# 2022 State of Nebraska Flood Hazard Mitigation Plan

*Supplement to the 2021 Nebraska State Hazard Mitigation Plan V1.2*

NEBRASKA

DEPT. OF NATURAL RESOURCES

# Executive Summary

The State of Nebraska is intimately familiar with the impacts of flooding on its residents, infrastructure, economy, and natural resources. This 2022 update to the State of Nebraska Flood Hazard Mitigation Plan (State FHMP) affirms Nebraska's commitment to continued improvements to its statewide flood mitigation strategy and program. Hazard mitigation helps to reduce or eliminate potential losses from future disaster. Hazard mitigation *planning* helps to establish and maintain a process that leads to the implementation of hazard mitigation actions.

The Nebraska Department of Natural Resources manages our most precious natural resource—water—and protects against flood threats through sound partnerships, cooperation, and science-based decision making. The plan update process began with a series of public meetings to ensure input from stakeholders across the state. The meetings were followed by the launch of a plan development committee to review and advise on initial draft content every two months, as well as provide current data regarding recent flood impacts, critical facilities, and resources available to Nebraskans.

The next steps involved detailed analysis of flood risk across the state and an assessment of vulnerabilities to flood risk. A thorough evaluation of the state's current mitigation capabilities was conducted and resulted in an updated flood hazard mitigation strategy for Nebraska. The revised strategy identifies four overarching mitigation goals and related mitigation objectives. These goals frame Nebraska's path forward in implementing flood hazard mitigation:

- Reduce or eliminate long term flood risk to human life and property.
- Preserve and enhance the natural and beneficial functions of floodplains.
- Promote public awareness of flood hazards and post-flood response.
- Coordinate with federal, state, and local partners for flood mitigation planning and program efforts.

The revised strategy also features several new and ongoing mitigation actions to be implemented in the path forward.

New to the 2022 State FHMP are the results of a GIS-based flood risk assessment. The risk assessment was a collaborative effort and relied on data provided by several collaborating agencies. The risk assessment provides flood risk analyses from across the state at a level never achieved before. Also new to the 2022 State FHMP are a series of mitigation strategy and practice sheets that serve as a detailed and accessible resource to communities in their implementation of mitigation actions.

In summary, this plan aims to represent the most robust evaluation of Nebraska flood risks, the most thorough catalogue of resources available to local jurisdictions, and the most actionable and forward-looking flood hazard mitigation approach the State has yet produced. District 23 Senator Bruce Bostelman and the members of the Natural Resources Committee deserve credit for initiating this important planning effort, recognizing the importance of flood hazard mitigation to Nebraska's citizens, and advancing LB632 through the Nebraska Legislature.

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## Abbreviations

| | |
|---|---|
| BLE | Base Level Engineering |
| BRIC | Building Resilient Infrastructure and Communities |
| CAP | Community Assistance Program |
| CDBG | Community Development Block Grant |
| CFR | Code of Federal Regulations |
| cfs | Cubic Feet Per Second |
| CISA | Cybersecurity and Infrastructure Security Agency |
| COOP | Continuity of Operations |
| CPI | Consumer Price Index |
| CPNRD | Central Plate Natural Resources District |
| CRS | Community Rating System |
| CTP | Cooperating Technical Partner |
| DAS | Department of Administrative Services |
| DHHS | Department of Health and Human Services |
| DWSRF | Drinking Water State Revolving Loan Fund |
| EAP | Emergency Action Plan |
| EAL | Expected Annual Loss |
| EPA | Environmental Protection Agency |
| ESU #5 | Educational Service Unit #5 |
| EWPP | Emergency Watershed Protection Program |
| FEMA | Federal Emergency Management Agency |
| FIRM | Flood Insurance Rate Map |
| FMA | Flood Mitigation Assistance |
| FSA | Farm Service Agency |
| FY | Fiscal Year |

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|---|---|
| GTFDR | Governor's Task Force for Disaster Recovery |
| HHPD | High Hazard Potential Dam |
| HMA | Hazard Mitigation Assistance |
| HMGP | Hazard Mitigation Grant Program |
| HUD | United States Department of Housing and Urban Development |
| ICC | Increased Cost of Compliance |
| IFC | Iowa Flood Center |
| LHMP | Local Hazard Mitigation Plan |
| NASS | National Agricultural Statistics Service |
| NCEI | National Center for Environmental Information |
| NDA | Nebraska Department of Agriculture |
| NDAS | Nebraska Department of Administrative Services |
| NDED | Nebraska Department of Economic Development |
| NDEE | Nebraska Department of Environment and Energy |
| NDOT | Nebraska Department of Transportation |
| NeDNR | Nebraska Department of Natural Resources |
| NEMA | Nebraska Emergency Management Agency |
| NET | Nebraska Environmental Trust |
| NFIP | National Flood Insurance Program |
| NGPC | Nebraska Game and Parks Commission |
| NIFA | Nebraska Investment Finance Authority |
| NLD | National Levee Database |
| NOAA | National Oceanic and Atmospheric Administration |
| NRC | Natural Resources Commission |
| NRCS | Natural Resource Conservation Service |
| NRD | Natural Resource District |
| NREA | Nebraska Rural Electric Association |
| NRI | National Risk Index |
| NRS | Nebraska Revised Statue |
| NWS | National Weather Service |
| PA | Public Assistance |
| Risk MAP | Risk Mapping, Assessment, and Planning |
| RL | Repetitive Loss |
| RWLF | Rural Water Loan Fund |
| SFHA | Special Flood Hazard Area |
| SHPO | State Historic Preservation Office |
| State FHMP | State of Nebraska Flood Hazard Mitigation Plan |
| State HMP | State of Nebraska Hazard Mitigation Plan |
| SoVI | Social Vulnerability Index |
| SRL | Severe Repetitive Loss |

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|---|---|
| UNL | University of Nebraska-Lincoln |
| USACE | United States Army Corps of Engineers |
| USDA | United States Department of Agriculture |
| USFWS | United States Fish and Wildlife Service |
| USGS | United States Geological Survey |
| WFPO | Watershed and Flood Prevention Operations |
| WSF | Water Sustainability Fund |

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# 1 Introduction

## 1.1 Purpose

The purpose of the State of Nebraska Flood Hazard Mitigation Plan (State FHMP) is to demonstrate Nebraska's commitment to reducing risks from flood hazards and serve as a guide for State decision makers in committing resources to reducing the effects of flooding. The State FHMP summarizes Nebraska's previous flood problems, assesses flood risk and vulnerabilities within the state, and recommends mitigation actions that will reduce or eliminate the potential threat to life, safety, and economic well-being that flooding represents.

The 2022 update to the State FHMP has been completed to formalize and guide the flood mitigation program's direction and activities at a state level, while also providing a framework for flood hazard mitigation actions at the local level. The primary authority for this effort lies within the Nebraska Department of Natural Resources (NeDNR). Ultimately, the primary purpose for this plan is to identify flood mitigation needs and priorities within the state and determine how these needs can be met effectively.

## 1.2 Objectives

The objectives of flood mitigation efforts and programs in Nebraska are to protect or enhance natural floodplain functions, prevent loss of life, eliminate damage to public and private structures and infrastructure, and minimize damage to agricultural lands. The State FHMP is intended to coordinate several sources of existing flood mitigation planning by doing the following:

- Revising and updating the prior State Flood Mitigation Plan (published May 2013). Valid content has been maintained while outdated content has been updated or modified to reflect current data and programs.
- Coordinating with the flood mitigation goals and objectives contained in currently effective local hazard mitigation plans (LHMP).
- Augmenting and coordinating with the current State of Nebraska Hazard Mitigation Plan (State HMP) (approved January 2021 and revised September 7, 2021). Data within this flood mitigation plan is also intended to be the basis for the future sections of the State HMP related to flood hazards.

## 1.3 Compliance with Laws and Regulations

For consistency with the State HMP, as well as the requirements of Chapter 44 of the Code of Federal Regulations (CFR) §201.4, Standard State Mitigation Plans, this plan is organized into sections that correlate with CFR requirements.

The plan has also been developed in accordance with Nebraska Revised Statute (NRS) §61-225 through 61-229, which acknowledges 2019's extreme flooding and its significant impacts on the

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State of Nebraska, and directs NeDNR to develop a State FHMP in collaboration with various stakeholders to be annexed into the State HMP.[1]

In fulfillment of NRS §61-226, a Plan Development Committee consisting of multiple federal, state, and local agency and community stakeholders was engaged throughout the planning process. The planning process and stakeholders engaged are discussed and documented in Section 2, Planning Process, and Appendix A of this plan.

Together with the Plan Development Committee, NeDNR has addressed the tasks identified in NRS §61-228, as summarized in Table 1.

**Table 1: State FHMP Conformance with NRS §61-228**

| Nebraska Revised Statute §61-228 | Description of efforts in Plan development |
|---|---|
| (1) Evaluate the flood issues that occurred in 2019, and identify cost-effective flood mitigation strategies that should be adopted to reduce the disruption of lives and livelihoods and prioritize making Nebraska communities more resilient; | • **Section 3.4, Historic Flood Events,** summarizes the issues and effects of historic flooding events across the state, including those faced during the 2019 flood.<br>• **Section 4.0, Mitigation Strategy,** describes the goals, objectives, and mitigation actions developed and prioritized in coordination with the Plan Development Committee to mitigate flooding impacts and promote community resiliency. |
| (2) Identify opportunities to implement flood hazard mitigation strategies with the intent to reduce the impact of flood events; | • **Section 4.2, Mitigation Actions,** summarizes the mitigation actions developed and prioritized in concert with the Plan Development Committee to reduce flooding impacts.<br>• **Appendix C, Flood Mitigation Strategies and Practices Project Sheets,** contains a series of guidance pages that serve as an accessible resource to communities in their exploration and implementation of mitigation actions. |
| (3) Work to improve knowledge and understanding of available recovery resources while identifying potential gaps in current disaster program delivery; | • **Section 5, Recovery and Funding Sources,** contains a compilation of current federal and state recovery and mitigation funding sources, as well as common funding issues and challenges faced.<br>• **Section 6, Capabilities and Challenges of Nebraska Flood Hazard Mitigation Programs,** discusses state and local program delivery capabilities.<br>• Additionally, during the public meetings conducted |

[1] Neb. Rev. Stat. §61-226. State flood mitigation plan; scope. "The Department of Natural Resources shall develop a state flood mitigation plan as a stand-alone document to be annexed into the state hazard mitigation plan maintained by the Nebraska Emergency Management Agency. Such plan shall be structured in accordance with Federal Emergency Management Agency guidelines, and shall be comprehensive, collaborative, and statewide in scope with opportunities for input from diverse stakeholders." Source: Laws 2020, LB632, § 10. Effective Date: November 14, 2020.

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| Nebraska Revised Statute §61-228 | Description of efforts in Plan development |
|---|---|
| | statewide, a station at each open house was dedicated to recovery resources and staffed by NeDNR and NEMA personnel. |
| (4) Identify potential available funding sources that can be accessed to improve the resilience of the state through flood mitigation and post-flood disaster recovery. The funding sources shall include, but not be limited to, assistance from (a) the Federal Emergency Management Agency's Flood Mitigation Assistance Grant Program, Building Resilient Infrastructure and Communities Grant Program, Hazard Mitigation Grant Program, Public Assistance Program, and Individual Assistance Program, (b) the United States Department of Housing and Urban Development's Community Development Block Grant Program and Community Development Block Grant Disaster Recovery Program, and (c) programs of the United States Department of Agriculture's Natural Resources Conservation Service. Identification of such funding sources shall be in addition to grants and cost-sharing programs available through other agencies that support flood hazard mitigation planning in communities; | • **Section 5, Recovery and Funding Sources,** contains a compilation of current federal and state funding resources from a host of agencies and programs that support recovery and mitigation activities.<br>• Additionally, common funding issues and challenges faced by local communities in securing this funding has been summarized in **Section 6, Capabilities and Challenges of Nebraska Flood Hazard Mitigation Programs**. |
| (5) Compile a centralized list of critical infrastructure and state-owned facilities and identify those with the highest risk of flooding. In compiling such list, the Department of Natural Resources shall consult and collaborate with other state and local agencies that have information that identifies vulnerable facilities; | • A database of critical infrastructure and state-owned facilities was created with input from local hazard mitigation planning areas and state agencies. This database was a fundamental component of the risk assessment conducted as part of the plan's development and documented in **Section 3.5, Flood Risk Assessment**. |

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| Nebraska Revised Statute §61-228 | Description of efforts in Plan development |
|---|---|
| (6) Evaluate state laws, rules, regulations, policies, and programs related to flood hazard mitigation and development in flood hazard-prone areas to support the state's administration of the Federal Emergency Management Agency's National Flood Insurance Program (NFIP), Community Rating System, and Risk Mapping, Assessment, and Planning Program; | • **Section 6, Capabilities and Challenges of Nebraska Flood Hazard Mitigation Programs,** provides an evaluation of Nebraska's flood hazard mitigation programs. The section provides an evaluation of state, federal, and local authorities, programs, capabilities, and challenges to both their capabilities and coordination between programs. |
| (7) Examine existing law and, if necessary, recommend statutory or administrative changes to help ensure collaboration and coordination between state and local entities in statewide flood mitigation planning; and | • **Section 6.5, Evaluation of Regulatory Framework,** documents the review of Nebraska's flood hazard mitigation programs. The review was completed in the context of authorities, regulations, policies, and programs from across the country that may enhance Nebraska's flood hazard mitigation efforts. |
| (8) Hold two public hearings, one prior to the first state flood mitigation plan development meeting and one prior to the completion of such plan. Notice of each hearing shall be published at least thirty days prior to the hearing date. | • **Section 2, Planning Process,** details the activities and participants engaged through the public planning process. Specific to this statutory requirement, planning efforts included a public hearing and series of statewide public meetings held June 1–3, 2021, prior to the first plan development committee meeting; as well as a public hearing and series of statewide public meetings held April 26–28, 2022, to solicit comments on the draft plan document.<br>• Throughout the planning process, the **State FHMP project website** (https://dnr.nebraska.gov/floodplain/nebraska-flood-hazard-mitigation-plan) has been continuously maintained to reflect the current status of the planning effort, and has featured the latest draft materials, presentation slides, and meeting recordings.<br>• Additionally, the **Stakeholder and Public Engagement Summary**, a companion document to the plan, compiles the outreach conducted throughout the plan development process. |

## 1.4 Authority

As empowered by Nebraska Revised Statutes Chapter 31, Article 10, Flood Plain, NeDNR has been given authority by the Nebraska Legislature for all matters pertaining to floodplain management. NeDNR is responsible for coordinating a program that encourages the wise use of land that subject to flooding. This is accomplished through several endeavors that include Floodplain Management, Flood Risk Identification, Flood Insurance Coordination and Mitigation

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Planning. These endeavors are discussed in detail in Section 6, Capabilities and Challenges of Nebraska Flood Hazard Mitigation Programs.

The State FHMP was most recently updated in May 2013. Since that time, elements of the plan have been used as the basis for the flood risk assessment and mitigation strategy within the State HMP, which was recently updated in 2021 under the direction of the Nebraska Emergency Management Agency (NEMA). The formal adoption of the State HMP occurred on November 24, 2020, and a separate adoption of the 2022 State FHMP is found in Section 1.5, Adoption by the State of Nebraska.

The information in this flood mitigation plan, developed by NeDNR, is anticipated to be the basis for the flood risk assessment and mitigation strategy and incorporated as part of Nebraska's State HMP.

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## 1.5 Adoption by the State of Nebraska

June 30, 2022

Ms. Andrea Spillars, Regional Administrator
US Department of Homeland Security
Federal Emergency Management Agency Region VII
11224 Holmes Rd.
Kansas City, MO 64131-3626

Under the authority of Nebraska Revised Statute §§61-225 through 61-229, the Nebraska Department of Natural Resources, with the assistance of local, state, and federal stakeholders, has prepared the 2022 State of Nebraska Flood Hazard Mitigation Plan to identify flood hazard risks, Nebraska's vulnerabilities to these risks, and opportunities to mitigate and protect against danger, damage, or loss from flood hazards.

This plan applies to all state agencies, boards, commissions, and departments assigned mitigation responsibilities, and to others as designated by the Governor. This plan supersedes all previous editions of the State Flood Hazard Mitigation Plan.

As Governor, I formally adopt this State Flood Hazard Mitigation Plan for the State of Nebraska and ensure that the State will comply with all applicable federal statutes and regulation in compliance with 44 CFR 13.11(c). I also direct the Nebraska Emergency Management Agency and Nebraska Department of Natural Resources to amend the plan whenever necessary to reflect changes in State or Federal laws and statutes as required by 44 CFR 13.11(d). At minimum, the state will review and update the plan every five (5) years from the date of approval in accordance with 44 CFR, §201.3(c)(2) and (3) to continue program eligibility.

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Pete Ricketts
Governor
State of Nebraska

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## 1.6 Record of Changes

The 2022 State FHMP is a dynamic document that is under continual review. The document may be changed administratively at any time under the authority granted by the Governor to his/her designee. Administrative changes may include:

- Corrections or revisions that clarify context and readability
- Updates that reflect adopted policy and/or procedures
- Hazard data and risk information that enhances the current plan
- Updates to current mitigation actions and new actions as approved by the Governor's Task Force for Disaster Recovery (GTFDR)
- Other authorized changes granted by the Governor or his/her representative

**Table 2: Record of Changes**

| Section | Description of Change | Authorized By | Date |
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# 2 Planning Process

## 2.1 Nebraska Flood Mitigation Plan History and Development

During the 1990s, 58 Nebraska counties were declared Presidential disaster areas because of flooding in seven separate disasters, which led to public assistance awards of over $110 million dollars (aggregate of 1990s disaster events, dollar basis varies). During the 2000s, losses continued due to significant flooding events. Ten declared disasters resulted in over $235 million dollars in public assistance awarded in Nebraska (aggregate of 2000s disaster events, dollar basis varies). This type of ongoing risk, along with NeDNR's mission to promote effective floodplain management and flood risk mitigation, was the purpose of the original 2003 State FHMP. Since that time, the plan was updated in 2013, and elements of the plan have been used as the basis for the flood risk assessment and mitigation strategy alternatives within the State HMP. The State HMP was updated under NEMA's direction in 2005, 2008, 2011, 2019, and most recently in 2021.

Since the 2013 State FHMP, numerous flood events have occurred, and mitigation projects have been completed at various locations. The focus of NeDNR's mitigation programs and projects has also changed as available funding sources have changed and the Federal Emergency Management Agency's (FEMA) initiatives, such as Risk Mapping, Assessment, and Planning (MAP), have been modified. Additionally, many of the mitigation priorities identified in the 2013 State FHMP have been implemented to some extent, including a significant expansion of effective local HMPs. While mitigation efforts have been implemented, the risk of flooding damage continues and is the reason for development of this 2022 State FHMP and future related updates to the State HMP.

Mitigation projects and programs occur at the local and state levels, which means that an examination of mitigation programs and measures must be conducted via flood mitigation planning to show that effective flood mitigation programs can be initiated or maintained in Nebraska. Mitigation plan coverage areas in Nebraska currently include villages, cities, counties, Natural Resource Districts, and emergency management districts. A comprehensive statewide flood mitigation strategy is vital for reducing or eliminating flood disaster impacts in Nebraska. It records where flood problems have occurred in the past and provides recommendations for how these vulnerabilities can be reduced or eliminated in the future.

According to FEMA, flood mitigation is defined as, "Any sustained action that reduces or eliminates long-term risk to people and property from the effects of floods." While most mitigation measures are put in place after a dramatic disaster captures public attention, the most effective flood mitigation activities seek to address a jurisdiction's flood problem before a flood occurs. Mitigation is a cost-effective way to reduce or eliminate the flood losses and recovery costs individuals, businesses, and the government must pay. Besides reducing the direct costs associated with natural hazards, mitigation reduces important indirect costs, such as the disruption of daily routines, community services, commerce, and industry. Mitigation has increased in popularity because the one-time expense of a mitigation project saves money compared to multiple potential future disaster assistance payments.

There are several approaches to flood mitigation, and they can be categorized simply as structural, nonstructural, and nature based. As the name implies, structural techniques seek to build structures to change or "control" the physical environment. Common techniques include dams, levees, or floodwalls. These methods are quite costly. Throughout the last century,

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national flood losses continued to increase despite expending billions of dollars for structural flood control.

As a result, nonstructural solutions are the preferred alternative and are strongly supported by NeDNR. Instead of modifying the physical landscape to modify the flood, nonstructural solutions encourage approaches that adapt development to the characteristics of the flood. Examples of nonstructural flood mitigation activities include plans that limit or redirect development away from flood hazard areas, floodplain zoning ordinances, flood warning systems, flood insurance, acquiring or elevating at-risk structures, and flood proofing. These approaches tend to be very cost-effective. Additionally, nature-based solutions aim to utilize natural functions to sequester and filter rainwater where it lands to reduce down-stream effects. They are also used to enhance a floodplain's natural functions and are rather cost-effective, while providing a host of additional ecosystem services.

## 2.2 Documentation of the Planning Process

To ensure a comprehensive approach and robust cross-agency collaboration, NeDNR assembled a broad group of state agency partners, natural hazard specialists, local jurisdiction representatives, and federal agency partners, referred to as the "plan development committee," to ensure a robust planning process. Virtual meetings were held on a bi-monthly basis and participation was open to the public. Participating agencies and stakeholders are discussed further in Section 2.3, Coordination with Other Agencies. For those who could not attend plan development committee meetings, meeting recordings and presentation slides were made available on the project website. The project website served as a central platform where interested parties could review and provide comments on draft documents, participate in surveys, review past meetings, review monthly project updates, and learn how to participate in future meetings. Comments were received from various stakeholders throughout the planning process. All comments were evaluated, and the draft flood mitigation plan was updated accordingly.

Two series of public meetings were held. The first series, occurring June 1–3, 2021, kicked off the plan development process with meetings in Lincoln, Kearney, Alliance, Valentine, and Norfolk, Nebraska. The second series, occurring April 26–28, 2022, presented the draft plan to the public in Lincoln, Kearney, Scottsbluff, Norfolk, and Fremont. Meetings notices were placed in newspapers with statewide circulation as well as local newspapers.

The dedicated team of individuals listed in Table 3 formed the core planning team behind the plan development and supporting activities. Several other material experts provided their services intermittently throughout the project.

**Table 3: Core Planning Team**

| Organization | Name | Title |
|---|---|---|
| NeDNR | Katie Ringland, PE, CFM | Chief, Floodplain Management Section; State NFIP Coordinator |
| NeDNR | Adele Phillips, CFM | Flood Mitigation Planner |
| NeDNR | Elijah Kaufman, CFM | Environmental Specialist |
| NeDNR | Michele York | Administrative Programs Officer |
| HDR, Inc. | John Engel, PE | Water Resources Engineer |

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| Organization | Name | Title |
|---|---|---|
| HDR, Inc. | Julie Molacek | Strategic Communications Coordinator |
| HDR, Inc. | Stephanie Rittershaus | Strategic Communications Manager |
| HDR, Inc. | Matt McConville, PE | Senior Water Resources Engineer |
| HDR, Inc. | Travis Tallbitzer | Senior GIS Analyst |
| HDR, Inc. | Rusty Jones | Senior Water Resources Engineer |

## 2.3 Coordination with Other Agencies

Noted participants included the Nebraska Department of Transportation (NDOT), Nebraska Department of Environment and Energy (NDEE), Nebraska Department of Economic Development (NDED), Nebraska Department of Agriculture (DOA), and NEMA. Local partners included several local governments and all the state's natural resources districts (NRD). Federal partners included the United States Department of Agriculture (USDA), the United States Army Corps of Engineers (USACE), the United States Geological Survey (USGS), and FEMA.

For a complete list of participating agencies and stakeholders, see Table A-1 in Appendix A. "Roster of Participating Agencies and Stakeholder Organizations".

## 2.4 Integration with Other Planning Efforts, Programs, and Initiatives

This State FHMP is intended to be the basis for updates to the flood mitigation sections of the future 2022 State HMP update. Data from this plan will be incorporated during the development of the future State HMP update. It is intended that future flood mitigation planning updates will be developed in conjunction with State HMP updates and incorporated directly into the State HMP.

For the purposes of this flood mitigation plan, NeDNR focused on the development of an improved flooding risk assessment via local plan coordination, as well as coordination of the plan elements with other State programs focused on flood mitigation and risk reduction.

# 3 Risk Assessment

## 3.1 Flood Hazard Overview

Nebraska has a diverse environment and a broad range of topography, geology, and weather variations from east to west and from north to south. For example, Nebraska can experience, on average, 34 inches of rain annually in the east and 16 inches of rain annually in the west. Due to the range of conditions, there are also different types of flooding along Nebraska's rivers. The type of flooding that takes place on a river is typically a function of watershed characteristics such as soils, slope, and level of development. Different types of river channels may have different flooding characteristics

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## 3.2 Types of Rivers and Channels

There are three general types of rivers and channels in Nebraska: mature, young, and modified.

Mature rivers are best characterized by shallow depth, low slope, and a braided appearance with numerous sandbars shifting with changes in stream flow. The Platte River in Nebraska is one of the best examples of a mature river in the nation. The character of mature rivers can be impacted by channel modifications, especially those that modify the channel length, such as straightening.

Young rivers are characterized by steep slopes and have a single channel with a straighter course than mature rivers. A young river typically erodes its channel bottom (downcutting) and banks (lateral erosion) to enlarge its channel to become more like mature rivers. Often, historical practices on these types of rivers, such as channel straightening, have increased erosion to the channel bottoms and banks. Most rivers and creeks in Nebraska are characterized as young rivers even though many have extensive floodplains. Examples of young rivers in Nebraska include the Little Nemaha, Big Nemaha, Little Blue, and Big Blue.

Modified rivers are characterized by extensive civil works such as channel widening and dredging, construction of navigation structures, and construction of flow modification structures such as levees. The best example of an extensively modified river in Nebraska is the Missouri River because most of the Missouri has been modified, channelized, leveed, or dammed. The Missouri River adjacent to some parts of Nebraska is braided and has characteristics of a mature river; however, these characteristics have been modified mostly for the river reach that borders the eastern edge of the State. For this reason, the Missouri River is unique among rivers that expose Nebraska to flood risk.

## 3.3 Types of Potential Flooding

Flooding of normally dry land areas typically results when a stream channel overflows due to excess runoff that exceeds channel capacity. These normally dry land areas adjacent to stream channels that have potential for flooding are floodplains. Every creek and river have a floodplain regardless of how long it has been in existence. Simply put, the floodplain is the area that is inundated by water during a flooding event. The characteristics of the flooding, such as rate of rise, overall magnitude (peak flow), duration, and frequency, are a result of the area's climate and geographic characteristics. Floods are typically measured in terms of magnitude and the probability that they will occur. FEMA floodplain maps and State floodplain management regulations are currently based on the 1-percent annual chance flood, which is the flood that has a 1 percent chance of being equaled or exceeded in any year.

Types of floods and overall flooding characteristics vary depending on the type of flooding and the source of the runoff. Flooding characteristics are also impacted by the presence of dams or levees—if these features are present within the subject watershed. Riverine floods, flash floods, groundwater flooding, ice jamming, snowmelt flooding, dam failure, and levee failure are the possible types of potential flooding in Nebraska.

- Riverine flooding happens because of heavy precipitation or snow melt runoff occurring over a watershed for a period of several days or weeks. This type of flooding most commonly impacts medium to large channels including, but not limited to, the Big Blue River, Elkhorn River, Loup River, Platte River, and Missouri River. NWS, USGS, and NeDNR work together to track stream gage heights to estimate future crests and stage heights. This allows for a timely dissemination of advance flood warning.

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Geology also has a unique impact on the nature of riverine flooding for some rivers in Nebraska. Sandhills rivers, located in certain areas of the central and western part of the state, are fed primarily through groundwater and flooding in general is rare. In addition, the sandhills act as a reservoir by quickly absorbing rainfall and adding it to groundwater supplies, which then release water to sandhills rivers and streams in controlled amounts.

- Flash floods develop quickly following extreme precipitation events, such as heavy thunderstorms, rapid springtime snowmelt, or breaks in dams, levees, or ice jams. This type of flooding is associated most with smaller channels and watersheds that have steeper slopes. Urban areas are also more prone to flash flooding due to impervious surfaces that do not allow water to infiltrate the ground. Typically, flash flooding cannot be accurately tracked and anticipated with crest and stage height estimates. This limitation hinders the potential for dissemination of advanced flood warning. NWS provides flash flood watches, advisories, and warnings as this specific information is gathered and modeled prior to and during an event.
- Ice jam flooding occurs throughout the state, and the most significant events occur on the Loup and Platte Rivers. Ice jam events are the result of air temperatures fluctuating above and below freezing and occur typically during the shifting temperature periods between winter and spring, but they can occur throughout the winter season. River ice sheets develop during below-freezing days and ice starts to thaw during above-freezing days, which causes it to break up and begin flowing downstream. Ice jams are caused by the broken-up ice sheets getting caught on an obstacle, such as a shallow river bend or bridge, and these floating ice sheets begin to pile up or stack upon each other, eventually creating an increase in water surface elevation upstream. Depending on the size of the blockage, amount of additional floating ice sheets, and amount of water flowing down the river, this can become a serious flooding issue for miles upstream. Additionally, depending on the amount of water being held back, a sudden breakup of the ice jam can create a serious flash flood issue downstream. Periods of rapid snowmelt and/or heavy rainfall accompanying the formation of an ice jam can increase flood severity.
- A flood is considered a snowmelt flood when melting snow is the major source of the water involved. Unlike rainfall, which reaches the soil almost immediately, snow stores the water until it melts for days, weeks, or even months. Once snowmelt reaches the soil, the water either soaks into the ground or runs off. When more water runs off than soaks into the soil, flooding occurs.[2] Mountain snow fields act as natural reservoirs for many western United States water-supply systems, storing precipitation from the cool seasons, when most snow falls and forms snowpacks, until the warmer seasons when most or all snowpacks melt, releasing water into rivers. In the western states, as much as 75 percent of water supplies come from snowmelt. During certain times of the year, water from snowmelt can be responsible for most of the streamflow in a river. An example of this is the South Platte River in Colorado and Nebraska.[3]

[2] National Weather Service Training Division. 2021. "Flooding Factsheet." Accessed October 21, 2021. https://training.weather.gov/nwstc/Hydrology/flooding_factsheet.pdf.

[3] US Geological Survey. 2019 "Snowmelt Runoff and the Water Cycle Completed." June 12. Accessed October 2021. https://www.usgs.gov/special-topic/water-science-school/science/snowmelt-runoff-and-water-cycle?qt-science_center_objects=0#qt-science_center_objects.

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- Dam failure flooding may occur due to hydrologic overtopping (exceeding design capacity) or structural failure of a dam embankment. Dams may be present in either rural or urbanized areas. A dam failure typically results in a rapid release of floodwaters over a short time. These floodwaters typically move downstream quickly and have the potential for serious impacts with little warning time.
- Levee failure may occur due to hydrologic overtopping (exceeding design capacity) or structural failure of a levee embankment. Levees may be adjacent to either rural or urban areas. A levee failure typically occurs while flooding is already underway and could result in a rapid release of floodwaters over a short time. These floodwaters typically move into the levee protected area quickly and have the potential for serious impacts with little warning time. Levee protected areas also have the potential for damage due to under seepage or internal drainage induced ponding on the landward side of the levee. These conditions may occur during high water due to seepage of flood water under the levee embankment, gravity drainage systems being closed, or lack of pumping capacity.

## 3.4 Historic Flood Events

Like most states, many flood problems in Nebraska are rooted in the initial development of communities along watercourses within the state. With its location on the Missouri River, Omaha played a role in the nation's westward expansion. During this time, water was vital for transportation, running mills, creating power, and homesteading; thus, most of Nebraska's communities and homesteads were built in close proximate to water sources. Flooding in Nebraska has the potential to affect both urban areas and rural agricultural areas. Nebraska has several major watersheds and rivers, including over 5,000 wetlands, 2,000 natural lakes, and over 1,000 reservoirs and sandpit lakes.[4] The following sections include an overview of the state's flooding history, by major watershed, and a summary of potential flooding risks due to dam and levee failures. Figure 1 shows an overview of the major watersheds within the state, around which this plan section is largely organized.

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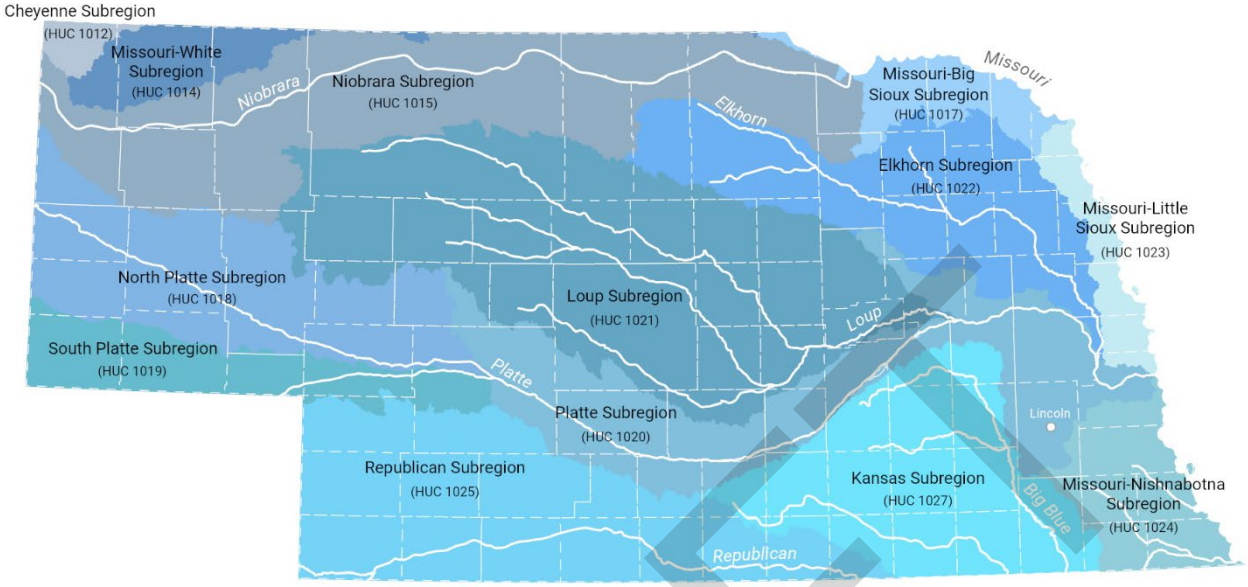
[4] University of Nebraska-Lincoln Institute of Agricultural and Natural Resources. 2020. "Ag Water Resources." CropWatch. February 27. https://cropwatch.unl.edu/cropwatch-youth/agwaterresources.

Figure 1: 4-Digit Hydrologic Unit Codes and Watershed Subregions




The following summary of historical occurrences of flooding in Nebraska contains a review of rivers that have historically caused the most damaging flood events. It also includes some mitigation actions already implemented within the referenced watersheds in response to historical flooding. It should be noted that this summary does not include all locations subject to potential flooding or all flood events. It is intended to show that the risk of flooding is present statewide and has occurred in a wide variety of watersheds and stream types. This information is being provided primarily to describe the historical occurrences of flooding and typical flooding characteristics of major watercourses in the state. Sources of information include articles from the Lincoln Journal Star and Omaha World Herald, the 2021 State HMP, the 2013 State FHMP, FEMA Flood Insurance Studies, and community narratives, among others. Monetary values reported are not adjusted to the Consumer Price Index (CPI).

### 3.4.1 BOMB CYCLONE FLOOD OF 2019

The most recent state-wide flood event occurred from March 12–20, 2019, and resulted in the deaths of two Nebraskans. Nebraska experienced record snowfall between January and March 2019, resulting in as much as 16 inches of snow remaining on the ground in areas of the state leading up to March 12. Along with this record snowfall, below freezing temperatures led to a deep frost depth. On March 11, Winter Storm Ulmer was identified. On March 12, 2019, Governor Pete Ricketts, in consultation with NEMA, issued an emergency declaration in anticipation of severe weather issues. An expedited federal declaration was approved by President Trump for the State on March 12, 2019. In total, 104 cities, 81 counties, and 5 tribal nations in Nebraska received State or Federal Disaster Declarations due to the flood events.

Throughout March 13 and 14, the system moved through the state with heavy snowfalls, high winds, and flooding. The widespread rainfall, up to 3 inches, along with rapid snow melt caused creeks and rivers to reach record levels in a matter of hours due to lack of infiltration because of the frozen ground. Many roads and bridges across eastern Nebraska were closed or washed away. Many communities, such as the City of Fremont, were isolated due to flooded highways preventing entry and exit. As local bridges continued to wash away, critical emergency routes

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were compromised. For example, Highway 281, which is the main link between O'Neill and Spencer, was completely washed away. The Spencer Dam, located on the Niobrara River, failed and was breached by ice and record stream flows, causing large blocks of ice to float downstream. Thirty stream gages reached record high water levels, including the Missouri River at Plattsmouth recording a crest of 40.62 feet. These record high numbers caused significant levee breaches over more than 350 miles along the Missouri, Elkhorn, and Platte Rivers. Among the more than 47 confirmed breaches reported in multiple states during this event, at least 19 Nebraska levee systems were documented as breached. The details of their repair are presented in Table 12.

Due to the levee breaches, flood damage devasted communities. Individuals lost their lives, hundreds had to be rescued by air or boat, and tens of thousands were evacuated. In addition, levee breaches added to flooding over widespread agricultural lands, compounding the economic losses related to the 2019 event. Significant repairs of the state's levee systems have been undertaken since the 2019 flood event.

As of March 15, several communities enforced mandatory evacuations (full and partial), including Beemer, Belgrade, Cedar Rapids, Dannebrog, Genoa, Inglewood, Randolph, northern Butler County, eastern Richardson County, Pender, Broken Bow, Linoma Beach, Norfolk, Anselmo, Lynch, Wisner, South Bend, Louisville, Cedar Creek, Plattsmouth, eastern Washington County, Pleasanton, Buccaneer Bay, Valley, Sarpy County, and West Point. Flood conditions in Lincoln resulted in power outages in and around the well fields that supply water to the city, resulting in a loss of water production capacity and triggering water use restrictions.

The 2019 flood was also devastating to agriculture as it tore through pasture lands and crop fields. Occurring in the middle of calving season, hundreds of calves perished while adult cattle were swept away and drowned or were stranded on islands. Damage in Nebraska from the 2019 flooding has been estimated at over $1.3 billion, including $449 million in damage to roads, levees, and other infrastructure; $440 million in crop losses; and $400 million in cattle losses. Further analysis of 2019 flood claims is included in Section 3.6.6, 2019 Flood Insurance Claim Analysis.

### 3.4.2 WHITE RIVER-HAT CREEK BASIN

The White River-Hat Creek Basin include 247 square miles in northwest Nebraska. The area includes the northern portions for Sioux, Dawes, and Sheridan Counties. The White River is in the northwest corner of Nebraska. It starts in Sioux County and runs through the north part of Dawes County before entering South Dakota. The Pine Ridge forms the divide between the White River/Hat Creek to the north and the Niobrara River to the south. Most of the streamflow in these basins are fed by stormwater.

#### 3.4.2.1 *White River*

On May 10, 1991, a thunderstorm dumped 12 inches of rain on the upper reaches of the White River and Soldier Creek. The White River crested at 15 feet and was half a mile wide in some places. The flood event killed one man and destroyed the water supply and a historical trout hatchery in Crawford. It also damaged approximately 9 homes in the Crawford area. In town it damaged the city park, bridges, and roads. Dawes County lost 11 bridges, and Sioux County lost 6 bridges and 22 miles of roads. The Chicago & North Western Railroad lost 20 miles of track and 45 bridges, while the Burlington Northern Railway reported losing one bridge and one line. Fort Robinson State Park had 100 windows damaged in six buildings, and only 3 of the original 32 grave markers remained after the flood. The Crawford Livestock Market reported up to 375

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cattle went missing. When it was all over, combined damages were estimated at up to $6 million.[5]

On June 9–10, 2010, the White River canal overflowed following 6–8 inches of rainfall. Water flowed rapidly and inundated 5th Street in downtown Chadron causing $1,000 in property damage to businesses and homes.

Flash flooding in the City of Chadron also occurred following heavy rain events on July 22, 2010; June 25, 2015; and July 27, 2016, but no significant damages were reported.

#### 3.4.2.2 *Rush Creek*

Rush Creek meanders through Sheridan County, Nebraska and has caused a handful of flash floods in the City of Rushville over the past few decades. On August 3, 1996, after 5–6 inches of rainfall, the creek flooded. The Rush Creek Bridge, 3 miles south of Rushville, was washed out. This flood event resulted in $500,000 in property damage.

Again, on July 11, 2011, the creek overflowed and created a flash flood that washed out a rural road 5 miles north of Rushville and resulted in $1,000 in property damage.

### 3.4.3 NIOBRARA RIVER BASIN

The Niobrara River Basin spans parts of eastern Wyoming, southern South Dakota, and northern Nebraska. The Niobrara River begins in eastern Wyoming and runs along northern Nebraska until its confluence with the Missouri River just upstream of Lewis and Clark Lake. The basin includes 535 river miles and drains 12,600 square miles. The Niobrara River is the longest river in Nebraska, and it connects the semiarid western landscape with the more humid midwestern prairie. It also includes a 76-mile stretch that is protected by the National Wild and Scenic River system. The river is fed by both ground and surface water.

#### 3.4.3.1 *Niobrara River*

The Niobrara River stretches across the northern part of Box Butte County, Nebraska and is confined to a narrow valley surrounded with high cliffs for much of its 568-mile path. The Niobrara River is one of Nebraska's longest Missouri River tributaries running through the northern tier of the Nebraska Sandhills.

The Missouri River flood of 1881 led to flooding along the Niobrara River. The water began to rise the night of March 29, 1881, in Niobrara, Nebraska (Knox County) and was documented to be anywhere between 2 and 7 feet deep. The town was surrounded with water, flooding homes, croplands, and killing large numbers of horses and cattle.[6] The Missouri River flood of 1881 led

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[5] Steve Frederick. 2016. "25 Years Ago, a Ruinous Flood Swept down the White River." *Star Hearld*. May 7. https://starherald.com/opinion/columnists/frederick-25-years-ago-a-ruinous-flood-swept-down-the-white-river/article_1759a241-4eb1-5664-8825-aecf108a0fb4.html

Kerri Rempp. 2011. "Crawford Residents Reflect on 1991 Flood." *Rapid City Journal*. June 15. https://rapidcityjournal.com/thechadronnews/latest/crawford-residents-reflect-on-1991-flood/article_1f32b4d8-9766-11e0-bec1-001cc4c03286.html.

[6] Patricia C Gaster. n.d. "The Missouri River Flood of 1881." *History Nebraska.* Accessed January 24, 2022. https://history.nebraska.gov/blog/missouri-river-flood-1881.

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to the design and construction of the six Missouri River mainstem dams and moving the entire Village of Niobrara to higher ground.

On July 19, 1999, the Niobrara River experienced major flooding when heavy rainfall occurred in Rock County. Flash flooding throughout the county caused $100,000 in property damage after roads and culverts were washed out.

On July 16, 2001, the Village of Newport experienced a torrential downpour of over 8 inches of rain, which resulted in a flash flood that washed out culverts, bridges, and agricultural lands amounting to $250,000 in property damages and $100,000 in crop damages. The Nebraska Department of Roads (now NDOT) reported more than 2 feet of water flowing over Highway 137, just seven miles north of Newport.

Nine years later, on June 12, 2010, Newport experienced another flash flood. It resulted in $120,000 in property damages and $20,000 in crop damages after Highway 20 and Highway 183 were underwater and numerous rural roads were severely damaged by flood waters. On April 26, 2012, the river overflowed its banks causing a flash flood in the City of Alliance. Flood waters as deep as 6 inches ran over Highway 87 and Highway 2 north of Alliance and filled up the surround ditches. Highway 87 had to be closed from mile markers 6–16.

The river reached flood capacity once again on July 2, 2015, flooding portions of Highway 2 west of Hemingford. County Roads 72 and 72 southwest of Hemingford were closed due to high waters and ditches full of flood waters.

The Niobrara River experienced a severe flood event in 2019. On the night of March 14, 2019, Spencer Dam failed sending a rush of water, huge blocks of ice, and debris moving down the river destroying continued downstream of the dam, destroying south bridge abutment on US Highway 281, and several structures downstream the dam. This event resulted in one fatality.

The Spencer Dam failure led to an independent investigation, which was requested by NeDNR, the state regulator, and the Nebraska Public Power District (the dam owner). The causes of the dam's failure were the combination of meteorological conditions that included frozen ground, substantial thicknesses of river ice cover, and snowpack that were impacted by a "bomb cyclone" winter storm resulting in heavy rainfall on the snowpack and frozen ground. for of the dam and it certainly did not exacerbate flooding of the dam. The investigation concluded that the flood of water and ice greatly exceeded the capacity of the dam and its spillways. Nothing the operators at the dam could have done would have prevented the dam from failing given the magnitude of the flood and ice. If the dam had not been present, the structures immediately downstream would not have been safe during these flood conditions.

In addition to the Spencer Dam failure several privately owned, low hazard potential dams failed in the 2019 event. The failure of the private dams increased overland flooding downstream. Large ice chunks on several rivers destroyed or damaged river bridges, including State-, County-, and privately owned bridges in multiple counties.[7]

[7] Nebraska Emergency Management Agency. 2021. "2021 Nebraska State Hazard Mitigation Plan." January 27. https://nema.nebraska.gov/sites/nema.nebraska.gov/files/doc/hazmitplan2021.pdf.

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#### 3.4.3.2 *Niobrara River Tributaries*

There are numerous smaller tributaries that run off the Niobrara River. Long Pine Creek runs south from the Niobrara River through the City of Long Pine, Nebraska.

On June 30, 1997, the creek experienced high levels of water that caused a flash flood to wash out a bridge near Long Pine, resulting in $500,000 of property damage.

Located in southwest Cherry County, Nebraska, Calf Creek experienced 7 inches of rainfall on July 26–27, 2001, causing large amounts of runoff from its banks. This resulted in a flash flood in the community of Eli. Several county roads and culverts were washed out, resulting in $39,000 of property damage.

The City of Valentine, Nebraska has experienced a few flash flooding events due to Minnechaduza Creek overflowing its banks. On June 22–24, 2003, flooding in rural areas west of Valentine resulted in $10,000 in property damage after a portion of German Settlement Road was completely washed out and many other roads were underwater or were partially washed out.

Flooding in Long Pine occurred again on March 13, 2019, due to 6 inches of snowfall followed by warm spring temperatures and several inches of rain, causing major run-off flooding. This caused an overwhelming amount of resource concerns to occur in the form of severe erosion and sediment issues, infrastructure damage, property damage, loss of land, channelization, loss of livestock, and damage to county roads, bridges, and culverts. The Old Highway 7 culvert was also compromised.

Later that year, on September 11, 2019, Brown County, Nebraska experienced more than 12 inches of rain over a 2-day period, causing similar flooding with much more devastating impacts. The bridge over Long Pine Creek was washed out once again due to high water levels, resulting in $150,000 in property damages to the City of Long Pine.

On July 10, 2020, 2 inches of rain fell over Minnechaduza Creek in just 30 minutes. This caused a flash flood and $1,000 of property damages due to county roads being flooded.

#### 3.4.3.3 *Verdigre Creek*

According to Joseph John Van Hoff's "A History of the Czechs of Knox County," written in 1938, old settlers spoke of the winter of 1880–1881 as being extremely severe. Snow was on the ground from October through late March. There were frequent blizzards causing 3 or 4 feet of snow on the open prairies.

Temperatures were lower than normal, and transportation was very delayed. On March 25, 1881, the weather moderated, and the snow began to melt faster than streams could handle it. Ice piled up in the Missouri River, above Niobrara, holding back turbulent waters and setting the stage for the most disastrous flood in the region. On March 29, the ice gorge broke, releasing the flood waters and completely inundating the village of Niobrara. The flood lasted a week until a return of low temperatures slowed the thawing of the snowbanks.

The loss was mostly in the form of livestock that drowned and structures damaged by water. In addition to the widespread general losses to the settlers, there were some indirect results of these floods of 1881 that slowed up the economic development of the entire region. The Chicago, Milwaukee, and St. Paul Railroad had built South Dakota, opposite Niobrara, in 1879. They had planned to extend the railroad south into Nebraska. They had secured the necessary right-of-way and had even constructed a grade of twelve or thirteen miles between Niobrara and

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Verdigre. This grade followed the Verdigre Creek and was seriously washed out by the floods. After the flood, the company ceased their construction and abandoned their plan to enter Nebraska. The Fremont, Elkhorn, and Missouri Valley Railroad had been constructed as far as Plainview in Pierce County and seemed about to come into Knox County, also held up further construction for several years.[8]

### 3.4.4 UPPER PLATTE RIVER BASIN (STATE LINE TO NORTH PLATTE)

With its wide channel, shallow depth, and braided appearance with sandbars, the Platte River is a classic example of a mature river. The drainage basin area of the Platte is second only to the Missouri River in Nebraska and is approximately 90,000 square miles at Plattsmouth, according to the Cass County Flood Insurance Study[9]. The North Platte River and the South Platte River meet to form the Platte River near the City of North Platte. The Platte River then flows the rest of the length of the state until it has a confluence with the Missouri River near Plattsmouth. Since most of the population of Nebraska lives in the eastern third of the state, most of the severe floods that have occurred on the Platte have been in eastern Nebraska. The flooding can be exacerbated by contributing streams such as the Loup River, Elkhorn River, and Salt Creek.

Dams along the North Platte River in Nebraska, including Lake McConaughy, have regulated flows and reduced the Platte River flooding risks, especially in western Nebraska. Lake McConaughy covers 35,700 surface acres, retains nearly two million acre-feet of water, has 105 miles of shoreline, and is a popular vacation and angling destination. Finished in 1941, the lake serves to retain snowmelt from the North Platte headwaters in Wyoming. Several other multifunctional dams on the North Platte River in Wyoming have served to reduce the severity of spring flooding. However, it should be noted that Glendo in Wyoming is the only reservoir with an authorized flood control purpose; the other reservoirs provide flood control, but it is incidental to their primary purpose, which is typically water supply and irrigation.

Ice jams and snowmelt are the most common cause of flooding in the Lower Platte from Columbus to Plattsmouth during the winter and early spring months. There are also more bridges that span the river in the Lower Platte because of higher levels of development and population. One of the most severe ice jam floods on the Platte prior to 2019 occurred in conjunction with high snowmelt flows in March and April of 1960. The entire town of North Bend was inundated.[8] In Fremont, hundreds of people were evacuated. In Valley, an ice jam breached the Union Dike levee [10]and forced the evacuation of several hundred residents. The National Guard Camp at Ashland was also evacuated. The entire Village of Waterloo was also evacuated after water flowed over Main Street north of the railroad tracks, inundating the town up to 6 feet deep in places.

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[8] Joseph John Van Hoff.1938. “A History of the Czechs in Knox County, Nebraska.” University of Nebraska-Lincoln. https://www.unl.edu/czechheritage/A%20History%20of%20the%20Czechs%20of%20Knox%20County%2C%20Nebraska.pdf

[9] Federal Emergency Management Agency. 1979. “FEMA 1979 Flood Insurance Study, City of North Bend, Dodge County.” September. https://map1.msc.fema.gov/data/31/S/PDF/310239V000.pdf?LOC=2735ccc3c44abf4a678f682514522e53%20September%201979%20FIS.

[10] Gloria Bucco. 2018. “The Power of Ice: When Spring Comes to the River.” Prairie Citizen. April 20. https://prairiecitizen.com/environment/the-power-of-ice-when-spring-comes-to-the-river/.

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Ice jams and snowmelt are not the only causes of floods in Nebraska. A flood event occurred along the Platte River between May 26 and June 16, 1967. Grand Island was most severely affected by this flood. Due to the Platte River flooding, water was backed up into Grand Island while Prairie Creek, Silver Creek, and Wood River were also over flood stage. Water was nearly 2 feet over flood stage for the Platte, which inundated approximately one-third of the town. Thousands of residents were evacuated and thousands more experienced property damage.

Like many of the rivers in Nebraska in 1993, the Platte River was flooded for a long period of time. In March, an ice jam and snowmelt flood destroyed a section of the Highway 64 bridge near Valley and nearly damaged the City of Lincoln's well field, which supplies the city with all its water for drinking, industry, and other uses.

During 2011, the Missouri River was flooded near its confluence with the Lower Platte for an extended period (approximately June–August) due to high water. Both the Lower Platte and the Missouri River flooded again during the flooding of 2019 due to heavy rainfall and snow melt.

Records also show that levee systems have been installed at several locations within the Platte River watershed. These include Schuyler, Valley, Grand Island, Ashland, Ames Diking District, Gering, and Sidney.

#### 3.4.4.1 *North Platte River*

The North Platte River near North Platte is regulated by Kingsley Dam and other upstream dams in Wyoming. These dams have assisted in reducing flood risk historically; however, flooding impacted the river corridor in 2011 due to significant snowmelt inflows that occurred in conjunction with heavy rainfall during May. Heavy snowmelt in Wyoming caused significant inflows to Lake McConaughy, which required higher than normal releases of flow from Kingsley Dam. During May and June, significant flooding occurred along the North Platte River from Scottsbluff to North Platte, with the North Platte reaching a record crest of 7.69 feet. Releases from Kingsley Dam caused the North Platte River, at North Platte, to reach stages above moderate flood stage for much of the rest of the summer and into August.

#### 3.4.4.2 *South Platte River*

From September 9–13, 2013, the front range of the Colorado Rocky Mountains received a record-breaking rainfall of 15 to 17 inches. This caused drastic flash flooding and river flooding in the South Platte River Basin within Colorado. The flood waters started crossing into Nebraska on September 17 and by September 18, 2013, measured 20,000 cubic feet per second (cfs). Significant rises across Deuel County began on September 18. The Roscoe River gage hit flood stage on September 19, and the North Platte gage hit flood stage on September 21. Floodwaters entered the Platte River at that point. The Brady gage on the Platte River hit flood stage on September 21. In this area of the river, rises of up to 1 foot an hour were observed as the flood waters moved through Nebraska.

Simultaneously, NeDNR, Central Platte NRD, South Platte NRD, Tri-Basin NRD, Twin Platte NRD, Central Nebraska Public Power and Irrigation District, Nebraska Public Power District, Paxton-Hershey Water Company, Platte Valley Irrigation District, Suburban Irrigation District, Thirty Mile Canal Company, and Western Irrigation District coordinated the timing of diversions to attenuate the peak flood flows. The diversions recharged the Ogallala aquifer by allowing water to seep into the ground beneath the canals and lakes along the South Platte and Platte Rivers. Estimates show that recharge from the diversions will positively impact water supplies for the next 50 years. By October 1, 2013, all gages were below flood stage, and it was apparent that

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the coordinated efforts between these agencies were highly effective, with minimal damage occurring to homes, businesses, roads and other infrastructure throughout the region.

### 3.4.5 CENTRAL PLATTE RIVER BASIN (NORTH PLATTE TO COLUMBUS)

Heavy rainfall and snow in eastern Colorado in May 2015 increased the South Platte River flows and caused flooding across Colorado and Nebraska. The river was estimated to peak at approximately 16,500 cfs at the Nebraska-Colorado state line, which caused minor to moderate flooding along the river. With high flows from the South Platte River, the Platte River reached flooding stage between Brady and Grand Island.

At the same time, 5–10 inches of spring snow and rain throughout much of eastern Wyoming and western Nebraska pushed Grayrocks Reservoir and Glendo reservoir levels into their flood pools, which required increased releases of water. With these two North Platte River Basin reservoirs' releases and high rainfall, the North Platte River rose to flood stage from the Wyoming-Nebraska state line all the way to Lewellen. The crest of the river was estimated to be around 6,000 cfs near the State border, which produced minor to moderate flooding along the river.

In anticipating floodwaters coming from Colorado, NeDNR worked with various irrigation and NRDs to divert water into the canals for groundwater recharge. NeDNR also coordinated with Central Nebraska Public Power and Irrigation District for storing water in Lake McConaughy. Many other partners including the USACE, US Bureau of Reclamation, and Basin Electric Power assist in synchronizing the reservoirs' releases for reducing downstream flooding. These efforts accomplish multiple goals: flood damage reduction, groundwater recharge, recreation enhancement, and more water for irrigation.[11]

#### 3.4.5.1 *Central Platte River*

Most of Hall County is in the Platte River valley, which means that there is very little change in elevation across the jurisdiction. The drainage system is primarily the Platte River, which flows from southwest to northeast. Only in the far northwest corner of the county will you find possible relief from upland streams. Like many communities in Nebraska, Hall County development occurred with to the proximity to water sources and railroad plans. As the reliance on proximity to surface water has declined over time many communities have significant water problems—not only flooding, but also related to a high-water table. Other than the Platte River, significant water courses in Hall County are Wood River, Prairie Creek, Moores Creek, Silver Creek, and Dry Creek. The Platte River is the controlling drainage for most of the County, which means that the water ways listed above either parallel or drain into the Platte. A small portion of Hall County south and east of Doniphan is in the Big Blue River watershed. Hall County's largest population center, Grand Island, has a large floodplain associated with the Prairie/Moores/Silver Creeks. They are often mentioned together as one flood source because they drain areas parallel to each other and a large enough rain will allow water to cascade from one of the creeks into the others.

[11] Shuhai Zheng. 2015. "Western Nebraska Sees Flooding and Mitigates with Groundwater Recharge." Nebraska Department of Natural Resources. June. https://dnr.nebraska.gov/sites/dnr.nebraska.gov/files/doc/floodplain/newsletters/Floodplain_Management_Today_June_2015.pdf

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The shallow depth of the Platte River channel leads to a higher risk of ice jams during the winter and early spring. The primary flood risk, however, is flash floods from intense warm-month rainfall events and from slower moving riverine floods on the Platte River, resulting from rapid snowmelt, excessive and sustained rainfall upstream, or both. Official flood reports other than the Platte River are difficult to find because there is a lack of reliable river gage data for Hall County. Most communities in Hall County were incorporated in the late 1800s, and the first flood reports on the Platte River date to that time.

There is only a small amount known about the "Great Flood of 1883" due to the limited development in Hall County at that time. There are minimal reports that do exist referring to flood damage in Kearney and Ashland and hence, the Platte was also flooding in Hall County. Hydrological journals of the day only reference this flood by saying there was a major inflow into the Missouri River somewhere between Sioux City, Iowa, and Kansas City, Missouri.

Hall County's most extensive early flood event occurred from a long period of excessive rainfall in May and June of 1967. The total damage from the Platte River flood of 1967 was $49,309,015. The Wood River was on the rampage in Grand Island, where it is reported that total damage was set at $6.25 million, 3 people were killed, 1,800 buildings were flooded, and 11,000 of the City's 28,600 residents were directly impacted.

On May 11 and 12, 2005, parts of Hall County received more than 7 inches of rain in a 24-hour period, causing $12 to $15 million in damage in the county. Hall County was later declared a federal disaster area (FEMA1590-NE-DR) by President Bush on June 23.[12]

#### 3.4.5.2 *Wood River*

According to the Central Platte Natural Resource District's Wood River Watershed Flood Risk Reduction Plan, the Wood River flooded Stolley State Park on June 20, 1947. Highway 2 was under water for one mile in Grand Island and damage was estimated at $5,000.

Wood River again caused flooding in Grand Island on June 10, 1949, resulting in $219,000 in damages.

In June of 1967, more than 10 inches of rain fell in Grand Island. At the peak of this event, the Wood River crested at 6 feet, with a flow of 25,000 cfs. Three people were killed, 1,800 buildings flooded, and over 10,000 residents were affected. Total damage to Grand Island was over $6 million. Though the Village of Alda is often lost in the details of hazard events reporting, records indicate the community experienced flooding in 1967, 1968, and 1969.[13]

The recently completed Wood River Flood Control Project was tested on May 11–12, 2005, when over 7 inches of rain fell in 24 hours and the Wood River flooded into the newly completed diversion project, which prevented any major flooding damage by diverting excess water from the Wood River and Warm Slough into the Platte River. The project's success was evident as this event would have resulted in damage similar to the 1967 flood with the diversion. The

[12] Nebraska Department of Natural Resources and US Army Corps of Engineers. 2008. "Hall County All-Hazards Mitigation Plan." Grand Island, NE. September. https://www.grand-island.com/home/showpublisheddocument/6384/635386213330930000.

[13] Central Platte Natural Resources District. 2021. "Wood River Watershed Flood Risk Reduction Plan." ArcGIS StoryMaps. November 20. https://storymaps.arcgis.com/stories/41d1e1f88fc24deb8cc5e9427735d8b5.

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Central Platte Natural Resources District (CPNRD), the City of Grand Island, Hall County, and Merrick County sponsored the project and estimated that the $17 million project paid for itself in this event, less than 1 year after dedication. the City of Wood River had to evacuate twelve people during this flood event as Wood River crested there at 9 feet and flooded most of the streets in town.[14]

According to the Central Platte Natural Resource District's Wood River Watershed Flood Risk Reduction Plan, Grand Island experienced flooding on August 22, 2007. In addition to heavy rain, there were reports of very high wind gusts, hail, and small tornadoes. Damages were estimated at $50,000.

Grand Island was impacted by multiple flooding events in 2019, including the statewide flooding in March and a record in August of almost a foot of rain. There was also flooding and warnings of evacuation along the Wood River in the Village of Alda, and hundreds of residences in the City of Wood River were affected by the March floods. The Wood River crested at a record of 17.4 feet in Gibbon during the March floods, causing flooding there also.[15]

### 3.4.6 LOUP BASIN

Heavy rainfall and snowmelt can cause flooding along the Loup and North Loup Rivers. The Loup River is also subject to ice jam risk. The Loup River has flooded portions of the City of Columbus several times in the past. During one of the worst Loup River floods, from August 12–15, 1966, thousands of people were evacuated in advance of the floodwaters. A third of the city was affected as the Loup reached up to 4 miles wide in some places. The flooding destroyed two homes and 25 more sustained major damage. The Wagner's Lake and Stire's Lake areas were hit particularly hard. Total public and private property damage from this event was estimated to be several million dollars. In 1973, as a response to this flooding, USACE constructed a levee on the Loup River designed to protect Columbus from the 1-percent annual chance flood. In March 1993, some families were evacuated when an ice jam at the Highway 81 bridge caused $2 million in damage to buildings that are outside of the levee system. During this flooding event, the Columbus Loup River levee system was at risk of overtopping due to the impacts of the ice jam flood.

One of the most notable dam failures in Nebraska's history was the 2010 failure of Bredthauer Dam in Valley County. The failure reportedly increased ongoing flooding through the Village of North Loup.[16]

The Calamus River runs through communities in Brown, Loup, and Garfield Counties. On September 12, 2019, the City of Ainsworth, located in Brown County, Nebraska, experienced a flash flood after a heavy rainfall event. A motorist had to be rescued from a washed-out portion of Meadville Avenue and NDOT reported water over Highway 20 and Highway 7.

[14] Nebraska Department of Natural Resources and US Army Corps of Engineers. 2008.

[15] Central Platte Natural Resources District. 2021.

[16] Nebraska Emergency Management Agency. 2021.

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Records also show that a levee system has been installed within this watershed at Broken Bow[17].

#### 3.4.6.1 *North Loup River*

The same storm that caused the Medicine Creek/Republican River flood of 1947 continued into central Nebraska, where 6 inches of rain on June 22 caused flooding along the North, Middle, and South Loup Rivers. The low-lying areas of Columbus were flooded from the Loup River. Also, parts of the Elkhorn River basin in northeastern Nebraska experienced flooding.

#### 3.4.6.2 *Middle Loup River*

In August 2017, Broken Bow was hit with rain and winds up to 80 mph. The community saw 1.63 inches of rain and hail that measured at 1.5 inches. As the rain and wind continued through the night, the storm damaged trees and flooded homes. Highway 2 had to be closed as water flooded the roadway and cars stalled attempting to drive through it.

In 1909, the residents of Sargent built a new bridge leading into town. 110 years later, the bridge was destroyed during the 2019 floods. The high floodwaters contained massive blocks of ice, causing the south side of the bridge to be pushed off the one remaining piling and twisted 45 degrees. The north side of the bridge spun downstream approximately 80 yards before catching on the dam. The loss of the historical bridge, in addition to 90 percent of homes in the area being damaged, was a difficult reminder of the devastation that can be caused by flooding.

The 2019 floods hit Custer County hard, with roads flooded across the villages and cities of Anselmo, Ansley, Broken Bow, Oconto, and Sargent. Bridges in the county were compromised by the flooding, making travel in the area extremely dangerous. Officials recommended not travelling in Custer County and Mayor John Berghorst declared a flood emergency in Broken Bow. As water reached record highs, the cities of Anselmo and Broken Bow were forced to evacuate.

#### 3.4.6.3 *South Loup River*

The Village of Pleasanton lies in a river bottom and was established in an oxbow of the South Loup River in 1890 that is surrounded by water on three sides. Pleasantonians say the 2019 flood pales in comparison to the 1947 flood. Heavy rain overfilled rivers on June 22–23, 1947, in south-central Nebraska. Up to 10 inches of rain fell near Sumner, Miller, and Amherst, and north of Elm Creek and Overton. Water in the South Loup River raged out of its banks and flooded downstream to Pleasanton where 4–5 inches of rain had fallen. Water was reported to be from 4 inches to 3 feet deep in many homes but the greatest damage in Pleasanton was likely done to the grain elevator. The elevator office was swept into a 15-foot-deep hole. The Union Pacific Railroad branch from Boelus to Pleasanton was also washed out but water, did not reach the depot. Damage to the track was so great that it was never replaced. A resident said local village men later straightened out the river to avoid future severe flooding. The water did run down the two streets closest to the river during the 2019 flood, but few homeowners had any water

[17] US Army Corps of Engineers. 2022a. “National Levee Database.” Accessed February 3. https://levees.sec.usace.army.mil/#/.

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damage. Most damage, if any, came from groundwater seepage into basements and crawl spaces.[18]

#### 3.4.6.4 *Mud Creek*

Mud Creek flows through Merna, Broken Box, Berwyn, Ansley, Mason City, and Litchfield. The south and north branches meet in Broken Bow. The stream does not regularly flow in Broken Bow but is subject to flash flooding. There have reportedly been over a dozen flash floods in Custer County between January 1996 and July 2015 causing property and crop losses.[19] Most prone to flooding is the northeast corner of Custer County, including the City of Sargent and the Village of Comstock.

The Village of Merna experienced various flooding events between June 2010 and March 2019. Notably, the June 2010 flood was caused by heavy thunderstorms and already saturated grounds. A sinkhole 4 feet deep formed between Merna and Victoria Springs and $335,000 in damages were reported.

The Village of Berwyn has experienced flood events along Mud Creek between May 2007 and March 2019. The May 2013 event caused $40,000 in property damage and a high water mark was recorded near Berwyn of 3.5 feet.

Flooding events in the Villages of Ansley and Mason City in the southeastern portion of Custer County have reportedly seen minimal flooding. During one occurrence in 2004, runoff from heavy rain washed-out fences as it moved through low lying areas, causing $15,000 in property damages in Mason City. Water reportedly rose to the headlights of cars on Main Street.[20]

#### 3.4.6.5 *Lower Loup River*

There is a long history of ice jam flooding in the Lower Loup Basin. I including either March 1848 or 1849 and according to pioneer recollections, the Platte and Loup valleys flooded from bluff to bluff. The flood inundated nearly all present-day Columbus. Many wild animals and an entire tribe of Pawnee Indians supposedly perished in the flood between present day Fullerton and Spaulding.

Multiple deaths and losses of large herds of livestock were reported by ice jam flooding that occurred on March 19, 1881. Many people escaped floodwaters by spending days stuck in tall trees. Railroad lines suffered heavy damage, a large portion of the Loup River Bridge was lost and multiple homes in Columbus were destroyed. Destruction of the Loup River Bridge also occurred during the ice jam flood in February 1905. After the water receded, large ice pads over 20 inches thick were seen scattered around the remains of the bridge.

Ice jam flooding occurred again on February 13, 1907, when flood stages rose more than 5 feet per hour. Areas along Shell Creek and the Platte River were flooded, and four Columbus

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[18] Erika Pritchard.2019. “Pleasantonians Say 2019 Flood 'Wasn't Anything Compared to the '47' Flood.'” Kearney Hub. July 24. https://kearneyhub.com/news/local/pleasantonians-say-2019-flood-wasn-t-anything-compared-to-the-47-flood/article_36ebb738-5a17-11e9-93e5-eba0124b5886.html.

[19] Lower Loup Natural Resources District. 2022. “Mud Creek Watershed Flood Risk Reduction Plan.” ArcGIS StoryMaps. January 24. https://storymaps.arcgis.com/stories/d734385f17024ae585a972871459980c.

[20] Lower Loup Natural Resources District. 2022.

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residents drowned trying to escape the floodwaters. Most of southern Columbus was underwater, including the stockyards and railroad.

In March 1910 many Columbus streets were buried in a foot of mud when an ice jam formed upstream of the Union Pacific Railroad bridge. It damaged both the Union Pacific and Burlington lines and the Platte River Wagon Bridge was swept away by ice flows.

Ice flow flooding on March 29, 1912, caused flooding along the Loup River. A railroad bridge was swept away, Pawnee Park was flooded, and some Columbus streets were covered in a foot of mud.

Heavy rainfall caused severe flooding in most of the Loup River Basin in June of 1923. This flood was supposedly the worst flood ever seen in the area to that point in time. Columbus was flooded to 6th Street. Widespread agricultural damage was sustained on the Loup River, Cedar River, Beaver Creek, Looking Glass Creek, and Lost Creek. Railroad tracks and some bridges between Genoa and Fullerton were severely damaged. The Loup Basin experienced $1 million in flood damages.

On April 26, 1935, extensive flooding resulted after 7 inches of rain fell near Columbus. US Highway 30-81 was inundated along with Pawnee Park.18 inches of floodwater stood in the southwest section of Columbus. Stages crested at 9.5 feet and stream flows peaked at 41,500 cfs.

Ice jam flooding on the Cedar River in March 1936 washed out the Fullerton, Nebraska east-west road near the Union Pacific depot. The flood caused a 450-foot-wide by 20-foot-deep gully through the road. Many homes were evacuated along the Loup and Cedar Rivers due to flooding. Damages were reported to the golf course and numerous farmland acres.

In February of 1941, one inch of rain fell in the Cedar River Basin compounding a .75-mile-long ice jam flood along the Loup and Cedar Rivers. The KND Highway was washed out and many roads were closed. The Union Pacific depot at Belgrade was flooded and a sink hole at the Fullerton Stock Yards swallowed a rail car as it grew to cover over 0.5 acre.

