or recovery? (Choose all that apply)

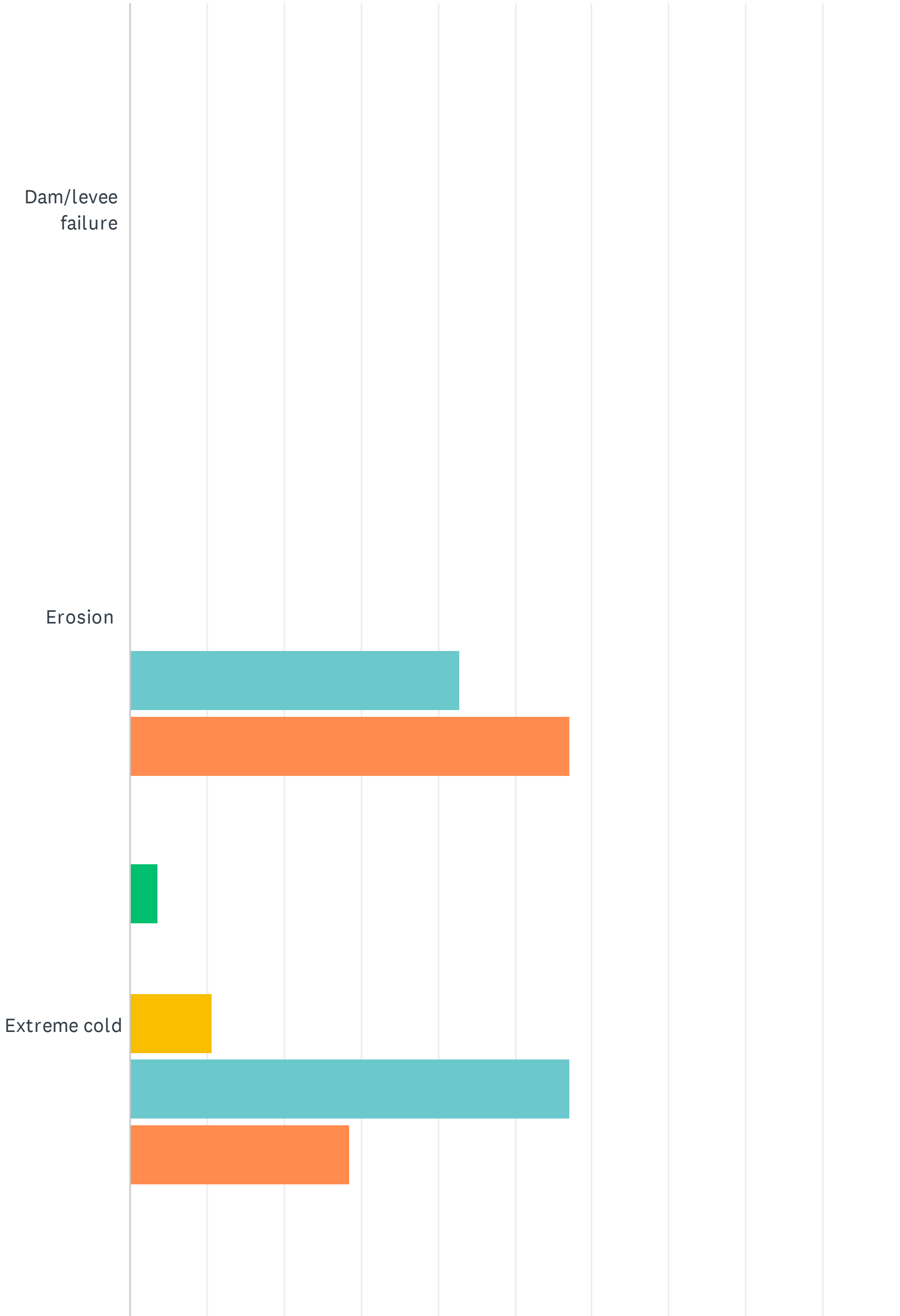
Answered: 46 Skipped: 1

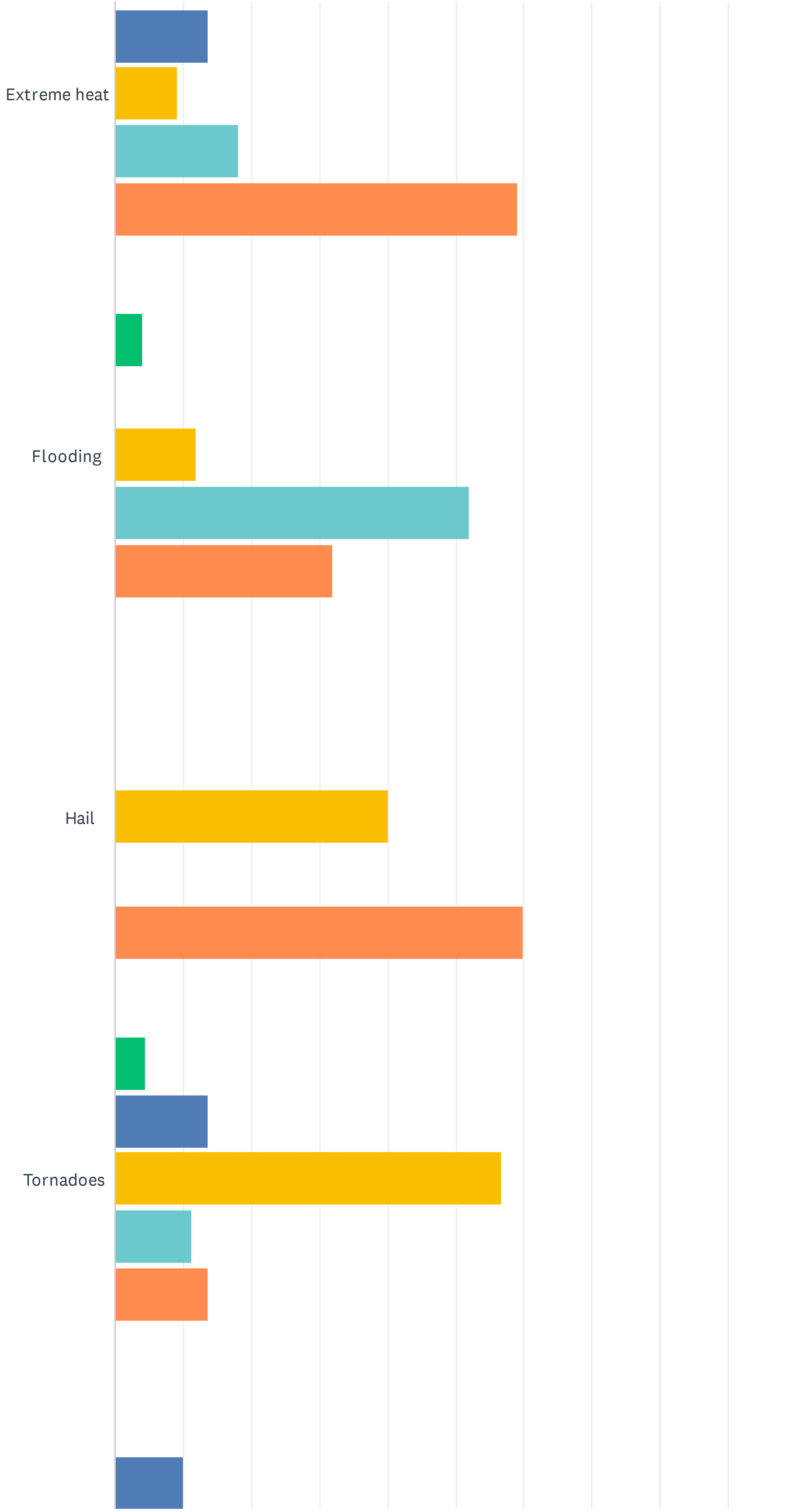


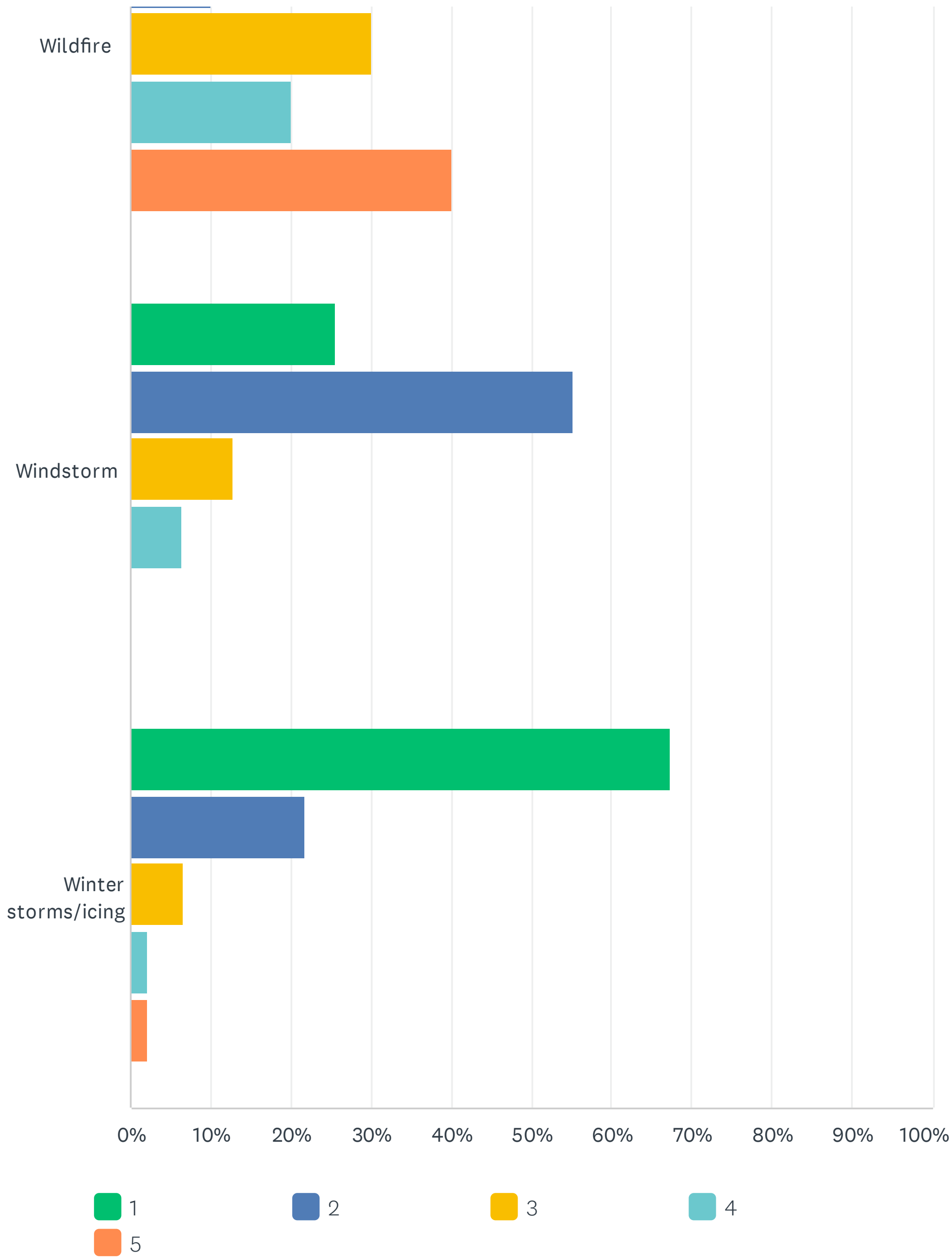
ANSWER CHOICES	RESPONSES	
Community development	6.52%	3
Community-based non-profits	8.70%	4
Emergency management	89.13%	41
Fire departments	78.26%	36
Law enforcement	84.78%	39
Private business	26.09%	12
Public Works	41.30%	19
Does not work with other groups	2.17%	1
Other (please specify)	4.35%	2
Total Respondents: 46		

Q8 Please rank the top 5 natural hazards by impact that adversely affect/damage your utility's infrastructure. (Please consider impact as severity of damage to the overall system infrastructure) (*Note: Only 5 natural hazards can be chosen for most impactful, column 1 being the most severe)

Answered: 47 Skipped: 0



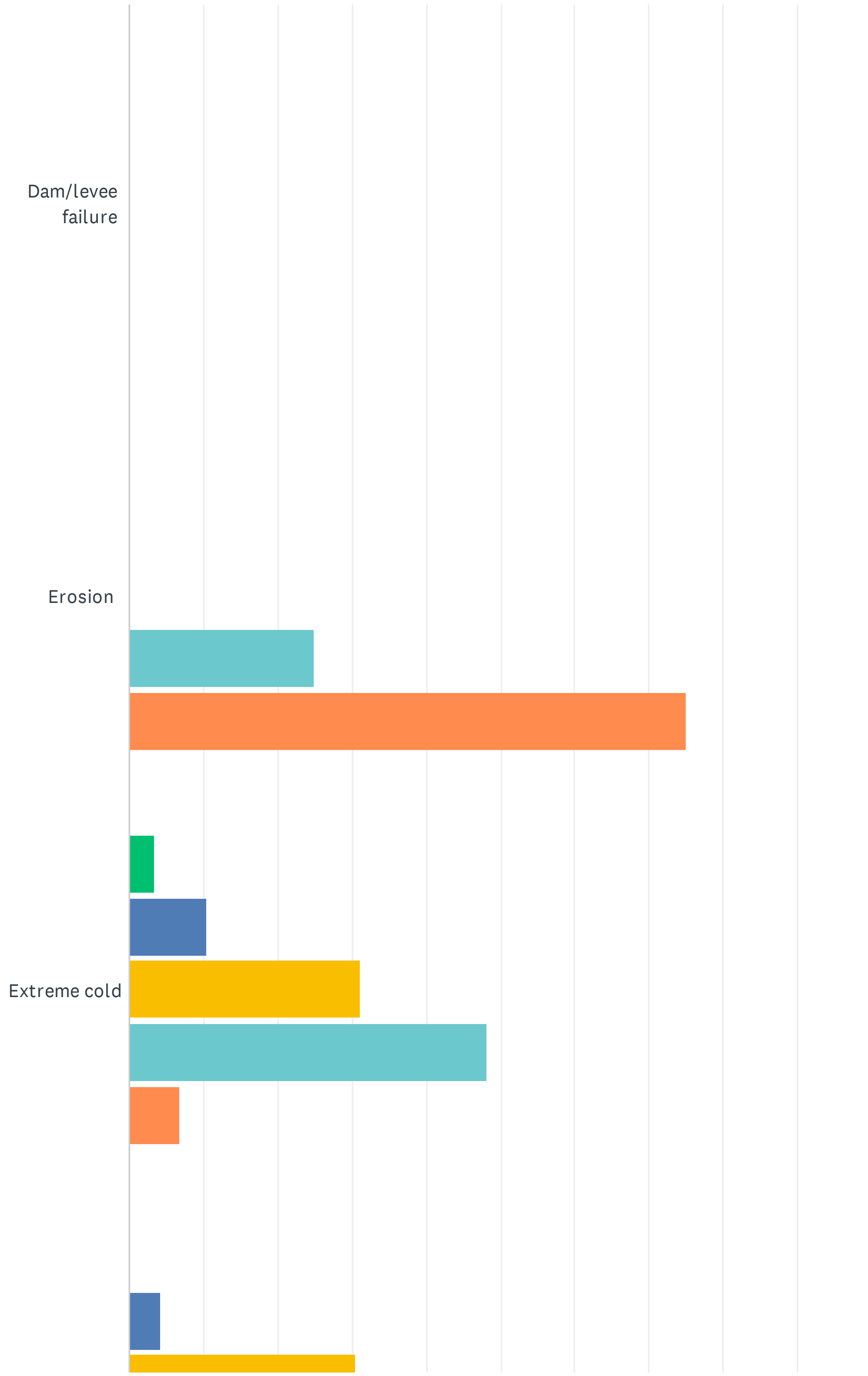

Extreme heat
Flooding
Hail
Tornadoes

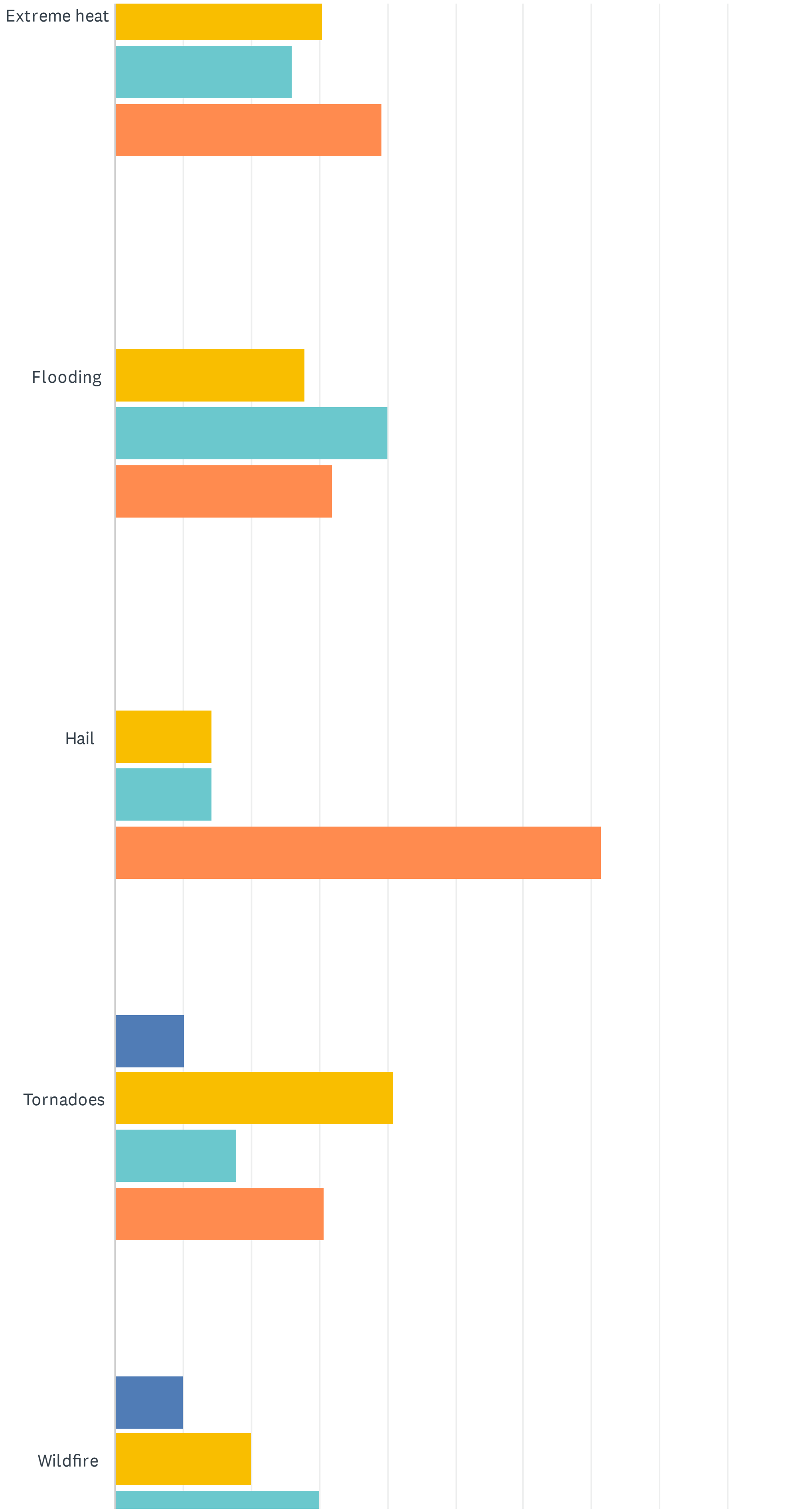

Wildfire
Windstorm
Winter storms/icing
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
1
2
3
4
5