Large areas of the Loup Basin received 6 inches of rain on June 21–22, 1947, with some localized portions measuring over 8 inches of precipitation. Flooding peaked in Columbus on June 23. Hundreds of residences, commercial businesses, the railroad switchyard, Pawnee Park, Wagner Lake, and the golf course were flooded. Upwards of 900 families were evacuated. Stream flows peaked at 85,000 cfs and stages crested at 12.0 feet and damages were estimated at $388,000.

Loup River ice jams were the cause of two separate floods in Columbus in February of 1948. They formed downstream of the US Highway 30-81 bridge on February 14–21 and again on February 28.

Flooding from the Loup confluence to Columbus on March 22–26, 1960, caused by snowmelt runoff was responsible for one death in Columbus. The peak discharge was 52,000 cfs and stages crested at 10.5 feet and the damages were estimated as $236,000.

A large storm system produced over 6 inches of rainfall in most of the Loup River Basin in August 1966. It is reported that 16 inches of rain fell at the storm's center near Walbach, Nebraska. This storm caused flooding to occur throughout the Loup River Basin from August 12–14 and severe flooding in the southwest portion of Columbus. Many residences and businesses were inundated. The Union Pacific Railroad tracks, Pawnee Park, the golf course

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and Wagner Lake were also flooded. 1,000 Columbus families had to be evacuated. Damages were estimated at $1,435,000.

On the evening of March 17, 1969,1969 an ice jam formed .5 mile downstream of the Highway 30-81 Bridge at Columbus. The jam extended .5 mile east and west of the Highway 30-81 Bridge at its largest and had to be blasted out on March 21. Damages included some commercial businesses flooded and road washouts. Multiple rural homes were also flooded.

A 3- to 5-mile-long ice jam happened at Genoa as a result of ice break up and a storm event from February 20–24, 1971. Little flood information is known about this event, but it is reported that areas southeast of Columbus were inundated.

Yet another ice jam formed on March 7, 1993, upstream of the Highway 30-81 Bridge at Columbus. Highway 30-81 was closed as both directions were inundated. Flood issues extended into Nance County affecting Fullerton, Nebraska. The ice jam produced a flood stage at Columbus that was equal to an open water flow of 200,000 cfs. High water mark showed flood waters reach an elevation of almost 9 feet above flood stage. Some claimed the floodwaters were 4–5 feet higher than the levels of the flood of August 1966, the highest open water stage recorded. Many residents consider the ice jam of 1993 the worst flood of their lifetime.[21]

#### 3.4.6.6 *Beaver Creek*

On June 2 and 3, 1950, flooding occurred in Beaver, Shell, and Union Creeks in east-central Nebraska after large thunderstorms on June 1 caused water levels to rise. The storm also caused flooding along Beaver Creek in the Loup River Basin, resulting in one death. On July 18 and 19, flooding again occurred along the Loup River, Shell Creek, and Beaver Creek. The floods of 1950 resulted in the loss of 25 lives and caused $65 million in damage.

### 3.4.7 UPPER ELKHORN BASIN (UPSTREAM OF NORFOLK)

Heavy spring or summer rain is the most common initiating factor for flooding along the Elkhorn River; however, rapid snowmelt and ice jam floods have also occurred. Ice jam flooding can be problematic, especially at the confluence of the Elkhorn and Platte Rivers.

The first major Elkhorn River flood documented happened in the communities of Waterloo, Arlington, Hooper, Scribner, Winslow, and possibly others on June 10–12, 1944. The discharge of the Elkhorn at Waterloo is listed as 100,000 cfs. Although there are not any detailed damage estimates noted for the 1944 flood, in comparison of this flood to the 40,000 cfs gage reading at West Point, which flooded one-third of the community from March 29 through April 5, 1960, the damages in 1944 throughout this area of the Elkhorn River may have been quite large. Waterloo flooded again from March 25 through April 1, 1962, and many had to be evacuated. During the years following USACE constructed several levees at communities within the Elkhorn River watershed. Waterloo, Hooper, Scribner, West Point, Howells, Clarkson, Pender, Wakefield, Norfolk, Madison, Pierce, and Meadow Grove are all communities within the watershed that now have some flood risk protection from levee systems. The flood protection levee systems within

[21] Loup Power District. 2011. "Loup River Hydroelectric Project." February 11. https://loup.com/wp-content/uploads/Relicensing/html/documents/FLA/1256_FLA_Vol3.pdf.

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the lower Elkhorn watershed represent the largest number of levee-protected communities within any watershed in Nebraska.[22]

Prior to 2019, the most recent flood event in the watershed happened in June 2010 when widespread rainfall over the basin caused flooding of the Elkhorn River and its tributaries. At least 3–5 inches of rain fell over much of the upper Elkhorn River basin in mid-June. West Point received nearly 11 inches in one week. This caused record or near record flooding along the Elkhorn River from Clearwater to the Elkhorn's confluence with the Platte River. The Elkhorn River near West Point crested close to 15.2 feet and remained above flood stage for over 10 days. Flood damages amounted to millions of dollars and federal disaster DR-1924[23] was declared for 53 counties.

### 3.4.8 ELKHORN RIVER

The Elkhorn River has a long flood history, impacting numerous communities along its 290-mile journey across northeastern Nebraska until reaching its confluence with the Platte River. Its flood history begins with a flash flood in eastern Holt County, Nebraska on July 19 and 20, 1999. After 5 inches of rain, the Elkhorn River outreached its banks and flowed into the county. The Nebraska Department of Roads (now NDOT) reported water running 15 feet deep and 40 feet wide near Highway 108, approximately 18 miles east of O'Neill. This included some parts of the highway being completely washed away. Culverts throughout the county were washed away and flood waters created gullies in many county roads. The flash flood resulted in $500,000 of property damage.

On July 6, 2000, the Village of Stuart reported $10,000 in property damage after a flash flood washed out two county roads. The City of O'Neill experienced a flash flood on May 29, 2004, causing $2,000 in property damage and $8,000 in crop damage after heavy rains accumulated quickly and covered county roads and agricultural lowlands. In 2007, flash flooding occurred on August 27 in the City of Tilden and Village of Oakdale causing $10,000 in property damage. The 2–4 inches of rainfall caused flooding along numerous county roads and agricultural lowlands. South of Oakdale, a bridge was almost completely covered by floodwaters and reported damage. On May 5, 2008, the Village of Ewing and City of O'Neill reported significant damage after 4 inches of heavy rain caused the Elkhorn River to overflow. The Holt County Emergency Manager reported water over Highway 281 just 3 miles south of O'Neill and estimated $8,000 in property damage. $150,000 in property damage was reported in Ewing due to numerous roads being underwater, gravel roads being washed out, and Old County Road 108, Highway 281, and County Road S45A were all closed due to high flood waters. On August 15 and 16, 2009, flood waters in Elkhorn Creek created a flash flood in the City of Neligh resulting in $50,000 of property damage after ditches and culverts ran full, damaging county roads and agricultural lands.

A few years later, on May 27, 2012, the City of Elgin experienced over 4 inches of rain causing flash flooding over a few roads and at least one bridge east of the city, resulting in $15,000 of property damage. Once again in 2015, the Village of Oakdale and City of Elgin experienced $75,000 in property damage and $50,000 in crop damage after heavy rains washed out areas of

[22] US Army Corps of Engineers. 2022a.

[23] Federal Emergency Management Agency. 2022. "Disaster Declarations Summaries – V1." Accessed February 3. https://www.fema.gov/openfema-data-page/disaster-declarations-summaries-v1#.

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US Highway 275 and Highway 70 as well as numerous acres of low-lying agriculture land. The City of Neligh experienced a flash flood after 2–4 inches of rain fell on August 15, 2017, resulting in $30,000 of property damage and $10,000 in crop damage as well as flooding along Highway 14. The most recent of the Elkhorn River floods in the Niobrara River Basin occurred on March 13, 2019, due to an ice jam upstream. Ewing experienced a flood that caused substantial damage to county roads and Highway 45B and was estimated at $250,000 in property damages.

#### 3.4.8.1 *Union Creek*

The Floods of 1950 were four major flood events that swept across south-central and southeast Nebraska from May to July. The first flood event occurred on May 8 and 9 and was most severe along the Little Nemaha River, Salt Creek, Weeping Water Creek, and several tributaries of the Big Blue River. On June 2 and 3 flooding occurred on Beaver, Shell, and Union Creeks in east-central Nebraska after large thunderstorms on June 1 caused water levels to rise. The most significant damage occurred where the City of Madison was inundated by Union Creek.

One of the most notable dam failures in Nebraska's history includes the 1999 failure of the Tyson Lagoon Cell #3 Dam in Madison County, which resulted in damage to a downstream railroad.[24]

Union Creek, another major tributary to the Elkhorn River, begins in southern Madison County, running northeast to meet the Elkhorn River just south of the City of Stanton. On May 31, 2008, Union Creek rose to just above flood stage after heavy rainfall from storms on May 29 and 30. Flood stage at the City of Madison gage on Union Creek is 20 feet. The flooding during this event would peak at this gage at 20.8 feet. Union Creek flooded from the City of Newman Grove to the City of Madison, causing multiple county roads to close and damaging agricultural lowlands.

On June 13, 2010, Union Creek overtopped its banks due to heavy rain producing thunderstorms the week prior. The high amount of water in Union Creek would cause prolonged flooding issues near the City of Madison and closed nearby Highway 81. The Union Creek gage near Madison peaked at 22.9 feet during this flood event.

#### 3.4.8.2 *Battle Creek*

Battle Creek runs through Madison County, beginning at the southwest corner of the county and running north to the Elkhorn River. Along the route it passes by the City of Battle Creek, which has been impacted by flooding on multiple occasions. On May 30, 2007, the City of Battle Creek experienced flooding from the rising Battle Creek, causing Highway 121 north of town to close. This flooding also impacted the water treatment plant and prompted sandbagging efforts around town. Around 400 homes experienced some form of flood damage because of this flood event.

On June 8, 2008, Battle Creek again rose out of its banks to close Highway 121 and multiple roads in town. Sandbags were again used in this event, but many homes on the east side of the city were still impacted.

[24] Federal Emergency Management Agency. 2022.

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#### 3.4.8.3 *North Fork Elkhorn*

The North Fork Elkhorn River runs through Pierce County in northeastern Nebraska. This area floods during and after prolonged flood periods of the Elkhorn River. The North Fork Elkhorn River caused frequent flooding in Norfolk and Pierce in the 1950s and 1960s. On April 2, 1960, most of Pierce was evacuated due to flooding, and in March and April of 1962, half of the town was again evacuated due to flooding. Corporation Gulch in Norfolk was also a frequently flooded area. In May and June of 1967 flooding caused an estimated $1.5 million in damage to an industrial area in Norfolk. Channel modifications and levees have since been added around the Norfolk area to help reduce flooding.

On August 4, 1996, after 5 inches of rain fell in Pierce County, the North Fork Elkhorn River flooded agricultural fields and washed-out country roads, resulting in $1 million in property damage and $250,000 in crop damages.

The City of Plainview experienced a flash flood on June 20–21, 2005, after 3 inches of rainfall resulted in multiple recreational areas being flooded across the city. On August 18, 2017, 3–4 inches of rain fell over sections of Pierce County, causing flash flooding across Old Highway 98 and washing out crops and gravel roads, resulting in $1,000 in property damages and $5,000 in crop damages.

In early October of 2017, the North Fork Elkhorn River rose above its flood stage for 65 consecutive hours after two heavy rainfall events occurred. The river crested at 13.36 feet in Plainview and caused $5,000 in property damages.

Most recently, on March 13, 2019, the North Fork Elkhorn experienced high flows due to heavy rains and rapid snow melt, resulting in flood waters rushing into the City of Pierce. Homes and businesses were flooded resulting in nearly $475,000 in property damage.

### 3.4.9 LOWER ELKHORN BASIN (NORFOLK TO CONFLUENCE)

#### 3.4.9.1 *Elkhorn River*

Residents of the City of Norfolk are no strangers to flooding. The Elkhorn River has flooded throughout the community's history, causing extensive damage. In 1944, what was said to be a 2.5-foot wall of water flooded the city, covering over 170 City blocks with 4 feet of water. The impact was widespread, with more than 180 business and 460 homes affected, resulting in over $4 million worth of damage. The flood is recognized as one of the worst floods in Nebraska history because of its widespread impact on communities around the Elkhorn River Basin. Communities surrounding the Elkhorn River continue to battle flooding to this day.

Some of the most devastating floods on record happened on the Elkhorn River in 1966, 1978, and 1993. In more recent history, the communities experienced major flooding in 2010, 2015, and 2019. These floods were devastating across Nebraska and impacted many communities along the Lower Elkhorn Watershed, contributing to significant property damage, including bridges, roads, and crops. While Omaha has experienced significant flooding, many smaller communities were also impacted, including Fremont, Scribner, and Valley.

In 2019, Valley residents found much of their town underwater. When the Union Dike broke, it sent floodwaters through the town, forcing community members to evacuate for their safety. Hundreds of miles of levees saw damage in the floods, requiring years of repairs. Community members were left to rebuild and felt vulnerable to future floods. As some county residents were allowed to build new homes on elevated ground and have ditches filled in, downstream

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residents were left more vulnerable to flooding as a result. Prior mitigation actions implemented within this watershed include multiple levees and acquisition and removal of flood-prone structures at King Lake.

Throughout Fremont's history, flooding has occurred due to flat land that results in extremely slow runoff. Across the city, there are numerous areas that are at high risk for flooding. In the 2019 floods, Fremont was one of the first places to flood and suffered extensive damage after a nearby levee overtopped. More than 1,500 homes and buildings were impacted, with over 247 red tagged. Over a year later, the community continues to battle flooding concerns, and as recently as February 2020, ice jams in the area nearly flooded the town's outer boundaries.

#### 3.4.9.2 *Logan Creek*

Logan Creek begins near the City of Randolph in southwest Cedar County, running south until it connects with the Elkhorn River just north of the Village of Winslow. On June 15, 2014, Logan Creek experienced heavy rainfall continuing overnight into the morning of June 16. The creek overspilled its banks, causing damage to multiple roads and some farmland nearby the creek.

In March 2019, Logan Creek overspilled its banks in multiple locations, impacting the nearby Villages of Uehling and Pender. The river gage at Uehling, operated by the USGS, peaked at 21.16 feet on March 15, 2019, with the major flood stage being 21 feet. Damages occurred to county roads along Logan Creek. Other flooded areas were low-lying areas of Oakland, which includes their city park.

#### 3.4.9.3 *Maple Creek*

The West Fork Maple Creek begins just south of the Village of Leigh, stretching east across Colfax County before joining with the East Fork Maple Creek east of the border of Colfax County with Dodge County. The East Fork Maple Creek begins in the southeast corner of Stanton County and runs south until it connects with the West Fork Maple Creek. Maple Creek then extends east until it connects with the Elkhorn River north of the Village of Nickerson. Maple Creek has also experienced multiple flooding scenarios in recent decades. On August 8, 2007, heavy rain caused by multiple rounds of storms brought flooding to the nearby City of Clarkson. The flooding impacted lowland areas, farm fields, and several county roads. Highway 91 experienced some flooding but was not overtopped.

In March of 2019, heavy rains, large amounts of snowpack, and frozen soil caused extensive runoff into Maple Creek. The creek rose out of its banks and impacted the nearby Village of Howells, causing lowland flooding and impacting roads and culverts.

#### 3.4.9.4 *Pebble Creek*

According to local flood records, Pebble Creek is a major source of flooding for the community of Scribner. Severe thunderstorms centered over the Pebble Creek Basin are often the cause of flooding along Pebble Creek. The floodplains of Pebble Creek and the Elkhorn River converge west of Scribner. Due to Pebble Creek's elevation as it enters the common floodplain, any overbank flows move toward the city and the Elkhorn River rather than returning to the Pebble Creek channel which continues in a southeasterly trajectory where it joins the Elkhorn approximately 2 miles southeast of Scribner. Flooding along the Elkhorn River is usually caused by either heavy rainfall or rapid snowmelt throughout the upper basin. Scribner does experience flooding from the Elkhorn River, but inundation has generally been limited to areas of Scribner adjacent to the river and the Pebble Creek-Elkhorn River confluence.

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In July 1891 a heavy rainfall caused Pebble Creek to overflow. An estimated $5,000 in flood damages occurred in rural areas along Pebble Creek including in residences and business establishments south of US Highway 275 in Scribner. In March 1912 a rapid snowmelt and ice on rivers caused major flooding throughout the Elkhorn River Basin. Pebble Creek flooding caused Scribner to incur an estimated $6,000 in damages. A few years later, in May 1915 Pebble Creek flooded out of its banks after a heavy rainfall. Floodwaters entered the southwestern part of Scribner and caused an estimated $9,000 in damages. In August of 1932, a heavy rain near Scribner again caused flooding from Pebble Creek. Damages were relatively minor at $3,000.

Most of the Elkhorn River Basin experienced a heavy rainfall in June 1940 resulted in flooding along Pebble Creek. Floodwaters entered the southern part of Scribner and caused approximately $5,000 in damages.

The flood of record for both the Elkhorn River and Pebble Creek at Scribner occurred in June 1944. Up to 6 feet of Pebble Creek floodwaters inundated most of Scribner. The entire business district and many homes were flooded; only a few people had time to evacuate the area. Damages were estimated at $378,300. The Pebble Creek floodwaters receded before the Elkhorn River reached its peak at Scribner. The Elkhorn River did not cause major flooding within Scribner and damages from it was minor. A few years later, flooding occurred in Scribner after a heavy rainfall in June 1947. Pebble Creek overflowed its banks and caused $1800 in damages.

Ice jam conditions and a rapid snowmelt in March and April 1960 caused flooding throughout the Elkhorn River Basin. There was only minor flood damage in Scribner. A similar flood occurred in March of 1962. At Scribner, floodwaters from both the Elkhorn River and Pebble Creek were relatively shallow, but damages were estimated at $13,000.

Extensive flooding occurred along the Elkhorn River and its tributaries on February 19, 1971, with conditions of heavy rains, melting snow, and ice jams. Flooding that affected mainly low-lying areas began around the middle of February continued to plague residents into March. Damages were estimated at $3,000. [25]

After weeks of rain the flood of June 1984 occurred. The ground was inundated and there was no place for new rainfall to go, except to roll over the land. Pebble Creek bridge on Highway 275 just east of Scribner was damaged and the road was closed.[26]

City of Scribner is now protected by a ring levee system comprising two earthen embankments built by the US Army Corps of Engineers (USACE). The Pebble Creek-Left Bank levee was completed in 1990, while the Elkhorn River-Right Bank followed in 1999. USACE estimates that since its construction the levee has prevented an estimated $50.9 million in damages.[27]

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[25] Scribner Rustler. 1984. “Scribner Flood History: Pebble Creek Is a Major Source of Flooding.” June 20. pp. 2–7.

[26] Scribner Rustler. 1984.

[27] US Army Corps of Engineers. 2022b. “Scribner – Pebble Creek LB & Elkhorn River RB.”. National Levee Database. https://levees.sec.usace.army.mil/#/levees/system/4705000053/summary

## 3.4.10 LOWER PLATTE RIVER BASIN (COLUMBUS TO MOUTH)

### 3.4.10.1 *Lower Platte River*

In 19961966 USACE reported there had been over $18 million in damages resulted from ice-jam flooding in the Lower Platte River Basin.[28] Flood damages in 1978 were severe when an ice jam overtopped and breached the Union Dike flooding 27,000 acres in Dodge and Douglas Counties. An ice jam that formed downstream from the Platte and Elkhorn Rivers confluence also caused substantial damages near Ashland. In all, over 60,000 acres were flooded, and 20 counties were included in the disaster area for the 1978 event.

In March 1993, the combination of ice jams and rapidly melting snow caused heavy flooding in the Lower Platte River basin. The south side of the Loup River at Columbus and just downstream from the confluence of the Elkhorn and Platte Rivers near Ashland were the two areas most affected. The event caused flooding in the area between the Loup and Platte Rivers and nearly overtopped the levee on the north bank of the Loup River. At Ashland, two major levee breaks occurred, flooding approximately 14,000 acres of farmland, destroying houses and threatened the well fields for the City of Lincoln. 14 counties were in the disaster area. The overall basin damages during the March 1993 event were more than $25 million.[29]

### 3.4.10.2 *Shell Creek*

Four major flood events swept across south-central and southeast Nebraska from May to July of 1950. The first flood event occurred on May 8 and 9 and was most severe along the Little Nemaha River, Salt Creek, Weeping Water Creek, and several tributaries of the Big Blue River. On June 2 and 3, flooding occurred on Beaver, Shell, and Union Creeks in east-central Nebraska after large thunderstorms on June 1 caused water levels to rise.

The National Oceanic and Atmospheric Administration (NOAA) National Center for Environmental Information (NCEI) Storm Events Database was consulted to learn more about the riverine and flash flood history along Shell Creek. The earliest entry in the database, June 18, 1998, states that heavy rains caused flooding of agricultural lowlands along the creek. Several more events have followed, many between 2005 and 2010.

On June 20–21, 2005, an estimated 5–10 inches of rain fell in the Shell Creek basin, causing flooding in Madison and Platte counties on June 22, 2005. The flooding extended from near Meadow Grove southeast through Platte Center, causing the closure of Highways 45 near Newman Grove and 91 west of Lindsay.

Prolonged cold in late January and early February of 2007 caused 1 foot of ice to form on slow moving streams and rivers in eastern Nebraska. When temperatures began to rise in late February, snow melt and ice break-up caused ice jams on creeks and rivers across the region. On February 25, 2007, ice jams along Shell Creek from Platte Center to northeast Columbus caused flooding of agricultural lowlands and inundation of a few county roads.

Later in 2007, 2 to 3 inches of rainfall between May 30 and June 1 caused Shell Creek to flood county roads from Lindsay to Platte Center to just northeast of Columbus. A few homes in the

[28] Kathleen D. White and Kay, Roger L. 1996. “Ice Jam Flooding and Mitigation: Lower Platte River Basin, Nebraska” US Army Corps of Engineers.

[29] Kathleen D. White and Roger L. Kay. 1996.

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Lindsay area had to be sandbagged. Some bridge damage was noted near Lindsay, with road damage reported from Lindsay to near Platte Center. Three to 4 inches of water flowed across Highway 81 south of Platte Center on May 30. The flooding continued through midday June 1.

Almost exactly a year later, heavy rain on May 24, 2008, caused water to flow over a few roads in the Platte Center area with mud and other debris on the road. Significant rains—2 to 4 inches with some unofficial reports of 8 inches—continued for nearly a week, culminating with a heavy rain on May 29. On May 30, flash flooding occurred around Lindsay through the Platte Center area along Shell and Elm Creeks. The flooding was most pronounced along Elm Creek in Platte Center where 50 to 70 homes and 10 businesses sustained flood damage. The flood waters also caused propane tanks to float down streets in town and forced most people to evacuate. Farmland was also flooded prompting rural evacuations. The flooding closed numerous county roads northwest through northeast of Columbus and closed Highway 81 near Platte Center and Highway 91 near Lindsay. By May 31, floodwaters eventually reaching the Schuyler area.

The flood stage of Shell Creek northeast of Columbus is 20 feet; at 1:00 pm on May 30, 2007, it reached just over 22 feet. The creek crested at 22.1 feet for 6 to 7 hours and was above flood stage from around 7:00 am on May 30 through 3:30 pm on May 31.

A little over a year later, 2–3 inches of rainfall in the northwest of Platte County from June 4–9, 2008, caused flash flooding of county roads along Shell Creek from around Lindsay to Platte Center. Besides flooding agricultural lowlands, almost every road that intersected the creek was closed due to flood waters.

Heavy rain from approximately June 7 through 14, 2010, caused prolonged flooding along Shell Creek and its tributaries from near Lindsay in Platte County downstream to near Platte Center then to Schuyler in Colfax County. The high water flooded many county roads and forced the closure of Highway 81 northwest of Columbus, Highway 91 between Humphrey and Lindsay, and Highway 15 north of Schuyler. Colfax county's emergency management reported that at one time as many as 40 county roads and 40 bridges were under water within the county. High water also damaged croplands. A motorist had to be rescued by area residents late on June 10, when his vehicle became flooded while attempting to drive through flood waters west of Platte Center; the motorist was uninjured. Shell Creek or one of its tributaries also flooded sections of northeast Schuyler prompting homes and businesses to sandbag to try to limit the damage. Nonetheless, about 200 homes and businesses sustained damage, mostly to basements.

During this event, Shell Creek near Columbus was above flood stage (20 feet) from evening of June 11 through the afternoon of June 14 and crested around 21.6 feet from late morning on June 12 through morning on the June 13. Downstream of the gauge in Colfax County, flooding probably lasted longer than June 14.

Less than 2 weeks later, on June 22, 2010, another 1–2 inches of rain fell near Columbus on soils saturated by the month's earlier rains. This produced some lowland flooding along Shell Creek from near Platte Center to east of Highway 81. The high water closed county roads and Highway 81 for a while from June 23–24 in addition to flooding farmland along the creek.

June 24–25, 2018, multiple waves of thunderstorms moved across eastern Nebraska and causing flooding through June 26. Hardest hit were Cuming and Platte Counties where rainfall totals of 6.0 to 6.5 were reported. High water from the heavy rains in Colfax County caused a levee to break on Shell Creek near County Road 15, just south of US Highway 30 and near Rogers. Flooding from the levee break impacted several county roads between the Platte River and US Highway 30.

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As with much of eastern Nebraska, Shell Creek experienced flooding in March 2019. The river gage near Columbus peaked at 22.21 feet at 7:30 am on March 14 (major flood stage is 22 feet), the second highest on record for that gauge. Shell Creek again flooded Highway 81, rural areas were inundated, and bridges damaged and destroyed. A Columbus man drowned on the March 14, 2019, while driving his tractor north on 175th Avenue over the Shell Creek Bridge. The bridge gave way, and the man was swept away by flood waters.

A levee on Shell Creek was topped by waters from heavy rain and fast snow melt. This caused the town of Rogers to be flooded. The town was evacuated in anticipation that water would enter the town.

Shortly after the March flooding, Shell Creek again flooded on May 27, 2019, causing closure of the south bound lane of Highway 81.

#### 3.4.10.3 *Salt Creek*

Four major flood events swept across south-central and southeast Nebraska from May to July of 1950. The first flood event occurred on May 8 and 9 and was most severe along the Little Nemaha River, Salt Creek, Weeping Water Creek and several tributaries of the Big Blue River. The flooding in the Salt Creek Basin resulted in the death of six people and there was considerable damage to agricultural land in the river basin upstream from Lincoln.

Salt Creek and its tributaries have caused frequent damage in Lincoln in the past. Ten creeks converge with Salt Creek in the vicinity of Lincoln. The larger creeks of note are Oak, Stevens, Middle, Antelope, Deadmans Run, and Haines Branch, and they combine to drain nearly 588 square miles above a point just downstream of the Stevens Creek confluence, according to the Lancaster County Flood Insurance Study[30]. Salt Creek and its tributaries have caused frequent damage in Lincoln in the past. For Antelope Creek, flood losses and risk are now greatly reduced due to the installation of Holmes Lake dam and construction of the $246 million, 600-square-block Antelope Valley flood control project completed in 2012.[31] From Lincoln, Salt Creek flows to the northeast until it empties into the Platte River near Ashland. Ashland has an extensive history of flooding because the Platte River, Salt Creek, Wahoo Creek, Silver Creek, and smaller tributaries converge near the city's boundaries.

Lincoln experienced multiple flooding events in the 1950s. Flooding occurred during May of 1950 that set a record flood crest and caused significant property damages. The widespread flooding in June and July of 1951 caused millions of dollars in damage, and Lincoln recorded a new record Salt Creek crest of 26.15 feet on June 2, 1951. USACE built ten dams in the Salt Creek watershed during the 1960s, which have had an impact on flooding risk from Salt Creek. In Lincoln, USACE also constructed a levee system from Superior Street to Calvert Street and modified the Salt Creek channel. This levee system provides the approximate level of protection of the 50-year flood, although this varies depending on the location along the levee system. During 2012, finalization of a major flood control and transportation improvement project along Antelope Creek including channel improvements was completed by the City of Lincoln, University of Nebraska, and the Lower Platte South NRD in cooperation with USACE.

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[30] Federal Emergency Management Agency. 2011a. "Lancaster County, Nebraska Flood Insurance Study." February 18.

[31] Lower Platte South Natural Resources District. n.d. "Antelope Valley Project." Accessed January 2022. https://www.lpsnrd.org/projects/completed-projects/antelope-valley-project

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In early May of 2015, over 6 inches of rain was recorded at the Lincoln Airport in less than 24 hours. The Lincoln Mayor's office encouraging residents to evacuate flood-hit areas of the city. The statement said, "Public safety officials are advising residents in the North and South Bottoms neighborhoods to voluntarily evacuate as soon as possible. The affected area is bordered by Folsom, 8th, Van Dorn, and Cornhusker. Salt Creek is getting close to topping the levee as other creeks drain into it." Multiple people were rescued from the floodwaters.[32]

#### 3.4.10.4 *Wahoo Creek*

The City of Wahoo and Village of Ithaca are frequently flooded by Wahoo Creek. Wahoo Creek has a large drainage basin of 511 square miles at its confluence with Salt Creek, according to the Saunders County Flood Insurance Study. As a result, heavy rainfall in the drainage basin causes flash floods in Wahoo and downstream to Ashland. It is not uncommon for Wahoo to be isolated by floodwaters from Wahoo Creek, Sand Creek, Dry Run, and Cottonwood Creek. Recently, the Lake Wanahoo project was completed on Sand Creek just upstream of Wahoo. This dam provides a reduction in peak flood flows along Sand Creek.

#### 3.4.10.5 *Mill Creek*

A dry spell in Louisville ended on September 27, 1923, when torrential rain poured for most of the day. Debris piled up against a bridge south of Louisville and water backed up in Mill Creek, which flows from south to north through Louisville. Many lives, homes, and businesses were lost. Several personal accounts may be read in the 2016 article "Louisville Remembers Deadly 1923 Flood" housed at the Nebraska State Historical Society.

### 3.4.11 MISSOURI RIVER AND TRIBUTARIES

#### 3.4.11.1 *Missouri River*

As the longest river in North America, it is no surprise that the Missouri River causes flooding throughout numerous communities across Nebraska. Along its 2,341-mile course, the Missouri River begins in the Rocky Mountains of western Montana and flows east and south before entering the Mississippi River north of St. Louis, Missouri. As the Missouri River shapes the Nebraska-Iowa and Nebraska-Missouri borders, it flows past many eastern Nebraska communities and is fed by countless tributaries as well.

The Missouri River has the largest upstream drainage basin of any river in Nebraska. According to the Otoe County Flood Insurance Study,[33] the drainage area is 414,400 square miles at Nebraska City. The Missouri has a long history of flooding, and flood problems will continue to potentially impact development within its floodplain. Between the 1930s and 1960s, USACE completed six large reservoirs along the Missouri upstream of Nebraska. These reservoirs are

[32] Richard Davies. 2015. "Nebraska Declares State of Emergency After Flood and Storm Damage." Floodlist.com. May 8. https://floodlist.com/america/usa/nebraska-declares-state-of-emergency-after-flood-and-storm-damage.

[33] Federal Emergency Management Agency. 2011b. "Otoe County, Nebraska Flood Insurance Study 2011." Map Service Center. February 18. https://map1.msc.fema.gov/data/31/S/PDF/31131CV000B.pdf?LOC=40fbaf8cdbb6aac7146e14165f377252.

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operated for eight authorized purposes, including flood control. However, as the Floods of 1993, 2011, and 2019 illustrate, the Missouri still has the potential for major flooding.

Ice jam, snowmelt, and intense rainfall are all causes of floods that have occurred historically on the Missouri. Floods along the Missouri River in Nebraska have occurred frequently; however, major floods occurred in 1881, 1943, 1952, 1967, 1978, 1984, 1993, 2010, 2011, and 2019. The flood of record for discharge in most areas is the flood of April 1952, while the flood of record for gage height in most areas is the flood of 2019. The reason for this may be that the 1952 flood event occurred prior to some channel and floodplain modifications, such as the installation of levee systems. It also occurred prior to completion of the upstream flood control dams.

Nebraska has been experiencing large-scale flooding from the Missouri River for centuries. The historic Missouri River flood of 1881 flooded numerous cities and towns along Nebraska's border and led to multiple deaths and significant damage. After an unusually heavy snowfall in the winter of 1880 and spring of 1881—particularly during January through March— water poured into the Missouri River following a quick increase in temperature during the last week in March. The small Cedar County Village of Green Island was faced with the Missouri River waters on March 30 after a large ice jam broke free. In just two hours, every home in the village had been swept away. Continuing through the state, the Missouri River flood of 1881 hit Omaha on April 23. Water levels had risen to nearly 24 feet above the original low-water mark. The large lumber yard and Union Pacific rail yard were submerged and inoperable for several weeks while Omaha's downtown areas were also flooded. Three drowning deaths occurred in Omaha as Union Pacific workers attempted to cross a break in a temporary dam when the river's current pushed them into the main channel. The flood waters finally began to recede on April 27 to reveal significant property damage, thousands of head of livestock killed, and the remains of several small riverside towns that had been washed away.

The Missouri River watershed, including the Missouri River right bank along Nebraska, includes multiple levee systems. There are levees at various locations, especially from Omaha south. These include levee units at Macy, Lake WaConDa, Omaha, and Missouri River Levee Units R-616, R-613, R-573, R-562, R-548, R-520, R-513, and R-512.[34] These levee units provide flood risk reduction for critical facilities ranging from Omaha's Eppley Airfield to the Cooper Nuclear Station at Brownville, Nebraska. Along much of the reach of the Missouri River adjacent to Nebraska, levee systems are also in place along the Iowa border on the left bank of the river. As a result, flooding through this reach, especially from Omaha south, is more complex due to the interactions of the flooding with multiple levee systems on opposing banks. The April 1952 flood was the flood of record for the Missouri River based on discharge. New levee and floodwall systems in the Omaha area were tested for the first time. Although the crest passed Omaha without causing a levee or floodwall breach, flood damage was extensive along the river. President Truman personally visited the scene of the flooding in Omaha and officially declared it a disaster area. Levees and dams along the Missouri River were tested by the 1952, 1993, 2010, 2011, and 2019 floods. Although the flood passed Omaha without causing a levee breach during the 1952 flood, other areas were not as fortunate. USACE estimated the damages from the 1952 storm at $11.9 million.

[34] US Army Corps of Engineers. 2022a.

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The Great Flood of 1993 impacted a majority of the eastern and southern Missouri River basin in Nebraska, Iowa, South Dakota, Kansas, and Missouri. Multiple storm systems brought heavy rainfall between March 14 and July 29 along various areas of the Missouri River Basin. From June 1–27, Omaha experienced multiple heavy rainfall events causing severe flooding on the Missouri River. From July 23–31, the river fluctuated between record or near-record peak discharges, reaching a record crest on July 23 and 24 that overtopped federal levee L-550 near Brownville. Also, levee units L-400 and L-246 were overtopped on July 26. The Great Flood of 1993 resulted in two deaths in Nebraska and $317 million in total damage with public infrastructure damage totaled at $44 million and 5.8 million acres of cropland flooded.

The Missouri River flood of 2011 devastated Nebraska, Iowa, and Missouri. Large amounts of snowpack and torrential rains in the upper Missouri River Basin began in May, stressing all five main-stream dams upriver, leaving the hydroelectric structure that backs up Lewis and Clark Lake as Nebraska's last line of defense against downstream flooding. The flooding lasted almost the entire summer in areas of Nebraska and Iowa. USGS reported that the river typically flows at 4 miles per hour, but in the early days of the flood, it was flowing at 11.6 miles per hour. On July 2, the Missouri River gauge at Nebraska City peaked at 36.29 feet and was still at 32 feet on August 28. The depth of the river channel at Nebraska City is typically 12–16 feet and during high water situations can be 25–30 feet. During the 2011 flood event, there were record depths of 66 feet. The Missouri River flood of 2011 caused more than $2 billion in damages, flooded 4,000 homes, and resulted in five deaths. It required the National Guard to be deployed to monitor conditions all the way from Sioux City, Iowa, south to Falls City.

In Nebraska, water flooded and flowed across Highway 2 at Nebraska City throughout the entire summer and destroyed three miles of Interstate 680 between Omaha and Interstate 29 near Council Bluffs, Iowa. Repairs needed from this flood stretched from Montana to Nebraska and cost $514 million to repair USACE levees, dams, and other flood control structures. The total cost to Eppley Airfield alone was $22 million.

In 1993, weather conditions brought wave after wave of storms over the Midwest during June and July, dumping record amounts of rain. In the southeastern counties of Pawnee, Nemaha, Otoe, and Richardson, 20–26 inches of rain fell. In a band from the Harlan County Dam to Omaha, 10–20 inches of rain fell. The Missouri River set significant crests in Plattsmouth and Brownville, and river levels from Omaha to Rulo were the highest since 1952. The river segment from Brownville to Rulo was above flood stage for the entire month of July. Overtopping along USACE levee R-548 near Brownville threatened the Cooper Nuclear Power Plant.[35] Nine states along the Upper Mississippi and Missouri Rivers had counties declared disaster areas. Due to the severe storms, 52counties were declared federal disaster areas. This flood event was one of the most damaging in Nebraska history at the time. In July alone, Nebraska's precipitation reached 8.35 inches. The Missouri River set record crests at Plattsmouth and Brownville. A USACE levee near Brownville breached and flood waters threatened but did not damage the Cooper Nuclear Power Plant. During the 1993 floods, 32 levees were overtopped, 5 of which were located along the Missouri River.[36]

[35] US General Accounting Office. 1995. "Midwest Flood – Information on the Performance, Effects, and Control of Levees." August.

[36] Nebraska Emergency Management Agency. 2021.

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The Missouri River has a long flood history within the Nemaha River Basin. The City of Plattsmouth experienced $12,000 in property damage after the Missouri River flooded, washed out numerous county roads, and caused the side of a large oil company building to collapse on June 23, 1997.

There are numerous other smaller channels and tributaries across Nebraska that are vulnerable to flooding under the right circumstances. Often these locations represent short term, flash flooding risks. One example is the 10-inch rainfall event of August 1999, which caused a Presidential Disaster Declaration for Douglas, Washington, and Burt Counties. From north Omaha to Tekamah, intense rainfall led to rapid runoff as stormwater drained east to the Missouri River. As a result, one person was killed in Omaha, a home was substantially damaged in Fort Calhoun, and the eastern portion of Tekamah was flooded due to ditch backwater and insufficient drainage.

During June 2010, many locations from central to northeast Nebraska received 3–4 inches of rainfall or more within 72 hours resulting in flooding on the Missouri River tributaries, and subsequently the Missouri River, extending from Omaha to Rulo. In Plattsmouth, the Missouri River crested at a little over 7 feet above flood stage. A federal disaster was declared for 53 counties in Nebraska for June flooding.

In 2010, the City of Plattsmouth experienced flooding from the Missouri River. On March 17–26, 2010, the Missouri River experienced prolonged flooding and remained at the 26-foot flood stage for 9 days before cresting at 29 feet on March 22. This long period of flooding resulted in $625,000 in property damage and washed-out agricultural lowlands and several roads and flooded Plattsmouth's public boat dock and water treatment plant. Then, just 3 months later, on June 30, 2010, another $100,000 in property damage occurred after heavy rains caused the Missouri River to flood and crest at over 33 feet. The river would remain over flood stage until early July and roads on the east end of Plattsmouth were closed due to flood waters during this time.

The Village of South Bend also experienced two floods in 2010, both in the month of June. On June 11, after several days of heavy rain, the Missouri River flooded past its bounds and caused $100,000 in property damage as county roads and recreation areas around the village took on flood waters. From June 21–23, the Missouri River flooded South Bend again—mainly the bottom lands along the river—causing $5,000 in property damage.

The flooding of 2011 was a result of record snowpack in the Rocky Mountains, and record rainfalls in the months of May and June for central and eastern Montana. The heavy rainfall resulted in heavy runoff, which filled the river and its reservoir system to record highs. To keep the Missouri River system's reservoirs from overtopping and/or failing, record releases were required from the dams. The record releases from Gavin's Point Dam started in May and increased to around 160,000 cfs by mid-June and remained at that level until early August. The high releases produced moderate to major flooding along the Missouri River adjacent to all of eastern Nebraska. Flooding worsened from May into June and then continued through August. The flooding in the Missouri Basin caused a need for approximately $81 million in public assistance and claimed 5 lives. During this time, USACE spent significant resources for maintenance and operations of the levees. They spent an estimated $2 million on levee repair and work in Omaha alone and close to $1 million on levee repair and work in Sarpy County.

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USACE also had to do post flood rehabilitation on levees.[37] Significant crop losses occurred between Sioux City, Iowa and Omaha, Nebraska. In the aftermath of this flood event, several proposed mitigation projects are in process, including some significant potential acquisitions of flood-prone property.

The latter half of 2014 was full of flooding along the Missouri River. Beginning on June 4, 2014, heavy rains caused flooding along the Missouri River from Brownville to Rulo. The river crested at 34.5 feet and impacted agricultural land, country roads, and a few cabins near the river, resulting in $25,000 worth of property damage. Next, June 18–25, 2014, Plattsmouth experienced $10,000 in property damage as heavy rain caused the Missouri River to pass flood stage, cresting at 30 feet and impacting a few local roads and washing out farmland near the river. At the same time, the Village of Barada also experienced $15,000 in property damage as several cabins, roads, and farmlands near the river were flooded. Barada experienced another smaller flood July 1–7, 2014, when the Missouri River crested at 18.5 feet, just over its flood stage in this area, and impacted a few county roads and cabins lining the river. A few months later, from September 10–12, 2014, the Missouri River flooded the City of Peru and Village of Rulo. Both communities experienced $10,000 in property damage and $25,000 in crop damage as the river crested at 35 feet and inundated low-lying areas. The Missouri River flooding spell of 2014 ended on October 5, 2014, after flooding Rulo for 4 days. The village experienced minor flooding that was mainly in agricultural lowlands and ended up with $5,000 in property damage and $10,000 in crop damage.

Rulo experienced two back-to-back floods in 2015. The second and more significant flood occurred June 11–15, 2015, and left the town with $75,000 of property damage and $50,000 in crop damage. These events resulted in significant flooding of agricultural lowlands as well as cabins and county roads along the river. According to the State HMP, heavy rains over a large part of south-central and southeast Nebraska lead to extensive flooding.

Most recently in 2019, rapidly melting snow and rainfall over a 48-hour period caused catastrophic flooding to occur due to the frozen ground and over a foot of ice remaining in rivers. The floods caused significant levee breaches over more than 350 miles along the Missouri, Elkhorn, and Platte Rivers. Among almost 50 confirmed breaches in multiple states during this event, at least six were reported in Sarpy County, Nemaha County, Otoe County, Valley, and two in Ashland. Levee breach flood damage was devasting to many communities. Tens of thousands had to evacuate, four individuals lost their lives, and hundreds had to be rescued by air or boat. Added to the economic losses related to the 2019 flood event, the levee breaches added to flooding over widespread agricultural lands.[38]

#### 3.4.11.2 *Bazile Creek*

Bazile Creek runs through Knox County, Nebraska in the central Niobrara River Basin. Heavy rainfall caused a chain of flash floods in 2010 after water overflowed the creek banks and flooded nearby communities. A flash flood occurred in Creighton after 3.5 inches of rainfall on June 22 and 23, 2010. This flash flood resulted in $2,000 in property damage and an evacuation of Bruce Park and City Hall.

[37] Nebraska Emergency Management Agency. 2021.

[38] Nebraska Emergency Management Agency. 2021.

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Later that summer on September 22, 2010, the City of Crofton reported over 7 inches of rainfall, resulting in flash flooding in streets and recreational areas and $2,000 of property damage.

The next day, September 23, 2010, the nearby Village of Santee also experienced flash flooding after 6–7 inches of rain, resulting in $2,000 in property damage and reducing Highway 12 to one lane just east of Niobrara.

Bazile Creek flooded again on August 15, 2017, following heavy rains. This flash flood resulted in $30,000 in property damage and $10,000 in crop damage as agricultural lands and county roads along Highway 13 were inundated with flood waters in the City of Crofton.

#### 3.4.11.3 *Ponca Creek*

Ponca Creek is a 139-mile-long creek that flows from southern South Dakota into northern Nebraska and the Missouri River just six miles northwest of Niobrara, Nebraska. The first flood history record contained in the NOAA NCEI Storm Events Database, occurred in the northern portion of Boyd County on July 19 and 20, 1999, after a flash flood washed out county roads across the county and resulted in $5,000 in property damages.

In 2008, Ponca Creek was responsible for two flash floods. The first occurred on June 5, 2008, in Bristow, Nebraska after 4 inches of rain caused water runoff to wash over numerous roadways and inundate the downtown area. This event resulted in $50,000 in property damages and $15,000 in crop damages. The second event occurred on August 11, 2008, in Butte, Nebraska. $100,000 in property damages and $25,000 in crop damages resulted after 5 inches of rain fell causing rapid runoff and significant damages to secondary roads and agricultural lands.

On May 9, 2016, law enforcement officials reported water over numerous roads southeast of Spencer, Nebraska and a 2–3 foot washout section along gravel roads near Bristow due to a flash flood. $30,000 in property damage was reported.

Most recently on July 29, 2020, a heavy rainstorm caused Ponca Creek to overstretch its banks, creating street flooding through the Village of Butte, but no significant damage was reported.

#### 3.4.11.4 *Papillion Creek*

The combination of a large drainage basin and increasing development has contributed to past flooding in Bellevue and Papillion. Numerous tributaries in the Omaha area all flow into Papillion Creek. A gaging station started on Papillion Creek in 1929 recorded 11 floods through 1965. The flood of record—June 16, 1964—killed seven people as floodwaters destroyed multiple mobile homes, caused major damage to hundreds of homes, and caused millions of dollars in damage in Millard, Ralston, and Papillion.

USACE included portions of Papillion Creek when it constructed Missouri River Levee Units R-616 and R-613. These levees were designed to supply 1-percent annual chance flood protection at the time of construction. USACE also built four dams in the Papillion Creek watershed to protect the population from major runoff events. In addition to federal efforts, natural resource agencies started installing levee protection systems in 1968 for Papillion Creek and its tributaries. Since then, the Papio-Missouri River NRD, City of Omaha, and USACE have modified or installed levees on many Papillion Creek tributaries.

Due to ongoing urbanization, Papillion Creek and its tributaries are currently most vulnerable from flash floods, especially if the flooding causes a levee to fail.

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#### 3.4.11.5 *Weeping Water Creek*

Weeping Water Creek runs through the northern portion of the Nemaha River Basin in Nebraska through Cass and Otoe Counties before draining directly into the Missouri River. This creek has been known to cause intense and extensive flooding.

Four major flood events swept across south-central and southeast Nebraska from May–July 1950. The first flood event occurred on May 8 and 9 and was most severe along the Little Nemaha River, Salt Creek, Weeping Water Creek, and several tributaries of the Big Blue River. The communities of Nehawka, Union, and Weeping Water were flooded by Weeping Water Creek, resulting in one death in Union.

The 262 square mile watershed includes the communities of Alvo, Elmwood, Avoca, Weeping Water, Manley, Wabash, Nehawka, and Union. Approximately 12,000 acres are in the floodplain and subject to flooding. The average annual flood damage was calculated to be nearly $500,000 as of the 1990s. Some flooding occurs nearly every year. On average, moderate floods occur approximately once every 4 years and major floods occur once every ten years. The Weeping Water Watershed Flood Reduction Project, constructed in the late 1990s, has reduced flooding. Floods of record included the May 1950 (29.8 feet), June 1984 (29.53 feet) July 1993 (30.97 feet), and June 2010 (29.98 feet) flood events.

On June 27, 1999, 2–4 inches of heavy rain fell over most of Cass County, which caused Weeping Water Creek to flood and crest at 27.4 feet. This led to $40,000 in property damage after eight county roads were washed out and one bridge over the creek was heavily damaged.

On June 6, 2007, Cass County experienced 4–8 inches of rain, causing Weeping Water Creek to become flooded for 2 days with a double crest, the first being 26.3 feet and the second being 30 feet. However, this flood only resulted in $10,000 worth of property damage as only a few county roads and farmlands were inundated.

Cass County experienced another flood on June 20, 2010, after 2–4 inches of heavy rain fell over most of the county. Numerous county roads were flooded, including State Spur 13, Highway 50, and Highway 75. Additionally, a few homes in the City of Weeping Water experienced flood damage. The next day, as flooding continued along Weeping Water Creek and its tributaries, the communities of Weeping Water, Union, Elmwood, and Nehawka were evacuated. At Union, the creek crested at a record 33 feet. Numerous roads, highways, bridges, homes, and farmlands were flooded. After 2 days, Cass County reported just over $100,000 in property damages.

### 3.4.12 REPUBLICAN RIVER BASIN

#### 3.4.12.1 *Republican River*

The Republic River flood of 1935 occurred on May 31 after 18–24 inches of rain fell in eastern Colorado and southwestern Nebraska the day prior. That morning, the Republican River was flowing at its upper reaches, carrying destroyed buildings, livestock, trees, and even people downstream. The communities closest to the river—Parks, Benkelman, Culbertson, and Cambridge—were flooded. Cambridge experienced the worst of the flooding, with three-fourths of its homes flooded. Ultimately, the Republican River flood of 1935 claimed 94 lives, damaged 341 miles of highway, destroyed or damaged 307 bridges, and resulted in an estimated $26 million of damage.

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The Republican River has the distinction of having caused the deadliest flood event in Nebraska history. The Spring of 1935 was very dry. Significant rainfall began in May over Nebraska and in Colorado producing significant rainfall amounts. Two feet of rain falling within in 24 hours was recorded along the South Fork Republican River. The entire Upper Republican Watershed witnessed an average rainfall of 9 inches.[39] This storm was also unique because it moved in the same direction as the drainage basin.

Eyewitnesses report that they could hear the flood water coming down the Republican Valley from over 5 miles away. Multiple survivors reported that flood water came up, receded slightly, then a second, much larger crest occurred. At one point, the water rose 6 feet in 30 minutes and was 10–15 feet higher than the previous crest. Water was over 18 feet deep in places, and the discharge at Cambridge was reported as 280,000 cfs. Floodwater inundated areas where the bluffs are typically 2 miles apart.[40] The Village of Haigler was spared because it is situated on higher ground, but places like Parks, Benkleman, Max, Stratton, Trenton, Culbertson, and McCook were severely impacted, and in some cases destroyed. In addition to these communities, deaths also took place in Perry, Arapahoe, Orleans, Oxford, Franklin, Alma, and Cambridge. Over 100 people lost their lives, and damage estimates were over $26 million.[41,42]

Just 12 years later, the Medicine Creek/Republican River flood of 1947 caused severe flooding along Medicine Creek, the downstream reaches of the Republican River in southwestern Nebraska, the Elkhorn River in northeast Nebraska, and the lower Loup River in Nebraska. Starting in Frontier County, just north of Cambridge, a large storm dumped 8 inches of rain on June 21 and 22, causing Medicine Creek waters to rise. The high waters then spilled into the Republican Basin, causing a record rise of 23 feet (14 feet over flood stage). Floodwaters swept through the City of Cambridge and flash flooding occurred downstream in Orleans, resulting in extensive property damage in both communities. The estimated total damage was $15 million. Residents fled the high waters by chopping holes in the roof of their homes; however, despite these efforts, 13 people drowned.

The impact of the 1935 and 1947 Republican River floods led to the construction of the Medicine Creek Dam in 1948 and 1949. This dam has provided decades of protection from potential flooding for these communities. There have been several large dams constructed in the Republican basin, in response to the 1935 flood. Harlan County Dam is the second-largest reservoir in Nebraska and was completed in 1952. In addition to the new reservoirs, levees were constructed at Indianola and Bartley.[43] However, flow rates have also decreased over time due to irrigation and other upstream uses. As a result of these updated conditions, damaging floods have not occurred since 1960.

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[39] Marlene Harvey Wilmot. 1996. "*Bluff-to-Bluff, Too!: The 1935 Republican Valley Flood."* Wilmot Ventures, Inc. Greeley, CO.

[40] Marlene Harvey Wilmot. 1995. "*Bluff-to-Bluff: The 1935 Republican Valley Flood."* Wilmot Ventures, Inc. Greeley, CO.

[41] Rocky Hoffman. 1983. *River Portraits: The Republican*. Nebraska Rivers. Volume 61, Issue1 (January–February): 58–65.

[42] NOAA National Weather Service. 2015. "Republican River Flood of 1935 – The Flood." March 4. https://www.weather.gov/gld/1935flood-flood.

[43] US Army Corps of Engineers. 2022a.

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#### 3.4.12.1 *Medicine Creek*

One of the most notable dam failures in Nebraska history is the 1895 failure of the Curtis Lake Dam (no longer in existence) in Frontier County that resulted in damage to a downstream railroad and a train derailment.[44]

In June 1947, 8 inches of rain fell in 24 hours in the Medicine Creek basin north of Cambridge. As the water spilled into the Republican basin, flash flooding occurred down to Orleans. Per the National Weather Service, despite residents chopping holes in the roofs of their homes to escape the rapidly rising water, 13 people still perished in the area from Cambridge to Orleans. There was $15 million in damages. The 8-foot-high wall of water badly damaged the railroad, roads, and bridges. The Medicine Creek Dam was constructed upstream of Cambridge in 1948–1949 to help prevent such disasters from happening again.[45]

#### 3.4.12.2 *Frenchman Creek*

In the 25-year period from 1935–1960, the Frenchman had five severe floods. Of the three floods with reports, one was an ice jam that caused high outflow from Enders Dam, and two were from heavy summer rains. More recently, the flow of the Frenchman has been depleted due to increased upland and irrigation uses; consequently, flooding has not typically been a problem in recent years.

Aside from the major flood of 1935, described in the previous section, perhaps the next most severe flood along the Frenchman took place on June 17–18, 1956, when over 4.5 inches of rain fell in a short period, inundating the entire Village of Wauneta.

### 3.4.13 BIG BLUE RIVER BASIN

#### 3.4.13.1 *Upper Big Blue River*

There is a lengthy history of flooding on the Big Blue River. According to the Gage County Flood Insurance Study (FIS),[46] the river has 3,901 square miles of upstream drainage area at Beatrice. Heavy spring or summer rain is the most common initiating factor for flooding in the Big Blue basin; however, rapid snowmelt and ice jam floods have also occurred. Flooding has caused the river to exceed the 18-foot flood stage numerous times in the 92 years of gage records for the City of Beatrice.

As mentioned previously in this plan, four major flood events swept across south-central and southeast Nebraska from May to July 1950. The first flood event occurred on May 8–9 and was most severe along the Little Nemaha River, Salt Creek, Weeping Water Creek and several tributaries of the Big Blue River. The Village of DeWitt was flooded by Turkey Creek. Although there was less severe flooding along the mainstem Big Blue River, two people were killed after an automobile was swept from the highway. The final two flood events were caused by

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[44] Nebraska Emergency Management Agency. 2021.

[45] Nebraska Department of Natural Resources. 2013. "2013 Flood Hazard Mitigation Plan, State of Nebraska." May 2013.

[46] Federal Emergency Management Agency. 2010. "FEMA 2010 Flood Insurance Study Gage County, Nebraska." Map Service Center. June 18, https://map1.msc.fema.gov/data/31/S/PDF/31067CV000A.pdf?LOC=c8c86987672e4c4c99f7905cd1a95cc6.

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thunderstorms farther downstream over the headwaters of the West Fork of the Big Blue River from July 8–10 and July 18–19. Flood waters were most severe along tributaries of the West Fork Big Blue River, particularly Beaver Creek. Large areas of the City of York and most of Beaver Crossing were inundated. Flooding downstream from the confluence of the West Fork and the mainstem of the Big Blue River was not as extensive. However, low-lying areas of Crete flooded, and serious damage occurred downstream in Beatrice.

Upstream of Beatrice, the Village of DeWitt is situated entirely in the Big Blue River floodplain. Major flood events in 1984 and 1993 were especially devastating for both DeWitt and Beatrice.

Flooding again occurred in 2007, when 4–5 inches fell over the watershed from May 4–6. The Big Blue River reached a crest of 23.9 feet at Beatrice on May 7, 2007, approximately 6 feet above flood stage.

On May 7, 2015, every street in DeWitt was flooded, closing off every entrance and exit to the town after a storm pounded Saline County, dumping between 13–17 inches of rain on various towns. DeWitt was evacuated, closed, and the electricity was turned off until May 8, 2015. The City of Fairbury and Village of Endicott were also evacuated and moved to higher ground due to flooding. Prior mitigation actions implemented within this watershed include levees at Fairbury and Seward[47] as well as acquisition and removal of flood-prone structures in Beatrice.

#### 3.4.13.2 *West Fork Big Blue River*

During July 8–10, 1950, flooding was caused by thunderstorms over the West Fork of the Big Blue River. Water levels increased, causing floods to develop on tributaries of the West Fork, particularly Beaver Creek. The City of York was flooded and most of Beaver Crossing was inundated. Flooding was not as extensive downstream from the confluence of the West Fork and the mainstem of the Big Blue River, but low-lying areas of Crete were flooded, and serious damage extended downstream in the City of Beatrice.[48]

#### 3.4.13.3 *Turkey Creek*

According to the September 2019 Turkey Watershed Discovery Report, the Village of DeWitt has a long history of flooding due to its proximity to Turkey Creek and the Big Blue River, which often overflow their banks following a heavy rain. Many of the flood events in DeWitt have been extensive, causing severe damage to most or all homes and businesses. On May 9, 1950, every home in DeWitt was flooded causing an estimated $203,700 in damages. In 1963 another flood caused significant damage in DeWitt, though very little information was recorded about this flood. On June 13, 1984, there was severe flooding in Turkey and Swan Creeks, with up to 5 feet of water throughout much of DeWitt. The entire village evacuated for 3 days. Two flooding events occurred in DeWitt during the spring of 2015. Major basement flooding occurred after most of the village was flooded.

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[47] US Army Corps of Engineers. 2022a.

[48] Pearson, David. n.d. “Top 5 Nebraska Floods – National Weather Service.” National Weather Service. Accessed February 3, 2022. https://www.weather.gov/media/gld/1935flood/pdf/Top5NebraskaFloods_for_HQ.pdf.

Additionally, the City of Wilber has experienced flooding from Turkey Creek in 1957, 1963, 1965, 1969, and 1984.[49]

#### 3.4.13.4 *Middle and Lower Big Blue River*

According to the NOAA NCEI Storm Events Database, in Gage County alone flooding from the Big Blue River caused $1.96 million in property damage between May 1996 and July 2020.

The City of Beatrice has an extensive flood history with its proximity to the Big Blue River. The impacts of flooding on the city are well documented, with a flood history dating back to 1881. In addition to spending hundreds of thousands of dollars on flood damage, Beatrice has also suffered events that have left hundreds homeless and incurred large amounts of agricultural losses. The City's highest recorded flood was in October 1973 when repeated heavy rainfalls caused significant damages. Following this event, Beatrice began to buy flood damaged properties, demolish the structures, and turn the space into a riverfront park. The buy-out program reduced the amount of flood losses in the 1987, 1993, 2015, and 2019 floods. As of the 2015 floods, the city had received an estimated 263 percent return on investment, totaling approximately $8 million in flood loss savings. An additional benefit to this program was the added resiliency shown by the 2019 flood when Beatrice received heavy flooding, but mostly in open space areas created by buy-outs after previous floods.

Wymore and Blue Springs are located directly adjacent to each other along the banks of the Big Blue River in Gage County. They have seen moderate flooding and some of the other major floods on the Big Blue River. Flooding events on record for these cities include those that took place in 1950, which caused over $150,000 in damage in Wymore; 1951, which closed two roads in Wymore; and 1976, which caused $7,000 in damage in Blue Springs. An event in 2008 also closed a bridge for several hours due to flooding across River Drive south of Blue Springs. Washed out roads and damage to some culverts were also reported due to this same event.

Crete has a long history of flooding from the Big Blue River with over 20 separate events dating back as far as 1902. From 1947 to 1952 there are records of a major flood every year and twice in 1950. The floods during this time were 8–12 feet over the 16-foot flood stage. The effects of these floods include the overtopping of the dam between the Middle Big Blue and Crete, and the evacuation of 200 families.

Both the cities of Milford and Seward are located along the Big Blue River in the Middle Big Blue Watershed and share much of their flooding history with the rest of the communities in the watershed. After the 1949 and 1951 floods, USACE built a levee in Seward to protect the community.

Like all the other cities in the Middle Big Blue Watershed, Wilber is built along the Big Blue River. While portions of the city are in the 1-percent annual chance floodplain, the city has not experienced large amounts of flood damage. There are reports of flooded basements in businesses in Wilber and county roads being washed out southeast of town. Most damages

[49] Nebraska Department of Natural Resources. 2019a. "Discovery Report Turkey Watershed, HUC-8: 10270204 Nebraska Report Number 01." September 25.

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that have occurred are to agricultural lowlands. Seven separate flood events have been recorded in Wilber beginning in 1897.[50]

#### 3.4.13.5 *Little Blue River*

Floods on the Little Blue River occurred in 1869, 1915, 1919, 1941, 1948, 1951, 2005, 2015, 2016, and 2019. These floods impacted many communities along the Upper Little Blue Watershed, causing significant property damage. Many small towns were impacted including Hebron, Deshler, Kenesaw, and Minden. Thayer County has experienced significant flooding in recent years, with Hebron being particularly hard hit. Heavy rain and flash flooding between 2015 and 2019 caused significant damage to the town, roads, and fields. Common damage from floods in this area includes washed out county roads and bridges and flooded cropland.

In the spring of 2015, 8–11 inches of rain fall in one evening in Deshler causing creeks to overflow and flood Deshler and surrounding communities. Roads were flooded, property and crops were damaged, and one individual tragically lost their life. Deshler flooded again in 2016 when nearly 8 inches of rain fell in one night. This event damaged several homes, flooded the local foundry, and prompted the evacuation of the nursing home and assisted living facility. When nearly 4 inches of rain fell in less than 4 hours in October 2019, First and Fourth Streets were under water due to flash floods from the Little Blue rising more than 2 feet above the flood level.

### 3.4.14 NEMAHA RIVER BASIN

#### 3.4.14.1 *Big Nemaha*

The Nemaha River has a long history of flooding that dates back as far 1857, when flooding impeded the sale of Table Rock City. The following year, in 1858, massive floods drove nearly all pioneers of Table Rock City to other places. Floods continued through the late 1800s and into the 1900s, where early accounts in newspapers and journals tell stories of high water and significant damage as the Nemaha River overflowed. Flooding occurred regularly throughout the 1900s, with some of the highest historic crests of Big Nemaha occurring in 1952, 1978, 1984, and 1993. The Big Nemaha has continued to see increasingly high crests during flood events, including most recently in 2018 when it reached a crested height of 40.62 feet. The normal flood stage is approximately 27 feet.

The Big Nemaha watershed has experienced a history of flooding on the Nemaha River, including events in 1858, 1881, 1941, 1944, 1954 and 1958. Major flooding in 2008, 2015, 2018, and 2019 was devastating across Nebraska and impacted many communities along the Big Nemaha watershed These events contributed to significant property damage, including bridges, roads, and crops. While Falls City was hit particularly hard, many smaller towns were also impacted, including Humboldt, Johnson, and Table Rock.

In 2008, cities within the Big Nemaha watershed experienced an onslaught of thunderstorms that included heavy rain and supercells in some areas. The heavy rain resulted in the river flooding and flash flooding in Tecumseh. In many areas, the sudden rain was followed by 3–8

[50] Nebraska Department of Natural Resources. 2019b. "Discovery Report Middle Big Blue Watershed, HUC-8: 10270202 Nebraska 9/12/2019." September 12.

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inches of heavy, wet snow resulted in damage to roads and bridges as well as impacted agricultural lowlands in the area. Damages were estimated to total $1 million.

The Nemaha River has experienced significant flooding in recent years, greatly impacting surrounding cities. In 2019, areas including Falls City were impacted by widespread flooding devastation that reached historical levels. The flooding wiped out bridges and highway systems and caused significant property damage within the watershed and across the state. With a dangerous combination of frozen ground, rain, and melting snow, the Missouri River was expected to climb over 26 feet in just a matter of days.[51] The ground was frozen to a depth of 25 inches.[52] When combined with 2–3 inches of rain and melting snow, devastating floods resulted across the State and even three years later at the time of writing recovery is ongoing.

#### 3.4.14.2 *Little Nemaha*

The Little Nemaha River is one of four major waterways of the Nemaha River Basin that drain directly into the Missouri River. Communities in the Little Nemaha Basin have had a history of minor floods since the late 1800s. In 1883, the Little Nemaha River valley had its worst recorded flood to that point. In Unadilla, stretches of track, both east and west of town, were completely washed out. A few bridges were destroyed. Southern Unadilla residents had to evacuate, and many people suffered individual losses along with major crop and livestock losses.

In 1902, the Little Nemaha River rose to its highest point since 1883. The Village of Brock was cut off from land north of the river due to flood waters. A few houses in the lower areas of Brock were slightly flooded, and some crops, bridges, and roads were damaged. The flood waters ripped out fences and inundated some pastureland. Other towns along the Little Nemaha River saw more damage from the fast-moving flood waters that spread from 1 to 3 miles in width from Talmage to Nemaha City.

In 1908, heavy rains brought a severe flood to Syracuse and Unadilla. Several houses were destroyed and six people died. After decades of regular flooding, the communities formed drainage districts.

Many areas of southeast Nebraska were affected by a severe flood in 1950. However, the Little Nemaha River had the greatest surge in water levels. In Unadilla, floodwaters ten feet in depth destroyed homes, bridges, railroads, and crops. Rising waters swept a bus 2 miles from the highway into the river channel. Seven people were killed. The floodwaters in Syracuse stretched over a mile wide and pulled buildings from their foundations. In Brock, the floods severely damaged bridges, highways, railroads, and farmland. In all, 35,000 acres and eight towns were flooded, and 14 lives were lost.

In 1951 Army engineers and soil conservation leaders met to plan for flood relief. In the 68 years of recording, there had been 43 floods in the watershed. Of those, 27 were considered severe. The group discussed their options including reservoirs, diversion dams, or levees that could control run-off water. They also chose soil retention methods to limit silt buildup.

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[51] Nikki McKim. 2019. “Heavy rain and melting snow could cause historic flooding.” Falls City Journal. March 14. https://fcjournal.net/2019/03/14/heavy-rain-and-melting-snow-could-cause-historic-flooding/

[52] National Weather Service. n.d. “Mid-March 2019: Historical, Catastrophic Flooding Impacts Parts of Central/South Central Nebraska.” Weather Forecast Office, Hastings, NE. https://www.weather.gov/gid/march2019flood

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After a heavy rainfall, the Little Nemaha River flooded on May 23, 1996, Unadilla reported $62,000 in property damages and $5.99 million in crop damages. Auburn also reported $680,000 in property damages and $2.1 million in crop damages. This flash flood caused significant damage to bridges, county roads, culverts, and crops.

On June 23, 2000, the Village of Brock experienced a flash flood resulting in $15,000 in property damages. Highway 75 near the Otoe County border was flooded and a culvert on Highway 67 was washed out.

In 2007, the Little Nemaha River was responsible for two flash floods. On May 6, 2007, the Village of Talmage reported $10,000 in property damages after flood waters crossed county roads near Talmage and Lorton, including Highway 128 and Highway 67. Telephone poles were washed out causing loss of phone service in Talmage. Johnson experienced a flash flood on August 8, 2007, resulting in $2,000 in property damages after 2 inches of rain caused the Little Nemaha River to flood across several county roads.

Flash floods crossed eastern Nebraska in fall 2018. Lincoln received over 6 inches of rain. Both Bennet Road and Rokeby Road, two important byways, were flooded. This affected traffic in Bennet and limited its access to adjacent communities from Lincoln to Unadilla. Flooded roads prevent access to critical facilities. They also create longer routes for emergency vehicles when they are needed most.

On March 13, 2019, the bomb cyclone left the central Rockies and headed for Nebraska. The Missouri River watersheds were still covered with 4 to 15 inches of snow, and many rivers had 1 to 2 feet of ice. Only 1 to 2.5 inches of rain fell, but the frozen ground could not absorb it. This caused widespread flooding across the region. It was declared a federal disaster and became one of the region's worst floods in recent history. Summer flooding followed that closed Interstate 29. As a result, the traffic on Highway 75 increased fourfold. The highway is Auburn's main road, so the town had heavy traffic for weeks. In addition to this disruption, the traffic levels increased the risk of accidents and caused damage to roads. One busy intersection saw two accidents with injuries while I-29 was closed.

## 3.5 Flood Risk Assessment

### 3.5.1 FLOOD RISK ACROSS NEBRASKA

#### 3.5.1.1 *Riverine Flood Risk*

Like most states, many flood problems in Nebraska have their roots in the initial development of communities along the state's watercourses. This pattern is clear in Figure 2. With its location on the Missouri River, Omaha played a role in the nation's westward expansion. During this time, water was vital for transportation, running mills, and creating power. Thus, development occurred near these water sources. As a result, historical infrastructure and development near rivers is often subject to flood risk. Flooding in Nebraska has the potential to affect both urban areas and rural agricultural areas.

Figure 2 illustrates the current type of flood risk mapping information available across Nebraska. Yellow areas highlight watersheds where most recent studies are ongoing and flood risk maps will soon be updated.