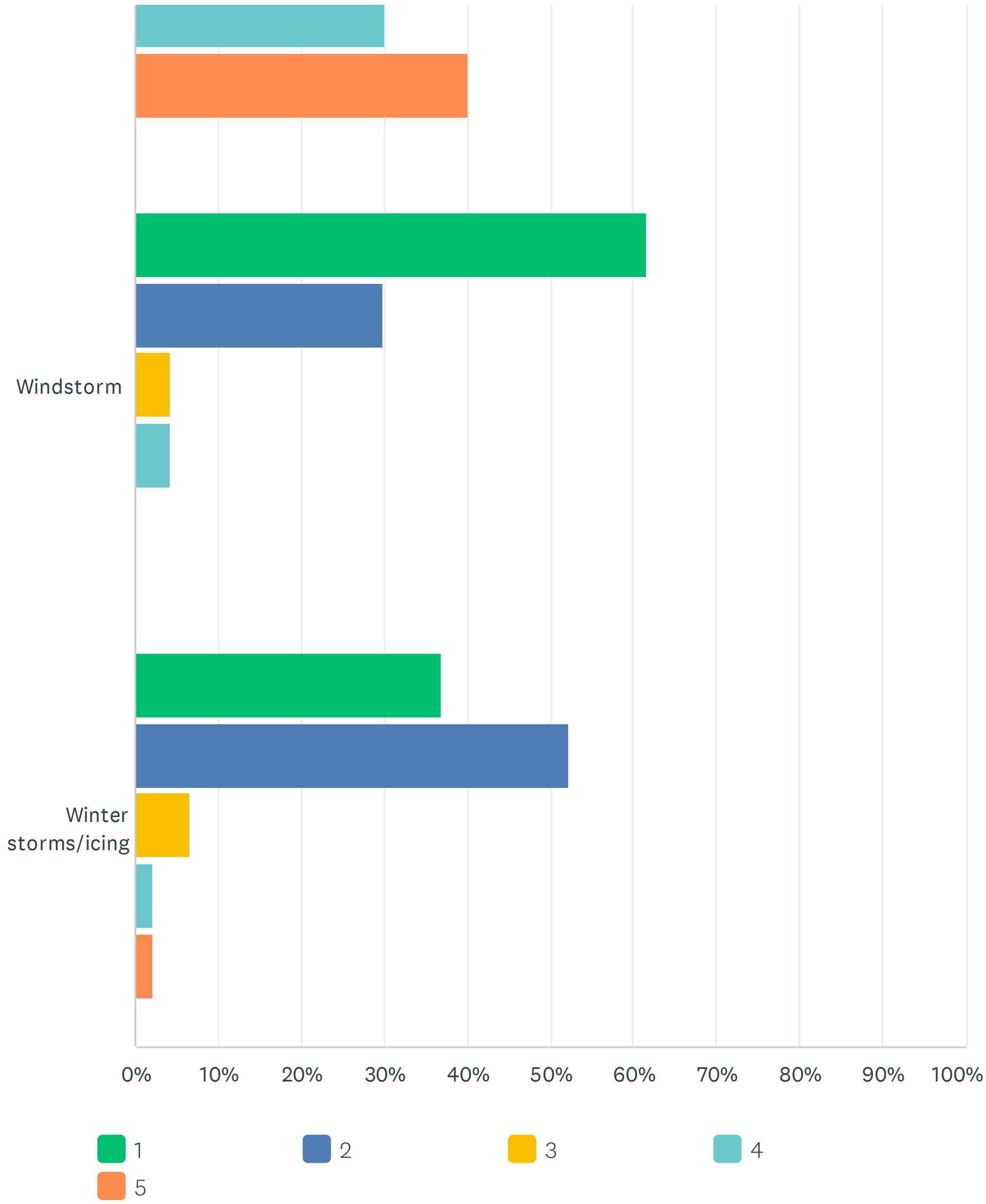
	1	2	3	4	5	TOTAL
Dam/levee failure	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0
Erosion	0.00% 0	0.00% 0	0.00% 0	42.86% 3	57.14% 4	7
Extreme cold	3.57% 1	0.00% 0	10.71% 3	57.14% 16	28.57% 8	28
Extreme heat	0.00% 0	13.64% 3	9.09% 2	18.18% 4	59.09% 13	22
Flooding	4.00% 1	0.00% 0	12.00% 3	52.00% 13	32.00% 8	25
Hail	0.00% 0	0.00% 0	40.00% 2	0.00% 0	60.00% 3	5
Tornadoes	4.55% 2	13.64% 6	56.82% 25	11.36% 5	13.64% 6	44
Wildfire	0.00% 0	10.00% 1	30.00% 3	20.00% 2	40.00% 4	10
Windstorm	25.53% 12	55.32% 26	12.77% 6	6.38% 3	0.00% 0	47
Winter storms/icing	67.39% 31	21.74% 10	6.52% 3	2.17% 1	2.17% 1	46

Q9 Please rank the top 5 natural hazards by frequency that adversely affect/damage your utility's infrastructure. (*Note: Only 5 natural hazards can be chosen for most frequency, column 1 being the most frequent)