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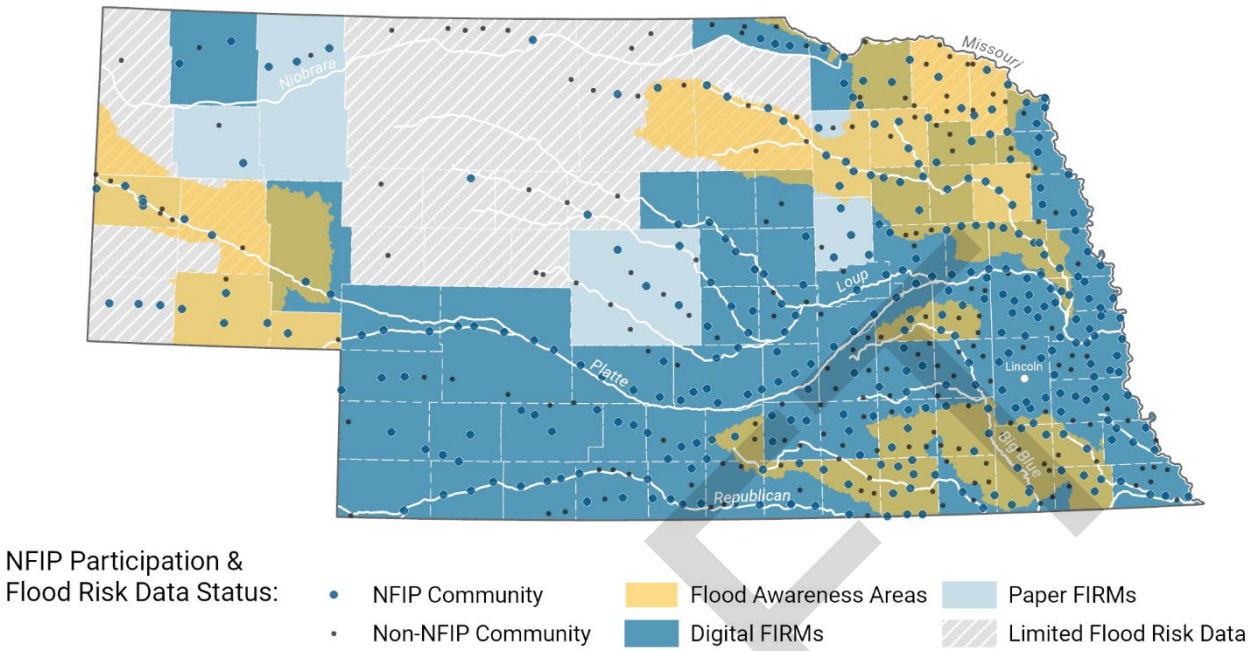
Figure 2: Floodplain Mapping Status Across Nebraska and NFIP Participation




Flood risk continues to increase across Nebraska. The increase is driven by several factors, all of which are caused by human action. Changes in land use and land cover, such as habitat removal or conversion to row crop, reduce sequestration of rainfall and increase overland flow volumes and speed. Conversion of pervious surfaces to impervious surfaces, such as building development, parking lots, and other paving, have similar effects in urban areas. Changing climate patterns are also resulting in greater storm event frequency and intensity, resulting in greater flows. Additionally, development within flood hazard areas inhibits the performance of a floodplain's natural functions to slow and sequester flows while simultaneously exposing people and structures to increased risk. Attempts to control flood risk through infrastructure such as levees, floodwalls, and dams often have counterproductive effects that exacerbate flooding. The land protected by a structural flood control project may attract further new development, which typically puts more lives and infrastructure at risk. Such infrastructure also has the capability of worsening flood levels both upstream and downstream.

NeDNR endeavors to map all of Nebraska's floodplains to accurately depict impacts to flood risk throughout the state. NeDNR's current priorities are to finish mapping where projects have been started. These areas include the Nemaha and Blue River basins. There were ongoing projects in the Elkhorn River Basin that have been put on hold due to large channel shifts that occurred during the 2019 Flood. These projects are also being reprioritized for completion. Figure 3 and Table 4 illustrate these priorities for the next several years. Further discussion of mapping projects and prioritization is offered in Section 6, Capabilities and Challenges of Nebraska Flood Hazard Mitigation Programs. For the most current flood risk mapping project information, the public may access quarterly project updates released by NeDNR's Floodplain Management Section. Additionally, details of current fiscal year and future mapping priorities for the next 5 years are found in the State of Nebraska Cooperating Technical Partners (CTP) Business Plan, updated annually by NeDNR and available via the Floodplain Management Section's webpage.

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Figure 3: Flood Risk Mapping Project Priority Areas

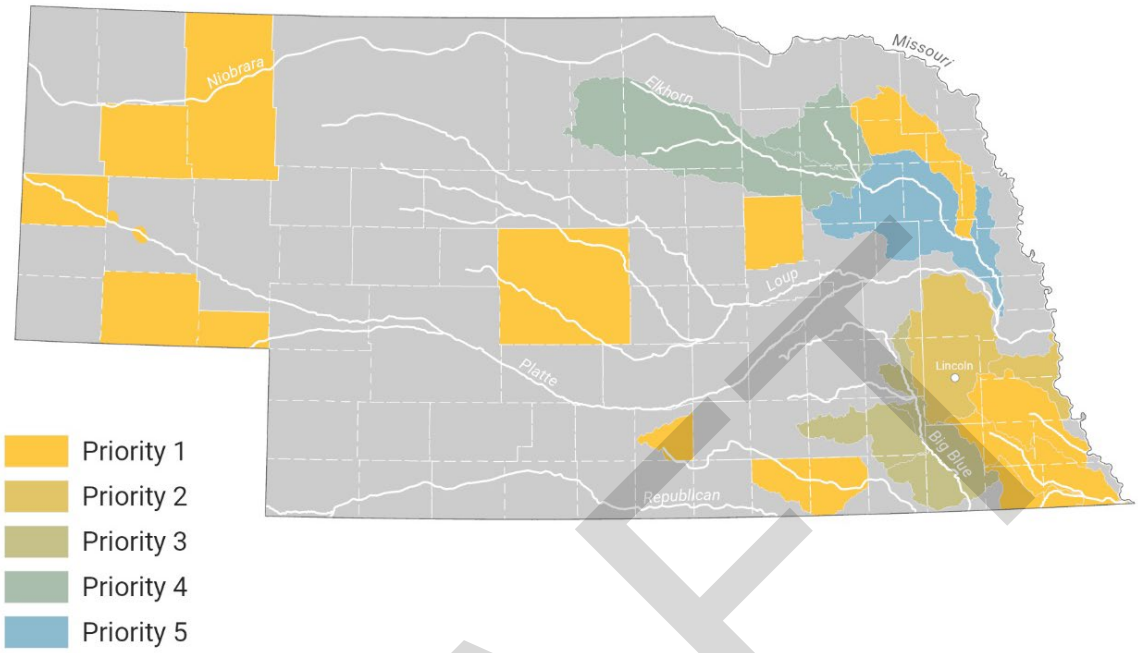


Table 4: Flood Risk Mapping Project Priority Areas

| Priority Level | | | | |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| **Big Nemaha** (10240008) | **Keg-Weeping Water** (10240001) | **Turkey Creek** (10270204) | **Upper Elkhorn** (10220001) | **Lower Elkhorn** (10220003) |
| **Little Nemaha** (10240006) | **Salt Creek** (10200203) | **Middle Big Blue** (10270202) | **North Fork Elkhorn** (10220002) | |
| **Logan Creek** (10220004) | | | | |
| **South Fork Big Nemaha** (10240007) | | | | |
| **Upper Little Blue** (10270206) | | | | |
| **Boone County** | | | | |
| **Box Butte County** | | | | |
| **Cheyenne County** | | | | |
| **Custer County** | | | | |
| **Deuel County** | | | | |

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| Priority Level | | | | |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| **Scotts Bluff County** | | | | |
| **Sheridan County** | | | | |
| **City of Bayard** | | | | |
| **City of Bridgeport** | | | | |

#### 3.5.1.2 *Dam and Levee Failure Flood Risk*

Dams and levees are commonly found throughout Nebraska. Dams and levees are artificial barriers constructed to hold back water, wastewater, or other liquid material. Dams forming reservoirs are constructed for a variety of purposes, such as recreation, power generation, water supply, fire protection, erosion control, and flood control. Levees are often constructed to increase areas of agricultural cultivation and to protect population and structures from floods.

Consideration of replacing or relocating development out of a floodplain has often been prohibitively expensive; thus, some communities have constructed structural flood control projects to protect these developments, such as a floodwall, levee, or dam. Unfortunately, these structural flood control projects have the potential to worsen flood problems. The land protected by a structural flood control project may attract further new development, which typically puts more infrastructure at risk. Thus, if a floodwall, levee, or dam is breached or overtopped during a flood event, damages tend to be much more severe and underinsured than if a floodwall or levee had never been built.

It is also important to recognize that a floodwall, levee, or dam that is designed to provide a certain level of flood protection may become outdated as upstream development changes. The designed flood protection level may be exceeded if the runoff upstream increases due to urbanization or other factors.

Dams and levees may fail or be overtopped. Overtopping occurs when floodwaters exceed the design capacity of the structure and water flows over the structure's lowest crest. The overflow leads to erosion on the landward side, which can then lead to failure. Many factors may lead to dam and levee failure, including but not limited to:

- 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 (older dams constructed prior to the development of current design standards may be of higher risk)
- Improper operation, including the failure to remove or open gates or valves during high flow

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- Corrosion and development of leaks in metal spillway and drainage pipes
- Upstream dam failure on the same waterway that releases water to a downstream dam

Dams are relatively complicated structures, and it can be difficult to predict how a dam will respond to stress. Failures are often the result of a combination of a trigger and a pre-existing weakness. Levees may fail because of surface erosion caused by water velocities and subsurface actions such as sand boils. Drainage tile outlets and other conduits may create weak points in levee-like structures and lead to failure.

Historical events of both dam and levee failure are described in this plan in Section 3.4, Historic Flood Events.

### DAM FAILURE FLOOD RISK

Of the 2,947 dams on the NeDNR-maintained Nebraska Dam Inventory, approximately 5 percent are classified as high hazard potential and 7 percent are classified as significant hazard potential due to the potential for loss of life and damages to property that could occur if they were to fail. Most of the inventoried dams are earthen embankment construction. Keith County's Kingsley Dam is the largest and the tallest dam in Nebraska. Constructed in 1941, it is 163 feet in height and has a maximum storage capacity of 2,200,00 acre-feet. Buffalo County's Kearney Dam, constructed in 1885, is the oldest Nebraska dam still in existence. NeDNR's Dam Safety division estimates that 85 percent of existing Nebraska dams were constructed after 1960. The average age of a dam in Nebraska is 45 years.

NeDNR has jurisdiction over dams in the state that have a total height of 25 feet or more or have an impounding capacity at the top of dam of 50 acre-feet or more. Dams in Nebraska are categorized primarily by the potential for loss of life and damages to property if the dam were to fail. The hazard potential classification is not an assessment of the dam's condition or its likelihood of failure. The four hazard potential classifications for dams are as follows:

- *High hazard potential* means a hazard potential classification such that failure or misoperation of the dam resulting in loss of human life is probable.
- *Significant hazard potential* means a hazard potential classification such that failure or misoperation of the dam would result in no probable loss of human life but could result in major economic loss, environmental damage, or disruption of lifeline facilities.
- *Low hazard potential* means a hazard potential classification such that failure or misoperation of the dam would result in no probable loss of human life and in low economic loss.
- *Minimal hazard potential* means a hazard potential classification such that failure or misoperation of the dam would likely result in no economic loss beyond the cost of the structure itself and losses principally limited to the owner's property.

Figure 4 illustrates the locations of known dams within the state as categorized by hazard potential.

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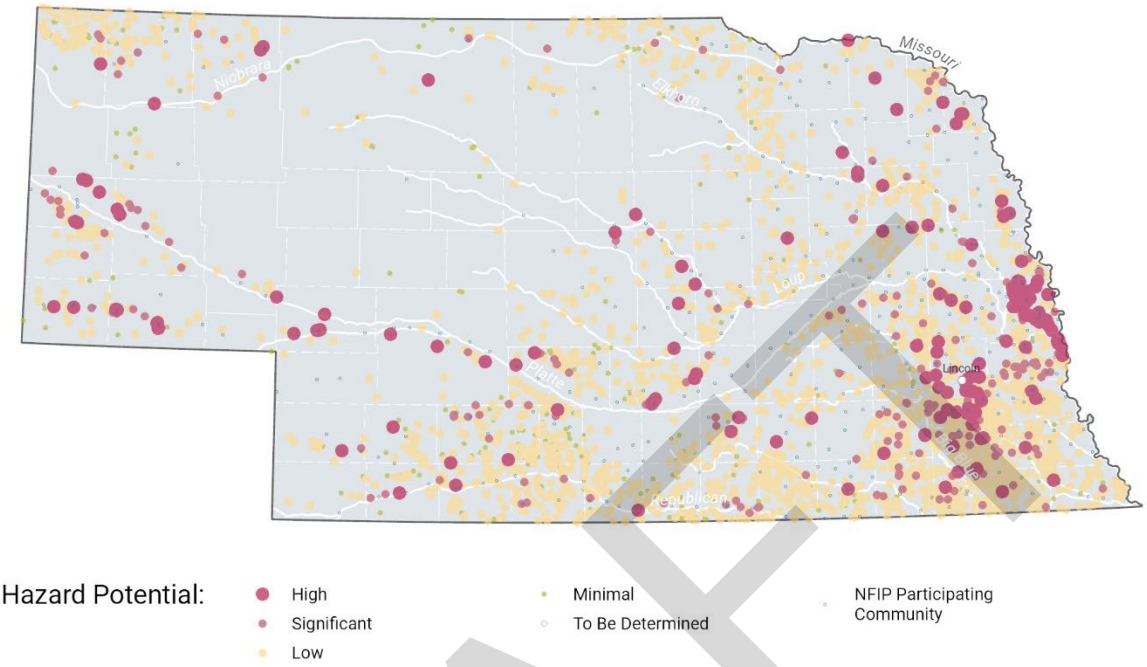
Figure 4: Dam Locations and Hazard Classifications




NeDNR's Dam Safety division maintains an inventory of all dams under NeDNR jurisdiction and maintains a schedule and record of safety inspection for these dams. High hazard dams are inspected annually, significant hazard dams are inspected every 3 years, low hazard dams are inspected every 5 years, and minimal hazard dams are inspected every 10 years. Owners are notified by letter of defects or deficiencies found during field safety inspections with recommended actions or directions for repair. NeDNR has the authority to require owners to correct deficiencies and defects to ensure that the dams operate safely.

Dams classified as high hazard potential require an Emergency Action Plan (EAP). As of January 2020, the owner of every high hazard potential dam (HHPD) in Nebraska has an EAP in place. EAPs detail actions the dam owner will take to prevent dam failure, who will be contacted in case of emergency, and the downstream area that will be evacuated should dam failure become imminent. Table 5 summarizes the potential impacts and consequences of dam and levee failure and is adapted from Table 3.2-2, Dam Failure Impact/Consequence Summary, and Table 3.6-1, Summary of Levee Failure Impacts/Consequences, of the 2021 State HMP.

Table 5: Dam and Levee Failure Impact Sectors and Summary of Potential Consequences

| Impacted Sector | Impact Description |
|---|---|
| Public: Housing, Casualties, Fatalities, Work, Food, Water | Housing: Structures within inundation areas could be destroyed depending on the depth and velocity of flooding.<br>Casualties/Fatalities: Dependent on warning time, the population at risk and the depth and velocity of flooding. People living and/or working in areas with less than 30 minutes of warning of a complete failure are the most at risk.<br>Work: Dependent on location in relationship to the failing structure.<br>Food/Water: Limited impact. |

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| Impacted Sector | Impact Description |
|---|---|
| Responders: Fire, Police, Medical, Public Works | Unless the responders live within inundation areas or their facilities are located within inundation areas, there should be no impact. During the response, care needs to be given to the possibility of pollution, disease, and potential hazardous materials in the flood waters.<br>Medical: Dependent on if the facilities are in the inundation areas. Some medical facilities could become quickly overwhelmed with victims if the inundation area includes a large population. In that event, medical surge plans will be activated. |
| Continuity of Operations (COOP) | If major governmental facilities (courthouse, city/county offices) are in the inundation area, failure of the structure could cause extreme damage to buildings and contents including electronic and paper records. If the jurisdiction does not have adequate COOP planning, the impact will be very high. |
| Property: Destroyed, Major, Isolated | Property within the inundation areas can expect impacts ranging from major and destroyed to minor depending on the depth and velocity of the flooding. |
| Infrastructure: Electricity, Water, Roads, Bridges | As with property damages, infrastructure can be seriously damaged. Water and wastewater systems can be contaminated, electrical structures can be damaged, and roads and bridges can be destroyed or isolated. Repairs could be delayed until water levels recede. |
| Environment | The environment in the inundated areas will be severely impacted with contaminates, erosion, and debris. |
| Economic Conditions | In Nebraska, economic impacts range anywhere from catastrophic to none depending on which structures fail and the amount of water the structure holds. |
| Public Confidence in the Governance | Public confidence will be dependent on the perception of whether the failure could have been avoided by any governmental action either taken or not taken. |

Table 6, adapted from Table 3.2-3 of the 2021 State HMP, sums the quantity of dams per jurisdiction according to hazard level. Papio-Missouri River NRD has the highest quantity of high hazard dams, whereas Little Blue-Lower Big Blue NRD has the highest quantity of low hazard dams. The fifteen dams under construction are listed in Table 7—adapted from Table 3.2-3 of the 2021 State HMP.

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Table 6: Dam Hazard Level Count by Hazard Mitigation Plan Jurisdiction

| Planning Area | High | Significant | Low | Minimal | Undetermined | Under Construction |
|---|---|---|---|---|---|---|
| Cedar Dixon HMP | 2 | 4 | 47 | 0 | | |
| Central Platte NRD | 7 | 15 | 129 | 16 | | 1 |
| City of Beatrice HMP | 0 | 0 | 1 | 0 | | |
| Hayes, Hitchcock, and Frontier HMP | 4 | 6 | 64 | 27 | | |
| Little Blue-Lower Big Blue NRD | 14 | 49 | 479 | 32 | | 2 |
| Lower Elkhorn NRD | 9 | 12 | 70 | 4 | | |
| Lower Loup NRD | 6 | 5 | 121 | 13 | 1 | 3 |
| Lower Platte North NRD | 3 | 10 | 111 | 2 | | 2 |
| Lower Platte South NRD | 30 | 35 | 136 | 6 | | |
| Nemaha NRD | 5 | 14 | 372 | 10 | | 2 |
| North Platte NRD | 8 | 15 | 47 | 2 | | |
| Papio-Missouri River NRD | 39 | 12 | 101 | 4 | | 1 |
| Perkins County HMP | 1 | 1 | 14 | 3 | | |
| Quad Counties HMP | 2 | 8 | 166 | 39 | | 1 |
| Region 23 HMP | 4 | 10 | 105 | 27 | | |
| Region 24 HMP | 1 | 2 | 67 | 21 | | |
| South Platte NRD | 7 | 6 | 25 | 8 | | |
| Tri-Basin NRD | 1 | 2 | 64 | 28 | | 1 |
| Tri-County | 0 | 3 | 95 | 13 | | |
| Twin Platte NRD | 8 | 1 | 19 | 5 | | |
| Upper Big Blue NRD | 2 | 3 | 72 | 11 | | |
| Upper Loup NRD | 0 | 0 | 1 | 3 | | |

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Table 7: Dams Under Construction

| Dam ID | NID ID | Dam Name | Hazard Level | Plan No. | County |
|---|---|---|---|---|---|
| 2150 | NE02150 | Blackwood Creek P-2 | Significant | P-20683 | Red Willow |
| 5064 | NE05064 | Jamie Carstens Dam (Modified) | Low | P-19271 | Gage |
| 5073 | NE05073 | Klinginsmith Holding Lagoon 1 Dam | Low | P-17848 | Howard |
| 8459 | NE08459 | Baker Holding Lagoon 2 Dam | Low | P-20235 | Sherman |
| 8466 | NE08466 | Pigeon Jones Creek 12A | High | P-20327 | Dakota |
| 8476 | NE08476 | Gottsch – Juniata Lagoon 10 Dam | Low | P-20420 | Adams |
| 8509 | NE08509 | Duck Creek 14-2 | Low | P-20508 | Nemaha |
| 8516 | NE08516 | Smart Soil Compost Dam | Low | P-20552 | Hall |
| 8517 | NE08517 | Eagle Heart Ranch Lagoon 2 Dam | Minimal | P-20561 | Howard |
| 8530 | NE08530 | Rowe Holding Lagoon 2 | Low | P-18258 | Gosper |
| 8631 | NE08631 | Binder Irrigation Diversion Dam 1 | Low | P-20602 | Pawnee |
| 10008 | NE10008 | AltEn Holding Pond 4 West Dam | Low | P-20847 | Saunders |
| 10009 | NE10009 | AltEn Holding Pond 5 East Dam | Low | P-20847 | Saunders |

### DAM FAILURE HISTORY

A detailed record of all historic dam failures in Nebraska is not available. However, based on records kept since 1970, there have been 104 dam failures. Of these failures, 4 were classified as minimal hazard potential, 94 low hazard potential, and 6 significant hazard potential. To date, there has not been a failure of a dam classified as high hazard potential in Nebraska.

The most notable dam failures in Nebraska history include the 1895 failure of the Curtis Lake Dam in Frontier County, which resulted in damage to a downstream railroad and a train derailment; the 1999 failure of the Tyson Lagoon Cell #3 Dam in Madison County, which also resulted in damage to a downstream railroad; the 2010 failure of the Bredthauer Dam in Valley County, which reportedly increased ongoing flooding through the Village of North Loup; and the 2019 failure of Spencer Dam on the Niobrara River in Holt County. Other notable dam failure incidents are reported in Section 3.4, Historic Flood Events. Details of the failure of the Spencer Dam may be found in the Spencer Dam Failure Investigation Report, produced by the Association of State Dam Safety Officials (2020).

In addition to the Spencer Dam failure, which was a significant hazard dam, several privately owned dams failed in the 2019 event. The failure of these private dams contributed to additional overland flooding and most likely exacerbated the flooding in localized areas.

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### HIGH HAZARD POTENTIAL DAMS.

Figure 5 illustrates the locations of HHPD in the state that are in poor condition. Nine dams need either corrective action or an engineering evaluation. Table 8 is updated from Table 3.2-4, High Hazard Dams in Poor Condition, in the 2021 State HMP, with data from NeDNR's Dam Safety Division, which is current as of March 2022.

Table 8: High Hazard Dams in Poor Condition

| ID | Dam name | Hazard level | Current Condition Assessment | Year Completed | County |
|---|---|---|---|---|---|
| NE00211 | BRULE CREEK 1-A | High | Poor – corrective action needed | 1970 | Keith |
| NE00659 | GERING VALLEY B | High | Poor – corrective action needed | 1964 | Scotts Bluff |
| NE00775 | PLUM CREEK 4-F | High | Poor – corrective action needed | 1969 | Pawnee |
| NE01124 | CARTER P JOHNSON DAM | High | Poor – corrective action needed | 1935 | Sioux |
| NE01734 | SPRING CREEK 19-B | High | Poor – corrective action needed | 1979 | Dawson |
| NE01887 | COTTONWOOD CREEK 21-A | High | Poor – corrective action needed | 1983 | Saunders |
| NE02134 | WILLOW CREEK DAM | High | Poor – corrective action needed | 1983 | Pierce |
| NE00153 | KOHTZ CITY OF ALBION DAM | High | Poor – corrective action needed | 1968 | Boone |
| NE00102 | BEAVER LAKE DAM | High | Poor – corrective action needed | 1973 | Cass |
| NE00750 | JANICEK DAM | High | Poor – corrective action needed | 1955 | Kimball |

There are limited funding opportunities available for reconstructing or removing dams that are in poor condition. Public dam owners can apply for funding assistance through the State's Water Sustainability Fund (WSF), but funds are limited and, to date, only one dam rehabilitation project has received funding through the program. Opportunities for private dam owners are either non-existent or extremely limited. There are two local NRDs that have developed local cost-share programs to help private owners rehabilitate their dams. The High Hazard Potential Dam Rehabilitation Grant Program, administered by FEMA, is a new federal grant program for eligible non-federal governmental organizations or nonprofit organizations for rehabilitation of dams that fail to meet minimum dam safety standards and pose unacceptable risk to life and property.

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### NATIONAL DAM SAFETY PROGRAM HIGH HAZARD POTENTIAL DAM GRANT PROGRAM.

NeDNR serves as the State's Dam Safety Agency, working in partnership with federal agencies and other stakeholders under the National Dam Safety Program to encourage and promote the establishment and maintenance of effective federal and state dam safety programs to reduce the risk to human life, property and the environment.

For the purposes of the HHPD grant program, all dam risk includes the incremental risk, non-breach risk, and residual risk associated with each eligible HHPD. High Hazard Potential is a classification standard for any dam whose failure or misoperation will cause probable loss of human life. There are 152 HHPDs in the state.

To be eligible for the HHPD grant, the high hazard dam must have an EAP approved by NeDNR, and the dam must fail to meet minimum state dam safety standards and pose an unacceptable risk to the public.

Funding from the HHPD program provides technical, planning, design, and construction assistance for eligible rehabilitation activities that reduce dam risk and increase community preparedness.

Objectives of the program include:

1. Provide financial assistance for repair, removal, or rehabilitation of eligible HHPDs.
2. Protect the federal investment by requiring operation and maintenance of the project for the 50-year period following completion of rehabilitation.
3. Encourage state, local, and territorial governments to consider all dam risk in state and local mitigation planning.
4. Promote community preparedness by requiring recipients to develop and implement floodplain management plans that address potential measures, practices, and policies to reduce loss of life, injuries, damage to property and facilities, public expenditures, and other adverse effects of flooding in the area impacted by the project; plans for flood fighting and evacuation; and public education and awareness of flood risks.
5. Reduce the potential consequences to life and property of HHPD incidents.
6. Incentivize states to incorporate risk-informed analysis and decision making into their dam safety practice.
7. Reduce the overall number of HHPDs that pose an unacceptable risk to the public.
8. Promote a program of EAP implementation, compliance, and exercise for HHPDs.
9. Reduce costs associated with dam rehabilitation through the deployment of innovative solutions and technologies.

Eligible activities include the repair, removal, or rehabilitation of eligible HHPDs. For the purposes of the HHPD program, rehabilitation means the repair, replacement, reconstruction, or removal of a dam that is carried out to meet applicable state dam safety and security standards. The HHPD grant period of performance is 36 months from the date of the award. Additional criteria for the HHPD program are provided in the publication FEMA Policy 104-008-7.

NeDNR policy and public safety concerns prohibit the dissemination of dam breach inundation maps for use in local or state mitigation plans. NeDNR considers special requests for this information on a case-by-case basis. Any information released must be viewed at an NeDNR office. Additionally, dam inundation mapping is not available through the National Dam

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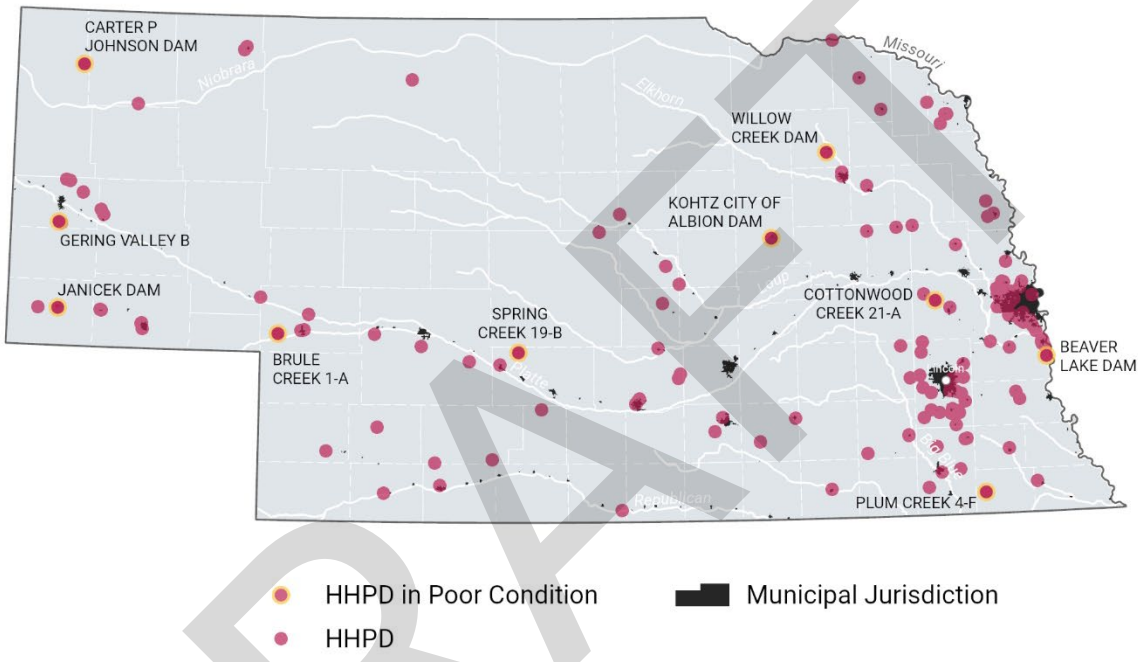
Inventory. Therefore, neither jurisdiction specific inundation data nor maps will be included in this revision of the plan. However, a simple GIS analysis was conducted to identify overlaps in community corporate limits and extraterritorial jurisdictions with NeDNR data describing mapped inundation areas of HHPDs. Figure 5, Table 9, and Table 10 identify communities in the state that are potentially subject to inundation by a HHPD. The dam inundation area data is also being incorporated into the GIS-based Flood Risk Assessment described in Section 3.5, Flood Risk Assessment.

### Figure 5: Location of HHPDs in Poor Condition and Municipal Jurisdictions Within a HHPD Inundation Area




### Table 9: NFIP-Participating Communities with Areas Potentially Subject to Inundation by High Hazard Dam

| Jurisdiction Name | Jurisdiction Name | Jurisdiction Name |
|---|---|---|
| Adams County | Boone County | Buffalo County |
| Burt County | Butler County | Cass County |
| Chase County | Cheyenne County | City of Albion |
| City of Alma | City of Ashland | City of Bayard |
| City of Beatrice | City of Bellevue | City of Bennington |
| City of Blair | City of Blue Springs | City of Bridgeport |
| City of Burwell | City of Cambridge | City of Central City |
| City of Columbus | City of Cozad | City of Dakota City |
| City of Falls City | City of Fort Calhoun | City of Franklin |
| City of Fremont | City of Fullerton | City of Genoa |
| City of Gering | City of Gibbon | City of Gordon |

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| Jurisdiction Name | Jurisdiction Name | Jurisdiction Name |
|---|---|---|
| City of Gothenburg | City of Grand Island | City of Gretna |
| City of Hartington | City of Hastings | City of Hebron |
| City of Hickman | City of Hooper | City of Humboldt |
| City of Indianola | City of Kearney | City of Kimball |
| City of La Vista | City of Laurel | City of Lexington |
| City of Lincoln | City of Louisville | City of McCook |
| City of Mitchell | City of Nebraska City | City of Norfolk |
| City of North Bend | City of North Platte | City of Ogallala |
| City of Omaha | City of Ord | City of Oshkosh |
| City of Papillion | City of Peru | City of Pierce |
| City of Plattsmouth | City of Ponca | City of Ralston |
| City of Ravenna | City of Red Cloud | City of Schuyler |
| City of Scottsbluff | City of Sidney | City of South Sioux City |
| City of Springfield | City of St. Paul | City of Stanton |
| City of Superior | City of Sutton | City of Tecumseh |
| City of Tekamah | City of Terrytown | City of Valley |
| City of Wahoo | City of Waverly | City of Wilber |
| City of Wood River | City of Wymore | City of Yutan |
| Clay County | Colfax County | Custer County |
| Dakota County | Dawes County | Dawson County |
| Dodge County | Douglas County | Franklin County |
| Frontier County | Furnas County | Gage County |
| Garden County | Garfield County | Gosper County |
| Greeley County | Hall County | Hamilton County |
| Harlan County | Hayes County | Hitchcock County |
| Howard County | Jefferson County | Johnson County |
| Kearney County | Keith County | Lancaster County |
| Lincoln County | Madison County | Merrick County |
| Nance County | Nemaha County | Nuckolls County |
| Otoe County | Pawnee County | Phelps County |
| Pierce County | Platte County | Polk County |
| Red Willow County | Richardson County | Saline County |
| Sarpy County | Saunders County | Scotts Bluff County |
| Seward County | Sheridan County | Sherman County |
| Stanton County | Thayer County | Thurston County |

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| Jurisdiction Name | Jurisdiction Name | Jurisdiction Name |
|---|---|---|
| Valley County | Village Of Adams | Village of Alda |
| Village of Arlington | Village of Ashton | Village of Bartley |
| Village of Bennet | Village of Boys Town | Village of Brady |
| Village of Brule | Village of Cedar Creek | Village of Chapman |
| Village of Clarks | Village of Culbertson | Village of Dannebrog |
| Village of Davenport | Village of Decatur | Village of Denton |
| Village of DeWitt | Village of Dodge | Village of Doniphan |
| Village of Duncan | Village of Elm Creek | Village of Elyria |
| Village of Firth | Village of Greenwood | Village of Guide Rock |
| Village of Hadar | Village of Hamlet | Village of Herman |
| Village of Hershey | Village of Homer | Village of Howells |
| Village of Inglewood | Village of Ithaca | Village of Jackson |
| Village of Leigh | Village of Leshara | Village of Lewellen |
| Village of Linwood | Village of Lyman | Village of Malmo |
| Village of Maxwell | Village of Monroe | Village of Nemaha |
| Village of Nickerson | Village of North Loup | Village of Otoe |
| Village of Overton | Village of Oxford | Village of Palisade |
| Village of Palmyra | Village of Pleasant Dale | Village of Potter |
| Village of Prague | Village of Raymond | Village of Richland |
| Village of Riverton | Village of Roca | Village of Rogers |
| Village of Rulo | Village of Salem | Village of Scotia |
| Village of Silver Creek | Village of South Bend | Village of Sprague |
| Village of Sterling | Village of Sutherland | Village of Swanton |
| Village of Taylor | Village of Trenton | Village of Waterloo |
| Village of Wauneta | Washington County | Webster County |
| Winnebago Tribe of Nebraska | | |

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Table 10: Non-NFIP Jurisdictions with Areas Potentially Subject to Inundation by High Hazard Dam

| Jurisdiction Name | Jurisdiction Name | Jurisdiction Name |
|---|---|---|
| City of Minatare | Dixon County | Iowa Tribe of KS and NE |
| Kimball County | Loup County | Morrill County |
| Omaha Tribe of Nebraska | Ponca Tribe of Nebraska | Sioux County |
| Village of Barneston | Village of Bloomington | Village of Broadwater |
| Village of Brownville | Village of Cotesfield | Village of DeWeese |
| Village of Edison | Village of Hardy | Village of Henry |
| Village of Holbrook | Village of Hubbard | Village of Kennard |
| Village of Maskell | Village of McGrew | Village of Melbeta |
| Village of Memphis | Village of Morrill | Village of Naponee |
| Village of Phillips | Village of Wynot | |

#### FUTURE POPULATION AND DEVELOPMENT TRENDS.

Dams are classified in four hazard potential categories based on the potential downstream damages if the dam were to fail. The hazard classification sets the design, construction, and inspection criteria for the dam. As the hazard classification increases, so do the standards for design, construction, and inspection. Dams constructed in rural areas are usually classified and constructed to low hazard standards. However, in most areas, there is nothing that prevents a home from being built downstream of a low hazard dam that could be flooded if the dam fails. This is especially a problem around cities seeing rapid growth into rural farmland. The construction of just one home can result in a change in a dam's hazard potential classification. This results in dam owners having to make costly upgrades to their dams. Downstream homes are especially at risk until dam upgrades can be completed. These upgrades can take several years to complete, and some dam owners do not have the resources to make the required changes to their dam.

While NeDNR does not have the authority to prevent development downstream of dams, it is continually monitoring potential development downstream of dams and revaluating the hazard potential classification of dams. A few local communities and jurisdictions have implemented zoning restrictions that restrict development in dam breach inundation areas.

### 3.5.1.3 *Levee Failure Flood Risk*

Levee failure causes water to inundate normally dry areas. Even if levee systems are maintained and closely monitored during potential events that could result in breaches, levees can still fail. The failure of a levee can be attributed to the loss of structural integrity of a wall, dike, berm, or elevated soil by erosion, piping, saturation, under seepage, or overtopping.

Table 5 in Section 3.5.1.2, Dam and Levee Failure Flood Risk, summarizes the potential impacts and consequences of dam and levee failure, and is adapted from Table 3.2-2, Dam Failure Impact/Consequence Summary, and Table 3.6-1, Summary of Levee Failure Impacts/Consequences, of the 2021 State HMP.

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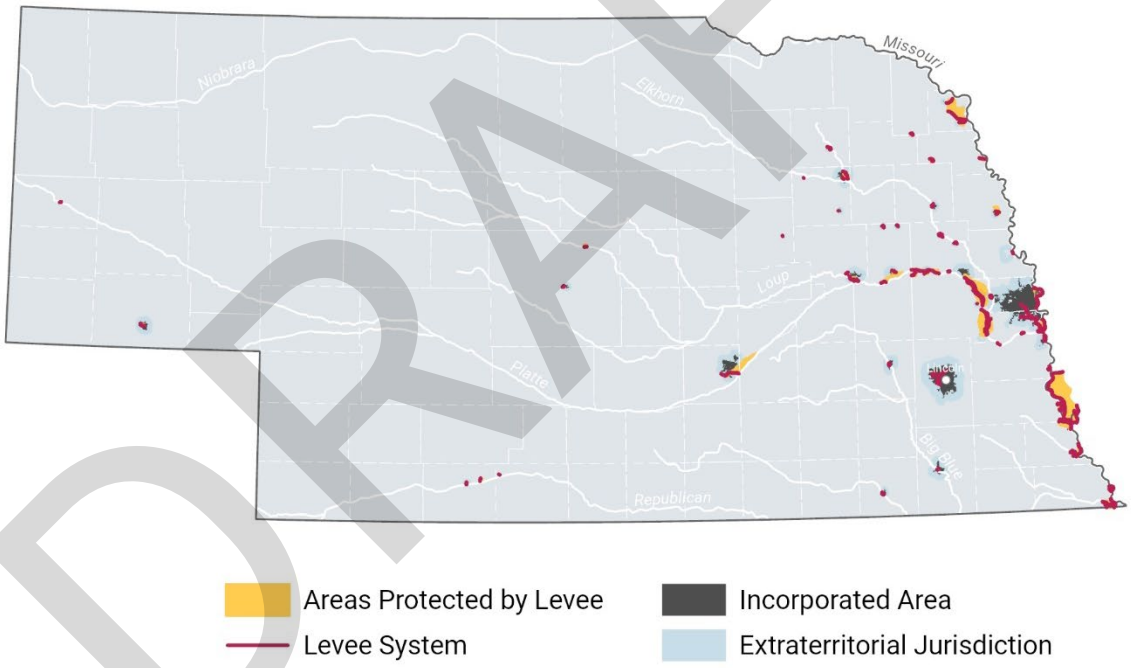
## LOCATION

Levees are found across the state, primarily along the Platte River, Elkhorn River, Missouri River, and their tributaries. To assess the areas at potential risk for levee failure, USACE's National Levee Database (NLD) was consulted. The Congressionally authorized NLD is the primary source for comprehensive information about our nation's levees. According to the NLD, as of March 2022, Nebraska has 127 levee systems, comprising 338 miles of levees. These systems are 53 years of age on average.

Figure 6 illustrates NLD data showing where Nebraska's levees are located, and the areas that they protect from flooding. While the NLD provides a large amount of data, there is not a definitive list of all the numerous municipal, agricultural, and other small levees located throughout the state. For many levees in Nebraska, levee location, design specifications, condition, and the value of assets protected are unknown. However, the goal of the NLD is for it to include data about levees owned and operated by all other federal agencies, tribes, states, municipalities, levee boards, and private entities. USACE adds information to the NLD as it becomes available.

Figure 6: Levee Locations and Protected Areas




NLD levee location data was analyzed to identify which entities in Nebraska have lands protected by levees within their jurisdictions. Table 11 lists these jurisdictions.

Table 11: Jurisdictions with Areas Protected from Inundation by Levee

| Jurisdiction | NFIP Participant? |
|---|---|
| Village of Bartley | Yes |
| Village of Homer | Yes |
| Village of Howells | Yes |

| Jurisdiction | NFIP Participant? |
|---|---|
| City of Terrytown | Yes |
| City of Valley | Yes |
| City of Wakefield | Yes |

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| Jurisdiction | NFIP Participant? |
|---|---|
| Village of Jackson | Yes |
| Village of Leshara | Yes |
| Village of Meadow Grove | Yes |
| Village of Nemaha | Yes |
| Village of Pender | Yes |
| Village of Rogers | Yes |
| Village of Rulo | Yes |
| Village of South Bend | Yes |
| Village of Waterloo | Yes |
| City of Ashland | Yes |
| City of Beatrice | Yes |
| City of Bellevue | Yes |
| City of Blair | Yes |
| City of Broken Bow | Yes |
| City of Cambridge | Yes |
| City of Clarkson | Yes |
| City of Columbus | Yes |
| City of Dakota City | Yes |
| City of Fairbury | Yes |
| City of Fremont | Yes |
| City of Grand Island | Yes |
| City of Hooper | Yes |
| City of Indianola | Yes |
| City of La Vista | Yes |
| City of Lincoln | Yes |
| City of Madison | Yes |
| City of Norfolk | Yes |
| City of North Bend | Yes |
| City of Omaha | Yes |
| City of Papillion | Yes |
| City of Peru | Yes |
| City of Pierce | Yes |
| City of Plattsmouth | Yes |
| City of Ralston | Yes |

| Jurisdiction | NFIP Participant? |
|---|---|
| City of West Point | Yes |
| City of Yutan | Yes |
| Boone County | Yes |
| Burt County | Yes |
| Butler County | Yes |
| Cass County | Yes |
| Colfax County | Yes |
| Custer County | Yes |
| Dakota County | Yes |
| Dodge County | Yes |
| Douglas County | Yes |
| Hall County | Yes |
| Merrick County | Yes |
| Nemaha County | Yes |
| Otoe County | Yes |
| Red Willow County | Yes |
| Richardson County | Yes |
| Sarpy County | Yes |
| Saunders County | Yes |
| Thurston County | Yes |
| Iowa Tribe of KS and NE | No |
| Omaha Tribe of Nebraska | No |
| Ponca Tribe of Nebraska | No |
| Sac and Fox Nation | No |
| Central Platte NRD | No |
| Little Blue NRD | No |
| Lower Big Blue NRD | No |
| Lower Elkhorn NRD | No |
| Lower Loup NRD | No |
| Lower Platte North NRD | No |
| Lower Platte South NRD | No |
| Lower Republican NRD | No |
| Middle Republican NRD | No |
| Nemaha NRD | No |

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| Jurisdiction | NFIP Participant? |
|---|---|
| City of Schuyler | Yes |
| City of Scribner | Yes |
| City of Seward | Yes |
| City of Sidney | Yes |
| City of Tekamah | Yes |

| Jurisdiction | NFIP Participant? |
|---|---|
| North Platte NRD | No |
| Papio-Missouri River NRD | No |
| South Platte NRD | No |
| Upper Big Blue NRD | No |

### LEVEE FAILURE HISTORY.

Levees and dams along the Missouri River were tested by the 1952, 1993, 2010, 2011, and 2019 floods. Descriptions of past levee failures in Nebraska are found in Section 3.4, Historic Flood Events.

Table 12, adapted from Table 3.6-4 of the 2021 State HMP, describes completed and ongoing levee system repair efforts following the 2019 flooding. Current reporting data and project statuses were sourced from https://www.nwo.usace.army.mil/Omaha-District-System-Restoration-Team.

**Table 12: Progress of Repair Projects on Levees Damaged in 2019 Flooding**

| Levee System | Stream | 2019 Impact | Last Update | Status | Contract Amount |
|---|---|---|---|---|---|
| Ames Diking | Platte River | Damaged – repair levee system to authorized level of flood risk management | 9/8/2020 | Repair completed 8/14/2020 | $1,260,000 |
| Broken Bow | Mud Creek | Damaged – repair levee system to authorized level of flood risk management | 11/8/2019 | Repair completed 10/24/2019 | $165,000 |
| Cedar Creek | Platte River | Damaged in 3 locations | 01/10/2020 | Repair completed 12/18/2019 | $1,343,000 |
| Clear Creek | Platte River | 4 breaches and substantial damages | 02/03/2021 | Repair completed 10/17/2020 | $9,200,000 (initial breach repair & final repair) |
| Columbus | Loup River | Damaged – repair gabion wall | 09/08/2020 | Repair completed 08/28/2020 | $2,200,000 |

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| Levee System | Stream | 2019 Impact | Last Update | Status | Contract Amount |
|---|---|---|---|---|---|
| Lake WaConDa | Missouri River | Damaged – repair levee system to authorized level of flood risk management | 02/03/2021 | Project design complete. Pending real estate acquisition, contract will be advertised for construction. | Undetermined |
| Norfolk | Elkhorn River | Damaged – repair levee system to authorized level of flood risk management | 02/03/2021 | 92% complete, and project expected to be substantially complete by end of February 2021. | $2,690,000 |
| Omaha | Missouri River | Damaged – repair levee system to authorized level of flood risk management | 02/03/2021 | 82% complete with levee repairs and currently restoring drainage outfall conveyance. | $1,255,879 |
| Papillion Creek System | Papillion Creek | Many of 13 levee systems damaged | 02/03/2021 | Repair completed 10/20/2020 | $7,300,000 |
| Pender | Logan Creek | Damaged – repair levee system to authorized level of flood risk management | 02/03/2021 | Repair Complete 11/20/2020 | $7,000,000 |
| Pierce | North Branch Elkhorn | Damaged – repair levee system to authorized level of flood risk management | 09/08/2020 | Repair Complete 10/01/2019 | $183,000 |
| R616-613 | Missouri River & Big Papillion Creek | Damaged – repair levee system to authorized level of flood risk management | 03/16/2020 | Repair Complete 03/2020 | $10,300,000 |
| Salt Creek System | Salt Creek | Channel bank erosion | 02/03/2021 | Repair Complete 09/13/2020 | $4,700,000 |

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| Levee System | Stream | 2019 Impact | Last Update | Status | Contract Amount |
|---|---|---|---|---|---|
| Scribner | Pebble Creek & Elkhorn River | Debris & sedimentation damage – repair levee system to authorized level of flood risk management | 12/062019 | Repair Complete11/7/2019 | $94,000 |
| Union Dike & No Name Dike | Platte River | Damaged – repair levee system to authorized level of flood risk management | 02/03/2021 | Initial breach repair complete 06/20/2019; Final repair complete 09/13/2020 | $2,675,000 (initial breach repair & final repair) |
| Wakefield | Logan Creek | Damaged – significant erosion; repair levee system to authorized level of flood risk management | 02/03/2021 | Repair Complete 01/05/2021 | $3,100,000 |
| Waterloo | Elkhorn River | Damaged – sand boils; repair levee system to authorized level of flood risk management | 02/03/2021 | 10% complete; anticipate completion by May 2021. | Design funding approved |
| Western Sarpy | Platte | Damaged – repair levee system to authorized level of flood risk management | 05/08/2020 | Repair complete O4/2020 | $4,200,000 |
| West Point | Elkhorn River | Damaged – repair levee system to authorized level of flood risk management | 02/03/2021 | Real estate acquisition in progress; once secured, contract will be advertised for construction | Design funding approved |

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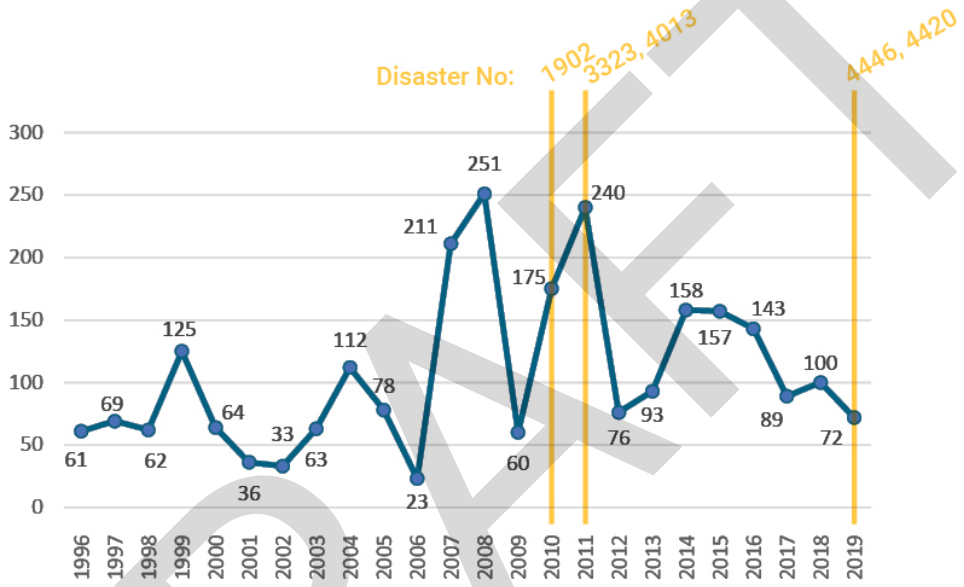
## 3.5.2 NEBRASKA FLOOD RISK PROBABILITY

### 3.5.2.1 *Nebraska's History of Federally Declared Flood Disasters*

FEMA has developed a series of data visualizations describing historical flood risk and costs by state and county. The visualizations are built from data reported to the NOAA Storm Events Database by the NWS. The blue line in Figure 7 shows the annual number of flood events for Nebraska in recent years, while the yellow bars note the occurrence of Federal Disaster Declarations occurring within that same span of time and involving flooding.

**Figure 7: Total Nebraska Flood Events by Year, and Recent Federal Flood Disasters Involving Flooding**




Note that NOAA's Storm Events Database contains data entered by NOAA's NWS and data can be entered for a county or for an NWS "forecast zone." FEMA defines a flood as, "a general and temporary condition where two or more acres of normally dry land or two or more properties are inundated by water or mudflow." Conversely, NOAA defines a flood as, "any high flow, overflow, or inundation by water which causes or threatens damages."

Disaster number 1902 covers the period of March 6 through April 3, 2010, during which a swath of many counties extending from Boyd in north-central Nebraska down to Richardson in southeast Nebraska experienced severe storms, ice jams, and flooding. Federal disasters 3323 and 4013, from 2011 involved, involved the Missouri River and the North Platte River. Federal disasters 4420 and 4446 encompass the March and June flooding of 2019 that affected nearly the entire state, with particularly disastrous effects in the east. More can be learned about each of Nebraska's disaster declarations—including maps describing areas impacted by each disaster—by visiting FEMA's website: fema.gov/disaster.

Figure 7 is an incomplete picture of flood-related, federally declared disasters that have affected the state. Figure 8 and Figure 9 show Nebraska's history of flood-related, federally declared disasters going back to 1960, as well as the months during which the flood-related disasters have occurred most. This data is made available through FEMA's Data Visualizations webpage describing historical flood risk and costs.

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Figure 8: Annual Quantity Flood-Related Federally Declared Disasters in Nebraska

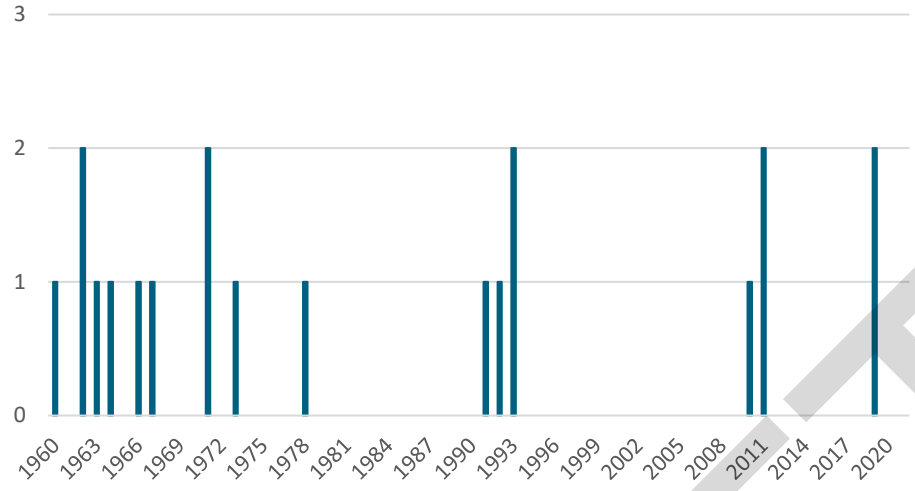
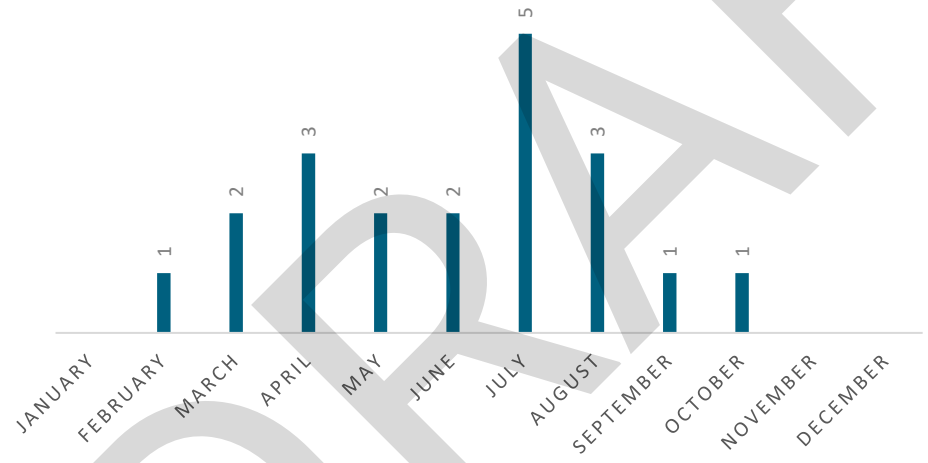



Figure 9: Months in Which Flood-Related Federally Declared Disasters Have Occurred




## NEBRASKA'S BILLION DOLLAR FLOOD EVENTS

NOAA's NCEI tracks and evaluates climate events that have great economic and societal impacts as part of fulfilling its responsibility for monitoring and assessing the climate. NCEI has recently published data describing the events that have had the greatest economic impact from 1980 to 2021, referred to as "Billion-dollar Disasters" (see Table 13). NCEI has developed the following disaster cost assessments by assembling statistics from a wide variety of sources who most accurately describe the estimated total costs of the events. Such sources include NWS, FEMA, USDA, National Interagency Fire Center, USACE, individual state emergency management agencies, state and regional climate centers, media reports, and insurance industry estimates. Values have been adjusted for inflation to CPI.

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The NCEI analysis identified five billion-dollar disasters that affected Nebraska between 1980 and 2021. The full table of information regarding these events is included in Appendix B.

- July 2019: Mississippi River, Midwest, and southern flooding
- March 2019: Missouri River and north central flooding
- May to June 2011: Missouri River flooding
- Summer 2008: Midwest flooding
- Summer 1993: Midwest flooding

Table 13: Billion-dollar Events Affecting Nebraska from 1980 to 2021 (CPI Adjusted)

| Disaster Type | Events | Events/Year | Percent Frequency | Total Costs | Percentage of Total Costs |
|---|---|---|---|---|---|
| Drought | 10 | 0.2 | 20.8% | $10.0B–$20.0B | 46.9% |
| Flooding | 5 | 0.1 | 10.4% | $2.0B–$5.0B | 17.5% |
| Freeze | 2 | 0.0 | 4.2% | $5M–$100M | 0.3% |
| Severe Storm | 30 | 0.7 | 62.5% | $5.0B–$10.0B | 35.1% |
| Wildfire | 1 | 0.0 | 2.1% | $5M–$100M | 0.2% |
| **All Disasters** | **48** | **1.1** | **100.0%** | **$20.0B–$50.0B** | **100.0%** |

Nebraska's billion-dollar flooding events can be further evaluated by decade, as illustrated in Table 14. Over the last 4 decades, Nebraska has seen an increase in the number of events per year, with associated recovery costs also climbing.

Table 14: Time Period Comparison of Nebraska's Billion-Dollar Flooding Statistics (CPI Adjusted)

| Time Period | Billion-Dollar Disasters | Events/Year | Cost | Percentage of Total Costs |
|---|---|---|---|---|
| 1980s (1980–1989) | 0 | 0.0 | $0B | 0.0% |
| 1990s (1990–1999) | 1 | 0.1 | $1.0B–$2.0B | 29.8% |
| 2000s (2000–2009) | 1 | 0.1 | $0.1B–$0.25B | 2.7% |
| 2010s (2010–2019) | 3 | 0.3 | $2.0B–$5.0B | 67.5% |
| Last 5 Years (2017–2021) | 2 | 0.4 | $2.0B–$5.0B | 62.4% |
| Last 3 Years (2019–2021) | 2 | 0.7 | $2.0B–$5.0B | 62.4% |
| Last Year (2021) | 0 | 0.0 | $0B | 0.0% |
| **All Years (1980–2021)** | **5** | **0.1** | **$2.0B–$5.0B** | **100.0%** |

The NCEI analysis estimates that Nebraska experiences an average of $0.12 billion flood events per year, which is slightly above the national norm. Further, NCEI provides an interactive map viewer to visualize both historic and future flood risk data as well as social vulnerability at the

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county level, as compared to state and US levels. Local jurisdictions are encouraged to explore this data at the following address: www.ncdc.noaa.gov/billions/mapping.

#### 3.5.2.2 *Riverine Flood History and Probability by County*

The NCEI Storm Events Database contains records of the occurrence of storms and other significant weather phenomena, including flooding events, since January 1950. Each flooding event record includes the affected counties, the dates of the event occurrence, and any reported loss. These records are used to calculate the annualized frequency for riverine flooding in FEMA's National Risk Index (NRI): https://hazards.fema.gov/nri/

Figure 10 categorizes Nebraska counties by their annualized frequency of riverine flooding and Table 15 lists the counties with the highest number of riverine flood events and annualized frequency. Annualized frequency is the expected frequency or probability of a hazard occurrence in any given year. Thus, the higher the annualized frequency of riverine flooding, the higher the likelihood of flooding occurring in said jurisdiction. The annualized frequency of riverine flooding is a factor in the computation of expected annual loss, which is discussed in Section 3.5.3, Estimation of Potential Losses. Because annualized frequency is a product of quantity of flood events over time, the map also depicts the counties with the greatest number of riverine flooding events over the record timeframe.

Consistent with NRI methodology, qualitative rating labels ranging from "Very Low" to "Very High" are applied to describe the nature of any one county's score in relation to all other counties in Nebraska. This is not a nation-wide comparison; however, such data is available via the NRI. To determine these rating tiers, k-means clustering, or "natural breaks," has been applied to the annualized frequency value. This approach divides all counties into 5 groups such that the counties within each group are as similar as possible while each group is also as different as possible.

If a community would like to reduce its flood risk, then it can do so by implementing mitigation measures that increase community resilience, decrease social vulnerability, and decrease the expected annual loss due to flood hazards (see Section 3.5.3, Estimation of Potential Losses). Mitigation measures are discussed in chapter 4 of this plan, and specifically illustrated with resource pages in Appendix C.

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Figure 10: Annualized Frequency of Riverine Flooding by County

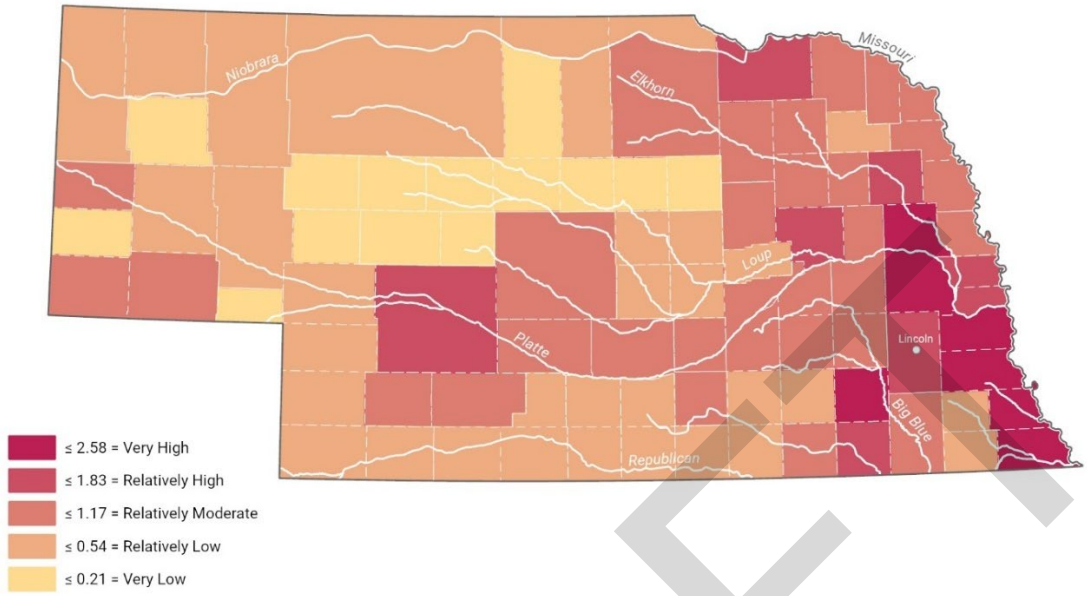


Table 15: Top 10 Nebraska Counties by Number of Riverine Flood Events and Annualized Frequency

| Rank | County | Number of Riverine Flood Events | Annualized Frequency of Riverine Flood Events |
|---|---|---|---|
| 1. | Saline | 62 | 2.58 |
| 2. | Nemaha | 60 | 2.50 |
| 3. | Richardson | 59 | 2.46 |
| 4. | Saunders | 56 | 2.33 |
| 5. | Otoe | 52 | 2.16 |
| 6. | Cass | 49 | 2.04 |
| 7. | Dodge | 47 | 1.96 |
| 8. | Douglas | 44 | 1.83 |
| 9. | Lincoln | 41 | 1.71 |
| 10. | Platte | 37 | 1.54 |

A complete table of all Nebraska counties describing number of riverine flood events and their annualized frequency of such events is included in Appendix B. Additionally, NRI data is available via census tract. While that level of data granularity is beyond the scope of this plan, local jurisdictions are encouraged to explore how risk levels and vulnerabilities vary across tracts.

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#### 3.5.2.3 *Probability of Future Dam Failure Events*

Dams in Nebraska are aging, with an average age of over 45 years. Many dams have exceeded their original 50-year design life. Without significant investment in repair, reconstruction, and removal of aging dams, dam failures in Nebraska will become more common. Currently, 733 dams, or 25 percent of dams in the state, are rated in poor condition due to problems such as inadequate spillway capacity, deteriorated spillway conduits, excessive seepage, or damage due to tree roots. The following statement from Tim Gokie—Chief, Dam Safety Section, NeDNR—summarizes the probability issue related to dams:

> *"The probability of failure of a well-maintained, well-designed dam is low. Nevertheless, with over 2,900 dams in Nebraska of varying age and condition, there is typically at least one dam failure in the State each year. Large storm systems that result in regional flooding, like the widespread flood events of 2010 and 2019, often result in several dam failures. The majority of the dams that fail are small, low hazard potential dams located in rural areas where the resulting damage is mostly limited to the dam itself and the dam owners' property. Low and minimal hazard potential dams are typically designed to safely pass either a 50-year or 100-year design flood event, so larger events will overtop the dam, which can result in dam failure. Dams that are classified as significant and high hazard potential are required to meet higher standards and failure of these dams is rare."*

Multiple factors create difficulty in calculating a quantitative recurrence level for dam failure:

- Many dams are privately owned or managed and are located on private land, leading to unreported dam failure incidents
- Dam failure does not always result in flood-type impacts to people, property, or the environment
- Dam failure is not reported through the NOAA/NCEI Storm Events Database

##### IMPACT OF CLIMATE CHANGE

Excessive rainfall events have the potential to impact dams. Under a higher emissions pathway, historically unprecedented warming is projected by the end of the 21st century,[53] and an increase the number of excessive rainfall events is predicted for Nebraska, as well as increases in winter precipitation. These factors will likely affect the performance of dams across the state.

##### DAM FAILURE AND LOCAL HAZARD MITIGATION PLANNING

Local plans estimate dam failure as a low probability. There is very limited data from previous regional and local plans on dam failure. The 2016 Papio-Missouri River NRD Multi-Jurisdictional HMP stated that the probability of dam failure is one percent annually, and the Little Blue-Lower Big Blue NRD Multi-Jurisdictional HMP reported a lack of information regarding dam failure in the planning area. The probability for this event is difficult to calculate and there is not a comprehensive source for historical dam failure in the planning area.

[53] National Oceanic and Atmospheric Administration National Centers for Environmental Information. 2022. "National Climate Report – Annual 2019." April 8. https://www.ncei.noaa.gov/access/monitoring/monthly-report/national/201913

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Local mitigation actions taken previously include evacuation plans, land use regulations, public education, encouraging citizens to purchase flood insurance, and natural open space preservation in floodplains.

NeDNR and NEMA are currently assembling a database of all local hazard mitigation planning actions and statuses, as reported in LHMPs. The database will be updated whenever a jurisdiction updates its LHMP. The database will be searchable by hazard type as well as several additional factors.

#### DAM FAILURE AND STATE ASSETS

As of plan writing, NeDNR is actively developing a GIS-based flood risk assessment tool to evaluate risked posed to state assets (including state-owned critical facilities such as roads and bridges) by flood hazard. The analysis includes dam and levee failure risks and the valuation of various assets threatened by these hazards. See section 3.5.3.2, GIS-Based Flood Risk Assessment, to learn about this analysis.

### 3.5.2.4 *Probability of Levee Failure*

The levees in Nebraska are exposed annually to risk during the flood season. Historical data suggests that storms will impact the state each season covering areas from a few counties to the entire state. While any individual levee is not likely to fail in any given year, the combined probability of failure of any levee is notable. The probability of a levee or floodwall failure is difficult to predict, because of the lack of coordinated data management on the local, state, and federal levels. Development in a watershed can raise flood levels and make a levee designed and constructed under previous characteristics inadequate for current runoff conditions. Lack of oversight and maintenance can also lead to a higher failure risk for any levee system. Generally, improvement in levee maintenance, assessment, and problem-tracking are needed. Although levee failure risk cannot be eliminated, preventative measures, such as proper maintenance, sound design, and proper construction, can limit the potential for levee failure. While levee failure is likely to occur in the future, specific probabilities and potential locations for failure are difficult to pinpoint.

#### IMPACT OF CLIMATE CHANGE

Excessive rainfall events have the potential to affect levees. Under a higher emissions pathway, historically unprecedented warming is projected by the end of the 21st century,[54] and an increase the number of excessive rainfall events is predicted for Nebraska, as well as increases in winter precipitation. These factors will likely affect the performance of levees across the state.

#### LEVEE FAILURE AND LOCAL HAZARD MITIGATION PLANNING

Most of Nebraska's levee systems are in the eastern portion of the state. Local plans consider levee failure a low hazard. The LHMPs reviewed for the 2021 update to the State HMP acknowledge dam and levee risks and what might overwhelm their respective hydraulic capacities. It is also heavily recognized in the plans that the probability of a levee overtopping is low. If levees do overtop, the risk is considered minimal by most districts who consider their

[54] National Oceanic and Atmospheric Administration National Centers for Environmental Information. 2022.

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levees well designed and effective flood mitigation systems. The pursued mitigation strategies in the case of levee failures are typically centered around public education of flood insurance, limiting development in flood prone areas, and redesigning land use in hazard areas to incorporate permeable surfaces and other green infrastructure components into municipal designs. Additionally, local plans often note the presence of an evacuation plan in case levee or dam failure does occur.

Though the local plans have levee failure as a low probability hazard, they recognize the potential of an occurrence. Douglas and Sarpy Counties have high concentrations of levee systems and the 2016 Papio-Missouri River NRD Multi-Jurisdictional HMP states the probability of levee failure is 1 percent annually. Most local plans with levee failure noted as a hazard have the same 1 percent probability.

The mitigation strategies adopted by counties and districts that contain levees remain simple, yet effective. LHMPS include the following mitigation measures: evacuation plans, encouraging flood insurance, public education awareness of potential impacts, and implementing land use regulations.

NeDNR and NEMA are currently assembling a database of all local hazard mitigation planning actions and statuses, as reported in LHMPs. The database will be updated whenever a jurisdiction updates its LHMP. The database will be searchable by hazard type as well as several additional factors.

#### LEVEE FAILURE AND STATE ASSETS

As of plan writing, NeDNR is actively developing a GIS-based flood risk assessment tool to evaluate flood hazard risks posed to state assets (including state-owned critical facilities such as roads and bridges). The analysis includes dam and levee failure risks and the valuation of various assets threatened by these hazards. See section 3.5.3.2, GIS-Based Flood Risk Assessment, for a discussion of this analysis.

### 3.5.2.5 *State Precipitation Trends*

As discussed previously, many cities and much of Nebraska's farmlands are located along the state's thousands of miles of rivers and at risk of flooding caused by extreme precipitation events and snowmelt. Nebraska's total precipitation can vary significantly from year to year and from season to season. The wettest consecutive 5-year interval was from 2015–2019 (Figure 11). The points in the graph represent annual values, while the bars are 5-year averages (most recent bar is a 6-year average representing 2015–2020). The horizontal black line shows the long-term average of 22.8 inches.

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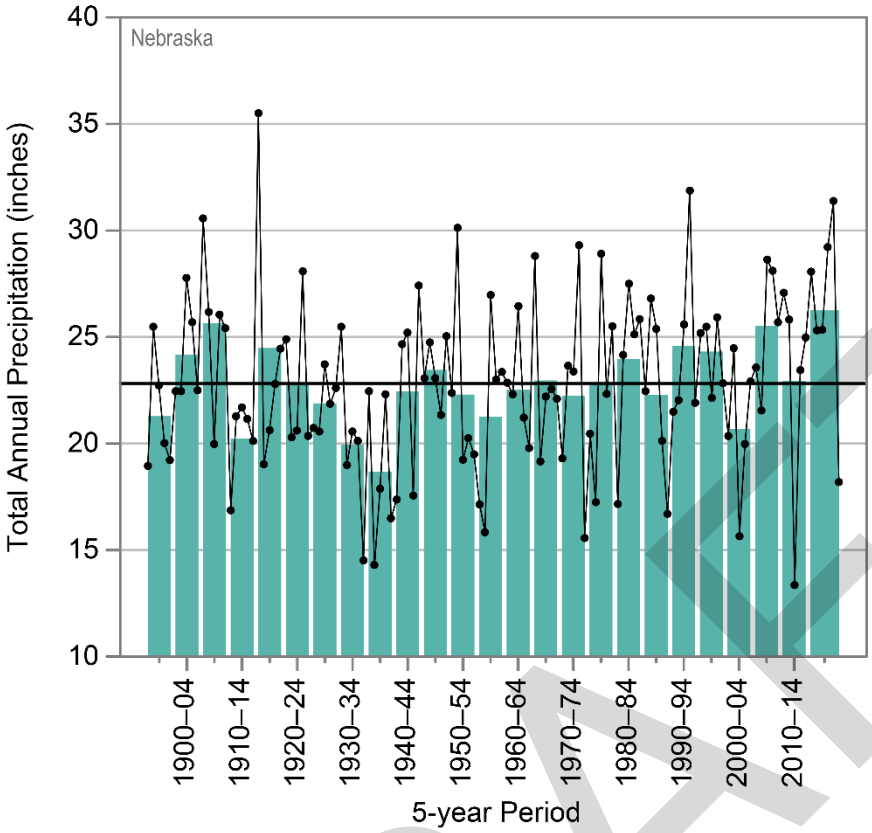
Figure 11: Observed Annual Precipitation




Considering only summer precipitation averages (Figure 12),[55] it is evident that summer precipitation has been above the historical average since 2005. The points in the graph represent annual values, while the bars are 5-year averages (most recent bar is a 6-year average representing 2015–2020). The horizontal black line shows the long-term summer precipitation average of 9.4 inches. 1993 was the wettest summer on record, which is evidenced not only in the data but by the extreme flooding that occurred that year.

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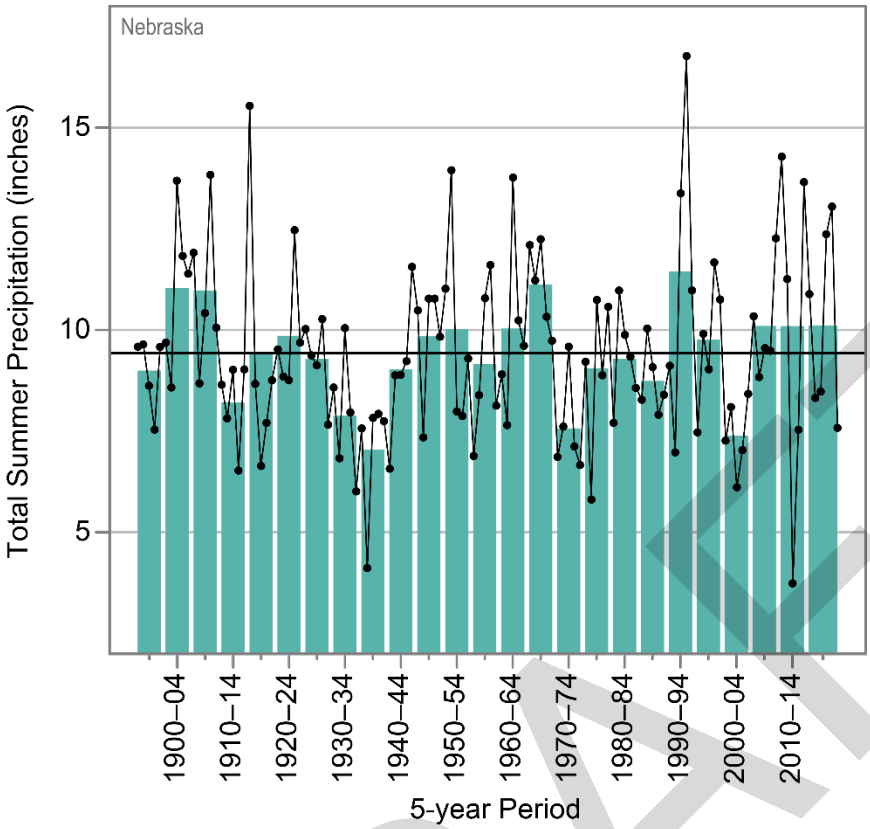
[55] National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI). "State Climate Summaries 2022 150-NE." Accessed February 17, 2022. https://statesummaries.ncics.org/chapter/ne/.

Figure 12: Observed Summer Precipitation




Most of Nebraska's precipitation falls during the spring and summer months, and flood risks are predicted to increase. Since 2005, Nebraska has experienced an above average number of 2-inch precipitation events (Figure 13).[56] "Event" is measured as a day with 2 inches of precipitation or more accumulated. The black dots represent annual values, and the bars show 5-year period averages (most recent bar is a 6-year average representing 2015–2020). A typical reporting station in Nebraska experiences 1 event per year, and the horizontal black bar in the graph shows this long-term average for the entire reporting period. The second highest number of extreme precipitation events occurred during the 2005–2009 period, averaging 1.3 events per year. These extreme precipitation events are projected to increase.

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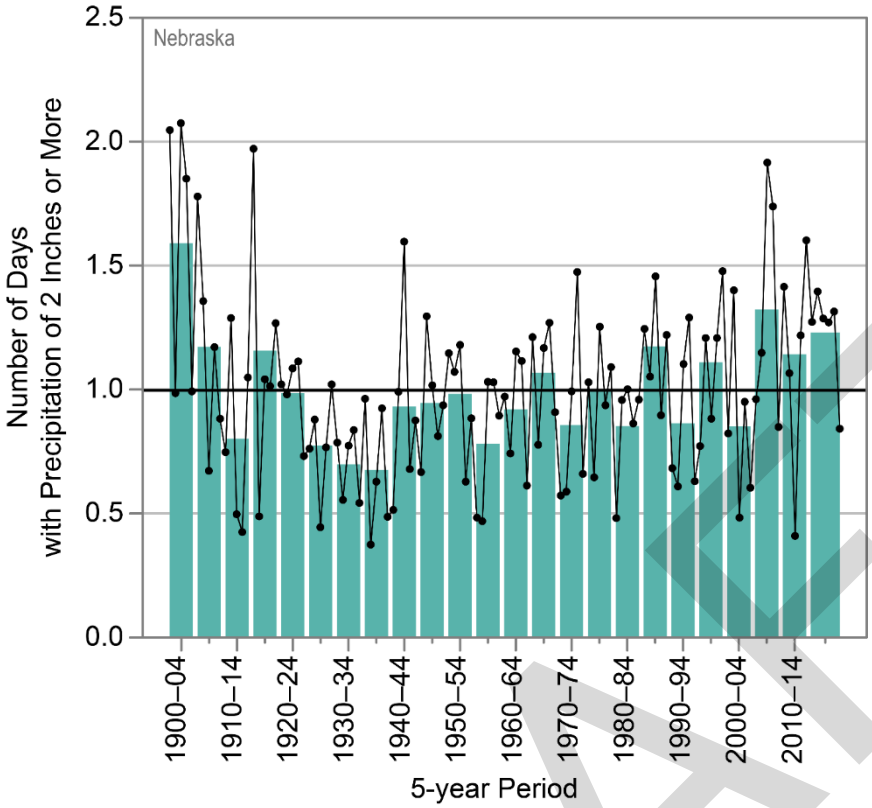
[56] NOAA NCEI. 2022.

Figure 13: Observed Number of 2-Inch Extreme Precipitation Events




While most of Nebraska's precipitation falls during spring and summer, winter and spring precipitation are projected to increase (Figure 14).[57] An increase in winter precipitation could benefit some crops; however, it may also delay spring planting. The black crosshatch areas on Figure 14 indicate locations where most climate models predict a statistically significant increase.

Other trends to be aware of include our warming spring and winter temperatures and climbing annual average temperatures. The full state summary is available at: https://statesummaries.ncics.org/chapter/ne/.

[57] NOAA NCEI. 2022.

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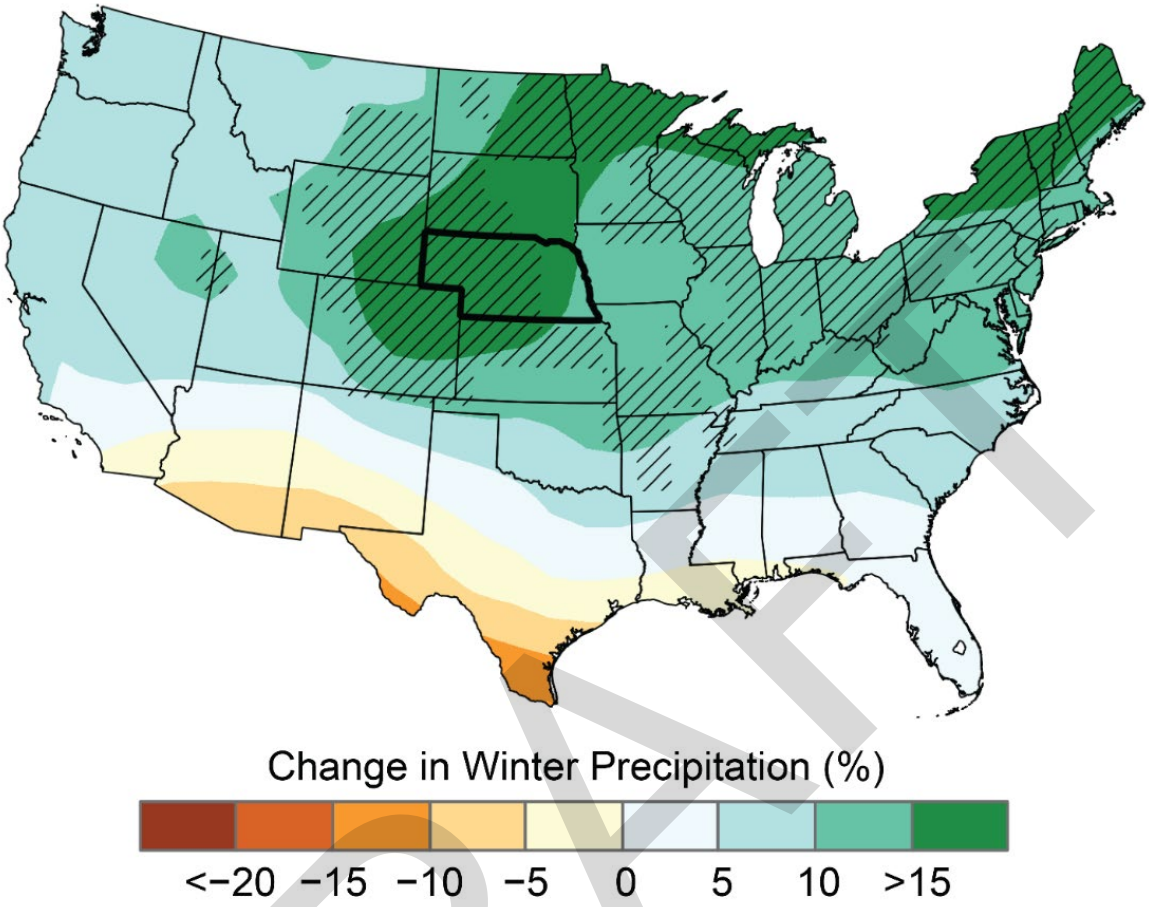
Figure 14: Projected Change in Winter Precipitation[58]




Increases in extreme precipitation events leads to increased runoff and flooding, which will in turn erode soils and reduce water quality. The best mitigation strategy for such conditions is to sequester as much rainfall as possible where it lands. In agricultural areas, this means improving soil health so that the soil structure can act as a sponge, absorbing rainfall before it flows off the surface and takes soil particles with it. In urban areas, initiatives to preserve or increase areas of permeable surfaces, prevent subsidence, and filter water on site are the most effective strategies. To achieve effective flood mitigation, these measures must be implemented in all parts of a watershed and not just reserved for mapped flood hazard areas. Upstream land use and development decisions such as removing vegetation and increasing impervious surfaces have severely detrimental downstream effects. Limiting development within flood hazard areas is one way to protect downstream residents and property from the effects of flooding. Additional mitigation measures are described in Chapter 4 of this plan.

### REGIONAL TRENDS

It is important to note that Nebraska's flood risk is inherently linked to precipitation trends in the north and western parts of the region. Precipitation patterns in Colorado, Wyoming, Montana, and South Dakota influence flow volumes in many of Nebraska's rivers.

[58] NOAA NCEI. 2022.

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## 3.5.3 ESTIMATION OF POTENTIAL LOSSES

### 3.5.3.1 *National Risk Index*

The National Risk Index (NRI) (hazards.fema.gov/nri/map) is intended to inform risk-based decision making while increasing risk awareness. NRI leverages nationwide datasets on hazard frequency and exposures at risk. The maps also reference the Social Vulnerability Index (SoVI), a location-specific assessment tool incorporating 29 socioeconomic variables that are deemed to contribute to a community's reduced ability to prepare for, respond to, and recover from hazards. The NRI provides data at both the county and census tract level. A jurisdiction may view its flood risk statistics in relation to state and national averages. These statistics include annualized frequency values, exposure values, expected annual losses, and historic loss ratios. Jurisdictions may also download the data for their own exploration and analysis of several hazard types. Measurements calculated in NRI are based on average past conditions and cannot be used to predict future outcomes for a community.

NCEI's Billion-Dollar Disaster analysis, referenced in Section 3.5.2.1, Nebraska's History of Federally Declared Flood Disasters, attempts to describe potential *future* impacts by incorporating high-emission scenarios and impacts, such as changes in percent crop yields, changes in mortality rates, and changes in electricity demand. However, the future impacts analysis cannot be segregated by hazard type and is representative of the impacts of all hazards. The data is not currently available for download to support inclusion in this plan. More information can be accessed here: https://www.ncdc.noaa.gov/billions/mapping

The following sections describe the relative exposure to riverine flood loss that Nebraska's counties bear. Exposure is defined as the representative value of buildings, population, or agriculture potentially exposed to a natural hazard occurrence. A completed list of Nebraska counties and their riverine flood exposure values according to county is included in Appendix B.

#### BUILDING EXPOSURE TO RIVERINE FLOODING

According to floodfactor.com, an online tool developed by First Street Foundation to make flood risk data more accessible to the public, there are 109,476 properties in Nebraska that have a greater than 26 percent chance of being severely affected by flooding over the next 30 years, representing 10 percent of all properties in Nebraska. 26 percent is the level of risk that is associated with the 1-percent annual chance flood hazard area.[59]

In NRI, building exposure value is defined as the dollar value of the buildings determined to be exposed to a hazard according to a hazard type-specific methodology. The maximum possible building exposure of an area (Census block, Census tract, or county) is its building value as

[59] Floodfactor's database considers properties of all types, vacant and developed, within the floodplain. And "severely affected" means that water would reach, at minimum, to the edge of a residential structure. In commercial or public structures, it means that citizens may not be able to safely access the building during a flood.

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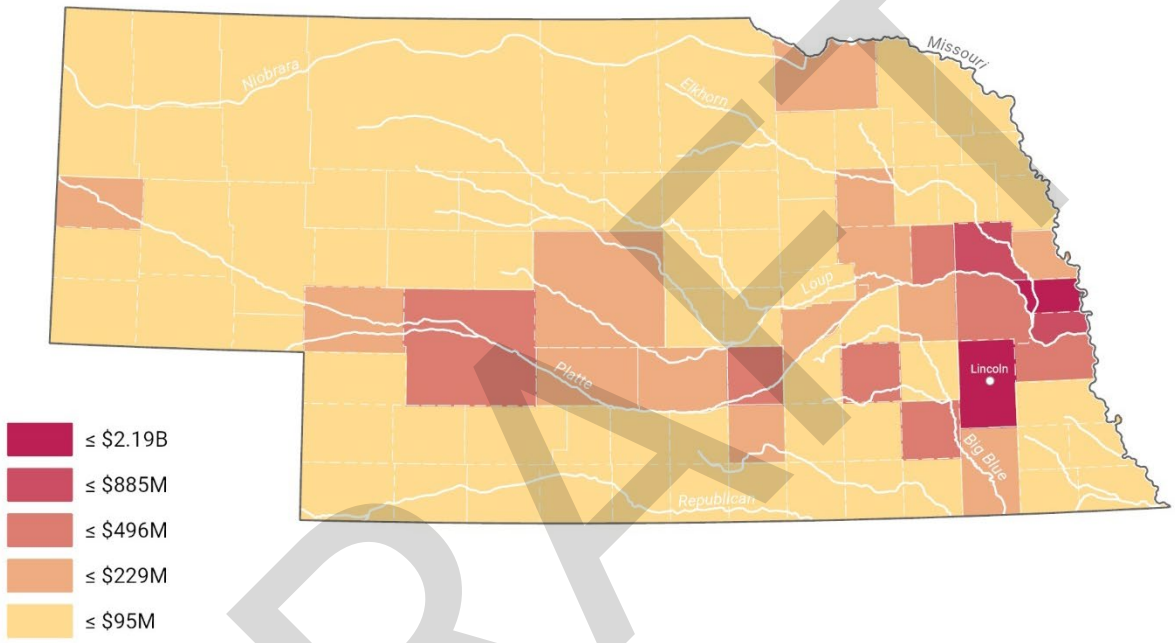
recorded in Hazus 4.2, Service Pack 01 (SP1), which provides 2018 valuations from the 2010 Census.[60]

Figure 15 and Table 16 illustrate the Nebraska counties with the greatest values of structural development at risk of riverine flooding. To determine the map symbology tiers, k-means clustering, or "natural breaks," has been applied to the building exposure value. This approach divides all counties into 5 groups such that the counties within each group are as similar as possible while each group is also as different as possible.

### Figure 15: Building Exposure to Riverine Flooding by County




### Table 16: Top 10 Nebraska Counties by Riverine Flooding Building Exposure Value

| Rank | County | Building Exposure Value (Dollars) |
|---|---|---|
| 1. | Douglas | 2,191,479,955.48 |
| 2. | Lancaster | 1,930,139,224.26 |
| 3. | Dodge | 884,924,204.76 |
| 4. | Sarpy | 781,759,872.11 |
| 5. | Hall | 495,890,749.84 |
| 6. | Cass | 401,580,528.07 |

[60] Federal Emergency Management Agency. 2021a. "National Risk Index: Technical Documentation." November. https://www.fema.gov/sites/default/files/documents/fema_national-risk-index_technical-documentation.pdf

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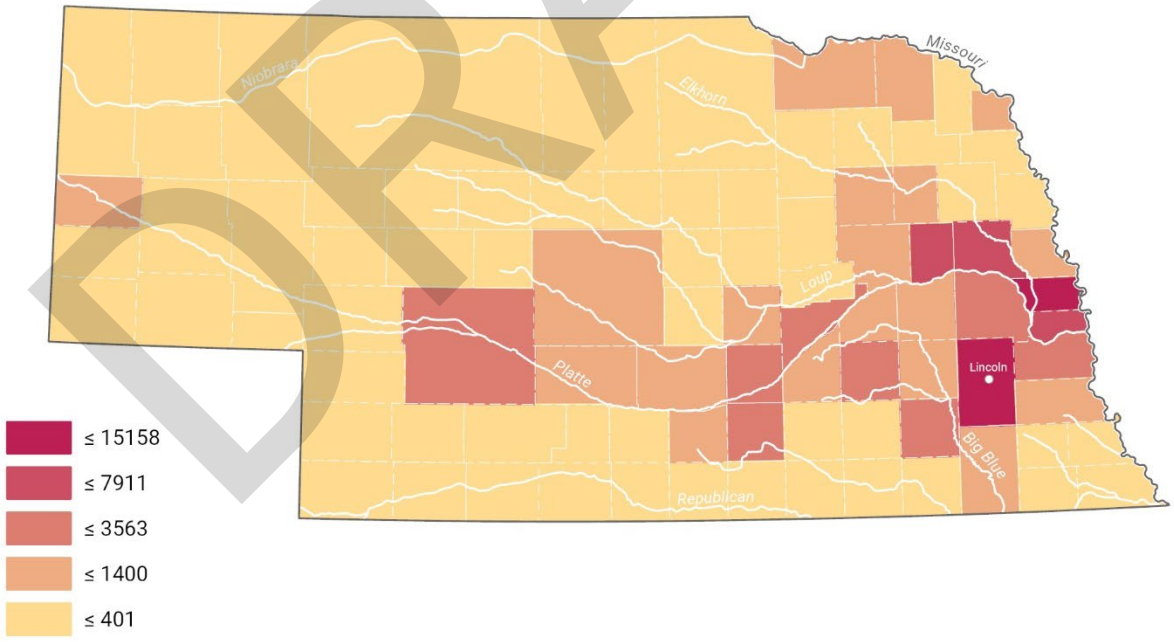
| Rank | County | Building Exposure Value (Dollars) |
|---|---|---|
| 7. | Saunders | 386,690,702.73 |
| 8. | Colfax | 377,694,993.47 |
| 9. | Saline | 325,972,888.21 |
| 10. | York | 319,557,649.78 |

## POPULATION

Population exposure, as illustrated in the following map and table, is defined as the estimated number of people determined to be exposed to riverine flooding according to the methodology developed for the NRI. The maximum possible population exposure of an area (Census block, Census tract, or county) is its population as recorded in Hazus 4.2 SP1.[61]

Figure 16 and Table 17 illustrate the Nebraska counties with the greatest population at risk of riverine flooding. To determine the map symbology tiers, k-means clustering, or "natural breaks," has been applied to the population exposure value. This approach divides all counties into 5 groups such that the counties within each group are as similar as possible while each group is also as different as possible. Naturally, the more densely populated a community's special flood hazard area (SFHA), the greater the degree of exposure risk to riverine flooding.

Figure 16: Population Exposure to Riverine Flooding by County




[61] Federal Emergency Management Agency. 2021a.

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Table 17: Top 10 Nebraska Counties by Riverine Flooding Population Exposure

| Rank | County | Population Exposure (Persons) |
|---|---|---|
| 1. | Lancaster | 15158 |
| 2. | Douglas | 13428 |
| 3. | Dodge | 7911 |
| 4. | Sarpy | 4766 |
| 5. | Colfax | 4025 |
| 6. | Hall | 3563 |
| 7. | York | 2821 |
| 8. | Saline | 2702 |
| 9. | Lincoln | 2289 |
| 10. | Saunders | 2041 |

To achieve a common unit of measurement for all expected annual loss (EAL) values, population loss has also been monetized into a *population equivalence value* by NRI. The Value of Statistical Life approach used by FEMA assigns $7.6 million of economic loss to each fatality or ten injuries.[62] Population equivalence values for each Nebraska county are included in Appendix B. Population equivalence values are commensurate with population exposure.

### AGRICULTURE

Agriculture is a vital sector of Nebraska's economy and is vulnerable to precipitation extremes (high and low). The agriculture exposure value refers to the estimated dollar value of crops and livestock determined to be exposed to a hazard (in this case, flooding) according to the riverine flood hazard-specific methodology developed for NRI. Data supporting the NRI analysis is derived from the USDA 2017 Census of Agriculture[63] county-level value of crop and pastureland.[64]

Figure 17 and Table 18 illustrate the Nebraska counties with the greatest monetary value of agriculture at risk of riverine flooding (NRI does not provide agriculture exposure in terms of acres or crop type). To determine the map symbology tiers, k-means clustering, or "natural breaks," has been applied to the agriculture exposure value. This approach divides all counties into 5 groups such that the counties within each group are as similar as possible while each group is also as different as possible.

A complete list of agriculture exposure values for every Nebraska county is included in Appendix B.

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[62] Federal Emergency Management Agency. 2021a.

[63] US Department of Agriculture. 2017. "2017 Census of Agriculture." https://www.nass.usda.gov/Publications/AgCensus/2017/index.php

[64] Federal Emergency Management Agency. 2021a.

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Figure 17: Agricultural Exposure to Riverine Flooding by County

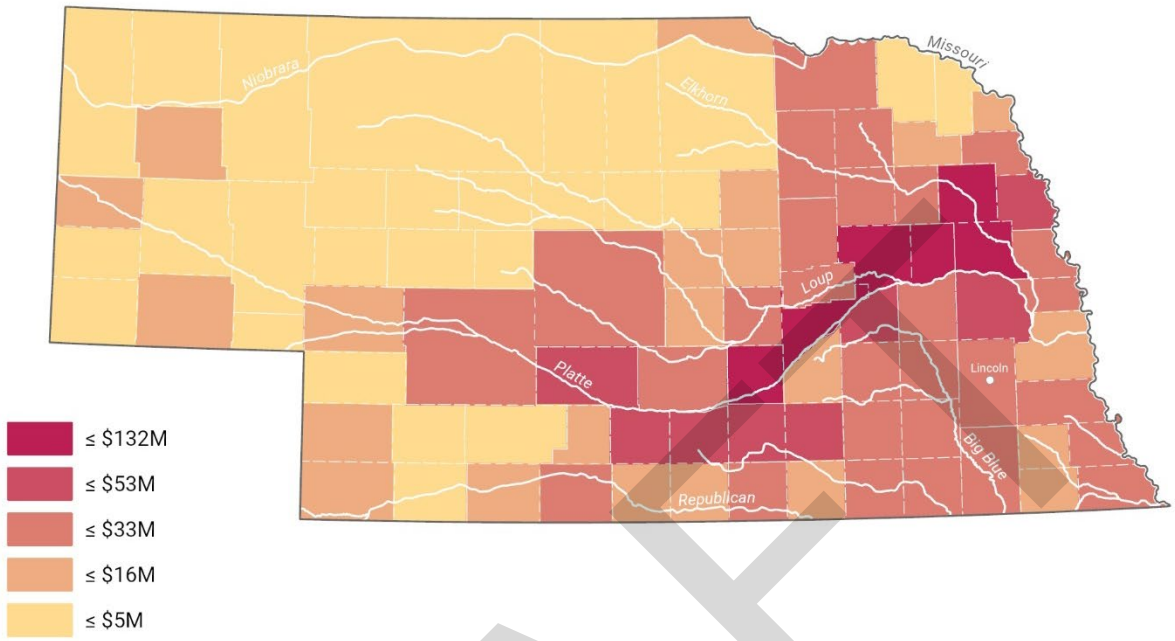


Table 18: Top 10 Nebraska Counties by Riverine Flooding Agriculture Exposure Value

| Rank | County | Agriculture Exposure (Dollar value of crops and livestock) |
|---|---|---|
| 1. | Cuming | 132,103,314.27 |
| 2. | Platte | 91,413,815.61 |
| 3. | Merrick | 87,717,173.08 |
| 4. | Dodge | 87,267,046.94 |
| 5. | Hall | 83,443,404.77 |
| 6. | Colfax | 83,312,052.58 |
| 7. | Phelps | 53,645,943.04 |
| 8. | Saunders | 51,696,504.75 |
| 9. | Polk | 51,114,999.45 |
| 10. | Dawson | 50,564,516.89 |

## EXPECTED ANNUAL LOSSES AND RIVERINE FLOOD RISK

Expected annual loss (EAL) for each county represents the average economic loss in dollars resulting from riverine flooding each year. EAL is a product of multiple factors including natural hazard exposure, historic loss ratio, and the likelihood risk factor of the flood hazard's annualized frequency. NRI computes EAL for the three consequence types—buildings, population, and agriculture—described in the previous sections. Figure 18 provides a composite

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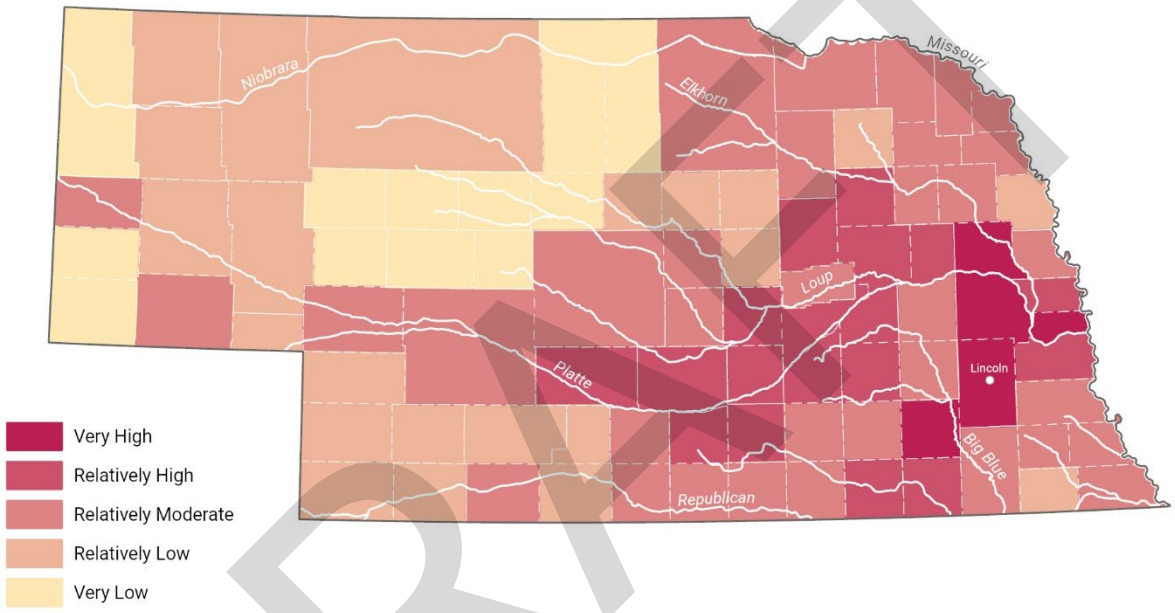
EAL for each county, having factored in the three consequence types. Maps describing EAL for each consequence type for each county can be made available upon request.

Consistent with NRI methodology, qualitative rating labels ranging from Very Low to Very High are applied to describe the nature of any one county's score in relation to all other counties in Nebraska. This is not a nation-wide comparison (however such data is available via NRI). To determine these rating tiers, k-means clustering, or "natural breaks," was applied to the annualized frequency value. This approach divides all counties into 5 groups such that the counties within each group are as similar as possible while each group is also as different as possible.

**Figure 18: Riverine Flooding Expected Annual Loss, In-State Comparison**




In addition to viewing data by county, the riverine flood hazard related EAL data is available at the census tract level. For the purposes of this plan, county level data is shown. NeDNR encourages local jurisdictions to access the NRI online map (hazards.fema.gov/nri/map) to view flood risk data by census tract. A community may generate reports detailing risk index, EAL, social vulnerability, and community risk scores. These reports compare local scores to state and national averages.

Figure 19 shows how Nebraska counties compare to one another in terms of riverine flood risk. Risk is the likelihood (or probability) of a hazard happening, multiplied by the expected consequences if the hazard occurs. To produce a risk score, NRI factors in expected annual loss and social vulnerability, tempered by community resilience. EAL represents the loss due to the natural hazard (in this case, riverine flooding). Social vulnerability—a measure of a social group's susceptibility to the hazard's adverse impacts—enhances the consequences of the natural hazard. Resilience—a measure of a community's ability to prepare for, adapt to, withstand, and recover from the hazard's adverse impacts—can reduce a community's risk score.

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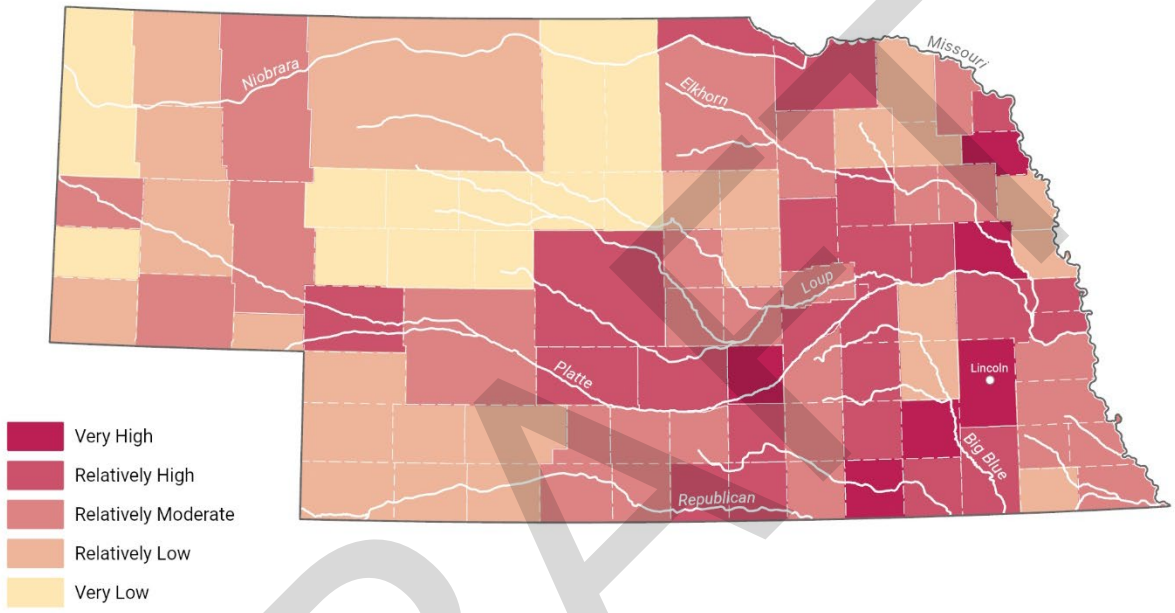
Consistent with NRI methodology, qualitative rating labels ranging from Very Low to Very High are applied to describe the nature of any one county's score in relation to all other counties in Nebraska. This is not a nation-wide comparison (however, such data is available via NRI). To determine these rating tiers, k-means clustering, or "natural breaks," has been applied to the annualized frequency value. This approach divides all counties into 5 groups such that the counties within each group are as similar as possible while each group is also as different as possible.

Figure 19: Riverine Flooding Risk Rating, In-State Comparison




In addition to annualized frequency, expected annual losses, and risk ratings, any of Nebraska's communities may also view their social vulnerability and community resilience scores through the NRI online interface.

### 3.5.3.2 *GIS-Based Flood Risk Assessment*

While NRI can be one source of information to support risk reduction investments, other information and tools (such as benefit-cost analysis and local knowledge) should also be considered. To this end, NeDNR is in the process of developing a GIS-based flood risk assessment tool. This tool will empower the State and local jurisdictions to achieve a finer grain understanding of the areas in Nebraska with the greatest flood risk.

#### FLOOD RISK METHODOLOGY

The GIS-based risk assessment tool relied upon available datasets of potential flood hazards and its potential impacts. Flood hazard risks for three types of flood hazards were compiled for this analysis.

1. Riverine Flooding: Riverine flooding inundation limits for the 1-percent annual chance exceedance limits were compiled from FEMA flood hazard mapping, where available, and supplemented with NeDNR developed Flood Awareness Areas.

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2. Levee-protected Areas: The National Levee Database and the FEMA datasets defining areas protected by levees were compiled to define extents and properties protected by levees.
3. Dam Failure Inundation: The NeDNR Dam Safety section provided breach inundation limits, where available, to assess dam failure risks.

Potential flood hazard risk impacts were developed from a collection of existing datasets that include:

1. The state-wide parcel dataset was provided by NeDNR and the Office of the Chief Information Officer (OCIO). This dataset includes parcel limits, identification, land use, and zoning information, as well as valuations for land and improvements on the parcel.
2. The state-wide critical facility dataset was compiled from data provided by the Nebraska Department of Education (schools), NEMA (data compiled from local hazard mitigation plans), NDOT (roadways, bridges, culverts, etc.), and NeDNR (dams and levees).
3. The state-wide, state-owned facility dataset was provided by the Nebraska Department of Administrative Services.
4. Agricultural lands were determined from the 2020 USDA-National Agricultural Statistics Service (NASS) Cropland Data Layer.
5. The railroad dataset was obtained from the USDOT North American Rail database.
6. Electrical Transmission line data was obtained from the DHS Homeland Infrastructure Foundation-Level Data (HIFLD).
7. Threatened and endangered species habitat were determined from the 2018 data from NGPC T&E Species Range datasets.
8. Wetland datasets were obtained from the US Fish and Wildlife Service (USFWS) National Wetlands Inventory.

Once the flood hazard and potential impact datasets were compiled, the analysis consisted of GIS-based operations intersecting the hazard with the impact datasets and compiling results on a county-by-county basis.

### GIS-BASED FLOOD RISK ASSESSMENT RESULTS

The following sections describe the results of the GIS-based risk assessment analysis with figures and summary tables included for the riverine flooding risk. Tabular county summaries for each category described below are also included in Appendix B for the riverine flood risk, the levee protected areas, and the dam failure risk.

### IMPROVEMENTS WITHIN THE FLOODPLAIN

The total value of improvements within the floodplain limits represents the total value of improvements at risk for the 1-percent annual chance exceedance flood event. The total value of improvements was determined based on the state-wide parcel data set using the total value of improvements associated with each parcel that lies with the flood hazard area. Figure 20 and Figure 21 show the total value of improvements and total number of structures at risk, respectively, by county. Table 19 and Table 20 summarize the top ten counties within Nebraska in terms of total value of improvements and structures at risk within the floodplain, respectively.

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Figure 20: Total Value of Improvements within Floodplain

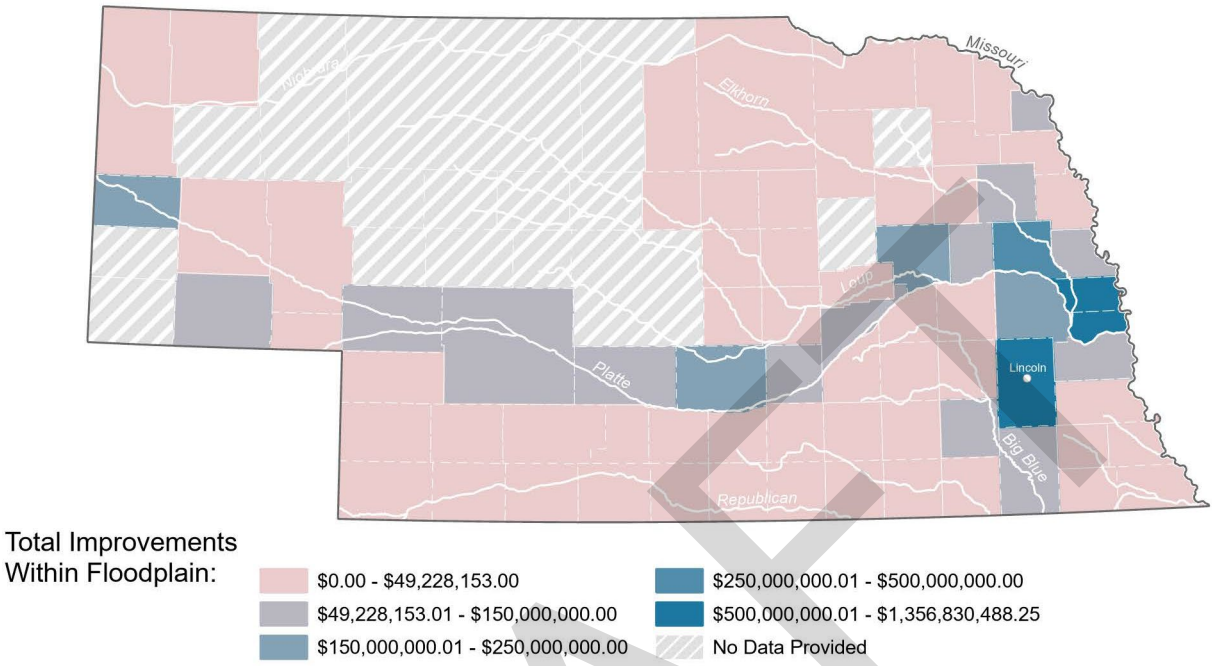


Table 19: Top 10 Nebraska Counties by Total Value of Improvements Within Floodplain

| Rank | County | Total Value of Improvements within Floodplain (Dollars) |
|---|---|---|
| 1. | Douglas | $1,356,830,488 |
| 2. | Lancaster | $921,954,700 |
| 3. | Sarpy | $627,020,425 |
| 4. | Dodge | $282,926,061 |
| 5. | Platte | $227,959,454 |
| 6. | Buffalo | $181,356,355 |
| 7. | Saunders | $177,744,069 |
| 8. | Scotts Bluff | $164,054,682 |
| 9. | Cass | $146,019,276 |
| 10. | Washington | $130,096,470 |

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Figure 21: Number of Structures Located within Floodplain

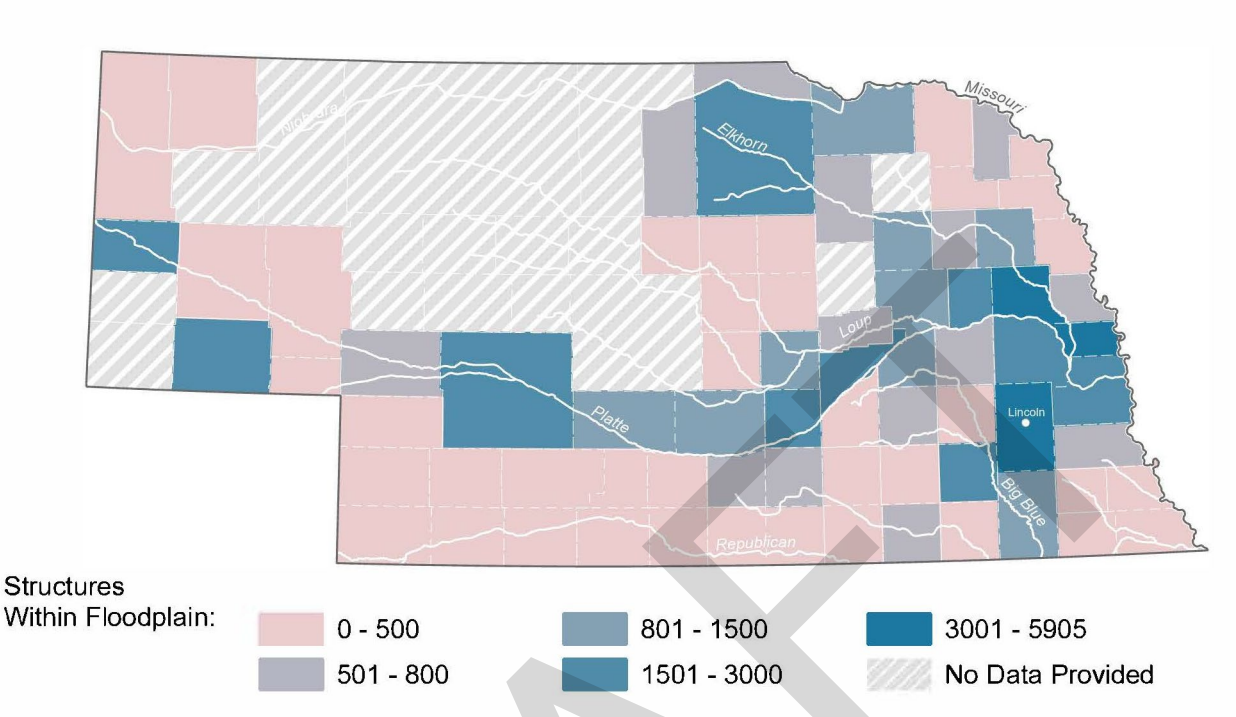


Table 20: Top 10 Nebraska Counties by Number of Structures Within Floodplain

| Rank | County | Total Number of Structures within Floodplain |
|---|---|---|
| 1. | Douglas | 5905 |
| 2. | Dodge | 5137 |
| 3. | Lancaster | 4798 |
| 4. | Scotts Bluff | 2877 |
| 5. | Merrick | 2551 |
| 6. | Hall | 2227 |
| 7. | Sarpy | 2197 |
| 8. | Lincoln | 2092 |
| 9. | Holt | 1892 |
| 10. | Colfax | 1834 |

## CRITICAL FACILITIES

The critical facility dataset was compiled from data provided by the Nebraska Department of Education (schools), NEMA (data compiled from local hazard mitigation plans), NDOT (roadways, bridges, culverts, etc.), and NeDNR (dams and levees). The tabular summaries by

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county of critical facility impacts included in Appendix B grouped the critical facilities into the following categories:

1. Transportation – railroad, roadways, bridges
2. Utilities – power, gas, water, sewer, treatment facilities, lift stations
3. Emergency Management – shelters, community centers, etc.
4. Emergency Response – fire stations, hospitals, resource stockpiles, etc.
5. Vulnerable populations – schools, retirement homes
6. Dams/levees

Figure 22 shows the total number of critical facilities at risk by county. Table 21 summarizes the top ten counties within Nebraska in terms of number of critical facilities within the floodplain.

**Figure 22: Number of Critical Facilities Located within Floodplain**

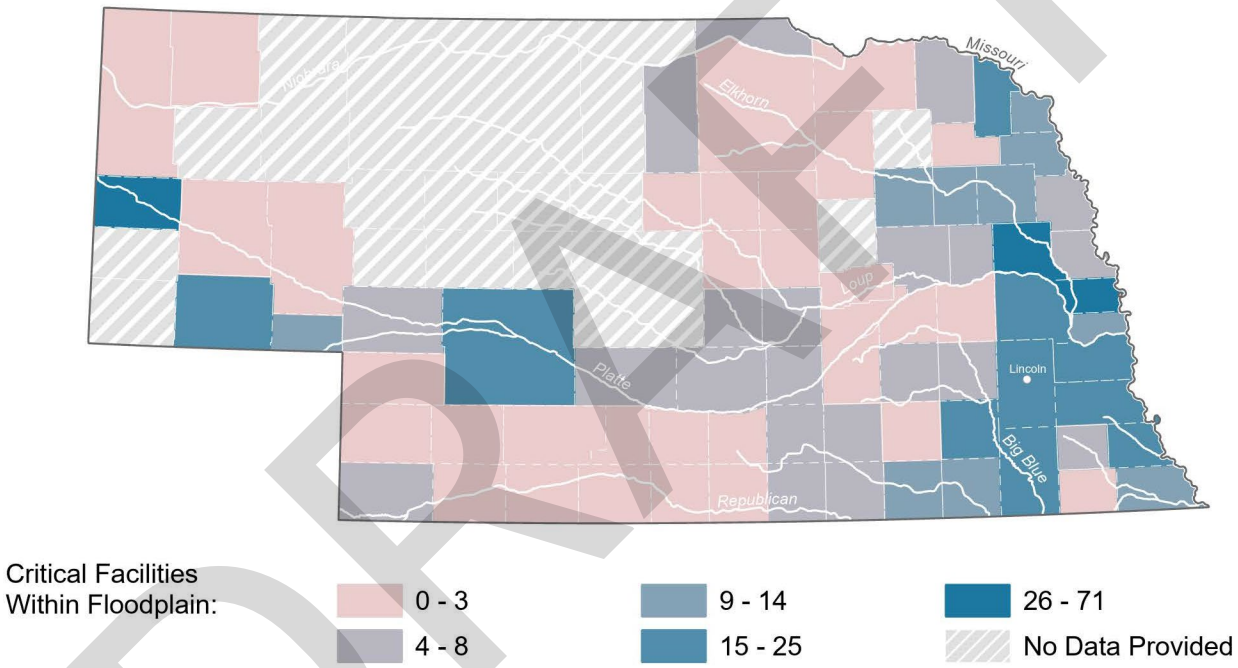


**Table 21: Top 10 Nebraska Counties by Number of Critical Facilities Within Floodplain**

| Rank | County | Total Number of Critical Facilities within Floodplain |
|---|---|---|
| 1. | Douglas | 71 |
| 2. | Scotts Bluff | 54 |
| 3. | Dodge | 46 |
| 4. | Cass | 25 |
| 5. | Lancaster | 24 |
| 6. | Lincoln | 21 |

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| Rank | County | Total Number of Critical Facilities within Floodplain |
|---|---|---|
| 7. | Saline | 20 |
| 8. | Gage | 19 |
| 9. | Cheyenne | 18 |
| 10. | Otoe | 18 |

### STATE-OWNED FACILITIES

The Nebraska Department of Administrative Services (DAS) provided a database of state-owned facilities which included 208 total listings. None of these facilities were located within flood hazard areas. It is noted that state park facilities such as restrooms, picnic shelters, etc. may be located within flood hazard areas but were not included within the DAS provided database.

### ROADWAYS

The miles of roadway located within flood hazard areas are shown in Figure 23 and the top ten counties in terms of miles of roadway at risk are summarized in Table 22. It is noted that the roadway data includes both state and locally maintained public roadways.

Figure 23: Number of Roadway Miles Located within Floodplain

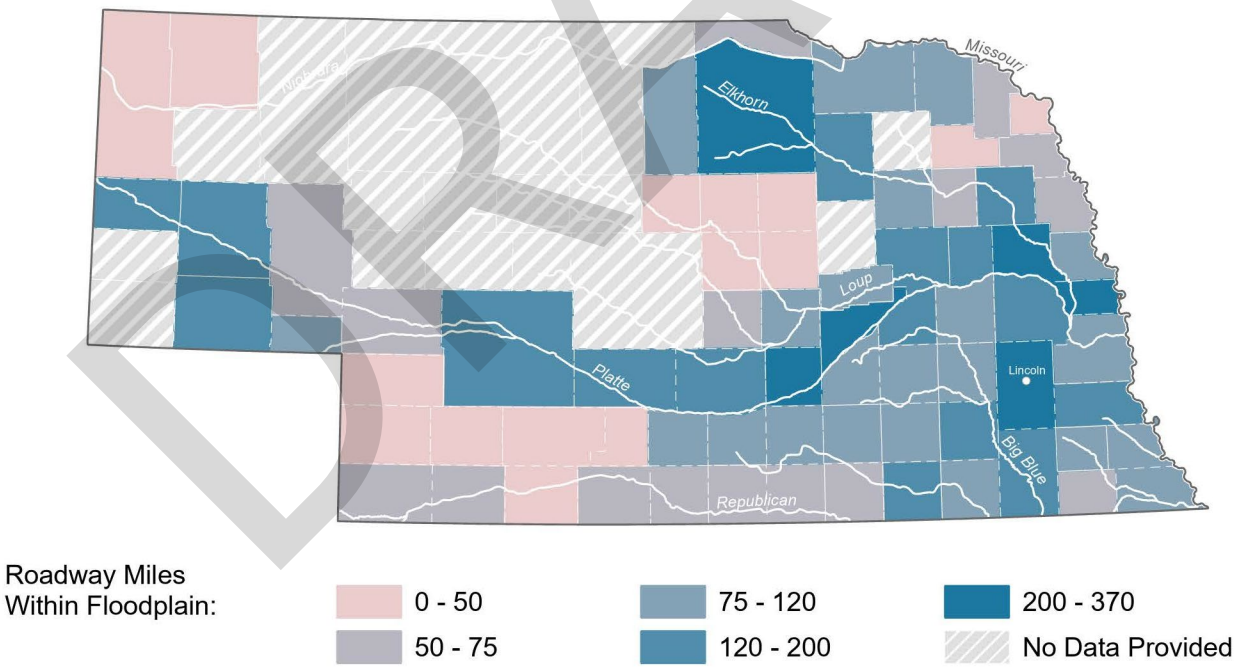


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Table 22: Top 10 Nebraska Counties by Miles of Roadway Within Floodplain

| Rank | County | Total Miles of Roadway within Floodplain |
|---|---|---|
| 1. | Merrick | 370 |
| 2. | Dodge | 369 |
| 3. | Holt | 345 |
| 4. | Hall | 265 |
| 5. | Douglas | 259 |
| 6. | Lancaster | 210 |
| 7. | Saunders | 193 |
| 8. | Colfax | 172 |
| 9. | Lincoln | 171 |
| 10. | Scotts Bluff | 166 |

## BRIDGES AND CULVERTS

The number of bridges and culverts located within flood hazard areas are shown in Figure 24 and the top ten counties in terms of number of bridges and culverts at risk are summarized in Table 23. It is noted that the bridge and culvert data includes structures located along both state and locally maintained public roadways.

Figure 24: Number of Bridge and Culverts Located within Floodplain

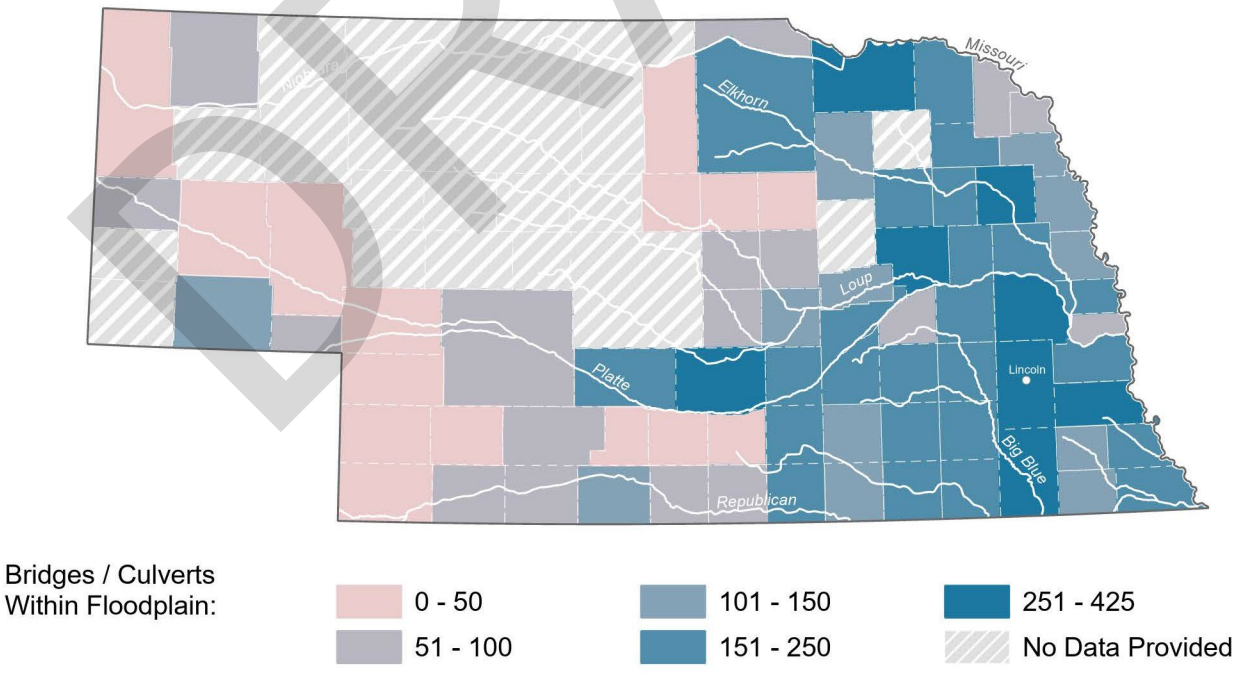


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Table 23: Top 10 Nebraska Counties by Number of Bridges and Culverts Within Floodplain

| Rank | County | Total Number of Bridges within Floodplain |
|---|---|---|
| 1. | Lancaster | 416 |
| 2. | Saunders | 378 |
| 3. | Buffalo | 318 |
| 4. | Gage | 316 |
| 5. | Otoe | 289 |
| 6. | Platte | 283 |
| 7. | Cuming | 251 |
| 8. | Knox | 251 |
| 9. | Dodge | 241 |
| 10. | Saline | 240 |

## ELECTRIC TRANSMISSION LINES

The miles of electric transmission lines located within flood hazard areas are shown in Figure 25 and the top ten counties in terms of miles of electric transmission lines at risk are summarized in Table 24. It is noted that the electric transmission line data includes assets from different utility owners.

Figure 25: Number of Miles of Electric Transmission Lines Located within Floodplain

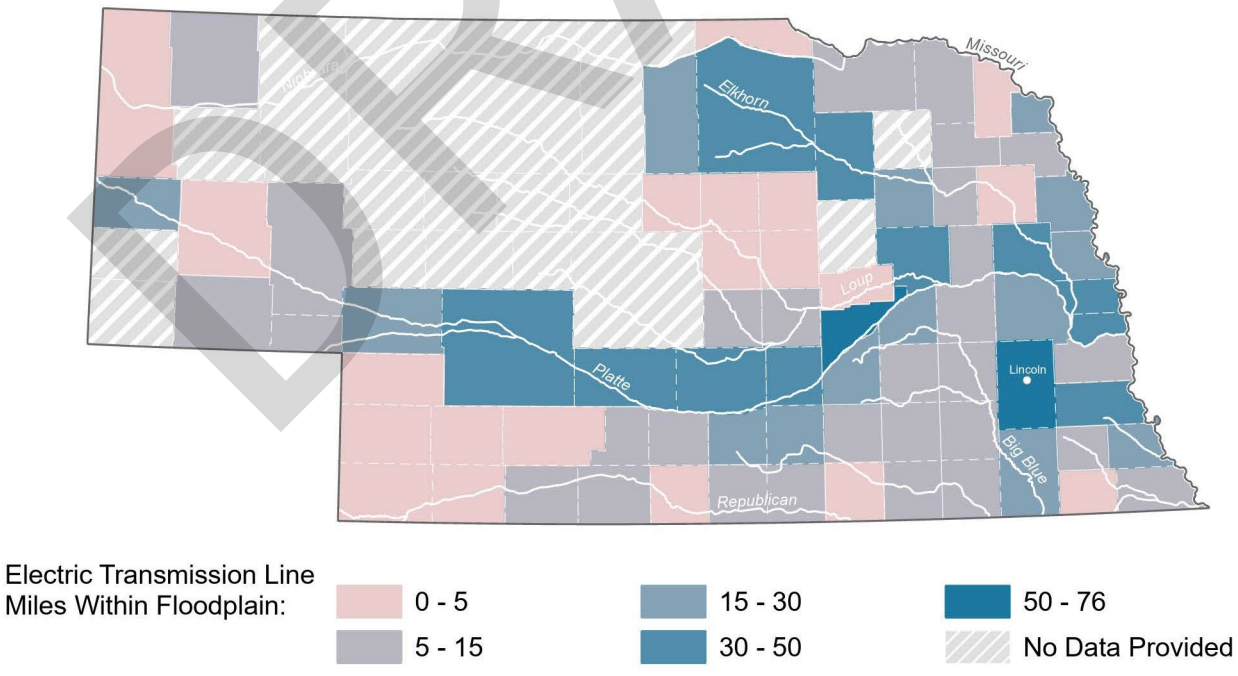


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Table 24: Top 10 Nebraska Counties by Miles of Electrical Transmission Lines Within Floodplain

| Rank | County | Total Miles of Electrical Transmission Lines within Floodplain |
|---|---|---|
| 1. | Lancaster | 76 |
| 2. | Merrick | 70 |
| 3. | Buffalo | 50 |
| 4. | Holt | 46 |
| 5. | Douglas | 45 |
| 6. | Hall | 42 |
| 7. | Dawson | 41 |
| 8. | Sarpy | 39 |
| 9. | Otoe | 38 |
| 10. | Platte | 37 |

## RAILROADS

The miles of railroad within flood hazard areas are shown in Figure 26 and the top ten counties in terms of miles of railroad at risk are summarized in Table 25. It is noted that the railroad data includes assets from different railroad owners and operators.

Figure 26: Number of Miles of Railroad Located within Floodplain

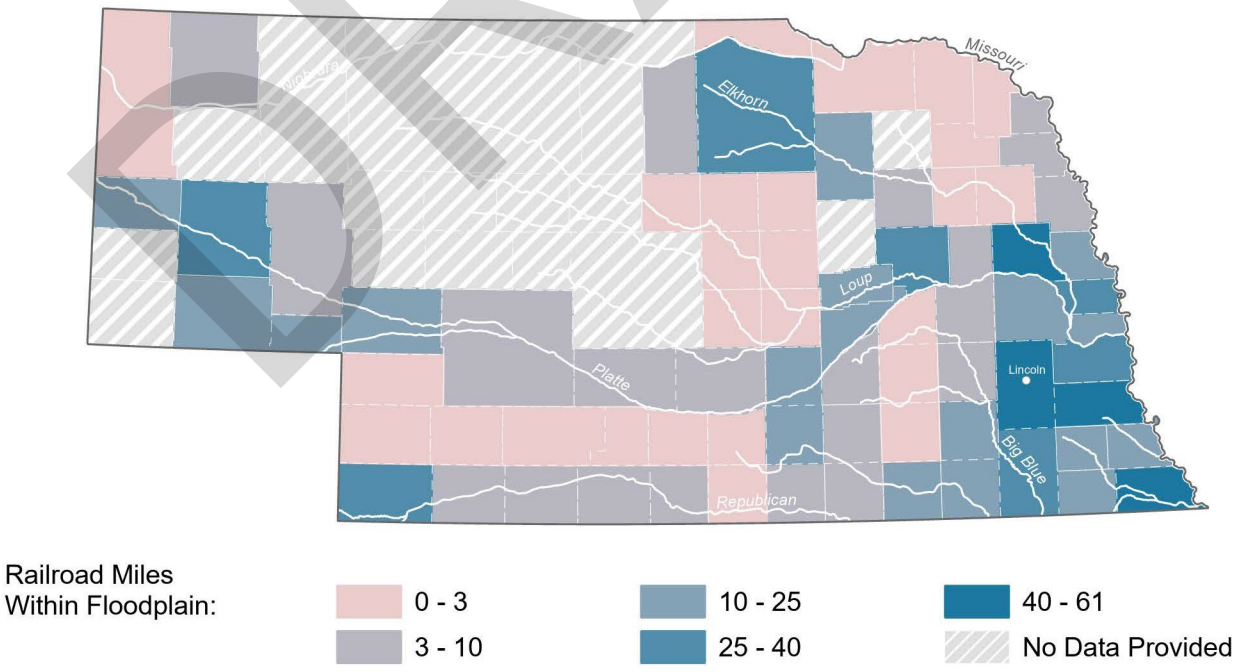


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Table 25: Top 10 Nebraska Counties by Miles of Railroad Within Floodplain

| Rank | County | Total Miles of Railroad within Floodplain |
|---|---|---|
| 1. | Lancaster | 61 |
| 2. | Richardson | 57 |
| 3. | Dodge | 53 |
| 4. | Otoe | 44 |
| 5. | Morrill | 39 |
| 6. | Cass | 35 |
| 7. | Dundy | 33 |
| 8. | Gage | 30 |
| 9. | Platte | 28 |
| 10. | Holt | 26 |

### AGRICULTURAL LANDS

The number of acres of agricultural lands within flood hazard areas are shown in Figure 27 and the top ten counties in terms of acres of agricultural lands at risk are summarized in Table 26. The number of acres of agricultural lands was determined from the Agricultural Land Use data in the 2020 USDA-NASS Cropland Data Layer.[65]

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[65] US Department of Agriculture. 2020. "USDA, National Agricultural Statistics Service 2020 Cultivated Layer." https://www.nass.usda.gov/Research_and_Science/Cropland/metadata/2020_cultivated_layer_metadata.htm

Figure 27: Number of Acres of Agricultural Lands Located within Floodplain

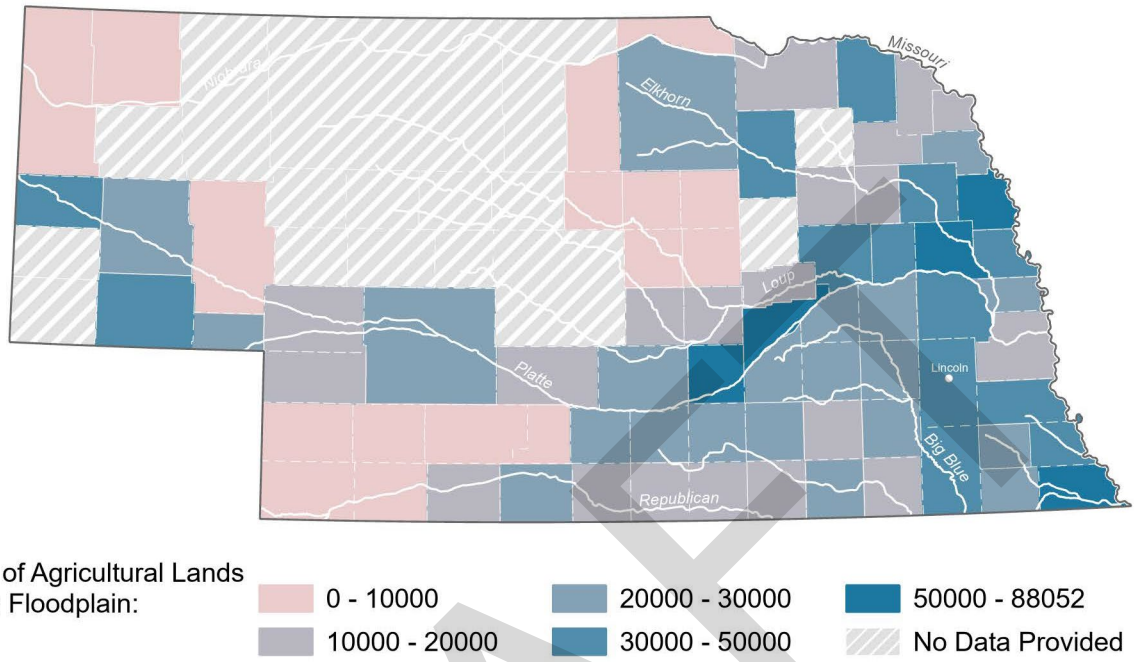


Table 26: Top 10 Nebraska Counties by Acres of Agricultural Lands Within Floodplain

| Rank | County | Total Acres of Agricultural Lands within Floodplain |
|---|---|---|
| 1. | Dodge | 88,052 |
| 2. | Merrick | 72,197 |
| 3. | Hall | 58,889 |
| 4. | Burt | 55,131 |
| 5. | Richardson | 51,044 |
| 6. | Saunders | 48,653 |
| 7. | Cheyenne | 46,130 |
| 8. | Otoe | 38,720 |
| 9. | Colfax | 38,416 |
| 10. | Nemaha | 37,420 |

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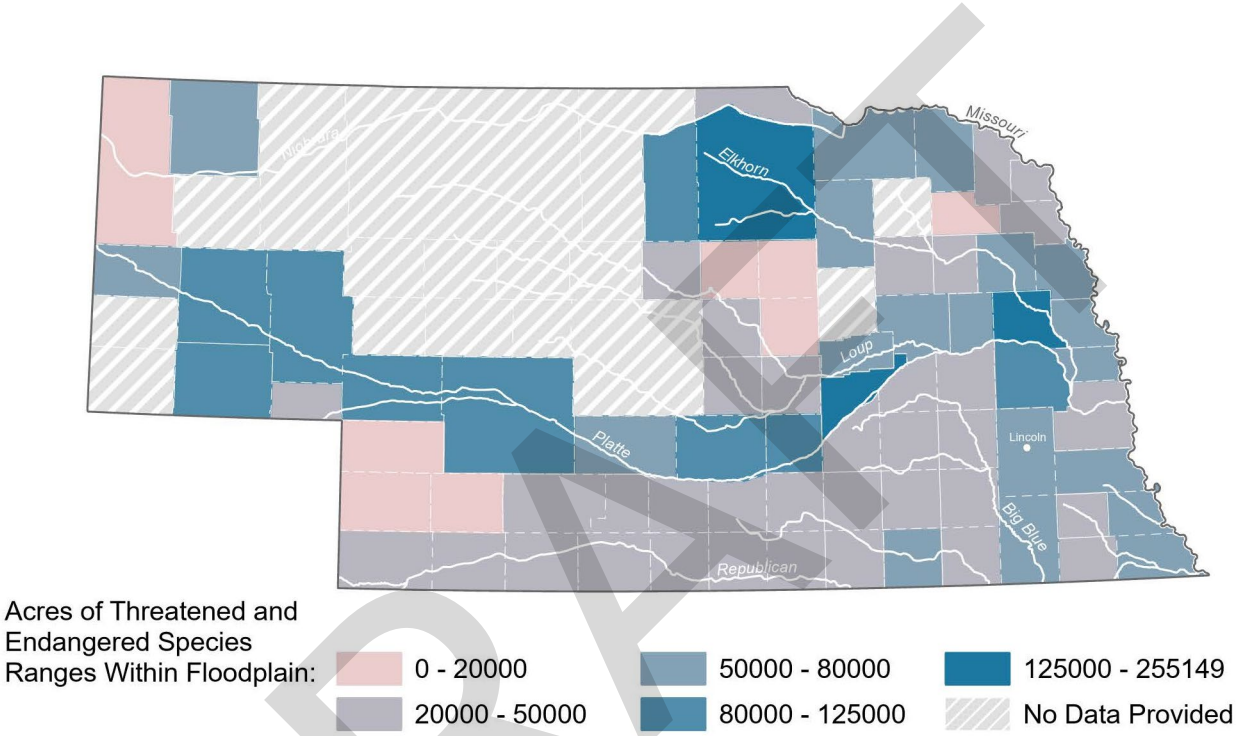
## THREATENED & ENDANGERED SPECIES HABITAT RANGES

The number of acres of threatened and endangered species habitat ranges within flood hazard areas are shown in Figure 28 and the top ten counties in terms of acres of threatened and endangered species habitat ranges at risk are summarized in Table 27. The results are based on the 2018 Nebraska Game and Parks dataset.[66]

### Figure 28: Number of Acres of Threatened and Endangered Species Ranges Located within Floodplain




### Table 27: Top 10 Nebraska Counties by Acres of Threatened and Endangered Species Habitat Ranges Within Floodplain

| Rank | County | Total Acres of T&E Species Habitat Ranges within Floodplain |
|---|---|---|
| 1. | Holt | 255,149 |
| 2. | Merrick | 127,228 |
| 3. | Dodge | 125,656 |
| 4. | Lincoln | 108,194 |
| 5. | Morrill | 105,277 |

[66] Nebraska Game and Parks Commission. 2018. "Threatened and Endangered Species Ranges." June 26. https://data-outdoornebraska.opendata.arcgis.com/datasets/threatened-and-endangered-species-ranges/explore?location=41.456104%2C-99.655543%2C7.28

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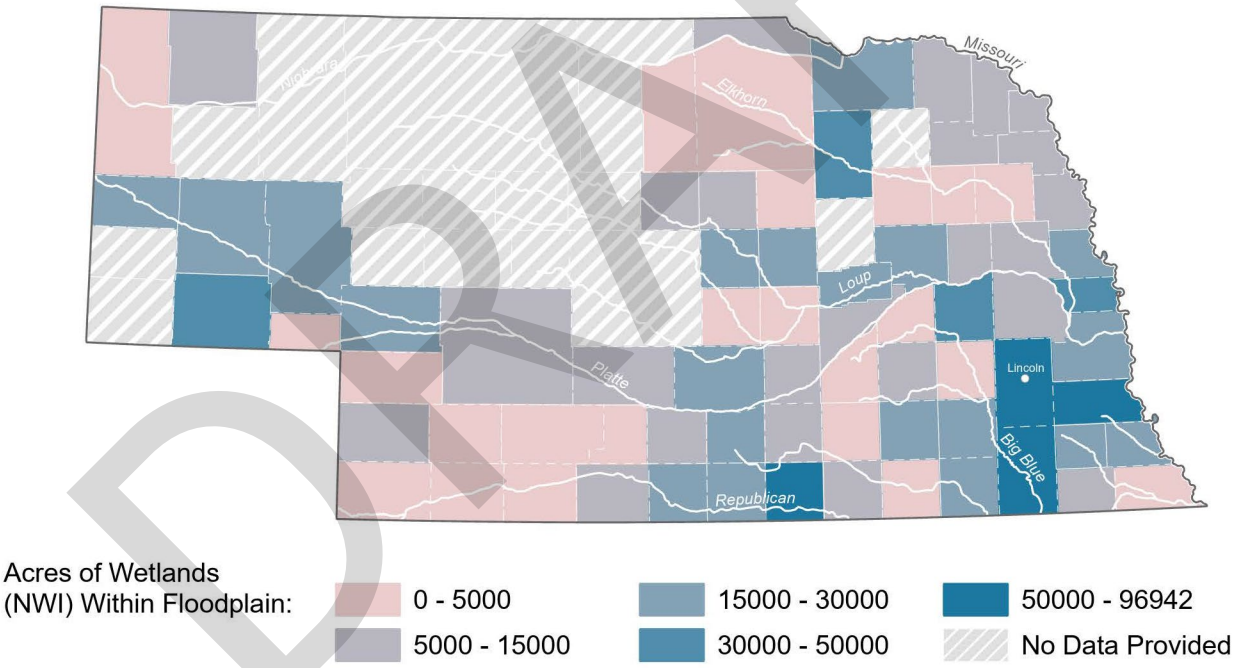
| Rank | County | Total Acres of T&E Species Habitat Ranges within Floodplain |
|---|---|---|
| 6. | Hall | 102,642 |
| 7. | Garden | 96,129 |
| 8. | Rock | 90,586 |
| 9. | Buffalo | 88,065 |
| 10. | Saunders | 82,065 |

## WETLANDS

The number of acres of wetlands within flood hazard areas are shown in Figure 29 and the top ten counties in terms of acres of wetlands at risk are summarized in Table 28. The results are based on the USFWS National Wetland Inventory dataset.[67]

Figure 29: Number of Acres of Wetlands Located within Floodplain




[67] US Fish and Wildlife Service. 2019. "US Fish Wildlife Service Wetland Boundaries." May 29. https://www.fws.gov/wetlands/data/data-download.html

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Table 28: Top 10 Nebraska Counties by Acres of Wetlands Within Floodplain

| Rank | County | Total Acres of Wetlands within Floodplain |
|---|---|---|
| 1. | Holt | 96,942 |
| 2. | Rock | 55,521 |
| 3. | Garden | 49,258 |
| 4. | Keith | 40,381 |
| 5. | Lincoln | 29,735 |
| 6. | Morrill | 27,913 |
| 7. | Knox | 20,166 |
| 8. | Buffalo | 19,525 |
| 9. | Harlan | 19,163 |
| 10. | Dodge | 15,637 |

## CULTURAL AND HISTORIC PROPERTIES

The number of cultural and/or historic properties within flood hazard areas are shown in Figure 30 and the top ten counties in terms of number of cultural and/or historic structures at risk are summarized in Table 29. The results are based on the National Register of Historic Places dataset.[68]

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[68] National Parks Service. 2021. "National Register Historic Places Public Dataset." March 3. https://irma.nps.gov/DataStore/Reference/Profile/2210280

Figure 30: Number of Properties on National Register of Historic Properties Located within Floodplain

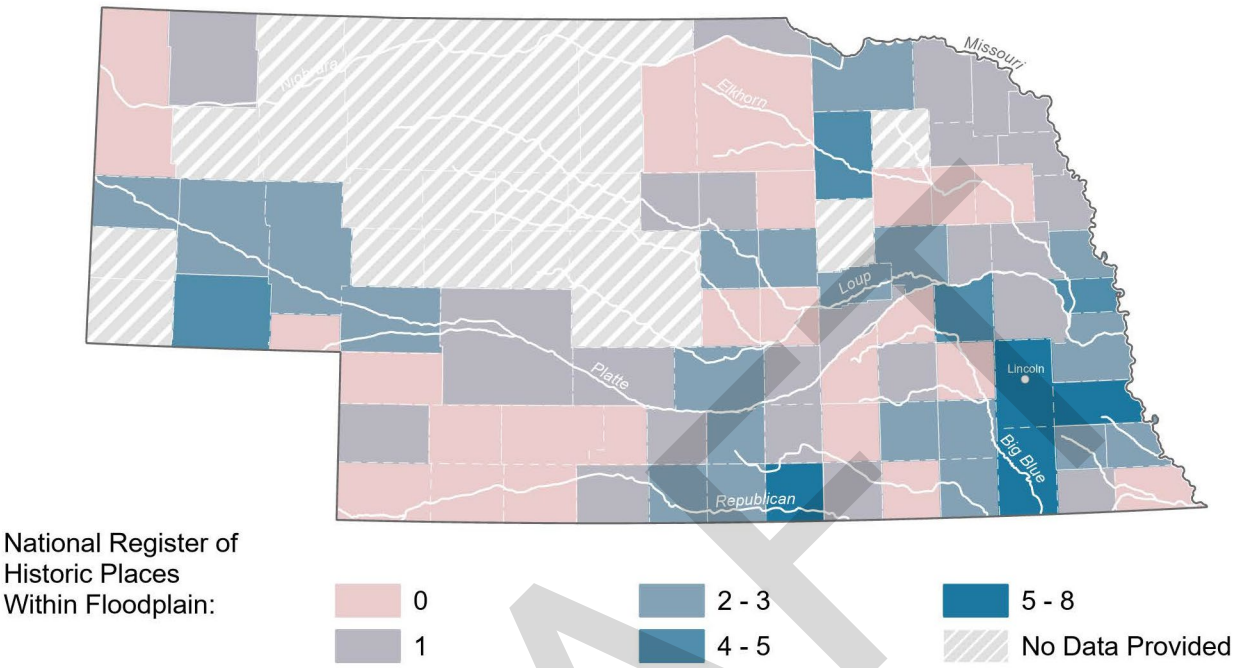


Table 29: Top 10 Nebraska Counties by Number of National Register of Historic Places Within Floodplain

| Rank | County | Total Number of Cultural/Historic Properties within Floodplain |
|---|---|---|
| 1. | Webster | 8 |
| 2. | Gage | 6 |
| 3. | Lancaster | 6 |
| 4. | Otoe | 6 |
| 5. | Cheyenne | 5 |
| 6. | Douglas | 5 |
| 7. | Antelope | 4 |
| 8. | Butler | 4 |
| 9. | Fillmore | 3 |
| 10. | Garden | 3 |

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## 3.6 Flood Insurance Policy and Claim Analysis

The following analysis uses insurance information obtained from the NFIP's PIVOT System. Policy and claims data depicted in Section 3.6.1, Number of NFIP Policies, through Section 3.6.5, Analysis of Claims Per Policy, is current as of September 30, 2021. Data specific to the 2019 flooding event in Section 3.6.6, 2019 Flood Insurance Claim Analysis, is also current as of September 30, 2021, and depicts the claims made that directly correlate with the duration of the flood event. The PIVOT System is a secure FEMA platform housing essential NFIP applications, including Floodsmart (FLSM), Claims and Policy, Document Case Management Tool (DCMT), the Risk Rating Engine 2.0 (RRE), and PIVOT Analytics and Reporting (PART).