Answered: 47   Skipped: 0



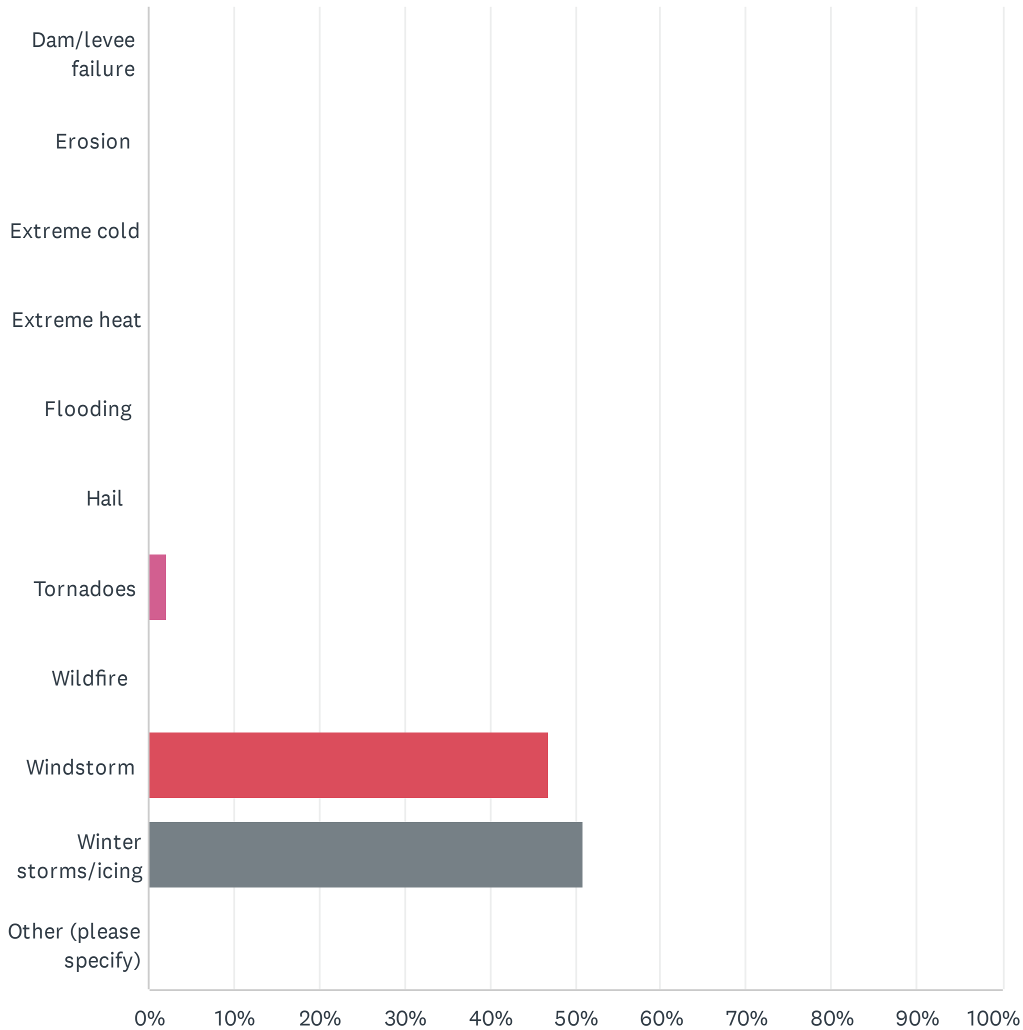

Extreme heat
Flooding
Hail
Tornadoes
Wildfire


Windstorm
Winter storms/icing
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
1
2
3
4
5

	1	2	3	4	5	TOTAL
Dam/levee failure	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0
Erosion	0.00% 0	0.00% 0	0.00% 0	25.00% 2	75.00% 6	8
Extreme cold	3.45% 1	10.34% 3	31.03% 9	48.28% 14	6.90% 2	29
Extreme heat	0.00% 0	4.35% 1	30.43% 7	26.09% 6	39.13% 9	23
Flooding	0.00% 0	0.00% 0	28.00% 7	40.00% 10	32.00% 8	25
Hail	0.00% 0	0.00% 0	14.29% 1	14.29% 1	71.43% 5	7
Tornadoes	0.00% 0	10.26% 4	41.03% 16	17.95% 7	30.77% 12	39
Wildfire	0.00% 0	10.00% 1	20.00% 2	30.00% 3	40.00% 4	10
Windstorm	61.70% 29	29.79% 14	4.26% 2	4.26% 2	0.00% 0	47
Winter storms/icing	36.96% 17	52.17% 24	6.52% 3	2.17% 1	2.17% 1	46

Q10 What natural hazard do you think will have the most adverse impact affecting/damaging your utility's infrastructure in the next 5 years?