The PIVOT System was used to access historical flood insurance reports for Nebraska. The year 1978 was used as the starting point for the historical analysis. This was the year the federal government started directly writing insurance policies and handling claims for the NFIP.

The figures found in this section were developed using county-level data to demonstrate flood insurance trends in the state. There are noted limitations with this flood-loss information, including:

- Only policies and losses to participating NFIP communities are included
- NFIP participation since 1978 is not static: communities joined the NFIP at various times since 1978 and individual policies can be purchased and dropped at any time for various reasons
- The number of flood insurance policies in effect may not include all structures at risk to flooding

Despite these limitations, the maps depict several patterns in flood insurance policies, flood losses, and loss payments across Nebraska. Note that while some counties may not participate in NFIP, the communities that exist within the county may participate separately, leading to claims and policies existing in non-participating counties. Uninsured losses are not depicted in these tables and figures.

### 3.6.1 NUMBER OF NFIP POLICIES

There are currently 8,417 NFIP flood insurance policies in the State of Nebraska. Douglas, Dodge, and Lancaster Counties account for most of this total, primarily due to large populations, large rates of development, and community proximity to major waterways such as the Missouri and Elkhorn Rivers. Table 30 lists the Nebraska counties with the highest number of policies.

**Table 30: Top Ten Counties – Effective Flood Insurance Policies**

| Rank | County | Total Policies |
|---|---|---|
| 1. | Douglas | 1,378 |
| 2. | Lancaster | 1,151 |
| 3. | Dodge | 1,069 |
| 4. | Sarpy | 759 |
| 5. | Cass | 480 |
| 6. | Saunders | 450 |
| 7. | Colfax | 331 |

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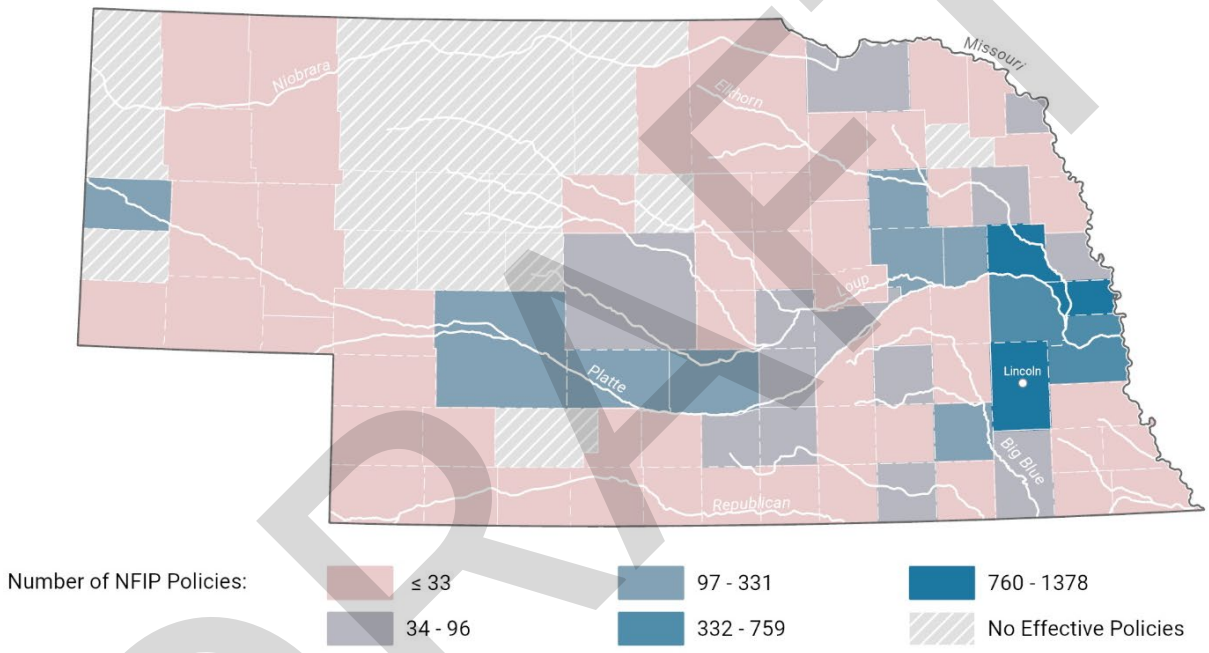
| Rank | County | Total Policies |
|---|---|---|
| 8. | Platte | 207 |
| 9. | Buffalo | 205 |
| 10. | Lincoln | 193 |

Most Nebraska counties have a much smaller number of flood insurance policies. The remaining Nebraska counties outside of the top ten average approximately 25 NFIP policies. This is largely due to smaller populations and substantially less development in the floodplain. Figure 31 depicts the number of NFIP policies in each county.

Figure 31: Total NFIP Polices per County




## 3.6.2 AVERAGE NET COVERAGE PER POLICY

Nebraska NFIP policies hold $1,819,148,300 in flood insurance coverage. The average net coverage for each policy in Nebraska, including structural and contents coverage, is $217,223. This is likely because the maximum amount of coverage a residential flood insurance policy can hold is $250,000. The highest average coverage can be found in Morrill, Thurston, and Dakota Counties, which average between $325,000 and $370,000. This is likely due to a higher number of commercial policies existing in these counties, which can have a maximum $500,000 in coverage. Table 31 lists the Nebraska counties with the highest average coverage per NFIP policy.

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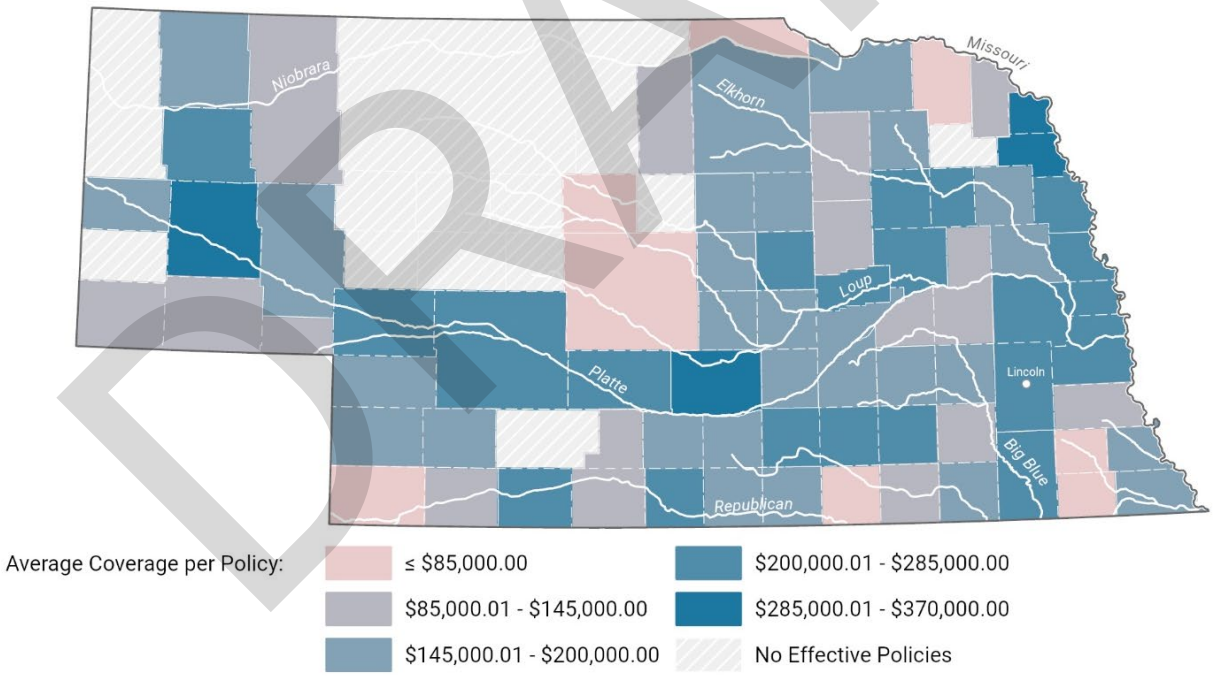
Table 31: Top Ten Counties – Average NFIP Policy Coverage

| Rank | County | Average NFIP Policy Coverage |
|---|---|---|
| 1. | Thurston | $367,200 |
| 2. | Morrill | $366,667 |
| 3. | Dakota | $333,383 |
| 4. | Buffalo | $288,295 |
| 5. | Keith | $277,963 |
| 6. | Sarpy | $270,868 |
| 7. | Platte | $269,612 |
| 8. | Saunders | $265,798 |
| 9. | Gage | $265,591 |
| 10. | Harlan | $265,333 |

For the remaining counties, the average coverage per NFIP policy is $160,167. Figure 32 depicts the average amount of flood insurance coverage per policy by county.

Figure 32: Average Coverage per NFIP Policy by County




## 3.6.3 TOTAL NUMBER OF CLAIMS SINCE 1978

Nebraska policyholders have filed 6,216 flood insurance claims since 1978. Most of these claims originate from Douglas, Sarpy, and Dodge Counties, each with more than 1,000 claims. This can be traced primarily to the populations and population densities of each county and the

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proximity of these communities to the Elkhorn and Missouri Rivers. Table 32 lists the counties with the highest number of flood insurance claims since 1978.

Table 32: Top Ten Counties – Total Number of Claims Since 1978

| Rank | County | Number of Claims |
|---|---|---|
| 1. | Douglas | 1,021 |
| 2. | Sarpy | 843 |
| 3. | Dodge | 803 |
| 4. | Cass | 396 |
| 5. | Lancaster | 310 |
| 6. | Saunders | 256 |
| 7. | Saline | 194 |
| 8. | Gage | 183 |
| 9. | Colfax | 168 |
| 10. | Washington | 150 |

The remaining counties with recorded claims average approximately 23 claims each since 1978. Figure 33 shows the number of NFIP claims in each county since 1978. Using this figure, a pattern can be traced along the Platte, Elkhorn, Missouri, and Big Blue Rivers.

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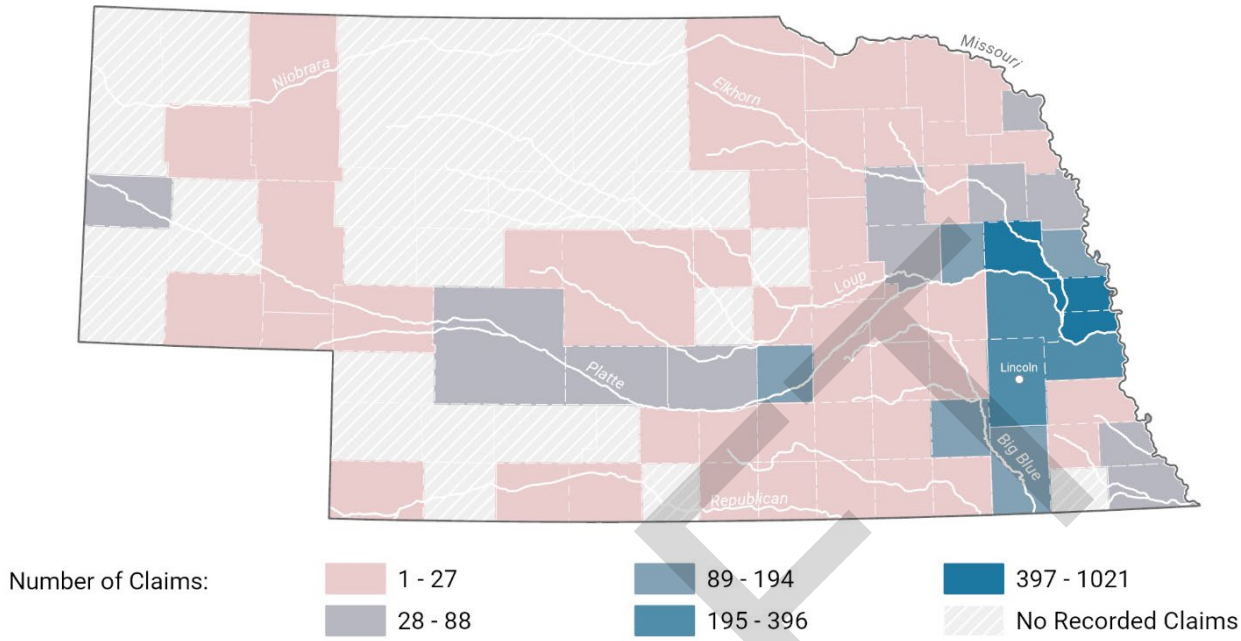
Figure 33: Total Number of NFIP Claims per County Since 1978




## 3.6.4 TOTAL PAYMENTS SINCE 1978

Flood insurnace claims in Nebraska have totaled $95,787,653 since 1978. This total includes both structural and contents coverage. Sarpy County has the highest claims cost, followed closely by Douglas and Dodge Counties. This can be traced primarily to the population densities of each county leading to higher rates of development and the close proximity of these communities to major waterways. There have also been a number of major historical floods along these waterways, resulting in higher claims occurances and costs. Table 33 lists the counties with the highest total net flood insurance claim payments since 1978.

Table 33: Top Ten Counties – Total Net Payments Since 1978

| Rank | County | Total Net Payments |
|---|---|---|
| 1. | Sarpy | $21,295,677 |
| 2. | Douglas | $13,754,086 |
| 3. | Dodge | $11,747,171 |
| 4. | Cass | $7,715,967 |
| 5. | Buffalo | $7,110,114 |
| 6. | Saunders | $4,106,996 |
| 7. | Madison | $3,376,475 |
| 8. | Lancaster | $2,978,967 |
| 9. | Washington | $2,961,494 |
| 10. | Richardson | $2,097,497 |

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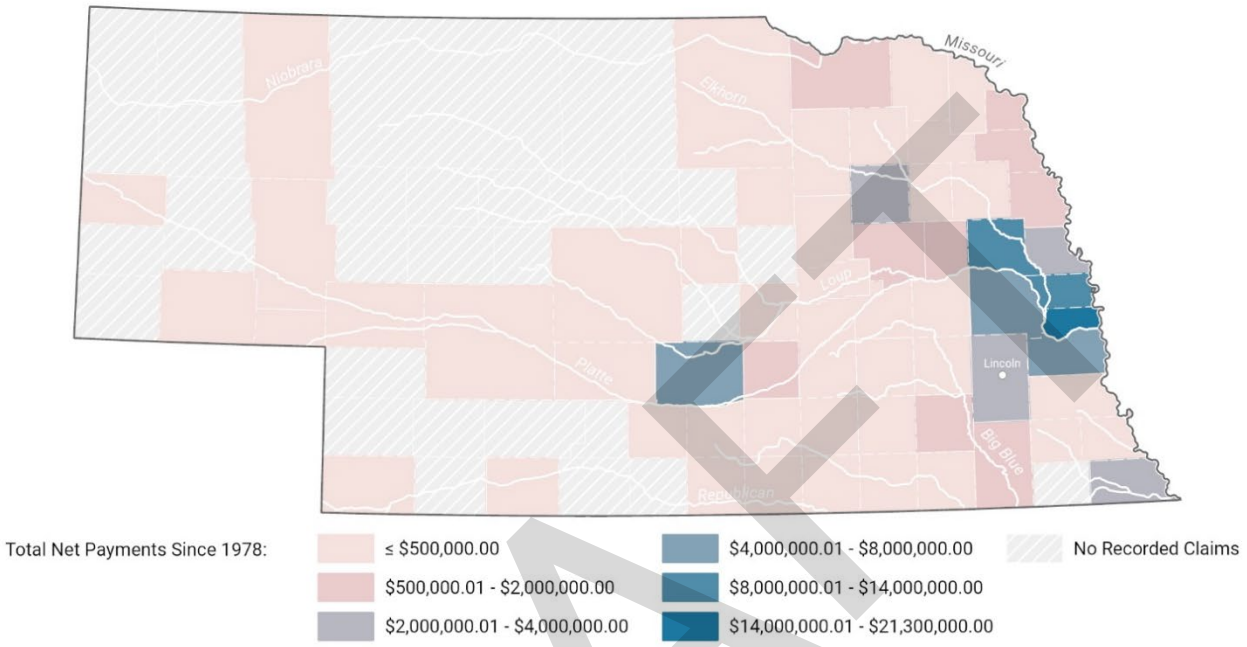
The remaining counties with recorded claims average approximately $278,652 each in total net payments since 1978. Figure 34 shows a map detailing total net payments, including structural and contents coverage in each county.

Figure 34: Total Net Payments Since 1978




## 3.6.5 ANALYSIS OF CLAIMS PER POLICY

In Nebraska, the average number of claims per policy is 0.65. This implies that 65 percent of policyholders have filed for a flood insurance claim. The purpose of this data is to help visualize the potential for repetitive losses (RL) and flood risk in each county across Nebraska. The counties with the highest ratios of claims per policy are Wayne and Richardson. Wayne County has 5 total claims since 1978; however, none of those policies are in effect today, which is why their rate is so high. Policies may be dropped over time due to the property being destroyed, the structure being removed from the floodplain by LOMA/LOMR or relocation, the property being bought and demolished by the community, the property owner is no longer required to obtain flood insurance, or the property owner has determined flood insurance is no longer needed. The case is different in Richardson County, which has 11 policies and nearly 70 claims. Table 34 lists the counties with the highest rates of claims per policies.

Table 34: Top Ten Counties – Claims per Policy Since 1978

| Rank | County | Total Claims | Total Number of NFIP Policies | Claims Per Policy Since 1978 |
|---|---|---|---|---|
| 1. | Richardson | 68 | 12 | 5.67 |
| 2. | Wayne | 4 | 0 | 4.00 |
| 3. | Thurston | 13 | 5 | 2.60 |
| 4. | Jefferson | 10 | 4 | 2.50 |
| 5. | Gage | 154 | 70 | 2.20 |

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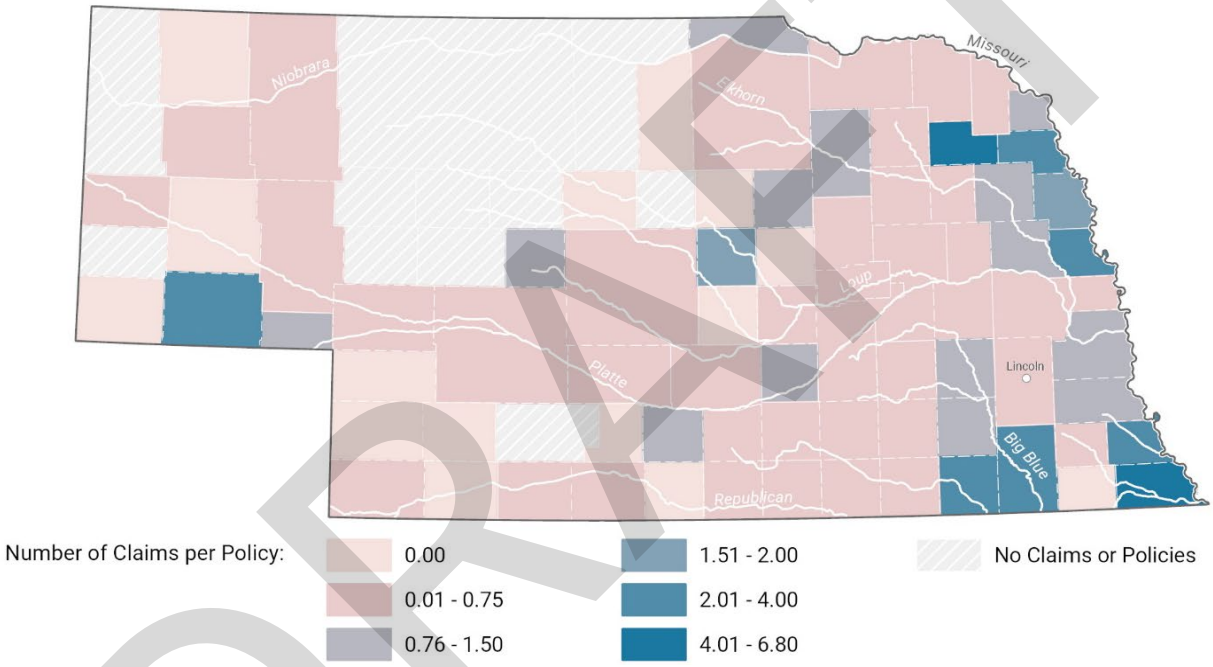
| Rank | County | Total Claims | Total Number of NFIP Policies | Claims Per Policy Since 1978 |
|---|---|---|---|---|
| 6. | Washington | 141 | 67 | 2.10 |
| 7. | Burt | 49 | 25 | 1.96 |
| 8. | Cheyenne | 18 | 11 | 1.64 |
| 9. | Valley | 8 | 5 | 1.60 |
| 10. | Phelps | 9 | 6 | 1.50 |

Figure 35 shows the ratio of claims per effective policy in each county.

Figure 35: Number of Claims per Policy Since 1978




## 3.6.6 2019 FLOOD INSURANCE CLAIM ANALYSIS

The flood claims that occurred during and as a result of the 2019 spring flooding represent a significant number of the all time flood claims since 1978. In total, there were 953 residential flood insurance claims and 74 commercial flood insurance claims throughout the 2019 flood event. From the map provided in Figure 36, a pattern can be drawn from the areas along the Elkhorn, Missori, and Platte Rivers where the majority of major flooding was experienced. Table 35 lists the counties with the most flood insurance claims as a result of the 2019 flooding.

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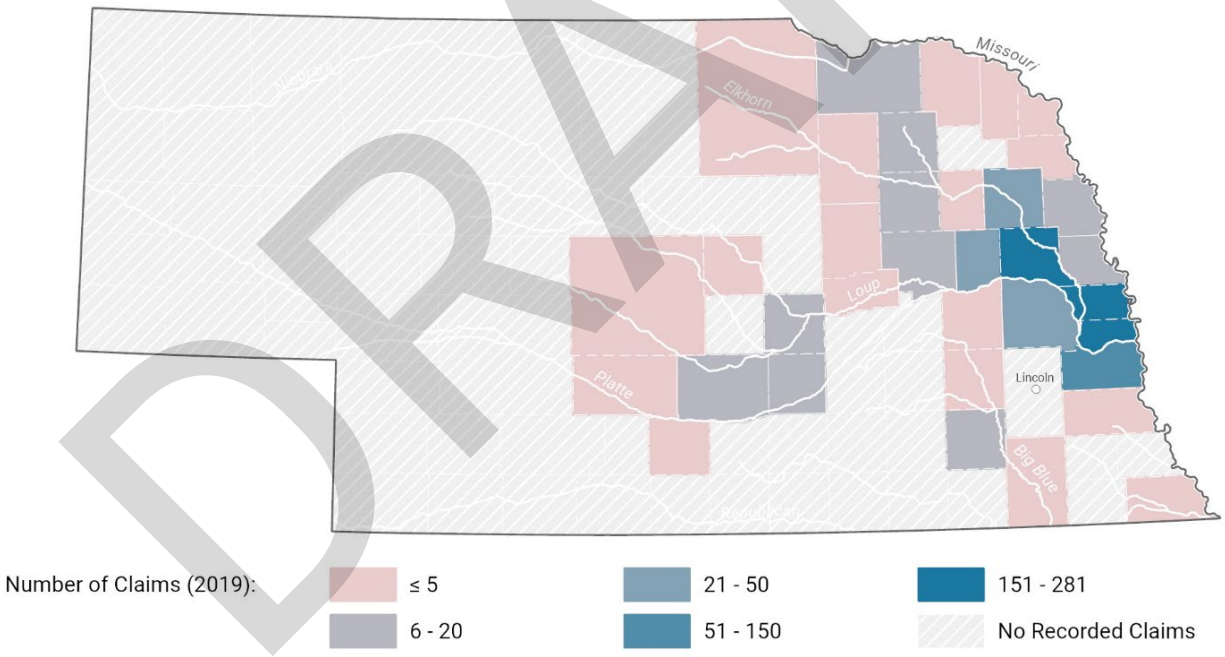
Table 35: Top Ten Counties – Number of Claims (2019)

| Rank | County | Number of Claims (2019) |
|---|---|---|
| 1. | Dodge | 281 |
| 2. | Douglas | 211 |
| 3. | Sarpy | 202 |
| 4. | Cass | 78 |
| 5. | Saunders | 50 |
| 6. | Colfax | 26 |
| 7. | Cuming | 25 |
| 8. | Washington | 16 |
| 9. | Platte | 14 |
| 10. | Buffalo | 12 |

Figure 36 shows the total flood claims made in each county.

Figure 36: Total Number of Claims (2019)




Flood insurnace claims in Nebraska during and as a result of the 2019 spring flooding have totaled $44,676,455, which represents nearly half of all flood insurance claim payments that have been made in the state since 1978. Claims on residential policies from the 2019 flooding equal $39,082,924. Claims on commercial policies equal $5,421,991. Sarpy County has the highest total claims cost, followed by Dodge and Douglas Counties, respectively. Table 36 lists the counties with the highest total net paymets resulting from the 2019 spring flooding.

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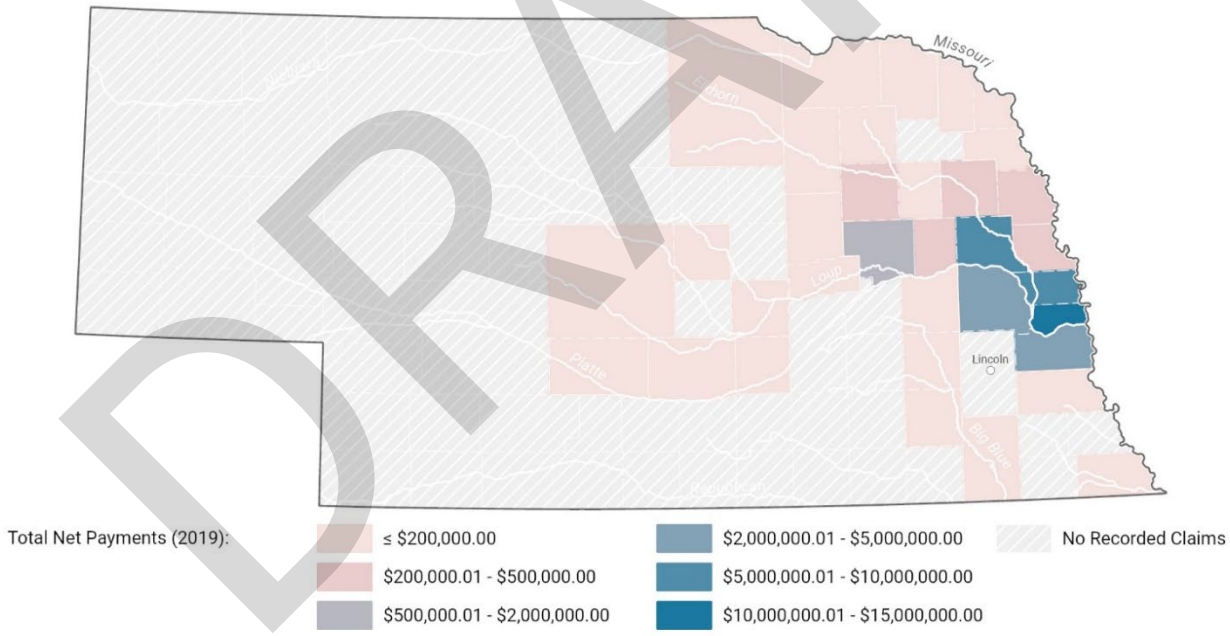
Table 36: Top Ten Counties – Total Net Payments (2019)

| Rank | County | Total Net Payments (2019) |
|---|---|---|
| 1. | Sarpy | $14,510,683 |
| 2. | Dodge | $8,976,205 |
| 3. | Douglas | $8,267,536 |
| 4. | Cass | $4,891,118 |
| 5. | Saunders | $2,001,435 |
| 6. | Platte | $1,152,596 |
| 7. | Cuming | $440,390 |
| 8. | Washington | $420,351 |
| 9. | Madison | $312,137 |
| 10. | Colfax | $308,662 |

Figure 37 shows the total net payments on all policies, including structural and contents coverage for residential, commercial, and non-residential non-commercial in each county.

Figure 37: Total Net Payments (2019)




## 3.6.7 INSURANCE ANALYSIS BY FLOOD ZONE

Nebraska has nearly every type of regulatory flood zone, except for coastal zones. Each zone requires floodplain management regulations. Most participating communities have A or AE zones, also known as 1-percent annual chance flood zones. These are the most common type of regulatory floodplain. The policies held within regulatory A zones make up approximately 65 percent of the total 8,417 policies in Nebraska. Another large portion of policies are held in X zones, or the area determined to be protected by levees or outside the 0.1 percent annual

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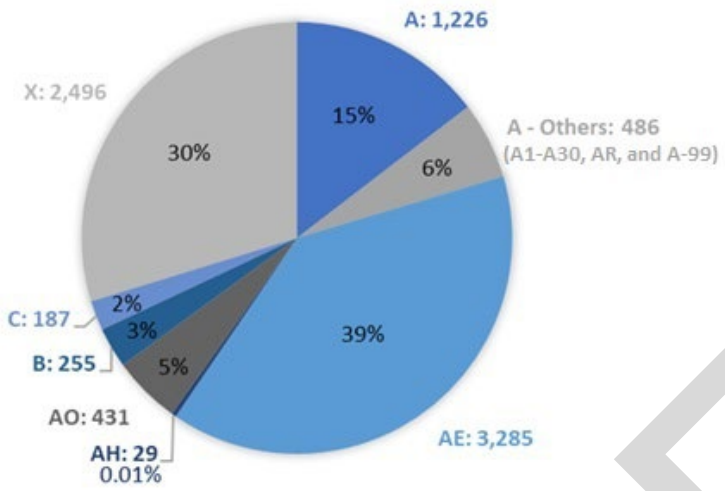
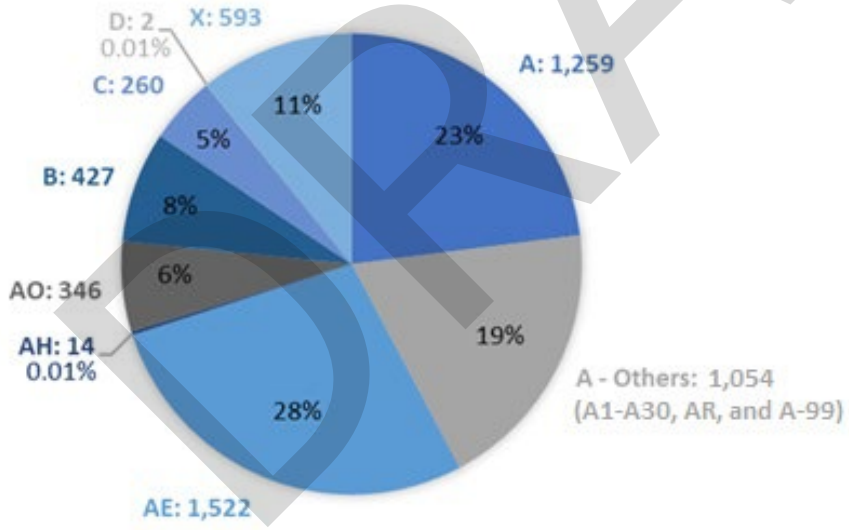
chance flood zone. These policies make up for 30 percent of the total policies in Nebraska. Figure 38 shows the number of policies in each flood zone in Nebraska.

Figure 38: Number of Effective Policies by Flood Zone




Regulatory A zones also account for most flood insurance claims in Nebraska, due to the large number of policies that exist within them. Figure 39 shows the total number of claims per each flood zone.

Figure 39: Number of Claims per Flood Zone Since 1978

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### 3.6.8 REPETITIVE LOSS ANALYSIS

RL and Severe Repetitive Loss (SRL) property information was obtained from PIVOT on September 23, 2021, and is summarized by county in Table 37. For NFIP purposes,[69] an RL property is one that has had 2 claims greater than $1,000 in any 10-year period since 1978. An SRL property is one that has had four claims greater than $5,000 or two or more claims that are greater than the building's value.

Nebraska has approximately 542 RL properties and 41 SRL properties. This number is subject to change based on potential Hazard Mitigation Grant Program (HMGP) projects that may result from the flooding that occurred in 2019. Of the total 583 RL/SRL properties in Nebraska, only 33 have been certified as mitigated.

It should be noted that the RL properties list may have some inaccuracies due to lack of updates over time. Common reasons for inaccuracies include changes to jurisdictional boundaries and the status of mitigated properties not being updated within the NFIP claims database. This information may require further verification for each individual jurisdiction. However, the information is beneficial to show overall trends and RL locations.

Sarpy County, which is bordered by both the Platte and Missouri Rivers, has approximately 122 RL properties. This is approximately 22 percent of the state total.

Table 37: Total RL and SRL Claims by County

| County | Number of RL/SRL Properties | County | Number of RL/SRL Properties |
|---|---|---|---|
| Sarpy | 122 | Madison | 4 |
| Douglas | 87 | Otoe | 4 |
| Dodge | 63 | Dakota | 3 |
| Cass | 36 | Thayer | 3 |
| Colfax | 24 | Boone | 2 |
| Gage | 23 | Platte | 2 |
| Saunders | 22 | Seward | 2 |
| Richardson | 18 | Boyd | 1 |
| Washington | 18 | Butler | 1 |
| Lancaster | 10 | Cheyenne | 1 |
| Buffalo | 8 | Cuming | 1 |
| Dawson | 8 | Custer | 1 |
| Hall | 6 | Hamilton | 1 |
| Burt | 5 | Nemaha | 1 |
| Saline | 5 | Valley | 1 |

[69] See Section 4.2.3, Repetitive Loss Mitigation Strategy, for further discussion of RL and SRL definitions.

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RL and SRL property claim cost information was obtained from PIVOT on September 23, 2021, and is summarized by county in Table 38. Sarpy County again shows the most losses in terms of aggregate claim amounts. Other counties of note with over $1 million in total claims from RL properties include Cass County, which is bordered by the Platte and Missouri Rivers; Dodge County, which is adjacent to the Platte and Elkhorn Rivers; and Richardson County, which is along the Missouri River. Most other counties with significant RLs are similarly located in eastern Nebraska along the Platte, Elkhorn, or Missouri Rivers.

**Table 38: Total RL and SRL Claim Costs by County**

| County | RL/SRL Claims Total | County | RL/SRL Claims Total |
|---|---|---|---|
| Sarpy | $7,494,800.41 | Dawson | $108,159.32 |
| Douglas | $3,437,254.79 | Saline | $100,599.72 |
| Dodge | $2,795,993.02 | Boyd | $90,311.25 |
| Cass | $2,407,204.55 | Thayer | $87,516.97 |
| Richardson | $1,991,858.48 | Seward | $82,505.38 |
| Saunders | $1,049,384.11 | Hamilton | $48,183.40 |
| Colfax | $924,562.21 | Butler | $45,919.62 |
| Gage | $741,298.00 | Cuming | $45,636.42 |
| Washington | $719,233.22 | Madison | $44,486.90 |
| Otoe | $360,582.10 | Valley | $34,645.26 |
| Lancaster | $231,813.34 | Nemaha | $33,225.72 |
| Burt | $228,981.30 | Platte | $31,787.49 |
| Buffalo | $227,935.65 | Cheyenne | $21,743.76 |
| Dakota | $188,824.91 | Boone | $16,826.95 |
| Hall | $167,638.68 | Custer | $6,334.19 |

### 3.6.9 STATEWIDE POLICY DATA TABLE

Included in Appendix B of this plan is a table listing for each of Nebraska's counties that includes the number of policies found in each county, the total dollar amount covered by those policies, the number of losses claimed, and the total net flood insurance payments made. The data has been split to show residential policies and commercial policies. This data was obtained from PIVOT. Policy and claims data by occupancy type in Appendix A represents policies as of September 30, 2021.

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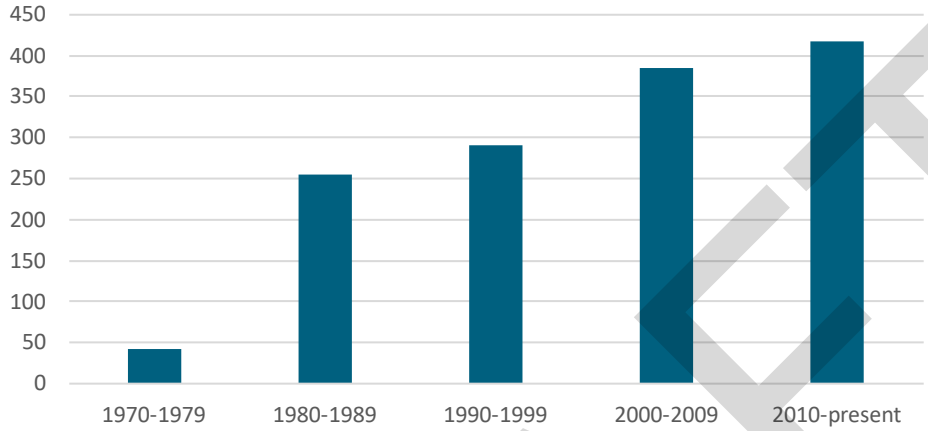
### 3.6.10 INCREASING ACCESS TO FLOOD INSURANCE

Nebraska has seen a steady increase in NFIP participation. As of February 2022, 418 communities in Nebraska have enrolled since 2010 (Figure 40), and more communities are expected to join within the year. Joining NFIP provides a wide range of benefits to a community, the most apparent of which is access to federally backed flood insurance.

Figure 40: Increase in NE NFIP Communities




# 4 Mitigation Strategy

## 4.1 Mission, Goals, and Objectives

In general, when a jurisdiction decides that certain risks are unacceptable, it develops goals and objectives to frame what should occur to mitigate the risk. At the outset, broad-based goals are developed in the form of long-term, general statements. These goals are then used to define objectives to help guide the resulting mitigation actions that will accomplish the goals.

Mitigation strategy goals and objectives from the 2013 State FHMP were first evaluated for their effectiveness, continued relevance, and potential gaps. The goals and objectives of this flood mitigation plan were then revised to be consistent with the 2021 State HMP, the 2013 State FHMP, and FEMA's mitigation action categories. The goals and objectives were initially developed by NeDNR, then made available for review and comment to NEMA, NRDs, and the members of the plan development committee.

Some goals and objectives remained the same, while others were merged or updated. A new goal and objectives were added to better align the plan with other state planning efforts. The goals are numbered for identification only and not ranked. The 2022 flood hazard mitigation goals and corresponding objectives applicable to achieving each goal are listed in Table 39 for the State of Nebraska.

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Table 39: State of Nebraska 2022 flood hazard mitigation goals

| Goal | Objectives |
|---|---|
| Goal 1: Reduce or eliminate long term flood risk to human life and property. | • Objective 1.1: Promote and support initiatives that protect or exclude human habitation in flood zones.<br>• Objective1.2: Improve emergency communication and flood warning systems.<br>• Objective 1.3: Manage development and growth to minimize flood risks.<br>• Objective 1.4: Reduce, remove, or mitigate existing structures in flood hazard areas.<br>• Objective 1.5: Identify opportunities to mitigate vulnerable state facilities, local critical facilities, and other lifeline-related facilities. |
| Goal 2: Preserve and enhance the natural and beneficial functions of floodplains. | • Objective 2.1: Encourage the use of green and natural infrastructure and promote resilient and sustainable construction to reduce vulnerabilities.<br>• Objective 2.2: Encourage integration of future climate trends in planning and design.<br>• Objective 2.4: Promote the continued use of natural systems and features and open space preservation in land use planning and development by local jurisdictions. |
| Goal 3: Promote public awareness of flood hazards and post-flooding response. | Objective 3.1: Provide educational opportunities to the public to learn about flood risk, flood mitigation, floodplain management, and post-flooding response. |
| Goal 4: Coordinate with federal, state, and local partners for flood mitigation planning and program efforts. | • Objective 4.1: Provide technical assistance to communities, state agencies, and federal agencies to assist with flood hazard identification.<br>• Objective 4.2: Provide best available floodplain mapping and regulatory data for floodplain management and hazard mitigation planning purposes.<br>• Objective 4.3: Coordinate with state and federal agencies regarding disaster response.<br>• Objective 4.4: Coordinate with state and local agencies on mitigation efforts and promote resiliency and sustainability. |

## 4.2 Mitigation Actions

Mitigation actions are activities or projects that support the accomplishment of the goals and mission. They are sustained actions taken to reduce or eliminate long-term risk to people and property from flood hazard and its effects. As natural disasters become more frequent and costly from which to recover, implementation of mitigation actions becomes ever more

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important. According to the National Institute of Building Sciences, every $1 spent on federal mitigation grants towards flood mitigation prevents an average $7 in post disaster recovery and repair costs. Simply put, mitigation saves money.

Mitigation actions identified in the 2013 State FHMP were reviewed to assess ongoing validity, alignment with FEMA initiatives and NeDNR programs, and coordination with the 2021 State HMP. Based on these criteria, a new portfolio of mitigation actions was developed. The potential mitigation actions, along with corresponding goals and objectives, are presented below as Table 40 and in Appendix C.

The following mitigation actions are proposed as holistic, discrete, and cost-effective approaches to flood hazard mitigation. The mitigation actions have been grouped in accordance with FEMA's four mitigation action categories:

- Structure and Infrastructure: These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct manmade structures to reduce the impact of hazards. Many of these types of actions are projects eligible for funding through the FEMA Hazard Mitigation Assistance program.
- Local Plans and Regulations: These actions include government authorities, policies, or codes that influence the way land and buildings are developed and built.
- Natural Systems Protection: These are actions that minimize damage and losses and preserve or restore the functions of natural systems. A host of additional ecosystem services are typically gained with implementing natural system protections. Many of these types of actions are projects eligible for funding through the FEMA Hazard Mitigation Assistance program.
- Education and Awareness Programs: These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. These actions may also include participation in national programs, such as the StormReady Communities initiative. Although this type of mitigation reduces risk less directly than structural projects or regulation, it is an important foundation to sustaining mitigation planning and implementation. A greater understanding and awareness of hazards and risks among local officials, stakeholders, and the public is more likely to lead to direct actions.

Table 40: 2022 Updated Mitigation Actions

| Action Category | Mitigation Action |
|---|---|
| **Structure and Infrastructure** | Limit percentage of **impervious surface** within re-developed parcels and those under development. |
| | Incentivize or require the use of **low-impact development** techniques to manage stormwater. |
| | Develop a **buyouts program** to acquire residential properties and local business that experience repetitive flood losses. |
| | Establish a **fund to maintain** or rehabilitate existing flood protection infrastructure, such as flood walls, levees, and diversions. |

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| Action Category | Mitigation Action |
|---|---|
| | Adopt policies to support **green infrastructure** for the absorption and retention of stormwater. |
| | Implement **best management practices for stormwater** when constructing or rehabilitating facilities. |
| | Routinely **clean and repair stormwater drains**, conduits, and other infrastructure. |
| | Require new residential development, walkways, driveways, roadways be elevated and designed such that **dryland access to evacuation** routes out of the floodplain area is ensured. |
| | Add or increase local **freeboard** requirement for structural, mechanical, and electrical equipment to 1 foot or greater. |
| | Require that fill within the SFHA result in **no net loss of natural floodplain storage** by providing equal storage volume at or adjacent to the development site. |
| | Adopt standards for **fill compaction, slope, materials,** and **armoring**. |
| | Use check valves, sump pumps, and **backflow prevention devices** in homes and public facilities. |
| | Increase stormwater utility drainage capacity with **detention and retention basins**, debris removal, and other methods. |
| | Design roadways, bridges, or utilities with **future flood conditions** incorporated. |
| | Use **natural bank stabilization** techniques. |
| | Build **levees or earthen dikes** around flood-threatened **critical public facilities.** |
| | Implement program of regular **maintenance of levees and dams**. |
| | Implement a **safe room program** to disincentivize use of basements in SFHA. |
| **Natural Systems Protection** | Establish or enhance programs to link, manage, and expand existing **parks** and **open space** to help manage stormwater. |
| | Develop an **open space acquisition, reuse, and preservation program** targeting flood hazard areas. |
| | Develop a **land banking program** for the preservation of natural and beneficial functions of flood hazard areas. |
| | Design policy and pursue projects to promote **stream and wetland restoration** for the retention, drainage, and diversion of stormwater. |
| | Obtain property **easements** for use as **water retention** and drainage. |

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| Action Category | Mitigation Action |
|---|---|
| | Require local construction to restore, protect, and **preserve wetlands for stormwater management**, especially those upstream of flood hazard areas. |
| | Adopt **stream and wetland buffers** or **setback** requirements. |
| | For subdivision and large developments, require a **stormwater management plan** limiting peak runoff for rainfall events and limiting impacts to downstream channels and floodplains. |
| | Require or promote the use of **vegetative buffers** around streams, channels, and water sources to sequester and manage runoff. |
| | Encourage the use of rain gardens, vegetation, landscaping, and other **techniques that sequester** and manage **stormwater**. |
| **Education and Awareness Programs** | Collaborate with emergency management to provide **flood forecasting and community warning** or public notification. |
| | **Annually distribute flood safety pamphlets** to residents in flood-prone areas. Encourage landlords to do the same. |
| | Educate citizens about **safety *during* flood** conditions, such as avoiding electrical hazards and not driving through flood water. |
| | **Teach residents** the importance of clearing storm drains of debris and securing propane tanks, yard items, or stored objects that may be swept away or pose a hazard. |
| | Encourage residents to develop **household evacuation plans**. |
| | Require realtors to disclose to potential buyers whether a property has incurred any damage due to flooding, and, pursuant to Neb. Rev. Stat. 76-2,120(4)(h), **disclose** in writing whether the property is in an SFHA. |
| | Direct residents to **GIS hazard mapping online** to better understand their risks. |
| | Identify **transportation solutions** for **vulnerable population** (low- to moderate-income, those living in compromised structures, older adults, individuals with mobility issues, and households with limited English proficiency) in the event of a flood. |
| **Local Plans and Regulations** | Integrate flood hazard mitigation into the community's **comprehensive plan**, agency **strategic plans**, or program guidance materials. |
| | Continually update plans and guidance as **new information** or **best available data** becomes available. |
| | Incorporate multiple **levels of backup safety** in plans should primary flood protections fail. |

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| Action Category | Mitigation Action |
|---|---|
| | Identify **vulnerable community** members and plan for additional support or public services during and after a flooding event. |
| | **Manage development** to limit flooding and improve runoff and stormwater management. |
| | **Prohibit storage of materials** that may be hazardous, flammable, explosive, or buoyant from storage within the SFHA. |
| | Adopt practices that comply with NFIP floodplain management requirements. |
| | Use **transfer of development rights** to allow developers to increase densities on parcels with low flood risk in return for keeping flood-prone areas vacant. |
| | Analyze for **future conditions** and incorporate anticipated conditions into present-day development regulation. |
| | Collaborate with other jurisdictions to incorporate **integrated flood management** approaches that consider entire **basins** or **watersheds** into local plans. |
| | Adopt a cumulative, substantial improvement policy. |
| | Adopt **stormwater management regulations** to promote sequestration of rainwater where it lands. |
| | Adopt **building codes** and establish a program of plans and building inspection. |
| | Create **incentives** that discourage developers to **limit or eliminate development** in flood-prone or critical upland storage areas. |

Appendix C contains a compilation of Flood Mitigation Strategies and Practices Project Sheets to assist local communities in their flood risk mitigation planning efforts. The appendix is divided into four sections based on the type of mitigation activity—Local Plans and Regulations, Education Awareness Programs, Natural Systems Protection, and Structure and Infrastructure. Each project page contains a description of the strategy, its applicability, an approach to implementation, relative cost considerations, and references or links for additional information. The project pages are intended to serve as a menu of mitigation strategies (with supporting information) that communities can choose and incorporate directly into their mitigation planning activities.

### 4.2.1 STATE-LEVEL MITIGATION ACTIONS AND PRIORITIZATION

The 2021 State HMP lays out the following state-level mitigation actions, all of which are applicable to flood hazards:

- Central repository for risk assessment data
- Statewide acquisition strategy for RL and SRL properties

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- Promote participation in hazard reduction community programs
- Establish floodplain management program for channel migration
- Establish program to promote building code updates and enforcement

Table 41 is adapted from the 2021 State HMP, detailing the single prioritization methodology adopted by the State. This ranking matrix is to be used by each department or agency to determine the priority level of each mitigation action. Generally, the ranking matrix prioritizes cost effective projects that are most effective in flood risk reduction (when applied to flood hazard mitigation actions) while minimizing environmental impact or optimizing environmental benefit.

It is the responsibility of each department or agency submitting mitigation actions to individually evaluate their proposed action. Before attempting to score an action, the department or agency should complete an action worksheet (an action worksheet template and example is provided in Appendix C of the 2021 State HMP). Once the data for a proposed action is collected and the action worksheet completed, then the criteria outlined in Table 41 may be utilized to determine the priority for implementation.

### LOCAL PLAN INTEGRATION

The mitigation action ranking matrix and associated action worksheet are applicable to local jurisdictions and should be utilized to complete and update their HMPs. Local jurisdictions are also expected to provide a mitigation action implementation status update with each plan update cycle. The process and forms for doing so are currently under development by NEMA, in collaboration with NeDNR.

Table 41: Mitigation Action Prioritization Ranking Matrix

| Category | Points | Criteria |
|---|---|---|
| Life Safety / Property Protection | 4 | Likely to protect more than 50% of the population and/or critical infrastructure and community assets |
| | 3 | Likely to protect between 25 and 50% of the population and/or critical infrastructure and community assets |
| | 2 | Could potentially protect up to 25% of the population and could potentially protect critical infrastructure and community assets |
| | 1 | Could potentially protect up to 10% of the population and could potentially protect critical infrastructure and community assets |
| | 0 | Potential for protecting lives and critical infrastructure and/or community assets cannot be determined at this time |
| Funding Availability | 4 | Little to no direct expenses |
| | 3 | Can be funded by operating budget |
| | 2 | Grant funding identified |
| | 1 | Grant funding needed |
| | 0 | Potential funding source unknown |

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| Category | Points | Criteria |
|---|---|---|
| Probability of Matching Funds | 4 | Funding match is available, or funding match not required |
| | 2 | Partial funding match available |
| | 0 | No funding match available or funding match unknown |
| Benefit Cost Review | 4 | Likely to meet Benefit Cost Review |
| | 2 | Benefit Cost Review not required |
| | 0 | Benefit Cost Review unknown |
| Environmental Benefit | 4 | Environmentally sound and relatively easy to implement; or no adverse impact on environment |
| | 3 | Environmentally acceptable and not anticipated to be difficult to implement |
| | 2 | Environmental concerns are somewhat difficult to implement because of complex requirements |
| | 1 | Difficult to implement because of significantly complex requirements and environmental permitting |
| | 0 | Very difficult to implement due to extremely complex requirements and environmental permitting problems |
| Technical Feasibility | 4 | Proven to be technically feasible |
| | 2 | Expected to be technically feasible |
| | 0 | Technical feasibility unknown or additional information needed |
| Implementation Timeframe | 4 | 1 year or less (Short-Term) |
| | 2 | 2–5 years (Long-Term) |
| | 0 | More than 5 years (Long-Term) |
| **Minimum Score:** | **0** | |
| **Maximum Score:** | **28** | |
| **Priority Ranking Level:** | **0–10** | **Low** |
| | **11–20** | **Medium** |
| | **21–28** | **High** |

### 4.2.2 MONITORING AND DOCUMENTING PROGRESS OF MITIGATION ACTIVITIES

To monitor the mitigation activities within the state, NeDNR will continue to provide oversight and technical assistance for flood mitigation projects that are undertaken by local or NRD authorities. Mitigation outreach, education, and program initiatives are typically undertaken at the state level by NEMA or NeDNR, with input and participation from NRDs or local authorities.

In recent years, most flood mitigation action projects have been completed using HMGP funds, which are administered by NEMA as the primary funding mechanism. As a result, these projects

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are administered and tracked via NEMA's established processes. These processes are described fully in Section 6 of the 2021 State HMP. As mentioned in Section 3.5.2, Nebraska Flood Risk Probability, NeDNR and NEMA are currently assembling a database of all local hazard mitigation planning actions and statuses reported in LHMPs. The database will be updated whenever a jurisdiction updates its LHMP. The database will be searchable by hazard type as well as several additional factors.

NeDNR will continue to monitor and record the results of mitigation actions for other flood mitigation activities completed under funding authorities such as the Flood Mitigation Assistance (FMA) program or the local NRD. NeDNR will provide technical assistance and floodplain data as necessary. NeDNR will also assist the community with updates to the RL list if the project mitigates RL or SRL properties. Finally, NeDNR will encourage communities to join the Community Rating System (CRS) program and will monitor participation and the progress of current CRS participants.

### 4.2.3 REPETITIVE LOSS MITIGATION STRATEGY

> 44 CFR §201.4 Standard State Mitigation Plans (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. In addition, the plan must describe the strategy the State has to ensure that local jurisdictions with severe repetitive loss properties take actions to reduce the number of these properties, including the development of local mitigation plans.*

It is a priority of the State to ensure property owners in flood risk areas are aware of programs to insure, buy out, and/or flood-proof their structures. Per Hazard Mitigation Assistance Guidance Part VIII.C.1,[70] to qualify for increased federal cost share of 90 percent, properties must meet one of the definitions below, which are consistent with the Biggert-Waters Flood Insurance Reform Act of 2012:

Per 44 CFR 77.2(i) **Repetitive loss structure** means a structure covered under an NFIP flood insurance policy that:

> (1) Has incurred flood-related damage on 2 occasions, in which the cost of repair, on average, equaled or exceeded 25 percent of the value of the structure at the time of each such flood event; and
>
> (2) At the time of the second incidence of flood related damage, the contract for flood insurance contains increased cost of compliance coverage.

Per 44 CFR 77.2(j) **Severe repetitive loss structure** means a structure that is covered under an NFIP flood insurance policy and has incurred flood-related damage:

[70] Federal Emergency Management Agency. 2015. "Hazard Mitigation Assistance Guidance." February 27. https://www.fema.gov/grants/mitigation/hazard-mitigation-assistance-guidance

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(1) For which 4 or more separate claims payments have been made under flood insurance coverage under subchapter B of this chapter, with the amount of each claim (including building and contents payments) exceeding $5,000 and with the cumulative amount of such claims payments exceeding $20,000; or

(2) For which at least 2 separate flood insurance claims payments (building payments only) have been made, with cumulative amount of such claims exceeding the value of the insured structure.

In both instances, at least two of the claims must be within 10 years of each other, and claims made within 10 days of each other will be counted as one claim. In determining SRL status, FEMA considers the loss history since 1978, or from the building's construction if it was built after 1978, regardless of any changes in the building's ownership. The term "SRL property" refers to either an SRL building or the contents within an SRL building, or both.

Note the following additional definitions pertinent to the RL strategy as they apply in NFIP and CRS settings.

Per the April 2021 Flood Insurance Manual with October 2021 Update, an **RL building** is one that meets the following conditions:

(a) The building is insured by a contract of flood insurance issued under the NFIP.

(b) The building has suffered flood damage on two occasions during a 10-year period which ends on the date of the second loss.

(c) The cost to repair the flood damage, on average, equaled or exceeded 25 percent of the market value of the building at the time of each flood loss.

(d) In addition to the current claim, NFIP must have paid the previous qualifying claim, and the State or community must have a cumulative, substantial damage provision or RL provision in its floodplain management law or ordinance being enforced against the building.

The April 2021 Flood Insurance Manual with October 2021 Update utilizes the same SRL definition as stated in 44 CFR 77.2(j) and listed previously.

For CRS program administration purposes, the 2017 CRS Coordinator's Manual defines the following:

**Repetitive loss community**: A community with one or more RL property.

**Repetitive loss property:** A property for which two or more NFIP losses of at least $1,000 each have been paid within any 10-year rolling period since 1978.

**Severe Repetitive Loss property**: As defined in the Flood Insurance Reform Act of 2004, those 1–4 family properties that have had four or more claims of more than $5,000 or two to three claims that cumulatively exceed the building's value. For CRS purposes, non-residential buildings that meet the same criteria as for 1–4 family properties are considered SRL properties.

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Additionally, note that for CRS purposes—such as the development of an RL list required for RL communities—other definitions of "repetitive" that may be found in a local floodplain management ordinance may not be used to determine the number of RL properties in a participating CRS community.

#### 4.2.3.1 *Previous Mitigation Activities*

The following locations were mitigated via FMA funding as confirmed by the NeDNR 3-year verification cycle survey completed in January 2020, including two additional acquisition projects completed in February 2020:

| Address | Community | Address | Community |
|---|---|---|---|
| 435 N 1st St. | Arlington | 640 S Center St. | Beatrice |
| 445 N 2nd St. | Arlington | 703 Grable St. | Beatrice |
| 460 N 2nd St. | Arlington | 721 Grable St. | Beatrice |
| 102 W Court St. | Beatrice | 916 S 8th St. | Beatrice |
| 103 W Court St. | Beatrice | 1105 S 8th St. | Beatrice |
| 305 W Court St. | Beatrice | 1106 S 8th St. | Beatrice |
| 413 W Court St. | Beatrice | 203 S 9th St. | Fort Calhoun |
| 631 S Center St. | Beatrice | 1206 Maenner Dr. | Omaha |

FMA funding supported the Parcel Level Flood Risk Assessment and Mitigation Plan for Deshler, NE. The project evaluated flood risk for numerous properties in Deshler and identified appropriate mitigation options for each structure. The risk assessment and mitigation plan were completed March 2020.

FMA funding was also integral in the installation of flap gates on drainage structures along Highway 103 near DeWitt to reduce the potential for back flow flooding from Turkey Creek. Four RL properties received benefits from this project.

Further, between 2013 and 2014, Hazard Mitigation Assistance (HMA) has been utilized by the Papio-Missouri NRD to complete several buyouts in Bellevue and Sarpy County. Five of the mitigated structures were RL.

NeDNR has a long and established history of coordinating with federal, state, and local entities to implement mitigation measures. The following sections include recently completed projects and other efforts.

##### NEBRASKA SILVER JACKETS REPETITIVE LOSS 2.0

This project was funded in 2018 and completed in March 2021. The project updated the previous statewide 2015 evaluation to include data from FEMA's RL and SRL property inventory, effective date March 21, 2019. The project updated and verified the RL list to provide a baseline that can be used by state and local governments to plan and prioritize mitigation efforts. This

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project was delayed after the 2019 flood to ensure that the correct properties were being evaluated and to determine whether the RL list changed.

After verifying the property data, the study evaluated 34 structures for nonstructural mitigation potential (acquisition, elevation, and wet floodproofing with flood vents). The total project cost estimate for mitigating all 34 structures was $4.7 million, with a net risk reduction benefit of $11.4 million over the project life.[71] Nineteen of the 34 structures showed a positive benefit cost ratio and, if mitigated at an estimated project cost of $2.7 million, would result in $10.4 million in risk reduction benefits. Additionally, the cost of elevation for 10 additional structures was found to be below $175,000. At the time of study this value was considered cost-effective and therefore potentially justifiable for FEMA grant opportunities. However, effective September 30, 2021,[72] FEMA increased the pre-calculated benefits to $323,000 per structure for acquisitions, and $205,000 per structure for elevation projects. It is possible that additional structures in the study could be eligible for FEMA funding.

The full report and supporting data may be requested from Nebraska Silver Jackets.

### LOWER PLATTE RIVER PRE-DEVELOPMENT RISK IDENTIFICATION

This project was funded in 2017. The project developed new hydrologic data for the Lower Platte River from Columbus to the confluence with the Missouri River. The previous study, completed in 1997, used hydrology that was developed in 1975. After the 2019 flood event, USACE obtained funding to update the study to incorporate the gage data to determine whether this event had any impact. The project partners were NeDNR, NEMA, USACE, USGS, and FEMA. This project was completed in October 2020.

### NEBRASKA SILVER JACKETS SANDPITS RISK ASSESSMENT AND RISK MANAGEMENT EVALUATION

This project was funded in 2017 and involved conducting an assessment estimating the flood risks associated with sandpit developments. Sandpit properties are typically located in areas with the highest risk of flooding. In Nebraska, there are roughly 103 sandpit communities along the Elkhorn, Loup and Platte Rivers. These developments provide a beautiful landscape in rural areas that are popular for household to build their homes. Most of these developments are residential with only a few commercial properties. The study looked closely at four of the developments and determined just those four have a nearly 1.14 million dollars estimated annual flood related damages. The study goes on to make recommendations for communities when permitting and planning for these communities. The project partners were NeDNR, NEMA, USACE, and FEMA. The project was completed in August 2021.

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71 Project life is equivalent to 30 years for elevation or flood vents and 100 years for acquisition according to FEMA's BCA Toolkit 6.0.

72 Kayed I. Lakhia. 2021. Update to "Cost-Effectiveness Determinations for Acquisitions and Elevations in Special Flood Hazard Areas Using Pre-Calculated Benefits." FEMA. Memorandum to Regional Administrators Regions I–X. September 29.

#### WOOD RIVER FLOOD RISK IDENTIFICATION

This project was funded in 2019 to update the Wood River hydrology while using HEC-RAS 2D to better understand the complex flow splits and sub-basin interflow. The project was conducted in parallel with a USACE Section 22 project to update the Central Platte hydrology and determine whether ice impacts are a factor in this reach of the Platte River. The Section 22 project was then used to determine the impact of Platte River ice events on the Wood River in areas where the Platte River spills into the Wood River during high events. The project partners were NeDNR, Hall County, USACE, and USGS. This project was completed in November 2020.

### 4.2.3.2 *Ongoing Mitigation Activities*

NeDNR is engaged in several ongoing mitigation activities related to flood mitigation and RL and SRL structures. The full scope of NeDNR activities is outlined in the April 2021 update to the State of Nebraska CTP Business Plan. Notable projects include:

#### LITTLE PAPILLION CREEK HYDRAULIC MODELING AND MAPPING

This is an ongoing project that was funded in 2019. The project team will modify the existing 1D model for the Little Papillion Creek and develop a 2D model near the confluence of the Little Papillion Creek with the Big Papillion Creek. The goal of the modelling effort is to better understand the flood risk from both streams at the confluence. USGS will then incorporate the information into their Flood Inundation Mapper for public distribution. The project partners are NeDNR, Papio-Missouri River NRD, USACE, and USGS.

#### HIGH WATER MARK ARCHIVE

This is an ongoing project that was funded in 2019. Multiple high water mark databases have been created by local, state, and federal partners from different geographic areas and timeframes. The project aims to compile these high water mark databases into a single, shareable database. The project partners are NeDNR, USGS, and USACE.

#### EDUCATIONAL RESOURCES TOOLKIT

This is an ongoing project that was funded in 2019. This project aims to develop short modules and study guides, linked to state curriculum standards, that can be integrated into multiple subjects and grade levels to educate students on the dangers of moving water, historic floods, and how to avoid flood risks. The project is being piloted in the Educational Service Unit (ESU) #5 region, with the goal of additional Educational Service Units implementing the curriculum in the future. The project partners are NeDNR, NEMA, USACE, FEMA, NOAA, the Nebraska Forest Service, the University of Nebraska Extension Office, and ESU #5.

#### FLOOD MITIGATION HISTORY PROJECT

This project was funded in 2021. The project involves developing an interactive map and story map outlining past mitigation projects across Nebraska as well as their funding sources. The intent is to raise risk awareness, to serve as a resource for communities, and to highlight the benefits of mitigation. The project partners include USACE, NeDNR, NEMA, FEMA, USGS, Natural Resources Conservation Service (NRCS), and Nebraska DED.

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#### HIGH WATER MARK SIGNS

This project was funded in 2021. It involves locating and developing additional high water mark signs at sites impacted by the historic 2019 flood. The project partners include USACE, NeDNR, NWS, and FEMA.

#### 4.2.3.3 *NeDNR's Repetitive Loss Mitigation Strategy*

NeDNR commits to continuing the following actions to provide a comprehensive approach to reducing RLs throughout the state and serve as the State of Nebraska's Repetitive Loss Mitigation Strategy:

- Provide technical assistance to communities on floodplain management, grant availability and eligibility, local mitigation strategies, and RL property information verification.
- Promote CRS to communities across the state. CRS requires communities to evaluate and analyze RL and SRL properties and potential mitigation alternatives when RL and SRL properties are extant.
- Promote and administer the Flood Mitigation Assistance Grant program, including prioritizing projects that reduce RL and SRL properties for funding.
- Promote the inclusion of RL and SRL mitigation projects and activities in local hazard mitigation planning development and revisions.

# 5 Recovery and Funding Sources

## 5.1 Federal Funding Sources

### 5.1.1 HAZARD MITIGATION GRANT PROGRAM

Following a presidentially declared disaster, HMGP[73] provides funding for impacted communities. HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act. Program guidance can be found in the HMA Guidance document. This grant focuses on funding projects following a disaster that allow applicants to rebuild in a way that reduces the impact future events. Common HMGP projects include:

- Acquisition
- Safe Room
- Elevating flood prone structures
- Utility retrofitting
- Slope stabilization
- Drainage improvements
- Post-disaster code enforcement
- Hazard mitigation plan development

[73] FEMA policy FP-206-2-0003 went into effect on August 27, 2021. This policy requires a higher minimum flood protection of 2.0 feet above base flood elevations. This policy is in effect for all FEMA Hazard Mitigation Assistance programs (HMGP, BRIC, and FMA).