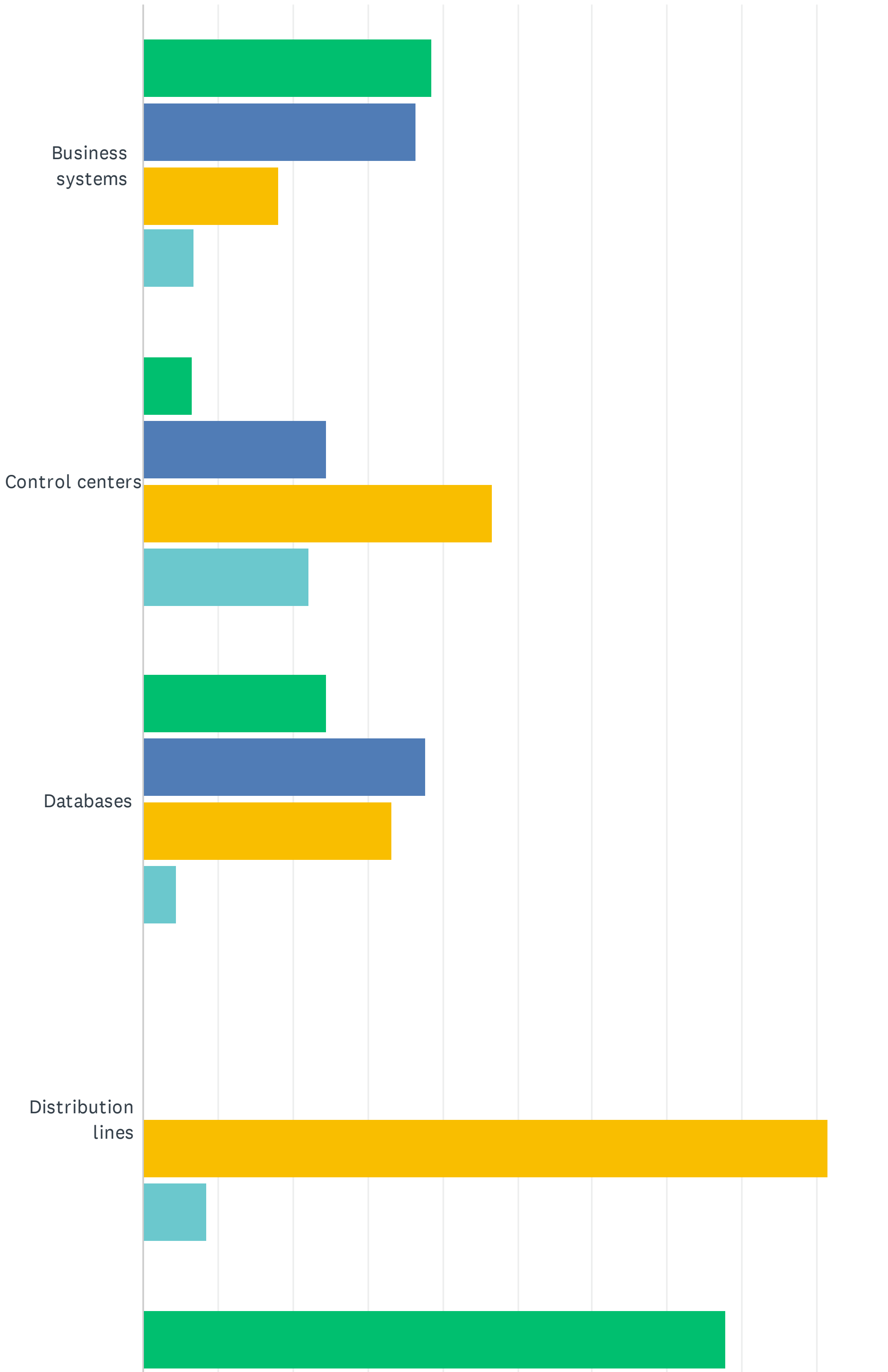
Answered: 47 Skipped: 0

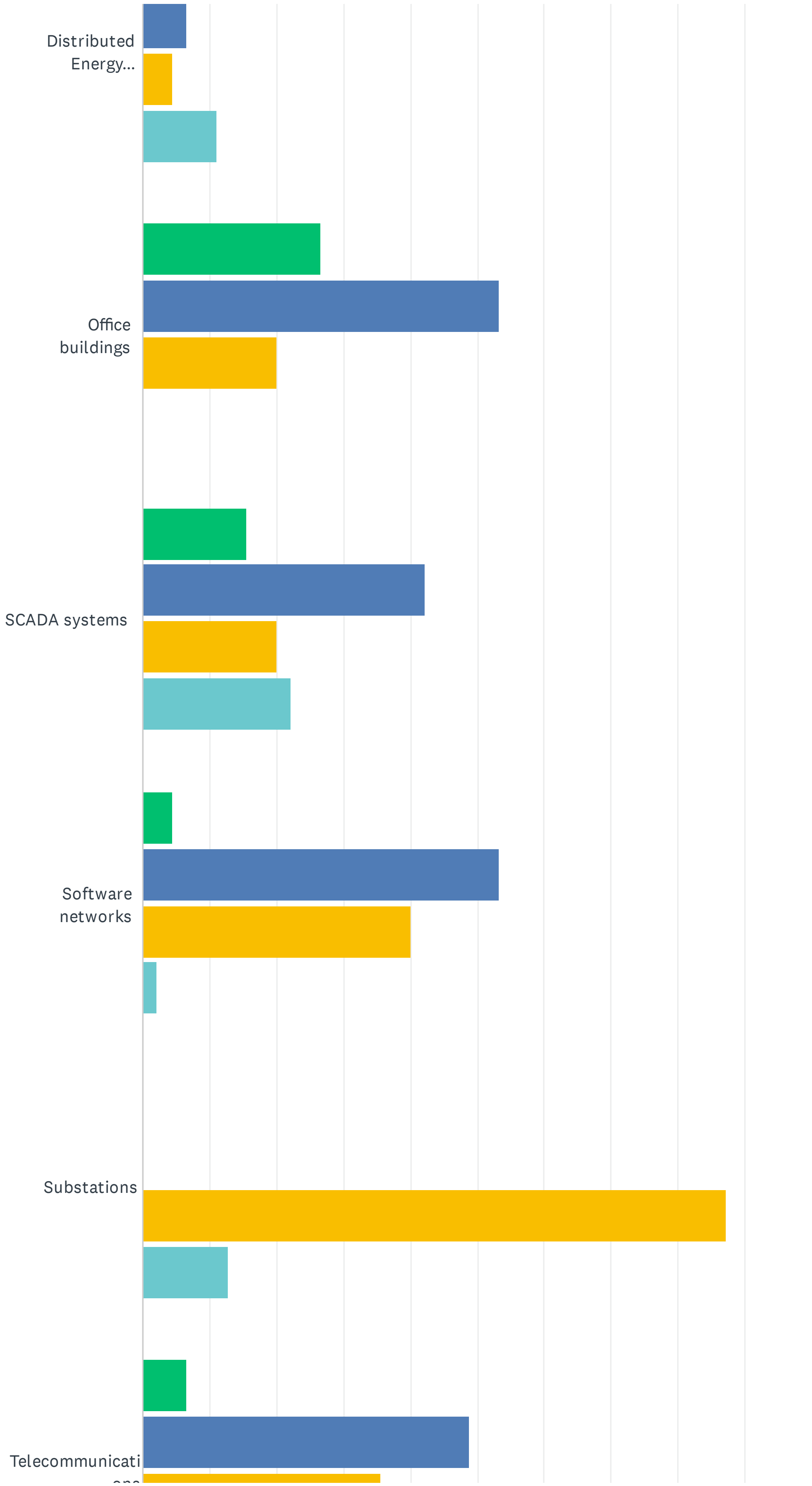


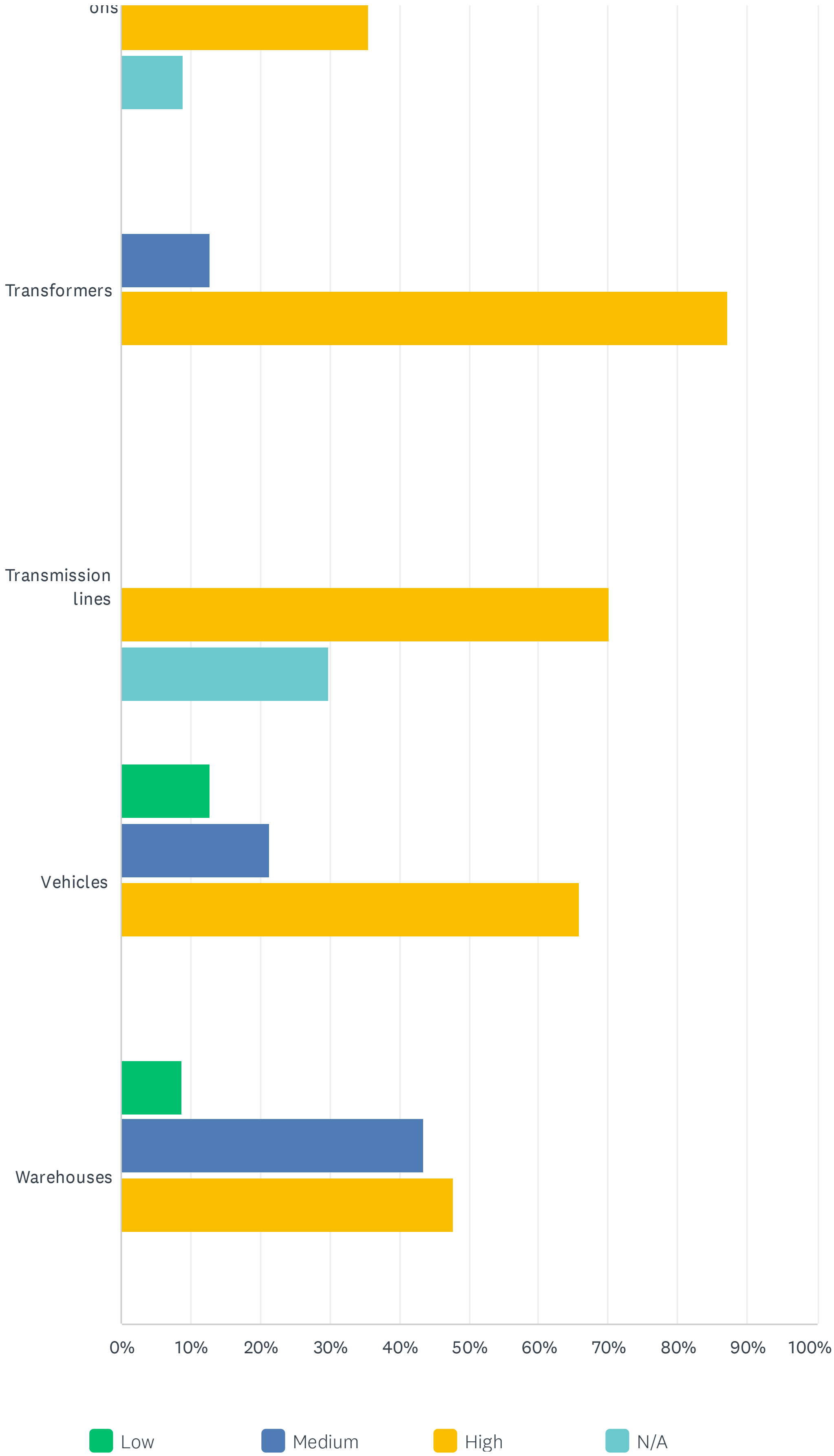
ANSWER CHOICES	RESPONSES	
Dam/levee failure	0.00%	0
Erosion	0.00%	0
Extreme cold	0.00%	0
Extreme heat	0.00%	0
Flooding	0.00%	0
Hail	0.00%	0
Tornadoes	2.13%	1
Wildfire	0.00%	0
Windstorm	46.81%	22
Winter storms/icing	51.06%	24
Other (please specify)	0.00%	0
TOTAL		47