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After a federally disaster declaration, States are awarded 15 percent of the federal portion of the federally declared disaster in HMGP funds. The State then has 12 months from the declaration date to submit sub-applications under this grant. Grant funds may be used to pay up to 75 percent of eligible project costs, the rest must be paid for using a local match. In-kind services and or materials can be substituted to pay for the remaining local match.

### 5.1.2 BUILDING RESILIENT INFRASTRUCTURE AND COMMUNITIES

The Building Resilient Infrastructure and Communities (BRIC) program replaced the Pre-Disaster Mitigation program in fiscal year (FY) 2020. In Nebraska, BRIC is administered by NEMA. The BRIC program focuses on mitigating the risks associated with disaster events. The BRIC program accomplishes this through:

- Capability and capacity building
- Encouraging and enabling innovation
- Promoting partnerships
- Enabling large projects
- Maintaining flexibility
- Providing consistency

For most BRIC projects, up to 75 percent of eligible project costs are covered by the federal grant funds, and at least 25 percent are covered by a local match. For economically disadvantaged rural communities, up to 90 percent of eligible project costs are covered by federal grant funds. FEMA will provide 100 percent of federal funding for applicant and sub-applicant management costs.

In FY2020, $500 million was awarded in BRIC grants nationally. For FY 2021 application cycle, the BRIC program has $1.16 billion available for awards.[74] The notice of funding opportunity is usually announced in August with a deadline of the following January.

### 5.1.3 FLOOD MITIGATION ASSISTANCE PROGRAM

Administered by NeDNR, the FMA[75] program is authorized by Section 1366 of the National Flood Insurance Act of 1968. FMA aims to reduce or eliminate flood risk and damages of frequent, severe events for buildings insured by the NFIP by supporting mitigation and mitigation scoping projects. FMA can also fund management costs. To receive non-emergency funding, applicants and sub-applicants must have developed and adopted a HMP. For FY 2020, $200 million were made available through FMA. The most common projects funded nationally in FY 2020 were:

[74] Federal Emergency Management Agency. 2021b. Press Release HQ-21-244, “Infrastructure Deal Provides FEMA Billions for Community Mitigation Investments.” November 15. https://www.fema.gov/press-release/20211115/infrastructure-deal-provides-fema-billions-community-mitigation-investments

[75] FEMA policy FP-206-2-0003 went into effect on August 27, 2021. This policy requires a higher minimum flood protection of 2.0 feet above base flood elevations. This policy is in effect for all FEMA Hazard Mitigation Assistance programs (HMGP, BRIC, and FMA).

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- Elevations
- Acquisition
- Engineering, Environmental, Feasibility, and/or Benefit-Cost Analysis
- Flood Control
- Mitigation Reconstruction
- Flood Mitigation Planning

The application period usually opens in September and closes the following January. For these projects, the grant will match up to 75 percent of eligible project costs. The federal share for mitigating SRL or RL structures that have NFIP insurance at the time of the application may be increased to 100 percent or 90 percent, respectively. For the FY 2021, $160 million is available through FMA. For FY 2022 through 2026, $700 million per year has been allocated per the Infrastructure Investment and Jobs Act, more than tripling the funds available for future flood mitigation.[76]

### 5.1.4 SAFEGUARDING TOMORROW THROUGH ONGOING RISK MITIGATION ACT

FEMA has been authorized, through the Safeguarding Tomorrow Through Ongoing Risk Mitigation (STORM) Act—signed into law January 1, 2021—to provide capitalization grants to states and eligible tribal governments to reduce risks from disasters and natural hazards. The Infrastructure Investment and Jobs Act, signed on November 15, 2021, provided the STORM Act with $100 million of funding per year for five years.[77] The new FEMA grant program can finance water, wastewater, infrastructure, disaster recovery, and community and small business development projects.

FEMA is in the process of establishing guidelines for accessing the new funding. As with other FEMA funding programs, applicants must have an approved HMP and will be expected to meet the requirements of the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), and the National Historic Preservation Act.

To take advantage of this new funding opportunity, the State of Nebraska will need to enter into an agreement with FEMA to receive federal funding for the purpose of establishing a hazard mitigation revolving loan program.

### 5.1.5 PUBLIC ASSISTANCE PROGRAM

FEMA's Public Assistance (PA) program provides supplemental grants to help communities recover quickly from declared disasters. This grant's goal is to reduce the number of structures that are frequently damaged in disasters. Eligible emergency projects must be done within 6 months and include:

- Debris removal
- Emergency protective measures

[76] Federal Emergency Management Agency. 2021b.

[77] Federal Emergency Management Agency. 2021b.

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Eligible permanent projects must be completed within 18 months and include:

- Roads and bridges
- Water control facilities
- Public buildings and contents
- Public utilities
- Parks, recreational, and other facilities

After a presidentially declared disaster, applicants have 30 days to submit a request for public assistance and 12 months to submit the application. For most projects, the federal grant pays for 75 percent of eligible project costs.

### 5.1.6 COMMUNITY DEVELOPMENT BLOCK GRANT

The Community Development Block Grant (CDBG) is provided by the US Department of Housing and Urban Development (HUD). 70 percent of CDBG funds are provided directly from HUD to "entitlement communities." These communities appropriate their funds as needed. The program provides support for community development projects. These projects include addressing community needs such as infrastructure, economic development, and public facilities. The CDBG program provides the following grants:

- Disaster Recovery (CDBG-DR)
- Entitlement
- Mitigation (CDBG-MIT)
- Section 108 Loan Guarantee
- State

Projects are awarded based on two formulas. Formula A accounts for a project's share of the local population served, population in poverty, and level of overcrowded housing. Formula B accounts for population growth, poverty level, and the number of housing units built before 1940. A project is awarded based on which formula scores higher.

### 5.1.7 EMERGENCY WATERSHED PROTECTION PROGRAM

NRCS's Emergency Watershed Protection Program (EWPP) allows for repair of public infrastructure to pre-disaster levels after a natural disaster. EWPP offers two funding programs:

- Floodplain Easement
- Recovery Assistance

Projects include dam repairs, debris removal, culvert replacement, etc. The disaster can be declared federally or by the NRCS State Conservationist. Funding is ongoing as disasters are declared.

Applications need to be submitted within 60 days of the disaster declaration. Applicants must be a public entity, commonly the county or local resource district. NRCS covers 75 percent of construction costs and 100 percent of engineering costs (up to 7.5 percent of total). The local agency must match 25 percent of the total cost. Project sponsors are responsible for obtaining all USACE permits needed for the project. A benefit-cost analysis will be conducted by NRCS, and the ratio must be greater than 1.

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### 5.1.8 ADDITIONAL FEDERAL FUNDING SOURCES

- Environmental Protection Agency (EPA)
    - Environmental Justice Small Grants Program (EJSG)
    - Region 7 Healthy, Resilient, and Sustainable Materials Management Grant
    - Water Infrastructure Finance and Innovation Act (WIFIA)
- Farm Service Agency (FSA)
    - Emergency Conservation Program (ECP)
- Federal Emergency Management Agency – Administered by NEMA
    - Emergency Management Performance Grant (EMPG)
    - Fire Management Assistance Grants
    - HMGP Post Fire
    - Homeland Security Grant Program
    - Rehabilitation of HHPD Grant Program
    - Tribal Homeland Security Grant Program
- Federal Highway Administration (FHWA) – Administered by NDOT
    - Emergency Relief Program
    - National Highway Performance Program
    - Surface Transportation Block Grant Program (STBG)
    - Transportation Alternatives (TA)
- National Parks Service (NPS)
    - Historic Preservation Fund – Annual State Historic Preservation Office Grants
    - Land and Water Conservation Fund (LWCF)
    - Paul Bruhn Historic Revitalization Grants Program
    - Tribal Heritage Grants
    - Underrepresented Communities Grants Opportunity
- Small Business Administration (SBA)
    - 504 Loan Program
    - 7(a) Loans
    - Community Development Block Grant Disaster Recovery Program
    - Microloan Program
    - United States Department of Housing and Urban Development
- United States Army Corps of Engineers (USACE)
    - Aquatic Ecosystem Restoration (Section 206)
    - Emergency Streambank and Shoreline Protection (Section 14)
    - Flood Damage Reduction (Section 205)
    - Flood Plain Management Services (FPMS)

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    - Flood Risk Management Program (FRMP)
    - Levee Rehabilitation & Inspection Program (PL 84-99)
    - Levee Safety Program
    - Planning Assistance to the States (Section 22)
    - Product Modifications for Improvement of the Environment (Section 1135)
    - Snagging and Clearing for Flood Risk Reduction (Section 208)
- United States Bureau of Reclamation (USBR)
    - Animal and Plant Health Inspection Service
    - Applied Science Grants
    - BOR-CPN Water Conservation Field Services
    - Cooperative Watershed Management Program
    - Drought Contingency Funding
    - Marketing Strategy Grants
    - Small-Scale Water Efficiency Projects
    - Title XVI – Water Reclamation and Reuse
    - Water Conservation Field Services Program
    - WaterSMART Water and Energy Efficiency Grants
- United States Department of Agriculture (USDA)
    - Business and Industry Loan Guarantees
    - Community Facilities Direct Loan and Grant Program
    - Emergency Community Water Assistance Grants
    - Emergency Watershed Protection Program
    - Rural Business Development Grants
    - Special Evaluation Assistance for Rural Communities and Households (SEARCH)
    - Sustainable Agriculture Research and Education (SARE) – Administered by the University of Nebraska – Lincoln (UNL) Extension Office
    - Technical Assistance and Training for Innovative Regional Wastewater Treatment Solutions Grant Pilot Program
    - Water and Waste Disposal Loan and Grant Program
    - Water and Waste Disposal Loan Guarantees
    - Water and Waste Disposal Predevelopment Planning Grants
- Natural Resources Conservation Service (NRCS) – Administered by Nebraska NRCS
    - Emergency Watershed Protection Program – Recovery Assistance
    - Emergency Watershed Protection Program – Floodplain Easement (EWPP-FPE)
    - Environmental Quality Incentive Program (EQIP)
    - Regional Conservation Partnership Program (RCPP)
    - Watershed and Flood Prevention Operations (WFPO)

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- United Stated Geological Survey (USGS)
    - Groundwater and Streamflow Information Program
    - Partners for Fish and Wildlife Program
    - USGS Water Use Data and Research Program

## 5.2 State Funding Sources

### 5.2.1 NEBRASKA COOPERATIVE DEVELOPMENT CENTER FUNDING

#### 5.2.1.1 *Cooperative Business Development Mini Grant*

The Cooperative Business Development Mini Grant provides new and existing cooperatively owned businesses with funding to complete their business development. There are two types of grants offered. The first is for initial development of the co-op, and the second is for established incorporated co-ops or multi-owner businesses. Non-profits, partnerships, sole proprietorship businesses, and businesses located in Omaha, Bellevue, or Lincoln are ineligible. Eligible expenses include:

- Accounting assistance
- Business planning assistance
- Capitalization plans
- Creation of marketing materials
- Education and training
- Feasibility and market studies
- Legal fees for incorporation
- Market development
- Member recruitment activities and materials
- Technical assistance
- Travel funds

The small grants provide up to $2,500 per application. The typical application period is in January of each year.

### 5.2.2 NEBRASKA DEPARTMENT OF ECONOMIC DEVELOPMENT FUNDING

#### 5.2.2.1 *Community Development Block Grant*

CDBG is provided by HUD and administered by NDED. 30 percent of CDBG funds are administered by individual states. The program provides support for community development projects. These projects include addressing community needs such as infrastructure, economic development, and public facilities. The multiple grants provided by the CDBG program include:

- Disaster Recovery
- Entitlement
- Mitigation
- Section 108 Loan Guarantee
- State

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Projects considered for funding benefit low- and moderate-income persons, improve impoverished areas, and address severe health and safety threats. The deadline to submit applications is generally late autumn of each year.

### 5.2.3 NEBRASKA DEPARTMENT OF ENVIRONMENT AND ENERGY FUNDING

#### 5.2.3.1 *Clean Water State Revolving Loan Fund*

The Clean Water State Revolving Loan Fund (CWSRF) grant provides low interest loans to municipalities for the construction of sanitary sewer systems and wastewater treatment facilities. It also provides matching grants to small communities for the same purpose. NDEE, the Nebraska Department of Health and Human Services (DHHS), and the Nebraska Investment Finance Authority (NIFA) oversee certain Drinking Water State Revolving Loan Fund (DWSRF) regulations.

The Nebraska SRF interest rate system is used for interest rates. Early payback may result in the reduction of the annual interest rate. Economically disadvantaged communities may also receive a reduced annual interest rate.

#### 5.2.3.2 *Drinking Water State Revolving Loan Fund*

DWSRF was authorized by the Federal Safe Drinking Water Act in 1966. This program provides low interest loans to eligible public water suppliers to protect drinking water sources or construct new water works. NDEE, Nebraska DHHS, and NIFA oversee certain DWSRF regulations.

The Nebraska SRF interest rate system is used for interest rates. Early payback may result in the reduction of the annual interest rate. Economically disadvantaged communities may also receive a reduced annual interest rate.

#### 5.2.3.3 *Nonpoint Source Water Quality Grants*

The federal government provides funding to each state to reduce nonpoint source water pollution. NDEE oversees the application of these funds within the State of Nebraska. NDEE offers two types of these grants: the Small Project Assistance Grant and the Watershed-Based Grant.

Small Project Assistance Grants provide quick funding for projects in critical need. Eligible projects include local events for demonstrating preparation of a larger watershed-based or state-based project. Each project is granted a maximum of $15,000, and the sponsor must provide 10 percent of the total project cost.

Watershed-Based Grants provide funding to large scale projects that restore or protect water quality within the watershed or groundwater recharge area. Eligible activities include:

- Creation of best management practices
- Source waters restoration
- Technical assistance
- Education

Each grant is limited to $300,000 and the sponsor must provide a 10 percent match of total project costs. 40 percent of the grant must come from non-federal sources.

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#### 5.2.3.4 *Source Water Protection Grants*

NDEE also administers the Source Water Protection Grant program. This fund provides grants to projects that are associated with source water protection in communities that have a population of 10,000 or less and can show financial hardship. Projects primarily focused on education, without tangible action, is discouraged. Land acquisition solely to develop a Wellhead or Watershed Protection Plan, personnel expenses, and operations and maintenance are ineligible activities for the grant. The most common projects to receive this funding include:

- Public education programs
- Water conservation programs
- Pollution prevention
- Restoration or conservation of source water protection areas
- Development of a Wellhead, Watershed, or Drinking Water Protection Plan
- Water quality monitoring
- Evaluations of agricultural practices and education on best management practices
- Installation of signs at protection area boundaries
- Source runoff diversion
- Abandoned well closures

Notice of availability is usually released in late winter or early spring each year. The grant consists of $100,000 total with a 10 percent cost-share.

### 5.2.4 NEBRASKA NATURAL RESOURCES COMMISSION

#### 5.2.4.1 *Water Sustainability Fund*

The Water Sustainability Fund's (WSF) goal is to help fund local projects in line with Neb. Rev. Stat. § 2-1506. NeDNR provides an initial review and filters out all applicants that do not meet the minimum standards. After the Natural Resources Commission (NRC) approves the project, NeDNR and the sponsor enter a contract to handle the funding procedures.

Applications are usually accepted every year in July. The total funding amount varies year to year. For example, the total approved in FY 2018 was almost $8 million, while almost $18 million was approved for FY 2019. Project sponsors must provide 40 percent or more of the total local project costs. 10 percent of the total WSF dollars awarded must go to projects separating storm and sewer water. Also, 10 percent of the total annual fund must be reserved for projects requesting $250,000 or less.

### 5.2.5 NEBRASKA ENVIRONMENTAL TRUST

The Nebraska Environmental Trust (NET) provides funding for projects deemed to conserve, enhance, and restore natural environments in Nebraska. NET focuses on projects where private and public partners cooperate to develop high-quality, cost-effective, and long-term results.

Funding varies year to year and is managed by the six-member NET board. Applications are accepted on or before the first Tuesday after Labor Day in September. Applications are then rated and ranked against each other. Grants can be funded in up to 3-year increments. No sponsor match is necessary, but it is rare that a project is funded completely through NET.

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### 5.2.6 ADDITIONAL STATE FUNDING SOURCES

- Nebraska Department of Economic Development
  - Civic and Community Center Financing Fund (CCCFF)
  - Community Development Assistance Act (CDAA)
  - Economic Development Certified Community
  - Enterprise Zones
- Nebraska Museums Association
  - Disaster Relief Mini Grants
- Nebraska Tourism Commission
  - Community Impact Grant Program

## 5.3 Other Funding Sources

### 5.3.1 NATIONAL RURAL WATER ASSOCIATION

#### 5.3.1.1 *Rural Water Loan Fund*

The Rural Water Loan Fund (RWLF) provides low-cost loans for small water and wastewater utilities. Eligible utilities must serve fewer than 10,000 people. RWLF was established through a grant from the USDA's Rural Utility Service and has been self-sufficient since then. Eligible projects include:

- Planning costs for infrastructure projects
- Replacing equipment
- System upgrades
- Maintenance costs
- Small capital projects
- Energy efficiency projects
- Disaster recovery or emergency loans

Loans may not exceed $100,000 or 75 percent of the total project cost. The maximum repayment period is 10 years. Emergency loans carry no interest for the first 90 days.

### 5.3.2 LOCALIZED FUNDING SOURCES

New funding sources occasionally become available at the local level. Information can be found through local governments, utilities, and private firms. These funding types include but are not limited to:

- Property tax revenues
- Local development fees
- Bonds
- Mitigation banking
- Public-private partnerships

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## 5.4 Common Funding Issues and Challenges

Common challenges and issues with funding mechanisms can be split into two categories, (1) process, and (2) project and implementation. Process issues can include documentation (both in applying for and managing funds), planning and project development, consistency with direction and points of contact for funding, and regulatory requirements and frameworks. Project and implementation issues can include obtaining and certifying matching funds, project operations and maintenance requirements, and other post project construction issues such as rehabilitation.

Process requirements can be a significant hurdle for local communities seeking funding assistance. Some funding sources, such as FEMA's BRIC program, require significant administration and documentation effort. This can include up to one full-time employee depending on the funding mechanism and significance of the expenditures. Other funding sources, such as NRCS, WFPO, or USACE programs, do require a full feasibility process often lasting 1–2 years.

Project and implementation issues are important to consider from the outset when seeking funding, particularly for smaller communities. Local matches are critical to project success. Finding project partnerships and interested partners to help sponsor the project with matching funds can greatly increase a project's chance for success. Furthermore, it is important to consider who will bear the long-term responsibility for the project's operation once it is complete to ensure it continues to function as designed.

# 6 Capabilities and Challenges of Nebraska Flood Hazard Mitigation Programs

## 6.1 State Capability Assessment

This section describes the State authorities, policies, regulations, and programs for state agencies and other political subdivisions to support flood mitigation efforts in Nebraska. A detailed review of state hazard mitigation capabilities is provided in the State HMP—Final Version 1.2 (revision date September 7, 2021) in Section 4.3, State Capability Assessment. A synopsis of State agencies and their capabilities specific to flood mitigation projects is provided in the following sections.

### 6.1.1 STATE POLICIES AND REGULATIONS

This section describes the State authorities, policies, and regulations that support state agency flood mitigation authority and that of other political subdivisions, such as natural resource districts. The following sections describe the legal authority, policies, and agencies or entities that support flood hazard mitigation efforts in Nebraska.

#### 6.1.1.1 *Article XI-5, Nebraska State Constitution*

This article allows for cities with populations of more than 100,000 to adopt home rule charters by majority vote of qualified electors. This enables a city to be independent of state legislation where strictly municipal matters are concerned. As an example, cities and counties are the entities responsible for preventing development in hazard-prone areas.

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#### 6.1.1.2 *Nebraska Revised Statute §81-829.31 to §81.829.75 Nebraska Emergency Management Act*

These statutes establish NEMA's authority and responsibilities, which are maintained in the Adjutant General's office. Responsibilities include assisting local governments, cooperating with the federal government and any public or private agency or entity in achieving any purpose of the act, and implementing programs that include disaster mitigation.

The Nebraska Emergency Management Act (effective July 19, 1996) is the foundation of NEMA. The purpose of the Nebraska Emergency Management Act is to reduce vulnerabilities pertaining to people and communities in the state by providing an emergency management system that includes all aspects of preparedness, response, recovery, and mitigation, including flood hazards. The Nebraska Emergency Management Act authorizes the coordination of mitigation activities and assistance in mitigation and disaster prevention within the state. The Nebraska Emergency Management Act addresses pre-disaster mitigation, post-disaster mitigation, and development in hazard-prone areas. For pre-disaster mitigation, "the governor shall consider, on a continuing basis, steps that could be taken to prevent or reduce the harmful consequences of disasters, emergencies, and civil defense emergencies" (§81-0829.43). It also provides the governor with the power to make recommendations for mitigation projects. In addition, the Act gives power to NEMA and other state agencies to study and monitor vulnerable areas and then pursue appropriate mitigation actions. Section 81-0829.42 of the Nebraska Emergency Management Act lists appropriate post-disaster mitigation actions, such as clearing debris and repairing bridges, and provides for "other measures as are customarily necessary to furnish adequate relief in cases of disaster, emergency, or civil defense emergency."

#### 6.1.1.3 *Nebraska Revised Statute §61-200 to §61-229 General Administration – Department of Natural Resources*

These statutes identify the powers, authorities, and general administration pertaining to NeDNR. Included in these statutes (§61-225 through §61-229) are the scope and duties related to the creation of this document, the 2022 State FHMP.

#### 6.1.1.4 *Nebraska Revised Statute §2-4601 to §2-4613 Erosion and Sediment Control Act*

The Erosion and Sediment Control Act outlines the state's policies to strengthen and extend the state's present erosion and sediment control activities and programs for both rural and urban lands, to improve water quality, and to establish and implement—through the Director of Natural Resources and the Nebraska NRC and in cooperation with NDEE, USDA NRCS, and other appropriate state and federal agencies—a statewide, comprehensive, and coordinated erosion and sediment control program to reduce damage from wind erosion and storm water runoff; to retard nonpoint pollution from sediment and related pollutants; and to conserve and protect land, air, and other resources of the state. This program is carried out by the NRDs in cooperation with the counties, municipalities, other local governments and political subdivisions of the state, and other public and private entities.

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#### 6.1.1.5 *Nebraska Revised Statute §2-1501 to §2-15,106 Soil and Water Conservation and Flood Control Needs, State Financial Assistance and Conditions*

These statutes identify the goals, rules, regulations, policies, and procedures pertaining to the protection and conservation of the state's land and water resources. The statutes outline the assistance provided by the state for soil and water conservation and flood control needs as well as the conditions to the available assistance. The statues of the Nebraska NRC (§2-1504) list the Commission's creation, functions, membership, selection, number of terms, and vacancies. Also included within these sections are details regarding state financial assistance programs, such as the Small Watersheds Flood Control Fund (§2-1503.1) and the WSF (§2-1506 through §2-15013). Such statutes are important to the capabilities of the state to protect its valuable resources that cannot otherwise protect themselves. Protecting these resources in turn leads to the protection of Nebraska's population from disaster damages and the impact they have on communities.

#### 6.1.1.6 *Nebraska Revised Statute §46-1601 to §2-1670 Safety of Dams and Reservoirs Act*

The purposes of the Safety of Dams and Reservoirs Act are to regulate all dams and associated reservoirs for the protection of the public health, safety, and welfare and to minimize the adverse consequences associated with the potential failure of dams and reservoirs. The Act outlines the authorities granted to NeDNR, regulations, and policies regarding the construction, modification, and operation of dams and reservoirs in Nebraska.

#### 6.1.1.7 *Nebraska Revised Statute §31-1001 to §31-1023 State Floodplain Management Program*

The Legislature finds that recurrent flooding in various areas of the state presents serious hazards to the health, safety, welfare, and property of the people of the state, both within and outside such areas. The hazards include loss of life, loss of and damage to private and public property, disruption of lives and livelihoods, interruption of commerce, transportation, communication, and governmental services, and unsanitary and unhealthy living and environmental conditions. The wise use of lands subject to flooding is a matter of state concern. The Legislature further finds that the establishment of improved floodplain management practices and the availability of financial assistance to citizens of the state whose property is damaged during times of flooding are essential to the health, safety, and general welfare of the people of Nebraska.

The purposes of sections §31-1001 to §31-1023 are to:

- Grant authorities to NeDNR
- Accelerate the mapping of flood-prone areas
- Assist local governments in the promulgation and implementation of effective floodplain management regulations and other floodplain management practices
- Assure that when state lands are used and state-owned and state-financed facilities are located and constructed, flood hazards are prevented, flood losses are minimized, and the state's eligibility for flood insurance is maintained
- Encourage local governments with flood-prone areas to qualify for participation in NFIP

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#### 6.1.1.8 *Nebraska Revised Statute §2-3201 to §2-3281 Natural Resources Districts*

These statutes discuss the necessity of natural resource protection within the state and establish NRDs as the most efficient way of managing these resources. There are 23 NRDs in Nebraska and by state statute they are responsible for the conservation, protection, development, and management of the state's natural resources. Drainage improvements, erosion and flood prevention, and flood control are included in these responsibilities (§2-3229). The state's NRDs actively participate in flood mitigation planning, floodplain management, and flood risk reduction projects in conjunction with federal, state, and local community partners.

#### 6.1.1.9 *Nebraska Revised Statute §13-327, §16-901, §19-901, and §23-114 Zoning*

Section §19-901 gives the legislative bodies in first class cities (population 5,000 to 100,000), second class cities (population 800 to 5,000), and villages (population 100 to 800) the power to adopt zoning regulations. The powers can only be exercised after a planning commission has been established by the municipal legislative body and a recommended comprehensive development plan has been received. The purpose of this is to promote the health, safety, and general welfare of the community. The zoning regulations adopted by legislative bodies may regulate and restrict the height, number of stories, and size of buildings and other structures, the percent of a lot that may be occupied, the size of yards, courts, and other open spaces, the density of population, and the location and use of buildings, structures, and land for trade, industry, residence, or other purposes. This can only be done after the planning commission has been created and a comprehensive development plan completed.

Section §19-903 regulates what must be included in said comprehensive development plan. Regulations for the plan are designed to "lessen congestion in the streets; to secure safety from fire, panic and other dangers; promote health and general welfare; to provide adequate light and air; to prevent the overcrowding of land; to secure safety from flood; to avoid undue concentration of population; to facilitate the adequate provision of transportation, water, sewage, schools, parks, and other public requirements; to protect property against blight and depreciation; to protect tax base; to secure economy in governmental expenditures, and to preserve, protect, and enhance historic buildings, places, and districts."

The existence of these statutes enhances the ability of local communities to prevent building in hazardous areas and relates to the goals and objectives of this plan. Section §23-114 gives the county board powers to create a planning commission and implement a county comprehensive development plan with zoning regulations and restrictions. Sections §13-327 and §16-901 outline policies and procedures for cities and villages to establish extraterritorial zoning jurisdictions beyond their corporate boundaries. For NFIP participants, this extraterritorial zoning jurisdiction includes enforcing floodplain development regulations.

#### 6.1.1.10 *Nebraska Revised Statute §46-101 to §46-1,163 (Irrigation District Act), §46-501 to §46-573 (Reclamation District Act), and §70-601 to §70-682 (Public Power Districts)*

These statutes outline the formation, powers, procedures, and authorities of irrigation districts, reclamation districts, and public power districts as political subdivisions of the State. These other political subdivisions own and operate infrastructure on streams throughout the state that divert, convey, and store surface water. These districts and their respective infrastructure play a large part in the management of surface water within the state, including actions taken during flooding events to mitigate potential impacts. Actions impacting floodplains undertaken by

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these entities fall under the State's authority as the NFIP program participant and must adhere to the State's floodplain management standards.

## 6.1.2 STATE AGENCIES AND FLOOD MITIGATION RELATED PROGRAMS

The state agencies and regional agencies described in the following sections highlight the primary state and regional-level entity capabilities that participate in, support, and implement flood hazard mitigation plans and initiatives, ensuring that appropriate mitigation actions serve to lower hazard risks and vulnerabilities.

### 6.1.2.1 *Nebraska Emergency Management Agency*

NEMA is charged by state statute to reduce the vulnerabilities of the people and communities of Nebraska from the damage, injury, loss of life, and loss of property resulting from natural, technological, or manmade emergencies and disasters, including flooding. NEMA is the lead agency, along with NeDNR, for the agencies in GTFDR, who work together to pursue appropriate mitigation actions. NEMA and NeDNR also work closely in the development and maintenance of hazard mitigation plans (including all hazard and flood hazard mitigation plans) for the State, as well as support and coordinate the development of local plans statewide.

NEMA's Recovery Section serves as the focal point for state recovery and mitigation efforts by reviewing and monitoring mitigation projects across the state. It also manages the PA Grant Program, HMGP, and BRIC Program. As the lead agency, NEMA is responsible for maintaining the Nebraska HMGP Administrative Plan, which establishes procedures for administering Section 404 of the Stafford Act Hazard Mitigation Grant Program. The plan is amended for each presidential disaster declaration.

### 6.1.2.2 *Nebraska Department of Natural Resources*

The Nebraska Unicameral passed the Nebraska Floodplain Regulations Act on October 24, 1967, which allowed for the implementation of Nebraska Floodplain Regulations Program on April 25, 1968. This predates Congress' approval of the National Flood Insurance Act of 1968, which created NFIP in August 1968. Coupled with Federal efforts, Nebraska has made changes these State Statutes over time. However, the purposes outlined in Nebraska Revised Statutes Chapter 31, Article 10, Flood Plain, has remain largely the same:

- Accelerate the mapping of flood-prone areas
- Assist local governments in the promulgation and implementation of effective floodplain management regulations and other floodplain management practices
- Assure that when state lands are used and state-owned and state-financed facilities are located and constructed, flood hazards are prevented, flood losses are minimized, and the state's eligibility for flood insurance is maintained

Encourage local governments with flood-prone areas to qualify for participation in NFIP, see section 6.1.1.7, Revised Statute §31-1001 to §31-1023 State Floodplain Management Program.

Under Chapter 31, Article 10, of the Floodplain Management Statute, NeDNR is named as the state agency responsible for fulfilling statutory requirements and has State authority for all matters pertaining to floodplain management. NeDNR is responsible for coordinating a program that encourages the wise use of land that subject to flooding. This is accomplished through several endeavors:

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- Developing rules and regulations concerning minimum standards for floodplain management programs in Nebraska
- Providing floodplain management technical assistance to local, state, and federal agencies
- Providing state coordination for the NFIP
- Identifying and delineating floodplains and floodways
- Providing technical assistance for the development of flood mitigation programs
- Administering FEMA's Flood Mitigation Assistance Grant

These endeavors fall under four main responsibilities: Floodplain Management, NFIP Coordination, Flood Risk Identification, and Mitigation Planning. NeDNR capabilities under each of these responsibilities is defined below. NeDNR receives FEMA grants yearly under the Community Assistance Program (CAP) and CTP programs to fund the Floodplain Management program to its current level. It is noted that NeDNR is statutorily required to provide these services to the state whether FEMA support is provided or not. However, without FEMA's funding NeDNR impact on Floodplain Management in the State would be significantly less. For example, staffing would decrease from 13 people to 5 people.

### NEDNR FLOODPLAIN MANAGEMENT

The state helps local communities build and manage their own floodplain management programs by developing minimum standards and offering outreach and technical assistance. Specific activities include:

- Providing base flood elevation information
- Assistance in monitoring floodplain management administration and enforcement
- Assistance to communities in joining NFIP and CRS
- Assistance in developing, reviewing, and approving floodplain management ordinances
- Prepares a quarterly newsletter that focuses on topics such as floodplain mapping, flood insurance, violations, historic flood events, and new or updated FEMA documents
- Developing and maintaining a state model ordinance for floodplain management programs that meets State and Federal rules and regulations.
- Training and educational workshops, including monthly virtual trainings, in-person workshops twice a year, and presenting for professional groups

### NEDNR NFIP COORDINATION:

NeDNR provides state coordination for NFIP serving as a liaison between local, State and Federal partners. NFIP Coordinating Agency activities include:

- Encouraging participation in NFIP and providing technical support to communities wanting to join the NFIP.
- Meeting with communities (frequently to go through their administrative procedures to ensure they meet Federal and State minimum standards.
- Promote and help communities join FEMA's CRS program.

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### NEDNR FLOODPLAIN MAPPING

NeDNR identifies and prioritizes areas that need flood risk data. NeDNR then creates new, accurate, and updated flood risk data in-house using both State and Federal funds. NeDNR prioritizes mapping needs throughout the state by considering the following factors per State Statute 31-1018:

- Potential for future development
- Potential for flood damage or loss of life
- Probability that adequate data and maps will be prepared within a reasonable time by other sources
- Availability and adequacy of any existing maps
- Availability of flood data and other information necessary to produce adequate maps
- Degree of interest shown by local governments in utilizing flood data and maps in an effective floodplain management program.

NeDNR provides several products through the mapping program that are available through NeDNR's Floodplain Management Interactive Map, http://ne.gov/go/floodriskmap, such as:

- Flood Awareness Areas: The floodplain boundaries for the 1 percent annual chance flood based on best available data that is not on a FEMA effective map, but typically in the process of being included on FEMA's Flood Insurance Rate Map (FIRM).
- Preliminary and Effective Maps: The floodplain boundaries for the 1 percent annual chance flood located on FEMA's FIRMs.
- Flood Risk Products:
    - Changes Since Last FIRM: Increases and decreases in SFHA
    - Water Surface Elevation Grids: Elevation as a specific location of each reoccurrence interval
    - Flood Depth Grids: Depth of flooding at a specific location
    - Percent Annual Chance Grids: Probability of flooding occurring at a specific location each year
    - Percent 30-Year Chance Grids: Probability of flooding occurring at a specific location over the course of a 30-year loan
    - Flood Risk Assessment: Same assessment as included in this document
    - Areas of Mitigation Interest: Locations of mitigation interest
    - Depth Grids: Depth of flood water

### NEDNR FLOOD MITIGATION

NeDNR works with communities to mitigate the risk of flood losses by helping them identify mitigation projects and by administrating FEMA's FMA grant. These activities include:

- Administration of the FMA Grant: NeDNR is the applicant for the State of Nebraska and state, local, and tribal governments are the sub-applicants. NeDNR works with sub-applicants to ensure they have complete applications before applying.

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- Real Time Technical Assistance (RTTA): These are projects that piggyback on mapping project to explore mitigation options for areas seeing a significant increase in flood prone lands due to new engineering or environmental impacts.
- Flood Risk Assessment: NeDNR plans to maintain the State Flood Risk Assessment yearly based on new data that is provided through the local HMP, and State agency updated layers.
- Local HMP: NeDNR reviews the flood section for each Local HMP in the state and provides comments to ensure they align with the priorities set forth in the plan.

NeDNR also works closely with Nebraska's NRDs the entities that sponsor or assist with funding most structural flood mitigation projects and many of the hazard mitigation plans across the state. In addition, NeDNR represents Nebraska on multi-state or federal partnership projects, such as the Lower Missouri River Planning Assistance to the States project that resulted from the 2019 flooding event.

NeDNR manages the state Dam Safety Program, which regulates the construction, operation and maintenance of dams statewide. NeDNR maintains an online interactive map that can be utilized to locate any dams in the state by name, National Inventory of Dams ID number, county, or downstream town. In addition, as part of the plan approval process, emergency action plans that include breach inundation areas are reviewed and approved. NeDNR Dam Safety is the administrative agency for the HHPD Grant Program.

#### 6.1.2.3 *Nebraska Department of Administrative Services – Risk Management*

The Nebraska Department of Administrative Services (NDAS) manages insurance purchase and self-insurance of state-owned property, maintaining a database of state-owned properties and insured assets for state agencies. This allows agencies to monitor and understand that insured resources are vulnerable to specific hazards, such as flooding. During disasters, NDAS captures losses to state-owned and managed properties.

#### 6.1.2.4 *Nebraska Department of Agriculture*

The Department of Agriculture provides disaster support that includes connecting producers with the FSA and USDA NRCS, which provides financial and technical assistance to farmers, ranchers, forest landowners, and other private landowners and managers. The agency also conducts internal tracking of self-reported, agriculture-related damages and losses during disasters.

#### 6.1.2.5 *Nebraska Department of Economic Development*

NDED administers CDBG, which provides grants to the state for communities to use in revitalizing neighborhoods and expanding housing, economic opportunities, and community facilities. These funds can be used to incorporate pre-disaster mitigation activities into communities as they address needs and issues and create a more resilient community. Additionally, CDBG funds may be used for the local match on HMA projects.

The state receives funds as a Participating Jurisdiction from the National Housing Trust Fund (HTF) and NDED is the administering agency.

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#### 6.1.2.6 *Nebraska Department of Environment and Energy*

Formerly the Nebraska Department of Environmental Quality and the Nebraska Energy Office, the two agencies were merged in July 2019. NDEE coordinates with the EPA to regulate, monitor, protect, preserve, and enhance the state's air, land, water, and energy resources.

The agency has broad mitigation capabilities related to its authorities, including oversight of hazardous materials mitigation, water and wastewater facilities, monitoring and permitting related to air quality, disaster debris management, and implementation of local weatherization programs with low-interest loans to upgrade and improve utility energy efficiency.

#### 6.1.2.7 *Nebraska Department of Health and Human Services*

Nebraska DHHS is responsible for all health-related and protection and safety programs, and serves as Nebraska's lead in health and medical preparedness, response, recovery and mitigation. This includes important flood-mitigation related services such as monitoring impacts and capacities of state and local health services during flooding events, continuity of medical support and assistance, and assistance in post-flood recovery—such as mold mitigation.

#### 6.1.2.8 *Nebraska Game and Parks Commission*

The Nebraska Game and Parks Commission (NGPC) is responsible for disaster operations, including damage assessment and mitigation in state-owned parks, recreation, and wildlife management areas. It is also responsible for identifying and protecting state listed threatened and endangered species and conducting environmental reviews as part of the approval process required for many flood mitigation projects as well as any federally or state-funded development. Environmental clearance for NEMA-managed mitigation projects is coordinated between NEMA and NGPC. Additionally, NGPC administers the Environmental Trust grants and Land and Water Conservation Fund grants, which can be used to support mitigation projects.

#### 6.1.2.9 *Nebraska State Historic Preservation Office*

Section 106 of the National Historic Preservation Act of 1966 (NHPA) requires federal agencies to consider the effects the projects they carry out, assist, fund, permit, license, or approve will have on historic properties. Housed within History Nebraska, the State Historic Preservation Office (SHPO) reviews all mitigation projects to ensure respect of all historic properties across the state when undertaking any project that might affect these sites. Additionally, the relationship between NEMA and SHPO allows for the development of mitigation activities to reduce risk to the state's historic properties.

SHPO manages state and National Register data on historical structures and archaeological sites, much of which are privately-owned land.

#### 6.1.2.10 *Nebraska Department of Transportation*

NDOT assists in disaster operations during flood response and recovery, including monitoring roadways, setting up closures and detours, and conducting post-flood inspections of bridges, culverts, and roadways. Following the 2019 flooding, NDOT set up four task forces to improve the response and resiliency of the state roadway system to flooding events, focusing on:

1. Vulnerable locations across the state
2. Severity of upcoming storms

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3. Standardized methodology to gather and assess damage data
4. Efficient and responsive processes to fund emergency repairs

NDOT also develops and maintains a Long Range Transportation Plan (LRTP), which considers flood hazards and the resiliency of the state roadway system to those hazards.

#### 6.1.2.11 *University of Nebraska – Lincoln*

The university has various academic and research centers that support flood mitigation, including:

- The Nebraska Public Policy Center focuses on research and projects to support policy-related initiatives in coordination with partners across a wide variety of topics including plans, studies, white papers, and briefing papers.
- The School of Natural Resources acts as a provider of natural resources information for stakeholders across Nebraska. Information on natural resources, ecosystems, climate, soils, air, plants, and wildlife and their interaction with citizens helps guide the development of flood mitigation projects that have a positive impact on the surrounding environment.
- The Nebraska State Climate Office compiles, synthesizes, and translates climate information for dissemination, providing near-term and long-term climate forecasts to the media, agriculture and educational audiences, government agencies, and the public.
- The Nebraska Extension Service serves as a resource center of technical information for families, businesses, and communities as they prepare for and recover from a disaster. The University of Nebraska – Lincoln has a statewide disaster coordinator and 83 extension offices to support local communication and education.

#### 6.1.2.12 *Natural Resources Districts*

NRDs across the state have acted as the local champions for most structural flood mitigation projects over the past couple of decades. NRDs participate and lead many of the local multi-jurisdictional flood hazard mitigation planning efforts. They also participant in development of other natural resource and water management plans, encouraging elements such as open space and riparian corridor preservation that support resiliency to flooding events. Many NRDs also provide technical support to local communities in reviewing and administering their floodplain development management program. Finally, NRDs have programs to provide technical and financial support to local communities during response and recovery from flooding events.

#### 6.1.2.13 *Public Power Districts and Irrigation Districts*

Public power districts and irrigation districts own and operate diversion, conveyance, and storage infrastructure on streams throughout the state. These facilities play a large part in the conveyance and use of water in Nebraska during normal conditions, as well as diversion and storage of flood flows using their facilities to mitigate impacts during flooding events.

### 6.1.3 STATE MULTI-AGENCY/MULTI-JURISDICTIONAL COORDINATION

Effective hazard mitigation brings together various organizations at all levels of government. All organizations need to function as a cohesive body to plan properly for disaster preparedness, response, and recovery. No one organization acting alone would be able to provide the

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resources to implement the State FHMP. There are many organizations that contribute to flood hazard mitigation efforts in Nebraska. The organizations described in the following sections highlight the state-level coordination bodies that oversee hazard mitigation planning and ensure that appropriate mitigation actions serve to lower hazard risks and vulnerabilities.

#### 6.1.3.1 *Governor's Task Force for Disaster Recovery*

GTFDR was established by the Governor's Executive Order 94-3 on January 19, 1994, and has the following objectives:

- Ensure disaster relief and recovery operations are coordinated efficiently between all agencies.
- Make a detailed examination of all features of state recovery efforts, including hazard mitigation grant projects with emphasis on the efficient utilization of the resources made available by federal grant programs.

GTFDR is composed of the following state agencies:

- Nebraska Emergency Management Agency
- Nebraska Department of Natural Resources
- Department of Health and Human Services
- Department of Economic Development
- Department of Environmental Quality
- Department of Agriculture
- Department of Labor
- Department of Administrative Services
- Game and Parks Commission
- Department of Transportation

The following federal agencies are also invited to participate in the taskforce:

- US Army Corps of Engineers
- US Department of Agriculture
- US Department of Housing and Urban Development

#### 6.1.3.2 *Nebraska Silver Jackets*

The Nebraska Silver Jackets are a collaborative group that designs plans and solutions for statewide flood risk management issues. Their functions include:

- Facilitating strategic life-cycle flood risk reduction
- Creating or supplementing a continuous mechanism to collaboratively solve state-prioritized issues and implement or recommend those solutions
- Improving processes, identifying and resolving gaps, and counteractive programs
- Leveraging and optimizing resources
- Improving and increasing flood risk communication and presenting a unified interagency message
- Establishing close relationships to facilitate integrated post-disaster recovery solutions

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The Silver Jackets is made up of the following federal and state agencies:

- Nebraska Department of Natural Resources
- Nebraska Emergency Management Agency
- US Army Corps of Engineers, Omaha District
- US Army Corps of Engineers, Kansas City District
- Federal Emergency Management Agency (FEMA Region VII)
- United States Geological Services, Nebraska Water Science Center
- US Department of Agriculture
- National Weather Service (NWS)
- Bureau of Reclamation, Great Plains Region

### 6.1.4 STATE FUNDING CAPABILITIES

Nebraska does not have formal state flood mitigation funding sources. Mitigation projects within the state usually utilize federal mitigation money supplemented by local cost share money. Local cost share money is often provided in part by NRDs. Federal money is typically provided by an established federal grant program. In recent years, HMGP has typically had the most funding available. The BRIC and FMA programs have also been instrumental in providing planning assistance, as well as providing funding for the implementation of several buyouts and flood protection projects. A thorough list of available mitigation and recovery funding sources is provided in Section 5, Recovery and Funding Sources.

NeDNR does receive financial support from FEMA for many of their floodplain management activities, including CAP and CTP program. This support is partial, and it is noted that NeDNR is statutorily required to provide these services to the state whether FEMA support is provided or not.

The HMGP and BRIC programs in Nebraska are administered by NEMA and can mitigate multiple hazards, while NeDNR is responsible for administration of the FMA program. The FMA mitigation grant program pertains only to flood mitigation. All sub-applicants of the three FEMA mitigation grant programs must have a FEMA-approved HMP and be in good standing with the NFIP program to receive funding. Additionally, to receive mitigation funding, applicants and sub-applicants must demonstrate a project's cost-effectiveness via a FEMA-approved benefit-cost analysis. For grantees and subgrantees to be eligible for increased federal cost share in the FMA program, the state and local HMPs must include an RL mitigation strategy. Nebraska's RL mitigation strategy is included in Section 4, Mitigation Strategy.

NRC administers the WSF. The goal of the WSF is to help fund local projects in line with Nebraska Revised Statute §2-1506, which includes flood mitigation as a stated purpose. Local sponsors prepare and submit applications for proposed projects every year in July in a competitive process using NRC defined criteria. Total available funding varies from year to year and local sponsors must provide 40 percent or more of the total project costs.

### 6.1.5 CHALLENGES TO STATE CAPABILITIES

Staffing to support the state's floodplain administration and mitigation efforts has been identified as an ongoing challenge. Increased staffing and continuity in staffing would allow increased engagement of local floodplain administrators, emergency managers and others

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engaged in flood hazard mitigation efforts across the state and bolster the technical resources available to support communities in those activities throughout the state.

Staff continuity is also a critical element to the coordination efforts among state agencies. NeDNR coordinates closely with NEMA on recovery and mitigation efforts and in supporting communities in the development of hazard mitigation plans. Development of Standard Operating Procedures (SOP) for these coordinated activities would provide a consistency and continuity to these joint efforts and mitigate the impacts of staff turnover on the state's capabilities.

The State of Nebraska itself is an NFIP participant. As such, Nebraska must comply with floodplain administration standards to maintain its eligibility within the program. This includes all state agencies, boards and commissions. NeDNR engagement and improved coordination with these entities at the outset and throughout project development and associated actions would enhance compliance with the NFIP program and ultimately benefit the project or activity, the respective agency, and the state. This engagement would also keep NeDNR informed of projects and activities within the floodplain during its hazard mapping efforts, preventing errors in mapping that would be burdensome for communities in the future.

Another challenge to the state's flood hazard mitigation efforts is the lack of a dedicated flood mitigation funding stream to assist communities in meeting local match requirements of federal funding programs, as well as the long-term operation, maintenance, and administration costs of flood hazard mitigation efforts. Further, to access recently allocated STORM Act funds, Nebraska will need to take legislative action establishing the necessary revolving loan program.

These challenges were echoed by results of a survey of members of the Plan Development Committee engaged throughout the development of this plan. This Committee, consisting of federal, state, and local stakeholders engaged in flood mitigation throughout the state of Nebraska, specifically identified staffing and funding at the state level as challenges to flood mitigation efforts.

Specific staffing shortages identified at the state level include:

- Staff to provide technical support to local flood mitigation efforts
- Staff to assist local communities during flooding events and emergency response
- Staff to enhance outreach and education efforts to support and engage local communities
- Staff to support local communities in preparing hazard mitigation grant applications

Funding challenges to flood mitigation efforts—which could potentially be addressed with additional capacity at the state level—include financial support to local communities for matching funds required by many grant programs, as well as the long-term operation and maintenance expenses associated with many flood mitigation projects. Suggestions for funding mechanisms from the Plan Development Committee included a dedicated state funding stream, similar to WSF, specifically for flood mitigation projects and a state revolving loan fund to provide low interest rate loan opportunities to local communities to support flood mitigation projects.

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## 6.2 Programs Administered by Federal Agencies

The State serves as the lead coordinator with several federal agencies that administer programs that support state and local flood mitigation efforts.

### 6.2.1 FEDERAL AGENCIES SUPPORTING HAZARD MITIGATION EFFORTS

The following sections summarize these federal agencies and their programs that support hazard mitigation efforts.

#### 6.2.1.1 *US Department of Agriculture*

FSA maintains an Emergency Conservation Program that provides technical assistance and allows for cost-sharing for damaged farms and ranches (fences, equipment, etc.) and the rehabilitation of crop land, terraces, and permitted farm dams. The Emergency Conservation Program also oversees a Livestock Indemnity Program, which provides benefits to livestock producers for death in excess of normal mortality, such as those caused by flood or adverse weather.

NRCS protects natural resources and critical infrastructure and assists in helping property owners achieve a high level of resilience to protect from future disasters. By implementing the sodbuster and swamp-buster provisions of the Food Security Act of 1985, NRCS helps protect lands that slow and sequester rainfall. Through participation in the Nebraska Healthy Soil Task Force, opportunities are sought for private landowners to promote soil health and reduce water runoff, flooding, and drought impacts. NRCS also has programs such as EWPP, a watershed recovery program to provide technical and financial assistance to local public sponsors to protect critical public infrastructure. Project types include streambank stabilization, removing debris from streams, repairing severely damaged and eroding stream banks (stabilization) that threaten critical infrastructure and other assets, acquisition and relocation of critical infrastructure if unable to restore, and to secure easements for private landowners who desire to restore natural floodplain functions on their property. WFPO programs are intended to provide technical and financial assistance to plan and mitigate flood risks, and restore ecosystems, among other purposes that support local public sponsors in their flood mitigation efforts.

The Risk Management Division maintains high risk maps of areas along the Missouri River, including Richardson, Nemaha, Sarpy, and Cass Counties, that are available to the public. The agency establishes policy rates using a risk assessment model in which high risk areas are identified along the Missouri River based on historic losses and events. Coverage for future planting losses is typically available within a specific timeframe. The agency also provides the opportunity to reduce the loss of products in storage through rebuilding with consideration of future flood risk.

USDA Rural Development provides services that include emergency community water-assistance grants, direct loans for disaster losses to single-family housing, and potential cost share for recovery of wastewater treatment plants.

#### 6.2.1.2 *US Geological Survey*

USGS collects flood data and conducts targeted flood science to help federal, state, and local agencies, decision makers, and the public before, during, and after a flood. Through the National Water Information System, USGS provides streamflow and stage data that characterize the

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extent, severity, duration, and frequency of previous floods and in real-time for active flooding. Streamflow data is available as far back as 1895 and supports flood hazard assessment and other analysis to inform the effectiveness of various flood mitigation measures such as before and after emplacement. USGS offers multiple products that allow our stakeholders and the public to be notified of high-flow conditions and USGS flood response activities. These products include Water Dashboard, WaterAlert, WaterNow, and regional and local flood alerts through RSS feeds. USGS provides interpretive studies including flood inundation maps that show what areas will likely be flooded under various stream stages: for example, two flood inundation libraries for the Big Papillion Creek watershed in Omaha and the North Platte River in Scottsbluff. As in 2019, USGS has the national expertise and capability to conduct extensive high water mark surveying campaigns—mobilization and deployment require a FEMA Mission Assignment. USGS provides training and methods manuals on the collection and recording of high water mark data. The USGS Flood Event Viewer provides easy public access to high water marks as well as data collected at stream gages and other locations during large, short-term floods. This data can also be downloaded through the USGS Short-Term Network Data Portal. USGS can measure peak flood flow and stage at ungaged locations using indirect discharge measurements. USGS flood frequency analysis uses recorded stream data to update annual exceedance probabilities and flood magnitudes. USGS Earth Resources and Science Center provides remotely sensed satellite data, such as the dynamic surface water extent layer, that can help assess and understand the magnitude/extent of flooding, as often as every 8 days. USGS provides cost-share through the Cooperative Matching Fund program for water-related data collection or studies for non-federal agency partners, such as local, county, regional, or state agencies.

#### 6.2.1.3 *US Department of Homeland Security, Cybersecurity, and Infrastructure Security Agency*

The US Department of Homeland Security, Cybersecurity, and Infrastructure Security Agency (CISA) has physical security, cybersecurity, and emergency communication experts who can be deployed to support state and local incidents, as requested and pending availability.

CISA conducts risk assessments for critical infrastructure, focusing on dependencies, interdependencies, and cascading impacts for lifeline functions, including:

- Water Management
- Energy
- Communications
- Transportation
- Healthcare/Public Health

CISA provides data support to inform disaster response and recovery, and hazard mitigation planning, including a static critical infrastructure list of Tier I and II assets whose disruption could cause national or regional catastrophic effects. CISA also maintains a “dynamic” critical infrastructure database and can conduct analysis during an incident that describes threats and vulnerabilities and potential consequences of disruption to critical infrastructure in impacted areas.

CISA maintains a list of critical infrastructure in the 100- and 500-year floodplain. In addition, the protective security advisor assigned to the state can advise critical infrastructure owners and operators on potential mitigation strategies to reduce facility vulnerability. This position works

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with the state to identify critical infrastructure sites that have sustained damage and that could benefit from HMA programs.

#### 6.2.1.4 *United States Army Corps of Engineers*

USACE assists the state in reducing risk to the public, property, and the environment by providing direct and technical assistance to communities. USACE studies provide information on flooding hazards and assist in identifying projects that address hazards. Various trainings, such as sandbagging and flood operations, are also available via USACE. The Nebraska Silver Jackets program is supported by the Flood Risk Management Program. Two funding programs of note include:

- Section 22: May be used for the development of flood mitigation plans with a 50 percent cost share from a non-federal sponsor.
- Section 205: Flood damage reduction program that can be used to study flooding problems in urban areas, towns, and villages. If a federal interest is found, this program can assist in designing and building flood reduction mitigation projects.

#### 6.2.1.5 *United States Fish and Wildlife Service*

USFWS ensures that mitigation projects meet federal requirements for the protection of wildlife and their habitat. This includes providing guidelines for mitigation project requirements such as bird diverters.

#### 6.2.1.6 *US Department of Housing and Urban Development*

HUD works with NDED to adapt programs to meet post-disaster needs and coordinates with the agency for the CDBG and CDBG-DR programs, which provide flexible grants to help cities, counties, and sates recover from presidentially declared disasters, especially in low-income areas.

#### 6.2.1.7 *Federal Emergency Management Agency*

FEMA supports Nebraska's mitigation efforts in several ways. FEMA conducts a thorough review of all LHMPs before approval. Additionally, FEMA Hazard Mitigation Assistance grants provide funding for mitigation projects across the state. NFIP assists in protecting local property owners financially from flooding by providing insurance for participating communities and encouraging smart floodplain management decisions.

FEMA's capabilities in supporting flood mitigation efforts in Nebraska include the following:

- *Community Assistance Program – State Support Services Element (CAP-SSSE*): CAP-SSSE helps states proactively identify, prevent, and resolve floodplain management issues in participating communities before a flood event occurs.
- *Community Rating System:* CRS is a voluntary incentive program that recognizes and encourages community floodplain management practices that exceed the minimum NFIP requirements.
- *Cooperative Technical Partners Program:* The CTP Program leverages partnerships to deliver high-quality hazard identification and risk assessment products, provide outreach support, and empower communities to take action to reduce risk based on informed, multi-hazard-based data and resources. This is in support of FEMA's Risk MAP Program.

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- *Increased Cost of Compliance (ICC) Coverage:* ICC Coverage is included with all NFIP policies located in high-risk flood areas that allow policyholders to receive up to $30,000 to bring their home or business into compliance with local floodplain management regulations.
- *HMA Grants:* FEMA's HMA grant programs provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from future disaster damages. HMA grant programs include the HMGP, FMA, and BRIC.

#### 6.2.1.8 *NOAA/National Weather Service*

NWS provides site-specific weather forecasting and data with a focus on weather, water, and climate. The NOAA NCEI provides a national clearinghouse for all weather events reported through NWS, which provides data from as early as 1950. Data reports include a summary of the incident by county and zone, number of deaths and/or injuries, and the amount of property and/or crop damage resulting from the event.

NWS data supports hazard risk and vulnerability analyses and provides site-specific data that can assist in developing mitigation action applications for grant funding.

### 6.2.2 CHALLENGES TO STATE AND FEDERAL COORDINATION

Many of the programs and initiatives driven by federal agencies are constantly evolving, but guidance and details regarding implementation often take months or years to fully develop, which casts uncertainty over program specifics. The State, serving as the liaison for local communities, often faces many questions for which federal guidance has not been finalized, creating frustration for all parties. The recent FEMA policy on agricultural structure guidance and the rollout of Risk MAP 2.0 are two such examples where guidance and training has lagged for more than a year.

## 6.3 Coordination of Local Mitigation Planning

The process for integrating local plans with the State HMP is described in the State HMP – Final Version 1.2 (revision date September 7, 2021) in Section 5, Local Coordination and Mitigation Capabilities. In general, most procedures for review of local mitigation plans and incorporation of findings from local plans into the State HMP are developed by NEMA. The process for general plan review is provided in the 2021 State HMP. NeDNR assists NEMA with plan reviews and planning process implementation.

NeDNR and other agencies encourage action at the local level through education about flooding risks and mitigation opportunities. NeDNR also assists with facilitating training that helps local NRDs and communities understand the benefits of mitigation planning. NEMA and NeDNR have the authority to advise and advocate the need for sound hazard mitigation planning and project development but are not regulatory agencies with the legislative authority to prevent, regulate, or preclude development in hazard-prone areas. Mitigation strategies are coordinated most successfully through partnerships with local entities throughout the state.

For this planning effort, NeDNR had access to the local HMPs from NEMA’s database of approved plans. NeDNR used this information to inform the development of this plan. Information such as community vulnerabilities, critical facilities, and emergency access routes were compiled into a database for use in this planning effort. This database will be updated during future plan updates to reflect the most recent available data. In addition, these local

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planning efforts informed the development of goals, objectives, and action items to achieve flood mitigation goals.

### 6.3.1 LOCAL POLICIES, PROGRAMS, AND CAPABILITIES

Local capabilities for flood mitigation vary widely across the state. This variability is due largely to population and funding levels. Larger cities, such as Lincoln, Omaha, Norfolk, Columbus, Fremont, and Grand Island, have larger resources. Smaller communities and counties share limited resources for floodplain management and emergency management in general. Implementation of mitigation projects in these areas is often difficult.

Primary policies, programs, and capabilities that support local mitigation efforts include:

- Floodplain management
- Planning capabilities
- Planning and zoning
- Flood mitigation studies and projects
- Education and public awareness

#### 6.3.1.1 *Floodplain Management*

Most flood hazard mapped communities participate in the NFIP which requires the adoption of State and Federal minimum standards for Floodplain Management Programs. In some cases, the regional NRD may serve as the primary contact within the region for mitigation assistance. The benefits of participating in NFIP include:

- NFIP insurance is available to everyone in the community, regardless of location
- Federal grants and loans for development in the identified SFHA are available from federal agencies such as:
    - Environmental Protection Agency
    - Housing and Urban Development
    - Small Business Administration
- Federal disaster assistance for flood damage is available to repair insurable private and public buildings in identified flood hazard areas
- Federal mortgage insurance or loan guarantees, such as those written by:
    - Federal Housing Administration
    - Department of Veteran Affairs
    - Farmer's Home Administration
    - Small Business Administration
    - Fannie Mae and Freddie Mac

As of March 2022, 419 communities participate in the NFIP. Of these, six jurisdictions (1 percent)—Lincoln, Papillion, Omaha, Fremont, Valley, and Scottsbluff—participate in the CRS by meeting higher standards of floodplain management. This scale rates 1–9 with 1 being the best. Lincoln rates at class 5 with Omaha and Papillion at class 7. Fremont and Valley are at

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class 8 and Scottsbluff is class 9.[78] Since the 2019 State HMP, Omaha has elevated its CRS rating from class 9 to class 7. In terms of flood insurance policies in force, 44 of the top 50 communities present an outreach opportunity for encouraging CRS participation.

#### 6.3.1.2 *Planning Capabilities*

Planning and plan integration allows for participants and the public to operate based on the same guidelines and reduce inconsistencies and confusion. State agencies prepare plans for response and mitigation support and encourage the development of local plans that can address hazard mitigation. When integrated with other local planning efforts (emergency operations plans, comprehensive development or master plans, park plans, transportation plans, etc.) or conducted in concert or partnership with other local entities (watershed or basin plans, all-hazard mitigation plans, etc.), consideration of flood hazards can occur in a holistic manner to increase a community's resilience to those hazards.

#### 6.3.1.3 *Planning and Zoning*

All communities have the authority to adopt and enforce planning and zoning.[79] Planning and zoning gives local communities the ability to coordinate development and land use activities within their community. Flood hazard mitigation measures may be incorporated through land use restrictions, floodplain ordinances, minimum finished-floor elevations on new buildings, or stormwater management requirements, to limit the community's exposure and vulnerability to flood hazards.

#### 6.3.1.4 *Flood Mitigation Studies and Projects*

Overall, flood mitigation projects that have been implemented to date have been very successful; however, due to funding and staffing constraints, the ability to implement mitigation projects at the local level is often low. This capability typically must be supplemented by funding assistance from the regional NRD, as well as technical assistance from state agencies including NeDNR and NEMA.

NRDs often serve to assist communities with development and implementation of mitigation studies and projects. Levels of assistance vary depending on financial and staffing resources. In many cases, if a cost-effective flood mitigation project were to be available to a community, the NRD would provide financial and technical assistance. This assistance is often very helpful to moving mitigation projects forward that may otherwise stall due to the community's funding and staffing limitations.

#### 6.3.1.5 *Public Education and Outreach*

Many communities promote seasonal flood hazard awareness campaigns. Information incudes flood hazard risks, vulnerabilities, mitigation actions, and available resources. This is typically conveyed through traditional media outlets such as print media and public service announcements, as well as the community's websites and social media outlets. Some communities also participate in educational campaigns at elementary and secondary schools.

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[78] Federal Emergency Management Agency. 2021c. "Nebraska CRS Map." October 1. CRSresources.org

[79] Nebraska Revised Statutes §19-901 and §23-114

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### 6.3.2 CHALLENGES TO LOCAL CAPABILITIES

The largest challenge to local flood hazard mitigation capabilities continues to be adequate resources. Many communities lack dedicated flood hazard mitigation staff or, rather, it is an additional assignment to staff that may already have limited capacity. Staff may also lack the necessary skillset for preparing grant applications and identifying partnerships and funding opportunities.

Many local communities lack the required funding for local cost share requirements for participation in state and federal funding opportunities. In addition, they lack the sustained funding stream for operation, maintenance, and administration required for many flood hazard mitigation projects and programs.

The Plan Development Committee survey results also identified the extended duration that is often associated with flood recovery efforts as a unique challenge. Many times, recovery and subsequent mitigation efforts extend years beyond the event occurrence. Community support for needed mitigation efforts is often eroded by the passage of time as memories of the flooding event and subsequent damage have grown distant. The additional staffing and funding support at the state level, summarized in Section 6.1.5, Challenges to Local Capabilities, was suggested as a way to reduce the duration of post-flood recovery activities.

## 6.4 What We Learned from the Past

The 2019 flood disaster was an unprecedented event in Nebraska's history and highlighted vulnerabilities statewide. The flooding impacted many communities of all sizes and caused mitigation strategies and priorities to be realigned across the state. As with all disasters, efforts must be taken during the recovery process to review and identify where improvements can be made.

Based on public input collected through multiple outreach campaigns across the State of Nebraska, and from previous lessons learned presented in NEMA's Long-Term Recovery and Resilience Plan, NeDNR was able to align this State FHMP's priorities with public priorities.

Multiple forms of media and in-person meetings were used throughout the public outreach campaign. The campaign began by advertising the comment period on NeDNR's social media platforms, including Facebook, Twitter, and the NeDNR Floodplain Management Newsletter. These advertisements were used to promote the plan itself as well as five meetings during the summer of 2021. During these meetings, the public could meet directly with NeDNR Floodplain Management and NEMA Hazard Mitigation representatives to learn about the plan and provide comments based on their flooding experiences.

The public was also encouraged to provide comments electronically using a form located on NeDNR's webpage and through comment forms on a "Story Map" that led them through a self-guided introduction to the plan. Both methods were advertised via social media and the in-person meetings.

The first comment period lasted from June 1, 2021, until July 23, 2021. Throughout the comment period, NeDNR received dozens of responses to both surveys from Nebraska citizens, local government officials, and state employees.

Of the responses provided, around 35 percent of individuals were very aware of the flood recovery resources available to them, while 21 percent were not aware. The results also indicate that most of the recovery resources accessed during the 2019 flooding were received through

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funding to rebuild homes and businesses, donated services from local or state non-profits, and from emergency and first responder personnel. Unfortunately, some responses to the surveys indicated a negative experience with post-flood recovery processes. These negative responses were primarily attributed to slow interaction with federal agencies, complicated forms, and the amount of funding provided to those who applied.

The respondents were also asked to identify the largest vulnerabilities within their communities that may have caused increased flood impacts. Many of these responses were related to loss of business due to road closures or damages, destruction of levee systems or flood mitigation projects, and impacts to critical infrastructure, such as wastewater facilities and agricultural industries.

Based on the public input received over the course of these outreach campaigns, and from previous lessons learned presented in NEMA's Long-Term Recovery and Resilience Plan, NeDNR was able to produce a list of lessons learned as they relate directly to the priorities of floodplain management.

The lessons learned include the following:

- Disasters can hinder effective coordination and communication. This creates challenges for Nebraskans as they attempt to understand the recovery assistance available to them, what state and local government is doing to alleviate challenges, or how citizens can advocate for their needs. Following the 2019 disasters, some funding entities had difficulty sharing information effectively about disaster recovery resources with impacted communities and individuals.
- Disaster-related federal funding provides a valuable opportunity for states to recover from disaster events, reduce risk from future events, and build resilience over the long-term. However, these programs have significant administrative work and cost-matching requirements that were a major burden on staff statewide following the 2019 disasters. Disbursing funds is also time consuming. While the state can partner with federal agencies to identify opportunities to streamline or adjust policies to increase the efficiency of federal programs, the outcomes of those efforts may not be fully in the state's control.
- While there are numerous federal programs providing funding to support the recovery from the 2019 disaster, the state may experience a shortage of funding to cover the entire cost. Additionally, some recovery costs increase significantly after a disaster. For example, NDOT experienced infrastructure replacement costs that were generally three times higher than expected.
- The 2019 disasters revealed flood risks in areas outside of SFHA. While NeDNR Floodplain Management is actively conducting mapping projects across Nebraska, there must be an understanding that even though flood maps use the best available data, flooding may occur beyond the mapped floodplain.
- Some pre-existing policies and regulations posed notable challenges to response and recovery efforts following the 2019 disaster. Adjusting requirements to provide greater flexibility during and after hazard events could allow for more efficient efforts to respond, recover, and increase resilience across the state. However, in many cases, it may not be practical or feasible to adjust policies.

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- Housing damaged by disasters and left unrepaired can rapidly become a burden to the surrounding community. Similarly, RL properties can create downstream administrative burdens for the state and local communities.
- During flood events, the process for a local jurisdiction to access funding to remediate an impacted property is often cumbersome and may be slower than the community desires.
- Homeowner's and renter's insurance policies typically do not cover damage resulting from flooding. While more than 400 Nebraska communities participate in NFIP, among Individual Assistance Program applicants in 2019, fewer than 20 percent of homeowners and less than 2 percent of renters had flood insurance coverage.[80]
- Raising awareness about flood risk and flood insurance can help increase understanding of insurance policies and encourage Nebraskans to enroll in flood insurance policies.
- Active mitigation measures can be difficult to implement, especially in instances of flooding where conditions can worsen rapidly and without warning. On May 7, 2015, the flooding that impacted the City of Fairbury, Nebraska posed challenges for the community to erect a levee gate in time before flooding spread throughout the city, causing $13 million in damage.[81]

These lessons provided reasons to create a new State FHMP and allowed NeDNR to realign the mitigation priorities for flood response and recovery at the state level. As recovery continues, the state will continue to face many challenges and make decisions about how to best recover from the disasters. This will involve decisions about where and how to allocate limited disaster recovery funds and how to balance the desire for a speedy recovery with the need for a forward thinking and resilient recovery. NeDNR Floodplain Management will continue to align its priorities with those identified during the flooding of 2019 and with future disaster recovery efforts.

## 6.5 Evaluation of Regulatory Framework

Several state flood hazard mitigation programs of neighboring states and from across the United States were reviewed in the context of authorities, regulations, policies, and programs that may benefit or enhance Nebraska's flood hazard mitigation efforts. Through this review, several state-provided functions in successful programs were identified consistently.

### 6.5.1 NATIONAL FLOOD INSURANCE PROGRAM SUPPORT

Most states designate a lead agency as the NFIP coordinating agency. In this role, the lead agency serves as a link between NFIP and communities. In this role, the lead agency guides and assists local communities to qualify for NFIP, assists in development of floodplain management regulations that meet NFIP criteria, and provides technical assistance in planning and qualifying for the NFIP CRS.

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[80] Nebraska Emergency Management Agency. 2021. "Long-Term Recovery and Resilience Plan." July. https://nema.nebraska.gov/sites/nema.nebraska.gov/files/doc/Long-Term%20Recovery%20%26%20Resilience%20Plan%20--%20FINAL%20--%20July%202020.pdf.

[81] National Weather Service. n.d. "May 7th, 2015, Heavy rain and flooding." NWS Omaha/Valley Weather Forecast Office. https://www.weather.gov/oax/event_archive_20150507.

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The lead agency also develops statewide minimum standards for compliance with the NFIP program. Many states have adopted the minimum FEMA standards with the understanding that communities may adopt more stringent regulations should they so choose. Some states have adopted more stringent statewide standards than the FEMA minimum, with the most common being the additional 1-foot elevation raise above the base flood elevation for any improvements. An additional example of a more stringent standard is from Wisconsin, which has adopted a 0.1-foot maximum surcharge for defining floodways (compared to the 1-foot allowable FEMA surcharge minimum). The lead agency also often develops model zoning ordinances that incorporate the state standards for local communities to adopt as part of their floodplain management program.

Nebraska's state floodplain policies are consistent with those found nationally and include three standards that are more stringent than the NFIP minimum standards:

1. 1-foot above base flood elevation for any improvements
2. No habitable structures allowed to be constructed within a floodway boundary
3. No storage of hazardous materials within a flood hazard area

FEMA Policy FP-206-2-0003 provided interim guidance, effective August 27, 2021, stating that a higher minimum flood protection elevation of 2.0 feet above base flood elevations would apply to all FEMA Hazard Mitigation Assistance programs (HMGP, BRIC, FMA).