Q11 Rate the following list of potential assets of your utility's infrastructure based on how critical each type is to maintaining power to consumers. (Please select N/A if your utility does not own/have a specific listed asset)

Answered: 47 Skipped: 0



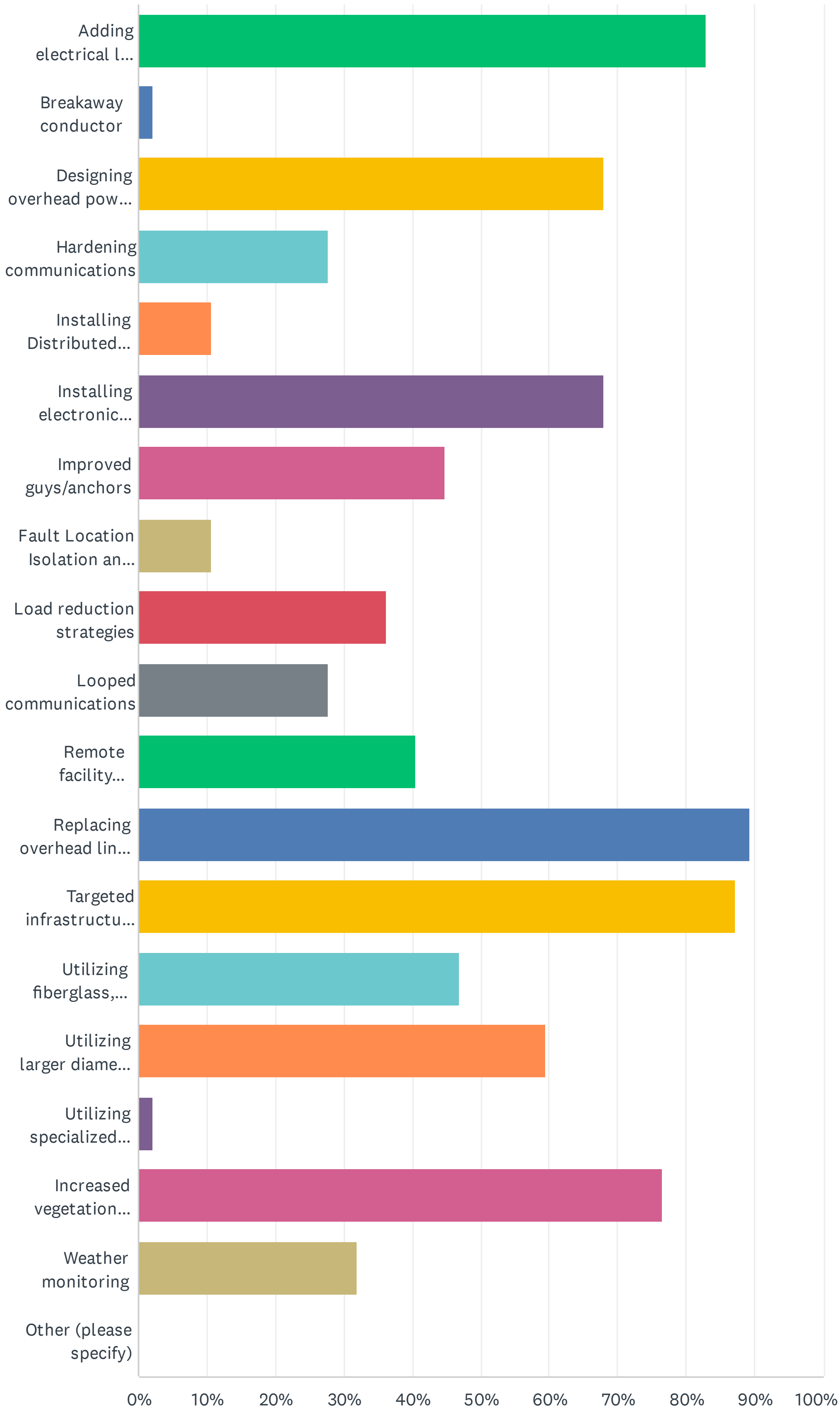

Distributed Energy...
Office buildings
SCADA systems
Software networks
Substations
Telecommunicati


ons
Transformers
Transmission lines
Vehicles
Warehouses
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Low
Medium
High
N/A

	LOW	MEDIUM	HIGH	N/A	TOTAL
Business systems	38.64% 17	36.36% 16	18.18% 8	6.82% 3	44
Control centers	6.67% 3	24.44% 11	46.67% 21	22.22% 10	45
Databases	24.44% 11	37.78% 17	33.33% 15	4.44% 2	45
Distribution lines	0.00% 0	0.00% 0	91.49% 43	8.51% 4	47
Distributed Energy Resources	77.78% 35	6.67% 3	4.44% 2	11.11% 5	45
Office buildings	26.67% 12	53.33% 24	20.00% 9	0.00% 0	45
SCADA systems	15.56% 7	42.22% 19	20.00% 9	22.22% 10	45
Software networks	4.44% 2	53.33% 24	40.00% 18	2.22% 1	45
Substations	0.00% 0	0.00% 0	87.23% 41	12.77% 6	47
Telecommunications	6.67% 3	48.89% 22	35.56% 16	8.89% 4	45
Transformers	0.00% 0	12.77% 6	87.23% 41	0.00% 0	47
Transmission lines	0.00% 0	0.00% 0	70.21% 33	29.79% 14	47
Vehicles	12.77% 6	21.28% 10	65.96% 31	0.00% 0	47
Warehouses	8.70% 4	43.48% 20	47.83% 22	0.00% 0	46

Q12 What methods/approaches has your utility taken in the past 10 years to make its infrastructure more resilient to natural hazard events? (Choose all that apply)

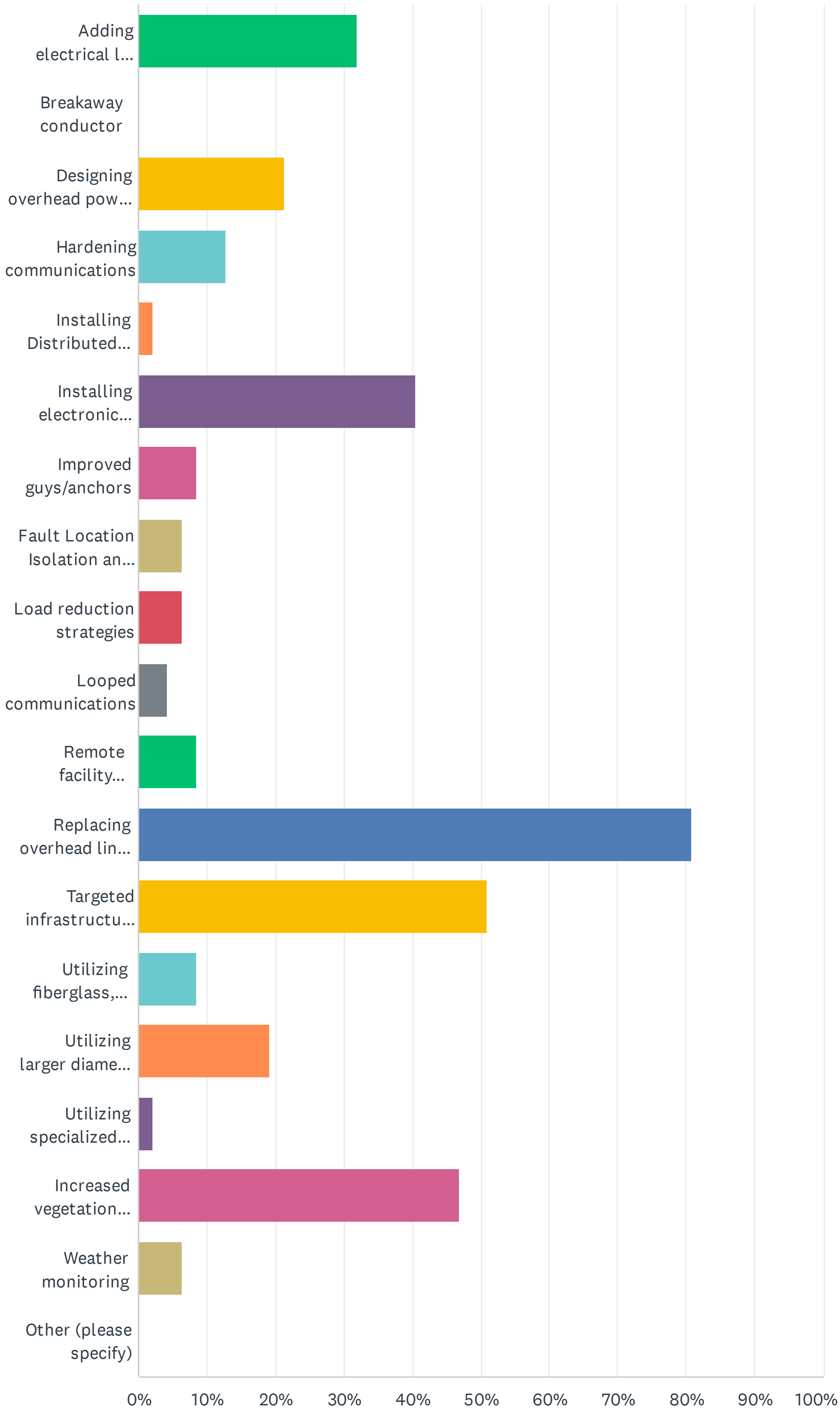
Answered: 47 Skipped: 0


Adding electrical l...
Breakaway conductor
Designing overhead pow...
Hardening communications
Installing Distributed...
Installing electronic...
Improved guys/anchors
Fault Location Isolation an...
Load reduction strategies
Looped communications
Remote facility...
Replacing overhead lin...
Targeted infrastructu...
Utilizing fiberglass,...
Utilizing larger diame...
Utilizing specialized...
Increased vegetation...
Weather monitoring
Other (please specify)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%

ANSWER CHOICES	RESPONSES	
Adding electrical loop feeds to an area	82.98%	39
Breakaway conductor	2.13%	1
Designing overhead power lines with shorter spans	68.09%	32
Hardening communications	27.66%	13
Installing Distributed Energy Resources	10.64%	5
Installing electronic sectionalizing devices	68.09%	32
Improved guys/anchors	44.68%	21
Fault Location Isolation and Service Restoration (FLISR)	10.64%	5
Load reduction strategies	36.17%	17
Looped communications	27.66%	13
Remote facility control	40.43%	19
Replacing overhead line with underground line	89.36%	42
Targeted infrastructure replacement	87.23%	41
Utilizing fiberglass, steel, or composite material for structures	46.81%	22
Utilizing larger diameter power poles	59.57%	28
Utilizing specialized overhead conductor	2.13%	1
Increased vegetation management	76.60%	36
Weather monitoring	31.91%	15
Other (please specify)	0.00%	0
Total Respondents: 47		

Q13 What are the top 3 methods/approaches your utility intends to use to make its infrastructure more resilient to natural hazard events in the next 5 years? (Choose the top 3 that apply)

Answered: 47 Skipped: 0



Adding electrical l...
Breakaway conductor
Designing overhead pow...
Hardening communications
Installing Distributed...
Installing electronic...
Improved guys/anchors
Fault Location Isolation an...
Load reduction strategies
Looped communications
Remote facility...
Replacing overhead lin...
Targeted infrastructu...
Utilizing fiberglass,...
Utilizing larger diame...
Utilizing specialized...
Increased vegetation...
Weather monitoring
Other (please specify)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%

ANSWER CHOICES	RESPONSES	
Adding electrical loop feeds to an area	31.91%	15
Breakaway conductor	0.00%	0
Designing overhead power lines with shorter spans	21.28%	10
Hardening communications	12.77%	6
Installing Distributed Energy Resources	2.13%	1
Installing electronic sectionalizing devices	40.43%	19
Improved guys/anchors	8.51%	4
Fault Location Isolation and Service Restoration (FLISR)	6.38%	3
Load reduction strategies	6.38%	3
Looped communications	4.26%	2
Remote facility control	8.51%	4
Replacing overhead line with underground line	80.85%	38
Targeted infrastructure replacement	51.06%	24
Utilizing fiberglass, steel, or composite material for structures	8.51%	4
Utilizing larger diameter power poles	19.15%	9
Utilizing specialized overhead conductor	2.13%	1
Increased vegetation management	46.81%	22
Weather monitoring	6.38%	3
Other (please specify)	0.00%	0
Total Respondents: 47		