The Plan Development Committee survey results indicated a consensus that Nebraska's state floodplain standards are appropriate to support flood hazard mitigation, and that educational efforts geared toward both local administrators and the public regarding flood hazards and current state floodplain management standards would be more beneficial than pursuing more stringent state standards.

### 6.5.2 NFIP ADMINISTRATION AND REGULATORY SUPPORT

States grant statutory authority for state and local governments to regulate development in flood hazard areas. Generally, three basic approaches have been used across the country to designate this authority:

1. The state explicitly or implicitly grants full regulatory authority to communities and retains no clearly defined regulatory role.
2. The state splits authority with communities by granting the authority to regulate some areas of the floodplain, while retaining regulatory jurisdiction over certain aspects based on flood hazard type or improvement type. For example, North Dakota requires state approval for any floodway development requiring a no-rise analysis, and some states retain permitting authority for state agency-led projects.
3. The state and communities have overlapping or shared regulatory authority over the same activities. For example, Indiana and Iowa have shared authorities through their joint application process.

It is noted that regardless of the authority, it is ultimately the responsibility of the local NFIP participant to comply with NFIP requirements to remain part of the program.

The State of Nebraska's regulatory role is consistent with approach 1, with the exception that state statutes allow the state to administer floodplain regulations within a local community in emergency situations.

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### 6.5.3 TECHNICAL SUPPORT

State lead agencies provide technical support for communities for a variety of efforts. Beyond the assistance in developing ordinances and setting up programs compliant with NFIP, this support may include planning assistance, identifying mitigation actions, and technical assistance in determining flood hazards.

In some cases, states like North Carolina have obtained designated reviewing authority from FEMA and provide review, approval, and processing of all Letters of Map Change statewide. In addition, North Carolina maintains a database of the FEMA effective model files statewide for use by communities.

Most states provide technical assistance upon request in the review of floodplain development permit applications for communities without adequate technical expertise or staff availability, or in cases of complex or unusual flood hazards.

The State of Nebraska's technical support is consistent with that found across the country. NeDNR provides community assistance in developing and reviewing floodplain ordinances, developing and reviewing mitigation plans, and defining flood hazards. NeDNR also provides technical assistance upon request to local communities in reviewing floodplain development permit submittals and interpretations of NFIP regulations. It is noted that NeDNR provides these review services, but the ultimate responsibility for approvals and compliance with the NFIP program lie with the local community.

### 6.5.4 FLOOD HAZARD IDENTIFICATION

Most state lead agencies provide technical leadership in identifying flood hazards throughout the state. In many cases, this has become a primary function and point of emphasis for many of the state programs over the past decade. Recovery funding assistance has been applied to this effort to develop statewide flood hazard information in user-friendly GIS platforms that are readily available for community and public use. This approach has been successful in states such as North Carolina and Texas. This flood hazard information is an expansion of the standard FEMA-defined flood hazards and includes elements such as base level engineering (BLE) hazards, dam and levee breach hazards, and other non-FEMA designated hazard areas. It also enhances the resources available for understanding flood risk greatly throughout the entire state.

As an example of these types of large-scale efforts, the state of Texas, through the Texas Water Development Board, has completed flood hazard risk assessments and established mitigation actions for river basins that have been used for water supply planning efforts since 1996. The effort builds upon previous statewide BLE mapping and the assembly of a detailed database of structures within SFHAs statewide. Most of these efforts were funded through recovery funding from Hurricane Harvey.

NeDNR's role in the flood hazard identification process is consistent with those found nationally. NeDNR has performed BLE mapping and provides a GIS-based platform on their website that is readily available to provide current statewide flood hazard information. This has been accomplished without the large influx of federal monies following disasters that many state programs have benefited from.

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### 6.5.5 TRAINING AND EDUCATION

Most state lead agencies, with the support of FEMA and organizations such as the Association of State Floodplain Managers (ASFPM), have active programs that offer education and training opportunities for community floodplain administrators. These opportunities vary in format and often occur as part of a webinar series or at annual conferences where a larger audience may be reached. Many states have reported improved community performance through these efforts in conjunction with state staff interaction with local communities.

NeDNR's training and education programs for supporting local communities is in the top tier nationally. FEMA's CAP recently conducted an evaluation of state programs to assess their training and education programs. Nebraska was one of six programs nationally rated as Advanced—the highest rating possible.

### 6.5.6 FUNDING

Funding for state programs varies considerably across the country. Funding typically comes in the form of state appropriations, FEMA support from their various programs, permit fees, and funding from declared disasters. This last category is where the largest discrepancy in program funding occurs. Many coastal states have been damaged by hurricanes over the last two decades and have subsequently received substantial federal aid that they have used to support their flood hazard mitigation programs. For example, North Carolina and Texas have used, or are using, this funding to advance their programs greatly.

Iowa is a unique example of a largely state-supported program. In response to the 2008 flooding and repeated flooding on the Missouri and Mississippi Rivers, the state legislature established (and funded) the Iowa Flood Center (IFC) at the University of Iowa. The IFC is an academic center focused on flooding with an outward-facing philosophy on direct service to the people of Iowa. To supplement state funding, the University of Iowa has aggressively pursued and successfully secured grant funding. IFC's projects include the following:

- Flood inundation maps for more than 30 communities
- Floodplain maps for all 99 counties in Iowa
- A statewide stream sensor network for providing and communicating real-time flood hazard information through an interactive website
- Education and outreach programs

Nebraska's funding sources are consistent with most states in types and magnitudes of funding, with the exemption of the federal disaster monies. Nebraska's damages from flooding events over the past two decades have been significant. However, the flooding events are substantially less in comparison to the scale and extent of large events like hurricanes and therefore have received lower levels of federal funding.

## 6.6 Plan Maintenance Process

### 6.6.1 COORDINATION WITH THE STATE HAZARD MITIGATION PLAN

On August 17, 2020, Nebraska's governor approved Legislative Bill 632, directing NeDNR to develop a State FHMP. Upon completion, the plan will be appended to the 2021 State HMP, most recently updated September 7, 2021.

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NEMA is the lead agency for the development and review of the State HMP. This is an ongoing process and changes in hazard mitigation policies and/or programs, funding availability, or a major disaster will prompt future evaluations and modifications to the State HMP. Section 6 of the State HMP describes the method and schedule for monitoring, evaluating, and updating the plan. Information contained within this State FHMP will be updated as part of the overall State HMP process.

NeDNR maintains a strong relationship with NEMA and continues to serve as subject matter specialists, providing new flood hazard data and supporting in the planning process. NeDNR assists NEMA in reviewing the flood portion of LHMPs and in reviewing and selecting BRIC projects. NeDNR also participates in GTFDR and will partake in the planning activities and responsibilities assigned in the State HMP maintenance process.

### 6.6.2 MAINTENANCE OF FLOOD HAZARD MITIGATION PLAN

As a supplement to the State HMP monitoring process, NeDNR will periodically complete additional evaluation and monitoring of the State FHMP. The State FHMP will be evaluated to ensure it is still current and no changes are required. Basic evaluation considerations include:

- Whether the plan's goals and objectives are still relevant
- Changes to the nature or severity of flood hazards and risks
- Whether flood mitigation actions that meet the plan goals and objectives are being completed
- Changes to state or local flood mitigation capabilities
- Effectiveness of flood mitigation actions
- Assessment of the adequacy of plan implementation resources
- Assessment of any implementation problems

This evaluation will be completed by NeDNR mitigation staff in coordination with NeDNR floodplain management section staff, NEMA, other state or federal agencies, NRDs, and local authorities as needed.

The plan will also be evaluated and updated following a major flooding disaster or when new risk assessment data becomes available. Examples of when the plan may be evaluated and updated on an as-needed basis include significant new regulation(s) enacted at the federal or state level that impact mitigation programs or priorities or other circumstances that dictate changes to the State's flood mitigation priorities.

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# Appendix A

## State FHMP Roster of Participating Agencies and Stakeholder Organizations

The agencies and stakeholder organizations named in the following table attended planning meetings and lent subject matter expertise throughout the planning process.

**Table A-1: Roster of Participating Agencies and Stakeholder Organizations**

| Agency | Acronym | Agency | Acronym |
|---|---|---|---|
| Adams County Emergency Management | | City of Creighton | |
| American Red Cross | | City of Crete | |
| Antelope County | | City of Fairbury | |
| Boone County | | City of Falls City | |
| Brown County/Rock County Emergency Management Agency | BREMA | City of Fort Calhoun | |
| Buffalo County Emergency Management | | City of Franklin | |
| Buffalo County Zoning | | City of Gibbon | |
| Cass County Long Term Recovery Group | | City of Gordon | |
| Central Nebraska Economic Development District | CNEDD | City of Gothenburg | |
| Central Platte Natural Resource District | Central Platte NRD | City of Grand Island – Hall County Emergency Management | GI Hall EM911 |
| City of Alliance | | City of Kimball | |
| City of Bassett | | City of La Vista | |
| City of Bellevue | | City of Lyons | |
| City of Blair | | City of Nebraska City | |
| City of Broken Bow | | City of Norfolk | |
| City of Clarkson | | City of North Bend | |
| City of Omaha | | East Coast Long Term Recovery Group – Preparedness | ECLTRG |

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| Agency | Acronym | Agency | Acronym |
|---|---|---|---|
| City of Ord | | Federal Emergency Management Agency | FEMA |
| City of Osmond | | Natural Resources Committee | NRC |
| City of Papillion | | HDR, Inc. | |
| City of Pierce | | Heartland Hope Mission | |
| City of Randolph | | History Nebraska | |
| City of Schuyler | | Howard County Zoning | |
| City of Scottsbluff | | JEO Consulting | |
| City of Scribner | | Kearney County Emergency Management | |
| City of Sidney | | Knox County Emergency Management | |
| City of St. Edward | | Lancaster County Engineering | |
| City of Sutton | | Law Office of Justin Wayne | |
| City of Terrytown | | League of Nebraska Municipalities | |
| City of Valley | | Lewis and Clark Natural Resources District | LCNRD |
| City of Waverly | | Loup Basin Public Health Department | |
| Cuming County | | Lower Elkhorn Natural Resources District | Lower Elkhorn NRD |
| Custer County | | Lower Platte North Natural Resources District | Lower Platte North NRD |
| Custer County Emergency Management | | Lower Platte South Natural Resources District | Lower Platte South NRD |
| Dodge County Emergency Management | | Middle Niobrara NRD | MNNRD |
| Douglas County | | Miller & Associates | |
| National Weather Service Omaha | NWS | Nebraska Game and Parks Commission | NG&PC |
| Natural Resources Conservation Service | NRCS | Nebraska Legislature District 23 | LD 23 |

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| Agency | Acronym | Agency | Acronym |
|---|---|---|---|
| Nebraska Association of County Officials | NACO | Nebraska Legislature District 9 | LD 9 |
| Nebraska Association of Resources Districts | NARD | Nebraska Military Department/Emergency Management Agency | |
| Nebraska Climate Office | | Nebraska Preparedness Partnership | |
| Nebraska Department of Administrative Service | DAS | Nebraska Public Power District | NPPD |
| Nebraska Department of Agriculture | NDA | Nebraska Region 11 Emergency Management Agency | Region 11 EMA |
| Nebraska Department of Economic Development | NDED | Nebraska Region 21 Emergency Management Agency | Region 21 EMA |
| Nebraska Department of Environment and Energy | NDEE | Nebraska Region 44 Emergency Management Agency | Region 44 EMA |
| Nebraska Department of Health and Human Services | DHHS | Nebraska Region 51 Emergency Management Agency | Region 51 EMA |
| Nebraska Department of Insurance | DOI | Nebraska Rural Electric Association | NREA |
| Nebraska Department of Natural Resources | NeDNR | Nemaha County Emergency Management | |
| Nebraska Department of Transportation | NDOT | Nemaha Natural Resources District | Nemaha NRD |
| Nebraska District 35 State Senator's Office | | Nuckolls County Emergency Management Association | Nuckolls County EMA |
| Nebraska Emergency Management Agency | NEMA | Papio-Missouri River Natural Resources District | P-MRNRD |
| Nebraska Farm Service Agency | FSA | Red Willow County Sheriff's Office | |
| Saunders County | | Sarpy County Long-Term Disaster Recovery Group | |
| Stanton County Emergency Management | | Upper Niobrara White Natural Resources District | Upper Niobrara White NRD |

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| Agency | Acronym | Agency | Acronym |
|---|---|---|---|
| STARR II | | Upper Republican Natural Resources District | Upper Republican NRD |
| The King's Garden | | Village of Amherst | |
| The Nature Conservancy, Nebraska Program | | Village of Bellwood | |
| United States Army Corps of Engineers | USACE | Village of Bushnell Volunteer Fire Department | |
| United States Department of Agriculture | USDA | Village of Ceresco | |
| United States Department of Agriculture – Farm Service Agency | USDA | Village of Dunbar | |
| United States Department of Agriculture – Risk Management Agency | USDA | Village of Eustis | |
| United States Department of Agriculture Emergency Support Function #11 | USDA | Village of Firth | |
| United States Department of Agriculture Rural Development | USDA | Village of Malmo | |
| United States Department of Housing and Urban Development | HUD | Village of Oxford | |
| United States Geological Survey | USGS | Village of Petersburg | |
| United Way of the Midlands | | Village of Prosser | |
| University of Nebraska – Lincoln | UNL | Village of Rulo | |
| University of Nebraska – Omaha Medical Center | UNMC | Village of Sterling | |
| Upper Big Blue Natural Resources District | Upper Big Blue NRD | Village of Verdigre | |
| Upper Loup Natural Resources District | Upper Loup NRD | Village of Waterloo | |
| Wayne County Emergency Management Agency | | | |

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# Appendix B

## Risk Assessment Supplemental Content

Table B-1: Nebraska Counties, Quantity Riverine Flooding Events, and Annualized Frequency

| County | Riverine Flooding Events | Annualized Frequency |
|---|---|---|
| Adams | 20 | 0.83 |
| Antelope | 22 | 0.92 |
| Arthur | 0 | 0.00 |
| Banner | 0 | 0.00 |
| Blaine | 2 | 0.08 |
| Boone | 25 | 1.04 |
| Box Butte | 2 | 0.08 |
| Boyd | 10 | 0.42 |
| Brown | 0 | 0.00 |
| Buffalo | 23 | 0.96 |
| Burt | 16 | 0.67 |
| Butler | 22 | 0.92 |
| Cass | 49 | 2.04 |
| Cedar | 18 | 0.75 |
| Chase | 8 | 0.33 |
| Cherry | 8 | 0.33 |
| Cheyenne | 28 | 1.17 |
| Clay | 12 | 0.50 |
| Colfax | 21 | 0.88 |
| Cuming | 33 | 1.38 |
| Custer | 27 | 1.13 |
| Dakota | 25 | 1.04 |
| Dawes | 7 | 0.29 |
| Dawson | 17 | 0.71 |
| Deuel | 5 | 0.21 |
| Dixon | 26 | 1.08 |
| Dodge | 47 | 1.96 |
| Douglas | 44 | 1.83 |
| Dundy | 8 | 0.33 |

| County | Riverine Flooding Events | Annualized Frequency |
|---|---|---|
| Jefferson | 36 | 1.50 |
| Johnson | 9 | 0.38 |
| Kearney | 10 | 0.42 |
| Keith | 11 | 0.46 |
| Keya Paha | 8 | 0.33 |
| Kimball | 28 | 1.17 |
| Knox | 30 | 1.25 |
| Lancaster | 36 | 1.50 |
| Lincoln | 41 | 1.71 |
| Logan | 4 | 0.17 |
| Loup | 3 | 0.13 |
| Madison | 22 | 0.92 |
| McPherson | 1 | 0.04 |
| Merrick | 17 | 0.71 |
| Morrill | 13 | 0.54 |
| Nance | 9 | 0.38 |
| Nemaha | 60 | 2.50 |
| Nuckolls | 9 | 0.38 |
| Otoe | 52 | 2.17 |
| Pawnee | 9 | 0.38 |
| Perkins | 10 | 0.42 |
| Phelps | 13 | 0.54 |
| Pierce | 16 | 0.67 |
| Platte | 37 | 1.54 |
| Polk | 17 | 0.71 |
| Red Willow | 12 | 0.50 |
| Richardson | 59 | 2.46 |
| Rock | 6 | 0.25 |
| Saline | 62 | 2.58 |

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| County | Riverine Flooding Events | Annualized Frequency |
|---|---|---|
| Fillmore | 13 | 0.54 |
| Franklin | 8 | 0.33 |
| Frontier | 20 | 0.83 |
| Furnas | 12 | 0.50 |
| Gage | 26 | 1.08 |
| Garden | 7 | 0.29 |
| Garfield | 5 | 0.21 |
| Gosper | 7 | 0.29 |
| Grant | 2 | 0.08 |
| Greeley | 7 | 0.29 |
| Hall | 25 | 1.04 |
| Hamilton | 16 | 0.67 |
| Harlan | 9 | 0.38 |
| Hayes | 19 | 0.79 |
| Hitchcock | 10 | 0.42 |
| Holt | 17 | 0.71 |
| Hooker | 0 | 0.00 |
| Howard | 13 | 0.54 |

| County | Riverine Flooding Events | Annualized Frequency |
|---|---|---|
| Sarpy | 35 | 1.46 |
| Saunders | 56 | 2.33 |
| Scotts Bluff | 17 | 0.71 |
| Seward | 20 | 0.83 |
| Sheridan | 7 | 0.29 |
| Sherman | 9 | 0.38 |
| Sioux | 6 | 0.25 |
| Stanton | 20 | 0.83 |
| Thayer | 19 | 0.79 |
| Thomas | 2 | 0.08 |
| Thurston | 20 | 0.83 |
| Valley | 7 | 0.29 |
| Washington | 25 | 1.04 |
| Wayne | 11 | 0.46 |
| Webster | 9 | 0.38 |
| Wheeler | 5 | 0.21 |
| York | 18 | 0.75 |

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## NCEI BILLION-DOLLAR FLOOD EVENTS

Table B-2: Billion-Dollar Flood Events Occurring Between 1980 and 2021 in Nebraska

| Event | Summary | CPI-Adjusted Estimated Cost (in Billions) | Deaths |
|---|---|---|---|
| Mississippi River, Midwest, and Southern Flooding<br>July 2019<br><br>03/15/2019 – 07/31/2019 | Additional major flooding impacted many Southern Plains states. Agriculture, roads, bridges, levees, dams and other assets across many cities and towns were affected significantly. The states most affected were Oklahoma, Nebraska, Missouri, Illinois, Kansas, Arkansas, Kentucky, Tennessee, Texas, Mississippi, and Louisiana. Very high water levels also disrupted barge traffic along the Mississippi River, which negatively impacted a variety of dependent industries. Indiana and Ohio were also affected by persistent heavy rainfall that flooded farmland, which prevented and reduced crop planting by millions of acres. | $6.7 | 4 |
| Missouri River and North Central Flooding<br>March 2019<br><br>03/14/2019 – 03/31/2019 | Historic Midwest flooding inundated millions of acres of agriculture and numerous cities and towns. It caused widespread damage to roads, bridges, levees, and dams. The states most affected were Nebraska, Iowa, Missouri, South Dakota, Minnesota, North Dakota, Wisconsin, and Michigan. This flood was triggered by a powerful storm with heavy precipitation that intensified snow melt and flooding. Of note, Offutt Air Force Base in Nebraska was also severely flooded—the third US military base to be damaged by a billion-dollar disaster event over a 6-month period (Sept 2018–Feb 2019). This historic flooding was one of the costliest US inland flooding events on record. | $11.7 | 3 |
| Missouri River flooding<br>May–June 2011<br><br>05/01/2011 – 06/30/2011 | Melting of an above-average snowpack across the Northern Rocky Mountains combined with above-average precipitation caused the Missouri and Souris Rivers to swell beyond their banks across the Upper Midwest (MT, ND, SD, NE, IA, KS, MO). An estimated 11,000 people were forced to evacuate Minot, North Dakota where 4,000 homes were flooded due to the record high water level of the Souris River. Numerous levees were breached along the Missouri River, flooding thousands of acres of farmland. | $2.5 | 5 |

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| Event | Summary | CPI-Adjusted Estimated Cost (in Billions) | Deaths |
|---|---|---|---|
| Midwest Flooding Summer 2008<br><br>04/01/2008 – 06/30/2008 | Heavy rain and flooding caused significant agricultural loss and property damage in Iowa, Illinois, Indiana, Missouri, Minnesota, Nebraska, and Wisconsin with Iowa being hardest hit with widespread rainfall totals ranging from 4 to over 16 inches. | $13.1 | 24 |
| Midwest Flooding Summer 1993<br>06/27/1993 – 08/15/1993 | Severe, widespread flooding in the central US was the result of persistent heavy rains and thunderstorms. There was extensive damage to agriculture, infrastructure, homes, and businesses in many areas across several states. Many river stations also established new records for historical flood heights. This is the costliest non-tropical, inland flood event to affect the United States on record. | $40.9 | 48 |

Table B-3: Exposure to Riverine Flooding

| County | Riverine Flooding Exposure Values | | | |
|---|---|---|---|---|
| | Building Value (Dollars) | Population (Persons) | Population Equivalence (Loss of Life in Dollars) | Agriculture Value (Estimated dollar value of crops & livestock) |
| Adams | 213,334,961.83 | 1773 | 13,478,311,058.23 | 46,736,775.05 |
| Antelope | 22,783,004.40 | 207 | 1,572,095,118.13 | 21,807,227.39 |
| Arthur | – | 0 | – | – |
| Banner | – | 0 | – | – |
| Blaine | – | 0 | – | 0.06 |
| Boone | 51,083,986.56 | 387 | 2,937,482,306.65 | 33,096,327.97 |
| Box Butte | 17,093,995.03 | 141 | 1,074,532,148.39 | 7,216,808.99 |
| Boyd | 43,910,356.56 | 172 | 1,303,505,546.48 | 7,092,492.86 |
| Brown | – | 0 | – | – |
| Buffalo | 207,737,768.66 | 1357 | 10,312,017,722.45 | 31,542,893.64 |
| Burt | 49,424,023.22 | 285 | 2,163,264,725.03 | 48,021,606.17 |
| Butler | 103,469,755.53 | 564 | 4,286,032,028.32 | 23,656,313.10 |
| Cass | 401,580,528.07 | 1974 | 14,998,827,420.12 | 11,180,909.18 |
| Cedar | 77,169,472.96 | 575 | 4,368,526,229.53 | 1,829,883.56 |
| Chase | 4,400,175.08 | 39 | 293,461,956.45 | 8,126,105.07 |

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| County | Riverine Flooding Exposure Values | | | |
|---|---|---|---|---|
| | Building Value (Dollars) | Population (Persons) | Population Equivalence (Loss of Life in Dollars) | Agriculture Value (Estimated dollar value of crops & livestock) |
| Cherry | 1,629,425.45 | 23 | 175,393,906.72 | 2,512.17 |
| Cheyenne | 54,556,788.26 | 369 | 2,805,766,470.47 | 8,772,738.63 |
| Clay | 55,960,034.23 | 402 | 3,052,131,761.19 | 38,947,908.11 |
| Colfax | 377,694,993.47 | 4025 | 30,590,728,824.35 | 83,312,052.58 |
| Cuming | 56,114,881.16 | 381 | 2,895,546,509.56 | 132,103,314.27 |
| Custer | 135,685,467.54 | 688 | 5,227,428,607.87 | 29,263,002.85 |
| Dakota | 88,250,054.07 | 702 | 5,338,417,122.56 | 10,071,149.55 |
| Dawes | 22,791,859.25 | 177 | 1,342,490,678.55 | 3,561,886.42 |
| Dawson | 179,313,809.43 | 1401 | 10,645,065,554.54 | 50,564,516.89 |
| Deuel | 11,289,821.00 | 69 | 525,846,331.88 | 4,109,164.08 |
| Dixon | 11,890,454.91 | 90 | 686,063,461.79 | 1,956,440.09 |
| Dodge | 884,924,204.76 | 7911 | 60,126,948,598.44 | 87,267,046.94 |
| Douglas | 2,191,479,955.48 | 13428 | 102,054,797,589.73 | 22,233,394.62 |
| Dundy | 13,087,086.80 | 83 | 630,602,269.25 | 7,892,754.00 |
| Fillmore | 21,231,004.40 | 166 | 1,258,147,943.88 | 17,548,800.99 |
| Franklin | 14,196,003.38 | 136 | 1,036,161,635.76 | 10,329,033.88 |
| Frontier | 7,610,793.49 | 51 | 384,627,957.05 | 3,814,829.83 |
| Furnas | 17,718,932.73 | 160 | 1,219,437,287.50 | 17,577,497.97 |
| Gage | 229,106,687.42 | 1292 | 9,822,734,666.50 | 23,754,441.47 |
| Garden | 34,210,700.32 | 223 | 1,694,033,724.35 | 3,235,483.61 |
| Garfield | 9,266,983.43 | 66 | 499,615,286.68 | 2,125,072.97 |
| Gosper | 11,439,312.87 | 76 | 574,125,330.94 | 5,848,488.87 |
| Grant | – | 0 | – | – |
| Greeley | 8,295,470.31 | 85 | 642,632,587.23 | 7,379,382.35 |
| Hall | 495,890,749.84 | 3563 | 27,081,432,779.43 | 83,443,404.77 |
| Hamilton | 64,005,053.10 | 556 | 4,227,827,632.61 | 16,075,150.40 |
| Harlan | 16,751,395.53 | 135 | 1,023,951,466.23 | 10,864,112.64 |
| Hayes | 3,361,383.61 | 29 | 222,127,060.22 | 5,026,001.08 |
| Hitchcock | 22,460,358.42 | 99 | 754,538,618.19 | 2,836,065.03 |
| Holt | 14,945,924.83 | 158 | 1,201,139,371.82 | 342,567.98 |
| Hooker | – | 0 | – | – |
| Howard | 78,911,381.85 | 570 | 4,329,915,647.72 | 23,749,174.55 |

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| County | Riverine Flooding Exposure Values | | | |
|---|---|---|---|---|
| | Building Value (Dollars) | Population (Persons) | Population Equivalence (Loss of Life in Dollars) | Agriculture Value (Estimated dollar value of crops & livestock) |
| Jefferson | 41,104,746.66 | 281 | 2,138,663,765.54 | 17,269,536.02 |
| Johnson | 41,963,375.43 | 361 | 2,744,376,826.76 | 9,122,828.21 |
| Kearney | 84,412,943.09 | 595 | 4,519,213,976.85 | 40,196,475.06 |
| Keith | 109,975,933.63 | 308 | 2,343,095,837.33 | 8,879,737.82 |
| Keya Paha | – | 0 | – | 103.49 |
| Kimball | 844,502.51 | 2 | 12,701,937.82 | 174.78 |
| Knox | 160,304,767.28 | 819 | 6,223,727,715.69 | 17,209,766.30 |
| Lancaster | 1,930,139,224.26 | 15158 | 115,200,931,506.14 | 18,540,983.32 |
| Lincoln | 311,881,900.53 | 2289 | 17,399,770,362.68 | 29,268,137.11 |
| Logan | 4,729.40 | 0 | – | 64.20 |
| Loup | 3,096,244.38 | 36 | 269,938,077.09 | 1,154,198.60 |
| Madison | 179,314,855.32 | 1341 | 10,194,592,189.28 | 22,798,160.00 |
| McPherson | – | 0 | – | – |
| Merrick | 219,317,545.24 | 1756 | 13,345,165,019.28 | 87,717,173.08 |
| Morrill | 4,182,403.67 | 21 | 160,683,217.29 | 20,348.44 |
| Nance | 28,497,209.79 | 234 | 1,775,676,210.16 | 23,561,457.08 |
| Nemaha | 30,513,006.22 | 289 | 2,196,514,455.67 | 21,288,781.90 |
| Nuckolls | 24,699,957.09 | 241 | 1,834,391,509.81 | 11,374,065.96 |
| Otoe | 89,138,566.86 | 691 | 5,252,306,009.30 | 21,697,564.55 |
| Pawnee | 21,504,932.17 | 164 | 1,249,691,920.18 | 7,794,374.97 |
| Perkins | 3,806,579.62 | 23 | 175,653,368.98 | 5,017,099.04 |
| Phelps | 30,093,186.86 | 225 | 1,708,928,988.21 | 53,645,943.04 |
| Pierce | 47,308,067.33 | 375 | 2,851,476,479.36 | 24,062,615.40 |
| Platte | 121,127,483.26 | 954 | 7,247,198,192.67 | 91,413,815.61 |
| Polk | 95,229,683.48 | 572 | 4,349,503,197.98 | 51,114,999.45 |
| Red Willow | 43,495,134.21 | 297 | 2,260,701,094.57 | 12,721,015.37 |
| Richardson | 33,552,974.93 | 210 | 1,597,372,166.67 | 21,775,019.24 |
| Rock | – | 0 | – | 0.74 |
| Saline | 325,972,888.21 | 2702 | 20,536,058,021.27 | 17,611,554.91 |
| Sarpy | 781,759,872.11 | 4766 | 36,223,917,312.97 | 9,331,365.49 |
| Saunders | 386,690,702.73 | 2041 | 15,515,108,066.79 | 51,696,504.75 |
| Scotts Bluff | 207,331,245.33 | 1252 | 9,514,128,183.22 | 13,983,744.02 |

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| County | Riverine Flooding Exposure Values | | | |
|---|---|---|---|---|
| | Building Value (Dollars) | Population (Persons) | Population Equivalence (Loss of Life in Dollars) | Agriculture Value (Estimated dollar value of crops & livestock) |
| Seward | 56,213,703.73 | 510 | 3,878,329,607.04 | 16,903,906.87 |
| Sheridan | 13,298,549.17 | 136 | 1,030,518,556.58 | 4,043,864.06 |
| Sherman | 17,890,471.75 | 191 | 1,450,512,266.36 | 10,322,245.32 |
| Sioux | 27,344.42 | 0 | 1,400,736.52 | 182.93 |
| Stanton | 60,050,400.77 | 494 | 3,754,711,918.79 | 19,906,749.95 |
| Thayer | 55,266,409.14 | 357 | 2,711,708,167.03 | 25,123,128.36 |
| Thomas | 1,534,706.55 | 5 | 37,036,754.03 | – |
| Thurston | 23,636,179.84 | 259 | 1,965,163,397.48 | 24,515,594.38 |
| Valley | 16,665,816.56 | 175 | 1,332,573,025.56 | 11,624,724.38 |
| Washington | 127,952,142.55 | 986 | 7,490,643,443.94 | 28,982,411.89 |
| Wayne | 31,719,248.33 | 254 | 1,933,459,547.74 | 15,039,258.45 |
| Webster | 17,185,048.63 | 151 | 1,145,937,925.63 | 33,212,472.99 |
| Wheeler | 4,216,465.65 | 38 | 286,969,854.75 | 8,879,179.14 |
| York | 319,557,649.78 | 2821 | 21,440,450,092.63 | 21,603,357.24 |

## STATEWIDE FLOOD INSURANCE POLICY DATA TABLE

For each of Nebraska's counties, the following table lists the number of policies found in each county, the total dollar amount covered by those policies, the number of losses claimed, and the total net flood insurance payments made. The data has been split to show residential policies (res.) and commercial policies (com.). This data was obtained from PIVOT and represents policies as of September 30, 2021.

Note the following terminology:

- *Number of Losses:* Represents the total number of losses associated with flood insurance policies within a set period.
- *Number of Policies:* Represents the total number of flood insurance policies.
- *Total Coverage:* Represents the total amount of flood insurance coverage including building and contents coverage.
- *Total Net Payments:* Represents the total payments for building, contents, and ICC on all claims minus payment recovery for building, contents, or ICC on all claims.

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### Table B-4: Flood Insurance Data by State and County

| County | Number of Policies | | Total Coverage | | Number of Losses | | Total Net Payments | |
|---|---|---|---|---|---|---|---|---|
| | Res. | Com. | Res. | Com. | Res. | Com. | Res. | Com. |
| NEBRASKA | 6,910 | 1,069 | $1,336,833,500 | $423,862,800 | 5,104 | 142 | $71,452,470 | $14,341,942 |
| Adams | 66 | 0 | $14,707,800 | $0 | 25 | 0 | $309,218 | $0 |
| Antelope | 17 | 0 | $2,667,600 | $0 | 10 | 0 | $384,672 | $0 |
| Arthur | 0 | 0 | $0 | $0 | 0 | 0 | $0 | $0 |
| Banner | 0 | 0 | $0 | $0 | 0 | 0 | $0 | $0 |
| Blaine | 2 | 0 | $73,000 | $0 | 0 | 0 | $0 | $0 |
| Boone | 26 | 2 | $2,500,700 | $131,000 | 11 | 1 | $44,777 | $47,258 |
| Box Butte | 4 | 0 | $962,100 | $0 | 2 | 0 | $0 | $0 |
| Boyd | 17 | 0 | $1,418,600 | $0 | 12 | 0 | $276,377 | $0 |
| Brown | 0 | 0 | $0 | $0 | 0 | 0 | $0 | $0 |
| Buffalo | 155 | 38 | $32,624,600 | $24,313,300 | 40 | 23 | $825,406 | $6,354,164 |
| Burt | 25 | 0 | $5,678,400 | $0 | 49 | 0 | $1,011,688 | $0 |
| Butler | 27 | 0 | $3,175,700 | $0 | 11 | 0 | $288,577 | $0 |
| Cass | 441 | 34 | $106,799,100 | $5,546,600 | 377 | 8 | $6,410,598 | $1,268,584 |
| Cedar | 33 | 0 | $2,792,600 | $0 | 4 | 0 | $23,727 | $0 |
| Chase | 2 | 0 | $385,000 | $0 | 0 | 0 | $0 | $0 |
| Cherry | 0 | 0 | $0 | $0 | 0 | 0 | $0 | $0 |
| Cheyenne | 11 | 0 | $1,642,700 | $0 | 18 | 0 | $63,603 | $0 |
| Clay | 11 | 8 | $2,152,200 | $2,533,400 | 1 | 0 | $1,561 | $0 |
| Colfax | 305 | 14 | $35,600,200 | $848,800 | 121 | 6 | $882,574 | $109,120 |
| Cuming | 21 | 15 | $4,069,400 | $3,521,200 | 23 | 14 | $324,844 | $147,189 |
| Custer | 42 | 8 | $3,828,500 | $480,200 | 11 | 0 | $83,436 | $0 |
| Dakota | 49 | 11 | $13,218,800 | $6,181,300 | 80 | 1 | $672,927 | $225,467 |
| Dawes | 8 | 0 | $1,390,100 | $0 | 0 | 0 | $0 | $0 |
| Dawson | 150 | 30 | $28,469,600 | $9,437,800 | 78 | 9 | $467,966 | $20,130 |
| Deuel | 2 | 0 | $388,800 | $0 | 2 | 0 | $12,035 | $0 |
| Dixon | 7 | 1 | $1,030,500 | $20,000 | 2 | 0 | $32,703 | $0 |
| Dodge | 970 | 84 | $141,771,400 | $29,789,100 | 777 | 17 | $10,680,493 | $1,032,555 |
| Douglas | 1,049 | 284 | $212,446,600 | $118,886,700 | 948 | 15 | $11,452,426 | $1,776,198 |
| Dundy | 0 | 3 | $0 | $166,800 | 1 | 0 | $3,019 | $0 |
| Fillmore | 6 | 0 | $1,220,600 | $0 | 2 | 0 | $25,000 | $0 |
| Franklin | 5 | 0 | $994,700 | $0 | 2 | 0 | $1,858 | $0 |
| Frontier | 0 | 0 | $0 | $0 | 0 | 0 | $0 | $0 |
| Furnas | 2 | 1 | $309,000 | $19,300 | 2 | 0 | $0 | $0 |
| Gage | 50 | 20 | $7,341,900 | $13,017,700 | 152 | 2 | $1,104,682 | $1,282 |
| Garden | 10 | 0 | $1,507,200 | $0 | 1 | 0 | $4,926 | $0 |
| Garfield | 1 | 0 | $175,000 | $0 | 0 | 0 | $0 | $0 |

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| County | Number of Policies | | Total Coverage | | Number of Losses | | Total Net Payments | |
|---|---|---|---|---|---|---|---|---|
| | Res. | Com. | Res. | Com. | Res. | Com. | Res. | Com. |
| Gosper | 3 | 0 | $343,400 | $0 | 0 | 0 | $0 | $0 |
| Grant | 0 | 0 | $0 | $0 | 0 | 0 | $0 | $0 |
| Greeley | 2 | 0 | $490,000 | $0 | 0 | 0 | $0 | $0 |
| Hall | 68 | 19 | $13,568,000 | $4,054,900 | 128 | 0 | $811,439 | $0 |
| Hamilton | 21 | 1 | $4,338,500 | $6,100 | 15 | 0 | $76,650 | $0 |
| Harlan | 3 | 1 | $650,000 | $650,000 | 0 | 0 | $0 | $0 |
| Hayes | 1 | 1 | $350,000 | $12,000 | 0 | 0 | $0 | $0 |
| Hitchcock | 2 | 1 | $424,000 | $6,500 | 0 | 0 | $0 | $0 |
| Holt | 11 | 0 | $1,845,400 | $0 | 6 | 0 | $4,899 | $0 |
| Hooker | 0 | 0 | $6,896,300 | $132,400 | 0 | 0 | $0 | $0 |
| Howard | 43 | 3 | $0 | $0 | 15 | 2 | $189,978 | $0 |
| Jefferson | 3 | 1 | $616,400 | $165,000 | 10 | 0 | $14,186 | $0 |
| Johnson | 13 | 1 | $987,900 | $20,000 | 2 | 0 | $0 | $0 |
| Kearney | 39 | 1 | $8,114,100 | $75,000 | 4 | 0 | $6,349 | $0 |
| Keith | 12 | 13 | $2,395,200 | $5,098,900 | 4 | 0 | $27,085 | $0 |
| Keya Paha | 0 | 0 | $0 | $0 | 0 | 0 | $0 | $0 |
| Kimball | 1 | 0 | $110,000 | $0 | 0 | 0 | $0 | $0 |
| Knox | 88 | 6 | $16,321,500 | $713,600 | 22 | 0 | $730,186 | $0 |
| Lancaster | 880 | 240 | $151,947,300 | $104,805,600 | 253 | 17 | $923,587 | $1,818,552 |
| Lincoln | 165 | 15 | $33,965,900 | $7,622,500 | 74 | 1 | $253,234 | $1,000 |
| Logan | 0 | 0 | $0 | $0 | 1 | 0 | $0 | $0 |
| Loup | 0 | 0 | $0 | $0 | 0 | 0 | $0 | $0 |
| Madison | 110 | 19 | $18,872,500 | $13,096,700 | 64 | 1 | $515,801 | $1,191 |
| McPherson | 0 | 0 | $0 | $0 | 0 | 0 | $0 | $0 |
| Merrick | 62 | 6 | $9,026,400 | $2,806,000 | 15 | 0 | $18,992 | $0 |
| Morrill | 5 | 4 | $1,750,000 | $1,550,000 | 0 | 0 | $0 | $0 |
| Nance | 10 | 2 | $1,952,100 | $869,000 | 4 | 0 | $28,953 | $0 |
| Nemaha | 11 | 1 | $1,575,600 | $550,000 | 15 | 0 | $98,932 | $0 |
| Nuckolls | 5 | 0 | $623,400 | $0 | 5 | 0 | $11,870 | $0 |
| Otoe | 24 | 2 | $2,653,700 | $110,300 | 17 | 0 | $87,867 | $0 |
| Pawnee | 0 | 0 | $0 | $0 | 0 | 0 | $0 | $0 |
| Perkins | 4 | 0 | $770,000 | $0 | 0 | 0 | $0 | $0 |
| Phelps | 6 | 0 | $1,005,000 | $0 | 9 | 0 | $79,046 | $0 |
| Pierce | 25 | 3 | $3,313,500 | $929,600 | 9 | 1 | $182,115 | $15,000 |
| Platte | 196 | 7 | $54,261,000 | $1,789,500 | 75 | 2 | $1,337,414 | $213,000 |
| Polk | 30 | 0 | $3,348,200 | $0 | 4 | 0 | $8,534 | $0 |
| Red Willow | 12 | 2 | $2,018,900 | $2,000,000 | 11 | 0 | $24,838 | $0 |
| Richardson | 11 | 1 | $1,658,800 | $128,000 | 68 | 0 | $1,707,236 | $0 |

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| County | Number of Policies | | Total Coverage | | Number of Losses | | Total Net Payments | |
|---|---|---|---|---|---|---|---|---|
| | Res. | Com. | Res. | Com. | Res. | Com. | Res. | Com. |
| Rock | 1 | 0 | $105,000 | $0 | 0 | 0 | $0 | $0 |
| Saline | 148 | 3 | $14,586,000 | $1,119,600 | 180 | 7 | $1,082,049 | $0 |
| Sarpy | 651 | 77 | $167,635,100 | $31,856,600 | 827 | 2 | $20,865,081 | $415,857 |
| Saunders | 417 | 6 | $111,735,100 | $287,100 | 235 | 4 | $3,859,557 | $125,277 |
| Scotts Bluff | 98 | 46 | $14,180,700 | $13,896,500 | 47 | 1 | $158,745 | $11,815 |
| Seward | 24 | 0 | $4,630,200 | $0 | 25 | 0 | $105,938 | $0 |
| Sheridan | 7 | 0 | $995,900 | $0 | 1 | 0 | $1,192 | $0 |
| Sherman | 5 | 0 | $670,800 | $0 | 0 | 0 | $0 | $0 |
| Sioux | 0 | 0 | $0 | $0 | 0 | 0 | $0 | $0 |
| Stanton | 16 | 2 | $2,722,400 | $1,717,000 | 3 | 1 | $3,405 | $150,000 |
| Thayer | 23 | 6 | $2,518,900 | $1,117,400 | 22 | 0 | $224,323 | $0 |
| Thomas | 0 | 0 | $0 | $0 | 0 | 0 | $0 | $0 |
| Thurston | 4 | 1 | $840,800 | $1,000,000 | 12 | 1 | $52,055 | $500,000 |
| Valley | 5 | 0 | $794,300 | $0 | 8 | 0 | $110,663 | $0 |
| Washington | 46 | 21 | $9,941,000 | $4,666,100 | 135 | 6 | $2,431,210 | $108,304 |
| Wayne | 0 | 0 | $0 | $0 | 4 | 0 | $5,444 | $0 |
| Webster | 3 | 0 | $770,000 | $0 | 3 | 0 | $13,326 | $0 |
| Wheeler | 2 | 0 | $315,000 | $0 | 2 | 0 | $7,763 | $0 |
| York | 80 | 4 | $13,432,300 | $1,450,000 | 8 | 0 | $3,434 | $0 |

## GIS-BASED FLOOD RISK ASSESSMENT RESULTS

County-by-county summaries of at-risk features for each of the three flood hazards assessed are included within Table B-6, Table B-7, and Table B-8. The GIS-based risk assessment tool relied upon available datasets of potential flood hazards and their potential impacts. Flood hazard risks for three types of flood hazards were compiled for this analysis.

1. Riverine Flooding: Riverine flooding inundation limits for the 1-percent annual chance exceedance limits were compiled from FEMA flood hazard mapping, where available, and supplemented with NeDNR developed Flood Awareness Areas.
2. Levee-protected Areas: The National Levee Database and the FEMA datasets defining areas protected by levees were compiled to define extents and properties protected by levees.
3. Dam Failure Inundation: The NeDNR Dam Safety section provided breach inundation limits in the event of dam failure, where available, to assess dam failure risks.

Table B-5 describes the type, source, and dates of the flood risk and potential impacts datasets used in the GIS tool to conduct the risk assessment. Independent verification of the accuracy, completeness, and validity of the datasets provided was not conducted as part of this assessment. The risk assessment was conducted based on flood hazard data provided by others that inherently contains uncertainty in defining the potential flood risks. Results of the risk assessment provide general estimates of those features throughout the state that are at-risk for planning purposes.

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### Table B-5: State FHM GIS Data Sources

| File Name | Data Type | Description | Source | Source URL | Acquisition Date |
|---|---|---|---|---|---|
| Railroad | Polyline | Railroad | North American Rail Lines USDOT BTS | https://hub.arcgis.com/datasets/usdot::north-american-rail-lines/explore | 3/5/2019 |
| Electric Transmission Line | Polyline | Electric Power Transmission Line | Homeland Infrastructure Foundation-Level Data (HIFLD) | https://hifld-geoplatform.opendata.arcgis.com/datasets/electric-power-transmission-lines | 1/1/2021 |
| Levee Centerline | Polyline | Levee Centerlines | NeDNR | – | 5/1/2021 |
| Cultural Resource Building Point | Point | National Register Historic Places Public Dataset | National Parks Service (NPS) | https://irma.nps.gov/DataStore/Reference/Profile/2210280 | 3/3/2021 |
| Cultural Resource District Point | Point | National Register Historic Places Public Dataset | NPS | https://irma.nps.gov/DataStore/Reference/Profile/2210280 | 3/3/2021 |
| Cultural Resource Structure Point | Point | National Register Historic Places Public Dataset | NPS | https://irma.nps.gov/DataStore/Reference/Profile/2210280 | 3/3/2021 |
| Cultural Resource Object Point | Point | National Register Historic Places Public Dataset | NPS | https://irma.nps.gov/DataStore/Reference/Profile/2210280 | 3/3/2021 |
| Cultural Resource Historic Building Polygon | Polygon | National Register Historic Places Public Dataset | NPS | https://irma.nps.gov/DataStore/Reference/Profile/2210280 | 3/3/2021 |
| Cultural Resource Historic District Polygon | Polygon | National Register Historic Places Public Dataset | NPS | https://irma.nps.gov/DataStore/Reference/Profile/2210280 | 3/3/2021 |
| Cultural Resource Historic Site Polygon | Polygon | National Register Historic Places Public Dataset | NPS | https://irma.nps.gov/DataStore/Reference/Profile/2210280 | 3/3/2021 |
| Cultural Resource Historic Object Polygon | Polygon | National Register Historic Places Public Dataset | NPS | https://irma.nps.gov/DataStore/Reference/Profile/2210280 | 3/3/2021 |
| Municipal Limits | Polygon | 2019 Tiger File City Boundaries | US Census Bureau | https://www.census.gov/geo/maps-data/data/tiger.html | 1/1/2019 |
| Wetland NWI | Polygon | US Fish Wildlife Service Wetland Boundaries | US Fish and Wildlife Service (USFWS) | https://www.fws.gov/wetlands/data/data-download.html | 5/29/2019 |
| County Boundary | Polygon | 2010 Tiger File County Boundaries | US Census Bureau | https://www.census.gov/geo/maps-data/data/tiger.html | 1/1/2010 |
| 100-Year Floodplain | Polygon | FEMA Mapped 100-Year Floodplain | FEMA | https://msc.fema.gov/portal/home | 2/15/2021 |

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| File Name | Data Type | Description | Source | Source URL | Acquisition Date |
|---|---|---|---|---|---|
| Schools - Public | Point | Education Facilities | Nebraska Map | https://www.nebraskamap.gov/datasets/school-districts/explore?location=41.464234%2C-99.634600%2C8.52 | 9/27/2021 |
| Schools - Private | Point | Education Facilities | Nebraska Map | https://www.nebraskamap.gov/datasets/school-districts/explore?location=41.464234%2C-99.634600%2C8.52 | 9/27/2021 |
| Agricultural Lands | Raster / Polygon | USDA-NASS Cropland Data Layer - 2020 | USDA / NRCS | https://datagateway.nrcs.usda.gov/ | 7/19/2021 |
| Road Centerlines | Line | Road Centerlines | NeDNR | – | 12/17/2021 |
| DNR Flood Awareness Areas | Polygon | Flood Awareness Areas | NeDNR | – | 12/17/2021 |
| Bridges | Point | Bridges | NeDNR | – | 12/17/2021 |
| Jurisdictional Dams | Point | Jurisdictional Dams | NeDNR | – | 12/17/2021 |
| Non-Jurisdictional Dams | Point | Non-Jurisdictional Dams | NeDNR | – | 12/17/2021 |
| Flood Awareness Areas | Point | Flood Awareness Areas | NeDNR | – | 12/17/2021 |
| Critical Facilities | Point | Critical Facilities Shapefiles From JEOHMPs | NeDNR | – | 5/10/2021 |
| Parcels | Polygon | Statewide parcel database | NeDNR | – | 12/15/2021 |
| Building Footprints | Polygon | Building Footprints | Microsoft / US Building Footprints Public | https://github.com/Microsoft/USBuildingFootprints/ | 6/1/2021 |
| T&E Species | Polygon | Threatened and Endangered Species Ranges | NGPC | https://data-outdoornebraska.opendata.arcgis.com/datasets/threatened-and-endangered-species-ranges/explore?location=41.456104%2C-99.655543%2C7.28 | 6/26/2018 |
| Nebraska State Plane_ft Surface | Raster | Surface Raster 1-Meter DEM | NeDNR | – | 3/4/2022 |
| Leveed Areas | Polygon | Areas protected by Levees | USACE NLD | https://levees.sec.usace.army.mil/#/ | 2/10/2022 |
| Dam Inundation Areas | Polygon | Areas impacted by Dam breaches | NeDNR | – | 3/4/2022 |

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## Table B-6: Critical Facilities[1] and Other Assets at Risk of Riverine Flooding[2]

| County | Natural and Cultural Assets | | | Population | Structures | | Land Use | Emergency | | Dams and Levees | | Transportation | | | | | | Utilities | | Total Values of Improvements at Risk[4] ($) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Roadway[16] (miles) | | Bridges and Culverts (count) | | | Railroad[17] (miles) | Electric Transmission Lines[18] (miles) | Other[3] (count) | |
| | Wetlands[5] (acres) | Threatened and Endangered Species Range[6] (acres) | Cultural Resources[7] (count) | Vulnerable Population[8] (count) | State Owned[9] (count) | Local or Privately Owned[10] (count) | Agricultural Lands[11] (acres) | Emergency Management[12] (count) | Emergency Response [13] (count) | Dams[14] (count) | Levees[15] (miles) | State | Local | State Bridges[19] | State Culverts[20] | Local | | | | |
| Adams | 3,946 | 40,206 | 1 | 1 | 0 | 671 | 23,324 | 2 | 2 | 21 | | 5.5 | 99.6 | 9 | 10 | 179 | 10.6 | 26.9 | | $49,228,153 |
| Antelope | 7,154 | 64,728 | 4 | | 0 | 786 | 32,954 | | | 6 | | 22.5 | 150.9 | 13 | 11 | 96 | 14.3 | 32.5 | | $31,252,035 |
| Arthur[21] | | | | | | | | | | | | | | | | | | | | |
| Banner[21] | | | | | | | | | | | | | | | | | | | | |
| Blaine[21] | 0 | 0 | | | | | | | | | | | | | | | | | | |
| Boone[21] | 0 | 4 | | | | | 0.3 | | | | | | 0.9 | | | 2 | | | | |
| Box Butte[21] | | | | | | | | | | | | | | | | | | | | |
| Boyd | 11,163 | 35,870 | 1 | | 0 | 527 | 4,792 | | 1 | 19 | | 6.0 | 50.9 | 6 | 11 | 41 | | 3.3 | | $6,880,900 |
| Brown[21] | | | | | | | | | | | | | | | | | | | | |
| Buffalo | 19,525 | 88,065 | 2 | 1 | 0 | 1485 | 26,154 | 1 | 2 | 50 | | 12.7 | 156.8 | 37 | 24 | 257 | 3.7 | 49.9 | | $181,356,355 |
| Burt | 6,390 | 68,488 | 1 | 1 | 0 | 271 | 55,131 | | 1 | 13 | 0.7 | 8.1 | 69.2 | 15 | 9 | 97 | 6.4 | 18.4 | | $3,229,214 |
| Butler | 4,973 | 41,772 | 4 | | 0 | 792 | 23,143 | | | 41 | 0.0 | 12.9 | 111.9 | 19 | 13 | 167 | 7.7 | 6.8 | 1 | $23,179,215 |
| Cass | 7,717 | 40,443 | 2 | | 0 | 1532 | 17,122 | 2 | 5 | 29 | 15.1 | 6.3 | 91.7 | 40 | 10 | 146 | 34.7 | 12.1 | | $146,019,276 |
| Cedar | 7,273 | 50,113 | 1 | | 0 | 472 | 33,201 | 1 | | 6 | | 13.8 | 107.7 | 27 | 16 | 144 | | 9.5 | | $19,569,430 |
| Chase | 4,256 | 14,267 | 1 | | 0 | 36 | 4,413 | | | 14 | | 1.1 | 17.9 | 3 | 3 | 20 | 1.4 | 3.9 | | $1,428,647 |
| Cherry[21] | | | | | | | | | | | | | | | | | | | | |
| Cheyenne | 3,320 | 80,973 | 5 | 1 | 0 | 1597 | 46,130 | | 2 | 14 | 0.0 | 18.6 | 165.5 | 16 | 24 | 70 | 18.7 | 13.2 | | $90,234,501 |
| Clay | 8,559 | 39,741 | 0 | | 0 | 252 | 21,583 | | | 28 | 1.0 | 12.2 | 113.0 | 8 | 9 | 102 | 7.8 | 11.9 | | $11,973,735 |
| Colfax | 4,813 | 62,006 | 1 | | 0 | 1834 | 38,416 | 2 | | 7 | 4.1 | 10.4 | 172.0 | 13 | 3 | 172 | 5.2 | 6.0 | | $106,872,450 |
| Cuming | 7,057 | 55,260 | 0 | | 0 | 1169 | 33,554 | 4 | 2 | 2 | 2.2 | 27.4 | 145.2 | 24 | 10 | 218 | | 4.3 | 2 | $77,709,083 |
| Custer[21] | 0 | 3 | | | | | 0 | | | | | | 0.0 | | | | | | | |
| Dakota | 3,568 | 22,581 | 1 | | 0 | 384 | 15,094 | 4 | 1 | 7 | 20.2 | 6.2 | 46.4 | 10 | 2 | 40 | 6.4 | 16.4 | | $54,269,570 |
| Dawes | 8,577 | 58,030 | 1 | | 0 | 359 | 5,956 | | | 43 | | 3.2 | 32.7 | 19 | 17 | 38 | 8.1 | 8.6 | | $20,501,745 |
| Dawson | 13,552 | 68,487 | 1 | 2 | 0 | 1147 | 18,372 | | 1 | 52 | | 13.2 | 123.6 | 25 | 27 | 106 | 5.6 | 40.5 | | $96,646,180 |
| Deuel | 2,340 | 36,201 | 0 | 2 | 0 | 383 | 20,837 | 3 | 1 | 4 | | 29.5 | 102.7 | 18 | 22 | 11 | 13.2 | 9.3 | 1 | $16,071,185 |
| Dixon | 6,521 | 28,470 | 1 | | 0 | 511 | 16,257 | 2 | 4 | 14 | 0.0 | 6.7 | 52.5 | 11 | 5 | 66 | 0.6 | 3.1 | 2 | $16,650,095 |
| Dodge | 15,637 | 125,656 | 1 | 5 | 0 | 5137 | 88,052 | 13 | 4 | 7 | 39.1 | 38.9 | 368.5 | 28 | 15 | 202 | 52.9 | 34.6 | 4 | $282,926,061 |
| Douglas | 7,392 | 59,711 | 5 | 4 | 0 | 5905 | 28,796 | 12 | 8 | 8 | 23.7 | 35.3 | 259.2 | 61 | 12 | 133 | 25.4 | 44.6 | 14 | $1,356,830,488 |
| Dundy | 2,327 | 34,755 | 0 | | 0 | 333 | 8,955 | | 1 | 23 | | 16.1 | 58.8 | 6 | 10 | 22 | 33.2 | 1.1 | | $8,201,736 |
| Fillmore | 5,368 | 31,180 | 3 | | 0 | 270 | 18,551 | | | 7 | | 2.9 | 78.4 | 10 | 8 | 141 | 1.2 | 7.5 | | $6,542,545 |
| Franklin | 6,279 | 40,213 | 2 | | 0 | 254 | 19,215 | | | 95 | | 4.8 | 68.1 | 10 | 15 | 51 | 2.1 | 6.3 | | $5,297,380 |
| Frontier | 6,573 | 27,650 | 0 | | 0 | 89 | 2,724 | | | 117 | | 1.6 | 31.3 | 17 | 6 | 57 | 2.7 | 4.2 | | $1,312,875 |
| Furnas | 5,392 | 43,563 | 1 | | 0 | 243 | 20,203 | | | 238 | | 7.6 | 58.1 | 25 | 28 | 92 | 5.9 | 6.0 | | $20,421,920 |

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| County | Natural and Cultural Assets | | | Population | Structures | | Land Use | Emergency | | Dams and Levees | | Transportation | | | | | | Utilities | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Roadway[16] (miles) | | Bridges and Culverts (count) | | | | | | | |
| | Wetlands[5] (acres) | Threatened and Endangered Species Range[6] (acres) | Cultural Resources[7] (count) | Vulnerable Population[8] (count) | State Owned[9] (count) | Local or Privately Owned[10] (count) | Agricultural Lands[11] (acres) | Emergency Management[12] (count) | Emergency Response [13] (count) | Dams[14] (count) | Levees[15] (miles) | State | Local | State Bridges[19] | State Culverts[20] | Local | Railroad[17] (miles) | Electric Transmission Lines[18] (miles) | Other[3] (count) | Total Values of Improvements at Risk[4] ($) |
| Gage | 7,579 | 71,541 | 6 | | 0 | 1066 | 33,557 | | 4 | 340 | 1.2 | 10.4 | 137.7 | 31 | 16 | 269 | 30.2 | 16.8 | 7 | $92,574,015 |
| Garden | 49,258 | 96,129 | 3 | 1 | 0 | 401 | 6,389 | 1 | | 6 | | 7.7 | 52.0 | 4 | 12 | 12 | 3.9 | 7.7 | | $13,543,565 |
| Garfield | 7,553 | 17,725 | 1 | | 0 | 87 | 1,328 | | | 3 | | 2.0 | 22.4 | 3 | 4 | 3 | | 0.3 | | $1,951,734 |
| Gosper | 5,266 | 21,635 | 0 | | 0 | 108 | 5,895 | | | 112 | | 0.7 | 36.4 | 5 | 1 | 34 | 0.2 | 8.5 | | $6,677,725 |
| Grant[21] | 12 | 16 | 0 | | | | | | | | | | | | | | | | | |
| Greeley | 3,874 | 17,835 | 2 | | 0 | 105 | 6,975 | | | 6 | | 3.1 | 29.6 | 11 | 12 | 49 | 1.5 | 1.2 | | $5,558,200 |
| Hall | 10,259 | 102,642 | 1 | | 0 | 2227 | 58,889 | 1 | | 12 | 11.4 | 18.5 | 265.5 | 36 | 12 | 162 | 13.5 | 41.6 | | $88,290,644 |
| Hamilton | 6,263 | 37,814 | 0 | | 0 | 447 | 21,028 | | | 15 | | 9.8 | 104.9 | 16 | 13 | 123 | 5.0 | 17.6 | 1 | $25,370,690 |
| Harlan | 19,163 | 46,142 | 3 | | 0 | 110 | 13,675 | | | 156 | | 7.5 | 61.6 | 24 | 14 | 46 | 5.8 | 4.3 | | $2,767,176 |
| Hayes | 2,411 | 16,122 | 0 | | 0 | 42 | 3,939 | | | 41 | | 0.8 | 27.9 | 9 | | 27 | 0.4 | 0.8 | | $1,710,635 |
| Hitchcock | 7,952 | 32,809 | 0 | | 0 | 179 | 4,483 | | | 78 | | 4.8 | 57.8 | 20 | 9 | 28 | 6.3 | 4.1 | | $11,130,675 |
| Holt | 96,942 | 255,149 | 0 | | 0 | 1892 | 24,275 | | | 10 | | 41.7 | 344.5 | 21 | 22 | 116 | 26.0 | 45.7 | | $28,808,688 |
| Hooker[21] | | | | | | | | | | | | | | | | | | | | |
| Howard | 11,623 | 48,381 | 0 | | 0 | 829 | 15,263 | 1 | 1 | 22 | | 8.5 | 81.7 | 13 | 9 | 95 | 2.8 | 8.3 | | $37,680,168 |
| Jefferson | 5,457 | 35,722 | 2 | | 0 | 271 | 16,520 | 1 | 1 | 50 | 0.0 | 7.2 | 76.8 | 16 | 15 | 172 | 18.1 | 5.8 | | $12,185,768 |
| Johnson | 1,746 | 32,417 | 2 | | 0 | 435 | 20,621 | 1 | | 31 | | 10.6 | 75.9 | 16 | 9 | 123 | 21.3 | 5.2 | | $7,566,143 |
| Kearney | 3,255 | 39,045 | 2 | | 0 | 657 | 28,636 | | | 15 | | 7.7 | 97.9 | | 8 | 37 | 0.2 | 19.8 | | $31,719,735 |
| Keith | 40,381 | 81,767 | 3 | 1 | 0 | 587 | 13,458 | | 2 | 7 | | 7.5 | 68.8 | 4 | 7 | 13 | 18.1 | 26.9 | | $62,023,015 |
| Keya Paha[21] | 1 | 1 | | | | | 0 | | | | | | | | | | | | | |
| Kimball[21] | | | | | | | | | | | | | | | | | | | | |
| Knox | 20,166 | 66,412 | 2 | | 0 | 1168 | 16,157 | | | 30 | | 21.6 | 119.4 | 28 | 24 | 199 | | 7.7 | | $32,571,570 |
| Lancaster | 11,735 | 68,587 | 6 | | 0 | 4798 | 30,488 | 5 | 7 | 74 | 16.8 | 20.0 | 209.8 | 73 | 23 | 329 | 61.0 | 76.4 | | $921,954,700 |
| Lincoln | 29,735 | 108,194 | 1 | 2 | 0 | 2092 | 24,830 | 3 | 5 | 9 | | 17.3 | 170.7 | 18 | 12 | 35 | 7.3 | 36.1 | | $113,024,798 |
| Logan | | | | | | | | | | | | | | | | | | | | |
| Loup | 4,620 | 22,301 | 1 | | 0 | 41 | 847 | | | 4 | | 3.3 | 26.1 | 3 | 7 | 9 | | 0.8 | | $1,401,110 |
| Madison | 4,873 | 37,788 | 0 | | 0 | 1013 | 18,993 | | 4 | 7 | 1.6 | 8.7 | 84.2 | 22 | 17 | 188 | 8.6 | 18.9 | | $31,083,538 |
| McPherson[21] | 0 | 0 | | | | | | | | | | | | | | | | | | |
| Merrick | 11,688 | 127,228 | 1 | 1 | 0 | 2551 | 72,197 | | 1 | | | 19.7 | 369.6 | 9 | 9 | 142 | 22.3 | 69.8 | | $92,359,577 |
| Morrill | 27,913 | 105,277 | 2 | | 0 | 437 | 21,408 | | | 18 | | 19.0 | 143.2 | 8 | 18 | 18 | 39.3 | 2.3 | | $20,051,320 |
| Nance | 15,367 | 57,128 | 2 | | 0 | 544 | 19,611 | | | 9 | 4.4 | 8.7 | 82.3 | 12 | 10 | 103 | 15.4 | 2.7 | | $15,263,865 |
| Nemaha | 4,509 | 55,596 | 3 | | 0 | 234 | 37,420 | | | 14 | 27.8 | 12.1 | 99.3 | 28 | 7 | 120 | 24.0 | 29.1 | | $2,687,503 |
| Nuckolls | 4,482 | 34,153 | 1 | | 0 | 285 | 15,259 | 1 | 1 | 70 | | 4.1 | 50.1 | 15 | 16 | 118 | 4.4 | 4.4 | | $8,291,885 |
| Otoe | 5,472 | 62,500 | 6 | | 0 | 501 | 38,720 | 1 | 4 | 85 | 6.7 | 15.5 | 134.5 | 36 | 13 | 240 | 44.4 | 38.5 | | $19,200,440 |
| Pawnee | 2,449 | 33,528 | 1 | | 0 | 236 | 20,745 | | 1 | 55 | | 8.3 | 66.0 | 13 | 5 | 131 | 13.3 | 3.2 | | $10,390,355 |

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| County | Natural and Cultural Assets | | | Population | Structures | | Land Use | Emergency | | Dams and Levees | | Transportation | | | | | | Utilities | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Roadway[16] (miles) | | Bridges and Culverts (count) | | | | | | | |
| | Wetlands[5] (acres) | Threatened and Endangered Species Range[6] (acres) | Cultural Resources[7] (count) | Vulnerable Population[8] (count) | State Owned[9] (count) | Local or Privately Owned[10] (count) | Agricultural Lands[11] (acres) | Emergency Management[12] (count) | Emergency Response [13] (count) | Dams[14] (count) | Levees[15] (miles) | State | Local | State Bridges[19] | State Culverts[20] | Local | Railroad[17] (miles) | Electric Transmission Lines[18] (miles) | Other[3] (count) | Total Values of Improvements at Risk[4] ($) |
| Perkins | 1,168 | 13,990 | 0 | | 0 | 35 | 10,662 | | | 5 | | 0.5 | 27.2 | | 1 | 10 | 0.6 | 1.3 | | $1,188,410 |
| Phelps | 5,177 | 35,511 | 1 | | 0 | 305 | 22,542 | | | 29 | | 2.4 | 95.2 | | 4 | 35 | 1.2 | 10.3 | | $13,270,630 |
| Pierce[21] | 0 | 3 | | | | | 1 | | | | | | 0.2 | | | | | | | |
| Platte | 12,383 | 70,624 | 2 | | 0 | 1107 | 36,028 | 1 | 1 | 4 | 8.3 | 9.2 | 129.8 | 23 | 12 | 250 | 27.9 | 37.1 | | $227,959,454 |
| Polk | 4,228 | 48,733 | 0 | | 0 | 1205 | 26,210 | | 1 | 28 | | 6.7 | 132.4 | 10 | 7 | 74 | 1.8 | 27.3 | | $32,079,572 |
| Red Willow | 3,620 | 39,742 | 0 | | 0 | 321 | 14,250 | | | 89 | 1.0 | 7.5 | 45.0 | 21 | 12 | 37 | 7.2 | 12.3 | | $18,416,055 |
| Richardson | 5,997 | 73,854 | 0 | | 0 | 336 | 51,044 | | 1 | 15 | 27.0 | 20.5 | 105.9 | 33 | 12 | 173 | 56.9 | 11.7 | | $7,705,910 |
| Rock | 55,521 | 90,586 | 0 | | 0 | 519 | 5,175 | | 1 | 1 | | 12.5 | 105.0 | | 1 | 3 | 6.7 | 27.7 | | $15,739,950 |
| Saline | 5,198 | 46,742 | 3 | | 0 | 1686 | 21,604 | 3 | 4 | 60 | | 12.0 | 121.2 | 17 | 16 | 207 | 13.0 | 10.7 | | $96,693,180 |
| Sarpy | 6,524 | 32,966 | 2 | 1 | 0 | 2197 | 13,318 | | 5 | 10 | 51.8 | 5.2 | 81.2 | 24 | 2 | 62 | 17.5 | 38.8 | | $627,020,425 |
| Saunders | 8,706 | 82,065 | 1 | | 0 | 1832 | 48,653 | 1 | 2 | 33 | 33.1 | 13.6 | 193.0 | 33 | 12 | 333 | 22.9 | 22.8 | 2 | $177,744,069 |
| Scotts Bluff | 9,618 | 74,926 | 3 | 5 | 0 | 2877 | 34,618 | 20 | 3 | 14 | 5.1 | 13.4 | 166.0 | 12 | 13 | 71 | 24.1 | 29.7 | 12 | $164,054,682 |
| Seward | 4,601 | 42,223 | 0 | | 0 | 494 | 26,548 | 1 | | 39 | 1.2 | 9.9 | 103.0 | 25 | 16 | 145 | 7.4 | 7.5 | 1 | $15,895,912 |
| Sheridan[21] | 4 | 7 | | | | | | | | | | | | | | | | | | |
| Sherman | 11,186 | 37,206 | 0 | | 0 | 294 | 12,003 | | | 9 | 1.6 | 11.8 | 50.4 | 15 | 18 | 61 | 1.4 | 7.7 | | $8,151,865 |
| Sioux | 987 | 15,490 | 0 | | 0 | 116 | 5,581 | | | 1 | | 0.7 | 33.3 | | 2 | 3 | 0.1 | 1.4 | | $4,998,429 |
| Stanton | 4,811 | 33,845 | 0 | | 0 | 512 | 17,013 | 1 | 1 | 11 | | 7.7 | 60.5 | 13 | 17 | 132 | 2.2 | 5.0 | 3 | $48,854,495 |
| Thayer | 3,916 | 50,182 | 0 | | 0 | 622 | 27,977 | 1 | 4 | 68 | | 18.2 | 135.0 | 21 | 24 | 148 | 19.4 | 7.8 | 1 | $18,356,567 |
| Thomas[21] | | | | | | | | | | | | | | | | | | | | |
| Thurston | 4,142 | 32,415 | 1 | 4 | 0 | 292 | 23,105 | | 1 | | 2.2 | 7.1 | 57.3 | 16 | 12 | 90 | 6.1 | 6.2 | 2 | $6,575,490 |
| Valley | 6,004 | 26,495 | 2 | | 0 | 197 | 6,420 | | | 18 | | 1.9 | 37.5 | 9 | 9 | 43 | 1.8 | 0.3 | | $10,161,315 |
| Washington | 4,468 | 54,037 | 2 | | 0 | 730 | 36,414 | 1 | | 30 | 0.6 | 7.4 | 92.7 | 21 | 5 | 86 | 10.4 | 19.1 | | $130,096,470 |
| Wayne | 1,775 | 19,605 | 1 | | 0 | 42 | 13,620 | | | 6 | | 3.9 | 44.8 | 17 | 12 | 167 | | 8.1 | | $4,530,390 |
| Webster | 6,596 | 43,329 | 8 | | 0 | 183 | 16,613 | | | 249 | | 8.5 | 65.7 | 15 | 21 | 125 | 6.6 | 5.4 | | $6,293,995 |
| Wheeler | 5,716 | 14,067 | 0 | | 0 | 78 | 1,509 | | | 8 | | 2.1 | 16.3 | 2 | 1 | 9 | | 0.4 | | $1,700,095 |
| York | 5,276 | 36,419 | 1 | | 0 | 765 | 22,752 | 1 | | 14 | | 4.8 | 103.3 | 14 | 11 | 126 | 1.8 | 10.0 | | $26,745,539 |

[1] Critical Facilities includes but is not limited to: hospitals; fire stations; police stations; vehicle and equipment storage locations; critical records storage locations; utility and transportation infrastructure; locations that produce, use, or store hazardous materials; and similar. A critical facility should not be located in a floodplain if at all possible. If location within a floodplain is unavoidable, then the facility should be protected from flooding to a level that will ensure its continued function during and after a flood. FEMA. FEMA 426, "Reference manual to Mitigate Potential Terrorist Attacks Against Buildings," (December 2003). Also https://www.fema.gov/glossary/critical-facility

[2] Levee Protected Areas are based on data provided by the USACE National Levee Database and represents areas protected from flood risk by federal and local levees.

[3] Other category includes features included in the critical facility database that didn't fall within defined categories. Typical Other features include post offices, parks and recreation facilities, and museums.

[4] Total value of improvements was estimated based on the appraised value of improvements on parcels located within the riverine flooding limits. The State parcel database was used for estimating value of improvements.

[5] Wetland areas are based on data from the USFWS National Wetland Inventory.

[6] Threatened and Endangered Species Range areas are based on mapping for state and federal T&E species range data from the Nebraska Game and Parks Commission.

[7] Cultural Resources are features with significant cultural or historical value. Data is from the National Register of Historic Places dataset of the National Park Service.

[8] Vulnerable Populations data was derived from the state-wide Critical Facility database, as well as the state-wide public and private school databases. Typical vulnerable populations include schools, daycares, and assisted living facilities.

[9] State Owned structure data was provided the Nebraska Department of Administrative Services.

[10] Locally or Privately Owned structure data came from the state parcel database, as well as the Microsoft U.S. building footprint database.

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| County | Natural and Cultural Assets | | | Population | Structures | | Land Use | Emergency | | Dams and Levees | | Transportation | | | | | | Utilities | Other[3] (count) | Total Values of Improvements at Risk[4] ($) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Roadway[16] (miles) | | Bridges and Culverts (count) | | | | | | |
| | Wetlands[5] (acres) | Threatened and Endangered Species Range[6] (acres) | Cultural Resources[7] (count) | Vulnerable Population[8] (count) | State Owned[9] (count) | Local or Privately Owned[10] (count) | Agricultural Lands[11] (acres) | Emergency Management[12] (count) | Emergency Response [13] (count) | Dams[14] (count) | Levees[15] (miles) | State | Local | State Bridges[19] | State Culverts[20] | Local | Railroad[17] (miles) | Electric Transmission Lines[18] (miles) | | |

[11] Agricultural Lands data was from the USDA/NRCS NASS-Cropland dataset.
[12] Emergency Management data was derived from the state-wide Critical Facility database. Typical emergency management features include shelters and community centers.
[13] Emergency Response data was derived from the state-wide Critical Facility database. Typical emergency response features include fires stations, hospitals, and resource stockpiles.
[14] Dams data was from the Nebraska Department of Natural Resources dams inventory database and includes both jurisdictional and non-jurisdictional structures.
[15] Levee data was from the Nebraska Department of Natural Resources levee database and includes both federal and local levees.
[16] Roadway data was from a dataset provided by the Nebraska Department of Natural Resources and included local roadways as well as state road information provided by Nebraska Department of Transportation.
[17] Railroad data was from the North American Rail Lines dataset.
[18] Electric Transmission Line data was from the Homeland Infrastructure Foundation-Level Data (HIFLD).
[19] State bridge data was provided by the Nebraska Department of Natural Resources and included data provided by Nebraska Department of Transportation.
[20] State culvert data was provided by the Nebraska Department of Natural Resources and included data provided by Nebraska Department of Transportation.

[21] Counties for which FEMA flood hazard limits or NeDNR flood awareness areas have been developed. Counties in this category with riverine flooding risks have small areas of riverine flooding risk limits developed for adjacent counties that extend into the county.

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## Table B-7: Critical Facilities[1] and Other Assets in Levee Protected Areas[2]

| County | Natural and Cultural Assets | | | Population | Structures | | Land Use | Emergency | | Dams and Levees | | Transportation | | | | | | Utilities | Other[3] | Total Values of Improvements at Risk[4] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Roadway[16] (miles) | | Bridges and Culverts (count) | | | Railroad[17] (miles) | | | |
| | Wetlands[5] (acres) | Threatened and Endangered Species Range[6] (acres) | Cultural Resources[7] (count) | Vulnerable Population[8] (count) | State Owned[9] (count) | Local or Privately Owned[10] (count) | Agricultural Lands[11] (acres) | Emergency Management[12] (count) | Emergency Response [13] (count) | Dams[14] (count) | Levees[15] (miles) | State | Local | State Bridges[19] | State Culverts[20] | Local | | Electric Transmission Lines[18] (miles) | | |
| Adams | | | 0 | | | | | | | | | | | | | | | | | |
| Antelope | | | 0 | | | | | | | | | | | | | | | | | |
| Arthur | | | 0 | | | | | | | | | | | | | | | | | |
| Banner | | | 0 | | | | | | | | | | | | | | | | | |
| Blaine | | | 0 | | | | | | | | | | | | | | | | | |
| Boone | 1 | 117 | 0 | | | 5 | 108 | | | | | | 0.4 | | | | | | | $220,895 |
| Box Butte | | | 0 | | | | | | | | | | | | | | | | | |
| Boyd | | | 0 | | | | | | | | | | | | | | | | | |
| Brown | | | 0 | | | | | | | | | | | | | | | | | |
| Buffalo | | | 0 | | | | | | | | | | | | | | | | | |
| Burt | 35 | 3,649 | 0 | 1 | | 351 | 3,214 | | | | 4.6 | 1.2 | 12.1 | | | | | | | $18,059,105 |
| Butler | | 0 | 0 | | | | 0 | | | | 0.0 | | | | | | | | | |
| Cass | 200 | 1,065 | 0 | | | 289 | 425 | | | | 7.3 | | 3.9 | | | | 1.5 | | | $25,279,101 |
| Cedar | | | 0 | | | | | | | | | | | | | | | | | |
| Chase | | | 0 | | | | | | | | | | | | | | | | | |
| Cherry | | | 0 | | | | | | | | | | | | | | | | | |
| Cheyenne | 5 | 836 | 2 | 5 | | 1616 | 16 | | 4 | | 0.7 | 1.0 | 23.7 | | 1 | | 1.9 | 0.1 | 1 | $103,297,280 |
| Clay | | | 0 | | | | | | | | | | | | | | | | | |
| Colfax | 286 | 5,757 | 1 | | | 701 | 2,494 | 3 | 6 | | 6.5 | 1.1 | 28.8 | 1 | | 4 | 0.7 | | 1 | $46,830,451 |
| Cuming | 7 | 368 | 0 | | | 480 | 36 | 2 | 4 | | 2.3 | 0.6 | 9.2 | | | 1 | | | 1 | $25,232,415 |
| Custer | 22 | 1,057 | 0 | | | 117 | 494 | | | | 2.3 | 0.8 | 3.8 | | | | 0.1 | | | $10,877,332 |
| Dakota | 126 | 26,430 | 0 | | | 637 | 24,187 | 5 | 2 | | 23.6 | 10.7 | 79.5 | 1 | | 4 | 6.8 | 22.7 | | $31,906,410 |
| Dawes | | | 0 | | | | | | | | | | | | | | | | | |
| Dawson | | | 0 | | | | | | | | | | | | | | | | | |
| Deuel | | | 0 | | | | | | | | | | | | | | | | | |
| Dixon | 3 | 476 | 0 | 2 | | 531 | 116 | 2 | 3 | | 2.0 | 0.8 | 9.5 | | | | | 0.4 | 2 | $33,274,685 |
| Dodge | 232 | 7,188 | 1 | 7 | | 1333 | 4,253 | 12 | 6 | | 23.3 | 6.6 | 46.1 | 1 | | 2 | 18.1 | 1.2 | 4 | $91,708,641 |
| Douglas | 1,367 | 25,567 | 1 | 6 | | 4442 | 10,769 | 6 | 9 | 1 | 30.8 | 14.5 | 173.1 | 13 | 2 | 15 | 52.5 | 31.8 | 7 | $630,927,954 |
| Dundy | | | 0 | | | | | | | | | | | | | | | | | |
| Fillmore | | | 0 | | | | | | | | | | | | | | | | | |
| Franklin | | | 0 | | | | | | | | | | | | | | | | | |
| Frontier | | | 0 | | | | | | | | | | | | | | | | | |
| Furnas | | 51 | 0 | | | 114 | | | | | 0.5 | | 1.8 | | | | | 0.0 | | $6,654,965 |

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| County | Natural and Cultural Assets | | | Population | Structures | | Land Use | Emergency | | Dams and Levees | | Transportation | | | | | | Utilities | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Roadway[16] (miles) | | Bridges and Culverts (count) | | | | | | | |
| | Wetlands[5] (acres) | Threatened and Endangered Species Range[6] (acres) | Cultural Resources[7] (count) | Vulnerable Population[8] (count) | State Owned[9] (count) | Local or Privately Owned[10] (count) | Agricultural Lands[11] (acres) | Emergency Management[12] (count) | Emergency Response [13] (count) | Dams[14] (count) | Levees[15] (miles) | State | Local | State Bridges[19] | State Culverts[20] | Local | Railroad[17] (miles) | Electric Transmission Lines[18] (miles) | Other[3] (count) | Total Values of Improvements at Risk[4] ($) |
| Gage | | 52 | 0 | | | 1 | 35 | | | | 1.2 | | 0.0 | | | | 0.0 | | | $- |
| Garden | | | 0 | | | | | | | | | | | | | | | | | |
| Garfield | | | 0 | | | | | | | | | | | | | | | | | |
| Gosper | | | 0 | | | | | | | | | | | | | | | | | |
| Grant | | | 0 | | | | | | | | | | | | | | | | | |
| Greeley | | | 0 | | | | | | | | | | | | | | | | | |
| Hall | 174 | 5,459 | 0 | | | 1001 | 3,063 | | | | 9.7 | 4.2 | 30.0 | | | 7 | 2.2 | 7.9 | | $86,092,101 |
| Hamilton | | | 0 | | | | | | | | | | | | | | | | | |
| Harlan | | | 0 | | | | | | | | | | | | | | | | | |
| Hayes | | | 0 | | | | | | | | | | | | | | | | | |
| Hitchcock | | | 0 | | | | | | | | | | | | | | | | | |
| Holt | | | 0 | | | | | | | | | | | | | | | | | |
| Hooker | | | 0 | | | | | | | | | | | | | | | | | |
| Howard | | | 0 | | | | | | | | | | | | | | | | | |
| Jefferson | 3 | 346 | 1 | | | 520 | 63 | 5 | 4 | | 1.8 | 0.1 | 9.0 | 1 | | | 1.7 | 1.0 | | $7,364,040 |
| Johnson | | | 0 | | | | | | | | | | | | | | | | | |
| Kearney | | | 0 | | | | | | | | | | | | | | | | | |
| Keith | | | 0 | | | | | | | | | | | | | | | | | |
| Keya Paha | | | 0 | | | | | | | | | | | | | | | | | |
| Kimball | | | 0 | | | | | | | | | | | | | | | | | |
| Knox | | | 0 | | | | | | | | | | | | | | | | | |
| Lancaster | 105 | 3,427 | 1 | | | 1823 | 170 | 1 | 4 | | 17.9 | 3.9 | 40.3 | 6 | | 4 | 6.2 | 12.9 | | $292,390,400 |
| Lincoln | | | 0 | | | | | | | | | | | | | | | | | |
| Logan | | | 0 | | | | | | | | | | | | | | | | | |
| Loup | | | 0 | | | | | | | | | | | | | | | | | |
| Madison | 133 | 5,223 | 0 | 16 | 10 | 6155 | 887 | 3 | 4 | 1 | 10.1 | 5.5 | 88.8 | | 3 | 10 | 7.1 | 3.8 | 5 | $458,947,167 |
| McPherson | | | 0 | | | | | | | | | | | | | | | | | |
| Merrick | 210 | 7,175 | 0 | | | 196 | 3,712 | | | | | | 27.9 | | | 11 | 0.9 | 19.8 | | $9,534,615 |
| Morrill | | | 0 | | | | | | | | | | | | | | | | | |
| Nance | | | 0 | | | | | | | | | | | | | | | | | |
| Nemaha | 387 | 14,743 | 0 | | | 67 | 11,706 | | | | 27.3 | 1.2 | 28.1 | | | 6 | 9.0 | 9.3 | | $382,492 |
| Nuckolls | | | 0 | | | | | | | | | | | | | | | | | |
| Otoe | 114 | 2,680 | 0 | | | 31 | 1,560 | | | | 7.7 | | 6.7 | | | 1 | 7.3 | 12.7 | | $- |
| Pawnee | | | 0 | | | | | | | | | | | | | | | | | |

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| County | Natural and Cultural Assets | | | Population | Structures | | Land Use | Emergency | | Dams and Levees | | Transportation | | | | | | Utilities | | Other[3] (count) | Total Values of Improvements at Risk[4] ($) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Roadway[16] (miles) | | Bridges and Culverts (count) | | | | | | | |
| | Wetlands[5] (acres) | Threatened and Endangered Species Range[6] (acres) | Cultural Resources[7] (count) | Vulnerable Population[8] (count) | State Owned[9] (count) | Local or Privately Owned[10] (count) | Agricultural Lands[11] (acres) | Emergency Management[12] (count) | Emergency Response [13] (count) | Dams[14] (count) | Levees[1] [5] (miles) | State | Local | State Bridges[19] | State Culverts[20] | Local | Railroad[17] (miles) | Electric Transmission Lines[18] (miles) | | | |
| Perkins | | | 0 | | | | | | | | | | | | | | | | | | |
| Phelps | | | 0 | | | | | | | | | | | | | | | | | | |
| Pierce | 27 | 539 | 0 | 2 | | 691 | 81 | 2 | 3 | 1 | 3.4 | 2.5 | 13.5 | | | | | | | | $47,869,825 |
| Platte | 170 | 2,285 | 2 | 2 | | 2138 | 588 | | 1 | | 8.0 | 1.7 | 43.3 | 2 | | 4 | 11.5 | 1.4 | | 1 | $222,217,485 |
| Polk | | | 0 | | | | | | | | | | | | | | | | | | |
| Red Willow | 5 | 880 | 0 | 3 | | 640 | 282 | 6 | 3 | | 2.0 | 1.6 | 15.7 | | | | 1.1 | | | 1 | $22,147,194 |
| Richardson | 198 | 7,482 | 0 | | | 17 | 6,294 | | | 1 | 27.4 | | 6.0 | | | 2 | 0.1 | | | | $514,750 |
| Rock | | | 0 | | | | | | | | | | | | | | | | | | |
| Saline | | | 0 | | | | | | | | | | | | | | | | | | |
| Sarpy | 457 | 16,607 | 0 | | | 1254 | 10,945 | 1 | | | 58.3 | 5.2 | 63.8 | 4 | 2 | 12 | 13.5 | 31.0 | | 1 | $130,104,284 |
| Saunders | 1,126 | 27,209 | 0 | | | 808 | 15,853 | | | | 31.6 | 3.8 | 81.4 | 2 | | 22 | 19.2 | 14.0 | | | $82,081,444 |
| Scotts Bluff | 0 | 53 | 0 | | | 92 | | | | | 0.7 | | 1.2 | | | | | | | | $1,069,653 |
| Seward | 2 | 168 | 0 | | | 84 | 41 | | 2 | | 2.1 | 0.3 | 2.2 | | | | 1.6 | | | | $3,024,992 |
| Sheridan | | | 0 | | | | | | | | | | | | | | | | | | |
| Sherman | | | 0 | | | | | | | | | | | | | | | | | | |
| Sioux | | | 0 | | | | | | | | | | | | | | | | | | |
| Stanton | | | 0 | | | | | | | | | | | | | | | | | | |
| Thayer | | | 0 | | | | | | | | | | | | | | | | | | |
| Thomas | | | 0 | | | | | | | | | | | | | | | | | | |
| Thurston | 19 | 2,673 | 0 | 2 | | 664 | 1,720 | 1 | 7 | 1 | 7.8 | 1.1 | 16.0 | | | 1 | | | | 1 | $45,532,122 |
| Valley | | | 0 | | | | | | | | | | | | | | | | | | |
| Washington | 2 | 88 | 0 | | | 8 | 52 | | | | 1.1 | | | | | | 0.8 | | | | $2,443,315 |
| Wayne | | 86 | 0 | 1 | | 115 | 5 | | | | | 0.0 | 1.8 | | | | | 0.5 | | | $10,606,675 |
| Webster | | | 0 | | | | | | | | | | | | | | | | | | |
| Wheeler | | | 0 | | | | | | | | | | | | | | | | | | |
| York | | | 0 | | | | | | | | | | | | | | | | | | |

[1] Critical Facilities includes but is not limited to: hospitals; fire stations; police stations; vehicle and equipment storage locations; critical records storage locations; utility and transportation infrastructure; locations that produce, use, or store hazardous materials; and similar. A critical facility should not be located in a floodplain if at all possible. If location within a floodplain is unavoidable, then the facility should be protected from flooding to a level that will ensure its continued function during and after a flood. FEMA. FEMA 426, "Reference manual to Mitigate Potential Terrorist Attacks Against Buildings," (December 2003). Also https://www.fema.gov/glossary/critical-facility

[2] Levee Protected Areas are based on data provided by the USACE National Levee Database and represents areas protected from flood risk by federal and local levees.

[3] Other category includes features included in the critical facility database that didn't fall within defined categories. Typical Other features include post offices, parks and recreation facilities, and museums.

[4] Total value of improvements was estimated based on the appraised value of improvements on parcels located within the riverine flooding limits. The State parcel database was used for estimating value of improvements.

[5] Wetland areas are based on data from the USFWS National Wetland Inventory.

[6] Threatened and Endangered Species Range areas are based on mapping for state and federal T&E species range data from the Nebraska Game and Parks Commission.

[7] Cultural Resources are features with significant cultural or historical value. Data is from the National Register of Historic Places dataset of the National Park Service.

[8] Vulnerable Populations data was derived from the state-wide Critical Facility database, as well as the state-wide public and private school databases. Typical vulnerable populations include schools, daycares, and assisted living facilities.

[9] State Owned structure data was provided the Nebraska Department of Administrative Services.

[10] Locally or Privately Owned structure data came from the state parcel database, as well as the Microsoft U.S. building footprint database.

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| County | Natural and Cultural Assets | | | Population | Structures | | Land Use | Emergency | | Dams and Levees | | Transportation | | | | | | Utilities | Other[3] (count) | Total Values of Improvements at Risk[4] ($) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Roadway[16] (miles) | | Bridges and Culverts (count) | | | | | | |
| | Wetlands[5] (acres) | Threatened and Endangered Species Range[6] (acres) | Cultural Resources[7] (count) | Vulnerable Population[8] (count) | State Owned[9] (count) | Local or Privately Owned[10] (count) | Agricultural Lands[11] (acres) | Emergency Management[12] (count) | Emergency Response [13] (count) | Dams[14] (count) | Levees[15] (miles) | State | Local | State Bridges[19] | State Culverts[20] | Local | Railroad[17] (miles) | Electric Transmission Lines[18] (miles) | | |

[11] Agricultural Lands data was from the USDA/NRCS NASS-Cropland dataset.
[12] Emergency Management data was derived from the state-wide Critical Facility database. Typical emergency management features include shelters and community centers.
[13] Emergency Response data was derived from the state-wide Critical Facility database. Typical emergency response features include fires stations, hospitals, and resource stockpiles.
[14] Dams data was from the Nebraska Department of Natural Resources dams inventory database and includes both jurisdictional and non-jurisdictional structures.
[15] Levee data was from the Nebraska Department of Natural Resources levee database and includes both federal and local levees.
[16] Roadway data was from a dataset provided by the Nebraska Department of Natural Resources and included local roadways as well as state road information provided by Nebraska Department of Transportation.
[17] Railroad data was from the North American Rail Lines dataset.
[18] Electric Transmission Line data was from the Homeland Infrastructure Foundation-Level Data (HIFLD).
[19] State bridge data was provided by the Nebraska Department of Natural Resources and included data provided by Nebraska Department of Transportation.
[20] State culvert data was provided by the Nebraska Department of Natural Resources and included data provided by Nebraska Department of Transportation.

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## Table B-8: Critical Facilities[1] and Other Assets at Risk of Dam Failure[2]

| County | Natural and Cultural Assets | | | Population | Structures | | Land Use | Emergency | | Dams and Levees | | Transportation | | | | | | Utilities | Other[3] (count) | Total Values of Improvements at Risk[4] ($) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Roadway[16] (miles) | | Bridges and Culverts (count) | | | | | | |
| | Wetlands[5] (acres) | Threatened and Endangered Species Range[6] (acres) | Cultural Resources[7] (count) | Vulnerable Population[8] (count) | State Owned[9] (count) | Local or Privately Owned[10] (count) | Agricultural Lands[11] (acres) | Emergency Management[12] (count) | Emergency Response [13] (count) | Dams[14] (count) | Levees[15] (miles) | State | Local | State Bridges[19] | State Culverts[20] | Local | Railroad[17] (miles) | Electric Transmission Lines[18] (miles) | | |
| Adams | 439 | 6,767 | 0 | | | 188 | 4,215 | | | 1 | | 0.1 | 11.6 | 2 | | 20 | 4.3 | 2.1 | | $22,974,628 |
| Antelope | | | 0 | | | | | | | | | | | | | | | | | |
| Arthur | | | 0 | | | | | | | | | | | | | | | | | |
| Banner | | | 0 | | | | | | | | | | | | | | | | | |
| Blaine | | | 0 | | | | | | | | | | | | | | | | | |
| Boone | 10 | 326 | 0 | 2 | | 298 | 64 | | 1 | | | 1.2 | 13.2 | | | 1 | 0.6 | 0.2 | | $19,046,325 |
| Box Butte | | | 0 | | | | | | | | | | | | | | | | | |
| Boyd | | | 0 | | | | | | | | | | | | | | | | | |
| Brown | 209 | 636 | 0 | | | | 1 | | | | | | | | | | | | | |
| Buffalo | 10,673 | 84,057 | 1 | 9 | 1 | 7936 | 39,655 | 5 | 4 | 5 | | 64.4 | 389.3 | 39 | 14 | 75 | 26.7 | 69.8 | | $893,936,165 |
| Burt | 3,841 | 81,834 | 2 | 4 | | 2024 | 69,848 | 3 | 5 | 1 | 4.7 | 15.9 | 212.2 | 7 | 2 | 26 | | 18.2 | | $55,199,691 |
| Butler | 2,872 | 15,482 | 1 | | | 590 | 6,504 | | | 1 | 0.0 | 2.8 | 30.4 | 4 | 2 | 15 | 1.0 | 2.6 | | $19,965,980 |
| Cass | 5,895 | 24,247 | 1 | | | 1843 | 9,736 | 4 | 6 | 8 | 17.9 | 4.4 | 72.8 | 16 | 5 | 15 | 30.6 | 5.1 | | $153,407,883 |
| Cedar | 5,315 | 24,347 | 1 | 4 | | 898 | 14,182 | 10 | 3 | 1 | | 6.3 | 61.2 | 2 | | 11 | 0.0 | 0.4 | | $39,201,525 |
| Chase | 111 | 2,526 | 0 | 2 | | 333 | 724 | 2 | 3 | 1 | | 2.4 | 13.6 | 1 | | 9 | 7.3 | 1.1 | | $9,839,313 |
| Cherry | 2,459 | 9,182 | 6 | | | 71 | 169 | | | 1 | | 1.1 | 5.9 | 4 | | 7 | | 0.2 | | $2,609,064 |
| Cheyenne | 61 | 1,546 | 2 | | | 1024 | 229 | 1 | 5 | | 0.0 | 2.0 | 19.8 | 2 | 1 | 3 | 2.4 | 0.1 | | $72,885,289 |
| Clay | 507 | 3,753 | 0 | | | 83 | 1,945 | | 1 | 1 | | 1.3 | 9.5 | 3 | | 21 | 0.2 | 0.9 | | $3,756,510 |
| Colfax | 3,762 | 37,208 | 1 | | | 2649 | 17,908 | 5 | 3 | | 3.5 | 5.2 | 125.6 | 5 | | 29 | 17.2 | 0.9 | | $176,617,485 |
| Cuming | | | 0 | | | | | | | | | | | | | | | | | |
| Custer | 4 | 49 | 0 | | | 2 | 2 | | | | | | 0.3 | | | | | | | $241,026 |
| Dakota | 3,303 | 64,741 | 0 | 11 | | 7449 | 50,185 | 15 | 12 | 1 | 25.0 | 33.3 | 304.8 | 17 | | 14 | 31.0 | 75.8 | | $825,869,605 |
| Dawes | 212 | 5,596 | 1 | | | 25 | 686 | | | 1 | | 0.6 | 4.3 | 2 | | 1 | | 0.8 | | $4,382,540 |
| Dawson | 11,453 | 173,417 | 2 | 19 | | 10997 | 109,671 | 11 | 20 | 5 | | 114.7 | 658.8 | 41 | 26 | 84 | 70.2 | 100.4 | | $753,763,327 |
| Deuel | | | 0 | | | | | | | | | | | | | | | | | |
| Dixon | 4,912 | 19,379 | 1 | | | 474 | 10,767 | 3 | 4 | | | 1.7 | 32.0 | 1 | | 5 | | 1.4 | | $12,811,490 |
| Dodge | 9,374 | 89,897 | 3 | 21 | | 14482 | 59,672 | 14 | 8 | 1 | 39.4 | 46.0 | 478.1 | 25 | 9 | 75 | 87.8 | 55.1 | | $1,188,029,248 |
| Douglas | 7,134 | 72,341 | 8 | 15 | | 14167 | 32,653 | 17 | 21 | 9 | 36.3 | 45.8 | 430.6 | 65 | 12 | 126 | 71.3 | 69.9 | | $2,842,127,249 |
| Dundy | | | 0 | | | | | | | | | | | | | | | | | |
| Fillmore | | | 0 | | | | | | | | | | | | | | | | | |
| Franklin | 2,778 | 21,059 | 2 | | | 516 | 13,690 | | 1 | 3 | | 2.1 | 52.8 | 2 | | 18 | 12.6 | 1.3 | | $9,425,765 |
| Frontier | 55 | 912 | 0 | | | 9 | 147 | | | 1 | | | 1.0 | | | 1 | | 0.4 | | $39,329 |
| Furnas | 2,565 | 29,551 | 1 | | | 1218 | 18,055 | | | | 0.5 | 13.2 | 62.3 | 12 | 6 | 13 | 17.5 | 7.3 | | $51,652,855 |

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| County | Natural and Cultural Assets | | | Population | Structures | | Land Use | Emergency | | Dams and Levees | | Transportation | | | | | | Utilities | | Total Values of Improvements at Risk[4] ($) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Roadway[16] (miles) | | Bridges and Culverts (count) | | | | | | |
| | Wetlands[5] (acres) | Threatened and Endangered Species Range[6] (acres) | Cultural Resources[7] (count) | Vulnerable Population[8] (count) | State Owned[9] (count) | Local or Privately Owned[10] (count) | Agricultural Lands[11] (acres) | Emergency Management[12] (count) | Emergency Response [13] (count) | Dams[14] (count) | Levees[15] (miles) | State | Local | State Bridges[19] | State Culverts[20] | Local | Railroad[17] (miles) | Electric Transmission Lines[18] (miles) | Other[3] (count) | |
| Gage | 885 | 6,215 | 3 | | | 235 | 2,997 | 3 | 5 | 4 | | 2.0 | 12.7 | 7 | 4 | 27 | 2.8 | 0.2 | | $15,036,220 |
| Garden | 6,473 | 44,844 | 3 | 5 | | 1442 | 9,315 | 24 | 6 | | | 31.4 | 101.5 | 5 | 8 | 4 | 28.3 | 7.2 | | $46,242,269 |
| Garfield | 1,010 | 5,526 | 0 | | | 121 | 1,594 | | | 1 | | 5.7 | 16.7 | 4 | | | | | | $3,069,054 |
| Gosper | 451 | 5,839 | 0 | | | 63 | 2,444 | | | 8 | | 0.3 | 11.8 | 1 | | 12 | | 4.7 | | $2,999,940 |
| Grant | | | 0 | | | | | | | | | | | | | | | | | |
| Greeley | 1,262 | 5,162 | 0 | | | 58 | 1,621 | | | | | 3.4 | 10.3 | 2 | 2 | 3 | 4.1 | 1.0 | | $1,264,600 |
| Hall | 9,566 | 95,189 | 1 | 12 | | 7824 | 46,473 | 4 | 5 | | 16.2 | 48.8 | 399.3 | 42 | 8 | 79 | 17.7 | 60.4 | | $696,259,988 |
| Hamilton | 2,669 | 10,030 | 0 | | | 278 | 1,922 | | | | | 3.7 | 24.1 | 1 | 4 | 2 | 1.3 | 8.2 | | $19,707,915 |
| Harlan | 3,788 | 18,636 | 0 | | | 85 | 9,731 | | | 1 | | 5.2 | 40.0 | 11 | | 8 | 4.5 | 1.8 | | $1,793,242 |
| Hayes | 329 | 7,410 | 0 | | | 220 | 2,856 | | | 2 | | 9.7 | 31.2 | 8 | 1 | 13 | 9.2 | 0.2 | | $3,669,725 |
| Hitchcock | 833 | 20,236 | 0 | | | 833 | 8,263 | | | | | 11.6 | 78.4 | 12 | 4 | 6 | 14.6 | 6.6 | | $23,215,915 |
| Holt | | | 0 | | | | | | | | | | | | | | | | | |
| Hooker | | | 0 | | | | | | | | | | | | | | | | | |
| Howard | 8,018 | 33,833 | 0 | | | 986 | 11,117 | 2 | 2 | 3 | | 7.4 | 68.3 | 7 | 2 | 33 | 4.5 | 3.1 | | $48,292,711 |
| Jefferson | 200 | 624 | 0 | | | 16 | 135 | | | | | | 1.1 | | | 8 | | | | $182,233 |
| Johnson | 227 | 845 | 1 | | | 43 | 97 | | 1 | 1 | | 0.3 | 1.8 | 5 | 1 | 5 | 0.4 | 0.1 | | $283,622 |
| Kearney | 657 | 35,004 | 2 | | | 911 | 28,124 | | | | | 11.3 | 98.0 | | 2 | 11 | | 17.0 | | $42,631,140 |
| Keith | 7,807 | 43,445 | 1 | 2 | | 1776 | 12,852 | | 4 | 3 | | 10.7 | 105.2 | 4 | 7 | 10 | 24.2 | 11.6 | | $118,916,735 |
| Keya Paha | 124 | 614 | 0 | | | 3 | 26 | | | | | | 3.0 | | | | | | | $ – |
| Kimball | 248 | 4,903 | 1 | 5 | | 891 | 1,373 | 2 | 1 | 2 | | 1.7 | 19.3 | 4 | | 3 | 1.7 | | | $40,126,925 |
| Knox | | | 0 | | | | | | | | | | | | | | | | | |
| Lancaster | 3,794 | 59,850 | 6 | 2 | 24 | 14533 | 28,367 | 8 | 20 | 18 | 19.4 | 45.1 | 393.8 | 87 | 22 | 174 | 121.9 | 77.3 | | $2,508,800,600 |
| Lincoln | 24,431 | 181,513 | 4 | 15 | 4 | 16877 | 67,478 | 7 | 9 | 6 | | 116.4 | 695.6 | 43 | 16 | 55 | 146.0 | 97.1 | | $1,350,801,716 |
| Logan | | | 0 | | | | | | | | | | | | | | | | | |
| Loup | 90 | 414 | 1 | | | 8 | 118 | | | | | 0.2 | 1.2 | | 1 | | | 0.4 | | $139,230 |
| Madison | 163 | 2,716 | 0 | 3 | | 2106 | 608 | | | | 4.6 | 5.0 | 38.3 | 3 | 5 | 14 | 9.2 | 1.6 | | $118,380,397 |
| McPherson | | | 0 | | | | | | | | | | | | | | | | | |
| Merrick | 9,860 | 139,234 | 1 | 12 | | 5566 | 85,734 | 18 | 10 | | | 64.4 | 507.8 | 8 | 7 | 93 | 62.8 | 92.8 | | $308,343,368 |
| Morrill | 17,490 | 87,354 | 2 | 13 | | 2897 | 26,099 | 18 | 18 | 4 | | 58.4 | 201.6 | 12 | 14 | 8 | 88.3 | 5.2 | | $165,208,298 |
| Nance | 11,758 | 25,396 | 0 | | | 150 | 3,849 | | | 1 | 4.3 | 5.3 | 19.7 | 6 | | 6 | 6.4 | 1.9 | | $4,478,065 |
| Nemaha | 2,644 | 26,980 | 3 | | | 285 | 17,446 | | | | 27.5 | 2.1 | 44.2 | 2 | | 15 | 13.7 | 13.5 | | $3,191,921 |
| Nuckolls | 2,218 | 17,970 | 1 | | | 334 | 11,979 | 1 | 1 | 9 | | 1.9 | 26.8 | 5 | 1 | 27 | 13.6 | 0.0 | | $8,084,245 |
| Otoe | 2,609 | 13,285 | 1 | | | 149 | 6,061 | | 1 | 1 | 7.7 | 0.3 | 13.6 | 3 | | 15 | 22.2 | 20.3 | | $2,802,900 |
| Pawnee | 160 | 245 | 0 | | | 4 | 28 | | | 1 | | 0.0 | 0.1 | 1 | | 1 | 0.1 | 0.0 | | $10,380 |

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| County | Natural and Cultural Assets | | | Population | Structures | | Land Use | Emergency | | Dams and Levees | | Transportation | | | | | | Utilities | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Roadway[16] (miles) | | Bridges and Culverts (count) | | | | | | | |
| | Wetlands[5] (acres) | Threatened and Endangered Species Range[6] (acres) | Cultural Resources[7] (count) | Vulnerable Population[8] (count) | State Owned[9] (count) | Local or Privately Owned[10] (count) | Agricultural Lands[11] (acres) | Emergency Management[12] (count) | Emergency Response [13] (count) | Dams[14] (count) | Levees[15] (miles) | State | Local | State Bridges[19] | State Culverts[20] | Local | Railroad[17] (miles) | Electric Transmission Lines[18] (miles) | Other[3] (count) | Total Values of Improvements at Risk[4] ($) |
| Perkins | | | 0 | | | | | | | | | | | | | | | | | |
| Phelps | 831 | 20,826 | 1 | | | 309 | 14,939 | | | 8 | | 1.1 | 60.1 | | | 9 | | 2.7 | | $10,480,970 |
| Pierce | 291 | 5,270 | 1 | 1 | | 556 | 3,338 | 1 | | 1 | 2.0 | 3.0 | 19.7 | 3 | 1 | 8 | | | | $30,244,645 |
| Platte | 9,838 | 42,300 | 4 | 4 | | 3869 | 16,035 | | 2 | 1 | 8.1 | 12.8 | 122.0 | 10 | 1 | 19 | 35.8 | 35.4 | | $565,899,874 |
| Polk | 3,196 | 38,571 | 0 | | | 992 | 19,067 | | | | | 4.2 | 102.4 | 3 | 2 | 29 | | 26.3 | | $22,497,152 |
| Red Willow | 1,745 | 32,896 | 0 | | | 802 | 17,516 | | | 4 | 1.5 | 14.6 | 63.9 | 8 | 6 | 13 | 22.4 | 10.0 | | $37,422,364 |
| Richardson | 1,926 | 10,547 | 0 | | | 92 | 5,517 | | 1 | 1 | 9.3 | 0.8 | 10.0 | 7 | | 7 | 1.7 | 1.2 | | $2,097,694 |
| Rock | | | 0 | | | | | | | | | | | | | | | | | |
| Saline | 199 | 1,773 | 0 | | | 305 | 630 | 3 | 2 | | | 1.1 | 8.1 | 1 | | 17 | 1.1 | | | $16,810,745 |
| Sarpy | 6,774 | 42,196 | 2 | 4 | | 4513 | 17,905 | 1 | 6 | 8 | 61.6 | 20.1 | 169.8 | 32 | 7 | 59 | 39.8 | 54.6 | | $1,096,969,868 |
| Saunders | 6,401 | 54,522 | 1 | | | 1967 | 29,077 | | 1 | 4 | 36.0 | 9.7 | 146.7 | 13 | 1 | 68 | 31.8 | 21.8 | | $204,870,301 |
| Scotts Bluff | 8,127 | 100,304 | 2 | 15 | | 12997 | 47,698 | 35 | 17 | 2 | 4.0 | 61.6 | 458.9 | 18 | 14 | 68 | 122.4 | 40.9 | | $849,822,680 |
| Seward | 32 | 813 | 0 | | | 25 | 497 | | | 1 | | 1.1 | 2.4 | 2 | 2 | 2 | | | | $1,135,560 |
| Sheridan | 987 | 10,449 | 2 | | | 779 | 695 | 2 | 3 | | | 4.3 | 23.4 | 4 | 1 | 6 | | | | $31,463,827 |
| Sherman | 221 | 4,030 | 0 | | | 233 | 2,453 | 2 | 1 | 1 | | 2.6 | 18.7 | 1 | 1 | 10 | | 0.6 | | $6,701,270 |
| Sioux | 12 | 178 | 0 | | | 8 | 1 | | | | | 0.2 | 0.2 | | | | 0.2 | | | $196,803 |
| Stanton | 14 | 179 | 0 | | | 88 | 67 | | | 1 | | 0.1 | 1.1 | 1 | | 2 | | | | $4,025,945 |
| Thayer | 823 | 2,645 | 0 | 1 | | 219 | 1,093 | | | | | 0.2 | 6.9 | 3 | | 15 | | 0.7 | | $10,680,275 |
| Thomas | | | 0 | | | | | | | | | | | | | | | | | |
| Thurston | 2,782 | 12,282 | 0 | | | 49 | 6,120 | | | | 5.0 | | 7.8 | | | | | | | $66,410 |
| Valley | 2,794 | 12,986 | 2 | | | 113 | 3,410 | | | 1 | | 2.6 | 15.6 | 1 | 2 | 7 | 1.2 | | | $4,898,205 |
| Washington | 3,518 | 44,355 | 2 | 1 | | 943 | 29,215 | 3 | 1 | | 1.6 | 6.8 | 79.1 | 6 | 1 | 14 | 9.8 | 21.5 | | $125,529,640 |
| Wayne | | | 0 | | | | | | | | | | | | | | | | | |
| Webster | 2,769 | 22,799 | 8 | | | 581 | 13,189 | 1 | 1 | 15 | | 12.2 | 57.4 | 9 | 7 | 13 | 18.4 | | | $14,014,735 |
| Wheeler | | | 0 | | | | | | | | | | | | | | | | | |
| York | | | 0 | | | | | | | | | | | | | | | | | |

[1] Critical Facilities includes but is not limited to: hospitals; fire stations; police stations; vehicle and equipment storage locations; critical records storage locations; utility and transportation infrastructure; locations that produce, use, or store hazardous materials; and similar. A critical facility should not be located in a floodplain if at all possible. If location within a floodplain is unavoidable, then the facility should be protected from flooding to a level that will ensure its continued function during and after a flood. FEMA. FEMA 426, "Reference manual to Mitigate Potential Terrorist Attacks Against Buildings," (December 2003). Also https://www.fema.gov/glossary/critical-facility

[2] Areas at risk of Dam Failure were determined based on data provided by Nebraska Department of Natural Resources that represent site-specific inundation limits in the event of dam failure for jurisdictional high hazard potential dam structures, where available.

[3] Other category includes features included in the critical facility database that didn't fall within defined categories. Typical Other features include post offices, parks and recreation facilities, and museums.

[4] Total value of improvements was estimated based on the appraised value of improvements on parcels located within the riverine flooding limits. The State parcel database was used for estimating value of improvements.

[5] Wetland areas are based on data from the USFWS National Wetland Inventory.

[6] Threatened and Endangered Species Range areas are based on mapping for state and federal T&E species range data from the Nebraska Game and Parks Commission.

[7] Cultural Resources are features with significant cultural or historical value. Data is from the National Register of Historic Places dataset of the National Park Service.

[8] Vulnerable Populations data was derived from the state-wide Critical Facility database, as well as the state-wide public and private school databases. Typical vulnerable populations includes schools, daycares, and assisted living facilities.

[9] State Owned structure data was provided the Nebraska Department of Administrative Services.

[10] Locally or Privately Owned structure data came from the state parcel database, as well as the Microsoft U.S. building footprint database.

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| County | Natural and Cultural Assets | | | Population | Structures | | Land Use | Emergency | | Dams and Levees | | Transportation | | | | | | Utilities | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Roadway[16] (miles) | | Bridges and Culverts (count) | | | | | | |
| | Wetlands[5] (acres) | Threatened and Endangered Species Range[6] (acres) | Cultural Resources[7] (count) | Vulnerable Population[8] (count) | State Owned[9] (count) | Local or Privately Owned[10] (count) | Agricultural Lands[11] (acres) | Emergency Management[12] (count) | Emergency Response [13] (count) | Dams[14] (count) | Levees[15] (miles) | State | Local | State Bridges[19] | State Culverts[20] | Local | Railroad[17] (miles) | Electric Transmission Lines[18] (miles) | Other[3] (count) | Total Values of Improvements at Risk[4] ($) |

[11] Agricultural Lands data was from the USDA/NRCS NASS-Cropland dataset.
[12] Emergency Management data was derived from the state-wide Critical Facility database. Typical emergency management features include shelters and community centers.
[13] Emergency Response data was derived from the state-wide Critical Facility database. Typical emergency response features include fires stations, hospitals, and resource stockpiles.
[14] Dams data was from the Nebraska Department of Natural Resources dams inventory database and includes both jurisdictional and non-jurisdictional structures.
[15] Levee data was from the Nebraska Department of Natural Resources levee database and includes both federal and local levees.
[16] Roadway data was from a dataset provided by the Nebraska Department of Natural Resources and included local roadways as well as state road information provided by Nebraska Department of Transportation.
[17] Railroad data was from the North American Rail Lines dataset.
[18] Electric Transmission Line data was from the Homeland Infrastructure Foundation-Level Data (HIFLD).
[19] State bridge data was provided by the Nebraska Department of Natural Resources and included data provided by Nebraska Department of Transportation.
[20] State culvert data was provided by the Nebraska Department of Natural Resources and included data provided by Nebraska Department of Transportation.

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# Appendix C

## Flood Mitigation Strategies and Practices Project Sheets

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# Flood Mitigation Strategies and Practices Project Sheets

This appendix is a compilation of flood mitigation strategies and practices to assist local communities in their flood risk mitigation planning efforts. The appendix is divided into four sections based on the type of mitigation activity, respectively: Local Plans/Regulations, Education Awareness Programs, Natural Systems Protection, and Structure & Infrastructure. Each project page contains a description of the strategy, its applicability, step-wise approach to implementation, relative cost considerations, and references or links for additional information. The project pages are intended to serve as a menu of mitigation strategies (with supporting information) that communities can choose and incorporate directly into their mitigation planning activities.

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NEBRASKA
DEPT. OF NATURAL RESOURCES

| Category | Strategies & Practices | Undeveloped Areas | Developed Areas | Low Cost | Low Maintenance | Nature-Based |
|---|---|---|---|---|---|---|
| LOCAL PLANS/ REGULATIONS | Integration of Comprehensive Flood Hazard Planning | X | X | X | X | |
| | Building Code Requirements | | X | X | | |
| | Stormwater Management Ordinances | | X | X | | |
| | Floodplain Ordinances | X | X | X | | |
| | Compensatory Storage Ordinances | X | X | X | | |
| | Low Impact Development | | X | X | | X |
| EDUCATION AWARENESS PROGRAMS | Emergency Preparedness Planning and Communication | X | X | X | X | |
| | Stormwater and Flood Education | X | X | X | | |
| NATURAL SYSTEMS PROTECTION | Natural Stormwater Best Management Practices (BMPs) | | X | X | X | X |
| | Maintain/Enhance Floodplain | X | | X | X | X |
| STRUCTURE AND INFRASTRUCTURE | Floodplain Acquisition and Relocation | X | X | | X | X |
| | Construction and Maintenance of Structural Measures | | X | | | |

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# Integration of Comprehensive Flood Hazard Planning

## WHAT

Integrate flood hazard mitigation plan elements into overall community planning efforts to provide comprehensive flood hazard planning for communities.

## WHERE

Any jurisdiction can take a comprehensive approach to planning for flood mitigation. When employing this mitigation action, communities implement comprehensive flood hazard mitigation strategies by integrating flood hazard mitigation plan elements into other community planning processes.

## WHY

Community benefits of comprehensive flood hazard planning include increased coordination, heightened safety, and effective usage of resources and funds.

## HOW

The comprehensive planning process will vary by community to address flood hazard and identify and integrate content from existing plan documents.

Communities are encouraged to take the following actions to proactively perform comprehensive hazard planning and incorporate flood hazard mitigation plan elements into other community planning efforts:

- If the flood hazard mitigation plan includes a mitigation action such as the establishment of a setback (a minimum distance between a stream and any development) to maintain flood flow or other floodplain functions, incorporate the setback requirements into floodplain or stormwater management ordinances.
- If the flood hazard mitigation plan includes recommended performance objectives such as target freeboard elevations or minimum structure discharges, incorporate them into design standards and processes.
- If the flood hazard mitigation plan identifies deficiencies and potential infrastructure improvements, incorporate them into the capital improvement plans of appropriate public works or engineering divisions.
- Coordinate with other communities/jurisdictions for holistic watershed approaches. Examples include developing consistent design standards and sharing flood hazard mitigation plans with surrounding communities for comment during development.
- Update plans with new information or data from government agencies such as FEMA, USGS, or NOAA as it becomes available.
- Incorporate redundancies into community plans to provide a level of safety should flood protection measures fail. For example, a plan calling for a flood protection berm could also include a deployable flood wall or sandbags as a redundant measure.

## COST CONSIDERATIONS AND BENEFITS

Costs are relatively low as there are no capital improvements directly associated with the integration of planning efforts. Community staff resources should be allocated for coordination, maintenance, and updates to planning documents. The labor cost of community staff resources for integration of flood hazard planning is anticipated to be minimal.

## RESOURCES

The Nebraska DNR prepared a Resource Guide for Nebraska Communities, which provides information, goals, actions and policies regarding comprehensive flood hazard planning for communities.

FEMA's Hazard Mitigation Planning Process webpage describes core planning process steps.

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# Municipal Code Requirements

## WHAT

Establish or enhance building code and zoning requirements to reduce flood risk to life and property.

Building codes can be crafted to elevate structures further above anticipated flood levels, better maintain function of equipment during a flood event, and promote greater safety by providing evacuation routes. Zoning regulations can be crafted to prohibit building of new structures in anticipated flood areas and enforce setbacks from flood prone waterways.

Floodplain management through building code and zoning requirements may include:

- Adopting building codes and establishing a program of plan and building inspections.
- Adding or increasing the community's local freeboard requirement for mechanical and electrical equipment and structures to one (1) foot or greater.
- Require new residential development, walkways, driveways, and roadways be elevated and designed such that dryland access to evacuation routes out of the floodplain area is provided.
- Adopting standards for fill compaction, slope, materials, and armoring.
- Using check valves, sump pumps, and backflow prevention devices in homes and public facilities.
- Implementing a safe room program to disincentivize use of basements in the Special Flood Hazard Area.
- Adopting setback standards for new building construction.

## WHERE

Adopting or enhancing building code and zoning requirements is a mitigation action that applies to rural and urban areas and can be implemented by communities (villages, cities, and counties) of all sizes. Building code and zoning requirements apply to new development and redevelopment as well as existing development.

## WHY

Building codes and zoning regulations promote public health and safety. They are important to communities for many reasons:

1. Building codes and zoning regulations increase protection against a wide range of hazards.
2. Up-to-date building codes and zoning regulations reduce natural disaster damages and costs.
3. Updating building codes and zoning regulations allows your community to benefit from the latest post-disaster research, making the community more sustainable and resilient.
4. Building codes and zoning regulations promote improved construction quality, consistent permitting, and strong code enforcement.
5. Building codes and zoning regulations can help a community reduce insurance premiums, lower bond ratings, and apply for federal grant funds.

Adapted from FEMA's 5 Reasons Building Codes Should Matter to You.

## HOW

Community officials can follow the steps below to enhance building code and zoning requirements:

1. Review your community's flooding and development history to understand potential risks.
2. Review your community's existing building code requirements and zoning regulations and requirements.
3. Develop requirements to address potential risks and/or provide enhanced safety.
4. Adopt the requirements through the community council's/board's process.

## COST CONSIDERATIONS AND BENEFITS

Costs are relatively low. Administrative resources are required to prepare, adopt, and implement the ordinance. Implementing the ordinance can be accomplished through integration with appropriate planning, zoning, and development application review processes. There are no capital improvements directly associated with building code and zoning requirements. Well-crafted building codes and zoning requirements increase public safety, reduce disaster damages and costs, protect property values, and encourage harmonious land development.

## RESOURCES

FEMA's collection of building code documents provides guidance on hazard-resistant provisions.

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# Stormwater Management Ordinances

## WHAT

Adopt development ordinances to address community stormwater objectives and requirements.

The regulations should address requirements for both construction and post-construction periods. These ordinances do not require specific measures but may work in conjunction with others that promote natural stormwater best management practices (BMPs) or low impact development (LID) measures. These ordinances specify stormwater requirements and allow flexibility for development approaches that protect flood-prone areas.

## WHERE

This mitigation action is applicable to areas of new development and redevelopment and is therefore most applicable to urban or developed areas.

## WHY

Many development activities influence stormwater runoff quantity and quality. Stormwater-related development ordinances establish controls to protect watershed and community resources from adverse effects that may accompany development.

**Stormwater ordinances generally address the following elements:**

1. Regulatory structure
2. Design
3. Development review
4. Maintenance
5. Inspection and enforcement

## HOW

Community officials can use the following framework to develop and adopt a stormwater ordinance:

1. Assess the existing ordinances. Some existing ordinances may not be consistent with modern stormwater management or National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit requirements.
2. Review and apply model ordinances based on the community's needs.
3. Develop the ordinance to meet the community's needs and to be compatible with your stormwater program. For example, the stormwater ordinance may reference design standards that can be updated more frequently.
4. Build community and political support.
5. Adopt the ordinance through your community governing body's process.

## COST CONSIDERATIONS AND BENEFITS

Costs are relatively low. Administrative resources are required to prepare, adopt, and implement the ordinance. Implementing the ordinance can be accomplished through integration with appropriate planning, zoning, and development application review processes. There are no capital improvements directly associated with stormwater/development ordinances.

## RESOURCES

Chapter 5 of EPA's Managing Stormwater in Your Community: A Guide for Building and Effective Post-Construction Program provides helpful information on developing a post-construction stormwater ordinance.

Model ordinances to protect local aquatic resources can be found at the Stormwater Manager's Resource Center.

The following Nebraska community resources include ordinances and regulations related to stormwater and development:

- City of Omaha Stormwater Program Regulations
- City of Lincoln Regulations and Standards
- City of Lexington Stormwater Ordinances
- City of North Platte Stormwater Program

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# Floodplain Ordinances

## WHAT
Adopt a floodplain ordinance to require responsible development and promote resilience.

## WHERE
Developing and adopting a floodplain ordinance is a mitigation action that applies to rural and urban areas and can be implemented by communities (villages, cities, and counties) of all sizes. Floodplain ordinances apply to new development and redevelopment but also affect existing development and the community's overall floodplain management efforts.

## WHY
Adopting a floodplain ordinance is a sound land use strategy and controls development to promote public safety and protect property. Floodplain ordinances are a preventative tool that significantly reduces individual and community flood risks, particularly for areas of new development.

Floodplain ordinances may be adopted by any community but are required for participation in the National Flood Insurance Program (NFIP), which affects community eligibility for FEMA funding and the ability of its residents and business owners to obtain flood insurance. Floodplain ordinances promote natural and beneficial floodplain values including improved flood flow, storage, and control; groundwater recharge; water quality function; and wildlife and diversity.

## HOW
Community officials can follow the steps below to prepare and adopt a floodplain ordinance:

1. Review flood sources and risks and understand the FEMA-designated special flood hazard areas in the community.
2. Obtain and review the appropriate model ordinance and higher/optional standards.
3. Refine ordinance language to meet your community's specific needs. A floodplain administrator needs to be designated to administer, implement, and enforce the provisions of the ordinances.
4. Obtain approval from the Nebraska DNR.
5. Adopt the ordinance through your community (village, city, or county) governing body.

**Key elements of a community's floodplain ordinance approach include:**

- Creating incentives that encourage developers to limit or eliminate development in flood-prone or flood storage areas.
- Adoption of practices that comply with or exceed NFIP requirements.
- Adoption of a cumulative substantial improvement policy (see Resources)

## COST CONSIDERATIONS AND BENEFITS
The cost of developing floodplain ordinances is relatively low and can have far-reaching effects on the community into the future. Floodplain ordinances and enforcement result in reduced flooding risks and greater community resiliency.

The cost of floodplain administration will vary based on community size and the number and nature of development activities.

## RESOURCES
The Nebraska DNR has prepared model ordinances that communities can apply based on FEMA special flood hazard areas. Additionally, resources are available for higher and optional standards (including a cumulative substantial improvement policy) for greater community resilience.

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# Compensatory Storage Ordinances

## WHAT

Adopt compensatory storage ordinances to prevent loss of floodplain storage.

The compensatory storage ordinance requires an amendment to a community's existing floodplain ordinance or creation of a new, complementary ordinance.

## WHERE

Adopting compensatory storage ordinances is a mitigation action that applies to developing areas and can be implemented by communities (villages, cities, and counties) of all sizes.

## WHY

Basic floodplain ordinances restrict development from obstructing the flow of water and limit increases to water surface elevations during a flood event. These ordinances do not address impacts to floodplain storage that may alter flood flows in downstream areas. Compensatory storage ordinances are one way that a community can enhance their floodplain requirements and thereby mitigate flood risk.

Floodplain ordinances often focus on channel flow but neglect to address impacts to storage in overbank areas.

## HOW

Community officials can follow the steps below to adopt a compensatory storage ordinance:

1. Review your community's Flood Insurance Study and floodplain mapping to understand potential risks.
2. Review your community's existing floodplain ordinance.
3. Develop requirements to prevent loss of floodplain storage.
4. Adopt the requirements through your community governing body's process by amending the existing floodplain ordinance or creating a new ordinance.

## COST CONSIDERATIONS AND BENEFITS

Costs are relatively low. Administrative resources are required to prepare, adopt, and implement the ordinance. Implementing the ordinance can be accomplished through integration with appropriate planning, zoning, and development application review processes. There are no capital improvements directly associated with compensatory storage ordinances. Maintaining floodplain storage better protects communities from flooding events.

## EXAMPLES AND RESOURCES

The City of Lincoln's Codes and Regulations (see Municipal Code Chapters 26 and 27) and Drainage Criteria Manual Chapter 10 – Flood Design Criteria for New Growth Areas provide an example of municipal compensatory storage requirements.

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# Low Impact Development

## WHAT

Low impact development (LID) is a land planning and design approach to reduce stormwater runoff and pollutant loading using green infrastructure. The LID approach is supported by community plans and regulations that require appropriate stormwater measures and include design, certification, and inspection requirements.

## WHERE

This mitigation action is applicable to new development and redevelopment and is therefore best suited to urban areas. While LID strategies can be implemented on an individual homeowner scale, a broad-scale community plan approach maximizes stormwater benefits. LID policies generally pertain to permanent measures rather than temporary construction measures.

## WHY

LID plans and regulations promote practices and measures that provide water quality and quantity benefits in a community. Implementation of LID plans and enforcement of regulations can result in a wide range of benefits such as reduced pollutants, reduced flooding, increased water supply, reduced watering/irrigation costs, enhanced project aesthetics, and increased wildlife and natural habitat.

## HOW

Communities can follow these steps:

1. Prepare or update a stormwater management plan to incorporate LID objectives and strategies.
2. Develop design guidance, standards, or requirements for acceptable LID measures.
3. Incentivize or require the use of LID techniques to manage stormwater for new development or redevelopment.
4. Incorporate review and approval procedures for site stormwater management plans within the community's platting/permitting process.
5. Specify and enforce LID measure inspection and performance requirements.

## COST CONSIDERATIONS AND BENEFITS

The cost of developing and adopting a LID approach to stormwater planning and regulations is relatively low and can have far-reaching effects on your community as development occurs. Administrative resources are required to prepare, adopt, and implement the plan and design guidance as well as to incorporate review, approval, and inspection procedures into your stormwater management program. LID strategies promote responsible and progressive stormwater management to control runoff and improve water quality.

## RESOURCES

The City of Omaha Stormwater Program highlights projects that have implemented LID measures and has created fact sheets for many common LID measures.

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# Emergency Preparedness Planning and Communication

## WHAT

Develop and adopt emergency communication protocols and content.

Communities can enhance flood forecasting and flood warnings to citizens by enhancing emergency communication content and collaborating with existing information outlets. Emergency communication methods can include sirens, automated phone notifications and calls, local radio and television warnings, and social media.

Key elements of emergency preparedness planning and communication include:

- Development of communication protocols related to flood threats
- Development of consistent warning content, made publicly available on city, county, or state government websites
- Collaboration with existing city, county, or state emergency management communications
- Public education on sources of flood warning information

**What should emergency warnings include?**

- Source (entity issuing the warning)
- Hazard type
- Location
- Duration
- Impact information such as travel limitations, evacuation procedures, and safety recommendations

## WHERE

Emergency preparedness planning and communication is applicable to rural and urban areas and to communities (villages, cities, and counties) of all sizes.

## WHY

Planning the response and communication channels to be used in an emergency flooding situation can reduce the likelihood of damages to private property, public infrastructure, and life in a community.

## HOW

Steps may include one or more of the following:

1. Integrate existing emergency management systems developed by the city, county, or state into your community's Emergency Preparedness Plan.
2. Identify an effective, community-specific communication method for warnings. This method should be selected considering community size, cellular service, and broadband accessibility.
3. Develop warnings to address the source (entity issuing warning), hazard type, location, duration, and impact information which may include travel limitations, evacuation procedures, and safety recommendations.
4. Conduct periodic reviews and emergency communication drills to prevent communication gaps due to personnel changes, and to ensure prompt coordination with emergency management during flood events.

## COST CONSIDERATIONS AND BENEFITS

Costs are relatively low and include up-front administrative labor costs to develop protocols, consistent content, and public education. Community staff resources should be allocated for evaluating and enhancing current community content and protocols, and for periodically reviewing and practicing notification protocols. During flood events, labor costs are required for monitoring and coordination with emergency management.

## EXAMPLES

The National Oceanic and Atmospheric Administration published an Example Warning that shows a communication transcript from the National Weather Service to a community during a flash flood warning.

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# Stormwater and Flood Education

## WHAT

Educate residents, business owners, and other professionals on stormwater management, flood risk, and floodplain management.

Stormwater and flood education can be applied to a number of groups including children/youth (schools), homeowners, business owners, and other professionals such as realtors. Education builds awareness of risks, encourages preparedness, and increases a community's potential for resilience.

Key elements of a stormwater and flood education program include:

- Annual distribution of flood safety pamphlets to residents in flood-prone areas. Encourage landlords to do the same.
- Teaching residents the importance of clearing storm drains of debris, and securing propane tanks, yard items, or stored objects that may be swept away or pose a hazard.
- Directing residents to GIS hazard mapping online to better understand their risks.
- Reminding realtors of State requirement to disclose in writing whether the property is in a Special Flood Hazard Area, or whether the property has incurred any damage due to flooding.

## WHERE

Stormwater and flood education is applicable to rural and urban areas and to communities (villages, cities, and counties) of all sizes.

## WHY

Effective stormwater and flood education programs increase stormwater and flood risk awareness, promote actions that reduce flood damages, and protect property owners.

## HOW

The following steps may be helpful in building your stormwater and flood education program:

1. Inventory existing community resources, such as floodplain mapping.
2. Identify community stormwater and flood needs and risks to be addressed through education.
3. Consider coordination with NeDNR floodplain management section for materials, information, and other assistance.
4. Determine your audience(s), which may include students, homeowners, business owners, landlords, realtors, and others.
5. Gather and develop materials to meet your community's needs.
6. Collaborate with educators.
7. Promote stormwater and flood education at community events, fairs, etc.

## COST CONSIDERATIONS AND BENEFITS

Costs are relatively low. Administrative effort is required to prepare, communicate, and disseminate educational messages and materials. There are no capital improvements associated with flood education.

## EXAMPLES AND RESOURCES

Educational materials and school lesson plans are available through the City of Omaha Stormwater Program (see Residential Downloads at the left-hand side of the webpage).

The UNL Institute of Agriculture and Natural Resources provides Stormwater Activity Sheets designed for students in Grades 4-6.

The National Weather Service Flood Safety Education and Outreach website has various resources including flood related videos, public service announcements, brochures, and links to additional information.

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# Natural Stormwater Best Management Practices (BMPs)

## WHAT

Natural stormwater best management practices (BMPs) are practices that use bioengineering and vegetative approaches to treat, prevent, or reduce stormwater runoff. Examples include rain gardens, stormwater wetlands, bioretention features/facilities, and vegetated filter strips.

## WHERE

This mitigation action is applicable to new development and redevelopment and is therefore more common in urban areas. Natural stormwater BMPs include temporary construction measures and permanent (post-construction) measures. A common construction BMP is a silt fence placed to control erosion of disturbed soils. An example of a permanent or post-construction BMP is a wet or dry pond that provides runoff storage and reduces downstream peak discharges.

## WHY

Natural stormwater BMPs improve water quality and reduce runoff through storage, infiltration, and/or evaporation. Selection of BMPs is context-sensitive, and the advantages or benefits also vary based on application. Potential benefits include reduced pollutants, reduced flooding, increased water supply, reduced watering/irrigation costs, and infrastructure cost savings. Natural stormwater BMPs complement community parks and open spaces, enhancing recreational use. Natural stormwater BMPs also provide wildlife and other natural habitat benefits.

## HOW

A natural stormwater BMP program includes the following actions:

- Address construction and post-construction periods
- Protect natural streams, wetlands, and adjacent property
- Design and construct natural measures that limit peak runoff and impacts to downstream channels and stormwater features as part of building permit/platting approvals
- Inspect and maintain BMPs

## COST CONSIDERATIONS AND BENEFITS

Costs to construct BMPs are borne by the owner/developer. Communities should also integrate natural BMPs into public works and engineering projects where applicable. Compared to traditional stormwater management infrastructure, natural BMP construction costs are typically less costly. Maintenance of natural BMPs may be required more frequently. While they generally require less capital cost, maintenance can be more time and labor intensive due to the landscaping (weeding, mulching, replanting) required to maintain the health of natural BMPs. Responsibility for maintenance costs of the BMPs will vary based on ownership and other factors. Responsible parties might include individual property owners, developers, sanitary and improvement districts (or other similar entities), and municipalities.

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# Natural Stormwater Best Management Practices (BMPs)

## RESOURCES

Bioswales are depressions that contain vegetation and allow for storage, infiltration, and evaporation of direct rainfall and surface runoff from adjacent areas.

Source: U.S. EPA, Different Shades of Green, October 2016.

Rainwater gardens are depressed landscape areas planted with grasses, flowers, and other plants that collect runoff from adjacent areas and allows it to infiltrate.

Source: U.S. EPA, Different Shades of Green, October 2016.

Planter boxes have vertical walls and open or closed bottoms. They are well-suited to collect and absorb runoff in dense urban areas where limited space is available.

Source: U.S. EPA, Different Shades of Green, October 2016.

| AGENCY/ COMMUNITY | GENERAL OR PROGRAM RESOURCES | BMP AND RELATED RESOURCES |
|---|---|---|
| EPA | National Pollutant Discharge Elimination System (NPDES) | • National Menu of Best Management Practices (BMPs) for Stormwater<br>• Construction BMPs<br>• Post-Construction BMPs |
| City of Omaha | Omaha Stormwater | Construction<br>• See Construction Downloads – Stormwater BMP Field Guide – 2018<br>Post-Construction<br>• BMP Design, Certification, and Inspection Resources |
| City of Lincoln | Watershed Management | • Requirements and Procedures<br>• Post-Construction BMPs |
| City of Grand Island | Stormwater Management Plan | Post Construction Stormwater BMP Master Plan |
| City of Kearney | • Stormwater Management Overview<br>• Post-Construction Stormwater Management Program Overview | Acceptable Stormwater Treatment Facilities (STFs) |

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# Maintain or Enhance Floodplains

## WHAT
Maintain or enhance floodplains through intentional use of parks and open space, securing lands for drainage and floodplain purposes, and adopting setback requirements.

## WHERE
This action applies to existing parks and open spaces adjacent to streams, property along streams that is developed or undeveloped, and property adjacent to streams that may potentially become open space.

## WHY
Maintaining or enhancing floodplains keeps residential, commercial, and other development away from flood-prone areas and thereby reduces flood damages. Other benefits include improvements to flood flow, storage, and control; groundwater recharge; water quality; fish and wildlife habitat; and recreation.

## HOW
A floodplain maintenance or enhancement program may include one or more of the following:

1. Link, manage, and expand existing parks and open space to help manage stormwater.
2. Acquire, reuse, and preserve flood hazard areas as open space.
3. Use land banking to preserve the natural and beneficial functions of wetlands and floodplains.
4. Acquire property or property easements for water retention and drainage.
5. Adopt stream and wetland buffers or setback requirements.

Stream and wetland buffers or setback requirements may be incorporated into community ordinances. For more information on adopting ordinances, see the Stormwater Management Ordinances and Floodplain Ordinances strategy pages.

## COST CONSIDERATIONS AND BENEFITS
Costs are lower for maintenance and higher for enhancement through land acquisition. Significant benefits are derived by avoiding unnecessary flood damages.

Operation and maintenance costs include those typically associated with parks and open space (mowing, tree care, etc.). Administrative effort is required to prepare, adopt, and implement buffer/setback requirements. Additionally, administrative effort is required to implement easement or land acquisition. Easement or land acquisition may introduce significant costs but will vary depending on the size of the program.

## EXAMPLES AND RESOURCES
The Nebraska DOT has used wetland mitigation banks to compensate for unavoidable adverse impacts to wetlands.

The Papillion Creek Watershed Partnership Management Policies include setback requirements (see Policy Group #3: Landscape Preservation, Restoration, and Conservation). Additionally, the Partnership is undertaking a Stream Setback Policy Update to better address stream degradation and protect property and infrastructure.

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# Floodplain Acquisition and Relocation

## WHAT

Develop a program to acquire and relocate residential properties and local businesses to avoid repetitive flood losses, create open space, and restore natural floodplain values.

## WHERE

This mitigation action is suited for rural or urban areas that experience repetitive flood losses and may be applied to individual structures or groups of structures.

## WHY

Acquisition and relocation projects are a sustainable mitigation action that results in a broad range of economic, environmental, and social benefits. These benefits include, but are not limited to, the following:

- Eliminating future disaster assistance needs; claim administration costs; and emergency evacuation, response, and management costs.
- Reduced flood debris, increased vegetation and filtration of pollutants, increased flood storage, and reduced erosion.
- Improved life safety and reduced neighborhood blight.

### What are natural floodplain values?

These include:

- Improved flood flow, storage, and control
- Groundwater recharge
- Water quality function
- Wildlife and diversity

## HOW

Key steps to implement a floodplain acquisition and relocation program include:

1. Identify potential acquisition project sites using your Hazard Mitigation Plan, FEMA's RiskMAP program, where available, and community members familiar with historic flooding and risks. For example, high risk areas such as floodways should be evaluated for potential acquisitions.
2. Identify potential relocation sites and reuses of acquired land. Relocation approaches include using available lots, annexing adjacent developable land, modifying housing density. Acquired lands may be reused for parks, recreational areas, rain gardens, or other beneficial functions.
3. Identify potential funding sources. These may include FEMA's Hazard Mitigation Assistance (HMA) program, Increased Cost of Compliance (ICC) funding, the Community Development and Block Grant Program (CDBG), or local funding.
4. Develop, submit, and implement the project. Prepare a scope of work and a detailed cost estimate addressing appraisals, legal costs, purchase and relocation costs, and demolition and site restoration costs.

Adapted from ASFPM's NAI How-to Guide for Mitigation.

## COST CONSIDERATIONS AND BENEFITS

Benefit-costs analyses have shown a strong return on investment for acquisition and relocation programs. Acquired land remains undeveloped in perpetuity, so benefits continue to accumulate over time with each flood event. Removal of development reduces downstream flooding impacts. For example, runoff is reduced when impervious surfaces such as streets, driveways, and parking lots are removed and restored to vegetated open space. The restored open space may be used for recreation, wildlife habitat, flood storage, and other beneficial uses.

## EXAMPLES AND RESOURCES

The Papio-Missouri River NRD provides a local example of an acquisition program from willing sellers: Floodplain Management (see Floodway Purchase). ASFPM's NAI [No Adverse Impact] How-to Guide for Mitigation provides guidance for anyone striving to strengthen community resilience.

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# Construction and Maintenance of Structural Measures

## WHAT

Construct and maintain structural measures designed to reduce community flooding risks.

Construction and maintenance is applicable to a community's new and existing structural measures. Constructing new structural measures can bring significant flood control benefits. A maintenance program for new and existing structural measures will allow a community to receive flood control benefits for the intended lifetime of the structural measure.

## WHERE

Construction and maintenance of structural measures is more common in urban areas but is also applicable to rural areas and to communities (villages, cities, and counties) of all sizes.

## WHY

Structural measures can bring significant flood control benefits by reducing or diverting flood flows, increasing flood-carrying capacity, and/or limiting flood inundation extents.

## HOW

A structural measures program may include the following elements:

- Routinely clean and repair stormwater drains, conduits, and other infrastructure.
- Establish a fund to maintain or rehabilitate existing flood protection infrastructure, such as flood walls, levees, and diversions.
- Increase stormwater utility drainage capacity with detention and retention basins, debris removal, and other methods.
- Implement structural best management practices for stormwater when constructing or rehabilitating facilities.
- Design roadways, bridges, or utilities with future flood conditions incorporated.
- Build levees or earthen dikes around flood-threatened critical public facilities.
- Implement program of regular maintenance of levees and dams.

Examples of structural measures include:

- levees
- flood walls
- dikes
- diversions
- dams
- detention and retention basins
- roads
- bridges
- culverts

## COST CONSIDERATIONS AND BENEFITS

Capital costs of structural measures may be significant. Capital improvement costs include construction of levees, dikes, detention and retention basins, roads, bridges, and other infrastructure. Costs for construction and maintenance of structural measures will vary based on community size, as well as the age and components of the community's stormwater and flood control systems. Structural measures require routine inspection and maintenance; associated costs will vary by measure type.

## RESOURCES

The Nebraska DNR website provides resources for Dam Safety and Maintenance.

The Omaha Regional Stormwater Design Manual provides information on structural measures such as culverts, detention and retention facilities, and other stormwater best management practices.

The Papio-Missouri River NRD's Flood Control program includes a system of dams and reservoirs that provides significant benefits to communities in the Papillion Creek Watershed.

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